

Pedaling to Sustainability

Developing world-class cycling infrastructure at the functional area level



FUNCTIONAL AREAS IN THE EU

Crossing administrative boundaries for green transition and sustainable development

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1.

The big picture: growing support for cycling at the EU level



1.1 Redeeming cycling as a full-fledged mode of transport

Quality cycling infrastructure is a core component of sustainable mobility planning by lowering carbon emissions and promoting a healthy and active lifestyle for citizens of urban and rural areas alike. By choosing cycling instead of driving, we can significantly reduce our carbon footprint and benefit from improved health and well-being. Moreover, cycling infrastructure also contributes to sustainable tourism and logistics.

Since its invention, the bicycle has followed a rather circular path. From the development of the first model in 1817, several technical upgrades have turned it into a preferred mode of transport, particularly in the late 19th century and the beginning of the 20th century. Due to its high efficiency and low cost, cycling was rapidly adopted as a travel mode, but as cars became more popular and accessible, it was relegated to the category of leisure. It is also worth noting that roads were first made for bicycles, as pavements required improvement to facilitate cycling. In fact, it was cyclists who first advocated for the improvement and extension of roads in the US and Europe¹ - in 1886, cyclists in the UK founded an influential organization that lobbied for better road surfaces, just a few years before motor cars started to become popular. A similar movement was started by bicyclists' organizations in the US - known as the *Better Roads Movement* (1870-1920), before the American Automobile Association joined the movement.

Starting with the invention of the first internal combustion engine in 1876, commercial cars took off and slowly replaced cycling. As a time reference, we know that in the 1970s, France dismissed cycling from transport statistics. Yet today, cycling is making a comeback and is increasingly redeemed as a full-fledged mode of transport.

Promoting cycling as a transport mode is particularly relevant for functional areas across the EU, which are often linked by streams of commuting and reflect the strong interdependencies related to services and economic opportunities.

With the advent of electric bikes and increasing technological innovation, cycling can transform mobility at the functional area level by regaining the human scale (positively impacting quality of life and health) and reducing carbon emissions. The European Green Deal aims to achieve a 90% reduction in emissions of greenhouse gases connected to transportation by 2050, and developing cycling infrastructure plays a major role in achieving this goal.

1.2 How is cycling supported through the Urban Agenda for the EU (UAEU)?

The Urban Agenda for the EU was officially established in 2016 by the Pact of Amsterdam, signed by EU Ministers responsible for urban matters. The delivery of the Agenda is based on three principles: better regulation, better funding, and better knowledge, and a growing number of thematic partnerships (including urban mobility air quality, circular economy, and climate adaptation) bringing together representatives from different government levels and other stakeholders, with the aim of defining and implementing focused action plans on each topic. In 2022, two new thematic partnerships were launched: Greening Cities, and Sustainable Tourism, with two others (Food and Cities of Equality) to follow in 2023. In the 2021–2027 programming period, support for the Urban Agenda for the EU will be provided under the [European Urban Initiative](#).

The objectives of the UAEU Thematic Partnership for Urban Mobility “are to have a sustainable and efficient urban mobility”. The focus will be on public transport, soft mobility (walking, cycling, public space) and accessibility (for disabled, elderly, young children, etc.) and efficient transport with good internal (local) and external (regional) connectivity.

Each thematic partnership is linked to an Action Plan. Designing and implementing cycling infrastructure projects is supported through Action 5 - Developing guidelines on infrastructure for active mobility supported by relevant funding.

A key point of the UAEU Thematic Partnership on Urban Mobility Action Plan is the need to support active modes of transport to reach their highest potential and to be „taken seriously in urban mobility policies”.

This implies a higher allocation of space and financing, in order to transform cycling and walking into viable options for daily travel, as a full-fledged transport mode. The active mobility infrastructure needs to also be accessible for vulnerable users and citizens with reduced mobility (children, elderly, citizens with disabilities, etc.). Moreover, there is a need to make funding opportunities as accessible as possible for local and regional authorities.

Recognizing that there are major differences in the experience of Member States in designing safe, comfortable, direct and attractive infrastructure for cycling and walking, the lack of EU standards that can support them in this process, as well as the need to promote funding opportunities for cycling infrastructure, the Action Plan included: The elaboration of quality design guidelines and An update to the EU Funding Observatory for Cycling (developed by the European Cyclists Federation - ECF).

The Urban Agenda for the EU: better regulation, better funding, better knowledge

- **UAEU Thematic Partnership on Urban Mobility**
 - **Action Plan**
 - an **update to the EU Funding Observatory for Cycling** (developed by the European Cyclists Federation - ECF). The interactive platform mapped all EU funding streams for cycling infrastructure that explicitly or implicitly refer to cycling infrastructure, which can be filtered by country and region.
 - The elaboration of quality design guidelines: the **European Commission Guidance on Cycling Projects in the EU** was published in 2019 and can be used as a source of inspiration for designing quality cycling infrastructure. The guidelines are a comprehensive collection of implementing design principles, factsheets on different measures to improve cycling infrastructure and supporting case studies ([link](#))

2016

EU Parliament Resolution: Towards a new European Cycling Strategy

In February 2023, the European Parliament passed a resolution² calling for the development of a European cycling strategy with the **aim of doubling the number of kilometers cycled in Europe by 2030** and elevating cycling to a fully-fledged mode of transport that should be treated with the same importance as any other mode of transport. The resolution also highlights the need to take cycling into account when building or upgrading the Trans-European Transport Network (TEN-T) and to foster synergies between the EuroVelo network and the TEN-T.

2023

Figure Source: Processed info from the UAEU Thematic Partnership on urban Mobility Action Plan

1.3 The role of cycling in achieving the 2030 Sustainable Development Goals

Globally, the New Urban Agenda (NUA) points to the role of cycling in achieving the 2030 Sustainable Development Goals. The New Urban Agenda (NUA) was adopted at the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) in 2016. It serves as a means of localizing the 2030 Sustainable Development Goals, including Goal 11 of making cities and human settlements inclusive, safe, resilient and sustainable.

Concerning mobility, the NUA emphasizes the strong connection between cycling and various qualities of public spaces, such as being healthy, safe, accessible, inclusive, green, and livable. Cycling is also seen as a means of promoting cultural exchange, participatory processes, and economic vibrancy, as well as enhancing the quality of life. Consequently, the signatories of the NUA have made a commitment to promote cycling lanes and walkability, improve road safety, protect and promote cycling mobility, and develop financing instruments for cycling infrastructure at national, sub-national, and local government levels.

The NUA also places great emphasis on making cities inclusive and accessible for everyone, with particular attention given to the needs of vulnerable groups, such as women and girls, children and youth, older persons, and those with disabilities. Cycling is viewed as a preferable mode of transportation compared to private motorized vehicles in achieving the sustainable and inclusive cities envisioned in the NUA.

New Urban Agenda (NUA)

Make cities inclusive and accessible for everyone by:

- Promoting cycling lanes and walkability
- Improving road safety
- Protecting and promoting cycling mobility
- Developing financial instruments for cycling infrastructure

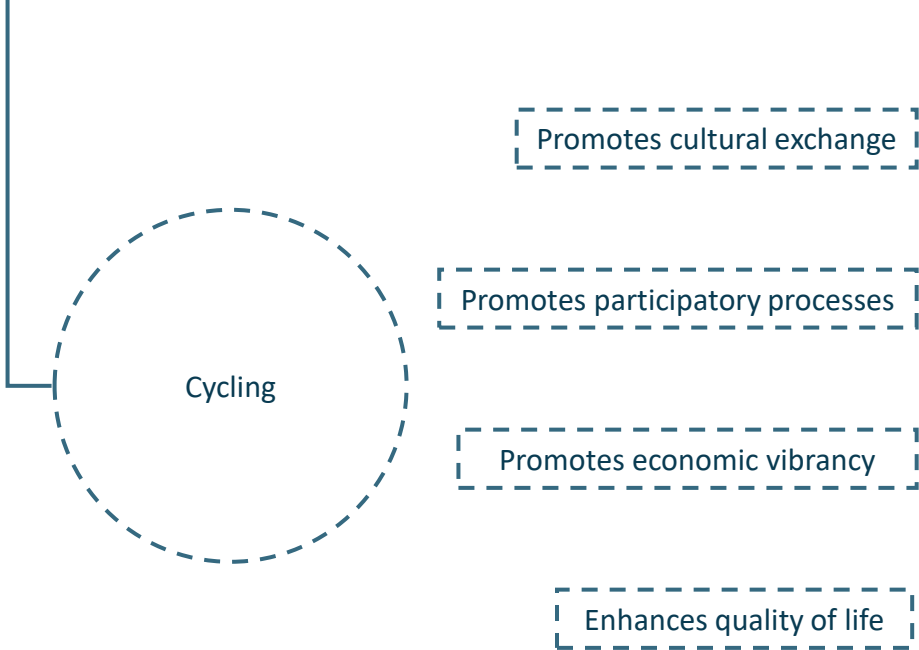


Figure Source: Processed info from habitat3.org/the-new-urban-agenda

2.

Cycling infrastructure at the level of functional areas



Beyond administrative borders

Cycling infrastructure at the functional area level
developed to span across administrative borders

2.1 Going beyond administrative borders

A functional area is defined by one or more specific territorial interdependencies related to various economic, social, cultural or geographical functions, which often overlap. Despite being primarily linked to urban agglomerations and commuting, functional areas reflect a variety of links between different places. A preparatory study conducted by the Council of Europe identified 17 types of FAs, capturing commuting flows, specific economic flows, natural characteristics, cultural links or demographic commonalities.

The functional approach enables planning development processes at geographic scales that are not artificially delineated by administrative boundaries but reflect the growing interconnections between places. Therefore, fragmentation needs to be overcome through joint planning and financing. One of the areas for such cooperation efforts is cycling infrastructure.

At the urban scale, planning for sustainable urban mobility needs to be aligned with the flows of people and goods. This approach requires strong interjurisdictional cooperation, which can contribute to achieving a balanced development across the EU. Prioritizing cycling directly supports the objectives of the Cohesion Policy by:

- Promoting integrated, sustainable and active mobility and reducing carbon emissions
- Improving territorial connectivity

- Creating economic opportunities (through developing the cycling industry, bike-sharing programs, cycle tourism, bicycle repair and maintenance services, and increasing the visibility of small businesses)
- Encouraging interaction and social cohesion.

The EU Cohesion Policy is primarily focused on decreasing territorial disparities, stimulating economic growth, and ultimately enhancing the overall well-being of citizens. As the EU's primary investment policy, the Cohesion Policy accounts for roughly one-third of the EU budget. The delivery of the Cohesion Policy in the 2021-2027 programming period is based on five policy objectives, with a clear commitment to bring resources and decisions closer to the people they will impact, through *Policy Objective 5 - A Europe closer to citizens by fostering the sustainable and integrated development of all types of territories*. Policy Objective 5 aims to address various interconnected territorial and local challenges. To achieve this, an integrated territorial development approach is required, entailing place-based and integrated strategies, as well as local empowerment and partnership. The use of territorial tools such as CLLD, ITI, or other similar approaches is essential to achieving Policy Objective 5.

Planning for sustainable urban mobility across the functional area

Sustainable Urban Mobility Plans (SUMPs) provide the framework for supporting the uptake of cycling at the functional area level, encompassing all three major areas of application: 1) transport, 2) logistics and 3) leisure, tourism and sport. Through their supra-local territorial coverage, SUMPs ensure that mobility planning is integrated and reflects the dynamics of the functional area. SUMPs also help identify and address barriers to cycling, such as inadequate infrastructure, safety concerns, and limited accessibility. Most importantly, the elaboration process facilitates the coordination and collaboration among stakeholders, including citizens, local authorities, transport operators and other relevant stakeholders, requiring cooperation across both jurisdictional and institutional boundaries.

The *Guidelines for Developing SUMP, 2nd edition (2019)* document is a key resource on developing SUMP plans and is available [here](#)³.

SUMP PRINCIPLES

Assure quality

Arrange for monitoring and evaluation

Involve citizens and relevant stakeholders

Cooperate across institutional boundaries

Plan for sustainable mobility in a “functional city”

Develop a long-term vision and a clear implementation plan

Assess current and future performance

Develop all transport modes in an integrated manner

Figure Source: Processed info from the Guidelines for Developing SUMP, 2nd edition (2019)

Lake Balaton, Hungary: Lake Routes in the Functional Area

Lake Balaton Functional Area in Hungary boasts a unique cycling infrastructure that spans across three counties and around the entire lake Balaton. This extensive network, providing cyclists with an opportunity to explore the picturesque surroundings of the lake, is truly remarkable. The main bike route surrounding Lake Balaton stretches approximately 208 km, offering a wonderful blend of scenic views and well-maintained trails. Furthermore, the interconnected routes within the area that connect with the main route account for approximately 1,693 km, creating an intricate web of pathways for both casual riders and serious cyclists alike.

The development of this extensive cycling infrastructure at the functional area level demonstrates a commitment to promoting sustainable and healthy transportation options. By providing a continuous network that integrates multiple counties, the infrastructure encourages both locals and tourists to explore the region on two wheels. It also serves to reduce traffic congestion and environmental pollution and fosters a sense of community among those who take advantage of these routes. The Lake Balaton area thus becomes a prime example of how careful planning and investment in cycling infrastructure can enhance not only the appeal of a region as a tourist destination but also its overall livability and sustainability.

The cycling infrastructure in the Lake Balaton Functional Area is continually developing and improving, with the potential to further transform mobility within a largely non-urban, touristic region. For an area where tourism plays a significant role, this type of alternative mobility is highly relevant, allowing both locals and tourists to explore and enjoy the landscape in an eco-friendly and healthy way. The document highlights best practices from other functional areas, illustrating how these strategies and concepts can be applied to enrich and expand the existing cycling network. This approach not only underscores the importance of cycling infrastructure in the region's sustainable development but also creates a path towards continuous innovation and improvement, inspired by the success of other similar regions.

Cycling and Hiking Routes – Lake Balaton

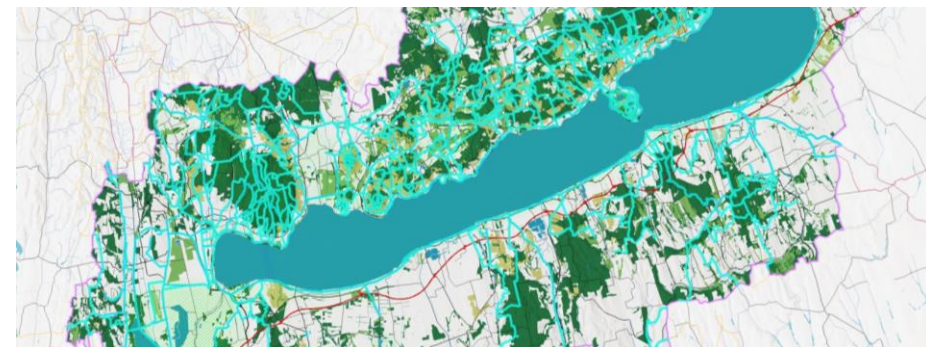
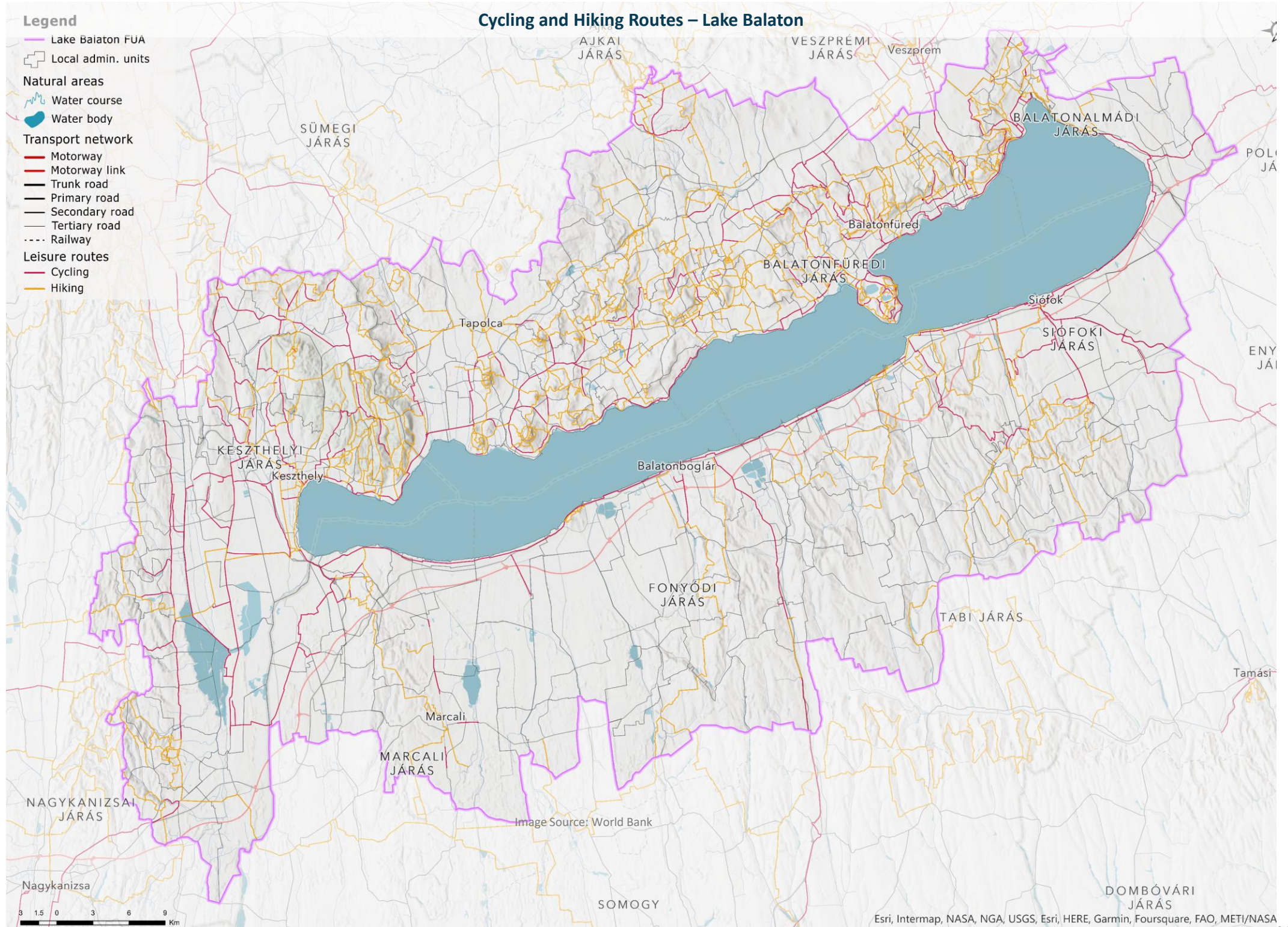


Image Source: World Bank



Cycling and Hiking Routes – Lake Balaton

Legend

- Lake Balaton FUA
- Local admin. units
- Leisure routes
 - Cycling
 - Hiking

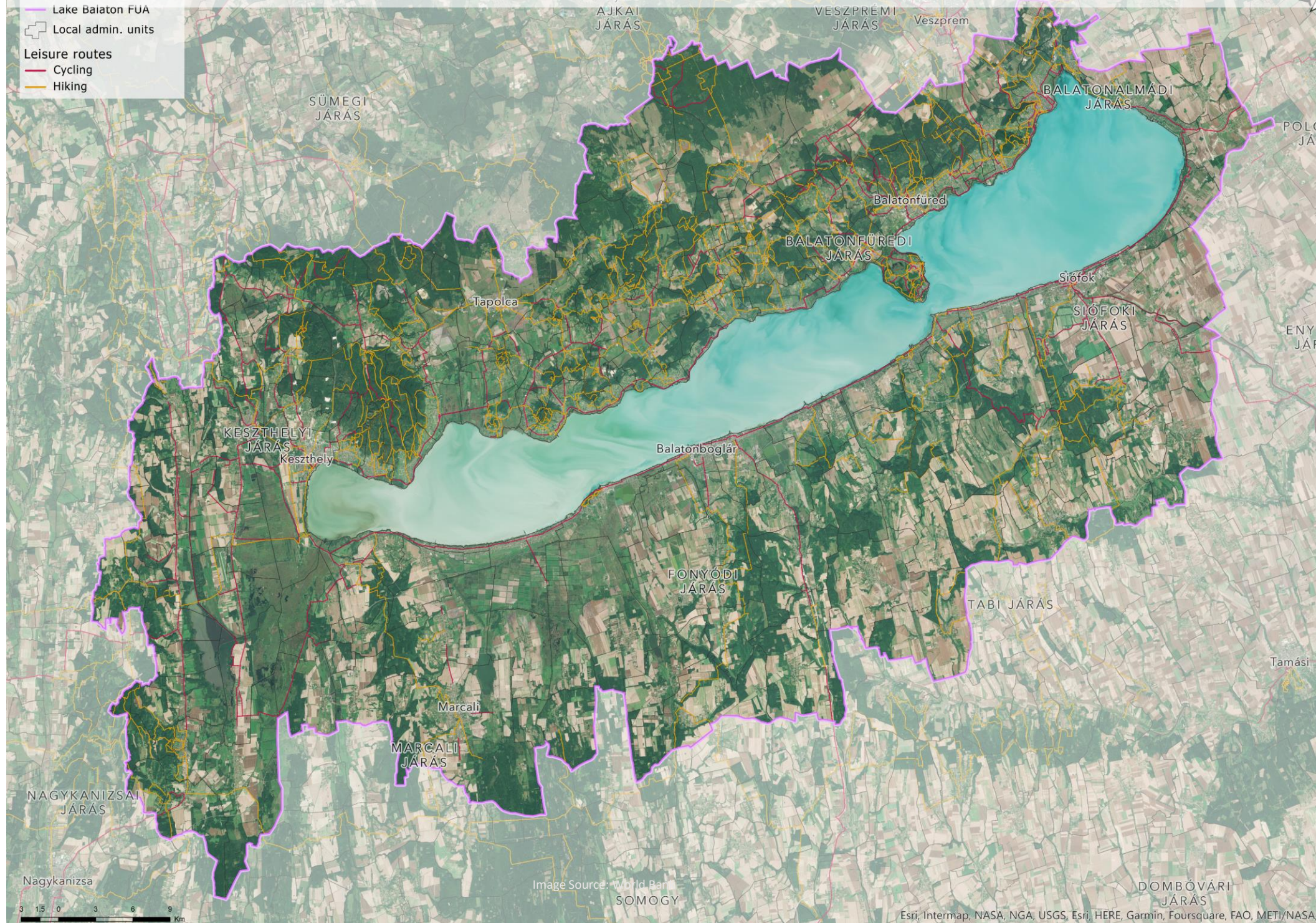


Image Source: World Bank

Esri, Intermap, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA

Zooming in: learning from practice

This section provides a series of examples of impactful cycling projects implemented in the EU, with a focus on cross-jurisdictional approaches or their Relevance for the functional area level. The examples are clustered within three major areas of application for cycling infrastructure and related services.

The first dimension is **transport**. As pointed out in the introduction, cycling needs to regain its status as a full-fledged mode of transport. Investments and programs to promote the uptake of cycling instead of driving can have a major role in reducing emissions from the transport sector, along with walking and public transport.

Secondly, the potential of cycling for **sustainable logistics** represents an area yet to be developed, with many untapped benefits in urban and non-urban areas alike. The examples will focus on optimizing last-mile deliveries through electric cargo bikes and the potential of mainstreaming their use.

The third one brings together **leisure and tourism**, highlighting the potential of cycling for health and well-being and developing sustainable tourism.

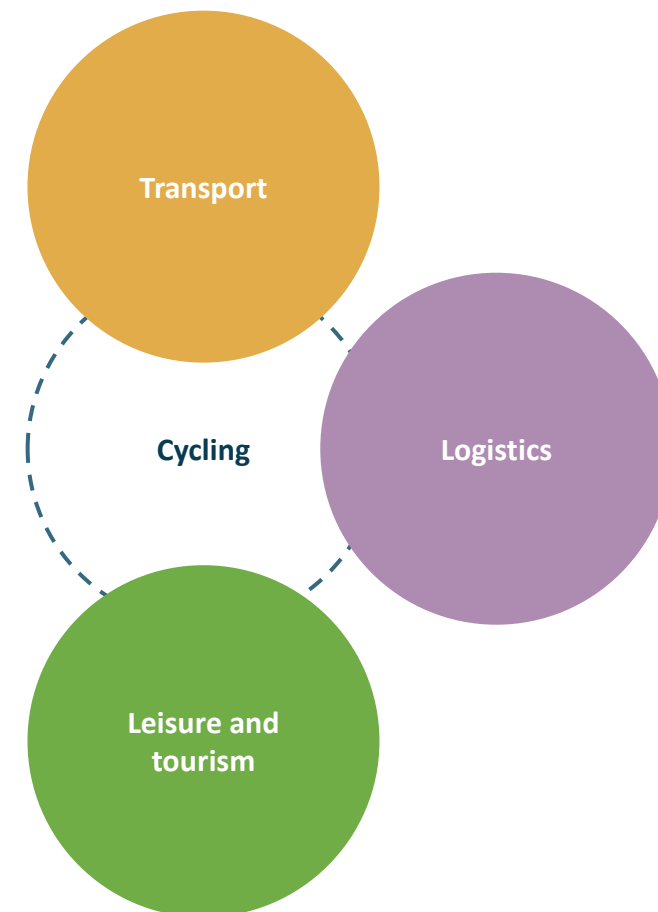


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Transport



2.2 Transport

Cycling as a transport mode in cities and functional areas

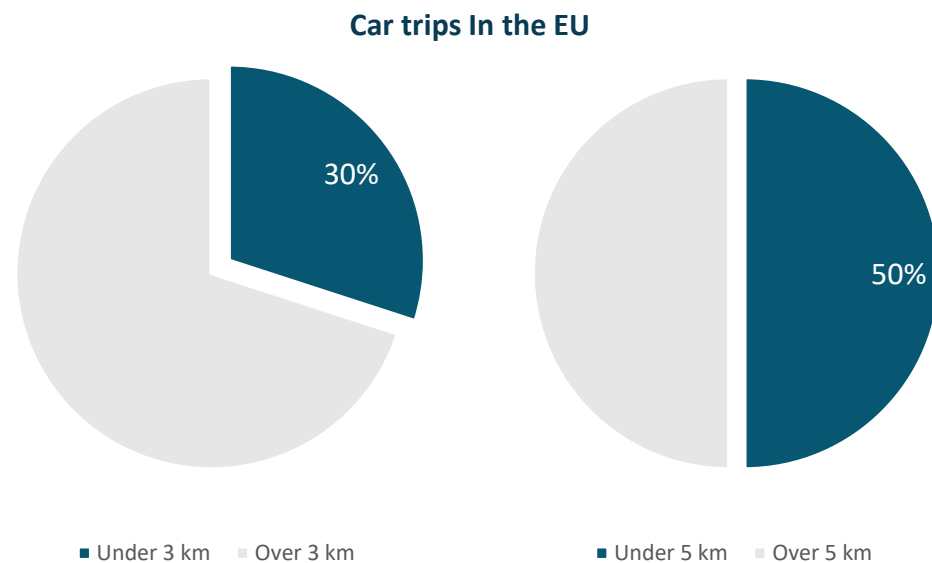
Supporting sustainable urban mobility interventions, particularly in increasing soft mobility options like cycle and pedestrian paths are a priority for dense urban areas, in their efforts to reduce emissions from transport. This involves expanding the existing cycle and pedestrian network, integrating with public transportation systems, and enhancing safety measures, coupled with additional measures such as rest areas and parking and repair facilities.

Therefore, part of the solution to the challenges related to air pollution from transport lies in developing cycling infrastructure that can accommodate cycling as a full-fledged transport mode. As car dependency often plagues dynamic areas as an effect of urban sprawl, the answer lies in offering viable alternatives for mobility at the functional level. Therefore, sustainable urban mobility planning implies cycling (in particular e-bikes) or a combination of cycling and public transport to ensure connectivity outside of urban areas.

As the latest Passenger Mobility report points out, commuting is one of the main reasons for daily travel across the EU. Travelling to work in the total distance ranges from 27 % in Germany to 47 % in Croatia⁴. Commuting is also at the core of the functional urban area concept, making it a priority area of coordinated intervention (the EU-OECD methodology for delineating functional urban areas

implies a minimum threshold of 15% of the population commuting to an urban center).

Moreover, within urban centers, the issue of short trips requires targeted actions, and the most suitable alternative to these trips is cycling. An early report of the European Commission regarding the need to promote cycling for towns and cities as opposed to car use found that 30% of car trips in Europe covered distances shorter than 3 km and 50% were less than 5 km⁵.



Graphs Source: European Commission – Cycling: the way ahead for towns and cities

Key benefits of cycling

ENVIRONMENTAL BENEFITS

Cycling is an environmentally friendly mode of transportation that contributes to reducing carbon emissions and promoting sustainable mobility. The carbon savings of an e-bike, compared to electric, hybrid and petrol cars are immense, as shown by the estimation performed by the Centre for Research into Energy Demand Solutions (CREDS)⁶. The results highlight that replacing car use with e-bikes results in significantly greater reductions in lifetime emissions compared to hybrid and electric vehicles.

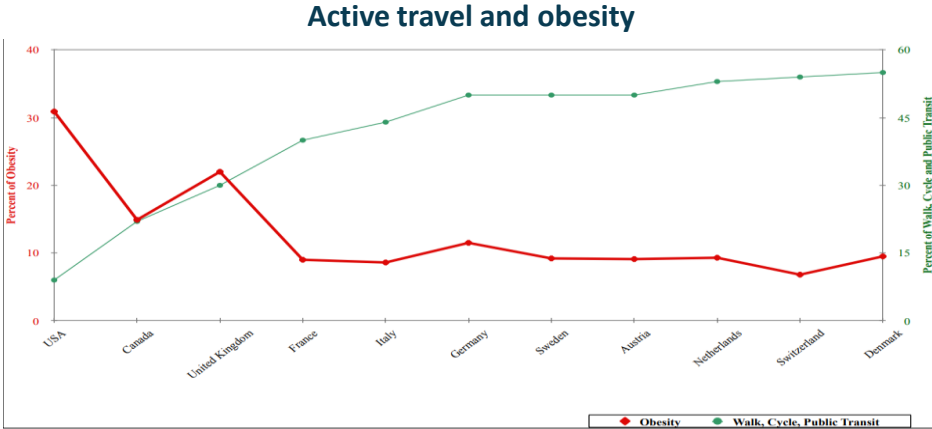
CO2 emissions per lifecycle (e-bikes versus cars)

Vehicle	Lifecycle CO2 emissions g/km
E-bike	22
Battery electric car – Nissan Leaf	104
Hybrid car – Toyota Prius	168
Petrol car – EU average	258

Table Source: Centre for Research into Energy Demand Solutions

HEALTH BENEFITS

Cycling as a form of active travel offers numerous health benefits. Regular physical activity plays a crucial role in preventing major noncommunicable diseases like heart disease, stroke, diabetes, certain types of cancers, hypertension or obesity. It is also associated with improved mental health, delayed onset of dementia, and enhanced overall quality of life and well-being. Research by Pucher and Dijkstra published in the *American Journal of Public Health* in 2003 highlights the positive impact of active travel, including cycling, on obesity and improving overall public health.



