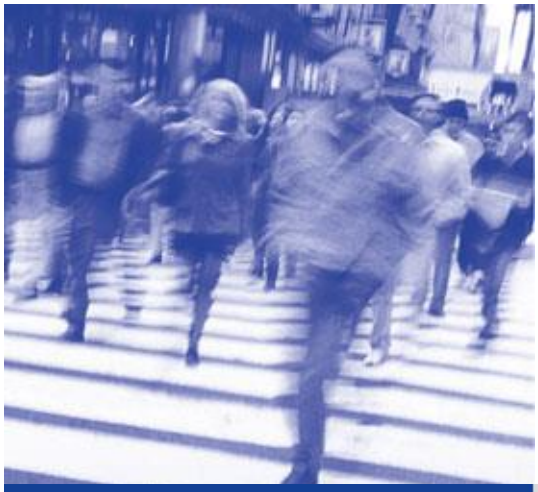

CiViTAS
Cleaner and better transport in cities

DYN@MO
AACHEN • GDYNIA • KOPRIVNICA • PALMA

Lessons learned and policy recommendations from CIVITAS DYN@MO

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DYN@MO

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Abstract

This document summarises the activities within the various DYN@MO measures within each of the four DYN@MO cities (Aachen, Gdynia, Koprivnica and Palma de Mallorca) and provides policy recommendations based on the achievements. Structured on the basis of the project's three technical work packages, with lessons learned drawn from the research and evaluation findings in the project, the document offers insights specific to each measure, with the aim of empowering local policy makers and technicians with similar ambitions to reproduce the measures. Each of DYN@MO's four cities implemented and developed an SUMP within the project, and based on this, a set of related recommendations and lessons learned was compiled. The outcomes of each SUMP-related measure indicated the importance of sufficient support and involvement of key politicians and stakeholders, appropriate resources and data, and communication. Further measure-specific recommendations are elaborated for measures contributing to SUMPs. Measures related to clean and energy efficient vehicles have results that emphasise the importance of leading by example and investing in renewable energies, as well as tips for including test phases as part of implementation. The cities' measures relating to the deployment of ICT and ITS yielded lessons on appropriate preparation and the importance of thorough integration of data and information into the new systems. The document concludes with policy recommendations for EU policy-makers, drawing supporting examples from the measures described in the previous chapters. The value of funding is highlighted, and EU policy makers are advised to make a city's adherence to an approved SUMP as one of the prerequisites to get national funding for implementing sustainable urban mobility measures.

Project Partners

Organization	Country	Abbreviation
Rupprecht Consult	DE	RC

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Dissemination Level: PC = Project Coordinator, SC=Site Coordinator, TC=Technical Coordinator, EM=Evaluation Manager.

Table of Contents

1 Introduction

1.1 About CIVITAS DYN@MO

DYN@MO – funded by the European Commission within the CIVITAS Initiative between December 2012 and November 2016 – is the acronym for the project motto “DYNamic citizens @ctive for sustainable MObility” which derives from the following project’s mission statement: “The CIVITAS DYN@MO mission is to strengthen sustainable mobility through promoting non-polluting lifestyles, through social interaction and collaboration on the basis of the new media, and through integrated implementation of innovative transport services for active citizens of all ages”.

Within the project, two leading cities, Aachen in Germany and Gdynia in Poland, as well as two learning cities, Koprivnica in Croatia and Palma de Mallorca in Spain, have strengthened their sustainable mobility by (1) promoting non-polluting lifestyles and engaging in a dynamic citizen dialogue for mobility planning and service improvement, (2) implementing city and citizen-friendly, cleaner mobility solutions, using new electric and hybrid vehicles, and (3) developing ‘Mobility 2.0’ systems and services through the application of ICT and ITS. DYN@MO is part of the CIVITAS Initiative, which supports cities in introducing ambitious transport measures and policies towards sustainable urban mobility.

Within DYN@MO, the 28 partners have implemented altogether 30 measures. The total project budget was almost €12.5 million, with an EC contribution of a bit more than €8.5 million.

1.2 About this document

This document draws lessons learned and policy recommendations from the results of measure from the project’s work packages 1-3, so that other cities can learn from the experiences of the DYN@MO cities. The content relies heavily on the reviewed draft Measure Evaluation Result Sheets of which the final versions will be available from the respective measure page on the CIVITAS website (see links included per measure below). The summaries cover both positive and negative aspects of implementing the measures, to enrich the learning process.

This document comprises six main chapters:

Chapter 1 provides general information on the CIVITAS DYN@MO project and about this document.

Chapter 2 covers the city’s measures on developing a Sustainable Urban Mobility Plan (SUMP) under WP1, encompassing the process of SUMP development and the status of its implementation at the end of the project. The main objective was to strengthen local partnerships and improve the planning and consensus process. The chapter concludes with a summary of the lessons learned and policy recommendations (for local policy-makers and technicians) based on the experiences of all cities.

Chapter 3 summarises all measures implemented within the cities which contribute in one way or the other to the goals and activities within the cities’ SUMPs, which were also features

of WP1. As these measures are all very different from another lessons learned and policy recommendations (for local policy-makers and technicians) are formulated for each of these measures individually.

Chapter 4 describes the measures of WP2, focussing on planning, testing and deploying innovative clean and energy efficient vehicles for public and private transport. These measures aimed to reduce noise and air pollution as well as gain understanding of innovative, low emission vehicle technologies for decision-making processes concerning future fleets. Again, lessons learned and policy recommendations (for local policy-makers and technicians) are formulated for each of these measures individually due to the diversity of the measures.

Chapter 5 covers all measures that were implemented in the field of Information & Communication Technologies (ICT) and Intelligent Transport Systems (ITS), which comprised WP3 of DYN@MO. WP3 sought to move alternate travel modes out of their niche status and into the realm of everyday city life. Again, lessons learned and policy recommendations (for local policy-makers and technicians) are formulated for each of these measures individually.

Chapter 6 concludes the document with policy recommendations for EU policy-makers, drawing supporting examples from the measures described in the previous chapters.

2 Developing Sustainable Urban Mobility Plans

A Sustainable Urban Mobility Plan (SUMP) is a strategic plan designed to satisfy the mobility needs of people and businesses in cities and their surroundings for a better quality of life. It builds on existing planning practices and takes due consideration of integration, participation, and evaluation principles. Within DYN@MO all cities elaborated SUMPs, either entirely new ones or based on previous documents, using the EU SUMP guidelines (http://eltis.org/content/sump-process) as a basis.

This chapter contains first a summary of the activities within the SUMP elaboration measure of all four DYN@MO cities, followed by lessons learned and policy recommendations derived from the processes in all cities.

2.1 Aachen's dyn@mic SUMP

The main objectives of Aachen's measure on SUMP (**A1.1 "Dyn@mic SUMP"**) were, at a strategic level, to establish participation of stakeholders and the public in the context of a new SUMP for the City of Aachen and to increase the recognition and application of the synergy effects of a balanced traffic model. Furthermore, the measure involved an effort to integrate an additional regional aspect in the SUMP of the City of Aachen. In the long term,

the measure aimed to extend and strengthen the local partnership of stakeholders and the beneficiaries of sustainable developments in the urban mobility planning.

The implementation of a SUMP depended on the close collaboration of local and regional stakeholders representing the City (and Municipality) Administrations, expert citizens, public transport companies, politicians, knowledge institutions, NGOs, and private companies.

The SUMP Aachen was envisioned as a lively instrument, offering a framework to evaluate regionally significant measures in relation to traffic and environmental effects. The planning process therefore considered a variety of transport modes including the issue of public transport. To develop a new SUMP for the City of Aachen, experts, institutions and politicians were brought together in eight technical committees as well as in a steering group. The project management in cooperation with the steering group prepared recommendations to implement the strategy papers and in the end, the mobility board of the City Administration approved those strategies.

Integrating citizens into the SUMP process was considered essential: For the first step of the SUMP, a new way of presenting a thematic input was given to the inhabitants of Aachen on an easy-to-understand level: After the experts had written down a vision for the year 2050 and a description of the status quo, a poster presentation had been designed. The presentation was held in a big tent at the city centre by the responsible planners for each of the eight thematic groups. About 500 citizens participated. After that, a three-week online participation was offered and was joined by 230 people. In both media the public's acceptance of the draft version of the vision mobility 2050 was very high.

Screenshot from video inviting citizens to discussion event on Aachen's SUMP, June 2013, https://www.youtube.com/watch?v=E9ymwTs04vI

The project partner under the lead of the StädteRegion Aachen defined and carried out regional mobility indicator sets. They described all relevant aspects that indicate mobility of the citizens in the regional area, e.g. the modal split of the people (differentiated by each municipality), the traffic volume in the region, the amount of commuters, the length of regional roads, all facts about the public transport, and many more.

More information on the measure and its results is available at: www.civitas.eu/A1.1.

2.2 Advancing towards a dynamic SUMP in Gdynia

With regard to Sustainable Urban Mobility Planning Gdynia implemented two measures: G1.1 "Advancing towards a dynamic SUMP" and G1.2 "Community project studies from SUMP".

The main objective of **measure G1.1 "Advancing towards a dynamic SUMP"** was to update and further develop the existing planning documents of the City of Gdynia towards a Sustainable Urban Mobility Plan, which would serve as best case example for other Polish cities and the national government. Apart from the consolidation of existing urban and

transport planning frameworks, it was assumed that the development of a new generation SUMP will actively involve all stakeholders. The new generation SUMP was anticipated to gain acceptance by all stakeholders (50% public support) and to be ratified by the City Council within the lifetime of the project.

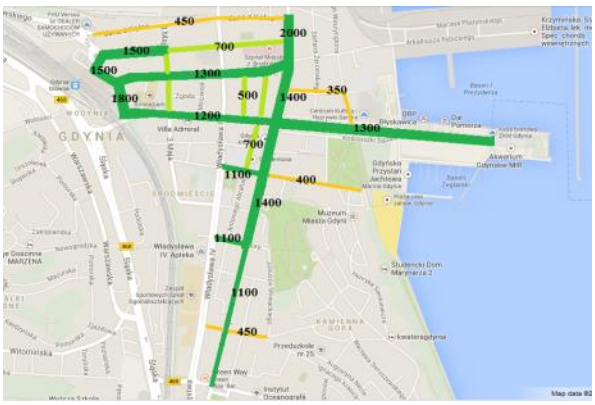
At the beginning of the project, Gdynia had three legal documents relating to transport planning, namely: Gdynia's Strategy of Development 2003-2013, the City's Transport Policy and the Integrated Plan of Public Transport Development in Gdynia for the years 2004-2013. Also, in 2009, as a result of the EU project BUSTRIP, Gdynia elaborated a Sustainable Urban Transport Plan for the period of 2008-2015, but it never was presented to and ratified by the City Council as a formal document.

The process of elaborating a SUMP, conducted within the DYN@MO project, took place pretty much exactly along the EC-endorsed SUMP guidelines, especially focussing on the SUMP development cycle. Both stakeholders and citizens were involved in the public consultation process from the very initial phase of the document elaboration. Community projects were held within the framework of a measure G3.4 by using the Mobility 2.0 internet platform, through direct meetings, workshops and site visits.

Mobility planning based on public participation in Gdynia

At the end of the entire process the SUMP for the City of Gdynia was developed for the period 2016-2025. It was ratified by the City Council on 26 October 2016.

More information on the measure and its results is available at: www.civitas.eu/G1.1.



Pedestrian traffic volume in Gdynia's city centre per hour (from study on road traffic modifications)

Measure G1.2 "Community project studies from SUMP" consisted of three major activities: (1) preparation of a concept study on a Personal Rapid Transit (PRT) line; (2) preparation of a study on road traffic modifications and public transport lines distribution; and (3) promotion campaigns on cycling and walking.

The studies took into consideration proposals and comments from citizens, gathered during stakeholder meetings and also via the MobilnaGdynia platform developed in measure G3.4 "Mobility 2.0 communication". The results from the studies provided input for the development of the SUMP.

More information on the measure and its results is available at: www.civitas.eu/G1.2.

2.3 Development and adoption of Koprivnica's SUMP

The objective of **measure K1.1 "Development and adoption of sustainable urban mobility plan"** was to introduce an integrated and participatory SUMP to the City of Koprivnica and thereby develop a mobility policy that meets people's needs, guarantees accessibility for all and reduces the negative environmental impact of transport.

To foster the participatory approach, regular meetings with stakeholders were organised by the city administration. Some of the most important stakeholders were public transport providers in city and region, the municipal Utility Company, companies and schools in the city and the Institute for Spatial Planning in the Koprivnica-Krizevci region. This participative approach to urban planning is not the norm in Croatia; nonetheless, consulting citizens through an array of communication tools and strategies proved to an asset to the development of the integrated SUMP.

Citizen involvement in decision about design options of Koprivnica's central square via CIVITAS DYN@MO blog

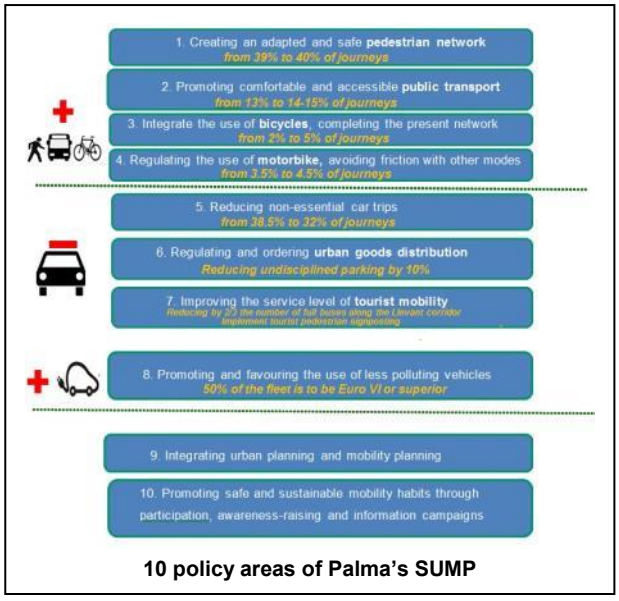
The leading participants with specific roles in the process were the three responsible city government bodies: 1) the Department for Spatial Planning, responsible for the compliance of the document with the current spatial and strategic planning documents, 2) the Department for City Development, focusing on recognising the main transport problems of the city and giving a basis for SUMP and 3) the Department for Sustainable Development and European Affairs, focusing on the compliance of the document with the current EU legislation and developing a manual for regional usage and cooperation with foreign experts on inputs for the SUMP preparation.

