SMART-MR
Interreg Europe

European Union
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Development Fund

# *TRANSFORMING* ***EUROPEAN METROPOLITAN REGIONS***

## *Smart mobility for better liveability*

**SMART-MR:** Sustainable Measures for Achieving Resilient Transportation in Metropolitan Regions

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**Editor: Janez Nared**

Ljubljana 2019

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**TRANSFORMING EUROPEAN METROPOLITAN REGIONS**
Smart mobility for better liveability



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# CONTENT

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# 1 INTRODUCTION

Transportation in urban areas, particularly metropolitan regions, generates congestion and vast greenhouse gas emissions, and thus imposes enormous challenges upon authorities in providing healthy living conditions and a supportive environment for businesses. Thus, the overall objective of the SMART-MR project was to support local and regional authorities in improving transport policies and providing sustainable measures for achieving resilient low-carbon transportation and mobility in metropolitan regions. To tackle this issue, ten project partners from eight metropolitan regions (Oslo, Gothenburg, Helsinki, Budapest, Ljubljana, Rome, Porto, and Barcelona) have shared their experience in transport and mobility planning by holding seven topically interrelated workshops. The goal of this publication is not to present all of the project results. It only focuses on the main lessons learned during the seven workshops. They are presented by following the Eight-Step Process for Leading Change (Kotter 1996; Table 1).

**Table 1:** Kotter's steps and chapters in this publication.

| Kotter's steps for leading change | Chapters in this publication |
|---|---|
| Establishing a Sense of Urgency | **2** The Sense of Urgency: The Climate Is Already Changing |
| Creating the Guiding Coalition | **3** Joining Forces to Face Climate Change in Metropolitan Regions |
| Developing a Vision and Strategy | **4** Creating a Vision and Strategy |
| Communicating the Change Vision | **5** Communicating a Vision and Empowering New Habits |
| Empowering Employees for Broad-Based Action | **6** Paving the Way to Long-Term Effects |
| Generating Short-Term Wins | **7** Generating Short-Term Wins |
| Consolidating Gains and Producing More Change | **8** Integrating Measures to Build Better Liveability in Metropolitan Regions<br>**9** Policy Recommendations |
| Anchoring New Approaches in the Culture | **10** Making the Shift toward Better Liveability in Metropolitan Regions |

The starting point of the publication is climate change and the challenges it poses to metropolitan regions. By following available knowledge and our own experiences, we define participatory planning as an effective tool for joining forces in countering climate change, whereas creation and communication of a vision and strategy are logical following steps. Focused on mobility and land-use planning, we present short- and long-term wins in mobility planning, low-carbon logistics, transport management, and the sharing economy, and the development of and around transport nodes. By acknowledging the importance of integrated planning, we present activities and policy recommendations that can be combined uniquely in each metropolitan region to reduce climate change impacts, improve mobility, and enhance liveability.

To facilitate reading, we have highlighted the main messages alongside the general text and provided informative figures and boxes that support the main messages with practical experiences from the participating metropolitan regions.

The main message we wish to deliver is that alternatives to current unsustainable modes of behaviour already exist; what is missing is a willingness to make a change. It is hoped that this publication will help everyone make a decisive step.

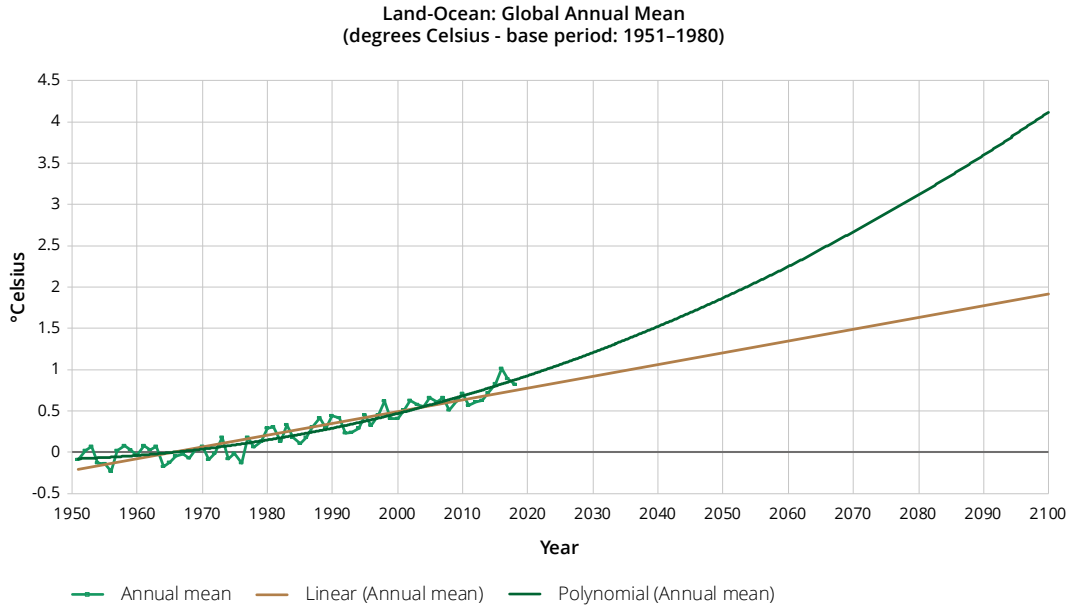

Ljubljana Cyclists' Network

# 2 THE SENSE OF URGENCY: THE CLIMATE IS ALREADY CHANGING

**Climate change challenges need to be addressed now!**

There is a strong message from scientists to every one of us: our planet is warming because of human -induced greenhouse gas emissions (Figure 1). This trajectory will affect humanity in many ways: primarily through water shortages, reduction of areas suitable for food production, the impacts of natural hazards, rising sea levels, climate-induced migration, and various kinds of effects on health. At the same time, population growth will concentrate in urban areas and further transform metropolitan regions. Sustainable growth thus requires knowledge of how to develop metropolitan areas, densify urban structure, and enhance sustainable mobility in metropolitan regions. These challenges must be considered while designing response strategies. We need to accelerate our efforts to reduce emissions now.

**Figure 1:** Temperatures have risen considerably since 1950 and will continue to increase in the future (NASA 2019).



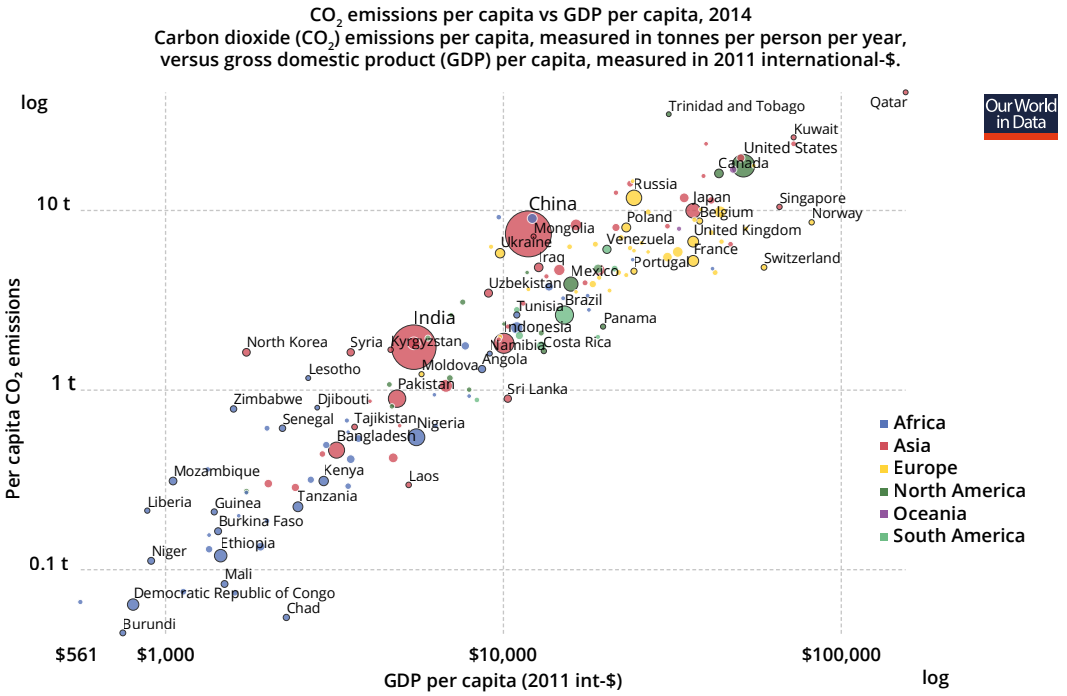

**The challenge is to have a common understanding that fast actions are needed.**

## 2.1 IMMEDIATE ACTIONS AND TIGHTENED CLIMATE TARGETS ARE NEEDED

The international community committed to halting global warming below 2 °C and pursuing efforts to limit the temperature increase to only 1.5 °C in the Paris Agreement (2018), which is the first ever legally binding and global climate deal. Although national governments are the signatories of the Paris Agreement, they also recognize the role of cities, regions, and local authorities in addressing climate change. Non-party stakeholders are also invited to scale up and support actions to reduce emissions and promote regional and international cooperation in tackling climate change.

Examining $CO_2$ emissions per capita shows the great differences between developed countries' responsibility for climate change and that of the developing countries. Due to their standard of living (Figure 2), Europeans have a larger per capita carbon footprint than those living in low-income countries. Therefore, Europeans should also be in the lead in reducing their emissions. This is not a mission impossible: Europeans have better access to climate-smart technology, the means to cooperate and share knowledge, and democratic decision-making processes. The challenge is to create a common understanding of how to transform the international goals into national and local goals and actions.

**Figure 2:** $CO_2$ emissions per capita versus gross domestic product per capita in 2014 (Ritchie and Roser 2018a).



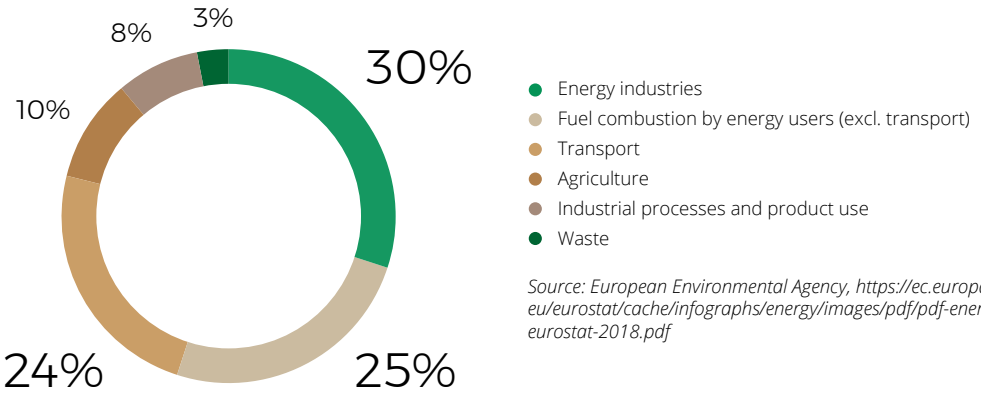

*Source: Global Carbon Project, Maddison (2017) OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY-SA*

**The transport sector needs to reduce its share of emissions by being more effective.**

The EU has set three key targets for 2030. There should be at least a 40% cut in greenhouse gas emissions from 1990 levels, a 27% share of renewable energy, and a 27% improvement in energy efficiency.

The transport sector represents nearly a quarter of Europe's greenhouse gas emissions (Figure 3). There has not been a gradual decline in its emissions, as has been made in other sectors. Emissions from the transport sector started to decrease only in 2007 and they remain higher than in 1990. Within the transport sector, road traffic is by far the biggest source of $CO_2$ emissions. Aiming to ensure that Europe remains competitive and able to respond to the increasing mobility needs of people and goods, the European Commission (2016) has adopted a strategy for low-emission mobility. The main elements of this strategy are built around increasing the efficiency of the transport system, promoting multi-modality, the deployment of low-emission alternative energy, and moving toward zero-emission vehicles. The objectives of the strategy can further be supported through smart mobility planning and by decreasing the need for mobility.

**Figure 3:** Share of EU greenhouse gas emissions by source, 2015 (Shedding light ... 2018).



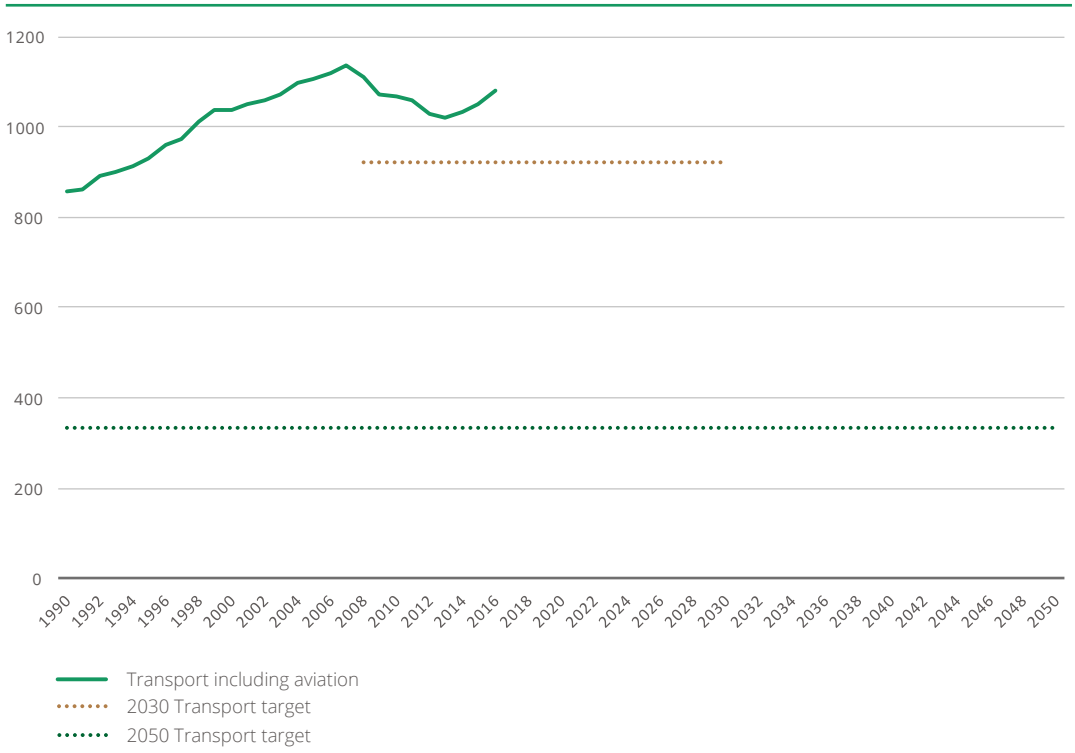

*Source: European Environmental Agency, https://ec.europa.eu/eurostat/cache/infographs/energy/images/pdf/pdf-energy-eurostat-2018.pdf*

**Land-use planning must support effective mobility.**

## 2.2 TRANSITION IN TRANSPORT SYSTEMS PROVIDES AN OPPORTUNITY FOR A LOW-CARBON FUTURE IN METROPOLITAN REGIONS

Increasingly more people choose to live in urban areas because of the wider choice of livelihoods and access to better services. However, not all of them are aware of the global challenge of climate change. Therefore, it is necessary to plan and build cities in such a way that everyday life is as climate-friendly as possible for everyone. The urban environment should support choices to reduce the carbon footprint (Figure 4). Housing, services, and especially transportation infrastructure should be made climate-smart, starting at the planning and development stage, as well as during the implementation stage, well before the area is fully occupied.

**Figure 4:** Greenhouse gas emissions from transport in the European Union (million tonnes of $CO_2$ equivalent; Greenhouse gas ... 2018).




**Transition to a low-carbon mode is necessary, and cities should take a lead.**

Transport systems are currently in a transition phase. Many cities are already doing much to reduce car dependency by adopting policies aimed at reducing car use, and promoting the use of public transport, walking, and cycling. The ramifications of getting people to shift from cars to alternative transport methods are manifold: this will enhance air quality, reduce noise levels, increase the attractiveness of the area, and lead to positive health effects. It will also affect personal finances by reducing car ownership.

By creating low-carbon transportation and areas, cities can contribute to the global commitment to reduce greenhouse gas emissions and at the same time improve the quality of life for city dwellers.