Graph Source: Pucher and Dijkstra, "Promoting Safe Walking and Cycling to Improve Public Health, Am. Journal of Public Health, 2003

ECONOMIC BENEFITS

Cycling also brings **economic benefits** to individuals and communities. The EU Cycle project, an INTERREG project, has identified and quantified the annual economic benefits associated with cycling. These benefits include savings in CO2 and reduced air and noise pollution, longer and healthier lives, fewer sick leave days for employees, increased cycling tourism and bicycle market, and savings on construction and maintenance of road infrastructure for motorized vehicles.

Cycling promotes better health and well-being, as well as increased productivity. Research confirms that cycling to work is associated with less sickness absence, with employees cycling to work being on average 1.3 days less absent due to sickness than those who do not cycle to work⁷. Based on this finding and Eurostat data on the average labor cost per day and an estimated rate of cycling to work of 8%, if cycling doubled in the EU, it would result in a significant economic benefit of €7 billion⁸.

The Health Economic Assessment Tool (HEAT)⁹ developed by the WHO estimated a health benefit equivalent to €0.70/km of cycling compared to driving a car, which consists of reduced exposure to pollutants, and less costs related to accidents and GHG emissions.

Moreover, to treat cycling as equal to other transport forms and to support its prioritization, cities such as Copenhagen have initiated economic analyses for cycling infrastructure, equivalent to the process required for large transport projects, such as highways. According to a survey of all economic analyses of Danish infrastructure projects, Cycle Superhighways are ranked among the top five most profitable projects. Concretely, an estimated €29 mil. Investment in the city's superhighway network has a cost-benefit gain of €76 mil, considering aspects such as cost of time, vehicle wear and tear, fuel, health, and expenses caused by traffic accidents, hospitalization and environmental impact¹¹.

Economic annual benefits of cycling

Benefit	Estimated Value (billion euros)
CO2 emissions savings	0.6 - 5.6
Reduction of air pollution	0.435
Reduction of noise pollution	0.3
Fuel savings	4.0
Longer and healthier lives	73
Less sickness absence at the workplace	5
Bicycle market	13,2
Cycle tourism	44
Easing of road congestion	6,8
Saving on construction and maintenance costs for road infrastructure for motorised vehicles	2,9
Total annual benefits	150 - 155 bn euros

Image Source: EU Cycle¹⁰ (INTERREG project)



Cycling infrastructure is the backbone of an Active City

Active cities are those where one can seamlessly integrate physical activity within daily life. They provide plenty of opportunities for physical activity for all and integrates movement in the daily lives of its residents and in how they travel, learn, work and play.

It is increasingly acknowledged that the adoption of an active lifestyle is not solely a matter of personal choice, but is significantly influenced by various factors, including the design of the built environment. According to the World Health Organization, “people’s participation in physical activity is influenced by the built, natural and social environments in which they live as well as by personal factors such as sex and age and ability, time and motivation.”¹² Research has also indicated a correlation between economic development and physical inactivity, with higher-income countries exhibiting lower levels of physical activity compared to lower-income countries¹³.

The levels of inactivity in the EU are rising, requiring measures to integrate physical movement into daily routines. The most recent Eurobarometer on sport and physical activity (2022) shows that the proportion of Europeans that never exercise or partake in physical activity is 45% (from 39% in 2009). More than a third do not meet the minimum recommendation of 150 minutes of moderate physical activity per week, a trend aggravated by the COVID-19 pandemic.

Therefore, planning for physical activity becomes increasingly necessary, and developing quality cycling infrastructure to encourage cycling as a mode of transport is a definitory part of this process. The planning process should not be understood as having fix boundaries for implementation but should take into account the functional area level - for example, by encouraging commuting by e-bike and ensuring intermodality.

Active transport (walking and cycling infrastructure, in particular) is a core pillar of strategies for increasing physical activity, along with interventions in the realm of urban planning and land use, education, leisure and workplaces. Local and functional area level authorities can drive inspiration from cities such as Hamburg or Liverpool, which elaborated dedicated Active City strategies¹⁴ to encourage a high level of physical activity among their citizens and are ISO certified for their efforts. The first step in adopting targeted measures is creating an active city diagnostic that can help understand current needs and challenges and provide baseline data for evaluation and monitoring, followed by the creation of a dedicated working group. To start with, the EU Sport and Physical Activity Barometer applied at national level can be adapted locally.

The OECD report published in 2023 on this topic (“Step Up! Tackling the Burden of Insufficient Physical Activity in Europe”) calls on policy

makers to step-up the policy response to increase physical activity and highlights the potential impact that increasing physical activity levels would have on the health of the population and the economy in the EU: “Investing in physical activity policies improves individual well-being and population health, while also returning €1.7 in economic benefits for every €1 invested”. Reaching recommended physical activity levels (adults: 150 minutes of moderate physical activity / week) would save on average 0.6% of EU Member State’s health budgets by 0.6 yearly, totaling about €8 billion per year¹⁵.

AI generated image



Image Source: AI generated

AI generated image



Image Source: AI generated

What are the types of public investments to support the uptake of cycling as a transport mode?¹⁶

Infrastructure Development:

- Constructing and modernizing cycling routes that facilitate commuting to work and public services, including routes leading to train stations and bus stops, to facilitate intermodality;
- Ensuring safety through separated cycling lanes; investments in additional cycling infrastructure like protected bicycle parking, supra-local / regional bike-sharing systems, charging stations for e-bikes or rest areas, incorporating traffic calming elements;
- Reallocation road space from cars to cyclists and pedestrians.

Integration:

- Integrating cycling with other forms of transport and establishing a one-stop-shop for transport services, through Mobility as a Service (MaaS);
- Ticketing integration between public transport and bike-sharing systems;
- Ensuring the connectivity and directness of cycle paths across the city, to reduce interruptions and increase safety;
- Including cycle paths in road modernization plans, along with measures aimed at pedestrians, and public transport users.

Promotion:

- Promoting the perception of cyclists as daily commuters, not just sports enthusiasts or tourists, to enhance the attractiveness of cycling. This can be done through dedicated events, organized in partnership with local companies, along with a strong communications strategy delivered through website, social media, apps, and other means for public communication;
- Installing automatic counters for cyclists can support communication through real-time data, while recurrent qualitative studies such as bikeability audits can provide valuable feedback from citizens.

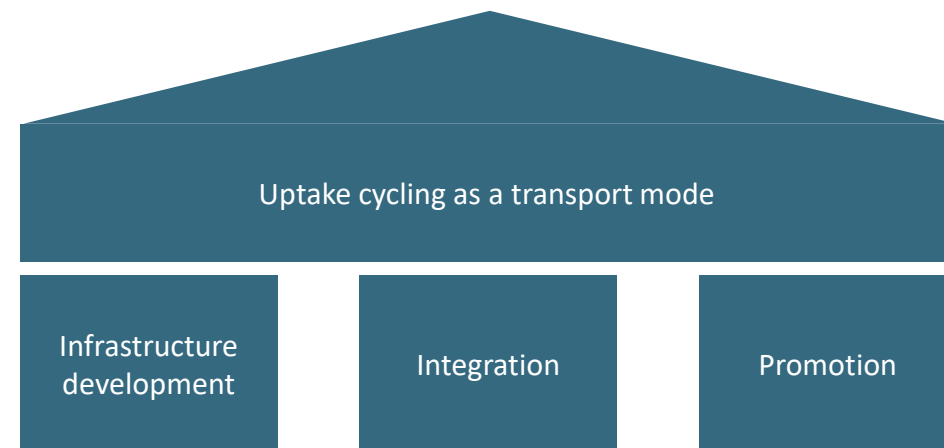


Figure Source: Processed info from the INTEGRATED CYCLING PLANNING GUIDE INVESTING IN CYCLING FROM EU STRUCTURAL FUNDS DURING THE 2021–2027 MULTI-ANNUAL FINANCIAL FRAMEWORK

Developing cycling infrastructure at the functional area level

Learning from practice

Further developing the cycling infrastructure at the functional area level is critical in fostering sustainable urban mobility and improving the overall quality of life. As urbanization continues to escalate, many cities face challenges such as traffic congestion, air pollution, and the inefficient use of public spaces. A well-designed cycling infrastructure helps alleviate these issues by encouraging a mode of transportation that does not contribute to emissions or congestion. Additionally, cycling is an affordable alternative for many citizens and tourists, making it a more inclusive mode of transport. The convenience brought about by extensive cycling networks often leads to reduced dependency on cars, which directly contributes to a decrease in air pollution levels and traffic, and indirectly promotes a more efficient use of urban spaces.

Furthermore, cycling infrastructure can have significant health benefits for the population. Regular physical activity is known to reduce the risk of numerous chronic diseases and mental health disorders. By providing safe and accessible cycling paths, functional areas enable their residents to incorporate physical activity into their daily routines effortlessly. This not only helps in promoting a healthier lifestyle among the population but also has economic benefits, as healthier citizens would imply reduced healthcare costs and increased productivity.

From an economic standpoint, cycling infrastructure can be a driver for local economic development. The establishment of bike lanes and cycling amenities can attract tourists and cycling enthusiasts, leading to an increase in spending at local businesses. Moreover, such infrastructure projects create jobs during the construction phase and can foster a vibrant community, attracting more residents and businesses to the area. Additionally, as cycling infrastructure requires significantly less space and maintenance compared to car-centric infrastructure, it is a more cost-effective and sustainable investment for functional areas in the long term. Through environmental sustainability, health benefits, and economic growth, cycling infrastructure proves to be a vital component in the development of functional areas.

Copenhagen, Denmark: Cycle Superhighways

Cycle highways are becoming increasingly widespread across the EU. "A Cycle Highway is a mobility product that provides a high-quality functional cycling connection. As the backbone of a cycle network, it connects cities and or suburbs, residential areas and major (work)places and it satisfies its (potential) users."¹⁷ The Cycle Highways Innovation for Smarter People Transport and Spatial Planning (CHIPS) project financed by Interreg North-West Europe aims to develop and promote cycle highways as a low-carbon commuting solution, with partners from Belgium, Germany, the Netherlands, and the UK. The partners explore solutions to overcome barriers, enhance connectivity with other modes of transport (train and bus), and integrate cycle highways into future spatial planning. The project also focuses on positioning cycle highways as a new mobility product and monitoring their performance.

Cycling for longer distances, as a mode of transport, is a highly viable option, provided that quality infrastructure is in place, as shown by Denmark's Cycle Superhighway connecting Copenhagen with its suburbs. Copenhagen boasts a "cycle superhighway" network built to facilitate daily commutes of 5 to 30 kilometers. The network is specifically designed to improve cyclist comfort and convenience, reducing stops and ensuring the interconnectedness of routes at the metropolitan area level.

The network connects residential areas to major workplaces and is designed to help cyclists maintain a steady speed of 20 km/h. To achieve this, the concept of "greenwaves" was implemented in Copenhagen to reduce stops by coordinating the traffic light system for cyclists, ensuring that if they maintain a speed of 20 km/h, they will not encounter red lights. By using green led lights that have speed sensors, cyclists receive cues to adapt their speed if they are cycling at a slower pace. Moreover, sensors were installed near intersections to detect approaching bicycles. If at least five cyclists are riding together in close proximity, the traffic light will remain green ahead of them until they have crossed the intersection.

The capital region of Denmark has developed a network of nine cycle superhighways, based on the collaboration of 26 municipalities, with a vision to expand to 45 routes covering over 850 km¹⁸.

The first superhighway was finished in 2012, however, the discussions started as early as 2009, with the primary goal is to alleviate congestion and promote cycling as a commuting option. By 2020, the region registered a 23% increase in cycling and a 14% reduction in car use. The projected cost-benefit gains of the full network are approximately €765 million¹⁹.

To ensure the success of inter-municipal cycle superhighways, the recommendations include establishing a cooperative structure across municipal borders (Cycle Superhighway Collaboration consists of a steering group, an operations group and a joint Office for Cycle Superhighways), setting a uniform infrastructural standard²⁰, and seeking political and financial support from regional and national governments - in the case of the Capital Region of Denmark, up to 50% of the infrastructure was state-financed. The collaboration between municipalities, backed by government support, has been essential in realizing this innovative cycling infrastructure.

Find out more [here](#).

Cykelslangen Copenhagen



Image Source: awol.com.au

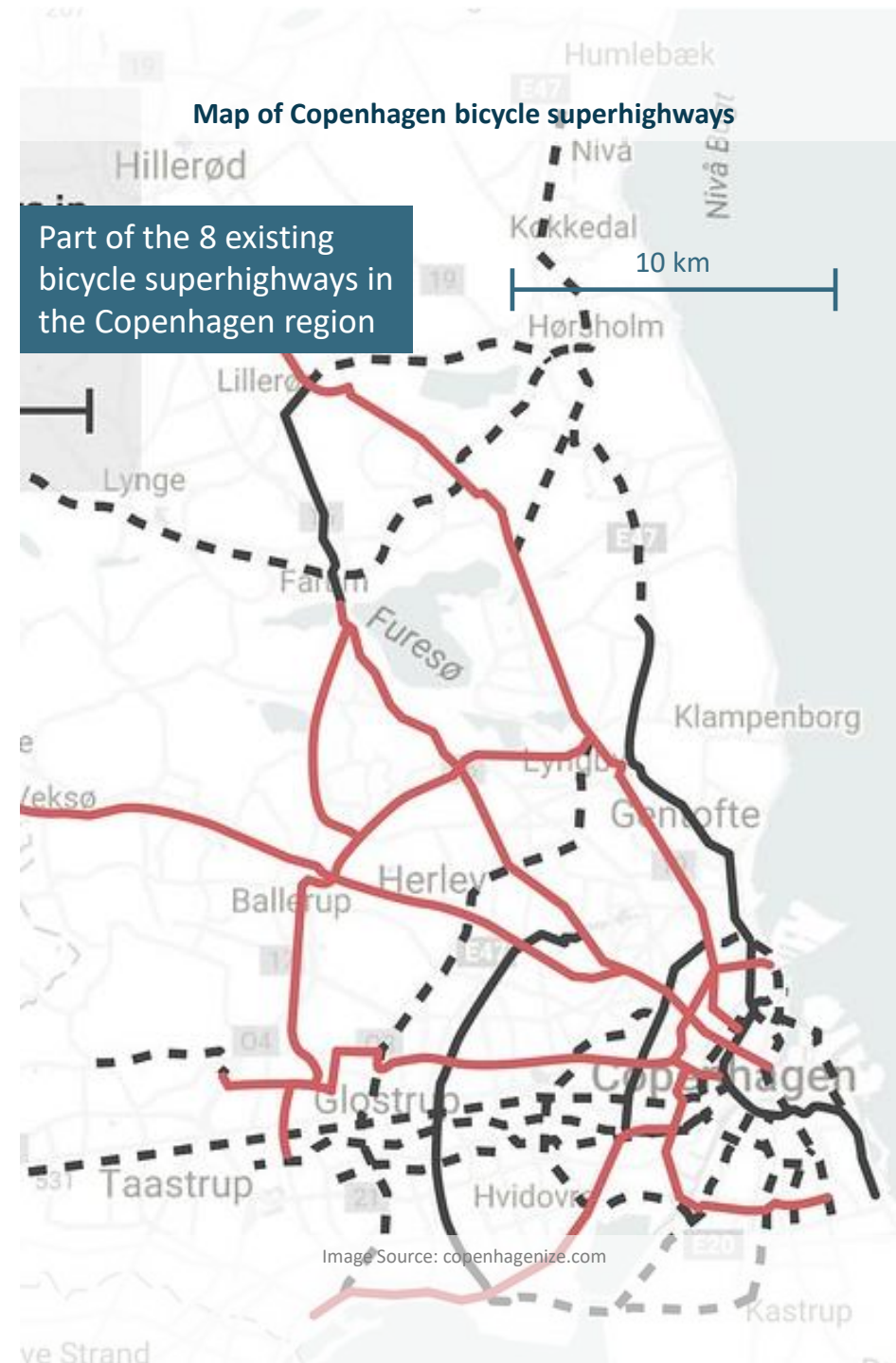


Image Source: copenhagenize.com

Zagreb Urban Agglomeration and Zagreb County, Croatia: Greenway Project

One of the most ambitious projects developed at the level of Zagreb Urban Agglomeration and Zagreb County is the Greenway Project (National Cycling Route No. 2), spanning nine jurisdictions (Zagreb City and eight other rural and urban localities). The Greenway project aims to promote sustainable mobility, increase traffic safety, and improve cycling lanes' connectivity.

The Greenway - National cycling route no. 2 is planned along the Sava river, from the border with Slovenia to Lijevi Dubrovčak. The new route has a total length of 121.6 km and crosses 9 municipalities, with over 50 kilometers within the city of Zagreb. Additional equipment including lighting, chargers for e-bikes, rest areas, parking lots, signage, and traffic counters are also planned. Connections to existing bridges, cycling and road infrastructure will also be improved, to offer safe and efficient alternatives to motorized transport.

The high number of daily commuters in Zagreb, estimated at 80,000, and an additional 20,000 people travelling daily to the city for various other purposes (according to data from the EC-Croatia Partnership Agreement) put a strain on the current infrastructure and require large-scale solutions for sustainable urban transport. Therefore, cycling infrastructure has been prioritized in the strategic planning for the ZUA, with the Greenway project being one of the nine strategic projects of the ZUA's Development Strategy for up to 2020.

In addition, the project promotes local natural attractions, rural development, active tourism, and a healthy lifestyle and encourages connection among people. As a result, it raises the potential of the Zagreb Urban Agglomeration and Zagreb County to attract a large number of European and national cyclists.

The project timeline starts in 2015 when the Feasibility Study was conducted. Technical support service was contracted a year later, and in 2017 the City of Zagreb and Zagreb County signed a Partnership Agreement for the preparation and implementation of the project. Following this agreement, a Coordination Body for project implementation was established, consisting of representatives from the City of Zagreb, Zagreb County, Regional Development Agencies of Zagreb County, Croatian Waters, Sava Program, Croatian Forests, Sava Commission, and a consultancy company. The purpose of the Coordination Body is to oversee and coordinate the implementation of the Greenway project, ensuring effective collaboration among the involved stakeholders.

The project encompasses the following activities: preparation of project documentation, project management and administration, construction of the bicycle route with connections to bridges and the existing bicycle and road infrastructure, equipping the route and the promotion and visibility of the route.

The favorable national and county-level context was a key enabling factor for the development of cycling infrastructure (the National Transport Development Strategy offers a framework for promoting cycling as a transport mode in cities, an Operational Plan for the development of cycle tourism in Zagreb County was elaborated, outlining measures aimed at improving the perception of cycling mobility and encouraging the use of bicycles for daily commuting).

Furthermore, the alignment with the guidelines of the Operational Program Competitiveness and Cohesion (OPCC), further supported the development of Cycling Route No. 2 in the Zagreb Urban Agglomeration and Zagreb County. One of the planned activities under the specific objectives to increase the number of passengers in urban public transport was the construction and improvement of bicycle paths and lanes, as well as the development of new cycling infrastructure to promote zero-emission transportation. This included infrastructure such as separated bicycle paths, dedicated traffic lanes on mixed-use roads, and designated parking areas.

The Greenway project is expected to result in the improvement of the cycling network of the City of Zagreb and the Zagreb County, an increase in the number of citizens using bikes as a means of transport in daily travel and commuting, an increase in traffic safety, the reduction of traffic jams and air pollution, an increase in the quality of life and in the attractiveness of the City of Zagreb and the

Zagreb County and the improvement of the touristic offer. The preparation of the Feasibility Study was co-financed by the European Regional Development Fund through the Transport Operational Programme 2007-2013, in the amount of 85%. The next phases of the project were financed within the ITI framework through the Competitiveness and Cohesion Operational Programme 2014 – 2020, and the project will be continued within the new ITI framework for 2021-2027.

Zagreb Urban Agglomeration Greenway Project



Image Source: functionalareas.eu/the-greenway-project

Oradea, Romania: Cross-border cycling lane and cycling network planned at metropolitan scale

Cycling lanes in cross-border areas respond to commuting and recreation purposes and are a prerequisite to sustainable mobility planning. Building on its geographic positioning next to the border with Hungary, Oradea MA has been actively seeking to implement additional projects on the metropolitan area level in a cross-border context. Through the Romania-Hungary Cross-Border Cooperation Program 2007-2013 and the European Grouping of Territorial Cooperation framework, the Oradea MA was able to take over the role of a Managing Authority and implement cross-border public procurement.

One of the flagship cross-border projects was the construction of a cross-border cycling lane of 35 km between Oradea and the Hungarian locality of Berettyoujfalu, finalized in 2013. The main benefits of the project consist in promoting green mobility and reducing environmental pollution, facilitating commuting, fostering cross-border tourism and offering a new leisure activity for residents, as well as reducing the number of road accidents involving cyclists.

The bike lane project involved four localities in Hungary: Berettyoujfalu, Mezőtérred, Biharkeresztes, Ártánd and two in Romania (Bors and Oradea) and was financed through the Romania-Hungary Cross-Border Cooperation Program. The project leader was the municipality of Berettyoujfalu, while Oradea MA elaborated the

feasibility studies and technical project.

Projects to improve cycling connectivity across the border are also implemented outside the Oradea Metropolitan Area – an example is the WeBike INTERREG project (ROHU 140), connecting the localities of Sarkad (Hungary), Salonta and Madaras (Romania). This will result in an extension of 8.78 km of existing bicycle routes between Salonta and Békéscsaba. Facilitating safe bicycle transport is a priority, since there is a clear preference of residents for alternative means of transport.

Oradea Cross border cyclingpath



Image Source: functionalareas.eu

Warsaw, Poland: Cycling Route

The Warsaw Cycle Route Network underwent a transformative development, which commenced in 2014 and culminated on 30 June 2020, financed by funds from the European Regional Development Fund²¹. With an allocation exceeding €19 million, the project implemented proposals outlined in the document "Development of possibilities for the development of cycling routes of a transport nature for the Warsaw Functional Area until 2023."

It featured the construction and refurbishment of bicycle roads spanning 73.4 kilometers to promote non-motorized individual transport as a viable alternative to passenger cars. The underpinning philosophy was the universal design principle, which entailed the creation of products, environments, programs, and services accessible and beneficial to all users, encompassing supplementary provisions for people with disabilities. The bicycle paths provide eco-friendly transit options and seamlessly connect residential areas to workplaces, harmonizing with public transportation hubs and pivotal motor traffic routes, thus fostering an integrated transportation network.

Map of Warsaw bike paths



Image Source: mapawarsawy360.pl

Oulu, Finland: Developing and mapping cycling infrastructure in the suburban area

The city of Oulu and its functional area are a global best practice example for all-year cycling, with residents using the bike for their daily mobility needs even on the coldest winter days. As a city of over 200,000 residents, Oulu faces similar challenges to other medium and large urban areas, particularly urban sprawl and suburbanization.

Developing sustainable mobility through a coherent cycling network and adjacent facilities is a key priority for the city and its functional area. According to Oulu representatives, “this network proves that people of all walks of life, in impressive numbers, will ride all year round when that network is safe and inviting and well maintained.”²²

The cycling network covers the entire city of Oulu and neighboring municipalities and is the most extensive in Finland. Cyclists can access a digital map to plan their route, which includes both active modes of transport (walking and cycling), public transport and private transport by cars.

Focus on Oulu bike paths



Image Source: eltis.org

Map of Oulu bike paths

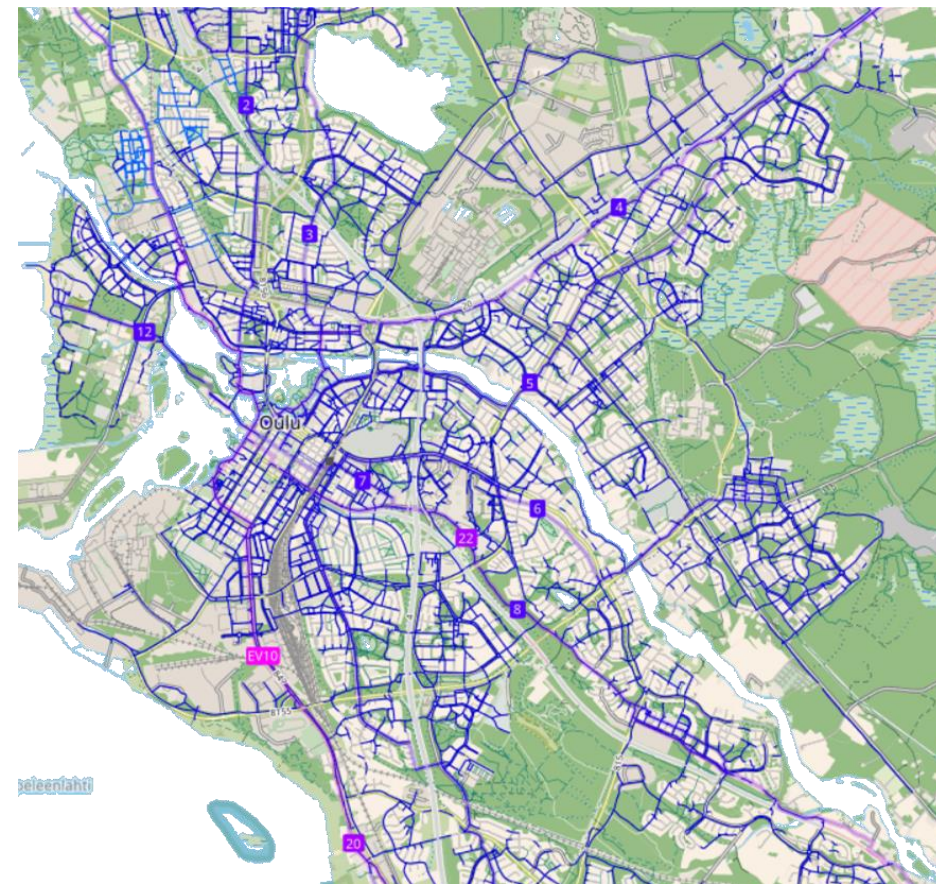


Image Source: bikecoloradosprings.org

Relevance for the functional area level

Cycling infrastructure for transport

Developing cycling infrastructure at the functional area level is of paramount importance for numerous reasons. Firstly, it enhances connectivity and accessibility across wider regions beyond city boundaries. This broader perspective aligns infrastructure development with the actual flow of people, considering their daily routines and patterns which often stretch across different administrative areas. This ensures that people can cycle safely and efficiently from one place to another, be it within a city or between towns and villages, thereby fostering a culture of active mobility and reducing the reliance on private motorized transportation.

Moreover, planning cycling infrastructure at the functional area level allows for a more comprehensive and strategic approach to sustainable mobility. By coordinating efforts and pooling resources, different municipalities within the functional area can benefit from shared knowledge, economies of scale, and a consistent cycling network that seamlessly links different parts of the region. This not only benefits the local population by providing them with reliable and safe cycling routes but also supports tourism, facilitating eco-friendly exploration of the area. In addition, it can significantly contribute to environmental goals, reducing carbon emissions and traffic congestion. Overall, it is a step towards creating more livable, healthy, and sustainable communities.

Bike-sharing systems

Learning from practice

Bike-sharing systems are an important part of the public cycling infrastructure and refer to bicycles owned by a municipality that citizens can borrow or rent. These systems are typically operated in urban spaces and have the main function to replace traditional modes of transportation such as cars, buses or trains, and to encourage citizens to cycle by offering them the means to do so. There are two types of bike-sharing systems: docked and dockless.

Characteristics:

- **Accessibility:** Bike sharing systems are generally easy to access, with stations often located near transit hubs, commercial areas, and residential neighborhoods.
- **Shared Usage:** Bicycles are used by multiple people throughout the day, allowing for higher utilization compared to private ownership.
- **Flexibility:** Users can pick up a bike at one location and drop it off at another, facilitating point-to-point travel.
- **Technology Integration:** Modern systems often use mobile apps or smart cards for unlocking bikes, providing real-time information on bike availability, and processing payments.
- **Variety of Bicycles:** Some systems offer different types of bicycles, such as electric bikes, to cater to various user preferences and needs.

Advantages:

- **Environmental Benefits:** Bicycles produce zero emissions, contributing to air quality improvement and reduction of greenhouse gases.

- **Reduced Traffic Congestion:** Bikes take up less space on the road, helping to alleviate traffic congestion, especially during rush hours.
- **Health Promotion:** Regular cycling has numerous health benefits, including improved cardiovascular health, muscle strength, and mental well-being.
- **Cost-Effective:** Bike sharing is often more affordable than owning and maintaining a car or using other forms of public transportation.
- **Space Efficiency:** Bike sharing stations require less space than parking lots for cars, allowing for more efficient use of urban space.
- **Promotion of Tourism:** Tourists often use bike-sharing systems to explore cities, benefiting the local economy.
- **Weather Dependency:** Inclement weather can reduce the usage of bike-sharing systems, as people may prefer other modes of transportation during rain, snow, or extreme temperatures.
- **Safety Concerns:** The risk of accidents and lack of safe cycling infrastructure can deter potential users.
- **Equity Issues:** If not properly implemented, bike sharing systems can sometimes neglect lower-income areas, causing concerns about equitable access.
- **Competition with Other Modes:** Bike sharing systems can face competition from other emerging micro-mobility options such as electric scooters.

Challenges:

- **Bike Redistribution:** Ensuring that bikes are available where and when they are needed is logistically challenging, especially during peak usage times.
- **Maintenance and Vandalism:** Bikes require regular maintenance, and they can be susceptible to vandalism or theft.

Docked bike-sharing systems

Docked systems imply that public bicycles can be picked up in designated places and should be returned in the same places. Docked systems normally follow a set of principles to ensure citizens can use them at their full potential. Some of these principles refer to the following:

- **Visibility:** docked bike-sharing systems, including the parking stations and the public bicycles, should be visible and easily identifiable.
- **Strategic positioning:** bicycle stations should be placed in strategic points around the city, so they encourage and contribute to velo mobility.
- **Intuitivity and inclusiveness:** the securing mechanism for the public bicycles, as well as their overall design, should be intuitive and inclusive to allow their use by all categories of citizens.
- **Sturdiness:** bicycles and bicycles stations should have a sturdy design and be weatherproof to be able to resist different weather conditions but also with vandalism.
- **Sustainability:** due to the fact that such systems require regular maintenance for safety reasons, they have increased annual operation and maintenance costs. The sustainability aspect should be taken into consideration.

Key differences between docked bike-sharing systems

- **Scale:** Docked bike-sharing systems can vary in size, from small-scale systems with just a few stations to large-scale national systems with hundreds or even thousands of stations. Such a system can be scaled up if demand requires it (build more stations and purchase more bikes), however, scaling down (removing stations or bikes) could backfire on municipalities.
- **Technology:** Different systems may use different types of technology to manage bicycles and docking stations. For example, some systems use smart docks to communicate with the bicycles to track usage and maintenance needs, while others use simple mechanical locking mechanisms (similar to supermarket cart locks). More technological features automatically imply higher initial purchase costs and higher yearly operation and maintenance costs.
- **Ownership and management:** Docked bike-sharing systems can be owned and managed by various entities, including governments, private companies, and non-profit organizations. This all depends on the legislation of the region where they are implemented, and the business/operational model associated with them.

