Study on urban mobility – Assessing and improving the accessibility of urban areas

Annexe 4: Task 4 Report - Developing Best Practice Examples – Increasing the Accessibility of Urban Areas

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March 2017

EUROPEAN COMMISSION

Directorate-General for Mobility and Transport
Directorate B – Investment, Innovation & Sustainable Transport

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Directorate-General for Mobility and Transport

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Luxembourg: Publications Office of the European Union, 2017

ISBN 978-92-79-66820-3
doi: 10.2832/341554

Executive summary

Study overview

The European Commission (Directorate General for Mobility and Transport) launched this study to improve the understanding of urban accessibility and road congestion in Europe. The study aims to advance the understanding of urban accessibility in order to improve the functioning of urban areas and make the transport system in Europe's urban areas more efficient. The study includes five key tasks:

- Task 1 – State of the Art Review;
- Task 2 – Estimation of European urban congestion costs;
- Task 3 – Relative efficiency of urban passenger transport modes;
- Task 4 – Best practice examples for increasing urban accessibility; and
- Task 5 – Policy proposals.

This report is the Task 4 report on best practice examples for increasing urban accessibility for both passengers and freight.

There are numerous policy measures that have the potential to enhance and increase the accessibility of urban areas. In line with the definition of accessibility in relation to the four dimensions (the transport component, the land use component, the individual component and the temporal/cost component) any measures that makes it easier for people or freight to reach opportunities (whether they are referred to as goods, services or destinations) increases the accessibility of an urban area.

The objective of Task 4 is to identify best practices measures for increasing the accessibility of urban areas for passengers and freight. The work has been subdivided into two sub-activities:

- Sub-task 4.1: Identification and classification of the most relevant measures
- Sub-task 4.2: Analysis and reporting of best practice measures

The initial list of measures is derived largely from the Urban Transport Road Map 2030 project[1]; the classification and evaluation of the measures however, is made in relation to a list of factors that have been identified as relevant in determining the level of accessibility of an area. A scheme has been drafted to describe the relation between factors, measures and accessibility, which is called the "Analytical Framework". This framework has then been used to assess the relevance of various measures in improving urban accessibility.

Building on this examples of best practice implementation of these measures have been identified. The analysis and reporting of best practice measures[2] has been divided into three main groups of activities:

- a literature survey through desk-based research to find out relevant policy applications
- the involvement of stakeholder in order to get their feedback on draft results
- the draft of factsheets to describe best practices examples.

[1] http://urban-transport-roadmaps.eu/

[2] Best practices are intended as successful application of a measure (or of a strategy including more measures) with respect to the target of improving accessibility

Key conclusions

There are different type of accessibility, as the accessibility by public modes is different from the one related to private mode and also different from active modes (walking and cycling). It is therefore evident that the objective of improving accessibility needs to be specified not only because accessibility by private transport is not the same as accessibility by public transport or by active modes but as in most of the cases, improving one type of accessibility implies that another type is worsened.

Thanks to the analysis conducted in this report first by building the analytical framework and then by analysing the best practices of the case studies presented) some conclusions can be drawn in relation to the different components of mobility.

Public transport accessibility is especially improved by adding new facilities and infrastructures or improving existing ones (additional lines, expanded services, improved vehicles and stops).

Being in a sustainability perspective, the improvement of accessibility for private mode has mainly the objective to serve those areas with low level of public transport accessibility, so that it can be easier for population to reach public transport lines and to use the private mode as a link to transport.

In relation to the accessibility for active modes, this is probably the area where a greater effort is needed from local authorities, as in most cases soft modes have not been taken in such a consideration. However, what is worth to notice from the analysis conducted for this report is that in addition to dedicated facilities (pedestrian areas, cycling lanes) all measures removing traffic improve active modes accessibility.

Overall it can be stated that to achieve the target of improved accessibility, all transport components (passengers and freight) have to be addressed and the implementation of a broad package of measures can help to achieve the targeted improvements.

However no universal solution exists to address all of the different urban mobility problems: tailoring the measures to the local environment is key to success.

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1 Introduction

Ricardo Energy & Environment (UK) and TRT Trasporti e Territorio (Italy) were commissioned by the European Commission to undertake a study on urban mobility and assessing and improving the accessibility of urban areas. This is the fourth deliverable for the study.

1.1 Study objectives and overview

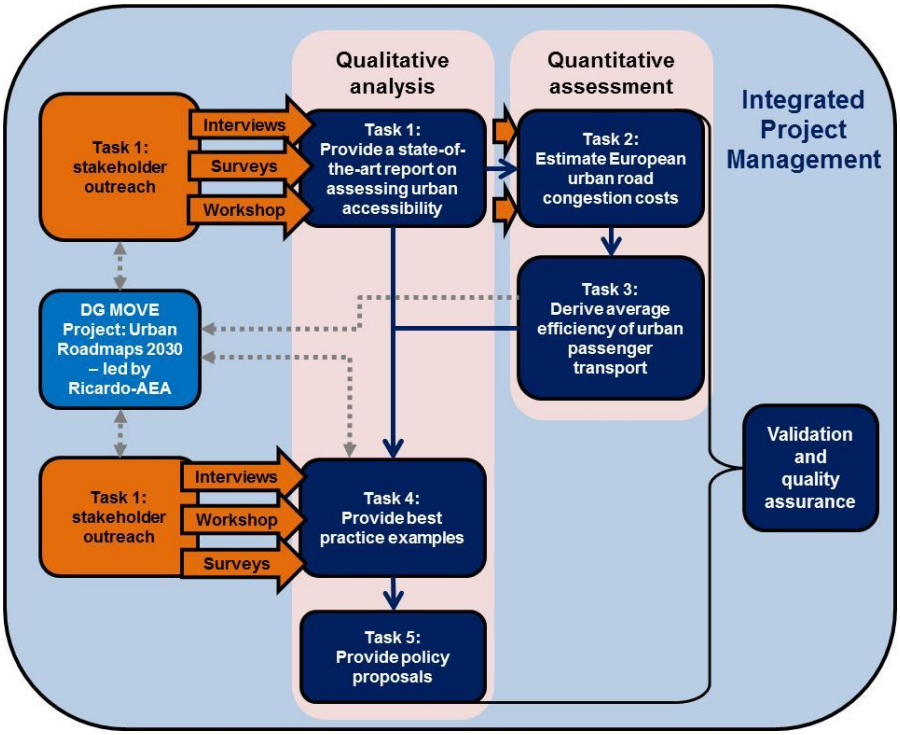
This study on urban accessibility has been designed in order to maximise the potential for useful outputs that will advance the understanding of urban accessibility in order to improve the functioning of urban areas and make the transport system in Europe's urban areas more efficient.

The study consists of five key tasks, which are as follows:

- Task 1: State of the art report – urban accessibility
- Task 2: Estimation of European urban road congestion costs
- Task 3: Relative efficiency of urban passenger transport modes
- **Task 4: Best practice examples – increasing accessibility**
- Task 5: Policy proposals.

Figure 1-1 provides an overview of how the different tasks fit together.

Figure 1-1: Overview of study tasks and methodology



The state of the art review in Task 1 made clear that accessibility differs from mobility, which just refers to the movement of people and goods, in that it involves consideration of the opportunities enabled by mobility. It also identified four key dimensions of accessibility:

- *Transport* – covering the various aspects of transport options available for passenger or freight movement, and is essentially the mobility element of accessibility.

- *Land-use* – the distribution and quality of destinations that passengers and goods need to access;
- *Individual* – the personal needs in terms of travel options or destinations;
- *Temporal* – the time constraints in relation to when destinations are open or transport services operate.

The key dimensions that can be influenced by urban policy are the transport and land-use dimensions, which together can be considered the factors that should integrated within a Sustainable Urban Mobility Plan (SUMP). Within the transport dimension the level of urban congestion and the efficiency of urban transport modes are key considerations in improving both mobility and accessibility. These two aspects are considered in a more quantitative assessment in Tasks 2 and 3, to provide data to help cities understand and improve these aspects of their urban transport system.

Tasks 4 and 5 go on to look at measures and policies that can help improve accessibility. Task 4 considers the range of measures available at the city level and examples of best practice in applying them. Task 5 pulls together the lessons from all the other tasks and considers action at the national and European level that can support cities in delivering improvements to accessibility.

Tasks 1 to 4 will result in a stand-alone, final publishable report. Task 5 will pull together all the outputs from the project and will be used to provide clear guidance on how urban accessibility can be improved.

1.2 Task 4 Best Practice Examples – Improving Accessibility

The objective of Task 4 was to identify best practice examples for increasing the accessibility of urban areas for passengers and freight. The focus was to identify and classify measures that can make it easier for people or freight to reach opportunities (whether they are referred to as goods, services, activities or destinations) - measures that can increase accessibility. These measures were then assessed in relation to their potential for increasing accessibility.

1.3 Task 4 Methodology

Task 4 was subdivided into two sub-tasks:

- Subtask 4.1 - Identification and classification of the most relevant measures
- Subtask 4.2 - Analysis and reporting of best practice measures

In subtask 4.1 the most relevant measures that were considered to positively impact on accessibility were identified and classified. The list of measures was largely derived from the Urban Transport Road Map 2030 project[3]. The classification of measures was made in relation to a list of factors that have been identified as relevant in determining the level of accessibility of an area.

An 'Analytical Framework' was developed in order to analyse all of the relevant relationships between factors, measures and accessibility.

In subtask 4.2 activities were divided into three main groups:

[3] The European Urban Transport Roadmaps study, supported by DG Move, provides a web based policy support tool to help cities across Europe explore policy options for Sustainable Urban Mobility Plans - (http://urban-transport-roadmaps.eu/)

- Review of the literature to identify relevant policy applications
- Stakeholder engagement in order to gain feedback on draft results
- Preparation of factsheets presenting best practices examples.

1.3.1 Desk-based research

Whilst the expert knowledge of study team in the urban transport mobility sector was used as a basis for the work, the methodology adopted in this task also relied on desk-based research. A review of the literature was undertaken to identify sources (documents, reports, studies, outcomes from different projects, evidences from real application of measures) that could be of relevance for the analysis to be conducted as part of the process of identifying factors which are likely to impact on accessibility

After completing the analysis of the most relevant accessibility measures, best practice examples in cities were identified. Best practice examples were identified based on the successful application of a measure (or of a strategy including a number of measures) with respect to the aim of improving accessibility in urban areas. Research was conducted utilizing a range of European databases addressing the topic of urban mobility, notably CIVITAS[4] and ELTIS[5].

1.3.2 Stakeholder engagement

During May and June 2016 the study team engaged with a wide range of stakeholders. The majority were previously contacted for the engagement exercise for Task 1 of the study, and included:

- Key stakeholders in the areas of policy-making
- ITS/ICT solution providers, infrastructure development
- Transport service providers/contractors
- Associations
- City networks; and
- Academics/think tanks.

Stakeholders were asked to participate through responding to a short survey focusing on:

- Actions available to improve accessibility in European cities (including barriers); and
- Supporting actions (EU level).

Stakeholders were also asked to review and comment on the draft accessibility analytical framework (for decision-makers in cities).

The survey was emailed to over 50 stakeholders. The stakeholder survey can be viewed in Appendix 1.

The results of the survey were used in the following ways:

- To identify actions to improve accessibility in European cities (confirming those identified already for the Analytical Framework);
- To identify supporting actions at EU level (this will feed into Task 5); and
- To confirm/update the information contained within the analytical framework.

1.3.3 Best practice case studies

Case studies were selected as best practice examples of how cities can implement measures in a strategy to increase the level of accessibility offered to citizens, city users

[4] http://www.civitas-initiative.org/
[5] http://www.eltis.org/it

or tourists. Each best practice case study has been structured in the style of a factsheet identifying the main elements to be analysed and reported including a list of measures, the primary objective of the intervention, known quantitative elements, quantitative impacts on accessibility, factors of success and transferability.

An overview and analysis of the best practice examples is set out in section 3 of this report, with full details of the best practice case studies being presented in Appendix 2.

1.4 Overview of the report structure

The remainder of this report is structured as follows:

- Section 2: Identification and classification of measures
- Section 3: Development of best practice case studies
- Section 4: Conclusions

2 Identification and classification of measures

As the basis of the work done within this Task 4, there is the logical assumption that there are some factors that have a role in determining the accessibility of an urban area. Therefore the implementation of policy measures that impact on these factors, also have an impact on accessibility.

An Analytical Framework was developed in Task 4.1 supporting the identification and classification of measures, and subsequently identifying their potential accessibility impacts. The framework is based on two main elements:

- Identifying and defining factors influencing accessibility
- Assessment of the Impacts of policy measures on the factors influencing accessibility

These two elements are discussed in more detail in the sections below.

2.1 Identifying and defining factors influencing accessibility

2.1.1 Factors affecting accessibility

The first step in the analysis was to identify a **list of factors** that have an impact/s on the four dimensions of accessibility (identified in Task 1 State of the Art Report):

- The **transport dimension** defines the disutility (whether measured in time, cost, discomfort etc.) for an individual (or a freight load) to cover the distance between an origin and a destination (a point of opportunity) using a (set of) transport mode(s), preferably at their choice;
- The **land use dimension** defines the amount, quality and spatial distribution of identifiable opportunities/ activity locations/ destinations of passengers or freight loads;
- The **individual dimension** defines the needs, abilities (depending on physical conditions, availability of travel modes etc.) and opportunities (depending on income, travel budget, educational level, etc.) of/for an individual (or a freight load); and
- The **temporal dimension/cost component** defines the availability and cost of opportunities at different times of the day as well as the time available for individuals to get to and participate in activities.

Six main domains covering 14 categories of factors were identified which had an influence on the accessibility of an urban area:

- Transport demand (need for transport) – current patterns of transport demand by space and time;
- Transport supply (Road supply, Private transport supply, Public transport supply, Active modes, Shared mobility services, Integration between transport solutions, urban freight logistics infrastructure) – characteristics of the transport system;
- Individual perception of the transport system (transport cost, user information, safety and security (perceived as well as actual));
- Demographic structure (population);
- Territorial policy context (Land use and local economy);
- Geographical and urban context (Territory).

Finally, each of the 14 categories were further subdivided into a list of 67 individual factors affecting accessibility (see Table 2-1).

Table 2-1: List of factors of relevance in determining the level of accessibility of an urban area

Domain	Category	Factors affecting accessibility
Need for transport	Transport demand	Need for travel
		Spatial pattern of trips
		Spatial pattern of freight deliveries
		Time pattern of trips
		Time pattern of freight deliveries
		Amount of passengers demand
		Amount of freight demand
Transport supply	Road supply	Road availability
		Road quality
		Access restrictions (Time Of Day -TOD, weight, vehicle size or type)
		Parking availability
		Parking payments ease and availability of multiple options
	Private transport supply	Car ownership rate
		Bike availability
		Availability of rechargeable points for electric vehicles (or other alternative fuel infrastructure) - personal cars
		Availability of rechargeable points for electric vehicles (or other alternative fuel infrastructure) - duty vehicles
	Public transport supply	Availability of public transport services (traditional collective passengers transport but also demand-responsive services)
		Accessibility to public transport services (vehicles and stops/terminals)
		Ease of payment of public transport services
		Frequency of public transport services
		Reliability
		Quality of public transport vehicles
		Quality of public transport stops
		Crowding on public transport vehicles
	Active modes	Safety for pedestrian
		Ease of access to pedestrian infrastructure (dropped curbs, way finding, etc.)
		Safety for cyclists
		Security of bikes (protection against thefts, e.g. secure cycle parking)
	Shared mobility services	Bike sharing systems availability (traditional bikes, but also pedelecs, cargo bikes, small bikes)
		Car sharing systems availability (round trip or station based)
	Integration between transport solutions	Ease of transferring between modes
		Quality of stations / Terminals
		Integrated ticketing
	Urban freight logistics infrastructure	Presence of UCCs (Urban Consolidation Centres)
		Locker boxes or pick up points availability
		Availability of loading/unloading bays
Individual perc	Transport cost	Private vehicle cost (fuel, vehicle ownership, insurance, etc.)
		Public transport fares

		Parking fares
		Road charges
	User information	Accessibility to public transport timetables (lines, frequency) and legibility/clarity
		Accessibility to real time traffic information
		Accessibility to real time parking information
		Reliability of information
	Safety & Security (perceived as well as actual)	Security on-board public transport modes
		Security at stations/bus stops
		Security at parking areas
		Security on bike and foot paths
Demographic structure	**Population**	Children, young people, elderly people, reduced mobility people, gender differences
		Propensity to walk
		Propensity to cycle
		Sensitiveness to climate conditions
		Income level
		Digitalization
		Environmental awareness
		Cultural attitude to e-commerce
		Cultural attitude to home-working
Territorial policy context	**Land use and local economy**	Population density
		Availability of relevant opportunities/destinations (jobs, services, etc.)
		Distribution of relevant functions on the territory
		Opening hours of relevant functions
		TOD (Transit Oriented Development)
		City sprawling
Geographic and urban context	**Territory**	Topography
		Climate
		Urban form (historical vs modern)
		Presence of natural or artificial barriers (rivers, lakes, canals, parks, infrastructures, monumental sites, etc.)

The second step in the analysis was the identification of **existing interactions** between **factors** and each of the **four dimensions of accessibility**.

An analytical framework (matrix) has been developed in order to visualize the interactions between each factor and the four dimensions of accessibility. It is also intended that this tool can be used by cities/policy makers when determining the likely accessibility impacts of measures. The sections below provide an extensive overview of the analysis offering key considerations on the most relevant factors.

2.1.2 Transport demand

Transport demand is defined by the need for travel (the purpose of the trip), the time pattern of trips (both for passengers and for freight), the spatial pattern of trips (for passengers and for freight) and by its quantity (amount of passengers and amount of freight).

