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ENVIRONMENT AND ENERGY

# SUSTAINABLE URBAN MOBILITY TOOLKIT



This Toolkit has been prepared within the framework of the project entitled “Support to Sustainable Transport in the City of Belgrade”, financed by the Global Environmental Facility (GEF) and implemented by the United Nations Development Programme (UNDP) in partnership with the Ministry of Agriculture and Environmental Protection and the City of Belgrade, through its Land Development Agency and Secretariat for Transport.

Project team: Miroslav Tadic, Aleksandar Jovanovic and Snezana Ostojic-Paunovic

The overall objective of the project is to reduce the metropolitan emissions in the City of Belgrade by improving the public transport scheme, reinforce the participation of cyclists in the traffic and provide the policy framework for sustainable urban transport development of the city of Belgrade.

The author of the toolkit is Elena Gavrilova.

The views expressed in this publication are those of the author(s) and do not necessarily represent those of the United Nations, including UNDP, or UN Member States.

# Table of contents

Executive Summary.....	4
1. Introduction.....	5
1.1. What Is Sustainable Urban Mobility Planning.....	5
1.2. Objectives and Key Outcomes of the Sustainable Urban Mobility Plans.....	5
1.3. Targeted Users of This Toolkit.....	6
1.4. Relationship between the Sustainable Urban Mobility Plans and Other Existing Plans.....	7
2. Preparatory process of the development of Sustainable Urban Mobility Plans.....	8
2.1. Major Stages of the Development of the Sustainable Urban Mobility Plan.....	8
2.2. Stakeholder Consultation Process.....	8
2.3. Citizen Involvement.....	9
2.4. Definition of the Assessment Boundary.....	9
2.5. Formulation of Responsible Working Groups Consisting of Essential Stakeholders.....	10
3. Data Collection and Analysis of the Existing Urban Mobility Structure.....	11
3.1. Review of the City Profile.....	11
3.2. Definition of Transport Analysis Zones.....	11
3.3. Review of Land Use Pattern & Population Density.....	12
3.4. Review of Existing Transport System Characteristics.....	12
3.5. Data Collection Methodology and Sources.....	15
3.6. Review of Urban Community Energy Consumption.....	15
3.7. Transport Demand Analysis.....	15
3.8. CO <sub>2</sub> Emissions, Air Quality and Noise.....	16
3.9. Status Analysis and Baseline Scenario.....	17
4. Development of Sustainable Urban Mobility Plan.....	18
4.1. Identification and Prioritisation of Projects.....	18
4.1.1. Sustainable Urbanism.....	18
4.1.2. Promotion of Non-motorized Transport Modes.....	19
4.1.3. Development of High Quality Cycling and Walking Infrastructure.....	19
4.1.4. Improved Bicycle Parking Infrastructure and Possibilities for Multimodal Transport.....	20
4.1.5. Increase of Bicycle Rental Facilities.....	20
4.1.6. Bike Sharing Programs.....	21
4.1.7. Development of Smart Secondary Infrastructure, Information System and Software Tools.....	21
4.1.8. Awareness Raising Campaigns.....	22
4.1.9. Less Crime and Fear of Accidents on Walking and Bicycle Tracks.....	23
4.1.10. Education of the Population about the Benefits of Non-motorized Transport.....	23
4.1.11. Safe Routes to Schools Programs.....	24
4.1.12. Reduced Road Danger.....	24
4.1.13. Communication Platform with Citizens to Address their Mobility Needs.....	25
4.1.14. Effective and Inclusive Campaigns for the Adoption of Eco-driving Modes.....	25

4.1.15.	High Quality Public Transport .....	26
4.1.16.	Promotion of the Use of Public Transport.....	27
4.1.17.	Promotion of the Use of Electric Vehicles.....	28
4.1.18.	Development of Appropriate Infrastructure for Electromobile Charging Stations .....	28
4.1.19.	Promotion of Energy Efficient Vehicles and Low Carbon Fuels.....	28
4.1.20.	Inclusive mobility .....	29
4.1.21.	Sustainable Parking Management.....	29
4.1.22.	Urban Logistics and Freight Vehicle Policy.....	30
4.2.	Preparation of the Implementation Program.....	30
4.3.	Final Design of the SUMP, Timing and Coordination of Activities.....	31
5.	Monitoring the Implementation of the Sustainable Urban Transport and Mobility Plans.....	32
6.	Conclusion .....	33
References	.....	34

# Executive Summary

This paper has been produced within the framework of the project “Support to Sustainable Transport in the City of Belgrade”, implemented by UNDP, the Ministry of Agriculture and Environmental Protection and the City of Belgrade. The project activities focus on the implementation of technical measures to reduce the impact of environmental and climate change on the city of Belgrade from its road transport sector, to demonstrate the benefits of sustainable transport measures, and to strengthen national and local capacities for sustainable urban mobility planning and implementation.

The “Toolkit for integrating sustainable mobility measures in cities in R. Serbia” is designed to become a guidance document for development and integration of sustainable urban mobility measures and plans. The targeted users of this toolkit are the policy makers, municipal authorities, stakeholders and experts that will work on sustainable urban mobility issues. The content presented in this paper is in line with the EU policy documents and guidelines on sustainable urban mobility and transport, and is focused towards design and implementation of cost effective solutions to achieve sustainable urban mobility goals and principles.

The Toolkit underlines the most important steps towards the development of the sustainable mobility measures and plans, identifies appropriate solutions and best practices and provides precise information concerning the technical concepts of sustainable mobility.

The Sustainable Urban Mobility Planning process recommended in this Toolkit are adapted to the institutional setup, national and local circumstances in R. Serbia, and consists of the following main steps and activities:

- **Consultative process**
- **Definition of the scope, objectives and targets of the Sustainable Urban Mobility Planning**
- **Data Collection and Analysis of the Existing Urban Transport Environment**
- **Development of Business as Usual (BAU) Scenario**
- **Development of Sustainable Urban Mobility Scenarios**
- **Impact assessment and definition of sets of mobility management and infrastructure related measures**
- **Development of Sustainable Urban Mobility Measures and Plans**
- **Preparation of the Implementation Program**
- **Official attribution of responsibilities and resources**
- **Monitoring of the implementation.**

Finally, the process of development and implementation of SUMP should be understood as a continuous improvement cycle, with a long term commitment for constant progress and design of innovative strategies for sustainable urban mobility management.

# 1. Introduction

## 1.1. What Is Sustainable Urban Mobility Planning

The cities are a habitat of a number of people and each individual in the community has specific needs for mobility in order to achieve economic prosperity, social needs, personal and intellectual development, public services etc.

Most of the larger cities in the world are faced with transport-related problems, ranging from worsening congestion and a growing number of road accidents, to constant noise pollution and high levels of greenhouse gas emissions.

These factors reduce the main benefits of urban living, the improved quality of living and the availability of services in the urban community. Furthermore, the productivity lost, the damage to health and the energy and fuel waste undermine national and local economic development.

Transport alone currently accounts for 30% of overall EU energy consumption. A half of all road transport fuel is combusted in urban areas. Some 98% of the transport related energy market depends on oil, the largest part of which (75%) is due to road transport. Energy import dependency is rising and increasing demand for fossil fuels (mostly petrol, diesel and gas) contributes to more greenhouse gas emissions. By 2030, transport related energy consumption is expected to grow by 30%. In 2030, 55% of the transport related energy consumption is predicted to be due to passenger transport, and 45% due to freight transport according to the baseline scenario.

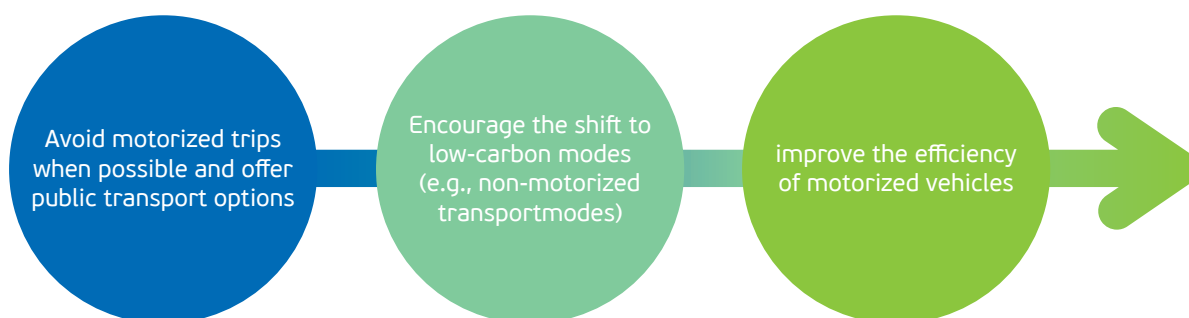
Effective transport planning requires long-term vision to plan financial requirements for infrastructure and vehicles, to design incentive schemes to promote high quality public transport, safe cycling and walking and to coordinate with land-use planning at the appropriate administrative levels. The sustainable transport planning should take account of safety and security, access to goods and services, air pollution, noise, greenhouse gas emissions and energy consumption, land use, as well as to cover passenger and freight transportation and all modes of transport.

The effective solutions for design and implementation of the Sustainable Urban Mobility Plans need to be community-specific, based on wide consultation with the public and other stakeholders, and the targets set must reflect the local situation and the forecasted transport demand in the city.

## 1.2. Objectives and Key Outcomes of the Sustainable Urban Mobility Plans

The Sustainable Urban Mobility Management has a main scope to provide and ensure accessibility and safe mobility for the entire urban population, irrespective of socio-economic background (gender and income), in a way that doesn't compromise environmental health. In other words, Sustainable Mobility should serve as a roadmap for actions and infrastructural development that will ensure the desirable level of mobility and reduce the transport sector carbon emission footprint.

