Potential of Soft Measures for Boosting the Transition Toward Sustainable Urban Mobility

An Applied Case: The European Mobility Week, Horsens

El Potencial de las Medidas Blandas para Impulsar la Transición Hacia una Movilidad Urbana Sostenible

Caso aplicado: La Semana Europea de la Movilidad, Horsens

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Final Dissertation

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ABSTRACT

Horsens has the third fastest growing population in Denmark, and it has started to reflect in the raising traffic levels. Although, Congestion is not the main challenge, but changing the modal split of the city. Currently, trips walking, cycling and by bus -together- account for less than half of the total.

This Thesis work comprises an initial exploratory essay of the transportation in Horsens, followed by a short review and analytical research of sound strategies for Sustainable Urban Mobility. It briefly explores the potential of soft-measures and its effectiveness to influence the modal choice of the users. The work also investigates the importance of the role that universities play to promote and lead innovative strategies for clean mobility.

As part of this Final Dissertation, a practical application was developed: the planning of The European Mobility Week in Horsens. With this, the strategies here reviewed and the information about the city were put together to generate an awareness campaign in collaboration with multiple stakeholders. The process is here documented as part of the contents of the Master Thesis.

The campaign considers simple but relevant solutions that are easy and inexpensive to implement (within the timeline of this Master Thesis work). and that contemplate community participation for the strategic planning process, therefore, aiming to contribute to the achievement of the clean mobility goals of the city.

ACKNOWLEDGEMENTS

To my beloved parents and brother,
for their unconditional support.

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GLOSSARY

Modal Split – how much is each mode of transport used from the total

Modal Speed – The most likely speed for a given transport mode in terms of the conditions affecting it.

Modal Shift – change from one mode to another

Modal choice – the selected mode of transport, usually the preferred one.

NMMs – on-Motorized Modes

Soft Measures – initiatives or measures that rely on the behaviour and psychology of the users to guide them toward the use of sustainable transport, mainly NMMs

VTBC – Voluntary Travel Behaviour Change

EFM – Environmentally Friendly Modes

SUMPs – Sustainable Urban Mobility Plan

PTP – Personal Travel Planning

Headways – time between the arrival of one bus and the next one.

Road traffic – any movement of vehicle within the road

Congestion – any slowing down of the traffic ahead caused by any internal or external cases.

Multimodal – transport performed with different modes, e.g. bike+train, walk+bus.

EC – European Commission

STRUCTURE OF THE DISSERTATION

The work presents an introduction composed by the background of Horsens (Denmark) and the relevance of Sustainable Urban Mobility in fast growing areas. In this section is presented how the city changed from being a small town to fast-growing small city with great focus on technology industry, and how it affected the traffic and congestion levels in the urban area. The research question that drives this work is presented here.

The Theoretical Framework is an investigation about the current city strategies and it is aimed to identify gaps where soft-measures and user engagement (Voluntary Travel Behavioural Change) could take a relevant role toward sustainable mobility in the city. It also explains how the Sustainable Urban Mobility in the terms of the European Commission.

The State of the Art presents a review of initiatives and programs that are analysed in search for possible strategies applicable to Horsens. The section explores the relevance of user-oriented strategies and soft measures in urban mobility and closes with the role of universities in the transition to cleaner mobility.

In the analysis section, the possible solutions for Horsens are determined by qualitative analysis. A review of a recently developed tool (Urban Roadmaps) designed to evaluate SUMPs is presented briefly here as an alternative to explore in the future.

The section of results presents the outputs of the example of an evaluation of Horsens with the Urban Roadmaps tool. As well, this section includes all the details of the applied case (the European Mobility Week Horsens). Finally, the conclusions and further work sections are presented.

1 INTRODUCTION

1.1 Background and Antecedents

Transport: Take or carry (people or goods) from one place to another by means of a vehicle, aircraft, or ship, as defined by the Oxford dictionary seems nowadays like a vague, almost empty definition for the term. Transportation is not only movement of people or goods as stated, but a backbone to development of societies.

The importance of delivering resources of any kind at any given time for supporting human activities has turned transportation into a burden to most urban centres. Transportation is a fundamental activity for human development and subsistence. From nomadic tribes that roamed through the changing seasons to gather resources, to the university students that commute daily from nearby towns, or the delivery of fresh goods to the grocery store; transport is strategic in our daily lives.

Most of the European citizens live in urban environments nowadays. More than 60% are living in urban areas with more than 10 000 inhabitants, sharing the transport infrastructure for their daily activities. Urban mobility accounts for 40% of the CO_2 emissions of road transport and around 70% of other pollutants from transport (European Commission, 2017b).

Congestion, accidents and pollution are common problems to most European cities; congestion alone causes losses for nearly 100 billion euros each year (Urban-Mobility website, European Commission), but seems less surprising knowing that 85% of the gross domestic product of Europe originates in urban areas (European Commission, 2007). Local authorities and national governments ore and more understand their specific situation are heavily encouraged to take the lead on developing the best-suited solutions for sustainable urban mobility based on the recommendations from the European Commission.

Denmark is among the leading countries in innovation and sustainable practices, and has even demonstrated that it is possible to decouple economic growth and energy consumption (Monday Morning, 2012).

(Monday Morning, 2012)
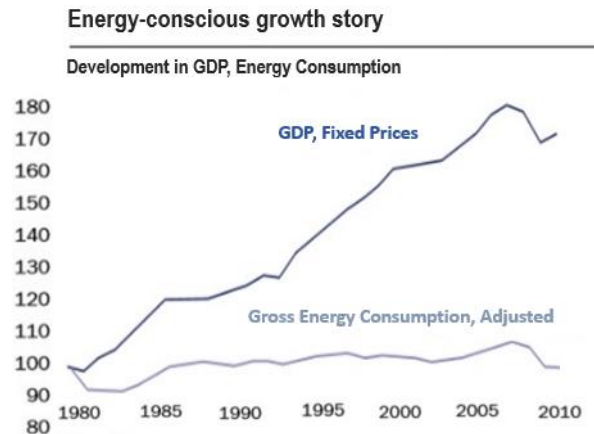
Figure 1.1 - GDP Vs Energy Consumption Decoupling

" *Horsens has set itself the target of becoming Denmark's leading competence centre within energy and green IT. By 2035, the city's electricity and heat supply must have switched entirely to renewable energy.*" (Monday Morning, 2012). Local energy companies Energi Horsens and NRGi Aarhus, entered in a merged business, creating a strategy toward clean development along with authorities, universities, entrepreneurs and researchers, and with the support of the Insero Fund (stablished in 2008 with a total value of 700million DKK) help to generate a strong industry around green technologies.

Strong acquisition power and daily lifestyle are contributors to the increasing number of vehicles on the roads, and most countries continue to experience an increment in the number of cars per capita and Horsens city is not an exception. See Figure 1.2.
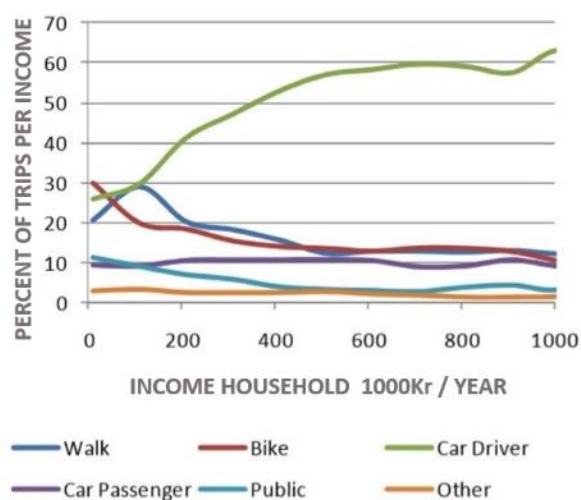
Figure 1.2 - Income vs Modal Share

Provided all the efforts that the city has done in terms of economic development, the population growth rate of the city is just behind that of Aarhus and Copenhagen, which populations are predicted to be 9.8% and 15% larger in 2027 (The Copenhagen Post, 2017), while Horsens city population is predicted to increase by 9.7% until 2027. By 2030 there will be around 96000 inhabitants compared to the current 87000 (Teknik og Miljø, 2012). By 2050 nine out of ten Danes will live in the major city centres, thus, many challenges are still waiting in terms of urban mobility.

This rapid economic growth comes along with more challenges for the local authorities, new residential areas will need to be developed to cope with the expected dwelling demand of the next couple of decades, and with that, the associated increment in traffic levels.
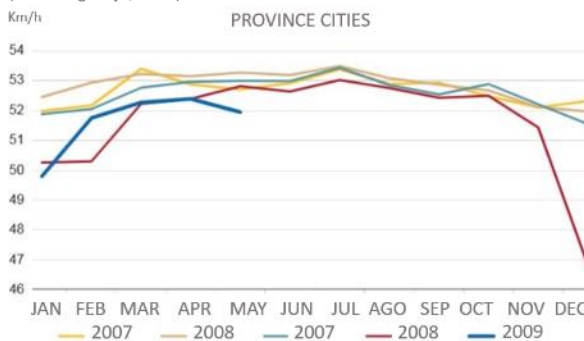
Figure 1.3 - Vehicle Speeds in Urban areas

Traffic levels and congestion have already raised during the last years, see Figure 1.3(Teknik og Miljø, 2012). The Horsens Kommune has worked on this since some years ago, monitoring the growing traffic levels and are now, preparing an ambitious traffic plan worth more than 1000 million DKK (€134 million) (Skjaerlund, 2017) that contemplates a series of updates and, construction of primary roads and bike paths to alleviate the congestion in the city area.

Number of Trips per Mode
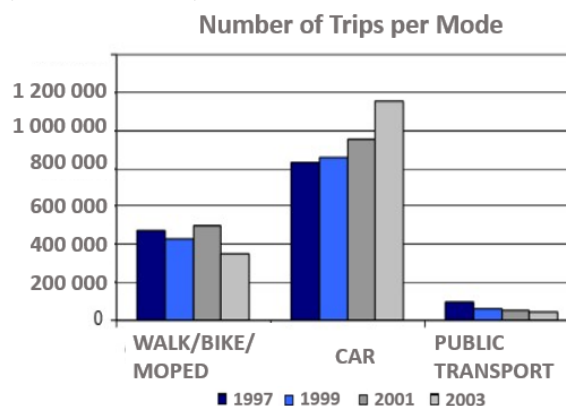
Figure 1.4 - Growing Car Traffic in Horsens

"The average Dane spends more time on transport than on completing their primary education, and Danish households spend an average 15 pr. cent of their income on transport. That is more than what we spend on food" The Danish Infrastructure Commission 2030 report (Transport Bygnings og Boligministeriet, 2017).

"The volume of car traffic almost everywhere is more or less arbitrary, depending on the available transportation infrastructure. Because we can always find new ways to increase our car use, building extra roads is a direct invitation to buy and drive more cars." (Gehl, 2013, p. 9)

1.1.1   Horsens CO_2 Reduction Targets

The *Klimarådet* or Danish Council on Climate Change "is an independent body of experts that advises on how the transition to a low-carbon society can be done in a cost-effective manner" Which aims to have a *"Denmark of very low greenhouse gas emissions while maintaining welfare and development."* (klimarådet, n.d.)

It   provides advise and general guidance on initiatives for transitioning to a low carbon future, and as such, it has given a set of recommendations for *Horsens Kommune*. The proposals are focused on the reduction of CO_2 emissions. The Klimarådet determined that the municipality should set a target of reducing 4% yearly their emissions to achieve the target of carbon-neutral by the year 2035. Such target was calculated taking as basis the emissions level from 2007, which account for 601 000 CO_2 tones (Klimarådet, n.d.).

To determine the targets, they assessed the potential energy savings when updating the current heating systems and the expansion of the electricity network in terms of offshore wind power generation. The Council proposed climate adaptation measures as well as citizen involvement and some concrete projects as further recommendations.

The main target after the assessment, is to reach a level of at least 75% of renewable energy in the energy supply by 2035. This takes as base phasing out oil and natural gas from heating system (Klimarådet, n.d.).

The recommendations made by the Klimarådet to Horsens Kommune include various energy production related solutions, as the incorporation of more solar energy conversion in public buildings, the use of high efficiency heat-pumps, the assessment of the current dwellings and the involvement of construction enterprises to use these technologies in future developments and refurbishments. *It also points out that the Municipality needs to be the authority to take the initiative in citizen involvement on climate actions, providing information and active engagement to reach this climate goals.* The importance of generating climate-conscious citizens is clearly defined and established as a key for the paradigm shift needed to achieve the goals suggested by the Klimarådet.

Additionally, it is recommended to the Municipality to work on business policies to look for development opportunities in green innovation and promoting cooperation between companies and educational institutions.

On the following tables, only the recommendations for the traffic sector are shown, although, the Climate Council has provided an extensive list of measurements on other sectors as private and public buildings, energy production and distribution, and agriculture. The proposed measures are provided in two separate groups. The first group gathers the actions that depend merely on the municipality (Table 1 - CO_2 Emissions Reduction Measures), and *in the second group those that require the active involvement of citizens and behavioural change.* (Table 2 - CO_2 Emissions Reduction Measures, Community Involvement.)

Initiative (Municipality responsibility)	Responsible	CO_2 reduction	Increment in Renewables	Status
Electric cars / electric bicycles for home care + operating wind farm. CO₂-saving requires CO_2-free electricity.	Horsens Kommune	168 ton (0,03 %)	N/A	Trials with 3 cars (in home care, town hall and farmhouse) are in progress.
More bike paths, safer cycling conditions, safe school roads.	Horsens Kommune	9000 ton (1,5 %)	No increase in road share.	Prioritization of wishes for new cycle paths initiated.
Infrastructure building for electric cars I.e.: 80% of passenger cars are electric cars in 2035. Prerequisite: setting of wind turbines	Horsens Kommune/NRGI	43.000 ton (7,2 %)	7 %	Setup of 2 chargers has been started.
Intelligent traffic management	Horsens Kommune	N/A	N/A	Will be examined further

Table 1 - CO₂ Emissions Reduction Measures - (Klimarådet, n.d.).

Initiative (Community involvement)	Responsible	CO_2 reduction	Increment in Renewables	Status
Rental of electric cars in Horsens municipality + loan cycles	Rental Companies/ Energi Horsens/Horsens Kommune	N/A	N/A	Will be examined further
Purchase of company electric cars / hybrid cars	Companies	N/A	N/A	Will be examined further
Greater use of collective traffic solutions. light cars and electric buses etc. In public transport.	Horsens Kommune	N/A	N/A	Will be examined further
Part of schemes in housing associations	Housing associations	N/A	N/A	Will be examined further

Table 2 - CO₂ Emissions Reduction Measures, Community Involvement - (Klimarådet, n.d.).

Sector (Horsens municipality as authority)	CO2 Reduction (Ton)	CO2 Reduction (%)	Increment in Renewables
Energy production and distribution	62 000	10.3	7
Industry and Agriculture	28 100	4.7	-
Traffic	52 168	8.7	7
Private Buildings	-	-	-
Sector (Horsens municipality as authority)	CO2 Reduction (Ton)	CO2 Reduction (%)	Increment in Renewables
Energy production and distribution	62 000	10.3	7
Industry and Agriculture	28 100	4.7	-
Traffic	52 168	8.7	7
Private Buildings	-	-	-
TOTAL	CO2 Reduction (Ton)	CO2 Reduction (%)	Increment in Renewables
	479 318	80.3	76.5* Adjusted value to meet goals

Table 3 - Total CO2 Emission Savings by 2035 - (Klimarådet, n.d.).

Pointing out from the specific recommendations of the Danish Society for Nature Conservation in about traffic:

-Greater use of collective traffic solutions. hybrid cars and electric buses etc. In public transport.

-More bike paths, safer cycling conditions, safe school roads.

-Rental of electric cars in Horsens municipality + loan bicycles.

1.1.2 The European Commission as a Driver for Sustainable Urban Mobility

"With growing freight and passenger transport, the risk of pollution and congestion risk is increasing. The European Commission is working towards a form of mobility that is sustainable, energy-efficient and respectful of the environment." (European Commission, 2017c)

The aim of the EC is to minimize the impacts of mobility. Passenger multimodal strategies and freight co-modality have taken an important part of the topics to work with. As well, great importance has been given to promote research for technical development of less polluting and more energy efficient transport, in both, long distance and urban environments.

The Directorate General for Mobility and Transport helps to regulate and provide guidance, legislation framework, establishes innovation & research lines, promotes cooperation, coordinates and communicates the state of the art, provides and administrates funding, among other functions with the aim of a common movement in Europe towards a clean and better connected Europe.

With different lines, The Directorate General for Mobility and Transport – DG Move is comprised of five directorates, subdivided in the following way:

Directorate A – Policies and coordination

Directorate B – Investments, innovation and sustainable transport

Directorate C – Land Transport

Directorate D – Waterborne

Directorate E – Aviation

Each of the directorates appointed by the DG Move, sets goals and, strategies in their field. Directorate A and B are more of coordinators of activities that affect the rest of the directorates. Directorate B is more directly involved in the Urban mobility and sustainable modes, passengers, society, smart cities, and social aspects of transportation services.

Both, the Danish Council on Climate Change and the European Commission mention indirectly the involvement of citizens and educational institution. The Danish council even provides two different tables separating clearly the actions that must be carefully planned to target a behavioural change in the citizens.

As this is noted, the term *Soft Measures or Soft Policies* arises in importance to this Thesis. This is aligned with the citizen involvement that has been mentioned just before.

Soft Policies or Soft Measures, being recently called "Smarter choice", are those more focused in the behaviour and psychological or economical motivation of the users to make their modal choice. These measures rely more on user behaviour, marketing and planning component than infrastructure-building orientation. Nonetheless, many of the soft measures rely in existent infrastructure, or small upgrades (Cairns et al., 2008).

Lately, *soft policies* have seen a great advantage when integrating IT solutions to support the initiatives and campaigns. These solutions can provide and analyse information about the users automatically and continuously, thus allowing to adjust the strategies accordingly.

Soft policies have been used during the last decade and have been focus of discussion, but there is something clear, the economic return that is possible to get with relatively small cost, making even possible to generate revenues.

These measures could play a very important if the correct policies are stablished to support it. (Cairns et al., 2008).

1.2 The Research Questions

From the previous sections, multiple doubts arise as interesting topics for research. Two have been chosen as drivers for this Dissertation. Based on the recommendations of the *Klimarådet*, the vision of the European Commission and the goals of the Horsens Kommune for the future:

What soft measures and community involvement practices could be implemented to support the already existing efforts of sustainable mobility in Horsens?

What is the role of the universities in the shift toward Sustainable Urban Mobility?

Therefore, this End of Master Work presents an in-depth review of the strategies that the city has used in the last years and the plans to follow in the future to identify possible areas of opportunity that could benefit from the application of soft policies for urban transport. From there, a review of soft measures that have been used in other European cities to increase the use environmentally friendly modes is presented to find solutions for Horsens.

1.3 Aim and Objectives

The aim of this work is to build a case about how soft-measures can contribute to meet the objectives of the Horsens Kommune in terms of Sustainable Urban Mobility. This considering the recommendations of the Danish Council on Climate Change and European Commission goals for 2030.

Two main objectives were derived from the research questions:

1- ***Identify possible gaps in the development plans*** that the city has for the upcoming years or studies that can be re-examined to provide continuation. These projects represent potential users of environmentally friendly modes.

2- ***Provide a review of possible solutions*** that align and contribute to the existing plans and the vision of Horsens Kommune. Soft measures that reinforce the infrastructure updates planned in the 2030 Road plan.

1.4 Definition of Work / Research Methodology

1.4.1 Exploratory Essay

The work presents an exploratory essay on the city strategies and antecedents reviewed in section 2.1. This is presented in terms of Sustainable Urban Mobility from theoretical and applied perspectives *to provide an answer to the first research Objective defined just in the previous section -identify gaps-*.

Due to the nature of the data presented, this section included a brief historical research about the previous initiatives and programs applied in the city; and it composes the Theoretical Framework of the thesis.

