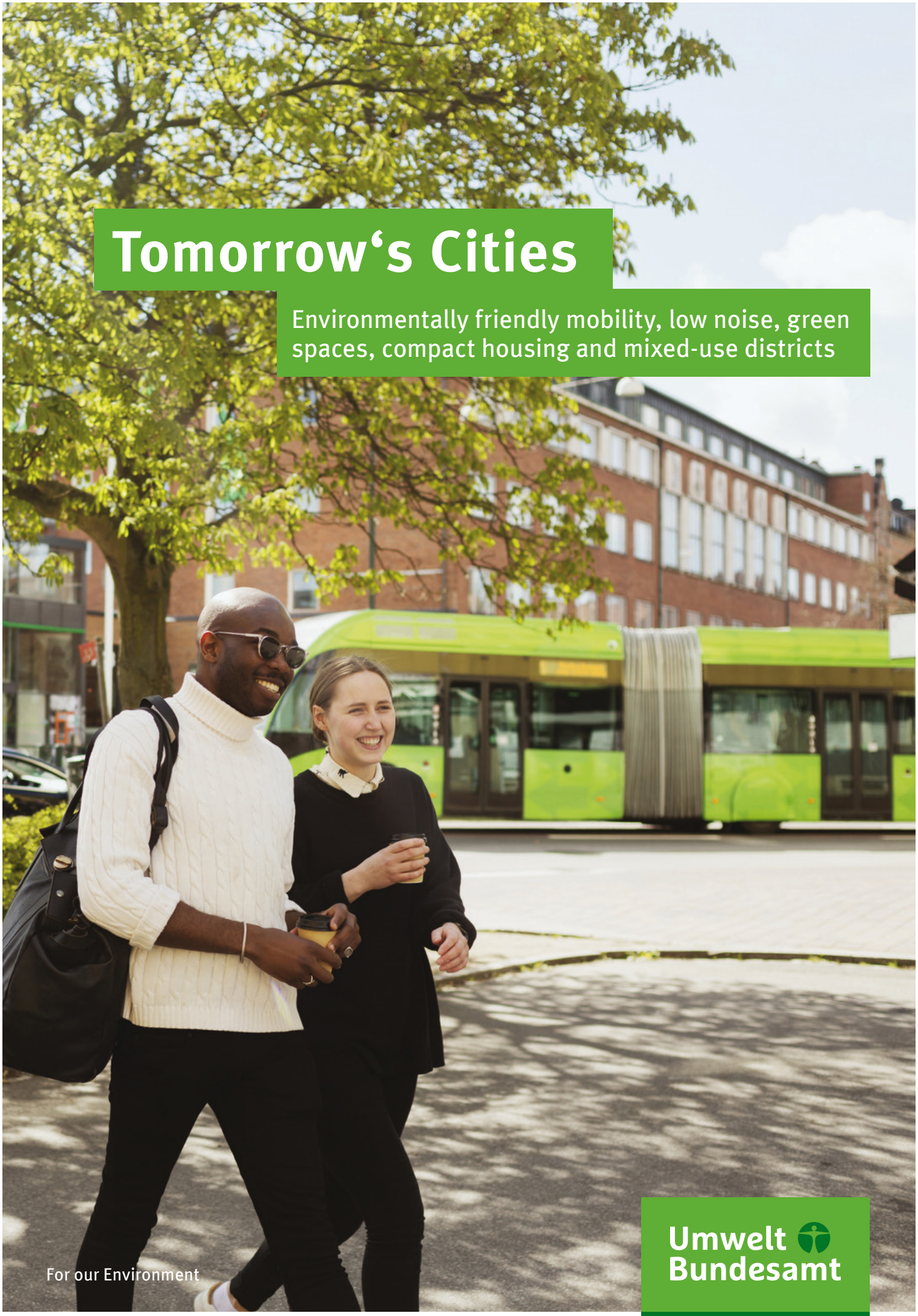

Tomorrow‘s Cities

Environmentally friendly mobility, low noise, green spaces, compact housing and mixed-use districts

For our Environment

Umwelt Bundesamt

Imprint

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Right at the heart of a vibrant city and yet leafy and quiet – this is how most people would describe their dream residential area. What we need therefore is an inclusive conversation about tomorrow's city as a place with environmentally friendly transport, low noise levels, a green, compact and mixed-use living space for the future.

Dear reader,

Big cities are by definition exciting, diverse and vibrant, but also loud and crowded, claustrophobic and exhausting. How do we want to live in our cities in the future? Is it at all possible to create an urban environment with environmentally friendly transport, low noise levels, green spaces and a functional mix?

Yes, such a city is possible. Our brochure explains how an environment with less traffic, fewer cars and fewer health and climate hazards can be achieved. Less on the negative side generates more positive features – such as green and compact spaces and more space for living.

At the heart of this brochure, you will find ten coordinated bundles of measures, comprising concrete steps towards the city of the future. These involve novel approaches as well as tried and tested methods. The individual suggestions are interconnected, often creating synergy effects. Obviously, a city that is fit for the future cannot emerge overnight. A clear time horizon must be set for the implementation of each step. Many of the measures envisaged can be directly implemented at federal, regional and communal levels through relevant legislation, administration and urban planning.

This paper wants to initiate a conversation about an important topic in our society. It provides a synopsis of options for an urban environment that can cope with the future, while also providing a space worth living in that protects our climate and nature. From our perspective, this is a first step that must be followed by further measures. It is, however, an important step that will allow cities to face up to the challenges of the future with the full support of society.

Content

Just imagine...

You live in a city with no traffic jams and unhealthy exhaust gases, without noise and time-wasting long journeys. Your bakery, greengrocer's shop, health centre, post office and kindergarten are all just round the corner. The next park is just a stone's throw away, as the local community was involved in turning a brown-field site into nice park with a dog play area, children's playground and a jogging course, with enticing cafes nearby. Although gaps between buildings in the area have been filled by the city with new residential and business complexes as well as small businesses, you can still sleep undisturbed with the windows open.

You travel to work using your bicycle, as the new cycle superhighways provide a direct, safe and convenient route. Trains and electric buses run at frequent intervals and have their reserved traffic space and will take you to the remotest corner of the city in no time at all. If, in spite of all that, you still need a car, you can use an app to order a quiet, emission-free electric car – it can be charged very easily – using the lamp post in front of your door.

A pipe dream? Of course, it is – after all, there is no German city that has low noise levels, is green compact and diverse or has a high-performing integrated transport system that protects health, the climate and the environment.

But it is not Utopia. A city fit for the future is achievable. How and with what means it can be achieved is what we are telling you in our brochure written by Department I 3 Transport, Noise and Spatial Development at the German Environment Agency.

We can assure you that tomorrow's city will be a better, more beautiful, more relaxed and healthier environment.

We will be a**s mobile as we are today**, but in a different way. We will be less 'auto-mobile' and use more public transport, the bicycle or footpaths. Nobody can or will want to ban cars – after all, mobility means getting from A to B at a certain time. But in future-proof cites, hardly anybody will need to own a car for that.

Towns will become both **more compact and at the same time greener**, due to qualified inner-urban development, instead of expanding into the urban fringe. The idea is to make better use of the available space inside existing settlements for more housing and that must be affordable, family-friendly and accessible, while also providing sufficient room for encounters, relaxation, sport and leisure within a public space.

Living quarters, commerce and services as well as leisure are not separate, but form a **functional mix**. This makes best economic use of a scarce resource – space. Any required journeys will be short and direct, saving time and emissions.

We look in particular at noise, one of the major environmental problems in many of our cities. In tomorrow's city, **noise exposure will fall to a minimum** – partially due to reduced car traffic, but also through intelligent construction that enables us to live quietly next to each other.

And how can we create such a city? The bundles of measures presented in this brochure cover a wide range and have very different aims. Many of the suggested steps go in a similar direction. In a future-proof city, hardly anyone needs their own car. **At a target value of 150 cars per 1000 inhabitants** – which is approximately one third of today's car density – **the cityscape would change noticeably** in more than one aspect. Space would be created that could be used more effectively and economically for living, recreation and environmentally friendly mobility.

A city with far less car traffic would also liberate communal finances, as no additional expensive roads, bridges or tunnels would have to be built and maintained in our ever-growing cities. Expensive public parking space in cities would become well-nigh obsolete at a traffic density of 150 cars per 1000 inhabitants.

A pipe dream will forever remain just that if no money is spent on implementing it. One thing is clear – without further money invested by the state, our municipalities will be unable to deliver. **The state must therefore support and fund the development of tomorrow's cities**, for example by increasing regional budgets for public transport or scrapping subsidies that harm the environment. Billions of euros could thus be freed to support active and climate-friendly mobility and compact, green high-quality living quarters.

Germany 4.0 needs cities 4.0. This can be achieved with digital tools at different levels. On the one hand, digitisation changes vehicles, mobility supply and the means to manage them. A city with more mobility and less traffic can thus be planned, coordinated and put into practice.

On the other hand, digitisation provides the tools for participation, involving those who live and work in cities. 'Tomorrow's cities' is precisely the type of project where local administrations and citizens must communicate about the many questions that concern people's daily lives. Many people are afraid of change. Giving them the opportunity to participate at an early stage adds transparency and will not only deal with fears, but also enhance the acceptance of measures and planning.

What about companies, service providers and tradesmen? They, too, benefit from a city with short travelling times, digital mobility, efficient technology and innovative logistics. Such concepts are essential not just for Germany's major cities, but may have relevant export potential, as private fossil-fuel traffic in megacities outside Europe is subject to severe restrictions so as not to suffocate the cities in exhaust gases and lack of space.

Tomorrow's cities are for people. They need the involvement of their citizens, stakeholders, industries and service providers. A city fit for the future is an ambitious communal project that requires courage and imagination, persistence and flexibility from all parties involved. It is worth the effort – a vibrant city with short journeys, lots of green space, low noise levels and good air quality – isn't that just what you always wanted?

