2020 CiViTAS
Cleaner and better transport in cities

DESTINATIONS

D9.1

Draft Evaluation Plan

Deliverable No.:	D9.1
Project Acronym:	DESTINATIONS
Full Title: CIVITAS DESTINATIONS	
Grant Agreement No.:	689031
Workpackage/Measure No.:	WP9
Workpackage/ Measure Title: Evaluation	
Responsible Author(s): Stefano Faberi, Francesca Pietroni, Mario Gualdi (ISINNOVA)	
Date:	17/07/2018
Status:	Final
Dissemination level:	Public

2020 CiViTAS
Cleaner and better transport in cities
DESTINATIONS

THE CIVITAS INITIATIVE
IS CO-FINANCED BY THE
EUROPEAN UNION

Project Partners

Organisation	Country	Abbreviation
Institute of Studies for the Integration of Systems	IT	ISINNOVA
The Research Committee of the Technical University of Crete	GR	TUC
Vectos (South) Limited	UK	VECTOS
Horários do Funchal, Transportes Públicos S.A.	PT	HF
MEMEX S.R.L.	IT	MEMEX
University of Malta	M	UOM
CINESI SL	ES	CINESI
Stratagem Energy LTD	CY	STRATA

Document History

Date	Person	Action	Status	Diss. Level
06.04.2017	Francesca Pietroni (ISINNOVA)	First draft	Draft	EM
15.05.2017	Stefano Faberi (ISINNOVA)	Second draft	Draft	EM
01.06.2017	Francesca Pietroni (ISINNOVA)	Third draft	Draft	EM
08.06.2017	Mario Gualdi (ISINNOVA)	Review	Draft	PC
23.06.2017	Paul Curtis (VECTOS)	Review	Draft	PC
17.07.2017	Francesca Pietroni (ISINNOVA)	New version of the D9.1	Draft	EM
12.08.2017	Stefano Faberi (ISINNOVA)	Revised version	Draft	PC
23.08.2017	Paul Curtis (VECTOS)	Language check of new sections 2.3.3, 2.4.2 and 3.2	Draft	PC
15.01.2018	Francesca Pietroni (ISINNOVA)	New version of the D9.1	Draft	PC
14.02.2018	Mario Gualdi (ISINNOVA)	Final version	Submitted	PC
17.07.2018	Francesca Pietroni	New version without annexes	Final	

Status: Draft, Final, Approved, and Submitted (to European Commission).

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

Table of Contents

List of Figures

List of Tables

1 The CIVITAS DESTINATIONS project

1.1 The CIVITAS Initiative

CIVITAS is a network of cities all dedicated to cleaner, better transport in Europe and beyond. Since it was launched by the European Commission in 2002, the CIVITAS Initiative has tested and implemented over 800 measures and urban transport solutions as part of demonstration projects in more than 80 Living Lab cities Europe-wide.

The knowledge garnered through these practical experiences is complemented, and supported, by a number of research and innovation projects, such as DESTINATIONS, ECCENTRIC, and PORTIS. These research projects look at ways of building a more resource-efficient and competitive transport system in Europe.

CIVITAS offers practitioners opportunities to see innovative transport solutions being developed and deployed first-hand, and learn from peers and experts working in the field. CIVITAS nurtures political commitment, new marketable solutions, and offers funding and knowledge exchange with a view to creating growth and better connected, more sustainable transport modes.

1.2 The CIVITAS DESTINATIONS Project

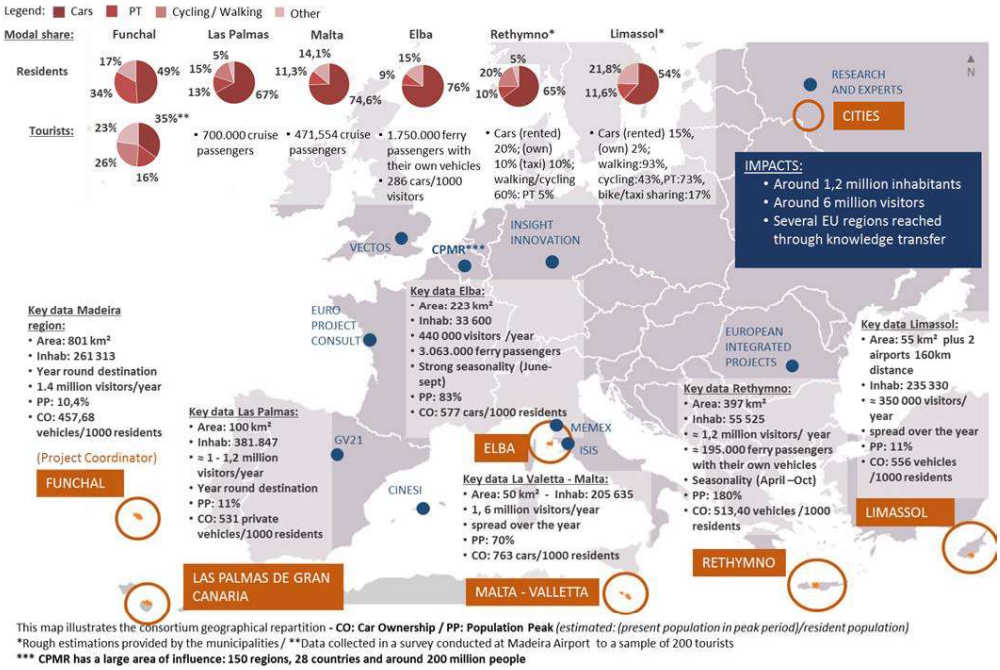
The ambition of the DESTINATIONS project is to extend and adapt as appropriate the CIVITAS initiative to the tourist destinations in Europe.

To show how to address this challenge, DESTINATIONS will implement a set of mutually reinforcing and integrated innovative mobility solutions in six urban laboratory areas (from different size and characteristics as explained in section 1.3): **Funchal,** Portugal; **Las Palmas de Gran Canaria**, Spain; **Limassol,** Cyprus; **La Valetta,** Malta; **Elba,** Italy; and **Rethymno,** Greece.

1.2.1 The 6 demonstration sites

The selected DESTINATIONS demonstration areas are facing major challenges in relation with the importance of tourism in their local economies and transport systems. They represent diverse geographical and topographical conditions as well as urban structure and functional systems. All the project cities have to manage tourist demands and habits in term of travel and mobility. Moreover, at a wider scale, mobility is part of the attracting or retaining strategies, and the tourism sector can represent up to 50% of the GDP of these territories. The map below shows key indicators.

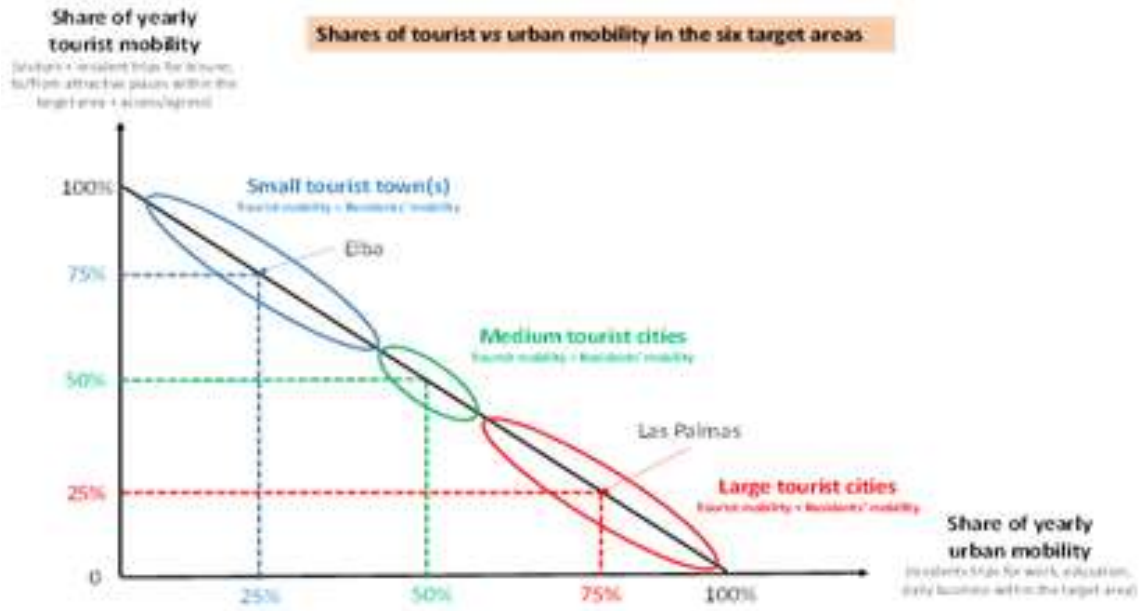
Figure 1 - The 6 demonstration sites and the main figures



The intensity of peak mobility problems varies with the dimension of the tourist destinations, as the influence of visitor's mobility is obviously greater in small destinations – where the peak population can double or more – than in large destinations, where this proportion is smaller. Conceptually, to distinguish small, medium and large touristic sites, DESTINATIONS proposes to compare the yearly volume of resident and tourist mobility, identifying three groups (see diagram):

- Small tourist towns/areas, where the yearly volume of tourist mobility is significantly higher than the volume of residents' mobility, like the island of Elba.
- Medium tourist cities, where the share of tourist and resident mobility is more or less balanced.
- Large tourist cities, where the yearly volume of tourist mobility is significantly lower than the volume of residents' mobility. These are contexts where the peak demand adds to an already high regular demand for mobility from the resident population, and the urban density threshold at which public transport infrastructure and services remain feasible is surpassed throughout the year (like in Las Palmas).

Figure 2 - Urban mobility and tourist mobility (DESTINATIONS project)



1.2.2 The strategic objectives

CIVITAS DESTINATIONS targets the resident and tourist mobility demand with a holistic and integrated planning approach, delivering sustainable mobility strategies at the **destinations** and in the **countries of origin**.

The strategic objectives are divided by the main following categories highlighted in Figure 3 - Objectives categories and are listed in Table 1:

Figure 3 - Objectives categories

Table 1 - The strategic objectives

More/better mobility (and accessibility) options available within the destination
Fewer vehicles and less road congestion
More vibrant and inclusive local economy
More/better tourist inflow
Less energy consumption
Less local pollution and CO2 emissions
More safety and security
More healthy travel and liveability

1.2.3 The sites specific objectives

The CIVITAS DESTINATIONS sites, in relation to the strategic objectives that the project aims to address, identified their local and specific goals to express the big effort they are intending to make:

Table 2 - The sites specific objectives

Site	Objectives
Madeira	Be at the forefront of information and marketing actions tailored to its visitors so as to highlight the key factors that differentiate it from other competing destinations
	Promote sustainable mobility through incentives, as a steppingstone to attract more visitors
	Stretch the offer of mobility choices so as to fit each visitor needs is a precondition to have a high quality and sustainable destination
Elba	Improve local mobility particularly in the summer with reduced use of private vehicles and greater use of environmentally friendly forms of mobility
	Reduce the emissions and energy consumption
	Increase the overall urban accessibility
	Improve and increase the use of public transport.
Las Palmas	Increase the use of sustainable urban mobility modes between tourists and citizens
	Reduce energy consumption, emissions and increase air quality
	Improve cost effectiveness and integration of transport and mobility services
	Regulate and decrease number of freight vehicles in the inner city
Limassol	Satisfy the mobility needs of tourism and citizens for a better quality of life
	Address transport related challenges and problems of urban areas in a more sustainable and integrative way
Rethymno	Reduce private car dependencies, traffic congestion and high environmental impacts (GHGs, urban noise)
	Address the position and inertia of the citizens/local businesses
	Engage key stakeholders to a sustainable growth model
	Inspire sustainable mobility habits and improve soft transport modes
	Address seasonal fluctuation due to tourism
	Attractive and convenient PT services
	Convenient access choices to main attractions
	Improve links between PT, cycling and walking networks and improve the coordination of inter-regional and airport transportation
	Design greener and safer public spaces
Valletta	Involve and engage stakeholders and public
	Test a number of innovative projects in sustainable mobility
	Develop a regional SUMP that collects the measures tested
	Realize an Effective communication of SUMP framework (how many have been engaged as users, participants, people affected)

1.2.4 The cooperation fields

To address the objectives that the sites identified, the measures have been grouped into thematic areas (Work Packages) that we will call *cooperation fields*:

WP2 - Sustainable Urban Mobility Planning for residents and visitors: provides a specific focus on the integrated planning process that forms the basis of a successful urban mobility policy. The local authorities of the six demonstration sites will lead a participative planning process for sustainable urban mobility planning (SUMP) that takes the importance of leisure trips by residents and visitors fully into account. New technologies for smart metering, open data, user-generated content and big data will be used to set up efficient monitoring and evaluation of the SUMP process and to bridge the existing data gap on leisure trips.

WP3 - Safe, attractive and accessible public spaces for all generations: Las Palmas, Madeira, Limassol, Elba and Rethymno have selected a laboratory area with tourism and leisure functions to work on an integrated set of actions. The goal is to develop attractive and accessible public spaces with preference for active modes and accessible to all residents and visitors. Specific technological and design solutions for the visually and hearing impaired will be implemented. Rethymno, Madeira and Limassol plan awareness programmes for pupils and students to increase traffic safety around schools and universities.

WP4 - Shared mobility and e-infrastructures towards zero emissions transport: Elba and Rethymno will use new technologies to set up a regional agency for shared mobility of all modes. Malta, Las Palmas, Rethymno and Limassol will introduce or expand their bicycle sharing system and introduce electric bicycles. Specific sharing solutions with electric cars for tourist trips will be introduced in Limassol (e-cars to connect to airport and cruise port) and Rethymno (to airport and for events). Four destinations (Madeira, Las Palmas, Rethymno and Limassol) support the uptake of electro-mobility through the installation and promotion of public fast charging points for cars and two-wheelers. Considering the fact that building a sharing mobility culture is also very important in China these days and given the success of Didi and Kuaidi sharing mobility applications used there, further exchanges might be foreseen in this work package.

WP5 - Smart and clean urban freight logistics at tourist destinations: All sites will work on freight consolidation solutions based on a close cooperation with local stakeholders and will develop Sustainable Urban Logistics Plans as part of their SUMP. The solutions will make use of data platforms and of clean vehicles for the last mile delivery. Concrete proposals include: making use of an underground tunnel (La Valetta), rationalizing e-commerce distribution (Las Palmas), delivery by bus and fixed pick-up points (Funchal), an access control system (Limassol) and dedicated services for tourists (Elba). Rethymno and Limassol will work on a specific opportunity based on the high amount of hotels and restaurants in tourist areas; collection of used cooking oils for the production of biofuel for local vehicle fleets such as refuse collection.

WP6 - Mobility demand management and awareness for sustainable mobility at tourist destinations: All sites will organize campaigns directed at leisure trips with new actors and through new channels. One of the main challenges is to reach tourists before they arrive at the destination. Therefore, the Elba partners will cooperate with tour operators to develop specific hotel & mobility packages that make it unnecessary for tourists to bring their own car. The demonstration sites will develop travel plans for hotels, cruise ports and large tourist attractions and implement soft measures to increase the use of active modes and public transport among

both guests and employees. A green credit scheme to boost the local economy will be developed in cooperation with local commerce at four DESTINATIONS sites. Gamification of mobility will make sustainable mobility options more fun and attractive. Funchal will implement games at bus stops and develop geo-caching challenges (treasure hunts) making use of public buses. Rethymno will launch a sustainable mobility agency to coordinate all transport activities (public/private), mobility services and involved stakeholders towards sustainable modes. Limassol will organize a bicycle challenge among the employees of local (tourist) companies. Madeira, Rethymno and Malta will introduce low emission zones in touristic areas. Madeira and Limmasol will implement smart solutions for parking and flexible use of streets.

WP7 - Attractive, clean, accessible and efficient public transport: An attractive, clean, accessible and efficient public transport system forms the backbone for a sustainable tourist destination. Both visitors and residents should be able to reach the main points of attraction through public transport without worrying too much about timetables and ticketing. The demonstration sites will implement improved public transport services that connect to main tourist attractions, airports and cruise terminals. This includes the promotion of a BRT system in Las Palmas and new public transport routes in Elba, Rethymno and Limassol. In La Valetta a local ferry service will be fully integrated into the public transport network. Electric and hybrid buses will be introduced in Funchal, Las Palmas, Rethymno and Limassol. Limassol, Las Palmas, Elba, Rethymno and Madeira will upgrade traveller information through the realisation of integrated traveller apps and information at bus stops. The smartphone application will integrate public transport information with other local mobility options and promote inter-modality. Public transport smart card systems will be further developed in Elba, Funchal and Las Palmas, to facilitate payment for integrated mobility and tourism products. Electric-powered vehicles are of much interest to the Chinese, and therefore China has also many initiatives linked to electric cars from which our EU destinations could learn and benefit, in particular because many Chinese cities today are laboratories where any new idea, concept, product, strategy or measure can be tested.

Table 3 explains how the cities will be involved in the different cooperation fields:

Table 3 – The WPs and the sites involvement

WP	Measures types	ELB	LPA	LIM	MAD	MAL	RET
2	SUMP taking tourist mobility into account	X	X	X	X	X	X
	Smart metering and crowdsourcing for SUMP	X	X		X		X
3	Increase traffic safety and improve disabled accessibility	X		X			X
	Attractive and accessible public space	X	X	X	X		X
	Safe routes to school			X	X		X
4	Shared mobility services	X		X			X
	New and extended public (e-)bike systems		X	X		X	X
	Shared e-charging infrastructures		X	X	X		X
5	Sustainable Urban Logistics Plans	X	X	X	X	X	X
	Solutions for efficient freight distribution	X	X	X	X	X	X
	Collection of used cooking oils for fuel			X			X
6	Mobility management and travel plans	X	X	X	X	X	X
	Behavioural change through competition	X	X	X	X	X	
	Low emission zones and parking management			X	X	X	X
7	Improved PT services for tourists and residents	X	X	X	X	X	X
	Demonstration of electric, hybrid and LPG buses		X	X	X	X	X
	Real-time mobility & tourist information and payment services	X	X	X	X		

1.2.5 The DESTINATIONS measures and the CIVITAS thematic categories

Within CIVITAS, 10 thematic categories of measures have been identified as the basic building blocks of an integrated strategy for sustainable mobility. These building blocks can be used to help put in place a planning framework, develop political involvement and establish partnerships.

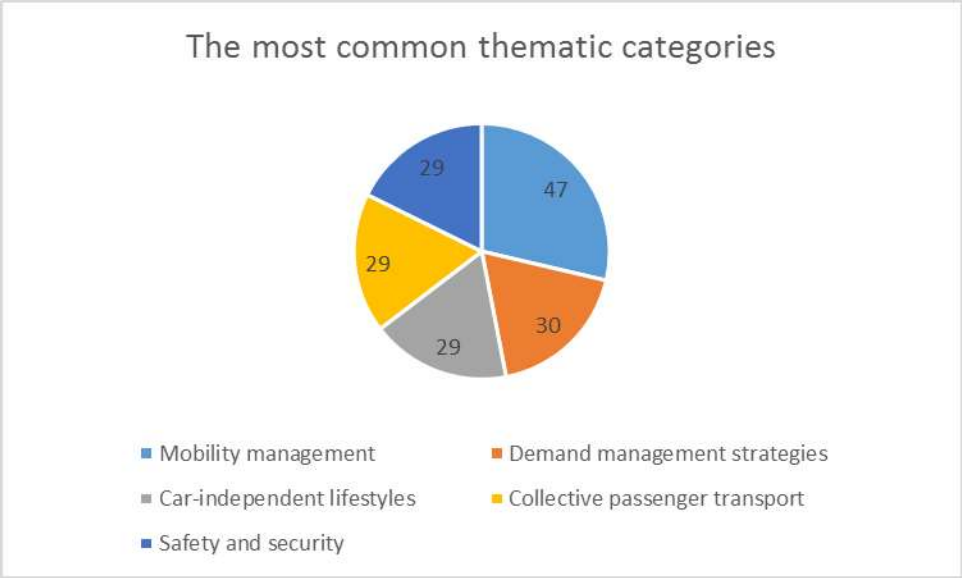
Starting from the thematic categories, the 6 DESTINATIONS sites chose their measures as a set of mobility solutions from these building blocks according to their local priorities.