The main concept of the Sustainable Mobility Measures design relies on "avoid, shift and improve methodology" which consists of the three main principles:



The Sustainable Urban Mobility Plan should address the following objectives:

- **To understand present travel characteristics and forecast travel demand for the planning horizon**
- **To prioritize mobility for all socio economic groups and gender**
- **To estimate the environmental impact of urban transport planning based on the travel demand and technological choices**
- **To integrate transport options with the land use structure and planned regional development and create alternative scenarios for achieving low carbon mobility**
- **To develop a Mobility Plan which is economically, socially, environmentally and technologically sustainable and climate resilient to achieve the goal of low carbon and inclusive transport incorporating development plans and urban master plans**
- **To suggest an implementation programme for successful execution of the selected interventions**
- **To give adequate attention to pedestrians and non-motorised transport within transport planning**

The long term objectives of Sustainable Urban Mobility are:

- **Improvement in mobility for all socio-economic groups and genders**
- **Reduction in CO<sub>2</sub> emissions with reference to the BAU scenario**
- **Improvement in air quality with reference to the BAU scenario**
- **Improvement in safety and security for pedestrians and NMT**
- **Urban noise level reduction**
- **Economic benefits and lower reliance on fossil fuels**
- **Achievement of desirable indicators and benchmarks**

The European Commission has emphasised in many of its transport-related policy documents<sup>1</sup> that strategic approaches and the integration of transport planning policies with other policy sectors like environmental protection, land use planning, housing, social aspects of accessibility and mobility as well as economic development are essential tools in the achievement of the EU strategic goals for substantive reduction of the GHG emissions and sustainable European development.

Since R. Serbia is an EU accessions country, transposition of EC legislation and policy documents is an essential evaluation exercise for the country.

In line with the national priorities and aspirations, this Toolkit provides Guidelines for integration of Sustainable Mobility Management practices based on relevant EU policy documents and strategic goals for sustainable urban mobility and transport.

### **1.3. Targeted Users of This Toolkit**

Targeted users of this toolkit include policy makers, municipal authorities, stakeholders and experts that will work on sustainable urban mobility issues.

This toolkit provides: guidance in setting Sustainable Urban Mobility Planning objectives for policy makers, the structure and the detailed process of Sustainable Transport development for city authorities, as well as detailed tasks to be performed by experts included in the preparatory and execution process.

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<sup>1</sup> EC transport related policy documents: Action Plan on Urban Mobility, the White Paper on Transport: Roadmap to a Single European Transport Area, Urban Mobility Package, and Transport 2050: Commission outlines ambitious plan to increase mobility and reduce emissions etc.

## **1.4. Relationship between the Sustainable Urban Mobility Plans and Other Existing Plans**

The most important policy and strategic planning documents of urban communities are the City Development Plans, Master Plans and Transport Development Plans.

The development of Sustainable Urban Mobility Plans should be closely correlated and in line with the goals and priorities set in the other policy papers and strategic documents of the assessed community.

Adequate consideration should be given to the common long term development goals and strategies, as well as to national development goals, priorities and transport network integration plans.

If needed, the former strategic planning document of the urban communities should be revised and upgraded in order to set priorities towards sustainable urban development and to bring to the communities long term viable economic and environmental friendly prosperity.



## 2. Preparatory process of the development of Sustainable Urban Mobility Plans

### 2.1. Major Stages of the Development of the Sustainable Urban Mobility Plan

The development of the Sustainable Urban Mobility Plan and Measures is a comprehensive task in which many different assessments, processes and activities should be synchronized and pointed to the same set of objectives and priorities.

The major stages of the development of sustainable urban mobility plans are as follows:

▼	Consultative process	▼
▼	Defining the Scope, Operational Objectives and Measurable Targets of Sustainable Urban Mobility Planning	▼
▼	Data Collection and Analysis of the Existing urban Transport Environment	▼
▼	Development of Business as Usual (BAU) Scenario	▼
▼	Development of Sustainable Urban Transport Scenarios	▼
▼	Impact assessment and definition of sets of mobility management and infrastructure related measures	▼
▼	Development of Sustainable Urban Transport Measures and Plan	▼
▼	Preparation of the Implementation Program	▼
▼	Official attribution of responsibilities and resources	▼
▼	Monitoring of the implementation	▼

### 2.2. Stakeholder Consultation Process

Stakeholder consultation is an important aspect and key success factor in the development of sustainable urban mobility concepts. The process of understanding the key tasks and responsibilities of the key stakeholders that have mandates, will and capabilities to support the development of sustainable transport plans and policies is a basic step towards the consultation and coordination process.

The stakeholders should be classified on the basis on their role in transport related activities in the urban communities:

- a) **Governmental and national institutions responsible for making decisions regarding transport, urban planning, environmental and climate change issues. The recommended stakeholders of this category in R. Serbia are: the Local Government together with its Land Development/Urban Planning Department, the Transport Department, the Environmental Department, the Ministry of Transport, the Ministry of Environment, the Ministry of Interior, and the Serbian Environmental Pollution Agency etc.**
- b) **Organizations or individuals who are not part of the government but are directly involved in the transport operations in the city. This could include taxi drivers association, the public transport companies, parking companies, local economic chambers etc.**
- c) **Organizations or individuals (government or non-government) whose activities shape and influence the transport needs and demands of the city. This will include urban development authorities, large industrial units.**

- d) **Organizations or individuals (government or non-government) whose activities are closely connected with the transport, environmental, climate change and sustainable development aspects. This group will include all national, local and international NGOs, companies and agencies that are dealing with these aspects.**
- e) **Organizations and individuals (government or non-government) who hold prominent positions are important opinion makers in the city. This will include the Press; Universities, Academic Institutes and Research bodies and other educational institutes; popular CSOs etc.**

The proper stakeholder consultation process will lead to appropriate definition of the key aspects of the Sustainable Urban Mobility Plan as follows:

- **The recommendations made have to be suited to the unique circumstances under which the city functions.**
- **Ground experience of the stakeholders within the city government will help in understanding not just the characteristics of the city but also help identify the main transport related problems and bottle necks.**
- **Understanding of the scope of work of each organization. This will help in the proper identification and delegation of activities and tasks.**
- **Development of scenarios that implicate the implementation of the Sustainable Urban Mobility Planning, in accordance with the institutional framework, policy and strategic objectives of the city.**
- **Enlargement of the cooperation between the stakeholders and creation of a sense of ownership and bond between the city government and other partners. This is highly necessary to ensure recommendations are smoothly implemented and problems and bottlenecks are minimized in the implementation stage.**
- **Involvement of high level representatives in the decision making process, and later in the monitoring of the implementation processes.**

## 2.3. Citizen Involvement

Citizen participation and stakeholder consultation are essential fundamentals to secure the quality, acceptance, effectiveness and legitimacy of the Sustainable Urban Mobility Plan and Measures. Broad public involvement should help to create a citizens ownership of the Sustainable Urban Mobility Plan and Measures. This is even more emphasized in urban communities where measures may affect life-styles and decisions need be taken on the basis of value orientations - as in the case of sustainable urban transport planning - policies and measures which have to rely on a broad consensus.

Involving diverse groups of stakeholders in developing the plan also helps in better understanding of the urban community character and stimulates innovative solutions and a competitive environment.

To ensure broad participation of citizens, the different target groups (including diversity in gender, age, health, ethnic and socio-economic background) need to be identified as a basis to choose the adequate means of communication (e.g. language and media) and to take their specific time availability into account (different for e.g. un-/employed, single parent with children, elderly).

## 2.4. Definition of the Assessment Boundary

Before the start of the technical preparation of the Sustainable Urban Mobility Plan, the assessment boundary of the plan should be clearly defined in terms of:

- **Planning area**
- **Target year or planning horizon (long, medium, short-term and immediate measures)**

The geographical planning area should be clearly defined at the beginning of the definition of the Sustainable Mobility Plan. It should cover the city/community area, future growth planning areas, as identified in the MasterPlan/Regional Plan.

In many aspects, the Master Plan assessment boundary should be used as a base for preparing the Sustainable Urban Mobility Plans. Furthermore the comprehensive SUMP must address not only the intercity transportation needs, but also the needs for interconnections with satellite towns and Economic Zones adjacent to the city.

Considering the time horizon area, if possible, it is recommended that the SUMP horizon is aligned with the Master Plan horizon. If we consider that the SUMP leads to changes or investments in transport infrastructures with long-term impacts on climate change and other issues, the SUMP long-term planning horizon should be at least 20 years from the base year. Short- and medium-term target ranges should be five and ten years, respectively. To allow for additional recommendations, since the social and economic situation in many modern cities is changing from year to year; the Sustainable Urban Mobility Plan and Measures should be regularly updated and revised in order to meet the new urban area characteristics and needs.

## **2.5. Formulation of Responsible Working Groups Consisting of Essential Stakeholders**

In order to ensure integration between all transport modes and policy sectors, as well as geographical coverage of the entire functional urban agglomeration, the process of the definition of the Sustainable Urban Mobility Plans and Measures have to be followed by close cooperation between all relevant authorities. The aim should be to create a shared ownership of SUMP by all relevant actors.

The continuing integration between SUMP and other urban planning documents is a recommended methodology for long term and effective plotting of the sustainable urban mobility principles in the overall urban community policies.

## 3. Data Collection and Analysis of the Existing Urban Mobility Structure

### 3.1. Review of the City Profile

To investigate the city profile and urban mobility structure, the present socio-economic profile and trends over a period of time have to be revised, as well as the data concerning the location, regional linkages, demography, land area and socio-economic groups. Furthermore, the observed trends have to be studied and structured in order to develop appropriate baselines and scenarios.

The general review parameters needed for definition of the city profile are as follows:

- **Location data: geographical location and climatic parameters.**
- **Land area data: total land area, growth pattern, identification of notified area**
- **Demographic data: population number, growth trend, number and size of the settlements, population age and sex etc.**
- **Socio-economic data: population by social groups, population by income, vehicle ownership by social groups etc.**
- **Environmental data: the observations and measurements concerning local air pollution, noise level, the annual environmental report etc.**

The Master Plan for the city can be taken as a starting point for the definition and preparation of the Sustainable Urban Mobility Plan. Land use structure and transport proposals indicated in the Master Plan can serve as guidance for the development of the BAU growth scenario and identification of the present and future community transport related problems, bottle necks and needs.