Robert Ramos

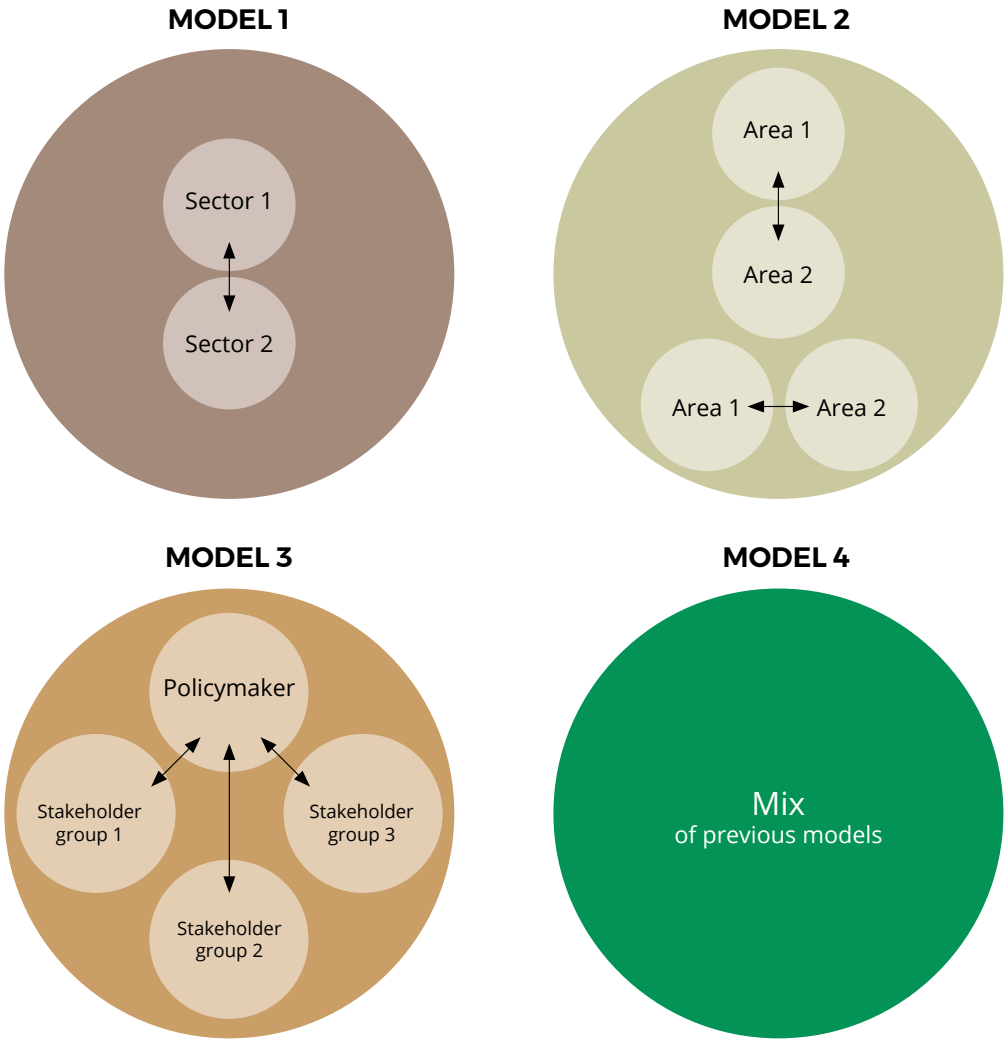
# 3 JOINING FORCES TO FACE CLIMATE CHANGE IN METROPOLITAN REGIONS

**We all need to work together in making the change.**

Coping with climate change requires intensive cooperation among all administrative levels, sectors, governmental and nongovernmental bodies, academia, and the public. Governance thus plays a significant role. It can only be effectively realized by acknowledging everybody's part in the adaptation process and allowing everyone to speak. Measures, investments, and activities should follow a well-defined strategy, which must be tested within the participatory process, engaging all the parties affected. Everyone should have a chance to take initiative or be involved in line with their abilities and needs.

Because the government structure and territorial organization differ from country to country, and because each measure involves a unique mix of stakeholders, the participatory process must be tailor-made for a specific territorial level and action taken (Figure 5). It must start at the very beginning of the planning process and should be sufficiently promoted to engage all the relevant and interested parties.

**Figure 5:** Models of governance (RURBANCE 2015).



**Decisionmakers have a huge responsibility in involving all the actors.**

By introducing collaborative inclusive participatory processes into planning, politicians, public administration, and planners would be the most responsible for successful planning and implementation. This approach should not disregard the needs and interests of other actors (e.g., residents, business, and NGOs).

**The right territorial level must be chosen for each task: entire functional areas should be included.**

Territorially, climate change adaptation measures must take place from the local level to the global level, each of them solving specific issues. Those at the local level are more concrete and easier to understand, whereas the complexity of tasks rises with the territorial level. This also affects the participation and engagement of the public. At the local level, initiatives often come from residents because they clearly understand the needs of the community and respond appropriately. At the regional, national, and international levels, the issues become more complex and abstract, and they can only be managed by politicians and professionals (i.e., planners and experts), whereas the residents are mostly represented by NGOs or representatives of the civil sector.

**Messages and the right communication channels must be thoroughly discussed.**

Regardless of the territorial scope, the media play an important role in awareness raising and mobilizing society to make a transformative change. Thus, they can contribute to a behavioural shift. In addition to the media, new technologies can also support stakeholders' involvement by offering new ways of data collection, analysis, and voting. Social media in particular could play an important role in mobilizing or informing interested groups of residents.

**Decisions must be data- and evidence-based.**

Because the participatory planning process at the regional level is complex, it is helpful to involve an experienced facilitator (Figure 6). It also requires sufficient data and studies so that the decisions are evidence-based and do not depend on the opinion of the most engaged stakeholders.

**Figure 6:** Workshops are often used to collect people's ideas and to discuss existing alternatives.

**One size does not fit all: decisions must be tailored to the specific needs of an area.**

**We all have to do our part.**

Due to specific government structure, legislation, and natural and social features, planning is specific for each region, as are the actors that should be involved in the planning process. In combating climate change and ensuring sustainable and resilient mobility in metropolitan regions, the transport sector must be addressed together with land-use planning and the housing sector. Consequently, participation is mostly institutionally based. It takes more effort, time, and energy to establish a strategy, whereas the results are long-lasting and ensure smoother implementation of the strategy. Every group of participants should be aware of their particular role in the planning process (e.g., planners suggest solutions and politicians make decisions) and contribute according to their abilities. Trust, mutual respect, and clear rules are important elements of the process.

Along with the stakeholders at the regional level, regional activities must be interwoven with activities and stakeholders at the local level as well as those at the national and international levels. It is essential to obtain broader agreement to fight against climate change, involving political parties, public bodies, and civil society. Hence, the problems of air quality and climate change should be tackled jointly using policies and measures that have been developed through an integrated approach (Air quality … 2018, 14). Thus, the objectives are shared and implementation is easier.

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# 4 CREATING A VISION AND STRATEGY

**The urban population is expected to grow in the future, and so ensuring sustainable mobility is a must.**

Almost three-quarters of the EU population lives in urban areas, and the share of the urban population in Europe is projected to rise to over 80% by 2050 (Eurostat 2018). Therefore, urban policies have entered the international political agenda (Urban Agenda… 2016; Draft outcome document… 2016; and UN Sustainable Development Goals 2016) and require a new planning model for integrated urban spaces, including in transport and mobility planning.

Considering the current traffic situation in cities, such an increase in the urban population without a serious commitment to sustainable mobility can cause a real collapse of the transport system, increase air pollution, and cause health problems. The European Commission, aware of the gravity of these problems, especially in metropolitan regions, has long been developing various tools for mobility issues.

## 4.1 EUROPEAN MOBILITY PLANNING TOOLS AND DOCUMENTS

In the last decade, numerous studies, such as the Action Plan on Urban Mobility (2009), the Transport White Paper (Roadmap … 2011), the Eltis guideline for sustainable urban mobility plans (SUMPs; Eltis 2014), and the EU initiative CIVITAS (2019), were directed to address transport-related challenges in Europe in a more sustainable way. They resulted in the SUMP (Sustainable Urban Mobility Plan) concept (Eltis 2014, Figure 7), which has been gradually introduced throughout Europe.

**Figure 7:** Shift to sustainable urban mobility planning (Eltis 2014).

| Traditional Transport Planning | | Sustainable Urban Mobility Planning |
|---|---|---|
| Focus on traffic | ▶ | Focus on people |
| Primary objectives: Traffic flow capacity and speed | ▶ | Primary objectives: Accessibility and quality of life, as well as sustainability, economic viability, social equity, health, and environmental quality |
| Modal-focused | ▶ | Balanced development of all relevant transport modes and a shift toward cleaner and more sustainable transport modes |
| Infrastructure focus | ▶ | Integrated set of actions to achieve cost-effective solutions |
| Sectorial planning document | ▶ | A sectorial planning document that is consistent and complementary to related policy areas (such as land use and spatial planning, social services, health, enforcement and policing, etc.) |
| Short- and medium-term delivery plan | ▶ | Short- and medium-term delivery plan embedded in a long-term vision and strategy |
| Related to an administrative area | ▶ | Related to a functioning area based on travel-to-work patterns |
| Domain of traffic engineers | ▶ | Interdisciplinary planning teams |
| Planning by experts | ▶ | Planning with the involvement of stakeholders using a transparent and participatory approach |
| Limited impact assessment | ▶ | Regular monitoring and evaluation of impacts to inform a structured learning and improvement process |

**Mobility plans at various levels could be the first step in addressing mobility challenges.**

The SUMP guidelines, based on a systematic consolidation of the knowledge acquired, describe the preparation process of a SUMP. This is a strategic plan designed to meet the mobility needs of people and businesses in a territory, limiting the negative effects of traffic on road congestion and safety, as well as on the environment (atmospheric and noise pollution). Thus, it ensures integrated mobility planning, combining land-use planning and transport planning. It also strives to achieve a better quality of life and contributes to reaching the climate and energy targets set by the European Union.

Preparation of the SUMP is a cyclical planning process starting from proper data collection, participation of the general public and stakeholders from the beginning, definition of a strategy, and regular monitoring for assessment and possible adoption of corrective measures. These guidelines have been adopted by several European governments and have therefore become a constituent element of many national regulations. Initially, the SUMPs were developed at the city level, but are now also shaped at the level of metropolitan regions because they present a functional urban area.

**The vision should address what kind of city people want to live in.**

## 4.2 COMMON VISION AS A DRIVER OF STRATEGIES

To ensure integral and sustainable development of metropolitan regions, a shared vision is crucial. The central issue to be addressed while formulating a shared vision is "what kind of city do we want to live in?" and it should be created by involving all interested parties. A common strategic vision provides a description of the quality of living in a metropolitan region and serves as a guide for developing general spatial planning measures in which mobility and transport are crucial, today and in the future (Figure 8).

**Figure 8:** Structural illustration of the Gothenburg region. An example of a shared vision for thirteen local municipalities in the Gothenburg region, Sweden (The Göteborg Region ... 2008).

**A vision must be realistic and shared among stakeholders and the general public.**

Sharing a common vision on mobility between stakeholders and the general public is an essential step in mobility planning. It should contribute to balanced and sustainable development of the environmental, economic, and social components of the territory and thus to a higher quality of life (Figure 9).

It is important to balance the level of the vision (and ambition) in a plan with the level of realism, consisting of what can actually be implemented during the timeframe of the plan.

**Figure 9:** Mobility planning must be combined with land-use planning, respecting the social, economic, and territorial dimensions of an area: the case of the Helsinki region planning, Finland (Granberg 2019).


## 4.3 FROM A VISION TO STRATEGIES

**A vision becomes tangible through strategies and plans.**

Transport planning develops scenarios and associated policies, specifying what actions to undertake to improve the transport system of a metropolitan region in a medium- or long-term period. This process needs to take into account the existing multimodal transport system, its conditions, and performance. It should also take into consideration land-use planning and factors that may affect the future of the area and the future performance of the transport system, including the availability of financial resources.

**Alternative scenarios should be provided to decide on the best one.**

Multiple scenarios should be developed, indicating possible alternatives. Each alternative scenario is compared to the reference scenario, including the interventions currently being implemented and to be implemented within the given timeframe.

Strategies designed to be functional for a specific territory are generally made up of various actions undertaken to achieve a set of objectives. Therefore, strategies are used to solve the problems highlighted by the initial analysis.

### THE AVOID-SHIFT-IMPROVE APPROACH

The traditional approach used to address increased transport demand has not delivered the expected results. An alternative approach is the Avoid-Shift-Improve approach (GIZ-SUTP 2012):

- "Avoid" refers to the need to improve the transport system's efficiency, reducing the need to travel and the length of the journey through integrated land-use planning and transport demand management.
- "Shift" instruments attempt to improve the efficiency of the journey through a modal shift from the most energy-consuming (i.e., cars) to more environmentally friendly urban transport modes:
  1. Non-motorized transport such as walking and cycling: these are the most environmentally friendly option;
  2. Public transport such as buses, trains, and so on; although public transport generates emissions, lower specific energy consumption per km and higher occupancy levels mean that the associated $CO_2$ emissions per passenger/km are lower when compared to cars.
- The "Improve" component focuses on vehicle and fuel efficiency as well as on improving transport infrastructure; it seeks to improve the energy efficiency of transport modes and vehicle technology. Furthermore, the potential of alternative sustainable energy use is encouraged.

Of course, the simultaneous application of all three strategies is the one that guarantees a result that is closest to achieving the objectives.


Iakov Filimonov, Shutterstock

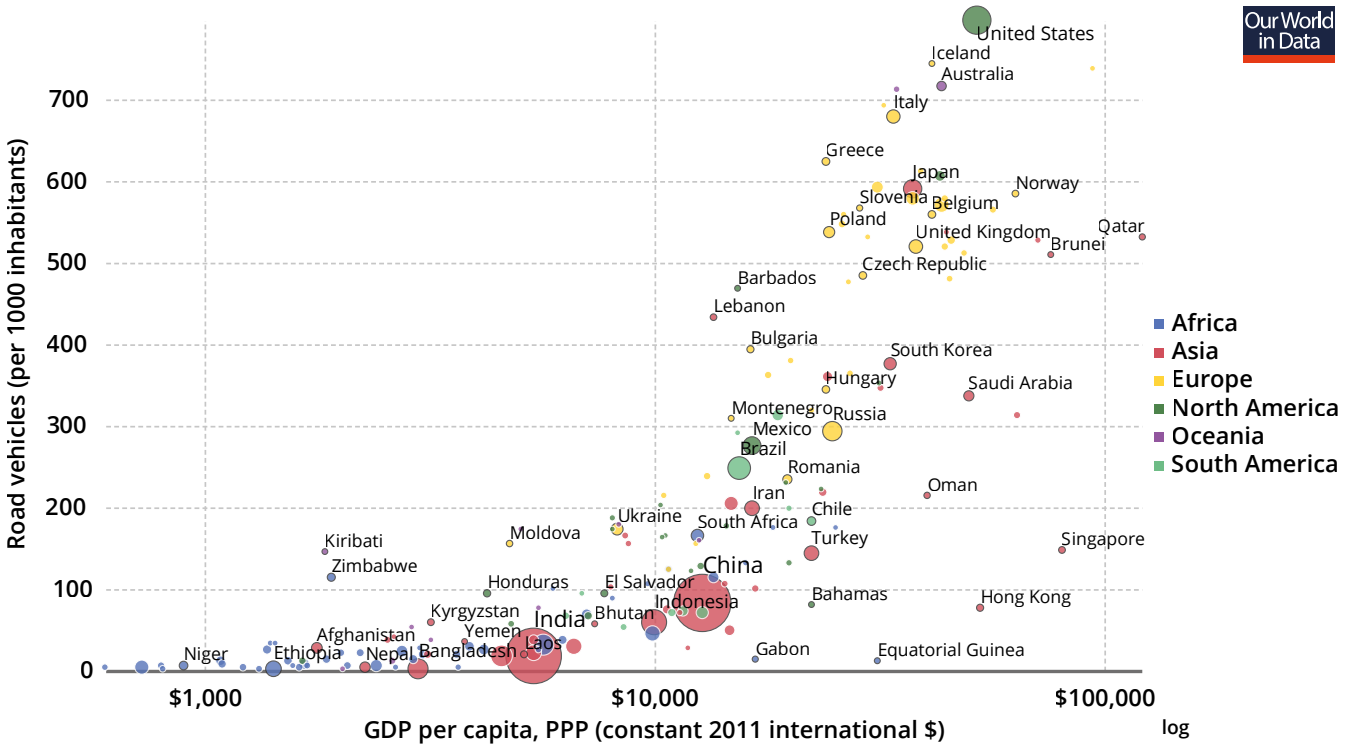
# 5 COMMUNICATING A VISION AND EMPOWERING NEW HABITS

**Communicating the vision to the public should motivate it instead of describing "if not" scenarios.**

No matter how good a vision and strategies are, they are powerless if not successfully communicated to the public. Thus, strong collaboration with the public is an essential tool for achieving common agreement on a transport vision and acceptance of the measures implemented. Despite the various territorial aspects (local/regional), complexity of measures (soft/hard), and levels of stakeholder involvement, only well-defined communication approaches can gain an adequate level of acceptance and be followed by expected long-lasting behavioural change.