Table 2-2: "Transport demand" factors and their interactions with the four dimensions of accessibility

Factors	**Accessibility Dimension**			
	Transport dimension	**Land use dimension**	**Individual dimension**	**Temporal dimension**

Need for travel		X	X	
Spatial pattern of trips		X	X	
Spatial pattern of freight deliveries		X		
Time pattern of trips			X	X
Time pattern of freight deliveries				X
Amount of passengers demand	X		X	X
Amount of freight demand		X		

The **need for travel** is a factor that has impact on the **individual dimension** of accessibility as it is strictly related to personal needs, lifestyles or travel habits and it is fully dependent on the distribution of availability of opportunities, e.g. **land use dimension**.

The **spatial pattern of trips** is a factor strictly dependent on the **land use dimension** and the distribution of functions and opportunities. If these opportunities and functions are located near to individuals, the spatial patterns will be shorter. Conversely, if they are located far away from individuals, spatial patterns will be longer. The same is true if these opportunities and functions are clustered or dispersed: the spatial patterns to reach them will be consequently clustered or dispersed. It is also evident that spatial patterns are closely related to individual needs and preferences (**individual dimension**).

The **amount of passenger demand** is related to the **transport dimension** (the availability of transport modes), and the **individual dimension** (people move for individual reasons and the total amount is generated by the sum of all transport needs (expressed by every single person). The factor has also relevant interactions with the **temporal dimension** as there are particular time of day in which transport demand usually has its peak hours (in the morning and in late afternoon).

2.1.3 Road supply

The **road supply** category is defined by considering road availability, road quality, the existence of possible restrictions to road access (related to the time of day, vehicle weight, vehicle size or type) and the availability of parking and the ease of payment.

Table 2-3: "Road supply" factors and their interactions with the four dimensions of accessibility

Factors	Accessibility Dimension			
	Transport dimension	Land use dimension	Individual dimension	Temporal dimension
Road availability	X			X
Road quality	X		X	
Access restrictions (Time Of Day - TOD, weight, vehicle size or type)	X	X		X
Parking availability	X	X		X
Parking payments ease and availability of multiple options	X		X	

The **road availability** factor has interactions with the **transport dimension** of accessibility (if roads are congested people may choose an alternative transport mode to get to their destination). Similarly, it is also strictly related to the **temporal dimension** as typically roads are more congested during peak hours.

Similar considerations are valid for **access restrictions** (time, vehicle weight or size). Besides impacts on the **temporal dimension** and the **transport dimension** (some modes of transport could be banned during specific time windows) of accessibility, this factor also has relevant impacts on the **land use dimension**, as some areas (and therefore opportunities and destinations there) may be banned or become more difficult or hard to be reached.

Parking availability has effects on **transport demand** (if car parks are available at final destinations or near them, the car mode can be preferred to other modes to reach them). It is also obviously related to the **land use dimension** (some destinations or opportunities can be more accessible if parking is available nearby) and the **temporal dimension** (as car parks are usually more or less full depending on the time of the day and/or of the week).

2.1.4 Private transport supply

Private transport supply describes the availability of private means of transport to individuals, so it can be fully explained by the car ownership rate, the private bike availability and the availability of recharging points for alternatively fueled vehicles (both personal cars and duty vehicles).

Table 2-4: "Private transport supply" factors and their interactions with the four dimensions of accessibility

Factors	Accessibility Dimension			
	Transport dimension	Land use dimension	Individual dimension	Temporal dimension
Car ownership rate	X		X	
Bike availability	X		X	
Availability of rechargeable points for electric vehicles (or other alternative fuel infrastructure) - personal cars	X			
Availability of rechargeable points for electric vehicles (or other alternative fuel infrastructure) - duty vehicles	X	X		

Within private transport supply, car ownership rate and bike availability have impacts with the **transport dimension** of accessibility (availability of different modes of transport influence the modal choice) and with the **individual dimension** as they are strictly dependent on individuals and steer individual preferences towards accessibility.

The private mode is also influenced by the availability of recharging points for electric or other alternatively fueled vehicles (both cars and duty vehicles). The availability of these facilities impact on the **transport dimension** of accessibility as it may be enhanced or decreased according to the diffusion of rechargeable points. As for goods vehicles, the **land use dimension** is also affected as key logistics destinations may be easier or more difficult to reach.

2.1.5 Public transport supply

Public transport supply describes the availability and the quality of public means of transport to individuals. It can be described in detail considering the availability of public transport services, their accessibility (vehicles and stops/terminals), the ease of payment, their frequency, their reliability, the quality vehicles and stops and the level of crowding on vehicles.

Table 2-5: "Public transport supply" factors and their interactions with the four dimensions of accessibility

Factors	Accessibility Dimension			
	Transport dimension	**Land use dimension**	**Individual dimension**	**Temporal dimension**
Availability of public transport services (traditional collective passengers transport but also demand-responsive services)	X	X		
Accessibility to public transport services (vehicles and stops/terminals)		X	X	
Ease of payment of public transport services	X		X	
Frequency of public transport services	X			X
Reliability	X			
Quality of public transport vehicles	X		X	
Quality of public transport stops	X		X	
Crowding on public transport vehicles			X	X

Factors within public transport supply mainly have impacts on the individual dimension and on the transport dimension of accessibility.

Factors including accessibility to public transport services, the ease of payment, the quality of public transport vehicles and stops and the level of crowding are subjected to personal sensitiveness, and are therefore related to the **individual dimension**. Other are more related to the **transport dimension**, including the availability of public transport services, the frequency and the reliability are more objective and determine the rationale between modal choice. Impacts are also registered for the **temporal dimension** (the level of crowding and the frequency are strictly related with time of day and have they peak at peak hours). Finally, the availability and the accessibility of public transport services have impacts on the **land use dimension**. Some activities and services become more accessible when located close to public transport systems.

2.1.6 Active modes

Within the **active modes** category a list of factors related to the availability and ease of use of infrastructure and services exclusively dedicated to these soft modes is included. The most relevant are: the safety for pedestrian, the ease of access to pedestrian infrastructure (dropped curbs, way finding, etc.), the safety for cyclists and the security of bikes (protection against thefts, e.g. secure cycle parking).

Table 2-6: "Active modes" factors and their interactions with the four dimensions of accessibility

Factors	Accessibility Dimension			
	Transport dimension	**Land use dimension**	**Individual dimension**	**Temporal dimension**
Safety for pedestrian	X		X	X
Ease of access to pedestrian infrastructure (dropped curbs, way finding, etc.)	X		X	
Safety for cyclists	X		X	X
Security of bikes (protection against thefts, e.g. secure cycle parking)		X	X	

Factors including safety for pedestrian and cyclists have interactions with transport (how safe one is feeling is a pre-condition to the choice to walk or to ride a bike to reach a destination) but also to the **individual dimension** (safeness is a personal feeling). The **temporal dimension** (selected time of day, especially when it is dark) may be considered an obstacle to the decision to walk or to use the bike to reach the desired destination. Also the ease of access to pedestrian infrastructure and the security of bikes are strongly dependent on individuals. These two aspects also have impacts relating to the **land use dimension** (the actual availability of security facilities determine the accessibility of one destination in respect to another) while the ease of access to pedestrian infrastructure may be a determining factor in the decision to use one mode of transport over another (transport dimension). Improved pedestrian facilities may also generally improve access also to the public transport network.

2.1.7 Shared mobility services

Shared mobility services describes the availability of the more traditional forms of transport sharing, namely bike sharing systems (traditional bikes, pedelecs, small bikes but also cargo bikes for transporting goods) and car sharing (in different forms such as round trip or station based).

Table 2-7: "Shared mobility services" factors and their interactions with the four dimensions of accessibility

Factor	Accessibility Dimension			
	Transport dimension	**Land use dimension**	**Individual dimension**	**Temporal dimension**
Bike sharing systems availability (traditional bikes, but also pedelecs, cargo bikes, small bikes)	**X**		**X**	
Car sharing systems availability (round trip or station based)	**X**		**X**	

The availability of shared modes of transport (both cars and bikes) is a factor with direct impacts on the **transport dimension** and on the **individual dimension** of accessibility. The existence of these modes is an additional opportunity to perform a trip that can be made available to people though the different components of population (younger, elderly, low-income people, high educated, etc.) are not familiar with shared mobility systems in the same way. These systems are not perceived neither used from population in a similar way. It is typically the younger generation that tends to use these innovative solutions (often requiring a minimum level of digitalization - apps for booking, for using the vehicles, for payments, etc.).

2.1.8 Integration between transport solutions

The **integration between transport solutions** category includes a list of factors related to available options for intermodal solutions while travelling. Inter-modality depends by the ease (or unease) of transferring between modes, by the quality of stations and terminals and by the existence of integrated ticketing systems.

Table 2-8: "Integration between transport solutions" factors and their interactions with the four dimensions of accessibility

Factors	Accessibility Dimension			
	Transport dimension	**Land use dimension**	**Individual dimension**	**Temporal dimension**
Ease of transferring between modes	**X**		**X**	
Quality of stations / Terminals		**X**	**X**	
Integrated ticketing	**X**		**X**	

The integration between different transport solutions consists of a range of different factors (ease of transferring, quality of stations and integration of ticketing) that have impacts on the **individual dimension** of accessibility. The availability of integration solutions is obviously a relevant factor in affecting the **transport dimension**: if modes of transport have more integration possibilities, more people are likely to be attracted to these modes.

2.1.9 Urban freight logistics infrastructures

The **urban freight logistics infrastructures** category describes the availability of solutions for freight transport. These include the presence and the availability of: UCCs (Urban Consolidation Centers), locker boxes or pick up points and loading/unloading bays for duty vehicles.

Table 2-9: "Urban freight logistics infrastructures" factors and their interactions with the four dimensions of accessibility

Factors	Accessibility Dimension			
	Transport dimension	**Land use dimension**	**Individual dimension**	**Temporal dimension**
Presence of UCCs (Urban Consolidation Centers)		**X**		**X**
Locker boxes or pick up points availability			**X**	**X**
Availability of loading/unloading bays	**X**			

Some relevant factors have been identified as relevant in determining the level of urban freight logistics and infrastructure. Urban Consolidation Centers have impacts on the **land use dimension** (their distribution affects the distribution of economic activities) and the **temporal dimension** as the consolidation of goods may be postponed to initial delivery and organized according other temporal conditions. With regards to consumers, the availability of lockers represent a real innovation in terms of increased accessibility to goods in terms of the **temporal dimension** as they can pick up purchased goods anytime (24h/24h).

2.1.10 Transport cost

Within the **transport cost** category, the cost components of transport are considered. In particular the elements considered as relevant are: in case of private transport all factors related to the cost of the vehicle but also costs (if any) related to the use of infrastructure (parking fares and road charge); in case of public transport options, only public transport fares are addressed.

Table 2-10: "Transport cost" factors and their interactions with the four dimensions of accessibility

Factors	Accessibility Dimension			
	Transport dimension	Land use dimension	Individual dimension	Temporal dimension
Private vehicle cost (fuel, vehicle ownership, insurance, etc.)	X		X	
Public transport fares	X		X	
Parking fares		X	X	X
Road charges		X	X	X

The factors related to the category of transport cost have a strong impact on the **individual dimension** of accessibility (the perception and the incidence of costs are subjective). Pricing variations are registered according to temporal intervals during the day or during the week (**temporal dimension**) and also according to locations (parking in inner central areas is usually charged and some road charging scheme may also be introduced to discourage private traffic in central areas) – **land use dimension**.

2.1.11 User information

The **user information** category includes all those elements related to the availability and quality of information for transport users, namely the accessibility to Public Transport timetables (lines, frequency) and their legibility/clarity, the accessibility to real time information on traffic and parking and also their reliability.

Table 2-11: "User information" factors and their interactions with the four dimensions of accessibility

Factors	Accessibility Dimension			
	Transport dimension	Land use dimension	Individual dimension	Temporal dimension
Accessibility to PT timetables (lines, frequency) and legibility/clarity	X			X
Accessibility to real time traffic information		X	X	X
Accessibility to real time parking information			X	X
Reliability of information		X		X

The availability of information, including availability in real time and reliability of information provided are factors of relevant importance in determining the **temporal dimension** of accessibility to users and also to the **individual dimension**.

2.1.12 Safety & security (perceived as well as actual)

Within the category **safety & security (perceived as well as actual)** are included those factors related to the actual conditions of vehicles and infrastructures but also to the perceived sense of safety and security by the users. These include: on-board Public Transport modes security, security at stations/bus stops, at parking areas and on bike and foot-paths.

Table 2-12: "Safety & Security (perceived as well as actual)" factors and their interactions with the four dimensions of accessibility

Factors	Accessibility Dimension			
	Transport dimension	Land use dimension	Individual dimension	Temporal dimension
Security on-board PUBLIC TRANSPORT modes			X	X
Security at stations/bus stops		X	X	X
Security at parking areas		X	X	X
Security on bike and foot paths		X	X	X

The sense of security (on board, at stations, at parking areas on along bike and foot paths) are all factors impacting on the **individual dimension** and the **temporal dimension** as individuals are sensitive to security in different ways, and the levels of security is connected with time of the day (at night it is usually perceived as less safe and secure to travel).

2.1.13 Population

There are many factors related to the **population** category**.** These are all related to the typology of transport demand that can emerge from population. First of all, the population structure and composition is considered: the presence in terms of quantity of children, young people and of elderly people, gender differences, and reduced-mobility people on the total of population. Then some general factors related to personal attitudes like the propensity to walk, the propensity to cycle, the sensitiveness to climate conditions, the environmental awareness, the cultural attitude to e-commerce, and to home-working, and also other economic and social factors like the income level and the level of digitalization.

Table 2-13: "Population" factors and their interactions with the four dimensions of accessibility

Factors	Accessibility Dimension			
	Transport dimension	Land use dimension	Individual dimension	Temporal dimension
Children, young people, elderly people, reduced mobility people, gender differences	X	X	X	X
Propensity to walk	X	X	X	
Propensity to cycle	X	X	X	
Sensitiveness to climate conditions	X			X
Income level	X			
Digitalization	X			
Environmental awareness	X			
Cultural attitude to e-commerce	X	X		
Cultural attitude to home-working				X

The factors of the population category mainly impact on the **transport dimension** of accessibility. Population composition, its income level and its cultural attitude towards environment, e-commerce and digitalization have a strong influence in choosing the modal choice. Some of these also have impact related to the land use and the individual dimensions. The propensity to walk or to cycle impacts on the individual dimension and

the land use dimension: some opportunities and destinations may become accessible of individuals are inclined to walk or cycle.

2.1.14 Land use and local economy

The **land use and local economy** category describes those factors that reflect the structure and the functionality of activities and opportunities in urban areas that can be planned or shaped by decision makers and politicians. Factors considered are: the population density, the availability of relevant opportunities/destinations (jobs, services, etc.), the distribution of relevant functions on the territory, the opening hours of relevant functions, the city development according to a TOD (Transit Oriented Development) model or on the contrary the city development under the influence of a sprawling effect.

Table 2-14: "Land use and local economy" factors and their interactions with the four dimensions of accessibility

Factors	Accessibility Dimension			
	Transport dimension	**Land use dimension**	**Individual dimension**	**Temporal dimension**
Population density	X	X		
Availability of relevant opportunities/destinations (jobs, services, etc.)		X		
Distribution of relevant functions on the territory		X		
Opening hours of relevant functions				X
TOD (Transit Oriented Development)	X	X		
City sprawling	X	X		

It is not surprising that all the factors in the category land use and local economy have impacts on the land use dimension of accessibility. The population density and distribution of functions, their availability of functions, their opening hours are all key factors in determining the **land use dimension** of accessibility as they determine the level of opportunities of accessing them.

2.1.15 Territory

Lastly, within the **territory category**, factors describing the given physical aspects and elements characterizing the urban environment are considered, such as those elements that cannot be planned or shaped by decision makers and politicians, namely the topography, the climate, the original urban form (historical versus modern) and the presence of natural or artificial barriers (rivers, lakes, canals, parks, infrastructures, monumental sites, etc.).

Table 2-15: "Territory" factors and their interactions with the four dimensions of accessibility

Factors	Accessibility Dimension			
	Transport dimension	**Land use dimension**	**Individual dimension**	**Temporal dimension**
Topography	X			
Climate	X			X
Urban form (historical vs modern)	X			
Presence of natural or artificial barriers (rivers, lakes, canals, parks, infrastructures, monumental sites)	X	X		

Factors in this category such as topography, climate and urban form (including the presence of artificial barriers) have a direct impact on **transport dimension** of accessibility. These factors may be constraints in opting for one mode over another (because of topography the use of bike can be very difficult and also climate may force to use some transport modes rather than others).

2.1.16 Summary

At this stage, the interactions between all factors and the four dimensions of accessibility are clearly defined.

The Accessibility Framework was then used as the starting point for the next step in the analysis: whereby measures are evaluated in relation to their impacts (positive or negative) on each of the factors, and consequently (according to each factor impacts on the four dimensions of accessibility) for their final impact on accessibility.

2.2 Impacts of policy measures on factors influencing accessibility

A list of policy measures to be analyzed was derived from the Urban Transport Road Map 2030 Project[6]: for the purpose of the project. Land use measures and social policy measures were also included in the analysis.

Table 2-16 presents the list of policy measures that have been analyzed and assessed.