Furthermore, revision of community development plans, strategies and policies is needed to fully evaluate the city transport system's characteristics and needs, and consequently provide good recommendations for the constitution of a sustainable urban transport system. In this phase, proper engagement of the local authorities and local experts is imperative for successful assessment of the city profile and definition of effective mobility measures.

### 3.2. Definition of Transport Analysis Zones

The sampling methodology called block data can be obtained from the local authority or census office. In the statistical theory of the design of experiments, blocking is the arranging of experimental units in groups (blocks) that are similar to one another. This will help in getting the data required for spatial mapping of socio-economic groups using block data areas as the smallest spatial unit and make possible the creation of transport analysis zones.

Network analysis builds upon GIS maps and location referencing concepts through analysis of traffic flows, goods, and other data over a topologically-connected network. Most of cities already have defined block population assessment data, which have been used in the development of the City Master Plan and other development plans. The same data, with slight modification and updates can be used for the assessment of urban mobility patterns and development of Sustainable Urban Mobility Plans and Measures.

The adequate addressing of the needs of each community and the definition of sustainable urban mobility measures requires modelling and estimating of the impacts of various policies and strategies. The modelling of transport performance must assure that the model structure reflects the population's behavior in an accurate manner.

### **3.3. Review of Land Use Pattern & Population Density**

The definition of which methods to use and sources to collect when analyzing land use and density data sets, should consider that population and land use data have high resolution and require well developed methodology for proper assessment of the input data. It is important to identify the smallest unit of analysis (See Chapter 3.1.2), and to move the analyses from small to large scale when merging the assessment.

City Master Plans and Smart Plans are a primary data source for reviewing existing land-use patterns. Additionally the local government can provide detailed and revised spatial plans and Land Usage Plans for the territories under their jurisdiction, as well as to present the future development and investment strategies and plans which are still not officially documented in the urban community policy documents. Population density is available from the population census data. Detailed data on population are available from the census of Serbia for the year 2011.

Other important assessment aspects are the locations and the extent of commercial and industrial activities in the land use map, as well as the location of the recreational facilities in the city. In addition to residential densities, jobs densities must also be studied and analysed. For this reason the indicator number of person/jobs per unit area should be developed, as a basis for classification of the assessment zones according to the employment capabilities and potential.

### **3.4. Review of Existing Transport System Characteristics**

A comprehensive and advances assessment of the existing transport infrastructure and facilities should be conducted for each transport mode (motor vehicles, two-wheelers, walking, cycling and public transport). The review should include all types of facilities and amenities including pavement description, intersection treatments, lighting, parking space, parking cost and operation-related parameters.

For each mode, there are different requirements for ensuring easy, comfortable and safe mobility. It is thus necessary to assess the existing infrastructure quality with respect to each of the modes, the environmental and climate change impact of each transport mode, as well as sustainability potentials and principles. Furthermore, it is necessary to assess the system's quality through parameters like traffic flow, delays, frequency and waiting time.

The following table presents the detailed technical assessments that would help technical experts in the collection of data needed for assessment of the existing transport system, model development and calibration (traffic flow simulation, etc.):

<b>DATA REQUIRED</b>	<b>SUBCATEGORY</b>	<b>DESCRIPTION</b>
<b>PEDESTRIAN INFRASTRUCTURE</b>	<b>FOOTPATH QUALITY</b>	Width
		Single sided/both side
		Continuity
		Disturbances by other activity/vehicles
		Pavement condition
		Lighting
	<b>INTERSECTIONS</b>	Clear markings
		Signalized crossing
		Level/raised crossing
		Traffic calming tools like speed breakers
		Intermediate crossing sections
	<b>ACCESS</b>	Crossing distance
Barrier free access to bus stops		
<b>BICYCLE INFRASTRUCTURE</b>	<b>BICYCLE TRACKS QUALITY</b>	Barrier free access to footpaths
		Cycle lanes/tracks
		Width of cycle lanes/tracks
		Both sided/single sided
		Disturbances by other activity/vehicles
		Lighting
	<b>INTERSECTIONS</b>	Pavement condition
		Signalized intersections
		Traffic calming tools
		Traffic calming for access to properties
	<b>BICYCLE PARKING</b>	Number of parking
		Distance of the parking facilities to the public transport stops
Parking charges		
<b>REVIEW OF MOTOR VEHICLE ROAD INFRASTRUCTURE</b>	<b>ROAD INFRASTRUCTURE</b>	Number of lanes
		Average speed on different roads
		Road encroachment
		Lighting
	<b>INTERSECTIONS</b>	Type of intersection signalized/un-signalized
		Turning time from each direction
		Signal phasing
	<b>PARKING</b>	Parking regulations
		Number of parking
		Parking charges by mode

<b>PUBLIC TRANSPORT SYSTEM</b>	<b>INFRASTRUCTURE</b>	Dedicated bus lanes (if any)
		Average speed on different roads
	<b>BUS/TRAM STOPS</b>	Number of stops
		Stops inventory
		Average distance between stops
		Location of stops with respect to junction
		Passenger amenities on stops
		Number of terminals
	<b>FLEET USAGE DETAIL</b>	Number of buses/trams by type (standard, mini, low floor), fuel used and age
		Fleet utilization rate
		Vehicular kilometers
		Average kilometers per bus/tram per day
		Percentage occupancy- peak hour and average
		Total passengers per day
		Route detail
	<b>COST AND FARES</b>	Route inventory
		Average route speed
		Service reliability
		Cost and fare
Operation cost per km		
Fare structure		
Revenue per km		
Profit/loss		
<b>REVIEW OF FREIGHT TRANSPORT SYSTEM</b>	Freight vehicle movement	
	Freight vehicle parking	
<b>REVIEW OF TRAFFIC CONDITIONS ON ROADS</b>	Traffic volume count, at intersections, by modes	
	Queue length by mode	
	Delay by mode	
	Travel speed by mode	
<b>REVIEW OF TRAFFIC SAFETY</b>	Number of accidents (by transport mode, age and location)	
	Number of victims involved in traffic fatalities (by transport mode, age and location)	
<b>REVIEW OF SECURITY</b>	Reported crimes (to include sexual harassment) disaggregated by mode and location	

### 3.5. Data Collection Methodology and Sources

The data mentioned in Chapter 3.1.4. can be obtained from many different national and local institutions: the Local Government with its bodies, the Ministries competent for Transport, Interior, Environment, the Serbian Environmental Protection Agency (SEPA), the State Statistical Office, the local Statistical Offices (e.g. Statistical Office of the city of Belgrade). Furthermore many relevant data can be found in the City Master plan, City Urban Plan, the National Energy Balances, the City Transport Plan or previous published relevant reports.

Another relevant and essential source of information are surveys. Primary surveys are administered for sampled zones and strategic sampling is recommended for collection of the required data.

The city can be divided into particular zones based on land use patterns and distance from the city core area or central business district to capture variation in infrastructure and the socio-economic profile of the residents.

Sustainable Urban Mobility Planning needs to account for different cross sections of society, and the survey sampling should cover all levels of society and its transport related data. It is also important to distribute the sample geographically, since different areas have different transport infrastructure, needs and population characteristics.

In this phase it is very important to utilize and rationalize resources in order to be efficient in the data collection process. All recently published national data and local data should be taken into account, as well as to make use of the knowledge and the experiences of the stakeholders for those issues concerning data collection and data gathering. For example, the road inventory for the entire city can be developed based on the GIS platform (since every city government has its own GIS department) and data can be directly obtained from this detailed local planning document.

### 3.6. Review of Urban Community Energy Consumption

The quantification of the road transport sector's energy consumption is the most important tool for estimating GHG emissions and local air pollution emissions from transport-related activities. In order to create a complete picture and verify the estimated fuel consumption, both top-down and bottom-up approaches for estimating energy consumption are required. The top-down approach makes use of the local energy balances and relies on information provided by the local energy suppliers. From the other side, the bottom-up approach relies on a primary survey of vehicle users to assess the energy consumption of different vehicle categories, which are furthermore coordinated with the city vehicle fleet database (vehicle population) to provide an estimate for total energy use within a city.

The city vehicle database can be obtained from the vehicle registration records, through the Ministry of Interior of R. Serbia. The detailed vehicle database should consist of the following vehicle parameters: vehicle category, type, mass, age, engine capacity, Euro categorization and annual mileage per vehicle class.

### 3.7. Transport Demand Analysis

The basic purpose of transportation planning and management is to match transportation supply with travel demand, which represents 'need for transportation within the urban area'. Detailed data on current travel patterns and traffic volumes are also needed to develop travel forecasting/prediction models.

Travel demand is measured and expressed in different ways for different types of analysis. Examples of different units of measurement are:

- **Trip (between two areas)**
- **Trip end (in a given area)**
- **Traffic volume (on a road segment)**
- **Person trip and vehicle trip**
- **Passenger vehicle and freight vehicle**
- **Person-mile traveled and vehicle-mile traveled.**



The prediction of future travel demand is an essential task of the long-range transportation planning process for determining strategies for accommodating future needs. These strategies may include land use policies, pricing programs, expansion of transport services and many other measures used in creating sustainable and resource efficient urban mobility.

If transport demand analyses have been recently conducted for another transport related exercise, it is good to evaluate the usability of the data and to make use of the suitable data in the development of Sustainable Urban Mobility Planning.

If previous transport demand analyses are not available, a variety of surveys can be performed for gathering information related to existing travel demand. However, the survey method for data gathering can be expensive and time consuming, and, therefore, care must be taken to identify the essential types of information that really would be useful for specific purposes, and then the most suitable and resource efficient procedures should be selected for gathering the information. Sampling techniques are useful, and valuable results can be achieved if the samplings are done in accordance with the appropriate sampling procedures.