The main result of the measure is the adopted Sustainable Urban Mobility Plan which already serves as a model case for Croatian towns. Furthermore, the measure led to new horizontal cooperation by, through meetings and workshops, connecting the city with stakeholders such as public transport providers in city and region, the municipal Utility Company, companies and schools in the city and the Institute for Spatial Planning in the Koprivnica-Krizevci region. Through the development of the SUMP, the city administration changed its conventional approach to urban planning within the city administration. The improved, integrated approach, which includes stakeholders that were previously not usually included in the planning process, will continue to improve strategic planning in the future.

More information on the measure and its results is available at: www.civitas.eu/K1.1.

2.4 Palma's dynamic SUMP

Measure P1.1 "Dynamic Sustainable Urban Mobility Plan" fulfilled its objectives as it successfully developed and started implementing a SUMP for the city of Palma. The SUMP was approved by the city council on 30 October 2014 and contains five objectives, ten policy areas, and 72 measures. The SUMP was elaborated through a set of diagnostic studies of the local mobility situation and projected future scenarios, while 15 indicators for monitoring and evaluation were set up and analysed. The process closely involved all local stakeholders in mobility through meetings, round tables, workshops, and open channels to collect individual ideas, and led to an improved cooperation between the public sector, the private sector, and social actors. The impact of the improved information channels and the awareness campaigns, together with the implementation of some measures, have led to a slight change of attitude towards sustainable modes (especially non-motorised) and a higher awareness of the advantages of sustainable urban transport among citizens.



10 policy areas of Palma's SUMP

Thanks to the SUMP, the City of Palma can now advance towards more sustainable mobility with solid political support based on the consensus achieved prior to its approval. This has been noticeable during 2015 and 2016 as many of the planned measures have been deployed; for example, new cycling infrastructure (bike lanes, bike parking and public bicycle scheme extension), pedestrianisation of streets, enlargement of the traffic restricted areas in the city centre, improved mobility information channels, pedestrian priority at the main regulated crossings, etc. Moreover, the involvement of actors from different sectors and the participation of neighbourhood associations, and the established and ongoing follow-up channels such as the Mobility Roundtables, thematic workshops and bilateral communications, are a remarkably positive footprint of the measure developed in DYN@MO.

The implementation of the measures included in the SUMP is ongoing, mainly following the priorities of the already set up strategies and the opportunities and demands that arise during the regular management of the city. As there isn't a detailed or compulsory schedule for implementation, the implementation is mainly driven by political decisions and budget availability. The Sustainable Energy Master Plan and the Noise Action Plan approved after the SUMP by the municipality of Palma are in line with sustainable mobility measures and will help developing the SUMP, which is expected to be fully implemented by 2020.

More information on the measure and its results is available at: www.civitas.eu/P1.1.

2.5 Lessons learned and policy recommendations on developing SUMPs (for local policy-makers and technicians)

- Make sure to have **support from key politicians** and **involve key policy-makers** right from the start of the planning process.

  For example, in *Gdynia*, the SUMP preparation schedule was officially ratified by the City Council.

  In *Aachen*, it was important to have a political decision for the development of an integrated SUMP as a permanent process. Politicians have been involved in thematic groups, which developed recommendations and in a steering group which steers the process. This led to the great achievement that the first part of the SUMP, the Vision Mobility 2050, was accepted unanimously by the mobility board with marginal modifications only.

  In *Palma,* the opposition parties were invited to stakeholder roundtables and thematic workshops and a dedicated workshop was organised with former mobility councillors from the city of Palma.

- Ensure **sufficient personnel resources** with the city administration for the SUMP development.

  In *Aachen,* the complexity of the dynamic SUMP measure, due mainly to the high number of stakeholders (administrations of both the City of Aachen and StädteRegion Aachen, the municipalities, politicians, transport providers, Public Transit Authorities, and other partners) required higher coordination efforts than anticipated.

  Also in *Aachen*, on city level a permanent staff member was employed to coordinate the process and edit all documents for the city's SUMP. This person is supported by additional staff from the mobility planning department for specific strategies. On regional level without extra staff, there was not enough drive to kick off a well-running SUMP process.

  In *Gdynia*, for example, additional staff was employed to support the responsible officials; three people were involved in the everyday coordination of the SUMP development activities, later supported by one additional person.

  In *Koprivnica*, identifying key staff to take on the responsibilities of developing and implementing the SUMP was an integral step in the process, as the lack of experience and expertise within the small city administration meant that substantial education and training would be needed.

  At the beginning of the project, *Palma*'s technical staff members from City Hall were not adequately aware of the tasks performed by the evaluation team. This disconnect led to insufficient information being delivered to the evaluation team. Once the needs of the evaluation team were defined, the communication and data collection improved.

- Make sure that **good quantitative and qualitative data** on mobility is available as a solid starting point for the preparation of the SUMP.

  In *Aachen*, a representative mobility survey for the city and the region was the starting point for two SUMP processes. In summer 2011, more than 6,000 people (of approx. 565,000 inhabitants) of the StädteRegion Aachen were interviewed.

In *Palma*, for example, a four month data collection period was conducted, including pedestrian counts at 42 cordon points, cyclist counts at 48 sections, car counts at 22 sections, on-street surveys with pedestrians and cyclists, interviews with car drivers entering the city centre, telephone survey about mobility aspects and awareness, turnover study of number plates in 20 paid parking zones, interviews with the users of underground car parks and interviews on origin/ destination with car drivers. In addition, a public transport demand study was carried out and an inventory of goods distribution was prepared.

- **Involve the public** from early on, also to increase public support.

  For example *in Aachen*, two big one day workshops for the public and two online surveys have been organised. They showed a low satisfaction with the status quo and a high support for changes towards more sustainable mobility.

  In *Gdynia*, a new mobility web platform was established (www.mobilnagdynia.pl) to inform citizens about the importance of developing a SUMP in the preparation phase and to explain the advantages for citizens.

  Koprivnica's SUMP strategy resulted in the involvement of stakeholders who had not previously been involved in decision-making processes, sometimes despite having expressed an interest in doing so. For example, some of the most active stakeholders were mobility-impaired group representatives, who knew from the start the importance of this document for their group.

  And in *Palma* a large public participation process was organised once the first draft of the SUMP had been developed. 29 concrete suggestions were received, of which six were incorporated into the final draft of the SUMP.

- Introduce **new communication channels** to overcome difficulties in communication among stakeholders

  For example, in April 2015, the City of *Aachen* established a Facebook page (web 2.0 applications) to interact with the citizens and discuss about issues on mobility and transport in the urban and regional areas.

  Another example, in *Gdynia* the web 2.0 platform mobilnagdynia.pl was launched and connected to a Facebook profile of the same name. It is actively used by Gdynia's citizens and stakeholders (see measure G3.4 "Mobility 2.0 communication" below). Thanks to this new tool Gdynia was able to increase people's involvement in transport planning and development (the evaluation data has shown that there are almost 40% more comments on the Facebook profile and e-mail notifications than in 2014). Especially younger people used this tool and let the City "in" on their new fresh ideas for Gdynia.

3 Measures contributing to cities' Sustainable Urban Mobility Plans

Within the SUMP work package DYN@MO implemented several other measures which are all in some way contributing to the goals and activities within the cities' SUMPs. This includes measures, for example, to advance existing planning frameworks in Aachen and Gdynia towards a new generation of SUMPs using innovative web 2.0 technologies, and to demonstrate strong mobility 2.0 elements in concrete projects resulting from SUMPs.

Below please find for each measure a summary of the activities within the measure, followed by measure-specific lessons learned and policy recommendations.

3.1 Demonstrating electric mobility at residential sites in Aachen

Measure A1.2 "Electromobile Living" aimed to increase the possibilities and advantages of combining mobility with electric and sustainable transport modes for tenants of chosen residential sites.

The measure involved an analysis of possible sites of gewoge, the biggest local housing company. Once sites were chosen, the tenants' demographics and mobility prerequisites were analysed and a special mobility offer was developed to meet their needs. Three mobility stations were implemented at three different gewoge sites and tenants were able to test the new mobility options. Following implementation, mobility behaviour analyses of the tenants living at the three pre-defined gewoge buildings, as well as an analysis of the general mobility behaviour of people living in the districts where the gewoge buildings were located, were conducted.

Flyer announcing new car sharing station at gewoge site Gut Kullen, Aachen, July 2015

The measure approach was successful in relation to the general acceptance of electromobility offers. The car sharing provider received especially positive results in utilisation rate and mileage. Although at the beginning of 2014 the utilisation rate of diesel and electric vehicles differed by more than 35% in favour of the conventional cars, by 2016 the discrepancy had been minimised. Similar trends had been recorded in the mileage statistics of the two types of vehicles. At the end of the project, the electric cars that were used in urban areas recorded a similar level of utilisation rate as diesel vehicles. In total, the five electric cars had a mileage of 92,200 km during the whole DYN@MO project lifetime. In summary, a trend of an increasing shift from conventional to electric vehicles was proven. The impact evaluation indicated a decrease in NO_x (-160g), PM (-1.8g) and CO_2 (-1.76to) after the installation of the

stations. Furthermore, in 2015, the new photovoltaic system produced an electricity of 11,600 kWh.

More information on the measure and its results is available at: www.civitas.eu/A1.2.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- Ensure a strong **network of mobility stations**, with a significant **share of electric vehicles**.

  The three mobility stations implemented in the DYN@MO project contributed to the positive development of mobility behaviour of people living in the districts where the gewoge sites were located. The opening of more mobility stations in urban areas proved to be very useful in convincing citizens to use more sustainable mobility options. Also, the extension of the mobility station network should have a high share of electric vehicles; Aachen took this into account by also enacting the extension of the local charging infrastructure.

- **Changing habits** takes time, therefore it is important not to abort a plan immediately if it is not resulting in the anticipated outcome.

  The different campaigns in Aachen did not lead to an immediate change in mobility behaviour of the people living in the three buildings. The test users had the option of testing the new, alternative option with the objective to improve the efficiency (ecological, economic) of their daily trips. Some slight changes were noted, but the evaluation results indicate that the majority of people would need more time to break with routines and to change the mobility behaviour sustainably.

3.2 Increasing the share of sustainable modes at Aachen's university campuses

The aim of measure **A1.3 "Sustainable university traffic"** was the development of sustainable mobility for the RWTH Aachen University and FH Aachen University of Applied Sciences areas including the new education, research and business area of the RWTH Aachen (named Campus Melaten). At a strategic level, this involved the implementation of mobility management to define and prioritise tangible measures of the Clean Air Plan and Sustainable Transport Plan for the university areas.

Opening of mobility station at Bayernallee, FH Aachen, September 2016

Within DYN@MO, one mobility station (combination of bus stop, car and bike sharing, charging infrastructure) at FH Aachen campus area and two at RWTH Aachen University were planned and implemented. A monthly public transport ticket was introduced at RWTH Aachen University, the employees of the universities were encouraged to use car sharing,

both universities focused on extending campus cycling infrastructure, and public relations measures such as social media promotion and fact sheets to inform target groups were enacted. The plans carried out in this measure continuously observed and reacted to the local developments and context.

The results of the RWTH Aachen University showed that the introduction of the monthly public transport ticket for employees had the greatest positive impact on mobility behaviour of all mobility management measures. Furthermore, the employees at RWTH and FH Aachen steadily increased their use of car sharing for business trips.

The public relation measures (homepage, fact sheets, Facebook, etc.) were useful to inform all target groups at the universities about future mobility topics and raised their awareness and acceptance on mobility topics and of course the usage rate of alternative mobility options positively.

More information on the measure and its results is available at: www.civitas.eu/A1.3.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- **Universities can be a good starting** point for enacting city-wide change in travel behaviour.

  As a major trip generator in the city, the campus based measures at the two universities had the potential to make a city-level impact. This is exemplified by the evaluation results, which indicated, for example, that the parking management and public transport measures implemented during the course of the project at RWTH saw a 14% reduction in car use amongst its more than 9,000 employees, which is sufficient to reduce congestion on the roads around the campus.

- To make cycling an attractive option, **provide infrastructure** that will also make it a *viable* option.

  Attractive cycling networks have connectivity (e.g. paths to many destinations) and safety (e.g. well-maintained paths and protection from other vehicles), as well as appropriate signage, parking, and (in the case of electric bikes) charging facilities. RWTH Aachen University and FH Aachen University of Applied Sciences both extended (electric) cycling infrastructure in campus areas, adding more charging points. This was very important to increase the attractiveness of cycling. After implementation, the modal split of cycling was measured as 5% higher.

- **Affordable monthly transport tickets** have a significant impact on mobility behaviour.

  The results of the RWTH Aachen University showed that an introduction of the monthly public transport ticket for employees led to a significant increase of PT use and a noticeable decrease of driving private cars as the main commuting mode. The overall modal shift was: 14% less car use, 11% more use of public transport, 5% more cycling, 3 % less walking, 1% more “other”.

- **Cooperation is key** for successful mobility management.

  Many aspects of measures A1.3 (e.g. commuter portal, mobility stations) had been planned cooperatively. One crucial factor of success of the whole measure A1.3 was the good collaboration between the project partners and other relevant stakeholders.

- **Inform and involve target groups** to increase acceptance and uptake of new mobility options.

  The mobility surveys of employees at RWTH and FH Aachen and the other successfully implemented mobility management measure raised the acceptance and engagement of university administrations in the field of mobility.