Table 2-16: List of policy measures

Domain	Policy measure
Transport demand management	Area wide and personalised travel planning Sustainable travel information and promotion Shared modes (bike sharing) Shared modes (car sharing) Delivery and servicing plans
Transport Infrastructure	Bus network and facilities Walking and cycling networks and facilities Park and ride Trolley, tram, metro networks and facilities Urban delivery centres and logistics facilities
Transport pricing	Congestion and pollution charging Parking regulation and pricing Public transport integrated ticketing and tariff schemes
Traffic management and control	Legal and regulatory framework of urban freight transport Prioritising public transport Access restrictions and road and parking space reallocation Traffic calming measures
Land use planning	Land use planning density and transport infrastructure
Social policy	For example: decentralised health care

For each measure, an assessment was made in relation to its impact on each of the 67 accessibility factors. For each policy measure, the following key elements were addressed:

1. The factor category and the factor on which there is an impact;

[6] http://urban-transport-roadmaps.eu/

2. Description of the potential impact on accessibility;
3. Description of available evidences (if available from literature)[7]; and
4. Assessment of the overall effectiveness of the measures in improving accessibility (based on evidence and expert judgement).

For each policy measure, the overall effectiveness in terms of accessibility has been evaluated in relation to:

- **Private Modes**: the use of individual cars, vans and motorbikes.
- **Public Transport**: the use of collective passenger transport but also car sharing and van sharing;
- **Active Modes**: walking, the use of individual bikes, and bike sharing options.

This distinction is considered necessary as a measure can impact positively on a factor for some aspects (so having positive effects for accessibility for some transport modes) and impact negatively on other aspects (so having negative effects on accessibility for other transport modes). The effectiveness has been evaluated using a scale from --- (very negative) to +++ (very positive).

Conclusions are drawn on the overall effectiveness for the three categories of mobility in order to provide a summary of the likely impacts that could be achieved from the application of each of the measures in terms of private, public or active modes. Together with effectiveness considerations in relation to the different kinds of mobility, cost considerations have also been estimated and presented with ratings ranging from € (less costly), to €€€ (more costly).

Table 2-17 summarizes all the results for all of the policy measures considered.

[7] The analysis on these three elements is reported in Appendix 4.

Table 2-17: Measures effects on accessibility and cost considerations

DOMAIN	MEASURES	OVERALL EFFECTIVENESS ON ACCESSIBILITY (+++ to ---)			Cost consideration (€ to €€€)
		Public Transport	**Private modes**	**Active modes**	
Transport demand management	**Area wide and personalised travel planning**	**++**	**0**	**++**	**€€**
	Sustainable travel information and promotion	**+**	**0**	**+**	**€**
	Shared modes (bike sharing)	**++**	**0**	**++**	**€€**
	Shared modes (car sharing)	**++**	**+**	**0**	**€€**
	Delivery and servicing plans	**0**	**+**	**+**	**€**
Transport Infrastructure	**Bus network and facilities**	**+++**	**+**	**++**	**€€€**
	Walking and cycling networks and facilities	**+**	**-**	**+++**	**€€**
	Park and ride	**+++**	**++**	**+**	**€€**
	Trolley, tram, metro networks and facilities	**+++**	**-/0**	**++**	**€€€**
	Urban delivery centres and logistics facilities	**+**	**+**	**+**	**€€**
Transport pricing	**Congestion and pollution charging**	**++**	**---/--**	**+++**	**€€**
	Parking regulation and pricing	**+/++**	**--**	**+/++**	**€**
	Public transport integrated ticketing and tariff schemes	**++**	**-**	**+**	**€**
Traffic management and control	**Legal and regulatory framework of urban freight transport**	**0**	**-**	**+**	**€**
	Prioritising public transport	**++**	**-**	**0**	**€€**
	Access restrictions and road and parking space reallocation	**+++**	**---**	**+++**	**€€**
	Traffic calming measures	**+**	**-**	**+++**	**€€**
Land use planning	**Land use planning density and transport infrastructure**	**++**	**+**	**+++**	**€**

n.a.=not applicable; 0=no effectiveness; --- to +++ = full negative to full positive

It should be noted that effectiveness hasn't been assessed for specific social policy measures due to the range of social policy measures that could be implemented. This category includes a large variety of specific measures, so the assessment of effectiveness was not possible.

The policy measures analysed in this task were derived from the Urban Road map 2030 Project and are therefore mainly policy interventions aimed at improving urban mobility. That is why in general all the measures considered discourage private mobility (in particular the use of private cars) and its accessibility. On the contrary, measures aimed at improving public transport accessibility and active modes are in the majority.

With this in mind, some considerations have been drawn by the analysis conducted in relation to the effectiveness towards each mode.

2.2.1 Summary: Transport demand management

Area wide and personalized travel planning and shared modes (bike sharing and car sharing) tend to be the most effective within the transport demand domain in terms of improving accessibility, particularly aimed at public transport and active modes. Sustainable travel information and promotion is less effective than the area wide/personalized travel planning, mainly due to the lower degree of consideration for the individual's accessibility requirements (which makes the latter so successful).

2.2.2 Summary: Transport infrastructure

The provision of transport infrastructure aimed at a range of public transport/active modes is considered to be very effective at improving accessibility. Public transport becomes more attractive with the increased reliability, comfort, security etc. However, it also tends to come with an associated high monetary cost. Park and ride schemes are also very effective at increasing accessibility for public transport – providing dedicated parking for users at easily accessible points, with access to the centre of urban areas by public transport. Infrastructure provision aimed at freight transport is less effective at increasing accessibility, mainly due to other restrictions on access directed specifically at freight vehicles.

2.2.3 Summary: Transport pricing

Congestion or pollution charging can have a negative impact on accessibility for private vehicle use (discouraging private vehicle access through monetary penalties). However, it can have a positive effect on public transport or active modes due to increased road space availability, reduced congestion, increased safety etc. similar effects (to a lesser extent) can be achieved through the use if parking regulation and pricing. Public transport integrated ticketing and tariff schemes are most effective in improving access to public transport, but there are also some associated benefits for active modes, through increased walking or cycling to public transport services.

2.2.4 Summary: Traffic management and control

Access restrictions and road parking space reallocation, and prioritisation of public transport modes is likely to be quite effective in improving access via public transport modes (e.g. increased reliability of services, and in turn attractiveness of mode). The former will also have a positive effect on effectiveness for active modes, as safety is increased for pedestrians and cyclists (as will traffic calming measures). All traffic management control measures are likely to have a negative effect on the effectiveness of improving accessibility for private modes due to the restrictions put in place and priorities given to other modes. Legal and regulatory framework of urban freight transport are least effective in improving accessibility (as they tend to discourage travel/access to urban centers, at least at certain times), but do have a positive effect for active modes due to increased safety.

2.2.5 Summary: Land use planning

Land use planning density and transport infrastructure is likely to be effective in improving accessibility across all modes (primarily active modes, followed by public transport). This is largely due to the careful consideration of the location of activities/opportunities and the placing of key transport links and facilities – covering the fundamental dimensions of accessibility. Land use planning is considered to be reasonably low cost. Through planning and implementing a mix of functions and opportunities within walking distance for the majority of people (or planned public transport links), excellent level of active accessibility can be obtained. However, this is more complex to put into practice for existing urban areas where it would require redevelopment/gentrification of city centres.

3 Selection and development of best practice case studies

According to the key conclusions presented in the summaries at the end of the previous chapter, some measures could be, in theory, more effective than others in achieving better levels of accessibility. However, when looking at practical cases, it is difficult to identify cities that have implemented actions with the sole objective of improving accessibility.

Instead it is more common to find cities implementing strategies (packages of measures and actions) to improve urban mobility, whilst at the same time addressing a wide range of different issues affecting transport modes (private, public and active).

Therefore the case studies selected and presented as best practices in achieving good levels of accessibility as part of Task 4 are not exclusively or explicitly targeted at this sole objective (i.e. accessibility).

The best practice case study cities selected within this task have primarily been derived from those within the CIVITAS[8] Initiative. The initiative was launched in 2002 to redefine transport measures and policies in order to create cleaner, better transport in cities and is now the most important initiative at European level that has the focus on sustainable urban mobility. The word CIVITAS was coined by joining three key components of a modern European society, namely City, Vitality and Sustainability. Better transport means efficient transport, and good accessibility is the precondition for efficiency. It is therefore not surprising that most of the cities presented have been CIVITAS cities in the past and are at present part of the CIVITAS Forum.

The best practice case study cities selected for Task 4 are:

- Porto, Portugal;
- Toulouse, France;
- Dublin, Ireland;
- Gothenburg, Sweden; and
- Donostia San Sebastian, Spain.

3.1 Rationale for case study selection

The rational for selecting each case study city is set out in more detail in the following subsections.

3.1.1 Porto

The city of Porto implemented a series of innovative measures to combat mobility issues in the city centre. The measures were primarily targeted at reducing the congestion caused by individuals commuting into the city by car and also aimed to reduce the modal share of cars for short journeys.

The city has been selected as a 'best practice' example as the mobility issues faced by Porto are similar to those encountered by many other European cities, while the solutions developed during the project were effective and are highly transferable to other areas. In particular, the increased availability of real-time public transport information and the development of a late night transport on demand bus service increased the attractiveness of public transport and contributed to improved accessibility.

[8] http://www.civitas.eu

3.1.2 Toulouse

Toulouse has focused on improving its transport network for many years and has been recognized for its achievements in sustainable urban mobility by the European Commission. This case study demonstrates the benefits of implementing a comprehensive package of measures and building on this strategy over a sustained period of time. The measures implemented in Toulouse cover all transport modes and have improved various aspects of accessibility.

In addition to vast improvements to the public transport system, other techniques to improve accessibility such as public space redesign, land-use planning and the implementation of a transport on demand service to connect inhabitants to major transport terminals have been demonstrated. The city has trialled innovative measures such as contactless integrated ticketing, new parking management policies and carpooling and has also led the way in terms of increasing accessibility for disabled users. In 2015, the public transport network was 100% accessible to disabled users and the city won third prize in the European Commission's Access City Award 2016.

3.1.3 Dublin

This case study covers the so called "dublinbikes" scheme, which is one of the most successful shared bicycle schemes in the world to date. Shared bicycle schemes are applicable to many European cities and can increase accessibility in a number of ways. For example, they greatly increase the availability of bikes, generally lead to improvements in cycling infrastructure and can help to remove the cost barrier associated with bike ownership. Well-designed schemes can also help to ease overcrowding on public transport.

In Dublin, the scheme has facilitated an increase in the modal share of cycling and has helped to connect users with public transport (due to the siting of rental stations outside key interchanges) and areas of the city that were previously less accessible without a car. Since its launch, the scheme has exceeded expectations, received excellent levels of customer satisfaction and has also undergone a series of expansions, which highlights its continued popularity.

3.1.4 Gothenburg

Gothenburg is a forerunner city in exploring and implementing solutions to improve urban mobility and accessibility.

The city was involved within the project CIVITAS TELLUS[9] in the first edition of the CIVITAS initiative (2002-2006). Also thanks to the experience gained during the participation under CIVITAS, the city has continued to develop in the following years a comprehensive strategy for addressing urban mobility, from the introduction of different transport demand management measures (travel plans, bike and car sharing systems) to the improvement of transport infrastructures (bus lines, trains, tunnels) and to the application of transport pricing strategy (road charge and parking strategy). Specific measures have been conceived for people (also with a particular attention to those with reduced mobility) and to goods.

The city of Gothenburg is the proud winner of the Access City Award 2014. The annual competition is organized by the European Commission and awards European cities that have shown exceptional good work with addressing accessibility issues. The competition is intended to recognize cities that have high goals and have a holistic approach to creating an accessible environment for everyone, with a focus on people with disabilities.

[9] Transport and Environment Alliance for Urban Sustainability

3.1.5 Donostia San Sebastian

The city of Donostia-San Sebastián is a good example of the implementation of a successful strategy towards the achievement of a better level of accessibility. Thanks to a comprehensive strategy, involving all the transport modes, the city has achieved the target to offer a greater number of transport options to its citizens, residents and users.

The strategy developed mainly under the participation under the CIVITAS ARCHIMEDES project (2008-2012), has addressed a large variety of topics relevant to urban mobility, resulting in a successful blend of policy interventions.

These have included personalized travel plans, car and bike sharing services, enhanced public transport infrastructures, testing innovative and sustainable ways for delivering goods in the city and redesign of the road space for better usage among all users.

In 2012 the city was honoured with the prestigious CIVITAS City of the Year Award "for a comprehensive approach that covers everything from cycling to public transport to personalized travel planning and also goods distribution.

3.2 Best practice case studies

For each best practice case study a factsheet has been drafted including the following information:

- **Where:** Place where the best practice has been implemented
- **What**: A description of the measure/s
- **Why**: Primary objective of the policy interventions
- **Policy content**: Short narrative description of the policy intervention
- **Policy intervention**: Known quantitative elements
- **Impacts on accessibility**: Quantitative impacts if available
- **Factors of success**: Elements that can be considered drivers for the success of the initiative
- **Transferability:** Consideration of whether the policy is transferable to other contexts
- **References:** List of references and sources

Each of the best practice case study factsheets are presented in Appendix 2.

3.3 Summary of success factors and lessons learned

The examples presented in the best practice case studies are relevant not only due to the results and impacts for the cities concerned, but also for the success factors and lessons learned that can be derived from them. Success factors/lessons learned can be used to help guide the adoption of similar strategies in other cities and can provide valuable inputs to consider during implementation. A summary of the success factors and lessons learned are provided below.

As demonstrated by the best practice cases studies, the decision concerning which policy measures to implement is dependent on the objectives of the local authority and the local accessibility issues that the policies are intended to overcome. However, regardless of the strategy, all of the best practice case studies indicate that a broad package of measures

helps to achieve the desired improvements. This is because synergies among measures usually exist and amplify each individual effect (particularly demonstrated by the strategy implemented in Toulouse).

To improve accessibility a comprehensive planning strategy is required, as demonstrated by the Porto case study. Measures can be implemented in different combinations according to the local context (which shows that tailoring the measures to the local environment is key to success) and also according to their different characteristics. Measures vary greatly in terms of required investment. They also vary in terms of how effective they are in enhancing accessibility for different modes, e.g. public transport or active modes. The implementation of a broad package of measures focussed on different transport modes (including walking and cycling) can therefore help to address different aspects of accessibility and lead to greater cumulative impacts over time.

No universal solution exists to address all of the different urban mobility and accessibility problems within European cities and towns. However, the best practice case studies covered within this task have addressed a wide range of issues and can provide local authorities with a starting point for their strategies.

To achieve the target of improved accessibility, all transport components (passengers and freight) have to be addressed. If goods transport and delivery is organised efficiently, then passengers' mobility also has more chance of being sustainable and well organised. Donostia – San Sebastian and Gothenburg are clear examples of this point.

If the objective is to promote a single transport mode, all efforts have to be made to provide users with the appropriate infrastructure. In Dublin for example, improvements to cycling infrastructure (such as the development of segregated cycle lanes, creation of cycle paths and secure parking facilities) have been essential to increase the attractiveness of cycling and develop a cycling culture. Good connections with public transport terminals (e.g. by creating rental stations outside PT stations) have also significantly increased the use of shared bikes and increased the ease of transfer between modes. Once the scheme is in operation, a degree of optimisation will be necessary to ensure better placement of stations. The analysis of rental station usage statistics can also be used to help plan expansions and identify areas where accessibility could be further improved. In parallel, other support measures should be developed to help and sustain the main policy measure, such as pricing strategies. In Dublin a fair and competitive pricing strategy has ensured high usage of the bicycles. Ease of payment via an easy to use interface is also essential. Besides the subscription fee, an average of 96% of journeys on dublinbikes are free. This removes any cost barriers associated with their usage.

The best practice case studies have also shown that the process of implementation is important. Firstly, political commitment, support and cooperation is fundamental. The cooperation between stakeholders and the involvement of citizens at all stages of the project are also key factors in overcoming some of the barriers to implementation.

Citizen involvement and support in particular plays a crucial role in implementing a measure. In several cases it was noted that the lack of engagement and consultation of citizens resulted in the abandonment or limited success of a measure. Marketing campaigns and collation of feedback on new measures are therefore very important for the success of projects. For example, when providing new services and facilities for public transport, user feedback can enable improvements to be carried out. The involvement of users/citizens can be performed by collating feedback via surveys and meetings in order to identify their needs. After measures are implemented, well-targeted communications and marketing campaigns are essential for promotional purposes and to increase the number of public transport users.

Finally, the consideration of other cities' experiences and the transfer of knowledge and expertise between cities is very important to increase the chances of success. This was specifically noted in the Dublin case study, where the local authorities considered a number of other successful schemes worldwide during the planning phase.

4 Conclusions

There are numerous policy measures that have the potential to enhance and increase the accessibility of urban areas - any measures that makes it easier for people or freight to reach opportunities (whether they are referred to as goods, services or destinations) can increase the accessibility of an urban area.

The implementation of measures to improve accessibility have varying effects (positive and/or negative) on public transport modes, private modes and active modes (walking and cycling). It is often the case that the implementation of a measure aimed at improving accessibility for one mode, can have a negative effect on the accessibility of other modes. For example, improving the accessibility of public transport can lead to some degree of penalisation of private transport accessibility (car access limitations, parking reallocations, road charging and others).

Thanks to the analysis conducted in this report first by building the analytical framework and then by analysing the best practices of the case studies presented some conclusions can be drawn in relation to the different components of mobility. Overall it can be stated that to achieve the target of improved accessibility, all transport components (passengers and freight) have to be addressed: if goods transport and delivery is organised efficiently, then also passengers' mobility has more chance to be sustainable and well organised. This is has to be born in mind, especially nowadays when freight deliveries (related to business activities but also to domestic destinations) continue to grow at an enormous pace, impacting significantly on the liveability of modern cities and towns.

A range of success factors/lessons learned were identified from the development of city best practice caser studies. These included:

- A broad package of measures should be implemented;
- Address all transport components (passengers and freight);
- Political commitment, support and cooperation;
- Cooperation between stakeholders and involvement of citizens at all stages of implementation;
- Consideration of other cities' experiences and the transfer of knowledge and expertise between cities.