1. **Car-Independent Lifestyles –** cycling, walking, car-sharing, bike-sharing, car-pooling, co-modality, ride-sharing
2. **Clean Fuels and Vehicles –** electric mobility, fueling infrastructures, hybrid vehicles, use of biodiesel, biogas and compressed natural gas, cleaner fleets
3. **Collective Passenger Transport –** accessibility, intermodality, service improvements, ticketing systems, innovative PT systems, fleet management, procurement schemes
4. **Demand Management Strategies –** congestion charging, access restrictions, parking management and strategies, low emission zones, car-free zones, priority lanes, mobility credits, financial incentives and disincentives
5. **Integrated Planning –** land-use, housing, new developments, sustainable urban mobility plans
6. **Mobility Management –** marketing and communications, personal and company travel plans, mobility info centers
7. **Public Involvement –** multi-stakeholder consultations, information campaigns, participatory processes

8. **Safety and Security –** traffic calming, infrastructure design, shared space, cycle highways, secure school paths, anti-vandalism measures
9. **Transport Telematics –** intelligent transport systems, communication, routing, smartphone applications, number-plate recognition systems
10. **Urban Freight Logistics –** urban delivery centers, distribution schemes, fleet management, cycle logistics, freight partnerships, urban freight transport plans

The 5 most common thematic areas at project level are shown in the following graph:

Figure 4 - The most common CIVITAS thematic categories



The detail of all the measures and the thematic areas they refer to are listed in the table below (the measures are in depth described in the Local evaluation reports).

Table 4 - Thematic areas distribution per site measures

SITE	MEASURE CODE	Car-independent lifestyles	Clean fuels and vehicles	Collective passenger transport	Demand management strategies	Integrated planning	Mobility management	Public involvement	Safety and security	Transport telematics	Urban freight logistics	New thematic categories
ELBA	ELB 2.1					X	X					
	ELB 2.2					X	X					
	ELB 3.1						X		X			
	ELB 3.2	X							X			
	ELB 3.3	X		X			X					
	ELB 4.1	X					X					
	ELB 4.2	X					X					
	ELB 4.3						X	X		X		
	ELB 4.4	X					X		X			
	ELB 4.5	X					X	X				
	ELB 5.1				X		X					
	ELB 5.2				X		X	X		X	X	
	ELB 6.1			X	X		X					
	ELB 7.1	X		X	X		X	X				
	ELB 7.2			X				X		X		
	ELB 7.3			X			X					
LAS PALMAS	LPA 2.1				X	X	X	X				
	LPA 2.2				X	X						X
	LPA 3.1	X		X		X	X	X	X	X		
	LPA 4.1	x	x									
	LPA 4.2		X		X		X					
	LPA 5.1								X		X	X
	LPA 5.2					x			x		x	
	LPA 6.1	X		X	X		X			X		

SITE	MEASURE CODE	Car-independent lifestyles	Clean fuels and vehicles	Collective passenger transport	Demand management strategies	Integrated planning	Mobility management	Public involvement	Safety and security	Transport telematics	Urban freight logistics	New thematic categories
	LPA 7.1	X	X	X	X	X	X			X		
	LPA 7.2	X	X	X								
	LPA 7.3											X
	LPA 7.4									X		
LIMASSOL	LIM 2.1	X	X		X		X		X			
	LIM 3.1	X	X	X	X		X		X	X		
	LIM 3.2				X				X	X		
	LIM 3.3	X							X			
	LIM 3.4	X	X	X						X		
	LIM 4.1				X		X					
	LIM 4.2	X	X		X		X					
	LIM 4.3		X				X		X			
	LIM 5.1		X		X				X		X	
	LIM 5.2		X		X							
	LIM 6.1	X	X	X			X		X			
	LIM 6.2		X	X	X		X		X	X		
	LIM 6.3	X	X	X	X		X		X			
	LIM 6.4				X		X		X	X		
	LIM 7.1	X	X	X	X		X		X			
	LIM 7.2	X	X	X			X		X	X		
	LIM 7.3	X		X	X		X		X	X		
	LIM 7.4	X		X	X		X		X	X		
MADEIRA	MAD 2.1					X	X	X				
	MAD 2.2						X	X	X	X		
	MAD 3.1			X					X			X

SITE	MEASURE CODE	Car-independent lifestyles	Clean fuels and vehicles	Collective passenger transport	Demand management strategies	Integrated planning	Mobility management	Public involvement	Safety and security	Transport telematics	Urban freight logistics	New thematic categories
	MAD 3.2					X	X	X				
	MAD 4.1	X	X				X		X			
	MAD 5.1		X		X		X		X	X		
	MAD 6.1			X		X						
	MAD 6.2			X		X						
	MAD 6.3				X		X		X			
	MAD 6.4				X	X	X					
	MAD 7.1		X									
	MAD 7.2			X		X				X		
	MAD 7.3									X		
	MAD 7.4			X			X		X	X		
MALTA	MAL 2.1						X					
	MAL 2.2						X					
	MAL 4.1	X		X								
	MAL 5.1		X								X	
	MAL 6.1						X					
	MAL 6.2	X										
	MAL 6.3			X								
	MAL 6.4									X		
	MAL 7.1			X								
RETHYMNO	RETH 2.1				X	X		X	X			
	RETH 2.2									X		
	RETH 3.1	X		X	X			X	X			
	RETH 3.2						X	X	X			
	RETH 4.1		X		X							

SITE	MEASURE CODE	Car-independent lifestyles	Clean fuels and vehicles	Collective passenger transport	Demand management strategies	Integrated planning	Mobility management	Public involvement	Safety and security	Transport telematics	Urban freight logistics	New thematic categories
	RETH 4.2	X						X				
	RETH 5.1					X				X	X	
	RETH 5.2		X									X
	RETH 6.1											
	RETH 6.2				X		X	X				
	RETH 6.3	X			X		X					
	RETH 7.1		X	X								
	RETH 7.2			X			X					

2 Approach to Evaluation

2.1 Introduction

Based on the evaluation work of CIVITAS POINTER and CIVITAS WIKI and a first analysis of recent evaluation approaches defining indicators for urban mobility, the methodology adopted is the result of an efficient cooperation between CIVITAS Satellite and the Project Evaluation Managers of the new Innovation Actions (ECCENTRIC, DESTINATIONS and PORTIS).

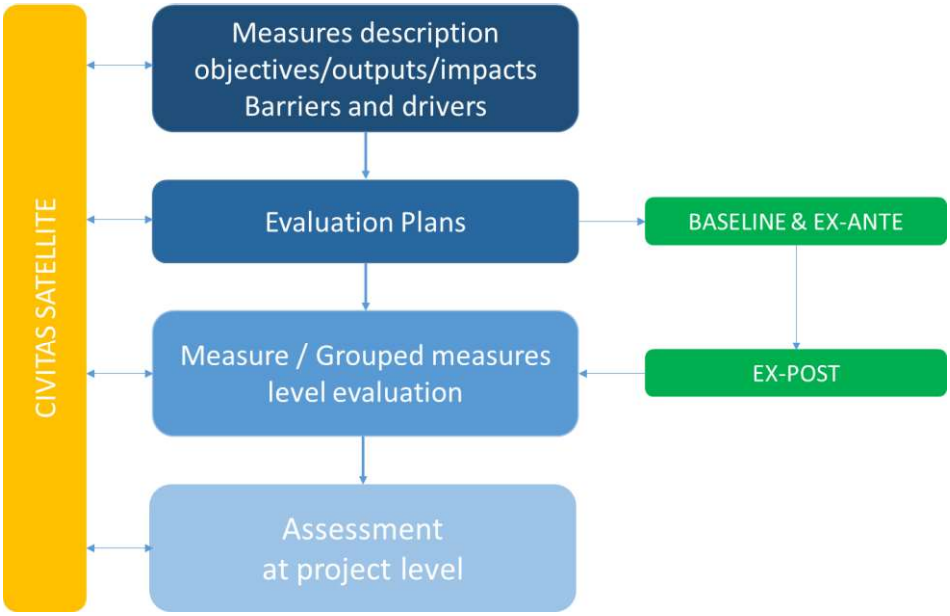
The focus of the evaluation work is the measures implemented in each CIVITAS DESTINATIONS site. Evaluation aims to describe the impact of the implemented measures in impact categories with a qualitative assessment (***Process evaluation***) and quantitative elements (***Impact evaluation***) against quantifiable targets set in advance.

Since the CIVITAS projects implement measures in a real, complex, functioning environment the CIVITAS evaluation needs an optimal balance between scientific, precise analyses and synthetic interpretation of observations of the evolution of urban mobility. This is an important challenge to address in order to make the evaluation work feasible, efficient, and useful for policy conclusions.[1]

The Evaluation Liaison Group (ELG) is a cooperation platform established within CIVITAS 2020 with the role of coordinating the Evaluation activities in the cities of the Innovation Action projects.

CIVITAS SATELLITE guides, coordinates and coaches the evaluation work, steers the ELG, and draws the conclusions at the CIVITAS level.

Figure 5 - Main steps of the evaluation process and synergies with CIVITAS Satellite



[1] Optimised CIVITAS process and impact evaluation framework. CIVITAS Satellite, 2017

2.2 The aim of the evaluation

Scientifically speaking, evaluation is a systematic determination of a measure's merit and significance, using criteria governed by a set of standards. It is part of a continuing management process consisting of planning, implementation and evaluation. In other words: evaluation tells you:

- what really happened to your measure compared to what should have happened;
- why it happened;
- and what you can learn from these deviations.

In addition, the evaluation will determine if you have reached your intended goals. In short, we evaluate because we want to:

- measure the performance;
- take corrective actions towards the targets set;
- learn for future projects;
- and exchange experiences.

2.3 Impact Evaluation

2.3.1 Introduction

Key to impact evaluation is the identification and measurement of appropriate performance indicators, which are nothing other than tools that enable a quantification of the impacts (or effects, results) of a project.

In order to evaluate the impacts of a measure, it first has to be clear what the objectives and outputs of the measure are. The objectives identify the quali/quantitative targets the measure wants to achieve while the outputs describe the innovations and transformations the measure intends to produce on the urban transport system. On the basis of these objectives and outputs a set of indicators, classified in accordance with the evaluation areas outlined before, have to be chosen indicating for each of them the corresponding measurement method, application area, target audience and the measurements scheduling.

Following the CIVITAS Satellite methodology, evaluation will be conducted on the basis of a "before (baseline) and after" situation using, as far as possible, common indicator sets to allow effective and meaningful performance comparison across cities. The measured improvement (if any) provided by the measure implementation in terms of social, transport, energy and environmental performances will be then compared with the ex-ante estimations provided by the cities' staff to evaluate to what extent the measure has been able to produce the expected results.

2.3.2 Baseline, Business-as-Usual, Ex-post evaluation

The **Baseline** is necessary to assess subsequent changes resulting from CIVITAS measures and is obtained carrying out a survey prior to the introduction of CIVITAS measures. The baseline measurements should be of sufficient scale to enable expected changes to be

judged statistically where this is appropriate and possible. It should encompass all measure-related indicators that may change.

Another objective of the baseline survey is to collect data necessary for the impact predictions of the business-as-usual scenarios (if any). The data collection should cover a long enough period to provide the inputs necessary for such predictions. The baseline surveys may also help to fine-tune the design of the measures.

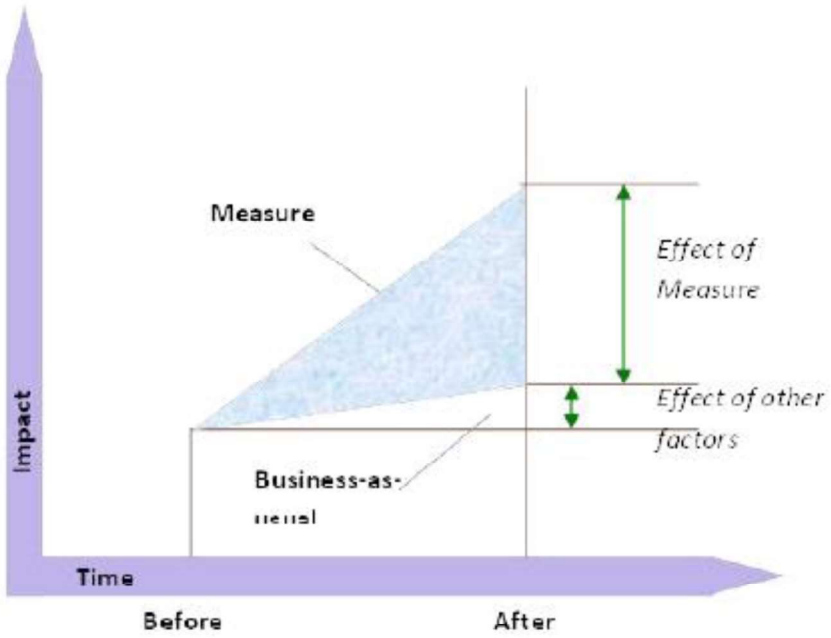
The business-as-usual (BAU) scenario: This type of analysis can be used to predict what would have happened at the end of the project if the CIVITAS measures had not been introduced. One of the main objectives of business-as-usual scenarios is thus to determine the impacts of the measures by comparing results between scenarios with and without the measures (see i.e. Figure 6).

Possible ways to estimate the 'business-as-usual' situation include:

- forecasting from historical data, modelling (if appropriate local models are available) or
- monitoring a parallel 'control' site with the same characteristics without applying the project measures to it.

All the factors which may change during the evaluation period and which could influence travel and its impacts in the cities need to be identified at an early stage of the project and included in the baseline records. These effects may be modelled, interpreted through processes of extrapolation and prediction, or some mixture of both may be used.

Figure 6 - Before (Baseline), Business-as-Usual & After scenarios



In the DESTINATIONS project the only factor that, in some of the demonstration sites, may change over the evaluation period is tourist flow as all the other factors (i.e. population, GDP, traffic share) are not being expected to substantially evolve over the project time lapse. In

reality, a robust increment in tourist flow can influence the impact of some types of measures, notably those concerning the change of mobility patterns (cyclability, car sharing, improvement of the public transport offer, etc.). The sites for which this BAU analysis will have to be carried out will be listed in the final version of this report while the new, foreseen, baselines will be calculated later on.

The after situation (Ex-post) provides a final set of measurements for evaluation, which can be compared with baselines, possibly recalculated basing on the BAU analysis, where this has been carried out, to assess the effectiveness of the measures implemented. This means that, once the measures will be implemented, many impacts will be measured directly upon real conditions.

To be able to compare a situation without the implemented measure with a situation after the implementation and to see the effects, a before data collection and an after data collection are necessary. Ideally, data are collected at multiple points in time both before and after the measure implementation. In CIVITAS DESTINATIONS the majority of the sites have actually planned this procedure envisaging at least two data collection points (intermediate and final). This data needs to be collected and/or recorded in due time (see also chapter 2.6 on data collection).

2.3.3 Levels of the evaluation

The impact evaluation will be, as far as possible, provided at three different spatial and intensity levels[2]:

Measure level: this is the basic level of evaluation from which all other levels depend. The first level of evaluation consists of each single measure to be implemented. Impacts of individual measures, in fact, should be clearly understood enabling a plain interpretation of results.

Cluster level: is the evaluation of packages of measures that, for their strong synergies and common objectives, have a combined effect on the foreseen impacts. In the majority of cases in CIVITAS DESTINATIONS this level corresponds to the project cooperation fields (WP2 to 7). In evaluating a bundle of measures, the coexistence and synergy of impacts must be taken into account. On the other hand, the distinction of impacts related to each measure is not easily determined except in the case of temporal or space differentiation in implementing them.

Site[3] level: is where the evaluation aims to assess the overall contribution of the implemented measures to the five main impact evaluation areas. This can be carried out using qualitative and quantitative methods also with the support of up-scaling techniques by forecasting the measure impact at a larger spatial scale.

[2] Definition taken from the Satellite Optimized Evaluation Framework, September 2016.
[3] In DESTINATIONS we prefer to use the term “site” instead of “city” because in some cases the measures refer to a geographical ambit larger than the city itself. The Elba island, for example, where the measures refer to both specific municipalities and the entire island territory.

In CIVITAS DESTINATIONS the evaluation manager will carry out this analysis mainly on a qualitative basis. The site level analysis will be discussed and analyzed later on in the project when the sites will have accrued and consolidated enough experience and data on the single measures impacts. This assessment will be then carried out with the support of the CIVITAS SATELLITE experts, also based on the achievements of the other parallel CIVITAS projects, and in close collaboration with the site managers, the LEMs and other project partners (see also paragraph 4.2 on the final evaluation report).

There are in CIVITAS DESTINATIONS two remarkable exceptions for what concerns the site level evaluation concerning two sites: Valletta (Malta) and Limassol (Cyprus). All the measures planned by the Maltese team are actually just pilot initiatives, designed with the purpose to provide information and data for the elaboration of the SUMP. These pilots will be carried out in some demonstration zones of La Valletta and other sub-urban places and it is then not possible to estimate a possible impact at a wider level. The impact is solely that provided by the measures, and/or by some measure clusters, on the site where they are implemented and a possible measure scale-up estimation will only be provided in the SUMP as ex-ante evaluation. The situation of Limassol is similar to that of Malta but, in this case, all the measures will be implemented in a demonstration zone and thus the impacts will be those monitored for this zone only. There is, nonetheless, the possibility to design an up-scaling scenario with future impacts at site level.

2.3.4 Fields of evaluation: the impact categories

Experience made within the CIVITAS initiative shows 5 impact categories relevant for assessing urban transport measures. These are: **transport, society, economy, environment,** and **energy**. Naturally and due to the varying character of the DESTINATIONS measures, these five areas do not apply to all the measures to the same extent.

Therefore, only the impact evaluation categories relevant for the individual cases will be considered in the course of the evaluation.

Economy focuses on the estimation of the effectiveness or benefits derived from a measure in relation to the costs associated with its preparation, implementation and operation. In economic efficiency terms, the balance between the impact a measure has and the willingness of users to pay the cost of achieving this impact has to be judged. This impact area also includes a measure's effectiveness in increasing the income of citizens or creating jobs.

Energy describes the consumption of energy. Using alternative fuels is one of the main measures proposed in CIVITAS. In addition, many other measures can also contribute to the reduction of fuel consumption (e.g. increasing public transport use) – these are mainly through an impact in the other impact areas.

Environment recognises that many of the CIVITAS measures aim to improve the environment by using clean vehicles and alternative fuels and reducing the modal share of private motorized transport. Environmental evaluation focuses on pollution/nuisance and resource consumption.

Transport system focuses on the performance of the mobility system in terms of usage and its technical characteristics. The emphasis here is on understanding how much the CIVITAS measures can contribute to improving the performance of the transport systems, and therefore contribute to better and cleaner urban transport, including also safety and security aspects (real and perceived).

Society includes the general acceptability of a measure and its effects on how easily people are able to travel around in a city with respect to physical and economic accessibility and also its effects on health. This includes the way society is organised both in terms of land-use (affecting the travel demand) and in terms of governance (affecting the way measures can be implemented and will be accepted).

2.3.5 Impact indicators

Taking into account the general objective of the CIVITAS measures 'working towards sustainable clean urban transport', the selection of indicators should measure any progress made in the CIVITAS cities towards sustainable mobility.

As there are often many indicator options for measuring an impact (e.g. for congestion level), the selection of the right indicators is very important for an evaluation with limited resources.

In selecting indicators, the main criteria to follow should include relevance, completeness, availability, measurability, reliability, familiarity, non-redundancy and independence:

- **Relevance**: each indicator should represent an assessment criterion, i.e. have a significant importance for the evaluation process;
- **Completeness**: the set of indicators should consider all aspects of the system/concept under evaluation;
- **Availability**: readily available for entry into the monitoring system;
- **Measurability**: the identified indicators should be capable of being measured objectively or subjectively;
- **Reliability**: clarity of definition and ease of aggregation;
- **Familiarity**: the indicators should be easy to understand;
- **Non-redundancy**: indicators should not measure the same aspect of an assessment criterion;
- **Independence**: small changes in the measurements of an indicator should not impact preferences assigned to other indicators of the evaluation model.