1.4.2 Qualitative analysis

The second fold of research constitutes the State of the Art, which comprise a collection of data about current initiatives from the EC and a review of soft measures applied in other European cities. The qualitative analysis was applied mainly to the soft measures and are presented classified by mode of transport. *This section will provide proposals to fulfil the second research Objective: - find suitable solutions-.*

The qualitative analysis carried out followed the *Grounded Theory Method (GTM)* which encourages continuous and persistent interaction of the researcher with the data (Bryant & Charmaz, 2010). The GT Methodology was selected for this work due to the diverse information sources. This research was started with very superficial knowledge of the city situation and without preconceived idea of the solutions here proposed, which suits the grounded theory method (Strauss & Corbin, 1998). Each piece of information about the city has been collected and used to continue narrowing information each time yielding to more specific findings and data. The freedom that the Grounded Theory Method gives to the researcher allows to generate knowledge or solutions in non-conventional ways, facilitating innovation process. This process allows to combine different ideas to create hybrid solutions.

1.4.3 Alternatives for Quantitative Analysis

It is important to note that the emissions gap is not being evaluated in detail in this Thesis (although it is presented as a driver justification from the Danish Council on Climate Change) since the detailed data to calculate the environmental impacts has not been included in the scope of the work. Additionally, the analysis required for such calculations, require a longer time framework than the available for this Dissertation. This work was aligned toward the initiatives suggested to reduce CO_2 emissions made by the Danish Council on Climate Change (reviewed in section 1.1.1) but not centred in providing the quantification.

Although this study has not been presented as a quantitative analysis, new tools have been lately developed to help to transform qualitative information and represent it as quantitative results by using statistical data collected from previous studies on the related topic, in this case sustainable mobility.Such is the case of the Urban Roadmaps tool, which is briefly reviewed here, (just for demonstration purposes) in section 4.1. The tool is oriented toward the decision-making process for mobility strategies when there is not enough information available to perform in-depth impact assessments.

1.5 Limitations and Scope

As in any project, time and economic resources provide limitations most of the times. Under the same line, this research is based mostly on the available information at the moment of writing it. The proposals are prepared only on the user information provided by previous studies.

The work does not provide any quantitative results of the practical case -European Mobility Week Horsens- since it will take place during a posterior date to the official delivery of this Thesis. Time constraint did not allow to involve biggest stakeholders as the bus operator company or the Municipality itself, since tight schedules are already set for them.

This work does not provide any financial analysis; nonetheless, due to the nature of "soft measures", the solutions proposed are meant to represent very small investments (when compared with the levels of infrastructure), and get returns by an improved commerce activity and by decreasing the social-economic costs due to the increased health benefits of a more active life, among other indirect benefits of EFMs.

The analysis presented in section 2.1 is based in data that is available to the public. Therefore, the study relies on the quality of the previous investigations performed by the Municipality and external consultants.

2 THEORETICAL FRAMEWORK

2.1 Review of Horsens City

As part of the development vision for the city, the local authorities together with the citizens and business sector have worked out a thorough strategy. Multiple renovation projects have been proposed, and therefore the developments have been divided into four main areas:

- Railway Station
- Harbour
- Commercial street
- Boulevard

The strategy contemplates the connection of the Railway station district, where the new campus will be located directly with the harbour area, an upgrade to the old industrial port of the city.

The municipality is aiming for an integrated strategy relying heavily on pedestrians and cyclists, but simultaneously providing solutions for accessibility to motorists. The city centre will be oriented toward new green spaces that can help to attract more life to the area.

The developments include housing and commercial activity, providing mixed used buildings and attractive public spaces for the citizens of different groups, therefore, varied housing offering in terms of price range and size, including offerings for single person or couples.

With the City Hall moving to the previous VIA University installations, a new use for the building will help to attract even more people to the city centre by offering a new library, restaurants and shops. The Rådhus -City hall- is currently in a strategic location between the commercial and pedestrian street Søndergade and the boulevard area which at the same time leads to the harbour. Therefore, it would help to better connect the current city centre to the new, fresh areas of the city.

"*The conclusion that if better city space is provided, use will increase is apparently valid in large city public spaces, and individual city spaces and all the way down to the single bench or chair. The conclusion is also generally valid in various cultures and parts of the world, in various climates and in different economies and social situations*" (Gehl, 2013, p. 17).

In this section, we will review the individual goals in terms of traffic, bus network and bicycle infrastructure that the city has planned for 2030 to better understand the needs and identify gaps in the strategy that could be compensated by the application of soft-measures and community engagement.

By direct observation of the city streets and bus system in Horsens it can be noticed that the user modal choice is heavily oriented toward private vehicle use. When comparing the city figures with those of Aarhus and Copenhagen for example, it can be noted an important gap to be filled in terms of sustainable mobility, mainly in terms of cycling and public transport, see Figure 2.1 - Modal Split Horsens Vs. Main Danish Cities.

(http://www.epomm.eu/tems/index.phtml)
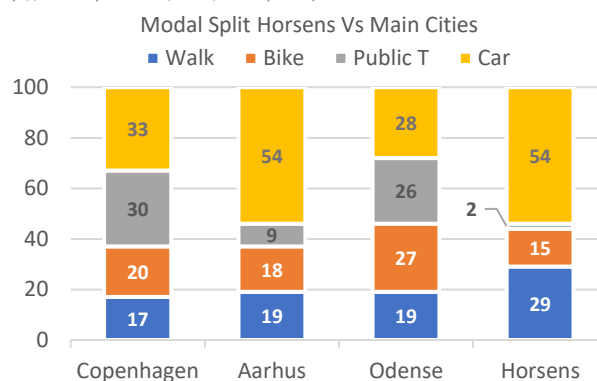
Figure 2.1 - Modal Split Horsens Vs. Main Danish Cities

Something important to point out from Figure 2.1 - Modal Split Horsens Vs. Main Danish Cities -due to the lack of data- is that the numbers shown for Odense, Copenhagen and Aarhus correspond to the total number of trips made in the city, while the

Horsens statistics the numbers correspond to trips below 6 Km. This scenario positions Horsens in a more favourable stand, but as Figure 2.2 - Modal Split Vs Travel Distance (Marie K. Larsen, 2010) shows, the share of trips at a national level vs. the length of trip, it can be noted that in any scenario below 6 Km, the modal share for bike and public transport are still low for Horsens.

(Midttrafik, 2012)
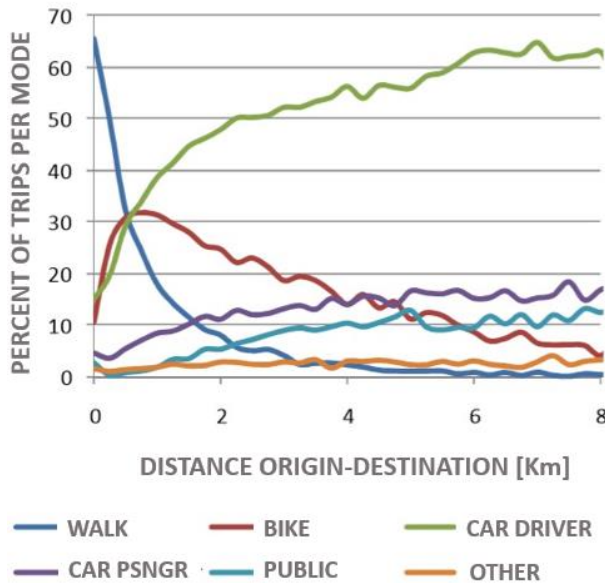
Figure 2.2 - Modal Split Vs Travel Distance

Odense and Copenhagen modal split for bus and bike are considerably higher. In general, smaller cities and suburban areas rely more on private motor vehicles, (Marie K. Larsen, 2010).

(Marie K. Larsen, 2010
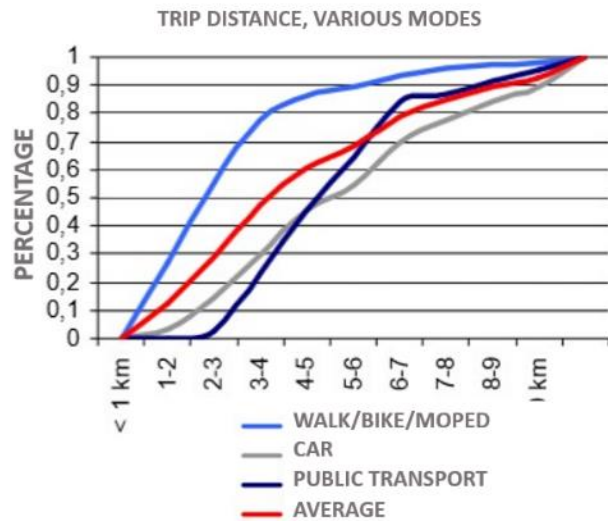
Figure 2.3 - % of Travels per mode vs Trip Length, Horsens

2.1.1   Road Traffic

Horsens is geographically situated in an important developing region in central Denmark, on the central-east region or Østjylland Horsens is along the main artery connecting the southern region with Aarhus and Aalborg, two of the most important cities in the country, the Jylland E45 Motorvej. A growing number of daily commuters from and to Horsens, ~13000 and ~12800 (2008 levels), respectively, make their way through the city and the E45 Highway, which is expected to have 45% increase in traffic by 2022 (from 2007 level). This as well, has implications in the local traffic since some of the city arteries serve sometimes as relief for the increasing load in the E45 depicted as the main red artery running north-south in Figure 2.4 - E45 Jysk Motorvej Predicted Load by 2030 (Teknik og Miljø, 2012).

Figure 2.4 - E45 Jysk Motorvej Predicted Load by 2030

Figure 2.5 - New Road Works 2030 Vejplan

The infrastructure upgrades and road construction plans reflect the efforts of the municipality to reduce the congestion levels both in the state road connections and the inner parts of the city (Teknik og Miljø, 2012).

The construction of a new external ring around the south-east part of the city will help to redirect the traffic, specially of heavy vehicles corresponding to freight going to the harbour and that currently travel across the city. As well as improvement works on several intersections at main city arteries and a new north corridor or north ring that will help to ease the traffic passing through the city centre, by directly connecting the north west and north east regions of the urban area (Teknik og Miljø, 2012). There upgrades ascend to a bill of DKK 900 million (€121 million) (Skjaerlund, 2017)

2.1.2 City Bus

The public transport system in Denmark relies on third party companies ruled by a main regulating bodies that awards the corresponding contracts to operate and maintain the bus, rail, tram, airports and road networks. The city bus system is financed by each of the municipalities, while the inter-city transport is financed by the Central Region of Denmark. The bus operators change from region to region and although this scheme works well on local level, the task of offering the users a fluid multimodal experience through the country becomes a bigger challenge. But this work will not consider such areas of opportunity due to the high political implications and to the fact that is more related to inter-urban connectivity.

Midttrafik operates in 19 municipalities, it manages ticketing system, scheduling, planning of infrastructure, customer satisfaction studies and other administrative functions required to maintain the network operating. Midttrafik administrates city buses, regional buses, school buses, on-demand service for disabled people and taxi companies, coordinating efforts to provide multiple solutions to their users (Midttrafik, 2012).

Nonetheless, the regional operator of Jutland, Midttrafik, has doubled the efforts to provide the

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best experience for the users, therefore, a review of the local conditions of the Horsens city bus - *Horsens Bybusser-* is presented here.

The current bus network in Horsens comprises 11 urban routes that work together with inter-urban service to neighbouring towns. See Figure 2.6.

http://sektorplaner.horsens.dk/dk/trafikplan-for-kollektiv-busbejtening-/status-bus/den-interne-bybusbetjening-i-horsens/)

Figure 2.6 - Current Bus Network, Horsens

In a user satisfaction survey made by Midttrafik in 2016 to more than approximately 11,000 participants, it was found that only 46% make use of the bus system. As per satisfaction levels, 26% considered unsatisfied or very unsatisfied with the service, while only 48% as satisfied.

18.3% of the users take the bus daily, 23.3% in multiple days a week, 32.2% less than 4 times a month and 26.3% very occasionally, less than one time per month see Figure 2.7. The trips reasons are relatively balanced among daily commuting, leisure, school, shopping, etcetera.
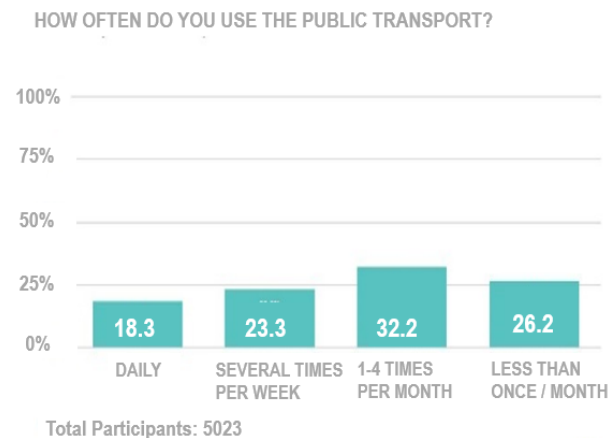
Figure 2.7 - Frequency of Use of Bus System

Bus lines 2 and 1 (Red and yellow, Figure 2.6) account respectively for 28.3% and 24.7% of the total trips in the network. That could be in part because these routes provide service to both the VIA University, the local hospital and the railway station, the main spots for commuters in the city (Midttrafik, 2017). The third most frequented line is number 5 with 15% (orange line, Figure 2.7). It connects the city centre with the southern neighbourhoods, somehow acting as an alternative for users of lines 4 and 6, that travel almost parallel to it (Teknik og Miljo Horsens Kommune, 2017b).

The most interesting data that the study reveals are the reasons for which the bus system is not being used by more than half of the surveyed population. As well, what could encourage the occasional users to travel more frequently by bus. The Figure 2.8 shows that the cost of the service is the first factor, followed by timeliness.

WHAT WOULD MAKE YOU TRAVEL MORE BY BUS?

Total Participants: 5 023
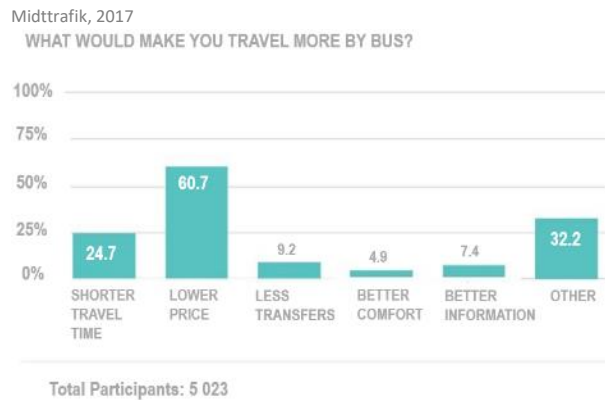
Figure 2.8 - What Would Encourage to Use more The Bus

The strategy proposed by Midttrafik and Horsens Kommune to improve this, is to shorten bus line number 2, the main route servicing the university and the hospital. Line 3 will service the route section removed from the line 2, and by alternating lines 1 and 2 the service will provide a 10-minute headway to this main bus stops, see Figure 2.9 - Proposed Bus Lines, Plan 2017 (Teknik og Miljo Horsens Kommune, 2017a). The rest of the lines have a headway of 30 minutes.

Figure 2.9 - Proposed Bus Lines, Plan 2017

The proposal includes a new bus route that circles around the city centre, line S12, which will operate only during daytime in weekends and rush hour during weekdays (Teknik og Miljo Horsens Kommune, 2017a), this route will be run and evaluated for one year (Teknik og Miljo Horsens Kommune, 2017a), see Figure 2.10.

Figure 2.10 - New Bus line S12

Increasing the frequency of the rest of the lines would imply even more costs for the system. Currently, Midttrafik spends DKK 132 million to keep all the operation in the region (2011 levels), of that alone, DKK 55.5 million are wages, while terminals, ticketing system and bus stops account for DKK 14.8 million (Midttrafik, 2012). Increasing the frequency of the buses would in any case require more buses, therefore chauffeurs to the system, further adding up to the wage expenses.

Interestingly, when analysing the answers of better comfort and improved information systems, it can be noticed that a combined solution could help to attract 12.3% of the occasional users.

That means a one-time investment like upgrading the main bus stops could help to draw more users to the network without increasing the yearly operating costs. An economic analysis would be necessary to confirm, but it is out of the scope of this work.

WHAT ARE THE REASONS FOR NOT USING THE BUS?
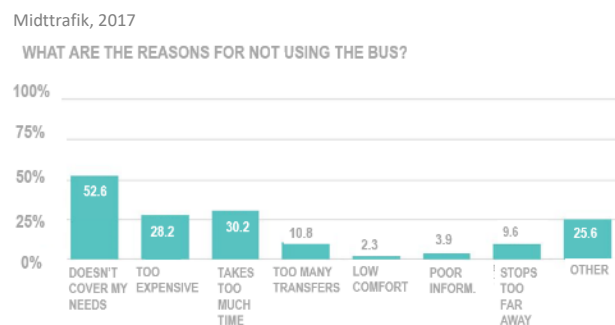
Figure 2.11 - Reasons for Not using the Bus

Improvements in comfort and information systems could help to attract 6.2% of the potential population not using the bus network, see Figure 2.11 - Reasons for Not using the Bus,. The rest of the answers are related to the needs of the user, the cost and the time.

Access time to the nearest stop. The bus stops cover all the city efficiently, see Figure 2.12, and most of them being accessible within a 400m radius, in some cases a little more, but still under 600m. See Figure 2.13.

(http://sektorplaner.horsens.dk/dk/trafikplan-for-kollektiv-busbejtening-/aendring-af-den-kollektiv-busbetjening/nyt-bybusnet/)

Figure 2.12 - Bus Stops of New Lines, Plan 2017

(http://sektorplaner.horsens.dk/dk/trafikplan-for-kollektiv-busbejtening-/aendring-af-den-kollektiv-busbetjening/nyt-bybusnet/)

RADIUS 400 m
FROM BUS STOP
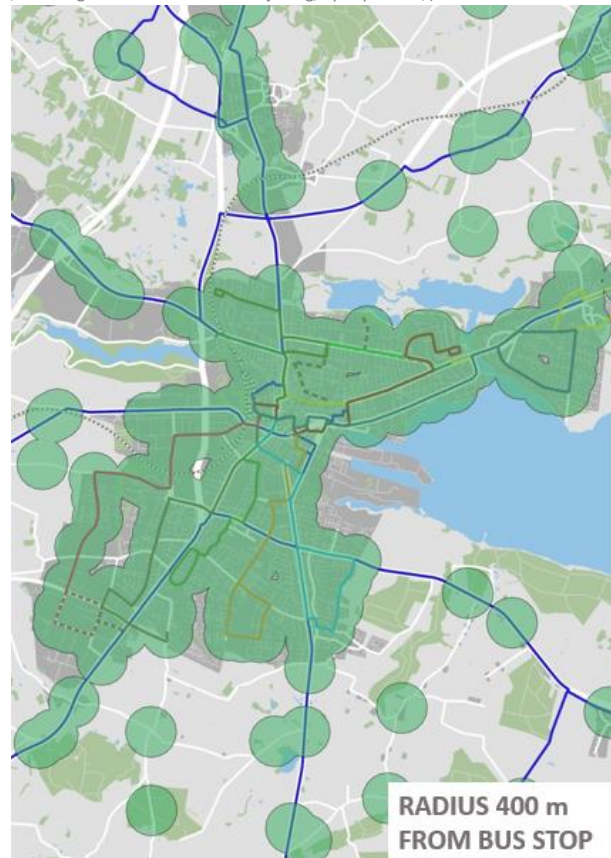
Figure 2.13 - Accessibility to Bus Stops, plan 2017

The Bus network is the result of the development of the city, meaning that the system is growing accordingly to the city plan and current dwelling developments (Figure 2.14) as well as the business area and number of employees (Figure 2.15)
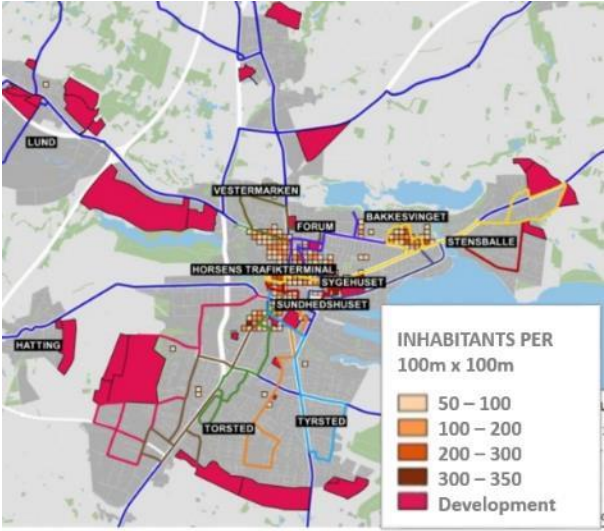
Figure 2.14 - Population Density and New Developments vs Bus Routes

Figure 2.15 - Business and Employee Number vs. Bus Routes

A lot of work has already been done to increase the use of the bus network, nonetheless the results of these changes will be reflected in the next couple of years through close monitoring of the network.