The city best practice examples should be taken into consideration for their specific aspects and cities that aim to achieve a better and more sustainable mobility system should be aware that no universal solution exists to address all of the different urban mobility problems. Measures should be implemented according to the local context of each city and town: tailoring the measures to the local environment is key to success.

Lastly although we have identified that urban accessibility is more than urban mobility in that it provides access to opportunities, it is clear that improving urban mobility is a key element of improving urban accessibility. Indeed most of the measures considered here and within the case studies are synonymous with improved urban mobility and the transport dimension of urban accessibility. However, by considering urban mobility within the wider land-use dimension such that land-use and mobility planning are integrated then further improvements in accessibility can be achieved. This is touched on in the case studies but is an area that needs further development and encouragement by considering urban accessibility as a whole rather than just mobility.

Appendix 1 - Stakeholder email survey

Actions to improve accessibility and supporting actions Stakeholder survey

The European Commission (Directorate General for Mobility and Transport) launched a study in 2015 to improve the understanding of urban accessibility and road congestion in Europe. The European Commission contracted Ricardo Energy & Environment (UK) with subcontractor TRT to conduct the study. The study aims to advance the understanding of urban accessibility in order to improve the functioning of urban areas and make the transport system in Europe's urban areas more efficient.

Accessibility in the context of this study can be defined as: "….the ease of reaching goods, services, activities and destinations in urban areas. It includes factors such as mobility options, travel information, transport network connectivity, land use patterns and cost for both passengers and freight."

These questions explore the actions available to improve accessibility in European cities, and supporting actions.

Background information

Organisation name:	Click here to enter text
Contact name:	Click here to enter text
Email address:	Click here to enter text
Telephone number:	Click here to enter text
Member State:	Click here to enter text
Type of organisation	☐ Local Authority / city ☐ Non-Governmental Organisation (NGO) ☐ Consultancy ☐ Academic ☐ Public Transport Operator ☐ Other Please specify

1. Actions to improve accessibility

The study team have prepared a draft analytical framework which aims to provide decision-makers in cities with information on the potential measures that can be implemented in order to improve accessibility. It contains the following:

Analytical framework matrix:
This tab provides an overview of the information contained within the spreadsheet. A number of measures were identified, and then assessed against the following:

- ***Accessibility dimension***: Indication of whether the measures affect the following four primary accessibility dimensions – transport, land use, individual or temporal.
- ***Accessibility factors:*** Indication of whether the measures affect a range of accessibility factors, including those related to transport demand, road supply, private transport supply, public transport supply, active modes, shared mobility services, integration between transport solutions, urban freight logistics infrastructure, transport cost, user information, safety and security, population, land use and economy, and territory.

- **Individual measure tabs:**
- Each measure has its own tab describing and assessing the potential impact that it has on the accessibility factors. It includes the following for each measures:
- **Impact:** Description of the potential impact of the measures on the accessibility factor
- **Evidence:** Where available, available evidence to support the description of the potential impact
- **Overall effectiveness of improving accessibility:** An assessment of the effect that the measure has on accessibility (from --- to +++) from a public, private and active mode perspective (acknowledging that there may be differences).
- **Summary of overall effectiveness on accessibility:** For public, private and active modes
- **Cost consideration:** An indication of cost to implement measure (from € to €€€).

We are very interested to receive your feedback on the analytical framework. Please answer the questions below related to general feedback. We understand that it could be quite time consuming to review the framework in detail, but if you do have any specific comments related to the measures and assessments contained within it, we would gratefully receive these within the spreadsheet and in addition to this survey (e.g. description of impact of measure on accessibility, effectiveness of improving accessibility (public, private, active) – by factor, additional supporting evidence, overall effectiveness and cost implications of measure).
Do you consider the analytical framework to be a useful tool to help cities to assess potential accessibility measures?

Yes	☐
No	☐
Please explain your answer	Click here to enter text

Please provide any general feedback you have on the analytical framework in the space below

Click here to enter text

If you have specific comments on the assessment of any of the measures please feel free to add comments directly into the spreadsheet.

As part of this study, we are also interested in identifying best practice examples of measures that have been implemented in cities in Europe that have resulted in improved accessibility (measures, actions or packages of measures. We understand that not all measures will have been implemented with the primary aim of improving accessibility but this has been achieved as one of the outcomes.
Are you aware of any best practice examples of measures, actions or packages of measures that have been implemented in cities in Europe that have improved accessibility? Please enter as much detail as you can

Best practice 1:

Name of city, country (where)	Click here to enter text
Measures implemented (what)	Click here to enter text
Primary objective of policy intervention (why)	Click here to enter text
Impact on accessibility	Click here to enter text
Success factors	Click here to enter text
Contact, website or report	Click here to enter text

Best practice 2:

Name of city, country (where)	Click here to enter text
Measures implemented (what)	Click here to enter text
Primary objective of policy intervention (why)	Click here to enter text
Impact on accessibility	Click here to enter text
Success factors	Click here to enter text
Contact, website or report	Click here to enter text

2. Supporting actions

Section 2 of this survey considered the measures that have already been implemented in Europe. This section seeks to identify how national and EU policies could further assist these measures to be implemented in European cities.

In your opinion, what are the barriers to taking action to improve accessibility?

City/regional level	Click here to enter text
EU Level	Click here to enter text

In your view what supporting actions or policies that could be implemented to overcome barriers?

City/regional level	Click here to enter text
EU Level	Click here to enter text

For example in our review of the literature we identified a number of potential supporting actions that could aid the implementation of measures aiming to improve accessibility. These included:
National level accessibility statistics to help cities compare and raise awareness
EU information on accessibility and how it links to sustainability (e.g. SUMPS)
Use of standard metrics for assessing accessibility
Access to a range of data sources
Requirements for accessibility assessment in National transport guidance
Provision of guidance on models

Final remarks
Are there any other comments you would like to make?

Actions to improve accessibility	Click here to enter text

Supporting actions	Click here to enter text

Would you be willing to be contacted further?

To discuss your answers in more detail?	☐ Yes	☐ No
To receive information regarding a final conference in December 2016?	☐ Yes	☐ No

Appendix 2 – Case Studies

Case Study 1: Porto, Portugal

Source: Wikipedia Picture (licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license)[10] Where - background

Porto is the second largest city in Portugal and is located in the north of the country, by the mouth of the Douro River. The city is considered to be the commercial capital of the north and has an area of 41 km^2. Porto is one of the oldest cities in Europe and is known for its culture and architecture, exemplified by the historic centre of Porto's status as a UNESCO World Heritage Site. This case study focuses on the measures implemented in Porto as part of the CIVITAS Mobilising citizens for vital cities (ELAN) project, which took place between 2008 and 2012.

In recent years, a shift in the population away from Porto city centre has been observed, with citizens instead preferring to live in the suburbs. According to census data[11], the population of the city decreased by almost 10% between 2001 and 2011, from 263,131 to 237,591. Over this same timeframe, the population of the Metropolitan Area of Porto (which covers 17 municipalities and has an area of 2,030 km^2) grew by approximately 2%, from 1.78 million to 1.82 million[12].

The shift away from the city centre has been linked to social and economic factors, such as deindustrialisation and changes in living standards[13]. This led to changing mobility patterns, with many people making longer journeys into the city by car, which resulted in congestion at the city's main entry and exit points.

[10] https://en.wikipedia.org/wiki/Metropolitan_Area_of_Porto
[11] http://www.citypopulation.de/php/portugal-admin.php?adm2id=1141312
[12] http://www.citypopulation.de/php/portugal-admin.php?adm1id=13
[13] http://www.shrinkingcities.eu/fileadmin/Conference/Exhibition/09_Porto.pdf

Porto has a variety of public transport services operating within the city centre and connecting the city to neighbouring municipalities. An extensive city and suburban bus network is available, while a metro system (which opened in 2002) is also in operation. The Porto Metro, which consists of six lines and currently has 81 stations across 67 km of track, operates within the city and six other municipalities. The most recent line opened in 2011, part-way through the CIVITAS ELAN project. The local train system can also be used for travel within the city, however it is more commonly used for journeys to other areas. A multimodal ticketing service called *Andante* has also been in operation since 2002. This covers transport within the city, including buses, the metro system and urban rail[14].

Despite the wealth of public transport options available, the modal split of cars had increased in the years prior to this project (as shown in the table below).

	2001	**2011**
Walking	30%	22%
Public transport	25%	26%
Car	44%	52%
Cycling	1%	-

Source: TEMS – EPOMM Modal Split Tool[15]

What – selected measures

Overall, six broad measures were implemented in Porto as part of the CIVITAS ELAN project. A number of these measures were not specifically intended to improve accessibility but may still have resulted in positive impacts on accessibility. The measures implemented in Porto are listed below, alongside the appropriate category, as defined in activity 4.1b of this project:

TRANSPORT DEMAND MANAGEMENT	**Area wide and personalised travel marketing**	•	- Establishment of a Mobility Agency (including a mobility shop and a mobility website)
	Sustainable travel information and promotion	•	- Mobile Mobility Information (LCD information board with public transport information and MOVE-ME application for internet devices)
	Shared modes (car sharing)	•	- Flexible Mobility Agency (car-pooling platform for trip announcements)
TRANSPORT INFRASTRUCTURE	**Bus network and facilities**	•	- Lightweight shuttle bus (a clean bus shuttle within the Asprela quarter, new public transport stops for shuttle users) - Flexible Mobility Agency (late night bus demand responsive transport)
	Walking and cycling networks and facilities	•	- Integrated accessibility planning in the Asprela quarter (implementing a cycle lane network, increasing the width of footpaths, improving accessibility to pedestrian crossing and improving traffic signalisation)

[14] http://www.linhandante.com/quemsomos.asp
[15] http://www.epomm.eu/tems/result_city.phtml

TRAFFIC MANAGEMENT AND CONTROL	**Access restrictions and road and parking space reallocation**	•	- Integrated accessibility planning in the Asprela quarter (reduction in on-street and off-street parking spaces)
	Prioritising public transport	•	- Integrated accessibility planning in the Asprela quarter (public transport priority at crossroads and at traffic lights)
LAND USE PLANNING	**Land-use planning, density and transport infrastructure**	•	- Participatory planning for new intermodal interchange

Why - motivation

Prior to the project, Porto faced serious mobility problems, which were attributed to a shift in the population away from Porto city centre to the suburbs. This led to a change in mobility patterns and resulted in problems with congestion at the city's main entry and exit points. To solve this issue, attempts had already been made to increase the road capacity. However, at the time of the project, the city had begun to focus more on the improvement of public transport. This theme was continued during CIVITAS ELAN.

The ELAN project took place between 2008 and 2012 as part of the CIVITAS Initiative, a city demonstration programme financed by the European Union's 7th Framework Research Programme. ELAN is one of five demonstration projects in the third round of the CITVITAS Initiative, called CIVITAS Plus. The expected impacts of CITITAS Plus are:

- Increased energy efficiency in urban transport
- Contribute to improving road safety in urban areas
- Increase share of biofuels and other alternative fuels
- Reduction of CO_2, pollutant emissions and noise
- Improving efficiency & effectiveness of urban transport & modal balance.

CIVITAS ELAN brought together five cities, one of which was Porto (the other cities involved were Ljubljana, Gent, Zagreb and Brno). The project had a focus on accessibility, as shown by the overall ambition which was ***'to "mobilise" our citizens by developing with their support clean mobility solutions for vital cities, ensuring health and access for all.'***

The Porto section of the project concentrated on the **Asprela** quarter, a fast growing area located in the north of the city. The area is the largest academic and health centre in Portugal and is home to many educational institutions and the Hospital de São João. Asprela suffered from severe accessibility and mobility problems due to high levels of journeys made by car, illegal car parking and traffic congestion, despite many public transport options being available. **A number of measures to improve mobility were therefore implemented.**

Policy Content

The Asprela ELAN corridor in Porto studied in this project covered an area of 3 km^2. Asprela is a major entrance point to the city centre for both public and private transport and is in close proximity to important road infrastructure such as the external ring road. It was estimated that 50,000 people enter the Asprela quarter per day for work or study, meaning that over 100,000 trips are made per working day.

The area contains bus stops with links to suburban and regional buses and is also connected to the metro, however travel by car is strongly favoured. Only a small percentage of trips within the area are made by active modes, mainly due to the lack of cycle lanes and poorly maintained footpaths.

Prior to the start of the project, a number of changes or announcements concerning the local transport network had also taken place including:

- The opening of a metro line (Line F) in 2011 with three stations in the area
- Plans for an additional metro line to serve the area
- Plans for an additional railway station in the area.

To improve mobility, a number of measures were implemented during the ELAN project. An overview of how these measures can improve accessibility is given below.

Transport Demand Management

The main objectives of the measures in this area were to provide information relating to public transport and to promote the use of sustainable transport options. To achieve these goals, a '**Mobility shop**' was set up in the Asprela quarter, in addition to a **website** which helped to publicise the latest developments. These two developments can help individuals to assess their need for travel. **LCD information boards** were installed in locations such as the hospital and the medical facility to provide public transport users with real time information on the routes available, timetables and the time until the next service. These were intended to inform about the transport options available and to help users to plan their journeys more effectively. Two other methods that were developed to help users to plan journeys in the city were the **MOVE-ME** smartphone app and an **internet platform/forum for car-pooling**. These two measures can help to increase accessibility by improving the provision of user information and by increasing the availability of cars.

Transport Infrastructure

Improving Porto's transport infrastructure was a major part of this project. A new **lightweight shuttle bus service** was implemented, which was intended to be a convenient alternative to using a car for short distance journeys. A **new demand responsive transport (DRT)** night bus service was also created, which improved the availability of public transport services for the large student population late at night.

A series of measures designed to improve accessibility to pedestrian and cycling infrastructure were also implemented. These included the **widening of footpaths**, improvement of **pedestrian crossings**, the creation of a **cycling lane** and construction of bus bays to increase the ease of getting on and off buses. These improvements have the potential to encourage modal shift away from cars and hence to relieve congestion. The improved quality of footpaths and new cycling facilities may also mean that some areas are now more accessible via active transport modes and are a feasible alternative to travelling by car for short trips.

Traffic Management and Control

A key goal of this project was to encourage modal shift away from cars. As part of the **integrated accessibility planning** measure public transport was given priority at crossroads, while a reduction in car parking spaces was targeted. Again, this served to improve the attractiveness of public transport options by improving the reliability of public transport services.

Land Use Planning

The development of a **new intermodal interchange** in the Asprela area was seen to be an important step in improving Porto's public transport network. This project contributed towards the planning of this facility and provided input on the needs of citizens to maximise accessibility in the future. In particular, it is expected to help accessibility by improving the ease of transfer between modes.

Policy interventions

Details concerning the policy intervention are reported in the following table, with quantitative elements for each of the policy measures provided where available.

Lightweight bus shuttle	A minibus was converted into a lightweight bus shuttle, which aimed to reduce the use of cars for short distance travel. The new bus was 380 kg (16%) lighter than the previous bus and had an increased capacity by 7 additional passengers. It operated on weekdays for 12 weeks during the project.
Integrated accessibility planning in the Asprela quarter	A 3.6 km bicycle lane network was implemented, while for pedestrians the quality of pavements was improved. One such way was by increasing the width of footpaths; in total, the area for pedestrians grew by 2,408 m^2, an increase of 3.6%. The accessibility of pedestrian crossings was also improved by creating parallel curved ramps and additional crossings were constructed. Public transport was given priority at crossroads and new bus bays at bus stops enabled better access for passengers.
Flexible Mobility Agency	As part of the Mobility Shop, a Flexible Mobility Agency was created. The agency carried out initiatives to improve the attractiveness of alternative, more sustainable transport modes (compared to cars). Services such as carpooling and a late night bus demand responsive transport (DRT) system were set up. The target users for the DRT were university students.
The Mobility Agency	A Mobility Shop was set up in the local area. Activities carried out by the Mobility Shop included: Providing public transport information to the local population Supporting the activities of the Flexible Mobility Agency (such as the DRT bus service) Citizen engagement activities, including publicising and developing marketing campaigns about the ELAN project and its activities Collecting information about mobility issues in the area Monitoring the acceptance of the measures being implemented.
Mobile mobility information	Two LCD information boards were installed to provide real time information on public transport in the area. These boards gathered data from 14 different operators in a single platform. The free MOVE-ME smartphone app was also developed to help people to plan journeys using the optimum combination of routes and modes.
Participatory planning for new intermodal interchange	Plans for a new multi-modal interchange are under development for the Asprela area. The aim of this task was to contribute towards the planning by carrying out research, considering stakeholders' opinions and proposing a conception design and business model. Aspects such as walking accessibility, bicycle infrastructure, park and ride schemes and logistical requirements for filling stations for alternatively fuelled vehicles were considered.

Impacts on Accessibility

Over the course of the project, changes in modal split were observed. These are shown in the table below. Red indicates a decrease in modal split, while green indicates an increase. The overall increase in sustainable transport modes is not solely due to the measures implemented but is also due to the increase in unemployment, higher fuel costs and the higher cost of public transport.

Transport mode	Students/ workers 2009	Students/ workers 2012	Inhabitants 2011	Inhabitants 2012
Car	47.3%	28.1%	41.6%	20.4%

Bus	18.1%	15.2%	20.5%	34.6%
Metro	24.4%	3.8%	7.7%	19.0%
Walking	4.7%	47.8%	30.0%	23.0%
Bike	1.0%	2.6%	0.0%	1.3%
Train	4.2%	1.4%	0.1%	0.2%
Motorcycle	0.2%	0.6%	0.0%	0.8%
Taxi	0.1%	0.4%	0.1%	0.8%

Notes: Please note that the modal split for students/workers was assessed in 2009 and 2012, while for inhabitants, modal split was assessed in 2011 and 2012. This may explain some of the differences in mode change, however overall, the study findings state that an increase in sustainable transport modes was observed.

