

A Sustainable Mobility System for Urban Resilience

A case study of Berlin





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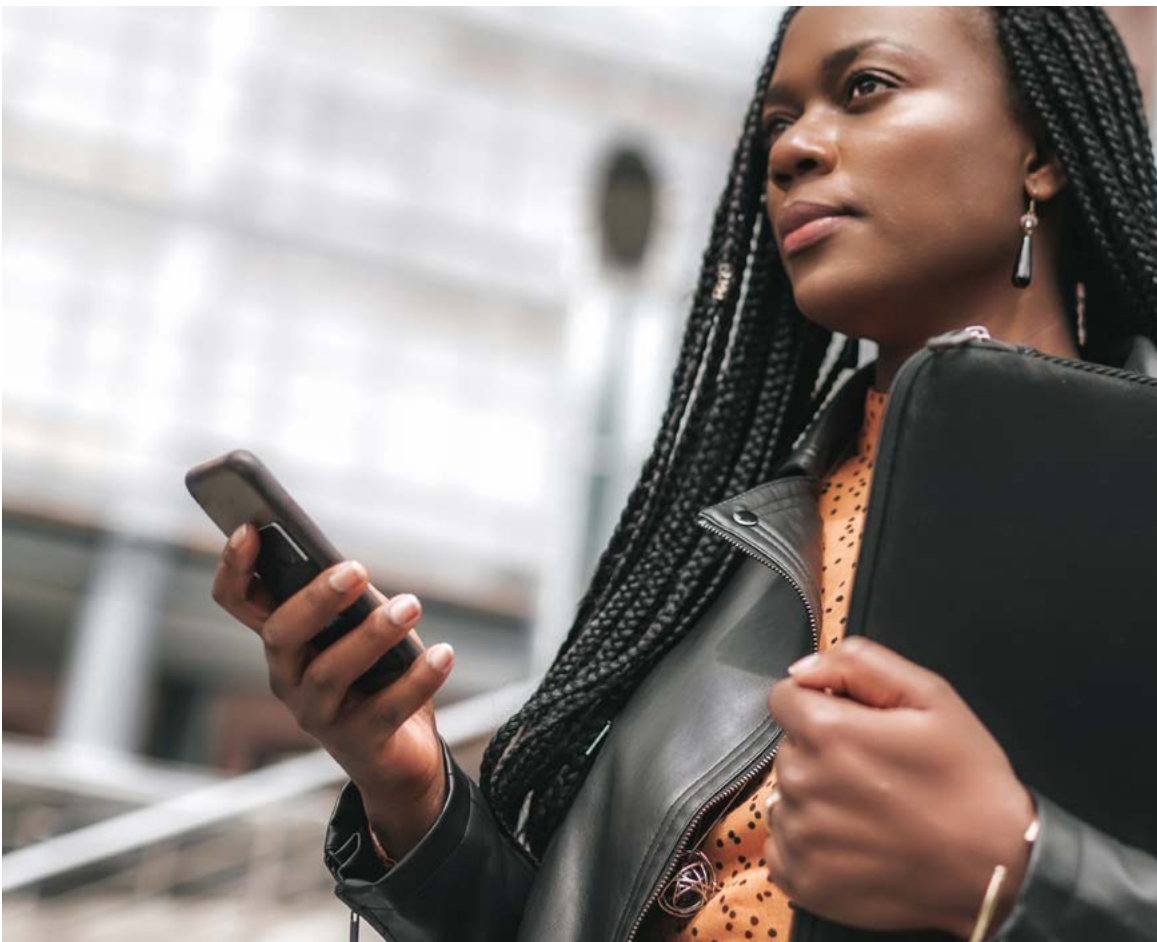
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Integration of key dimensions into strategic action areas for mobility in Berlin

Mobility trends on the near horizon

Digitalization, automated vehicles, and electrification are disrupting the mobility space and can be considered a new starting point for mobility.

Climate change is a call to action for the development of sustainable modes of transportation. As cities are becoming increasingly congested, we are facing the challenge to maintain our mobility systems in a safe, comfortable, and affordable manner. Arcadis works in cities around the world to improve quality of life by creating connected and sustainable mobility that combines existing infrastructure with new and innovative technologies. The following key trends for urban mobility are on the horizon.