Tomorrow‘s Cities

The Challenges

Who would not like a place in the sunshine? Land use, noise exposure and pollutant emissions must be curbed in the city in order to create more spaces for relaxation and social encounters.

Cities have always been social hubs. They have a lot to offer by way of jobs, education, shopping and leisure, and that is what has always attracted people to them, now and in the past. And yet, today's cities face totally new challenges. People flood into our cities to find work, young people go there to study, while the proportion of elderly citizens with their special needs and accessibility problems also increases and must be addressed. Online shopping led to a rapid increase in urban logistics, while at the same time stationary retail undergoes structural changes. The number of privately owned cars is high, leading to a scarcity of parking space, high noise levels and bad air quality.

In order to achieve the targets of environmental, health and climate policy, the use of land and resources, noise levels and pollutant emission must be decreased in cities. Currently, cities are a long way away from our ideal – an environment worth living for with short journeys, lots of green spaces, healthy air, essential shopping near residences and environmentally friendly mobility.

Car-sharing with the help of an app, the next bus arrival displayed on your mobile phone – smartphones offer new innovative transport services.

Trends are hopeful and progress in technology looks promising, especially as far as tomorrow's mobility is concerned. Electromobility is more climate and environment-compatible and will reach mass consumer penetration within the coming years. Intelligent traffic management systems will be able to guide the traffic flow better.

Mobile Internet and public WiFi hotspots make innovative mobility services and distribution concepts possible. More and more companies offer rental, swapping or DIY models that make it easier for city-dwellers to give up their own car.

In a compact city with mixed-use developments and short journeys, the bicycle is one of the most important means of transport

All change in the city

Cities are changing – which is associated with enormous challenges as well as great opportunities. Urban spaces in particular can be hothouses of innovation and inspire sustainable solutions in the future. They represent a potential that will not only have an impact on millions of cities, but also help rural regions to develop a sustainable lifestyle and economy.

But what exactly would tomorrow's cities look like? What measures will increase urban quality of life, while also reducing the burden on the climate and environment? How quickly can they be implemented? These are questions that Department I 3 Transport, Noise and Spatial Development at the German Environment Agency (UBA) discussed intensively over several months. This paper introduces the vision we developed and the supporting bundle of measures. In September 2016, a first draft was discussed with selected experts whom we would like to thank for their many inspiring ideas.

Not all aspects and solutions are new, and many of the measures suggested have been discussed for over 30 years. However, even concepts that have existed for a long time do not lose their value, as the obstacles that got in the way of their implementation can now be addressed (see Box Where there is a will...).

Where there is a will....

Many people would like to know why there is often so little progress made, despite numerous discussions, alternatives being pointed out and remedies suggested.

To make progress, introducing change and re-evaluating the situation, political will is crucial. This demands courage among political leaders and the will to take challenges seriously and be pro-active. The decisions to be taken are not always popular – including measures suggested in this paper. But only if unpopular decisions are made and implemented will politicians and councils be able to act responsibly in the interest of their electorate, for now and future generations. By the way – lack of funding is no excuse. Where there is a political will, there is a way of funding effective measures, for instance by redistributing existing funds.

Of course, councils must weigh interests when planning and implementing measures for the common good. This is particularly true when it comes to taking decisions on such a complex and comprehensive matter as the shape of the city of the future. Before any decision is taken, all stakeholders and their arguments must be heard. Weighing up interests is anything but simple – in some cases, it seems to slow down or hinder the implementation of sensible measures. Here, targets and frameworks must be firmly set by democratically elected communal bodies (city and community councils) to facilitate the job at hand for the administration.

High-quality, effective bus and train services will make private cars in cities well-nigh obsolete.

For instance, setting greenhouse gas neutrality as a target for transport or the rapid changes brought about by the digitisation of our daily lives may speed up the implementation of measures that have long been discussed.

The merits of limitation

Our current paper focuses on five topics: environmentally friendly mobility, low noise, green spaces, compact housing and mixed-use developments. The guiding question is always: how can cities face future ecological challenges, guarantee the protection of health and the environment as well as improve quality of life for their inhabitants? A successful strategy very much depends on the further development of existing resources in combination with new approaches under changing conditions.

Obviously, there are many more aspects to a city fit for the future than just the five mentioned. For instance, how can energy be secured in a carbon-neutral way, while also protecting resources? How can the structure of built-up areas be adapted to climate change?

What options can smart city concepts offer for an environmentally friendly, sustainable development? There are connections and synergies that can and must be exploited.

Who will foot the bill?

When developing a vision of Tomorrow's Cities, questions of funding do not come into the equation. This does not mean that no plans on funding exist. Large sums could be freed simply by abolishing subsidies that damage the environment.

Every year, our country spends 57 billion euros in subsidies for measures that substantially damage the environment. Most of these subsidies go into the transport sector. In 2012, these amounted to 28.6 billion euros. One example is subsidised diesel fuel. Owners of diesel-fuelled vehicles pay 18.4 eurocents less per litre than owners of petrol-fuelled vehicles. This kind of subsidy costs the tax payer up to 7.8 billion euros per year, of which 3.5 billion are paid to the users of diesel cars. Even after subtracting the higher vehicle tax on diesel cars, there remains a subsidy of 1.5 billion euros for diesel technology every year. By comparison, the purchase of electric vehicles is subsidised by 600 million euros – over a three-year period.

Stress-free shopping without the need to chase elusive parking spaces – this would become reality for everybody in a sustainable city. Environmentally friendly mobility enhances quality of life as well as the attractiveness of cities.

Above all, the paper will focus on ecological questions exclusively, while social and economic objectives only play a marginal role. However, environmental goals and health protection in cities will only become achievable if social aspects are taken into account and funding is secured (see Box Who will foot the bill?). At the same time, improvements in the environment often have economic effects, as lower health care expenses and lower mobility costs can save money.

This paper primarily focuses on large cities with at least 100,000 inhabitants. However, many of the suggested solution strategies may also be of interest to smaller communities. Thus, when expanding public transport, the crucial factor is not the number of inhabitants but rather whether a viable public transport network exists that could serve as a backbone for future mobility plans. In addition, limiting the concept to large cities is a simplification because the hinterland and suburban space play a crucial role in a functioning public transport system.

This is why adjacent regions were included wherever it seemed to be necessary, for instance when looking at commuter movements and the expansion of attractive public transport.

Electricity supply on the roof, bicycle, bus and railway at the doorstep – Tomorrow's Cities will protect the climate and environment.

There is no need for city centres to be dull and grey. Many cities are already using their imagination, working passionately on green solutions for confined spaces.

If you have visions, don‘t go see the doctor!

Visions are necessary – without them, no progress would be possible – in research as well as in technology. Having visions is healthy, no need to “go see your doctor.”

Tomorrow’s cities, too, require vision, imagination and ideals. Without them, it will not be possible to convince people to accept changes that do not have an immediate positive effect, but will reveal their full benefit only in the mid to long term. It is not an easy route, but well worth the effort.

This paper will give practical advice on action to be taken as well as parties involved and the time scale for each measure to be taken. Short-term measures are those to be implemented within the next three to five years (by 2020, i.e. within the current election period). Short to mid-term means implementation timelines up to 2025 and mid-term looks at a time horizon up to 2030.

The measures that are implementable in the short term include some that have been adopted, but have so far not been implemented.

Accessibility must become the rule in mobility – especially environmentally friendly public transport.

The transformation of the transport sector („Verkehrswende“) - key to Tomorrow‘s Cities

What will distinguish a future-proof city with environmentally friendly mobility, low noise, green spaces, compact housing and mixed-use developments from today’s situation? What are its crucial characteristics?

The core message of this brochure is that we must transform our transport systems in a way that is climate-friendly and environmentally as well as socially compatible in order to make lives in the urban environment more worthwhile. The much-discussed transformation of the transport sector (“Verkehrswende”, comparable to the “Energiewende” or energy transition) must become real. Cities must be transformed in such a way that people only need to travel short distances to meet most daily needs.

A compact city with mixed-use developments allows the number of cars to decrease, with a long-term target density of 150 cars per 1000 inhabitants. This would change our cityscapes noticeably in more than one aspect. A significant drop in private car numbers will free space that could be used more economically for living and recreational purposes as well as environmentally friendly mobility. Another advantage would be that more ambitious noise limits of 40 dB(A) at night and 50 dB(A) during the day could be implemented much more easily, in spite of a more intense use of space. This will settle disputes about too much noise exposure.

One of our key questions is therefore: How much automobility is needed in tomorrow’s cities?

More green spaces in more compact cities – green spaces will characterise the cityscape of the future, offering room for social encounters, play and leisure.

Tomorrow‘s Cities

The Vision

Our Vision of Tomorrow's Cities is intended to outline a vivid picture of how city-dwellers can be on the move in an environmentally friendly manner and what makes a green, compact and mixed metropolis attractive. We have brought our vision to life in fifteen elements that will give them a more concrete understanding of what lies ahead. The sequence in which we present the elements is not hierarchical, and individual readers may sort them to suit their individual vision.

The city design is **compact and space-saving, avoiding unnecessary traffic**

Compact living, efficient use of urban space, reducing traffic

- Compact cities mean that derelict land and spaces between buildings are being re-used and the potential of retroactive densification is exploited, including areas freed from traffic.
- Priority for bicycles and public transport must be established first: In a first step, cycle paths are added to all main roads, while 50% of the main road network will have dedicated lanes for public transport (even if that costs car parking space). In addition, car parking space will be turned into cycle parking space along streets and on private land (possibly supported by funding initiatives). Parking space along streets and on residential properties is limited to a maximum of 3 square metres per inhabitant.
- In a next step, car-friendly features of the city will be reversed: Parking space along streets and on residential properties is limited to a maximum of 1.5 square metre per inhabitant. Freed spaces will be used for cycle paths, bus lanes and tram tracks, but also for leisure activities and green spaces as well as cycle parking and – to a limited extent – for car sharing.
- A city of short journeys – the average journey length will be just 8km and total length of journeys will be 28 km per person per day, which is 25% less than today.
- Easy access to the great outdoors – cities are connected to their hinterland by public transport and cycle superhighways.