The impacts on accessibility are reported here in relation to each of the mobility components proposed in the analytical framework (public, private, active).

Public Mobility:

- The measures to increase the provision of information about public transport (the **MOVE-ME**[16] mobile app and the **Mobility Shop**[17]) were highly successful.
- A total of 4,055 active downloads were registered for the MOVE-ME mobile app. The app had an average rating of 4.2 across the Android market and the Apple store. Between February 2012 and June 2012, a total of 157,112 information requests were received via the app, an average of 936 per day. Based on user feedback, the app has also been improved.
- A survey of users of the MOVE-ME app found that 21% of respondents considered that they travelled by car less as a result of using the app.
- On average, the Mobility Shop attracted 1,100 visitors per month.
- Satisfaction was also very high for both services: in user surveys, the mobility shop achieved an average satisfaction of 4.7 out of 5, while the MOVE-ME app scored 3.7.
- **Lightweight bus shuttle.** The number of users steadily increased throughout the project. On average, 261 passengers were transported per day although the average during the last month of the project was 343 passengers per day. According to a survey, 27% of the users did not previously use public transport, meaning that on average 71 people per day no longer use their car for this journey. User satisfaction was also very high, 60% stated they were completely satisfied and 37% said rather satisfied. Suggestions were also received to extend the service in terms of the route, number of stops and number of services.
- The target to improve punctuality by 25% for bus services was achieved by two bus operators, while the other two operators managed a 7% improvement and a 0% improvement respectively. However, overall the number of complaints about the bus service reduced by 64% compared to the last four years.
- During the trial 1106 passengers used the **DRT bus service**, an average of 26 passengers per night. A survey found that 73% of commuters in the area were aware of the new service.

Private Mobility:

- A significant reduction in congestion was achieved and all of the metrics used to assess congestion exceeded their target values by at least three times. The project

[16] MOVE ME – A mobile app that provides access to the ground transportation network directly from a mobile phone.
[17] Mobility Shop – Created to support innovative mobility services in Porto. Aims to increase the levels of customer satisfaction for public transport and to achieve changes in travel behaviour in favour of public transport.

team views the 'integrated accessibility planning in the Asprela quarter' to be the most effective measure. The results are shown in the table below.

Congestion metric	Morning peak	Afternoon peak
Average journey time	-17%	-29%
Average speed	+27%	+39%
Average delay	-31%	-48%
Average time spent stationary	-41%	-42%

- A 2% decrease in the number of off-street parking spaces and a 17% decrease in on-street parking was achieved. Compared to 2009, there was a 10% decrease in the level of illegal parking.
- Carpooling attracted 700 registered users, however only a limited number of trips were shared directly through the online platform.

Active Mobility:

- A new 3.6 km cycle lane network was developed, which led to an increased modal share for cycling.
- Facilities for pedestrians were improved, including wider pavements and safer crossings.

Success factors

The measures implemented in the ELAN project were highly applicable to the mobility problems observed prior to the project, therefore good results were seen after implementation. The cooperation between stakeholders, involvement of citizens and promotional campaigns were also vital for the success of the measures implemented.

Transferability

A number of the measures implemented in Asprela during the ELAN project have already been scaled up to other areas of Porto, or implemented in other cities. For example, the LCD information boards have been installed at Porto airport, while the MOVE-ME app has been implemented in Lisbon. It is expected that the app will be developed for other cities in Portugal.

Other measures could be easily scaled up to improve the accessibility in other areas of Porto. In particular, the lightweight bus shuttle and the DRT night bus show good potential for transferability. With adaptations relevant for the local area, the measures in this project would also be suitable for implementation in other cities. For example, the Mobility Shop was seen to be a good information point for public transport users, while ideas such as the carpooling platform could be implemented in other locations with high levels of commuting.

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Case Study 2: Toulouse, France

Where - background

Toulouse is located in the southwest of France, 150km from the Mediterranean Sea and just over 200km from the Atlantic Ocean. By population, it is the fourth largest city in France. Toulouse is also the centre of the European aerospace industry and is home to several large universities.

The population of Toulouse city itself is approximately 450,000[18], while the metropolitan area has 1.29 million inhabitants. Since 2006, the city has seen one of the highest population growth rates in France, which has been attributed to the city's vibrant economy and job opportunities in high-tech sectors.[19]

This case study mainly focuses on the measures implemented in Toulouse as part of the CIVITAS Mobility Initiatives for Local Sustainability (MOBILIS) project, which took place between 2004 and 2009. However, more recent updates highlighting the progress of these measures after the MOBILIS project concluded are also included where appropriate.

The modal split in 2004, prior to the MOBILIS project is shown in the table below.

[18] http://www.insee.fr/fr/ppp/bases-de-donnees/recensement/populations-legales/commune.asp?annee=2013&depcom=31555

[19] http://www.toulouse.aeroport.fr/en/professionnels/compagnies/actualites-pink-city/toulouse-metropolitan-area-has-fastest-growing-population-france

	2004
Walking	21%
Public transport	9%
Car	67%
Cycling	3%

Source: TEMS – EPOMM Modal Split Tool[20]

Toulouse has good public transport facilities, which as described in this case study, were the target for improvements throughout the course of the MOBILIS project. Since 2002, the transport authority of the Toulouse urban area has been branded as *Tisséo*.

In 2005 (at the beginning of the MOBILIS project), the Tisséo network consisted of one metro line and an extensive bus network, while there was also access to the urban rail system. Since this time, the public transport network has developed considerably - the MOBILIS project has contributed to several of these improvements, as described in this case study. The Tisséo network now consists of two metro lines (the second of which opened in 2007), two tram lines (which began operation in 2010), 84 scheduled bus lines, the City Centre Shuttle (a free, electric bus service) and nine transport on demand services. A multimodal integrated ticketing system is also in operation in Toulouse, which gives access to the metro, tram and bus services in the Tisséo network.

What – selected measures

Overall, 21 measures were implemented in Toulouse as part of the CIVITAS MOBILIS project[21]. Those with clear links to the measures to improve accessibility defined in activity 4.1b of this project are shown in the table below:

TRANSPORT DEMAND MANAGEMENT	**Area wide and personalized travel marketing**	•	- Marketing campaign to raise awareness and encourage new mobility behaviours - Set up of a mobility agency and customized services
	Sustainable travel information and promotion	•	- Development of commuter and school mobility plans - Development of an integrated multimodal traveller information system - Demonstration of EGNOS/Galileo service use for public transport control and information systems
	Shared modes (car sharing)	•	- Promotion of car-pooling and development of a car sharing service. Both schemes were integrated with public transport services.
TRANSPORT INFRASTRUCTURE	**Bus network and facilities**	•	- New infrastructure for buses including the use of CNG and biodiesel buses, segregated bus lanes and high quality bus corridors

[20] http://www.epomm.eu/tems/result_city.phtml
[21] Please note, a number of measures described in the MOBILIS project have been grouped in the table

			- Improvement of the quality of service and accessibility of public transport - Development of a transport on demand service, complementary to public transport.
	Walking and cycling networks and facilities	•	- Development of a new cycling culture/policy and integration with public transport services
	Trolley, tram, metro networks and facilities	•	- Improvement of the quality of service and accessibility of public transport
TRANSPORT PRICING	**Public Transport integrated ticketing and tariff schemes**	•	- Innovative multimodal public transport contracts, services and electronic ticketing in Toulouse
TRAFFIC MANAGEMENT AND CONTROL	**Legal and regulatory framework of urban freight transport**	•	- Clean urban logistics and goods distribution platform
	Prioritising Public Transport	•	- Implementation of bus priority scheme
	Access restrictions and road and parking space reallocation	•	- Definition and implementation of an innovative parking management policy
LAND USE PLANNING	**Land-use planning, density and transport infrastructure**	•	- Public space redesign and implementation of an urban mobility plan, including development of pedestrian areas and environmental zones - Development of proximity services at important passenger transport hubs

Following the CIVITAS MOBILIS project, Toulouse has continued to progress in these areas. In 2009, Toulouse committed to increasing the modal share of cycling to 15% by 2020 in signing the Charter of Brussels at the European Cycling Federation's (ECF) Velo-city event.

In addition to this, its latest Sustainable Urban Mobility Plan (SUMP) aims to support car-sharing schemes, workplace mobility plans and the operation of a global parking policy. In 2012, the city's achievements were recognised by the European Commission, when Toulouse was a finalist in the European SUMP awards.

Why - motivation

At the start of the project in 2005, several mobility issues were identified in Toulouse. These included: congestion in the city centre, a large share of journeys made by car and expansion of the city causing urban sprawl and associated mobility issues. In addition to this, careful consideration needs to be given to the design of policy interventions implemented in Toulouse due to the large number of narrow streets, essential in preserving character of the area.

The MOBILIS project took place between 2005 and 2009 as part of the CIVITAS Initiative. The project brought together five cities (Toulouse, Debrecen, Ljubljana, Venice and

Odense) and primarily aimed to implement new strategies for clean urban transport. This included factors such as promoting modal shift away from cars towards more sustainable transport modes, improving the quality of public spaces and promoting safety, security, social inclusion and equity in urban mobility.

Toulouse's three main objectives as part of the project were to:

- Reorganise traffic circulation in line with an urban re-qualification process and the promotion of sustainable mobility
- Give an innovative and attractive image to the urban public transport network, by improving its quality of service
- Promote the use of alternative mobility solutions and develop intermodal behaviour.

Policy Content

The policy measures implemented in Toulouse were primarily targeted at **encouraging modal shift from cars to public transport and active modes**.

A discussion of how these types of measures can impact accessibility is given below.

Transport Demand Management

A range of techniques were employed in Toulouse to increase public engagement in mobility, with the aim of influencing travel behaviour. A key measure in this area was the establishment of a '**Mobility Agency**', which acted as an information point for matters related to public transport. Measures such as the development of personalised **commuter mobility plans** helped commuters to consider their transport options, while **marketing campaigns** raised the awareness of new mobility options. Efforts were also made to increase the **information provision** in relation to multimodal trips. The promotion of a **carpooling** service and the implementation of a **car sharing** scheme (both of which were integrated with public transport) may have also given people access to alternative methods of transport.

Transport Infrastructure

The public transport infrastructure in Toulouse was revamped during the course of the MOBILIS project. The development of **high quality bus corridors** increased the quality and the reliability of public transport, while specific measures to increase the **accessibility for disabled users** were also implemented. By 2015, the Toulouse public transport system was 100% accessible to disabled people.

The accessibility for people living in low-density areas also increased due to the development of the **transport on demand service**. This service connected users to important public transport nodes. A **bike rental system** was also established in this city, with many rental stations being set up outside underground stations. This increased bicycle availability and again, may have encouraged citizens to think about their travel options and to consider alternative modes of transport.

Transport Pricing

An **electronic contactless ticketing** system was developed for use on the Toulouse public transport system (bus, metro and trams). An overhaul of the fare structure was also conducted for multimodal journeys which may have encouraged users to consider travelling via public transport. The integrated ticketing system may also help to improve the ease of transfer between transport modes and easier payments may further improve accessibility.

Traffic Management And Control

Various traffic management and control measures were put into place to reduce congestion in the city centre and to help deliver a more reliable bus service. A widespread **parking management policy** was implemented, whereby residents were able to purchase parking permits. This helped to optimise the access to parking spaces in the city for a variety of user groups (residents, tourists, shoppers, businesses etc.), whereas previously demand for parking spaces was high due to long-term parking. To improve public transport, a **bus priority** system was trialled, which intended to raise the punctuality and speed of bus journeys. Access restrictions were also implemented for freight deliveries, in addition to the creation of **dedicated delivery areas**.

Land Use Planning

Urban planning was a very important part of this project and provided the foundations for other measures implemented in Toulouse after the conclusion of CIVITAS MOBILIS. The **redesign of public spaces** aimed to encourage use of active modes and provided a safer and more pleasing environment for pedestrians and cyclists. The development of **proximity services (such as shopping facilities) at important intermodal hubs** also aimed to increase accessibility and provide convenient facilities for public transport users.

- **Other Potential Impacts**

In addition to having a positive impact on accessibility, the policy measures implemented during this project were developed with a particular focus on achieving the following results:

- Lowering the level of congestion during the rush hour through reduced car use
- Lowering the energy consumption and level of air pollution through a combination of reduced car use and more efficient buses
- Increasing public awareness of mobility and in particular, promoting more sustainable travel options
- Creating a modal shift from private car to public transport use through improving the attractiveness and quality of public transport and by encouraging intermodal travel behaviour
- Improving the mobility of dedicated target groups (such as disabled people) and increasing transport safety.

Policy Intervention

Details concerning the policy intervention are reported in the following table, with quantitative elements for each of the policy measures provided where available.

New infrastructure for buses including the use of CNG and biodiesel buses, segregated bus lanes and high quality bus corridors	A 100% 'clean vehicles' bus fleet was implemented by 2009. Tisséo purchased 28 new CNG buses in 2005 and ordered a further 40 CNG buses for delivery in 2009. A new gas filling station to serve the vehicles was installed, while research on CNG engine optimisation and the use of biogas was carried out. In relation to diesel buses, research on biodiesel was carried out, 101 diesel buses fitted with particle filters were ordered, while particle filters were fitted to 28 diesel buses already in use. Two high quality bus corridors were also constructed and were connected to the metro network. In addition, segregated bus lanes were created in the city centre to improve reliability. The first corridor is 10.9 km long with 9.5 km of segregated lanes, while the second corridor is 6.9 km, with segregated lanes all the way along. 11 bus stops are located along each line.

New parking management in Toulouse	Prior to MOBILIS, Toulouse city centre offered 12,000 parking spaces, most of which were available for free. This caused conflicts between different user groups (tourists, business, residents etc.) as parking spaces were often occupied. A local parking plan was therefore established in which a 'resident' parking rate was implemented. Parking permits were available for residents to purchase at a cost of €15 per month. By the end of the scheme, 4,669 free spaces were available, compared to 6,938 pay spaces (meaning also a slight reduction in the total number of parking spaces in Toulouse).
Public space redesign and implementation of an Urban Mobility Plan	This set of measures were designed to improve mobility, facilitate the use of public transport and active modes and to improve parking management. As part of this, improved pedestrian access to 20 underground stations was implemented, the pedestrianised zone was extended and special area for freight deliveries was created. The traffic layout was also modified on some streets, with some two-lane streets modified to become single-lane streets. This allowed for the creation of cycle lanes and wider walkways for pedestrians. In some areas of the city, regulated parking 'blue zones' were created. These allowed free parking to be preserved, however parking was limited to short-term only, with a maximum stay of two hours.
Innovative multimodal public transport contracts, services and electronic ticketing in Toulouse	Since 1992, Toulouse has been equipped with a multimodal ticketing system based on a magnetic system. To reduce fraud, enable an overhaul of tariffs and learn more about the behaviour of public transport users, an electronic contactless system was launched in 2007. This system is called the Carte Pastel.
Improvement of the quality of service and accessibility of public transport	Most aspects of this measure dealt with improving the reliability of public transport, increasing the provision of information to passengers and increasing accessibility for disabled users. 44 buses were equipped with sensors to collect data on the punctuality of services, while an action plan was put in place to allow for certification from the national standardization authority. In relation to accessibility, an action plan was set up to ensure that the public transport network was fully accessible to disabled persons by 2015, as required by national law.
Development of proximity services at important passenger transport hubs	In preparation for the new underground line, a review was carried out to identify what services could be provided at intermodal junctions to increase the attractiveness of public transport and modify travel patterns. The busiest metro station (Jean Jaurés) was revamped and a new shopping centre was built, which opened in 2007.
Development of a transport on demand service, complementary to public transport	A flexible, demand-responsive service was fully integrated with the Toulouse public transport network. This enabled citizens living in low-density areas with limited transport links to be connected to important intermodal nodes of the network.
Promotion of car-pooling, development of a car sharing service and integration with public transport services	In MOBILIS, the existing carpooling scheme was reviewed and integrated with the public transport system. A car sharing service was also launched in 2009, with 11 vehicles at six stations in the city.

Clean urban logistics and goods distribution platform	A new freight delivery regulation was implemented in the city centre which restricted deliveries to certain areas and times. A local delivery service restructured its delivery operations and replaced its six diesel lorries with three electric vehicles, one CNG vehicle and two electrically self-propelled delivery vehicles moved by a walking deliveryman. An urban distribution centre was also planned but it was not possible to implement during the course of the project.
Marketing campaign to raise awareness and encourage new mobility behaviours	A marketing strategy was set up to inform the public of improvements to the Toulouse public transport system. A users' panel consisting of 1,000 users was established and three communication campaigns took place during the project.
Development of a new cycling culture/policy and integration with public transport services	At the start of the project a cycling technical working group was created. After an initial review, several schemes were implemented to further cycle lane development, and to monitor bicycle use trends (through creation of a cycling observatory and a cycling network monitoring system). Communication activities were carried out to promote cycling, while cycling infrastructure was improved by better signage and the creation of secure parking facilities at metro stations. In addition, a bicycle renting scheme, Vélô-Toulouse, was established, with rental stations installed outside the entrances of metro stations and bus interchanges. By the end of 2008, 253 stations (containing 2,400 bicycles) had been constructed.
Set up of a mobility agency and customised mobility services	Objectives of the mobility agency were to inform about the existing public transport and integrate this with information on other mobility options such as car sharing or bicycle rental in order to promote new mobility behaviours.
Development of commuter and school mobility plans	Three sector commuter plans were developed in business areas in Toulouse. An educational toolkit was also distributed to 1,000 companies to promote the Commuter Plan concept.
Demonstration of EGNOS/Galileo service use for public transport control and information systems	To improve the performance of the public transport system, the use of GNSS systems (EGNOS & Galileo) was explored. A test campaign to evaluate the performance was carried out in collaboration with local aerospace companies. A simulation of the Galileo system was also performed.
Implementation of bus priority scheme in Toulouse	Two bus lines were equipped with a radio call priority request system. This system communicates with traffic lights to limit the amount of time spent stopped at junctions and therefore improve punctuality.
Development of an integrated multimodal traveller information system in Toulouse	An extensive intermodal information system was established. This system provided information relating to public transport, park & ride and the traffic on urban highways.