The figures about the actual use of the network: The Horsens City Buses (Bybusser) provide service to more than 1.7 million trips in the year, between 4000 and 6000 daily trips.

Figure 2.16 shows a graphical representation of the total passenger count per bus stop in a day. This

information will be useful to determine specific locations to implement new solutions and to reach a greater number of users. In accordance to this, a proposal will be elaborated further in Sections 3.3.3 and 4.3.3

The busiest Stops in the network are:

Bus Stop	Passenger count in/out
Horsens Trafik Terminal (Bus/Train Station)	4857
Sønderbrogade / Bygholm Parkvej	1354
Nørretorv	574
Chr. M. Østergårvej (VIA University)	465
Horsenshus Centre	379
Horsens Sygehus. Sundvej (**(http://sektorplaner.horsens.dk/dk/trafikplan-for-kollektiv-busbejtening-/status-bus/den-interne-bybusbetjening-i-horsens/)**)	313

Table 4 - Most Frequented Bus Stops, Horsens

Figure 2.16 – Average Daily Passenger Count Per Bus Stop

2.1.3   Cycling
Antecedents

Horsens Cykelby – Horsens a bicycle city

The city of Horsens has been heavily working on the implementation of a great number of projects to increase the number of cyclists in the

municipality, with the goal of turning Horsens a bicycle-friendly city both for commuting and recreational activities. By creating the *Horsens Cykelby* or *Horsens Bicycle City* and launching in 2011 a big campaign, *Vi gør det! – We'll do it!* Under which many projects have been completed with state funding. The program is still active hence, more projects will be completed in the next years (Cykelby Horsens Kommune, 2004).

The projects include a great number of infrastructure improvements, studies on user behaviour and marketing among the population. Everything, from kilometres of cycling paths to free pumps in key spots around the city centre, parking improvements, recreational trails, safe crossings, bicycle traffic counters, green waves among others. In the first four years of the initiative more than DKK 40 million were invested, the efforts are still on-going.

Promoting cycling is an important part of the health and socioeconomic goals of the municipality. The benefits from cycling are not only reflected in less traffic congestion or pollution, it represents an integral approach to health and well-being. Therefore, around DKK 145 million (€20 million) have been designated to cycling infrastructure in the 2017-2030 road plan (Horsens Folkeblad, 2017) The investment aims to improve both the local and inter-urban cycling conditions by providing direct and safe connection with nearby towns.

The city can be easily crossed by bike from one side to another in less than 30 minutes. With a near-flat terrain it is easy and almost effortless, hence bicycles have a great potential. Currently, the modal split for cycling in Horsens for trips under 6 Km-long is only 15%, and the goal of the municipality is to rise it to at least 20% by 2030 (Teknik og Miljo Horsens Kommune, 2017b)

The current bicycle infrastructure of the city includes multiple city lanes, inter-city routes and outdoor trails. The city has more than 80Km of

reserved cycling lanes in the city and at least 50Km of cycling/walking trails. The Bicycle parking places in the city have more than 660 spaces around the city centre and spots of interest.

http://webkort.horsens.dk/spatialmap

Figure 2.17 - Cycling Lanes, Horsens

Future Infrastructure

The Horsens Kommune has prepared in the road plan 2030 an ambitious upgrade of the city, and the cycling infrastructure is not disregarded. The connection of the city centre and the southern exit of the city, with the surrounding towns like Egebjerg, Hatting, Lund and Stensballe will be improved by means of the Supercykelsti -bicycle highway -. The plan aims to integrate specific places for "park and ride". The bicycle highway is expected to be a competition with the automobile for the commuters traveling from the surrounding towns to Horsens. The network has been designed in such way that surrounds the city centre forming a cycling ring.

This new ring will connect the most attractive points of the city and future places of interest. The new campus VIA University, the future shopping centre and the renovated harbour area will as well be served by this new cycling road. The ring will provide a direct and safe cycling connection to this attractive points of the city. It will include park and ride places outside the city centre giving the chance to the motorists to park their vehicles in surrounding strategic places.

In addition to the extension Supercykelsti, other important changes are planned. In one of the busiest intersections of the city, Niels Gyldings Gade - Høegh Guldbergs Gade, a new tunnel crossing for pedestrians and cyclist will provide a more convenient and safer crossing point. Currently this intersection is traffic signal operated both for pedestrians and cycles, but the 2030 plan will offer a faster pass to these users.

Another notable project to be carried out as part of the 2030 Vejplan. It will be in Nørregade, this street is the north boundary of the city centre pedestrian area, and runs east to west, connecting VIA University (through Sundvej) to the heart of the city and the business area. The traffic will be reduced in this section, therefore increasing the safety for both, pedestrians and cyclists. More Pedestrian streets help to attract clients to the local businesses. When Strøget in Copenhagen, was closed to car traffic in 1962, an increment of 35% in the number of clients in the street was recorded just one year after implementing the measure (Scotland, 2012, 27:27).

Currently, Nørregade has no designated cycling path, although it provides parallel parking along almost all the length of the street. This area has high commercial activity, and these improvements suppose better business opportunities for the local stores in the area, as found in a study made by COWI Consultors and seven municipalities from Jylland, later explained in this section.

This upgrade will be supported by two parking places that will be located where the pedestrian area intersects Nørregade, in a strategic location for visitors to park and walk straight into the pedestrian area, instead of driving deeper into the city centre (Teknik og Miljo Horsens Kommune, 2017b).

The new VIA Campus is one of the most important developments in the city, and as such, the plan includes improvements in the area, which will also benefit to the users arriving to the train station.

The cycling infrastructure around this area will be upgraded to provide a safe, direct connection to the harbour trough the city centre pedestrian zone.

The effectiveness of all these infrastructure upgrades and improvements to the city will need to be supported with a strong campaign and further actions oriented to discourage the use of the automobile. Soft measures have demonstrated that are a valuable instrument in aiding the transition toward EFMs in various cities.

Past Programs and Studies

Cycling to School

Horsens Municipality has the goals of providing convenient and safe cycling for everybody. In the "Proposal for Action Plan for Traffic-Safe Schoolchildren, 2005", it is mentioned that 80% of the children in school age, 2nd grade and older should be transporting themselves to school, either walking, cycling of by bus (Teknik og Miljo Horsens Kommune, 2005).

Infrastructure plays a key and powerful role in a cycling city and the willingness of their citizens to use it. But it is not only about infrastructure, it is part of the culture, and early education is key for achieving this challenge.

Four of the towns part of Horsens Kommune (Hatting, Braedstrup, Lund and Nim) were under the target a set of 21 measures across the four towns was implemented. The project was the result of a workshop organized to find the best solutions to improve safety on the routes frequented by the students. With a designated budget of DKK 2.5 million, the campaign successfully managed to raise three out of the four towns above the 80% target. A combination of an intensive campaign and infrastructure updates were necessary to achieve a successful result (Cykling Embassy of Denmark, 2015).

The efforts to improve the safety for children cycling to school were continued. An extensive study with 23 local schools was conducted in 2008 with the help of an external consultancy firm to set the grounds for the future infrastructure developments in the city.

The survey conducted was designed to collect precise information regarding: the transport options of the students, their common routes home-school-home, locations that the students considered dangerous, among others. The objective: design safe common routes for each school (Horsens Kommune, 2008).

Almost 2,200 students took the survey, this represented the 23% of the total population of the schools

(Horsens Kommune, 2008).
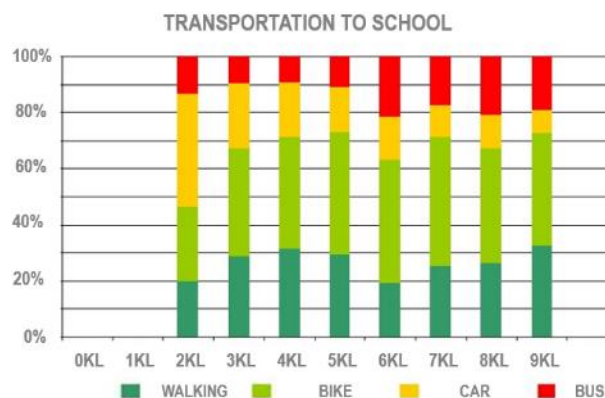
Figure 2.18 - Modal Split to school by grade, students in Horsens

The results of the study showed that the greatest number of students was either walking or cycling to school, in comparison to those driven by car or taking the bus. This revealed some substantial potential for cycling and walking to school. The study found as well that only one third of the students cycling was using helmets while riding.

Something to note in the trend of the graph is that the most consistent pattern corresponds to cycling (40% of modal spilt from second grade onwards). Walking drops almost to half in 6th year but it recovers within two years (Figure 2.18 - Modal Split to school by grade, students in Horsens).

But the most important thing probably to note in the graphic is that it appears that the students being driven to school by car switch mode to public transport, if the graph is analysed with attention. This can mean that the students that are not walking or cycling at early stage will switch from car to bus, perhaps for convenience or because of the distance they need to travel.

The importance of understanding these data was to provide safest environment for the students to commute to and from school.

Creating an early cycling culture in Horsens is vital for the transport situation of the next decades. Use of bicycle among the young adults in the city is far below the national level, see Figure 2.19 (Horsens Kommune, 2006).

(Horsens Kommune, 2008).
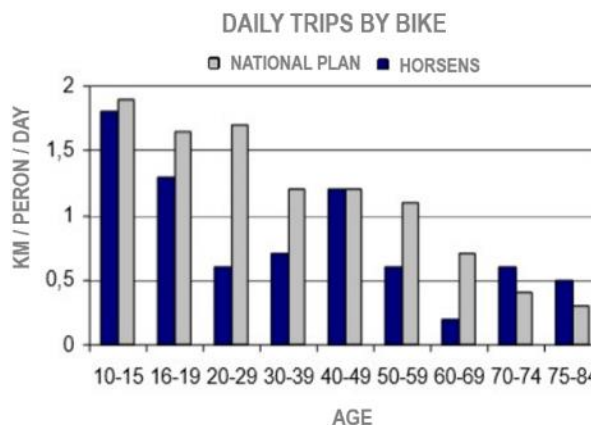
Figure 2.19 - Cycling Km Trips per Age

Automobile is quickly becoming the preferred mode of transport, and next younger generations will most likely base its commuting preferences in the same way if no positive influence is achieved with current young generations.

Cycling and Commerce Activity Study

In 2015 Aarhus Kommune received support from The Danish Road Directorate to conduct an analysis of the habits of consumers and the preferred transportation mode when running their errands.

The study was conducted by the external consultant COWI in a total of 20 different locations in 7 municipalities along Denmark central region (*Aalborg, Aarhus, Horsens, Ikast-Fires, Kolding, Odense, and Randers)*. The locations were chosen to have different urban environments so to analyse as well, the influence that the urban area has over the modal choice. The investigation relied on more than 2200 interviews in all the participating cities and 1700 surveys collecting in total, information of nearly 2800 shopping trips with different urban backgrounds and purposes (COWI A/S samarbejde med Horsens, Ikast-Brande, Kolding & Randers, 2015).

The original study was divided in 5 groups: suburban cities (Seden, Beder-Malling and Storvorde), "Train-station cities" (Ikast, Brande, Braestrup and Vamdrup), shopping malls (Aalborg, Randers, Kolding), City centres of large cities (Aalborg, Randers, Kolding, Horsens, Aarhus, Odense), town centres (Dronningborg, Trojborg, Dalum).

The results show a tendency of smaller towns to use the automobile. Interestingly, the modal split that is affected most in the smaller towns is the corresponding to public transport, which compared to bigger cities drops to only 1%., see Figure 2.20 (COWI A/S samarbejde med Horsens, Ikast-Brande, Kolding & Randers, 2015).
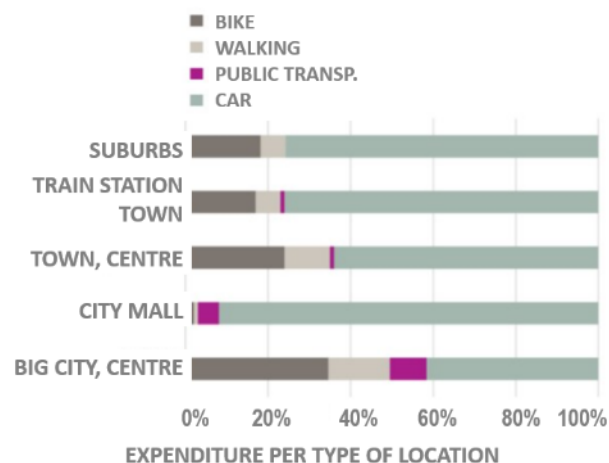
Figure 2.20 - Modal Split per Type of Location

According to Figure 2.21, Figure 2.22 and Figure 2.23, the automobile appears to take over bicycles and pedestrian, but more importantly, over the public transport, most likely for convenience due to low frequencies of the system. While bicycle is still widely used (22-30%) and pedestrian is between 13% and 17% (COWI A/S samarbejde med Horsens, Ikast-Brande, Kolding & Randers, 2015).
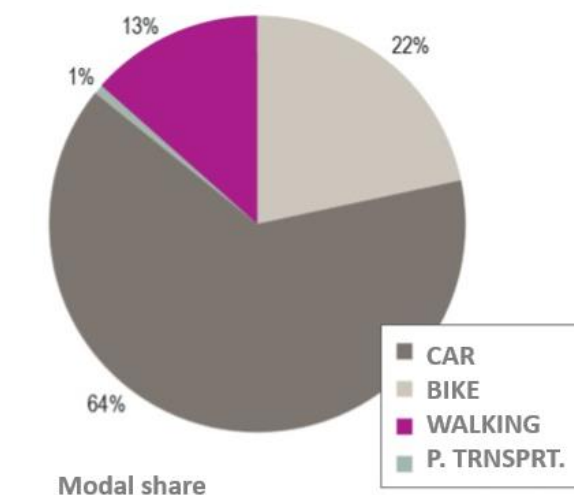
Figure 2.21 - Modal Split for Shopping activities in Suburbs

Figure 2.24 - Modal Split in City Centres of Large Cities
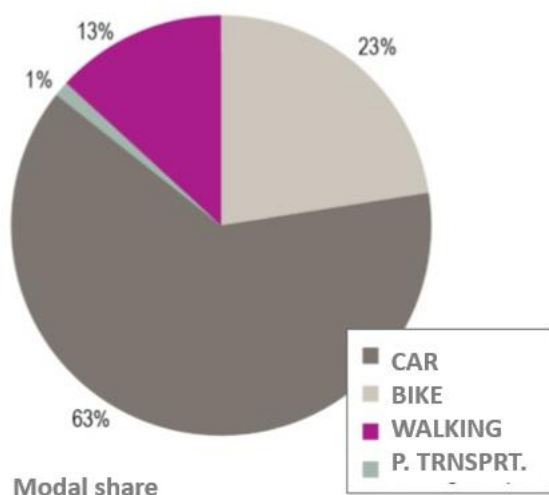
Figure 2.22 - Modal Split for Shopping activities in Train Station Cities.

Shopping activities of cyclists and pedestrians in centres of large cities represent 50% of the total expenditure per trips, while (35% and 15% respectively). In small towns, the combined expenditure of cyclists and pedestrians is 23 to 35%.

The most notorious effect in terms of shopping activity is grocery shopping. This shows the biggest gap between the users' choice between cycling or using the car. Most likely when the volume of shopping is too large or the items too heavy to cycle safely, as the study found in the surveys. See Figure 2.25.

Figure 2.23 - Modal Split for Shopping Activities in Towns City Centres.

In the group of larger cities, the result is considerably different, as in Figure 2.24 the combined (of 6 cities) modal share of automobile for shopping trips is 30%, bike is 37%. Pedestrian and public transport take a bigger share as well.
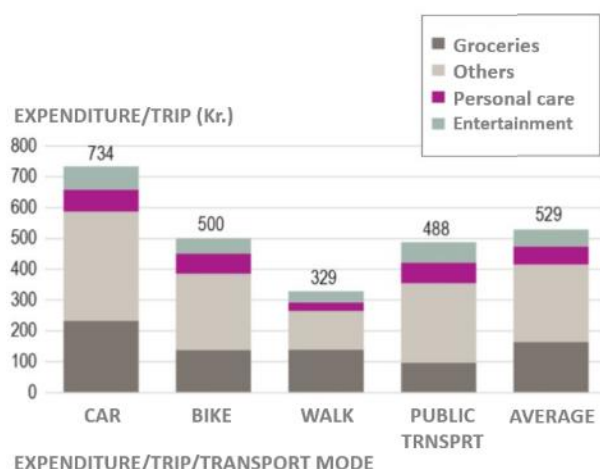
Figure 2.25 - Expenditure by Purpose, per Mode of Transport (Centres of Big Cities)

While the combined results of all the six mayor cities in the study shows that the bicycle is clearly the preferred mode of transport in big city centres is up to discussion. If we look at the isolated statistics from Horsens Kommune (not part of this study) confirms the observations of the daily life in the city. The preferred mode of transport in the city for shopping and leisure is automobile.

(Horsens Kommune, 2006)
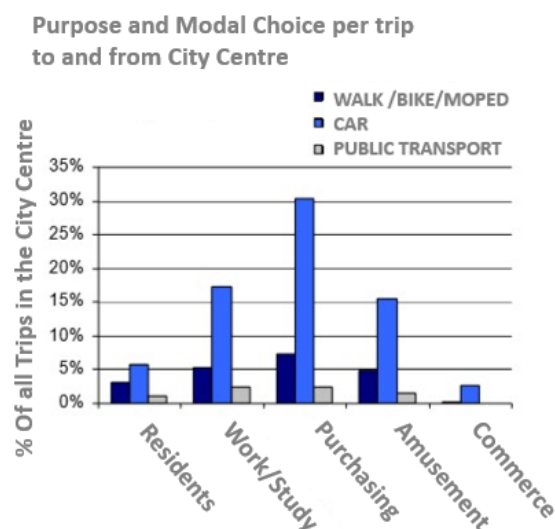
Figure 2.26 - Travels to and from Horsens City Centre per Mode of Transport, per Purpose

The commercial activity of the city can be very much influenced by cyclists and pedestrians. The average number of shops that the surveyed population visited per trip is higher for the trips made by bike than the ones made by car (1.9 vs 1.7 respectively). This means that the cyclists interact more with the area and the local businesses.

It is consistent with the theory, cycling and walking have better engagement in the buyers due to the proximity to the stores and the traveling speed. The sensory experience and details granted by low-speed architecture helps to grasp the attention of users to nearby stores (Gehl, 2013). According to Figure 2.26 (Horsens Kommune, 2006) there is a big potential to increase the clients and revenue of the commercial area by reducing the amount of car users. Almost 70% of the travels to the city centre are for leisure or shopping are made by car.

Added to the fact that some commerce streets can't be directly accessed by car (Søndergade, for example) thus, allowing pedestrians and cyclists to get closer and faster than car drivers.