Key Trends

Increased sharing and connectivity

The development of connected mobility services is changing the way users view mobility by shifting the behavior from ownership towards “sharing” and a multimodal transportation system. Cities are experimenting with new policies, programs, and partnerships to foster shared mobility. Micro-mobility providers are entering the playing field and Mobility-as-a-Service platforms will provide us a fully integrated offering of different providers. With one subscription, we will have access to a range of mobility options to plan an intermodal journey.

Sustainable and inclusive local offerings

The introduction of mobility hubs can support mixed-use area development and alternative sharing options. Mobility hubs will reduce parking space demand in cities, especially in the denser areas, and stimulate sustainable mobility by providing charging stations and electric vehicles fleets. By considering citizen demands and requirements, mobility hubs can provide a great opportunity for inclusive mobility based on the local demography, the need for accessibility, and household income.

Modernization of public transit hubs

As we are shifting towards an integrated view on mobility, public transportation systems gain in importance. Their commuting capabilities contribute substantially to a city’s sustainability balance. Investments in expansion and modernization of the networks will motivate and encourage citizens to prioritize them as primary choice for transportation services. Transit companies have a crucial role in providing intermodal, high-frequency and high-capacity services in dense urban corridors and provide first and last-mile connections through driverless shuttles.

The “New Normal”

The latest impact on mobility and a challenge for city resilience is the ongoing pandemic. Mobility has been affected as lockdowns, and safety measures are prevailing. We observed a decline in the usage of public transportation because of social distancing. In general, private car usage experienced an upheaval as it was regarded to be a safe means of transport. Active mobility and sharing options, such as e-scooters and bike-sharing, have shown an increase in inner-city mobility. Questions arise to how we adapt our Mobility behaviors and how we will return to a “new normal” in a post-pandemic situation.

Renewable energy

The trend of replacing nuclear and coal-fired power production with renewable sources in Mobility will continue to remain a key force. The future growth of e-mobility depends heavily on the battery prices. Electricity refueling will have to become significantly cheaper than petrol or diesel, and the infrastructure should improve substantially. Hydrogen will become one of the most important alternatives pushing sustainable mobility forward in the coming years.

The Arcadis Cities Program works alongside with the world's most forward-thinking cities on urban transformational programs to improve the quality of life. Like many metropolises, Berlin is facing the challenge to sustainably integrate trends in urban mobility and to adapt existing systems. With urban resilience as a core element, this whitepaper discusses the most important developments and fields of action in the area of mobility for the city of Berlin.





Mobility in Berlin

Berlin is Germany's largest city with almost 4 million citizens and is known as one of the major cultural, political, and scientific centers in Europe.

The city has one of the largest public inner city transportation systems in the world with an extensive public metro and suburban railroad network (S-Bahn and U-Bahn). Berlin central station is one of the most important stations and largest railway hubs of Europe. In 2008, Berlin was one of the first German cities to adopt a low-emission vehicle zone and make emission stickers for cars mandatory. It is a thriving metropolis, committed to become safer, more mobile and climate friendly.

Urban Transformation Plans

Urbanization is still one of the key influencing factors to future mobility concepts and the city life. Projections show that urbanization, combined with the overall growth of the world population, could add another 2.5 billion people to the urban population by 2050 with the existing infrastructure reaching its capacity limits. The UN 2030 Agenda for Sustainable Development developed 17 Goals to make cities and communities inclusive, safe, resilient, sustainable and to build resilient infrastructure and support innovation.

The 5 Key Sustainable Development Goals shown in the figure, focus on improved urban life and incorporate goal setting for mobility in cities. They aim to provide access to safe, affordable, accessible, and sustainable transport systems for all, to develop a resilient infrastructure, to manage natural resources in an efficient and cyclic manner, and to incorporate climate change measures into transport policies and planning.

Following the approach of the UN, the Berlin Urban Development Concept for 2030 is defining eight key strategies to tackle the major challenges the city will be facing in terms of sustainable development between now and 2030. Specific area development projects will incorporate measures for improved mobility as described in the StEP MoVe Program, designed to achieve the mobility goals for 2030. These goals have been formulated around social, economic, and sustainable dimensions – bearing in mind, that future mobility needs to inherit sustainable and resilient solutions that balance both peoples and environmental needs.