Impacts on accessibility

The CIVITAS MOBILIS project led to a significant improvement of public transport, improved facilities for active modes and successful parking policies in Toulouse. This had

a positive effect on the quality, sustainability and accessibility of transport within the city. The impacts on accessibility are reported here in relation to each of the mobility components proposed in the analytical framework (public, private, active).

Public Mobility:

- The number of public transport users increased by 49% over the course of the project and there were 300,000 subscribers to the Carte PASTEL contactless ticketing system.
- By 2008, 50% of bus stops, 55% of vehicles and 100% of the metro system were accessible to disabled people. By 2015, Toulouse was 100% accessible for disabled citizens and won third prize in the European Commission's Access City Award 2016.
- Buses running on dedicated bus lanes have reduced their average running time by 10%. Buses using the new bus corridors enabled a 20%-40% time saving for public transport users to reach the centre of Toulouse from the outskirts.
- Over a two-week trial, outstanding results were seen for the adaptive bus priority system. 96% of priority requests were satisfied, which led to an increase in bus speed due to the lower waiting time at junctions (52% less on average). The system showed a good level of acceptability from bus driver's point of view and had no impact on general traffic conditions.
- The demand-responsive transport system was highly successful, with a growing number of users throughout the project and a 95% satisfaction rate.

Private Mobility:

- Car traffic reduced significantly. Between 2006 and 2008, the volume of car traffic in the morning peak period reduced by 12.5%.
- The new parking policy was a success. The average parking time reduced from 23 minutes to 5 minutes and 80% of residents subscribing to the resident parking subscription scheme were satisfied. Parking occupancy rates dropped significantly (by 17% in the parking management area and by 11% in areas where free parking was still available), while the level of illegal parking reduced by 2%.
- In areas of the 'blue zone' parking policy, a 59% reduction in long-term parking was seen due to an increased turnover at parking spaces. This led to better access to local facilities for citizens.
- Between 2005 and 2007, the number of registered users to the carpooling service increased from 194 to 1,866. Of those surveyed, 17% use carpooling on a daily basis. During this time, it was estimated that 1.6 million car km were avoided.
- The ideas of a mobility agency and customised mobility services were deemed to be very successful. On average there were 200 visits per month, plus 800 visits to the website. Furthermore, the Public Transport Authority decided to expand on this idea and establish more mobility agencies at key transport nodes in the public transport network.
- 80 personalised commuter plans were implemented by the end of 2008. Early engagement with employees was deemed to be essential.
- The implementation of dedicated freight delivery areas was also a success.

Active Mobility:

- The cycle network in Toulouse expanded by approximately 70% throughout the course of the project. There was an overall increase in bicycle use, however the mode share remained at 3%. Towards the end of the project, the numbers of cyclists on Toulouse's main street grew constantly. This street had been redesigned to favour active modes.
- The Vélô-Toulouse bike renting scheme established in November 2007 was very successful, with the number of people renting bicycles tripling in the first year. By the end of 2008, 11,460 subscribers had registered and 614,000 rental cards had been sold. On average, there were 3,800 cycle rentals per day.

Success factors

A vast number of measures were implemented in Toulouse during the MOBILIS project in the fields of public transport, urban planning and the promotion of alternative modes. Many of these have continued to be a success since the project has concluded. A key success factor was the commitment, support and cooperation of politicians, transport operators and other stakeholders during the course of this project. This was particularly important in the implementation of new parking policies, public space redesign and the improvement of the public transport network. An important step during this process was also to involve the users/citizens – one way to do this was via surveys and follow-on meetings to identify their needs. After the measures were implemented, well targeted communications and marketing campaigns were then essential for promotional purposes and to increase the user base.

Transferability

The package of measures implemented in Toulouse are transferable to other cities that are also aiming to encourage a shift from private cars to alternative transport modes (public transport and active modes). This is because the individual measures are applicable to a variety of types of cities and are not specific to Toulouse. For example, contactless intermodal ticketing systems, improvements to public transport infrastructure, development of parking regulations, the establishment of a bicycle renting scheme and the introduction of a carpooling scheme could be implemented in many cities.

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Case Study 3: Dublin, Ireland

Where - background

Dublin is the capital of the Republic of Ireland and is situated on Ireland's east coast. The city is the country's economic hub and economic activity in the Dublin region accounts for approximately 47% of Ireland's GDP. At the time of the last census in 2011, Dublin city had a population of 527,612, while the Dublin urban area had a population of 1.27 million[22]. The population is growing rapidly (7% between 2006 and 2011[23]) although the population density in Dublin city centre has remained relatively low (approximately 4,600 people per km^2). This has created urban sprawl and has led to a high dependency on cars.

This case study focuses on cycling in Dublin and primarily on **dublinbikes**, a highly successful public bicycle rental scheme that was launched in Dublin in 2009.

Bus, train and tram public transport services are also available in Dublin. The main bus operator, Dublin Bus, provides a comprehensive service within the city and surrounding areas. The main train service operating in the city is called the Dublin Area Rapid Transit (DART) and runs a frequent service along the coast of Dublin, while other train services connect Dublin to other cities. The LUAS tram service, which consists of two lines, connects the city centre with suburbs in the south and south-west of the city.

An integrated contactless ticketing system called the Leap Card has been in operation in Dublin since December 2011. It covers public transport within the city, including Dublin Bus, DART and LUAS. An app is now available for NFC-enabled smartphones that allows the Leap Card to be topped up at any time, facilitating faster payments. Transport for Ireland has developed several other apps that provide travel information. These include

22 http://www.cso.ie/en/statistics/population/populationofeachprovincecountyandcity2011/

23 https://www.dublincity.ie/sites/default/files/content/YourCouncil/AbouttheCouncil/CouncilDepartments/Documents/Dublin%20Demography%20Report%20Jan%202012.pdf

the following apps: Journey Planner, Real Time Ireland transport information, Taxi Driver Check and Dublin Cycle Planner. The Dublin Cycle Planner app provides information on the best cycling routes in Dublin and can be customised to individual cycling capabilities.

The modal split in Dublin is shown in the table below. Further discussion concerning the increase of cycling in the city is included in later sections of this case study.

	2009	2012	2014
Car	61%	64%	63%
Bus	9%	8%	9%
Rail/Tram	4%	4%	3%
Walk	21%	19%	19%
Cycle	2%	3%	3%
Other	4%	3%	3%

Source: National Travel Surveys Central Statistics Office Ireland[24,25]

In 2009, the Irish Department of Transport also announced a target for 10% of all trips to be made by bike, by 2020. To support this, the first National Cycle Policy Framework was also published in 2009.

What – selected measures

The dublinbikes scheme has links to several measures to improve accessibility (as defined in the analytical framework developed in activity 4.1b of this project), as shown in the table below. In addition to dublinbikes, additional policy interventions that have been implemented to support cycling (such as traffic calming measures) are also included in the table.

TRANSPORT DEMAND MANAGEMENT	**Sustainable travel information and promotion**	•	- dublinbikes shared bike scheme - Infrastructure provision and traffic calming (including construction of segregated cycle lanes) - Cycling promotional events - Financial incentives (interest free loan to purchase a bike)
	Shared modes (bike sharing)	•	
TRANSPORT INFRASTRUCTURE	**Walking and cycling networks and facilities**	•	
LAND USE PLANNING	**Land-use planning, density and transport infrastructure**	•	

Why - motivation

In the years leading up to the introduction of the dublinbikes scheme, Dublin City Council conducted extensive research to improve mobility and to assess sustainable transport options within the city. It had been noted that the number of people commuting into Dublin from surrounding counties had increased but as these areas were served by only limited public transport links, many people opted to travel by car. Analysis of trips in the city in 2006 showed that 64% of journeys were made by cars. This caused problems such as congestion, low traffic speeds and high transport-related emissions.

Furthermore, it was identified that if commuters instead decided to travel by public transport in the city, the demand could not be satisfied by the existing network. Dublin City Council therefore decided to implement a bicycle rental scheme. This was primarily aimed at encouraging modal shift from cars for short journeys but was also intended to

[24] https://www.ucd.ie/t4cms/NTS%20Report%202009.pdf

[25] http://www.cso.ie/en/releasesandpublications/ep/p-nts/nationaltravelsurvey2014/detailedanalysis/howwetravelled/

ease the pressure on the public transport system and to provide an alternative solution for last mile transportation. The specific objectives of the scheme are to:

- Improve mobility within the city and reduce travel times
- Reduce the number of trips made by cars in the city
- Complement the public transport system – e.g. via the construction of bike rental stations outside important public transport stations
- Reduce air pollution and CO_2 emissions and to promote sustainability by eliminating some transport related emissions
- Increase accessibility by developing a robust network of bike stations that facilitate city-wide movement and improve connectivity to homes, employment, services and amenities
- Improve the quality of life, encourage physical activity and increase cycling within the city.

Policy Content

The dublinbikes scheme covers the city centre and rental stations are distributed throughout the core area to enable easy access to many popular locations. Prior to the launch of the scheme, the city had seen a reduction in the number of people cycling. A number of factors contributed to this, such as a shift in consumer preferences, and poor transport and housing planning. The infrastructure required to create a growing cycling community was also not in place, however this has now seen improvements since the dublinbikes scheme was established. For example, the availability of bikes is now significantly higher. An overview of how the dublinbikes and other cycling-related measures can improve accessibility is given below.

Transport Demand Management

Alongside the launch of the Dublin shared bikes scheme, several other activities took place to promote cycling. This included a large amount of media coverage including radio, television and print media and the launch of an annual bike week. These activities can positively influence accessibility by encouraging people to assess new travel options. Advertising for the dublinbikes scheme was put up around the city, while more generally, cycling was also promoted in schools. The shared bike scheme also has the potential to impact other areas, such as limiting crowding on public transport and reducing the demand for car travel for short journeys.

Transport Infrastructure

To support the development of cycling in Dublin, improvements to cycling facilities were carried out, while planning guidelines were issued to ensure that the design of new roads and junctions considers the needs of cyclists. The construction of new cycle paths and segregated bike lanes is also likely to have had a positive impact on accessibility by connecting users to other locations and by improving safety while cycling. In addition to this, efforts were made to increase the attractiveness of cycling by ensuring that cycle paths are maintained to a high standard, are well-lit and that appropriate signage is in place. The development of secure parking facilities and integration with public transport was also addressed. This can influence accessibility by reducing overcrowding on public transport and by encouraging people to re-assess their travel plans. Secure bicycle parking facilities also help to protect against theft.

Land Use Planning

The provision of dublinbikes at strategic locations has strengthened the link between land use and transportation. More generally, Ireland's National Cycle Policy Framework also states that the future planning, development and design activities in cities will be cycling and pedestrian friendly. This will promote long-term accessibility.

Policy Intervention

The dublinbikes shared bike scheme opened in Dublin in 2009 and initially consisted of 44 stations and 550 bicycles. The bikes are unisex three-speed bicycles with an adjustable saddle, front basket to carry small items and a locking system. The bikes are also fitted with a bell and a rear LED light for safety.

The scheme has since been expanded several times (most notably in 2011, 2013 and 2014) and at the beginning of 2016 contained over 1,500 bikes and 101 rental stations. These stations are situated at strategic points in the city centre.

To use the scheme, users rent bicycles from automated self-service stations, which are accessible between 05:30 and 00:30 every day. After use, the bikes must be returned to any dublinbikes station. In terms of payment, there are initially two options to use the service: a three-day ticket, or an annual card. The first 30 minutes of the journey is then free, after which a service charge is debited from the user's account. The maximum rental time is 24 hours. The full pricing structure for 2016 is shown in the table below.

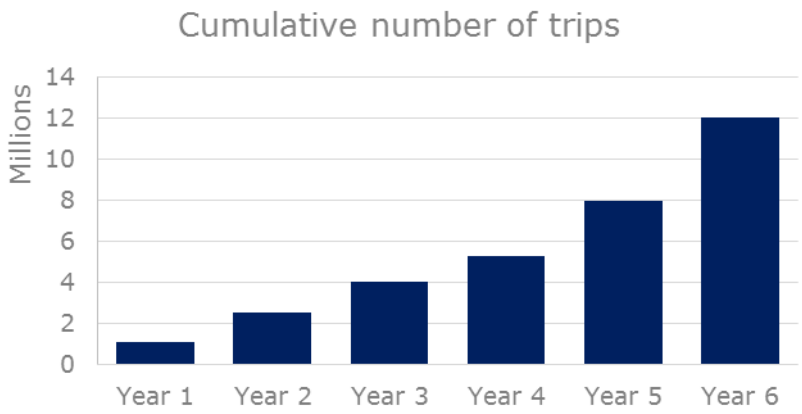
1. SUBSCRIPTION FEE					
3 day ticket: **€5**			Annual card: **€20**		
A guarantee of €150 is required					
2. SERVICE CHARGE					
First ½ hour	Up to 1 hour	Up to 2 hours	Up to 3 hours	Up to 4 hours	Every extra ½ hour
FREE	€0.50	€1.50	€3.50	€6.50	€2.00

Further details concerning the scheme are reported in the following table, with quantitative elements for the other relevant policy measures provided where available.

dublinbikes	**2009:** Scheme opened with 44 stations and 550 bicycles. **2010:** 5 year expansion plan announced with a goal for 5,000 bikes and 300 stations by 2016. **2011:** 4 stations and 100 bikes were added to the system. **2013:** Plans for expansion of the system for 2013/2014 announced with a further 950 bikes and 58 stations to be added.
Infrastructure provision and traffic calming measures	Between 1990 and 2014, 120 km of cycle lanes have been constructed in Dublin. 30 km speed limits in the city centre were also implemented. Measures to reduce the number of heavy goods vehicles in the city centre and make it a safer and more attractive environment for active modes were also taken. A freight tunnel (the Dublin Port Tunnel) opened in 2006 which connects Dublin Port to the outer motorway and since this time, HGVs with five or more axles have been no longer allowed to travel through the city centre.
Promotion of cycling	In 2009, the Irish Department of Transport launched a national cycle policy document, alongside an ambitious target for 10% of all trips to be made by bike by 2020. An annual Bike Week has also been running since 2009. During this week many event take place in Dublin to encourage cycling. These include: family cycles, removing traffic from streets, bicycle repair clinics and activities to persuade children to pursue cycling.
Financial incentives	Tax-free loans to purchase bicycles have been implemented in Ireland. Under this system, 48% of bike purchases were made by people who had not owned a bike in the seven years leading up to the scheme.

Impacts on Accessibility

Since its launch, the dublinbikes scheme has been very successful and has become an example for other cities around the world to follow. It has enabled a cycling culture to develop in Dublin and has encouraged residents to think about their travel options. As of 31st May 2016, there have been over 15 million trips in total. The cumulative number of trips since launch is shown in the chart below.



The number of long-term subscribers to the scheme has also increased over time. In 2016 there are over 60,000 long-term subscribers, compared to approximately 45,000 subscribers in 2010. On average, approximately 96% of the journeys are currently free, with an average journey duration of 14 minutes. The busiest day ever recorded was in October 2015, with 17,222 journeys made.

There have also been impacts on modal share of cycling for people travelling into the inner city area[26] during the morning peak period. The table below shows the evolution of cycling modal share since the introduction of the scheme in 2009. Over this same period, the share of walking has also increased, while public transport has remained relatively constant. More importantly, the share of car journeys during the morning peak period has seen a decline since 2010.

Mode	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Bus	28.9%	28.0%	30.3%	29.8%	27.8%	29.6%	28.0%	29.2%	29.4%	28.8%
Rail	16.2%	17.5%	16.2%	13.6%	13.0%	12.5%	12.9%	13.0%	12.9%	14.8%
LUAS	4.4%	4.5%	4.6%	4.7%	5.0%	5.4%	5.4%	5.6%	6.1%	6.3%
PT total	49.4%	50.0%	51.1%	48.1%	45.9%	47.5%	46.4%	47.9%	48.4%	49.8%
Car	37.1%	35.1%	33.9%	37.7%	39.8%	38.0%	37.0%	35.4%	33.3%	32.6%
Cycle	**2.3%**	**2.8%**	**3.1%**	**3.4%**	**3.3%**	**3.7%**	**4.3%**	**4.7%**	**5.4%**	**5.4%**
Walk	8.3%	9.1%	9.2%	7.8%	8.3%	7.9%	9.2%	9.1%	10.2%	9.4%
Other	3.0%	3.0%	2.8%	3.1%	2.7%	2.9%	3.1%	2.9%	2.7%	2.7%
Total trips	207,379	203,959	199,767	188,540	181,042	183,569	185,454	192,188	192,670	199,943

Source: Dublin City Council Canal Cordon Report 2015, PT total = Bus + Rail + LUAS (TRAM), Other includes Taxi, Motorcycle and Goods vehicle.

The impacts on accessibility are reported here in relation to each of the mobility components proposed in the analytical framework (public, private, active).

[26] Since 1980, Dublin City Council has been conducting traffic counts at 33 locations around cordon formed by the Royal and Grand Canals. Since 1997, the counts are conducted between 07:00 and 10:00 in the month of November.