Tomorrow's cities are **green**

Creating and preserving green spaces

- Green spaces, including water bodies, will be reserved for recreation, the conservation of biodiversity, the supply of cool, fresh air and the retention of water, depending on their type and extension.
- It's about short distances – the proportion of publicly accessible green and recreational spaces within walking distance will be high. Some buildings include private or semi-public green spaces and gardens. Providing access to them could save extra journeys to the city's outskirts and would make good use of existing space.
- High quality environments – high-end green spaces and tree-lined squares and streets will enhance the quality of life in working and living quarters.

- Green and healthy – green spaces and water bodies improve the microclimate and provide ideal surroundings for healthy exercise.
- Green spaces invade the concrete desert – roofs can carry plants and ponds, facades can be adorned with plants and water cascades, and other available spaces such as courtyards can be enriched with plant life, improving the immediate environment and providing a fresh breeze in hot, stuffy summers.

More space for social encounters and community

Cities provide **space for social encounters and community**

- The quality of public spaces can be enhanced by providing seats and benches and keeping noise exposure and pollution to a minimum.
- The spaces available for social encounters, recreation and communication should be diverse.
- Living space rather than parking space – there are hardly any private cars left that occupy public space. Consistent parking management has made parking in cities expensive.
- A city undivided – main thoroughfares or rails no longer cut dividing lines through the city or their dividing effect has at least been mitigated.
- Space for encounters and shared space for the various means of transport will shape the cityscape

Direct connections – short distances

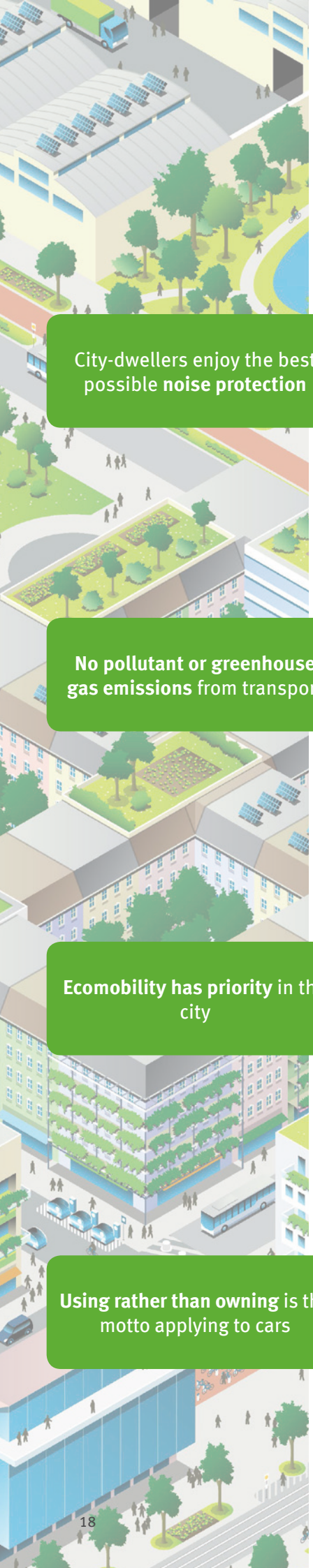
Short distances to main destinations which are **accessible for all without a private car**

- Everyday destinations can be reached by all with no need for private cars. Ideally, distances are walkable or cyclable.
- Goods and services are easy to access, depending on frequency of need: within walking distance for daily needs, within cycling distance or easy reach of public transport for periodic needs and for less frequent needs by public transport or car-sharing.
- Comprehensive access to emergency services is guaranteed.

Creating attractive mixed-use areas

Living quarters are **attractive, mixed-use and affordable**

- Living in areas close to city centres is encouraged as well as the availability of private, semi-public and public spaces for social encounters.
- Industries with low noise levels and emissions will be kept within residential areas or relocated there, whereas noisy industries are avoided as far as possible in mixed-use developments. They are housed in industrial zones.
- Inner cities are built up more densely, but attractively, e.g. by exploiting spaces between buildings and making use of courtyards and superfluous parking space.
- Brown-field sites will be re-used and reactivated, mainly by building more compact, yet attractive housing that will allow a healthy lifestyle and good quality of life.
- Housing is adapted to the very different needs of the old and the young and managed in a flexible manner.



- Shops and amenities, cultural institutions and social centres are varied, covering the needs of diverse users.
- Courtyards of tenement buildings are turned into quiet havens in vibrant areas.
- Affordable housing will become more easily available and the rich and the poor are no longer geographically separated.

City-dwellers enjoy the best possible **noise protection**

Providing quiet living quarters

- Noise exposure of L_{eqDay} > 50 dB(A)) during the day and $L_{eqNight}$ > 40 dB(A), at night from technical sources is avoided.
- Quiet areas near residential areas will be preserved and protected from rising noise levels.
- Compact, closed housing design will create quiet courtyards that are protected from noise.
- Neighbours will be considerate and reduce noise levels during their leisure activities, thus adding to peaceful coexistence.

No pollutant or greenhouse gas emissions from transport

Pollutant-free and greenhouse gas-neutral transport

- All transport within the city (individual and goods transport) is green-house gas-neutral and (almost) emission-free.
- Only vehicles with electric motors are allowed in the inner city. Electric cars are smaller and adapted to use in cities. All public transport is electric. .
- Electric vehicles are powered by electricity from renewable energy sources.
- Air quality thresholds according to the current state of scientific knowledge are adhered to (NOx, particulates, ozone, etc.)

Ecomobility has priority in the city

Priority for ecomobility

- Privately owned cars play a lesser role in urban traffic.
- Any journeys within the city can be easily made on foot, by bicycle or public transport – flexibly, comfortably and economically.
- Public transport is the backbone of the system, taking passengers safely to their destination even in case of unexpected disruptions, due to an effective disruption management system.
- Integrated mobility services such as car sharing, bicycle rental systems or online ridesharing platforms complement public transported and are interconnected.

Using rather than owning is the motto applying to cars

Using rather than owning

- Car sharing for electric cars as well as bicycle rental systems have been established throughout the city.
- The number of cars in the city has been significantly reduced and those left are used efficiently, use less space and can be charged anywhere with electricity from renewables. The target car density is a maximum of 150

registered cars per 1000 inhabitants – including car sharing vehicles and taxis.

- The city car of the future is small, quiet and electric. It is shared by several possible and may even be driverless..

Protecting resources

- Local repair and exchange shops can make repeated replacement purchases unnecessary and thus save on transport and resources.
- The use of resources for urban transport infrastructure, means of transport and transport routes, including the use of vehicles, is kept to a minimum.
- Communally used rooms (e.g. laundries, workshops) can reduce per capita demand for living space and resource consumption as well as contribute to social enrichment.

Making mobility affordable

- Individual mobility is affordable for all walks of society:.
- Continued development of transport modes have been sufficiently budgeted for the long term.

Participation in planning, collaboration in action

- Cities and surrounding regions collaborate so that settlements and infrastructure are planned and structured in a way that avoids an increase in traffic.
- Citizens are involved in transportation and urban planning processes.
- Transportation and urban planning are harmonised and take into account other sectoral planning (e.g. energy, waste).

Full accessibility to transport for all

- All modes of transport are fully accessible to all.
- Unaided, independent mobility is possible for all.
- The transport system offers alternatives to private cars for the elderly and disabled, such as accompanied travelling, or mobility aids such as scooters. .

Adapting the speed of transport to urban life

- A statutory speed of 30km/h applies to streets in the city.
- Regular speeds depend on the use and function of the road.

Safety

- A sense of safety in the city will not be just restricted to road safety.
- The ‘Vision Zero’ idea has become real – no road traffic fatalities or serious injuries, error-tolerant infrastructure in cities.

Tomorrow’s cities **protect resources** and minimise the need for transport

Mobility that is **based on solid funding and affordable for all**

Citizens, planning and regional authorities will be involved in a **collaborative planning process**

In tomorrow’s cities, people enjoy **full accessibility to transport**

The **speed of transport is adapted to urban life**

Feeling safe in city traffic and the entire urban environment has become widespread.

Tomorrow's Cities

The Measures

1) Implementing compactness and mixed use in cities

2) Providing urban greenery and open spaces

3) Reducing noise

4) Expanding active mobility networks

5) Encouraging integrated mobility services and e-mobility

6) Improving public transport quality

7) Making commercial transport within the city environmentally friendly

8) Managing motorised transport

9) Exploiting digitisation for the benefit of the environment

10) Fostering Participation and collaboration in planning and implementation

What use is the loveliest vision if you cannot explain how it can become reality? What measures are needed to make a city with environmentally friendly mobility, low noise, green spaces, compact housing and mixed-use developments come true?

In this chapter of the paper, ten bundles of individual measures are presented that prepare the ground for the realisation of the vision. Many of the options suggested are not new, but are still very topical, as they have not put into practice yet. The selected measures were considered to be the most effective and to stand a good chance of being implemented. The focus was on measures that could be put into practice in the short-to-mid-term. Admittedly, tomorrow's cities must also undergo long-term changes, but from today's perspective, we are unable to give details of such long-term measures, and our list is by no means complete.

Organising individual measures into ten bundles allows readers to get a better overview. We made a conscious decision not to list measures twice in different contexts, although they could have been used in various bundle contexts. The bundles, however, should not be looked at in isolation, as they are closely interconnected. Looking at them in a wider context will ensure that synergies will come into play. The same applies to the implementation of the measures – only the combination of individual steps will achieve results.