The following table shows the list of common indicators for the impact evaluation agreed upon by CIVITAS Satellite and coming from previous CIVITAS projects and from the World Business Council for Sustainable Development (WBCSD). Some indicators are new and have been introduced by CIVITAS DESTINATIONS.

The indicators are sorted by evaluation areas (outlined in paragraph 3.1), sub areas and impact aspects according to the taxonomy suggested by the Satellite Optimized Evaluation Framework. Moreover, for each indicator the source and a brief description indicating the unit of measurement are provided.

Table 5 - List of common impact indicators

Impact category	Impact aspects	Nr	Core indicators	Source	Description
ECONOMY					
Benefits	**Operating Revenues**	1	Average operating revenues	CIVITAS WIKI nr.1	Revenues per pkm or vkm
Costs	**Investment costs**	2A	Capital costs	CIVITAS WIKI nr.2A	Total capital costs for purchase of infrastructure, equipment and vehicles
	Operating costs	2B	Average operating costs	CIVITAS WIKI nr.2B	Operating costs
ENERGY					
Energy consumption	**Fuel Consumption**	3	Vehicle fuel efficiency	CIVITAS WIKI no.3	Fuel used per vkm, per vehicle type
		4	Fuel mix	CIVITAS WIKI	The percentage of the market share of transport fuel for each type of fuel used in a given period.
Energy use	**Energy resources**	5	Used Cooking Oil collection	DESTINATIONS TUC	Total volume of UCO collected annually
ENVIRONMENT					
Pollution and Nuisance	**Air Quality**	6	CO levels	CIVITAS WIKI no.5	CO concentration
		7	NOx levels	CIVITAS WIKI no.6	NOx concentration
		8	Particulate levels	CIVITAS WIKI no.7	Particulate PM10 and/or PM2.5 concentration
		9	Level of VOC	DESTINATIONS TUC	Average hourly (or peak/off-peak) VOC concentration over a full year
		10	CO2 level	DESTINATIONS TUC	Average hourly (or peak/off-peak) CO2 concentration over a full year
	Emissions	11	CO2 emissions	CIVITAS WIKI no.8	CO2 per vkm by type
		12	CO emissions	CIVITAS WIKI no.9	CO per vkm by type
		13	NOx emissions	CIVITAS WIKI no.10	NOx per vkm by type
		14a	Small particulate emissions	CIVITAS WIKI no.11	PM10 and/or PM2.5 per vkm by type
		14b	VOC emissions	DESTINATIONS TUC	VOC g/vkm by type
	Noise	15	Noise perception	CIVITAS WIKI no. 12	Percentage of people troubled by transport noise

Impact category	Impact aspects	Nr	Core indicators	Source	Description
TRANSPORT SYSTEM					
General	**Modal split**	16	Average modal split (passengers km)	CIVITAS WIKI no.26	Percentage of passenger-km for each mode
		17	Average modal split (trips)	CIVITAS WIKI no.28	Percentage of trips for each mode
		18	Average modal split- passengers	CIVITAS CAPITAL no.1	Number of all trips by residents made by each mode for all purposes. Walking, cycling, public transport, car driver or passenger, and other modes are all included in the definition. The main mode of a trip is that used for the longest stage of the trip by distance. With stages of equal length the mode of the last stage is used.
Car	**Traffic levels**	19	Traffic flow by vehicle (peak)	CIVITAS WIKI no.21	Average vehicles per hour by vehicle type - peak
		20	Traffic flow by vehicle (off peak)	CIVITAS WIKI no.22	Average vehicles per hour by vehicle type – off peak
	Congestion levels	21	Average vehicle speed – peak	CIVITAS WIKI no.23	Average vehicle speed over total network
		22	Average vehicle speed - off peak	CIVITAS WIKI no.24	Average vehicle speed over total network
	Vehicle occupancy	23	Average occupancy	CIVITAS WIKI no.29	Mean no. persons per vehicle/day
	Parking	24	Use of space for parking	CIVITAS CAPITAL no. 18	Space devoted to parking (total, includes on street, off-street, private residential and non-residential) as proportion of an urban area.
Public transport	**Service reliability**	25	Accuracy of timekeeping	CIVITAS WIKI no.18	Number and percentage of services arriving / departing on time
	Service availability	26	Public transport service per head of population	CIVITAS CAPITAL no.14	Number of departures per day from all public transport stops divided by the total population of the city.

Impact category	Impact aspects	Nr	Core indicators	Source	Description
Walking	**Opportunity for walking**	27	Extent of off-street walking path network	CIVITAS CAPITAL no.9	Percentage of paths and links of at least 50m in length that are off-street, as a percentage of the length of total walkable routes. In urban neighbourhoods, these paths and links include those through and in green spaces, pedestrianised zones and so on.
Cycling	**Opportunity for cycling**	28	Extent of on-street cycle network	CIVITAS CAPITAL no.11	Percentage of urban roads with speed limits of 40 km/h or more with segregated cycle facilities alongside or on close parallel routes providing similar journey times
		29	Opportunity for active mobility	WBCSD no.16	The length of roads and streets with bike lanes and 30 km/h (20 mph) zones related to total length of city road network (excluding motorways)
Freight	**Freight Movements**	30	Goods vehicles moving in demo areas	CIVITAS WIKI no.25	Daily number of goods vehicles moving in area
New shared systems	**Bike sharing availability**	31	Bike sharing bikes and stations per capita	CIVITAS CAPITAL no.13	This indicator is derived by dividing total population by the number of bike share bikes.
	Car sharing availability	32	Car share cars and stations per capita	CIVITAS CAPITAL no.21	This indicator is derived by dividing driving age population (18 and over) by the number of car share cars
Safety and Security	**Personal Security**	33	Personal Security (actual)	DESTINATIONS VECTOS	No. reported thefts / cases of harassment
		34	Personal Security (perceived)	DESTINATIONS VECTOS	Feeling of security: 5 point scale ranking options
	Road Safety	35	Road Safety (actual)	DESTINATIONS VECTOS	No. Killed and Seriously Injured KSIs / collisions reported per year
		36	Road Safety (perceived)	DESTINATIONS VECTOS	Feeling / experience as road user: 5 point scale ranking options
		37	Traffic calmed and car-free / pedestrianized streets	CIVITAS CAPITAL	Percentage of the total distance of the city's streets and squares that are / is speed limit of 30 km/h or below

Impact category	Impact aspects	Nr	Core indicators	Source	Description
		38	Road Safety Audits	DESTINATIONS VECTOS	Audit conducted by experts at Feasibility stage (to guide the location and design type) and post construction (to ensure installed as planned and to review interaction by road users).
SOCIETY					
Acceptance	**Awareness**	39	Awareness level	CIVITAS WIKI no.13	Awareness of the policies/measures
	Acceptance	40	Acceptance level	CIVITAS WIKI no.14	Attitude survey of current acceptance of the measure
	Satisfaction	41	Citizens satisfaction with transport system	CIVITAS CAPITAL no.22	Rating on a scale of the quality of transport infrastructure and service by mode on journeys the respondent makes regularly
	Physical accessibility towards transport	42	Perception of accessibility level of service	CIVITAS WIKI no.15	Perception of physical accessibility of service
	Physical accessibility of transport vehicle	43	Perception of accessibility level of transport vehicle	DESTINATIONS VECTOS	Perception of physical accessibility to the mode of transport (namely step free access for push chairs, wheelchairs, suitcases for tourists).
	Car availability	44	Car ownership	CIVITAS CAPITAL no.20	Cars owned per 1000 population, disaggregated by city district if possible.
	Bike availability	45	Bike ownership	CIVITAS CAPITAL no.12	Bikes (pedal cycles) owned per 1000 population, disaggregated by city district if possible. Toy bicycles and those for children aged under 5 should not be counted.
Health	**Health economic assessment**	46	Health benefits of walking or cycling	HEAT (WHO)	Economic assessment of the health benefits of walking or cycling by estimating the value of reduced mortality that results from specified amounts of walking or cycling.

All the details concerning the selection of indicators for each measure, the method of measurement, the baseline and the ex-ante evaluation are available in the Deliverable 9.2. in the " *Local Evaluation Plans".*

2.4 Process Evaluation

2.4.1 Introduction

Process evaluation supplies critical information as to the factors that played a role in sustaining or weakening the outcomes of a measure. Such assessment is particularly relevant in complex projects like CIVITAS, and it accordingly requires an ad-hoc exercise within each demonstration site. In order to do so the project Evaluation Coordinator steers the assessment activity on the basis of a shared methodology and the Local Evaluation Managers (LEMs) accordingly assess the planning and implementation phases of the measures taking into account the influence of the local governance system as well as that of the institutional, political, legal, and financial organizations.

The process evaluation will mainly take place at the measure level. It is linked with the typical development phases of a measure, which can be divided in three time-periods (see the Gantt diagrams in the respective local evaluation plans to see how these three time-periods have been set by each site measure):

- *Preparation phase*: the measure is developed in detail and design work for the measure is conducted. At the end of this phase all planning details are fixed, including all decisions and permissions that are a pre-condition for starting the implementation phase.
- *Implementation phase*: the measure will be implemented in real life. At the end of this phase the measure starts operation. It is worth noting here that some measures could not have this phase or that this phase coincides with a testing period where the measure is fully operative but has to be still tested and tuned up in-field. This phase can be also accompanied by information activities addressed to the public interested by the measure itself.
- *Operation phase*: the measure is opened to the public and the users are able to take advantage of the new services/opportunities it offers. The length of this phase lies within the time-frame of the CIVITAS Initiative. The long-term running is the outstanding time (beyond CIVITAS) until the measure comes to the end of its life, which could be caused by technical facts, programme termination, end of funding, redesign, or reconstruction.

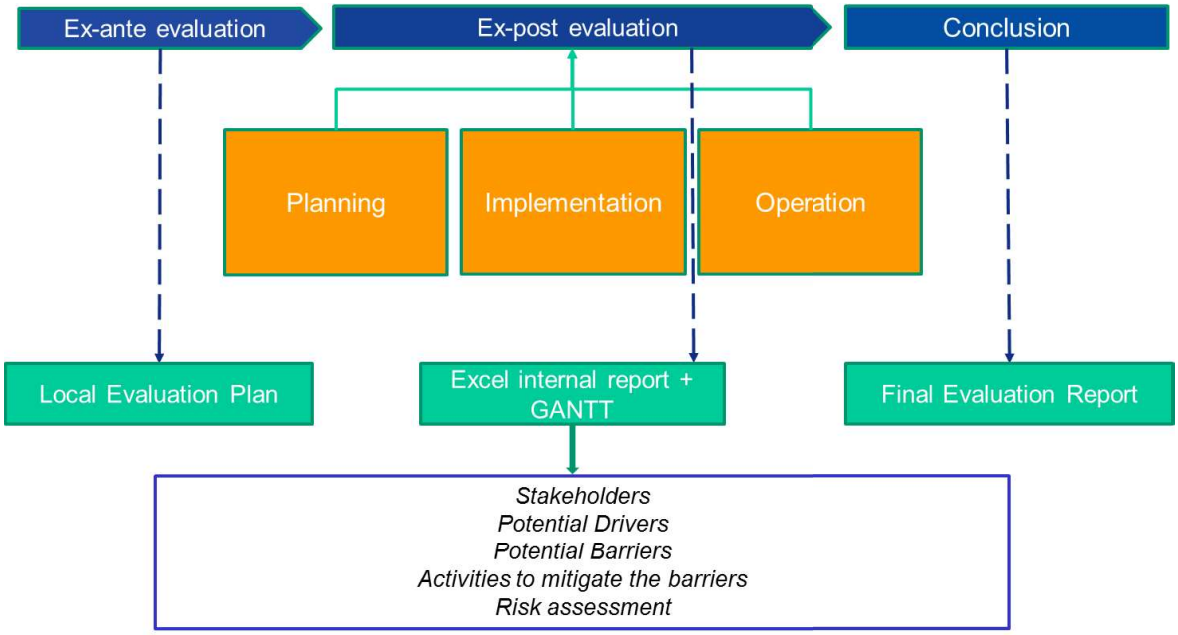
Process evaluation will supply complementing information to ex-post impact evaluation, detecting and understanding critical success factors and/or unexpected barriers for all the three phases (preparation, implementation and operation). The process evaluation steps are drafted in the figure below where:

i) the process **ex-ante evaluation** is part of the Local Evaluation Plan,

ii) the process **ex-post evaluation** will be done in three different moments, after each of the three phases (planning, implementation and operation). The information will be collected in the internal periodic reports (excel form).

iii) **the final conclusions** will be delivered within the Final Evaluation Report.

Figure 7 - Process evaluation steps



A specific focus lies in the identification of potential barriers, which might lead to a serious delay in the implementation of the measure or even to cancellation. During the initial stages of planning and preparing a transport measure, it is important to establish the constraints and context within which the project is designed and implemented. The tables below show the main types of barriers that may hinder the measures implementation and effectiveness and the drivers that, conversely, might assure the measures success.

Table 6 - Examples of barriers that might hinder the measures implementation.

NR	Barrier field	Examples of barriers
1	**Political / strategic**	Opposition of key actors based on political and/or strategic motives, lack of sustainable development agenda or vision, impacts of a local election, conflict between key (policy) stakeholders due to diverging beliefs in directions of solution
2	**Institutional**	Impeding administrative structures, procedures and routines, impeding laws, rules, regulations and their application, hierarchical structure of organizations and programs
3	**Cultural**	Impeding cultural circumstances and lifestyle patterns
4	**Problem related**	Complexity of the problem(s) to be solved, lack of shared sense of urgency among key stakeholders to sustainable mobility
5	**Involvement, communication**	Insufficient involvement or awareness of key (policy) stakeholders, insufficient consultation, involvement or awareness of citizens or users
6	**Positional**	Relative isolation of the measure, lack of exchange with other measures or cities
7	**Planning**	Insufficient technical planning and analysis to determine requirements of measure implementation, insufficient economic planning and market analysis to determine requirements for measure implementation, lack of user needs analysis: limited understanding of user requirements
8	**Organizational**	Failed or insufficient partnership arrangements, lack of leadership, lack of individual motivation or know-how of key measure persons
9	**Financial**	Too much dependency on public funds (including CIVITAS funding) and subsidies, unwillingness of the business community to contribute financially
10	**Technological**	Additional technological requirements, technology not available yet, technological problems
11	**Spatial**	No permission of construction, insufficient space
12	**Other**	…

Table 7 - Examples of drivers that might foster the measures implementation and success.

NR	Driver field	Examples of drivers
1	**Political / strategic**	Commitment of key actors based on political and/or strategic motives, presence of sustainable development agenda or vision, positive impacts of a local election, coalition between key (policy) stakeholders due to converging (shared) beliefs in directions of solution
2	**Institutional**	Facilitating administrative structures, procedures and routines, facilitating laws, rules, regulations and their application, facilitating structure of organizations and programs
3	**Cultural**	Facilitating cultural circumstances and lifestyle patterns
4	**Problem related**	Pressure of the problem(s) causes great priority, shared sense of urgency among key stakeholders to sustainable mobility
5	**Involvement, communication**	Constructive and open involvement of key policy stakeholders, constructive and open consultation and involvement of citizens or users
6	**Positional**	The measure concerned is part of a (city) program and/or a consequence of the implementation of a sustainable vision, exchange of experiences and lessons learned with other measures or cities
7	**Planning**	Accurate technical planning and analysis to determine requirements of measure implementation, accurate economic planning and market analysis to determine requirements for measure implementation, thorough user needs analysis and good understanding of user requirements
8	**Organizational**	Constructive partnership arrangements, strong and clear leadership, highly motivated key measure persons, key measure persons as 'local champions'
9	**Financial**	Availability of public funds (including CIVITAS funding) and subsidies, willingness of the business community to contribute financially
10	**Technological**	New potentials offered by technology, new technology available
11	**Spatial**	Space for physical projects, experimentation zones
12	**Other**	…

2.4.2 The Process Evaluation approach in DESTINATIONS

The DESTINATIONS process evaluation of measure implementation will be conducted with an innovative and dynamic approach. This involves the continuous monitoring of measure implementation through the facilitation of focus groups attended by the key actors of each local project "action group" in cooperation and synergy with the SUMP activities planned in WP2.

The action groups will be composed by local stakeholders, active citizens and local project partners (according to the approach of each site) and the participants will meet on a regular basis (at least once per year) to discuss the state of the art of the project measures.

WP9 will take advantage of these action groups allowing the Local Evaluation Managers to regularly interview the cities and the participant stakeholders about the progress of the measures implementation pointing out the possible barriers that might delay or, even, hinder the planned activities. These activities will be monitored through webinars and questionnaires according to the CIVITAS SATELLITE requests.

Table 8 below shows how planning can be integrated with implementation, monitoring and evaluation activities in each site while Table 9 shows the main types of stakeholders that are going to be engaged by the project cities.

Figure 8 - Integration of the measures implementation, monitoring and evaluation activities

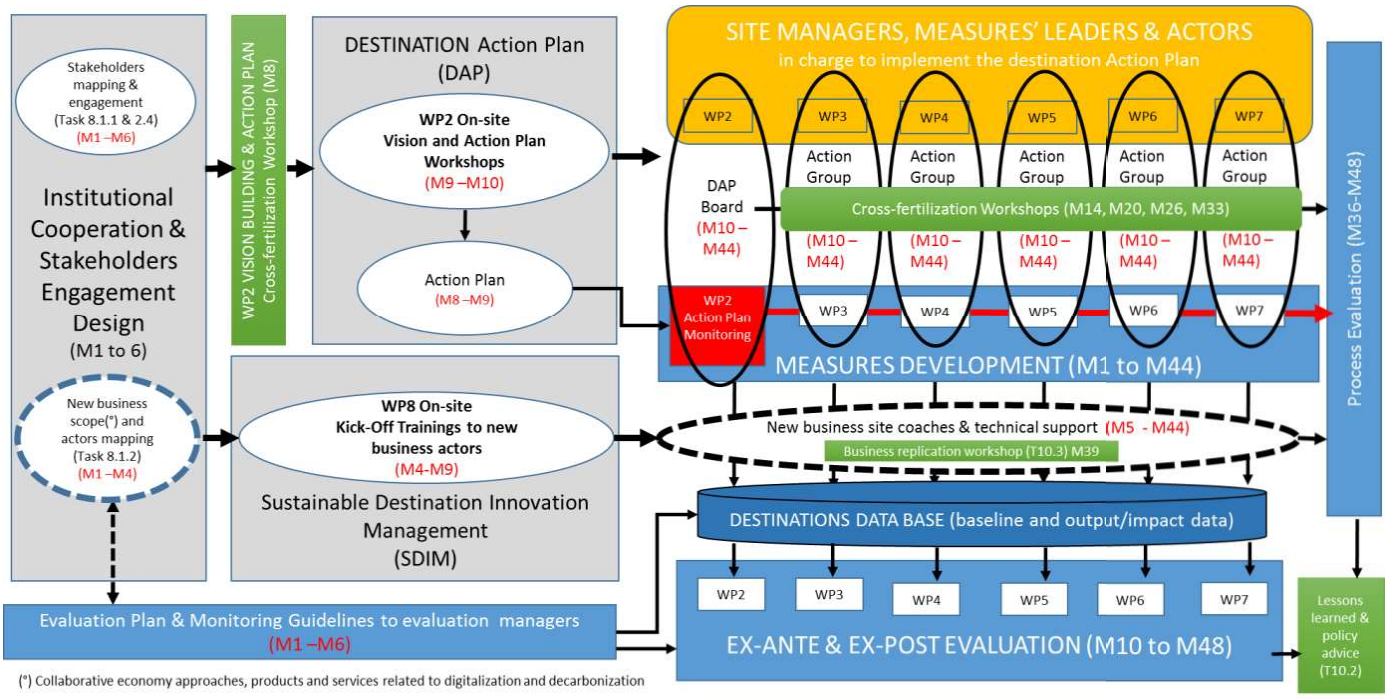


Table 8 - Main stakeholders' types by city

MAD	Municipality of Porto Santo	Electric cars and charging point operators	National association of electric cars	Association for visually impaired	Hotels
LPA	Regional government	Chamber of Commerce	Tourism Board	Regional Transport Authority	Entrepreneur association
RET	Regional unit of Rethymno	Energy Group	Tourism Directorate Crete	Public transport operators	Chamber of commerce
LIM	Limassol Municipality	Electricity authority of Cyprus	Cyprus Tourism Organisation/ multiple tourist boards	LIM Bus Company	Cyprus cycling association
MAL	Local Councils Association	General retailers association	Ministry of Tourism	Transport Malta integrated Transport	Malta hotel associations
ELB	Local Authorities Portoferraio and Marina	Local business association	Local interest groups	Local Public Transport operator	Cycle/ walking groups

2.5 Roles and Responsibilities

2.5.1 Partners and roles

Table 9 below shows the partners involved in this Work Package, highlighting their role and main tasks.