Public Mobility:

- Overall, introduction of dublinbikes has led to a better connected city with improved transport links and a greater availability of transport options. Siting rental stations outside metro and bus stations has integrated the scheme with public transport, allowing users to plan their journeys better.
- Of dublinbikes users surveyed, 31% of users previously used public transport as their main mode of transport; instead, they now use dublinbikes as their primary mode of transport or as a primary mode in combination with public transport.
- Public transport generally has a positive effect on dublinbikes. On average, rental stations in the city centre that are close to major public transport hubs see greater usage, than rental stations that are further away from public transport facilities. However, rental stations on the outer zone that are next to public transport stations see less usage on average – this is only a minority of rental stations.

Private Mobility:

- A small modal shift from cars was observed. Of dublinbikes users surveyed, 3% of users previously drove to their final destination, either by car or by motorbike.

Active Mobility:

- The majority of dublinbikes journeys are as a substitute for walking. Of dublinbikes users surveyed, 54% of users previously walked to their final destination.
- 12% of users previously used their own bicycle and have now changed to using dublinbikes. This indicates that dublinbikes may be a cheaper alternative to owning a bike.

Success factors

The dublinbikes scheme surpassed expectations and has improved the ease of travelling around Dublin. Several lessons can be learnt from the scheme, however it is first useful to point out that Dublin is naturally well suited to cycling as its roads are relatively flat and the climate is mild. While planning the scheme, Dublin considered other cities' experiences of shared biked schemes and integrated this learning into the design process.

Prior to launch, the cycling infrastructure in Dublin was improved to increase the attractiveness of cycling and an extensive marketing campaign was carried out to increase public awareness. Since launch, the scheme has been expanded and cycling facilities have been refined with the construction of additional segregated cycle lanes and further secure parking areas. Detailed analysis has also been carried out to optimise the placement of rental stations to ensure greater use.

Several other factors have been important for its success. Overall, the scheme is relatively inexpensive: the subscription fee is relatively low and journeys are free for the first 30 minutes. This has meant that besides the subscription fee, on average around 96% of journeys are free. It has also been popular with tourists, due to cycle paths connecting attractive tourist destinations. Overall, the scheme has shown that shared bikes have great potential to contribute towards accessibility when integrated with the public transport system. Rental stations outside bus/rail stations were very popular as cycling within cities is particularly suited as a form of last mile transportation.

Transferability

Shared bike schemes such as dublinbikes are highly transferable to other cities, providing that adequate infrastructure is in place to allow for convenient and safe cycling within the

city. In fact, shared bike schemes have been launched in over 600 cities worldwide[27]. As highlighted by this case study, Dublin has been one of the most successful schemes to date, therefore for better transferability and high levels of customer satisfaction, close attention should be given to the success factors described above.

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Case Study 4: Gothenburg, Sweden

Where - background

Gothenburg is located on the west coast of Sweden and it is the second largest city in Sweden with 543,000 inhabitants within the City boundaries, and nearly a million in the urban region (13 municipalities with 971,000 inhabitants). It is estimated that by 2035 the city will have 150,000 more residents and 80,000 more jobs. The city is situated where the river Göta Älv flows into the Kattegat; the Göta Älv divides the city in to two parts.

Gothenburg is a centre of trade, bank and industry. The blue collar industries dominated with shipyards and industries and hi tech industries. The city is one of the biggest exhibition centres in Europe.

The city provides a wide range of transport modes to its residents and visitors. Having a dedicated network of 160 km and 130 operating stations/stops, the blue iconic tram of the city is the largest light rail scheme in Scandinavia. Together with the city's bus network, which includes a four-line bus rapid transit scheme and express busses, trams form the basis of a public transport system and are responsible for 196 million trips per year (Trafikkontoret, 2014a). There are also daily boat and ferry services catering for the needs of a city that is defined (even in terms of its own name) by the river Göta. The city hosts Sweden's largest cycle network, with a total length of 793 km. The cycle network consists of 486 km cycle paths, 150 km local cycle paths and 157 km mixed streets where the speed limit is 30 km/h (Trafikkontoret, 2013).

In order to be in a position to welcome more inhabitants, visitors and businesses in a denser city, and to do so sustainably, the transport system needs to change.

What – selected measures

According to the "Gothenburg 2035 transport strategy for a close-knit city", the city is aiming to develop the Transport Strategy focusing on three areas – travel, urban space and transport of goods:

- **Travel**: strengthening the potential to travel to, from and between the city's cores and key destinations; increasing access to neighbourhood services, retail outlets, meeting places and other everyday functions; making more efficient use of roads and streets.
- **Urban space:** Prioritising pedestrians and cyclists and adapting speeds mainly to pedestrians; rearranging the streetscape to create more space where people want to be and where they can move around; creating a denser and more interconnected network of streets without barriers.
- **Transport of goods:** Ensuring good accessibility for goods transport in Gothenburg while at the same time reducing negative local environmental effects; collaborating regionally in the establishment of logistics centres and transport-intensive operations; stimulating innovation in collaboration with academic institutions and businesses.

In the table below the most relevant measure implemented by the city towards the achievement of a more sustainable and accessible city are listed.

TRANSPORT DEMAND MANAGEMENT	**Area wide and personalized travel marketing**	•	Gothenburg 's Big Commuter Experiment campaign
	Sustainable travel information and promotion	•	Changing travel habits
	Shared modes (bike/car sharing)	•	- Styr & ställ Bicycle pool - Sunfleet Carpool
TRANSPORT INFRASTRUCTURE	**Bus network and facilities**	•	- The KOLLA-project - Electric buses and innovative bus stops - The "Västsvenska paketet" (West Sweden package)
	Walking and cycling networks and facilities	•	Walking speed areas
	Trolley, tram, metro networks and facilities	•	-The "Västsvenska paketet" (West Sweden package) -Flexlinjien
	Urban Delivery Centres and city logistics facilities	•	City Delivery Concept "Stadsleveransen"
TRANSPORT PRICING	**Congestion and pollution charging**	•	The congestion charging tax
	Parking regulation and pricing	•	Parking policy

Among the principles of implementation of this strategy, one is mainly worth to be mentioned: "ensure that accessibility is maintained while the close-knit city is being realised".

For sake of completeness and to provide the full picture of what the city is actively doing within the mobility sector to achieve a better mobility system (making it also more accessible), here is the list of projects the city is involved in: OPTICITIES[28], SMARTSET[29], SENDSMART[30], GO:SMART[31], CIVITAS, POLIS, GOTRIS, NVF-ITS.

Why

The transport strategy developed in the SUMP has three main objectives: a liveable, attractive city, high accessibility as the regional core and the confirmation of the city role as logistic centre of Scandinavia.
The transport strategy is aiming at 200% increased cycling and double public transport by 2025 and 25% decrease in car traffic by 2035. In relation to freight transport, the aim was to reduce CO_2 emissions from goods transport within Gothenburg's geographical area by at least 80 per cent by 2030 compared with 2010, and more than double public transport from today's 24 per cent to 55 per cent by 2035.

Policy Content

The following sections explain what measures can influence accessibility and in what terms.

Transport Demand Management

Gothenburg's Big Commuter Experiment campaign: Drivers were offered a free two-week ticket on public transport. Car owners received information in a letter sent to their homes. The letter was combined with a public campaign in newspapers, on billboards and on a dedicated campaign site on the internet**.** The aim was to attract new travellers to public transport and the campaign was part of an effort to double the number of journeys made using public transport in Västra Götaland by 2025. By shifting away people from private cars, increased accessibility can be achieved for more sustainable transport modes (public transport, overall).

Changing travel habits: In August 2006 the Lundby Mobility Centre (LMC) started the Mobility Coaching project. The target group comprised people who used no other means of transport than their car. Participants signed an agreement with the Traffic & Public Transport Authority/LMC whereby they undertook to leave the car behind at least three times a week. In turn LMC agreed to support and encourage the participants.. The outcome was to enrich the awareness of travel opportunities.

Styr & ställ bike sharing: The scheme launched its operations in August 2010, consisting of 300 bicycles and 20 stations: now it counts 60 stations and 1000 bikes. The 60 stations are scattered at 300-500 meters intervals throughout the city centre to enable easy access and use. Sited near bus stops and railway stations, the stations terminal make everyday life easier for users. The system helps improving accessibility as it offers city dwellers an efficient alternative to the systematic use of a car for short journeys.

[28] OPTICITIES - Enhancing smart mobility - http://www.opticities.com/
[29] SMARTSET – Efficient Urban Freight Transport - http://smartset-project.eu/
[30] SENDSMART – Sustainable Freight Transport in Urban Areas - https://www.chalmers.se/en/projects/Pages/SENDSMART.aspx
[31] GO:SMART – Mistra Urban Futures - http://www.mistraurbanfutures.org/en/project/gosmart

Sunfleet car sharing: Sun fleet Car sharing began in 1998 and then become established as the only car sharing in the world with only environmentally friendly cars. In 2012, the City Council adopted new goals to promote and increase the use of car sharing in Gothenburg: at least 40% of the City of Gothenburg's inhabitants are to have access to a car sharing car within 400 meters' walking distance. In 2014 it counted 37 car sharing locations in Gothenburg.

Transport Infrastructure

In the year 2000 the Swedish government launched the plan 'From Patient to Citizen: A national Action Plan for Disability Policy' stipulating that public transport should be accessible for people with disabilities In Gothenburg **the KOLLA-project** (KOLLA – kollektivtrafik för all = public transport for everybody) was launched to implement the plan. in 2005. KOLLA has mainly aimed at improving the physical availability and to influence people who use the special transportation services (STS) to travel more with flexible bus lines and other public transport.

Electric buses and innovative bus stops: The new bus-route 55 bus route offers quiet, exhaust-free buses that meet the needs of passengers. In fact, passenger wishes for a pleasant environment and practical functions on board have impacted the design of the electric bus in several ways. For instance, all entry and exit takes place quickly and conveniently via an extra-wide door opening in the middle of the bus. Here too there is a large open space with a low and flat floor to make things easy for passengers with child buggies or wheelchairs. The interior is bright and airy. The bus is equipped with Wi-Fi and power sockets for passengers who want to surf or charge their mobile phones, as well as displays for information and news. The doors are better suited for passenger flows, with an extra wide middle door. The interior is flexible. Certain seats can be folded up in rush hour traffic, thus creating space for more passengers. The electric buses pick up passengers indoors and are powered by electricity from renewable sources. All these characteristics contribute to make public transport more attractive, and thus help in increasing accessibility.

The **"Västsvenska paketet" (West Sweden package)**[32]: A major infrastructure investment action plan for West Sweden is currently in progress investing 34,000 MSEK (approximately 3,700M€) during 2011-2027 to develop the regions infrastructure. The program's overall objectives are to increase liveability, enlarge the labour market region and stimulate economic growth. The main goal is to double the market share of public transport for commuters to 40% (currently 26%). The project is based on three main areas of interventions:

- Initial steps involved improving public transport so that more people can travel by that means. This included longer platforms that can accommodate longer trains, more bus lanes, more buses and trains, better frequencies, bike and commuter parking and other investments in transport hubs.
- Construction of two new links over the River Göta, which are important for unifying the city;
- The biggest investment in the project is in the railways. This part of the package is known as Västlänken (West Link) and comprises a double-track train tunnel under Gothenburg with three central stations. Once Västlänken has been built, commuter trains will go through (under) the city rather than reversing at the Central Station as they do today. This will allow for significantly more trains, and far more passengers will be able to reach their destination without having to change.

[32] http://www.vasttrafik.se/#!/en/1/17/11/

Flexlinjien: Flexlinjen is a demand-responsive bus service that can be used by everyone. It runs in limited areas and can get closer to the destination than other public transport. Trips are booked in advance and therefore seats are guaranteed. The price for travelling with Flexlinjen is the same as for other public transport in Gothenburg.

Walking and cycling speed areas: Gothenburg has a good experience since many years of rebuilding 5-10 streets in central parts of the city to "walk-speed streets". In walking speed areas motorized traffic is allowed, even heavy vehicles, but they must drive so slowly and carefully that pedestrians can walk on the entire street. No parking is permitted, only short stops for deliverances can be made. The walking speed areas are considered as a big improvement for distribution traffic as the vehicles can stop anywhere along the streets, and don't have to use specific loading bays (which often may be occupied). In the last years, Gothenburg has taken this concept one step further by rebuilding two central major streets to "cycle-speed streets". The roads are redesigned to promote cyclists to use all of the streets for cycling, and to promote car- and truck drivers to adapt their speed and driving behaviour to the cyclists.

The **City Delivery Concept "Stadsleveransen":** The project was started in autumn 2012 as part of efforts to reduce the number of delivery vehicles in Gothenburg's city centre. The concept involved the transfer of goods from trucks to electric vans and electric delivery cycles at a central terminal, for consolidation and transport to the heart of the city. To facilitate the needs of smaller businesses which are not able to organise early-morning drop-offs, the city of Gothenburg helped launch Stadsleveransen (the City Delivery) to pool together deliveries for shops and businesses within a central zone stretching about 10 streets.

Transport Pricing

The congestion charging: On 2 January 2013 Gothenburg became the second city in Sweden to introduce congestion charging. There are 36 crossing points on the system's cordon, which operates for 12.5 hours every weekday between 6.00 am and 6.30 pm. Cars, lorries and buses that weigh less than 14 tonnes have to pay the congestion tax.

In order to have a real impact on reducing traffic, the amounts charged are different (from 9 SEK -nealry1.00€ - to 22 SEK – nearly 2.50€) at different times: the cost is highest during the periods and in the places where the traffic is heaviest.

Parking policy: as part of the West Swedish Package, expanded parking facilities for commuters at stations and by bus stops along the routes into the city, to allow for connecting journeys by car or bike have been implemented. The City of Gothenburg's parking policy aims for the city centre to retain the same number of car spaces, but for space-demanding surface parking to be reduced. This will allow squares, streets and quays to be converted into attractive thoroughfares and meeting places, thus increasing accessibility: the policy also aims to contribute to more people choosing public transport and cycling rather than the car.

Traffic Management and Control

Environmental zone for heavy goods vehicles: the 15-km^2 environmental zone established in Gothenburg in 1996 has proved to be an effective system in ensuring minimum environmental standards for heavy goods vehicles and buses in the city centre. The environmental zone was expanded incorporating Euro IV criteria and an on-site measurement system for the emissions control of individual vehicles was also set. In April 2007, the city extended the low-emission zone to include areas on the north bank of the

river where greater numbers of goods lorries were in circulation. Thanks to improved air quality, the liveability of the area is improved and accessibility is consequently enhanced.

Traffic calming and "Vision Zero": In the view of the city's decision makers, road safety was "one of the most important prerequisites for an attractive city". Already in 1978 the city of Gothenburg implemented specific infrastructure changes designed to reduce speeds of motorized vehicles and give priority to non-motorized transport. More recently the "Vision Zero" approach (aimed at having zero fatalities due to road accidents) became widely established as a result of cooperation between the various players in the road safety sector.

Policy Intervention

The policy intervention is reported in the following table, providing quantitative elements (were available) for each measure.

Göteborg's Big Commuter Experiment campaign	50,133 motorists applied for the free ticket and 27,498 of them met the criteria. The eligible motorists received a two-week public transport ticket through the post. If all 27,498 travellers left the car at home for two weeks this would provide an area equivalent to 43 football fields of extra parking space every day.
Changing travel habits	1 Mobility Centre
Styr & ställ bike sharing	1,000 bicycles in 60 places in the city centre at 300-500 meters intervals. The season has increased gradually so the bikes are now put away only 2 months in the wintertime.
Sunfleet car sharing	37 car sharing locations
KOLLA Project	All tram and trunk bus stops and the 70 most used other bus stops are to be improved during the project period.
Electric buses and innovative bus stops	1 fully electric bus line (line 55) has been introduced.
The "Västsvenska paketet" (West Sweden package)	New trains (39 stations and 11 trains) Express buses – 8 new lines with higher frequencies (7,5 minutes) 55 km new bus files 4,000 commuter parking places
Flexlinjien	1 demand-responsive bus service
Walking and cycling speed areas	5-10 streets in central parts of the city has been rebuilt to "walk-speed streets"
The City Delivery Concept "Stadsleveransen"	Close to 500 businesses take part – from small offices to major retailers – and more than 350 packages are delivered each day.
The congestion charging	6 crossing points on the system's cordon, which operates for 12.5 hours every weekday
Environmental zone for heavy goods vehicles	Over 15 km^2 of low emission zone
Traffic calming and "Vision Zero":	By 2004, the municipality had implemented nearly 3,000 countermeasures to force drives reduce their speed.

Impacts on accessibility

Although the main focus of the wide range of measures implemented was on improving sustainability of mobility, some impacts on accessibility can be identified.

They are reported here below in relation to each mobility component (public, private, active).