Remarkable fact -and identified gap- in the study is that *almost 90% of the surveyed population needs to travel less than 2 Km to the closest supermarket. Controversially, from the first 5 reasons for using the car instead of the bike the one that had more votes was the travel distance,* followed by number of items and weight of the items.

Only 21% of the travels by car (for purchasing) are above 2 Km in distance (COWI A/S samarbejde med Horsens, Ikast-Brande, Kolding & Randers, 2015). That means that 79% of the automobile modal split (30%) could easily switch to bike if desired, that is a potential of 23.7% of all shopping trips. This is considering the statistics of the COWI consultation, but the gap is bigger if we use the local statistics, here we used the "least favourable" scenario, still it is very attractive.

Therefore, a considerable gap in favour of the bikes can be explored, and soft measures could play an important role if properly designed.

People is the driver for the life of the city, not cars, as Jan Gehl clearly points out: *"The mayor attraction in these recreational spaces are not the trees and the flowers, but that is, the age-old attraction of other people".*

Therefore, not only more people would be spending time in the area, spending more money and, visiting more stores per trip. at the same time, it will attract more people, creating not only a striking atmosphere in the city, but bigger sales for the businesses of the area.

On section 4.3.3 a suitable proposal will be developed on based on this potential.

Current Initiatives in the City

Free City Bikes (Bycykler)

An initiative that has been running already for some years, the Horsens free city bikes, or Horsens Bycykler. The objective is to provide free bikes to the visitors in the city, or occasionally any local that needs a bike. There are 120 bikes distributed in 13 locations (Visit Horsens, 2007), see Figure 2.27 - Bycykler Locations H*otel Scandic Bygholm Park - Jørgensens Hotel - Hotel Opus Horsens - Teaterhotellet - Hotel Danica - Horsens Ny Teater - Hotel Pejsegården - Fængslet - Danmarks Industrimuseum - Forum Horsens - Danhostel Horsens (vandrehjem) - Bygholm Sø Camping - Husodde Strand Camping - Lystbådehavnen og i Lunden.*

Many students don't know about this initiative, even after being living in Horsens for one year or more. This will be reviewed in section 4.3.3 to design a strategy so the students know about the service and use it.

(Visit Horsens, 2007)

Figure 2.27 - Bycykler Locations

Horsens Cykelbibliotek - Try an e-bike for free

As part of the efforts that the municipality is doing for turning Horsens into greener city, they started the project try an e-bike for free to the citizens so they can test the technology, and get familiar with the idea. To borrow a bicycle Is necessary to leave a deposit, which is returned when handing back the bike. The program will run in partnering with local bike shops, the reservations can be made online (Horsens Kommune, 2017).

These are the bike shop that participate:

Fri BikeShop i Horsens, på Smedegade 86-88

Design Cykler i Horsens, på Høgh Guldbergs Gade

Horsens Cykler in Horsens, Sønderbrogade 27-29

Østbyens Cykler in Horsens, Sundvej 28 F

Fri BikeShop in Brædstrup, Bredgade 15

2.2 Opportunities for Soft-Measures in Horsens

This section presents a summary of the gaps identified in the previous section to make easier to visualize and work with in section 3.3.

Raise the Occupation of the Buses.

Bus is used on only 2% of the trips under 6 Km in the city. The surveys show that increasing the comfort and the information systems has potential of attracting users.

Potential: 5.2% of new users and 12.3% of occasional users. *Combined 17.5% potential more riders for the system by providing increased comfort and better information systems.*

Cycling and shopping

Only 21% of the travels by car (for purchasing) are above 2 Km in distance. That means that 79% of the automobile modal split for shopping (30%) could easily switch to bike if desired.

Potential: that is a *potential of 23.7% of all shopping trips in Horsens.*

Young population is cycling less

Cyclists 16-29-year-old total travelled Km are very low compared with the national average, Barely half. See Figure 2.19 - Cycling Km Trips per Age, Cycling to School.

Potential: VIA University College has a student population of over 6000 students (Figure 2.28 - Student Population, VIA University College). All of them are between 16 and 29 most surely. More than 2000 are international students ("Kilde: VIA University College Horsens," 2016), and most of them do not own a car in Denmark, approximately 400 live in the Student Village. If we consider that Horsens City population is 56 000, those students (outside the Student Village) represent a **potential of almost 3% of the city population that could be bike commuters.**

("Kilde: VIA University College Horsens," 2016),
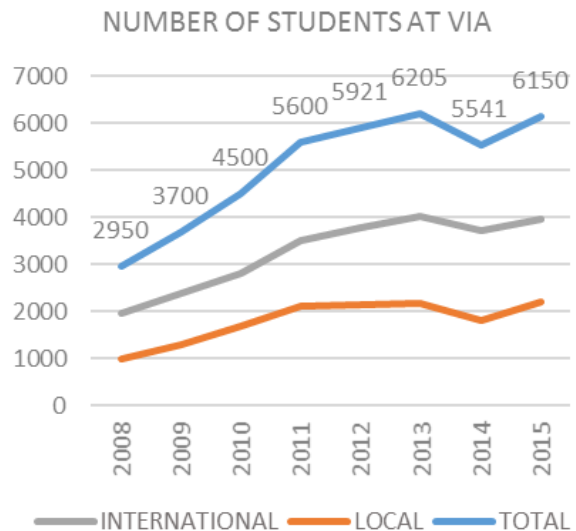
Figure 2.28 - Student Population, VIA University College

Congestion reduction in terms of car sharing or multimodal approaches.

Potential: from Figure 1.2 - Income vs Modal Share & Figure 1.4 - Growing Car Traffic in Horsens

Only about 20% of the total trips by car between 2 – 6 Km are travelled as a passenger. That means that **80% left corresponds to "solo" vehicles.** Carpooling has a great potential in the city, and it should be encouraged with companies and schools.

Individual "Mobility Actions" will be proposed for the European Mobility Week Horsens in section 4.3.3. The proposals will be based on the potentials here identified.

23

2.3 Defining Sustainable Urban Mobility

"*The sustainable mobility requires actions to reduce the need to travel, to encourage modal shift, to reduce trip lengths and to encourage greater efficiency in the transport system*" (Banister, 2008).

ELTIS, the Urban Mobility Observatory appointed by the European Commission, does not provide a formal definition of what Sustainable Urban Mobility is, although, it presents it in the applied version of SUMPS of Sustainable Urban Mobility Plans, which defined, together with policy makers, experts and stakeholders of multiple areas as "*A Sustainable Urban Mobility Plan 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* (Eltis, 2014)*.*

As pointed out in the Green Paper (2007): "*any strategy formulated at European level can only be successful if decisive action is taken at the local level; concrete actions will be taken over and implemented by local authorities*". This brings the decision power to the side of the local governments and main actors for change. They must take active and responsible role in implementing and proposing solutions on their own, while the European Commission collects and organizes the debate, providing to the municipalities with innovation, intelligent transport systems, economic incentives and legislation frameworks. It will be up to the municipalities to combine these resources effectively to achieve the best possible results for their needs.

Zegras (2005), presents an extensive investigation of the term of Sustainable City and moreover, Sustainable Transportation. The term appears often to be confused, showing that the literature most of the times mistakenly mixes goals, objectives and indicators, and uses them to define Sustainable Mobility. What is common finding in the investigation is that Sustainable Transportation, Sustainable Urban Mobility (being considered a variation of the term for the sake of simplicity) is most of the times defined in an *operational way.* Depending on the organization in play. It is commonly tilted towards three different planes: economic, environmental or social basis. The OECD, for example, defines it transport as a system that covers access needs without endangering public health or ecosystems. While the World Bank provided a definition that is financially oriented taking "efficient use of resources and proper maintenance of assets".

In 2005, Zegras proposes in his work an operational definition: *"Sustainable Mobility: maintaining the capability to provide non-declining accessibility in time". Where he explains that "Accessibility essentially represents the welfare that people derive from the transportation system", while "Capability comes from the fact that we cannot know what levels of accessibility future generations will desire".*

This Thesis aligned more to the definition of the European Commission on Sustainable Mobility, considering the vision and goals set by the EC for 2050. Nevertheless, the proposed definition of Zegras comprises in concise way what Sustainable Urban Mobility should be, without entering in the specificities of goals.

For the development of this work and because of the social component (user behaviour) that it has, the definition will be more oriented toward the user, based in the principles that Banister and Gehl propose, see Table 5 - Traditional vs. Sustainable Transport Approach,

Sustainable Urban Mobility looks both at the individual scale and needs in its urban context, as well as land use and Environmentally Friendly Transport. Every individual must be able to reach any point interest with ease and do it so preferably by walking, cycling of by using clean public

transport. The city and spaces need to provide attractive to the users, so the commute is *not time spent but more of an enjoyable experience*. To achieve so, it is intrinsically necessary the participation and adoption of the mobility strategies by the community (Banister, 2008).

2.4   Efforts of the European Commission

The best practice approach that the European Commission has adopted dates to 1995 and 1998, with its first proposal for urban mobility policies, the so-called "Citizens' Network", giving birth to a series of subsequent initiatives that have gradually shaped the framework for sustainable transportation and collaborative development (European Commission, 2017b), followed by the "2001 Transport White Paper – European transport policy for 2010; time to decide" and in September of 2007, the adoption of the "Green Paper – Towards a new culture for urban mobility", opening a cornerstone debate about more sustainable ways of transportation, smart, easily accessible and safe urban mobility for all citizens in Europe. The green paper leading to the Action Plan on Urban Mobility, which was adopted two years later in September of 2009 (European Commission, 2017a).

Later, following with the 2011 "White Paper – Roadmap to a Single European Transport Area, towards a competitive and resource efficient transport system" the European Commission formulated a set of 40 initiatives for the next year. The primary focus of the initiatives was to reduce the use and therefore the dependence of fossil fuel and cut carbon emissions 60% by the year 2050 (European Commission, 2011); doing so in such fashion that enhances competitive transport, increased mobility and grow employment.

Conventional Planning vs Sustainable approach

(Banister, 2008)

The conventional approach Transport Planning and Engineering	An alternative approach Sustainable Mobility
Physical dimensions	Social dimensions
Mobility	Accessibility
Traffic focus, particularly on the car	People focus, either in (or on) a vehicle or on foot
Large in scale	Local in scale
Street as a road	Street as a space
Motorised transport	All modes, hierarchy: pedestrian and cyclist at the top and car at the bottom
Forecasting traffic	Visioning on cities
Modelling approaches	Scenario development and modelling
Economic evaluation	Environmental and social concerns (multicriteria)
Travel as a derived demand	Travel as a valued activity as well as a derived demand
Demand based	Management based
Speeding up traffic	Slowing movement down
Travel time minimisation	Reasonable travel times and travel time reliability
Segregation of people and traffic	Integration of people and traffic

Table 5 - Traditional vs. Sustainable Transport Approach,

In 2013 the European Commission provided continuation to the 2011 Transport White paper with an Urban Mobility Package specifically designed to work on the initiatives 31, 32 and 33 of the White Paper. Initiatives that contemplated the establishment of mechanisms and procedures of financial support for Urban Mobility Plans at European Level, the creation of a package for access-restriction and road-charging schemes and, the instruments and best practice guidelines to manage freight activities in urban areas (European Commission, 2017a).

2.4.1   2007 Green Paper

The Green Paper *"Towards a New Culture for Urban Mobility "*comes as the initial step that the European Commission took for defining the Action Plan on Urban Mobility.

It was in September 2007 when the consultation which consisted on a 25-question survey was lunched and open to the many stakeholders involved, companies, municipalities, citizens, etc. With this, the EC was looking to know the standing of those parties that could be involved in the future changes. As well as to find what these parties were expecting from the European Commission in terms of regulatory actions, monetary resources, the role that the EC should take in agreement with the stakeholders among others.

The consultation returned more than 400 inputs of different backgrounds. The predominant response was from German organizations and citizens (28%), followed by France and UK (respectively 12% and 10%). From all responses, 25% were submitted by citizens (European Commission, 2007).

The questions are covering 25 topics considered key for the future of sustainable urban mobility. The stakeholders had an opportunity to express the support of the idea, be neutral or criticise. As well, they had the opportunity to propose actions, in general oriented toward the European Commission role.

Here is presented the list of the topics released in the Green Paper to understand better what were the main concerns back in 2007. The stakeholders commented whether they support or not the initiative and the main burdens that they consider relevant. The level of criticism of each of the answers, and the main concerns were recorded to be considered when designing the Action Plan on Urban Mobility (European Commission, 2007).

Toward free-flowing towns and cities

1. Labelling Scheme for recognizing cities pioneering in the topic.
2. Cycling and walking, how to promote the as real alternatives to car.
3. Modal shift, how to promote it toward sustainable transport.

Towards Greener Towns and Cities

4. Clean energy and efficient technologies, how to increase its application in urban transport.
5. Joint green procurement, how to promote it.
6. Green zones, is a criterion needed for its definition and restrictions? how compatible are with the free circulation and cross border enforcement?
7. Eco-driving, how to promote it.

Smarter Urban Transport

8. Better information systems, shall they be better developed and promoted?
9. Standardization of interfaces, how to ensure interoperability between cities, which applications should be prioritized?
10. Exchange of information and best practices, how to improve the exchange among all the involved parties.

Accessible Urban Transport

11. Quality of Collective Transport, how to increase it in European cities.
12. Rights and Obligations, is a European Charter needed for this.
13. Integration of passenger and freight transport, how to integrate it in research and planning.
14. *Coordination of transport and land-use planning.*

Safety and Security

15. Safety and security in urban transport, what actions shall be taken to help cities meet these requirements?
16. Better informed operators and citizens, how to keep them informed about the available technology.
17. Automatic radar devices, should these used in the urban environment, how to promote them?
18. Video surveillance, is it a good tool for safety and security in urban transport?

7 New Urban Mobility Culture

19. Bringing stakeholders together, shall they work together to develop a new mobility culture?
20. *European Observatory, would it be useful to have it to support cooperation?*

*Fina*ncing

21. Use of existent financial Instruments, and how they could help to get right.
22. Economic instruments, how market-based instruments can support clean and energy efficient urban transport.
23. Integrating urban constraints and urban traffic development, how target research activities could be integrated.

24. Urban charging, should cities be encouraged to use it, is there a framework for this?
25. Added value of clean and energy efficient urban transport funding, what added value would it bring in the long term.

These 25 questions helped to the EC to shape and design the White Paper of 2011, where taking all the feedback defined a set of goals and strategies for 2050.

2.4.2 2011 White Paper

"Roadmap to a Single European Transport Area, Towards a Competitive and Resource Efficient Transport System"

The European Commission is aware that the infrastructure changes can take decades in terms of transport technologies. Updating today's technologies will define the transportation that we will have in 2050 (European Commission, 2007).

The vision that the EC has defined is divided in three main segments: medium distances, long distance and urban transport.

The main goal in the transportation sector for the European Commission is to achieve 60% reduction of emissions by 2050, and doing it so in a way that does not compromise neither mobility nor economic growth. This is mainly to be achieved by reducing our oil dependence and using less and cleaner sources of energy.

There must be an efficient multimodal network for freight and inter-city mobility. Improved fuel efficiency of vehicles, greater use of waterborne ways, creation of freight corridors, and greater use of multimodal freight operations. Better virtual services, as online ticketing and a better integrated network for easier and reliable transfers.

When talking about long distance travel and intercontinental freight there is a clear domination

of aviation and maritime sectors, therefore, airports should be enlarged to match the growing demand. By 2050 new low emission fuels will become a standard and will reach 40% use. While maritime emissions should be cut by 40% of 2005 level (European Commission, 2011).

In terms of clean urban transport and commuting, cleaner vehicles, denser populations, making public transport more frequent, cycling and walking more attractive,

By 2050, all main airports and ports shall be connected to high speed railway network and waterways when possible.

The European Commission provides the strategy and initiatives for rail services, European Single Sky, capacity and quality of airports, a blue belt for the seas around Europe, road freight, among others, although, here we review the section only focused to urban mobility:

Mobility planning will play a key role on sustainable user behaviour, but it is essential to encourage it actively. Smart inter-modal ticketing systems with common standards Europe-wise will help the users to have a seamless travel experience therefore, the willingness to use public transport.

ICT has the advantage of providing services without need for mobility, therefore it should be explored. Mobility plans for cities above certain population will be encouraged to develop Urban Mobility Plans fully integrated with the Urban Development Plans.

Road and noise charging for passenger vehicles will have a main role to help phase out motorized private vehicles both in city centres and in inter-city networks.

During the next decade, the EC will work to develop legislative framework to ensure the competitiveness of transport but with a reduction of 60% of green-house gases by 2050 (European Commission, 2011).

3   STATE OF THE ART

3.1   Programs and Initiatives from the EC

3.1.1   CIVITAS

Funded in 2002 by the EC aims to provide a shared ground for sustainable transport for European cities. The core of the program is composed by a network of cities that are currently committed to create a change toward clean mobility. The Initiative has ten different lines of development, on which different projects are funded individually:

Logistics and Urban Freight, Public Involvement, Clean fuels and vehicles, Mobility Management, Transport Telematics, Safety and Security, Demand Management Strategies, Collective Passenger Transport, Car independent lifestyles, Integrated Planning

The initiative is helping to develop an adequate political framework, exchange of knowledge and information, and market solutions (European Commission, 2013).

3.1.2   FLOW Project

Flow project was founded under the umbrella of CIVITAS initiative and the H2020. Current participating cities testing the ideas are Budapest, Dublin, Gdynia, Lisbon, Munich and Sofia. The main objective of it is to develop a methodology to better model the impacts of cycling and pedestrian measures applied to current traffic simulation models (Flow, 2017).

Nowadays, traffic simulation tools do not consider the effects of modal shifting to non-motorized modes. What the project states is that any portion of users that switch to non-motorized modes would help to decrease the congestion levels.

For this, is necessary to develop a new methodology to assess these impacts. Based on Multimodal key performance indicators, in this case, delay, level of service, and density. The methodology indicates that individual kpi's are assigned to each mode. The methodology uses a person-oriented calculation instead of a car-oriented one. It considers the congestion level of each of the modes and provides a general grading for the network (FLOW, Frederic, & Szabo, 2016).

The project Is ambitious and many details of the real interaction between modes are difficult to represent in the simulations. Nevertheless, FLOW aims to raise awareness about the topic among the professionals of traffic and planning so these parameters start being considered in future developments.

So far, the project has found interesting results which were recently published, such as:

Narrowing roads and shortening pedestrian crossings do not increase congestion. Pedestrian improvements reduce bus delay by 40%. Pedestrian plazas reduce journey time for taxis and buses by 15%. Reduction of car speed limits and enhancement of bike and pedestrians contribute to reduce congestion, noise and accidents. Bike sharing is a good alternative when roadworks need to be done. In a series of 15 facts of cities that are part of the program, the importance of shifting to bike is clear. These dissemination actions are as well part of the objectives of FLOW to raise awareness toward non-motorized modes (The Civitas FLOW, 2017).

3.1.3   Organicity

Organicity is funded under The EU Framework Programme for Research and Innovation and not under the Transit Observatory. The project purpose is to allow the creation of an experimentation platform for urban initiatives.

The project was initially running in three cities at the same time, London, Aarhus and Santander.

These common platforms are based on open data, therefore, anybody who wants to have access to it can be granted under authorization. The idea behind is that data should be shared to allow other researchers use the data from other cites that might not be available in their city to experiment

with it, process it, use it as needed on their developments.

The project includes a varied collage of ideas in different topics, but it is centred in Smart City applications, which include smart and sustainable transport. Mainly information systems for buses and rental bike systems and traffic information in some cases.

The idea is to integrate the information collected by many sensors around the city, providing weather information, air quality, etc.

The project is currently being used to support live information for the users of the bus system of Santander TUS.

In Aarhus, the project has supported as well a variety of initiatives, but one is reviewed here due to is urban mobility nature. Aarhus Cykelby is an initiative started some years ago, as a proposal to increase the modal share of bicycle in the city.