- **Pricing structure:** The pricing structure for bike-sharing systems can vary depending on the system, with some charging flat rates per rental and others charging based on rental duration or distance travelled. The pricing structure can have a significant impact on the general usage of such a system, so different models should be consulted before settling on one of them.
- **Availability:** Docked bike-sharing systems can also vary in terms of availability, with some systems operating 24/7 and others having limited hours of operation. Besides this, some systems may be available to every citizen, no matter their residency, while others may require national/local residency to use them. This aspect should be considered when designing such systems to benefit local tourism.
- **Geographical coverage:** Docked bike-sharing systems can cover different areas, from small neighborhoods to entire cities or regions. Regional coverage of such a system can benefit commuters and contribute to increased cohesion and collaboration between municipalities in that region.
- **Types of bicycles:** Some systems may offer different types of bicycles, such as electric or cargo bicycles, in addition to standard ones.

The differences between docked bike-sharing systems reflect the unique needs and characteristics of the communities they serve. By offering a range of options in terms of scale, technology, ownership, pricing, and availability, these systems can provide a convenient and sustainable form of transportation for urban residents and visitors.

Marrakech bike-sharing system



Image Source: cities-today.com

Dockless bike-sharing systems

Dockless bike-sharing systems allow users to pick up and drop off bicycles at any location within a designated area without the need for designated docking stations. These systems have become increasingly popular in recent years, particularly in urban areas.

The defining characteristics of dockless bike-sharing systems include:

- **GPS-enabled bicycles:** Dockless bike-sharing systems use bicycles that are equipped with GPS tracking devices, allowing the system to track the location of each bicycle in real-time.
- **Mobile app:** Users can locate and reserve bicycles using a mobile app, which allows them to unlock and lock the bicycles using a code or QR scan.
- **No designated stations:** Unlike docked bike-sharing systems, dockless systems do not require designated docking stations, allowing users to park and pick up bicycles anywhere within a designated area.
- **Flexible pricing:** The pricing structure for dockless bike-sharing systems can vary but is often based on rental duration and distance travelled.
- **Minimal infrastructure:** Dockless bike-sharing systems require less infrastructure than docked systems, as there is no need to install and maintain docking stations.

Dockless bike-sharing systems have several advantages, including:

- **Flexibility:** Users can pick up and drop off bicycles anywhere within a designated area, making it easy to get to their destination without being tied to a docking station.
- **Scalability:** Dockless bike-sharing systems can be scaled up quickly and easily, as there is no need to install and maintain docking stations.
- **Lower costs:** Dockless bike-sharing systems can be less expensive to operate than docked systems, as there is no need to install and maintain docking stations.

However, dockless bike-sharing systems also have some challenges, including:

- **Disorderly parking:** Users may park bicycles in inappropriate or unsafe locations, leading to cluttered streets and sidewalks.
- **Theft and vandalism:** Bicycles in dockless systems are at higher risk of theft and vandalism than those in docked systems, as there is no secure docking station to keep them in.
- **Maintenance:** The bicycles in dockless systems may require more frequent maintenance and repairs, as they are subject to more wear and tear.

Dockless bike-sharing systems provide a flexible and convenient form of transportation for users but require careful management and regulation to ensure their success and sustainability.

Unlocking Spin bike with a smartphone



Image Source: GeekWire

Mobike preferred location and bike parking



Image Source: Mobike

Aarhus, Denmark: bike-rental scheme

The public cycling program in Aarhus, Denmark, was initiated in 2004 and ceased operations in December 2022 due to insufficient support. Nevertheless, it served as an excellent example of a shared cycling infrastructure, with more than 52 strategically located cycling stations near university campuses, bus and train stations, and other major population centers in the Mid-Jutland region. The program had over 450 bicycles and was operational for nearly 20 years. The bicycles had a well-designed structure, night lights, a bike horn, and a recognizable appearance. The bicycles were available for rent 24/7, and citizens could borrow them by inserting a 20 DKK coin into the locking mechanism, which functioned similarly to a supermarket cart. This made the system inclusive, allowing anyone to rent a bicycle indefinitely for a small fee.

However, despite the mechanical aspect of the system, there were increased operation and maintenance costs because both bicycles and stations required regular upkeep. The coin-based rental system allowed bikes to be used for free, as citizens received their deposit back when returning the bike to any station, making the system inclusive but not holding users accountable for their usage behavior, leading to vandalism and hacking. Additionally, the mechanical system did not allow for real-time tracking and analysis of cycling behavior or commuting routes.

The shared cycling system in Aarhus depended on operating grants

from municipalities and the National Rail Network Company (DSB), **as well as advertising income**, to cover annual operation and maintenance costs. Bikeshare Denmark A/S, a company owned by the City and Commuter Bicycle Foundation, operated the system.

Aarhus old city bikes



Image Source: Wikipedia

The Netherlands: OV-fiets, a national bike-sharing system

Docked shared-cycling systems may include features meant to offer to municipality data related to cycling behavior and to make citizens more accountable. Such an example is the OV-fiets bike-sharing system in the Netherlands which is operated by the Dutch national railway company, Nederlandse Spoorwegen (NS). The system provides bicycles for short-term rentals at railway stations across the country.

OV-fiets has become a popular option for commuters in the Netherlands, providing a convenient and sustainable way to travel to and from railway stations. Users can rent bicycles for a small fee and return them at any of the 300 OV-fiets stations across the country. In 2022 the system registered over 5.4 million rides.

Some of the key features of OV-fiets include:

- **Availability:** OV-fiets has a large network of stations across the Netherlands, making it easy for users to find and rent bicycles. Unlike the system in Aarhus, the stations are situated only near the train stations.
- **Integration with public transport:** The OV-fiets system is integrated with the Dutch public transport system, allowing users to easily switch between bicycles and trains, buses, or trams.
- **User-friendly:** The OV-fiets system is user-friendly, with a simple rental process and a mobile app that allows users to reserve bicycles in advance.

- **Affordable:** The rental fees for OV-fiets are relatively low, making it an affordable option for short-term transportation.
- **Sustainable:** By providing a bike-sharing system, OV-fiets promotes sustainable transportation and reduces the use of cars and other polluting forms of transportation.

Unlike the system in Aarhus, the OV-fiets bicycles include electronic components that allow users to rent them using membership cards. This means that the operating company has a better view on the cycling behavior of citizens using bikes and the period they are used for. In contrast to the bike system in Aarhus, where all citizens with a 20 DKK coin could rent any bike, the OV-fiets system allows only citizens with a Dutch bank account to create an account to rent OV bikes. Users can rent the bikes only from specially built garages and the renting period ends when they are returned to the same location. Bikes can be returned to other locations, but users are charged a €10 extra fee, thus increasing the accountability of users but also making the whole system sustainable.

Overall, OV-fiets has become an important part of the transportation infrastructure in the Netherlands, providing a convenient and sustainable option for commuters and travelers alike. The success of OV-fiets has also inspired other countries and cities to adopt similar bike-sharing systems to promote sustainable transportation and reduce traffic congestion.

OV-fiets outdoor bike docks



Image Source: ovmagazine.nl

OV-fiets new card lock/unlock mechanism



Image Source: ns.nl

Rental bike from private company - Lake Balaton



Image Source: Photo taken on site

Rental bike from private company - Lake Balaton



Image Source: Photo taken on site

Veszprem: V-Bike System

Close to the Lake Balaton Functional Area, in Veszprem, a public bike-sharing system called the V-Bike has been implemented. This initiative enables citizens to rent public electric bicycles to explore the city, adding an environmentally friendly transportation option. The project, which was funded through EU grants, has been designed with convenience in mind. Users can request a card to use the system or rent the bikes with a generated PIN code after registration. A variety of rental options are available, ranging from a daily ticket costing around 500 HUF with a 10,000 HUF deposit to three-day, weekly, half-year, or annual tickets. The V-Bike system thus exemplifies how strategic planning and investment can create accessible and sustainable transportation alternatives for a community.

Locations of V-Bike bike sharing stations in Veszprem

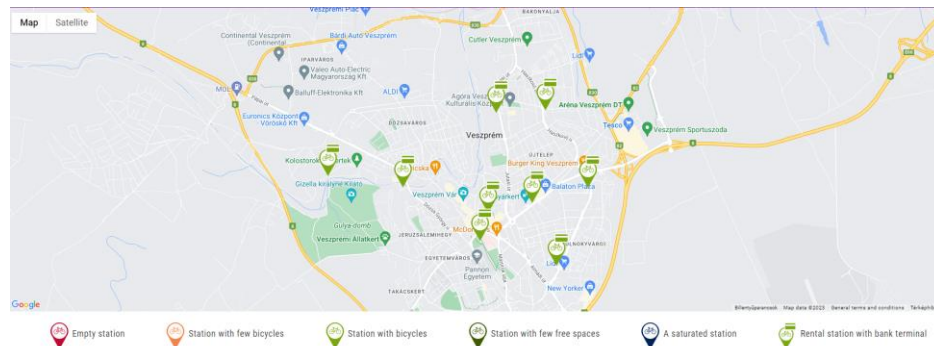


Image Source: vbike.hu



Image Source: Photo taken on site



Image Source: Photos taken on site



Image Source: Photos taken on site

Concept: gridHEROES - Rental bikes for better strategic planning

The Lake Balaton Functional Area, like other similar regions, grapples with various challenges including pollution from the transport sector, sedentary and environmentally harmful citizen behaviors, a lack of digitalization within public administration, and the absence of a data-driven decision-making framework.

The gridHEROES concept offers an integrated solution, aligning with the GRID (Green, Resilient, Inclusive, and Digital) principle, made up of three interconnected elements aimed at monitoring cycling behaviors and their impact on climate, planning new cycling infrastructure, and inspiring people to use and share bicycles. The ultimate ambition of this concept is to turn everyday citizens into grid heroes. These elements include:

- Intelligent, eco-friendly public charging stations situated near key locations like train stations, city halls, or public beaches. These stations are solar-powered and crafted with resilience and inclusiveness in mind.
- Safe and accessible public e-bicycles designed to assist riders across challenging terrain, reduce CO2 emissions, and encourage individuals of all ages to adopt climate-neutral practices and develop a passion for bicycling.
- A software application tailored for municipalities, gathering both real-time and historical data about the location and use of public e-bicycles. This app is instrumental in assessing climate effects,

producing behavioral statistics, planning fresh cycling infrastructure, and innovating ways to gain traction for the project, such as fostering public support or gamifying bike riding and sharing. This type of solution also increases the municipality's digital resilience and decision-making capacity.

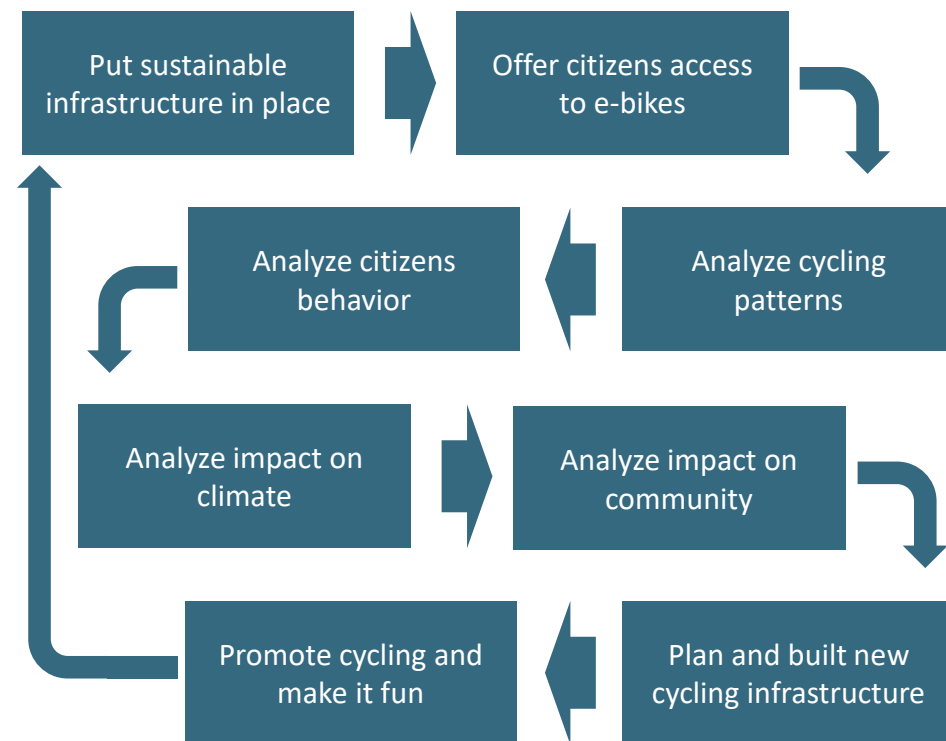


Figure Source: Processed info from gridHEROES concept

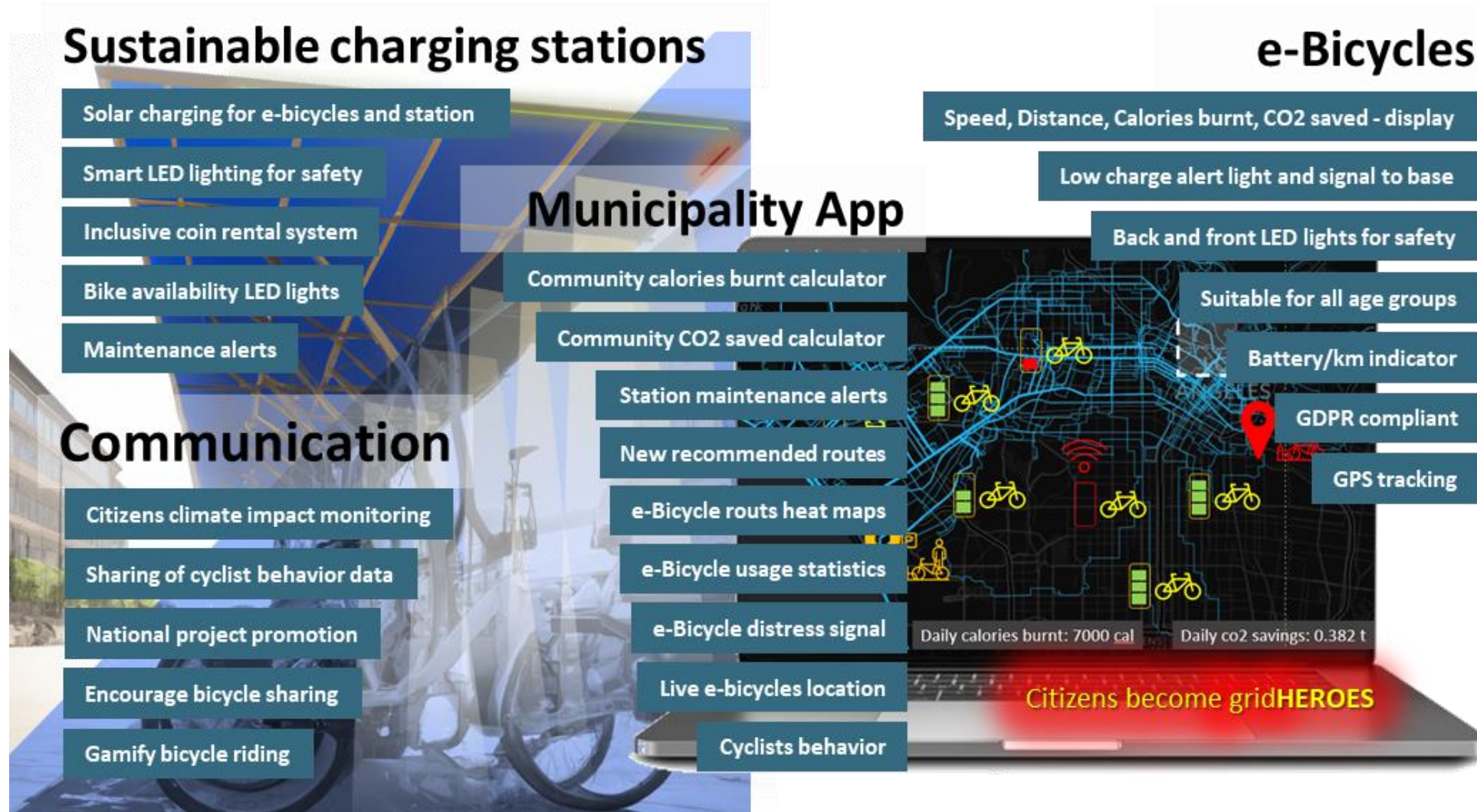


Image Source: gridHEROES Proposal – West Ialomita Functional Area, Romania

Concept Before: Possible location for bike sharing System



Concept After: Sustainable and inclusive bike sharing system



Image Source: Image taken on site and solution generated using AI

Relevance for the functional area level

Bike sharing systems

Bike sharing systems play a crucial role in redefining mobility within functional areas, which are regions with high interconnectedness in terms of economic and social activities. By implementing bike-sharing on a supra-local, regional, or national scale, it becomes possible to create a more sustainable and environmentally-friendly transportation network, which drastically reduces emissions and traffic congestion. The smaller footprint and maneuverability of bikes make them highly efficient, especially during peak hours. Moreover, such systems promote economic efficiency by being cost-effective, and when integrated with public transportation, they provide seamless intermodal commuting options. The health benefits of cycling are an added advantage, contributing to the physical well-being of the population.

Furthermore, large-scale bike-sharing systems contribute to social inclusion by providing accessible transportation options for marginalized communities. They also enable better urban planning by reducing the space required for roads and parking, which can be repurposed for green spaces and pedestrian zones, enhancing the quality of life. Moreover, the adoption of bike-sharing systems can initiate cultural shifts, fostering community building as people are more likely to engage with each other on bikes compared to being isolated in cars. In essence, supra-local bike-sharing systems have the potential to transform functional areas into more sustainable, efficient, inclusive, and community-oriented spaces.

Bike-to-work schemes

Learning from practice

Bike-to-work schemes are becoming increasingly popular in Europe, as governments and employers seek to promote sustainable transportation and improve public health. The Netherlands, France, or Belgium are the European countries with some of the most successful cycle-to-work schemes. These schemes offer incentives to employees who choose to cycle to work instead of driving or using public transport to reduce traffic congestion, promote sustainable transportation, and improve employees' health and well-being through active travel. Ensuring access to purchasing or renting e-bikes is a core requirement to facilitate longer commuting routes and address topography challenges.

Characteristics:

- **Incentives:** Bike-to-work schemes provide incentives such as financial rewards, tax benefits, or subsidies to encourage cycling.
- **Technology:** E-bikes are the most efficient for commuting, and their purchase or rental should be eligible from bike-to-work program rewards
- **Infrastructure:** Successful schemes also rely on the development and improvement of cycling infrastructure, including bike lanes, parking facilities, and showers/changing rooms at workplaces.
- **Education and support:** bike-to-work schemes can be enhanced by offering training programs, workshops, or resources to educate and support participants in cycling safely and confidently.

Advantages:

- **Health and wellbeing:** Cycling to work promotes physical activity, contributing to improved health and well-being for individuals. It helps reduce sedentary behavior and offers a convenient way to incorporate exercise into daily routines.
- **Employee Engagement and productivity:** Encouraging active commuting fosters employee engagement, motivation, and overall well-being, leading to potential productivity gains.

- **Environmental sustainability:** Bike commuting reduces carbon emissions and air pollution
- **Cost Savings:** Cycling is a cost-effective mode of transportation, requiring minimal expenses compared to owning and maintaining a car or using public transport.
- **Reduced Congestion:** By encouraging cycling, bike-to-work schemes help alleviate traffic congestion and contribute to smoother traffic flow in urban areas.

Challenges:

- **Infrastructure Gaps:** In some locations, inadequate cycling infrastructure, such as bike lanes and secure parking facilities, can pose challenges for bike commuting.
- **Safety Concerns:** Safety is a significant concern for cyclists, particularly in areas with heavy traffic or a lack of awareness from other road users. Addressing safety issues through infrastructure improvements and awareness campaigns is necessary.
- **Distance and terrain:** Longer distances or challenging topography may discourage some individuals from choosing cycling as their primary mode of transportation. Access to e-bikes is, therefore, a necessity for such areas.

- **Weather Conditions:** Adverse weather conditions can make cycling challenging and less appealing for some commuters. Therefore, training and support should also cover this topic, building on best practices from cities with year-long cycling (see Oulu, Finland).

Bike to work art



Image Source: vantagefit.io

European bike-to-work schemes

In the Netherlands, bike commuters benefit from an allowance scheme per kilometer, which they redeem from their employers. The tax-free travel allowance went up from €0.19 to €0.21 in 2023 and will be €0.22 in 2024. This allowance was previously used for drivers to cover their fuel costs, and since 2006, this was expanded to cyclists, encouraging more people to cycle to work and reducing the use of cars.

Belgium's "bike-to-work" scheme also offers a financial reward to employees who cycle to work (similar to the Netherlands), as well as tax incentives for employers who provide facilities for cyclists, such as bike parking and showers.

In 2020, a scheme called the "Forfait Mobilités Durables" by the French government, allows companies to provide tax-free financial incentives for employees who use environmentally friendly modes of transport. For example, those cycling to work can claim €0.25/cycled km, to a maximum of €800/year. The scheme also involves sustainable transport operators, and employees can use the money to pay for subscription services (e.g. e-bike).

Other European countries, such as Denmark, Sweden, and the United Kingdom, also have different cycle-to-work schemes. These schemes include tax incentives for employers, financial rewards for cyclists, free bikes or bike rentals, and other incentives to encourage cycling to work.



Helsingborg, Sweden: promoting cycling for commuting

300 Test Cyclists is a project implemented in Helsingborg in collaboration with Lund University to generate a modal shift away from cars towards cycling as a mode of transport. According to the results of the project, up to 80% of participants who tested cycling for commuting purposes for six weeks, wish to continue. The project will also include a guide to replicate solutions to create behavioral change across neighboring municipalities.

Another project implemented to support sustainable mobility, including cycling, at a cross-jurisdictional level is *Sustainable Business Travel 2.0*, bringing together the County Administrative Board Skåne, the Energy Office Skåne, Lund University, Lund Municipality and the City of Helsingborg, with financing from the Energy Agency. The project aims to support 20-30 companies in Helsingborg and Lund to transition to more sustainable travel by promoting commuting to work in a sustainable way (by choosing railway transport, cycling, or a combination of the two, depending on the distance travelled), as well as increasing the proportion of digital meetings, in an effort to reduce CO2 emissions. Companies can register for the project to benefit from saving money, becoming more attractive employers, and contributing to healthier employees and reduced congestion in cities. The project continues the successful Sustainable Business Travel 1.0 project, implemented between 2018-2020.

Kungstorget in Helsingborg



Image Source: ecf.com

Relevance for the functional area level

Bike-to-work schemes

Bike-to-work schemes are invaluable assets for functional areas, addressing multiple challenges associated with commuting. Encouraging employees to switch from private vehicles to bicycles alleviates pressure on road infrastructure and ensures smoother traffic flow, particularly during peak hours. With bicycles being a zero-emission mode of transport, these schemes contribute towards reducing carbon footprints, which is essential in densely populated functional areas prone to pollution. Moreover, cycling as a form of physical exercise confers numerous health benefits, including cardiovascular fitness and mental well-being, leading to a more productive and energized workforce.

Integrating e-bikes into bike-to-work schemes is especially beneficial for catering to longer commuting distances within functional areas, enabling an even broader demographic to participate due to the reduced physical exertion compared to conventional bicycles. This further supports sustainability goals and extends the health benefits of cycling to a larger population. Additionally, the growing adoption of cycling can initiate a cultural shift, prompting cities and municipalities to invest in better cycling infrastructure such as dedicated lanes and secure parking. Through enhancing connectivity, promoting health, and bolstering sustainability, bike-to-work schemes stand as a potent and holistic solution for modernizing transportation within functional areas.

Mobility as a service (MaaS): a one-stop-shop for transport needs

Learning from practice

Integrating various transport services into a single, on-demand mobility service that replaces the need for multiple ticketing systems and payment operations is commonly known as Mobility as a Service (MaaS).

The definition used in the *Mobility as a Service (MaaS) and Sustainable Urban Mobility Planning Guidance (2019)*²³, is offered by MaaS Lab of the University College London: “Mobility as a Service is a user-centric, intelligent mobility management and distribution system, in which an integrator brings together offerings of multiple mobility service providers and provides end-users access to them through a digital interface, allowing them to seamlessly plan and pay for mobility.” This definition summarizes key elements of MaaS, focusing on user benefits, while the scheme below showcases the

roles and interrelations of such a system, where the supply side (transport operators, infrastructure and adjacent services) meets the demand side (users) through a Maas Operator.

A key requirement for establishing MaaS is legislation allowing private companies and public transit authorities to share data with each other, following GDPR rules. Data sharing is at the core of creating integrated and efficient transportation systems that benefit both the public and private sectors. By sharing data, transport operators can gain valuable insights into user demand and travel patterns, enabling them to optimize their services and better meet user needs.

Find out more: The [MaaS Alliance](#)²⁴ is a public-private partnership that brings together public authorities, transport/mobility service providers, technology solutions providers, associations, and consultancy, research, and innovation organizations. Its primary goal is to establish a standardized framework for Mobility as a Service (MaaS) and facilitate economies of scale to ensure the successful adoption and worldwide implementation of MaaS. Additionally, UITP (Union Internationale des Transports Publics) is the International Association of Public Transport, serving as a global platform for collaboration and knowledge sharing in the transportation industry. A report on Maas and policy implications is available [here](#)²⁵.

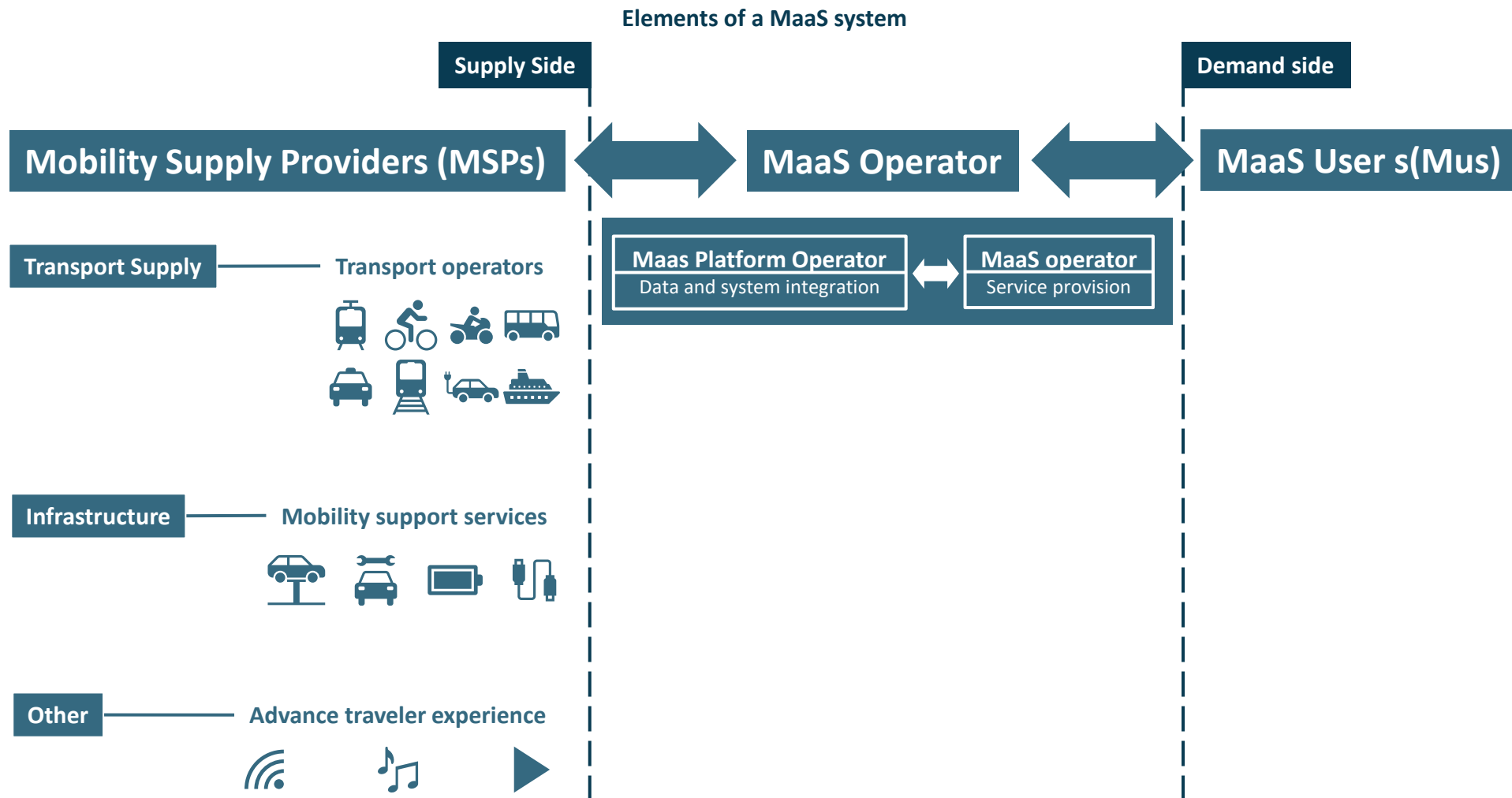


Figure Source: Processed info from Mobility as a Service (MaaS) and Sustainable Urban Mobility Planning Guidance

Antwerp, Belgium: implementation of MaaS

Antwerp has ambitious targets to promote cycling as one of the main modes of transportation throughout the functional urban area. Within the Transport Region Antwerp, which encompasses 32 municipalities, diverse stakeholders collaborate with a shared ambition embodied in the slogan "Moving Forward Together" (Samen Vooruit). The region's goal is to undergo a comprehensive transformation of mobility, treating it as a unified multimodal system (through the implementation of Mobility as a Service - MaaS), with the objective of ensuring that 50% of all journeys are facilitated by sustainable transportation methods.

Antwerp has actively supported the integration and adoption of Mobility as a Service (MaaS), through its "Smart Ways to Antwerp" app. Through a single application, people can conveniently plan their routes and access various multi-modal travel options. This was possible by implementing a license model for shared mobility and data obligations, data standardization, establishing a marketplace for mobility projects, and creating an "Application Programming Interface" (API) marketplace. The app brings together all public transport, bike-share, e-scooter, moped and car-sharing services.

The city of Antwerp also developed a 4-year *Bicycle Policy Plan*²⁶ and a *Bicycle Action Plan - Antwerp World-class cycle city*²⁷ (2015-2019), which involved identifying and addressing any deficiencies in the network, such as missing, weak, unsafe, or unclear links and

fostering a cycling culture. The plan includes measures for both cycle highways and "cycle streets", where cyclists have priority to cars, which are regarded as guests.