The measures presented focus on the five topics of environmentally friendly mobility, noise reduction, green spaces, compactness and mixed-use developments. Further topics need to be addressed when developing an overall concept of a city fit for the future. These include the resilience of socio-technological systems, climate adaptation, energy supply and protection of resources. They are not covered by the ten bundles of measures below. However, the synopsis will deliver first steps towards a future-proof and desirable city worth living in – in other words, the implementation of these measures will be necessary, but not sufficient.

1 Implementing compactness and mixed use in cities

More and more people are drawn to big cities. They hope for living, work, shopping and leisure to be all within easy reach. Tomorrow's cities will encourage the development of compact, mixed-use districts with a vibrant and creative community. Cars are not needed for daily errands. To achieve this, the potential of inner-urban development must be harnessed, reclaiming derelict areas and gaps between buildings, as well as sensitively building up more densely existing housing estates, making also use of space no longer occupied by traffic or parking.

The Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) published a programme in October 2015, entitled "Neues Zusammenleben in der Stadt" (new conviviality in the city) where it calls for more mixed cities in every aspect – use, social environment and urban structure. The ideal of a compact, integrated and environmentally friendly city is to be implemented gradually, and compact, green areas with mixed use has also become part of the BMUB's integrated environmental programme for 2030, published in August 2016, "Den ökologischen Wandel gestalten" (shaping ecologic change).

The example of a densified, mixed city demonstrates how closely interlinked the measures suggested are: Housing and commerce need space and therefore compete with green and other public spaces (measures bundle 2). The main challenge lies in reconciling compact housing structure with high environmental standards and quality of life. Qualified inner-urban development is the key strategy that combines compact housing with further development of green and recreational spaces.

However, qualified inner-urban development also means that space taken up by oversized roads and parking spaces must be reduced to free additional space. This can only be successful if walking and cycling is encouraged (measures bundle 4), public transport improves (measures bundle 6) and an integrated mobility services network exists (measures bundle 5). Solutions must be adapted to the geographical and structural situation at hand and not have a negative impact on noise protection (measures bundle 3).

Federal Government could support in the shape of urban planning regulations that allow city areas to be built up more densely, while at the same time strengthening the importance of green spaces. At the same time, high standards in noise protection have to be ensured. Introducing a preliminary environmental audit in particular cases and also for simplified or fast-track planning projects would ensure that environmental concerns would have always high priority. In addition, the Federal Government should expand its urban development promotion programme to enable municipalities to reclaim oversized roads and parking spaces and create housing, green and recreational spaces.

The Federal States could strengthen qualified inner-urban development by making requirements for car parking on private ground more flexible in their State building codes. Federal State and regional planning could also ensure that in the regions surrounding the cities, development happens along public transport lines and junctions so that more commuters could reach the city centres by public transport and roads would no longer bear the brunt of commuter traffic with its environmental implications. Federal States could set quantitative limits to the use of greenfield sites in order to slow down further urban sprawl beyond existing settlements and public transport routes and to curb individual car traffic. A relevant regulation has been incorporated into the Federal spatial planning act.

 Individual measures **Implementing compactness and mixed use in cities**	Time frame	Decision	Implementation
Incorporating **qualified inner-urban development** in urban planning legislation (e.g. by introducing minimum building densities in the BauNVO (Land-Use Ordinance) and adding the principle of sufficient supply of green and free spaces to the BauGB (Federal Building Code)	short-term	F	M
Introduction of a **new land-use category** in the BauNVO (Land-Use Ordinance) with the aim of achieving a small-unit, mixed-use development with a high proportion of residential use and a floor area ratio of 3.0. This would promote qualified inner-urban development and space-saving. also keeping up high noise protection standards	immediate	F	M
Making car park regulations more flexible in order to reclaim private car parking lots for green and recreational spaces	short-term	S	M
Funding from the urban development promotion programme should increasingly be used for reclaiming oversized roads and car parks	short-term	S	M
Concentration of settlement developments at existing settlement centres and along settlement axes, underpinned by public transport routes and junctions as part of regional planning.	short- to mid-term	Planning at Federal and regional levels	M
Further development of the Federal Spatial Planning Act (ROG) Article 2 Section 2 No. 6 Sentence 3) by adding quantified specifications on the reduction of land take for settlements and transport infrastructures	immediate	F	Planning at Federal and regional levels M
Introduction of a mandatory case-by-case preliminary environmental audit when simplified or fast track planning projects are submitted (independent of the size of the area which is subject to planning) as part of the BauGB (Federal Building Code)	short-term	F	M

immediate; short-term; short- to mid-term; mid-term; EU; F Federal; S Federal state; M municipality; C company

2 Providing urban greenery and open spaces

Future-proof cities provide desirable living quarters and public space for social interaction. At the heart of our cities, a welcoming environment with high recreational value will enhance social exchange and add vibrancy. Accessibility for all social groups and inclusive planning that considers the needs of all inhabitants are essential prerequisites. Especially with more densely built-up areas, it is now more important than ever to revive urban life in public spaces which encourage encounters across generations in an environment that does not require consumption.

Public and semi-public green spaces must be available for leisure activities around living quarters that cater for the needs of the inhabitants. The number, size, quality and accessibility of green and blue infrastructure is crucial, as green spaces and water bodies play an important part in social life, the ecology, economy and culture of a city. Their multifunctional nature becomes more important facing growing user requirements and the necessity to adapt to climate change. The preservation, expansion and re-appreciation of green spaces and water bodies are thus crucial for sustainable urban development. Green spaces must be interconnected within the city, but also at regional level.

Urban green spaces must be secured in urban planning and funding programmes and designed to allow multiple use for leisure and recreation, exercise, well-being and as gardens or allotments. In addition, their significance in terms of green appearance, biodiversity, the supply of cool and clean air as well as water reservoirs must be recognised.

Furthermore, the urban planning of green spaces must acknowledge that there are many demands on the use of space. Many stakeholders in the city must become involved in maintaining its green spaces to ensure that quality of life as well as the ecological value of green spaces remains high. This also includes introducing vegetation to buildings (roofs, facades), streets as well as sports facilities and playgrounds. The Federal Government should lead by example, introducing vegetation to embellish Government-owned buildings. Such complex challenges should encourage communities with a tight housing market to plan new projects on the lines of qualified inner-urban development.

Tomorrow's cities must provide a sufficient supply of green spaces and open areas. Land can be reclaimed by coverting oversized roads, streets and car parks. This requires new approaches to transport planning (see measures bundles 4-8). The qualified inner-urban development strategy (measures bundle 1) will help to create a sufficient amount of green spaces and open areas in compact cities with mixed-use developments.

Planning public open spaces can lead to conflicts of interest, as community life in such spaces is associated with noise. Planning must therefore also take into account the protection of residents from noise (measures bundle 3).

The Federal Government has several options for supporting municipalities and other stakeholders in their planning efforts for green and open spaces, including promoting urban green spaces in their urban development promotion programme and implementing their own concept. Standards for the supply of green and open spaces should be developed which could provide a basis for urban planning and decision-making.

 Individual measures **Providing urban greenery and open spaces**	Time frame	Decision	Implementation
Funding of urban green spaces must be increased in urban development promotion programmes, e.g. by connecting integrated city development concepts to city-level green space planning and clarifying Article 136 of the BauGB (Federal Building Code) to state that inaccessible or absent green spaces are a considerable urban development deficiency.	short-term	F S	M
Establishing a continuous funding scheme for urban green spaces: Implementing and communicating the new urban development promotion programme entitled „Zukunft Stadtgrün“ (future green city) on a permanent basis (with the aim of adding vibrancy to public spaces)	immediate	F S	M
Developing quantitative and qualitative standards for providing green and open spaces (such as accessibility, multi-purpose use) and suitable documentation and evaluation methods in collaboration with municipalities	short- to mid-term	F	M
Developing standards for accessibility and the adaptation of public spaces to the needs of all users	short- to mid-term	F S	M
Model projects and campaigns for **integrating green and blue infrastructure into urban planning** (e.g. developing formal and informal planning tools, concepts for the revitalisation of derelict areas and intermediate use)	short-term	F	M
Promoting **green roofs and walls on buildings** and other structures in guidelines for planning authorities, developers and home owners (e.g. information on how to incorporate greenery in the binding land-use plan or information on qualified roadside vegetation management plans)	short- to mid-term	F	M
The Federal Government must lead by example and improve green spaces on existing properties as well as new building projects, using and developing further existing strategies and instruments	short-term	F	F

immediate; short-term; short- to mid-term; mid-term; EU; F Federal; S Federal state; M municipality; C company

3 Reducing noise

Noise in cities is not just a nuisance, but can actually make people ill. In order to avoid such negative health effects, the World Health Organisation (WHO) recommends an equivalent continuous sound level (night time averaging sound level) of 40 dB(A). This level is exceeded in many cities so that noise exposure must be reduced.

The EU Environmental Noise Directive (2002/49/EC) is an important instrument for improving the noise situation. The aim is to reduce environmental noise and prevent an increase in noise levels in previously quiet areas. Noise exposure is documented in noise maps that will provide the basis for municipalities to establish noise action plans with public participation. They can thus plan and implement concrete steps towards noise reduction, especially where it concerns the most relevant source of noise in cities – road traffic.

There is a wide range of measures in traffic noise protection – including long-term strategic approaches to traffic prevention and measures implementable in the short term, such as local speed limits, the use of low-noise road surfaces, rail grinding at regular intervals and bans on through-traffic. However, there is a continuing need for the realisation of action plans and other optional actions, while the implementation of strategic and planning approaches must be speeded up. The main purpose is to reduce individual car traffic, to promote ecomobility (measures bundles 4-6) and to manage traffic wherever needed (measures bundle 8). Other noise sources apart from road traffic noise must also be mitigated.