A common mistake is to think that raising people's awareness and influencing attitudes is a simple one-step process that can change behaviour with nothing but simple information activity. Current generations are already accustomed to the fact that cars occupy nearly 70% of public space in cities. They almost view car ownership as a "human right" and are reluctant to change their behaviour (Figure 10). People unused to environmentally friendly modes of transport are hesitant to shift their mobility habits only because they have received information about the positive health impacts of cycling-related measures. Therefore, change must first take place in people's minds, and only then are they prepared to adopt a common vision and change their behaviour. It is of great importance for communication strategies to strongly and clearly explain to different levels of the public what the situation will be at the end of the planning process, and what the main social benefits are (CIVITAS Vanguard... 2011). One way is by showing good examples to the public about things that really will change in their daily lives and comparing them to negative alternatives if transportation measures continue to ignore the climate-smart principle.

**Figure 10:** Road vehicles per 1,000 inhabitants versus gross domestic product per capita in 2014 (Ritchie and Roser 2018b).




*Source: NationMaster Database; World Bank - World Development Indicators (WDI) OurWorldInData.org/technology-adoption/ • CC BY-SA*

**Laying one's cards on the table is always an effective communication strategy.**

**Public participation is beneficial for the planner and the participants.**

One of the main challenges for metropolitan regions is to select appropriate communication approaches and tools for different planning phases (Figure 11). In order to raise public interest and receive early encouragement, promotion of activities should begin early in the process. Although basic information material usually suffices in the initial stages, later in the process various effective communication measures must take place. Some of the commonly known approaches are workshops, social media involvement, information events, press conferences, and TV/radio broadcasting. No matter which tools are used, the aim of communication activities must be to overcome solely notifying the public about set goals, visions, and measures. Its main aim is to tailor participatory processes in an attractive manner; not only to consult, but also to involve and empower the target audience in a sufficient manner.

**Figure 11:** Communication must address the right questions and the right people.


**Building trust is a way toward a better participatory planning culture.**

In the process of public involvement, it is important to emphasize that the number of activities, expense, and time devoted to public participation do not equal the actual influence on decisions. If people perceive that they have significant influence on a final decision, whereas in the end they do not, they will be dissatisfied with the outcome of the process regardless of the amount of participatory activities performed. Therefore, it is important to be open and honest at the beginning of the process about the level of influence that the public has in order to avoid the possibility of future disappointment.

**Social media can effectively support communication with the public.**

Public involvement can also result in disagreements that are sometimes difficult to overcome. Thus, one challenge is to communicate proposed measures in an agreeable manner and find a way of accommodating disagreements. Ensuring the overall quality of communication and the participatory process therefore requires skilled moderation of discussions, strategic selection of appropriate communication tools, and potential mediation in the case of emerging conflicts (CH4LLENGE 2016).
In this way, the main challenge of communication is to determine joint interests in mobility and to sensitize participants to a culture of planning that is based on regular communication, trust, mutual consultation, and joint decision-making, which is the best way to mitigate potential conflicts already in the initial stages.

Because the fight against air pollution and climate change is far from being won, appropriate communication processes in the transport sector are currently very high on the list of priorities. Communication activities that are already complex should become even more direct, smart, and creative in their purpose to achieve commonly shared key targets of

sustainable mobility. Even if social media was once perceived as a one-way communication tool, good practices of new formats of social media platforms (e.g., Twitter, Facebook, LinkedIn, YouTube, and Instagram), blogs, online surveys, and wiki sites now provide fresh opportunities for visitors to “like” posts, comment, and directly engage in the dialogue process with their own content. Sharing is surviving, and communicating is living!

Matjaž Geršič

# 6 PAVING THE WAY TO LONG-TERM EFFECTS

The large share of the population living in metropolitan regions means it is an important source of global greenhouse-gas emissions. However, because of high population density, at the same time it is also the answer to how to address climate change; dense settlement makes possible efficient public transport and optimal provision of services.

**Integrative thinking is crucial in addressing climate-change challenges in metropolitan regions.**

To achieve a low-carbon future, metropolitan regions must still improve their organization. Changes need to be made in transportation, housing, and consumption. At the same time, integrated climate change mitigation and adaptation actions should together improve resilience in urban areas (IPCC 2018).

In combating climate change, metropolitan regions face new challenges, especially in regional mobility, which cannot be solved solely with traditional mobility measures. A broader perspective is needed, integrating relevant sectors, new technologies, and new solutions. Establishing a healthy and liveable environment for future generations in transportation, land-use planning, and environmental protection requires sustainable measures that ensure long-lasting effects toward a low-carbon society. In this chapter, selected measures in regional mobility planning, low-carbon logistics, transport management and sharing solutions, and transit-oriented development supported by low-carbon station areas are presented. These are crucial, but they do not embrace all the measures possible. The measures presented are supported by case studies, which were successfully implemented in participating metropolitan regions.

## 6.1 REGIONAL MOBILITY PLANNING

**Sustainable mobility plans are necessary for cities and metropolitan regions.**

To define long-term targets, to set goals, and to guide the process leading to sustainable mobility, mobility plans are necessary for cities and metropolitan regions. A metropolitan mobility plan is a medium- or long-term plan (ten years) and provides for an update every five years.

**Solutions are numerous but should be tailored to regions' needs.**

In a long-term perspective, the objective of the mobility plan is to provide a safer and more efficient mobility system. It also ensures an environmentally, economically, and socially more sustainable system of mobility, especially when the actions contributing to the aforementioned objective are identified during the creation of the plan together with institutions, stakeholders, and the general public. The mandatory monitoring of the plan involves measurement of the indicators linked to each individual action every two years.

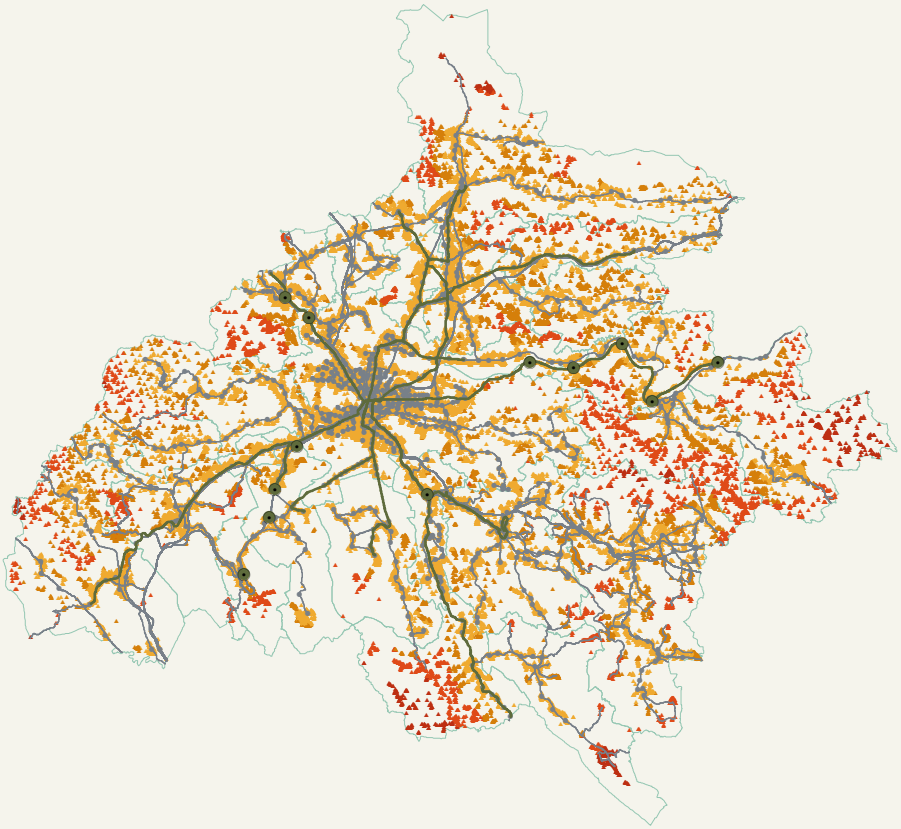
The actions to be applied concern:

- Integration between the various transport systems (redistribution of the transport network in favour of public transport, pedestrians, and cyclists, strengthening interchange nodes);
- Improvement of public transport provision (lanes reserved for public transport, increase of accessibility to public transport for passengers with reduced mobility, and use of information and communication technologies (ICT) to improve public transport management);
- Development of pedestrian and bicycle mobility (creation of cycling routes and services for cyclists);
- Introduction of shared mobility systems (shared mobility equipment at train or underground stations, transit and parking facilities for shared mobility, and promotion of shared mobility in public bodies and companies);
- Use of low-pollution vehicles (installation of electric charging stations, and replacement of vehicles for passenger and freight transport with electric vehicles);
- Rethinking urban logistics (changing the collection and distribution of goods in urban areas in order to reduce traffic and pollution, and redistributing the road capacity for improved flows of goods vehicles);
- Dissemination of the culture of safe mobility (improving the most dangerous road network, creating stops and protected sidewalks for pedestrians, and protected bicycle lanes).

## A SUSTAINABLE URBAN MOBILITY PLAN FOR THE LJUBLJANA URBAN REGION

More than a decade ago, stakeholders and the regional and municipal authorities of the Ljubljana Urban Region (LUR) committed themselves to taking active measures toward sustainable development of the region. With awareness that mobility challenges demand a long-term perspective and can only be solved through the joint effort and cooperation of all municipalities and key stakeholders, the municipalities of the Ljubljana Urban Region recognized that sustainable mobility is a priority development task. Initial steps toward that common goal were already taken in 2007, when the municipalities began to actively participate and formulate an expert basis to manage public transport in the region. Based on that common vision, various activities have focused on finding solutions to provide accessible, fast, efficient, safe, and environmentally and economically acceptable transport. Only further development of sustainable mobility can pave the way for the Ljubljana Urban Region to further develop its potentials, while also representing an important role in ensuring a comfortable lifestyle and connecting people (Figure 12).

**Figure 12:** Areas in the Ljubljana Urban Region with insufficient access to public transport.




Map by: Matej Gabrovec, Nika Razpotnik Visković
Source: Ministry of the Interior, Ministry of Infrastructure, Surveying and Mapping Authority of the Republic of Slovenia

SUMP is a key tool for implementing a new approach to transport and spatial planning, which has already been used in Slovenia at the local level (nine municipalities in the region already have local SUMPs), but until recently has not been approached at the regional level. In the framework of the SMART-MR project and with the cooperation of all twenty-six municipalities, we prepared a Sustainable urban mobility plan for the Ljubljana Urban Region (SUMP LUR).

The preparation of the SUMP LUR followed the European platform on SUMP guidelines (Eltis 2014; Figure 13) and the national SUMP guidelines prepared by the Ministry of Infrastructure (2012) with logical modification of the proposed procedures for regional needs. At the regional level, it is more important to involve various stakeholders and representatives of the organized public at various levels (state and municipal), and the involvement of the general public should be planned more carefully and be more focus-oriented.

Preparation of the SUMP LUR involved various stakeholders and the general public at all stages. As part of the state-of-the-art analysis, two workshops were held: for key stakeholders and for representatives of municipalities. In order to collect future prospects on mobility development, interviews were carried out with all twenty-six mayors of LUR municipalities. For the general public there was an online survey on travel habits, regional mobility challenges, and views on the priorities for the development of sustainable mobility, with almost two thousand participants. The state-of-the-art analysis on the five main pillars comprised cycling and walking, public transport, motorized transport, logistics, and transport planning, and it served as the foundation for defining a common vision for regional transport development and sixteen strategic goals. The vision and the goals were the focus point of five public workshops carried out in various parts of the region and on an online GIS portal, in which the residents of the region, stakeholders, and regional decisionmakers could also graphically submit their initiatives for priority actions that will help achieve those goals. Priority measures, which are an integral part of the action plan, were verified at workshops with representatives of the municipalities and key stakeholders, and additionally with interviews with key stakeholders that will be actively involved implementing measures in the future.

The first SUMP at the level of the entire development region in Slovenia was unanimously approved at the tenth regular session of the Council of the LUR (twenty-six mayors). It is an innovative strategic document arising from actual needs of the region as a whole and reacting to its concrete challenges in sustainable mobility. The main aim of the measures included in the action plan is to raise the quality of life with an emphasis on decreasing car use, promoting public transport and non-motorized means of transport, decreasing high levels of emissions and traffic noise, and reducing traffic congestion.

**Figure 13:** Phases in preparing the Sustainable urban mobility plan for the Ljubljana Urban Region.

**City logistics must also become more efficient.**

## 6.2 LOW-CARBON LOGISTICS

The long-term actions and impacts of low-carbon logistics planning mainly focus on the reduction of transport externalities and vehicle movements, as well as improved acceptance and understanding of commercial activities in metropolitan regions. Thus, low-carbon logistics planning must become part of transport planning, which so far has not been particularly common.

First, long-term reduction in carbon emissions and improvement of air quality can be achieved from reduced vehicle movements. However, freight volumes are expected to grow by 40% by 2050 (McKinsey 2017). Therefore, to reduce freight traffic in metropolitan regions the total demand for freight transport must decrease or deliveries must become more efficient. Efficiency can be achieved through implementing solutions that increase load factors; for example, consolidation. Additional emission reductions can be expected from the transition to cleaner fuels and the introduction of eco-friendly vehicles for deliveries (Figure 14).

**Figure 14:** The last-mile solution in Gothenburg: an electric vehicle providing transportation from a transportation hub to a final destination in the home.


**Logistics mostly relate to the private sector, which must also be included in planning processes.**

The second long-term benefit of low-carbon logistics planning is improved acceptance and understanding of these activities among all stakeholder groups. Increasing this acceptance might result in opportunities for shared infrastructure because stakeholders then become aware of the needs of the business sector. Another benefit is more effective and consensus-based stakeholder collaboration, which in the end provides a valuable framework for decision-making and policy implementation. Whereas the municipality traditionally focuses on social and environmental issues, businesses emphasize efficiency. Authorities also have the opportunity to guide industry by changing their own delivery and procurement practices, either by having deliveries performed by one single operator or by imposing requirements of zero-emission vehicles on operators delivering their goods. Improved knowledge of the private-sector needs helps improve the quality of public planning, and the best solution is based on the compromise achieved when the municipality knows the needs of businesses and the general public.

Finally, metropolitan regions are facing rapid changes in the transport sector due to digital and technological developments. With these changes in mind, long-term logistics planning and efficient public-private collaboration will improve the commercial potential of sustainable distribution solutions and provide more efficient management of freight traffic in metropolitan regions, which in turn will help reduce emissions.

## LOGISTICS IN OSLO

The City of Oslo has decided on major steps in its climate strategy with an effect on city logistics. Its aim is to achieve a 20% reduction in traffic by 2020, fossil-free goods distribution by 2030, and no more new fossil-fuel cars to be sold by 2025, with the exception of heavy-duty vehicles until 2030.

In developing the city's Sustainable Urban Logistics Plan, planners followed the guidelines from the project NORSULP (TØI 2019) and focused on specific measures and concrete dialogue with stakeholders. The city's logistics need to be improved by concrete measures from both the municipal side and the industry side.

One private-driven initiative is a cargo bike micro terminal. DHL Express has started delivery of parcels and express goods for the Oslo central area using electric cargo bikes, replacing diesel cargo vans (Figure 15). This is made possible by establishing a small depot or micro terminal in central Oslo and reorganizing the logistics with this new infrastructure. One cargo van picks up the goods at the DHL main terminal some 20 km north of Oslo and transports the load to the micro terminal in the early morning hours, after which the e-bikers transport the goods the last mile to offices and shops during opening hours. The e-bikes are charged overnight at the micro terminal.