Cycle streets are characterized by the fact that they are used predominantly by cyclists, they can use the entire width of the street, cars are not allowed to overtake them, and they must stay within a 30 km or lower speed limit. Since 2012, cycle street signs have been incorporated into the national traffic law.

Find out more [here](#).

Smart to Antwerp App

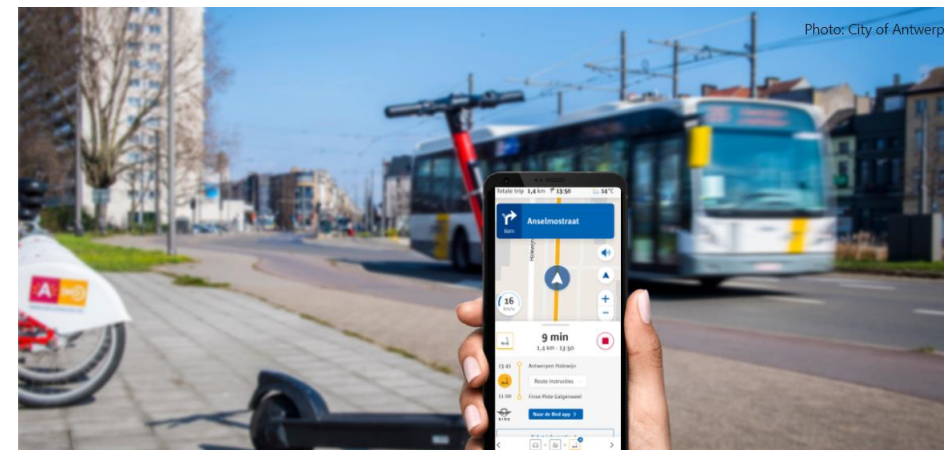


Image Source: cities-today.com

Concept: One MaaS app/website for all private bike rentals and travels in the Lake Balaton Functional Area

The integration of a municipality (functional area) app for all private bike rental companies in the Lake Balaton Functional Area could be an innovative leap towards the concept of Mobility-as-a-Service (MaaS). Such an app could provide an integrated and customer-centered solution for all travel needs, connecting different transportation methods through a unified platform. A unified app could significantly benefit both the service providers and the users in the context of the Lake Balaton Functional Area:

- **Enhanced User Experience:** By consolidating all private bike rental services in one app, users can effortlessly find, compare, and book the most suitable bicycle for their needs. With real-time information and a seamless booking process, the app can enhance the user experience, making cycling an attractive and convenient transportation option.
- **Improved Accessibility and Inclusivity:** A functional area-backed app could ensure that the services are available to everyone, irrespective of age or technical proficiency. With user-friendly interfaces and dedicated support, even those not accustomed to digital platforms could easily utilize the service.
- **Data-Driven Decision Making:** By centralizing all private bike rentals, the app can generate valuable insights into user behavior, preferences, and traffic patterns. This data can guide municipalities in planning and developing cycling infrastructure, aligning with community needs and environmental goals.
- **Sustainability and Integration with Other Transport Modes:** The app could act as a hub for not just bike rentals but an integration point for other transportation modes like buses, trains, or car-sharing. This would support the creation of a truly interconnected and sustainable mobility system, allowing users to plan and combine different modes of transport within one application.
- **Economic Opportunities:** For private bike rental companies, being part of a functional area-endorsed platform could boost visibility and trust among potential users. This could lead to increased rentals, fostering economic growth within the sector.
- **Community Engagement:** A unified platform opens the door for community-driven features such as gamification, rewards, and social engagement. These aspects could create a stronger sense of community among users and encourage more people to adopt cycling as a primary means of transportation.
- **Enhancing the MaaS Ecosystem:** By incorporating private bike rentals into a municipality app, Lake Balaton Functional Area would take a significant step towards the realization of the MaaS concept. This move towards a comprehensive, customer-focused transportation service that emphasizes flexibility, sustainability, and connectivity could revolutionize how residents and visitors navigate the region, placing emphasis on ease of use, inclusivity, sustainability, and interconnectedness.

Concept: Tourists using Lake Balaton MaaS App



Image Source: AI generated

Concept: Tourists travelling around Lake Balaton



Image Source: AI generated

Relevance for the functional area level

Mobility as a service (MaaS): a one-stop-shop for transport needs

Mobility as a Service (MaaS) is crucial for functional areas, as it presents a more sustainable and efficient alternative to the traditional car-dependent model of transportation. In urban and suburban areas where transportation demands are high, MaaS platforms can facilitate a shift from personal vehicle use to a combination of public and shared mobility solutions, reducing traffic congestion and lowering greenhouse gas emissions. By offering integrated services such as route planning, real-time information, and payment options through a single platform, MaaS encourages the utilization of public transportation, ridesharing, bike sharing, and other alternatives. This seamless integration makes it convenient for users to find and access the most efficient mode of transportation, thereby encouraging behavioral changes that favor sustainability.

Furthermore, MaaS addresses diverse transportation needs through its demand-responsive nature, particularly in less densely populated areas, by providing customized solutions such as on-demand shuttles, bridging the mobility gap and promoting social inclusion. Additionally, as data is collected on commuting patterns MaaS's data-driven insights allow for the optimization of public transport routes and resource allocation, contributing to the overall enhancement of livability and economic competitiveness in functional areas.

Logistics



2.3 Logistics – The promising role of cargo bikes

„The last mile is currently regarded as one of the more expensive, least efficient and most polluting sections of the entire logistics chain”²⁸

The rise of e-commerce has skyrocketed freight-related transport over the past decade, contributing to increased intra-urban congestion as goods find their way to their destination. The "last mile" refers to the final segment of a business-to-consumer (B2C) parcel delivery, where the goods are transported to the ultimate recipient's home or a designated pickup point. It is the most challenging aspect of logistics, as it can involve navigating through congested urban areas and contribute to increased pollution.

Replacing motorized vehicles such as cars, vans and lorries with cargo bikes presents a significant opportunity to decrease CO₂ emissions and enhance air quality. Studies show that an estimated 30% of emissions from transport in European cities are attributed to commercial deliveries²⁹. The adoption of cargo bikes can also effectively reduce traffic congestion by eliminating the need for vans to continuously search for parking spaces, while also decreasing noise levels.

Major economic savings are also at stake. The last one or two kilometers in the supply chain journey are responsible for up to 70 % of delivery costs, according to findings of the City Changer Cargo Bike

project dedicated to exploring the full potential of cargo bikes for public, private and commercial users, funded through Horizon 2020. Moreover, 51% of all motorized goods transport trips in European cities could be done by bicycle or cargo bicycle³⁰.

The findings of a cost modelling and simulation of last-mile deliveries suggest that the utilization of cargo bikes for deliveries in urban areas can potentially lead to a substantial cost reduction of up to 45%³¹. These savings are additional to those from the lower price and running cost compared to motorized vehicles, making cargo bikes the most cost-effective transportation option for urban deliveries. In a study undertaken in London, researchers tracked deliveries by cargo bike using GPS technology and found that they are between 25% to 50% faster than vans in city centers³².

In terms of private use, letting go of cars can be a difficult decision, particularly for those who use them as a means for getting children to school, or for carrying goods in daily errands.

In such scenarios, relying solely on a traditional bicycle might not be sufficient. However, cargo bikes are a suitable alternative. Diverse models are available for various requirements, including carrying children, shopping items, and business deliveries.

Cargo bikes are widely embraced by individuals for private use, particularly for picking up and dropping off kids. For instance, in the Copenhagen metropolitan area, approximately 40,000 cargo bikes are used daily, with 26% of families in Copenhagen owning a cargo bike if they have two or more children. Similarly, in Amsterdam, a staggering 90% of cargo bikes are purchased by parents seeking a practical and eco-friendly means of transporting their kids³³.

The Cyclelogistics EU-funded project developed a list of “20 Good Reasons to Ride a Cargo Bike”, with the European Cyclists' Federation and the European Cycle Logistics Federation as the contributors. Discover it [here](#).

Cargo-bikes used to transport children to school



Image Source: copenhagenize.eu

Danish Postal Service using cargo-bikes



Image Source: copenhagenize.eu

Sustainable Urban Logistics Plans (SULPs)

A Sustainable Urban Logistics Plan (SULP) is an integral part of the SUMP and should follow the same principles, and its development and implementation imply a cross-jurisdictional approach. Active participation of industrial stakeholders, including businesses and logistics organizations in the planning process, needs to inform decision-making, in order to ensure that the measures contribute to increased profitability and efficiency. As part of the elaboration of the 2nd edition of the SUMP Guidelines in 2019, several topic guides were developed, including a guide on *Sustainable Urban Logistic Planning*³⁴, detailing each of the planning steps, based on the SUMP framework. According to the guide, the definition of the territory of a SULP “should be guided by the typology of supply chains with an origin/destination in the area”, based on the functional urban area.

In 2015, a separate **methodology for developing SULP with a focus on small and medium towns**³⁵ was created by the EU-funded ENCLOSE (ENergy efficiency in City LOGistics Services for small and mid-sized European Historic Towns) project and was tested by 9 participating towns. The methodology can be used by other European cities and functional urban areas looking to tackle urban freight concerns within the broader context of urban mobility planning. The use of cargo bikes, along with low-emission and zero emission vans, is listed as a key measure for ensuring sustainable logistics.

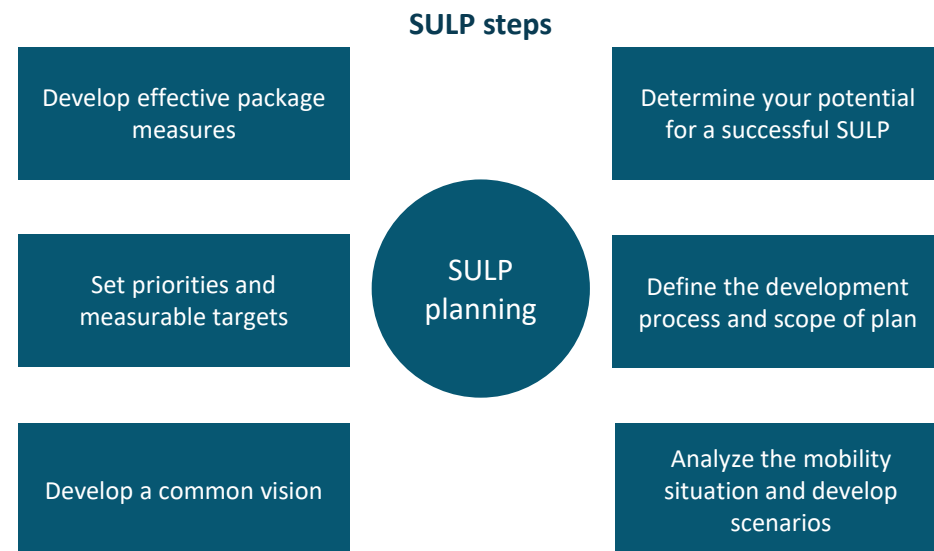


Figure Source: Novelog Project WP7 - Business models and guidance - Guidance Strategy on Business Model Development: the NOVELOG “Guidance” tool

What are the types of public investments to support the uptake of cargo bikes for sustainable urban logistics?

Local and functional area authorities can take various measures to promote the uptake of cargo bikes for sustainable logistics, contributing to the reduction of carbon emissions and improved air quality: creating cycle-friendly environments, providing space for storage and hubs, initiating cargo bike rental and purchase programs, promoting cargo bikes to businesses and leading by example³⁶.

- **Cycle-friendly environments:** Authorities should prioritize the development of infrastructure that supports safe and efficient cycling, such as dedicated cycle lanes, bike parking facilities, and traffic calming measures, according to the five principles for high-quality cycling infrastructure: safety, directness, connectivity, comfort and attractiveness.
- **Space for storage and hubs:** Authorities can allocate space for the storage of cargo bikes and establish central hubs for parcel sorting and distribution. These locations should be strategically positioned within one to two kilometers of the intended delivery area, facilitating convenient access for cargo bike operators.
- **Cargo bike rental and purchase programs:** Authorities can launch programs that enable individuals and businesses to hire or purchase cargo bikes at affordable rates. By making cargo bikes more accessible, these schemes encourage their adoption and facilitate the transition to sustainable logistics practices.

- **Promotion of cargo bikes to businesses:** Authorities can actively promote the benefits of cargo bikes to businesses, highlighting the advantages such as reduced emissions, improved air quality, and cost savings. They can organize informational campaigns to raise awareness and showcase successful case studies of businesses that have implemented cycle logistics solutions.
- **Leading by example:** Local authorities can lead by example by incorporating cargo bikes into their own public services. They can use cargo bikes for various tasks such as street cleaning and maintenance, internal post, or other deliveries to public sector buildings.

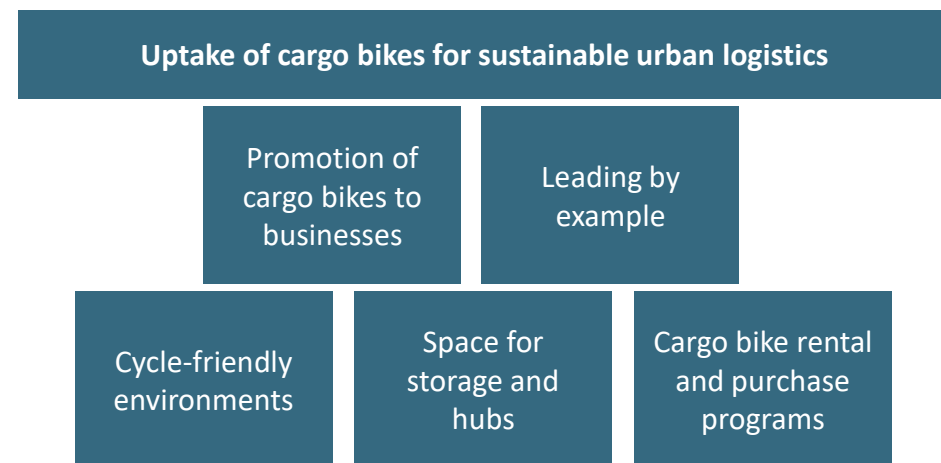


Figure Source: Processed info from text on page

Relevance for the functional area level

Sustainable Urban Logistics Plans (SULPs)

Sustainable Urban Logistics Plans (SULPs) are key to achieving efficient and sustainable goods distribution in functional areas, which are often complex environments that encompass urban, suburban, and rural territories. In such regions, SULPs are highly relevant as they holistically address the logistical challenges of transporting goods, ensuring that both urban centers and peripheral areas are well-served. The strategic implementation of SULPs ensures that all areas within the region, including less accessible rural or peripheral areas, benefit from effective logistics systems. This can lead to improved economic activity, better access to goods and services, and increased quality of life.

Beyond these benefits, SULPs also play a crucial role in environmental sustainability. They aim to minimize the environmental impact of logistics operations by promoting the use of cleaner vehicles, optimizing delivery routes, encouraging off-peak deliveries, and implementing innovative solutions like urban consolidation centers or cargo bikes. These measures can significantly reduce carbon emissions, air and noise pollution, and traffic congestion in the functional area. Therefore, SULPs not only optimize logistics in the functional area, but also contribute significantly to the broader goals of sustainable development, making them an essential component of planning and policy in these regions.

Cargo bikes

Learning from practice

Characteristics

- **Transport capacity for goods and people:** Cargo bikes are specially designed bicycles with a larger frame and built-in cargo capacity. They have a sturdy construction, including a longer wheelbase and a front or rear cargo area. E-cargo bikes are particularly efficient for commercial but also private use.
- **Variety of configurations:** Cargo bikes come in a range of configurations (with different load capacities and prices). Lighter models, priced between €1000 and €2000, can handle loads up to 80 kg, whereas heavier models, ranging from €2000 to €12000, have a greater load capacity of up to 350 kg³⁷.

Advantages

- **Reduced emissions from last-mile logistics:** Cargo bikes offer an alternative to motorized vehicles for transporting goods, reducing carbon emissions and environmental impact (concentrated in the last mile)
- **Efficiency and health:** Cargo bikes (in particular, e-cargo bikes) can navigate through congested urban areas more easily than larger vehicles, allowing for faster and more efficient delivery of goods, with the added benefit of health gains for users.
- **Commercial and private use:** Businesses can use cargo bikes for efficient delivery services, while individuals can benefit from cargo bikes for personal use, such as carrying groceries, transporting children, or running errands.
- **Cost Savings:** Using cargo bikes can result in significant cost savings compared to using motorized vehicles for transportation.

Challenges:

- **Infrastructure and accessibility:** The availability and accessibility of infrastructure, such as separated cycle tracks, micro-logistics hubs and secure parking facilities, is required.

- **Limited load capacity:** While cargo bikes can carry substantial loads, there are limits to their capacity. Large or heavy items may require alternative transportation methods.
- **Topography and weather conditions:** Cargo bikes (particularly non-electric ones) may face challenges when operating in hilly areas or adverse weather conditions, as these factors can impact cycling efficiency and rider comfort.
- **Perception and awareness:** Cargo bikes may need more awareness among businesses, customers, and policymakers regarding their capabilities and benefits. Raising awareness and changing perceptions is necessary for wider adoption.

Ai generated cargo bike



Image Source: AI generated

AI generated cargo bike



Image Source: AI generated

Gdynia, Poland: Rental and purchase scheme of cargo bikes

The Polish city of Gdynia was one of the municipalities involved in the City Changer Cargo Bike project and has implemented multiple initiatives to support the take-up of cargo bikes, including a subsidy scheme. The city launched a cargo bike rental service in October 2019, initially offering three e-cargo bikes to residents for free trial periods before making a purchase. Local influencers were invited to experience the bikes, followed by satisfaction surveys to identify infrastructure needs. Another rental scheme was launched in late 2018, targeting NGOs and local businesses with the objective of reducing commercial van traffic in the city center.

Gdynia's "Cargo bikes in Gdynia – rental and purchase subsidy" initiative won first prize from the national Ministry of Climate and Environment, recognizing its positive impact on the environment and citizens' quality of life. The city also received the Legacy Award at the CIVITAS Forum, acknowledging its successful sustainable urban mobility plan.

The city plans to expand its cargo bike rental scheme, making bikes more accessible in residential areas, particularly around schools and public buildings. It is also exploring subscription-based rental systems with start-ups and companies.

The City Changer Cargo Bike project explored the transformative potential of cargo bikes as commercial and private transport vehicles, urban furniture and a platform for moving vendors.

It involved 22 partners, including cities, research institutions, NGOs, and companies across Europe, aiming to test solutions to support the uptake of cargo bikes.

Find out more about the City Changer Cargo Bike project and learn from the other cities involved [here](#) and [here](#) (project presentation).

Carrier preparing to deliver a package with a cargo bike

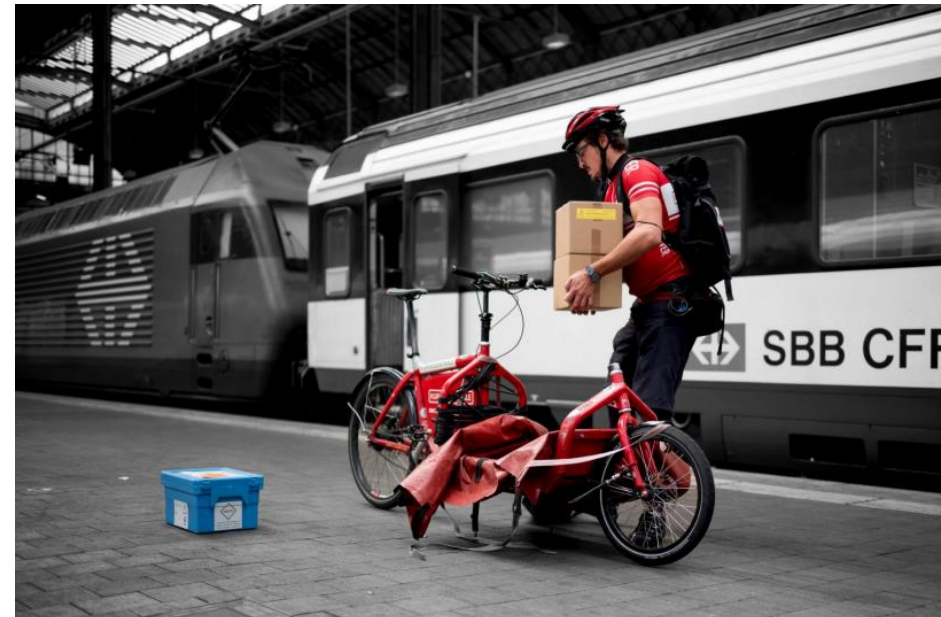


Image Source: ecf.com

Prague and Brno, Czech Republic: piloting micro-depots

“For Prague, the use of electric cargo bikes is a huge step toward a sustainable city. I am delighted to set an example for other European cities in green city delivery.”

Ondřej Boháč, Director of the Prague Institute of Planning and Development

In November 2020, Prague opened its first electric cargo bike depot in the Florenc area, serving as the parcel delivery depot for the city center. The project was nominated in the top three projects in the 'Zero Pollution' category of Eurocities' Awards in 2021, highlighting its positive environmental impact. The facility is operated by the Technical Road Administration of Prague.

Building on the success of the Florenc depot, Prague has decided to open a second depot in one of its business districts, beneath the city's inner ring road. The location facilitates convenient access for vans to drop off goods and enable cycle couriers to cover the last mile.

The pilot project demonstrated the positive impact of micro-depots in city centers on logistics efficiency, ensuring that goods reach their destinations via the shortest possible routes. The expansion of depots and the use of cargo bikes is a major initiative in the city's strive for sustainability.

Brno is also actively developing strategies and measures to address congestion in its compact historic city center and adjacent areas. In addition to implementing parking and access restrictions for private cars, the city is now seeking to reduce the number of delivery vans in the area. To achieve this, Brno intends to devise a comprehensive strategy that will explore and incorporate the utilization of cargo bikes and micro-depots.

Logistics depot for e-cargo bikes in Prague



Image Source: cargobikefestival.com

Cluj-Napoca, Romania: cycle logistics measures included in SUMP

The Cluj-Napoca Sustainable Urban Mobility Plan (SUMP) for 2021-2030 puts forward various measures to address the negative environmental impact of deliveries in the city center, including the use of cargo bikes. A reconfiguration of the goods delivery system is coupled with measures for eliminating heavy traffic and extending and improving the cycling network and continuing the pedestrianization process. Measures include:

- Limiting or discouraging daytime supply to commercial units
- Encouraging deliveries by electric vehicles, offering discounts on the access fee in the central area
- Promoting deliveries with cargo bikes
- Supporting bicycle couriers
- Facilitating the development of an "Easy Box" micro-deposit network for small parcels.

A significant project within the SUMP concerns establishing a network of electro-micro-mobility hubs (estimated at €3.5 mil.), serving as collection points for last-mile deliveries. Storage spaces for parcels will be strategically located outside the city center, reducing the emissions resulting from the delivery of goods. Depending on available space, the hubs will be equipped with facilities to transfer cargo from cars to cargo bikes.

The SUMP also proposes measures to support businesses that provide deliveries by bicycle, such as subsidies for the purchase of e-bikes specifically for couriers or offering tax benefits. Another proposal is to introduce a requirement for courier service apps to display the mode of transport used for deliveries (bicycle, scooter, or car) and, whenever feasible, provide information on the emissions generated. This simple requirement can increase transparency and awareness regarding the environmental impact of courier services, so that customers can make informed choices and support more sustainable options, while service providers are encouraged to prioritize low-emission modes of transport. By including emissions information, users can better understand the environmental consequences associated with their delivery choices.

Currier delivering packets with bike



Image Source: AI generated

Concept: Cargo Bikes Balaton

The Lake Balaton Functional Area's extensive network of approximately 1700 km of cycling paths makes it a prime location for developing cycling logistics hubs. This infrastructure promotes the feasibility of using bicycles for transportation and cargo delivery, providing ample space and connectivity. As a major tourist destination known for its beautiful lake, the area could capitalize on this infrastructure to establish cycling logistics hubs that serve not only the local communities but also the bustling tourist hotspots. The availability of such well-connected paths ensures that bicycles can move with ease, making logistics both sustainable and efficient.

Cargo bikes could be particularly transformative in this region, serving as quick supply routes for public beaches on the lake. During the peak tourist season, these beaches require a constant supply of amenities, food, and beverages. Traditional vehicular transport can be hampered by traffic and the often narrow roads leading to beach areas. Cargo bikes, on the other hand, can maneuver through congested areas with greater agility, ensuring timely deliveries. Additionally, the eco-friendly nature of cargo bikes aligns with the recreational and natural setting of the lake, preserving its beauty. Implementing cargo bikes for beach supply would not only enhance the region's logistical capabilities but also contribute to a more pleasant and environmentally conscious visitor experience.

Cargo bike delivering goods around Lake Balaton



Image Source: AI generated

Relevance for the functional area level

Cargo bikes

Cargo bikes hold a vital position in the sphere of sustainable logistics within functional urban areas. The multifaceted nature of sustainable logistics planning necessitates a comprehensive analysis and the development of integrated solutions that encompass the broader functional urban area, as facilities and operations often span beyond city boundaries. This cross-jurisdictional approach is essential in ensuring enhanced accessibility for all parties involved in the supply chain while simultaneously minimizing environmental impacts. A Sustainable Urban Logistics Plan (SULP) can serve as an instrumental tool in this regard, as it addresses the entire cycle of origin-destination trips within the functional area, considering the broader spectrum of sustainable urban mobility planning.

Cargo bikes offer a more agile and environmentally friendly alternative for transporting goods compared to traditional freight vehicles. As part of a well-structured SULP, cargo bikes can be seamlessly integrated into the logistics chain by establishing transfer points where goods can be shifted from larger freight vehicles to cargo bikes for final delivery. This not only enhances the efficiency of deliveries by navigating urban areas more effectively but also contributes to reducing congestion and emissions, which are exacerbated by larger vehicles. Furthermore, this approach supports the goal of creating more livable urban environments by decreasing noise pollution and making streets safer and more accessible for pedestrians and cyclists.

Leisure and tourism



2.4 Leisure and tourism

According to the definition by Sustrans, leisure cycling is “a trip undertaken for the purpose of the journey itself and, in this sense, is not a form of transport”, while cycling tourism entails recreational journeys far from home, where leisure cycling is at the core of the trip.

Cycling holds a dual role in functional areas as both a means of transport and a leisure activity, which can significantly contribute to the local tourism industry. Many travelers and tourists are increasingly seeking active and environmentally friendly ways to explore destinations. Cycling offers an immersive experience, allowing tourists to discover both urban landscapes and natural surroundings at a pace that permits a deeper connection with the environment. Functional areas can capitalize on this trend by developing cycling routes that highlight historical sites, cultural landmarks, scenic vistas, and other attractions. Moreover, cycling events and festivals can be organized to draw enthusiasts from various locations, further bolstering tourism.

Furthermore, the integration of cycling into the tourism offerings of a functional area contributes to sustainable tourism development. By promoting cycling as an alternative to motorized transport for tourists, functional areas can reduce the environmental impact of tourism, particularly in terms of emissions and congestion. This not only preserves the natural and urban environments, making them

more appealing to visitors but also enhances the quality of life for local residents.

Additionally, cycling-oriented tourism often supports local businesses such as bike rental services, cafes, and artisan shops, creating a more vibrant and economically sustainable community. Through the interplay of leisure and tourism, cycling becomes a valuable asset for functional areas in cultivating a sustainable and thriving tourism ecosystem.

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Image Source: AI generated

Eurovelo network

The European Cyclists' Federation (ECF), in collaboration with local and national partners, created the EuroVelo network of cycling routes. A single European network called EuroVelo combines existing and future national and regional cycle routes. By 2021, 64% of the total EuroVelo network of over 90,000 km was completed. The routes will also be marked with the EuroVelo signage.

The network provides many opportunities for developing cycling tourism across the EU, as proposed routes are increasingly integrated into national, regional and local strategies for sustainable mobility and tourism.

Find out more [here](#).

EuroVelo Map

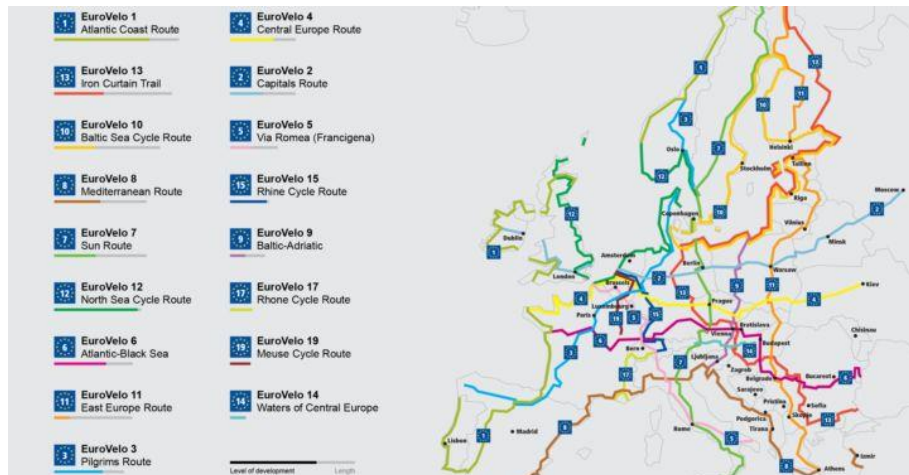


Image Source: en.eurovelo.com

EuroVelo Overview Map



Image Source: CyclingEurope.org

Slow, sustainable tourism

Cycling tourism offers a practical and effective solution for implementing tangible transformations in the tourism industry. The European Cyclists' Federation (ECF) has identified several actions to foster the growth of cycling tourism by leveraging the potential of Eurovelo networks³⁸. These are summarized below:

- **Integration of cycling tourism and EuroVelo in policies and strategies:** Advocating for the inclusion of cycling tourism and EuroVelo in national, regional, and local strategies for sustainable mobility and tourism
- **Development of seamless cycling infrastructure:** While progress has been made, there is still work to be done to achieve a fully connected EuroVelo network. ECF seeks to include EuroVelo in the Trans-European Transport Network (TEN-T) and calls for financial support to improve infrastructure quality and consistent route signage.
- **Facilitation of multimodality and cycling-friendly services:** Supporting the development of services such as parking facilities, multimodal options, bike rentals, and accommodations that cater to cycling tourists. Public subsidies and dedicated schemes can encourage SMEs to invest in cycling-friendly services.
- **Marketing and promotion of EuroVelo and cycling tourism:** Launching campaigns to promote cycling tourism and raise

awareness of EuroVelo. Providing access to up-to-date information and digital solutions for trip planning and booking. Innovative marketing activities are crucial to attract more people to cycling holidays.

- **Support for the development and understanding** of cycling tourism: Quantifying the positive impacts of cycling tourism on the local economy, environment, health, and job creation. Updating studies and research on EuroVelo and cycling tourism to gain a better understanding of the sector. Decision-makers' support and financial resources are essential for realising the full potential of cycling tourism.