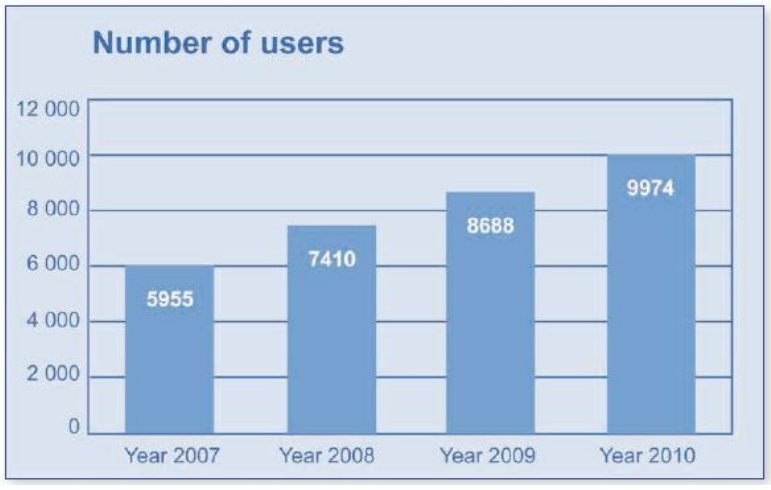
Public Mobility:

- The introduction of the congestion charge between 2012 and 2013 brought historic changes in travel habits in Gothenburg. The number of journeys by bike and public transport increased while the number of journeys by car fell. The biggest winners were the express buses in and around the city where an initial boost of around 10% finished the year with passenger numbers 21% higher than a year earlier. Passengers on trains registered an increase of 15%.
- Punctuality of public transport has improved. This is due to the congestion charge as well as to an increase in priority bus lanes. The number of passengers on express buses increased by 18 % and patronage on the commuter train rose by 13 %. Total year-on-year public transport use rose 3% in January.
- Compared with 2011 the use of public transport has increased by 10% in 2016.
- 600,000 passengers in 6 months on line 55 (electric buses line)

Thanks to the KOLLA project, transport data has changed over time as reported here below:

2005	2010
40% of the tram stops and 10% of other main stops are accessible	90% of the tram stops and 100% of the other main stops are accessible
50% of the trams and 86% of the buses have step free access	62% of the trams have step free access and ramp. All buses have step free access and ramp.
50% of the vehicles have automatic voice announcements	90% of vehicles have automatic voice announcements
There are 8 Flexlines and you need a permit to travel	There are 20 Flexlines and everyone can travel with them.

The use of car sharing by private individuals and companies in Gothenburg has grown significantly from 2007 to 2010



Source: Goals and focus to promote car sharing development in Gothenburg

Private Mobility:

- After 10 months from the introduction of congestion charging (November 2013) the volume of traffic passing the charge points was 11% lower than the previous year. Reduced congestion has sped up travel times. From the northern suburb

Kungälv to downtown, travel time dropped from 22 to 13 minutes. From the west part of the city incoming journeys shortened from 18 min to 15 minutes.

- Accessibility by car is very good in Gothenburg. Today it is possible to reach all types of places, in principle, from any starting point in the municipality, within 30 minutes by car.

Active Mobility:

- The Swedish National Road and Transport Research Institute stated in 2006 that 3/4 of the significant reduction of deaths and injuries on roads were attributed to the effects of the implemented traffic-calming measures. The Traffic and Public Transport Authority reports state that the total reduction by year 2003, based on the statistics for years 1985-89, was approximately 2460 people, which represents a reduction of 47%. This means safer and more attractive roads for pedestrian and cyclists.
- Thanks to traffic calming measures in the Bräcke area (one of the districts of the city) 30% of the citizens reported that they walk and cycle more now than before the countermeasure were introduced.
- Compared with 2011, the number of cycle trips has increased by 26% in 2016

The Low Emission zone has generated positive impacts: results 2008 were very positive, with more than 96% of vehicles authorised to drive in the zone (thanks to emission standards compliance). The extension of the zone has been calculated as reducing emissions of NO2 by 40 tonnes per year and emissions of particulates by 1 tonne per year from 2007, that's contributing to a better, and more attractive inner city area.

Success factors

The City of Gothenburg has long experience of working with sustainable transport solutions. The city introduced traffic calming measures in late 1970s, environmental zones in the late 1990s, have been retrofitting the city core successively, introduces city-bikes in 2010 and congestion charges in 2013.

These are the key factors that have helped in decreasing congestion in the city centre:

- Strong support from politicians;
- An understanding of problems that leads to action and solutions;
- Collaboration between politicians/local authorities, the business world and academia;
- Using the region's own companies as a driving force for new concepts;
- Environmental requirements placed on the municipality's transport suppliers, contracts and services;
- Investment in planning, aims, strategies, engaging those who are employed in the local authorities.

Transferability

Several concepts and ideas have been born in Gothenburg and then spread across the country and even become international, for example, road safety and traffic calming, low-emission zones, green car sharing and travel policies. Just to cite one the Swedish Vision Zero is changing the approach to road safety work around the world. An example is New York City, where Vision Zero was introduced in 2014.

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Case Study 5: Donostia – San Sebastian, Spain

Where - background

The overall urban mobility strategy is defined by the municipality, in particular by the Mobility Department. Since 2000 local policymaking is assisted by the permanent Mobility Advisory Board that acts as a forum for the identification and discussion of potential actions in the urban mobility field.

There are four public transport operators in Donostia – San Sebastián, providing urban and interurban bus and rail services. The Municipality maintains a close cooperation with DBUS (public transport company) for the planning of urban bus services, which are managed and operated by the latter. Regional and provincial bodies manage metropolitan and regional public transport services.

Donostia – San Sebastián has an extensive cycling lane network of over 50km which also benefits from traffic calming conditions in a number of 30-km-zones distributed among several neighbourhoods in the city.

The following table summarizes the modal split over the years.

Modal split in Donostia San Sebastian - Municipal trips (with origin and destination inside the municipality			
	1999	**2002**	**2006**
Walking	47.3%	48.2%	42.5%
Public transport	19.4%	17.3%	25.5%
Car	26.6%	28.0%	23.4%
Cycling and others	6.7%	6.4%	8.5%

Source: M. Van Bemmelen (2009)

What – selected measures

The strategy considered in this case study consists of a large set of measures as described below. Most of the measures reported in the table are not primarily targeted at improving accessibility but they are included as, based on the results of the analysis conducted in the analytical framework, they may result in positive impacts on accessibility under a different set of aspects.

TRANSPORT DEMAND MANAGEMENT	**Area wide and personalized travel marketing**	•	- Personalized Travel Plans - Mobility Management for the university Campus
	Sustainable travel information and promotion	•	- Travel Plans
	Shared modes (bike/car sharing)	•	- City bike scheme - Car sharing scheme
TRANSPORT INFRASTRUCTURE	**Bus network and facilities**	•	- High-quality bus corridors - Real time information for bus passengers - New business district bus services - New fleet management system
	Walking and cycling networks and facilities	•	- Extension of infrastructure for cycling and walking - Vertical Transport
	Park and ride	•	- Advanced Park and Ride network - Park and Ride parking guidance system
	Trolley, tram, metro networks and facilities	•	- The conversion and expansion of the Metro Donostialdea
	Urban Delivery Centres and city logistics facilities	•	- Efficient goods distribution
TRANSPORT PRICING	**Parking regulation and pricing**	•	- Advanced Park and Ride network - Changing Parking Behaviour
TRAFFIC MANAGEMENT AND CONTROL	**Legal and regulatory framework of urban freight transport**	•	- Efficient goods distribution
	Prioritising Public Transport	•	- High-quality bus corridors
	Access restrictions and road and parking space reallocation	•	- Changing parking behaviour -Efficient goods distribution
	Traffic calming measures	•	- Safe districts and limited speed zones

			- Road Safety measures

For sake of completeness and to provide the full picture of what the city is actively doing within the mobility sector to achieve a better mobility system (making it also more accessible), here is the list of projects the city is currently involved in: TIDE[33], SITE[34], SmartCEM[35], SWITCH[36], CYCLELOGISTICS AHEAD[37] and CIVITAS CAPITAL[38].
The city of Donostia-San Sebastián has also approved a Sustainable Urban Mobility Plan in 2008, with a time-horizon at 2024. Currently, the Plan is in the process of being updated to better address the mobility needs of the city, both consolidating the policy action deployed over the last years, as well as embracing the new emerging approaches to mobility issues.

Why - motivation

The city of Donostia – San Sebastián has further deployed its mobility strategy, within the CIVITAS ARCHIMEDES project covering all 8 action fields identified by CIVITAS (Clean Fuels and Vehicles, Car-Independent Lifestyles, Collective Passengers Transport, Demand Management Strategies, Mobility Management, Safety and Security, Transport Telematics, Urban Freight Logistics). The aim was to **achieve a shift towards sustainability of current mobility patterns**.

Policy Content

The following sections explain what measures can influence accessibility and in what terms.

Transport Demand Management

With measures like **Personalised Travel Plans (PTP)** in two districts (Amara and Antiguo) and the **Mobility Management Plan** for the University Campus, the city aimed to achieve a reduction in the use of cars and an increase in walking, cycling and the use of public transport. As emerged from the analytical framework, personalised travel planning may encourage recipients to review their current travel and question the need for travel, the time and spatial patterns of trips, reducing for example the number of trips. Other traffic demand management strategies implemented in the city also included the development of **car and bike sharing schemes**, which provided additional transport alternatives for trips. Though the car-sharing scheme has started on a small scale, the service has been awarded in 2012 for 25 years and will most probably reflects its positive impacts in shaping new model of urban mobility and in increasing accessibility in the coming years, also thanks to a probable expansion.

Transport Infrastructure

With the development of a **High-quality bus corridor**, the city strived to deliver more reliable public transport experience to its citizens. The improvement of the public network was also made possible thanks to the **Real time information for bus passengers;** this information was made available to all citizens, even the visually impaired, thanks to the use of ICTs.

[33] TIDE – Transport Innovation Deployment for Europe - http://www.tide-innovation.eu/en/
[34] SITE – Smart Integrated Ticketing for Europe - http://www.site-project.eu/ (http://www.site-ticketing-project.eu/wp-content/uploads/SITE_tripticoA4_EN.pdf)
[35] SmartCEM - Smart Connected Electro Mobility - http://www.smartcem-project.eu/
[36] SWITCH – Embracing Active Travel for Health - http://www.switchtravel.eu/
[37] CYCLELOGISTICS AHEAD - http://www.cyclelogistics.eu/
[38] CIVITAS CAPITAL - http://www.civitas.eu/

The city also planned **an extension of the extension of infrastructure for cycling and walking** and completed the missing connections in the cycling network, created new walking routes and extended the pedestrian zones in the city centre.
The hilly topography of Donostia-San Sebastián can be a significant barrier for people to cycle or walk to the city centre. As half of the inhabitants live in these hilly parts of the city, the municipality introduced a **vertical transport** solution to make trips for cyclists and pedestrians easier and more convenient.

The city decided to develop a **new management and pricing strategy of the Park and Ride offer** with the objective of increasing the use of public transport within the city without reducing accessibility. In conjunction to this measure the city implemented a **real-time parking guidance system** that informs drivers who enter the city about park and ride sites and the occupancy rate of inner-city underground parking areas.
In relation to transport infrastructure provision, the city converted the urban path of a regional train in **Metro Donostialdea** into an **urban rapid transit system**.

Transport Pricing

A new **pricing policy** has been designed and introduced in order to reduce the number of car trips in the centre of the city. Parking pricing can have a positive effect on different aspects related to accessibility, such as time and spatial patterns of trips and parking availability.

Traffic Management and Control

The city developed an **implementation plan** to improve the efficiency in **freight distribution** in order to reduce the number of commercial vehicles travelling within the central retail and business area and therefore reducing congestion and improve accessibility. Delivery plans, urban delivery centres and city logistics facilities are likely to have a positive effect on safety for pedestrians and cyclists, thus improving the accessibility for those categories of demand. The city made also efforts in the **prioritization of public transport**, within the development of the high quality bus corridors, in order to improve reliability and average speed of public transport.

Since 1995 Donostia-San Sebastián introduced a **specific street regulation**, the so called 'Flexible streets' that means: flexible use of the street, according to the real needs of residents, businesses and, of course, visitors/tourists. This regulation increased the accessibility of the streets.

The city of Donostia-San Sebastián developed **road safety plans** and implemented **30 kilometer/h zones** for 3 of its neighbourhoods. The physical interventions in the road infrastructure involved both speed reduction actions directed at cars and changes to make 50 crossings safer for pedestrians and cyclists. According to the analytical framework, these interventions can have a positive role in improving accessibility, especially in relation to increase the level of safety and its perception, thus contributing to make some areas more accessible especially to pedestrians and cyclists.

Land Use Planning and Social Policy

From the land use and social policy point of view, Donostia-San Sebastián affirms its objective to be a city on a human scale. With the **Urban Strategic Plan E2020DSS**, designing the city strategy from 2008 to 2020. **The E2020DSS strategy** is based on four strategic areas: "designed in DSS", "people and values", "a connected city" and "live and enjoy". The aim is to set a strategy that help in building a city for citizenship, with a well distributed network of health care and citizens' services provided through centres nearby and with a urban area of excellence, with a friendly, accessible and sustainable landscape.

Policy Intervention

The policy intervention is reported in the following table, providing quantitative elements (were available) for each measure.

Travel Plans	**Awareness raising events** for children and parents were organized. In particular, 60 workshops in 24 schools within the city were held, engaging over 2,500 pupils, 60 teachers and 3,500 parents.
	The way-to-school: **constitution of walking and cycling groups.**
City Bike Scheme	After a pilot test with 5 dispatch points, the municipality of Donostia has permanently implemented and enlarged the City Bike scheme initiated in 2008 to 9 **dispatch points** and introduced **150 new public bicycles**.
Car Sharing Scheme	Within CIVITAS ARCHIMEDES the municipality of Donostia – San Sebastián has put in operation an electric car-sharing system in the city. In its beginning stage, the car-sharing scheme accounts for **6 cars** (4 electric and 2 plug-in hybrids) available for subscribers to the service in **3 locations**. Then, with sm@rtCeM Project [39] the city is testing an **EV car sharing** application, running in urban and interurban environments with both FEV (fully electric vehicle) and HEV (hybrid electric vehicle) car-sharing vehicles (**30 electric cars and 33 charging points**).
High-quality Bus corridors	Infrastructural changes have been undertaken on **2 bus corridors** (lines 5 & 28) in terms of dedicated platforms, as well as priority measures, in order to improve public transport reliability and operation.
Extension of infrastructure for cycling and walking	The city has extended the **pedestrian zone** by **4 kilometers**. Also the cycle network has been completed with **22 kilometers of additional cycling lanes.**
Vertical transport	Considering the hilly orography of the city, the Municipality of Donostia-San Sebastian initiated in 2007 the development of a vertical transport network. In addition to those already existing (2 sets of ramps and escalator and 7 lifts), within the CIVITAS project the city of Donostia-San Sebastián has expanded the existing vertical transport network by implementing **7 additional elevators** and **6 new escalators/ramps** to support cycling and walking inside and towards the city centre.
Advanced Park and Ride Network	**Four car park locations** were selected to provide P&R services due to their good connection to the main public transport lines, as well as its location nearby the main arterial corridors entering the city, thus providing an alternative to as much commuters arriving to Donostia-San Sebastián as possible.
Changing parking behaviour	Four Pricing Zones were defined, following a radial criterion.
Safe districts and limited speed zones	**Three 30/km areas** in different parts of the city speed control cameras in **5 different locations** changes to make 50 crossings safer for pedestrians and cyclists

[39] http://www.smartcem-project.eu/en/pilot_sites/gipuzkoa_-_san_sebastian/

Impacts on accessibility

Although the main focus of the wide range of measures implemented was on improving sustainability of mobility, some impacts on accessibility can be identified. They are reported here below in relation to each mobility component (public, private, active).

Public Mobility:
Thanks the introduction of high-quality bus corridors, Park & Ride as well as of the provision of real time information for bus passengers using public transport has become significantly easier and more effective. Actually, between 2006 and 2011, there was an increase of 2.55 million extra travellers in public transport system, which represents a 9,6% increase in the number of users. At the same time the perceived quality of service has increased.

Private Mobility:
Thanks to the parking pricing policy parking demand has decreased by 21%, thus contributing to enhance accessibility, though if not for free.
The effects of the new urban freight delivery strategy are a reduction in, thus increasing accessibility for operators.

Active Mobility:
The city bike scheme and the extension of infrastructure for cycling and walking have much improved the possibility to use bike for moving within the city. Indeed, bike trips have grown by 33% from 2008 to 2011 and the number of bike sharing users has increased every year, reaching 5.006 subscribers in 2011. Most of the bike sharing trips have duration below 15 minutes and are made during the weekdays, which means that the service is being used mostly for daily mobility. 4 new dispatch points were installed and 50 additional bikes were made available.

The vast majority of the surveyed population (97%) believes that "vertical transport" has increased the accessibility of hilly neighbourhoods.

By reducing on-street parking a pedestrian network could be established making most of the city comfortably and safely reachable on foot.

Road safety and speed limiting interventions have made areas next to schools increasingly safe, thus increasing the accessibility to schools also by foot.

Success factors

One of the keys for the success was the comprehensiveness of the strategy deployed, with a clear interrelation of measures providing a balanced mix of push and pull ones.
Also, the city has a long tradition of involving citizens in public management with several instruments like surveys.

Transferability

The strategy implemented in Donostia - San Sebastián is transferable at other cities as there are no specific local circumstances behind the content of the measure or their implementation. The main condition is a strong political commitment.

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Glossary of key terms

Accessibility	The ease of reaching goods, services, activities and destinations in urban areas. It includes factors such as mobility options, travel information, transport network connectivity, land use patterns and cost for both passengers and freight
CIVITAS	EU initiative launched in 2002 to redefine transport measures and policies in order to create cleaner, better transport in cities.
ELTIS	Europe's main observatory facilitating the exchange of information, knowledge and experience in the field of sustainable urban mobility.
Mobility	Movement of people and goods
Congestion	Condition where vehicles travelling on road links are delayed
Opportunities (in the context of accessibility)	Key services, activities or destinations which individuals would like to get to/access

Abbreviations

Acronym	**Meaning**
DG MOVE	Directorate General for Mobility and Transport
DSP	Delivery Service Plan
EU	European Union
ICT	Information Communication Technology
ITS	Intelligent Transport Systems
LUP	Land Use Planning
PT	Public Transport
SUMP	Sustainable Urban Mobility Plan
TOD	Transit Orientated Design
UCC	Urban Consolidation Centre

MI-04-16-283-EN-N

doi:10.2832/341554