3.3 Introducing pedestrian areas and access management in Gdynia

The aim of **measure G1.3 "Pedestrian areas and access management"** was to identify the location for a first pedestrian area in Gdynia. Three potential pilot areas were indicated – closure of particular sections of roads and creating pedestrian zones – Świętojańska street, Starowiejska street or Skwer Kościuszki blvd. (including Jana Pawła II str). The pilot project included test closings and research, public consultations and awareness-raising. On the basis of this process the city was to make a decision of where to implement the pedestrian area. Closing a street with traffic re-organisation in the city centre was to be implemented after successful consultation with the public. In the end, the consultations unfortunately were not successful and, due to the high opposition, no pedestrian areas were implemented.

However, based on the results from the research and consultation process on the optimal traffic re-organisation, within the measure 30 km/h zones were introduced on two streets that were originally planned for pedestrianisation: Starowiejska St. and Świętojanska St. To increase accessibility, 20 benches were placed on sidewalks in the 30 km/h zone on Starowiejska Street and a relaxation area was introduced.

Marking of 30 km/h zone on Batorego St., Gdynia

As a result of the consultation process two NGOs were established: 1) shopkeepers against pedestrianisation of Starowiejska Street, and 2) shopkeepers and residents of Starowiejska Street opting for high car restriction on the Starowejska Street. The NGOs were very active during the lifetime of the project. The initiatives that were the result of this process were three civic budgets won to improve the quality of space on Starowiejska Street and its vicinity.

In Gdynia's SUMP – ratified on 26 October 2016 – the quality of public space is a key aspect and thus in the Action Plan for 2017 and 2018 activities are planned for temporary closures of streets or sections of streets to raise awareness and acceptance of restricting car traffic in the city centre.

More information on the measure and its results is available at: www.civitas.eu/G1.3.

Lessons learned and policy recommendations
(for local policy-makers and technicians)

- Identify and target **specific user groups**.

  Dedicated workshops and meetings were organised for business owners for each potential pedestrian zone as the successful implementation of pedestrian areas especially requires the support of local business owners whom are directly affected by changes in traffic organisation. Although there was no agreement to implement pedestrian areas it was possible to get the support for the implementation of 30 km/h zones as an alternative.

- The implementation of a measure can be enhanced by the **testing and implementation of cutting-edge technologies**.

  Gdynia used ITS and ICT based tools for data collection, modelling and public sharing of information. An innovative three-level transport model (see measure G3.1 "Traffic model development to expand Gdynia's SUMP") allowed analysing several variants of the measure and presenting them in a form of visualizations used in the process of pedestrian areas implementation. Gdynia also used the Mobility 2.0 platform (Mobilna Gdynia website, see measure G3.4 "Mobility 2.0 communication") for mutual contact with citizens. These technologies were an asset to the implementation of the alternative plan that has been implemented in measure G1.3.

3.4 Establishing a zero CO_2 university campus in Koprivnica

The primary objective of **measure K1.2 "Zero CO_2 University Campus"** was to develop and implement a zero emission university campus concept that involves the use of zero emission vehicles for personal and freight transport.

Within the measure, the project team developed a sustainable mobility plan for the users of the campus ground, proposing measures based on an analysis of the current mobility situation of the campus users in order to improve their mobility options in a sustainable way. In September 2016 a virtual mobility centre was set up which provides information on all transport options in Koprivnica including: public transport, electric buses, e-bikes, bike sharing, a map of cycling infrastructure, a map of the city with main destinations, etc.

First steps of the measure involved identifying users on the still-growing campus as well as defining the stakeholders than would need to be involved. Four locations on the campus were chosen to be developed with the new mobility options: 1) fast electric charges and electric car parking, 2) bike parking, 3) bike sharing station for campus bikes and electric bikes incorporated in public bike sharing, and 4) bus stop for electric buses.

Surveys were conducted during the preparation phase to assess the travel habits and interests of employees and students. The results were used to estimate the commuting patterns to and from the campus area and the likelihood of users who would take advantage of the new system.

Opening of the pedelec sharing station at University North, Koprivnica, June 2015

EV chargers and bike shelters were set up and put into use in June 2015. The electric bike scheme was integrated in the existing bike sharing system which in total had 595 users at the end of the project, which represents 1.7% of the population of the city of Koprivnica. Upon the set-up of the pedelec station on campus, training was offered to users during the first week of the system's operation in June 2015. An electric bus stop was built at the Northern entrance of campus area and the line, which goes to the campus, is mainly used by university students.

By implementing the aforementioned features of measure K1.2, the campus serves as a lighthouse example for other similar facilities in Croatia and the region.

More information on the measure and its results is available at: www.civitas.eu/K1.2.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- **Mobility options** influence modal split.

  If residents have options besides private car use, and those options are attractive means to reach their destination, they will be empowered to choose how they travel and may not always opt for the car. Following the installation of the e-bike system, in a survey with university staff and students 61% stated that before using the e-bikes they used their own car or car-pooled. This point is also supported by Aachen's measure A1.3 "Sustainable university traffic", which, after implementation of a PT ticket for employees at RWTH Aachen indicated 14% less car use, 11% more PT use, 5% more cycling, and 3 % less walking.

- **Know your target group.**

  Lack of information on the student population was initially a barrier for the implementation of measure K1.2. Because the university is relatively new, the baseline surveys and data were based on a student population that was not yet on campus.

- **SUMPs provide a sound basis** for the implementation of further sustainable mobility measures.

  The City of Koprivnica's SUMP was in development in parallel to the implementation of the campus mobility plan. Objectives and measures from the SUMP helped to develop a better plan for the campus area and ensured that the measure was in line with the overall city plan.

- **Political will is an essential component** to implementing measures.

  There was a strong political will and consensus to make the campus a zero CO_2 emission zone. The campus area was declared an area of special interest in the city, so the city government was eager to implement a plan accordingly and invest in the campus area and especially in the development of the University North on the campus site.

3.5 Planning a public transport system for the city of Koprivnica

The main goal of **measure K1.3 "Planning public transport system"** was to design an innovative public transport system for a small city of 31,000 inhabitants. One of the main characteristics of the system is that prior to the CIVITAS DYN@MO project, no form of urban public transport system existed in Koprivnica. There was an attempt to introduce a bus service in 2002, but the operational phase did not last.

The objective of this measure was to plan and build up a public transport system in Koprivnica. The measure was led by the City of Koprivnica, responsible for cooperation and management of the measure together with the public transport company *Čazmatrans* as a partner, which developed design options for an intermodal passenger terminal and a feasibility study of intermodal transport solutions.

Design option for intermodal passenger terminal at Koprivnica's train station

The City of Koprivnica developed the plan for the first public transport system inside the city with connections to other modes (bus, bike sharing, railway). It is the first integrated public transport in towns of a similar size in the wider region and had the goal to be a beacon for similar cities in the wider region.

Measure activities included: a survey of current transport modes for the municipal and data collection on potential users; a study of various service modes; the test of various models of public transport for analysis and establishment of best solutions.

The impact of the implementation of this measure and the development of public transport in Koprivnica was very positive from the environmental, social and governance perspective. Furthermore, the measure increased the level of participation of all stakeholders and citizens, due to interest in the city's new mobility solution. The indicator analysis reveals significant changes towards a culture of sustainable mobility (from 1% to 10% public transport in the overall modal share within three years). All three studies that were conducted helped to accelerate transformation of the city's transport approach towards a more sustainable model with more social inclusion and more mobility solutions for all citizens and daily commuters (and other visitors).

The new situation with more mobility solutions and better accessibility for all, especially for older people and people with disabilities, shows a step towards a more inclusive planning culture with higher participation of citizens from the start.

More information on the measure and its results is available at: www.civitas.eu/K1.3.

Lessons learned and policy recommendations
(for local policy-makers and technicians)

- **Data** is needed to facilitate good decision-making.

  During the preparation phase of this measure, lack of necessary data posed a barrier. In order to make a compelling case for the development of a PT system, extensive and reliable data is needed. Koprivnica had to start from scratch, as no studies had been conducted to analyse the potential for public transport.

- **Good dissemination** goes a long way.

  During measure implementation, there was substantial criticism from the local media, which viewed the PT system development as an expensive and unprofitable endeavour. It is important that the media and the public are well informed of the benefits that a good PT system can bring to a community. In addition to decreasing resistance to the measure, it can strengthen enthusiasm and raise ridership.

- **Integrated ticketing** of public transport options is a crucial factor to achieve higher usage of public transport; prioritise cooperation among all providers.

  At the end of the project, the integrated ticketing feature has not been fully implemented in Koprivnica's developing PT system. The plan for establishment has been developed, with the vision of integration of tickets for e-buses and e-bikes (within the city) in the next two years, but during the project the national railway company blocked the integration of their ticketing system with the local one, so further effort is needed in order to assure full integration of the system.

- Identify and reach out to **target groups**.

  Minority groups (mobility-impaired, elderly, etc.) with an interest in the establishment of the PT system were strong partners in the implementation of this measure, as they were able to see how it would improve their quality of life and meet needs that were previously not being sufficiently addressed.

3.6 Development of a curriculum in clean urban mobility for the University North in Koprivnica

The goal of **measure K1.4 "Development of curriculum in clean urban mobility for university of Koprivnica"** was to develop a study programme in clean urban mobility for the new university established in Koprivnica. The intention of the study programme is to educate a new generation of transport planners that are able to change the planning culture that was mostly based on personalised car transport.

At the beginning of the DYN@MO project, the university did not exist. The plan was to establish it with the help of the Croatian state. After the establishment of the university, an innovative public tender was developed and conducted, external experts were chosen and, in cooperation with the newly established University North and the City of Koprivnica, a curriculum in clean urban sustainable mobility was developed.

The development of the programme – the first educational programme in sustainable mobility in Croatia and the wider region – involved establishing its validity in strategic documents of the University North and the relevant national strategy by linking its objectives and content with the strategic objectives of the university, as well as the Strategic Plan of the Ministry of Science, Education and Sports for the period from 2014 to 2016. The necessary skills that students had to acquire were determined on the basis of knowledge defined in the terms of reference and comparing them with the skills that are emphasised by eminent experts in the field.

More information on the measure and its results is available at: www.civitas.eu/K1.4.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- **Strong research** and a good **status analysis** are important.

  In order to determine ways to develop a new and original curriculum, strong research on good practice examples has to be done. There are a number of good practice examples in Europe from which Koprivnica was able to draw inspiration. Equally important was the city's analysis of its own climate for establishing a programme at the new university.

- **External, high-quality expertise** is important, especially within smaller administrations.

  This recommendation applies to city administrations, organisations, and universities alike. Very few institutions have the necessary expertise that is needed for developing such a programme. It is of high importance to find experts that will help you in this process. In order to fully understand the concept of developing a curriculum that is very specific, the project staff of the City of Koprivnica had to make additional efforts in order to understand the process, and make decisions accordingly. The city administration is simply too small to deal with such a complex process where the size and the lack of qualified experts proved to be a barrier in the development of this measure. Ultimately, the efforts paid off; the development of the curriculum was one of the most successful parts of the measure. A good, very strong community of experts with good coordination and backup from the City of Koprivnica and the University North has developed a very high quality document.

- To incorporate the high-quality expertise, use **innovative public tendering** processes.

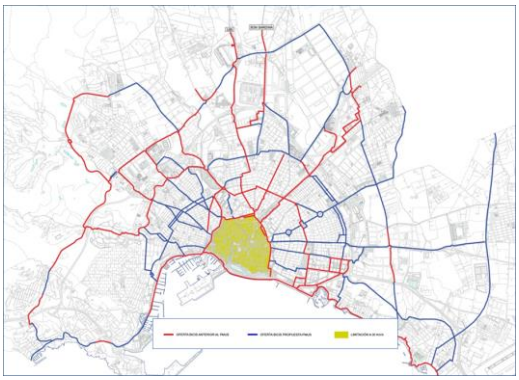
  Innovation in this context means not using only the "lowest price" criteria, but including other criteria, such as former participation in similar projects, EU project experience, etc. By incorporating these criteria, Koprivnica was able to effectively bring this measure forward.

3.7 Planning for cycling and walking in Palma

Within **measure P1.2 "Planning for cycling and walking"** the cycling infrastructure was expanded and two healthy walking routes were developed, cycling and walking were promoted as a mode of transport and the quality of public space was improved by reducing road space for private cars. In terms of cycling infrastructure the targets of this measure have

been surpassed, as more than 11 additional kilometres of cycling lanes have been built on top of the 5 km that were planned. The public bicycle scheme Bicipalma has also been strengthened with two expansions, amounting to a total of 150 new bicycles and 190 new anchor points distributed across nine new stations. These actions have been translated into an observed increase of cycling trips by 11.4%, below the envisaged 20%, but showing a good tendency.

The main success of this measure has been the extensive construction of cycling lanes, overcoming the initial barriers and proving that this is a strategic endeavour with a positive cost-benefit result. Social acceptance of cycling actions has proven that citizens understand the benefits of cycling as one of the pillars of local mobility, and that the perception of cycling and walking conditions in the city is improving, while the cycling culture is growing fast in Palma. Another relevant success is the design and implementation of five safe routes to schools, which was not initially foreseen and has opened another strategic line with an already mature methodology.



Planned extension of Palma's cycling network (as included in the SUMP)

More information on the measure and its results is available at: www.civitas.eu/P1.2.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- **Include cycling and walking measures in SUMP**.

  One of the main drivers for the success of walking and cycling measures was the fact that they were an integral part of the city's SUMP. Infrastructure measures and promotional campaigns were part of a comprehensive strategy to facilitate a change in the modal split. Also, this way in integrated approach is being ensured, by regarding cycling and walking as modes in intermodal journeys.

- **Involve the public**, not only for higher public support, but also to make use of the collective knowledge of users of specific modes and to learn about their needs.

  31 neighbourhood councils were involved in the development of safe walking routes and the network of bicycle lanes.

- **Inform residents** before constructing new cycling lanes to increase support.