Figure 1. SDGs relevant for sustainable development in urban areas

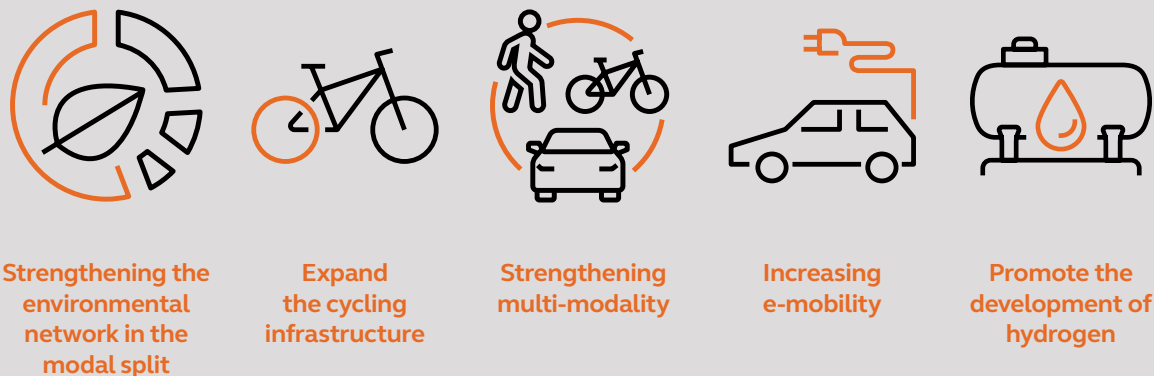


Figure 2. Mobility Goals in Berlin

Mobility Goals

The Berlin city goals for mobility and traffic development are heavily focused around strengthening the environmental network of walking, cycling and local public transport. Berlin sets out to become climate neutral in 2050. It faces the challenge of reducing transport-related CO₂ emissions by 42 percent and reducing vehicle traffic by at least 10 percent in 2030. The mobility measures focus on increasing the environmental network in the modal split to 82 percent by 2030, increasing zero-emission free zones to include the entire city, and aiming for a completely emission free public transportation network.

According to the Berlin's Mobility StEP MoVe Program, the city plans to increase the already rising cycling percentage in the modal split from 13 percent (2015) to 23 percent (2030). Berlin's city authorities plan to invest roughly 6 million euro on a yearly basis to maintain and renovate the existing cycling infrastructure. Besides that, they are committed to further develop and expand the cycling infrastructure by approximately 100 km in fast lanes, touristic cycling routes, and expansion of bicycle parking spaces.

The city aims to reduce the share of private car usage from 25 percent (2015) to 18 percent (2030) by strengthening multimodality and promoting innovative approaches for space-saving and climate-neutral transport. Berlin is considered Germany's main start-up hotspot and has welcomed new mobility solutions. In 2019, mobility start-ups in Berlin received approximately 51 percent of the total capital invested in Germany in the Mobility sector. Many new modes of micro-mobility have become available. Micro-mobility encompasses all electrically powered micro vehicles that can drive a maximum of 25 km/h, which is compatible with the further expanding Tempo 30 plans in Berlin.

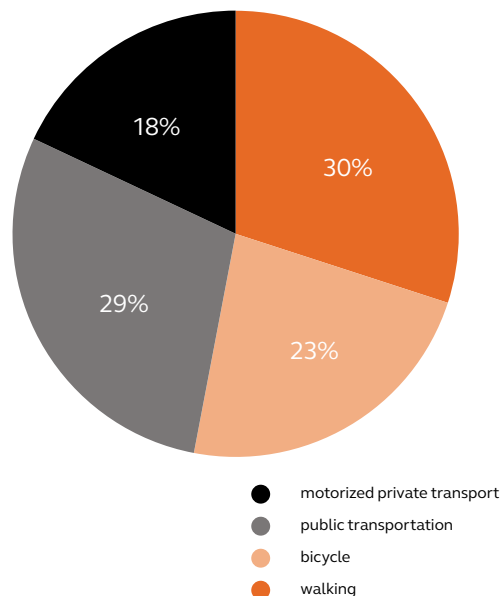


Figure 3. Modal Split aim for 2030: increasing the environmental network in the modal split to 82 percent (Source: StEP MoVe)

According to the Berlin Agency for Electromobility, about 25,000 electric vehicles are driving through Berlin in 2021. The city is planning to increase the number of electric vehicles to between 250,000 and 330,000 by 2030. To meet the charging demand, the number of charging stations needs to increase up to 100,000 charging points in 2030. The city sets out to a complete conversion of the Berliner Verkehrsbetriebe (BVG) fleet. It operates the largest public bus fleet in Germany and transports more than 1 million people with around 1,500 vehicles daily. By 2030, all BVG buses are planned to be converted to e-buses.