Table 9 - WP9: Partners and roles

Partner	Role
ISINNOVA	The *Project Evaluation Coordinator (PEC*) is responsible for the WP. It coordinates and gives methodological support to the Local Evaluation Managers and the Impact Leaders in performing the evaluation. The PEC also draws conclusions on the evaluation **at project level.**
TUC, VECTOS, EIP, ISINNOVA	The *Impacts Leader (IL*) supports the PEC by defining the methodology of the respective impact category(ies), accordingly providing support to the Local Evaluation Managers, and distilling impact category conclusions for the final evaluation report.
HF, STRATA, TUC, MEMEX, UOM, CINESI	The *Local Evaluation Manager (LEM)* is responsible for the impact and process evaluation at **measure and site level**. LEMs in cooperation with the Measure Leaders are responsible for finalising the local set of indicators, deciding all significant aspects of impacts to be measured. Finally, LEMs are responsible for reporting on impact evaluation and process evaluation and delivering this information through the **MER** and **the Internal Periodic Report** (excel) to the Project Evaluation Coordinator.
All cities Measures Leaders	The *Measure Leaders (ML)* are responsible for organising the preparation, implementation and operation of their measure(s). The MLs also have an important role in the evaluation of their measures

2.5.2 Management and communication flow within WP9

All CIVITAS DESTINATIONS sites will follow the same methodology. Regular local evaluation meetings will be scheduled amongst LEMs, MLs and SCs, possibly on a quarterly basis to follow the course of action and assess the impacts regularly for any required corrective action (a LEMs responsibility). As CIVITAS DESTINATIONS is a project with high seasonality, each indicator needs to clearly indicate the frequency of measurement. If needed, it would be useful to present the peak situation and identify problems caused by/during those peaks to each site. LEMs may decide to make more measurements than advised to better highlight a measure's impact and to recommend how it can be improved.

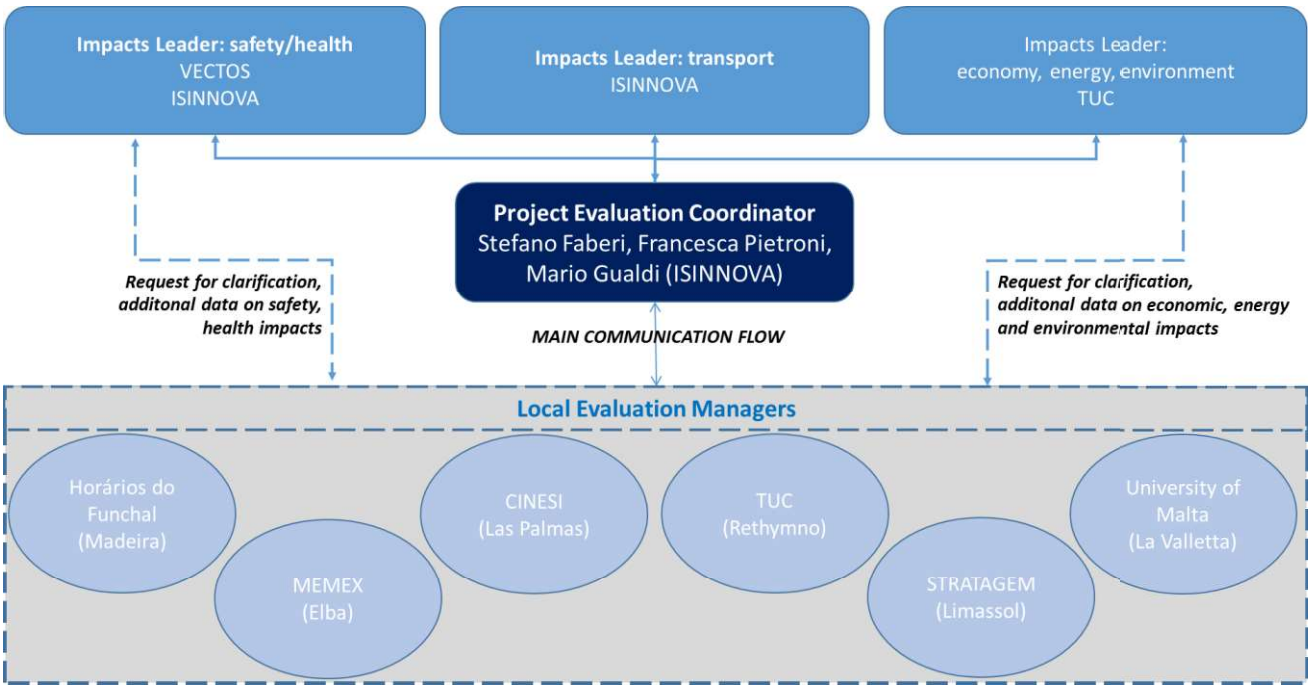
Considering the complexity of our roles and inter-relations, to avoid overlaps, misunderstandings and waste of resources, a **common communication strategy** has been set.

The PEC will be the main point of contact for all the main communication activities and contributions' requests from the LEMs and ILs. Concerning the different categories of impacts indicators at measure, cooperation field (WP) and site level, in case of need the ILs will contact directly the LEMs asking for additional information, clarifications, comments and

suggestions. The MLs will liaise with the LEMs and ILs, which will bring to the attention of the PEC only issues that may have overarching evaluation implications.

The PEC will be in copy in all important communications via email.

Figure 9 - Cooperation flow chart



2.5.3 Activities and responsibilities

The evaluation is performed by the sites (LEMs and MLs) with the methodological support of the Project Evaluation Coordinator (PEC) and the Impacts Leaders (ILs) and consists of the main following activities:

1. Define and agree on common indicators from the proposed CIVITAS DESTINATIONS list (and on additional indicators if necessary) and methodologies for measurements (PEC, ILs, LEMs);
2. Produce evaluation plans containing the methodology description, the detailed measures description, the ex-ante evaluation of the impact indicators, barriers and drivers (PEC, LEMs);
3. Collect data for impact and process evaluation (LEMs and MLs);
4. Perform impact and process evaluation (LEMs and MLs);
5. Report to the PEC on impact evaluation and process evaluation delivering the MER and the PER (LEMs and MLs).

2.6 Data collection

2.6.1 Type of data collection

As explained in a previous CIVITAS project, MIMOSA (where ISINNOVA was the Project Manager), there are in general two different kinds of data that can be used for impact evaluation: data that already are available (e.g. statistics on sold tickets, accident statistics, fine statistics, counts on traffic and users) and data that will be specifically collected for the impact evaluation of a measure. The acquisition of the latter data is called *primary data collection* since the data is collected by the evaluators themselves (or their subcontractors). When data has been already collected and re-analysed or used for impact evaluation, it is called *secondary data analysis*.

It is always advisable to scan already available data for whether it can be useful for impact analysis. This data could for instance be:

- statistics on companies;
- ticket sales numbers;
- accident statistics;
- fine statistics;
- statistics on purchased new vehicles;
- periodic traffic counts and speed measurements;
- public transport passenger surveys;
- mobility surveys.

Often also primary data collection is necessary to monitor the effects of a measure in all selected indicators. Examples for primary data collection are:

- Vehicle counts / vehicle type counts;
- Traffic flow;
- Fuel consumption measurements;
- Measurement of km driven;
- Bicycle user / public transport user surveys;
- Acceptance/ attitude/ perception surveys;
- Mobility surveys.

2.6.2 Surveys

The qualitative data can be collected by using interviews, a data-collection technique involving oral questioning of respondents, either individually or as a group, or written questionnaires, that could be sent by e-mail with clear instructions on how to answer the questions and asking for mailed responses; by gathering all or part of the respondents in one place at one time, giving oral or written instructions, and letting the respondents fill out the questionnaires; or by hand-delivering questionnaires to respondents and collecting them later.[4]

Planning and executing surveys, as all other forms of data collection, is a responsibility of the PEMs and MLs. To provide high quality and consistent data for the evaluation, before starting

[4] MODERN Final Evaluation Plan, 2009

this process some general points concerning surveys and data collection should be highlighted (Cochran, 1963):

- **Objectives of the survey**. A clear statement is always helpful, as it easy to get caught up in the details and make decisions that do not align with the overall objectives.
- **Population to be sampled**. The population is the aggregate group of people or objects of interest. For a questionnaire survey on the opinion of a city's residents about transport and related issues, the population is the number of people in the city. Alternatively, the population could be a specific group in society, such as people who use a specific bus service or tourists that visit a specific site.
- **Relevance of data**. All data that is collected should be relevant and no essential data omitted. With questionnaires there is often a tendency to ask too many questions, some of which are subsequently never analysed. An overlong questionnaire lowers the quality of the answers to the important questions as well as the less important ones and can increase refusal rates.
- **Precision required**. Results of sample surveys are always subject to some uncertainty, because only a part of the population is being included and because of errors in measurement. This uncertainty can be reduced by taking larger samples and by using better means of measurement, but both can be costly. Hence it is important to specify the degree of precision desired in the results; this is further considered later in this section.
- **Method of measurement**. This may include a choice of measurement equipment or approaches to the population, e.g. interview, self-administered questionnaire; use of mail, telephone, email, text message, personal visit, etc.
- **Sampling units**. These are the separate, non-overlapping parts of the population that are to be sampled. This is often obvious, for instance a bus from a fleet of buses. But in sampling people in a city, the unit may be an individual, a family or perhaps drivers, aged 17-20, living in a specific area.
- **Sample selection**. Usually a simple random sample of the population of concern is required (i.e. so that one group within the population has not responded disproportionably compared to another). A plan is required as to how such a random sample is to be selected and the survey administered. A number of different plans may be possible so for each a rough estimate of the sample size (based on the degree of precision required) will help to provide comparative costs (see 3.6.3).
- **Pilot test**. A pilot test of the questionnaire and approach is always useful to identify problems of understanding/interpretation of the questions and of the method of conducting the survey.
- **Fieldwork organisation**. Staff will need special training for administering the survey. Adequate supervision is required and early checking of the quality of the collected information is invaluable.

2.6.3 The sample size[5]

It is important to give proper consideration to the size of the sample required. Too large a sample can be a waste of resources while too small a sample may diminish the usefulness of the results. However it should be remembered that within CIVITAS although an individual

[5] Optimised CIVITAS process and impact evaluation framework. CIVITAS Satellite, 2017

sample for a particular measure may seem insufficient, such survey information can be used in conjunction with comparable survey results from other similar measures to provide a useful and statistically valid outcome.

The main steps involved in deciding a sample size are as follows:

(1) The desired precision of the result needs to be determined. This is likely to be in terms of the accepted confidence interval (or margin of error) around the sampled result and the level of chance that the true result is outside this range. For instance, it may be required that the result lies within +/-3% of the true result and that there is a 95% level of confidence that this is correct. However, the desired precision will also depend on the size of the result expected. For example for modal split, if you are trying to measure the percentage of commuters using a bicycle where the current mode share is only about 2%, a higher precision level (and therefore higher sample of all commuters) may be needed than if you are principally determining the percentage of car users or public transport users.
(2) An appropriate formula for linking n with the desired precision is required.
(3) If results are required for subsets of the population, then separate calculations need to be made for each subset and the total n found by addition.
(4) Usually more than one item or characteristic is measured in a sample survey and each may require a different degree of precision. The required sample values then need to be reconciled.
(5) Finally, the chosen value of n must be appraised to see whether such a sample size is feasible within the resources available. If not, the desired precision may need to be reviewed or greater reliance given to combination with results from similar measures in other cities to give the required precision.

In designing a questionnaire survey, it is easy to become overburdened by trying to generate a perfect random sample whereas in reality a perfect random sample will never be achieved. Whilst measures can be taken to improve the random nature of the sample there will always be some people who will be more inclined to respond to a questionnaire than others. For example, retired people will have more spare time with which to 'get around' to filling in the questionnaire, or because it is quite an emotive issue those more concerned about transport issues will be more inclined to fill it in. It is therefore important to choose sample sizes large enough to have enough respondents within certain sub-samples of interest (e.g. young people compared to old people).

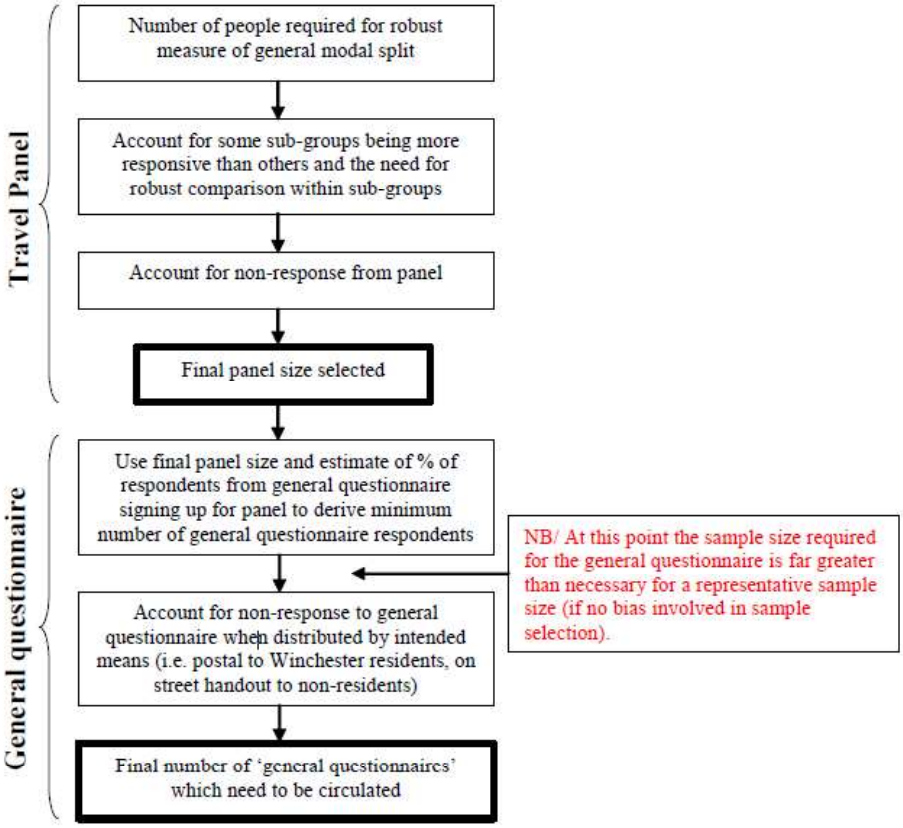
It should be noted that the sample sizes are the numbers required to be returned, and this can differ quite drastically depending on the subject of the questionnaire, incentives for reply and the target group. Local information on response rates from previous questionnaire surveys can be very informative. This response rate will depend on your survey method (e.g. postal, email, face to face, handed out). Of course, there is also the financial limitation on how many questionnaires you can produce/undertake.

Another consideration in determining the number of questionnaires to be distributed is the use of an initial, relatively general questionnaire to recruit people for more detailed questionnaires. As reminded by CIVITAS Satellite, this approach was followed for large-scale travel questionnaires and diaries in Winchester for the MIRACLES project in CIVITAS I.

This approach is called **transport panel.** A transport panel consists of a set of people (the larger, the better) in a city that use the transport system which are contacted a number of

times during the different phases of the measure to take part in a survey or to fill in a questionnaire. The benefits of a transport panel are that the shifting opinions based on the effects of a measure are well recorded. This is more accurate compared with different people that are contacted a number of times.

Figure 10 - Flow diagram showing how sample sizes for large scale questionnaires in Winchester were developed



2.6.4 Advantages and disadvantages of data collection methods

Selection of an appropriate method requires careful consideration of many factors, not the least of which is coverage of the target population. While the method of data collection might be largely dictated by the population coverage and sample frame, other common determinants include survey costs, response rates, and data quality issues. Method selection can also be influenced by the complexity and length of the survey and timeliness needs.

In-person data collection typically yields the most complete coverage, achieves the highest response rate, and produces the best quality data. Not surprisingly, in-person interviews are also the most expensive of the four methods. For this reason, telephone and mail methods are more commonly used despite well-recognized trade-off in data quality. Apart from high cost, other obstacles to personal interview include personal security and access, such as to gated communities, etc.

In a **telephone questionnaire**, respondents are called by survey teams to answer a series of questions which are recorded during the survey. Depending on the scale of the survey, it can be costly to set up the appropriate systems to conduct telephone surveys, though professional agencies may provide a suitable solution. Compared to postal questionnaires, telephone

surveys can get higher response rates, so can be more representative of the population, provided possible bias in the telephone number sampling frame is addressed (e.g. young people using mobile phones). It may also be difficult to obtain a sample within a defined geographical area.

The main advantage of **postal questionnaires** is that they are relatively inexpensive, and they can have a wide geographical distribution. However, postal questionnaires take a long time to send out and get back. Low response rates and incomplete forms are common problems with such methods.

For data collection through the **internet**, respondents are asked to complete a questionnaire on-line, and the results are sent directly into a database allowing the survey team to access the response immediately. They are also relatively cheap to conduct. The problem with such methods is that unless the population being surveyed all have access to the internet, a random sample is difficult to achieve and so the results may be biased to higher socioeconomic groups and younger people who do have access to the internet and miss out other groups.

The table below provides a summary of four methods of data collection along with associated features of each, though the response rates and data quality can be very dependent on the group being sampled, the procedures adopted and country of operation.

Table 10 - Comparison of data collection methodologies (Sharp, 2004)

	In-person	Telephone	Mail	Internet
Description	Interviewer travels to respondent's home or office and administers questions in face-to-face interview	Interviewer contacts respondent and administers questions over the telephone	Questionnaire mailed to respondent and is returned by mail or data retrieved by telephone	Respondent completes survey on web
Coverage	Most complete	Omits non-telephone households	Similar to in-person depending on how the addresses were obtained	Only households with Internet connection or access to Internet
Response Rate	Highest of all modes	Intermediate	Among the lowest	Among the lowest
Data Quality	Highest of all modes	Intermediate	Lowest of all modes	Intermediate; mixed results
Cost	Most expensive (this often leads to geographically clustered sample cases, leading to a reduction in the effective sample size.)	Intermediate	Among least expensive	Among least expensive (though high start-up cost compared to data collection cost)

2.6.5 Data Management

Data collected by the CIVITAS DESTINATIONS project are mainly related to local activities of demo measures design, setup and implementation and then this process deals mostly with responsibilities of Site Managers. This is reflected in the production of Local Data Management Plans for which each site provides its contribution. The overall definition of Data Management procedures has been delivered in the Project Data Management Plan (D1.2).

3 The Evaluation Reporting

3.1 The reporting timeline

Within evaluation, reporting is an issue that should meet the requirements of the different evaluation aspects.

This initial **Project Evaluation Plan** (containing the 6 Local Evaluation Plans) is the basis of the evaluation work and takes into account all the impacts and process evaluation aspects at methodological level and for what concerns the ex-ante evaluation.

At the end of the project, at month 47, the **Final Evaluation Report** will assemble all results at impacts and process level.

From month 12 (Project Evaluation Plan) to month 47 (Final Evaluation Report) a series of reporting documents will be delivered to monitor the progress of measure implementation. These documents will follow the CIVITAS Satellite guidelines.