  Building new bike paths means inevitably is a burden for residents. To overcome the possible negative feedback, it is important to inform residents about the upcoming construction works. The City of Palma distributed brochures that explained about the works, changes to bus stops, new crosswalks, map of the new cycling lane, etc. and also about the advantages of having a new bike lane on their street, such as reduction of noise, increase of safety, embellishment, etc. Announcements about the construction of bike lanes were also published in newspapers.

4 Clean and energy efficient vehicles

Planning, testing and deploying innovative clean and energy efficient vehicles for public and private transport is a central policy field of the CIVITAS Initiative. In DYN@MO all cities implemented measures involving clean and energy efficient vehicles, with a strong focus on electric vehicles. Measures focussed on improving the enabling environment for clean vehicles through innovative technology to increase the energy efficiency of systems, implementing clean, energy efficient and silent public transport vehicles, and acquiring the relevant data and information for deploying clean vehicles.

Below please find for each measure a summary of the activities within the measure, followed by measure-specific lessons learned and policy recommendations for local policy-makers and technicians.

4.1 "Aachen goes electro" – the electromobility strategy of the City of Aachen

The **measure A2.1 "Aachen goes electro – Electromobility strategy Aachen"** was implemented to inform citizens about electromobility, to make them more aware of electromobility offers and to convince them to use more electric or other alternative drive systems for their daily travel. As it turned out, the citizens of Aachen are very interested in the topic of electromobility which was confirmed by the high feedback rate to the online surveys. One requirement for higher acceptance was the expansion of the electric mobility options and charging infrastructure.

The city administration acted as a role model by using a new electric fleet for their business trips. Two electric cars were purchased by the city administration and put into daily operation (a Renault Kangoo Z.E. in January 2013 and a Renault Zoe in June 2013). One pedelec for local deliveries was put into daily operation. Two car sharing stations were opened in the region (Herzogenrath and Eschweiler), providing four cars. Three pedelec sharing stations were opened and put into daily usage. Three new charging points, operating to power the vehicles of the mobility stations, were implemented. In February 2016, an e-car sharing pool with two e-smarts and one conventional diesel-fuelled car were implemented for one department of the city administration. The aforementioned electromobility introductions were supported by ongoing promotion activities, including a yearly public "Aachen goes electro" event, each with more than 5,000 participants.

Pedelec sharing station at Westbahnhof Aachen

The key results of the measure were as follows:

- In comparison with conventional diesel cars, the two implemented and operating electric cars of the city administration achieved positive results in terms of fuel efficiency, reduced emission level and energy efficiency.
- The share of electric bicycles in Aachen increased from 2% to 3.5% from prior to implementation to the end of the project.
- The total number of electric vehicles increased from 268 to 594; in the StädteRegion (incl. the city of Aachen), the stock more than doubled from 516 to 1,119 vehicles. The nation-wide and the Aachen slope factor in that period of time were nearly equal 1.16 (Germany) and 1.21 (Aachen).

More information on the measure and its results is available at: www.civitas.eu/A2.1.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- **Lead by example**.

  To increase the level of awareness and acceptance of electromobility, it was very important for the city administration to act as a role model. In that context an extension of the car pool with electric vehicle for business trips of the employees would be advisable.

- **Involve renewable energies**.

  For the public acceptance of electromobility – at least in Germany – it is necessary to have a very clear link to the production of zero emission energy. The extension of renewable energies was in Aachen the measure with the highest support from the public concerning electromobility.

- Electromobility has to **cover all modes of transport.**

  Zero emission cars can only reduce emissions, but not space. Simply converting all cars to e-cars would not be a solution to the mobility challenge of congestion. In this respect a wider strategy is needed; one that takes bicycling and public transport into account. Therefore Aachen supports the extension of electric public transport, car sharing and promotes pedelecs as an alternative for car trips up to 10 km, also through the implementation of a pedelec sharing scheme.

- **Involve the public regularly** throughout the process of measure development and implementation.

  The results of the citizen and stakeholder surveys delivered useful insights to their opinions on electromobility. Regular repetition of the surveys uncovered the changes of their awareness over the years. Furthermore, the results gave some good advice as well as hints about what was missing or unsatisfactorily solved in the electromobility strategy, established by the City of Aachen.

- Citizen acceptance and **changes in travel behaviour can take time**; this should be taken into account in the planning process.

  More than one year of acclimatisation was needed to establish the acceptance of potential users of the new mobility options offered in the Aachen regional area.

4.2 The path from a diesel bus fleet to an electric bus fleet of Aachen's public transport operator ASEAG

Measure A2.2 "From a diesel bus fleet to an electric bus fleet" focused on the integration of buses with modern and alternative drive systems towards a clean fleet in public transport. With the help of the DYN@MO project, it was possible to implement market research to define the most sustainable drive systems for buses. Aachen's local public transport operator, ASEAG, in collaboration with the RWTH Aachen, conducted several fuel consumption measurements as well as noise and vibration measurements on hybrid buses. Additionally, passengers of hybrid buses were asked about their awareness and acceptance of the new technology in buses.

After getting unsatisfactory results of the measurements and the introduction of the new emission standard EURO 6 in Germany (which led to high technical and constructive requirements of hybrid buses), the measure leader decided to follow another approach. An articulated hybrid test vehicle was purchased and converted into the nation-wide first articulated fully electric powered bus. Furthermore, ASEAG and RWTH Aachen tested lightweight buses (9 tons in comparison to conventional diesel bus with a weight of 11.6 tons) as another efficient bus concept alternatively to conventional diesel buses.

Converted articulated e-bus of Aachen's public transport operator ASEAG

In comparison with the hybrid buses (cost-benefit-ratio of 0.2), the electric bus (0.4, because of reduced emission level and energy efficiency on the one hand but the high conversion costs on the other hand) and the lightweight bus (8.7, because of higher fuel consumption efficiency during the same acquisition costs) achieved better cost-benefit-ratios. In the context of Cost-Benefit Analysis (CBA), each alternative bus concept was compared with a relevant conventional diesel bus. The results confirmed that ASEAG pursued the right strategy to implement more lightweight and electric buses.

After the positive measurements in the cost-benefit analysis, details of which can be found in the Measure Evaluation Result Sheet, a purchasing decision was made by the City of Aachen in favour of lightweight buses and electric buses. In January 2016, five new lightweight buses were introduced into the public fleet and the potential of fuel savings was confirmed during the first months of operation within the DYN@MO project. Furthermore, the decision to buy 15 new electric buses was made. Hence, the first five buses would be purchased at the end of 2016 (five e-buses to follow in 2017 and five more in 2018). The topic "electromobility" became very important in local policies and the political attractiveness of that theme grew steadily during the project.

Summarising, the tests of new technologies and a subsequent integration of those vehicles with new, alternative drive systems into the public transport fleet were fundamentally important. Furthermore, this level of innovation made funding feasible. The DYN@MO results show that a hybrid bus was inappropriate; electric and lightweight buses achieved

good results and positive cost-benefit-ratios (inter alia those reasons led to a purchasing decision in each case). On the other hand, it was recommended by the PT operator, not to pursue the hybrid bus technology further.

More information on the measure and its results is available at: www.civitas.eu/A2.2.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- **Testing new technologies** (in the local context) is an essential component of the implementation process as it can help ascertain whether adjustments need to be made prior to a larger-scale or more permanent implementation.

  In Aachen the careful testing of new vehicle concepts, especially in relation to the level of emission and fuel consumption, in the concrete local situation, was essential to implement a successful measure. Fuel consumption especially depends strongly on local topography, climate, etc., as well as on driver behaviour. Testing in DYN@MO led to the discovery that a hybrid bus was inappropriate for Aachen's purposes and that electric and lightweight buses achieved good results and the latter also a positive cost-benefit-ratio.

- Testing can be the **first step towards adopting**.

  The tests of new technologies and a subsequent integration of those vehicles into the public transport fleet were fundamentally important. Aachen's willingness to test and operate vehicles with new drive system technologies was the impetus to the change of the existing fleet into a fully electric and sustainable PT fleet.

- **Communicate** results to the public.

  The communication and public presentation of positive results in Aachen helped to make the measure objectives more visible to the citizens. The results and new converted vehicles further served as marketing instruments.

4.3 Introducing innovative Li-Ion hybrid trolleybuses in Gdynia's public transport fleet

The city of Gdynia is constantly updating its trolleybus system as a notable example among other cities in Poland. Part of the plan was to extend trolley lines into areas without wired infrastructure, which was done within **measure G2.1 "Innovative Li-Ion hybrid trolleybuses on new line"**. The original plan within CIVITAS DYN@MO was to purchase two chassis of used diesel buses, convert them into trolleybuses and equip them with Lithium batteries acquired from the market. Thus, in January 2014 PKT – Gdynia's trolley bus operator – launched a public tender for the purchase of two Li traction batteries. However, there was no response from the market. Apparently it was not economically viable or profitable for manufacturers to provide specially designed battery units fitting into buses to be converted. Therefore, PKT decided to buy new trolleybuses already equipped with Li-Ion batteries. Surprisingly, this proved to be a faster and cheaper solution than a conversion.

Li-Ion trolley bus of Gdynia's trolley bus operator PKT at Skwer Kościuszki

In March 2014 PKT published a new tender on the purchase of two new trolleybuses with an alternative drive based on Lithium-Ion batteries. The new tender received a considerable response and a contract was signed with Solaris Bus&Coach on 23 May 2014. In March 2015 the two new 12 meter trolleybuses were delivered for the price of €400,000 each. After technical approval both buses were put into regular service from May 2015. The new trolleybuses operate at line no. 21 on its extension at Skwer Kościuszki for 2 km off traction. The extended service proved to be very popular among the passengers. Initially the plan was to stop it for late autumn and winter, but after many requests it was decided to keep it in operation all year round as a regular line with ten services on working days and eight on Saturdays and Sundays.

The evaluation of the measure conveyed the following results:

- The new Li-Ion batteries are almost twice as effective as the previous Nickel-Cadmium batteries (1 kWh from 9.7 kg of battery instead of 17.2 kg).
- Up to 5,000 kg of CO_2 emissions have been saved compared to the planned introduction of trolleybuses with auxiliary diesel electricity generator (so called duo-buses) at the extended section.
- Decrease in operational costs by €1,309 per year compared to the duo-buses scenario.
- The number of passengers at a bus stop considered for evaluation remained the same despite a general decrease in public transport ridership in Gdynia. It could be assumed that the extension of the line 21 attracted additional passengers which counterbalanced the general trend.

More information on the measure and its results is available at: www.civitas.eu/G2.1.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- It is faster and cheaper to **buy trolleybuses already equipped with Li-Ion batteries** than purchasing a trolleybus chassis with diesel auxiliary drive and retrofit it with Li-Ion battery packs

  The tender launched by *Gdynia*'s trolley bus operator PKT for two Li-Ion battery packs in order to convert diesel buses into trolleybuses showed that manufacturers are not interested in the development of Li-Ion battery packs when only two units are being ordered. However, for PKT it was possible to order complete trolleybuses equipped with a newly developed Li-Ion battery pack. In PKT's case this proved to be a faster and cheaper solution than a conversion as the chassis of the trolleybuses with diesel auxiliary drives would have also had to be purchased. Buying the Li-Ion trolleybuses also ensured a high standard of the final product and reduced the risk of incompatibility with technical requirements. Moreover, the testing phase was undertaken at the manufacturer's plant.

- While being useful for trolleybuses, **Li-Ion batteries may also be useful for trams**

  Modern trams are equipped with additional batteries which allow them to cross short sections of track without being connected to the overhead power network, e.g. during service trips, direction change, etc. Li-Ion batteries could be used to extend their range and plan tram lines where it was not previously possible, for example across historic squares where no overhead network was allowed due to visual hindrance and preservation.

4.4 Installing supercaps in Gdynia's trolley bus system

Power substation at Wielkpolska St., Gdynia

Within **measure G2.2 "Supercaps for more efficient trolley system"** a supercapacitor device was installed at a *Wielkpolska St.* power substation in Gdynia. The investment was carried out by PKT (Przedsiębiorstwo Komunikacji Trolejbusowej), which operates trolleybuses transport in Gdynia and Sopot on 12 regular lines. The main objective of the measure was the reduction of energy consumption and optimisation of operational costs in public transport. More than half of the trolleybus fleet is now equipped with a modern regenerative braking system, which means that during braking the vehicles generate energy instead of consuming it. This energy can be used by other vehicles, provided that there is a stationary device (the supercapacitor) that stores it and returns to the power network. The supercapacitor had to be designed according to specific requirements of PKT as no ready-made systems were available due to high complexity and unit cost.

The supercapacitor was put into service in June 2014. Leading up to that, in February 2013, the power substation at *Wielkpolska St.* was selected as the optimal location. In June 2013, PKT signed a contract with the Polish company Medcom for the design, production and assembly of the system. In June 2014, all assembly works were finished.

The impact evaluation revealed that the objectives were substantially achieved. A key result was the reduction of energy consumption; the amount of energy saved ranged from 18% to 38% with an average level of 32.5% for the recently introduced vehicles. Furthermore, the measure implementation led to 22% reduction in energy cost in 2015 compared to 2013.

More information on the measure and its results is available at: www.civitas.eu/G2.2.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- Before implementation, **identify** the circumstances through which the new technology can provide the targeted benefits.

  The section of the trolleybus network powered by a supercapacitor should provide the possibility to recoup enough energy, especially during braking, for other vehicles connected to

the network in need of power (e.g. starting or accelerating). This narrows the application of this type of device to specific parts of the network with significant elevation differences and high frequency of services, in order to attain the desired results in an economic manner. Trolleybuses must also be equipped with a regenerative braking system in order to fully utilise the recuperation potential. The higher the share of vehicles with this system, the higher are the energy savings and the efficiency of the system which deploys the supercapacitor. The presence of both aforementioned factors should be considered as the main decision criterion for the implementation of a supercapacitor at power substations. However, it should be noted that the cost efficiency analysis has revealed that when comparing the costs of the measure (€107,116) with total energy saved (50,175 kWh) to save 1 MWh €213 have been spent. As in 2013 the cost of 1 MWh was €68, this means that in that year €213 have been spent to save €68, or €3.13 have been spent for €1 saved.