This integration of transport systems and live information is vital to positively influence the user behaviour.

The users need to know about these live information systems most likely through marketing and user oriented campaigns, otherwise the system will remain unused. Therefore, again, the importance of soft measures and awareness campaigns for urban mobility.

3.1.4   European Mobility Week

The European Mobility Week – EMW is an initiative from the UE that started in 2000 as the World Car Free Day. In 2002 it changed name to EMW. The idea of the mobility week is to involve the communities and municipalities to try new alternatives of urban mobility. It is a European-wise campaign to which every city even outside Europe is invited to take part to promote or try new and current ideas of sustainable mobility.

The European Mobility weeks is held every year since then, on the 16th to 22nd of September.

The European Mobility Week was chosen as the practical case to be developed in this Dissertation. Since it represents a suitable scenario for soft policies, commonly used by the municipalities to show to the citizens what they have done through the year, or to launch new projects. In section 5.3.2 an in-depth review of the EMW is presented, together with the development of the applied case.

3.2   The Relevance of User-Oriented Strategies and Soft Measures

User-Oriented Strategies are widely used nowadays for several applications, therefore, the available strategies, tools and approaches are virtually endless, with technology evolving constantly and new marketing tools rolling to the market almost constantly.

This section presents a short review of two approaches that are specifically applicable for the case of Sustainable Urban Mobility, and provide a good ground for Voluntary Travel Behavioural Change, especially for campaigns as the European Mobility Week.

Despite the efforts made by governments and regulating bodies to advertise, inform and educate the population about the use of environmentally friendly modes, the status-quo seems to have a strong momentum. Cars manufacturers keep pushing the boundaries of car-ownership, and no matter how good the public transport might be, car ownership still is growing.

Governments could help to increase the cost of ownership by means of car-use charges, but political burdens restrain the public actors of taking such measures. Therefore, high costs and difficulty to acquire a driving license and insurance are the main players in ownership cost (Banister, 2008).

Banister presents means to raise public acceptance to the point that it creates both support and engagement toward sustainable Urban Mobility.

Public consultations in the European Union have revealed that the public in general and business are more willing to adopt and support changes toward EFM and in fact, they are expecting actions from the governments so congestion can be reduced. Support level toward mobility actions was found to be around 80%. Controversially, the same actors have a very distinct perception of the support of others and support levels toward other's. For example, the view of the public about the politicians taking these kind of actions, the agreement level falls to about 40%. Indicating that people is really expecting more actions than the governments are doing; politicians should be aware of this potential and use it to establish changes and new strategies.

"*It is through the active involvement of the users of transport in a partnership that change can be realised.*" (Banister, 2008). Implementation of urban projects must be an active process, participatory and inclusive. At an individual scale, Banister (2008) points out two key elements that rule the personal behaviour: acceptance that the policy proposal will be successful, and, that "a small change, if sufficiently supported and advertised **-as, example, the European Mobility Week-**, has the potential to drive new attitudes about private vehicle use. "

Demonstration projects are an effective way to slowly introduce changes and let the population realize *themselves* about the benefits under a "trial period". Heavily rejected and criticized measures as congestion charges in London, allowed the users try the benefits. Before the implementation of the trial period, 40% was pro the measure and 60% against; After reaching a reduction of 20% of traffic in the zone, and up to 15% higher speeds, both motorists and bus users benefited mutually, bus run more efficiently and faster with 3o% less waiting times. The poll was run again after these

results and the acceptance went to 55%, while only 30% remained against (Banister, 2008).

Similar was the case of Stockholm, where congestion charges of 1-2€ were introduced on a congested bridge for a trial period, even such small charging, managed to drop 20% traffic the next day of stablishing the congestion measure. Prior to the trial, support was only 30%, after the trial period, support rose to 70%, now they are keen to pay a fee for the before free road (Eliasson, 2012).

As he points out: "*When you try to solve really complex social problems, the right thing to do most of the time, is create the incentives… you don't plan the details and people will figure out what to do, how to adapt to this new framework…*".(Elias son, 2012, 8:06)

These two examples show situations where the authority took a decision even when the population was initially against the measure, but it was easier since those were a "trial" period only.

By Introducing the measures, I such way people will be less reactive, and it would allow them to see the benefits that the authorities and planners expected. Even if the measure does not work as expected, as it was introduced as a trial, it can be easily removed. But it if is successful, people will embrace, accept, and even support the change.

This traffic-control measures had virtually no cost to the authorities, in turn, they represent revenues. Instead of enlarging roads, adding lanes, or spending great budgets in infrastructure, the answer is in allowing the people some time to embrace the changes and enjoy the benefits. Then, releasing the measure into a permanent level.

Other approach, a participatory and user-oriented strategy for Voluntary Travel Behaviour Change - and recent field of research-, as pointed by Meloni & Teulada (2015), is *Persuasive Technology*. Basically, the idea of **individualized marketing strategies**.

In this approach, Meloni (2015) points out three cores for behaviour change: motivation, ability and, triggers. All of them being necessary for a successful conduct shift. Noting that even if an individual possesses both, high level of motivation and ability, if there is no trigger, no change will happen. ICT and mobile technology can be very efficient in providing these incentives and helping to build up a trigger point and maintain the adopted behaviour. For these, Fogg (as cited in Meloni, 2015) stablished 7 points for persuasion: tailoring (individual needs), reduction (simplify procedures), Self-monitoring (for the user), tunnelling (guidance through procedures), Suggestion (tips, hints and reminders), Surveillance (people behave better when feel monitored), Conditioning (provide incentives to modify the behaviour).

"Sustainable mobility has a central role to play in the future of sustainable cities, but it is only through the understanding and acceptance by the people that it will succeed."(Banister, 2008, 80)

"New ideas are continually being tested; many fail, but the best ideas thrive and are adapted elsewhere. The lesson of these efforts is that the key to sustainable transport will be leadership from political figures and policy professionals who have the optimism and vision to innovate, and the courage to learn from occasional failures." (Goldman & Gorham, 2006).

Brög (2004) points out that behaviour is a combination of willingness and possibility of doing something. Where the possibility is represented by the available options and the willingness is set by the information level, perception and preferences of the user. The common agreement on these areas that the user needs to be externally influenced to make a behavioural change. Given this premise, there are three main lines of action commonly taken: Offering more options (widely available bike parking sites), behavioural control (parking fees) and restrictions (no parking zones). But Brög has found through some -criticized-

studies, that this is not true completely. SocialData is the company running the surveys with their Indimark software, a e-marketing tool for behavioural change.

One study revealed that more than half of the trips made by car in Germany had no significant reason not to shift to a sustainable mode. In the Figure 3.1 are represented the total travel car trips in Germany, from which 13% had no suitable option to switch to, 10% had some other constraint and therefore obligated to use the car, but from the 66% using car, half of them had no good reason for using the car, that means 33% of the total trips made by car in Germany (2000 data) this potential can be transformed into actual users through soft measures and proper information campaigns and guidance (Brög, 2004).

The study points out, that there is no need to give up completely to cars, but to begin using it less, to significantly help to reduce congestion. People needs clear information, about costs, time and schedules options. Their subjective reasoning is that public transport is worse, which by the case is not true, but it is subjective reasoning which controls willingness -therefore, behaviour-, and is here where soft policies and user-oriented strategies could take another important role.
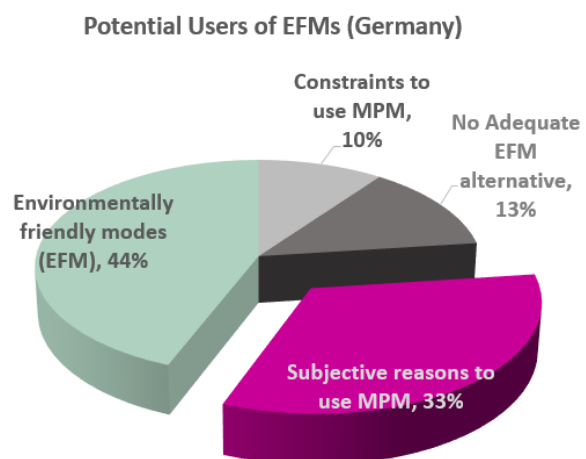

Potential Users of EFMs (Germany)

Figure 3.1 - Potential Users of Green Transport, Germany (ADAPTED FROM BRÖG, 2004)

Individualized market is an approach that was developed to provide information about suitable alternatives to the users. Better known as PTP or Personalized Travel Planning. These campaigns have proven to be successful in achieving modal shift in the users. The company -SocialData- participated in European level study "Switch to public transport" where these strategies and soft measures were evaluated and proven.

The engagement of the users continued after the trial period. The initiative consisted of providing a free public transport pass to all those willing to make a shift from car. Then information campaigns and personalized assessment was performed to give to the users the best option for their commuting needs. A later study in Perth showed that without need of any external measure, but the personalized campaign is possible to reduce the car share. The total trips made by car were reduced by 14% only by applying this approach (Social Data, study).

Under this context, ICT currently offers five great advantages as Brög points out: high level of personalization, live data visualization, readiness for data acquisition, large scaling automation, analytic capabilities.

3.3 Soft Measures and Strategies, A Short Review

This sections is a review, mostly a list of soft measures that have been successfully implemented in different cities. Most of these have been reported in several studies and success degree varies generating doubt in the experts. Still a common methodology for evaluating soft policies is to be developed.

It is important to note that soft-measures greatly depend on previous infrastructure available. It will not be possible to achieve change if the cycling network is not good or safe enough for using it in a daily basis, of if the bus network is unreliable and with very high headways.

For pedestrian-oriented strategies it is essential to have proper sidewalks, clean, safe and with good lighting conditions for the adoption of walking habits.

Value for the money, Soft measures first

In the study made by Goodwin (2010) for the Commission of Integrated Transport in Bristol, an analysis consisting of different projects of varied magnitudes of investment and nature (cycling infrastructure, automobile, tram lines, and smart choices) was examined from a benefit-cost ratio perspective, and tested along with conventional infrastructure projects.

For this, Goodwin defined aspects and assigned a monetary figure to the smart choices, so they could be compared with the investment. For instance, for automobile soft-measures he designates car-km removed from the roads, and by assigning the equivalent congestion cost (as a saving) use the total figure of removed cars from the road as an actual economic figure or return. Same for cycling infrastructure, using health expenses and accident-reduction instead. The remarkable conclusion from the study is that the first millions of a transport / road budget should be spent ***"on a large number of small relatively cheap projects aimed at local safety schemes, smarter choices, cycle improvements and some quality improvements to bus services"*** (Goodwin, 2010). To which he adds that these small projects are commonly overlooked by bigger, high-profile projects. In other words, ***"spending on these schemes is not yet sufficiently 'on the agenda'"*** (Goodwin, 2010, p. 35). Basically, the study reveals that soft-measure-based schemes have the best cost-benefit ratio.

The following sub-sections show a list of measures that have been adopted previously in cities around different countries. Due to the user-oriented nature of soft measures, no program will be the

same. Modifications and fine tuning need to be done to better suit the context of the users. The success of the soft measures will depend in great degree in how well tailored was the measure to the participants. The More is known about the users, their pre-disposition to switch their habits, the better will be the outcome obtained.

3.3.1   Automobile

-Lowering of speed limits in all residential areas and other areas with high concentration of pedestrian and cyclists (30 Km/h).

-Car pooling promoting programs for companies and universities.

-Congestion charges in City Centres.

-Work from home, home-office once or twice a month.

-Online shopping with delivery.

-Freight time restrictions, nocturnal delivery schedules.

-Multi-business shared travel (users living in a certain area but traveling to different companies)

3.3.2   Parking

-Reserved parking for car-pooling, at least 30% of the parking spots should be implemented gradually and have a reduced cost or be free.

-Exclusive parking for electric and hybrid vehicles, without need for having a charging station.

-Volatile pricing per traffic conditions, distance from the city-centre and rush hour.

3.3.3   Bus Systems

-Better information systems

-Seamless integration with train, tram, rental bicycle systems.

-Smart, comfortable bus stops with reliable information systems

-Personal travel planning strategies.

-Price reduction/free bus days to events or predicted congestion days.

-Marketing and brand-building (multimodal branding).

-Personalised Travel Planning (PTP).

-Multimodal approach (bike racks in buses)

3.3.4   Bicycle

-Proper cycling lanes (well signalled)

-Pumps and tools for bikes around the city

-Free bike repairs/service once a month for those shifting from car to bike

-Shower facilities at workplaces.

-Safe cycling to school programs.

-Bike sharing systems, integrated payment with bus/train.

-Information systems for Bike sharing systems.

-Wayfinding with times to main spots in the city. For pedestrian and cyclists

-Workshops about cycling safety for occasional users.

-Adult cycle training.

- "Bike it" programmes in schools

-Electric bicycles to students who agree to change their commute by car some days per week.

-Active app for activity tracking, integrated rewards system.

-Cycling for elderly residents, volunteer support).

-Free lending of bike trolleys for errands.

-Mandatory bike racks in every taxi.

-Yearly free gear to employees that cycle.

-Free bike repair classes.

-Electrically-assisted Bicycle taxis

3.3.5 Walking

- Step-o-meters: Pedometer, applied to recovery patients, or people who needs exercise.

- Walk to work, for residents living nearby or to combine with bus.

- Walk information and active life programs.

These measures do not represent an exhaustive list of measures, since programs can vary a little bit among them, creating several possibilities. Although, building upon those listed, it will be enough for the proposals to be used for the European Mobility Week.

3.4 The Role of Universities as Ground for Experimentation and Support

Universities play a key role for enabling change in our societies. It is somehow obvious that new challenges will be first addressed by this education and research institutions. But it is not only the scientific value that we need to value, but the overall guidance of the students toward the challenges we are facing. Universities must take an active role and enable change through participation.

Green behaviour is not an exception by any means. Recycling programmes, energy saving classrooms and automatic lighting is not enough. Transportation accounts for more than 25% of the total emissions in the UE. It is essential that young generations understand the implications and embrace a real change.

Many universities are already immersed in strict sustainable transport policies for their staff and alumni, and the efforts to get more institutions to do the same are already coming to the light.

Here are two examples of interesting initiatives currently open for universities that might be interested in taking a more active attitude for urban transport:

3.4.1 Green Campus (Sustainia)

Sustainia is a collaborative platform formed by several companies. Which aim is to move toward a greener future, in any aspects, energy, transportation, agriculture, healthcare among others. They have developed a "Green Guide" for campuses around the world. With collaboration with Oxford, UCPH, UC Berkley, Tokyo Un. and some more top universities in the world. The guide is a comprehensive document for sustainable campus, in which one chapter is dedicated to sustainable mobility and SUMPS.

3.4.2 U-Mob project

U-Mob project is leaded by a Spanish consultancy, Novotec Consultores. The program is running with funds from the EC until 2021. With the objective of use universities as a nest for awareness, best practices, reduce emissions, but more importantly, create a collaborative culture among universities to share strategies to engage students in green mobility. Strategies that include the creation of a program to design SUMPS for the campus and the creation of a new role in the universities named as Sustainable Mobility Manager.

4 Analysis & Results

4.1 Qualitative analysis (sorting) and direct comparison

All the soft measures examples that were collected and investigated are presented already sorted. Since the quantity of data was not extensive simple sorting and grouping was used to analyse the data (soft measures). The data was -catalogued- with just one main criterion in mind, the mode of transportation to which it is applicable or over the one that has the greatest impact. This simple grouping was more than enough for the quantity of data collected.

This way of sorting allowed to easily access the information already catalogued, by mode of transport that would be applicable. It can be said that is was the most intuitive yet useful arrangement to use in this case.

However, a second sorting and third criterion were used when comparing two or more initiatives directly, this second criteria was either this was by budget level required, involvement of the authorities and timeframe required to implement.

For example, closing of one street for the car-free day, would require virtually no money allocation when compared with the creation of a new section of cycling path or an upgrade to an existing road, although, the events to be held in the closed street would represent some cost, the cost is negligible compared with an infrastructure investment, therefore, easily accessible for a Municipality.

That two different levels of budget were used when assessing the actions to implement. A budget threshold of for example 500DKK for simple expenses as printed material or small prices were considered as virtually free, although, a budget considering this small expenses is to be prepared and recorded.

This multicriteria evaluation process was used to determine the most suitable actions to be implemented during the Mobility Week.

Since the Municipality claimed that no support could be provided for the European Mobility Week, at least this year, all the actions that would involve the participation of the municipality or the traffic department were automatically discarded. Making the selection process faster.

As well, the budget allocated for the project was not known, but it was available as a fund from the Student organization board and it would be upon request. So, for the evaluation, only initiatives catalogued as "free" would be used, although, we know that small budget is required and available. A second round of initiatives was evaluated with the University with a little bit of more budget.

The sorting and comparison in this work considered three criteria i.e. first criterion, already discussed, the participation of the municipality, second criterion to discard proposals, investment, and third, the timeframe required.

As many criteria as we need could be used, in fact, using the target group, or how measurable an action could be. It will merely depend of the needs of the project and the results or data that the researchers or authorities are willing to use.

The analysis has been carried out and is presented in detail in ANNEX 1 (Processing and Selection of Initiatives), the criteria used for the multicriteria analysis carried out is explained next.

For the multicriteria evaluation of the ideas to be selected for the EMW: All the initiatives were assigned a row and evaluated by the three main criteria mentioned, budget requirement, involved stakeholders and timeliness. Values of 7, 3 and 1 were assigned on the following fashion High=7, Med=3, low=1. Then all the soft measures were evaluated in a "arbitrary" empirical way, but the equivalents are somehow matching the next criteria:

Budget

1= printing papers and basic material, access to video rooms.

3= small investments <1000€ in total for a pilot

7= >1000 €.

Stakeholders

1= one or two people can do the work

3= needs participation of a third party, most likely supportive and willing to help.

7= involves the municipality or more than two big companies. With high bureaucracy.

Timeliness

 1= can be planned and done within some hours of work. Less than one week, less than part time.

3=requires more planning and probably buying things that will need delivery time

7=requires actual project management full time

For the evaluation, first round was conducted assigning the grades with the criteria already explained.

The values were added arithmetically since it appeared to yield good results with the scale assigned. Good differentiation of big and more complex projects was made in the first round. The only initiative that was in the planning but was not possible to get in the EMW is the only idea included in the first screening but had a score right in the upper level of the "doable" initiatives (Cycling for elderly residents). If the price goes over the 1000€ (or even less, for student programs). Additionally, if it requires involvement of a third party, the project can stop there very easily, no matter if the potential of the idea is good. In this case, this idea was selected prior to the analysis because the social aspect that it included had a high attractiveness level. Even though, we can see in Annex 2, table 8, the only initiative marked on

yellow is this one. And it was the only case of the ideas selected that could not be implemented. Due to negotiations and time for proper planning.

Going back to the analysis, once all the values were calculated, The best rated initiatives were compared with an empirical list made prior to the analysis, in this case, all the initiatives that were pre-screened, were confirmed to be the most suitable ones after applying the multicriteria analysis. The selected ideas went through the next phase of the project planning the EMW, contacting the stakeholders involved and uploading them to the EMW website..

4.2 Urban RoadMaps Tool (Ricardo, European Commission Open Platform)

Urban RoadMaps is an on-line urban mobility assessment tool developed by Ricardo Energy & Environment for the Directorate General of Transport, DGMove.

The tool aims to give a quick solution, based on historical data of multiple projects that the EC has completed about urban mobility.

The tool is easy to use, presents a series of menus that can be easily navigated and intuitive to use. Although, the options are many, it requires some time to explore all the available possibilities that the tool presents.

The importance of this tool is that enables the use of qualitative data that can be obtained easily for many cities, and yields actual quantitative and detailed results in terms of emissions, energy consumption and economy.

It presents a very nice visual representation of how different green policies could affect or benefit a Sustainable Urban Mobility Plan. It is very easy to see the results by isolating and toggling on or off the desired policy to see the effect that it would

have in the future. It allows to set different baselines to easily compare between two policies.

The input of data requires some time but it is not a tedious process or utterly complicated, is friendly, straight forward and requires, of course, some basic data of the city and the transport plan and current situation.