### **3.8. CO<sub>2</sub> Emissions, Air Quality and Noise**

The concept of Sustainable Urban Mobility Planning needs to utilise the four strategic levers: urban form, non-motorised transport (NMT), public transport and technology. The framework should investigate the impacts of alternative strategies using key indicators for mobility, safety, and the local environment, as well as more aggregate indicators like CO<sub>2</sub> and energy use.

The development of local GHG inventories is lately a commonly used practice to track the environmental and climate change impact of urban communities and to evaluate the integration of sustainable development measures.

If the local GHG inventory is not available, it is good practice to match the GIS -based transport planning model with the local energy consumption of the road transport sector, which can furthermore serve as a basis to analyse the impact of the transport related activities, energy use and CO<sub>2</sub> emissions on the local environment.

Other important indicators such as data related to ambient air quality are helpful for understanding the impacts of the transport sector on local air pollution. Pollution measurement equipment for monitoring urban air quality is already installed in most cities in R. Serbia, and the emissions data are available from the annual air quality reports and from the relevant authorities.

Concerning noise pollution, motorised transport is the largest cause of community noise in most cities. Noise levels are increased both by higher traffic volumes and higher traffic speeds, with the level of human exposure also determined by other factors such as the proximity of the source of noise. Urban transport noise levels usually exceed the guidelines for health protection set by the World Health Organization. Moreover, urban transport noise levels contribute to annoyance and sleep disturbance which affect health. Latest assessments suggest that around 20% of the EU's population suffer from noise levels that scientists and health experts consider to be unacceptable.

The noise levels in the majority of cities in R. Serbia are not continuously monitored, but transport related noise is a very familiar factor of disturbance for the overall urban population in densely populated areas in the country.

### **3.9. Status Analysis and Baseline Scenario**

Before the final identification of the Sustainable Urban Mobility Measures, a comprehensive review of the current situation must be carried out, identifying the most result oriented and suitable solutions to provide sustainable mobility management practices and measures.

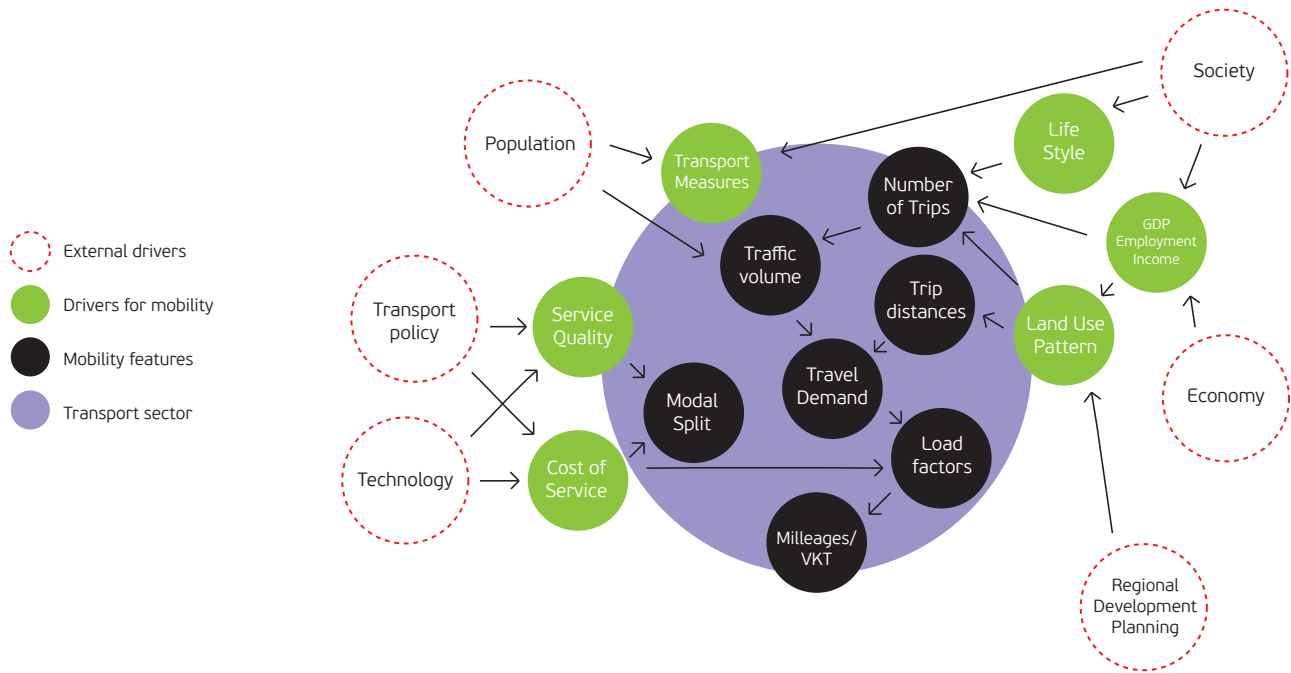
As a basis for SUMP, a comprehensive review of the current situation has to be carried out, to identify the resources and characteristics of the urban community and act in accordance with sustainable urban mobility principles. This review shall include:

- **Suitable indicators that describe the status of the urban mobility in the assessment boundary;**
- **Ensure that all necessary data is also made available by the agencies concerned;**
- **Evaluate previous plans (urban transport and other) regarding their impacts and effectiveness ;**

- **Develop a baseline scenario from which progress can be measured;**
- **Develop a Sustainable Urban Mobility scenario as a general quantitative background to the plan.**

As can be seen in the diagram below, urban mobility patterns are influenced by many external drivers, drivers for mobility, mobility features and transport sector characteristics. When developing a baseline and sustainable urban mobility scenario, these factors should be well correlated and evaluated in order to develop a standalone and valuable basis for the development of urban mobility measures and management practices.

## Key Factors that Influence Urban Mobility



Source: Andrea Ricci ISIS

A baseline scenario reflects the continuation of present trends in transportation, moderated by likely changes in legislation and technology, or certain previous measures which are under implementation and are considered to be effective in the baseline scenario.

The Sustainable Urban Mobility Scenario should reflect only the sustainable mobility measures prescribed in the SUMP which is considered to be implemented within the time frame of the scenario.

## 4. Development of Sustainable Urban Mobility Plan

### 4.1. Identification and Prioritisation of Projects

Most of the cities of R. Serbia, as with the majority of European cities, are gradually developed and built in a manner that adjacent population areas are added to the city when the city is faced with a lack of urban living areas.

Rather than applying a “one size fits all” approach, the mix of measures for a particular urban community will vary because of different land use planning and different problems. Available evidence and experience show that there is a need in most cases for a set of consistent push and pull measures from the ten following categories:

Sustainable Urbanism	Promoting and improving collective transport	Encouraging cycling and walking
Urban freight management	Parking management	Urban road pricing
Traffic calming and reallocation of road space to most environmentally friendly vehicles and modes of transport	Restricting access for the most polluting road vehicles (low emission zones)	Fostering the use of cleaner, quieter and lower CO2 road vehicles
	Soft and smart measures (car-sharing, school travel plans, mobility management centres, awareness raising campaigns)	

The mix of prioritized measures for each urban community should be selected following environmental and health impact assessments, cost-benefit and cost-effectiveness analyses and thorough consultation processes. Attention has to be paid to ensure that the measures are mutually supportive (e.g. benefits selected for promotion and support of cleaner vehicles can be undermined by car traffic growth brought by supported measures in the field of land-use, parking or public transport).

In addition to this Chapter, different sustainable urban mobility measures are included in order to serve as models for sustainable and innovative solutions for constitution of SUMP in the Serbian cities.

#### 4.1.1. Sustainable Urbanism

Sustainable Urbanism is an evolving and growing design reform movement that combines the creation and enhancement of walkable and diverse places with the need to build high-performance infrastructure and buildings. It is an approach that encourages cities to begin to integrate walkable, transit-based transportation systems along with high performance green buildings and associated infrastructure into their current developments and ongoing plans. The concept focuses specifically on “sustainability and livability.”

Sustainable Urbanism can be implemented in cities, towns, and neighborhoods through coordinated leadership and communication. The following policies can be used to move a city into a more sustainable path:

- **Increasing sustainability through density**
- **Integrating transportation and land use decision making**
- **Creating sustainable neighborhoods with walk-to-work neighborhood centers of locally-owned businesses, car-sharing on every block, walkable neighborhoods and universal accessibility.**
- **Construction of dedicated public transport lanes for improved flow of public transport vehicles.**
- **Establishment of “No-private-vehicle zones” in congested city centers.**

Land use policy necessarily touches on every aspect of local government concern. Sustainable land urbanism involves decisions on crosscutting and multi-layered issues that affect air quality, water quality, access to transportation options, economic vitality and quality of life.

With better coordination, communities can plan more comprehensively for housing, commercial and retail uses, and for the provision of education and other public services, all in the context of accessible transportation. These efforts can result in the installation of a new public transit line, the construction of bicycle or pedestrian paths or the redesign of heavily-used roadway, depending on the needs of the individual community. With its focus on providing options that meet local needs while protecting local assets, integrated land use and transportation planning offers flexibility and choice.

In recent years Freiburg gained international attention for its progressive vision of integrating functional and social aspects of sustainability. The City has also released a publication called “Charter for Sustainable Urbanism” which not only shows its own route to becoming a sustainable city but consists of a series of guiding principles that seek to inspire other cities to follow suit. More information can be found on: <http://www.academyofurbanism.org.uk/freiburg-charter/>.

### 4.1.2. Promotion of Non-motorized Transport Modes

Initiatives in cities, companies and schools can promote cycling and walking, for example through traffic games, road safety practical training or educational measures. Additional measures that can be promoted in public companies for employees that use bicycles are financial incentives as an encouragement and good example for the local community.

To promote the importance of walking and cycling, local and regional authorities should also ensure that these modes are fully integrated and long term mainstreamed into the development of urban mobility plans and policies. The larger municipalities should consider appointing a policy officer especially in charge of walking and cycling related issues.