- **Take depreciation costs into account** when planning and budgeting for infrastructure.

  Another important issue when considering the implementation of an infrastructural measure is its cost and depreciation. It has to be noted that in Gdynia only 1/8 of the total supercapacitor cost was provided by the project's budget due to depreciation regulations. The rest was covered directly by PKT. This topic has to be carefully analysed by any city or transport operator interested in implementing a similar measure.

4.5 Establishing an electric municipal car sharing scheme in Koprivnica

Within **measure K2.1 "Electric municipal car sharing scheme"** the City of Koprivnica purchased seven innovative and energy efficient vehicles (five electric, one hybrid and one plug-in hybrid car), set up a charging infrastructure for those vehicles (consisting of five fast electric chargers that were constructed in partnership with the national electricity provider HEP) and developed a car sharing scheme for the employees of the city administration as well as municipal companies and institutions, optimising the use of vehicles used by the municipality. As a result the CO_2 emissions of the municipal fleet were reduced by 25% and the operating costs for the fleet of vehicles decreased by 28%. In addition, the intense promotion of the measure contributed to a gradual increase of the use of electric vehicles by the citizens and industry at the local and regional level.

Opening of Koprivnica's municipal e-car sharing scheme, November 2014

More information on the measure and its results is available at: www.civitas.eu/K2.1.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- Electric municipal car sharing schemes should consist of **different car models.**

  Since electric vehicles have a limited range, it is necessary that the car sharing fleet also includes vehicles that can cover greater distances. The optimal solution for that would be plug-in hybrid vehicles that use electric power in urban areas and a parallel conventional fuel for longer journeys.

- Electric municipal car sharing schemes should comprise **at least one fast charging stations of high capacity.**

  It would be good if at least one high capacity charging station would be available for the car sharing scheme. If such a station is accessible to the system, fast charging of the vehicles could be done, minimising the risk of vehicles running out of power and not to be used in the system.

- **Train the end users well** in order to successfully realise an electric municipal car sharing scheme.

  In order for the electric municipal car sharing scheme to work well, it is of utmost importance that the end users accept the system. To understand how the scheme works and how to drive the electric cars, several trainings should be conducted with various small groups of staff members.

- **Prepare the tender documents well,** with a clear idea of the specifications required by your local context, for purchasing electric vehicles.

  Koprivnica is a relatively small city in a relatively small country. Hence, there was the lack of similar tendering procedures in Croatia which Koprivnica could have used as examples. Therefore, it took the City much longer to prepare the tendering documentation for the purchase of the electric vehicles and the car sharing system. Much research had to be done by city staff beforehand, e.g. an extensive survey on electric vehicles available on the market at that point in time, research on the viable car sharing system software available in Croatia or extensive search for partners willing to support the installation of the charging structure. The result of the meticulous research and consideration of goals led to a successful tendering outcome.

- **Convince the public** about the advantages of putting an electric municipal car sharing scheme in place.

  In Koprivnica, the general public at the beginning was rather critical about setting up an electric municipal car sharing scheme. Many citizens looked at the measure as a simple measure of purchasing new vehicles for the city staff. Hence, intensive dissemination about the benefits of introducing the vehicles and the system was done, pointing out the cost savings and the environmental benefit.

4.6 Setting-up a low emission public transport system in Koprivnica

Measure K2.2 "Low emission public transport in Koprivnica" aimed to establish the first public transport for the City of Koprivnica, through the purchase of two electric minibuses in accordance with the guidelines set up in measure K1.3 "Planning public transport system". This measure was intended to increase the efficiency of transport and mobility of citizens and reduce emissions of CO_2 by 20% in relation to a business-as-usual PT operation.

The purchased e-buses are using the existing charging infrastructure that was set up under measure K2.1 "Electric municipal car sharing scheme". The arrival of the electric buses was followed by a period during which the operation of the e-buses was tested. The knowledge from the testing period and the experience from using the charging network is being used to fully implement the electric buses in the public transport system of the City of Koprivnica.

E-buses of Koprivnica's newly established public transport system

This measure has shown the results of using electric vehicles in public transport in a small city of 30,000 inhabitants. It was especially innovative in establishing financially sustainable public transport in a small city, the type of place where there is often low demand and therefore high running costs for such a service. The results gave an insight into the cost-effectiveness of the whole operation, since the electric vehicles are more expensive to purchase than conventional vehicles, but on the other hand have much lower operation costs than the conventional vehicles.

More information on the measure and its results is available at: www.civitas.eu/K2.2.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- **Developed charging infrastructure** is essential for a PT system of electric buses.

  If the vehicles run on an intensive time table, the consumption of the vehicles will be high and charging during the day will be required. While it is possible to install a large battery pack in order not to charge during the day, this drastically increases the price of the vehicles. On the other hand, if there is a good charging infrastructure with high powered "fast chargers", small fast charging sessions are possible, fewer batteries are needed, and therefore the price of the vehicles is significantly lower.

- Overcoming the lack of resources for implementing innovative technologies requires that operators are **open-minded and collaborate for innovation.**

  One of the measure leader's main concerns at the beginning of the project was to find an reliable bus operator for the system. Many private bus operators in Croatia face situations such as lack of funds, operating on minimum funds, and other impediments. Capable and tech-savvy drivers are needed to operate the buses according to the specific requirements of the

producers. Furthermore, the measure team in Koprivnica observed that most of the PT operators have been working with the same technology for a long time and sometimes harbour a small resistance to implementing new technologies. Therefore, more education and awareness-raising for the PT operators in needed.

- **Good dissemination** is a key factor in acceptance of new systems.

  In smaller cities like Koprivnica, every mistake or failure can be scrutinised by the local media. In research and development projects, like CIVITAS DYN@MO, some failures will occur, as this is a normal part of the process. Therefore, a good dissemination plan is of great importance in order to minimise the damage that will occur because of inadequate media reporting. Koprivnica faced criticism by the local media, stemming from lack of understanding of the innovative technology. Conversely, the national media praised the project and has improved the image of the City of Koprivnica as an innovative and open environment. This example underscores the importance of good dissemination not only at a local level, but also at the national level.

4.7 Introducing biogas and CNG in Palma's municipal fleets

Measure P2.1 "Biogas and CNG in municipal fleets" involved two partners, EMT (the municipal transport company of Palma) and EMAYA (the municipal company owned by the City of Palma and in charge of the water management), working towards a common goal: to introduce CNG powered vehicles in their fleets of vehicles.

During CIVITAS DYN@MO a CNG filling station has been built at the municipal premises of EMAYA, eight new CNG waste collection vehicles have been acquired and another 18 have been converted from diesel to CNG. EMT ultimately ruled out implementation of the measure, due to financing difficulties. Thus the measure was cut back to cover only the evaluation of the existing 12 CNG buses that were purchased in 2010, prior to the DYN@MO project start.

First newly purchased CNG three axes truck of Palma's municipal company EMAYA

A set of evaluation indicators for the measure included reduction in air pollution, noise, energy costs, and consumption. Data were collected on the new CNG vehicles and diesel vehicles, in order to compare results. Some results obtained when comparing the pre-project and end-of-project situation were:

- Emissions of NO_x in CNG buses were reduced by 379%, below 3 g/km. For the remaining pollutant gases, the CNG buses had higher emission values.
- Emissions of NO_x in the new CNG trucks purchased by EMAYA were reduced by 64%, with NO_x emission values of 214.1 mg/ KWh. In addition, these new CNG trucks also managed to reduce CO_2 emissions, but a much lower reduction: 9.3%, with values of 626.99 g/ kWh.

- Noise emissions on CNG buses showed a reduction compared to diesel buses. Thus on the outside of the CNG buses the noise emission has been reduced by 13.5% and in the interior by 9.8%.
- In the CNG trucks of EMAYA, noise reduction was 1.3%.

More information on the measure and its results is available at: www.civitas.eu/P2.1.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- Carry out a **feasibility study** prior to implementation.

  In the case of EMAYA, before starting transformation, a preliminary study of the situation and viability was performed, and phases to develop to achieve the transformation of its municipal fleet CNG vehicles were defined. The EMAYA experience has shown that it is important to have your own resources to be able to create the necessary infrastructure (CNG service station) to be able to supply the new CNG vehicles. These actions require a high economic investment, so it is necessary that the actors involved are fully convinced of the environmental and economic benefits of the transformation.

- **Own resources** are important to enable achievements that may otherwise not be reached.

  In the above mentioned case of the EMAYA experience, the importance of own resources are illustrated by the successful creation of the necessary CNG service station. Had these resources not been available, the measure would likely have stalled or not achieved as successful an outcome.

- Look to concrete examples for **evidence**.

  The existing 12 CNG buses provided a good basis to evaluate the differences between CNG and diesel buses. This situation was useful in developing part of the evaluation process for this measure, and for testing the performance of the CNG buses in Palma.

- Ensure that **sufficient financial resources** are secured for undertaking the measure.

  In the case of EMT, vehicle renewal was conditional upon receipt of financial assistance for the purchase of buses. This anticipated financial contribution from the state was not possible and as a result EMT decided not to continue with its strategy of renewing its fleet. Furthermore, this strategy only included the purchase of CNG vehicles and no investment in building the necessary recharging infrastructure.

- Procurement of new vehicles must be accompanied by **the installation of appropriate infrastructure**.

  One of the main barriers to the development of the measure was related to the need of building a gas refuelling station in the EMT facilities; otherwise the fuel availability was a critical question for the final decision about purchasing new CNG buses.

4.8 Introducing electric vehicles in Palma's municipal fleets

Second electric vehicle purchased within DYN@MO for Palma's municipal fleet (Mobility Department)

Measure P2.2 "Electric vehicles in municipal fleets" was set up in order to promote the uptake of electric vehicles (EVs) in Palma's municipal fleets. Considering that before DYN@MO there were no electric vehicles in Palma's public fleets, the measure was to some extent a local challenge. The inexperience in such technologies together with their high cost of acquisition have somehow affected the initial goals in terms of numbers (initially 21 EVs owned by public local entities + 20 EVs for city subcontractors) and especially types of vehicles. During the course of the project the measure objectives had been reformulated several times to be in line with the actual findings and opportunities, and even with the delays, the overall result is positive as at the end of the DYN@MO project Palma has 44 EVs in its municipal fleets: 6 owned by the City, 7 in local public companies, and 31 in the fleets of some city service subcontractors (street light maintenance, park maintenance, etc.). Charging infrastructure goals have also been achieved with more than 20 charging points used by these vehicles. It is also relevant that the mayor's office acquired 1 EV for its official trips, which has a great impact on public perception.

More information on the measure and its results is available at: www.civitas.eu/P2.2.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- When installing a new mobility system or service, make sure that they include **data communication systems**.

  To promote electric vehicles in municipal fleets, it is necessary to include a data communication system for charging points, to know usage and consumption and thus improve the management of electric vehicles.

- Give v**isibility** to the electric vehicles.

  The introduction of electric vehicles in municipal fleets is an action that serves to promote this type of vehicle among other administrations, but also among citizens. Thus, the dissemination through news in the newspapers or in open days to the public or directed to other administrations, have a positive effect.

- Consider all possible **sources of finance**.

  Another element to be taken into account is the knowledge, on the part of the people in charge of the public administrations, of possible financing lines (nationally or at European level) that would be helpful for the purchase of electric vehicles and also for the creation of the necessary infrastructure (charging stations). Such systems often require substantial initial investments.

4.9 Promoting the uptake of electric vehicles among the general public and goods distribution companies in Palma

The aim of **measure P2.3** was to **promote the uptake of electric vehicles among the general public and goods distribution companies**, with specific targets in terms of charging infrastructure, registered electric vehicles (EVs), incentives for EV users and dissemination events. All objectives have been achieved; only the target of 1,000 EVs in Palma is difficult to measure exactly (currently ca. 800 EVs are entitled to free parking, but there could be more EVs that aren't registered yet).

The main positive results of this measure are the increased amount of charging points (15 on-street and 18 at municipal parking facilities), the launch of a regional interoperable card for EV users (to be able to use the over 150 charging points in the Balearic Islands), the granting of incentives to EV users in Palma (free on-street parking, 30 minutes for free in underground car parks and vehicle tax deductions), and the numerous participation in the four major promotional events organised during DYN@MO.

Presentation of electric vehicles during European Mobility Week 2015 in Palma

More information on the measure and its results is available at: www.civitas.eu/P2.3.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- **Interoperability between municipalities** makes using an EV more convenient.

  This signing of a cooperation agreement between the Balearic Government and the municipalities that installed charging points allowed drivers to use the same card to use the different charging points on the island of Mallorca. Furthermore, a strong driver of this measure's success was that until the end of 2017, users of electric vehicles will be able to charge their vehicles for free at the charging points installed through the call for assistance of the Balearic Government.

- **Political will** plays a key role in promoting EVs use.

  A city that is EV-friendly must have proper infrastructure in place to support a growing ownership. Associated with this measure, the Regional Government announced the creation of 2,000 charging points in the Balearic Islands, thus demonstrating the political will to promote EV use, which was also helpful in progressing the measure as planned in the DYN@MO project.

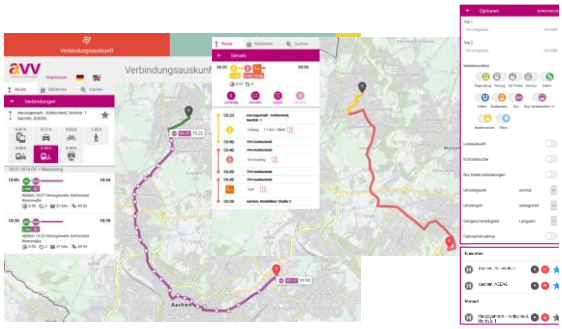
5 Deployment of ICT and ITS

Information & Communication Technologies (ICT) together with Intelligent Transport Systems (ITS) are the technical backbone to improve service quality of public transport; communication and maintenance of transport systems; support for preparing, discussing and updating sustainable urban mobility plans; and involvement of stakeholders and citizens into these processes. Within DYN@MO, all cities – apart from Koprivnica – implemented a diverse set of measures in this realm.