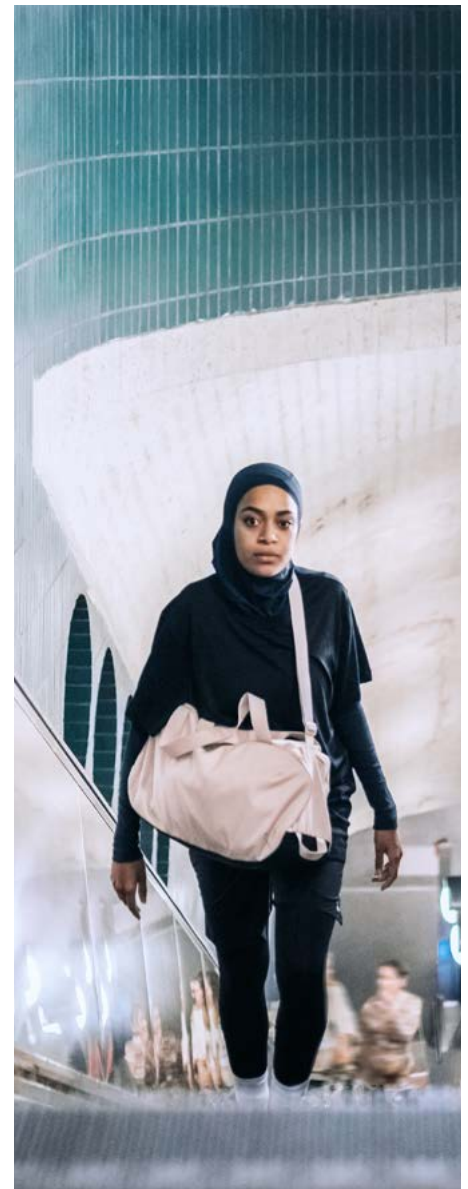
The topic of hydrogen is gradually gaining momentum, but many processes are still at an early stage. The city of Berlin has set up the Berliner Stadtwerke (2013) to produce green electricity from wind power and photovoltaics. The total hydrogen demand in Berlin is expected to be around 9,000 tons by 2025, which compares to roughly 2 weeks of power generation by a wind turbine. On June 10th 2020, the Federal Ministry for Economic Affairs and Energy published the first national hydrogen strategy which outlines the actions for the future production, transport, and further use of hydrogen to achieve the climate goals by 2030.

Mobility in the Pandemic

The pandemic first hit mobility in Berlin in March 2020 as the first incidents were reported and started to increase during that first month. Towards the end of March, the distancing measures were introduced, and citizens were urged to stay at home. This caused a drop of about 80 percent in the usage of public transportation. End of April 2020, Berlin was the latest Federal State to introduce the mandatory wearing of face masks on buses and trains. Public transportation made a recovery to 55 percent towards the end of May 2021.

As an initial response to the pandemic, the usage of micro-mobility sharing services fell sharply in all European cities. The large e-scooter supplier Lime reported a decline in sales of up to 95 percent in Germany. TIER Mobility was the only provider to remain active and launched the “Commute with TIER” program. An alternative that unlocks a monthly pass of free rides to commute with scooters, for commuters who own a public transport subscription ticket. As people became wary of travelling in crowded buses and trains, e-scooters and bike-sharing options experienced an upheaval, vehicles were brought back in stages, and micro mobility providers gained the larger market share in comparison to public transportation.

Active Mobility experienced an increase in the city. Walking gained a boost in popularity, as it became a relieve for people during lockdown periods. Cycling became significantly more popular as a positive side effect of the pandemic. The Berlin Senate responded by installing pop-up bicycle lanes. Bicycle provider Swapfiets experienced a boom in demand of bicycles in the larger German cities during the first quarter of 2020. A survey pointed out that cycling was perceived a better alternative to public transport by new customers who wanted to avoid public transport due to health risks. The sale of e-bikes in Germany experienced an increase of 60 percent in 2020 compared to 2019.



The usage of private cars decreased significantly with 70 percent during the first months of the pandemic. However, in June 2020, private car usage was back to pre-pandemic levels, as it enabled individual mobility in line with the social distancing rules. In Germany, carsharing declined at about 50 percent compared to the average pre-pandemic use. One of the most prominent carsharing providers, WeShare, reported a decline of 61 percent in Berlin in April 2020 compared to April 2019. The effects of the pandemic are believed to have contributed to a growing movement supporting a car-free city, leading to reduced congestion and improved air quality.