Within the framework of the project “Support to Sustainable Transport in the City of Belgrade”, the “Let’s Cycle in Belgrade!” public awareness campaign was launched in 2011. The objective of the campaign is to raise awareness on the positive aspects of cycling and to put this transport mode in the forefront, not only as a recreational activity, but as a proper transport mode in its own right. The campaign points out the environmental, economic and health aspects of cycling, and contributes to a significant increase in the number of cycling trips in everyday traffic in Belgrade, and accordingly to lowering the GHG emissions and improving the environment. More information can be found at: <http://www.biciklirajbeogradom.com/eng/public-awareness-campaign-lets-cycle-in-belgrade/>

### 4.1.3. Development of High Quality Cycling and Walking Infrastructure

Every citizen should be able to live and to move in the living community with safety and security. When walking, cycling, or driving a car or a truck, one should be able to do that with minimum personal risk. The most vulnerable groups are the users of non-motorized transport, which are not prioritized in the former land planning aspects and at the same time are the most vulnerable to physical injuries.

The best way to support and strategically promote non-motorized transport is to develop a high quality primary infrastructure for walking and cycling, good design and maintenance of infrastructure, especially at intersections, proper lightning of the movement areas and enough secondary infrastructures to ensure the proper integration of these groups in the transport network. Several points are important for the non-motorized infrastructure, such as the development of junctions, roundabouts and traffic lights and the safety of bicycle and walking lanes, including good signaling and lightning. The main requirements for bicycle and walking -friendly infrastructures are:

- **Improved traffic safety;**
- **Short and fast routes from origin to destination;**
- **Improved cycling comfort: good surfaces, substantial space and decreased interruption from other road users;**
- **Pleasant, socially safe and environmentally safe environment, no pollution or noise nuisance;**
- **Logical and cohesive routes.**

Within the framework of the project “Support to Sustainable Transport in the City of Belgrade” significant technical measures for the renovation of existing bicycle tracks, building new infrastructure, and improved horizontal and vertical signalization in the city of Belgrade have been undertaken. In the 4-year implementation period 37 km of bicycle tracks have been renovated and 4km of tracks have been built. The assessments and surveys done in the project framework showed that only 1% of the population of the city of Belgrade uses the cycling transport mode for every day commuting activities. The long term perspective of the City of Belgrade’s urban community would enable an adequate cycling infrastructure in order to increase bicycle travel to 5 -10%.

#### 4.1.4. Improved Bicycle Parking Infrastructure and Possibilities for Multimodal Transport

The cycling network must be considered together with other facilities for cyclists, such as parking areas, links with public transport, workplaces, shops, shopping centers. The availability of safe and convenient parking is critical for cyclists and the bicycle parking infrastructure is still not appropriately introduced near shops, offices, schools, big car parking facilities and other buildings. Bicycle parking facilities need to be visible, accessible, easy to use, and should preferably be covered and well lit, as well as concentrated around the public transport stops and near the commercial and recreational areas.

Improved integration of the network is a measure that helps the development of multimodal means of transport, developing a scheme of integrated networks, like walking and cycling lanes directly and logically connected with the public transport network. This integration and provision of convenient usage of multimodal transport can increase the number of users of eco-friendly means of transport (NMT and public transport).

The following measures can support the development of urban multimodal mobility:

- **Public transport stops: increase accessibility for cyclists creating suitable, secure and sheltered bicycle parking facilities near public transport stops;**
- **Trains and buses equipped with bicycle stands, as allowing the carriage of bicycles goes a long way towards helping cyclists take longer journeys in cities and suburban areas.**
- **Bicycle parking facilities and bike rentals near large car parking facilities, as a possibility for partial modal switch and usage of NMT in some city segments (e.g. city center or restricted vehicles areas).**
- **Bicycle sharing: every year more and more cities are implementing bicycle sharing schemes, with increasing success, especially amongst commuters.**

One of the main visions of the National strategy of development of cycling transport and cycle touring in the Slovak Republic is the emancipation of the cycling transport with other transport modes for it to become a regular part of urban and regional transportation systems. The National Strategy is developed in cooperation with the Minister of Transport, Construction and Regional Development of Slovak Republic, and the Ministry is also a responsible body for implementation of measures resulting from the National strategy of development of cycling transport and cycle touring in the Slovak Republic and their translation into regional, local and business strategies. More National strategy of development of cycling transport and cycle touring in the Slovak Republic can be downloaded on the following link: [http://www.centralmeetbike.eu/palio/html.wmedia?\\_Instance=centralmeetbike&\\_Connector=palio&\\_ID=1161&\\_Checksum=313515098](http://www.centralmeetbike.eu/palio/html.wmedia?_Instance=centralmeetbike&_Connector=palio&_ID=1161&_Checksum=313515098)

#### 4.1.5. Increase of Bicycle Rental Facilities

Provision of bicycle rental facilities is a measure that can trigger the community for the convenience and the benefits of cycling as a transport mode and increase the use of cycling instead of using vehicles. Bikes can be used as an alternative means of transport, especially in the center of the city, which means lower gas emission and, as a result, a healthier and cleaner environment

Market research is needed to accurately determine the demand for bike rental facilities, but the practice worldwide has shown that bike rental facilities are very well accepted and commonly used by the urban community population,

commuters and tourists.

The rental of electric bicycles is also an interesting and innovative way to promote all the advantages of traditional bikes but with a little friendly help for those with less physical power. The e-bike has an integrated electric motor which can be used for propulsion. There are a great variety of different types of e-bikes available worldwide, from e-bikes that only have a small motor to assist the rider's pedal-power (i.e., pedelecs) to somewhat more powerful e-bikes which tend to be closer to moped-style functionality.

E-bikes use rechargeable batteries and the lighter varieties can travel up to 25 to 32 km/h, while the more high-powered varieties can often do in excess of 45 km/h.

The national and local governments can provide incentives to increase the number of rental facilities in the city through measures for subsidizing the annual store rental expenses or store inventory expenses, subsidized credit lines or tax incentives.

The project "Rent a Bike" was created in collaboration with the City of Skopje, the Public Enterprise City Parking- Skopje and the Citizen's Association Eco- Sense, in, 2010. The aim of the implementation of the project was to raise the eco-sense among citizens and to encourage them to use bicycles as a mean of transport. The project has now developed as a model for a functional rent-a-bike system and has the rental capacity of 250 bicycles and 10 new electric bikes tailored for urban transportation, at a very low and affordable rental price.

#### 4.1.6. Bike Sharing Programs

A bicycle sharing system, or public bicycle system, is a service in which bicycles are made available for shared use to individuals on a very short term basis. Bike share schemes allow people to borrow a bike from point "A" and return it at point "B".

Many bike-share systems offer subscriptions that make the first 30–45 minutes of use very inexpensive, encouraging their use as a means of transport.

Bike-share use is made more predictable with Smartphone mapping apps which show where nearby stations are located and how many bikes are available at each station. This is also important for riders looking to return a bike; they need to know if there is a dock open at a certain station, since stations can fill up with bikes. So using bike-share to get around a city is made far easier with real-time, GPS-based smartphone applications with bike-share station information overlaid on a city map.

Public bike sharing programs address some of the primary disadvantages to bicycle ownership, including loss from theft or vandalism, lack of parking or storage, and maintenance requirements. However, by limiting the number of places where bicycles can be rented or returned, the service itself essentially becomes a form of public transit, and has therefore been criticized as less convenient than a privately owned bicycle capable of point-to-point transport.

Government-run bicycle sharing programs can also prove costly to the public unless subsidized by commercial interests, typically in the form of advertising on stations or the bicycles themselves.

The launch of the Public Bicycle Scheme in Lyon, France turned out to be a milestone in the successful implementation of the Bike sharing programme. Before the launch of the Velo'v project in 2005, the city of Lyon was considered to be bike unfriendly. The city observed an increase of 500% in bicycle trips, a quarter of which were due to the bike sharing system. The Velo'v project introduced a number of innovations that were later copied by most other systems, including electronic locks, smart cards, and telecommunication systems and on board computers.

#### 4.1.7. Development of Smart Secondary Infrastructure, Information System and Software Tools

The development of a new smart infrastructure and software tools should be considered the way to modernize and service a city's every-day traffic experience.

Well designed and synchronized traffic lights, traffic junctions and the establishment of urban transport management centers can significantly contribute towards sustainable urban mobility.

Traveling by car or public transport, or walking and cycling can be more direct and efficient when using new innovative smart measures.

Integrated mobility-related information, such as public transport timetables, the availability of bicycle infrastructure at some destinations, the location of bicycle rental facilities and real time data concerning traffic conditions in the city can help citizens choose greener and smarter modes of transport in their urban communities.

The interactive Android and web application Skopje Green Route is designed to serve as a navigation tool which promotes greener means of transport through the city of Skopje. The concept was developed by UNDP Macedonia and the Government of the City of Skopje, and is expected to promote cleaner and more economical means of transport, to provide continuous and real time information concerning city traffic conditions and measured CO<sub>2</sub> emissions, and ultimately to reduce the GHG emissions caused by motorized transport in the city of Skopje. The official release of the application caused huge public interest and wide acceptance by the overall community. More information concerning the project is available at: [www.skopjegrreenroute.mk](http://www.skopjegrreenroute.mk)

#### 4.1.8. Awareness Raising Campaigns

Education, information and awareness-raising campaigns play an important role in the creation of a sustainable urban mobility culture. Awareness raising campaigns are the collaborative way to reach people and raise public awareness of the need to use sustainable transport modes. There are a number of ways to approach the issue of raising public awareness about sustainable urban mobility.

The most-often-used practices focus on:

- **Organization of campaigns to influence policy making.**
- **Activities which can reach target audiences: policy makers, opinion leaders, media and general public.**
- **Activities for developing countries and communities, in which the NMT is rather promoted as a way of transportation, than a recreational activity.**
- **Thematic events**
- **Low cost events consisting of conferences, printed materials and brochures**
- **High impact activities, such as Car free days**
- **Promotion of successful stories from cities that implement sustainable urban mobility measures.**

Public campaigns should be covered by the media and supported by officials and influential NGOs, as well as by famous people and celebrities.