At present DHL serves the Oslo central area with eight cargo vans, and the new micro terminal system will reduce the number of vehicles to only five. According to DHL, it is profitable to replace the vans with e-bikes because they are cheaper. This is a development project; it is hoped that it will work satisfactorily, and if so the electric cargo bike services will be extended to other parts of Oslo.

The project is a cooperation effort between DHL, the City of Oslo's Agency for Urban Environment, and the Norwegian Public Roads Administration's City Logistics project. The Institute for Transport Economics will evaluate the results in due course.

**Figure 15:** Electric cargo bike in Oslo.


Janez Nared

**Sustainable mobility in metropolitan regions primarily depends on the provision of public transport.**

## 6.3 TRANSPORT MANAGEMENT AND SHARING SOLUTIONS

The backbone of a metropolitan region's transport system should be public transport, which is one of the most effective and sustainable ways of moving people in metropolitan regions – also in the long term. Public transport should be accessible, reliable, and comfortable, in most cases having electrically driven track-bound modes on the main lines with high capacity (Figure 16). In the long term, public transport should be decarbonized, phasing out diesel buses. However, this is not so easy at the moment because current electric bus operational models face many uncertainties. Currently, electric buses have low ranges and charging requires significant time. Trolleybuses could be a good option, especially in cities, where they are already available, because the basic infrastructure is quite expensive. Nevertheless, metropolitan regions' mobility strategies' target of zero-emission buses by 2030 is contingent upon improving battery and charging technology.

**Public transport should also decrease its dependency on fossil fuels.**

**Figure 16:** Provision of effective public transport is crucial for all metropolitan regions.


Dávid Nyitrai

**By prudently combining land use and mobility planning, soft transport modes can gain in importance.**

An important option for decarbonizing transport is to enhance walking and cycling as soft transport modes because the cleanest modes are those that do not require any energy except manpower. Even better is to reduce transport needs with appropriate land-use planning, the help of new communication technologies, work from home, and so on.

**Electric cars are not an all-encompassing solution.**

With the future development of autonomous vehicles, parking problems could be partially solved; however, this will not help reduce road transport. The same also applies to electric cars, which do not reduce congestion. Autonomous vehicles are already available in public transport (mainly in the underground system); tests with autonomous trams and buses are ongoing (Figure 17). Their penetration into individual transport will cause enormous changes in the transportation system, which are not yet fully predictable.

**Figure 17:** New technologies allow remote control and better efficiency of transport systems.

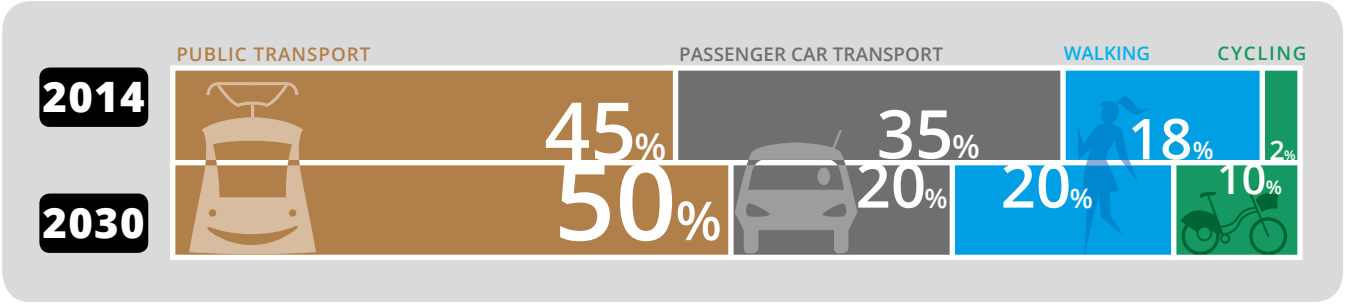

**The right mix of transport modes and mobility as a service can enhance the attractiveness of public transport.**

There is a need for integration between the city and region regarding transport management, between different sectors, and also between service providers. A new manner of integration is realized in the Mobility as a Service (MaaS) system, in which a joint platform has been set up to integrate planning and managing trips together with buying and validating tickets.

A future challenge of managing transportation is to find the right mix between various transport modes, shared solutions, and autonomous vehicles in order to cut greenhouse gas emissions and create a liveable urban environment without limiting mobility options.

In the traditional mobility paradigm, the modal split is based on the majority of people using cars, followed by those using public transport, and on a small scale people that walk, bicycle, or use other transport modes (Figure 18).

**Figure 18:** Modal split targets of Budapest according to the SUMP (BKK 2015). The modal split in Budapest differs from the traditional mobility paradigm because public transport still prevails.



**The sharing economy should support and supplement public transport.**

The sharing economy could be a good way to increase the efficiency of public transport because it allows rapid change of this mobility paradigm: from car ownership to car sharing, from owning a parking space to sharing different parking spaces, and from one solution to go from point A to point B to a multiplicity of solutions in the palm of the hand (on a mobile phone). Public transport, car sharing, carpooling, bicycling, bike sharing, walking, and so on – different transport solutions, different providers, and the flexibility to make the decision on the transport mode according to the needs of each moment and with access to all the real-time information – allow people to make the best choice.

New business models in the sharing economy with their collaborative platforms, using transport digitalization, with access to big data, are changing the way people move. The main outputs of this change should be fewer cars, less congestion, and less pollution.

This allows cities to have much more space dedicated to people than to cars (Figure 19), permitting people to use public space to have fun, to play, to live with each other – in other words, to be happier.

**Figure 19:** Urban development in Oslo is based on a car-free city.


**Sharing-economy models in mobility must be properly regulated so as not to create unfair competition.**

Sharing solutions combined with autonomous vehicles could also be a good solution, especially for low-density areas.

Proper planning and regulation of new (sharing) business models in mobility can supplement existing public transport with new solutions for better mobility (Figure 20) and at the same time promote fair competition between different companies, allowing traditional business to thrive in identical conditions as new ones. It is important to never forget that the target is to have fewer cars, and in the majority of cities this requires efficient public transport that allows the transportation of significant numbers of people.

**Figure 20:** The car-sharing system in Ljubljana uses electric cars.


**The transit-oriented development model focuses on public transport hubs.**

**Combining transport corridors with densification of settlement and services can reduce the need for a car.**

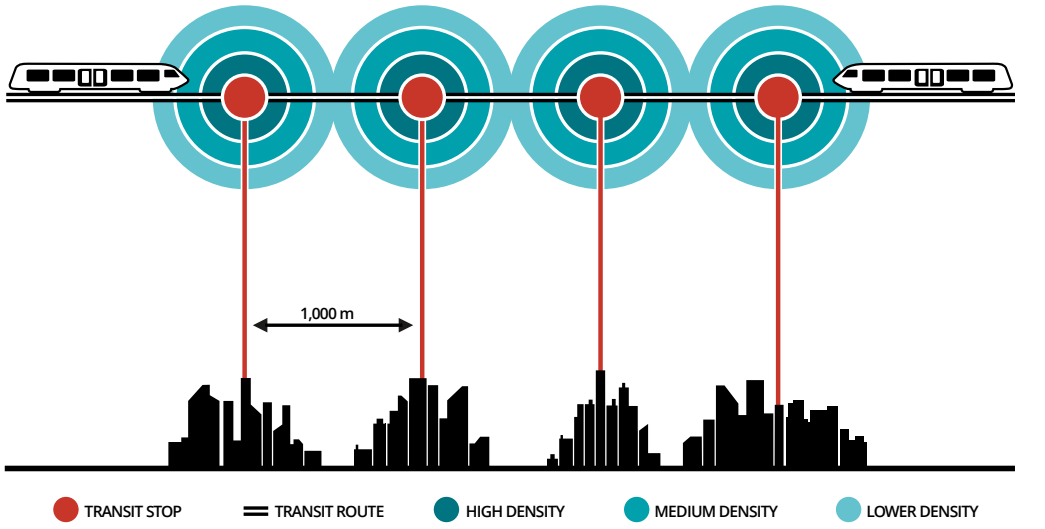
## 6.4 DEVELOPMENT OF AND AROUND TRANSPORT NODES

Transit corridors, especially rail-based corridors, are vital for urban development. Station areas are recognized as a development priority in terms of mobility, urban development, and climate targets. They are the starting points for transforming the urban environment from low-carbon station areas to low-carbon metropolitan regions.

Station areas or public transport hubs are the key focus for transit-oriented development (TOD). The TOD main drivers are reduction of car use and reducing congestion and pollution by avoiding urban sprawl. At the same time, TOD aims to increase regional accessibility by acquiring well-connected and affordable land for development in transport corridors.

TOD integrates transport and land-use planning, but at the same time it is a narrow concept that focuses on transport and how to make transit as effective as possible. It is defined as an area that has a compact and dense design with both housing and services within walking distance of public transport and with regional connectivity (Figure 21). Thus, TOD economizes mobility by decreasing the need for travel and by making possible efficient provision of public transport. In addition to TOD, there is a need for a broader perspective for community and low-carbon development, both in densifying the existing urban area and in creating new station areas.

**Figure 21:** Transit-oriented development (Lehmann 2015).



**The LOAD method can optimize creation of sustainable, compact, and accessible station areas.**

The new development concept creates the need to redefine TOD. Supported by the study "Sustainable Density in Station Communities" (Nordström, Swartz and Ståhle 2017), recommended density for exploitation used by UN Habitat (2015) is added.

The aim of the sustainable densification and compact areas is both to increase the population within the given space and also to maintain a well-defined division of land use that ensures that a high-quality and accessible urban area with an optimal land-use mix is obtained (Figures 22 and 23).

**Figure 22:** Example of efficient distribution of land use (Nordström, Swartz and Ståhle 2017).

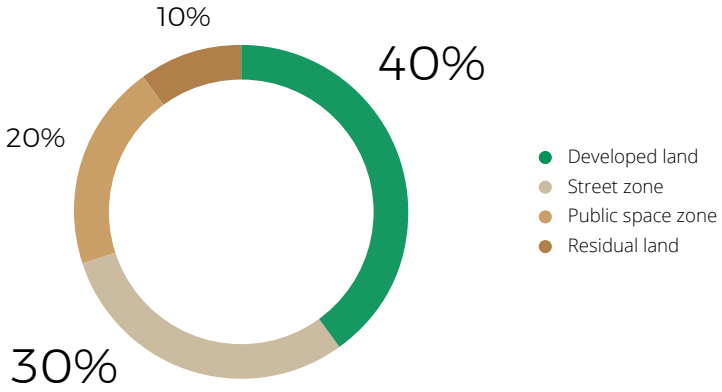
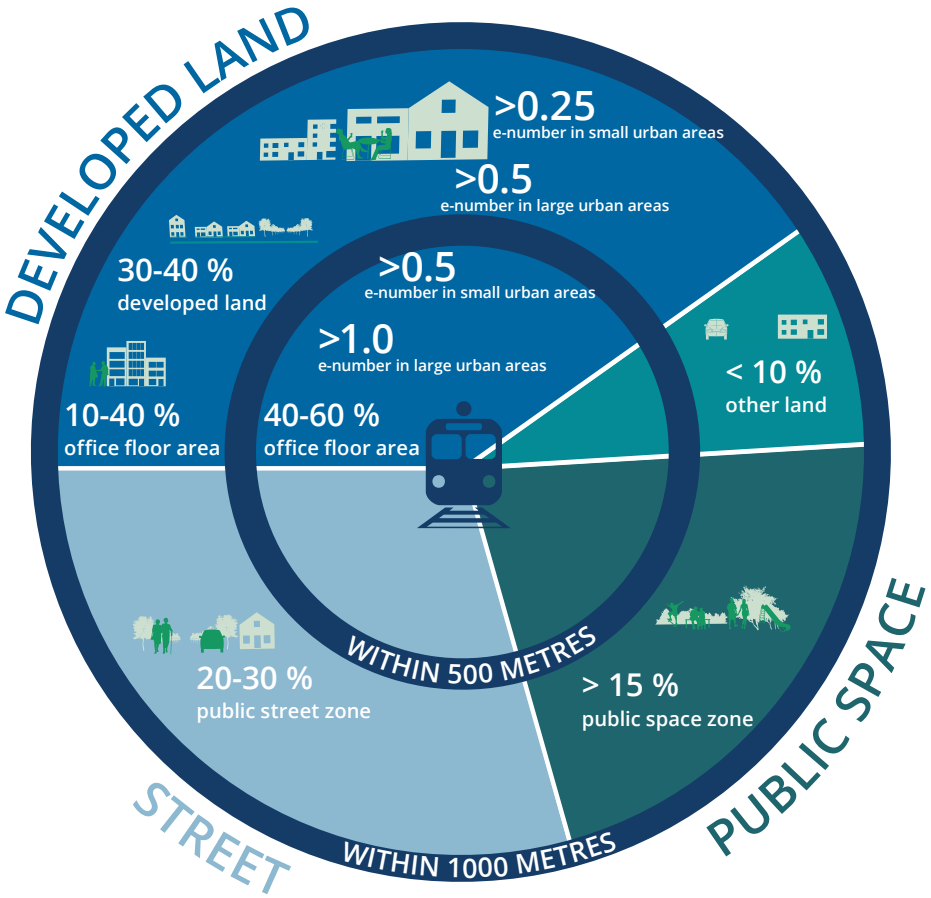



**Figure 23:** Land-use recommendations; e-number is the floor space on the plot divided by the surface area of the plot. 1.0 e-number is equal to one floor covering the total surface area (Nordström, Swartz, and Ståhle 2017).



## CREATING LIVEABILITY-ORIENTED AREA DEVELOPMENT (LOAD)

Development is all about creating an attractive and liveable space for generations to come. This can be done by starting the planning process from other perspectives than just transport. A social-environmental holistic approach is needed instead. It was concluded in the project that a new methodology named Liveability-Oriented Area Development (LOAD) should be introduced.

LOAD is proposed to use what is commonly considered a sustainable development perspective, combining the three dimensions: economic, environmental, and social development.

LOAD is defined by an area developed with dense housing, mixed use, and liveability targets that create attractiveness.

LOAD uses a methodology that is based on UN Habitat's guidelines.

LOAD recommends considering these guidelines as an inspirational tool for development and using the set principles outlined as goals.

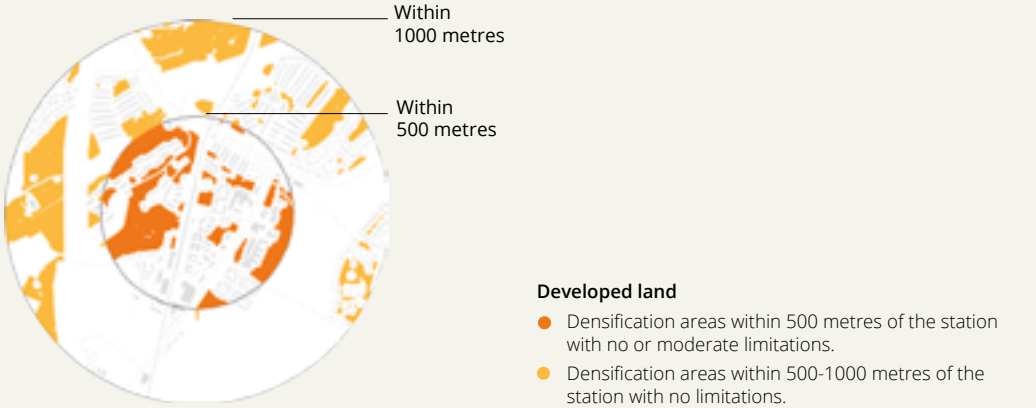
LOAD proposes a flexible attitude for how to reach these goals at the local level, adapting recommendations to unique circumstances but with the overall goals in mind.

The LOAD concept, from the perspective of efficient land use and the land-use mix in station areas, is recommended to be applied both for pre-existing station areas when complementing urban structures and for new station areas when planning land use. According to LOAD with a low-carbon development aspect, the building stock in station areas should consist of energy-efficient multifunctional buildings with businesses integrated with housing. Housing should also be mixed; that is, station areas should provide different types of housing supply for people's different needs. It is also important to increase affordable housing near stations. Increasing the amount of housing stock and residents improves the ability of services to enter the region and increase their profitability. All this requires close joint planning of land use, housing, and mobility.

By applying the given principles and recommendations for sustainable development to a case study of Ytterby in Sweden's Gothenburg region, a theoretical potential of more than twice the present number of inhabitants and jobs within a 1 km radius from a station could be attained.