There are many synergies to be achieved with noise reduction and other objectives of Tomorrow's Cities. Speed reductions, for instance, not only reduce noise, but also have a positive effect on road safety, traffic flow and road capacity. A 30km/h speed limit is an example of positive synergy, as it reduces traffic noise and enhances traffic safety, thus contributing to a better environment for pedestrians and cyclists. In addition, the speed limit also reduces road traffic emissions. It is therefore important that urban and transportation planning as well as environmental protection be more closely interconnected in the future. Cities and surrounding municipalities in a region should forge strategic alliances wherever possible.

When developing a speed limit strategy, municipalities must take into account the concerns of all parties involved. This requires not only more decision-making powers than they currently have, but also the option of introducing speed limits that deviate from general rules as well as establishing traffic-calmed zones. Such zones could be shared spaces with equal rights for all traffic participants or places of social encounter. A general speed limit of 30km/h is essential in urban spaces – something that could be prioritised and implemented in the short term.

Not only is the mitigation of existing noise exposure crucial, but also the preservation of quiet areas in our cities.

Recreational areas around housing estates that allow inhabitants to enjoy some peace enhance the quality of life and environmental quality in densely populated and compact cities (measures bundle 2).

Noise has a high potential for conflict, but such conflicts can be resolved. In compact, densely populated districts, construction measures for noise protection may mitigate noise arising from the neighbourhood. Possible conflict caused by noise from traffic and industry (measures bundle 1) can be prevented by closed street front design and intelligent planning. Soundscaping, the acoustic design of the environment, is another option, where disruptive noise is masked by superimposing more pleasing sounds, thus shaping the soundscape in residential areas or public spaces.

Aviation is another source of conflict. For reasons of preventative healthcare, the German Environment Agency recommends a ban on flights to and from airports near cities between 10 p.m. and 6:00 a.m, while during daytime, a noise threshold should be in place.

 Individual measures **Reducing noise**	Time frame	Decision	Implementation
Introducing a regular speed limit of 30km/h in cities by amending Article 3 Section 3 No. 1 of the Road Traffic Regulations **and amendment of Road Traffic Legislation in order to give municipalities more decision power on regulating speed limits**	short-term	F	S M
Identifying quiet areas in cities pursuant to the EU Environmental Noise Directive in order to enhance quality of life and the environment	short-term	M	M
Ambitious **new limits for tyre and vehicle noise**	short-term	F	F S M
Increasing enforcement of noise and speed limits and wider use of feedback displays	immediate	S M	S M
Funding for low-noise road surfaces in road construction	immediate	F S M	F S M
Consistent use of noise mitigation in rail infrastructure maintenance (e.g. grinding rails including tram rails – at regular intervals)	immediate	F S M	C
Night-time flight restrictions for airports close to cities between 10 p.m. and 6:00 a.m.	short-term	F S	F S
Air traffic noise limits for airports during the day (setting a noise exposure limit based on parameters such as noise level, expansion zone and number of inhabitants affected)	mid-term	F S	S
Noise reduction through soundscaping in residential areas and green spaces by acoustically designing the environment	immediate	S M	S M
Structural noise protection according to VDI (Association of German engineers) standard 4100 will reduce noise immissions resulting from traffic and neighbourhood where active noise protection is insufficient	immediate	F S M	S M

immediate; short-term; short- to mid-term; mid-term; EU; Federal; Federal state; municipality; company

4 Expanding active mobility networks

The proportion of pedestrian and cycle paths in cities is slightly increasing, but many people still do not walk or cycle, although this type of active mobility has everything going for it. It is healthy and quiet, producing neither noise nor greenhouse gases nor air pollutants. It also uses far less space than car traffic.

Therefore, Tomorrow's Cities must make walking and cycling attractive by providing a comprehensive, safe and closely connected network of footpaths. Appealing building design, many pedestrian routes through green spaces, good lighting, accessibility for the disabled, good maintenance of pedestrian routes and safe road crossings are all part of it. Developing and implementing communal pedestrian strategies in connection with a pedestrian funding programme not only makes sense, but is absolutely necessary and must be integrated in a communal transport and urban development concept. Pedestrian-friendly shared spaces will make sure that the simplicity and joy of walking will appeal to many people.

Cycling, too, must become safer with easier and more direct routes. More people will be attracted to cycling if there is a convincing route infrastructure, featuring a comprehensive network of direct, comfortable and safe cycle routes. Extra efforts must be made to make road junctions safe. However, a network of routes is not sufficient, but must be complemented by safe, secure and accessible cycle parking in residential, work and shopping areas as well as access points to public transport and car-sharing stations. Cycle parking should not only be practical, but fit in harmoniously with the cityscape.

Commuters can travel not only by car and public transport, but also by bicycle. Developing cycle superhighways that are largely intersection-free will create convenient connections between frequently visited places as well as proper commuter routes. Thus, even mid-distance routes between 10 and 20 km can become part of the modal shift from cars to bicycles. E-bikes are predestined for this kind of transport.

With shorter and more direct routes, more people will decide to walk or take the bicycle. Thus, a city of short distances will massively contribute to healthy, active mobility (measures bundle 1). A regular speed limit of 30km/h and traffic-calming measures such as shared spaces make cycling and walking easier (measures bundle 3).

Active mobility may also be promoted by new mobility services and attractive public transport offers. The synergies (measures bundles 4 and 5) generated by both could be harnessed by meticulous planning to coordinate the various networks. People will be prepared to include a journey on foot or by bike and leave their own car at home, as long as they can reach their final destination quickly and comfortably by bus, train or a car hired on their smartphone.

While active mobility is encouraged by other measures bundles, it, in turn, will enhance the deployment of those measures. For instance, more active mobility results in less car traffic and a lower long-term demand for precious and expensive parking space. This, in turn, makes compact building with more green spaces (measures bundles 1 and 2) possible. These effects demonstrate that a desirable, future-proof city could not exist without active mobility.

 Individual measures **Expanding active mobility networks**	Time frame	Decision	Implementation
Establishing a comprehensive, safe, attractive and direct pedestrian network, making use of supporting funding from the Federal Government and the Federal States	short-term	F S M	F S M
Amending the Road Traffic Regulations by adding pedestrian-friendly shared traffic spaces	short-term	F S	S M
Expanding cycle route infrastructure to create a comprehensive cycle route network that complies with the Road and Transportation Research Association (FGSV) recommendations for cycle routes.	short- to mid-term	S M	S M
Providing suitable bicycle parking facilities (including parking for e-bikes, well adapted to the cityscape) in residential, work and shopping areas as well as access points to public transport, car-sharing points and service stations.	immediate	S M	S M
Expansion of largely intersection-free cycle superhighways, connecting essential destinations (commuter routes)	short- to mid-term	S M	S M

immediate; short-term; short- to mid-term; mid-term; EU; F Federal; S Federal state; M municipality; C company

5 Encouraging integrated mobility services and e-mobility

Nobody needs a crystal ball to predict that mobility in cities will change completely – change is already happening – a complete shakeup of urban transport systems.

New service providers offer online information, booking and payment systems that make multimodal travel easier. Such services include car-sharing, bicycle and e-bike rentals as well as car-pooling. Local booking systems make vehicles simply and easily available nearly anywhere (measures bundle 9), with no phoning and shopping around or visiting car rental places. Journeys need not be planned long in advance with a rigid timeframe.

In Tomorrow's Cities, owning a car will be the exception, and, whenever a car is needed, car-sharing services will provide an emission-free, electric vehicle. A drop in private car ownership will reduce the need for public car parking space. The areas that are freed can be used for social encounter and leisure, for more green spaces and water bodies or as pedestrian or cycle routes.

Tomorrow's mobility will be characterised by car-sharing, active mobility and public transport. A car density of 150 vehicles per 1000 inhabitants will be sufficient to meet transport needs within the city.

However, such innovations are often held back by the existing legal framework. A comprehensive revision of the Passenger Transportation Act (PBefG) is indispensable. A revision must ensure that alternative and flexible services such as call a bus-services or shared taxis become the rule, while making sure that there is fair competition in the taxi business and the integration of public transport and car-pooling is supported. As a matter of principle, car-sharing should have priority over individual transport.

The "Energiewende" (energy transition) in the transport sector is a prerequisite for clean, quiet and carbon-neutral transport. Only electric vehicles should be permitted in cities. In the long term, their electricity should come from renewables only, while internal combustion engines are gradually phased out from the city centre and eventually banned from the whole city.

To set the right incentive for such an "Energiewende", the promotion of e-mobility must be underpinned by a long-term funding programme that covers all modes of transport. It will ensure that urban bus and car-sharing fleets will be emission-free to strengthen ecomobility (measures bundle 6). It will promote the electrification of urban logistics with goods being delivered quietly and without pollution (measures bundle 7). Other non-road mobile machinery and equipment, such as building machinery, will also be switched to electric or partially electric operation. If combustion engines are to be banned from cities, electromobility must be flanked by measures controlling motorised traffic (measures bundle 8).

Electromobility relies not only on electric vehicles, but also on a tight and reliable network of charging facilities. Establishing charging stations in public areas only will not be sufficient, as they must become part of modern planning routine when designing new housing, commercial and industrial estates. E-bike charging must also become part of urban planning. In order to ensure the most efficient form of energy transmission, public transport systems with overhead wiring or quick-charging systems will receive preferential funding.

Electromobility generates many synergies in conjunction with other measures. At low speed, electric vehicles are significantly quieter than those with combustion engines (measures bundle 3). Electrification will further boost the environmental credentials of public transport (measures bundle 4). Above all, cities no longer need to provide expensive car parking space – a prerequisite for qualified inner-urban development, which, in turn, will ensure the development of compact, mixed-used cities (measures bundles 1 and 2).