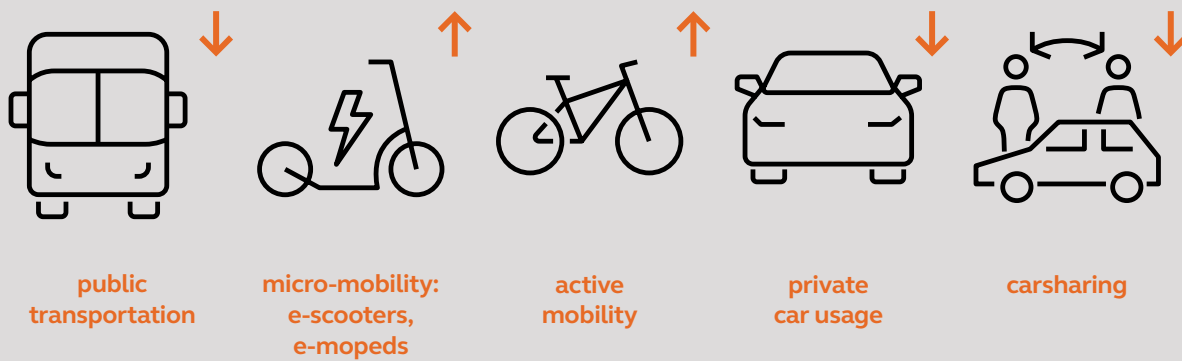


Figure 4. The initial effects of the pandemic of different modes of transportation during the months of April/May 2020

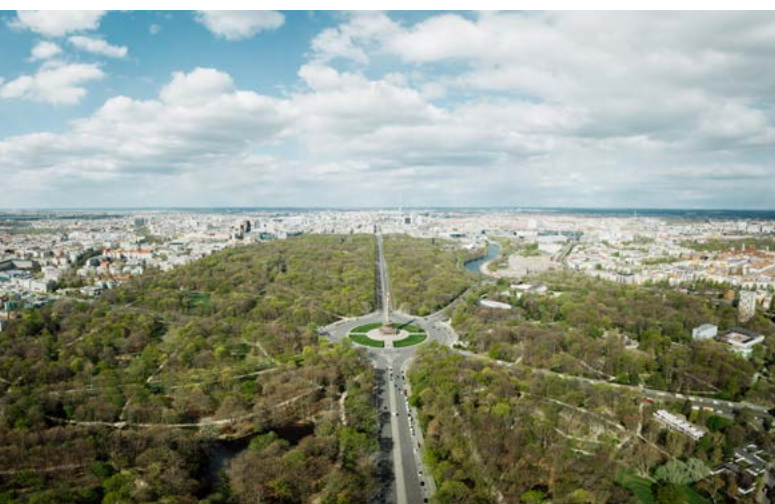
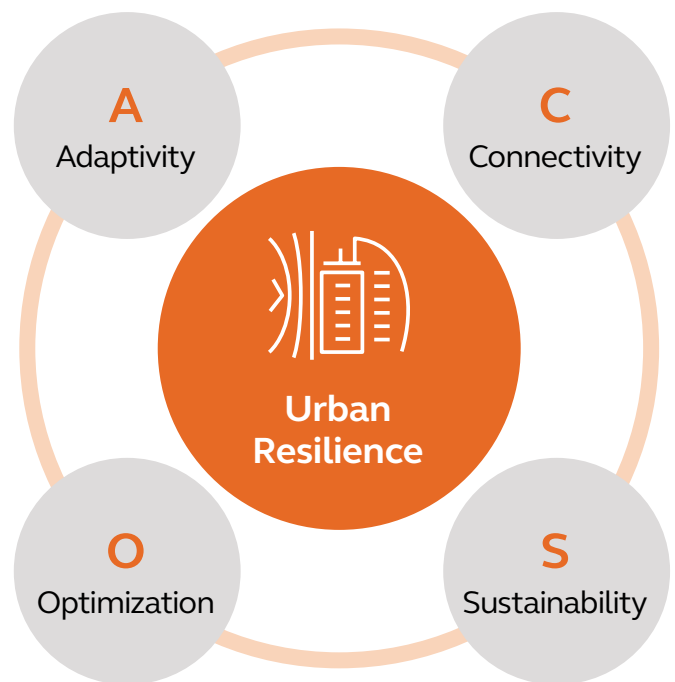




Key dimensions for future mobility solutions

Due to their density and diversity, cities are vulnerable to crises. At Arcadis, we believe that urban resilience makes cities crisis-proof.