In the densification scenario, areas within 500 m of the station are developed with no or moderate limitations. Only areas with no limitations are developed outside 500 m. With these conditions, the densification scenario shows major densification potential within 500 m of the station in Ytterby. Twenty-five per cent of the area (200,000 m²) has no or moderate limitations. Within 500 to 1,000 m of the station, there is above all a densification potential in the western and northern parts. However, agricultural land in the southeast has only moderate limitations. Based on the detailed overview plan, new production of residences ought to be minimized beyond the 1,000 m line from Ytterby station until the areas within have been developed (Figure 24).

**Figure 24:** Densification scenario for Ytterby (Nordström, Swartz, and Ståhle 2017).



**Low-carbon and liveable station areas reduce emissions.**

In the Helsinki region, a concept for low-carbon station areas has been developed for assisting planners to meet climate targets. The concept will help cities develop low-carbon areas both in existing urban structure as well as in planning new station areas. In the concept, there are four perspectives on low-carbon station areas – land use, housing and living, mobility, and businesses and services – and there are four cross-cutting themes: climate change mitigation, resilience, a circular economy, and social sustainability and health. In addition, technology integration and leadership are recognized as essential parts of transformation. Nearly seventy different criteria will help planners and city developers transform low-carbon areas step by step (Figures 25 and 26).

**Figure 25:** The low-carbon district toolkit for station areas includes planning criteria in four themes and four crosscutting perspectives.

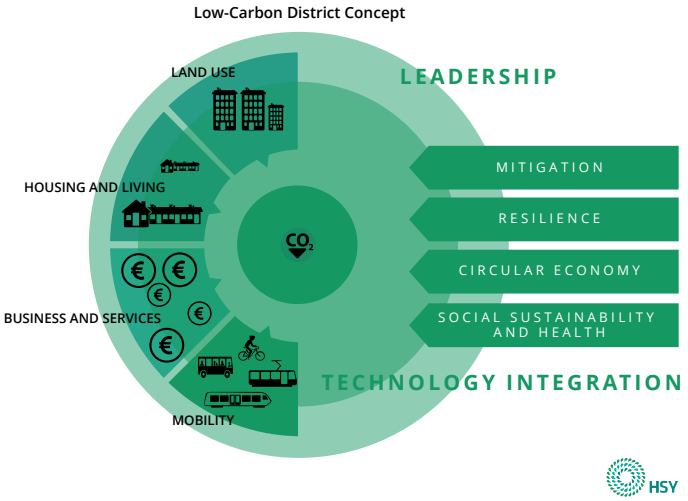
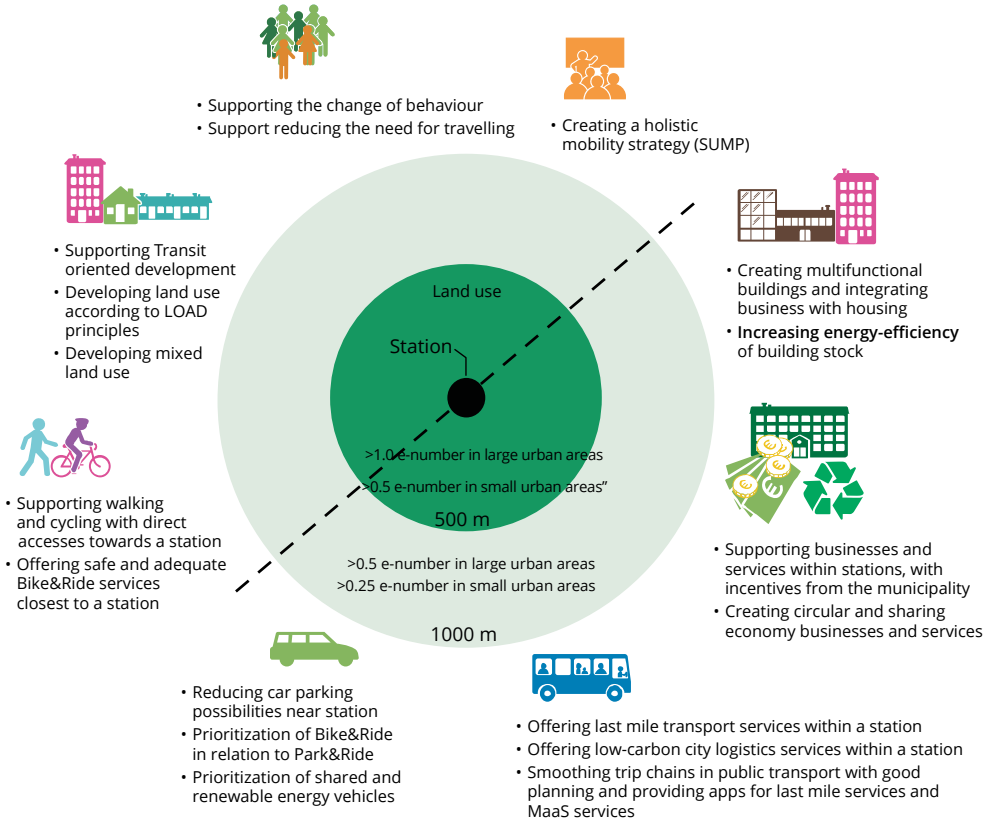



**Figure 26:** Low-carbon district toolkit for developing climate-friendly station areas.



From a business operational viewpoint, stations have much untapped potential as a marketplace. Improving and strengthening services at station areas will increase the added value of trip chains, will make rail transportation more attractive, and will also reduce the need for travel (Figure 27). Enhancing the service palette of the stations makes people's everyday lives easier and encourages movement toward low-carbon mobility. Last-mile transport services, low-carbon city logistics services, and MaaS services within a station also reduce emissions. A vibrant station area also makes a sharing economy possible. Sharing and circular economies and new models of ownership can be seen as a means to reduce consumption.

**Figure 27:** Good transport connections are key for developing station areas. The case of Tikkurila, Finland.


**Low-carbon development of and around transport nodes yields long-term results.**

The public sector is considered to have a key role in encouraging and facilitating companies to locate themselves close to stations and introduce new types of low-carbon business operations. New business operation models may result from new types of public-private partnerships. The public sector is also seen in encouraging and facilitating the public's initiatives. Social sustainability is an important theme in developing liveability-oriented station areas.

If the active development of station-based services is further enhanced, the added value of the trip chains can be strengthened and people can be encouraged to use public transport. Developing station areas as small hubs for city logistics can be part of modern e-commerce and its logistics can be handled in a centralized way to reduce number of trips.

The development of public space and safety are considered key measures for improving station areas. Upgrading public space in particular is the most focused measure to be taken to increase station areas' usability, also from the perspective of safety.

Locating services centrally on ground floors at the station and nearby will also increase social activities and enhance safety. As a minor measure, increasing smart and energy-efficient lighting and enhancing underpasses and overpasses will also increase the feeling of safety.

Gregor Steklačič

# 7 GENERATING **SHORT-TERM WINS**

**Short-term wins help convince the public and politicians.**

To support the shift to sustainable and resilient transportation in metropolitan regions, it is important to implement measures that have both short- and long-term wins. The short-term wins should be communicated in order to mobilize stakeholders and the general public around the same targets. Short-term wins in regional mobility planning are essential to allow broad commitment to the principles of sustainable mobility and to get the relevant people on board.

## 7.1 REGIONAL MOBILITY PLANNING

**In the short term, regional mobility planning can contribute to better public acceptance.**

Like every planning processes, regional mobility planning also takes time to show its results, particularly when infrastructure investments and massive transformations are expected. It can also support some soft measures, whereby focusing on promotion and implementation of small steps can provide some tangible and short-term results that meet the demand for sustainable mobility of people and goods.

Regional mobility planning must go hand in hand with visioning and goal setting, both of which should include public engagement and thus contribute to greater public awareness. Awareness-raising helps in better understanding and accepting long-term projects.

**Optimization of current infrastructure by harmonizing and integrating timetables can provide tangible short-term wins.**

Regional mobility planning can also define some short-term and quickly realizable goals, such as development of smart ICT solutions, which require relatively small investments compared to infrastructure developments. Optimization of the current transport system, improvement of planning solutions, harmonizing timetables, and connecting different transport modes can also provide tangible short-term wins (Figure 28).

**Figure 28:** Some measures do not require large investments but can considerably improve the mobility: the case of Kavalir, a free public transport option in the pedestrian area in Ljubljana.


**Mobility managers can effectively support regional mobility by defining problems and possible solutions.**

For addressing soft measures in mobility, mobility managers can be important. They closely work with public offices, private companies, schools, and universities to meet the needs of employees and to propose solutions to the problems of mobility in daily journeys. Mobility managers can also participate in creating mobility plans, providing relevant information for the territory they cover.

In general, the objective of reducing the environmental impact from traffic in metropolitan regions is also pursued through the following actions:

- Establishing a network of regional mobility managers that also promote and disseminate the principles of sustainable mobility through specific training activities in companies or schools;

- Promoting cost-effective and sustainable solutions in areas with low population density and low frequency of public transportation, such as car sharing and carpooling;
- Providing grants and incentives for sustainable mobility projects;
- Improving public transport services through the interconnection of innovative and complementary services such as bicycle and electric vehicle rental services;
- Intensifying communication through diversified communication systems: real-time information on board and at stops, on websites, on social networks such as Facebook and Twitter, on smartphone apps, on screens and loudspeakers in stations, at stops, and in cars;
- Organizing awareness campaigns, road education, and conferences on sustainable mobility;
- Creating home-school and home-work paths for bicycles and walking, and promoting collective pedestrian mobility.

**MOBILITY MANAGERS ENHANCING EFFICIENT MOBILITY IN ROME, ITALY**

In 1998, Italian law envisaged the role of mobility managers. Their task is to analyse mobility needs of employees in public bodies and large companies and to identify effective solutions.

Considering that a large share of people's daily movements take place on the paths from home to work and from home to school (Figure 29), it is easy to imagine the strategic importance that mobility managers can have in planning and managing local mobility. They collect and analyse massive data on types of vehicles, times, and itineraries of daily travel, and thus provide insight into the needs of travellers. In this way, concrete solutions can be identified, sometimes very simple ones, to facilitate the systematic movement of the home-to-destination pole, be it a place of study, work, or other places with a strong attraction of mobility demand.

The function of a mobility manager is therefore a valuable element of dialogue with the territory and an important and unique node of the information network in the mobility system.

The network of mobility managers has slowly expanded, and today it includes more than two hundred mobility managers appointed in Rome companies that represent a system of over 230,000 employees moving daily in the metropolitan area. Sixteen school places have been appointed for scholar mobility managers, for a current total of 18,583 students.

The coordination of this network aims to increase the supply of alternative and sustainable mobility solutions, including projects and experimental initiatives for reducing travel, tariff reductions for employees and students, activation of company or inter-company shuttles, electric mobility, bike-to-work projects, and so on.

**Figure 29:** Mobility managers can decrease car dependency in Rome by providing attractive alternatives.

Tupungato, Shutterstock

**Optimization of current infrastructure supported by smart ICT solutions can have some short-term effects.**

## 7.2 LOW-CARBON LOGISTICS PLANNING

In the short-term perspective, a shift to low- and zero-emission vehicles in logistics must be supported. Rapid development of battery technologies will make such vehicles more competitive in the future, but in the short run various incentives and supporting measures could be applied. An increased uptake of these vehicles can be achieved through prioritizing zero-emission vehicles in loading/unloading and parking, restrictions on fossil-fuel vehicles, and improved charging infrastructure. These measures have the overall benefits of reduced emissions in metropolitan regions. For industry, these supporting measures are beneficial when developing new technologies due to reducing the uncertainties of changed operations (e.g., by subsidizing zero-emission vehicles as long as their price is higher than prices for fossil-fuel-driven vehicles).

A second benefit of low-carbon logistics planning is improved use of existing infrastructure. Rather than constantly building new infrastructure, it is important to adapt existing infrastructure to changing needs of end users and improve the utilization of what is already available. For example, reduced accessibility for cars in city centres (e.g., by removing parking places) can impact accessibility for goods and service deliveries (Figure 30). Thus, it increases the alternatives for loading and unloading. Innovative tools, ICT platforms, or booking systems can be used in managing loading areas in the metropolitan regions, which also improves utilization of the existing infrastructure. Having certain standards or requirements to existing freight delivery areas is also a way of improving infrastructure and making freight deliveries in metropolitan regions more efficient. Another possibility is to differentiate the usage of space depending on time while jointly considering the needs of both passenger and freight transport.

**Figure 30:** Delivery in the city centre of Ljubljana is limited to morning hours.

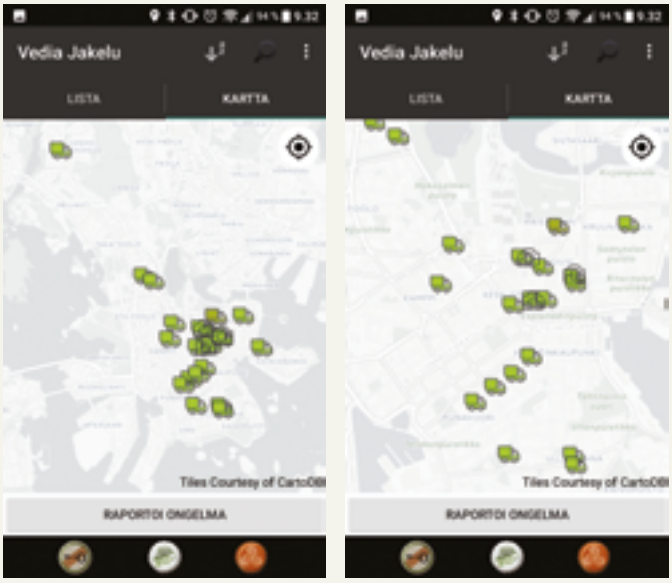

Klemen Gostič

## PILOT PROJECT FOR FREE LOADING-UNLOADING PLACES FOR CITY LOGISTICS

In the city centre of Helsinki, 40% of light lorry drivers report that they have difficulty finding a place for loading and unloading. This causes an increase in costs and emissions, as well as problems with air quality. In 21% of the cases, drivers say that they have to park on the sidewalk, which creates obstacles and insecurity for pedestrians. From a business perspective, these parking issues are also often a significant ineffective factor in operation.

Although there is much experience in optimizing the logistics industry, accurate scheduling in urban conditions is not practicable. The City of Helsinki, Forum Virium Helsinki, and ten logistics companies have developed an app together that they are now piloting for locating free loading-unloading places for city logistics (Figure 31). The aim is to find ways to enhance distribution. In this pilot project, drivers can scan twenty-two loading-unloading places in city centre and see whether they are vacant. These places are equipped with cameras, and status information can be shared in real time. For reporting, the program registers every stop lasting more than three minutes, and drivers are able to report causes for stopping. In this way, the pilot project also provides statistical data on distribution and traffic problems and generates a timeline specifically showing when deliveries take place during a day or month. A short time-reservation system is part of the developing pilot project.

**Figure 31:** Free loading-unloading places for city logistics in Helsinki have brought important improvement despite low costs; screenshot from the application (Forum Virium Helsinki ... 2017).




The pilot project started in August 2016 and is still ongoing. In order to estimate the effects of different seasons, particularly the snowy winter, the pilot project must run for a full year.

The pilot project was produced mainly on a voluntary basis. The total budget, including the cameras for twenty-two loading-unloading places, was small. Installation services were provided by the city. ICT programming and developing were also carried out voluntarily by Vediafi and Tieto.

Companies consider the new cooperation in developing distribution logistics together with the city to be very important. The pilot project has improved the flow and efficiency in logistics and deliveries. Costs have been lowered by savings in fuel, emissions have decreased, and air quality and road safety have been improved. One of the goals is to keep the city centre lively and services close for residents while also building an attractive city for businesses. The pilot project will provide new information for the city planning regarding the need for parking space and its utilization at different times.

In summary, short-term actions in low-carbon logistics planning can include measures that reduce local emissions and improve accessibility for commercial vehicles through better use of infrastructure.

**Low-budget ICT solutions can considerably improve passenger satisfaction.**

## 7.3 TRANSPORT MANAGEMENT AND SHARING SOLUTIONS

In public transport, as the backbone of the transport system, improvements to the passenger information and ticketing system or other ICT solutions can also ensure short-term wins. Passengers require real-time information about the lines, routes, and transfers, while special attention should be given to less-frequent users of the system as well (e.g., tourists). Fast and reliable information about the traffic situation is essential, especially in the case of any unexpected events or disruptions. Passengers appreciate easy ways of getting tickets; for example, directly via mobile applications.