Table 11 shows the timeline for the next 3 years:

Table 11 - Timeline of deliverables and reports

Date	Deliverables and Reports
31/05/2017 (M9)	Draft version of the Project Evaluation Plan and Local Evaluation plans
31/08/2017 (M12)	Final versions of the Project Evaluation Plan and Local Evaluation plans
30/05/2018 (M21)	First version of the MER[6] (Measure Evaluation Results)
30/05/2018 (M21)	First version of the PER[7] (Process evaluation Report)
31/08/2019 (M36)	Updated version of the MERs and PERs
30/06/2020 (M46)	Final versions of the MER and the PERs
31/07/2020 (M47)	The Final Evaluation Report

3.2 The final evaluation report

As described in Chapter 3, the ex-post measures impact assessment, carried out in the final evaluation report, will allow for the further elaboration of the overall results achieved by the 6 sites.

Starting from the evaluation of each single measure, the document will analyse how the measures worked together under the common cooperation areas (WPs 2-7) and to what extent their results were mutually enhanced due to their synergic actions. This analysis will also

[6] To comply with the CIVITAS Satellite requirements and to follow a common approach the reporting template at measure level for the impact (MER) evaluation has been already defined among the three CIVITAS projects.
[7] Obtained from the information collected in the Intrnal Periodi report: measure status, barriers, drivers, risks

facilitate the estimation of the measures impact at cluster (cooperation areas) level, that will be achieved by summing up the impact indicators (i.e. those concerning the mobility, energy and environmental variables) and, especially for what concerns the social indicators, qualitatively elaborating the results of the corresponding surveys.

Similar work will be carried out to estimate the measures impact at site level but this assessment will be mainly based on qualitative assumptions. Also external positive effects of DESTINATIONS project (local economies, social inclusion, health assessment, migration) will be take into consideration.

In addition to the impact evaluations at cluster and site level, the final report will also contain a summary assessment on the whole evaluation activities, that will focus on the following aspects:

- an overview of the implementation process of the measures (process evaluation) outlining the main barriers the sites have faced, the drivers that have fostered measure implementation and outlining the possible gaps between the initial expectation and objectives and the gained results;
- an evaluation of the issues encountered and the successes obtained at organizational level within the evaluation team, such as organization of the work, points of discussion, resolution of criticalities, relationship among the team members, respect of the deadlines;
- a focus on the data collection methods, with an overview on the surveys, organizations and counting campaigns (when, where and how were they organised, including sample sizes, etc.), description of the methodologies adopted (control sites, baseline data, BAU, cost-benefit analysis, etc.);
- an overview of the more interesting success stories of measure achievement and results;
- the description of lessons learned in relation to the evaluation activities carried out, such as deviations in the measures implementation, relationship with stakeholders throughout the project, access to data, usefulness (or not) of some specific activities.

With the aim of **verifying the data collected** and **interpreting**, in the most accurate way, the **results obtained**, the evaluation will be sustained and fostered through site visits.

The qualitative and quantitative results obtained by the project and the possible discrepancies with project expectations will be discussed by:

- **Meeting** with Local Evaluation Managers, Site and Measure Leaders,
- **Interviews** carried out with sites experts, within and outside the project consortium,
- **Analysis and forecast** on the potential medium, long-term impacts in case the tested measures might be implemented on a wider scale.

4 Annex A: Indicator Definition & Methodology Sheets

1 Economy

Core Indicator 1:	**Average operating revenue**
Category:	Economy
Sub-category:	Benefits
Impact aspects:	Operating revenues
Context and relevance	This indicator focuses on the changes in operating revenues as a result of CIVITAS measure(s) and, therefore, on the economic perspective of the intended measure packages. In addition to social and environmental perspectives, the inclusion of the economic perspective of new measure(s) is important for a complete sustainable development assessment. Many CIVITAS measures will have direct or indirect impacts on operating revenues, including demand change (e.g. more PT users due to improved service), changed cost (e.g. using clean vehicles or using alternative fuels), new services (car pooling and car sharing). This indicator should be applied to all transport services including passenger and freight transport. For a complete picture of the economic performance of new measures, this core indicator needs to be considered in conjunction with core indicators 2A "Capital Costs" and 2B "Average operating costs".
Definition	**Average operating revenue** is defined as the ratio of total income generated from fares and tickets divided by the total passenger-km or vehicle-km completed by the service in a given time period (for example day, week, month or year). So: A = B / C A = Average operating revenue for the service (€/pkm or €/vkm) B = Total operating revenue for the service (€) C = Total passenger-kilometres (pkm), or total vehicle-kilometres (vkm) for the service **Unit**: €/pkm or €/vkm
Methods of measurement	**Method of data collection**: The data needed can be provided by service operators or derived from other data available. Services with and without CIVITAS measures (e.g. buses using alternative fuels against those using traditional fuels such as petrol/diesel) should be counted separately to show the impacts of the measures. The results from cases without CIVITAS measures can be used for baseline or business-as-usual assessments. **Frequency:** Once a year until the end of the project **Accuracy**: The data about operating revenues and vkm or pkm of each type of vehicle should be kept as complete as possible. **Target group**: transport services operators **Domain:** demonstration area and/or city
References:	

Core Indicator 2A	**Capital costs**
Category:	Economy
Sub-category:	Costs
Impact aspects:	Investment costs
Context and relevance	This indicator focuses on the capital costs as a result of CIVITAS measure(s) and, therefore, on the economic perspective of the intended measure packages. In this indicator, two cost categories are distinguished: capital investment costs in infrastructure, equipment, vehicles and preparation and design costs. In addition to social and environmental perspectives, the inclusion of the economic perspective of new measure(s) is important for a complete sustainable development assessment. Most CIVITAS measures will have preparation and design costs and at least some capital investment costs in purchasing infrastructure and equipment necessary for the measure. This indicator should be applied to all transport services including passenger and freight transport. For a complete picture of the economic performance of new measures, this core indicator needs to be considered in conjunction with core indicator 1 “Average operating revenues” and indicator 2B “Average Operating Costs”
Definition	**Capital investment cost** is defined as the total capital costs for the purchase of infrastructure, equipment and vehicles.**Unit**: € Preparation and design cost is defined as total costs expended in setting up the measure and cover a period from the initiative of the measure preparation until the start of the measure implementation. **Unit**: €
Methods of measurement	**Method of data collection**: The data needed should be provided by service providers or derived from other data available. **Frequency:** Once at the start of the project **/** revised following implementation **Accuracy**: The data should be as complete and accurate as possible. Where such information is particularly sensitive a cost range may be acceptable. Comments on the elements of the costs which are specific to an initial trial rather than a more general application should be made. **Target group**: transport services providers **Domain:** demonstration area and/or city
References:	

Core Indicator 2B	**Average Operating costs**
Category:	Economy
Sub-category:	Costs
Impact aspects:	Operating costs
Context and relevance	This indicator focuses on the changes in operating costs as a result of CIVITAS measure(s) and, therefore, on the economic perspective of the intended measure packages. In addition to social and environmental perspectives, the inclusion of the economic perspective of new measure(s) is important for a complete sustainable development assessment. Many CIVITAS measures will have direct and indirect impacts on operating costs, including demand change (e.g. more PT users due to improved service), changed cost (e.g. using clean vehicles or using alternative fuels), new services (car pooling and car sharing). This indicator should be applied to all transport services including passenger and freight transport. For a complete picture of the economic performance of new measures, this core indicator needs to be considered in conjunction with core indicator 1 “Average operating revenues”
Definition	**Average operating cost** is for measures with a direct relation to transport defined as the ratio of total operating costs incurred by a service divided by the total passenger-km, vehicle-km or tonne-km completed by the service in a given time period (for example day, week, month or year). Operating costs include, for example, the personnel costs, fuel, electricity and maintenance costs for the vehicle(s) involved. The maintenance costs should include not only the regular weekly/annual maintenance, but also longer term maintenance, such as engine replacement. They do not include the initial investment costs in vehicles and infrastructure, etc, which should be identified separately. So: A = B / C, where: A = Average operating cost for the service (€/pkm or €/vkm), B = Total operating cost for the service (€), C = Total passenger-kilometres (pkm), or total vehicle kilometres (vkm), or total tonne kilometres (tkm) for the service **Unit**: €/pkm or €/vkm or €/tkm There is also a second category of average operating costs for measures not directly related to transport (e.g. mobility information campaign, mobility service center). For this category the operating costs are for example, the personnel costs and maintenance costs. These costs should be divided per time period to calculate the average value. **Unit**: €/time period
References:	

2 Energy

Core Indicator 3:	**Vehicle fuel efficiency**
Category:	Energy
Sub-category:	Energy consumption
Impact aspects:	Fuel consumption
Context and relevance	Worldwide, the transport sector consumes more than 60 per cent of oil products, which constitute about 98 per cent of transport energy use (OECD, *Working Group on the State of the Environment*, Oct. 1999). The structure of energy consumption by transport is directly related to the composition of pollutant emissions. Furthermore, growth in road transport was the main cause of the increase in energy use up to 1997 (*EEA*, 2001). The increasing use of heavier, more powerful cars and trucks, together with low occupancy rates and load factors, have offset improvements in fuel economy – mostly related to engine technology. Higher vehicle fuel efficiency means less fuel consumption and lower emissions (at the same level of traffic demand). Many CIVITAS measures will have impacts on fuel efficiency including clean vehicles (freight and passenger transport), alternative fuels, car pooling and increased PT use (resulting in higher PT occupancy, reduced private car use and reduced congestion).This is one of the main indicators used to measure the environment impacts of CIVITAS measures.
Definition	Vehicle fuel efficiency is defined as the energy consumption per unit of transport activity. This should be derived by vehicle type and fuel type. In CIVITAS, the indicator is used to compare vehicle fuel efficiency with and without the measures. Vehicles: car, bus, lorry, tram, metro. For road vehicles, the distribution of vehicles should ideally be based on COPERT categories. Fuels: petrol, diesel, liquefied petroleum gas, compressed natural gas, alcohol mixtures, hydrogen, bio-fuels, electricity and others. So: A = B / C where: A = Average vehicle energy efficiency (MJ/vkm) energy consumed for the vehicle(s) (by type and fuel) considered, unit: (MJ) amount of vehicle-kilometres completed by the vehicle(s) (by type and fuel) considered, unit: (vkm) Unit: MJ/vkm

Methods of measurement	**Method of data collection**: For commercial vehicles (PT and freight fleet), fuel consumption by each type of vehicle and the corresponding vehicle-km and passenger-km can be collected from service operators, by recording fuel used and passenger-km or vehicle-km completed during the given periods. Vehicles using both traditional fuels and alternative fuels should be included. The results from former cases can be used for baseline or business-as-usual assessments. For passenger cars, the data may be obtained from local or national sources such as transport statistics report or others. Information from other relevant sources are also useful for the measurement including vehicles manufacturers, fuel producers and distributors, national automobile Clubs, specialised magazines, national (or regional) environment protection agencies, goods transport associations, other transport associations. **Frequency:** Data should be collected on an annual basis. Measurements should be made at least twice, i.e. before the CIVITAS measure is introduced (baseline) and at the end of the project (ex-post), and once a year during the project where appropriate. **Accuracy**: For commercial vehicles, the records of fuel consumption and vkm or pkm associated with a group of vehicles (by vehicle type and fuel) should be kept as complete as possible. **Target group**: commercial vehicles (PT and freight transport)
References:	Methodology Report of COPERT III Computer to calculate emissions from road transport (http://vergina.eng.auth.gr/mech/lat/copert/copert.htm) Sustainable Seattle, 1998. Indicators of Sustainable Community: www.sustainableseattle.org UN Department for Policy Coordination and Sustainable Development (DPCSD), 1997. Indicators of Sustainable Development, Framework and Methodologies, 1996-1997. Gopher: //gopher.un.org/00/esc/cn17/1996-97/indicators/SOCIAL.IND%09%09%2B - 'Cities for Climate Protection': http://www.iclei.org/transit.htm

Core Indicator 4:	**Fuel mix**
Category:	Energy
Sub-category:	Energy consumption
Impact aspects:	Fuel consumption
Context and relevance	Despite efforts at the EU level to promote alternative (electricity, natural gas, fuel cells) and renewable energy sources (bio-fuels) for transport, these still have a low penetration. The consumption of all petrol sold in the EU, expressed in oil equivalents, increased by 2.5 % per year between 1985 and 1998. The consumption of LPG and natural gas for transport increased less rapidly (about 1.8 % and 2.0 % per year, respectively, between 1985 and 1998). The share of LPG and natural gas in total energy consumption by road transport has thus decreased (from 1.5 % in 1985 to 1.4 % in 1998). However, this share was lowest in 1992 (1.2 %) and has since increased (except for a minor decline in 1996). Although alternative fuels still account for only a small fraction of total fuels sold, their usage is increasing (EEA, *Uptake of Cleaner Fuels*, 2001). Many CIVITAS measures will have impacts on fuel use including clean vehicles (freight and passenger transport), alternative fuels, car pooling and increased PT use (resulting in higher PT occupancy, reduced private car use and reduced congestion).
Definition	**Fuel mix** is the percentage of the market share of transport fuel for each type of fuel used in a given period. Fuel mix can be measured at the transport operator level or at a wider level (e.g. city). Fuels: petrol, diesel, liquefied petroleum gas, compressed natural gas, alcohol mixtures, hydrogen, bio-fuels, electricity and others. So: A = B / C where: A = Fuel mix, or percentage for the fuel considered (%) B = total energy consumption for the fuel considered (MJ) C = Total energy consumption for all transport vehicles (MJ) **Unit**: % The calculation will be made for the PT but it can also extend to private vehicles.

Methods of measurement	**Method of data collection**: Data about fuel mix can be collected at the service level or a city level. For assessment at a service level (PT and freight fleet), the service operators are required to record all information about each type of fuel consumed on an annual basis. By comparing the results with and without CIVITAS measures, the indicator can be used to measure the impacts of CIVITAS measures on alternative fuel use. For assessment at a city level, the total annual vkm of all vehicles should be split by vehicle type and fuel type. For each fuel type, the total amount of vkm driven multiplied by the corresponding vehicle fuel efficiency factor will provide the market share for the fuel type considered. Information about fuel consumption and transport can be obtained from local or national source such as transport statistics reports or others. Information from other relevant sources is also useful such as vehicles manufacturers, fuel producers and distributors, national automobile clubs, specialised magazines, national (or regional) environment protection agencies, goods transport associations, other transport associations. **Frequency:** Data should be collected on an annual basis. Measurements should be made at least twice, i.e. before the CIVITAS measure is introduced (baseline) and at the end of the project (ex-post), and also, if possible, once a year during the project as appropriate. **Accuracy**: For assessment at a service level, the records of fuel consumptions of all vehicles (by vehicle type and fuel) should be kept as complete as possible. **Target group**: transport operators or city

Core Indicator 4:	**Fuel mix**
References:	Directive 98/70/EC1 relating to fuel quality sets quantitative targets for 1 January 2000, including (1) phase out leaded petrol; (2) reduction of the sulphur content in petrol and diesel to a maximum of 150 and 50 mg/kg, respectively; (3) reduction of the benzene content of petrol to a maximum of 1 %. With Directive 98/70/EC, an almost complete phase-out of leaded fuel should be achieved in 2000. Due to derogations, however, a complete phase-out will not be achieved before 2005.

Core Indicator 5:	**Used Cooking Oil collection – New (TUC)**
Category:	Energy
Sub-category:	Energy use
Impact aspects:	Energy resources
Context and relevance	"Waste cooking oils are purified fats of plant or animal origin, which are liquid at room temperature. Like all fats, cooking oils are esters of glycerol and a varying blend of fatty acids, are biodegradable, insoluble in water, but soluble in organic solvent. Cooking oils are generally processed and used in the production of products fit for human consumption and do not contain toxic substances." (EEA) Used cooking oil refers to oil degraded after it is used for cooking or frying at home or HORECA facilities. The total amount of UCO in Europe is estimated to be near 1 million tonnes (Ecofys). UCO can be converted to biodiesel - a form of diesel that can be used directly or after mix with regular diesel to diesel fueled cars – with a method called esterification. Some cities like Rethymno with installed infrastructure to collect UCO and relevant DESTINATIONS measures will expand this infrastructure, others will launch new collection systems.
Definition	**UCO collection** is defined as total volume of UCO collected annually. **Unit**: m^3
Methods of measurement	**Method of data collection**: UCO collection authority will measure the collected volume every time the collection truck collects the available UCO in the containers. UCO should be collected regularly to avoid lost volume due to full containers. Collection authority should keep constant records of the collection volume. Measurements must be done in volume or by weight after the density of UCO is measured. **Frequency:** The collected UCO volume must be registered directly after collection. **Accuracy**: Results from monitoring stations will be affected by many factors such as sites and weather conditions etc. Therefore, care must be taken in planning such measurements. In order to obtain more reliable and accurate data, cities which already use a traffic and dispersion model should apply them. **Target group**: population of city or demonstration area **Domain:** city and/or demonstration area
References:	Ecofys, 2013. Low ILUC potential of wastes and residues for biofuels: straw, forestry residues, UCO, corn cobs.

3 Environment

Core Indicator 6:	**CO level**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact aspects:	Air quality
Context and relevance	CO is produced by the incomplete burning of carbon in fuels. High concentrations of CO occur along roadsides in heavy traffic, particularly at major intersections. The health effects of CO vary depending on the length and intensity of exposure and the health of the individual. Effects of CO include dizziness, headache, fatigue, visual impairment, reduced work capacity, reduced manual dexterity, and poor learning ability. Although CO is now not seen as a problem at all in many western European cities, this may not be the case for some eastern European cities. Many of the measures included in the CIVITAS projects aim either directly (through incentives to promote the use of cleaner fuels or vehicles or more environmentally friendly behaviours) or indirectly (e.g. congestion reduction and access restriction measures) at reducing the emission and the level of air pollutants. In such a context, the success or the failure of the measures must be assessed by taking into account air quality indicators. Yet some of the indicators were excluded either because their determinants are going to be gradually reduced (or substituted) from fuels (e.g. sulphur, benzene) – making it difficult to assess whether the improvements are to be attributed to CIVITAS - or because their impact on health has not yet been fully demonstrated.
Definition	**CO level** is defined as the average hourly (or peak/off-peak) CO concentration over a full year. **Unit**: ppm or g/m^3
Methods of measurement	**Method of data collection**: For data collection through monitoring stations, the measurement points should be located where CIVITAS measures should have an impact on the environment. Other approaches such as simulation can also be used. For local models used, a full description of the assumptions would be needed. In addition, the simulation models used should be validated to increase the credibility of the results. **Frequency:** At monitoring stations, average hourly concentration levels need to be collected daily over a year. Calculation of the average concentration levels should be made once a year until the end of the project **Accuracy**: Results from monitoring stations will be affected by many factors such as sites and weather conditions etc. Therefore, care must be taken in planning such measurements. In order to obtain more reliable and accurate data, cities which already use a traffic and dispersion model should apply them. **Target group**: : population of city or demonstration area **Domain:** city and/or demonstration area

References:	Several air quality limit values for ambient concentrations have been set to protect human health. Current EU legislation (the EC Framework Directive on Ambient Air Quality and Management (CEC, 1996) and related daughter Directives) is based on WHO-recommended threshold values. For CO the objective to be met before 1-1-2005 is 10 mg/m^3 (max daily 8h concentration). WHO guidelines for Europe, 1996 set the target values of 30 mg/m3 (1 hour average) and 10 mg/m^3 (8 hours).