The European Commission supports the organisation of public campaigns at all levels, including the widely recognized support of the European Mobility Week. The European Mobility Week is an annual campaign on sustainable urban mobility, organized with the political and financial support of the Directorates-General for the Environment and Transport of the European Commission. The aim of the campaign, which runs from 16 to 22 September every year, encourages European local authorities to introduce and promote sustainable transport measures and to invite their citizens to try out alternatives to car use.

Since its introduction in 2002, the impact of European Mobility Week has steadily grown, both across Europe and around the world. In recent years, the campaign has spread to countries such as Argentina, Japan, Taiwan, Brazil, Canada and Vietnam. In September 2011, within the scope of the SUMP, the City of Belgrade joined the activities of the framework of European Mobility Week for the first time. Since then, the city of Belgrade annually organizes ceremonies and campaigns within the framework of the European Mobility week. In 2014, 2013 cities from 44 countries officially registered for the campaign. More than 9,000 permanent measures have been implemented, mainly focusing on infrastructure for cycling and walking, traffic calming, improving transport accessibility and raising awareness about sustainable travel behaviour.



### 4.1.9. Less Crime and Fear of Accidents on Walking and Bicycle Tracks

Cycling and walking activities require an appropriate infrastructure that provides separate space to move safely and comfortably. Safer, wider and more secure cycling infrastructure is required to encourage more people to get on their bikes and build a strong cycling community. Countries whose cycling culture has existed for some time, like the Netherlands or Denmark, have separate cycling tracks and advanced solutions for safe, comfortable and year-long cycling, as well as walking activities. The wide usage of NMT in these countries is a result of an appropriate and comfortable infrastructure to support active transportation modes.

The absence of separate bicycle tracks dedicated only to cyclists or pedestrians leads to unsafe situations, especially at crossroads and intersections. Enhancing visibility, for example by providing better lighting and more visible enforcement officers on the street, can help increase the feeling of safety and security.

The existence of a strong infrastructure and lightning, combined with more people using the walking and cycling tracks will decrease the fear of crime and encourage citizens to use the walking and cycling infrastructure throughout the day. Additionally, the local governments and police departments have to take a range of measures to increase safety on the pedestrian walks and bicycle tracks, such as police patrols on the corridors, video surveillance, and other systems for prevention.

In an effort to raise the modal split of cycling, the city of Gdansk in Poland, improved the conditions of its cycling infrastructure in 2010. These improvements backed by an information campaign aimed to make cycling safer and a more attractive alternative to the car. The investments for improving safety and security along the seaside cycle path brought long-lasting results. An upward trend of 7% in biking leisure activities was registered in 2010-2011 alone, while a 24.3% increase in the rate of daily walking was registered for the same period. The campaign "Cycle Safely in Gdansk" turned out to be a great success and may easily be replicated in other cities.

### 4.1.10. Education of the Population about the Benefits of Non-motorized Transport

Education of the population about the benefits of non-motorized transport, as well as education of pre-school and school children about road safety measures is an important tool to bring substantive awareness raising and behavioral changes.

The education of the population can be organized for the following focus groups:

- **Education of pre-school children**
- **Education of school children**
- **Education of the general public through public campaigns.**

The education of pre-school and school children can be widely modified and organized in many different ways. The commonly used methodologies are:

- **Presentation of educational movies about the benefits of non-motorized transport**
- **Lectures on sustainable urban transport solutions as an important need for healthy urban communities**
- **Organized road safety trainings as a measure to provide safe movement for children in the city**
- **Lectures concerning the environmental aspect of urban living**
- **Pedi bus campaigns and activities for safe and secure group movement of children on their way to school.**

The education of the general public is mainly supported by media promotions, social media campaigns and other activities in the framework of the NGOs activities and local initiatives.

The main focus of the general public educational campaigns is the promotion of the benefits of using NMT, its health and



safety aspects, and its relevance to climate change and the environmental impact of sustainable transport technologies.

CIVITAS DYN@MO is an ambitious project with strategic importance to sustainable mobility planning in four dynamic European cities. This includes two leading cities, Aachen in Germany and Gdynia in Poland, as well as two learning cities, Palma de Mallorca in Spain and Koprivnica in Croatia. The mission of the CIVITAS DYN@MO cities is to strengthen sustainable mobility by promoting non-polluting lifestyles, fostering social interaction and collaboration on the basis of the new media, and providing integrated implementation of innovative transport services for active citizens of all ages. Additional information for the CIVITAS DYN@MO project can be found on: <http://www.civitas.eu/content/dynmo>

#### 4.1.11. Safe Routes to Schools Programs

About 50% of children don't walk to school regularly and more and more pupils are being driven to school by car. This trend contributes to reduced physical activity and increased childhood obesity, as well as to urban congestion and air pollution in school areas.

The Safe routes to school program can encourage more parents and children to engage in active transportation to school, since the program supports the construction of accident free movement paths and convenient movement of children to their schools.

Walking to school has a wide range of benefits:

- **It keeps children healthy**
- **It reduces traffic and congestion on the roads as well as pollution at the school gate**
- **It reduces emissions of carbon dioxide**
- **It provides quality time before school for parents and children**
- **It is an opportunity for children to play, socialize and exercise before school**
- **It engages children with their local communities and environments**

In the framework of the project "Support to Sustainable Urban Transport in the city of Belgrade", a public awareness campaign and a specific practical assignment "Safe Routes to Schools" have been completed. Safe routes to five primary schools in Belgrade have been designed in order to increase the safety of the youngest population in their daily home-school commuting, and to raise the awareness of children about the environmental aspects of transport. Additionally, education and awareness rising of the youngest population about green modes of mobility was introduced. The value of changing the behaviour and habits of parents, teachers and children was demonstrated through a demo project, which involved, "Pedi buses"- group walking for primary school pupils and the marking of safe routes to schools. The pilot project gained fundamental attention and recognition, and is expected to be replicated in other primary schools within the territory of the city of Belgrade. The cumulative mitigation potential of the pilot implementation of the component Pedibus in one primary school in the city of Belgrade for the period 2013– 2020 is estimated at 0.045 kt of CO<sub>2</sub>-eq.

#### 4.1.12. Reduced Road Danger

Two thirds of overall road accidents and one third of overall road deaths occur in urban agglomerations. In conurbations, powered two-wheelers, pedestrians and cyclists are frequently victims of road accidents with the 14-25 age group the most affected. Most accidents occur along arterial roads and at crossings due to poor road design, poor driving and excessive speed. In some conurbations speed limits are exceeded by more than half of road vehicles.

The main objectives of the European Commission's current road safety policy are:

- **Education and training of road users**
- **Increased enforcement of road traffic rules**

- **Safer road infrastructure**
- **Safer vehicles**
- **Use of modern technologies and in-vehicle safety systems**
- **Improved emergency and post-injury services**
- **The safety of vulnerable road users**

Road Design and Maintenance is important in reducing danger for motorized and non-motorized transport. Many improvement measures such as additional cycle lanes, increased lightening of the roads, winter maintenance of public walking and cycling lanes, cross-section improvements are needed to achieve safer urban transport and reduced road danger.

Traffic control is another area to work on in order to reduce road danger. Speed limits and speed reducing devices are used to support traffic calming in shared public and pedestrian areas. Speed humps and raised junctions are the usual structural and physical tools to calm the traffic, but road narrowing and rumble strips (ridges on the road surface that lead to knocks, vibrations and noise within the car) can be also used. Traffic control for pedestrians and cyclists is also important, especially for bicycle users, since they should have safety equipment (helmets and lights). Ultimately, all participants in the transport system should act in accordance to the rules and regulations, obey alcohol free driving and respect the other users of the urban transport infrastructure.

The Swedish government has adopted a long-term, vision-zero commitment for the number of people who are killed or seriously injured in traffic accidents in Sweden. Stockholm City has defined an objective to reduce the number by 40 per cent by 2020. Road safety efforts will have progressed by 2030. Through a dedicated collaboration between police authorities and the city, traffic ethics will be raised and road safety significantly improved. The city's road safety programme defines the measures to be adopted by the city. Speed limits, in particular, must be respected.

#### **4.1.13. Communication Platform with Citizens to Address their Mobility Needs**

A communication platform with citizens to address their mobility needs and ideas will help the local government identify community needs and problems, as well as will help in the development of the Sustainable Urban Transport Measures. Effective communication between the city government and citizens is a crucial factor for the successful development of valuable Sustainable Urban Mobility Measures.

The communication platform should preferably consist of an electronic interface, built on the basis of web communication and smartphone applications. The city government should regularly evaluate and reconsider the citizens' input.

Last year in Helsinki (Finland), the development of a new transport master plan Helsinki 2050 was prepared through an online map-based questionnaire (see a demo at the link below) answered by some 4,700 respondents. Together, respondents marked more than 30,000 locations in the city where they would like to see residential development, better transport connections and recreational areas. The project used the Finnish SoftGIS methodology. The results have been published as open data to allow all those interested in the subject to make use of them. Helsinki is also supporting ten resident-driven democracy pilot projects to seek new means of participation and interaction. More information concerning the activity is available at: <http://www.yleiskaava.fi/en/2014/helsinki-residents-identify-thousands-locations-construction-development-city/>

#### **4.1.14. Effective and Inclusive Campaigns for the Adoption of Eco-driving Modes**

Eco-driving is a smart way of driving, which contributes to the reduction of fuel consumption, the emission of greenhouse gases and accident rates. Eco-driving is an adapted driving style, which best fits modern engine technology. Eco-driving means smart, smooth and safe driving at lower engine speeds (1,200 – 2,500 revolutions per minute), which saves 5- 10% fuel on average, without an increase of travel time.