**Bike-sharing platforms have proved successful in many cities.**

Reducing greenhouse gas emissions in transport is essential for protecting the environment. Electric buses will be the long-term solution, but in the short and medium terms low-emission diesel buses (euro 6), hybrid, and CNG buses can be a temporary solution.

Enhancing cycling in the city can also contribute to space saving and lower $CO_2$ emissions. Introducing a bike-sharing scheme (Figure 32) can improve the situation in the short term, making bike transport accessible for non-bike-owners or tourists. Bike sharing can be fully integrated into the public transport system; the first step in the integration should be the ticketing system and the journey planner. Bicycle routes and infrastructure also need to be developed in order to facilitate cycling and to make it safer.

**Figure 32:** Bike-sharing systems have been developed in many European cities.


Dávid Nyitrai

**We should plan for people, not cars.**

A congestion charge or tax and effective parking policies can be effective tools for regulating car use in the inner city. By using public space for people rather than for cars, inner-city areas will increase their attractiveness. In line with European development directives, the need to create a liveable urban environment requires traffic calming and mitigation of car traffic in the inner zones, and the ratio of public transport must be increased. One of the possible means to reach this goal (which has worked well all over the world) is to promote combined transport modes and to connect private and public transport effectively; for example, creating park-and-ride sites on the outskirts of the city (Figure 33). The essence of the park-and-ride system is to combine the comfort and flexibility of car use with the economical and space-saving operations of track-bound vehicles.

**Figure 33:** The Barje park-and-ride site on the outskirts of Ljubljana provides sufficient service with frequent buses, bike sharing, and 347 parking places (seventeen of them for disabled people).


## SUPERBLOCKS IN BARCELONA

The Superblocks project in Barcelona is one of the largest urban transformations ever planned. It is conceived as units of urban organization. The inner streets of the superblocks that were full of cars in the past have become spaces where the right of passage of vehicles is no longer the main function, but they become a space to stay and socialize, for games, leisure, and so on.

The objective of the superblock concept is to free certain routes from passing traffic in order to humanize them and regain them for peoples' activities. The superblock model gives priority to pedestrians, followed by bicycles and public transport (Figure 34).

In this sense, the implantation of the superblocks in Barcelona enhances liveability and changes the current way of managing, understanding, moving, and living the public space of the city, also by using an open model of public participation.

**Figure 34:** Superblock image.

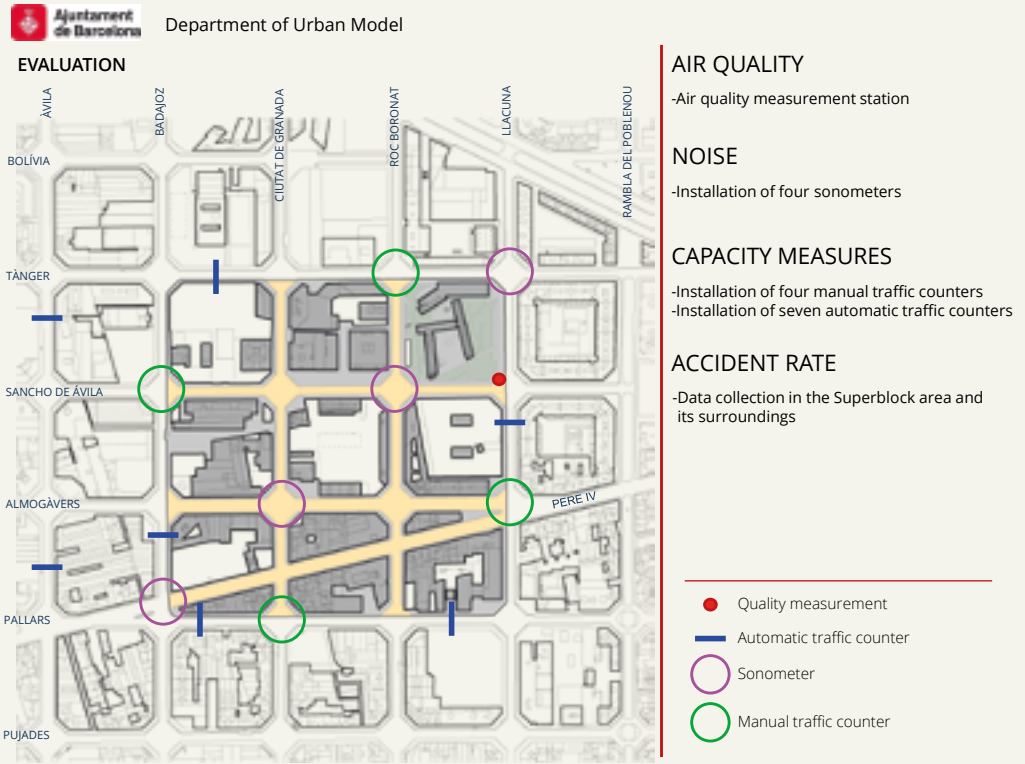
The first pilot project was developed in the district of Sant Martí (2016–2017). Basic mobility measures were applied, with temporary and fast execution, to visualize the new uses that could be achieved. This was followed by a process of assessment and proposals from residents to promote working together.

The final mobility scheme was implemented with actions in public space to adapt the model to the territory, its residents, and their activities (Figure 35).

The benefits of implementing the superblock model in Barcelona are:

- Improving the habitability of public space;
- Progress toward more sustainable mobility;
- Increasing and improving urban green spaces and biodiversity; and
- Promoting the participation and shared responsibility of the general public.

**Figure 35:** The superblock model in Barcelona. Evaluation phase in the first Barcelona's Superblock project (Barcelona City Council 2016).




In the long run, the superblock in Sant Martí aims to go from:

- 8.7% of current traffic calming zones (10 km/h) to 58%;
- 46.1% of pedestrian space to 65.8%;
- 95% of the population with a cycling network less than 300 m from home to 100%;
- 174.7 ha of green spaces to 380.8 ha;
- 53% of the population with admissible air quality to 71%; and
- 55% of the population with admissible noise levels to 72%.

Greater flexibility can also be provided by the sharing economy with new and innovative business models that directly compete with more traditional ones. They use technological platforms and mobilize start-ups to collect, analyse, and share transport big data. Thus they can supplement existing public transport modes, whereas their regulation is one of the priorities that metropolitan regions must solve.

Without proper regulation, these models can cause disruption to the current transport system. Therefore, the crucial stakeholders should sit together and agree on a common vision and strategy that, among other mobility targets, will link the new forms of mobility to the existing transport system.

The new sharing-economy business models in the transport sector should be complementary to public transport. It is important to have an intermodal ticketing system that allows the integration of different providers, regardless of whether they are for-profit or aimed at the public interest. This would allow people to make optimal choices for their mobility.

**SOPOTNIKI (CO-TRAVELLERS): THE FREE TRANSPORT SERVICE PROVIDING JUST AND EQUITABLE MOBILITY IN SLOVENIA**

Sopotniki (2019) is an organization for intergenerational solidarity that was established to help the elderly become involved in an active social life and ensure that their mobility needs are taken care of. The free transport service enables the elderly to run errands that would otherwise be out of reach independently and in a carefree manner. The drivers are volunteers of various ages and occupations that have adapted their work and study obligations in such a way that they can provide the service six days a week, from morning until the last passenger arrives home safely. This service has developed in the Slovenian municipalities of Hrpelje-Kozina, Divača, Sežana, Sevnica, Brežice, Krško, Kočevje, Postojna, Pivka, Ajdovščina and Ankaran-Ancarano (Figure 36).

The organization aims to prevent the isolation and loneliness of elderly people from small remote villages, who almost never leave their homes due to remoteness, lack of transport means, or poor traffic connections. The service is considered an innovative approach toward the mobility of the rural elderly that will soon expand to other parts of Slovenia.

Currently it is financed from three sources: municipalities, donations from supporters and satisfied users, and corporate donations. The success and acceptance of the practice is allowing expansion to other municipalities, especially to the most remote areas.

**Figure 36:** The free transport service Sopotniki.


**Integration of public transport modes makes their use more attractive.**

The intermodal ticket system should have considerable benefits for people that choose more sustainable modes of transport; namely, public transport. For this reason, it is important to rethink the simplification of ticketing systems (e.g., a flat price) and, if necessary, a reduction of public transport prices.

### ANDA: THE NEW TICKETING SYSTEM FOR THE PORTO METROPOLITAN AREA, PORTUGAL

ANDA is a mobile ticketing system for the Porto Metropolitan Area, using ex-post billing that optimizes the cost of using public transport.

The main objective of the ANDA project is to simplify the experience of using public transport in the Porto Metropolitan Area, particularly for those that do not use public transport today because they do not want to overcome the "knowhow" barrier.

In fact, the intermodal ticketing system for public transport in the Porto Metropolitan Area is considered complex by a significant part of the population, in particular due to a complex zoning system (forty-seven zones) and a complex intermodal tariff.

With ANDA, passengers can simply install the ANDA APP on a mobile phone to be able to use public transport (Figure 37). They will receive the bill afterward based on the trips they make each month (post-billing), applying the tariff combination that is most favourable for the passenger (a spot price).

In that way, passengers do not need to have any prior knowledge about the rules (tariffs, zones, or values) of the intermodal system.

Another important strategic objective of the project is that ANDA can be used in the near future as a "Mobility as a Service (MaaS)".

**Figure 37:** Promotion of ANDA (Andante 2019).


The ANDA APP is a solution that truly simplifies mobility:

- A single invoice is issued at the end of the month, benefiting from adjusted fares according to real use;
- Passengers do not need to have any knowledge of the tariff system;
- There is a possibility to join additional services, such as car sharing, bike sharing, park-and-ride, taxis, and so on; and
- There is a possibility to reward users for their mobility choices.

**Sharing business models intensify the use of ICT in metropolitan mobility.**

Finally, to face this new reality, stronger cooperation between different policy levels is important to enhance sustainable urban mobility.

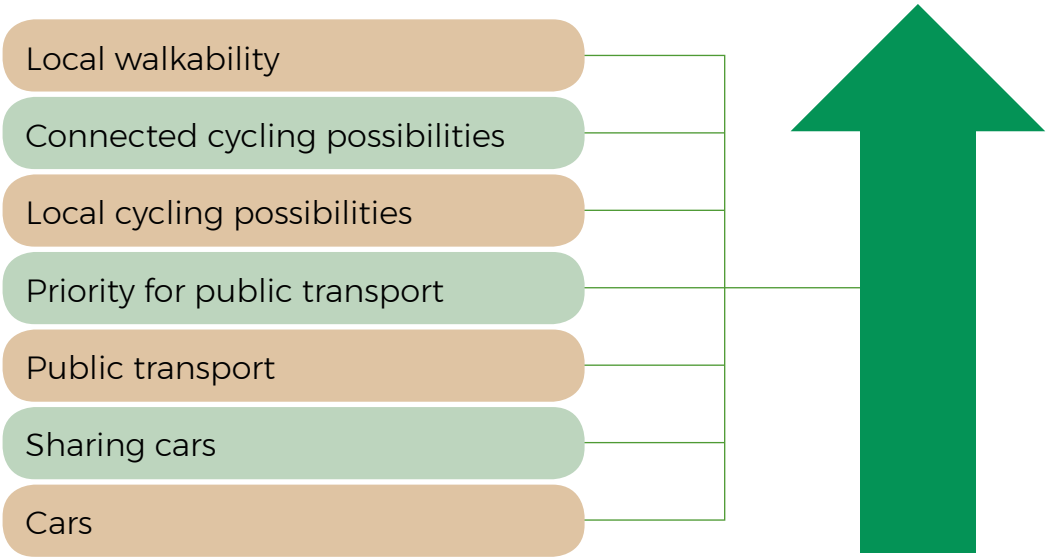
**In station areas priority is given to walking, cycling, and public transport.**

In conclusion, the sharing economy offers an opportunity for better multi-mobility. It allows the transport industry to tap into new opportunities created by digitalization and new technologies. It also makes it possible to move in a smarter and more sustainable way.

## 7.4 DEVELOPMENT OF AND AROUND TRANSPORT NODES

In the short term, one main focus in low-carbon station areas is to develop walking and cycling opportunities, public transport, and smooth trip chains to support the shift in people's behaviour toward a low-carbon everyday lifestyle. The priority order in planning urban space around stations and in station areas should be walking, cycling, public transport, logistics, car-sharing services, and finally limited space for parking cars (Figure 38).

**Figure 38:** The priority order of transport modes in low-carbon areas.




**Station areas contribute to low-carbon trip chains.**

Direct, uninterrupted, and unimpeded walking and cycling connections to station areas with good, safe, and weatherproof bicycle parking and maintenance facilities are a starting point for low-carbon trip chains. By prioritizing bike-and-ride in planning, an attractive mobility alternative will be offered. Promoting the use of electric bikes as city bikes and with better charging infrastructure would also expand the functional area of a station. Cars are not a priority in parking, and park-and-ride areas should be planned further away from the station, especially if implemented close to city centres. This land area is more important to use as a liveable urban space or for housing. These measures can make possible low-carbon trip chains in a reasonably short-term perspective, thereby reducing emissions from the transport sector.

**THE DEVELOPMENT OF THE TIKKURILA STATION AREA, VANTAA, HELSINKI REGION, FINLAND**

The Helsinki region is growing rapidly and urban sprawl has been strong. To ensure sustainable development, both regional and local plans steer new developments in the vicinity of existing urban structure and toward the station area.

Tikkurila is the administrative centre of the city of Vantaa and is located on the main railway line from Helsinki to other parts of Finland. Tikkurila was developed in the 1960s and 1970s and was loosely planned and built; it is dominated by car parks and low-storey housing.

The city started the development project in 2007 and created a plan framework for identifying possibilities to infill the station area (Figure 39). The city implemented dismantling renovation and increased the gross floor area by 125,000 m² in seven years. At the same time, the new Ring rail line into the airport was constructed via Tikkurila. The rail company, the Finnish Transportation Agency, and the city concluded a joint contract for planning and construction of a new station hub. It contained a new covered terminal for rail lines, a large shopping centre with office buildings, and a multi-storey car park for offices and park-and-ride. In addition to the transportation hub, the building project also included business premises to infill the economical expectations of the private investors. The site between the railroad and the street was extremely narrow, and construction was not allowed to cause any trouble for rail traffic. This is why cooperation with all involved parties was a key issue during the entire process.

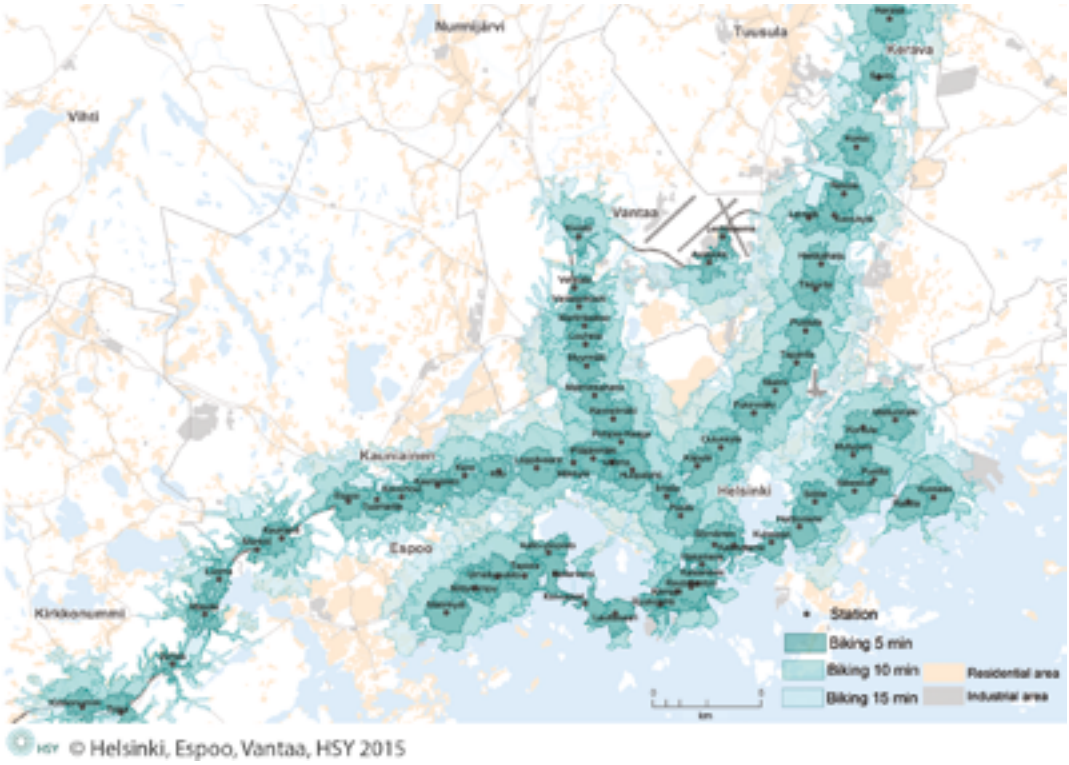
Now Tikkurila is one of the most desirable areas in Vantaa and it offers good connectivity with excellent services and modern housing for new residents. The different sides of the main railroad are better connected, and the quality of the new public spaces is much higher than before.