Below please find for each measure a summary of the activities within the measure, followed by measure-specific lessons learned and policy recommendations for local policy-makers and technicians.

5.1 Establishing a mobility platform in Aachen

With the introduction of a Mobility Alliance in Aachen in **measure A3.1 "Mobility Alliance"**, local mobility providers for bus, trains, car sharing and pedelec sharing worked together in order to develop a mobility platform for the regional transport market and to offer multimodal and intermodal mobility options for citizens. As a first step a market analysis was conducted. On this basis, a first Mobility Alliance concept was elaborated, including various organisational, financial, technical and legal issues. In the implementation the pilot phase of a Mobility Alliance with 100 test users was carried out from April to July 2016. The test users tried a simplified integrated access to buses and trains as well as the city's car sharing and pedelec sharing schemes, including joint registration and chip card access to the car sharing and pedelec sharing vehicles. In addition, a new multimodal information and routing platform has been introduced by Aachen's Transport Association AVV, available from www.avvmulticonnect.de. Furthermore, through the work in the project the cooperation of the mobility service providers was strengthened.



Example of multimodal connection information from www.avvmulticonnect.de, AVV, Aachen

More information on the measure and its results is available at: www.civitas.eu/A3.1.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- When developing a mobility platform, **plan a test phase with a limited number of users** to gather detailed feedback and to adapt the platform to the users' needs.

  Within this measure the mobility platform was tested for several months by 100 test users who provided feedback to the different features of the platform and the chip card that was given to

them. Based on the feedback, the AVV confirmed that indeed the acceptance and usability of the platform would increase if there is an integrated booking and billing system. Based on the feedback, it also became obvious that the organisation of a mobility alliance should be centralised. This central institution should be able to provide a monthly overview of mobility costs to avoid that a customer receives individual invoices from different mobility providers. There should be one invoice that includes all modes of transport.

- When developing multimodal travel apps **plan sufficient time for the preparation phase** as many partners are involved.

  In measure A3.1 more time was needed than planned to consult with all partners during the preparation phase, esp. for the development of the business model of the mobility alliance. The coordination and administration was much higher than planned.

- When developing multimodal travel apps **integrate all information directly in the app**; avoid linking only to information on certain modes.

  Test users of the travel app developed within this measure were not happy with the linkage between AVVmulticonnect and the parking information, because the user was forwarded to the external homepages of the parking provider. But users rather want an integrated design and information system. The new routing information system with the (display of the) combination of different transport modes was assessed as very positive and would help to simplify an intermodal trip.

5.2 Establishing a multimodal travel app in Aachen

Measure A3.2 "Travel Assistance – individualised notification system" involved the development of a travel assistance system including real-time data on public transport, alternative routing based on real-time information and current public transport event information such as traffic deviations, construction sites or public events. These features were implemented from 2013 to 2016 in the passenger information systems of Aachen's Transport Association AVV. In October 2013, the AVV started its "Customer Dialogue 2.0" in social media (Facebook, Twitter, Instagram, YouTube and Blog). In the newly developed multimodal platform of measure A3.1 "Mobility Alliance" all real-time and event features were included. Moreover, the test users of the accompanying pilot phase (100 test users from April to July 2016) with a Twitter account (18 test users) shared tweets and retweet about their trips.

Multimodal travel assistance app of Aachen's Transport Association AVV

More information on the measure and its results is available at: www.civitas.eu/A3.2.

Lessons learned and policy recommendations
(for local policy-makers and technicians)

- **Reliability and immediacy** of information is of paramount importance.

  Test users of the system rated real-time data, information about connection risks, and suggestions for alternative connections in case of delays as the most important features. Evaluation results indicated that approximately 85% of surveyed users had accessed the new website at least once.

- **Social media** is helpful when applied well, but it is not a catch-all.

  Regarding the evaluation results, the acceptance of social media application in the context of public transport services was not very high during the whole DYN@MO project lifetime. On the one hand, offering a social media channel that provides quick reactions and personal contact is regarded as very important by the customer. The use of social media elements became the typical means of communication with the customers. Furthermore, public transport users wanted to be informed about delays, disorders, schedule changes on their own or communicate their opinions. But on the other hand it became clear that from the users' point of view nowadays it was not necessary to directly integrate social media channels into connection information of bus, train, sharing offers or other mobility options. Those users who are interested and active in social media want to communicate with AVV directly via their preferred social media channel. In case of AVV Facebook is used as the main dialogue channel. Based on these evaluation results, AVV is continuing an active dialogue on Facebook, but will not integrate social media features within the multimodal information platform.

5.3 Developing a traffic model for Gdynia

The main objective of **measure G3.1 "Traffic model development to expand Gdynia's SUMP"** was to set up a 3-level transport model for Gdynia, which provides sound data and information for updating Gdynia's SUMP. The model was to be a tool to accomplish detailed analyses and verification of effects on mobility management initiated by the SUMP. Furthermore, it was to provide the basis for the realisation of infrastructure improvements aimed at increasing the attractiveness of alternative modes of transport. The model was also the basis for analyses, evaluation of different scenarios of measures, and presentation of results in measures G1.2, G1.3, G3.2, G.3.3, G3.4, and G3.5.

Before the DYN@MO project, Gdynia had no model and all traffic analyses were tendered. At the start of the project, within this measure a complex traffic survey was conducted for Gdynia, covering both public and individual transport to investigate transport behaviour, preferences and needs for the local community. Also, a detailed disaggregation of districts within the area of the city was done, together with a detailed analysis of traffic and public transport parameters/ effectiveness of measures for the road network and PT transport lines. This was the basis for the development of a transport model consisting of three levels: a macroscopic, a mesoscopic and a microscopic model, the latter enabling the verification and demonstration of results obtained from the macro- and mesoscopic models. The model provided important input for the community projects within measures G1.1 "Advancing

towards a dynamic SUMP" and G1.2 "Community project studies from SUMP", the MobilnaGdynia internet platform established in measure G3.4 "Mobility 2.0 communication" as well as for the evaluation of different scenarios of measures, and the presentation of results in measure G1.3, G3.2, G.3.3, and G3.5. More specifically, the model was used for:

- the analysis of the effectiveness of a Personal Rapid Transit system in Gdynia (measure G1.2 "Community project studies from SUMP"),
- the analysis of changes in traffic organisation (changing course or line extension of public transport, including trolley lines, bus lanes, closures and modernisation of streets) (measures G1.2, G1.3, G3.1 and G3.5),
- the analysis of the impact of road accidents on traffic conditions (measure G3.2 "Setting up an automatic traffic incident detection in Gdynia"),
- the analysis of the usage of the weigh-in-motion system to manage freight transport accessibility (measure G3.3 "Weigh-in-motion and enforcement"), and
- the publication of the results on the Mobilna Gdynia website (measure G3.4 "Mobility 2.0 communication").

The implementation of TRISTAR, the Tricity's integrated traffic management system, in Gdynia provided the opportunity to supply the 3-level model with information on traffic intensity in real-time.

The added value of the measure is that the model is continuously being updated and fed with data from TRISTAR. The tool is also available to investors when planning new investments in the city, which don't need to subcontract the analysis, but can do it in-house.

Since its availability, the transport model is used by the City of Gdynia employees in many ways to help with planning and operating sustainable traffic measures and personal mobility.

- Using the model they are able to analyse traffic in Gdynia and implement changes to give priority to sustainable mobility over individual car traffic.
- They are able to analyse and visualise changes in traffic during road repairs and minimise congestion created by them (i.e. during the implementation of bus lanes).
- The model was also used during the implementation of bus lanes (on 10 Lutego, Władysława IV, Morska, Estakada Kwiatkowskiego and Chwarznieńska streets) and bicycle lanes (on 3 Maja street) in Gdynia.
- The model is used to monitor impact of changes in traffic control system and testing different traffic control strategies and programmes.
- The City also uses the model to examine changes proposed by different stakeholders, e.g. suggestions from NGOs and citizens.

More information on the measure and its results is available at: www.civitas.eu/G3.1.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- Plan well, considering the **availability of data** needed for the development of a transport model.

  The verification and calibration of the model was delayed, as data from several sources was not available on time, e.g. because a survey had to be postponed due to problems during the tendering procedure to find an organisation to conduct the survey, or due to the late implementation of a cross-city traffic management system, which was implemented later than planned as the coordination process took longer than planned.

- Make sure that **data needed is applicable** for the transport model for model calibration.

  Some of the data received from other organisation could not be used for the development of the model because it did not match the required level of detail, e.g. in terms of observing the origin and destination of passenger trips. Also, data input from different city departments differed from each other and it was difficult to be brought in line. Therefore, the preparation for the development of a three-level transport model should be preceded by intensive internal consultations and presentations of potential applications of the model. Especially for people not directly involved in transportation planning this might be beneficial in terms of building a common vision and understanding the model's requirements. The data needed should form the basis to standardise the methodology of data provision between selected providers of data, esp. city departments.

- When developing a transport model, use **standard software applications** in terms of information input and expected results.

  During the development of the model, it became apparent that the development of a coherent and effective modelling environment requires standard software applications in terms of information input and expected results. This implies that incompatible data standards require time consuming adaptation. To ensure the compatibility of the macro and mesoscopic model and TRISTAR data, a reference database had to be developed to help feed the mesoscopic model with macroscopic model data, the microscopic model from the macroscopic or mesoscopic model and the macroscopic model with TRISTAR data.

- **Start with a macro-level model** when developing a transport model for a city for the first time.

  The implementation of a transport model is closely related to each city's needs, available resources and transport policy priorities. Strategic level models (macro models) are easier to implement because they are less time and resource consuming due to the high level of simplification at the cost of accuracy. In Gdynia, the development of the comprehensive transport model could have been divided into phases including different levels of coverage and details. However, this approach has a possible drawback in terms of changing transport policy principles, limited funds and requirements to provide coordination between different models in a changing city environment.

5.4 Setting up an automatic traffic incident detection in Gdynia

In **measure G3.2** it was planned to install a pilot **automatic traffic incident detection** (ATID) system at two traffic hot spots in Gdynia, which were supposed to lead to:

- a shortening of the time of road accident detection by 50%
- a shortening the time of the rescue operation by 20%
- a decrease of number of fatalities in road accidents by 20%
- improved traffic conditions due to shortening the time of rescue operation

In this respect the long-term objectives of the measure were to improve the safety for transport users and to optimise urban mobility by improving the management of traffic. Within this measure it was planned to equip junctions (along arteries with traffic signals) and/ or use infrastructure from TRISTAR – the Tricity's integrated traffic management system and at the same time the first Polish incident detection system on city roads – (inductive loops, etc.) with devices based detection systems. A pilot project for the two most dangerous junctions in the city was planned to test the compatibility of the incident detection technology with ITS and chose the optimal technology.

Based on the results of European research, it is estimated that the use of transport telematics can reduce the response time and the intervention of the emergency services by up to 30% and the use of emergency calls automatically generated by the systems used in these vehicles can increase the probability of survival of accident victims by 15%. Another reason for introducing solutions to improve transport management by automating operations is that traffic incidents are a main cause for congestion. It has been estimated that 50-60% loss of time on dual carriageways and motorways in urban areas are due to traffic incidents. On Gdynia's urban roads there are about 2,000 accidents and collisions per year.

Unfortunately, it was not possible to implement the pilot project planned in this measure within the lifetime of the DYN@MO project. While the TRISTAR system together with the traffic management centre is operating in Gdynia, it is owned by the City of Gdynia only since 16 October 2015. The ATID system was to be operated from the traffic management centre but due to the ownership laws the City of Gdynia had to get permission from that company to implement it. Unfortunately there was a lack of cooperation and no or insufficient technical details passed on to the City of Gdynia by that company.

Although it became clear already in the 3rd year of the project that the pilot project on the ATID system at two traffic hot spots in Gdynia could not be implemented during the lifetime of the project, the measure team continued to work on this measure in order to be able to implement the system after the end of the DYN@MO project which is still regarded as possible and worthwhile. Work focused on the mathematical algorithms which will be used for the ATID system. Algorithms were developed by using the neural networks method and time series. The algorithms were verified with satisfactory results (using offline data) and are now ready to be implemented into the TRISTAR system.

More information on the measure and its results is available at: www.civitas.eu/G3.2.

Lessons learned and policy recommendations
(for local policy-makers and technicians)

- Technologically sophisticated **systems are not "one size fits all"**.

  This measure is not a subject for direct replication due to its reliance on the TRISTAR system, which is unique to Gdynia. More generally, a number of prerequisites must be met to create a base for automatic incident detection technology, the most important being availability of a fully operational traffic management system. There are different specifications and possible functions of traffic management systems. Traffic incident detection should be included into a technical specification from the very beginning to facilitate later improvement of a system. Despite this, issues with compliance with standards still might occur, and ensuring compatibility of different systems requires a lot of effort. Furthermore, a high level of research is required to develop, test and implement detection algorithms. In each case they have to be adapted to the local situation, data quality and system's overall performance.

- Data can and should be gathered from a myriad of **reliable and complementary data sources**.

  Automatic incident detection systems need to be calibrated with accurate and current data about duration of incidents in selected area, as well as duration of rescue operation. This requires close cooperation of all institutions which are involved in traffic incidents rescue or control such as police, fire department and paramedics. A thorough survey of the data is critical to verify what is available and which institution would be the most reliable source of information.

5.5 Implementing a weigh-in-motion and enforcement system in Gdynia

The main objectives of **measure G3.3 "Weigh-in-motion and enforcement"** were:

- to prepare a feasibility study for access restriction of heavy and overloaded vehicles,
- to introduce a weigh-in-motion (WIM) system at one entry point of the city,
- to cut road maintenance costs due to overweight trucks on controlled roads by 15%,
- to reduce the number of overweight trucks on city roads (by 90% on controlled roads) to decrease environmental and noise pollution and to increase road safety, and
- to share the experiences with Polish cities.