Urban resilience allows cities to quickly adapt to new situations as needed. The Covid-19 pandemic challenges the resilience of cities. The investment in a robust and sustainable mobility system with urban resilience at its core helps cities gain a competitive advantage. Our concept of “ACOS” places urban resilience at the core in reviewing urban mobility systems on the following four dimensions:



Adaptivity

Adaptivity responds to human-centric factors and results from institutional structures. Changing mobility behaviors, policymaking for mobility, and the roll-out of new measures are driving factors in adapting the mobility system. Mobility behaviors result from factors such as availability and connectivity, cost of transportation, level of trust, and cultural factors. The institutional structures of a city affect the speed of policymaking and the roll-out of new measures to adapt the mobility ecosystem.

Connectivity

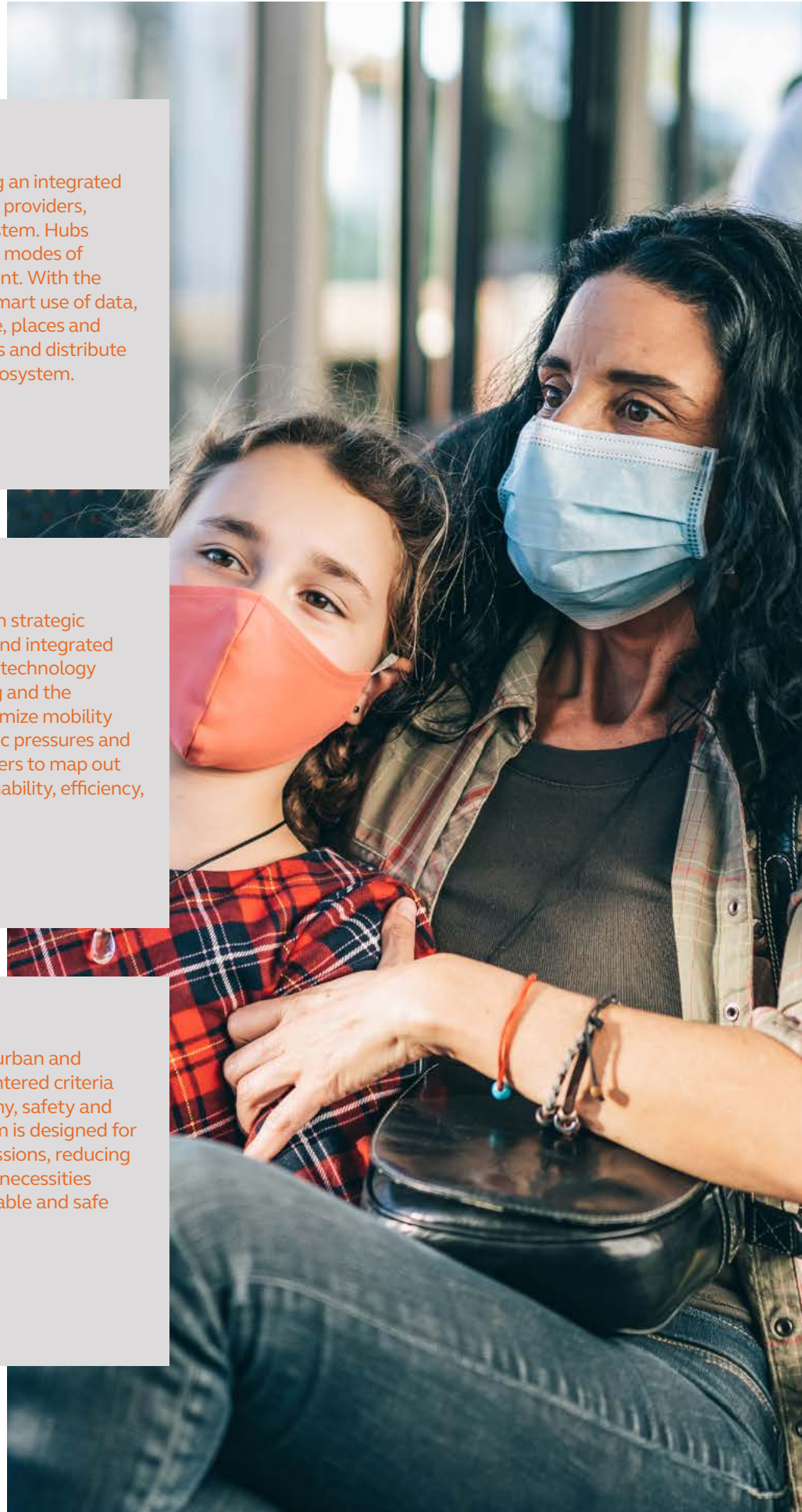
Connectivity is a prerequisite for realizing an integrated mobility system by linking infrastructure providers, vehicles, and mobility users in the ecosystem. Hubs play a crucial role in connecting different modes of transportation in the physical environment. With the development of new technologies and smart use of data, we can ensure the connectivity of people, places and goods across all transport modes in cities and distribute information across the entire mobility ecosystem.