AI generated image



Source: AI generated

Cycling tourism is a booster for the local economy

The development and promotion of Eurovelo routes can have a significant economic impact on the regions and functional areas they pass through. Eurovelo routes often pass through rural and less-visited areas, providing an economic lifeline. These routes can attract a growing number of cyclists, resulting in increased revenues for small local businesses ranging from accommodation facilities, restaurants, bike rental shops, tour operators or cycling equipment stores and thereby boosting the local economy.

Cycling tourism routes also have the potential to extend the tourism season in areas that are traditionally popular only during peak seasons. Cyclists may visit regions during off-peak periods, boosting local businesses during slower times and helping to balance tourism demand throughout the year.

Other opportunities for economic growth generated by Eurovelo routes include increasing property values, attracting real estate investment and boosting the local housing market, as well as savings in healthcare costs associated with air pollution-related illnesses and lack of physical activity.

What are the types of public investments to support cycling for leisure and tourism?³⁹

- **Infrastructure development:** constructing and modernizing cycling routes for exploring natural and cultural heritage;

establishing itineraries (tourist routes) and signage; building additional infrastructure such as rest areas, shelters, and bicycle stands; building observatories, implementing cycling markings on existing routes to enhance tourist experience.

- **Cycling tourism facilities:** creating, extending, and renovating investments in accommodations, common areas, and equipment or services for cyclists, such as bicycle storage and maintenance spaces for cyclists; establishing a "Cycling guesthouse" label that requires fulfilling specific criteria, such as providing secure bike storage or small repair workshops.
- **Planning and coordination:** developing a coordinated regional plan for cycle routes to position the region as a cycling tourism destination; ensuring overall consistency with other supported tourism actions to leverage tourism for economic development

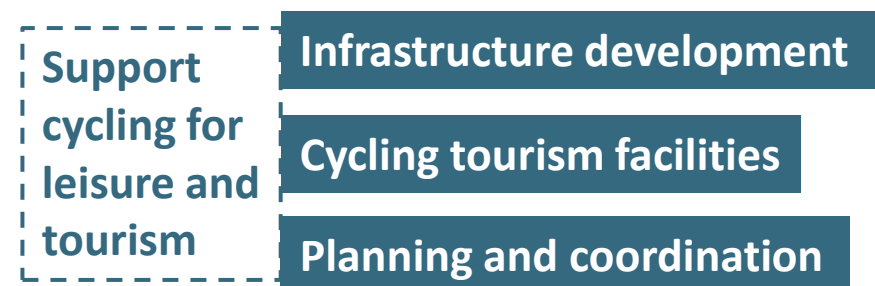


Figure Source: Processed info from INTEGRATED CYCLING PLANNING GUIDE INVESTING IN CYCLING FROM EU STRUCTURAL FUNDS DURING THE 2021–2027 MULTI-ANNUAL FINANCIAL FRAMEWORK

Cadiz, Spain: Using ITI for financing Eurovelo cycling tourism routes

Across EU countries, the EuroVelo network is strongly embedded in the planning of new cycling routes. The province of Cádiz in the Spanish region of Andalusia has used the Integrated Territorial Investment (ITI) instrument to develop a network of cycle routes and cycling tourism. In a comprehensive effort to reduce disparities compared to the rest of the region and the country, the province mobilized ITI funding to develop a route included in the EuroVelo cycling network (EuroVelo 8 - Mediterranean route) and support the development of sustainable tourism.

The project was implemented through the Interreg Europe ECO-CICLE project and aimed to create new opportunities for employment in the cycling tourism industry, diversify touristic offers in the province and facilitate access to natural areas. The network has also increased the connectivity between the municipalities and promotes sustainable mobility across the province.

The €30 million project resulted in 95 km of improved routes and 60 km of newly constructed routes along the EuroVelo 8 cycle route (with specific signposting), and an additional 64 km of improved routes and 68 km of new routes outside the Eurovelo network. The EuroVelo 8 Route is set to pass through numerous significant natural areas, thereby playing a crucial role in promoting cycle tourism within these regions.

Sign for the “Ruta Mediterránea de cicloturismo”



Image Source: pro.eurovelo.com

Timisoara – Serbia Cycle Route

The Timișoara-Serbia bicycle route is a 40km trail that begins in Timișoara, Romania, and winds along the Bega River to the border with Serbia, connecting with EuroVelo 11 and EuroVelo 13 cycling routes. The route contributes to local development and connects municipalities across country borders.

Over 40 organisations signed a joint declaration to support cycling tourism and the development of cycling routes in Romania, which included the commitment to create a working group to lead to developing and promoting of the EuroVelo routes and cycling tourism in Romania.

Timișoara, known as the city of flowers, is rich in culture and history with over 14,500 historic buildings. The bicycle route enables tourists and locals alike to immerse themselves in the rich culture and engage with the city's diverse population.

However, the Timișoara-Serbia bicycle route is more than just a pathway for cyclists; it is a conduit for cultural exchange, local engagement, the promotion of the region's historical and natural assets and a sustainable connecting route between the city and Timisoara and other smaller localities. The route fosters connectivity between Romania and Serbia and enhances local development through labor migration to and from the city of Timisoara and by providing opportunities for leisure and exploration.

Find out more [here](#).

Bike path in the city of Timisoara



Image Source: Eurovelo.com

Helsingborg - Gothenburg, Sweden: “Kattegattleden” National Route

“Kattegattleden”, [Sweden's first national cycle route](#), is the result of a collaboration between the municipalities, regions and the Swedish Transport Administration along the path, starting in Helsingborg. The city, together with the entire region, offer a wide range of opportunities for leisure cycling. The 390 km long cycling route connects several localities and natural attractions, all the way to the city of Gothenburg, along the coast. The cycling route is well promoted through a dedicated webpage, offering sightseeing information, services, path surface and difficulty levels for each of the 8 sections of the trail. Cyclists can use this platform to plan their route and explore other cyclists' experiences and share their own.

The city of Helsingborg is also a champion in promoting cycling as a means of transportation, with several initiatives such as bike-sharing programs (through an innovative bicycle library concept, the city offers free e-cargo bike and cargo bike rentals for three weeks), the construction of bike lanes and parking facilities, bike-to-work programs and education campaigns aimed at increasing awareness and safety for cyclists (including a traffic school for children).

Find out more [here](#).

Coastal Kattegattleden



Image Source: Skedaddle.com

Lake Balaton Natural Functional Region, Hungary: connected cycling routes around the lake

Cycling routes around Lake Balaton offer stunning views of the lake and the surrounding landscape. The route is mostly flat, making it suitable for cyclists of all levels, and it passes through many charming towns and villages along the way. Municipalities around Lake Balaton, the largest shallow, freshwater lake in Central Europe, have developed an extensive, well-connected cycling network, covering over 200 km. While projects have been individually implemented by local authorities as beneficiaries of national and EU-allocated funds (through the Territorial Operational Program), attention was paid to ensuring that the network is coherent and is promoted unitarily.

Considering the seasonality of tourism in Lake Balaton, developing cycling tourism is a major opportunity for extending the tourism period to spring and autumn. The cycling paths represent a major asset for leisure tourism, as they connect the main attractions around the lake. At the same time, the network supports sustainable mobility, enabling residents to choose cycling as a means of transport. Many investments were implemented with the help of EU funds.

For example, the ERDF-funded project "Green Zala Coast — development of a cycling route for tourist purposes along Zala and Gébart"⁴⁰ aimed to create a safe and high-quality cycling network that connects tourist destinations of the Balaton region.

The route is part of the EuroVelo 13 Corridor, connecting Austria and Lake Balaton. The project also involved building new cycling routes, renovating existing ones, and improving the related infrastructure, such as rest areas or drinking water sources.

Several bike rental services are available in the region, making it easy for visitors to explore the area on two wheels. Additionally, there are many rest areas and bike-friendly accommodations along the route, allowing cyclists to enjoy a multi-day cycling trip around the lake.

Lake Balaton bicycle path



Image Source: naturetravel.pl

Lake Balaton Functional Area Cycling and Hiking Network

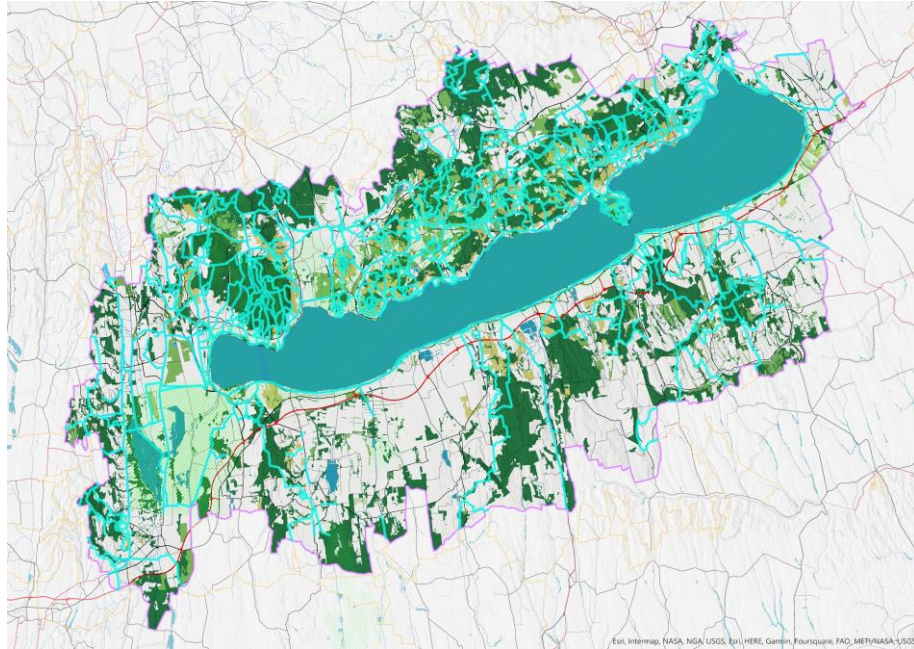


Image Source: World Bank

Cyclists around Lake Balaton



Image Source: Photo taken on site

Cyclists around Lake Balaton



Image Source: Photo taken on site





Cycling path leading to public beach - Alsóbélatelep Báthori Utcai Szabadstrand

Image Source: Photo taken on site



Tourist amenities at public beach – Alsóbélatelep Báthori Utcai Szabadstrand

Image Source: Photo taken on site

Tourist amenities at public beach – Alsóbélatelep Báthori Utcai Szabadstrand



Image Source: Photo taken on site

Cycling racks at public beach - Alsóbélatelep Báthori Utcai Szabadstrand



Image Source: Photo taken on site



Cycling resting place including cycling wine destinations map

Image Source: Photo taken on site



Map including bicycle racks at Festetics Palace

Image Source: Photo taken on site

Promenade cycling path in Balatonfüred



Image Source: Photo taken on site

Group of cyclists visiting Festetics Palace



Image Source: Photo taken on site

3.

Design principles for high-quality cycling infrastructure in practice



“Build it and they will come”

This section will dive into inspiring examples of applying world-class design principles for cycling infrastructure. But before that, let's take a step back to reflect on why building cycling infrastructure is necessary, even when there is a low level of demand among citizens. EU Member States have very different levels of cycling (with countries like the Netherlands and Denmark leading the way) but building cycling infrastructure should be a priority across all states. The answer to the question *Should we build cycling infrastructure if there is no demand for it?* is simple: build it, and they will come.

This statement equally applies to motorized and non-motorized traffic and stems from the principle of induced demand. The more roads we build for cars, the more car traffic we will have. The more high-quality cycling infrastructure, the more cyclists.

The five design principles for cycling infrastructure

The principles were first identified by the Dutch design manual, CROW (2007) and were also adopted by the European Commission as guidelines for developing cycling infrastructure. The five principles are: safety, comfort, coherence, directness and attractiveness. According to the *Guide for cycling projects in the EU*⁴¹, these design principles should be prioritized depending on the main use of the specific cycling route or network (utility or recreational), as follows:

- **Utility/transport cycle routes:** safety, directness, cohesion, comfort, attractiveness.
- **Recreational cycle routes:** safety, attractiveness, cohesion, comfort, directness.

A selection of the most important guides on designing cycling infrastructure is presented below. In an effort to standardize cycling projects at the EU level, a comprehensive review of existing recommendations was undertaken at the initiative of DG MOVE. This resulted in a collection of measures, factsheets and case studies (*Guidelines for cycling projects in the EU*). However, it emphasizes that practitioners should refer to national cycle infrastructure design standards or regulations, if available.

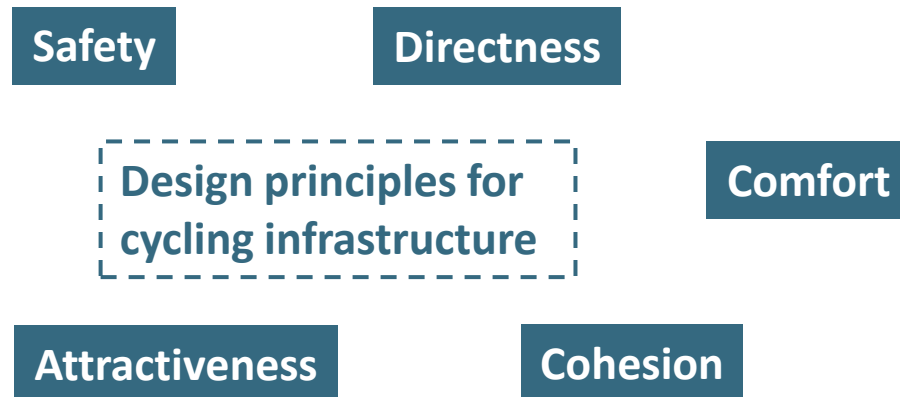


Figure Source: Processed info from CROW (2007)



Key resources on designing cycling infrastructure

- [Guidelines for cycling projects in the EU \(European Commission, 2019\)](#)
- [Urban Bikeway Design Guide \(NACTO, 2014\) - North American City Transportation Officials. GDCI: Global Street Design Guide *](#)
- [Handbook for cycle-friendly design \(Sustrans, 2014\)](#)
- [Cycle Highway Manual](#)
- [Safer Cycling Advocate Program – Best practice guide](#)
- [Urban Corridor Road Design](#)
- [National Guidance \(e.g. Guide for cycling infrastructure development, Romania\)](#)

* The NACTO Urban Bikeway Design Guide is based on a review of best practices in cycling infrastructure around the world. The guide is being updated between 2022-2023. Several working papers which will be integrated in the new version are available here: [link](#)

Safety

Designing high quality cycling infrastructure with safety in mind

3.1 Safety

Safety is a crucial aspect in the decision to choose cycling over motorized modes of transport. To develop safe cycling infrastructure, basic quality design principles aim to limit conflicts between cyclists and other road users, separate bicycle routes from pedestrian routes and fast/heavy motorized traffic. Additionally, cycling facilities need to be well-lit and well-maintained. These measures should be complemented by interventions and activities for increasing driver awareness.

Vision Zero principle: “In every situation a person might fail, the road system should not.”

The fundamental idea of the Vision Zero principle is to ensure that nobody is

fatally or seriously injured while using road networks - with pedestrians and cyclists being the most vulnerable. This objective entails devising strategies that eliminate all traffic-related deaths and severe injuries, while enhancing safe, equitable, and healthy mobility for everyone. The concept originated in Sweden in 1997, when the country's parliament adopted it as an official policy to eliminate all road fatalities by 2020 (with zero being the only acceptable number of deaths within transportation systems). So far, a reduction of over 50% was achieved (there were 204 road fatalities in 2020 compared to 541 in 1997). The Swedish Traffic Safety Council also advocates for biking as a means to improve quality of life, recognizing the benefits of biking for health and community wellbeing. They prioritize road safety and encourage protection and support for pedestrians and bikers, which can benefit society as a whole.

Find out more [here](#).

Separate and protect

Cycling infrastructure for all ages and abilities needs to provide safety, through separation from other types of traffic. The primary aim is to reduce risks posed by motorized vehicles, but also to separate from pedestrian traffic for a seamless flow and higher cycling speed. Protected cycle tracks are the safest type of cycleway that can be implemented, often requiring a redesign of the road space to accommodate them. Other phrases to describe them are street-level protected bikeways, protected lanes or separated lanes, entailing a physical separation element. As opposed to painted lanes, they require three-dimensional separators, which can range from modular to permanent ones.

The working paper *Material Success. Designing Durable Bikeways* was released by the North American City Transportation Officials (NACTO) in 2023, as part of an ongoing update of the world-class guide on cycling infrastructure *NACTO Urban Bikeway Design Guide*, launched in 2014. The paper offers practical recommendations for separating street-level cycling lanes by using more durable materials.

The material provides guidance on selecting, installing and maintaining different separator options and emphasizes the importance of choosing appropriate materials based on the street context and stressors, in three scenarios: High-speed streets, Streets without on-street parking, Streets with on-street parking.

Streets with high motor vehicle volume, speed, truck traffic, or pedestrian activity may require more robust separation materials than just flexible delineators. By upgrading to more durable materials with lower lifecycle costs, maintenance needs and costs can be minimized.

The main bike lane separation options proposed in the guidance are constructed medians, modular concrete barriers and modular delineators.

According to the guide, median-separated bikeways are the most complex to install but are the most robust and attractive. Barrier-separated bikeways use precast concrete or other durable barriers that can be installed or removed quickly. Modular, flexible delineators offer fast implementation, but are also less durable and require replacement more often.

A clear recommendation for ensuring the highest impact on a limited budget is to prioritize the use of more permanent means of separation, such as raised constructed medians or modular concrete barriers in intersections and driveways (to reduce conflict between modes of transport).

Source: Eurovelo.com

Ways to separate bicycle paths from road



Image Source: NACTO

Separated bicycle path



Image Source: Cambridge separated bike lane

One-way protected cycle track with raised curb and parking buffer



Image Source: NACTO

One-way protected cycle track with parking buffer



Image Source: NACTO

Raised cycle track with mountable curb



Image Source: NACTO

One-way raised cycle track



Image Source: NACTO

Raised cycle track with parking buffer



Image Source: NACTO

Two-way separated cycle track with parking buffer



Image Source: Shutterstock-1361475992

Separated cycling lane near main road – Lake Balaton



Image Source: Photo taken on site

Separated cycling lane near main road – Lake Balaton



Image Source: Photo taken on site

Cycling track that can be better separated and protected - Siofok



Image Source: Photo taken on site

Separated cycling lane in Keszthely

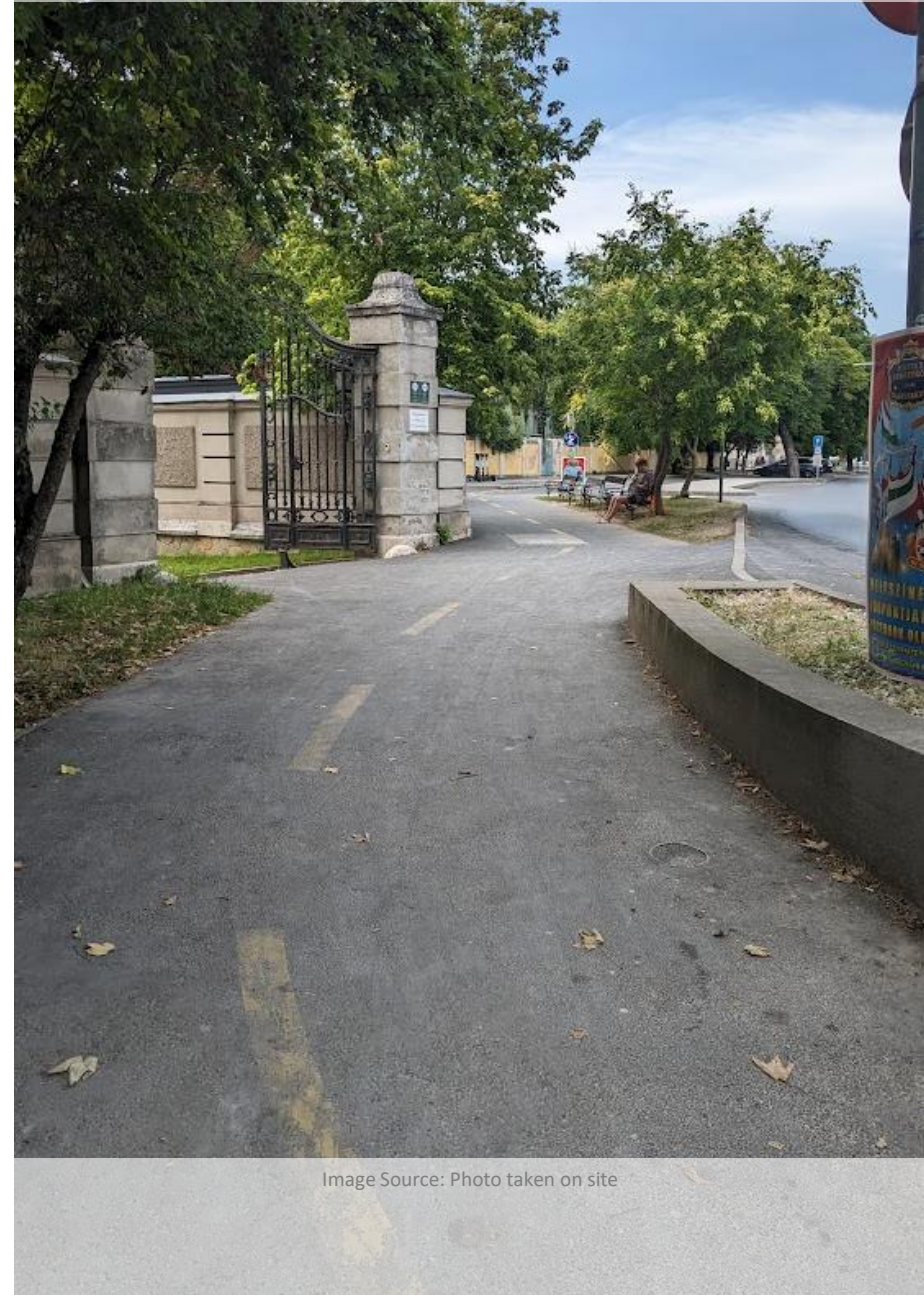


Image Source: Photo taken on site

“Don't give up at the intersection” (NACTO)

Intersections are the most dangerous sectors on a road, requiring clear priority rules, high visibility and predictability measures to avoid collisions. While many new cycling lanes are being built, they are often interrupted at intersections, requiring cyclists to get off their bikes or make risky maneuvers. Often due to the lack of guidance, intersections are left out of the planning process.

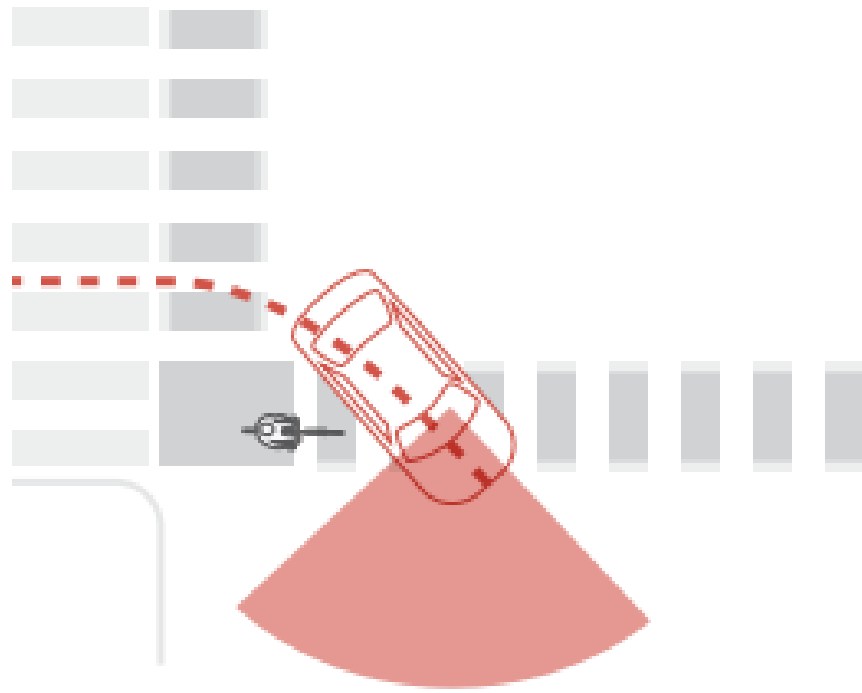
The NACTO guide "Don't Give Up at the Intersection" highlights the importance of intersection design in creating safe and accessible streets for all users, including cyclists. The report identifies common intersection design flaws and provides practical recommendations for improving intersection safety and functionality. Some of the key guidelines for cycling infrastructure include:

- Providing dedicated bike signals to reduce conflicts between cyclists and motor vehicles at intersections.
- Designing protected intersections. This type of intersection offers the highest level of safety and comfort, by separating cyclists from motor vehicles up until the intersection and including a corner island at an angle that requires drivers to take the turn at slower speeds. The corner island also creates a protected queuing area for cyclists waiting to turn. As a result, protected bikeway intersections ensure high visibility and predictability.

- Designing dedicated intersections. This type of intersection aims to provide a safe path for cyclists through intersections, even where protected intersections are not an option due to limited space. It includes turn speed reduction through corner wedges and can be combined with bike signal phasing to improve safety. As opposed to protected bike intersections, they have a narrower buffer or no buffer, and no queue space within the intersection.
- Applying bike boxes or two-stage turn boxes (markings on asphalt to facilitate the safe navigation of cyclists in larger intersections).
- Implementing traffic calming measures such as curb extensions or chicanes to slow down vehicles and reduce the severity of crashes at intersections.
- Ensuring intersection design accommodates all types of cyclists, including those with disabilities, by providing detectable warning surfaces, accessible signals, and sufficient space for all types of bicycles.

The report also emphasizes the need for cities to adopt a Vision Zero approach to intersection design, prioritizing safety and reducing the risk of serious injuries or fatalities. Additionally, the report highlights the importance of community engagement and collaboration in the intersection design process to ensure that the needs and concerns of all stakeholders are addressed.

Conventional intersection



Protected intersection

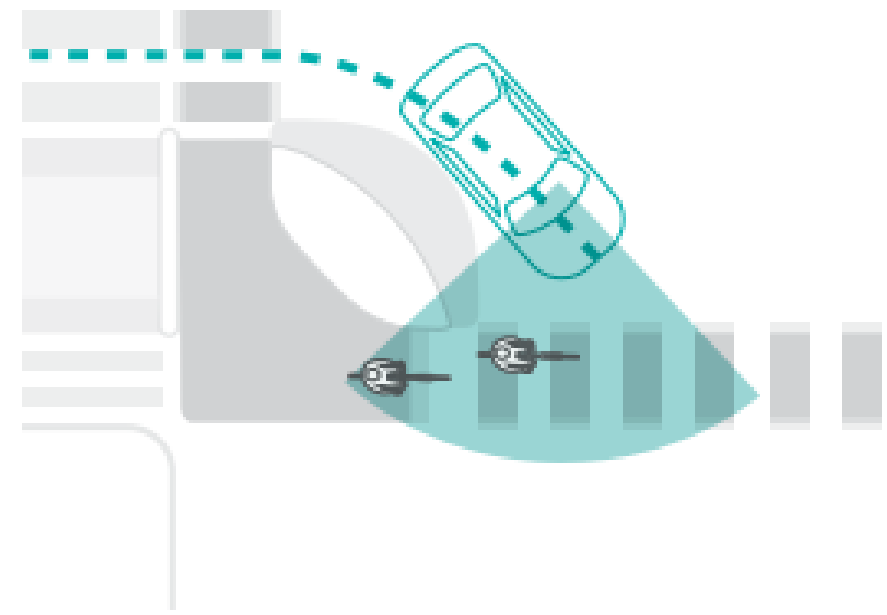


Image Source: NACTO

Example of improving the safety of cycling and pedestrian crossings in major intersections (bicycle crossings in green)

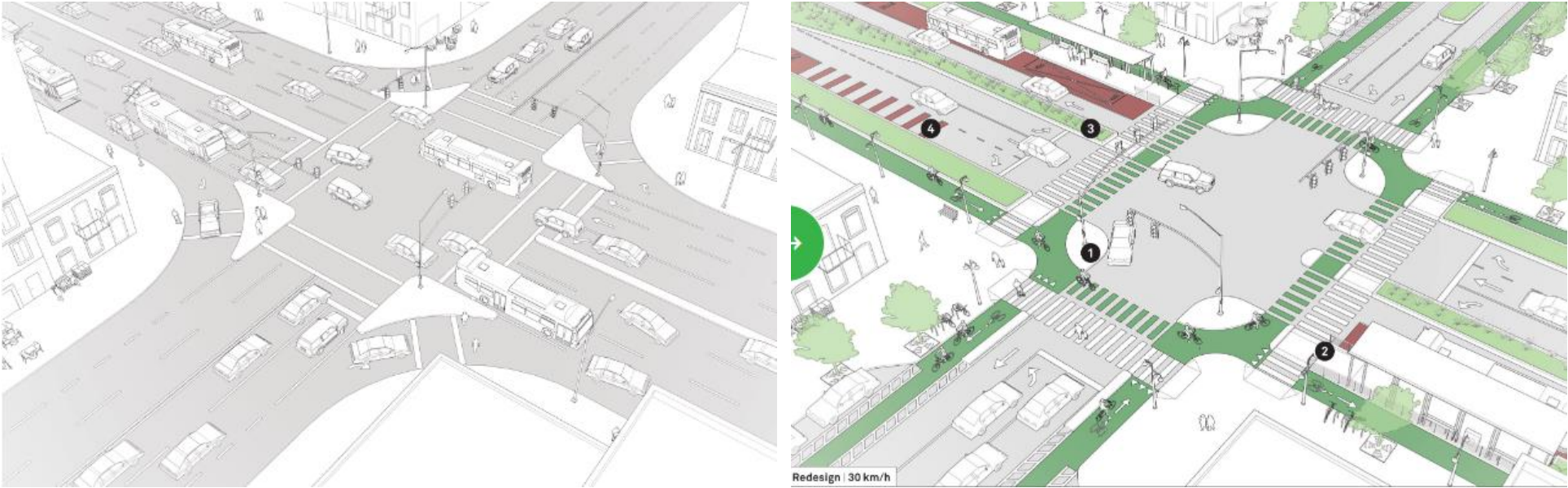


Image Source: GDCI⁴²

Design of cycle friendly intersection

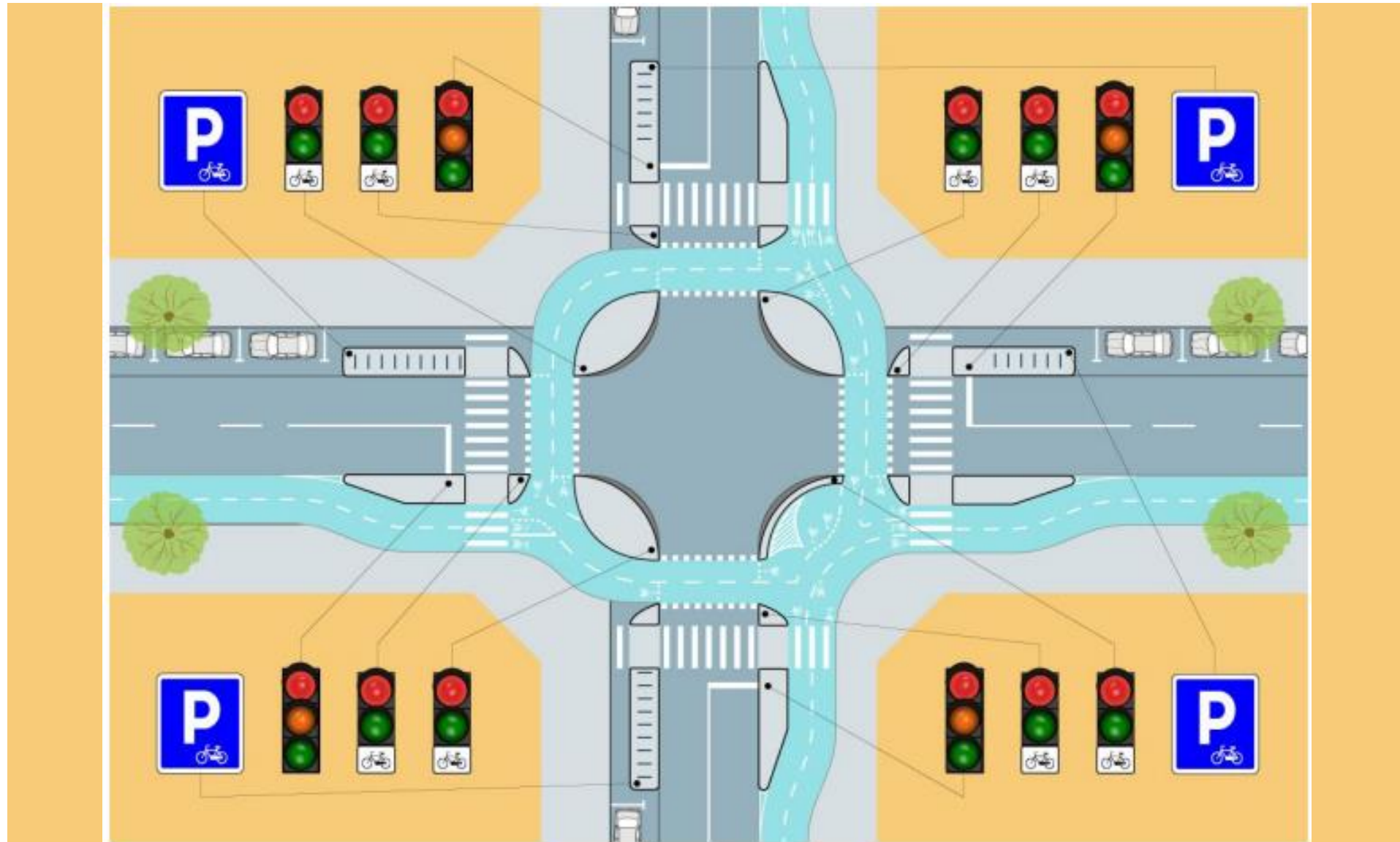


Image Source: Romania National Cycling Infrastructure Guide

Cycling path crossing railway - Alsóbélatelep Báthori Utcai Szabadstrand



Image Source: Photo taken on site

Slope leading to railway crossing - Alsóbélatelep Báthori Utcai Szabadstrand



Image Source: Photo taken on site

Light it up

According to the *Design Manual for Bicycle Traffic (CROW)*, the minimum illuminance recommended is 7 lux.