As a review of the tool, a case for the city of Horsens was made with the data that was available, the objective was to evaluate the tool as a support for planning, just to provide an idea of the alternative that current urban planners and policy makers need to take decisions, See ANNEX 3 – Urban Roadmaps Tool, for further discussion and results.

It is worth mentioning that the tool was recently released in June of this year (2017), therefore, updates are expected and most likely the results will get more precise.

Even when the evaluation exercise performed with the Urban Roadmaps tool was more exploratory in terms of the tool capabilities, some results were obtained. The input data was as detailed as possible with the information available about the city. It is important to note that the main policies that were selected to implement match the strategy of the city as close as possible. Although it was not the main objective of the work, and exploration of this tool is worth considering for future research.

An intro to the tool and how to set it up is shown In Annex 3. An additional exercise comparing two different scenarios based in the simulation here presented is also included just to show the capabilities of the tool.

For the effects of the simulation here presented, the policy groups 1 and 5 were used but freight and delivery related topics were unticked.

The tool displays results I three different areas: transportation, economy and environment. Only

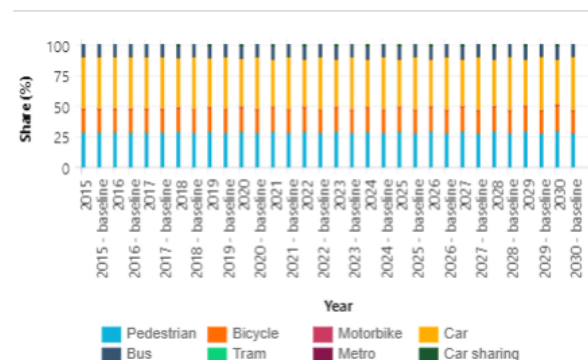some of the parameters are shown here. But the full scenario can be accessed in the following link:

[Urban Roadmaps - Simulation Horsens](http://www.urban-transport-roadmaps.eu/scenario/3566afb1)

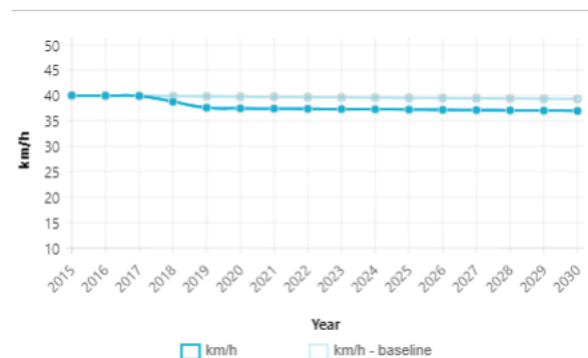(http://www.urban-transport-roadmaps.eu/scenario/3566afb1)

Most of the graphs depict a baseline scenario (light blue trend) vs the scenario with transport policies applied. This exercise considered mainly
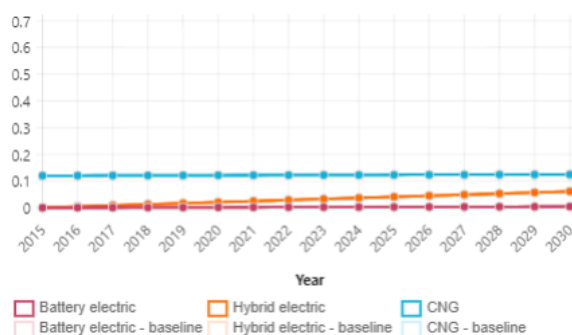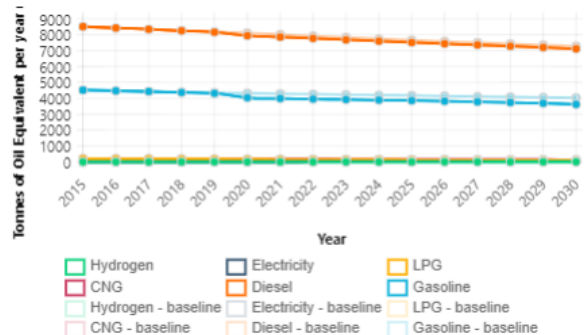
SOME RESULTS FOR TRANSPORTATION

Penetration of alternatively fuelled bus vehicles ⓘ

Legend:
- Battery electric
- Battery electric - baseline
- Hybrid electric
- Hybrid electric - baseline
- CNG
- CNG - baseline

Total fuel consumption by fuel type ⓘ

Tonnes of Oil Equivalent per year

Legend:
- Hydrogen
- CNG
- Hydrogen - baseline
- CNG - baseline
- Electricity
- Diesel
- Electricity - baseline
- Diesel - baseline
- LPG
- Gasoline
- LPG - baseline
- Gasoline - baseline

SOME RESULTS FOR ENVIRONMENTAL IMPACT

CO2 emissions (tonnes) ⓘ

Tonnes

Legend:
- Tonnes
- Tonnes - baseline
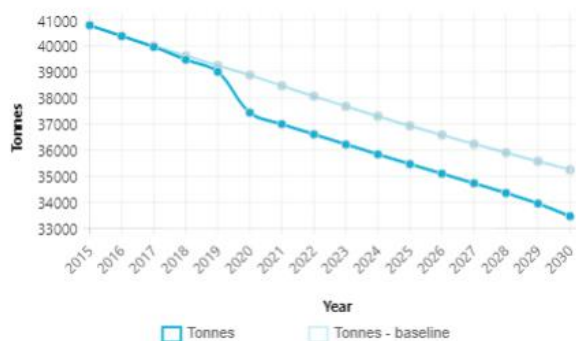
Total passenger fuel consumption by mode ⓘ

Tonnes of Oil Equivalent per year

Legend:
- Car sharing
- Bus
- Bicycle
- Metro - baseline
- Car - baseline
- Pedestrian - baseline
- Metro
- Car
- Pedestrian
- Tram - baseline
- Motorbike - baseline
- Tram
- Motorbike
- Car sharing - baseline
- Bus - baseline
- Bicycle - baseline

PM emissions (tonnes) ⓘ

Tonnes

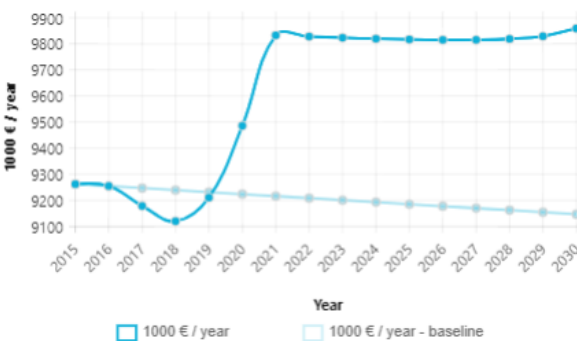Legend:
- Tonnes
- Tonnes - baseline
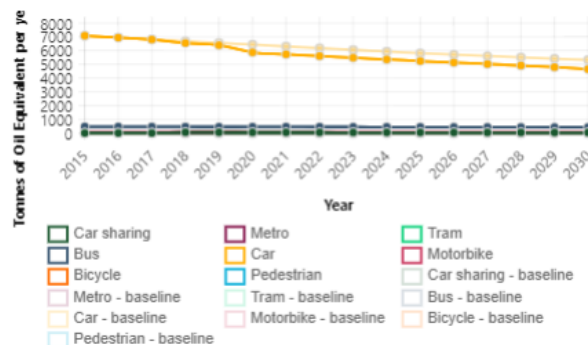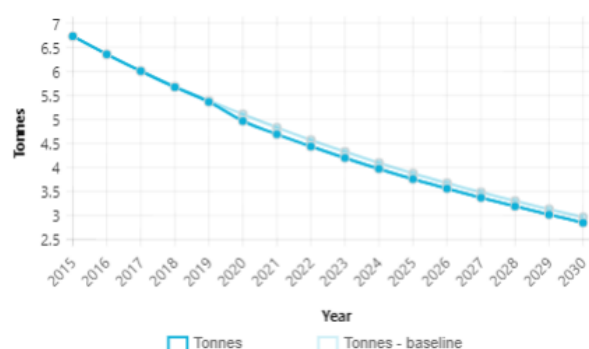
FINALLY, SOME OF THE OUTPUTS IN THE ECONOMY SECTION.

This section of results will be particularly appealing for policymakers. It helps to visualize the investment flow needed to implement the initiatives that we just input to the system. Something important to note is that for each implementation selected, the tool offers to phase it and ramp it up according to a selected date. So, let's suppose the case that the cashflow required by this specific plan is not possible for the municipality, it would be possible to save this scenario (via url) and go to modify some of the investments and phase it off to a posterior date or as needed. This could be done in just minutes offering an unmatched response for taking decisions. For further discussion about the tool, refer to ANNEX 3 – Urban Roadmaps Tool.
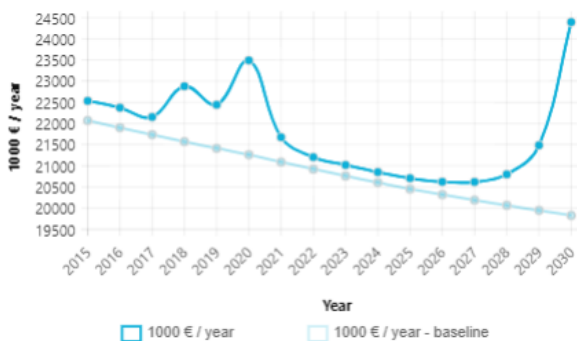
Transport expenditure of public administration (1000 Euro/year) ⓘ

y-axis: 1000 € / year
x-axis: Year
Legend: ☐ 1000 € / year   ☐ 1000 € / year - baseline

Revenues of public administration (1000 Euro/year) ⓘ

y-axis: 1000 € / year
x-axis: Year
Legend: ☐ 1000 € / year   ☐ 1000 € / year - baseline

Transport social monetary costs (1000 Euro/year) ⓘ

y-axis: 1000 € / year
x-axis: Year
Legend: ☐ 1000 € / year   ☐ 1000 € / year - baseline

Net financial result for public administration (million Euro) ⓘ

€-15

Baseline: €-8

4.3 Mobility Week Horsens

In this section I present the practical application of the work performed in the previous sections. This projects aims to place into practice all the information gathered about the city, the literature review and the project management and stakeholder engagement components of the Master Degree.

4.3.1 General figures

During the Mobility Week, the cities are encouraged to participate in three different ways:

- Permanent measures
- Week of activities
- Car-free day

Each year the campaign has one theme, this year is "Clean, Shared and Intelligent Mobility", and the slogan is "Sharing gets you further".

The municipalities are encouraged to centre their activities of the week around this theme, to give a general meaning to the campaign, although, it is not a strict requisite, since any mobility action is accepted.

All around, 20% of the participant cities or towns implement the three of them, being awarded the rating of "Golden" participants for their commitment. The 80% left mainly fails to implement the car-free day, since it is the measure that causes more problems to the towns and citizens, therefore the authorities are less willing to implement it, although, the report shows that the number of participants organizing it has rose for the last four years (Figure 4.1 - Cities Organizing Car-Free Day, 2016), even when the car-free day has been held on weekdays.

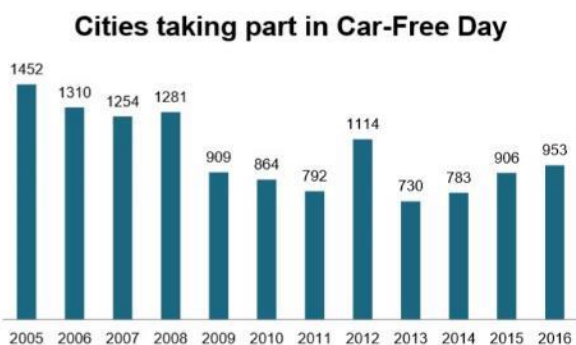**Cities taking part in Car-Free Day**

Figure 4.1 - Cities Organizing Car-Free Day, 2016

Last year was the first time that another important date was paired with the Mobility Week the so-called European Day Without a Road Death, organized by project EDWARD, also under the EC, was held on September 21st, just before the Car-free day, which is globally held on the 22nd.

That might have contributed to raise the number of participating cities and set the record of 2427 cities, the event even had participation from cities in U.S.A., Canada, Mexico, Argentina and Japan.

4.3.2 Analysis of participation of previous years

Horsens has not participated on the European Mobility Week before, the last and only participation that is registered in the database of the EC is from 2000, when the event was "Car-free day".

Interestingly, when looking only at the participation rate of Denmark we could think that most developed countries as Scandinavia have less interest to show what they are working on. Denmark is a leading country in sustainable practices and many actions are done across the country. But why is Denmark particularly indifferent to the campaign? looking at the list, we can see all the neighbours with relatively constant participation and interest in the campaign through the years, Sweden has the highest and constant figures and the biggest rate of "gold" participants, in fact, Malmö received the EMW award 2016 for

the efforts shown on sustainable Mobility.(Report, 2002)

Country	2011	2012	2013	2014	2015	2016
Denmark	1	0	0	1	0	9
Finland	8	13	29	27	34	27
Norway	18	18	18	18	20	33
Sweden	88	105	98	87	90	83
Netherlands	10	24	18	14	2	20
Germany	50	14	12	8	11	29
Belgium	48	55	78	30	35	117

Table 6 - EMW 2016, Participation, Shortlisted

The regulating body (Kollektiv Trafik Forum) in Denmark helps to promote and unify the campaign materials but for some reason the municipalities are not participating. It could be the cases that the entity is not a body with direct influence over the municipalities as for example Ministry of Traffic, Building and Housing.

In general, the campaign has drawn so much attention and interest that the European Commission decided to add one more award to the two already existing (SUMPs and EMWAward) specifically targeted to small municipalities (<50000 inhabitants). This might contribute to keep the interest and collaboration of these small towns.

4.3.3 EMW Horsens 2017 – Turning Objectives into Mobility Actions.

For the practical case, "The European Mobility Week Horsens 2017" and in accordance to the theoretical goals stablished in section 1.1.1, and the gaps identified and listed in section 2.2 the proposal was made in accordance to fulfil the objective, and Mobility actions, were designed accordingly.

In ANNEX 1 (Processing and Selection of Initiatives) is presented the procedure followed to get to the 10 proposals showed in this section. The Annex 1 contains a basic multi-criteria analysis and direct comparison method to select the most suitable proposals to use for the EMW Horsens 2017.

The Multicriteria analysis is explained on detail in section 4.1.

The procedure (on ANNEX 1) can be skipped for now and continue reading through this section. But it is presented as evidence of the analysis made to determine the results of the practical case.

(Continues in next page).

1- **Objective**: Develop a proposal to increase the users of the bus network with the application of user-oriented solutions.
   Proposal: *Increase the comfort of the bus stops*.
   Justification*: section 1.2.4 - CITY BUS, showed a potential to increase 16.6% the number of occasional users and 5.2% the non-users of the network by increasing the comfort and improving the information systems of the bus system. Bus modal share in the city is only 2%. The idea is to update three of the most frequented bus stops determined in section 2.1.2., fig Figure 2.16 – Average Daily Passenger Count Per Bus Stop
   Mobility Action: *Involve students of Construction Engineering and Architecture and ICT to a **competition workshop** where they will have the chance to make a design proposal for a **prototype bus stop** that includes sustainable features and information systems. Teams must be multidisciplinary. The jury will be composed by teachers imparting the workshop.*
   Budget: The incentive is to be negotiated but the initial proposal is to win a monthly pass to ride in the bus. For the winners.
   Stakeholders involved: Teachers: To be Defined / VIA / Midttrafik (Ideally)

2- **Objective**: Matching suitable cycling strategies with the results of the studies about **safe cycling**.
   Proposal: *Provide Road Cycling Education*
   Justification: More than 2000 students in VIA are not Danish. They do not know the Danish regulations nor the safety practices to minimize accidents. Additionally, Cyclists 16-29-year-old total travelled Km are very low compared with the national average. Section 1.2.4 CYCLING, Cycling to School.
   Mobility Action: *Safety Cycling Workshop for International Students*
   Budget: give 15 sets of led lamps and bells to the first students that sign up. To be defined.
   Stakeholders involved: Apero Bikes / VIA / SikkerTraffik (ideally)

3- **Objective**: **Matching suitable cycling strategies** with the results of the studies about **commercial relevance of the cyclists** for local businesses (1st action).
   Proposal: *Offer a suitable option for going to the shop by bike*
   Justification: Section 1.2.4 CYCLING, Cycling and commerce, In the closing section, it was found a potential of 23.7% of the trips to the shop could easily switch to bike. 90% of the surveyed population needs to travel less than 2 Km to the closest supermarket.
   Mobility Action: Buy a bicycle trailer for shopping purposes. The students will be able to borrow the trailer at any time in the reception, in this way we will encourage replacing trips to the shop by car, and in the worst scenario, students will have a mindset that they can go to the shop by bike. Students commonly ask for a ride with a friend, that would be avoided in some of the trips with this measure. The objective of this idea is to demonstrate the idea and work together with some shops in the city that help to support this, by setting parking places for trolleys (currently none of the stores offers where to park – safely, this kind of trailers). Additionally, the trailer could have the branding of the store, and it would be free advertising for them.
   Budget: A bicycle trailer will be bought by VIA. Cost still to be defined.

Stakeholders involved: VIA / Administration office / A Store, ideally (Bilka, Netto, Rema)

4- **Objective**: **Matching suitable cycling strategie**s with the results of the studies about **commercial relevance of the cyclists** for local businesses (2nd action).
Proposal: *Offer a clean alternative for Senior Citizens transportation -* *instead of Flextraffik.*
Justification: Section 1.2.4 CYCLING, Cycling and commerce, In the closing section, it was found a potential of 23.7% of the trips to the shop could easily switch to bike. Additionally, this action brings a social/health contribution.
Mobility Action: Buy a bicycle rickshaw for adults. This idea is based on Cykling Uden Alder, an initiative of providing free, voluntary served, bicycle rides to elderly citizens instead of the regular taxi service. Health benefits are both for the seniors and the volunteers.
Budget: The rickshaw can be acquired with Cykling Uden Alder. 4500€, alternatively this will be proposed as a final project for mechanical engineering students, at the end of the semester they will need to deliver the functional prototype. To be defined.
Stakeholders involved: VIA / Professors of Mechanical Engineering / Sundhed Horsens.

5- **Objective:** Find possible solutions for **congestion reduction in terms** of car sharing or multimodal approaches (1st action).
Proposal: *Promote Car Pooling in VIA*
Justification: Rapidly increasing traffic in Horsens, only from 1997 to 2003 travels by car increased by approximately 30%, only

20% of the total trips by car are made with more than two people in the car, the other 80% of the times the car is only used by the driver. Potential of congestion reduction and emissions reduction is big. The MOBI program from EC achieved 20% of CO2 reduction, and reduced the automobile split from 44% to 26% in the participating companies. **Mobility Action: Designate exclusive parking places for car-pooling**, Trial during the EMW.
Budget: to be defined. The places need signs and the cars stickers or some identifier.
Stakeholders involved: VIA / Building Administration.

6- **Objective:** Find possible solutions for **congestion reduction** in terms of car sharing or multimodal approaches (2nd action).
Proposal: *Promote TADAA! E-bil car sharing APP* *with the students.*
Justification: Follow the recommendations made by the Danish Council of Climate Change (CO_2 emissions reduction with the use of electric vehicles)
Mobility Action: An Interactive Contest So the students get familiar with the e-cars, the app and the rental system, as well they will learn where are the charging stations in the city.
Budget: to be defined. Prize for the winner of the contest will be a month subscription.
Stakeholders involved: VIA / Insero (Tadaa!).

7- **Objective:** Raise the awareness of the users about the sustainable mobility infrastructure that the city already has (1st action).
Proposal: Promote the Bycykler (Free City Bikes)

Justification: Cyclists 16-29-year-old total travelled Km are very low compared with the national average. Recommendation of the Danish Council of Climate Change. These bikes are oriented toward visitors or residents sporadically using them, having tourism riding bikes could benefit commerce, as reviewed in section 1.2.4. Section 1.2.4 CYCLING, Cycling and commerce, Tourists and visitors could spend more time and visit more shops 1.9shops / trip by bike vs 1.7 shops / trip by car.