Core Indicator 7:	**NO_x level**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact aspects:	Air quality
Context and relevance	Exposure to air pollution is associated with adverse health effects, most acute in children, asthmatics, and the elderly (WHO/EEA, 1997), and can damage vegetation (foliar injuries and reductions in yield and seed production) and materials (notably, the cultural heritage). Within the transport sector, road traffic is the most important contributor to urban air pollution. National and EU regulations aimed at automobile emission reductions (such as the introduction of catalytic converters or unleaded petrol) have resulted in considerably lower emissions per vehicle, but the continuous expansion of the vehicle fleet is partly offsetting these improvements. Many of the measures included in the CIVITAS projects aim either directly (through incentives to promote the use of cleaner fuels or vehicles or more environmentally friendly behaviours) or indirectly (e.g. congestion reduction and access restriction measures) at reducing the emissions and the level of air pollutants. In such a context, the success or the failure of the measures must be assessed by taking into account air quality indicators. Yet, some of them were excluded either because their determinants are going to be gradually reduced (or substituted) from fuels (e.g.: sulphur, benzene) – making it difficult to assess whether the improvements are to be attributed to CIVITAS - or because their impact on health has not yet been fully demonstrated. NOx levels are important to assess air quality both for their own toxicity and for their contribution, under certain conditions, to particulate level (which would not be otherwise taken into account).
Definition	**NO_x level** is defined as the average hourly (or peak/off-peak) NOx concentration over a full year. **Unit**: ppm or g/m^3

Methods of measurement	**Method of data collection**: For data collection through monitoring stations, the measurement points should be located where CIVITAS measures should have an impact on the environment. Other approaches such as simulation can also be used. For local models used, a full description of the assumptions would be needed. In addition, the simulation models used should be validated to increase the credibility of the results. **Frequency:** At monitoring stations, average hourly concentration levels need to be collected daily over a year. Calculation of the average concentration levels should be made once a year until the end of the project **Accuracy**: Results from monitoring stations will be affected by many factors such as sites and weather conditions etc. Therefore, care must be taken in planning such measurements. In order to obtain more reliable and accurate data, cities which already use a traffic and dispersion model should apply them. **Target group**: : population of city or demonstration area **Domain:** city and/or demonstration area
References:	Several air quality limit values for ambient concentrations have been set to protect human health. Current EU legislation (the EC Framework Directive on Ambient Air Quality and Management (CEC, 1996) and related daughter Directives) is based on WHO-recommended threshold values. For NO_2 the objective to be met before 1-1-2005 is 200 µg/m^3 (8 hour average) and 40 µg/m^3 (year). WHO guidelines for Europe (1996) set the target values of 200 µg/m^3 (1 hour average).

Core Indicator 8:	**Particulate levels**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact aspects:	Air quality
Context and relevance	Exposure to air pollution is associated with adverse health effects, most acute in children, asthmatics, and the elderly (WHO/EEA, 1997), and can damage vegetation (foliar injuries and reductions in yield and seed production) and materials (notably, the cultural heritage). Within the transport sector, road traffic is the most important contributor to urban air pollution. National and EU regulations aimed at automobile emission reductions (such as the introduction of catalytic converters or unleaded petrol) have resulted in considerably lower emissions per vehicle, but the continuous expansion of the vehicle fleet is partly offsetting these improvements. Particulate matter irritates the membranes of the respiratory system, causing increased respiratory symptoms and disease, decreased lung function, alteration of the body's defence system, and premature mortality. In addition to health problems, airborne particles cause soiling and damage to materials and reduce visibility. Many of the measures included in the CIVITAS projects aim either directly (through incentives to promote the use of cleaner fuels or vehicles or more environmentally friendly behaviours) or indirectly (e.g. congestion reduction and access restriction) at reducing emissions and levels of air pollutants. In such a context, the success or the failure of the measures must be assessed taking into account air quality indicators. Particulate matter can be emitted directly by a source or formed by the transformation of gaseous emissions such as SO_x, NO_x, and volatile organic compounds (VOC): this is why a direct measurement (or estimate) is necessary.
Definition	**Particulate level** is defined as the average hourly (or peak/off-peak) PM_{10} and $PM_{2.5}$ (if possible) concentration over a full year. **Unit**: ppm or g/m^3
Methods of measurement	**Method of data collection**: For data collection through monitoring stations, the measurement points should be located where CIVITAS measures should have an impact on the environment. Other approaches such as simulation can also be used. For local models used, a full description of the assumptions would be needed. In addition, the simulation models used should be validated to increase the credibility of the results. **Frequency:** At monitoring stations, average hourly concentration levels need to be collected daily over a year. Calculation of the average concentration levels should be made once a year until the end of the project **Accuracy**: Results from monitoring stations will be affected by many factors such as sites and weather conditions etc. Therefore, care must be taken in planning such measurements. In order to obtain more reliable and accurate data, cities which already use a traffic and dispersion model should apply them. **Target group**: population of city or demonstration area **Domain:** city and/or demonstration area

References:	Several air quality limit values for ambient concentrations have been set to protect human health. Current EU legislation (the EC Framework Directive on Ambient Air Quality and Management (CEC, 1996) and related Directives) is based on WHO- recommended threshold values. For PM_{10} the target to be met before 1-1-2005 is an annual mean of 40µg/m^3 (50µg/m^3 on 24h av.). Before 1-1-2010 the target threshold is 20µg/m^3 on an annual mean.

Core Indicator 9:	**Level of VOC – new (TUC)**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact aspects:	Air quality
Context and relevance	Volatile Organic Compounds (VOCs) are "Organic chemical compounds that under normal conditions are gaseous or can vaporise and enter the atmosphere. VOCs include such compounds as methane, benzene, xylene, propane and butane. Methane is primarily emitted from agriculture (from ruminants and cultivation), whereas non-methane VOCs (or NMVOCs) are mainly emitted from transportation, industrial processes and use of organic solvents." (EEA 1) NMVOCs particularly "contribute to the formation of ground-level (tropospheric) ozone, and certain species such as benzene and 1,3 butadiene are directly hazardous to human health" (EEA 2). Emissions of VOC occur when there is combustion of carbon compounds. Emissions are the result of incomplete combustion, spillage or evaporative emissions. Exposure to VOCs can cause chronic diseases, such as cancer, central nervous system disorder, liver and kidney failure, reproductive system disease, and various embryonic
Definition	**Level of VOC** is defined as the average hourly (or peak/off-peak) VOC concentration over a full year. **Unit**: ppm or g/m^3
Measurement	**Method of data collection**: For data collection through monitoring stations, the measurement points should be located where CIVITAS measures should have an impact on the environment. Other approaches such as simulation can also be used. For local models used, a full description of the assumptions would be needed. In addition, the simulation models used should be validated to increase the credibility of the results. **Frequency:** At monitoring stations, average hourly concentration levels need to be collected daily over a year. Calculation of the average concentration levels should be made once a year until the end of the project **Accuracy**: Results from monitoring stations will be affected by many factors such as sites and weather conditions etc. Therefore, care must be taken in planning such measurements. In order to obtain more reliable and accurate data, cities which already use a traffic and dispersion model should apply them. **Target group**: population of city or demonstration area **Domain:** city and/or demonstration area
References:	EEA 1. VOC - http://www.eea.europa.eu/themes/air/air-quality/resources/glossary/voc EEA 2. NMVOCs http://www.eea.europa.eu/data-and-maps/indicators/eea-32-non-methane-volatile-1/assessment-4 CIVITAS ELAN - Sustainable Electro mobility Plan for Ljubljana p.30

Core Indicator 10:	**CO_2 level – new (TUC)**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact aspects:	Air quality
Context and relevance	Directly and indirectly, fossil fuels provide the energy for almost all transport activities. Transport is the fastest growing energy consumer in the EU. Carbon dioxide emissions (CO_2) are also a surrogate for the use of fossil fuels (EEA). Transportation CO_2 emissions account for more than 24% in total 2014 emissions in the European Union. (EU) Many of the measures included in the CIVITAS projects aim either directly (through incentives to promote the use of cleaner fuels or vehicles or more environmentally friendly behaviours) or indirectly (e.g. congestion reduction and access restriction measures) at reducing the emission and the level of air pollutants. In such a context, the success or the failure of the measures must be assessed by taking into account air quality indicators. Yet some of the indicators were excluded either because their determinants are going to be gradually reduced (or substituted) from fuels (e.g. sulphur, benzene) – making it difficult to assess whether the improvements are to be attributed to CIVITAS – or because their impact on health has not yet been fully demonstrated.
Definition	**CO_2 level** is defined as the average hourly (or peak/off-peak) CO concentration over a full year. **Unit**: ppm or g/m^3
Methods of measurement	**Method of data collection**: For data collection through monitoring stations, the measurement points should be located where CIVITAS measures should have an impact on the environment. Other approaches such as simulation can also be used. For local models used, a full description of the assumptions would be needed. In addition, the simulation models used should be validated to increase the credibility of the results. **Frequency:** At monitoring stations, average hourly concentration levels need to be collected daily over a year. Calculation of the average concentration levels should be made once a year until the end of the project **Accuracy**: Results from monitoring stations will be affected by many factors such as sites and weather conditions etc. Therefore, care must be taken in planning such measurements. In order to obtain more reliable and accurate data, cities which already use a traffic and dispersion model should apply them. **Target group**: population of city or demonstration area **Domain:** city and/or demonstration area
References:	EEA (2001) p.14 EU Energy in Figures European Commission Statistical Pocketbook 2016 p.164

Core Indicator 11:	**CO_2 emissions**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact aspects:	Emissions
Context and relevance	Carbon dioxide is the most significant greenhouse gas, contributing about 80% of total EU greenhouse gas emissions. In Europe, carbon dioxide emissions result primarily from the combustion of fossil fuels in energy industries (32% in 1998), transport (24%) and industry (22%). Other sources, including domestic and commercial, contributed 20%. Emissions from transport increased by 15% between 1990 and 1998, while emissions from other sectors fell or remained almost stable. Carbon dioxide emission reductions from the use of energy could be achieved by fuel conversion, increased efficiency, reducing energy demand and increased use of non-fossil energy sources. The upward trend in CO_2 emissions from transport is due mainly to growing traffic volumes, as there has been very little change in average energy use per vehicle-km. Recent projections (EC, 2000) suggest that existing policies and measures would at best limit the increase of total EU carbon dioxide emissions to 3% by 2010, from 1990 levels (based on projections by the Member States that have measures in place). Initial results from the (draft) study on the economic evaluation of sectoral emission reduction objectives for climate change (EC, 2000) suggest that the increase of total EU emissions will be 4%. According to the EC, the largest increase in CO_2 emissions would be in the transport sector: 25% from 1990 levels assuming implementation of the EU strategy to reduce emissions from cars ('ACEA agreement') or 35% without the ACEA agreement. Many CIVITAS measures will have impacts on CO_2 emissions directly (through incentives to promote the use of cleaner fuels or vehicles or more environmentally friendly behaviours) or indirectly (e.g. congestion reduction and access restriction measures). This indicator can be used to assess the impacts of such measures on CO_2 reduction.
Definition	**CO_2 emissions** is defined as the average CO_2 emissions per vehicle-km by vehicle and fuel types **Unit**: g/vkm Vehicles: car, bus, lorry, tram, metro. For road vehicles, vehicle split should be based on the COPERT category. Fuels: petrol, diesel, electricity, liquefied petroleum gas (LPG), natural gas, alcohol mixtures, hydrogen and bio-fuels
Measurement	**Method**: CO_2 emissions can be measured by many methods including field trials or modelling. The COPERT software can be used to estimate emissions of all regulated air pollutants (see http://vergina.eng.auth.gr/mech/lat/copert/copert.htm) (CO, NOx, VOC, PM) produced by different vehicle categories (passenger cars, light duty vehicles, heavy duty vehicles, mopeds and motorcycles) as well as CO_2 emissions on the basis of fuel consumption. Other software may also be appropriate **Frequency:** Measurements should be made at least twice, i.e. before the CIVITAS measure is introduced (baseline) and at the end of the project (ex-post), or once a year during the project where appropriate. **Accuracy**: as good as can be obtained within limits of models/resources available **Target group**: vehicles in demonstration area **Domain:** city and/or demonstration area

References:	The limits for CO_2, CH_4 and N_2O emissions at national levels are regulated by the UN Framework Convention on Climate Change (UNFCCC) Kyoto Protocol. Countries that ratify the Protocol agree to reduce aggregate anthropogenic CO_2 equivalent emissions of greenhouse gases by at least 5% below 1990 levels in the period 2008-2012.

Core Indicator 12:	**CO emissions**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact aspects:	Emissions
Context and relevance	Emissions from the transport sector represent a high proportion of overall man-made emissions in industrialized countries. Most of these emissions are directly related to the consumption of energy by transport activities world-wide, the transport sector consumes more than 60% of oil products, which constitute about 98% of transport energy use. These emissions are further influenced by a number of factors, including type and size of the engine, type and quality of fuel used, average fuel efficiency, the age of the vehicle, etc. (*Working Group on the State of the Environment*, OECD, 1999). Specific CO emissions (per pkm) from passenger cars fell significantly (73% in 1998 compared to 1981). Emissions of CO from public transport remained substantially unchanged in the same period. Specific emissions of CO from public transport could fall significantly by increasing occupancy rates. Without such improvements public transport has relatively high specific emissions per pkm compared to passenger cars. Many of the measures in CIVITAS projects aim either directly (through incentives to promote the use of cleaner fuels or vehicles or more environmentally friendly behaviours) or indirectly (e.g. congestion reduction and access restriction) at reducing the emissions and the level of air pollutants. Moreover, as far as PT is concerned, one of the main CIVITAS objectives is to increase PT patronage (to the detriment of the "car mode") thus increasing the occupancy rates of PT vehicles. In such a context, the success or failure of the measures must be assessed by taking into account emission indicators. Yet some of the indicators were excluded either because their determinants are going to be gradually reduced (or substituted) from fuels (e.g. sulphur, benzene) – making it difficult to assess whether the improvements are to be attributed to CIVITAS - or because their impact on health has not been fully demonstrated yet (VOC).
Definition	**CO emissions** are defined as the annual average CO emission per vehicle-km by vehicle and fuel type. **Unit**: g/vkm Vehicles: car, bus, lorry, tram, metro. For road vehicles, vehicle split should be based on the COPERT category. Fuels: petrol, diesel, electricity, liquefied petroleum gas (LPG), natural gas, alcohol mixtures, hydrogen and bio-fuels.
Measurement	**Method**: CO emissions can be measured through many methods including field trials or modelling. The COPERT software (see http://vergina.eng.auth.gr/mech/lat/copert/copert.htm) emissions of all regulated air pollutants (CO, NOx, VOC, PM) produced by different vehicle categories (passenger cars, light duty vehicles, heavy duty vehicles, mopeds and motorcycles) as well as CO_2 emissions on the basis of fuel consumption. **Frequency:** Measurements should be made at least twice, i.e. before the CIVITAS measure is introduced (baseline) and at the end of the project (ex-post), or once a year during the project where appropriate. **Accuracy**: as good as can be obtained within limits of models/resources available **Target group**: vehicles in demonstration area **Domain**: city and/or demonstration area
References:	Kyoto Protocol targets for emissions on a national level (no targets set on a city level).

Core Indicator 13:	**NO_x emissions**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact aspects:	Emissions
Context and relevance	After increasing slightly in the early 1980s, specific NO_x emissions (per pkm) from passenger cars fell significantly (56% compared to 1981), mainly as a result of the introduction of catalytic converters. For heavy and light duty trucks specific NO_x emissions also decreased markedly by 29% between 1981 and 1998. Specific NO_x emissions from buses were stable during the same period, mainly because of decreases in occupancy rates. Specific NO_x emissions are projected to continue to decline. Many of the measures in the CIVITAS projects aim either directly (through incentives to promote the use of cleaner fuels or vehicles or more environmentally friendly behaviors) or indirectly (e.g. congestion reduction and access restriction) at reducing the emissions and the level of air pollutants. In such a context, the success or failure of the measures must be assessed by taking into account emission indicators. Yet some of the indicators were excluded either because their determinants are going to be gradually reduced (or substituted) from fuels (e.g. sulphur, benzene) – making it difficult to assess whether the improvements are to be attributed to CIVITAS - or because their impact on health has not been fully demonstrated yet (VOC).
Definition	**NO_x emission** is defined as the annual average NO_x emission per vehicle-km by vehicle and fuel type. **Unit**: g/vkm Vehicles: car, bus, lorry, tram, metro. For road vehicles, vehicle distribution should be based on COPERT categories. Fuels: petrol, diesel, electricity, liquefied petroleum gas (LPG), natural gas, alcohol mixtures, hydrogen and bio-fuels
Measurement	**Method**: NO_x emissions can be measured through many methods including field trials or modelling. The COPERT software (see http://vergina.eng.auth.gr/mech/lat/copert/copert.htm) can be used to estimate emissions of all regulated air pollutants (CO, NO_x, VOC, PM) produced by different vehicle categories (passenger cars, light duty vehicles, heavy duty vehicles, mopeds and motorcycles) as well as CO_2 emissions on the basis of fuel consumption. **Frequency:** Measurements should be made at least twice, i.e. before the CIVITAS measure is introduced (baseline) and at the end of the project (ex-post), or once a year during the project where appropriate. **Accuracy**: as good as can be obtained within limits of models/resources available **Target group**: vehicles in demonstration area **Domain:** city and/or demonstration area
References:	The Directives on emission standards for new passenger cars and trucks should result in significant reductions of specific NO_x emissions from 2000 up to 2010: 66% for cars and 55% for trucks. Kyoto Protocol targets for emissions on a national level (no targets set on a city level).

Core Indicator 14a:	**Small particulate emission**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact aspects:	Emissions
Context and relevance	The specific emission of particulate matter (PM) from passenger cars increased up to 1985, but has since been declining, mainly as a result of improved technology and the introduction of limit values for PM emissions from diesel engines by Directive 88/436/EEC. For trucks the specific emission of PM is also decreasing, but at a slower rate as compared with passenger cars. Benefits from the introduction of the 'Clean Lorry Directive' (91/542/EC2), reducing limit values for emissions in two phases, are becoming visible and clearly show the delay in effect. This is due mainly because new trucks replace older models relatively slowly. Again, for buses, occupancy rates seem to be an important factor in emission reduction, since the specific PM emission of buses has not improved in recent decades, while the same emission standards apply to buses and to trucks. Many of the measures included in the CIVITAS projects aim either directly (through incentives to promote the use of cleaner fuels or vehicles or more environmentally friendly behaviours) or indirectly (e.g. congestion reduction and access restriction) at reducing the emission and level of air pollutants. It is obvious that in such a context, the success or the failure of the measures must be assessed by taking into account emission indicators. Yet some of them were excluded either because their determinants are going to be gradually reduced (or substituted) from fuels (e.g. sulphur, benzene) – making it difficult to assess whether the improvements are to be attributed to CIVITAS -
Definition	**Small particulate emission** is defined as the annual average particulate matter (PM10 and PM2.5) emission. **Unit**: g/vkm Vehicles: car, bus, lorry, tram, metro. For road vehicles, vehicle distribution should be based on the COPERT categories. Fuels: petrol, diesel, electricity, liquefied petroleum gas (LPG), natural gas, alcohol mixtures, hydrogen and biofuels
Measurement	**Method**: Small particulate emissions can be measured through many methods including field trials or modelling. The COPERT software can be used (see http://vergina.eng.auth.gr/mech/lat/copert/copert.htm) to estimate emissions of all regulated air pollutants (CO, NOx, VOC, PM) produced by different vehicle categories (passenger cars, light duty vehicles, heavy duty vehicles, mopeds and motorcycles) as well as CO_2 emissions on the basis of fuel consumption. **Frequency:** Measurements should be made at least twice, i.e. before the CIVITAS measure is introduced (baseline) and at the end of the project (ex-post), or once a year during the project where appropriate. **Accuracy**: as good as can be obtained within limits of models/resources available **Target group**: vehicles in demonstration area **Domain:** city and/or demonstration area
References:	Kyoto Protocol targets for emissions on a national level (no targets set on a city level).