 Individual measures **Encouraging integrated mobility services and e-mobility**	Time frame	Decision	Implementation
A fundamental **revision of the Passenger Transportation Act** (PBefG) and relevant by-laws and regulations to enable the introduction of novel mobility services	short-term	F S	S
Preferential treatment of car-sharing over individual car transport (e.g. by revising regulations regarding civil service, tax and insurance legislation)	short-term	F S	F S
Initiating an integrated programme promoting e-mobility that facilitates investment in the electrification of public transport and car-sharing fleets, communal vehicles and trucks, non-road mobile machinery and equipment	immediate	F S	M C Private individuals
Integrating intelligent charging infrastructure for e-cars, e-trucks and e-bikes when planning housing, commercial and industrial estates by amending the BauNVO (Land-Use Ordinance)	short-term	F	S M
Preferential funding for public transport systems with overhead wiring such as trams and trolleybuses or buses with quick-charge systems.	immediate	F S	M competent local authority

immediate; short-term; short- to mid-term; mid-term; EU; Federal; Federal state; municipality; company

Improving public transport quality

Alongside pedestrian and bicycle traffic, public transport will be the backbone of tomorrow's environmentally friendly mobility. Buses, trams, underground and surface rail systems, regional trains and ferries are all tried and tested means of transport within a city. They aggregate demand – in other words, many people wanting to travel roughly the same route at roughly the same time can share a vehicle. Public transport makes efficient use of space and energy and is safe and cost-effective. In Tomorrow's Cities, all public transport vehicles will run electric and be quiet, non-polluting and carbon-neutral (measures bundle 5). Environmental standards for air pollutant and noise emissions must be developed further and implemented for the purchase of buses and trains. This could be supported and speeded up by using Blue Angel badge criteria.

The appeal of public transport must become so strong that buses and trains are the most obvious choice for travelling distances too far for walking or cycling, rather than private cars. Public transport must therefore be a reliable, accessible and comfortable way for people to reach their destinations. Services must run frequently with a network that gives access to remote parts of the city and its surroundings, while relevant information is well presented and comprehensible. Separate lanes and tracks for buses and trains ensure that connections are fast and reliable.

As communal funding of public transport in Tomorrow's Cities will be secure, ticket prices can be kept low, which, in turn, further enhance the appeal of buses and train. Further innovative transport services could be harnessed to facilitate multimodal mobility and complement public transport where it could otherwise not operate efficiently (measures bundle 5).

People tend to use mobility services more often if they meet their needs and expectations. This is why participation in decision-making and transparent decision processes are crucial for the further development of networks, routes and frequency of services. Participation in transport development planning gives users an active role in planning their public transport services. New digital citizen participation platforms facilitate their involvement (measures bundle 10). At the same time, the increasing digitisation of public transport helps to develop services that accommodate the needs of users (measures bundle 9).

Good, user-centred transport services require reliable long-term funding. The 2019 amendment of the Municipal Transport Financing Act (GVFG) must therefore be complemented by increasing regionalisation funds. These funding instruments are crucial, as they lay the foundation for high-quality public transport. Both GVFG and regionalisation funds must have clear criteria to allow funding to be allocated according to quality of service and environmental impact. The Blue Angel badge could provide some orientation.

As the public transport replacing private cars-policy succeeds, less traffic space will be needed and areas can be reclaimed, opening up new opportunities for qualified inner-urban development (measures bundles 1 and 2). Higher urban density also helps the efficiency of public transport.

An increase in public transport, however, may increase noise levels. Preventative steps must be taken to counteract such negative effects. The buses used in the future will be electrically powered and be substantially quieter than conventional diesel buses. In addition, public transport will largely replace the use of private cars and thus contribute to noise mitigation (measures bundle 3).

 Individual measures **Improving public transport quality**	Time frame	Decision	Implementation
Amendment of a new Municipal Transport Financing Act (GVFG) to include environmental and quality-of-service criteria to secure long-term funding	short-term	F	S M
Increased regionalisation funds to be allocated on the basis of environmental criteria and quality of services to secure long-term funding	short- to mid-term	F S	S
Further development and **application of environmental standards** (energy consumption, CO2-emissions, air pollutants and noise) **and accessibility criteria when purchasing new vehicles for public transport** (using Blue Angel Badge standards if appropriate)	short-term	F S M Also under EU	S M C
Further development of public transport through participation of users and **transparent decision-making processes**	short- to mid-term	S M	S M C
Installing separate lanes and tracks for public transport where needed and road width allows for it	short-term	S M	S M

immediate; short-term; short- to mid-term; mid-term; EU; Federal; Federal state; municipality; company

7 Making commercial traffic within the city environmentally friendly

Commercial traffic is not usually considered to be the main cause of air pollution and noise, but it is a source of emissions that cannot be neglected, for several reasons. In comparison to its mileage, its contribution to emissions in the city is disproportionate. It also is a significant emitter of greenhouse gases. As more and more people order goods online and receive deliveries, courier, express and parcel services will continue to increase and add to the environmental burden of commercial traffic in the city.

In order to keep pollution to a minimum and goods traffic flowing on the roads, innovative and sustainable concepts and technologies for urban logistics must be developed.

In Tomorrow's Cities, freight and goods will be directed into micro-depots and consolidated in urban distribution centres, thus shortening travelling distances. Goods may even travel the last mile on (electric) cargo bikes or electric goods vehicles. Another form of consolidation may come as parcel boxes on private grounds, where parcels could be safely delivered if recipients are not at home. This would save double or triple journeys. As micro-depots and parcel boxes would be provided by private companies, incentives could be given by funding programmes to implement such concepts.

However, complementary communal concepts must be developed that embed freight traffic in an overall urban transportation and development strategy. Often, commercial traffic only plays a minor role in urban development. Consolidation of urban freight traffic and shifting on smaller vehicles fit in seamlessly with the complementary concept for long-haul traffic, known as slow logistics, which aims at combining journeys to the same destination to use resources more efficiently and avoid extra journeys. This may slow down the delivery of some goods, but will make traffic as efficient as possible.

In a city fit for the future, electric vehicles must be used to supply goods and services, to dispose of waste and for journeys to and from building sites. This means that electric vehicles get funding priority (measures bundle 5). E-bikes and e-cargo bikes may be a viable alternative to cars and vans for tradespeople, repair and nursing services. Here, too, target-oriented funding would facilitate change.

Transporting fewer goods in vehicles with internal combustion engines will reduce noise exposure, greenhouse gas and air pollutant emissions. It would represent a major step towards the EU target of achieving 'zero emissions' city logistics in major urban centres by 2030. Certified, particularly quiet vehicles, machines and processes could be used for retail delivery near residential areas. This could even happen at night, as long as the noise limits are adhered to. This would reduce times of congestion as well as fuel consumption of delivery vehicles and avoid competition for space from other road users. As a side effect, the use of electric cargo vehicles (measures bundle 5) would become more attractive.

As a short-term measure, heavy goods vehicles (HGVs) must be directed along routes that will have the lowest environmental impact (measures bundle 8). Beyond those routes, modern, IT-supported routing systems could find the least damaging route to the destination. These systems must have access to the latest maps and traffic data, including temporary restrictions, and must be available to satnav systems (measures bundle 9).

Environmentally friendly and efficient logistics concepts that require less storage space, reduce superfluous journeys and avoid motorised traffic in city centres will add to quality of life in cities (measures bundle 2). Vice versa, urban logistics also benefits from the other measures. Thus, the support of active mobility (measures bundle 4) creates a cycle route network that can be used by cargo bikes. In addition, compact cities lend themselves to consolidated distribution with short travel distances (measures bundle 1).

 Individual measures **Making commercial traffic within the city environmentally friendly**	Time frame	Decision	Implementation
Encouraging consolidated, localised solutions for environmentally friendly last-mile deliveries by courier, express and parcel services and relevant logistics concepts for municipalities.	short-term	F S M	M C
Certification of low-noise vehicles, equipment and processes for last-mile distribution to retailers close to residential areas and adhering to existing noise limits	short- to mid-term	F	M C
Funding programme for (electric) cargo bikes in commercial individual transport, in particular for tradesmen and nursing services	short-term	F S M	C
Definition of a guided route system for HGVs in cities	immediate	M	M

immediate; short-term; short- to mid-term; mid-term; EU; Federal; Federal state; municipality; company

Managing motorised traffic

Tomorrow's Cities will no longer be dominated by private car traffic, but shared more equally between pedestrians, cyclists, public transport and e-car-sharing. Cars will continue to be part of city life, but consistent management of car traffic will be necessary to keep it in check so that its environmental impact can be reduced, while other, more future-proof alternatives can establish themselves on the market.

Many of the regulatory instruments are not new, but have often not been used to their full potential. Most follow a simple principle – most car drivers are price-sensitive. If driving into the city centres or parking there becomes very expensive, they will leave their car at home and use alternative transport modes instead.

Such economic instruments include comprehensive, demand-driven parking management and distance-based road charging, also on city roads. They reflect the real costs of road traffic and enhance the appeal of ecomobility.

Distance-based road charging also on city roads may include environmental criteria (greenhouse gases, air pollutants and noise) as well as traffic parameters (location, time, congestion, speed) in pricing. Thus precise regulation according to the polluter-pays principle will be possible. Based on smart city concepts, parking management and effective road pricing systems will be developed to achieve the best possible ecological benefit for inhabitants (measures bundle 9).

Access restrictions to certain city areas may also lower pollution and can be implemented in the short term. Such restrictions could be based on existing low-emission zones which could be turned into low or zero-carbon zones in the mid-term, where only electric vehicles are allowed and internal combustion engines are banned.

Environmentally and socially compatible changes to commuters‘ tax allowances are also brought up in the debate. Such changes would make long commutes financially less viable and counteract urban sprawl. However, if used consistently, existing simple regulatory instruments, such as speed checks and issuing parking tickets, can also be very effective, but would require investment in personnel and technology.