The city of Vantaa has managed to develop a more sustainable and densely built station area with a combination of good planning

**Figure 39:** The Tikkurila station area.


and a participation process, attracting investors into projects and making joint contracts for funding, and to involve major actors such as the Finnish Transport Agency and rail company. The development process has increased the volume of new residents near railroads, making possible low-carbon mobility instead of car-dependent urban sprawl. The different sides of the main railroad are now better connected, and the quality of new public spaces is much higher than before.

**Figure 40:** Spatial analysis of five-, ten-, and fifteen-minute journeys to a station by bicycle in the Helsinki region.

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# 8 INTEGRATING MEASURES TO BUILD BETTER LIVEABILITY IN METROPOLITAN REGIONS

**Integrated mobility planning should include all public and private sectors as well as the general public.**

The need for change in metropolitan regions is driven by urban population growth and by the impacts of global warming, air-quality issues, and shifting business structures. This requires an approach to create sustainable mobility that meets the needs of a larger population, including businesses and freight distribution in these areas. To summarize, mobility in many metropolitan regions is car-dependent and logistics is often excluded from mobility thinking. To change this, the regional and local authorities need an overall picture of mobility and freight transport patterns in the area. Using information and communication technologies (ICT) to collect data on end users' travel behaviour can provide this information and offer users an improved travel experience. Car-oriented mobility needs to be substituted by a more sustainable provision of mobility by providing sharing options or improved public transport – for example, through integrated ticketing. In addition, car-dependent regions can be developed into rail-based and transit-oriented urban areas (Figure 41).

**Figure 41:** Sustainable growth in metropolitan regions is only possible by giving priority to public transport.


**Collaboration of all the actors at all the levels must be intensified.**

The lack of metropolitan collaboration (at the institutional, administrational, planning, and operational levels) has been identified as a barrier in tackling suburban car traffic and the development of suburban public transport services. The focus on inter-municipal and regional collaboration is essential to solve these issues. Different responsibilities in local and regional authorities on transport planning and land-use planning require extended collaboration between the levels of government. A joint metropolitan development agenda is an area where urgent actions are needed to further develop the mobility system of the metropolitan regions.

Finally, a sectorial approach to infrastructure development separating modes and means of

**Planning should optimize both land use and mobility.**

transport is no longer appropriate. Investments must be aligned with transport strategies connecting both transport and spatial planning, which might decrease the need for mobility and provide more sustainable development (Figure 42).

Overall, the changes that need to be produced are 1) a better approach to mobility and knowledge of mobility patterns, 2) using ICT for better public transport experiences, 3) reduction in car-dependent mobility, 4) improved metropolitan cooperation, and 5) more integrative and less sectorial thinking.

**Figure 42:** Smart Kalasatama is an urban redevelopment project in Helsinki in which the core will be a modern railway station. Its population will rise from 3,000 to 25,000 and it will also offer jobs for 10,000 people. The vision of Smart Kalasatama is to save one hour of people's time every day by using smart services.


Within these overall changes, the metropolitan regions seek to achieve some more specific actions that combined could contribute to greater liveability in metropolitan regions. Some of them are presented in Table 2.

**Table 2:** Set of activities that could lead to greater liveability in metropolitan regions.

| Field of intervention | Activity | Short-term effects/wins | Long-term effects/wins | Indicators for measuring progress on the activity |
|---|---|---|---|---|
| **Participatory transport planning** | Public consultation | - New local knowledge and possible tailor-made solutions from stakeholders<br>- Awareness raising<br>- Mutual learning | - Higher public acceptance<br>- Better quality of plans/ strategies | - Number of consultation rounds<br>- People attending the consultations<br>- General acceptance of the plan |
| **Creating a mobility plan** | Promotion and implementation of interventions to organize and manage the demand for mobility of people and goods | - Broad commitment to the principles of sustainable mobility<br>- Involvement of relevant people | - Lower environmental impact deriving from traffic | - Number of travellers on public transport<br>- Number of private goods transport operators involved |
| | Regulation of access in some zones (and/or parking) | - Fewer cars<br>- Lower pollution/ emissions<br>- Less noise from traffic congestion | - Shift to public transport<br>- Lower environmental impact from mobility | - Number of travellers on public transport<br>- Shortening the time of trips<br>- Measurable lower levels of pollutants in the air |
| | Support for intermodal nodes and infrastructure planning for both passengers and freight | - Multimodal approach to travel<br>- Optimization of the use of means of transport (more passengers on each means of transport)<br>- Less traffic<br>- Less pollution | - Improvement of mobility<br>- Improvement of resilience of the transport system (through multimodality)<br>- Lower environmental impact from mobility<br>- Better traffic flows | - Number of travellers on public transport<br>- Number of private goods transport operators' trips, last mile<br>- Time of trips<br>- Levels of pollutants in the air |
| | Informatization of mobility, provision of real-time data on public transport and traffic; integrated ticketing systems on mobile and personal devices | - Optimization and simplification of multimodal travel | - Shift to public transport<br>- Improvement of resilience of the transport system (giving best solutions in real time for travelling)<br>- Lower environmental impact from mobility | - Number of travellers on public transport<br>- Number of users of apps showing real-time data and giving tickets<br>- Time of trips<br>- Levels of pollutants in the air |
| | Promote diffusion of and experimentation with collective services such as car sharing, carpooling, bike sharing, etc. | - Optimization and simplification of travel in modal shifts<br>- Fewer cars<br>- Less congestion | - Improvement of mobility<br>- Lower environmental impact from mobility | - Number of sharing/ pooling service users<br>- Levels of pollutants in the air |
| | Increase in the size of areas and uninterrupted paths for bicycles and pedestrians | - More soft mobility<br>- Fewer cars<br>- Less noise from traffic congestion<br>- Better and healthier quality of life | - Improvement of mobility<br>- Shift to soft mobility<br>- Lower environmental impact from mobility | - Length of cycle lanes<br>- Pedestrian areas<br>- Levels of pollutants in the air |

| Field of intervention | Activity | Short-term effects/wins | Long-term effects/wins | Indicators for measuring progress on the activity |
|---|---|---|---|---|
| **Low-carbon logistics** | Planning low-carbon logistics<br>– Multilevel governance<br>– Involvement of stakeholders | - Shift to low- and zero-emission vehicles<br>- Better use of existing infrastructure<br>- Improved terminal structure<br>- Shared data on freight | - Reduction in carbon emissions<br>- Better air quality<br>- Better acceptance and understanding among all stakeholder groups | - Share of low-carbon freight vehicles<br>- Level of $NO_x$ and PM<br>- Dialog between stakeholders and public authorities |
| | Low-carbon last-mile pilot projects:<br>– Establish consolidation centres for last-mile freight<br>– Transition to e-vehicles in last-mile freight<br>– Transition to bikes in last-mile freight<br>– Extended use of ICT tools<br>– Reduce kerbside parking for private vehicles | - Reduction in freight transport by vans<br>- Better use of existing infrastructure<br>- Modal split in favour of cargo bikes and e-vehicles<br>- Improved efficiency in loading/unloading<br>- Reduction in "search traffic"<br>- Improved accessibility for deliveries | - Reduction in carbon emissions<br>- Better air quality<br>- Better use of existing infrastructure | - Share of low-carbon freight vehicles<br>- Level of carbon emissions<br>- Level of noise pollution<br>- Amount of "search traffic"<br>- Level of $NO_x$ and PM |
| | Establish charging infrastructure adapted for freight vehicles (vans) | - Transition to e-vehicles in last-mile freight | - Reduction in carbon emissions | - Share of low-carbon freight vehicles<br>- Level of $NO_x$ emissions<br>- Level of noise pollution |
| | Establish low-/zero-emission zones | - Modal split in favour of cargo bikes and e-vehicles | - Reduction in carbon emissions<br>- Better air quality | - Share of low-carbon freight vehicles<br>- Level of $NO_x$ emissions |
| **Managing transportation** | Improving mobility solutions | - Better mobility options<br>- Accessible, reliable, and comfortable public transport | - Lower greenhouse gas emissions<br>- More public space for people | - Modal split<br>- Number of public transport trips made |
| | Park-and-ride solutions | - Increased parking capacity in station areas<br>- Fewer cars entering the inner-city area | - Decreased congestion in the city centre<br>- Healthier environment | - Number of park-and-ride sites<br>- Number of park-and-ride spaces<br>- Smaller number of vehicles in the inner-city area |
| | Introduction of alternative fuelled buses | - Cleaner diesel engines with reduced emissions<br>- Hybrid technology for less fuel consumption | - Zero-emission buses for lower GHG emissions<br>- Healthier environment | - Level of $CO_2$ emission from public transport<br>- Number of low-/zero-emission buses |

| Field of intervention | Activity | Short-term effects/wins | Long-term effects/wins | Indicators for measuring progress on the activity |
|---|---|---|---|---|
| **Sharing economy** | Promotion of the sharing economy | - New and innovative business models | - More mobility solutions | - Number of new business models |
| | Regulating the sharing economy | - Fair competition<br>- Integration of new business providers with public transport (mobility as a service)<br>- Allowing and encouraging sustainable new solutions and models | - Sustainable mobility<br>- Wellbeing of people | - Existence of regulation at the local/ metropolitan level |
| | Integrating sharing mobility solutions with public transport | - Enables travellers to gain access to public transport on an as-needed basis<br>- Last-mile solutions | - Public transport sustainability | - Modal split (% reduction on private car) |
| **Transit-oriented development** | Definition of "Liveability-Oriented Area Development" (LOAD) methodology | - Integration of spatial and transport planning<br>- Co-creation of the neighbourhood | - Higher regional accessibility<br>- Reduction of car use<br>- Reduction of congestion and pollution | - Existence of LOAD methodology |
| **Shaping low-carbon areas** | Promoting use of the low-carbon district concept | - Lower emissions from the transport sector<br>- Liveability of station areas<br>- New businesses | - Sustainable urban structure<br>- Contributes to achieve regional low-carbon targets<br>- Promoting low-carbon modes of transport | - Level of $CO_2$ emissions<br>- Modal split |
| | Supporting new services in stations | - Added value to trip chains<br>- Improved social safety | - Vital and attractive stations | - Service level |

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# 9 POLICY RECOMMENDATIONS

## 9.1 POLICY RECOMMENDATIONS AT THE EU AND THE INTERREG EUROPE PROGRAMME LEVEL

### Support participatory planning at all levels and in all fields

Participatory planning should become an integral part of planning in all fields and at all territorial levels. This includes coordination among administrative levels (local, regional, and national authorities), sectors, non-governmental organizations, and the general public. The European Commission should enhance participation in its decision-making processes. At the same time, inclusion of relevant stakeholders must be required in new regulations from all fields.

### Support exchange of experiences and consolidate collaboration networks within European programmes

European Union programmes should support exchange of experiences to allow cities and metropolitan regions to learn from each other. Consolidating collaboration networks, such as SMART-MR, can allow better transferability of knowledge by sharing examples of good and bad practice. By evaluating different systems and developing new methods and tools, it is possible to achieve faster changes in fields such as participatory planning, urban logistics, or sharing economy.

### Support research, development, and innovation (RDI) in metropolitan mobility and logistics

Transportation systems and logistics in metropolitan regions require vast investments and considerable progress to become carbon neutral. To support this process, research programmes on carbon neutral mobility and logistics must be enhanced, making possible development of zero-emission vehicles, use of big data, and the development of business models supporting efficient mobility and logistics. Academia, research institutions, and other relevant actors should be included in the process.

### Develop a common European framework for a sharing economy

A common regulation framework for a sharing economy should be established at the European level in accordance with top-down logic and include a definition of a sharing economy and a demarcation of the roles regarding market access and activity, among others. This common framework is important for activating similar regulations at the national level, particularly in mobility, where the sharing economy should supplement public transport and not compete with it in an unregulated manner.

### Promote integrated spatial and mobility planning to generate polycentricity

The implementation of the Liveability-Oriented Area Development (LOAD) concept should be promoted in order to create polycentricity. A sustainable approach requires overcoming the distinction between spatial and mobility planning. They need to be considered together with economic, social, and environmental planning. In order to do so, the public transport network, especially rail-based transit corridors, should be strengthened and station areas prioritized as development targets in transforming new and existing urban structure into low-carbon / carbon-neutral areas. Hence, a polycentric urban model integrated by various nodes of dense housing and well served by mass public transport would help reduce car dependency. It is necessary to recognize metropolitan regions as having viable solutions for sustainability, to support polycentricity at all levels, and to support station areas as nodes for everyday services and platforms for climate-smart services.

## 9.2 POLICY RECOMMENDATIONS AT THE NATIONAL LEVEL

### Enhance multilevel governance

Solving complex and nationally relevant issues such as climate change, air pollution, and mobility requires the engagement of all administrative levels, sectors, non-governmental organizations, and the general public. The limited competences of a single authority should raise interest in cooperating and coordinating activities with others instead of slowing down the change process. Cooperation should start as early as possible in the planning

process and should become part of the planning culture. National authorities should provide a forum for cooperation between the players involved: various levels of competences, roles, financial capabilities, and so on. In order to improve metropolitan mobility management, integration is required regarding information, territories, and sectors, especially in land use, housing, and transportation.

**Adopt evidence-based decision-making supported by participatory processes**

Participatory processes should be supported by solid data, studies, or pilot projects. Developing strategies and plans must be supported by a combination of both solid data and participation because none of them alone could provide optimal results: data are sometimes difficult to interpret and should be contextualized through the planning process; on the other hand, participatory processes could depend too much on stakeholders' capacity to influence decision-making, and so results from participatory processes should be thoroughly examined. A combination of both can optimize decisions by complementing information with valuable stakeholders' experiences and by influencing stakeholders' positions with relevant information. The authorities should understand the need and collaborate with local and regional entities.

**Provide space for logistics distribution centres in central urban areas**

Terminals are large investments for a society, and it is therefore recommended that the national authorities take responsibility in ensuring the provision of terminal structures in line with future logistics developments. National recommendations or guidelines can require that regional or local authorities change the structure of terminals so that transhipment points are closer to city centres and that space for logistics activities is secured in regional and local plans. Securing inner-city space for logistics activities should be anchored at the national level in order to allow the transfer to clean vehicles. Even though this recommendation is carried out at the regional and local levels, the national authority has the responsibility to place this issue on the political agenda.

**Public transportation should become the core of urban mobility**

A solution for air pollution and climate change caused by car traffic could be to make public transport attractive, efficient, and affordable by encouraging the use of trams, buses, and the underground. Settlement and the public transport network should go hand in hand, and major investment should be made in infrastructure to make public transport more appealing. Transportation should be integrated in terms of joint ticketing and timetables. Public transport should become competitive with cars.

**Apply road pricing policies**

A taxation system for car usage should be established, aimed at reducing congestion and all other negative externalities from traffic. Road pricing policies can be applied at the national level to tax traffic on highways and roads. In order to prevent cars from accessing central urban areas, congestion charging schemes can be implemented so that more polluting vehicles pay higher fees for driving in the inner city.

**Develop regulation and tax systems for sharing-economy services**

Because there is no single tax system in Europe, each country will be able to develop tax systems for the various sharing-economy services. A regulation framework and a taxation system should be established to ensure sustainable mobility and the priority of public transport, while at the same time allowing the emergence of new business models complementing public transport.

**Co-create land-use and infrastructure development plans**

New housing and development areas need to be planned and coordinated with connections to public transport to avoid car dependency. It is important that the public transport service already be provided when the residents move in. To accomplish this co-creating, land-use planning and infrastructure investments are a key factor. The participating stakeholders will need to agree on timelines, project size, and financing, and on setting common sustainable mobility goals. The stakeholders will be bound by the agreed amount of housing being built and infrastructure being in place on time.