Core Indicator 14b:	VOC emissions – new (TUC)
Category:	Environment
Sub-category:	Pollution/Nuisance

Impact	Emissions
Context and relevance	VOCs and NOs are the main contributors of ozone creation in the atmosphere during large periods of warm weather and increased direct sunlight (CIVITAS ELAN). VOC without methane which is called non-methane volatile organic compounds (NMVOCs) have decreased by 57% since 1990 (EEA). Emissions of VOC occur when there is combustion of carbon compounds. Emissions are the result of incomplete combustion, spillage or evaporative emissions. VOCs contribute to ozone formation, have direct toxic effects on humans and animals, including carcinogenesis and neurotoxicity, and is harmful to plants. VOC emissions reduced largely since 1990 because of the achievements in the transport sector. Technologies like catalytic converters or carbon canisters on gasoline cars contributed to the reduction. EU has also adopted tighter emissions standards and introduced regulations for the volatility of fuels(EEA).
Definition	**VOC emissions** are defined as the annual average VOC emission per vehicle-km by vehicle and fuel type. **Unit**: g/vkm Vehicles: car, bus, lorry, tram, metro. For road vehicles, vehicle split should be based on the COPERT category. Fuels: petrol, diesel, electricity, liquefied petroleum gas (LPG), natural gas, alcohol mixtures, hydrogen and bio-fuels.
Measurement	• **Method**: VOC emissions can be measured through many methods including field trials or modelling. The COPERT software (see http://emisia.com/products/copert) emissions of all regulated air pollutants (CO, NOx, VOC, PM) produced by different vehicle categories (passenger cars, light duty vehicles, heavy duty vehicles, mopeds and motorcycles) as well as CO_2 emissions on the basis of fuel consumption. • **Frequency:** Measurements should be made at least twice, i.e. before the CIVITAS measure is introduced (baseline) and at the end of the project (ex-post), or once a year during the project where appropriate. • **Accuracy**: as good as can be obtained within limits of models/resources available • **Target group**: vehicles in demonstration area • **Domain**: city and/or demonstration area
References:	CIVITAS ELAN - Sustainable Electro-Mobility Plan for Ljubljana p.30 EEA - NMVOCs http://www.eea.europa.eu/data-and-maps/indicators/eea-32-non-methane-volatile-1/assessment-4

Core Indicator 15:	**Noise perception**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact aspects:	Noise
Context and relevance	Noise affects people physiologically and psychologically: noise levels above 40dB L_{Aeq} can influence well-being, with most people being moderately annoyed at 50dB L_{Aeq} and seriously annoyed at 55dB L_{Aeq}. Levels above 65dB L_{Aeq} are detrimental to health (WHO, 2000). LAeq is equivalent sound pressure level in dB(A). Overall, the external costs of road and rail traffic noise have been estimated at some 0.4% of GDP (ECMT, 1998). About 120 million people in the EU (more than 30% of the total population) are exposed to road traffic noise levels above 55 L_{dn} dB. More than 50 million people are exposed to noise levels above 65 L_{dn} dB. In large urban agglomerations, the effect of noise is further aggravated by high concentrations of people living in close proximity It is estimated that 10% of the EU population are exposed to rail noise above 55 L_{Aeq} dB. The data on noise nuisance by aircraft are the most uncertain, but studies indicate that 10% of the total EU population may be highly annoyed by air transport noise. The measurement of noise level can be made only for very small areas and it is unlikely to be properly modelled. Perception (scales of values, total, day/night) is much more suitable to point out contingent changes in the level of noise. Many of CIVITAS measures would have impacts on noise levels (e.g. access control, road pricing, new concepts for goods distribution). This indicator can be used to measure the impacts of such measures on reducing noise levels.
Definition	**Noise perception** is defined as the percentage of people troubled by transport noise. Environmental noise is unwanted or harmful outdoor sound created by human activities, including noise emitted from road and rail traffic. This indicator is used to measure environmental noise level based on people's perception. **Unit**: %
Measurement	**Method**: Although actual noise could be measured in some circumstances, it is people's perception that really counts. Therefore, a questionnaire survey is recommended for noise level assessment. Noise levels need to be assessed for both day time and night time conditions. In the questionnaire, the environmental noise can be categorised into levels of satisfaction, such as the following five levels: Very satisfied, Fairly satisfied, Neither satisfied or dissatisfied, Fairly dissatisfied, Very dissatisfied, Don't know **Frequency:** Measurements should be made at least twice, i.e. before the CIVITAS measure is introduced (baseline) and at the end of the project (ex-post), or once a year during the project where appropriate. **Accuracy**: The samples chosen for the survey should be sufficient in size and distribution (e.g. age, gender, disabled people) to give a good representation of people's perception of the noise level in the areas investigated. **Target group**: inhabitants and visitors (split by age, where possible) **Domain:** demonstration area and/or city
References:	Noise impact in Prague: http://www.ceroi.net/reports/prague/issues/noise/impact.htm ; Noise state in Prague: http://www.ceroi.net/reports/prague/issues/noise/state.htm ; Noise impact in Moscow: http://www.md.mos.ru/eng/air/shum.htm

4 Transport

Core Indicator 16: **Core Indicator 17:**	**Average Modal Split (passenger km)** **Average Modal Split (trips)**
Category:	Transport System
Sub-category:	General
Impact aspects:	Modal split
Context and relevance	Motorised vehicles pose a burden on the environment in terms of emissions, noise, congestion, etc. Alternatives should be systematically encouraged, and the performance of the corresponding measures should be monitored through the dynamics of modal split. In particular, the modal shares of non-motorised modes (cycling, walking) are directly relevant for short distance trips, while long distance trips lend themselves to shifts towards public transport. Overall, it is essential to monitor how the modal split develops during awareness campaigns, improvements of public transport, improvements of bicycle paths and other campaigns for the promotion of non-motorised modes, etc. Many CIVITAS measures will have impacts on modal split including: access and parking control, promotion of PT, bicycle use and walking etc. These indicators are quite widely used since it gives insight to the entire travel picture and it enables easy comparisons (among target groups, different areas and so on).
Definition	**Average Modal Split (passenger km)** is defined as the percentage of vehicle km or passenger km by transport mode over the year. **Unit**: % of vehicle km or passenger km or trips Modes: walk, bicycle, bus, tram, metro, train, car (driver and passenger), motorcycle
Measurement	**Method**: The data can be collected through surveys, e.g. asking travellers to record their travel modes and route each day in a travel diary. Samples should be chosen appropriately to cover those areas where CIVITAS measures are likely to have an impact on modal split (e.g. access control, public transport innovation, promotion of bicycle use and walk). Apart from surveys, other approaches can also be used e.g. network modelling. **Frequency:** Measurements should be made at least twice during the project, i.e. before the CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: For data collected through surveys, the sample size chosen should be sufficient to give a good representation over the year. A standard error of 5% with a probability of 95% is acceptable. **Target group**: travellers (residents and tourists) **Domain:** city or demonstration area
References:	

Core Indicator 18:	**Average Modal Split-passenger – CIVITAS CAPITAL**
Category:	Transport System
Sub-category:	General
Impact aspects:	Modal split
Context and relevance	Motorised vehicles pose a burden on the environment in terms of emissions, noise, congestion, etc. Alternatives should be systematically encouraged, and the performance of the corresponding measures should be monitored through the dynamics of modal split. In particular, the modal shares of non-motorised modes (cycling, walking) are directly relevant for short distance trips, while long distance trips lend themselves to shifts towards public transport. Overall, it is essential to monitor how the modal split develops during awareness campaigns, improvements of public transport, improvements of bicycle paths and other campaigns for the promotion of non-motorised modes, etc. Many CIVITAS measures will have impacts on modal split including: access and parking control, promotion of PT, bicycle use and walking etc. These indicators are quite widely used since it gives insight to the entire travel picture and it enables easy comparisons (among target groups, different areas and so on).
Definition	Number of all trips by residents made by each mode for all purposes. Walking, cycling, public transport, car driver or passenger, and other modes are all included in the definition. The main mode of a trip is that used for the longest stage of the trip by distance. With stages of equal length the mode of the last stage is used.
Measurement	**Method**: The best way to collect data is through a household survey. If necessary, the people conducting the survey need to be given detailed guidance on how to do household survey, how often, the format, sampling, drafting relevant questions, etc or potentially how to exploit existing national surveys (including paying to boost sample size locally). A lower cost but rather less accurate alternative to a household survey is to conduct visual counts of pedestrians and vehicle (bus, car, van) occupants across a cordon or screenline, once or twice per year, in the peak hour. It has to be noted that peak hour for pedestrians may be different from motor vehicles. Near the city centre the pedestrian peak hour is often at noon. Whilst not accurate in absolute terms, this can help to monitor trends over time in modal split although it will not produce data for trip length and therefore emissions. **Frequency:** Measurements should be made at least twice during the project, i.e. before the CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: For data collected through surveys, the sample size chosen should be sufficient to give a good representation over the year. A standard error of 5% with a probability of 95% is acceptable. **Target group**: travellers (residents and tourists) **Domain:** city or demonstration area
References:	

Core Indicator 19: **Core Indicator 20:**	**Traffic flow (peak)** **Traffic flow (off-peak)**
Category:	Transport System
Sub-category:	Car
Impact	Traffic levels
Context and relevance	Congestion is possibly one of the foremost problems faced by most European cities. It is responsible for negative effects both at the economic level and with regard to fuel consumption and air quality. Congestion levels, however, are difficult to measure in a robust and homogeneous way. This indicator (together with indicator 23-24 - average vehicle speed) provides a rough but objective input to traffic intensity and congestion measurement. Many CIVITAS measures will have impacts on traffic levels including road pricing, access control, parking control, promotion of PT, bicycle use and walking. The indicator can be used together with indicator 23/24 (peak, off-peak average vehicle speed) to indicate traffic levels on city road networks.
Definition	**Traffic flow (peak / off-peak)** is the average daily vehicle flow during the peak and off-peak hours. The peak and off-peak hours must be defined by each city to correspond with the local conditions. **Unit**: vehicles/hour
Measurement	**Method**: Sites or areas where CIVITAS measures have significant impacts on traffic flows need to be identified (e.g. access control, road pricing). Many methods can be used to measure traffic flows including loop detectors, counts from video recordings, roadside counting, etc. Data collection should cover both peak and off-peak periods. **Frequency:** Data are collected on weekdays (Monday to Friday) to provide typical average daily flows, at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data can be collected on an annual basis. **Accuracy**: **Target group**: general traffic **Domain:** city or demonstration area
References:	

Core Indicator 21: **Core Indicator 22:**	**Average vehicle speed (peak)** **Average vehicle speed (off peak)**
Category:	Transport System
Sub-category:	Car
Impact aspects:	Congestion levels
Context and relevance	Congestion is possibly one of the foremost problems faced by most European cities. It is responsible for negative effects both at the economic level and with regard to fuel consumption and air quality. Congestion levels, however, are difficult to measure in a robust and homogeneous way. This indicator (together with indicator 21/22 - traffic flow) provides a rough but objective input to congestion measurement. Many CIVITAS measures will have impacts on traffic levels including: road pricing, access control, parking control, promotion of PT, bicycle use and walking. The indicator can be used together with indicator 21-22 (peak, off-peak average vehicle flow) to indicate traffic levels on city road networks.
Definition	**Average vehicle speed** is defined as the average network or route speed by vehicle type. The peak and off-peak hours must be defined by each city to correspond with the local conditions. **Unit**: km/hr.
Measurement	**Method**: Areas where CIVITAS measures have significant impacts on traffic speeds need to be identified (e.g. access control, road pricing). Many methods can be used to measure speed including loop detectors, speed radars, number plate matching (by cameras), journey time estimates, and modelling. Data collection should be carried out for both peak and off peak periods. **Frequency:** Data are collected on weekdays (Monday to Friday) to provide typical average daily speeds, at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data can be collected on an annual basis. **Accuracy**: For data collected through surveys, the sample chosen should be sufficient to give a good representation of the typical speed in the areas targeted. A standard error of 5% with a probability of 95% is acceptable. **Target group**: general traffic **Domain:** city or demonstration area
References:	

Core Indicator 23:	**Average occupancy**
Category:	Transport System
Sub-category:	Car
Impact aspects:	Vehicle occupancy
Context and relevance	Occupancy rates have a direct impact on traffic intensity, and therefore on congestion, air quality etc. For a given level of travel demand (in pkm), the higher the occupancy the lower the number of vehicle km. Many CIVITAS measures will have impacts on occupancy including: car pooling, access control and pricing schemes, and promotion of PT use by improving service quality.
Definition	**Average occupancy** is defined as the average number of passengers per vehicle per trip. **Unit**: number of passengers per vehicle
Measurement	**Method**: Sites or areas where CIVITAS measures would have significant impacts on occupancy need to be identified (e.g. access control, road pricing, P&R). Data should be collected by mode both during the peak and off peak periods. For PT vehicles, data can be collected by patronage counts, For private cars by manual roadside counts, or from traveller surveys Other approaches may also be appropriate e.g. modelling. **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: Data collected should be sufficient to give a good representation over the year. A standard error of 5% with a probability of 95% per transport mode is acceptable. **Target group**: passenger cars **Domain:** city or demonstration area
References:	

Core Indicator 24:	**Use of space for parking – CIVITAS CAPITAL**
Category:	Transport System
Sub-category:	Car
Impact aspects:	Parking
Context and relevance	This measure is a driver behind mode shift away from car, has the potential to reduce congestion and parking search and improves street space and therefore quality of life.
Definition	Space devoted to parking (total, includes on street, off-street, private residential and non-residential) as proportion of an urban area. Off-street parking means parking your vehicle anywhere but on the streets. These are usually parking facilities like garages and surface car parks. Off-street parking can be both indoors and outdoors. On street parking means parking your vehicle on the street, anywhere on or along the curb of streets, in contrast to parking it in a parking garage. In some streets you can always park your vehicle on the street, but sometimes there are restrictions. There are also on-street parking situations where you need a parking permit to park. To make sure people follow these rules and restrictions, cities may employ enforcement officers, or enforcement may be the responsibility of the police. Private residential parking refers to areas for short-term and long-term storage of cars and other private vehicles which is not open to the general public. Most commonly these are only available to owners and tenants. Private non-residential parking (PNR) is generally associated with parking at a workplace which is reserved for the use of employees and is not available to the general public; or at shops and other facilities, where it is reserved for their customers and visitors. PNR parking can affect mode choice by encouraging workers to continue to travel to work by private car.
Measurement	**Method**: Requires count of parking spaces. There may be problems counting private non-residential (e.g. workplace, shopping centre) spaces as they are on private land. **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: Data collected should be sufficient to give a good representation over the year. A standard error of 5% with a probability of 95% per transport mode is acceptable. **Target group**: passenger cars **Domain:** city or demonstration area
References:	

Core Indicator 25:	**Accuracy of time keeping**
Category:	Transport System
Sub-category:	Public transport
Impact aspects:	Service reliability
Context and relevance	Public transport is in continuous competition with other transport modes like the private car. Most passengers still prefer to use the private mode irrespective of distance rather than using public transport or non-motorised modes. Public transport has real and perceived disadvantages compared to the car: lower comfort, (often) longer travel times, unavailability of door-to-door service, (often) lower reliability, trips subjected to interval times, safety, lack of privacy, etc. Lack of reliability can be regarded as one of the most important barriers to using public transport. PT passengers must be able to rely on the scheduled arrival and departure times in order plan a journey with confidence, and in particular, make connections without unpredictable waiting times. This means that the public transport service should neither depart earlier than is stated on the time table nor arrive later than a couple of minutes from the time stated on the time table. Many CIVITAS measures will have impacts on public transport time keeping including PT priority, bus lane control, using telematics for PT monitoring and control etc. This indicator provides an objective measure of public transport service quality. It may also be used as a measure of reliability of just-in-time freight deliveries.
Definition	**Accuracy of time keeping** is defined as the number and percentage of public transport services that arrive within an acceptable interval around the planned times given by timetables. This indicator accounts for the real (not the perceived) reliability of arrival times of public transport services at PT stops and stations. **Unit**: number and % of the total arrival times per year that are within a given interval around the time shown in the timetable.
Measurement	**Method**: Services (e.g. bus service) on which CIVITAS measures have significant impacts on time keeping (e.g. bus priority, access control, road pricing) should be identified first. Data can be collected from PT service operators if they keep records of vehicle arrivals at stops or through observations at bus stops. **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: For observations at bus stops, the amount of data collected should be sufficient to give a good representation of the typical PT service in the areas investigated. **Target group**: PT services **Domain:** demonstration area or city
References:	

Core Indicator 26:	**Public transport service per head of population**
Category:	Transport System
Sub-category:	Public transport
Impact aspects:	Service availability
Context and relevance	In cities of more than 50,000 population, public transport can be the backbone of a sustainable urban mobility system. It is important to be able to quantify how well the population is served by the system, so that improvements can be made.
Definition	Number of departures per day from all public transport stops divided by the total population of the city. Train services that stop at only one station within the city boundary should be excluded.
Measurement	**Method**: A map of public transport stops, timetables from each of these stops, and total population numbers are required. For each route (e.g. tram line 1) take one stop and derive the number of departures per day for a normal weekday, excluding night services. Multiply this by the number of stops on the route. Do the same for each route in the city. The sum of the results is the total number of departures for all stops in the city as a whole each day. Divide the resulting number by the total population of the city. **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: For observations at bus stops, the amount of data collected should be sufficient to give a good representation of the typical PT service in the areas investigated. **Target group**: PT services **Domain:** demonstration area or city
References:	

Core Indicator 27:	**Extent of off-street walking path network – CIVITAS CAPITAL**
Category:	Transport System
Sub-category:	Walking
Impact aspects:	Opportunity for walking
Context and relevance	The availability of an extensive off-street walking path network in a city allows more people to make use of more environmentally-friendly modes such as walking that are more suited to shorter distances than the car. They are usually safer to walk (no vehicles - no danger), are often shortcuts and provide an attractive environment. Last but not least, the health benefits of walking should also be considered.
Definition	Percentage of paths and links of at least 50m in length that are off-street, as a percentage of the length of total walkable routes. In urban neighbourhoods, these paths and links include those through and in green spaces, pedestrianised zones and so on. Total walkable routes are all routes along which pedestrians can travel, including footpaths alongside roads, but also those that are off-street.
Measurement	**Method**: The on- and off-street networks must be identified, through mapping, and their length then measured in metres. If a road has footpaths along both sides, the network length is that length of road multiplied by two. Distances can be measured by measuring off a map or by using GIS. Most cities have at least an approximate view on how long their street network – and therefore on-street walking network – is. A map or GIS will have to be referred to in order to derive the off-street network length. **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: Data collected should be sufficient to give a good representation over the year. A standard error of 5% with a probability of 95% per transport mode is acceptable. **Target group**: residents and tourists **Domain:** city or demonstration area
References:	

Core Indicator 28:	**Extent of on-street cycle network – CIVITAS CAPITAL**
Category:	Transport System
Sub-category:	Cycling
Impact aspects:	Opportunity for cycling
Context and relevance	An extensive on-street cycle network in a city should provide users with direct, convenient and safe routes, minimising unnecessary delay and effort in reaching their destinations. It also contributes to improving the image of cycling and allows more people to make use of more environmentally-friendly modes such as walking and cycling that are more suited to shorter distances than the car. The positive health aspects of cycling should also be considered.
Definition	Percentage of urban roads with speed limits of 40 km/h or more with segregated cycle facilities alongside or on close parallel routes providing similar journey times.
Measurement	**Method**: Most easily done via GIS. If GIS data is unavailable or difficult to obtain, a manual survey or manual measurement from maps can be conducted instead. The data are not problematic to gather but the ease is increased if GIS is available. **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: Data collected should be sufficient to give a good representation over the year. A standard error of 5% with a probability of 95% per transport mode is acceptable. **Target group**: residents and tourists **Domain:** city or demonstration area
References:	