Mobility Action: Present the free City Bikes to the new international students and the interactive map where they can find the locations where to get a bike.

Budget: None.

Stakeholders involved: VIA / Horsens Cykelby

8- **Objective:** Raise the awareness of the users about the sustainable mobility infrastructure already available in the city (2nd action)

Proposal: *Promote Bike rental at affordable prices for students*

Justification: Cyclists 16-29-year-old total travelled Km are very low compared with the national average. Recommendation of the Danish Council of Climate Change. Section 1.2.4 CYCLING, Cycling and commerce, In the closing section, it was found a potential of 23.7% of the trips to the shop could easily switch to bike. 90% of the surveyed population needs to travel less than 2 Km to the closest supermarket.

Mobility Action: Apero visits VIA and makes easier for the students to rent a bike.

Budget: Printing posters only, to be defined.

Stakeholders involved: VIA / Apero Bikes team.

9- **Objective:** Raise the awareness of the users about the sustainable mobility infrastructure that the city already has (1st action).

Proposal: *Promote Bus Live Information app.*

Justification: from section 1.2.4 - CITY BUS, showed a potential to increase 16.6% the number of occasional users and 5.2% the non-users of the network by increasing the comfort and improving the information systems of the bus system. Bus modal share in the city is only 2%.

Mobility Action: Promote the Midttrafik live map App among the students and explain them how it works**.** Better information about the scheduling or live information should help to get more users for the system.

Budget: None, a Screen is needed to show how the app works.

Stakeholders involved: VIA / Midttrafik (Nice to have.)

10- Raise awareness of the importance of the role that VIA University could have on the successful transition to non-motorized modes and clean transport strategies.

This will be somehow a result of hosting the EMW this year. Promoting this Mobility Actions an being part of is the first step to show how VIA can an example and experimental ground for strategies that the municipality might not be willing to implement at large scale.

11- Set a baseline and antecedent to create a Sustainable Mobility Policy for the New VIA Campus Horsens.

The actions held by VIA are already oriented toward this purpose. All these proposals can be considered as a very basic precedent of what kind of actions the policy should consider.

4.3.4 Stakeholder Involvement Process

The European Mobility Week is an event that allows to any entity that has interest in promoting sustainable mobility to disseminate ideas or initiatives in a common framework for communication. The campaign has a well-built sense of identity and inclusiveness, which represents an attractive opportunity for different entities of any kind as a platform to discover, evaluate & present initiatives, products or services that contribute to turn our cities cleaner and more liveable.

The main stakeholder that should take participation in the Mobility Week is of course the municipality. It will work as a cohesive actor for the rest of the involved entities. Bringing attention of larger stakeholders with much larger impact potential. It is primary to get the municipalities working on this. The European Mobility Week is an event that should be scheduled in any Municipality agenda year to year.

Currently the cities already organize many events that are citizen-oriented. And there is no need to design special activities for the European Mobility Week. A good strategy for the Municipality is to pair these other activities during the dates of the Mobility Week and align them to the theme of the year. The EMW does not necessarily implies extra workload for the local governments. But this need to be planned timely.

Something important to remind to all municipalities is that they can to report mobility actions along the year. That means that they can identify all actions that are within the theme of the year and make sure to report them. If they keep track of the upgrades, it would be possible to create events based on that, so the people meet these spots or get to try the new infrastructure.

Public transport operators are the second most important target to join the EMW. If we want to reduce congestion and switch to sustainable mobility, these stakeholders are target for the Mobility Week. It represents the perfect time to attract more users to the network by promoting campaigns during this time. Upgrades to the network and other updates as information systems can be easily promoted during the EMW. Here is important to include all companies involved in transport, with attention to shared-economy industry, car and bike sharing systems can get much of the EMW if a good strategy is used.

Universities, as we have reviewed, are a focal point for development and innovation. And transport innovation must be promoted from the inside-out. Education institutions are key players in the promotion of environmental practices, provide a technical ground and controlled environments for running experiments for mobility. It is important to engage all educations institutions for the EMW. Clean Mobility is something that should be celebrated and promoted as a goal, as a lifestyle.

The current generation is very attached to automobile use, and if universities do not take active role in promoting sustainable mobility practices, it will be difficult to target this age group later when they start acquiring vehicles.

Companies, as such are somehow cause of most of the traffic that we see in our cities, trying to engage big companies with large number of employees to participate and make car sharing for one week could take out of the streets significant number of cars. The EMW is a perfect time of the year for these companies to promote and launch programs of sustainable transport. Work from home day would be a very interesting proposal to make as well.

NGO's and volunteer groups play as well an important role in attracting organizers to the events, this can help to the municipalities to organize more events if they lack workforce. Local cyclist groups, sport clubs are a good target to raise participation, it is easy to organize activities that involve walking, cycling and enjoying the public space with active-oriented stakeholders.

For this case, all these stakeholders were contacted and invited to take part of the activities that were planned for the European Mobility Week. The first approach, was the university, as any scholar project, it is the natural best choice to get support from other stakeholders.

VIA University agreed to take part and host the activities of the EMW. It will be the precedent for switching the Urban Mobility of the students, and this trials shall be replicated at a larger extent in the new Campus.

With the support of the university and a venue for the EMW, engaging more entities was easier.

The second approach was to the *Horsens Kommune*, although they were contacted from different channels of supporters, the answer was clear, they had a full agenda and lack of resources. But the first approach was enough to get attention toward the EMW. It opens the possibility to plan the EMW for next year, most likely with collaboration of VIA involved professors and students.

Companies were the second contact to approach, *Insero*, the IT company boosting Horsens development in energy and sustainability had the perfect business for this. *Tadaa!* A locally created car-sharing company that uses exclusively e-vehicles. That is the type of companies that should take part during the EMW when possible, with attractive products that promote clean mobility. They agreed to plan and offer an event to present the system to the students so they learn how to use it, and to understand how car-sharing schemes could be a solution to car ownership and congestion.

NGOs, in this case, the Student organization *AperoBikes.* The group of volunteer students that rents during one semester bikes to the students in VIA. The rental system is affordable and targeted only to students to avoid conflicts with the local bike shops that the students cannot afford. New students usually don't know about the option of having a bike, promoting cycling is about options, and having the option of renting a bike for a low fee would promote cycling among students. They will present the safe cycling workshop, and is a good opportunity for them to recruit new volunteers for the group.

Unfortunately, it was not possible to get answer back from Midttrafik. The correct channel for working with them is through the Municipality, but since they will not take part this year, it was not possible. The idea was to provide a Free Bus day, during at least the 22nd of September, to further reinforce the Car-free day initiative.

Due to the short time to the date, it was not possible to engage another of the NGOs that the project considered in the actions, Cycling Uden Alder – Aarhus. They provide bike rides to elderly citizens with help or volunteers. They were contacted and showed interest in supporting the idea of presenting the idea in Horsens, but it was not possible to complete the collaboration with them.

When targeting the stakeholders is key to first identify their business and how mobility affects or benefits them before making a proposal. The key idea behind engaging them is that all parts should get a benefit by participating in the EMW, does not necessarily derived from a commercial activity, at least not directly. The strategy used for the stakeholders that were approached here was to prepare two proposals with different levels of commitment and planning involved.

It is possible to present them the simplest idea, if they show more interest or support and they have the resources, they might take the more elaborated option, since it is supposed to be more engaging and attractive. But the goal is to get them engaged in participate. Since the event is held each year, more planning for the next year will be possible.

Being prepared is key, a small presentation showing what the EMW is and how the goals, then the ideas that could be implemented with the specific stakeholder is useful resource. It is important to clearly identify what is needed from them, otherwise, it will make the process slower, at least to have a list of things that are necessary make the meeting easier.

4.3.5 Planning, Calendar & Activities

Since the Calendar of the EMW is fixed to the 16th to the 22nd of September, it is only necessary to set the dates and times for the individual events. The schedule is designed in such way that at least we have two events each day.

The events will be held twice a day probably, during lunch time. Details are still to be defined with each of the participating parties.

Since the events will be run by volunteers, the time will be adapted to school hours and their availability. Nonetheless, it is planned to have one person at least providing information about the event.

In terms of image, the EMW provides with all the material, graphics, guidelines, everything that one could need to prepare business / pitch presentations or advertisement. This helps to keep the strong identity of the campaign and saves time to all those participating, it is a very efficient way to turn the organization of events easy and faster. Everything is pre-casted, and very easy to use.

When planning a EMW it is a good idea to review all the possible events that could line up with the 16th-22nd of September, then target those events to attract more users for the campaign and vice-versa. The reach of the EMW can be multiplied if any other event planned during the same week invites the population to make use of a clean transport mode to assist.

4.3.6 Creating a Profile and Registering the Mobility Actions

As secondary objective of the applied case is to evaluate the workload and resource allocation required to apply to the selected EC initiative, in the case of this work, The European Mobility Week. Therefore, here will be provided an example of documentation of the application. How tedious, long or non-user friendly are the steps and interfaces, to know if this has some influence on the number of participating cities and how keen are the municipalities to assign resources to this initiative.

The Mobility Week allows two kind of actions, being the only difference who are the actors organizing them.

The first type of action is held and organized by local authorities, and only the municipalities are allowed to sign up and organize events under this scheme.

The second one is the remaining part of the program "Make the Right Mix", which allows to any organization, individual, business etcetera, to create and organize events during the EMW, under this scheme, there is no need for the authorities to take part, although, having the support of the municipality is the ideal situation. This scheme is the one that was used for this project. Due to time constraints, the Municipality was not open to participate in the organization of activities, at least not for this year.

In any of the two options, the process to be part of the EMW is easy and straight forward. The information asked does not take more time than opening any e-mail account, or less. General data as name, address, e-mail, phone, organization.

Once the account is created, the process of upload the actions is as simple as creating the account.

For creating the action, only the name, place, and some details are asked. The actions can always be updated afterwards, that means that if at the moment of uploading the actions all the details are not still defined, still it can be uploaded and later modified. The updating process is equally easy.

Pictures, material campaign, see ANNEX 2 (Account Sign Up, Upload Information, Campaign Material)

4.3.7 Det Kollektiv Trafik Forum, The Moderator of DK activities.

The national Danish moderator for the European Mobility Week is the Kollektiv Trafik Forum. The organization has the role of gathering all the actions that the municipalities will run, ensure that these activities are properly registered in the EC website of the European Mobility Week, prepare joint promotional material, coordinate press coverage and publish the results of the EMW in their number of Kollektiv Trafik newsletter.

The organization is not in charge of providing financial aids of any kind of any other local arrangements.

They upload all the actions that are in the EMW site to the Kollektiv Trafik Forum website, all this actions will appear in Danish. The translator was kindly provided by the editor in charge and the information is already in their website.

See Annex 2 to see the Kollektive Traffic Forum.

5 Conclusions and Further Work

5.1   On Universities and Soft Policies

The idea of setting a small ground for collaboration for sustainable mobility is exciting enough, but given the current transport situation of Horsens and the upcoming projects, this initiative has the potential to open a collaboration plane for further development. Why young generation is already automobile dependant and the older generations are cycling more (Figure 2.19 - Cycling Km Trips per Age).

It will be valuable to observe the reaction and opinion of the students about sustainable mobility before and after the EMW.

Part of the intention of this project is to get a grasp of what could be the right approach with the young generations to engage them in a voluntary choice toward NMM and public transport.

Soft policies can help to ease the gap between infrastructure implementation and planning. As we have reviewed, user oriented strategies can yield significant results without the implementation of infrastructure, therefore, policy makers and governments should take a serious call on it. As Banister (2004) points out, policymakers most times underestimate the willingness of the users to shift, and users most of the times do not possess enough information to take a conscious decision about their modal choice.

If Soft policies can be implemented in a shorter time, with much less resources and easily adapted to changes and reactions of the users, why not to make broader use of them? both, prior and in parallel to infrastructure upgrading. We are in the era of ICT and mobile technologies, and this represents a great opportunity to develop innovative solutions and involve the users.

Implementation of better-choice programs have been widely recorded, although, the information has been collected with different techniques, making difficult to compare results among studies.

Most of the studies report improvements in the behaviour toward NMMs, with different levels of success. Special focus has should be done in shifting to cycling and car-pooling to work, since congestion levels in peak hours are heavily linked to commuters to work and topped up with school related traffic.

As for the importance of universities taking active part in the community to implement innovative solutions and proposals for sustainable mobility I consider is a must. The institutions have the freedom, unlike the government, to try more radical ideas without getting immersed in political implications. Students will adapt faster than the society in general, and will find a way to get to school even if the parking lot is reduced by half. They are more prone to use technology and provide as well a better ground for testing digital platforms.

Universities are a nest of creative and technical talent and it is somehow a social responsibility role of the university to point that talent toward the biggest problems of current society. And mobility clearly should concern us all.

5.2   The Importance of the Mobility Week

The campaign has served during more than 15 years as a perfect opportunity for local authorities and interested parties as companies, organizations or universities to attract participation in relevant projects for the community. This presents a good opportunity to scale ideas, get funding, evaluate the user reaction in a friendly, collaborative framework.

Nevertheless, it might be challenging to evaluate the reaction of the users when the event has finished, furthermore, if there was a permanent behaviour change.

It is difficult to know If the European Mobility Week has a direct influence in local governments and citizens toward the implementation of permanent sustainable practices. Per the report from 2016,

each city (in average) implemented 3 permanent actions. It would be interesting to know if this actions are being encouraged by the community and executed by local authorities. It is interesting to note that all these cities that are very involved, are pairing their actions with *awareness campaigns*. If we look at the graph, "awareness-raising campaigns" is in the 4th place.

We should would expect to see in the future, a greater number of campaigns than infrastructural updates. Although, it makes sense now, because many of these cities are still preparing and adapting their networks to the new needs for sustainable transport. But the more infrastructure is built, the more campaigns must be created, not only to raise awareness but to provide a reinforcement in the behaviour.

Report, 2002)
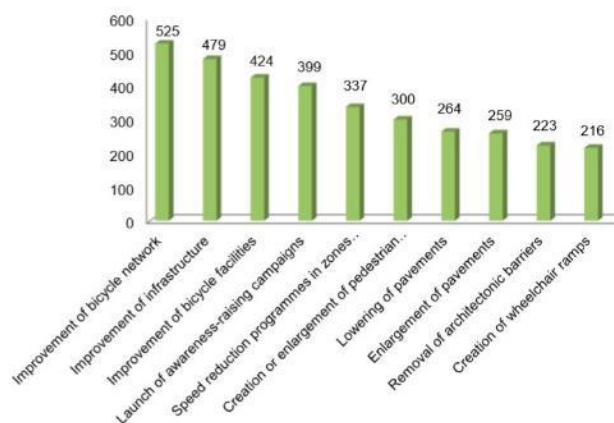
Figure 5.1 - Predominant Permanent Measures implemented, European Mobility Week 2016

If the EMW is working as a catapult both to share initiatives and to enhance a friendly competition/cooperation among municipalities and cities. The participation numbers keep growing and more cities are interested in taking part of the EMW.

 If citizens are being engaged and there is a generalized feeling of pride toward the actions that the local governments are doing, is more likely that they support other initiatives oriented to

sustainable mobility. Going back to Brög and the importance of willingness, users need to discover that they are keen to certain ideas, but if they are not presented with the option or they miss the opportunity to try it, that might not happen, they need a push (meloni).

Part of the importance of the EMW might be etched there, it is the right opportunity for the local policy makers and planners to set the trigger needed by users to change their behaviour. Even if this trigger is temporary, the user will register that stimuli/experience as a positive (if that's the case) and would be receptive for a future event. That could be the implementation of certain traffic measure permanently.

The European Mobility Week as well provides a fertile ground for testing in small scale multiple solutions and evaluate the response of the users to make the best choice before scaling. Having feedback of the users is as well a great opportunity for the governments to engage citizen participation. If there is a specific solution that the municipality would like to try, it would be possible to gather valuable information if the event is well planned and the correct mechanisms for data collection are prepared.

5.3   Further Work

5.3.1   Additional Research Questions

Further research questions that derive from the current investigation but cannot be included in this work for time reasons are:

- If the Urban Roadmaps tool is set to a prior date, i.e. 2007, and we simulate the strategies that the city applied during 10 years, how the results compare with the actual situation of the city?
- Why participation rates of Danish cities is so low?
- Is the European Mobility Week seen as a time-loss for the Municipalities?
- Is it possible to engage all the municipalities in DK bigger than 50,000

inhabitants to be part of the European Mobility Week 2018, what are the reasons for not being part of the EMW?

- What would be needed to make one common framework or forum for all the municipalities so they can collaborate for the EMW and stay engaged through the year.
- What would be necessary to connect actively engaged students that want to volunteer organizing at least one mobility action per university for the 2018 EMW, and take the lead toward active participation.
- Has all the knowledge about applied urban strategies been compiled, apart from the reports, in terms of success, is that part of the program?

5.3.2 European Mobility Week – Documentation of the Campaign Results

The next step for the EMW is to collect data about the events, assistance, the main questions, the reaction of the students, if they found useful or not the information.

Under ideal situation, small questionnaires about how the students are traveling and why. It is true that most of them either walk or bike, but still a good number of students is using the car to go to school. Only a quick questionnaire will be filled trying to find how known are the services of the free city bikes, Tadaa!, the live-bus app, and see if the information is or not useful for newly arrived students.

Gathering the data will not be performed for time reasons and resources but is something that should be included and carefully planned to evaluate the reaction of the users. An app would be an ideal solution for this purpose.

5.3.3 Funding opportunities

Some of the ideas proposed have potential to become a program in bigger scale, finding budget suitable for this projects in advance could help to convince the municipality to take active part.

The European Commission currently has no open calls for projects under the Directorate General of Transport. Funding might be available through current projects, although, a review of open projects was performed and there is no open call in any of them.

A call will open in October:

- NRGi VÆRDIPULJE

9. oktober til 10. november.

Pool: 2Dkk million

NRGi established a fund in 2016 with 6 million as retribution to the consumers for the earnings, 4 million have been already allocated and the remaining 2 will be distributed in this round. Projects can be either big or small and should be oriented toward promoting sustainable development in the supply area. Participating ideas that: *reduce energy consumption, ease the traffic conditions in the city*, or a recreational area. Characteristics of the project:

Projects in NRGi's supply area

The project strengthens and has an anchorage in the community

The project is innovative and sustainable

Everybody who is a member of NRGi and has an electricity meter from NRGi can apply for the pool. This applies as an individual, association and company as well as private and public organization.

As the found information shows, projects aiming to reduce energy consumption and reduce the traffic in the city are applicable, therefore, any of these ideas would be applicable to get some funding or full funding, depending of the available budget.