**Prioritize station areas in the development of low-carbon mobility and sustainable urban living**

Station areas should be developed as nodes of climate-smart housing and mobility by applying an integrated planning approach that includes land use, housing, and transport planning. Rail transport should be prioritized as the basis for urban development, and the

service level of low-carbon public transport should be secured. Developing station areas as resilient communities could be fostered by dense housing, by increasing energy efficiency in housing, and by promoting sustainable travel modes.

## 9.3 POLICY RECOMMENDATIONS AT THE REGIONAL AND LOCAL LEVELS

### Adapt participation processes to each specific regional or local context

Planning processes at the local and regional levels depend greatly on the local or regional context: the government structure, natural and social features of the area, the legal framework, stakeholders' engagement, and so on. For this reason, the participation process must always address local specifics by raising the right questions, involving relevant stakeholders, and following local and regional traditions and habits. The participatory process should have clear rules agreed upon from the beginning. A combination of participatory inputs and data should be used for decision-making.

### Develop personalized communication campaigns for different stakeholders

Public authorities need to develop communication campaigns focused on different stakeholder groups, emphasizing the benefits that each of them will experience from the actions to be implemented. Sometimes effective solutions to certain problems require unpopular measures that might not be positively accepted by the public. In order to avoid this, focus can be placed on communicating the objective and not the measure itself, so that the acceptance rate will be higher, with people being aware of a greater cause. The participatory process realized should also be communicated.

### Ensure sufficient competence on logistics transport among local and regional authorities

Increasing municipalities' knowledge and information about the impact of logistics in cities and business is crucial for low-carbon logistics planning. Ensuring that authorities have knowledge about the impact of each policy or measure before implementation is also recommended. Urban logistics should be given increased priority in public administration. Recruiting staff with logistics competence and having such skills in-house makes the authorities able to work collaboratively with logistics firms without relying exclusively on industry experiences to guide their decisions.

### Develop local and regional logistics plans and strategies

Logistics planning should be part of low-carbon urban mobility and land-use plans because space is an important factor. This will crystallize in developing sustainable urban logistics plans. A combination of regional and municipal planning is key in providing comprehensive logistic plans. By developing pilot projects, transparency and knowledge of new logistics solutions will be transferred.

### Regulate sharing-economy services as part of the public transport system

Local legislation should provide a regulation framework for the management of sharing-economy services as part of public transport. If sharing-economy services remain a private model, competition between operators (e.g., periodic calls for licenses), defining drop-up zones, and the obligation for sustainability (e.g., fleets of zero-emissions vehicles only) need to be ensured, and mobility information should be shared with the public authorities.

### Redesign public open space in favour of pedestrians, cyclists, and public transport

In metropolitan regions, an integrated design process according to sustainable mobility principles (e.g., TOD principles) guarantees transport development toward sustainability-oriented objectives. Traditionally, public open space has been adapted to cars. Therefore, a revision of public space is required, giving priority to public transport and soft transport modes such as walking and cycling. In general, by applying a substantial reduction in road capacity for motorized traffic in favour of green space, lower pollution levels and greater liveability standards of public space are achieved.

### Use station areas as pilot platforms for new solutions that can contribute to low-carbon daily life, smoothing trip chains and making possible circular and sharing-economy solutions

Prosperity of station areas can be strengthened by supporting the allocation of services at a station or close to it. Therefore, co-creation of services between private and public actors is recommended to add value to trip chains and attractiveness of low-carbon rail-based

transportation. It is also recommended to identify the challenges of station areas as business environments and to map the customer needs in the region. Furthermore, a culture of experimentation should be supported in order to identify customer needs and regional challenges, and to create new solutions with an emphasis on using open data, big data, and digitalization. Station areas should be revitalized and developed especially as circular and sharing-economy platforms and city logistics hubs. Services could be up-scaled and transferred to other areas in metropolitan regions.

**Implement the Liveability-Oriented Area Development (LOAD) concept in local master plans**

The Liveability-Oriented Area Development (LOAD) concept is recommended for implementation in local master plans. Developing areas near railway stations with dense housing, mixed use, and liveability features creates attractiveness. An increase in population, embracing both residents and workers, gives businesses a basis to develop services in the area. Dense housing development makes possible non-car-based mobility. In addition, other transport modes within the community can be used, such as walking, cycling, and mobility sharing. Adding to attractiveness, regional accessibility will be within a short distance. Therefore, it is important to define the land-use potential of station areas and to set priorities for it.

**Develop an accessible regional network of LOAD communities**

Developing a fast, frequent, and reliable public transport network, integrated by different transport modes, will make sustainable mobility possible. A regional network of public transport that connects LOAD communities will be the basis of an effective mobility structure. Residents will be able to choose where to live, work, and recreate according to their personal preferences without jeopardizing solutions addressing climate change mitigation.

**Prioritize station areas as starting points for low-carbon area development**

Land-use and transport planning need to be integrated in metropolitan regions and urban infill should be located near railway stations. A regional low-carbon-roadmap based on regional challenges should be worked out in order to build cooperation between stakeholders and prioritize the implementation of the measures listed. Station areas should be the starting point for actions and pilot projects regarding low-carbon-area development. This development should be based on the concept of the low-carbon district concept, which embraces climate-change mitigation, resilience, a circular economy, social sustainability, health, and technology integration. Recommended actions should include the improvement of liveability, walkability, and the public transport environment, as well as smoothing trip chains. By improving the quality of public open spaces, safety and liveability of station areas will also be improved. Land areas for circular and sharing-economy solutions should be revised in land-use planning.

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# 10 MAKING THE SHIFT TOWARD BETTER LIVEABILITY IN METROPOLITAN REGIONS

**Climate change challenges call for immediate action.**

**Visions and strategies must lead to more liveable and sustainable metropolitan regions.**

The global warming challenges call for urgent actions. All stakeholders need to be identified and invited to participate in these urgent actions to mitigate climate change challenges (Figure 43). Stakeholders have different perspectives and their role must be clearly defined and recognized in each process/action taken. A co-creating process must be established that benefits from stakeholders' contribution and creates a common understanding on the need for a jointly adopted common vision and strategy. In metropolitan regions it is necessary for the vision to be sustainable and for innovations to create liveability, also by supporting residents' mobility needs. The vision needs to be shared by stakeholders and jointly expressed.
To empower urgent actions that mitigate climate-change challenges, stakeholders that are professionally responsible for planning and decisionmakers should include the metropolitan vision and strategies in their work regardless of subject. For example, when creating any new project, reduction of greenhouse gas emissions and climate change challenges should be part of this and addressed accordingly, and positive gains should be communicated.

**Figure 43:** The change to a low-carbon future requires strong leadership.

**A win-win future exists for greater liveability and for the planet.**

By communicating the impact of global warming, including and empowering stakeholders to take actions mitigating the challenges, it is possible to create a greater, but possibly different, liveability in metropolitan regions. An awareness must be enhanced that a win-win future exists for the climate, the planet, and its inhabitants.

**Alternative solutions are here; willingness to apply them is what is lacking.**

By sharing the best practices, inspiring local examples, innovations, and stories, one can motivate stakeholders at all levels to focus on actions and positive results. The changes toward low-carbon metropolitan mobility and urban space as well as services should be communicated using clear visual information. The aim is to share knowledge, raise awareness of local solutions, and encourage people to try new low-carbon solutions. By doing this, attitudes can be changed, and that will change the culture of mobility.

As observed, there is a common understanding of what needs to be done to create a long-term sustainable and liveable society. The main concern is the lack of willingness to make the necessary sacrifices at the global, national, and individual levels. There is a call for strong leadership that will lead people forward.

**GRETA THUNBERG SPEECH AT COP24, KATOWICE, POLAND, DECEMBER 2018**

"*You say you love your children above all else, and yet you are stealing their future in front of their very eyes. You only talk about moving forward with the same bad ideas that got us into this mess – even when the only sensible thing to do is to pull the emergency brake. You are not mature enough to tell us it like it is. Even that burden you leave to us children. Our civilization is being sacrificed for the opportunity of a very small number of people to continue making enormous amounts of money. Our biosphere is being sacrificed so that rich people in countries like mine can live in luxury. It is the suffering of the many that pays for the luxury of the few. In the year 2078 I will be celebrating my seventy-fifth birthday. If I have children, maybe they will spend that day with me. Maybe they will ask me about you. Maybe they will ask why you didn't do anything while there still was time to act. Until you start focusing on what needs to be done, rather than what is politically possible, there is no hope. We cannot solve a crisis without treating it as a crisis. We need to keep the fossil fuels in the ground and we need to focus on equity. And if the solutions within the system are so impossible to find, then maybe we should change the system itself. We have not come here to beg the world leaders to care. You have ignored us in the past, and you will ignore us again. We have run out of excuses, and we are running out of time. We have come here to let you know that change is coming, whether you like it or not. The real power belongs to the people*."

(Thunberg 2018, transcript).

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# 11 SOURCES


Action Plan on Urban Mobility. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Brussels, 2009. Internet: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52009DC0490&from=EN (4. 1. 2019).

Andante 2019: Anda app. Internet: https://www.linhandante.com/index.asp (29. 1. 2019).

Barcelona City Council 2016: Omplim de vida els carrers. Internet: http://ajuntament.barcelona.cat/superilles/sites/default/files/20160928_Superilles_ari.pdf (29. 1. 2019).

BKK 2015: Balázs Mór Plan. Budapest Mobility Plan 2014-2030. Internet: http://www.sump-challenges.eu/sites/www.sump-challenges.eu/files/bmt2016_eng_v3.pdf (31. 1. 2019).

Air Quality in Europe — 2018 Report. EEA Report 12/2018. Internet: https://www.eea.europa.eu//publications/air-quality-in-europe-2018 (16. 12. 2018).

CH4LLENGE Participation Manual: Actively Engaging Citizens and Stakeholders in the Development of Sustainable Urban Mobility Plans, 2016. Internet: http://www.sump-challenges.eu/kits (17. 10. 2018).

CIVITAS 2019: City VITAlity and Sustainability. Internet: https://civitas.eu/about (4. 1. 2019).

CIVITAS Vanguard. Reaching the Citizen: Toolkit on Effective Communications and Marketing, CiViTAS Initiative, 2011. Internet: http://www.civitas.eu/content/reaching-citizen-toolkit-effective-communications-and-marketing-0?_ga=2.268289678.1684804293.1539935224-1521954661.1539779035 (18. 10. 2018).

Draft Outcome Document of the United Nations Conference on Housing and Sustainable Urban Development (Habitat III), 2016. Internet: http://habitat3.org/wp-content/uploads/Draft-Outcome-Document-of-Habitat-III-E.pdf (16. 1. 2019).

Eltis 2014: Guidelines. Developing and Implementing a Sustainable Urban Mobility Plan. European Commission. Brussels 2014. Internet: http://www.eltis.org/sites/default/files/guidelines-developing-and-implementing-a-sump_final_web_jan2014b.pdf (10. 1. 2019).

European Commission 2016: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A European Strategy for Low-Emission Mobility. Internet: https://eur-lex.europa.eu/resource.html?uri=cellar:e44d3c21-531e-11e6-89bd-01aa75ed71a1.0002.02/DOC_1&format=PDF (16. 1. 2019).

Eurostat 2018: Sustainable Development in the European Union. Monitoring Report on Progress Towards the SDGs in an EU Context. Luxemburg. Internet: https://ec.europa.eu/eurostat/documents/3217494/9237449/KS-01-18-656-EN-N.pdf/2b2a096b-3bd6-4939-8ef3-11cfc14b9329 (18. 1. 2019).

Forum Virium Helsinki, Vediafi, and Tieto 2017: App for Parking Spaces for City Logistics. Internet: https://forumvirium.fi/jakeluliikennetta-tehostetaan-uudella-kokeilulla/ (29. 1. 2019).

GIZ-SUTP 2012: Sustainable Urban Transport: Avoid-Shift-Improve (A-S-I). Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH, Eschborn. Internet: https://sutp.org/files/contents/documents/resources/E_Fact-Sheets-and-Policy-Briefs/SUTP_GIZ_FS_Avoid-Shift-Improve_EN.pdf (18. 1. 2019).

Granberg, M. 2019: Helsinki Region Planning. Helsinki Region Transport. Helsinki. Previously unpublished.

Greenhouse Gas Emissions from Transport. European Environmental Agency, Copenhagen, 2018. Internet: https://www.eea.europa.eu/data-and-maps/indicators/transport-emissions-of-greenhouse-gases/transport-emissions-of-greenhouse-gases-11 (10. 1. 2019).

IPCC 2019: Special Report: Global Warming of 1,5 °C. Internet: https://www.ipcc.ch/sr15/ (5. 1. 2019).

Kotter, J. 1996: Leading Change. Harvard Business School Press. Boston.

Lehmann, S. 2015: Transit-oriented development. Previously unpublished.

McKinsey 2017: An Integrated Perspective on the Future of Mobility, Part 2: Transforming Urban Delivery. McKinsey Centre for Business and Environment. Internet: https://www.mckinsey.com/~/media/mckinsey/business%20functions/sustainability%20and%20resource%20productivity/our%20insights/urban%20commercial%20transport%20and%20the%20future%20of%20mobility/an-integrated-perspective-on-the-future-of-mobility.ashx (20. 1. 2019).

Ministry of Infrastructure, 2012: Trajnostna mobilnost za uspešno prihodnost: Smernice za pripravo celostne prometne strategije. Ljubljana, 2012.
Internet: http://www.trajnostnamobilnost.si/Portals/0/publikacije/TM_Brosura_FINAL_Civitas.pdf (28. 3. 2018).

NASA 2019: Global Land-Ocean Temperature Index in 0.01 Degrees Celsius. Internet: https://data.giss.nasa.gov/gistemp/tabledata_v3/GLB.Ts+dSST.txt (10. 1. 2019).

Nordström, T., Swartz, S., Ståhle, A. 2017: Sustainable Density in Station Communities. Stockholm. Internet: https://goteborgsregionen.se/download/18.4925f05315e64856972c7088/1510570417702/Sustainable%20density%20in%20station%20communities.pdf (28. 2. 2019).

Ritchie, H., Roser, M. 2018a: "$CO_2$ and other Greenhouse Gas Emissions". Published online at OurWorldInData.org. Internet: https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions (10. 1. 2019).

Ritchie, H., Roser, M. 2018b: "Technology Adoption". Published online at OurWorldInData.org. Internet: https://ourworldindata.org/technology-adoption (10. 1. 2019).

Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system. White paper. European Commission. Brussels, 2011. Internet: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0144&from=EN (4. 1. 2019).

RURBANCE 2015: For a Balanced Development of Relations between Rural and Urban Areas. Milano. Internet: http://alpine-space.org/2007-2013/fileadmin/media/Running_Projects/Rurbance/RURBANCE_Final_project_booklet_Short_edition_eng.pdf (10. 1. 2019).

Shedding Light on Energy in the EU. A Guided Tour of Energy Statistics, 2018 edition. Eurostat, Luxembourg, 2018. Internet: https://ec.europa.eu/eurostat/cache/infographs/energy/images/pdf/pdf-energy-eurostat-2018.pdf (10. 1. 2019).

Sopotniki, 2019. Internet: https://www.sopotniki.org/ (1. 2. 2019).

Sustainable Development Goals, 2016. Internet: https://www.un.org/sustainabledevelopment/sustainable-development-goals/ (16. 1. 2019).

The Göteborg Region Association of Local Authorities 2008: Structural Illustration for the Göteborg Region. Internet: https://goteborgsregionen.se/download/18.276a42981270147ed3580006332/1359469265417/Structural%20Illustration%20for%20the%20Göteborg%20Region.pdf (29. 1. 2019).

The Paris Agreement 2018: Internet: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement (16. 1. 2019).

Thunberg, G. 2018: Speech at COP24, Katowice, Poland, December 2018. Transcript. Internet: https://www.youtube.com/watch?v=VbDnPj0G0wY (1. 2. 2019).

TØI 2019: NORSULP. Internet: http://norsulp.no/logistikkplaner-i-by-norsulp/ (30. 1. 2019).

UN Habitat 2015: International Guidelines on Urban and Territorial Planning. Nairobi. Internet: https://unhabitat.org/books/international-guidelines-on-urban-and-territorial-planning/ (1. 2. 2019).

Urban Agenda for the EU, Pact of Amsterdam, 2016. Internet: https://ec.europa.eu/regional_policy/sources/policy/themes/urban-development/agenda/pact-of-amsterdam.pdf (16. 1. 2019).

# THE SMART-MR PARTNERSHIP

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Project partners at the meeting in Oslo.
**Marc Iglesias Perez**

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