Optimization

The use of data can help optimize cities in strategic decision-making and create a seamless and integrated experience to benefit travelers based on technology and data management. Traffic modelling and the development of new algorithms will optimize mobility management considering real-time traffic pressures and travel hours. Mobility platforms allow users to map out their optimal journey considering sustainability, efficiency, payment willingness and travel time.

Sustainability

Sustainable mobility solutions balance urban and environmental needs. Sustainability-centered criteria are renewable energies, circular economy, safety and inclusivity. A sustainable mobility system is designed for longevity, oriented at reducing CO² emissions, reducing waste, designed to meet the needs and necessities of all target groups, and providing a reliable and safe transportation system.



Action Areas for Mobility in Berlin



Integrated mobility concepts are the starting point for defining a vision for future mobility. Mobility concepts can achieve the intended shifts in the modal split and formulate the measures for future traffic development. By bringing all stakeholders together in a participatory process and aligning their perspectives, a support base for the concept is created. The ACOS concept is used to review the resilience of urban mobility systems and recommending measures for municipalities. Using the ACOS dimensions to review the urban mobility system of Berlin, has led to define three action areas.



Adaptivity



Sustainability

Allowing for more cycling infrastructure

For more than a century, the German automobile industry has been regarded as the most competitive and innovative, and the private car is deeply embedded in the national mobility culture. Even though a private car is only used for 1 hour per day on average, it seems challenging to get car owners out of their private vehicles and switch to greener forms of transportation. In 2018, Berlin passed the “Berlin Mobility Act” which was aimed at improving the infrastructure for cycling and organizing the modal split around active and environmental-friendly mobility. The city has been experimenting with pop-up cycle lanes, which have a high level of acceptance among users, as well as pedestrians and public transport users. However, a lack of bicycle infrastructure, such as bike lanes and storage racks, has impeded the efforts of boosting cycling. The expansion of bicycle lanes and bicycle paths is not yet sufficient to guide cyclists safely and attractively through the streets of Berlin. Currently many cyclists turn to sidewalks as their main cycling path - whilst endangering pedestrians.

The effects of the Pandemic

During the pandemic, cycling is perceived as a safe alternative for urban transportation and caused an increase in the number of cyclists in the city. The city responded with pop-up bicycle lanes and efforts to make them more permanent. The pandemic is underlining the transformation of Berlin away from being a car-oriented city, however, the city is simultaneously experiencing resistance against transformation towards a car-independent city.



Modernizing the public transportation system

Berlin benefits from an established and well-used metro network. However, the city shows low investments in renovating the public transport system and a lack of progress in digitizing public transportation services. The current public transport system can be described as outdated. Stations and rail facilities are still in their original state and do not represent Berlin as a modern city for mobility. Public transit hubs are crucial in connecting the mobility, offering and providing a seamless transfer between intermodal options. Hubs with an intermodal mobility offering, public- and social facilities, a sustainable energy supply, and the integration of digital solutions can become cornerstones of our urban environment. Strengthening the intermodal offering, improved stations and digital solutions for access and platform security can contribute to a reduction in the proportion of private motorized vehicles. The city is planning a modernization of the public transportation system with an investment of 28 billion euros by 2035.

The effects of the Pandemic

For public transportation to remain the backbone of the inner-city mobility system in a post-pandemic Berlin, it is advisable to prioritize investments in an upgrade of the system. With the current awareness around safety, passengers will expect the necessary measures taken for protection, such as protection shields, frequent cleaning of vehicles and sufficient ventilation. Digital solutions can further optimize the protection of passengers by providing real-time information about safety risks and decrease risk levels by smart routing and dividing of passenger volumes over vehicles.