One of the primary benefits of proper illumination is enhanced safety. Well-lit paths reduce the risk of accidents as cyclists can clearly see the path ahead, including any potential obstacles, turns, or uneven surfaces. It also makes cyclists more visible to each other and to any nearby vehicles or pedestrians, which is crucial in preventing collisions.

Adequate lighting also deters criminal activity. Dark or poorly-lit areas can be hiding spots for individuals with malicious intentions. When a cycling path is well-lit, it creates a sense of security among cyclists, as the chances of theft, assault, or other criminal acts are significantly reduced. Additionally, with proper illumination, cycling paths can be used beyond daylight hours. This is particularly beneficial during winter months when days are shorter. People are more likely to use cycling paths for commuting, exercise, or leisure if they know that they can safely do so at any time of the day or night.

Besides the obvious safety aspects, well-placed lights can also act as guides or markers, helping cyclists to easily navigate the path. This is particularly helpful in winding or complex paths, or in areas where the cycling path intersects with roads or pedestrian walkways. At the same time, by ensuring the cycling paths are accessible and safe during nighttime, it accommodates individuals who work late hours

including night-shift workers. This inclusivity enables all members of the community, regardless of their schedules, to take advantage of the cycling paths.

Also, proper lighting can also enhance the aesthetic appeal of cycling paths. Creative lighting solutions can contribute to the ambiance of the area, making the experience more enjoyable for cyclists. One such solution is the use of fluorescent paint in places where the cycling path cannot be illuminated with traditional lighting systems (forest paths or others). Fluorescent paint has the ability to store sunlight and lights coming from headlights and release it over the night. This can help in improving the visibility of horizontal road markings at night and particularly in poor weather conditions.

AI generated image



Image Source: AI generated

Fluorescent paint used to mark road edges in an area where there is no public lighting



Image Source: LuminoKrom

Concept: fluorescent cycling path in city near Balaton



Day | Night

Image Source: Photo taken on site and processed with AI

Concept: fluorescent cycling path in remote area near Balaton



Day | Night

Image Source: Photo taken on site and processed with AI

Calm down traffic – Slow streets

Traffic calming measures may be easily implemented, through the use of chicanes, road humps, rumble strips, or may require the narrowing of lanes and redistribution of road space, as well creating tighter car turn radii that encourage reduced speeds. These measures effectively promote safer and slower traffic flow, ensuring the overall calming of the road environment.

The concept of filtered permeability encompasses measures to priorities walking and cycling by limiting car traffic on certain streets. The goal is to create a more appealing environment for pedestrians and cyclists, while still ensuring accessibility for local residents, deliveries, and emergencies. Measures can range from blocking access to a street by using bollards and barriers, or transforming it into a one-way street, where cyclists can ride in a contra-flow.

AI generated image



Image Source: AI generated

AI generated image



Image Source: AI generated

3D crossings

3D crossings, also known as 3D zebra crossings, are innovative road safety measures that use optical illusions to create the appearance of raised platforms on the road surface. 3D crossings can make cyclists feel safer. Knowing that the crossing is designed to slow down traffic and raise awareness can encourage more individuals to use bicycles as a mode of transport.

3D crossings serve as a reminder to drivers that they are approaching a shared space where they must yield to cyclists and pedestrians. By giving the crossing an elevated appearance, it subconsciously conveys the message that the crossing is a space prioritized for non-motorized traffic. This, in turn, makes drivers more cautious and respectful of cyclists' right-of-way and may determine them to lower their speed.

Traditional raised crossings or speed bumps can be expensive to construct and maintain while 3D crossings can achieve similar results in terms of slowing down traffic but at a fraction of the cost. This makes them a cost-effective safety enhancement that can be widely implemented, providing more extensive safety benefits for cyclists across various neighborhoods and communities.

3D crossing in Aarhus, Denmark



Image Source: themayor.eu

Video surveillance

The integration of video surveillance systems in cycling routes and road networks is a significant stride towards ensuring the safety of cyclists. The presence of these systems serves as a deterrent to potential criminal activities like theft, vandalism, or assault. This is because the awareness of being under constant surveillance may discourage would-be offenders, thereby creating a safer environment for cyclists. Besides this, video cameras are essential in real-time traffic monitoring and management. Authorities can analyze the flow of vehicles, bicycles, and pedestrians, and subsequently make informed decisions such as adjusting traffic light timings to ensure cyclists' safety.

Moreover, video surveillance plays a critical role in gathering evidence in case of accidents. It helps in fact-finding, determining liability, and facilitating justice, particularly crucial for cyclists who often suffer severe injuries in accidents. The mere knowledge of surveillance in place can foster responsible behavior among all road users, potentially reducing reckless driving that puts cyclists at risk. In the event of emergencies or accidents, video surveillance can enable rapid alerting of authorities, ensuring a quicker response which could be lifesaving. Further, surveillance aids in infrastructure monitoring for timely maintenance, and data collection for improved urban planning. Lastly, for cyclists riding at late hours, video surveillance provides enhanced personal security, encouraging more people to embrace cycling as a mode of transport.

Thus, the importance of video surveillance in enhancing cyclist safety is multidimensional and far-reaching.

Monitoring the safety of the cyclists based on their proximity, along with their predicted intentions of motion depending on their orientation

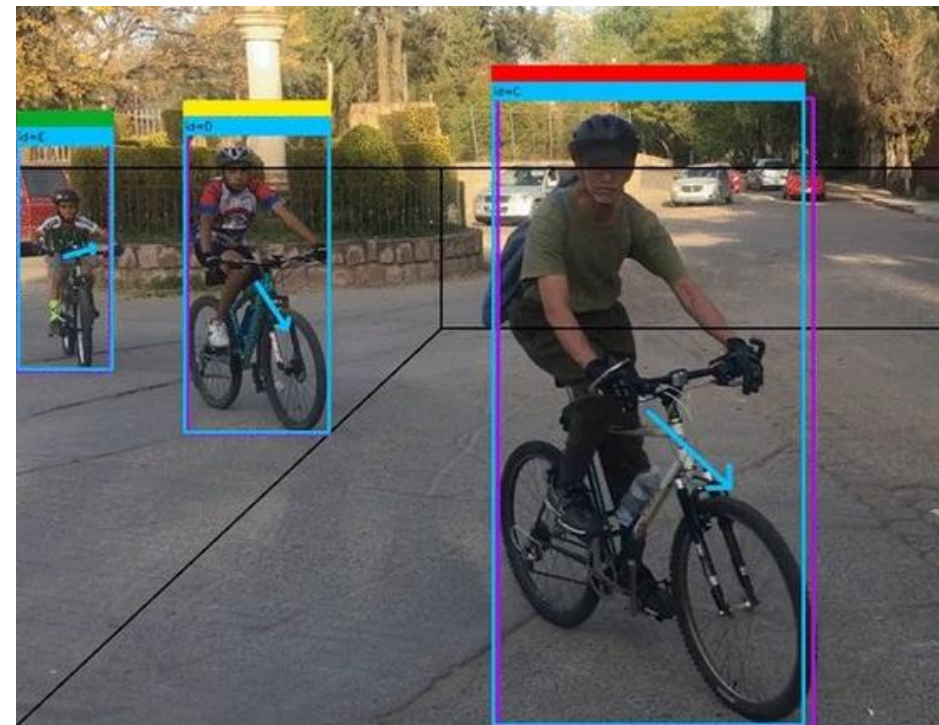


Image Source: ResearchGate - On the safety of vulnerable road users by cyclist detection and tracking

SOS buttons

SOS buttons serve as a lifeline for cyclists, especially in emergencies. These buttons, often integrated with GPS, enable cyclists to swiftly alert emergency services in case of accidents, health issues, or security threats. This accelerates the response time of emergency services, which can be lifesaving. Moreover, in areas that are remote or less populated, an SOS button provides an essential safety net, allowing for help to be summoned even in the most isolated locations. In addition to personal emergencies, SOS buttons can be employed to discreetly thwart criminal activities by notifying authorities, which serves as a crime deterrent.

Furthermore, the sense of security provided by SOS buttons encourages more people to embrace cycling. This is beneficial not only for individual health but also for environmental sustainability. The buttons are particularly reassuring for those who may cycle during odd hours, in unfamiliar areas, or have underlying health conditions. Additionally, SOS buttons contribute to documenting accidents which can be invaluable for legal, insurance, and risk mitigation purposes. For cyclists who might face mechanical issues, SOS buttons can also be used to request roadside assistance. In essence, the incorporation of SOS buttons in cycling gear is instrumental in fostering a safer and more conducive environment for cycling.

AI generated: digital (up) and physical (down) SOS buttons

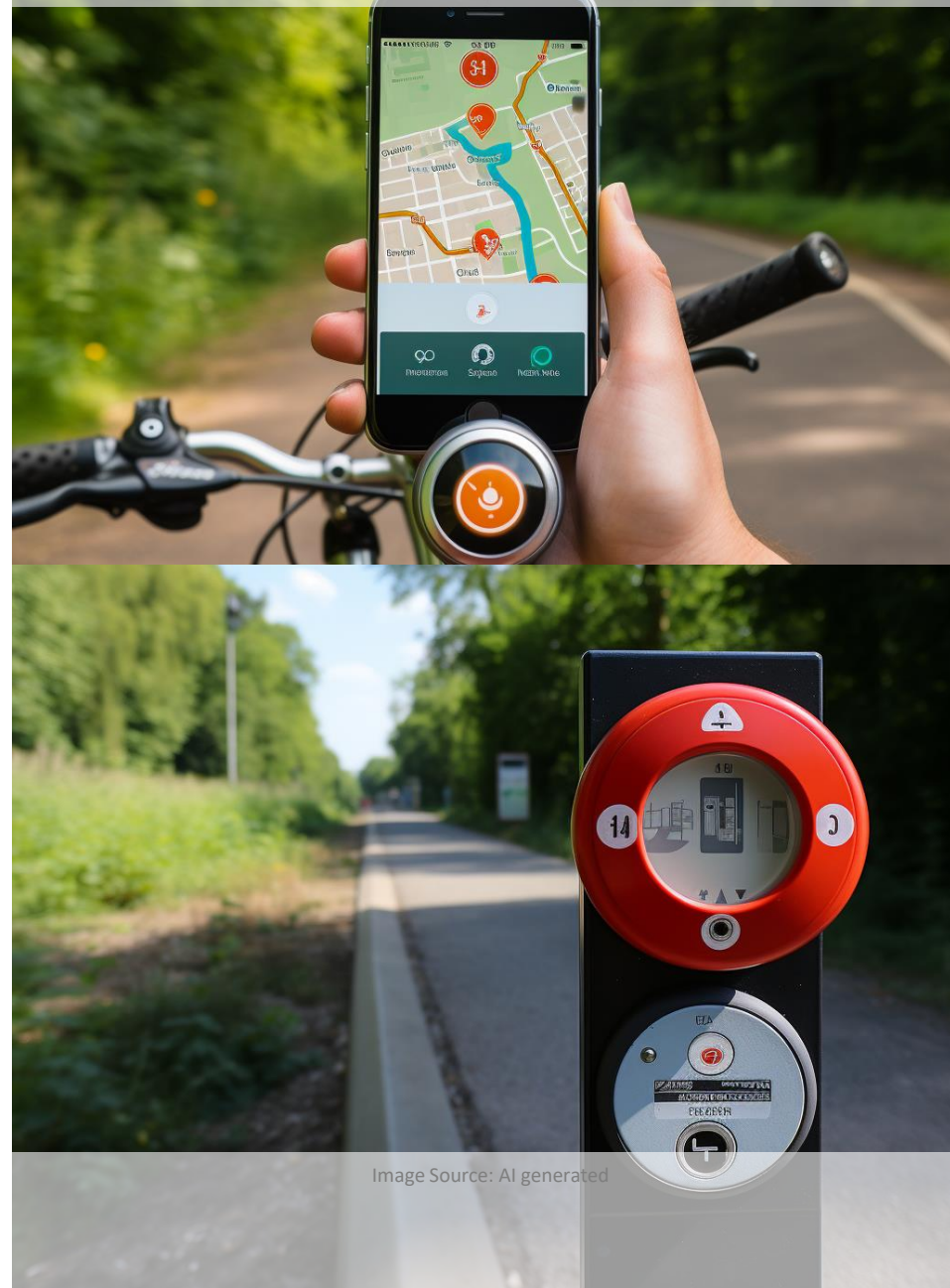


Image Source: AI generated

Concept: AI cameras to count cyclists, monitor behavior and alert authorities in case of emergency

The implementation of AI cameras in the Lake Balaton Functional Areas could be a groundbreaking initiative aimed at enhancing cycling safety and monitoring. Strategically placed throughout the network of cycling paths, these cameras could leverage advanced artificial intelligence algorithms to count the number of cyclists, meticulously monitor cycling behavior, and generate real-time cycling heat maps:

- **Monitoring and Counting Cyclists:** By continuously monitoring the flow of cyclists, the AI cameras could provide precise statistics about the number of cyclists using various routes at different times. This data could be invaluable for city planners in helping them understand usage patterns and design better cycling paths that cater to actual needs and avoid over- or under-utilization of certain routes.
- **Cycling Behavior Analysis:** The AI cameras could analyze the behavior of cyclists, identifying any erratic or unsafe practices. This includes monitoring speed, detecting wrong-way riding, or even recognizing when a cyclist might be struggling. By understanding how cyclists behave on the paths, authorities can implement educational campaigns or make infrastructure changes to ensure safer riding conditions.
- **Real-Time Cycling Heat Maps:** Generating real-time heat maps could offer a dynamic view of where cycling activity is most concentrated at any given moment. This information can be vital for both everyday cyclists and authorities. For riders, it might inform them about congested areas to avoid, while for planners, it can guide decisions on where to expand or improve infrastructure.
- **Emergency Alerts:** Perhaps most crucially, the AI cameras could have the capability to automatically alert authorities in case of emergencies. Whether detecting a fall, a collision, or other anomalies, the system could immediately notify emergency services, thereby reducing response times and potentially saving lives.
- **Integrating with Other Safety Measures:** These cameras could also integrate with other safety features, such as lighting or electronic signages, to respond dynamically to current conditions. For example, if a camera detects a high concentration of cyclists in a particular area after dark, it might automatically brighten pathway lighting to enhance visibility.
- **Privacy Considerations:** While the benefits are numerous, it's worth noting that such a system would need to be implemented with careful consideration of privacy issues. Ensuring that data is anonymized and used solely for the purposes of enhancing safety and planning would be paramount.

Source: Eurovelo.com



Increase driver awareness

Close-passing by motorized vehicles is a major risk for cyclists, where separation of cycling lanes is not possible. This may be a major deterrent for would-be cyclists, who are not willing to expose themselves to drivers that are unaware of minimal overtaking distances or do not respect these. Considering that the minimum recommended distance for passing should be 1.5 m, a solution endorsed by *Cycling UK* is using educational ground mats to showcase this in driver awareness trainings. Such conventional cycling lanes are most applicable when speeds are below 40 km/h (*Global Street Design Guide*, GDCI).

Another idea for improving driver awareness of cyclists is to promote preventive practices, to the level that it is embedded in automatic behavior. For example, promoting the “**Dutch reach**” technique could be a valuable addition to such trainings. This technique, which involves using the hand opposite to the door to open it, requires drivers and passengers to turn their body and better see approaching cyclists, while also limiting how far the door can be opened. To learn more, visit www.cyclinguk.org/dutchreach.

Cycle training for children and youth is also necessary to enable safe and responsible cycling, as well as confidence to use the bike as a means of transport. Sustrans UK recommends that primary school children should receive this training, especially those living in deprived areas, and that the cost should be covered and incorporated into the education curriculum.

Moreover, cycle training at young ages can support a more responsible driver behavior, as it creates a foundation for drivers that includes the cyclist's perspective. Find out more on key principles for safety [here](#).

Caricature emphasizing the Dutch reach

WAYS TO GET OUT OF YOUR CAR

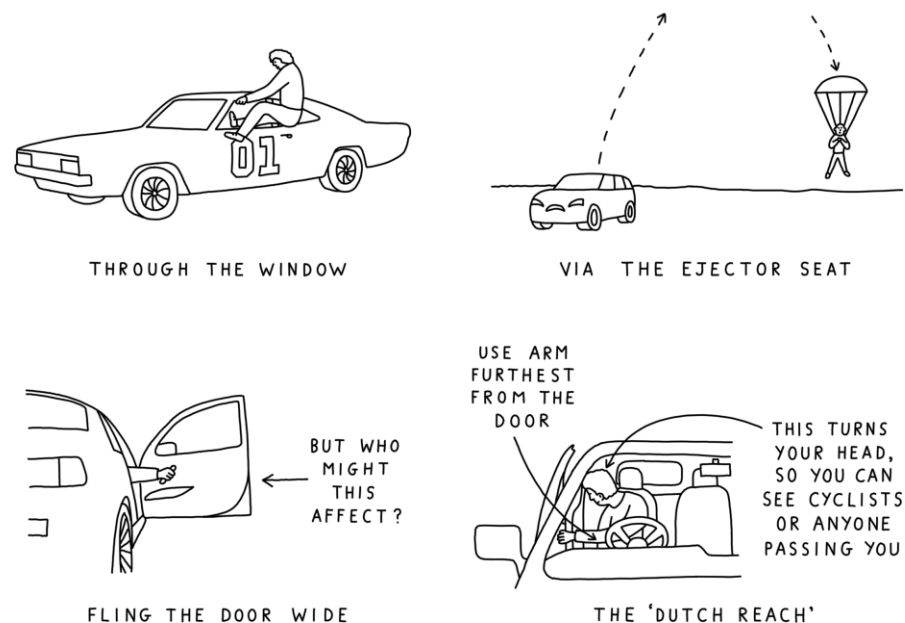


Image Source: CyclingUK.org

Relevance for the functional area level

Safety

Safety is paramount in any mode of transportation, and for cycling, this translates into secure infrastructure that inspires confidence in potential and regular cyclists alike. At the functional area level, the establishment of well-lit and well-designed bike lanes and intersections, complete with proper signage, contributes to nurturing a sustainable and healthy community. Equally crucial are monitored and secure bicycle parking facilities, which provide reassurance for cyclists and further promote the adoption of this eco-friendly mode of transportation. By creating a safe environment for cycling, communities can significantly decrease their dependency on motorized vehicles, thereby mitigating traffic congestion, reducing carbon emissions, and improving air quality.

Moreover, the establishment of safe cycling infrastructure serves several additional functions that boost the overall quality of life within a functional area. For instance, it encourages physical activity among residents, promoting public health and wellbeing. It also creates an interconnected network, linking residential areas with workplaces, schools, and recreational spaces. This accessibility supports local economies by facilitating local commuting and fostering a sense of community among residents. Therefore, it becomes evident that safe cycling infrastructure is not merely a transportation feature, but a multifaceted asset that greatly enhances the overall living conditions within a functional area, thereby advocating for its prioritization in urban planning.

Directness

Designing high quality cycling infrastructure with directness in mind

3.2 Directness

Designing direct cycling routes that minimize travel time by providing cyclists with the most direct and fastest route, minimizing detours, stops, and traffic lights while maintaining constant cycling speed and providing priority for cyclists over motorized traffic is an essential principle of designing high-quality cycling infrastructure.

Ideally, the network should connect residential areas with all major travel generators at the functional area level, such as schools and universities, retail areas, healthcare institutions, major private companies, clusters and industrial parks, public transport hubs, leisure and tourist attractions.

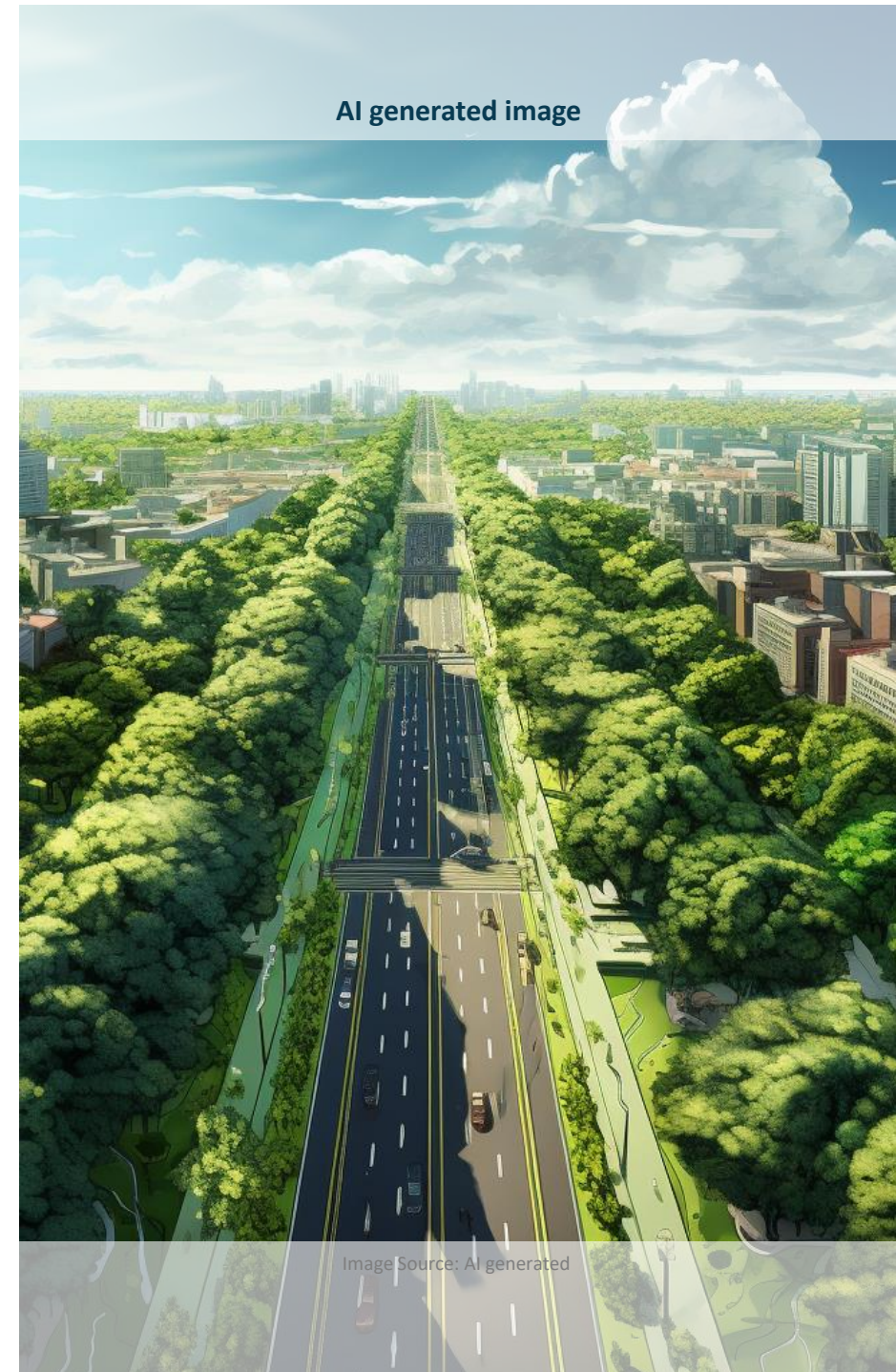


Image Source: AI generated

Connect key attractors at the functional area level

Cycling infrastructure that connects key attractors such as workplaces, shopping centers, schools, parks and transportation hubs are essential for creating cohesive and vibrant communities. Firstly, by offering an alternative mode of transport to these key attractors, cycling routes can reduce traffic congestion and the demand for parking spaces, leading to more livable urban environments. These routes also encourage residents to engage in physical activity, which has numerous health benefits. Moreover, when people can cycle to parks, markets, or cultural sites, it encourages outdoor activity and community engagement, which can be vital for mental well-being’.

Furthermore, cycling routes connecting key attractors have economic benefits. They increase the accessibility to local businesses, encouraging residents to shop locally, which in turn supports the local economy. Moreover, well-designed cycling infrastructure can be an attractor in itself, drawing tourists and visitors who are keen to explore the area by bike. This not only boosts tourism but can also enhance the reputation of the area as being forward-thinking and environmentally conscious. In summary, cycling routes that connect key attractors are not just pathways; they are an integral component in enriching the social, health, and economic fabric of communities.

AI generated image



Image Source: AI generated

Oradea, Romania

The city of Oradea, Romania benefits from extensive cycling infrastructure that integrates various key attractors within and beyond the city boundaries. The nearly 60 km of routes in the city link residential areas, industrial parks, universities, a science and technology park, sports facilities, public parks, commercial areas, and the city center, with a continuous path along the river, catering for both mobility and leisure purposes. The network ensures that citizens can conveniently cycle to essential destinations.

A large urban mobility project connecting two neighborhoods and key travel generators was recently implemented through EU funds, resulting in the first urban mobility corridor in Romania fully aligned with EU standards. Automobile parking was relocated to ensure continuity of cycling infrastructure, eliminating unnecessary maneuvers and stops and extending green spaces. The project also included the separation of lanes from pedestrian traffic. This has resulted in a more efficient cycling infrastructure, as mixed traffic was a common barrier to cyclists, particularly for using the bike as a means of transport.

Moreover, cycling network is well developed at the level of the Oradea Metropolitan Area, and major extensions are planned to fit commuting and leisure needs. The metropolitan cycling infrastructure is highlighted on the map (in yellow - Feasibility Study elaborated, in blue - proposed new cycling infrastructure).

New cycling lanes are planned to be funded under the Recovery and Resilience Facility and the Regional OP.