The measures suggested would put an end to environmentally damaging subsidies and translate the environmental damage from motorised traffic into monetary terms, and directly manage traffic according to the ‚polluter pays principle'. Thus, this measures bundle can achieve many positive synergies with other fields of action. Low- or zero-carbon zones can be an incentive for electromobility, while parking management may speed up the distribution of charging points (measures bundle 5).

However, the past has shown that traffic management measures in particular can trigger evasive behaviour. For instance, shoppers will no longer visit regulated city centres, but use out-of-town shopping centres, reinforcing negative impacts on out-of-town areas such as noise exposure and air emissions. Such possible negative effects can be prevented by coordinating urban and regional planning as well as attractive city centres and public traffic services in the region (measures bundle 10).

Individual measures **Managing motorised traffic**	Time frame	Decision	Implementation
Developing and expanding parking management based on Federal State legislation for country-wide provisions and minimum pricing of parking facilities, including bus and high quality bicycle parking space	short-term	S M	M
Environmentally and socially compatible changes to commuters' tax allowances to counteract urban sprawl	mid-term	F S	S
Introducing **distance-based and polluter-targeting road charging** in all parts of the city and for all motorised traffic (taking into account environmental and traffic criteria)	short- to mid-term	EU F S	F S
Access restrictions for certain types of motorised vehicles according to environmental criteria such as air pollution, greenhouse gases (e.g. low-emission zones or zero emission zones)	short-term	F S M	M
Consistent supervision of all flowing and stationary traffic and **enforcement of the Road Traffic Act (StVO)** using more personnel and technology.	immediate	S	S M

immediate; short-term; short- to mid-term; mid-term; EU; Federal; Federal state; municipality; company

9 Exploiting digitisation for the benefit of the environment

Digitisation has become part of our daily lives and will shape the future of our cities.

Smart city approaches will become increasingly important in organising urban life. This applies to technical infrastructure, buildings and services as well as traffic and administration. Smart city concepts rely on the coordination of different aspects through innovative management systems and networks.

Usually, digitalisation is driven by companies introducing innovative business models which are likely to shape the future of our cities and mobility. Digitisation offers new opportunities for future-proof reorganisation of mobility in the city, but may also compromise data protection and security of data as well as lead to heavy reliance on particular IT systems. However, the challenge lies in generating a framework that maximises the ecological benefit, but minimises the risks and uncertainties associated with digital networks.

Digitisation in the traffic sector is closely connected to other measures bundles, as new services provide information on multimodal routes and enable users to book car-sharing vehicles and rented bicycles (measures bundle 5). To make multimodal travel available for all, integrated ticketing, e.g. using a smartcard, would be an advantage, with no need to make separate bookings for public transport and car-sharing services. This would make modal shift easier.

It is crucial that smart mobility options are not only fast and convenient, but also sustainable. They should help to reduce pollution and noise, protect resources and add to energy efficiency, all of which add to a better quality of life in the city. Digitised systems, for instance, can help to steer the flow of freight traffic, keeping HGVs out of residential areas at night-time through intelligent routing (measures bundle 7). Intelligent transportation systems provide the infrastructural backbone.

Will the cars of the future even need a driver? From today's perspective, there are still some technological as well as legal issues to be sorted before autonomous vehicles will be on our roads.

One thing is certain – even if all cars in our cities are driverless, this will not necessarily mean less traffic and less environmental pollution. However, driverless vehicles, used under the right conditions, can reduce car traffic in cities (measures bundle 5). Electric shared cars (robot taxis) that have been booked could drive autonomously to the client's doorstep, making picking up and bringing back the cars superfluous.

Such a service would enhance the appeal of car-sharing, make better use of available cars and reduce the need for parking space. This could be complemented by autonomous buses and trains systematically reducing energy consumption and operational costs in public transport (measures bundle 6), provided that a framework exists to ensure that public transport has a higher share in city traffic than robot taxis.

Comprehensive digitisation has an effect not only on vehicles and traffic services, but opens up new forms of communication and participation. Cities fit for the future can enhance the planning process by including their citizens in the early planning stages (measures bundle 10). This would allow active mobility networks (measures bundle 4) and public traffic routes (measures bundle 6) to accommodate the wishes and expectations of users.

In order to use the potential of digital concepts for environmentally friendly traffic, municipalities need consistent support. For instance, open access to data on traffic surveys and models would facilitate sustainable urban mobility planning, achieve transparency and give rise to new business models (measures bundle 5). This can be achieved by creating a legal framework and involving all stakeholders – be they companies with a commercial interest or users of smart services.

Individual measures **Exploiting digitisation for the benefit of the environment**	Time frame	Decision	Implementation
Setting an ecological framework for self-driving vehicles in public transport, car-sharing and private cars in order to improve quality of life in cities and enhance environmental compatibility	short-term	F S M	F S M
Including **environmental criteria** in the development, support and implementation of **smart city concepts**	immediate	F S M	M
National open city data initiative to encourage the collection of data on traffic and city development, initiating central surveys at Federal State level	short- to mid-term	F S	S M
Building intelligent transportation systems, including relevant infrastructure	mid-term	F	F S M
Improving multimodal services by support programmes, focusing on integrated ticketing across all modes of public traffic	short-term	F S	F S Where possible with EU funding

immediate; short-term; short- to mid-term; mid-term; EU; Federal; Federal state; municipality; company

Fostering participation and collaboration in planning and implementation

The conventional perception that those in power decide and people must put up with their decision is now clearly outdated. Planning and decision processes can be made transparent and comprehensible in an open and modern society. Citizens are kept informed from an early stage and invited to take part. Transparency means the exchange of arguments, objections and opinions at a stage when final decisions have not yet been made and options are still open. Citizens as well as entrepreneurs, associations and other organisations can be involved in the decision-making process.

Cities are complex systems, comprising various interconnected infrastructures that enable life in an urban region. Participation is key to life in tomorrow's cities, as decisions have to be taken that affect people's lives directly. However, it is also true that whenever a large new infrastructure project is being planned, citizens will protest. In other words, planning procedures and participation must meet higher standards today than 15 or 20 years ago.

A mutual exchange of views requires trust between all parties involved. Trust does not just emerge by itself, but must be worked upon, by establishing clear decision criteria, transparency of the decision process and comprehensive involvement of the public – including people from all walks of life and their representatives.

Digitisation is an important instrument to enable participation. New digital tools and platforms provide new opportunities to involve the public that did not exist before and should be harnessed consistently in a city fit for the future (measures bundle 9). Without a culture of participation, it will be very difficult to create a future-proof urban environment that not only protects the climate, mitigates emissions and reduces travelling distances, but is also accepted and appreciated by its inhabitants.

There are enough instruments to choose from – informal dialogue forums could be used alongside official planning and permission routes, especially when it comes to neighbourhood issues such as urban gardens. Experimental spaces such as urban transition labs can help in the planning of complex, controversial projects. In an urban transition lab, certain measures and their effects can be tried out in a small space for a limited time to see whether they stand the test of everyday life. Here, various planning options can be tested, which is especially important for interconnected projects such as those bringing urban development and innovative ideas on housing and mobility together.

Not only participation, but also cooperation within and across municipalities will help to deliver an integrated regional, urban and transportation development policy. Especially sustainable urban mobility plans have proven to be a useful way of lining up the objectives of overlapping policies and sectors as well as different administration levels. Open access to data from traffic surveys and traffic models enhances sustainable urban mobility planning (measures bundle 9).

Early involvement in all steps of the process will ensure that planned measures are more widely accepted, which heightens their chances of being implemented, e.g. in traffic management (measures bundle 8). Planning can be improved substantially by applying such open decision processes. For instance, early involvement in the planning of public and green spaces can result in a more effective use and vitalisation of such places (measures bundle 2). Pedestrian and cycle routes can be planned to accommodate users' wishes and needs (measures bundles 4 and 5). Digitisation and smart city concepts facilitate and accelerate participation processes and should therefore be consistently used throughout (measures bundle 9).

 Individual measures **Fostering participation and collaboration in planning and implementation**	Time frame	Decision	Implementation
Expert as well as financial support for **using informal processes and instruments to prepare and support formal planning procedures** (e.g. forums, dialogues, networks, communal and regional development concepts, sustainable urban mobility plans)	short-term	F	M Regions
Creating experimental grounds and platforms to try out new forms of **participation and empowerment** of various stakeholders **in the city development process**	short-term	F S	M
Mutual information, collaboration and harmonisation between neighbouring cities as well as cities and their hinterland when planning and implementing projects	immediate	F	M Regions
Dialogue process on how to best **exploit the potential of urban gardens** and their social and ecological benefits	short-term	F	F S M

immediate; short-term; short- to mid-term; mid-term; EU; Federal; Federal state; municipality; company

Tomorrow‘s Cities

The Next Steps

Overview of measures

Immediate

- Introduction of a new land-use category to the Land-Use Ordinance to promote inner-urban development and economic land use.
- Further development of the Federal Spatial Planning Act by introducing quantified criteria on the reduction of land use.
- Establishing continuous funding scheme for urban green spaces
- Increasing enforcement of noise and speed limits
- Funding for low-noise road surfaces
- Consistent use of noise mitigation in rail infrastructure maintenance
- Noise reduction through soundscaping
- Structural noise protection according to VDI (Association of German Engineers) 4100
- Providing suitable bicycle parking facilities
- Initiating an integrated programme promoting e-mobility
- Preferential funding for public transport systems with overhead wiring
- Definition of a guided route system for HGVs in cities
- Enforcement of the Road Traffic Act (StVO) in flowing and stationary traffic
- Environmental criteria for smart city concepts
- Mutual information, cooperation and harmonisation between neighbouring cities as well as cities and their hinterland when planning and implementing projects