Connectivity



Optimization



Sustainability

Organizing for new mobility providers

As cities become playing fields for many new mobility providers, the question arises how Berlin will maintain its grip on organizing mobility in the city. Shared mobility is seen as a critical component in transitioning to a Mobility-as-a-Service ecosystem, which offers access to the entire range of mobility options in one app and thereby reducing the need for car ownership, making it easier to travel and making the city more attractive for travelers. In addition, it offers cities the opportunity to promote sustainable mobility services. In the decision-making around traffic flows, inclusivity and accessibility, insight into the mobility flows is needed. Through shared data, policy makers could get a better insight into the traffic flows, concentration of (micro-) mobility usage and user groups. In a recently published research into “The opportunities, bottlenecks and practical possibilities of a European data standard for shared mobility operators (Jan 2021)” by the city of Amsterdam, Berlin is regarded as one of the European cities with the largest backlog in data governance and the creation of open data standards for new mobility providers to comply.

The effects of the Pandemic

Challenges around data sharing and unsuccessful adoption in certain cities have led some to doubt the potential of digital solutions. However, Covid-19 has changed the landscape, with an increased willingness among the public to share data if required to ensure safety and reliability, as well as increased enthusiasm for ‘micro mobility’ due to its ease of use and compatibility with social distancing guidelines. Since the onset of Covid-19, we have witnessed a more systematic effort by governments to integrate user data such as for contact tracing apps. It is possible that this newfound positive approach towards data sharing can extend to new services that ensure increased safety of our transportation system, while making it more efficient and reducing emissions.



Adaptivity



Connectivity



Optimization

Summary and Outlook

We present the most important emerging trends for urban mobility, and the way Berlin is incorporating these trends. The city aims to deliver on future sustainability goals by reducing the use of private motorized vehicles and promoting multimodality on an environmental transportation network.

The Covid-19 pandemic has affected mobility in Berlin. It underlined the importance of safety in public transportation, established the position of micro-mobility providers in urban mobility, and exposed a transition away from a car-oriented city.



The pandemic challenges the resilience of cities to adapt to new situations. At Arcadis, we developed ACOS to review an urban mobility system that centers around urban resilience. Four dimensions focus on the Adaptivity, Connectivity, Optimization and Sustainability of the urban mobility system. Using ACOS, we observed the following action areas for Berlin to build a robust mobility system:

Modernizing the public transportation system

Renovating and modernizing the Berlin public transportation system can strengthen its position as the backbone of the urban mobility system. Digitization of the Berlin public transportation system can further increase connectivity of the total mobility ecosystem and public transit hubs are key in connecting the intermodal mobility offering, providing seamless transfers, and represent future corner stones of our urban environment. Digitization contributes to optimizing safety in public transportation through real-time information about safety risks, which the pandemic has put into focus.

Allowing for more cycling infrastructure

Berlin is oriented at creating a shift in mobility behavior away from a car-oriented culture to environmental modes of transportation, but experiences resistance against reduction of car infrastructure for new bicycle lanes. The pandemic contributed to a rise in popularity as cycling was perceived as a safe alternative for urban transportation. The expansion of the cycling infrastructure can contribute to advancing environmental-friendly mobility on the modal split.

Organizing for new mobility providers

Berlin has welcomed many new mobility providers. Sharing mobility is key in transitioning to a Mobility-as-a-Service ecosystem, in which the entire range of mobility options is provided in one app with sustainable mobility offerings and contributing to the reduction of car ownership, while making it easier to travel and a more attractive city for travelers. Berlin can optimize its strategic decision-making for managing mobility based on data insights. However, there is a challenge for policy makers to catch up on the creation of standards for open data, to which new mobility providers would have to comply.

Cities are continuously changed and challenged by technology-driven mobility innovations. The prospects for future mobility focus around further transitioning to renewable sources, newer modes of transportation, and increasing digitalization. Next trends on the rise concern urban air mobility, hydrogen-fueled vehicles and hyperloops. The Arcadis Cities Program works alongside some of the world's most forward-thinking cities on transformational programs. Cities that are prepared to respond to new developments have a generational opportunity to achieve long-stated goals in urban resilience and improving quality of life.



About Arcadis

Arcadis is the world's leading company delivering sustainable design, engineering, and consultancy solutions for natural and built assets. Applying our deep market sector insights and collective design, consultancy, engineering, project and management services we work in partnership with our clients to deliver exceptional and sustainable outcomes throughout the lifecycle of their assets. We are more than 27,000 people, in over 70 countries, dedicated to improving quality of life. We support UN-Habitat with knowledge and expertise to improve the quality of life in rapidly growing cities around the world.

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