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7 ANNEX 1 (Processing and Selection of Initiatives)

Selection of Activities for European Mobility Week

LOW=1 MED=3 HIGH=7	TOTAL	BUDGET (QUALITATIVE)	STAKEHOLDERS INVOLVED	EXECUTION TIME
1.1.1 Automobile				
-Lowering of speed limits in all residential areas to 30Km/h	11	1	7	3
-Car pooling promoting programs for companies and universities.	5	1	3	1
-Congestion charges in City Centres.	17	3	7	7
-Work from home, home-office once or twice a month.	3	1	1	1
-Online shopping with delivery.	17	3	7	7
-Freight time restrictions, nocturnal delivery schedules.	17	7	7	3
-Promote car sharing services	5	1	3	1
-Multi-business shared travel (users living in a certain area)	7	1	3	3
1.1.2 Parking				
-Reserved parking for car-pooling, at least 30% of the parking spots, gradually	5	1	3	1
-Exclusive parking for electric and hybrid vehicles, without need for charger	5	1	3	1
-Volatile pricing according to traffic conditions, distance and hour or the day	17	3	7	7
1.1.3 Bus Systems				
-Better information systems	21	7	7	7
-Promotion cammpaign of Information systems (existing)	3	1	1	1
-Seamless integration with train, tram, rental bicycle systems.	21	7	7	7
-Smart, comfortable bus stops with reliable information systems	9	3	3	3
-Personal travel planning strategies.	7	3	1	3
-Price reduction/free bus days to events or predicted congestion days.	13	3	7	3
-Marketing and brand-building (multimodal branding).	21	7	7	7
-Personalised Travel Planning (PTP).	7	3	1	3
-Multimodal approach (bike racks in buses)	9	3	3	3
1.1.4 Bicycle				
-Proper cycling lanes (well signalled)	21	7	7	7
=-Pumps and tools for bikes around the City (university in this case)	5	1	3	1
-Free bike repairs/service once a month for those shifting from car to bike	3	1	1	1
-Shower facilities at workplaces.	13	3	3	7
-Safe cycling to school programs.	13	3	3	7
-Bike sharing systems, integrated payment with bus/train.	21	7	7	7
-Information systems for Bike sharing systems.	13	3	3	7
-Wayfinding with times to main spots in the city. For pedestrian and cyclists	13	3	7	3
-Workshops about cycling safety for occasional users.	3	1	1	1
-Adult cycle training.	3	1	1	1
-"Bike it" programmes in schools	7	1	3	3
-Electric bicycles to students who change their commute by 70% per month	7	3	3	1
-Active app for activity tracking, integrated rewards system.	11	3	1	7
-Cycling for elderly residents, volunteer support).	7	3	3	1
-Free lending of bike trolleys for errands.	3	1	1	1
-Mandatory bike racks in every taxi.	13	3	7	3
-Yearly free gear to employees that cycle.	5	3	1	1
-Free bike repair classes.	5	1	3	1
-Electrically-assisted Bicycle taxis	13	7	3	3
1.1.5 Walking				
- Step-o-meters: Pedometer, applied to recovery patients	5	1	3	1
- Walk to work, for residents living nearby or to combine with bus.	3	1	1	1
- Walk information and active life programs.	3	1	1	1

Table 7 - Soft Measures, Multicriteria Evaluation

Selection of Activities for European Mobility Week (SHORTLISTED)

LOW=1 MED=3 HIGH=7	TOTAL	BUDGET (QUALITATIVE)	STAKEHOLDERS INVOLVED	EXECUTION TIME
1.1.1 Automobile				
-Car pooling promoting programs for companies and universities.	5	1	3	1
-Work from home, home-office once or twice a month.	3	1	1	1
-Promote car sharing services	5	1	3	1
-Multi-business shared travel (users living in a certain area)	7	1	3	3
1.1.2 Parking				
-Reserved parking for car-pooling, at least 30% of the parking spots, gradually	5	1	3	1
-Exclusive parking for electric and hybrid vehicles, without need for charger	5	1	3	1
1.1.3 Bus Systems				
-Promotion cammpaign of Information systems (existing)	3	1	1	1
-Personal travel planning strategies.	7	3	1	3
-Personalised Travel Planning (PTP).	7	3	1	3
1.1.4 Bicycle				
=-Pumps and tools for bikes around the City (university in this case)	5	1	3	1
-Free bike repairs/service once a month for those shifting from car to bike	3	1	1	1
-Workshops about cycling safety for occasional users.	3	1	1	1
-Adult cycle training.	3	1	1	1
-"Bike it" programmes in schools	7	1	3	3
-Electric bicycles to students who change their commute by 70% per month	7	3	3	1
-Cycling for elderly residents, volunteer support).	7	3	3	1
-Free lending of bike trolleys for errands.	3	1	1	1
-Yearly free gear to employees that cycle.	5	3	1	1
-Free bike repair classes.	5	1	3	1
1.1.5 Walking				
- Step-o-meters: Pedometer, applied to recovery patients	5	1	3	1
- Walk to work, for residents living nearby or to combine with bus.	3	1	1	1
- Walk information and active life programs.	3	1	1	1

Table 8 - Soft Measures, Multicriteria evaluation first cut

Second round, short-listing, final cut

LOW=1 MED=3 HIGH=7	TOTAL	BUDGET (QUALITATIVE)	STAKEHOLDERS INVOLVED	EXECUTION TIME
1.1.1 Automobile				
-Car pooling promoting programs for companies and universities.	5	1	3	1
-Promote car sharing services	5	1	3	1
1.1.2 Parking				
-Reserved parking for car-pooling, at least 30% of the parking spots, gradually	5	1	3	1
1.1.3 Bus Systems				
-Promotion cammpaign of Information systems (existing)	3	1	1	1
1.1.4 Bicycle				
=-Pumps and tools for bikes around the City (university in this case)	5	1	3	1
-Free bike repairs/service once a month for those shifting from car to bike	3	1	1	1
-Workshops about cycling safety for occasional users.	3	1	1	1
-Cycling for elderly residents, volunteer support).	7	3	3	1
-Free lending of bike trolleys for errands.	3	1	1	1
1.1.5 Walking				

Table 9 - Soft Measures – Selected

8 ANNEX 2 (Account Sign Up, Upload Information, Campaign Material)

ACCOUNT SIGN UP – The process is simple, as it has already been discussed in section 6.2.6.

This short presentation shown next was used to introduce the Mobility Week to the prospect stakeholders, the design followed the colour-schemes, typography and general branding of the EMW.

Proposals 1, #MobilityWeekHorsens

Raise awareness of already existing infrastructure, get more users.

- Promote the visitor pink bikes

- One day/week of free bus rides

Proposals 2, #MobilityWeekHorsens

Help local transport initiatives, help user to create their accounts, explain the system.

- Offer Tadaa! Rides to students and university staff that open their account for one day.

- Help Apero Bikes (student organization) to get new students enrolled, explain to locals how they contribute.

Proposals 3, #MobilityWeekHorsens

Offer workshops to Involve the actual users of the system and use that information to improve.

- Workshop 1 – How to improve current Bus-stops.

- Workshop 2 – Cycling safety, basic rules and recommendations.

Proposals 4, #MobilityWeekHorsens

Improve the sharing behaviour of the users.

- Promote car-sharing through VIA staff and students, mark the parking lots, set a quota for ride-share spots.

- Launch Cykling Uden Alder Horsens, borrow a bike from a town nearby, get students to volunteer.

HORSENS KOMMUNE · INSERO · ARRIVA · midttrafik · UC · VIA · 8

Proposals 5, #MobilityWeekHorsens

Invite innovative companies e-bikes, electric cars, bike equipment, etc.

- Strom Bikes, Indiegogo campaign just launched.

- Invite Local dealers to show the available electric models available?

HORSENS KOMMUNE · INSERO · ARRIVA · midttrafik · UC · VIA · 9

Proposals 6, #MobilityWeekHorsens

Plan with Horsens Kommune one day without cars, along the bus route 2 or 1.

- Probably on Sunday 7.00-14.00, promote it among the locals, turn the street fully pedestrian.

- Probably a 5K race for mobility? Involve local magazine and newspaper to promote

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Facebook Website to Promote the Event

The report from the EMW 2016 showed the importance that the Facebook page has for the campaign, from engaging the participants to spreading the events and receiving feedback from the participants, therefore, from the available social networks it was chosen to further contribute to the general branding of the EMW at European Level.
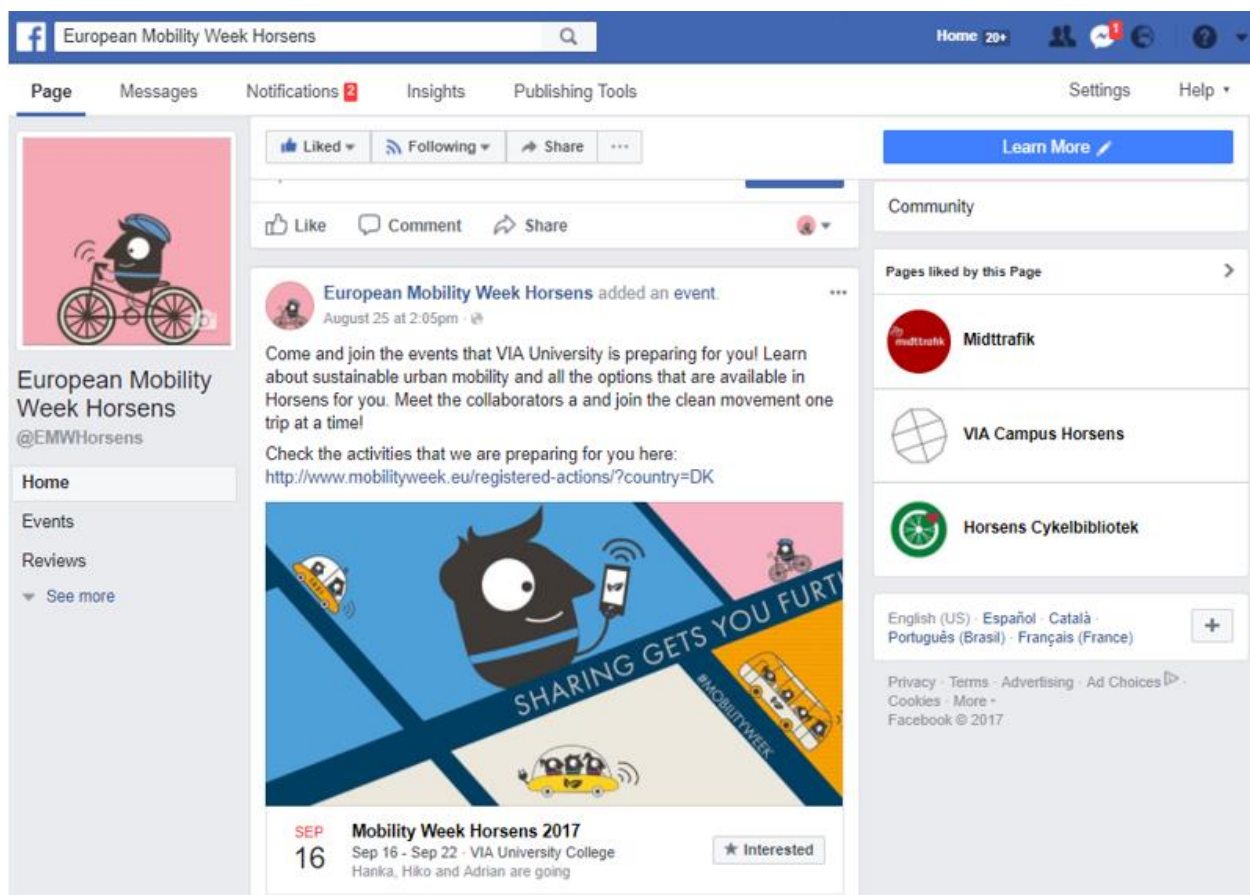
9 ANNEX 3 – Urban Roadmaps Tool

The Urban Roadmaps tool as explained previously, aims to help authorities and urban planners to take better decisions using data from past projects from the EC that were carefully recorded.

Here is shown briefly how the tool can generate a scenario very fast, and as soon as one is familiar with the parameters, changing through scenarios is much faster and provides better insights.

The Urban Roadmaps initiative is in marketing phase; therefore they are giving free webinars and online free training material for all those interested.

This section has no intention of being a tutorial under any reason, but to show how easy and fast the tool can yield some interesting results to understand how certain policies work in a given urban environment. Preparing one simulation when already familiar with the tool and the data, would take 5-10 minutes.

The tool is accessible here: http://www.urban-transport-roadmaps.eu/

It starts in the browser any mayor browser works well.
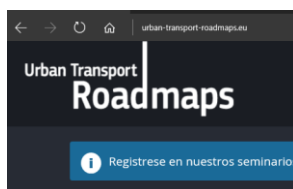
The tool is started with a single click.

Language can be adjusted on the right
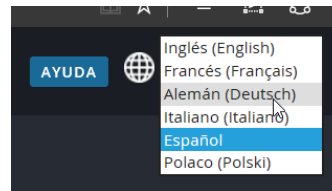
Then, the city wizard, select country, size of the city, and more details as the concentration of population.
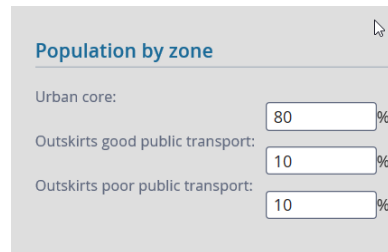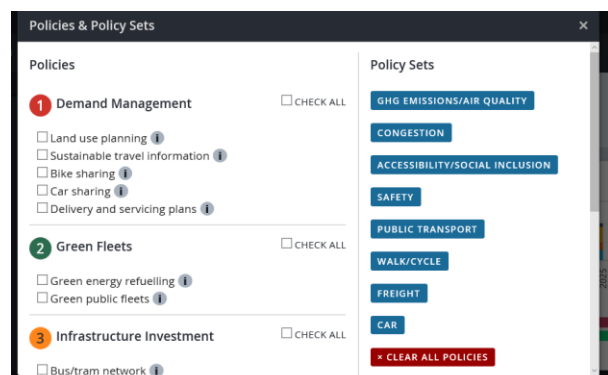

Some more questions, about transport:

Next, the questions about the transportation systems, metro, train, bus, and it goes into the simulation section already.
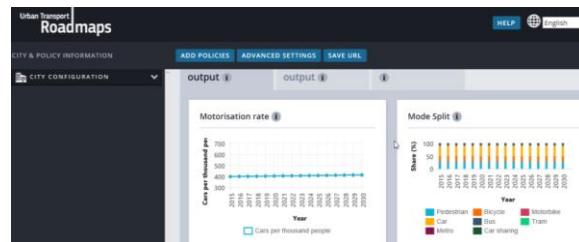
Now we can start configuration of the policies or go at any title to make special considerations …

The policies considered are listed in 5 categories: Demand management for car, bus, bike, delivery etc. Green fleets+ Infrastructure+ Pricing and financial incentives + traffic management and control. It necessary to set a baseline for comparison, the system automatically configures the system at a starting point, but it can be configured as necessary.

One can select the policies as they are planned or set the details.

Here is shown the small exercise of comparing the same policy package with diffferent time of implementation (by 10 years) one scenario is investing in 2020, the next scenario is 2030. Same parameters are used, although the economic results are much different. It would seem obvious that sooner is the investment in some initiatives, the sooner the revenues will show, in this case occurs that, the revenue is the graph that experiments the best. But other positive impacts result from this policy being implemented earlier.

2030 scenario:

Revenues of public administration (1000 Euro/year) ⓘ
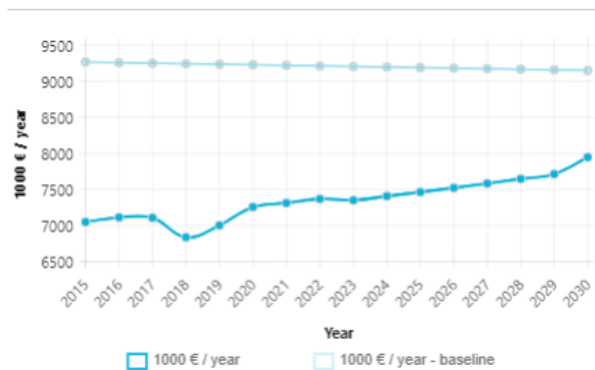
Transport social monetary costs (1000 Euro/year) ⓘ

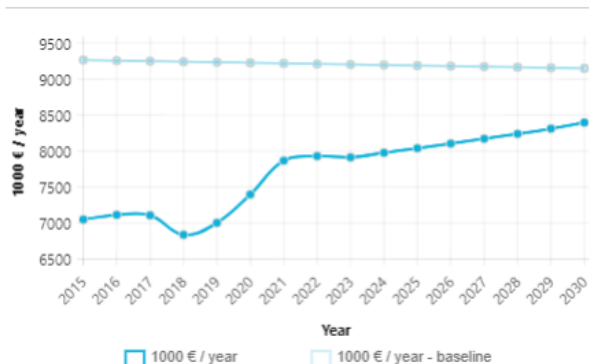Net financial result for public administration (million Euro) ⓘ

€-10

Baseline: €-8

Scenario 2020

The same initiative started at different time has the potential for better return for the governments, in this case, the factor selected was Prioritization of the Public transport. Which makes sense if the desired effect is to remove cars from the roads and discourage them by making it easier for the buses to move through the city, faster and more efficiently.

Revenues of public administration (1000 Euro/year) ⓘ

Transport social monetary costs (1000 Euro/year) ⓘ
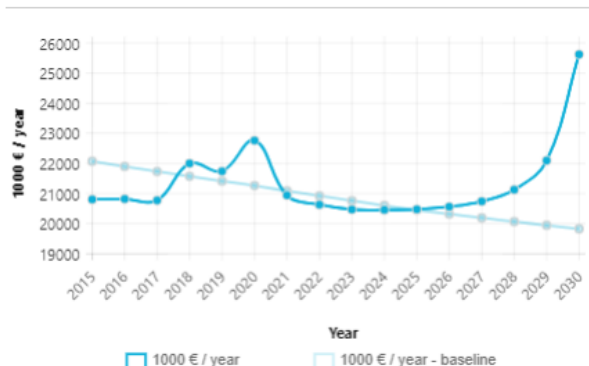
Net financial result for public administration (million Euro) ⓘ
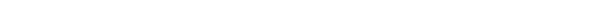
€-8

Baseline: €-8

It is definitely interesting, but, what happens when we pair two soft-measures of high impact at the same time and set them to ramp up in the same year? So that the effect of one measure adds up immediately to the other…. To the example (reserved right of lane for bus), we add congestion charges and parking restriction, with an increased cost of 2€ per hour parked, and REDUCE the tariffs of the bus system from 0.85€ to 0.5€ for work purposes and from 1.5€ to 1.1€ for leisure…. Then, set implementation of both initiatives in 2020.

Note that that the baseline (lighter blue is without the parking and congestion policies)

Transport expenditure of public administration (1000 Euro/year) ⓘ
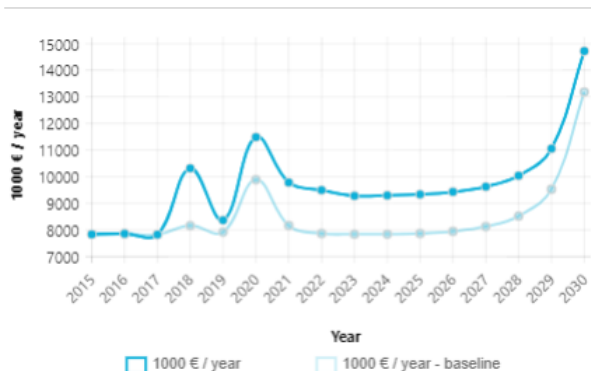
Revenues of public administration (1000 Euro/year) ⓘ
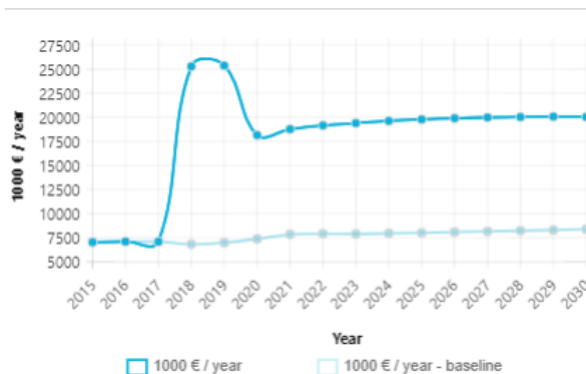
Transport social monetary costs (1000 Euro/year) ⓘ

Net financial result for public administration (million Euro) ⓘ

€87

Baseline: €-8

So, now the administration is getting revenues! Big ones, but somebody must be paying for that! Yes, the tool shows that the yearly expenditure per individual increased from 1008€ to around 1240€. So, is it possible to find a balance point between an economic compromise for both parties and that is good for the environment? Well, that is the goal of many administrations. And that's the value I find in this tool. Also is to note that since these are somehow soft-policies, the more we understand the users, the better and easier and more accurate are going to be these kind of planning strategies.