Eco-driving comprises the following five elements:

- **Educating novice drivers;**
- **Re-educating licensed drivers;**
- **Fuel saving in-car devices;**
- **Tire pressures;**
- **Purchasing behavior (e.g. car labelling)**

The successful implementation of eco-driving modes in public companies can be supported by different types of incentives for drivers, ranging from salary extras, reduced working hours, various kinds of achievement awards and improved working conditions. Energy-efficient driving is already a mandatory part of the training and testing of professional drivers in the EU countries. Currently, the EC is discussing possibilities for how energy-efficient driving could be included in driving tests for private drivers, and will consider follow-up actions and give respective attention to this issue.

In the framework of the “Support to Sustainable Urban Transport in the city of Belgrade”, 25 instructors and 15 professional drivers from the city of Belgrade Public Transport Companies have been trained for eco-driving. This activity provided a basis for further spreading of eco-driving within companies/beneficiaries and national stakeholders. The monitoring of fuel consumption during hands-on training on eco-driving showed a 7% reduction in fuel consumption. According to the mitigation assessment conducted during the project framework, the total mitigation potential of the implementation of eco-driving procedures in the public transport companies of the city is estimated at 31 kt of CO<sub>2</sub>-eq. for the period 2013 – 2020 (cumulative reduction).

#### **4.1.15. High Quality Public Transport**

High Quality Public Transport can be achieved with observation of the needs of the public transport users, and at the same time tracking the population growth and the development of the city urban areas.

The Infrastructure, the schedule and the vehicle fleet are the main parts of the Public Transport system, and improving them that can improve the quality and the number of users.

The schedule of the public transport is the primary characteristics for delivering quality to its users. 24-hour service should be provided to users, and the schedule should be adjusted for different types of users.

Revisions of the network and schedule should be conducted annually in order to meet the needs of citizens.

The condition of the vehicle fleet is essential because of its impact on the environment and the comfort of the users. The tram and bus fleet should be improved annually because new vehicles will be more energy efficient, the new trams will spend less electricity and a new bus fleet (euro 5, euro 6) will spend less diesel fuel.

With the improvement of the vehicle fleet the comfort and safety of the passengers will be improved and the environmental impact of the public transport will be reduced. Low floor public transport vehicles, easy to use bus and tram entrances, and a dedicated place inside the trams and buses for people with disabilities are essential for the achievement of high quality public transport.

The integrated bus-tram system must be analyzed and improved, so the location of the bus stops and tram stop cover the entire urban area. In the cities in the EU with high quality public transport, 80% of the citizens have access to public transport at a 30-minute walking distance, which is considered by users as healthy exercise.

The bus and tram stations and stops must be continuously improved, properly covered and lightened, clean, and if possible with integrated safe parking spaces for cycles. The stations should also be equipped with electronic schedules, timers and real time info boards for the users.

Additional issues concerning the security of passengers of the public transport can be improved if surveillance cameras are installed on board the vehicles and at bus and tram stations.

Introduction of new technologies will also improve the quality of public transport, such as free wi-fi on the trams, buses and at the stations, on-line ticket shops and other electronic devices will attract a greater number of young population

users. Informative software tools for smartphones, such as applications for public transport network coverage and its schedule are another convenient aspect for the use of new and innovative technologies to increase the quality of the public transport.

A SOLUTION is a research project launched in 2013 that aims to support the adoption of innovative sustainable urban mobility solutions in cities around the world. EMBARQ Turkey is one of 25 national and international institutes participating in the effort, which is coordinated by the Wuppertal Institute. The project is funded by the European Commission 7th Framework Program (FP7). In the Mediterranean region, SOLUTIONS is focusing on facilitating dialogue and spreading solutions around four thematic clusters:

- Public transport: High quality, modern and energy efficient public transport can be integrated with other transport modes to make cities more attractive and environmentally friendly, while offering fast and suitable alternatives to private car use.
- Transport infrastructure: Public transport infrastructure includes dedicated bus lanes, rail infrastructure, and passenger waiting areas, in addition to active transport infrastructure such as bike lanes and public spaces for pedestrians.
- City logistics: Using city logistics can improve the efficiency and sustainability of transport while decreasing traffic congestion, energy consumption, and environmental externalities from private transport.
- Integrated planning/sustainable urban mobility plans: Government planning must shift to focus on people, not cars. Sustainable urban mobility plans consider the needs of a wide variety of stakeholders and engage citizens in the planning process to improve quality of life. More information is available at: <http://www.embarq.org/news/cities-across-turkey-gather-sustainable-mobility-workshop>

#### 4.1.16. Promotion of the Use of Public Transport

Public transport is often quicker and cheaper than using a car – especially in congested areas where parking is limited. Greater use of public transport also has benefits for our environment and communities too, causing less pollution and congestion and enabling a more active, connected community. Public transport is a good commuting option for many people. The best way to promote public transport for citizens is by setting up event and campaigns that are media supported, so the perception of public transport will improve.

In Serbia there is a need to change the stereotypes that public transport is only alternative transport for people who can't afford to buy and use personal vehicles. The attitude change is essential, since public transport is used in the EU and all over the world because it is practical, time and resource efficient. The benefits of public transport use extend both to citizens and to the environment.

In the framework of the CIVITAS project campaign for promotion of the public transport was done. The campaign involved relatively many participants, which was considered as a success. Data from participants were utilized for measure evaluation (indicators of acceptance and awareness level) and will be further exploited for future activities of the city and the public transport company. Ústí nad Labem plans to organize similar events in the future, based on experience and best practice from CIVITAS campaigns. The basic objectives of public transport promotion included:

- Highlighting advantages of public transport compared to individual motor transport;
- Attracting new passengers while keeping the existing ones;
- Improving provision of information about transport services;
- Increasing awareness about public transport;
- Improving accessibility of services by providing targeted information to passengers; and
- Supplying favorable services, such as time coupons and SMS tickets.

See more at: <http://www.civitas.eu/content/public-transport-promotion-campaign#sthash.cLcGFNHG.dpuf>

### 4.1.17. Promotion of the Use of Electric Vehicles

Promotion of the use of electric vehicles is important because it can significantly contribute to the urban issue of traffic pollution. A number of European cities promote and subsidize the usage of electric vehicles as a substantial transport mode in urban areas.

The state and city government should consider creating policies, additional infrastructure, subsidy schemes and incentives that will help increase the use number of electro mobiles in Serbian cities.

One of the best example cities for promotion of the usage of electric vehicles is the city of Oslo in Norway. The local government implements measures that lead to the rapid expansion of the usage of electric vehicles in the city. The incentive measures are: no purchase tax, free charging of the electric vehicles in public spaces, free parking and free road taxes for users of electric vehicles. (<http://www.evnorway.no/>) Other cities have different measures, e.g. Barcelona's taxis are allowed to operate in the city centre only if they are hybrid-electric vehicles, while the city of Lisbon has 3-wheel electric taxi vehicles, which are considered city landmarks and a tourist attraction.

### 4.1.18. Development of Appropriate Infrastructure for Electromobile Charging Stations

The use of electro mobiles is a rising trend in Europe and worldwide, and the expansion of electro mobiles is only possible with parallel development of the appropriate infrastructure (charging stations), so that users of the electro mobiles can easily, comfortably and safely charge their electric vehicles.

Urban planners should strategically identify locations for electric vehicle charging stations, in order to provide efficient distribution within the urban area. The location of the charging stations should be publically available and pointed out on city maps. The charging infrastructure should be both user-friendly and safe.

Charging stations can be independently installed and placed at the specific locations or they can be integrated into the existing infrastructure of the city (for example, with the street lightning).

The experience of cities that have already developed a charging infrastructure has shown that the most used charging stations are those installed on big parking lots, street parking places and on parking lots that are in front of big commercial buildings.

The fleet of plug-in electric vehicles in Norway is the largest per capita in the world, with Oslo recognized as the EV capital of the world. In March 2014, Norway became the first country where over 1 in every 100 passenger cars on the roads is a plug-in electric vehicle, out of a registered fleet of over 2.52 million passenger cars. Norway's fleet of electric cars is one of the cleanest in the world because almost 100% of the electricity generated in the country comes from hydropower. More information is available at: <http://www.evnorway.no/>

### 4.1.19. Promotion of Energy Efficient Vehicles and Low Carbon Fuels

EEV- Energy efficient vehicles are defined as vehicles that meet a set of defined specifications in terms of carbon emission levels (g/km) and fuel consumption (l/100km). EEV includes fuel efficient vehicles, hybrids, electric vehicles and alternatively fuelled vehicles like CNG, LPG, Biodiesel, Ethanol, Hydrogen and Fuel Cell.

Promotion of EEV vehicles is a durable measure to directly decrease city pollution levels. In some cities in the EU the drivers of these vehicles enjoy benefits such as free parking and road taxes and the free charging of electrical vehicles, among others.

An increase of the usage of the EEV and low-carbon fuels can significantly reduce the carbon intensity of the transport sector and improve local air quality. Additionally, the EEV can provide significant financial benefits for citizens and the local economy, since the usage of these vehicles is less energy and resource intensive.

National and local governments should support the local producers of Biodiesel and Ethanol with appropriate subsidy schemes and tax incentives, and furthermore support the local population in the procurement of EEV or installation of systems for the usage of low-carbon fuels.

The CIVITAS DYNAMO is an ambitious project bringing together four European cities that have agreed on a mission to strengthen sustainable mobility. The DYNAMO cities are strongly committed to making their public transport cleaner and to enhancing the environmental performance and energy efficiency of their fleets. Besides acquiring new, more environmentally friendly vehicles for public transport and the municipal fleet, these cities will test and promote other electric vehicles and modes of sustainable transport through pilot projects.

#### **4.1.20. Inclusive mobility**

It is critical that designs for people with mobility impairments should be held to the highest possible standards. The term disability is a wide-ranging term which includes people with physical, sensory or mental impairment. A conservative estimate is that between 12 and 13 per cent of the population has some degree of impairment. Some face barriers to move in the urban environment.

In the process of development of the Sustainable Urban Transport Plans and Measures, inclusive mobility should be considered as one of the most important aspects of the constitution of the sustainable transport structure. Different types of communication and interaction should be developed between representatives of those groups and the urban government in order to improve quality of life and to identify the mobility needs of the overall community.