Velo network – Oradea Metropolitan Area

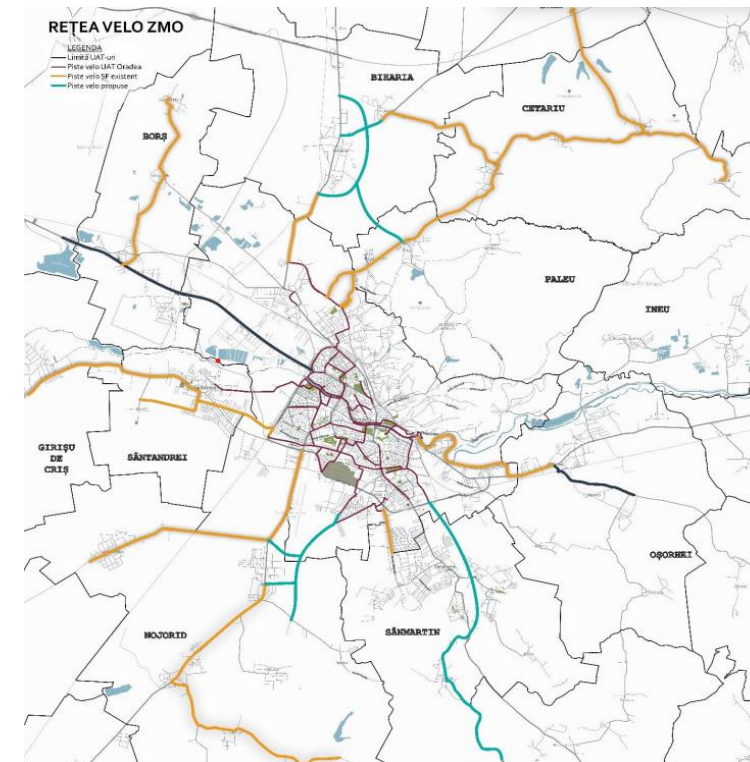
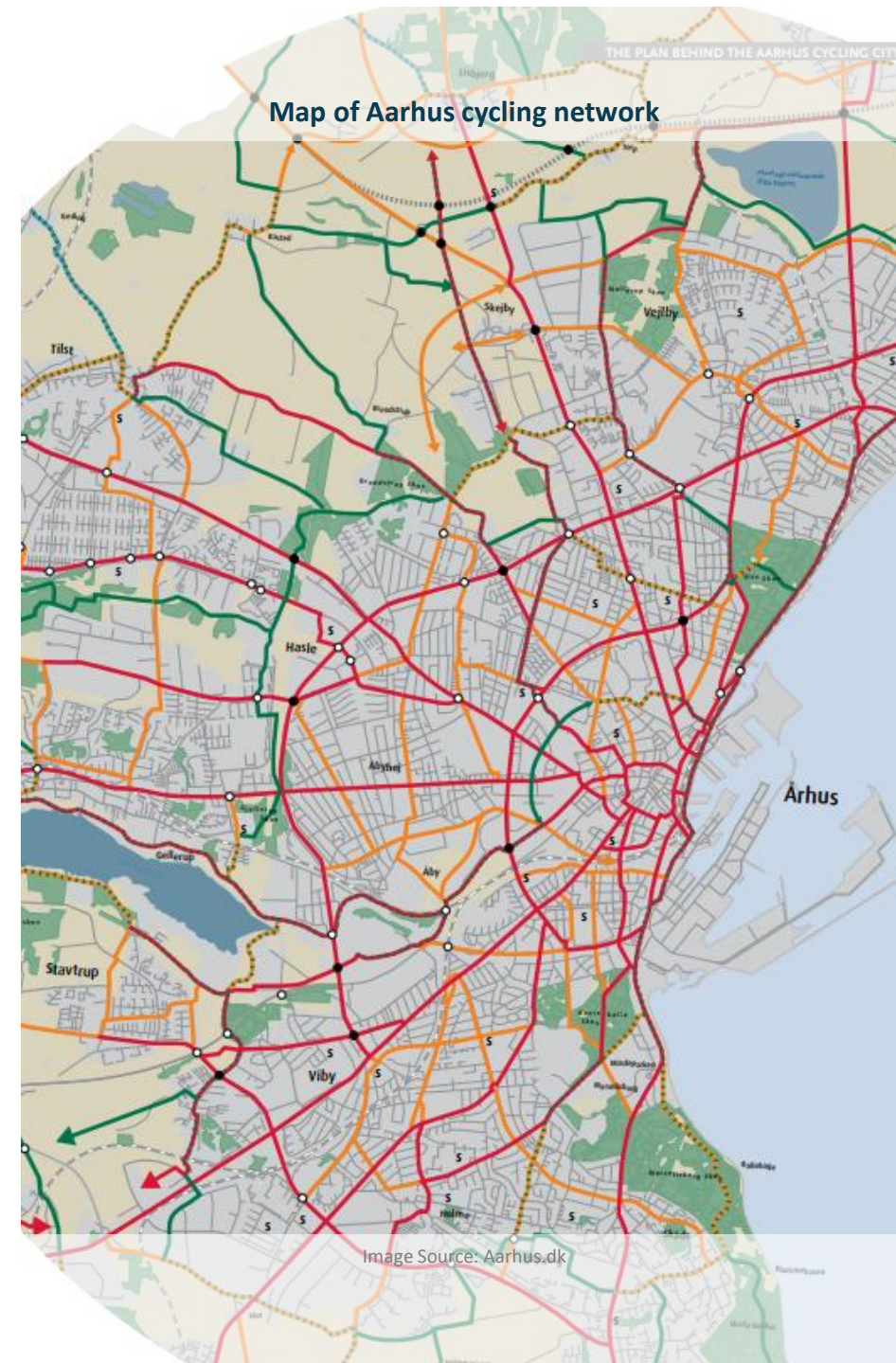


Image Source: Oradea City Hall

Aarhus, Denmark

In **Aarhus**, Denmark, the cycling infrastructure is lauded for its innovation and efficiency in connecting citizens to the city's main attractions and beyond. Aarhus features an extensive network of bike lanes and paths, including the renowned Cycle Superhighways, which serve to connect outlying areas and neighboring towns to the city center. This facilitates easy access for both residents and commuters to key destinations such as universities, business districts, cultural sites, and recreational areas. The design considers the varied needs of cyclists, with features such as well-paved surfaces, ample lighting, and resting areas, which make cycling a practical and appealing mode of transportation. Furthermore, Aarhus's cycling infrastructure is continuously evolving with a commitment to green and safe transportation, thus ensuring it remains an integral part of the city's identity and development.



Relevance for the functional area level

Directness

The importance of direct cycling routes at the functional area level cannot be overstated. Firstly, direct routes significantly reduce travel times, making cycling a more competitive and efficient mode of transportation compared to other options like cars or public transit. This is especially crucial for daily commuters who are likely to choose the quickest and most convenient way to get to their destinations. Secondly, direct cycling routes enhance connectivity between different areas within a region, facilitating easier access to amenities, workplaces, educational institutions, and recreational areas. This can lead to more balanced and sustainable urban development as people find it more feasible to live, work, or engage in activities in different parts of the area. Moreover, by encouraging cycling through direct routes, cities and regions can lessen traffic congestion and reduce carbon emissions, contributing to environmental sustainability and improving the quality of life for residents. Finally, direct cycling routes are more intuitive and easier to navigate for both locals and visitors, which can enhance the overall user experience and promote cycling as a more attractive option for transportation.

Cohesion

Designing high quality cycling infrastructure with cohesion in mind

3.3 Cohesion

A coherent network links trip origins and destinations, has signage, provides consistent protection for cyclists, and ensures connection with other transport modes, such as public transport, while also providing secure cycle parking. According to the CROW manual, cycling infrastructure should “form a cohesive whole and link all origins and destinations that cyclists may have”.

The principle of cohesion involves ensuring that lanes are all connected and there are no missing links. It also implies connections with other transportation modes, particularly public transport. A key asset are railway stations, which can become intermodal hubs for commuters across the functional area.



Image Source: AI generated

Intermodality

Intermodality refers to the seamless integration and coordination of different modes of transportation and is a key dimension of sustainable mobility planning. An intermodal system allows the easy transfer of passengers or goods between various modes of transportation, such as trains, buses, bicycles, and walking. This requires the creation of intermodal hubs and unitary regulations for bike transportation on public transport and parking facilities.

Cycling expands the reach of public transport services, offering increased mobility to users at the start and end of their journeys. In order to ensure an improved travel experience, a MaaS platform can be designed, where all transport operators are integrated (see *Transport* chapter).

Train wagon with space for bicycles



Image Source: ECF

Train wagon with space for bicycles from Polish rail operator



Image Source: ECF

Copenhagen Train Station

In Denmark, 23% of bike trips are combined with public transport, and passengers can bring their bikes on trains for free. The image below highlights the key interventions at the **Copenhagen** train station, namely: on/off ramps for bikes, including ramps for access to the platforms, bike parking spots, secure parking with green roofs, cargo bike parking and a bike shop for service and maintenance.

Integrating bike and railway transport in Copenhagen

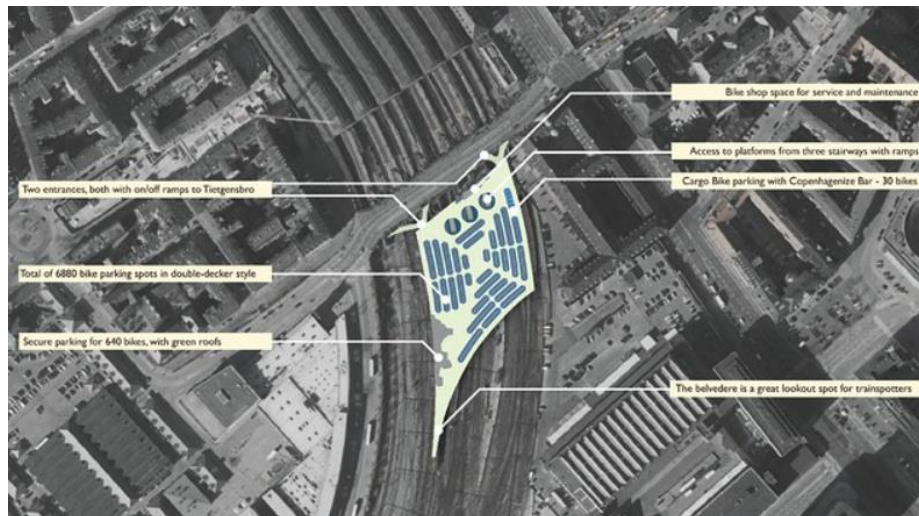


Image Source: copenhagenize.com

Copenhagen train station



Image Source: cupapizaras.com

Brno Central Railway Station

A project for developing an intermodal hub is currently being implemented at the new **Brno Central Railway Station**, as a result of an international design competition launched in 2020. The proposed new Brno railway station aims to become a dynamic and multi-modal main transportation hub for Brno and its metropolitan area, the second-largest city in the Czech Republic. The new station intends to serve as a catalyst for regional growth and development. By integrating various modes of transport (cycling facilities, new bus station, connection to metro and improved pedestrian access), the station will provide a seamless connection for commuters and city-dwellers alike. The project also includes spaces for offices, a hotel, apartments, a waterfront park, an urban promenade, retail, food, and drink that will contribute to transforming the train station into a vibrant public space.

Proposal for Brno Central Railway Station



Image Source: Grimshaw Architects, AFRY CZ

Proposal for Brno Central Railway Station

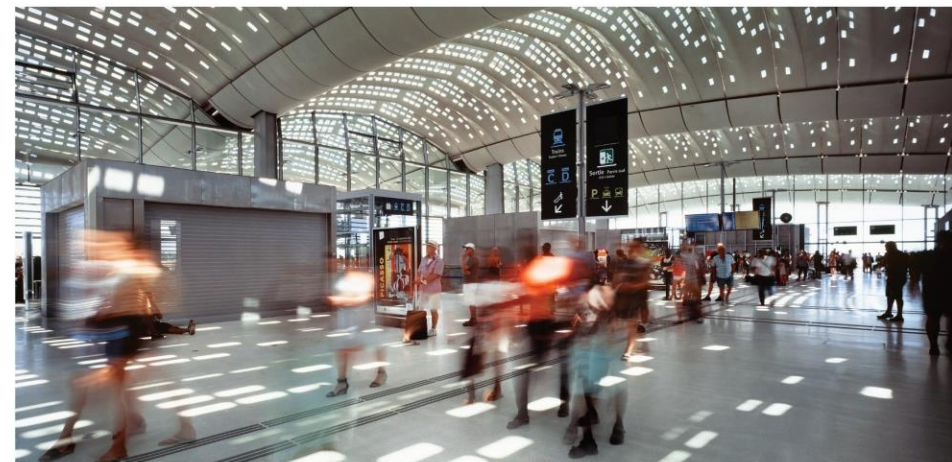


Image Source: Marc Mimram Architecture & Associates

Signage and markings

To improve coherence and wayfinding, cycling infrastructure at the functional area level requires easy readability. Proper signage helps cyclists navigate their routes efficiently, ensuring a unitary brand and providing information about directions, distances, and points of interest. Markings on roads and cycle paths, such as dedicated bike lanes, shared lanes, or cycle tracks, improve safety by clearly indicating spaces designated for cyclists. Moreover, markings on the edge of higher kerbs can avoid safety hazards and contribute to a more comfortable experience.

Signage and markings also contribute to the awareness of the routes. Place identity can be strengthened by naming and branding them accordingly. Cycling lanes or highways can be branded using a central brand color, similar to cities like London, and Copenhagen.

Cycling signage in Denmark



Image Source: cyclingsolutions.info

Cycling signage in Nijmegen, the Netherlands



Image Source: bicycledutch.wordpress.com

Signage for cyclist in Lake Balaton Functional Area



Image Source: Photo taken on site

Cycling path marking in the Lake Balaton Functional Area



Image Source: Photo taken on site

Cycle parking

Bicycle racks

Bicycle racks are an essential component of urban and community infrastructure, providing cyclists with secure and convenient locations to park and lock their bicycles. These racks come in various designs and materials, catering to different spatial requirements and aesthetic preferences. By installing bicycle racks near main attractors as well as public buildings, transit stations, shopping centers, parks, and other public spaces, cities and communities encourage cycling as a sustainable mode of transportation. This not only aids in reducing traffic congestion and lowering carbon emissions but also supports a culture of health and wellness. Additionally, bicycle racks prevent haphazard parking, keeping sidewalks and entryways clear and accessible for pedestrians.

Placement of racks on a car parking space

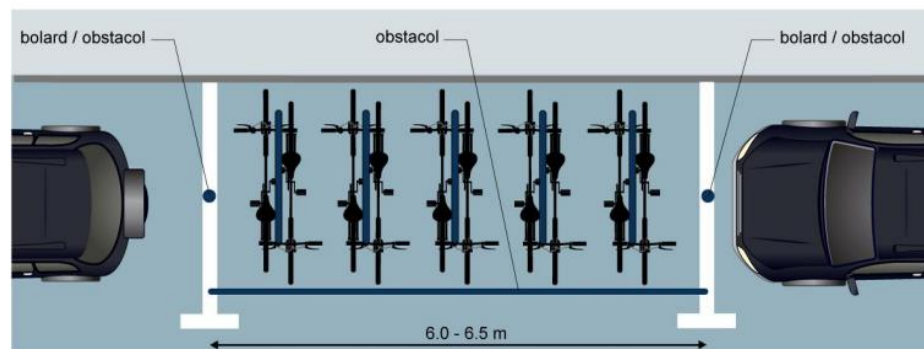


Image Source: Romania National Cycling Infrastructure Guide



Utrecht, Netherlands

The largest bike parking in the world is in Utrecht, Netherlands spans over 17,100 sqm and currently has 12,500 parking places (for regular bikes, e-bikes and cargo bikes). The facility cost over €30 million and was built under the main train station. Moreover, the parking garage offers additional amenities to enhance the user experience. These include repair stations for quick maintenance tasks, tire pumps, and even charging stations for electric bicycles. The facility also provides rental services for OV-fietsen, public transport bicycles that can be used by commuters and visitors.

Cycle parking in Utrecht



Image Source: bicycledutch.wordpress.com

Cycle parking in Utrecht



Image Source: archdaily.com

Barcelona Metropolitan Area created Bicibox

The **Barcelona Metropolitan Area** created Bicibox, a network of secure bike parkings with the goal of encouraging daily cycling and enhancing intermodality with public transportation. The boxes provide secure bicycle storage for up to 48 hours on weekdays and 72 hours on weekends. The modules are supplied with solar energy and are free to use.

The registration process involves the creation of an online account, where the identification data of the bicycle is also entered, as the service includes bicycle insurance and covers the risk of theft, fire or other hazards, while parked in the Bicibox. A card is sent to the user after validation of data.

To encourage the integration of bicycles with public transport, Bicibox cycle lockers have been strategically installed at the entrances of several metro stations. This aims to facilitate seamless transitions between cycling and public transportation for commuters. The network currently has over 12.000 users, according to the AMB website. The metropolitan institution also developed an identity manual for the parking boxes⁴³, which is coherent at the level of the entire area and is aligned with the AMB brand.

An app was also developed to map the bicycle parkings across the metropolitan area. Find out more [here](#)

Bicibox Barcelona

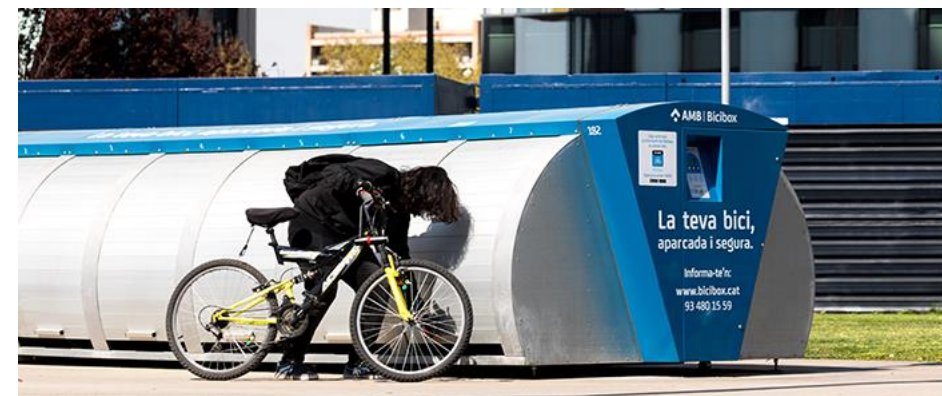
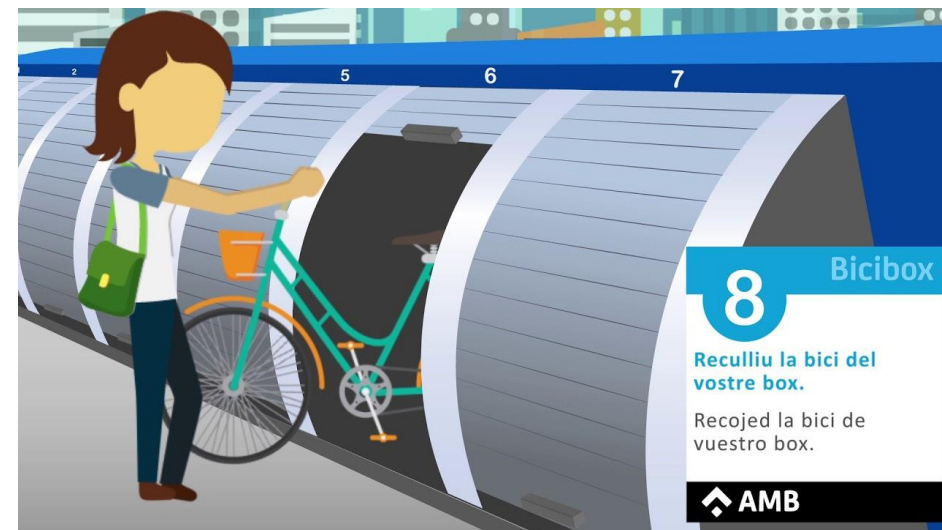


Image Source: bicibox.cat

Cluj-Napoca and Oradea, Romania

A similar solution was developed by a Romanian startup from Oradea, enabling reservation and safe locking of bicycles through a mobile app. The app was launched in 2022 and the first parking was installed near an office building in **Cluj-Napoca**. In 2023, the startup partnered with a local initiative representing the startup ecosystem in the city of **Oradea** and launched a public engagement campaign to identify the most suitable locations for the parkings.

Besides creating new parking facilities, allocating existing space within car parking to bicycles can be a practical solution that also signals that bicycles transport is encouraged. A company from Cluj-Napoca developed a solution to address the issue faced by residents who own bicycles and are forced to store them in unorganized spaces. The containers can be installed in car parking lots and are equipped with easy-to-use parking systems that optimize storage space. In addition to the parking system, the containers are equipped with access control, video surveillance, smart lighting, etc. As part of projects for developing smart city infrastructure and aiming to achieve maximum efficiency, the containers can be equipped with off-grid photovoltaic panels and batteries for energy storage, making them completely independent of the local grid.

Rastel.io parking (top) and Urban Tech parking (bottom)



Images Source: rastel.io (top) and Emil Boc Facebook (bottom)

Relevance for the functional area level

Cohesion

At the functional area level, cohesion and intermodality play a significant role in providing seamless connections between cycling and other modes of transport. It ensures that cycling is integrated into the overall transportation system, allowing commuters to easily switch between different modes such as buses, trains, or trams. This integration enhances the accessibility and convenience of cycling as a viable transportation option within the functional area.

Moreover, clear and well-designed signage and markings for the cycling network enhance the wayfinding experience in the functional area and contribute to strengthening the supra-local identity.

Sufficient cycle parking infrastructure, strategically located near public transport hubs, commercial areas, and workplaces, encourages more people to choose cycling as a mode of transport on their daily commute. Adequate cycle parking facilities reduce the concerns of theft or vandalism, provide convenience for cyclists, and support the integration of cycling with other modes of transport at the functional area level.

Comfort

Designing high quality cycling infrastructure with
comfort in mind

3.4 Comfort

Comfortable width and smooth surfaces play a major role in the quality of cycling infrastructure. According to most guidelines, the standard recommended width for a two-way cycling lane is 3-4 meters, while unidirectional paths should be at least 2.5-3 meters wide.

Basic design principles for a comfortable cycling experience include smooth and well-maintained surfaces, material selection to reduce vibrations and shocks, minimizing interruptions and complicated maneuvers, adequate width, avoiding steep gradients, and minimizing noise and visual disturbances from other traffic.

A smooth surface of the cycling lane is a prerequisite for a comfortable ride. Special attention needs to be given to the maintenance of the cycling infrastructure, as vibrations and

avoidance maneuvers caused by uneven surfaces on the road can negatively impact the likelihood of regular cycling behaviors. The *CROW Dutch Design Manual* highlights that “*what can be regarded as a light damage for motorized traffic is very easily moderate or even serious damage for cyclists*”.

Noise pollution should also be reduced as much as possible for a comfortable cycling experience. Whenever possible, cycling lanes and routes should take advantage of existing slow streets (with low levels of motorized traffic), while keeping the principle of directness in mind. This ensures a safe, and also more comfortable ride, reducing the exposure to stressors such as noise and low air quality on busy streets.

AI generated image



Image Source: AI generated

Asphalt and kerb design

Asphalt is the preferred material for cycling infrastructure, because of its advantage of smoothness and evenness. However, if its foundation is not solid, asphalt may be highly susceptible to wear and tear, requiring attentive maintenance. Therefore, the quality of building materials is the most important aspect.

The use of innovative asphalt mixes that do not contain bitumen and can be recycled (known as eco-asphalt) contributes to sustainability by reducing reliance on conventional bitumen-based materials. Eco-asphalt provides a durable and smooth surface for cyclists, ensuring a comfortable and safe riding experience.

Colored asphalt will provide the necessary visual separation from other traffic, even when already separated and will contribute to a more attractive and comfortable cycling experience.

Enhancing the design of the kerb (the raised edge of a pavement or path) is a potential area for improving both comfort and safety. One example is implementing a 45-degree angled kerb, which can expand the perception of the usable surface of the lane. This modification helps decrease the risk of collisions with cyclists' front wheels, thereby reducing the potential for injuries. Moreover, it contributes to minimizing the perceived division between different road users, promoting a more harmonious coexistence. A lower-cost measure is marking the kerb with paint, where modifying the design is not possible.

45-degree angle kerb (top) vs normal kerb (bottom)



Image Source: [Bicycledutch.wordpress.com](https://www.bicycledutch.wordpress.com)

What are some innovations in building materials for cycling infrastructure?

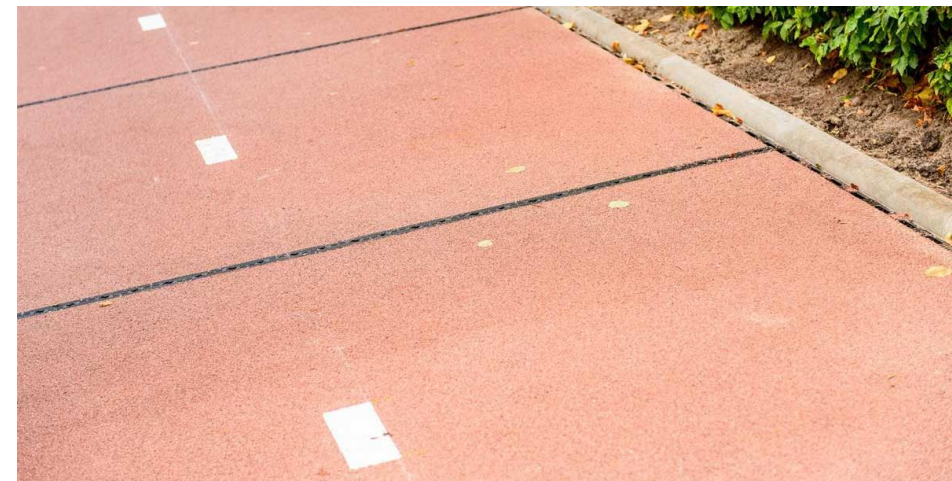
Plastic Path

Since 2018, the world's first PlasticRoad has been successfully implemented in the Dutch city of Zwolle, specifically at Deventerstraatweg, through collaboration between the province of Overijssel and the municipality of Zwolle. The PlasticRoad was designed to address a persistent issue of flooding during heavy rainfall, thanks to its water storage capacity within its hollow structure. Remarkably, even during extreme downpours, the bike path remains dry, with only 48% of its water storage capacity being needed at the highest water level. Moreover, the 30-meter-long path has demonstrated resilience to all conditions and heavy loads, while also contributing to environmental sustainability by containing the equivalent of 218,000 plastic cups or half a million bottle caps in plastic and achieving at least 52% carbon savings compared to a traditional bicycle path.



Image Source: theindexproject.org

Plastic road Zwolle



Images Source: plasticroad.com

Solar Path

In Maartensdijk, Netherlands, authorities have inaugurated what is claimed to be the world's longest solar bicycle path, which stretches 330 meters and is constructed of prefabricated concrete blocks topped with a transparent layer. This layer allows sunlight to reach the solar cells within the blocks, generating sustainable energy while providing an emission-free travel route for cyclists. The project aligns with the province of Utrecht's goal to become climate-neutral by 2040 and is part of a broader effort to innovate dual-use infrastructure for both transportation and renewable energy production, maximizing the utility of limited space. This initiative coincided with the European Union's unveiling of ambitious climate legislation aimed at reducing greenhouse gas emissions.

Solar bicycle path



Image Source: tno.nl

Solar bicycle path in Maartensdijk



Image Source: apnews.com

Kinetic Path

Incorporating kinetic tiles into bike paths can enable the path to generate electricity from the pressure exerted by the bicycles. This energy can be stored and used for various purposes, such as lighting the path at night.

Porous Asphalt Path

This material allows water to pass through it, minimizing puddles and reducing the risk of hydroplaning. This asphalt is quieter and can help in reducing the heat island effect in urban areas.

Rubberized Asphalt Path

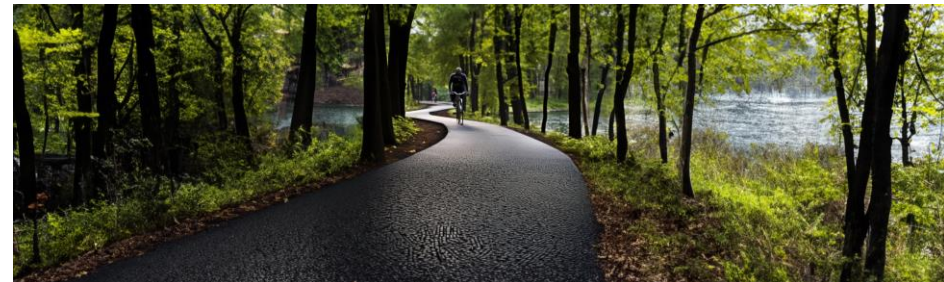
Made from recycled tires, rubberized asphalt not only helps in waste reduction but also creates a smoother and more durable surface that is less prone to cracks and requires less maintenance.

Zoom on kinetic, porous asphalt and rubberized asphalt concepts



Images Source: AI generated

AI generated kinetic, porous asphalt and rubberized asphalt concepts



Images Source: AI generated

Modular Steel Grids Path

Durable and easy to install, modular steel grids can be used to quickly create temporary or permanent bike paths, particularly in areas where it is difficult to lay traditional pavement.

Wood Path

In some places, wooden bike paths have been installed. This material can be particularly useful in areas like wetlands, where traditional pavement might not be feasible. It's also a more natural-looking alternative for paths through parkland.

Recycled Glass Path

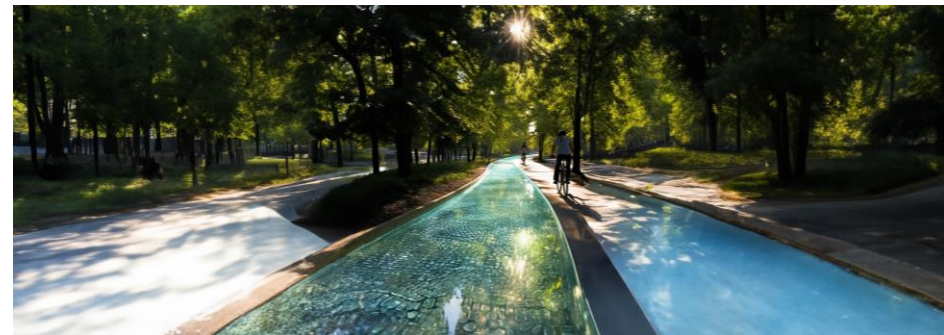
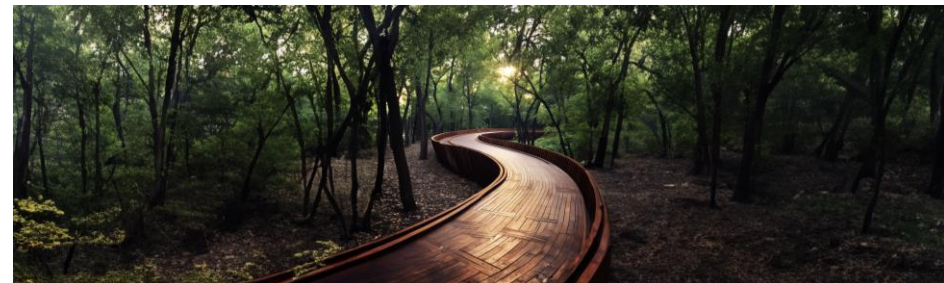
Some bike paths have experimented with using recycled glass as a paving material. This can provide a durable surface and also have environmental benefits due to recycling.

Zoom on modular steel grids, wood and recycled glass concepts



Images Source: AI generated

AI generated modular steel grids, wood and recycled glass concepts



Images Source: AI generated

Helsingborg, Sweden: Bicycle pumps, repair stations

Having the appropriate support facilities such as air pumps and repair stations for bicycles has multiple benefits. In the first place, it increases the levels of comfort and safety for cyclists, who can rely on them when needed, making the decision to opt for cycling over motorized transport significantly easier to make. The installation of such facilities can positively impact would-be cyclists to make the transition to cycling from their usual transport mode, while responding to the challenges faced by regular cyclists on their daily routes.

Secondly, the decision to install these facilities sends a strong message about elevating cycling to a full-fledged transport mode. Such measures recognize that cyclists, just as drivers, have similar needs in terms of maintenance and repair and they require dedicated facilities for a safe and comfortable mobility experience. Investments in air pumps and repair stations signal that cycling is prioritized and there is a clear commitment to encourage its widespread adoption as a mode of transport.

In **Helsingborg, Sweden**, cyclists enjoy a wide variety of facilities, including bicycle pumps. These can be found across the city and can be checked on a digital map. Cyclists are also encouraged to report broken pumps through an e-service for reporting issues related to streets, parks, schools, culture, leisure and others. The pumps are suitable for several types of valves and can also be used for prams

and wheelchairs, for free. The air pumps were partially financed with the help of the city of Helsingborg's local climate compensation fund.