2017 — 2020

Short-term

- Incorporating qualified inner-urban development in urban planning legislation
- Making car park regulations more flexible
- Funding from the urban development promotion programme should increasingly be used for reclaiming oversized roads and car parks
- Introduction of a mandatory case-by-case preliminary environmental audit
- Funding of urban green spaces must be increased in urban development promotion programmes
- Model projects and campaigns for integrating green and blue infrastructure into urban planning
- The Federal Government must lead by example and improve green spaces on existing properties as well as new building projects
- Identifying quiet areas in cities
- Introducing a regular speed limit of 30km/h in cities in Städten
- Amendment of Road Traffic Legislation in order to give municipalities more decision power on regulating speed limits
- New limits for tyre and vehicle noise
- Night-time flight restrictions for airports close to cities between 10 p.m. and 06:00 a.m.
- Establishing a comprehensive, safe, attractive and direct pedestrian network
- Amending the Road Traffic Regulations by adding pedestrian-friendly shared traffic spaces
- A fundamental revision of the Passenger Transportation Act

Short to mid-term

- Concentration of settlement developments at existing settlement centres and along settlement axes
- Developing quantitative and qualitative standards for providing green and open spaces
- Developing standards for accessibility and the adaptation of public spaces to the needs of all users
- Promoting green roofs and walls on buildings and other structures
- Expanding cycle route infrastructure
- Expansion of largely intersection-free cycle superhighways
- Increased regionalisation funds to be allocated on the basis of environmental criteria
- Further development of public transport through participation in decision-making processes
- Certification of low-noise vehicles, equipment and processes for last-mile distribution
- Distance-based and polluter-targeting road charging
- National Open City Data Initiative

Mid-term

- Air traffic noise limits for airports
- Environmentally and socially compatible changes to commuters‘ tax allowances
- Building intelligent transportation systems

2025 **2030**

- Preferential treatment of car-sharing over individual car transport
- Integrating intelligent charging infrastructure for e-cars, e-trucks and e-bikes when planning and refurbishing housing and commercial buildings
- Amendment of a new Municipal Transport Financing Act (GVFG) to include environmental and quality-of-service criteria
- Application of environmental standards and accessibility criteria when purchasing new vehicles for public transport
- Separate lanes for public transport
- Encouraging consolidated, localised solutions for environmentally friendly last-mile deliveries
- Funding programme for (electric) cargo bikes in commercial individual transport
- Developing and expanding parking management
- Access restrictions for certain types of motorised vehicles according to environmental criteria
- Setting an ecological framework for self-driving vehicles
- Improving multimodal services by support programmes
- Using informal processes and instruments to prepare and support formal planning procedures
- New forms of participation and empowerment in the city development process
- Starting a conversation on how to use the potential of urban gardens

Fewer cars in the city would have many advantages, including less noise, fewer emissions and greenhouse gases, less land use for parking and roads, but much space for green recreational areas

Value added for people

Noise, poor air quality, restricted space and stress – many of the downsides of life in the city are caused by steadily increasing road traffic. When analysing the ten measures bundles and the synergies and conflicts of interest they may cause, it became clear that many measures have similar objectives, as they try to solve problems in today's cities by reducing private car traffic significantly.

Fewer cars in the city would have some clear advantages - less noise, fewer emissions and greenhouse gases, less land use for parking and roads. Instead there would be more space for green recreational areas, public spaces and the creation of an ideal compact, multi-functional city. In other words, a city with less car traffic allows for a quieter, better, healthier and more pleasant lifestyle.

For these synergies to bear fruit, a city fit for the future should focus on reducing its share of cars to 150 cars per 1,000 inhabitants.

This is not a utopian objective. Observations indicate that even today, younger people in particular are less interested in owning a car than in reaching their day-to-day destinations quickly and conveniently at a reasonable price.

New apps and internet services are intended to cater for these needs. As public transport and car-sharing will gain in popularity, the number of car-less citizens will continue to increase.

The analysis of the measures bundles also revealed that positive interdependencies between various options largely outweigh possible conflicting interests.

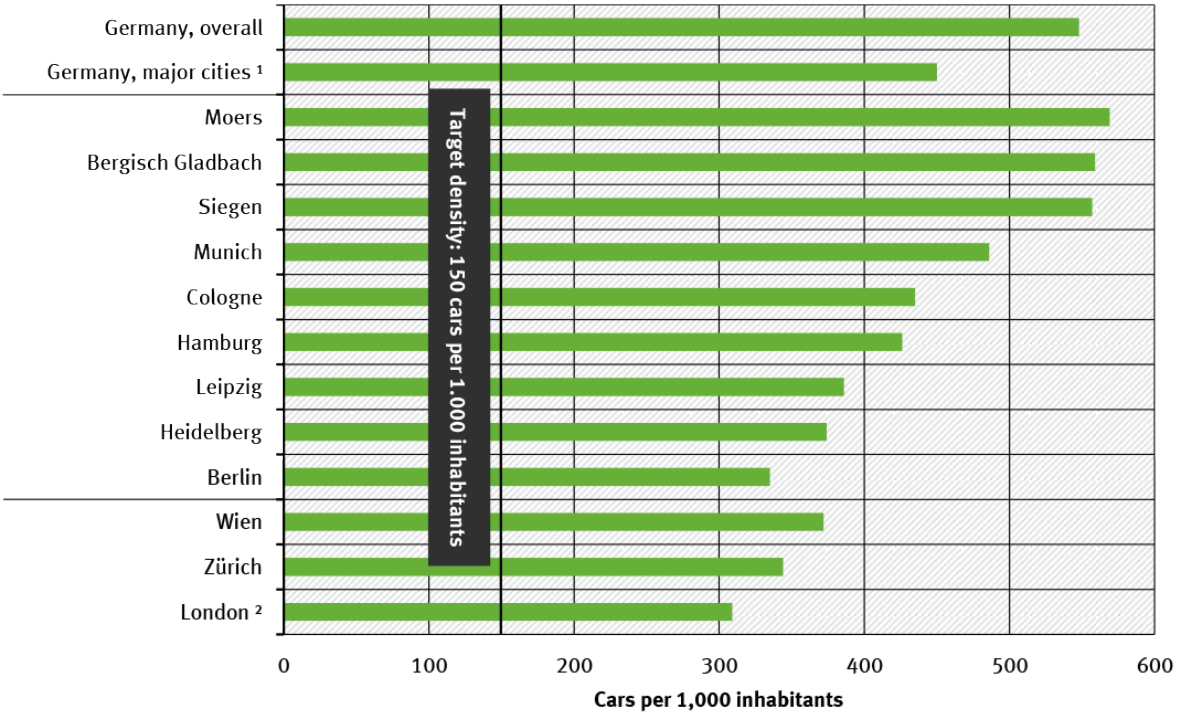
Only positive synergies were found for the measures bundles combination Encouraging integrated mobility services and e-mobility and Fostering participation and collaboration in planning and implementation. In many cases, it was found that combining suggestions and recommendations can be more effective than just one measure in isolation.

This is why it is important to be ambitious and implement the entire bundle of measures as comprehensively as possible to make our vision of the city of the future come true.

E-bikes save space, they are a fast and convenient means of transport – ideal for the city, even over long distances.

Comparison of car density in selected cities and target density

Last updated in 2016



¹ weighted according to number of inhabitants
² Greater London (all city districts)

Sources: Statistisches Bundesamt, 2017; Kraftfahrt -Bundesamt, 2016; Statistik Austria, 2016; Stadt Zürich, 2017; UK Department of Transportation, 2016

Tomorrow's Cities will serve their inhabitants, and participation is at the heart of all planning.

However, six combinations of measures bundles result not only in synergies, but also in conflicting interests. This is true for the densification of city developments and comprehensive noise protection for inhabitants. It is no surprise that in areas where people live and work cheek by jowl, noise levels will rise and noise protection becomes more challenging.

Such conflicts of interest can be resolved. Noise problems can largely be avoided by intelligent planning of inner city densification. Closed perimeter blocks and sufficient distance between noise sources and sensitive living quarters and recreational areas can reconcile both interests. Lowering noise protection levels is not the way forward, as this would impact quality of life in the city. There would not even be a need for it, provided that intelligent planning is in place. Rather than loosening noise protection legislation, it would be far better to balance and think through the measures to be implemented, identifying and using synergies and keeping an eye on resolving conflicts of interest that may arise.

One thing is certain – Tomorrow's Cities must serve their inhabitants and provide an environment that is green, compact, low-noise and mixed-use. This requires careful planning and implementation with participation and approval of inhabitants. True participation begins where people are affected – right at their doorstep, i.e. planning transport systems, creating a green environment, reclaiming derelict land, managing individual car, HGV and air traffic. There is a wide range of views about what life in Tomorrow's Cities should look like. If local authorities are able to regard this diversity as an opportunity rather than a problem, they will be able to transform a vision into sustainable reality, to the benefit of their citizens as well as the environment and climate.

Synergies and conflicting interests										
Implementing compactness and mixed use in cities (1)		⊕⊖	⊕⊖	⊕	⊕	⊕	⊕	⊕⊖	⊕	⊕
Providing urban greenery and open spaces (2)			⊕⊖	⊕	⊕	⊕	⊕⊖	⊕	⊙	⊕
Reducing noise (3)				⊕	⊕	⊙	⊕	⊕	⊙	⊕
Expanding active mobility networks (4)					⊕	⊙	⊕⊖	⊕	⊙	⊕
Encouraging integrated mobility services and e-mobility (5)						⊕	⊕	⊕	⊕	⊕
Improving public transport quality (6)							⊕	⊕	⊕	⊕
Making commercial traffic within the city environmentally friendly (7)								⊕⊖	⊕	⊕
Managing motorised transport (8)									⊕	⊕
Exploiting digitisation for the benefit of the environment (9)										⊕
Fostering participation and collaboration in planning and implementation (10)										

Legend: ⊕ Synergy; ⊙ no significant interaction; ⊖ conflicting interests

Background and sources

Note: Translation of titles in brackets are unofficial to give readers an indication of the content.

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