The City of Stuttgart, Germany has developed a Sustainable Urban Mobility Plan called Agenda 21. The sustainable goals of the Agenda 21 are to provide: Socially inclusive, environmental-friendly and economy-promoting transport in the city of Stuttgart. Cities need to ensure that all residents are able to share in mobility, including disabled persons, parents with small children, the sick and elderly, and poorer people. Mobility is socially inclusive only if it does not pose a substantial danger to the health of people.

#### **4.1.21. Sustainable Parking Management**

The availability and the cost of parking facilities is an important determinant for choosing a transport mode to particular destinations, as well as for decisions concerning car ownership. The on-street parking practices which are generally present in all cities in Serbia and the region cause many additional problems such as lack of appropriate walking and cycling infrastructure, increased congestion and air pollution and disturbances for the local population.

Sustainable urban parking management is based on the following principles which are meant to impose behavioral changes and improve parking practices in cities:

- **Establishment of Parking Zones**
- **Access limitation in city center**
- **Reduction of parking supply in city center**
- **Parking Pricing**
- **Reduced parking fee for low emission cars**
- **Improve other transportation modes**
- **Establishment of Private+Rental parking facilities**
- **Shared parking**
- **Increased public awareness**

The integration of sustainable parking management practices can provide significant benefits in terms of reduced car

usage, improved conditions for usage of the NMT modes, reduced climate change and environmental impact of the transport sector and ultimately financial benefits for urban communities.

Copenhagen, Denmark has introduced a plan to reduce the number of on-street parking spaces in the City's core. The plan calls for the removal of 2-3% of on-street parking spaces per year, in order to facilitate the ongoing development of pedestrian infrastructure.

#### 4.1.22. Urban Logistics and Freight Vehicle Policy

Urban logistics covers all the activities involved in the transport of goods in a city. It lies on the crossroads between urban development issues, economic dynamics and quality of life, It is an increasingly important consideration in the overall running of the city, and its management requires an efficient rationalization of its mechanisms. Urban logistics includes the organization of flows generated by the commercial, industrial or service companies in the trade sector; private individuals' shopping trips; the related flows covering a diversified reality (waste transport and public transport).

The city usually remains the main place for exchanges and consumption, and it has seen an escalation in the number of deliveries, even though the expansion of e-commerce tends to dematerialize part of shopping at the ordering level. Urban logistics is destined to become a high value added service business, but to grow it has to rationalize its structures.

Trucks and big commercial vehicles are the main shippers of goods and materials in the cities, and despite smart urban logistic patterns, freight vehicle policy measures can be introduced in the cities central areas. Many new technologies of the freight transport vehicles offer fuel economy and environmental advances, such as advanced design of the vehicle's engines and the introduction of electric freight vehicles in urban areas. Besides vehicle and engine technology, driving style contributes significantly to fuel consumption per truck-kilometre. Eco-driving training for freight transport companies can reduce their energy consumption and offer CO<sub>2</sub> mitigation potential. The integrated urban logistics and freight vehicle policy as part of the constitution of Sustainable Urban Mobility Plans should include the following elements:

- **Smart and integrated planning of goods delivery**
- **Formulation of in-city urban logistic centers**
- **Implementation of fuel economy standards for trucks**
- **Support for fuel efficient retrofits**
- **Support and incentives for introduction of electric freight vehicles**
- **Introduction of eco-driving programs for commercial vehicles**

FREVUE (Freight Electric Vehicles in Urban Europe) project is co-funded by the EU Seventh Framework Programme (FP7), and is designed to demonstrate to industry, consumers and policy makers how electric freight vehicles can provide a solution to many urban freight mobility problems and constrains. The demonstration projects will be implemented in Amsterdam, Lisbon, London, Madrid, Milan, Oslo, Rotterdam and Stockholm. In the project framework 127 electric freight vehicles will be exposed to the day-to-day rigors of the urban logistics environment and demonstrate that the current generation of large electric vans and trucks can offer a viable alternative to diesel vehicles; particularly when combined with state of the art urban logistics applications, innovative logistics management software, and well-designed local policy.

#### 4.2. Preparation of the Implementation Program

This segment should finalize the formal constitution of the SUMP consisting of various urban mobility measures. The necessary interventions for constitution of the SUMP must be prioritized into the following categories:

- **Immediate priority / actions (0 - 2 years)**
- **Short term (next 2-5 years)**



- **Medium term (5-10 years)**
- **Long term (more than 10 years)**

The interventions and the targets represent the most concrete form of commitment in a SUMP, stating the desired degree of change within a given timeframe. They are needed to assess whether an adopted measure really achieves the desired outcomes.

Targets and priorities sets in the SUMP should be SMART (specific, measurable, achievable, realistic, and time-bound) and refer to the agreed objectives. Targets are essential for monitoring and evaluation purposes<sup>2</sup>.

### **4.3. Final Design of the SUMP, Timing and Coordination of Activities**

The final pre-implementation activities should include the development of:

- **Formal revision of the summarized key measures**
- **Costs - benefit assessment of the measures (and packages of measures)**
- **Development of draft objectives and discussions with the key stakeholders**
- **Development of final draft of the SUMP measures and activities**
- **SUMP action plan including the timing of the activities, as a crucial element for successful implementation of the measures and activities prescribed in the SUMP**
- **The documentation of the formal engagement of the delegation of the clear responsibilities between the stakeholders**
- **Exchange of experience between the stakeholders and alignment of the resources**
- **Reality check of objectives in early stages of development of targets**

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<sup>2</sup> Source: BUSTRIP Project 2007, Moving sustainably – Guide to Sustainable Urban Transport Plans, [www.movingsustainably.net/index.php/movsus:planning\\_process](http://www.movingsustainably.net/index.php/movsus:planning_process)



## 5. Monitoring the Implementation of the Sustainable Urban Transport and Mobility Plans

The Sustainable Urban Mobility Plans are the basis for approving projects, strategic plans and various regulatory measures within the city transport system, and it is therefore important to monitor and measure the impact of the integration of the sustainable mobility measures.

The first level of monitoring focuses on the status of implementation of the Sustainable Urban Mobility Plans and Measures in terms of time frames proposed and achieved. This is helpful to understand the dynamics of the measures implementation.

The second level of monitoring provides an understanding of the impacts of the implementation of the measures. The indicators created as a part of the constitution of the Measures can form the basis of this monitoring, and this monitoring can be done on a biannual basis. The CO<sub>2</sub> emissions are also a part of these indicators.

Monitoring activities should be focused on the following targets:

- **Land use evolution;**
- **New infrastructures;**
- **Normative actions;**
- **Mobility demand satisfied by different transport modes;**
- **Air pollution;**
- **Noise;**
- **Road accidents.**

The monitoring mechanism aims to identify and anticipate difficulties in the implementation, and to enable a “re-packaging” of measures in order to achieve targets more efficiently. The reporting should ensure that the actually measured results of plan implementation feed back into the public debate, thus enabling all actors to consider and make corrections where necessary (e.g. if targets are achieved, measures appear to be conflictive, etc.). Where relevant, data should be used that is gender-disaggregated.

Land use and infrastructure monitoring must be continuous along with air pollution and road accident monitoring. Mobility demand and noise monitoring should follow Urban Traffic Plan timing with an update every 2 years.

The credibility of the SUMP strongly depends on the actual independence of the assessments undertaken and the level of stakeholder involvement achieved. Therefore, the evaluation should safeguard transparency and objectivity, based also on the rules of co-funding institutions. The SUT-Plan must define the procedures and responsibilities for detailed evaluation. The evaluation shall be transparent, carried out by an independent agency and cover the following components:

- **Quality of the plan (including the preparatory process) and the timetable**
- **Quality of the implementation process**

In the course of the plan implementation process, a complementary reality check should be carried out by:

- **Involving stakeholders, the public and possibly peers from other cities**
- **Establishing links to good practice in the EU (informal benchmarking)**

## 6. Conclusion

Human mobility has existed as long as humanity itself and is the main factor that enables prosperity and growth. Motorized mobility symbolizes the 20th century, as a historical milestone of the world economic and technological development and rise of individualism. Motorization has radically changed the world, made distances shorter and transformed our landscapes, towns and cities. Since cars became an integral part of everyone's life, many consequences such as traffic jams, increased travel times, energy consumption and pollution have become severely evident in urban communities.

Sustainable Mobility Planning is the only solution to the continuously growing challenges of an undermined living environment and to economic prosperity and health and social well-being.

The successfully designed and implemented Sustainable Mobility Plan and Measures can provide a variety of economic, social and environmental benefits:

- **Efficient land use and enabling smart urban growth - Efficient land use will increase accessibility and improve travel options, and at the same time reduce public service costs. Sustainable land use planning will support open space and cultural resource preservation, and will lead to improved community cohesion.**
- **Congestion reduction - Reduced road and parking congestion will prevent urban delays, additional fuel consumption and emissions of GHGs and other air pollutants. At the same time, congestion reduction will improve walking and cycling condition, and will reduce the need for infrastructural expansion.**
- **Roadway construction and maintenance cost savings, as well as reduced traffic service costs (secondary traffic infrastructure and emergency services).**
- **Parking cost savings - Parking facility construction and maintenance cost savings.**
- **Consumer savings - Reduced consumer costs, such as vehicle operation and ownership expenses.**
- **Transport diversity - mobility options for non-drivers and different social groups. This will also support the equity objectives, such as the fair share of resources to non-drivers and affordability.**
- **Road safety - Reduced road crashes, accidents and emergencies.**
- **Energy conservation - Consumer cost savings. Reduced economic costs of importing fossil fuels.**
- **Pollution reduction - Reduced air, water and noise pollution emissions. Improved public health.**
- **Public health - Increased walking and cycling increases fitness and health.**

If the right mix of measures is implemented in the community, citizens will have the opportunity to instantly recognize the benefits and the sustainable outcomes of sustainable mobility, and consequently to take advantage and support the integration of sustainable urban mobility policies and principles in their communities.

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