Bicycle repair station in Helsingborg, Sweden



Image Source: helsingborg.se

Bike Service point at resting place in Lake Balaton Functional Area



Image Source: Photo taken on site

Bike service point in Veszprem, Hungary



Image Source: Photo taken on site

Barcelona, Spain: App for drinking water fountains

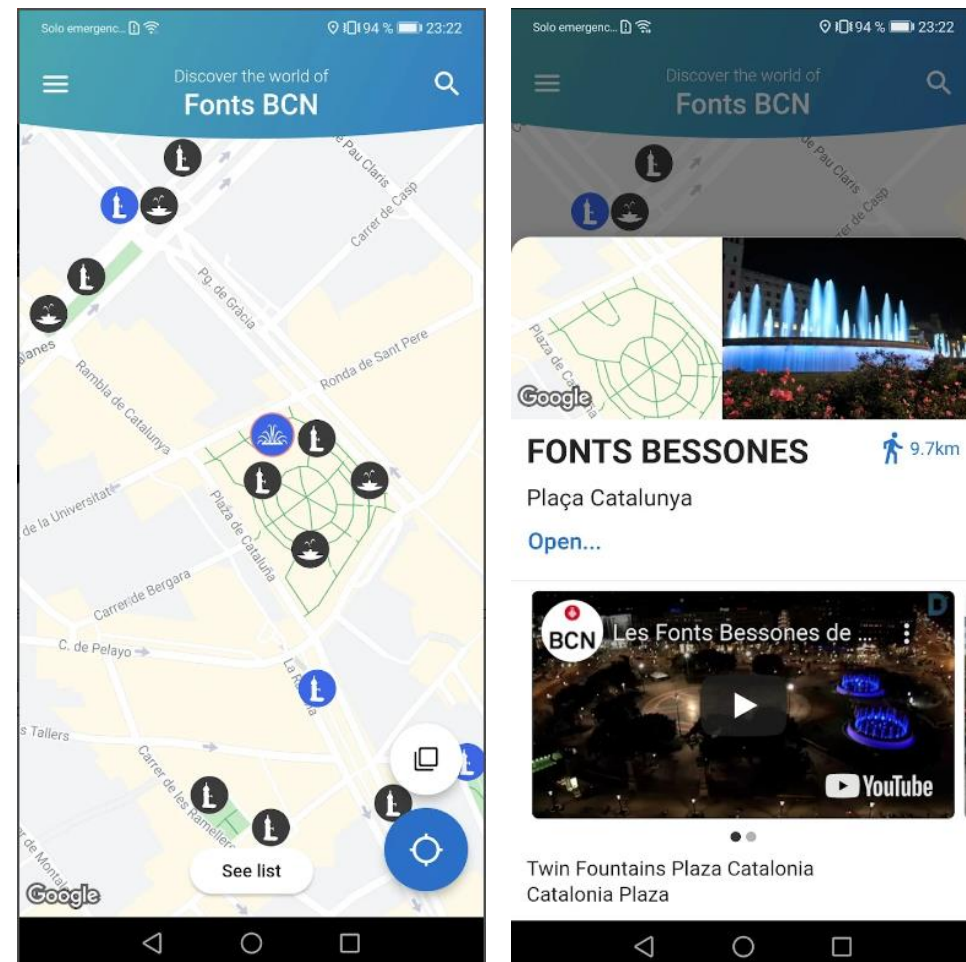
Drinking water fountains are an often-overlooked public facility when planning new cycling routes or modernizing them and should be integrated into all major commuting and leisure routes. For increased comfort, fountains can also be mapped for cyclists to easily access drinking water, and plan their route, accordingly, resulting also in reduced single-plastic use. In this sense, the **Barcelona Municipality** has developed an app for mapping the drinking fountains available in the city, to help users find the closest to them (*Fonts Bcn*). Besides directions, the app also offers information on the historical and artistic background of the water facilities, some of which are part of the city's heritage.

App Apple IOS icon



Image Source: IOS Store

App screenshots from Google Play Store



Images Source: Google Play Store

Malmö, Sweden: Repair shops

Compared to air pumps, repair shops require additional resources in terms of costs and operation, usually implying the work of technicians and a wide variety of tools. However, many such facilities combine professional services with self-service, and can also work on a voluntary basis. The aim of these is to complement privately-owned repair facilities, particularly in areas with a lower level of cycling, as they are likely to multiply as a cycling culture is created. Additionally, measures to raise awareness on the importance of proactive maintenance and repair activities for safety and comfort, as well as the location of available facilities is recommended.

According to the *Guidance for Cycling Projects in the EU*, the choice of location is a key factor for the success of such measures and proposes their placement within parking, park and ride facilities and intermodal hubs. This way, users can also leave their bikes for repairs while they are not in use.

Moreover, SOS buttons can be installed across cycling tracks in the functional area, for fast repair services. Such a network can be developed unitarily across multiple localities, to ensure coverage and minimize discomfort associated with malfunctions in areas that are far from a repair shop.

In **Malmö, Sweden**, a “Bicycle Kitchen” was created for cyclists to self-repair their bicycles, with the assistance of volunteers or

employees. The focus of the initiative is to increase the self-reliance of cyclists and equip them with the necessary skills, rather than provide a service. The “kitchen” provides open access to tools and also organizes bike repair and maintenance courses. Find out more [here](#).

Bicycle kitchen self-repair shop



Image Source: cykelkoket.com

Brno, Czech Republic: Workplace facilities for cyclists

Workplaces are the main traffic generators in functional areas. To make commuting by bike more attractive, companies have a major role to play, by offering employees additional facilities such as secure bike parking and shower facilities.

While many companies may voluntarily offer such options, local authorities can also create regulations to require companies to plan measures that support sustainable mobility. An example of such a regulation can be found in the Sustainable Urban Mobility Plan of **Brno**⁴⁴, which includes a regulation that made it mandatory for companies with over 100 employees to have corporate mobility plans (companies with over 50 employees are required to develop these by 2025). This can serve as a motivating factor for companies as it enables them to access subsidies for retrofitting facilities for their employees. These plans will also incorporate support for utilizing public transportation or organizing shared travel options like carpooling for employees. A key aspect in developing successful workplace mobility plans is ensuring a participatory process for employees, to understand their needs and identify the most suitable solutions.

AI generated image



Image Source: AI generated

Relevance for the functional area level

Comfort

As a low-cost intervention, planning a network of air pumps at the functional area level may be a first step to encourage commuting (provided that cycling lanes are available) and can strengthen its identity and perception as an area prioritising sustainable mobility. The placement of the facilities needs to take into account the main attractors (large employers, schools, universities, commercial centres etc) and it is most efficient when based on inputs from citizens, suggesting the locations based on their needs. These should be easily visible and accessible, pinpointed on maps and ideally, branded with the logo of the supra-local structure (e.g. metropolitan area, natural regions).

On a longer commuting route or leisure trip, access to drinking water can strongly enhance the cycling experience and contribute to sustainability by reducing single-use water bottles. Finally, workplace facilities for cyclists commuting to work, particularly sanitary facilities, are targeted to current and would-be cyclists, who may be discouraged or may feel discomfort in choosing to cycle on a daily basis on a longer route, particularly in hot weather.

Attractivity

Designing attractive high quality cycling infrastructure

3.5 Attractivity

Attractive cycling routes are particularly important for leisure trips, but this principle should also be considered for utility trips. The attractiveness principle of cycling infrastructure implies designing aesthetically attractive and visually appealing cycling infrastructure that complements the local surroundings, considers the personal security of users, and is well-maintained.

Additional facilities that enhance the safety, coherence and comfort of the cycling network are also directly contributing to its attractivity. These include cycle parking, preferably sheltered, which should be available at major destinations, service points with basic tools for maintenance and repair, drinking water fountains along the cycling network, or signage of the cycling network to improve wayfinding.

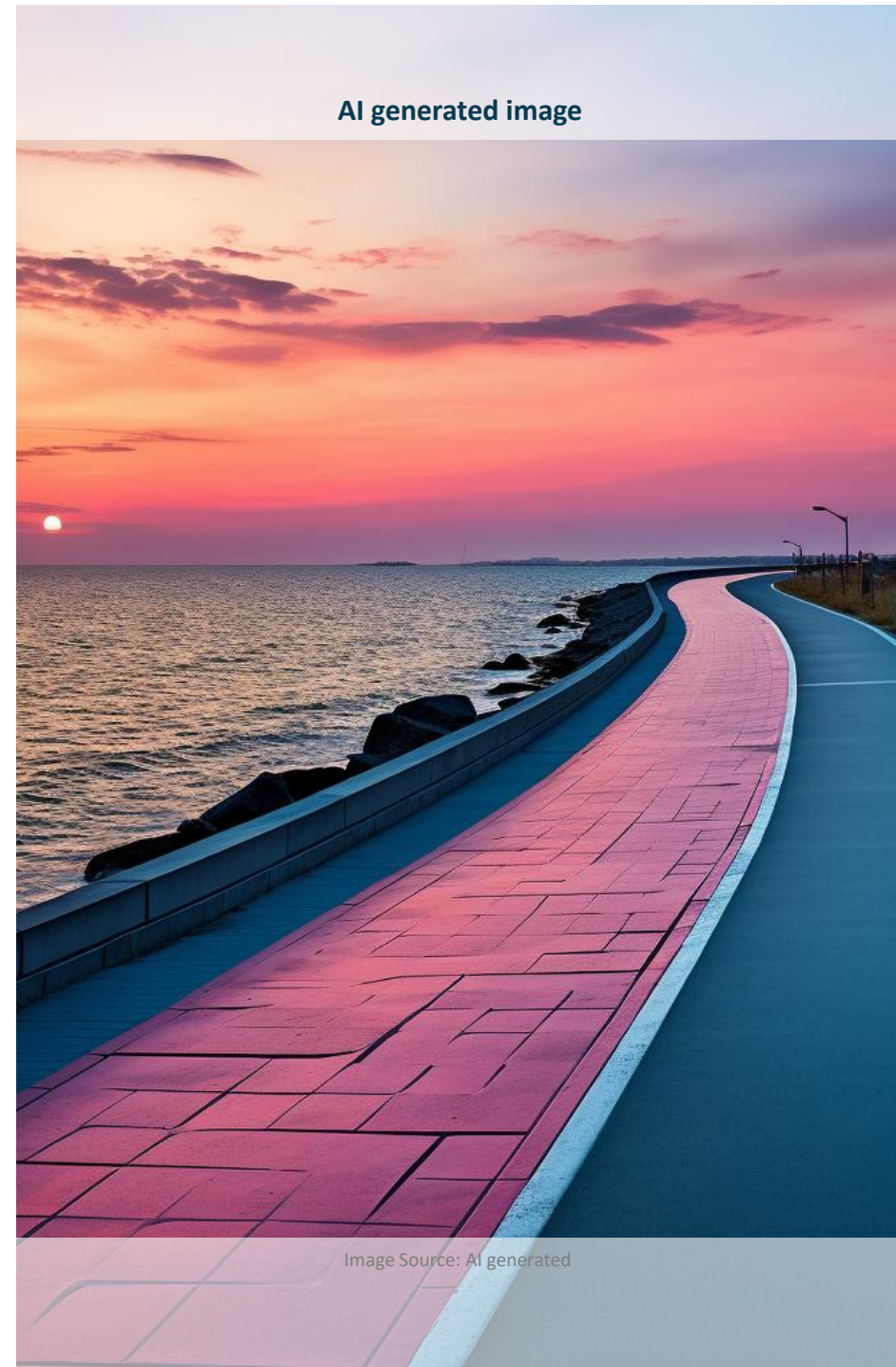


Image Source: AI generated

The use of bright and highly visible colors

To increase the comfort and attractiveness of cycling infrastructure, colorful designs are recommended. The use of bright and highly visible colors can effectively differentiate cycling infrastructure from other modes and establish a unique sense of place. Incorporating colorful designs can encourage pedestrian traffic and activities, and bring attention to potential conflict areas like crosswalks, intersections, and shared spaces.

When selecting colors and patterns for cycling infrastructure, it is important to check local legislation regarding color and pattern requirements, or existing national guidance for cycling infrastructure. Patterns, colors, and shapes should not resemble traditional traffic markings to avoid confusion. It is best to opt for bright colors with high contrast compared to the pavement, and even fluorescent paint, as they increase visibility, particularly during low-light conditions.

A major program that promotes the delivery of transformative, cycle-friendly street designs is **BICI - the Bloomberg Initiative for Cycling Infrastructure**. The call for projects was launched in October 2022, and the 10 selected cities were announced in June 2023, awarding funding of up to \$1 million. The winning projects can be consulted on the website⁴⁵. The program is led in partnership with GDCI (Global Designing Cities Initiative), which offers inspiration for world-class infrastructure through its resources and publications

(particularly the Global Street Design Guide⁴⁶) and will guide the winning cities in implementing their projects. Some of its successful initiatives include the co-design of cycling lanes through interim or final interventions, using colorful designs that create a sense of place and community, as highlighted below.

BICI project cover



Image Source: BICI project

Planning routes through beautiful, interesting scenery, natural elements

Planning cycling routes through beautiful, interesting scenery and natural elements is essential for multiple reasons. Firstly, such routes can significantly enhance the mental well-being of cyclists. Engaging with nature has been shown to reduce stress, improve mood, and increase concentration. Riding through scenic areas can provide a much-needed mental break and can be a form of ecotherapy.

Additionally, incorporating natural beauty in cycling routes can incentivize more people to take up cycling as a form of exercise or as a recreational activity. The aesthetic appeal of the route makes the experience enjoyable and fulfilling, and people are more likely to engage in an activity if it's pleasurable and stimulating. This can lead to increased physical activity among the population, with consequent health benefits including reduced risk of chronic diseases.

Furthermore, cycling through scenic areas can foster a deeper connection with and appreciation for the environment. This can lead to greater environmental awareness and a sense of stewardship. People who regularly experience the beauty of natural settings are more likely to support conservation efforts and adopt sustainable practices.

For tourists and visitors, cycling routes through stunning landscapes and natural settings can be a major attraction. This can significantly boost local tourism, bringing economic benefits to the area.

Tourists are increasingly seeking authentic and eco-friendly travel experiences, and cycling through beautiful scenery provides just that.

Lastly, when routes are planned through natural elements, they often tend to be away from heavily trafficked roads, which not only makes the cycling experience more peaceful but also safer. Cyclists are less exposed to vehicle emissions and have a reduced risk of accidents involving motor vehicles.

Cyclist in Balatofured Park



Image Source: Photo taken on site

Via Francigena

The Via Francigena is a historic pilgrimage route spanning approximately 1,800 kilometers or 1,100 miles from Canterbury, UK, to Rome, Italy. This route, traversing England, France, Switzerland, and Italy, has been a path for pilgrims since the Middle Ages. Its name translates to "Road from France" or "Frankish Route," and it offers a diverse landscape including the English countryside, the Swiss Alps, and Italian vineyards.

The route gained prominence in the 10th century when Archbishop Sigeric the Serious of Canterbury documented his journey to Rome. In modern times, its popularity has seen a resurgence, particularly after it was declared a "Cultural Route" by the Council of Europe in 1994. Now, not only religious pilgrims but also cultural and adventure tourists embark on this journey, engaging deeply with history, nature, and diverse cultures. The whole route can be cycled in approximately 20 days making it a go to place for travelers who enjoy cycling.

Via Francigena in Tuscany



Image Source: visittuscany.com

Wild Atlantic Way

The Wild Atlantic Way represents the ultimate adventure challenge, offering a cycling tour that leaves a lasting impression. This iconic journey covers the full length of Ireland's dramatic west coast, from the southernmost to the northernmost points. Cyclists traverse through wild mountain passes, discover secluded beaches, navigate near steep cliffs, and pass through picturesque villages and expansive bogs, providing an unparalleled opportunity to witness the raw beauty of the Wild Atlantic Way coastline.

The route spans 875 km (543 miles) and is typically completed over 14 days. It presents a diverse blend of Ireland's landscapes, rich history, and vibrant culture. A brief detour in the journey allows exploration of Galway, one of Ireland's most charming cities. With expert guidance available to interpret the intricacies of this untamed landscape, cyclists can focus on the exhilarating challenge that the Wild Atlantic Way presents. This route is renowned for its breathtaking panoramas, local cuisine, and warm accommodations, making the Wild Atlantic Way cycling route a truly unforgettable journey and one of the most Instagrammable cycling routes in Europe.

Part of the Wild Atlantic Way



Image Source: tripsavvy.com

Helsinki, Finland: Gamification and creative setups

A creative way of making cycling lanes more attractive is to integrate gamification into particular routes, by scanning QR codes placed along it and collecting points in an online app. This type of approach is suitable for both leisure and commuting routes. Moreover, attractiveness may also be increased by placing creative setups, urban furniture or arranging look-out points along the route, while prompting social media engagement through the use of a particular hashtag when posting photos.

Gamification of cycling was piloted in **Helsinki**, as part of the CIVITAS project called MUV (Mobility Urban Values), aimed to inspire behavioral change in communities and explore the use of crowdsourced data for urban planning by using gamification and co-creation. The project focused on promoting sustainable and healthy mobility choices by engaging local communities, businesses and policymakers.

The pilot project was conducted by Forum Virium, a non-profit innovation company owned by the City of Helsinki. The MUV mobile game was introduced in the neighborhood of Jätkäsaari, encouraging residents to use sustainable modes of transportation and collect points by walking, cycling, and using public transportation. Involving local businesses, such as providing incentives for arriving by foot or bike, proved to be an effective strategy. The game also generated valuable data on residents' mobility choices, helping city planners

understand their needs better.

One study⁴⁷ dedicated to the topic confirmed using cycling gamification apps can promote cycling among urban residents and recommends offering tangible rewards or small monetary incentives as a means of reward.

MUV project cover



Image Source: forumvirium.fi

Relevance for the functional area level

Attractivity

One significant element in promoting the cycling culture, particularly within a functional area, is the attractiveness and accessibility of cycling routes. The Cycle Highways Assessment Tool emphasizes the crucial role of "route awareness", effectively brought about through recognizable network or route "brands" and their visibility in the public space. These elements increase the potential of attracting new users and encouraging the development of a healthier, environmentally friendly mode of transportation. The incorporation of a unique route brand not only raises awareness but also reinforces the identity of the routes, leading to a memorable user experience and in turn, an increasing number of cyclists.

For enhanced efficacy, a unitary approach at the functional area level is suggested. This approach aims to ensure consistency and further fortify the supra-local identity, connecting communities and regions in a more meaningful way. Recommendations include the use of consistent colors and names for the routes, strategic planning through aesthetically pleasing and intriguing sceneries, thereby turning cycling into not just a mode of transport, but an adventure. The implementation of innovative digital methods such as interactive cycling apps and social media campaigns can also be an effective way of attracting new cyclists. By blending physical and digital elements, the approach ensures that cycling routes appeal to a wide range of demographics, thereby bolstering their attractiveness and usage.

4.

Communication and citizen engagement in the transition to sustainable mobility





Communication and citizen engagement

Communication and citizen engagement play a crucial role in facilitating the transition to sustainable mobility, particularly in promoting cycling as a viable transportation option. A set of recommendations for effectively engaging citizens and promoting sustainable mobility were developed as part of the CARMA (Cycling Awareness Raising and Marketing) project⁴⁸, co-funded by the Intelligent Energy Europe Programme, including the following:

- Conduct thorough research to understand the demographics, preferences, and interests of cyclists. Explore their motivations, hobbies, and media consumption habits. This knowledge will help tailor communication strategies and campaigns more effectively.
- Focus on segments of the population that are more likely to respond positively, such as individuals who have previously cycled or expressed interest in cycling but have stopped for various reasons. By targeting these groups, efforts can be more efficiently directed towards potential behavior change.
- Foster collaboration with other stakeholders, such as NGOs, community groups, and local businesses. Strategic partnerships can provide valuable insights, resources, and support for shaping communication strategies and implementing campaigns.
- Apply monitoring tools, such as citizen surveys and digital panels, to measure the results of activities and track overall developments and policies.
- Incorporate evaluation methods into the project from the beginning to measure effectiveness and gather reliable data.
- Integrate marketing into infrastructure - Recognize that infrastructure itself communicates messages. Consider how infrastructure design and implementation can effectively convey the benefits and safety of cycling.
- Create interactive and informal meetings to allow for active participation and open dialogue. Adopt an informal and inclusive approach to engage cyclists and their representatives effectively.

Community cycling festivals

Organizing a cycling community festival can be a great way to promote cycling and provide opportunities for people to engage in cycling activities. One of the most valuable assets of cycling festivals is the fact that they involve collaboration with a wide range of stakeholders such as local authorities, cycling associations, businesses, and community organizations. These partnerships create a supportive network, sharing resources and expertise, and contribute to the development of a sustainable cycling culture beyond the festival itself.

Education is another key component of cycling festivals, by organizing information stands, workshops, and demonstrations focused on cycling. These educational initiatives can cover topics such as cycling safety, bike maintenance, and route planning. Moreover, guided cycling tours organized as part of the festival can encourage people to overcome any barriers, they may have with regard to cycling and identify solutions. By highlighting the benefits of cycling as a mode of transportation, festivals can inspire individuals to choose cycling for their daily commutes.

The dimension of active engagement of participants in cycling activities is key. A study⁴⁹ dedicated to the impact of large professional cycling sports events (such as the world cycling championship held in Tirol, Austria) highlighted that such events do not directly lead to an increase in the adoption of cycling as a means

of transport, but it can serve as a final catalyst or motivating factor for individuals who were already contemplating the option of cycling on a daily basis.

Such events can be organized within the European Mobility Week (16 - 22 September) or around World Bicycle Day, celebrated on June 3rd. Find out more on best practices in organizing community cycling events [here](#).

Brisbane Cycling Festival



Image Source: Brisbane Cycling Festival

Velo-City world cycling summit

Velo-City⁵⁰ is a renowned international event that was first organized in 1980, in Bremen, Germany. It brings together experts, policymakers, professionals, and enthusiasts from around the world to discuss and promote sustainable mobility, with a specific focus on cycling. Organized annually by the European Cyclists' Federation (ECF), the conference serves as a platform for knowledge exchange, networking, and showcasing innovative ideas and practices in the field of cycling and urban mobility. The 2023 edition was held in Leipzig and focused on how cycling can lead the transition to climate neutrality⁵¹.

One of the key objectives of the Velo City Conference is to foster collaboration and exchange of best practices among attendees. It creates a unique platform for stakeholders from different sectors, including government officials, urban planners, transportation experts, bicycle advocates, and industry representatives, to come together and learn from each other's experiences. The conference facilitates networking opportunities, allowing participants to establish connections, build partnerships, and inspire new initiatives and projects. Through its flagship status and visibility, the Velo-City Conference plays a significant role in influencing policy development at local, national, and international levels.

The conference program includes keynote speeches, panel discussions, workshops, presentations, and interactive sessions.

Participants have the opportunity to explore various themes related to cycling, such as infrastructure design, policy development, advocacy strategies, behavior change, technological advancements, and the integration of cycling with other modes of transport. The conference provides a comprehensive view of the latest trends, research findings, and success stories in promoting cycling as a sustainable and healthy transportation option.

In addition to the formal conference program, Velo City offers various activities that showcase cycling culture and the host city's bicycle-friendly initiatives. These activities include guided bike tours, cycling festivals, and exhibitions, allowing participants to experience firsthand the practical implementation of cycling infrastructure, urban design, and community engagement strategies.

Cover image for Velo-City Leipzig 2023



Image Source: Velo City Leipzig 2023

Cycling audits

Engaging the community in cycling audits before and after an intervention can provide invaluable insights and promote a sense of ownership. A cycling audit can ensure that the infrastructure is designed and implemented with consideration for various factors such as safety, accessibility, and user experience, across different ages and levels of abilities. The sample audit below can be applied at the functional area level for routes of interest that connect key attractors (such as routes to work, school, or different services), across different localities, or at the neighborhood level.

AI generated image



Image Source: AI generated

AI generated image



Image Source: AI generated

Tool: Cycle audit

The cycle audit tool below is adapted based on the Bikeability checklist - Chapel Hill, NC, Pedestrian and Bicycle Information Center, 2008 (included in *A healthy city is an active city: a physical activity planning guide*, WHO⁵²).

How cycling-friendly is your city?

Take a bicycle ride in your community and then answer each question. Circle an overall rating for each question and note any problems you encountered by checking the appropriate box(es). Make a careful note of any specific locations that need improvement. Add up the numbers to see how you rated your ride.

1. Did you have a place to bicycle safely?

a) On the road, sharing the road with motor vehicles

Yes, some problems:

- No space for cyclists to ride
- Bicycle lane or paved shoulder disappeared

- Heavy and/or fast-moving traffic ☐ Too many trucks or buses ☐ No space for bicyclists on bridges or in tunnels
- Poorly lit roadways
- Other problems: _____

b) On an off-road path or trail, where motor vehicles were not allowed

Yes, some problems:

Path ended abruptly

Path did not go where I wanted to go

Path intersected with roads that were difficult to cross

Path was crowded

Path was unsafe because of sharp turns or dangerous downhill

Path was uncomfortable because of too many hills

1.

Path was poorly lit

Other problems: _____

Overall rating as a safe place to ride: (circle one)

1- awful / 2 - many problems / 3 - some problems / 4 - very good / 5 - good / 6 - excellent

1. How was the surface on which you rode?

Good, some problems. The road or path had:

Potholes

Cracked or uneven pavement

Debris (such as broken glass, litter, gravel, etc.)

Dangerous drain grates or utility covers

Other problems: _____

Overall surface rating: (circle one)

1- awful / 2 - many problems / 3 - some problems / 4 - very good / 5 - good / 6 - excellent

2. How were the intersections through which you rode?

Good, some problems:

Had to wait too long to cross

Couldn't see crossing traffic

Signal did not give me enough time to cross

Unsure where or how to ride through intersection

Other problems: _____

Overall intersection rating: (circle one)

1- awful / 2 - many problems / 3 - some problems / 4 - very good / 5 - good / 6 - excellent

3. Did drivers behave well?

Yes, some problems. Drivers:

Drove too fast

Passed too close

Did not signal

Harassed me

Cut me off

Ran red lights or stop signs

Other problems: _____

Overall driver rating: (circle one)

1- awful / 2 - many problems / 3 - some problems / 4 - very good / 5 - good / 6 - excellent

4. Was it easy for you to use your bicycle?

Yes, some problems:

No maps, signs, or road markings for cyclists

No secure place to leave my bicycle

No way to take my bicycle with me on the bus or train

Scary dogs

Hard to find a direct route I liked

Route was too hilly

Other problems: _____

Overall rating of ease of use: (circle one)

1- awful / 2 - many problems / 3 - some problems / 4 - very good / 5 - good / 6 - excellent

How does your community rate in terms of bikeability? Add up your ratings and decide.

1. _____

2. _____

3. _____

4. _____

5. _____

Total _____

26–30 You live in a bicycle-friendly community.

21–25 Your community is pretty good, but there is room for improvement.

16–20 Conditions for riding are okay, but plenty of opportunity for improvements.

11–15 Conditions are poor and you deserve better! Call the city now.

5–10 Oh dear. Consider wearing body armour before venturing out again.

5.

Measuring impact





Measuring impact

Measuring the impact and usefulness of cycling infrastructure in a functional area is essential for its long-term sustainability and effectiveness. Quantitative data such as cyclist counts, travel time comparisons and safety records offer critical insights into the infrastructure's utility. Monitoring traffic congestion and air quality can further highlight the environmental benefits and potential for reducing road traffic. It's also vital to evaluate the economic effects through aspects like business growth, property values, and tourism, as well as considering connectivity, accessibility, and integration with other transportation forms. Health studies reflecting changes in population health, such as obesity and respiratory conditions, can additionally signify the positive effects of cycling infrastructure on public health.

Complementing quantitative data with qualitative insights adds depth to the evaluation. User surveys can gauge satisfaction levels and gather recommendations for improvements. Furthermore, an assessment of maintenance requirements and the infrastructure's lifespan aids in understanding its sustainability and cost-effectiveness. Community engagement, as observed through participation in cycling-related events or programs, also serves as an indicator of social impact. By combining these various metrics, a well-rounded view of the cycling infrastructure's impact within a functional area can be obtained, facilitating informed decision-making and continuous enhancement.

A series of devices and technologies can be used to automatically collect data and measure the impact of cycling infrastructure in a functional area.

- Automatic bicycle counters: These devices can be installed on bike paths to automatically count the number of bicycles that pass by. They can be in-ground induction loops or infrared counters.
- GPS trackers: By encouraging cyclists to use GPS devices or smartphone apps, planners can collect data on popular routes, speeds, and travel times.
- Video cameras: Strategically placed cameras can record bicycle traffic and, using image recognition software, analyze data regarding cyclist numbers, behaviors, and interactions with other road users.
- Air quality monitors: These can be placed along bike routes to measure changes in air quality, which can be attributed to increased bicycle use and consequent reductions in vehicle emissions.
- Wearable fitness trackers: Encouraging cyclists to use wearables that track physical activity can provide data on health impacts, such as average calories burned during bike commutes.
- Smartphone surveys and feedback apps: These apps allow cyclists to give feedback on their experiences, suggest improvements, and report issues, providing qualitative data on user satisfaction.

- Smart bicycle racks: Some bike racks are equipped with technology to count the number of bikes parked, indicating the utilization of specific areas or routes.
- Heat maps: Utilizing GPS data from various sources, heat maps can be generated to visually represent high-use areas and routes within the cycling network.
- Social media analytics tools: Monitoring mentions and sentiment regarding cycling infrastructure on social media can offer insights into public perception and areas of concern.
- Economic data collection tools: Using software that integrates local economic data, it's possible to analyze how changes in cycling infrastructure affect local businesses and property values.

These technologies and devices can help municipalities develop output indicators required to measure the achievement of objectives for new cycling infrastructure, usage, and safety of the cycle network, as well as the environmental, health, economic and strategic impact of given projects. Some examples of possible output indicators can be the following:

INFRASTRUCTURE

- Increase in length of cycling network
 - X kilometers of cycle paths will be constructed at the functional area level in a specific period

- Number of new cycling-related infrastructure (e.g. repair shops, air pumps)

USAGE

- Increase in cycling modal share (the share of bicycle traffic in the total transport)
 - The share of cyclists among commuters should increase from x% to y% during a specific period.
- Number of cyclists using the infrastructure
- Hours travelled on dedicated bicycle tracks

SAFETY

- Decrease in the number of fatalities involving cyclists
 - The number of fatalities among cyclists at the functional area level will decrease from X/1,000,000 to Y/1,000,000 people during a specific period.
- Percentage of bike lanes protected from motorised traffic
 - The percentage of bike lanes separated from motorised traffic at the functional area level will increase from X to Y during a specific period.

ENVIRONMENTAL AND HEALTH IMPACT

- Improved air quality (Particle emissions reduction)
- Daily/monthly/yearly CO2 saved by cyclists as opposed to using cars
- Calories burnt by local cyclists in a specific area

ECONOMIC, STRATEGIC IMPACT

- Additional revenue generated in the functional area
- Kilometers of new bike routes planned/year
- Number of new bicycle parking's and service stations planned to be developed/year

BIKEABILITY AUDIT

- A bikeability audit can be applied as a qualitative tool to measure the perception of quality, safety and attractiveness of the cycling network, before and after the implementation of a specific project, or regularly (for example, once a year).

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FUNCTIONAL AREAS IN THE EU

Crossing administrative boundaries for green transition and sustainable development