Before the DYN@MO project, there was no weight pre-selection system in the City of Gdynia or in the region. Such systems were innovative in Poland at that time and were only implemented in a few cities. At the start of the DYN@MO project, the possibility of installing scales at 14 different points around the city was analysed in a feasibility study. Potential locations were analysed for traffic intensity, pavement quality and use by heavy goods vehicles (HGVs). Based on the verification it was determined that scales could be located at:

- ul. Janka Wiśniewskiego, ul. Kontenerowa, Trasa Kwiatkowskiego
- ul. Janka Wiśniewskiego, ul. Morska

Finally, due to the vicinity of the port and heavy transit traffic, it was decided that the scales for the pilot WIM project should be installed on Janka Wiśniewskiego Street, in the Obłuże district direction in December 2015. Acquiring data began in January 2016. In April 2016, when weather conditions allowed, the system was first calibrated and finally commissioned for category B+(7). An important reason for having chosen this location was also the proximity to the fixed scales on Kontenerowa Street which enable verification of vehicles identified as being overloaded and hence allow the enforcing of penalties (the present regulations do not permit the imposition of penalties solely based on weigh-in-motion measurements).

Video surveillance point of weigh-in-motion system at Janka Wiśniewskiego St., Gdynia

Despite the pilot nature of the system, the system proved to lead to a reduction in the number of overloaded vehicles leaving the port and going further via Estakada Kwiatkowskiego and onto the network of national roads. To that end, agreements were made with the monitoring institutions authorised to carry out inspections of HGVs: the police (agreement signed on 26 August 2016) and Road Traffic Inspection (agreement signed on 24 August 2016). Subject to these agreements, web application login data was provided, with offence information being made available to these institutions in real time.

Polish legislation prevents the imposition of penalties directly, based on data acquired from the WIM system. Therefore, the institutions have to weigh the vehicles on certified scales or weighbridges. In Gdynia, there are certified scales located on Kontenerowa Street, and vehicles pre-selected by the WIM point should be directed there.

More information on the measure and its results is available at: www.civitas.eu/G3.3.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- Carefully **review formal regulations** before planning weigh-in-motion systems.

  A thorough review of existing formal regulations regarding weigh-in-motion systems must precede implementation. It is crucial when enforcement is planned as part of the system. In Gdynia, the major problem is that the Polish legislation prevents the direct imposition of penalties based solely on data acquired from the WIM system. When an overloaded vehicle is detected, the institutions first have to weigh it on certified scales or weighbridges before being able to impose fines.

- WIM systems should **not be implemented by the city administration alone**.

  An institution officially in charge of truck weighing and enforcement of fines (in Gdynia this is the police or Road Transport Inspectorate) should be involved as an active partner from the very beginning of implementation. The City of Gdynia implemented the WIM system on its own, having to seek cooperation with responsible bodies thereafter. The earlier these entities are

involved, the smoother the decision-making processes can be, as all involved parties are well informed.

- **Inform stakeholders** early.

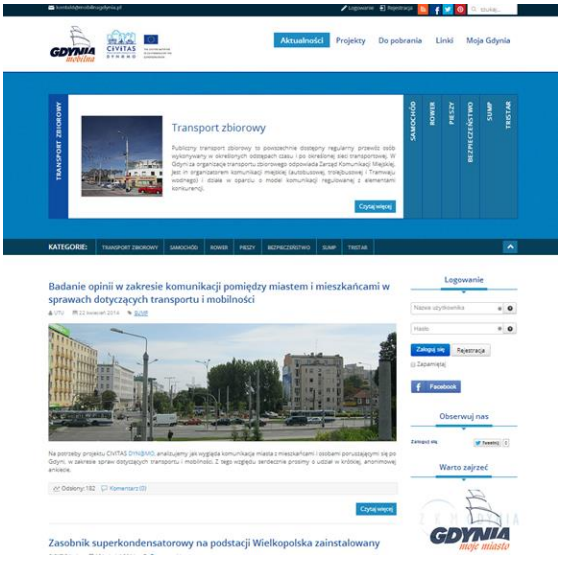
  Already during the preparation phase, the City of Gdynia sent an information letter to the Pomeranian Association of Road Hauliers to inform them about the implementation of the WIM station. The main objective of this letter was to keep road hauliers updated about measures influencing their everyday business activities and to show benefits of compliance to existing road transport regulations.

5.6 Gdynia's mobility communication platform "Mobilna Gdynia"

The main objective of **measure G3.4 "Mobility 2.0 communication"** was to develop a Mobility 2.0 communication platform to allow an interactive dialogue with Gdynia's citizens, providing the necessary support for public consultation and planning of SUMP actions. At the beginning of the project, there was no internet platform providing such a possibility. There were only few or ineffective tools and means to reach the public and raise awareness and knowledge on SUMP (such as: press conferences, press articles, formal and informal meetings with inhabitants). Taking into consideration the above mentioned, it was decided by the City of Gdynia to develop a Mobility 2.0 communication platform in cooperation with Gdansk University of Technology, combining elements such as: thematic forums, surveys, descriptions of activities and plans, simulations, presentations of good practices. It supported and continues to support the full-scale implementation of Gdynia's measures and has created a basis for updating and extending Gdynia's SUMP.

One of the first activities in the measure was the creation of the Mobilna Gdynia fan page on Facebook in March 2013, which became the first channel of online public participation in Gdynia. Thereafter, the internet platform for Mobility 2.0 communication (www.mobilnagdynia.pl) was developed by the City of Gdynia, in cooperation with Gdansk University of Technology. The website was launched on 10 February 2014. Since then, as of 2 November 2016, the platform has had 55,223 users, 186,539 total entries, and 83,572 sessions.

More information on the measure and its results is available at: www.civitas.eu/G3.4.



Mobilna Gdynia main page (www.mobilnagdynia.pl)

Lessons learned and policy recommendations
(for local policy-makers and technicians)

- Mobility 2.0 services are **more accessible to some target groups than to others**; special consideration should be paid to groups that may not be easily reached.

  In the preparation phase of measure G3.4, Gdynia faced difficulties reaching specific groups of users not falling within the "digital natives" group. The nature of web 2.0 surveys narrows the group of actively involved people to those who are everyday users of modern communication channels. Therefore, Mobility 2.0 services should be broadcast in many forms of media to reach new users; this refers to traditional press, local information websites, etc.

- Mobility 2.0 services must have **added value**.

  The Mobility 2.0 services implemented in Gdynia faced competition from pre-existing websites related to public transport issues, run by transport operators, organisations, etc. With a number of other websites with partly similar content, some of which were available longer than the Mobilna Gdynia website and thus are more visible to the users, Gdynia needed to clearly define the purpose of Mobility 2.0 services and carefully position them among other similar services in order to eliminate duplication and competition. Integration with existing communication activities is highly advisable to avoid confusion with too many activities and provide the best use of existing resources.

- Mobility 2.0 services must be **well maintained and always up-to-date**.

  It is important to factor in resources for maintaining Mobility 2.0 platforms and services. Gdynia's experience indicated that after an initial phase, eager maintenance of the platform becomes an everyday task. Therefore, it should be clear who will be responsible for updating the service and what that entails. Usually it takes much more time than previously planned and has to merge with other tasks. Hence, a dedicated personnel effort should be ensured to keep the service up-to-date and running.

5.7 Implementing dedicated bus lanes control with the use of ITS in Gdynia

The main objective of **measure G3.5 "Dedicated bus lanes/ HOV lanes control with the use of ITS"** was to introduce dedicated bus and high occupancy vehicle (HOV) lanes along major arterial roads. This was to contribute to the: (1) increase of the share of public transport (PT) in the modal split with the target of 85% PT and 15% HOVs on the dedicated lanes, (2) improvement of the quality and punctuality of PT travel and service, (3) assurance that PT is more competitive with individual transport (due to shorter journey trips) and (4) decrease of the number of car trips and cars to achieve 10% less congestion.

At the beginning of the project, there were no HOV lanes/priority bus lanes in the City of Gdynia. Such lanes were at that time very innovative in Poland. Within this DYN@MO measure, three bus lanes were introduced in Gdynia in 2015. The implementation was preceded by research led by experts from Gdansk University of Technology and simulations

conducted with the use of transport model for Gdynia elaborated within DYN@MO in measure G3.1 “Traffic model development to expand Gdynia’s SUMP”.

Dedicated bus lane at Władysława IV St., Gdynia

Two of these dedicated lanes are situated on streets leading to residential areas of the city with high population density – namely Obłuże and Witomino. According to the transport model the bus lanes would lead to the reduction of journey time by public transport by 10 minutes. The third one is located on Władysława IV Street – an important street in the city centre. The latter was equipped with a video camera system, enabling the identification of unauthorised cars and drivers driving on the bus lane. The system is a part of TRISTAR, the Tricity’s integrated traffic management system, and after the testing and calibration period it is foreseen to be an instrument to enforce the existing traffic law.

After the introducing of the bus lanes, the City of Gdynia conducted an awareness-raising campaign on the bus lanes, consisting of events focused on the idea of bus lanes in Gdynia, and an e-leaflet that was published on Mobilna Gdynia and sent to stakeholders.

Within the lifetime of the project, the positive attitude of the inhabitants towards the introduction of bus/HOV lanes in the city has significantly increased. The survey conducted on the bus lanes revealed that citizens regard the existing infrastructure of the bus lanes as good and want it to expand. 44% of inhabitants answered that the existing bus/HOV lanes should be expanded to the greatest possible extent and 21% wanted the expansion to happen only on the main arterial roads.

The evaluation of the bus lane on Władysława IV Street revealed that, since the implementation of the bus lane, no change of the modal split had been observed. This refers to traffic counts which covered all lanes including the bus lane. Between October 2015 and October 2016 the total number of private cars decreased only by 0.3% while the total number of buses remained the same. Also, on average travel time of buses decreased by only 7 seconds after implementation of bus lane, which still transforms into 4,776 litres of fuel less per year in public transport at this 750 m section.

The main challenge is that according to current national law, the City is not able to enforce fines. Since 1 August 2016 the City regularly passes information on unauthorised vehicles to the police and they act on this. Thanks to this close cooperation the number of unauthorised vehicle on the bus/HOV lanes dropped from 420 (in the first week of August 2016) to 165 (in the last week of October 2016). Furthermore, the use of these advanced technologies allows the City of Gdynia to collect valuable data which are important for the further planning.

More information on the measure and its results is available at: www.civitas.eu/G3.5.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- Both **political and public support** are essential pillars of implementation.

  Political commitment at a local level is required when changes to existing patterns of transport infrastructure utilisation are considered for implementation. Changes have to be included into long-term transport planning documents to ensure a comprehensive approach. If a pilot action in the form of a single bus lane section is planned, it is advisable that it is considered as a part of a wider concept of improvement to public transport schemes. This public support should take a form of well-aimed promotional activities, showing the benefits for commuters related to implementation of bus lanes. This may be related to perceived decrease in travel time and better punctuality of public transport services. Taking into consideration results of surveys in Gdynia, even a short section of bus lane may positively influence a perception of travel time. This is important to get a support of the public transport users which could counterbalance opposing voices coming mainly from private car users.

- **There is no need for an "all or nothing" approach** when it comes to dedicated bus lanes.

  Dedicated bus lanes are intended to influence public transport performance providing they form a well-developed network covering as many of the roads as possible. However, even separate elements of the network may change attitudes towards such a solution among commuters and the general public. This should encourage local authorities to start a pilot implementation of bus lanes at selected road sections. However, such pilots should be immediately followed by follow-up projects to maintain the momentum.

5.8 Mobility 2.0 services in Palma

Within **measure P3.1 "Mobility 2.0 services"**, the City of Palma has developed a comprehensive information platform on mobility (public transport, car parks, charging points, taxi stops, public bicycle stations and traffic service) that can be accessed over the internet (website) and via applications on smartphones. This platform is known as MobiPalma and has a smartphone app with more than 1,200 daily users and a website (www.mobipalma.mobi) that integrates all the transport information of the app as well as mobility news and documentation (like the SUMP). Within the measure a new website for the local public transport operator EMT has also been launched in September 2016, with improved usability and better quality of information. The launch of the Telpark application in 2014 substituted the original plan of a smartphone application to pay bus tickets, which would have been a complicated and expensive action as it would require the extensive modification of the on-board equipment installed on EMT buses. Telpark allows street parking payment via smartphone and can send warnings to

Welcome screen of MobiPalma app

the user about the remaining time. Its usability and attractiveness has led to a constant increase of users, reaching a 5% increase of payments in less than two years.

The main objective of this measure was to increase the attractiveness of sustainable mobility for the so-called “digital natives”, and this has certainly been achieved as the use and impact of existing mobility applications, websites and social network profiles is growing steadily in Palma (Facebook followers have multiplied by a factor of 10 between 2012 and 2016, while in Twitter the growth hast reached a factor of 8). In parallel, the amount and quality of users’ feedback has steadily increased due to the impact of the mobility awareness campaigns and the creation and active management of profiles in social networks (Facebook, Twitter and YouTube). In 2012 Facebook messages were around 50 per month and in 2016 it has peaked over 1,100, while in the same period Tweets have raised from 100 per month up to 2,400. These so-called Mobility 2.0 activities have certainly helped improving local policies in the field of sustainable urban transport and it is expected to continue evolving towards a more consistent tool for bilateral communication and planning.

More information on the measure and its results is available at: www.civitas.eu/P3.1.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- When developing mobility apps **plan sufficient time for the preparation phase** as many interests are involved.

  Within this measure the opinions and input from different departments of the city as well as the public transport operator had to be coordinated. It proved to be very difficult to reach agreements which led a delay in the implementation of the App.

- **Manage social network profiles professionally**.

  In Palma, the public transport operator EMT hired an external company to manage the company’s profiles on Facebook, Twitter and YouTube. Hiring a so-called community manager has facilitated the more regular creation of updated content and quicker responses to users. It also enabled the social networks to become a new channel of communication between the company and the users. This strategy proved to be successful and the number of followers has increased continuously. Unlike EMT, the city’s Department of Mobility does not have the support of an external company to manage their social networks. Instead, staff from the department was responsible for generating content but they neither had the necessary knowledge nor the time to properly manage the profiles. This is one of the reasons why the city’s social network profiles have fewer followers.

- **Advertise** newly developed mobility apps **widely**.

  Palma’s partners conducted several comprehensive campaigns to raise awareness about the availability of the mobility applications developed during the project. Promotion was carried out through posters, brochures and stickers (at the sides of the public bikes, at the parking ticket vending machines, etc.). Also, news items were published on social networks and in local newspapers. These dissemination activities were one of the main factors for the high number of download of both the MobiPalma and EMT apps, which have been download almost 200,000

times, which means that about have of the city's inhabitants have installed any of these apps on their smartphone.

5.9 Setting up a parking guidance system in Palma

Within **measure P3.2 "Parking guidance system"** the Municipal Parking Society (SMAP) developed a new dynamic information platform for parking in Palma by implementing a common system to provide parking data, the update or renewal of technologies and software in each parking facility, the installation of 18 dynamic car park occupation panels (and 68 static signs) in carefully designed points of the city, and the integration of the dynamic information in the recently created mobility app MobiPalma (see measure P3.1 "Mobility 2.0 services"). The process involved a total of 14 underground carparks, seven controlled by SMAP and seven controlled by different private operators, with a total 5,402 parking spaces. Moreover, in order to increase intermodality the local public bus operator (EMT) modified a route to connect with a parking facility and SMAP introduced discount fares at P&R sites, 30 free bicycles for clients and bicycle parking at all its sites.

Dynamic car park occupation panel at Avda. Alexandre Rosselló, Palma

The guidance system started operating during the summer of 2016 and the initial results show that the demand responded almost instantly to the provided information as occupation records have been achieved in several parking facilities and a remarkable increase of visitor demand has been experienced in car parks outside the area of the historical centre. The implementation was slow and complicated though it brought many interesting lessons for the involved partners. The main success of the measure – besides the increased amount of panels (18) installed compared to the original goal (14) – has been to overcome the difficulties of a process driven by public and private actors, in terms of investment, technological competences and the differences in perspectives and priorities among the operators. Hence, this public-private partnership has become a local success story which is already on its way to reach the longer term objectives of the measure such as to reduce congestion, increase underground parking occupation (especially at P&R sites), increase shopkeeper satisfaction with the parking situation and promote cycling, walking and PT use from/to underground car parks.

More information on the measure and its results is available at: www.civitas.eu/P3.2.

Lessons learned and policy recommendations (for local policy-makers and technicians)

- **Cooperation** among all operators is helpful and may be aided by a public entity serving as the mediator.

  Within this measure, the public entity defined the system and conducted the necessary tests to verify the reliability and performance. This favoured an easy and rapid expansion to other private car parks. The measure relied to a great extent on the willingness of diverse parking operators to cooperate, which are sometimes in competition with one another. Ongoing communication efforts should be made to clearly explain the shared benefits of the initiative and gain their support. Good communication is also necessary for technical purposes, since the same information from each parking operator is required in order to build a common connection system.

- **Integrate** the new system into **today's plans** and building codes.

  For future implementation of the system in all city private parking lots, it is advisable to insert in the building authorisation a clause requiring owners of new parking lots to interface with the system in order to have an expandable system. It is also important to include monitoring and control clauses, which oblige operators of private car parks to meet the requirements of the agreement.

- A parking guidance system **improves space efficiency**.

  With the implementation of the parking guidance system in Palma, the number of vehicles increased in the Sa Riera and Santa Pagesa P&R. These car parks are close to the city centre and have nearby bus stops that facilitate access to the city centre. The measure results also indicate that the great majority of car park users spend less than five minutes waiting at the queues at the car parks. In 2016, 82% of respondents perceived it as easy or very easy to park in the car parks of the city, compared with 42% of respondents 2013.

  The evaluation also revealed that P&R car parks experienced much higher demand – higher by several thousand vehicles per day – after the introduction of the parking occupancy signs. It is reasonable to suppose that this is a city-wide impact, as these vehicles would likely have previously travelled to a central car park.

6 Recommendations for EU policy-makers

Each of the aforementioned measures yielded lessons learned and policy recommendations for local policy-makers and technicians. Similar lessons can be drawn from many of the measures, including the importance of community and stakeholder involvement, early political engagement, and sufficient planning, to name a few. The measures also provided insights that are useful for EU policy-makers, indicating the importance of funding to achieve certain results, as well as the challenges that some cities face in terms of national context. By understanding these drivers and barriers, EU policy-makers can consider these lessons learned as they forge ahead with the development of new policies and the elaboration of existing ones. The EU's potential to influence the success of city-level solutions is powerful and can perhaps be constructively bolstered by taking into account the experiences and recommendations from CIVITAS DYN@MO.

6.1 General recommendations

- **Invest in educational and training programmes** tailored to address the challenges faced by cities today.

  In *Koprivnica*, the newly established University North would like to become a major player at the regional level. Currently many contacts with other universities are being established, mostly universities from the surrounding countries of western Balkans who see the University North as an organisation from the EU and want to use this cooperation in order to improve their work. There have been several meetings with the University of Novi Sad from Serbia that has shown interest in participating in the implementation of the study programme in clean urban mobility. This in itself is encouraging, as is the greater goal of training transport and urban planning professionals to address practical issues that cities face.

- There are great economic and employment benefits to be reaped from **increased funding for sustainable mobility projects**.

  During the DYN@MO project, Croatia established the EU Operational programmes for the period 2014-2020. This document set a goal to fund sustainable mobility projects. "Business as usual" transport development projects that are not based on sustainable mobility will not be funded, therefore, main investors, mostly public bodies, will have to focus on sustainable mobility in order to finance investments in the transport infrastructure. This is causing an increased interest and demand for sustainable mobility experts that can manage such projects.

- **Mobility measures** are an effective way to take on **social policy objectives**.

  Activities in DYN@MO also relate to the Commission's White Paper "A strategy for Europe on nutrition, overweight and obesity related health issues", which aims to reduce the risks posed by the aforementioned issues and references the important role of transport, specifically travelling to and from work by walking, cycling or in any other physically active way. *Aachen*'s pedelec sharing system, the establishment of new pedestrian areas in *Gdynia* and new walking routes towards the historic city centre in *Palma*, the provision of campus bicycles and pedelecs for the zero CO_2 University Campus in *Koprivnica*, and the expansion of the city bike scheme in *Palma* were measures that influenced modal split in favour of active travel. Though the health impacts cannot

be traced through the scope and duration of the project, there is sufficient evidence to indicate that such modal shifts are associated with positive health outcomes.

Additionally, measures that expanded the mobility options for under-served populations had visible impacts on those groups' access to other parts of the city. For example, measure K2.2 "Low Emission Public Transport" introduced public transport service in Koprivnica, where there had been none whatsoever before. The impact was particularly important for older people who previously had been reliant on lifts from friends and relatives. This therefore provided connectivity and accessibility for people who had previously been more limited in their travel options.

Similarly, measure G2.1 "Innovative Li-Ion hybrid trolley buses on new Line" introduced public transport service to a new area previously unserved which was therefore a major increase in connectivity for this area.

- **Modern technology presents new opportunities** for stakeholder engagement.

  Each of the four DYN@MO cities has used social media and other web 2.0 technology to communicate with their citizens. This provided useful guidance for the implementation of measures ranging from SUMP development to ITS installation. The communication and engagement possibilities presented by modern technology should be taken into account at an EU policy level, e.g. taking into account that cities can now use this means of communication, encouraging them to incorporate citizen engagement, and pushing them in that direction so that their measures may be more successful and appreciated by the public. Evaluation results of measures involving Mobility 2.0 techniques indicated that such strategies resulted in unprecedented public involvement in mobility issues for the cities. The biggest impact was involving age groups in public participation who had not been involved in more conventional forms of public involvement (e.g. public meetings) previously.

- **EU projects** provide a good basis for instilling in cities **a systematic approach to evaluation**.

  Before the DYN@MO project commenced, the four project cities had little in the way of evaluation strategies. The pre-existing evaluation experience had been acquired through previous EU projects, but there was no knowledge or experience in conducting an ex-post evaluation, and little in the way of traditions to evaluate or monitor a measure following its implementation. Through DYN@MO, the cities' data collection practices were optimised and the value of evaluation as a crucial component of a measure, rather than an additional task that follows a measure, was instilled. The results of the project's rigorous evaluation practices can be read about in depth in the Measure Evaluation Result Sheets and the project's Final Evaluation Report.

6.2 SUMP recommendations

- Provide **funding** for cities for the development of SUMPs.

  The fact that SUMP measures were a prominent aspect of this EU funded project, and that there were related planning and reporting obligations, meant that measure leaders and partners were constantly aware of the time plan and the time frame in which the SUMP had to be finalised. This facilitated an overall excellent planning throughout the project. Also, the DYN@MO framework that included SUMP made it easier to involve citizens and politicians and to create participatory bodies

for all measures. Furthermore, each city's SUMP led to a wider range of more sustainable transport measures than in previous plans or practice.

- Push Member States to **make availability of an approved SUMP prerequisite for national funding** for sustainable urban mobility measures.

  In *Palma*, for example, one important driver for the development of the SUMP was that since 2011 national subsidies for urban public transport now depend on the availability of an approved SUMP (Law of sustainable economy, 2/2011).

6.3 Clean and energy efficient vehicles recommendations

- Cities can effectively advance the transition towards **energy efficiency and renewable energy in transport**.

  DYN@MO's investments in measures focussed on renewable energy and energy efficiency, and their subsequent measured impacts align with the goals of the Communication "Energy2020 – A strategy for competitive, sustainable and secure energy" [COM(2010) 639 final]. *Gdynia*'s trolley system supercaps installed in measure G2.2, for example, resulted in an average energy savings of 32.5%, indicating how the actions of a city can advance the transition towards renewable energy use and greater energy efficiency.

- The transition from conventionally fuelled to hybrid and electric vehicles has a measurable impact on **reducing emissions**.

  With transport being responsible for about 25% of greenhouse gas emissions, a concentrated effort to reduce the emissions of vehicles has the potential to significantly improve air quality. This can be seen in the example of *Gdynia*, in which up to 5,000 kg of CO_2 emissions were saved by the introduction of buses with Li-Ion batteries, and *Aachen*'s testing of clean vehicles led to an informed decision to purchase a fleet that will result in significant emissions savings. Cities making similar transitions from conventionally fuelled vehicles to clean vehicles for their public transport fleets will thus be contributing to Europe's climate policy targets.

  This also holds true for private vehicles. In *Koprivnica*, measure K2.1 "Electric municipal car sharing scheme" secured a 25% reduction in total annual CO_2 emissions and a 28% reduction in total annual operating costs in the municipal fleet. Electric car sharing cars in a housing area in *Aachen* realised CO_2 savings of 80% per km compared to their internal combustion engine counterparts. Two further electric cars in Aachen's city administration secured a similar reduction in CO_2 emissions and cost half per km to run compared to diesel cars.

- E-vehicles and infrastructure require substantial investments; **provide incentives** to potential investors to support procurement.

  In *Aachen,* the implementation of electric vehicles was linked to high acquisition costs. The high prices and low ranges of the batteries led to a decrease of stakeholders' as well as of providers' acceptance resp. motivation. Furthermore, the high costs for the implementation of charging infrastructure influenced the willingness to make quick decisions. The local companies were reluctant to be involved in the implementation of electric vehicles because the added economic value was not great enough.

- Encourage Member States to invest in **local renewable energy production** in tandem with procurement of electric vehicles.

  The photovoltaic system, installed at Frankenberger Viertel (Turpinstraße) in *Aachen*, produced approx. 11,600 kWh per year. Two of the five electric vehicles in the measure A1.2 were directly powered by that system. Transport plays a key role in meeting overall decarbonisation goals, and local governments can use and create local resources to push that agenda forward.

- **National legal frameworks and market conditions** need to be taken into account.

  In *Aachen*, the introduction of the EURO 6 emission standard required lengthy tender procedures for hybrid vehicles. Furthermore, the changing market conditions and development of technology and research was faster than expected. After the introduction of EURO 6 there was no focus on hybrid systems anymore, because experts did not see any future in hybrid technology for utility vehicles. Hybrid drives got new legal, technical and constructive requirements, which indicated significantly less economic viability. Therefore a new market analysis became necessary.

6.4 ICT and ITS recommendations

- **Lack of affordable market solutions can be a barrier** in some EU countries.

  One of the main obstacles for *Koprivnica* in implementing PT measures was the lack of affordable market solutions regarding electric buses. Much research was necessary for the city to set up the public procurement tender that fit the requirements of measure K1.3 as well as fit in the city's budget. The resulting findings indicated that there are only a small number of producers that offer such a product on the European market, and none offers such a product in the Croatian market. Such conditions were a major barrier to vehicle purchase in Croatia, since there was no servicing network and therefore no possibilities to have a guarantee period. The latter point was particularly important because the vehicles carried a new technology which was expected to have difficulties in the starting period. This barrier instigated further research of alternative solutions. The outcome was a number of producers that offer the conversion of conventional vehicles into electric vehicles and offer the post-sale services and guarantee.

- **Encourage the collection of data**; consider providing data guidelines, as the collection strategies and level of detail of different entities varies widely.

  From equipping planners with valuable knowledge, to allowing the measurement of impacts, to providing information to citizens, data is an important feature of planning a modern urban mobility network. It was through a thorough collection and analysis of data that the DYN@MO project cities were able to successfully implement many of their measures. Data is not only useful on the planning end, but also on the user side of urban mobility, as providing users with relevant data facilitates their travel planning and decision-making. *Gdynia* used ITS and ICT based tools for data collection, modelling, and public sharing of information. Furthermore, *Aachen* and *Palma* relied heavily on data collected at the outset of the project in order to develop their SUMPs.