Core Indicator 29:	**Opportunity for active mobility – WBCSD**
Category:	Transport System
Sub-category:	Cycling
Impact aspects:	Opportunity for cycling
Context and relevance	An extensive on-street cycle network in a city should provide users with direct, convenient and safe routes, minimising unnecessary delay and effort in reaching their destinations. It also contributes to improving the image of cycling and allows more people to make use of more environmentally-friendly modes such as walking and cycling that are more suited to shorter distances than the car. The positive health aspects of cycling should also be considered.
Definition	The length of roads and streets with side walks and bike lanes and 30 km/h (20 mph) zones and pedestrian zones related to total length of city road network (excluding motorways).
Measurement	**Method**: The indicator measures the spaces where active mobility is possible; therefore, this indicator is calculated as the percentage of the length of roads and streets with sidewalks and biking lanes and 30 km/h(20 mph) zones and pedestrian zones related to total length of city road network (excluding motorways). However if a length of road comes under more than one category it is only counted once. This ratio is preferably obtained using spatial data and GIS. An alternative is using existing data of road length. Using GIS, it is possible to map both the length of the city network (without the motorways) and the length of the roads where active mobility is possible, which results in two different shape files that can be compared by performing an "identity operation". **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: Data collected should be sufficient to give a good representation over the year. A standard error of 5% with a probability of 95% per transport mode is acceptable. **Target group**: residents and tourists **Domain:** city or demonstration area
References:	

Core Indicator 30:	**Freight Movements**
Category:	Transport System
Sub-category:	Freight
Impact aspects:	Freight movements
Context and relevance	Freight distribution, pickups and deliveries (sometimes there is a distinction between delivery traffic and goods transport), while essential to ensure the vitality of cities, bear an important responsibility in determining high congestion levels, traffic disruptions, and, therefore increased levels of emissions, noise, and other social costs. City centres are often areas with small streets and high population densities. The performance of urban freight systems is geared to a variety of factors related to vehicle types, delivery schedules, load optimisation etc. In CIVITAS, the measures within "new concepts for goods distribution" aim at improving freight services. This indicator will be used to provide a simple – though rough – measure of the overall impact of freight traffic on the overall urban transport system.
Definition	**Freight movement** is defined as the number of freight vehicles moving into a demonstration area (e.g. city centre). **Unit**: number of movements per day.
Measurement	**Method**: Sites or areas where CIVITAS measures have significant impacts on freight movements need to be identified (e.g. innovative goods distribution systems, urban transhipment centre, access control through low emission zones). The counting of freight movement should include mass freight transport (by trucks) or small items deliveries (e.g. by vans) For small item delivery, data may be collected by a survey of goods delivery services (web shopping), counts or modelling. For mass freight transport, roadside counts can be used to record the number of freight vehicles moving into the areas investigated. **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: **Target group**: freight transport service and delivery service for large shops. **Domain:** city or demonstration area
References:	

Core Indicator 31:	**Bike sharing bikes and stations per capita**
Category:	Transport System
Sub-category:	New shared systems
Impact aspects:	Bike sharing availability
Context and relevance	Bike sharing adds to and diversifies the exisiting set of mobility options within a city. It can contribute to increased levels of cycling, and to changing motor vehicle driver attitudes and behaviour towards cyclists.
Definition	This indicator is derived by dividing total population by the number of bike share bikes. Bike share bikes are those that are available on street for users (who sometimes have to go through a registration process and pay a registration fee) to hire, although often the first half hour of use is free of charge.
Measurement	**Method**: The method is defined in the indicator definition. The bike share operator in a city can supply data on the number of bikes. The population is derived from national statistics. **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: **Target group**: freight transport service and delivery service for large shops. **Domain:** city or demonstration area
References:	There is an interesting study done in Spain by Alberto Castro and Esther Anaya https://bicicletapublica.wordpress.com https://bicicletapublica.wordpress.com/datos

Core Indicator 32:	**Car share cars and stations per capita**
Category:	Transport System
Sub-category:	New shared systems
Impact aspects:	Car sharing availability
Context and relevance	Each car share club car may replace several individually owned cars. Car sharing reduces the mileage driven and increases the use of other modes such as walking, cycling and public transport.
Definition	This indicator is derived by dividing driving age population (18 and over) by the number of car share cars, that is, those cars in commercially or community run car share clubs that provide hourly hire of cars parked on street in local areas, bookable and payable by the hour, by club members only.
Measurement	**Method**: Driving age population is available from national censuses. The number of car share club cars in a city is available from the operator(s) of those car clubs. **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: **Target group**: freight transport service and delivery service for large shops. **Domain:** city or demonstration area
References:	Examples: www.cambio.be, www.citycarclub.co.uk.

Core Indicator 33:	**Personal Security (actual)**
Category:	Transport System
Sub-category:	Safety and Security
Impact aspects:	Personal Security
Context and relevance	
Definition	No. reported thefts / cases of harassment per year
Measurement	**Method**: Data Collection (police / local authorities). Data to be provided at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Target group**: Service users on board Public Transport & Pedestrians in Public Spaces connecting with public transport modes. (mix of residents, tourists, age, gender, disabled) **Domain:** city or demonstration area
References:	Examples: www.cambio.be, www.citycarclub.co.uk.

Core Indicator 34:	**Personal Security (perceived)**
Category:	Transport System
Sub-category:	Safety and Security
Impact aspects:	Personal Security
Context and relevance	
Definition	Feeling of security: 5 point scale ranking options: Very high; Quite high; Neither high nor low; Quite low; Very low
Measurement	**Method**: Survey (before and after MD implemented) Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Simple extra question to add to general customer satisfaction survey. Measure how secure they feel (EG a well lit street, with good sight lines will feel more secure than a dark street) **Frequency:** Measurements should be made at least twice during the project, i.e.

Core Indicator 34:	Personal Security (perceived)
	before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Target group**: Service users on board Public Transport & Pedestrians in Public Spaces connecting with public transport modes. (mix of residents, tourists, age, gender, disabled) **Domain:** city or demonstration area
References:	Examples: www.cambio.be, www.citycarclub.co.uk.

Core Indicator 35:	Road Safety (actual)
Category:	Transport System
Sub-category:	Safety and Security
Impact aspects:	Road Safety
Context and relevance	
Definition	No. Killed and Seriously Injured KSIs / collisions reported per year
Measurement	**Method**: Data Collection (police / local authorities). Data to be provided at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: **Target group**: Motorists, Cyclists, Pedestrians **Domain:** city or demonstration area
References:	Examples: www.cambio.be, www.citycarclub.co.uk.

Core Indicator 36:	**Road Safety (perceived)**
Category:	Transport System
Sub-category:	Safety and Security
Impact aspects:	Road Safety
Context and relevance	
Definition	Feeling / experience as road user: 5 point scale ranking options: Very high; Quite high; Neither high nor low; Quite low; Very low
Measurement	**Method**: Survey (before and after MD implemented). On street survey with specifically cyclists, pedestrians including mobility impaired. **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Target group**: Cyclists, Pedestrians (mix of residents, tourists, age, gender, disabled) **Domain:** city or demonstration area
References:	Examples: www.cambio.be, www.citycarclub.co.uk.

Core Indicator 37:	**Traffic calmed and car-free/pedestrainized streets – CIVITAS CAPITAL**
Category:	Transport System
Sub-category:	Safety and Security
Impact aspects:	Road Safety
Context and relevance	If the city is to be friendly to active travel and more environmentally-friendly modes (such as walking and cycling) and to cut traffic casualties then reducing motor vehicle speeds is crucial. This measure also makes these modes more competitive in terms of journey time. Traffic calming is a key measure in cities that are recognised to be leaders in sustainable transport in making these cities more liveable and welcoming with a higher quality of life and safety for their residents.
Definition	Percentage of the total distance of the city's streets and squares that are entirely car free or where there is a speed limit of 30 km/h or below. The “distance” of a square is the sum of the length of its sides.
Measurement	**Method**: Data Collection (local authorities). Data to be provided at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Target group**: Motorists, Cyclists, Pedestrians **Domain:** city or demonstration area

Core Indicator 38:	**Road Safety Audits**
Category:	Transport System
Sub-category:	Safety and Security
Impact aspects:	Road Safety
Context and relevance	
Definition	Audit certificate issued YES or NO
Measurement	**Method**: Audit conducted by experts at Feasibility stage (to guide the location and design type) and post construction (to ensure installed as planned and to review interaction by road users). **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: **Target group**: these will be performed on selected infrastructure improvements Rethymno in WP3 **Domain:** city or demonstration area
References:	Examples: www.cambio.be, www.citycarclub.co.uk.

5 Society

Core Indicator 39:	**Awareness level**
Category:	Society
Sub-category:	Acceptance
Impact aspects:	Awareness
Context and relevance	People are more likely to take advantage of new measures if they are aware of them, i.e. if they are informed about them, and the performance of a given measure usually increases with awareness levels. Operators (or other authorities with an interest in an increased awareness of new measures) may initiate information campaigns in order to raise awareness of the new integrated measures among potential users. Information regarding these new measures may be disseminated by means of advertisements, leaflets, posters in PT vehicles, etc. In this context, the core indicator will show what percentage of people has been reached and to what extent they have actually gained knowledge about the new measures, and thereby, whether or not (or to what degree) such an information campaign has been successful. The core indicator intends to assess whether the awareness of the policies and integrated measures (integrated measure package) has changed since they were implemented.
Definition	**Awareness level** is defined as the percentage of the target population with knowledge of a measure on account of provided information. This indicator is used to assess the awareness of the general public or a particular target group on CIVITAS measures. **Unit**: %
Measurement	• **Method**: Sites or areas where CIVITAS measures would have significant impacts should be identified first. Data could be collected by means of surveys (e.g. questionnaires by mail or by face-to-face interviews). Awareness can be at a variety of levels e.g. having heard of project/measures, recognise a logo, and understand the aim of the project and the potential benefits and disbenefits of the measures. • **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. • **Accuracy**: The samples chosen for the survey should be sufficient in size and distribution (e.g. age, gender, disabled people) to give a good representation of awareness levels in the areas investigated. • **Target group**: general public (including residents and visitors), operators, PT customers, etc. • **Domain:** demonstration area and/or city
References:	

Core Indicator 40:	**Acceptance level**
Category:	Society
Sub-category:	Acceptance
Impact aspects:	Acceptance
Context and relevance	Core indicators on awareness and acceptance are closely related and should be analysed in conjunction. Those aware of a measure may or may not be satisfied with its existence and/or use. The core indicator intends to assess satisfaction with the existence and/or use of the measure.
Definition	**Acceptance level** is defined as the percentage of the population who favourably receive or approve of the measure. **Unit**: % This indicator is used to assess the acceptance levels of general public or target groups on CIVITAS measures. A measure is deemed to be well-accepted if users (citizens, operators, PT customers, etc.) are satisfied with its existence and/or use.
Measurement	• **Method**: Sites or areas where CIVITAS measures have significant impacts should be identified first. User acceptance can be assessed through surveys (e.g. questionnaires by mail or by face-to-face interviews). In the questionnaire, user acceptance could also address: - **Understanding level** (% of users with good understanding of the measures) - **Usefulness level** (% of users feeling measure is useful) - **Willingness to change** (% of users likely to change mobility behaviour) • **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. • **Accuracy**: The samples chosen for the survey should be sufficient in size and distribution (e.g. age, gender, disabled people) to give a good representation of acceptance levels in the areas investigated. • **Target group**: general public (including residents and visitors), operators, PT customers, etc. • **Domain:** demonstration area and/or city
References:	

Core Indicator 41:	**Citizens satisfaction with transport system**
Category:	Society
Sub-category:	Acceptance
Impact aspects:	Satisfaction
Context and relevance	The quality of transport infrastructure and service is closely linked to the pereceived quality of life and safety in a city. The more satisfied people are with the public transport system in their own city, the less likely they will be to use their cars, which is also a driver behind mode shift away from car travel. The level of citizen satisfaction is also important to city authorities as it informs them about what people really think.
Definition	Rating on a scale of the quality of transport infrastructure and service by mode on journeys the respondent makes regularly.
Measurement	**Method**: Household or opinion survey – could be added to household survey used for modal shift. An alternative will be to piggy back onto any general survey about quality of public services. A question in either survey should be "How satisfied are you with the quality of your regular walk/cycle/bus/train/metro/car journeys in the city?" and the answer can be given on a five point scale of "very satisfied" to "very dissatisfied". • **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. • **Accuracy**: The samples chosen for the survey should be sufficient in size and distribution (e.g. age, gender, disabled people) to give a good representation of acceptance levels in the areas investigated. • **Target group**: general public (including residents and visitors), operators, PT customers, etc. • **Domain:** demonstration area and/or city
References:	

Core Indicator 42:	**Perception of accessibility level of service**
Category:	Society
Sub-category:	Accessibility
Impact aspects	Physical accessibility towards transport
Context and relevance	The main barriers to social inclusion in transport are accessibility, affordability and travel horizons. In terms of social inclusion and accessibility, this indicator concentrates on spatial accessibility and assesses the extent to which user perception of spatial accessibility changes compared to the situation prior to the implementation of the measure Accessibility in the context of this core indicator is limited to the spatial access to the service. User perception of accessibility should thus focus on such spatial dimension and disregard other accessibility factors such as economic (price of using the service in relation to personal income) or physical (e.g. problem-free access to a PT vehicle) accessibility. Spatial accessibility not only includes the distance to the closest PT stop, but also the convenience of getting there (through walkways, bicycle paths, access ways, etc.).
Definition	**Perception of service accessibility** is defined as the user's perception of the physical accessibility of the service. This concerns, for instance, the distance to the nearest PT stop and the convenience of getting there. **Unit**: Feeling / experience of convenience of service: 5 point ranking options: Very easy; Quite easy; Neither easy nor difficult; Quite difficult; Very difficult.
Measurement	• **Method**: Survey (before and after MD implemented): Question on how easy it is to reach your nearest public transport service (i.e. in terms of distance and convenience) • **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. • **Accuracy**: The samples chosen for the survey should be sufficient in size and distribution (e.g. age, gender, disabled people) to give a good representation of accessibility level in the areas investigated. • **Target group**: Public transport users (mix of residents, tourists, age, gender, disabled) • **Domain:** city or demonstration area
References:	MATISSE (Methodology for Assessment of Transport Impacts of Social Exclusion), a preparatory action funded by the EC's DG Employment and Social Affairs serves as a reference. MATISSE aims to increase the understanding of relationships between transport and social policy makers. See www.matisse-eu.com

Core Indicator 43:	**Perception of accessibility level of transport vehicle**
Category:	Society
Sub-category:	Accessibility
Impact aspects	Physical accessibility towards transport
Context and relevance	The main barriers to social inclusion in transport are accessibility, affordability and travel horizons. In terms of social inclusion and accessibility, this indicator concentrates on spatial accessibility and assesses the extent to which user perception of spatial accessibility changes compared to the situation prior to the implementation of the measure Accessibility in the context of this core indicator is limited to the spatial access to the service. User perception of accessibility should thus focus on such spatial dimension and disregard other accessibility factors such as economic (price of using the service in relation to personal income) or physical (e.g. problem-free access to a PT vehicle) accessibility.
Definition	**Perception of accessibility level of transport vehicle** to the mode of transport (ie namely step free access for push chairs, wheel chairs, suit cases for tourists). **Unit**: index of "accessibility perception" on a 5-point scale
Measurement	• **Method**: CIVITAS measures having significant impacts on PT accessibility should be identified. Data can be collected by means of surveys (e.g. questionnaires by mail or by face-to-face interviews). For a question on how easy it is to reach your nearest public transport service (i.e. in terms of distance and convenience), the following categories can be used: - Very easy - Quite easy - Neither easy nor difficult - Quite difficult - Very difficult - Don't know • **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. • **Accuracy**: The samples chosen for the survey should be sufficient in size and distribution (e.g. age, gender, disabled people) to give a good representation of accessibility level in the areas investigated. • **Target group**: Service users • **Domain:** city or demonstration area
References:	MATISSE (Methodology for Assessment of Transport Impacts of Social Exclusion), a preparatory action funded by the EC's DG Employment and Social Affairs serves as a reference. MATISSE aims to increase the understanding of relationships between transport and social policy makers. See www.matisse-eu.com

Core Indicator 44:	**Car ownership**
Category:	Society
Sub-category:	Accessibility
Impact aspects	Car availability
Context and relevance	A measure of the degree of diversity of mobility options, and an extremely important determinant of the use of other modes of transport.
Definition	All cars (including company cars) owned per 1000 of the population aged 18 or over. Percentage of households that have no car, preferably disaggregated by city district.
Measurement	• **Method**: This piece of information can be gathered from a household survey, but if not available, the national statistics department in your country will most likely have data on car ownership at a lower level of spatial resolution. • **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. • **Accuracy**: The samples chosen for the survey should be sufficient in size and distribution (e.g. age, gender, disabled people) to give a good representation of accessibility level in the areas investigated. • **Target group**: citizens and tourists • **Domain:** city or demonstration area
References:	

Core Indicator 45:	**Bike ownership**
Category:	Society
Sub-category:	Accessibility
Impact aspects	Bike availability
Context and relevance	A measure of the degree of diversity of mobility options. Bikes owned, if used, support an active healthy lifestyle. In some cities, extensive bike share systems perform a similar function, and should be monitored as well.
Definition	Bikes (pedal cycles) owned per 1000 population, disaggregated by city district if possible. Toy bicycles and those for children aged under 5 should not be counted.
Measurement	• **Method**: If a household survey of travel behaviour is carried out (see indicator on Modal Split) then this indicator can be gathered at the same time. If not, a smaller sample survey of residents should be carried out, preferably of a random sample of households by telephone, or if not, by an on-street survey in two to three locations in the city (e.g. city centre, out of town shopping centre), aiming for a sample of 200 households. Only bikes that actually function should be counted. • **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. • **Accuracy**: The samples chosen for the survey should be sufficient in size and distribution (e.g. age, gender, disabled people) to give a good representation of accessibility level in the areas investigated. • **Target group**: citizens and tourists • **Domain:** city or demonstration area
References:	

Core Indicator 46:	**Health Assessment**
Category:	Society
Sub-category:	Health
Impact aspects:	Health
Context and relevance	This core indicator intends to monitor the take up of active travel in cities by measuring mobility and health data such as distance, calories burned, speed, and elevation gained.
Definition	The indicator provides the economic value of a more active and healthy population (that is the value of reduced mortality), using data on the length of additional walking and cycling journeys made. **Unit**: Euro
Measurement	• **Method**: Data are provided by a tool made available by the Word Health Organization (WHO) named HEAT (Health Economic Assessment Tool) and can applied to measures involving cycling and walking. • **How and when to apply the tool (from the WHO- HEAT website)**: - **HEAT is to be applied for assessments on a population level, i.e. in groups of people, not in individuals.** - **HEAT is designed for habitual behaviour, such as cycling or walking for commuting, or regular leisure time activities.** Do not use it for the evaluation of one-day events or competitions (such as walking or cycling days etc.), since they are unlikely to reflect long-term average behaviour. - **HEAT is designed for adult populations.** HEAT calculations are based on mortality rates for the age ranges of 20-74 years for walking, and 20-64 years for cycling. HEAT should not be applied to populations of children or adolescents, since the scientific evidence used by HEAT does not include these age groups. The upper age boundaries have been set by consensus to avoid inflated health benefits from misrepresenting active travel behaviour in older age groups with higher mortality risks. If the assessed population is considerably younger or older than average, the user can specify a lower or higher age range. - **The tool is not suited for populations with very high average levels of walking or cycling**. HEAT applies evidence from studies in the general population and not in sub-populations with very high average levels of physical activity, i.e. for example bicycle couriers or mail personnel. While the exact shape of the dose-response curve is uncertain it seems that benefits from physical activity start to level off above levels that are the equivalent of perhaps 1 hour of cycling and 2 hours of brisk walking per day. Therefore, the tool is not suited for populations with average levels of cycling of about 1.5 hours per day or more or of walking of about 2 hours per day or more, which go beyond activity levels common in an average adult population. - **The HEAT air pollution module should not be used for environments with very high levels of air pollution**.

Core Indicator 46:	**Health Assessment**
	Most of the studies on health effects of cycling and walking and of air pollution used for HEAT have been carried out in environments with low or medium levels of air pollution (i.e. concentrations of fine particulate matter up to about 50ug/m3. They are therefore unsuited for application to environments representing an exposure for cyclists or pedestrians of particulate matter of considerably more than 50ug/m3. It seems that negative effects from air pollution start to level off at higher levels and effects on cyclists and pedestrians have not yet been well studied at such levels of exposure. - **Important note1**: the accuracy of results of the HEAT calculations should be understood as estimates of the order of magnitude, much like many other economic assessments of health effects. More methodological information is provided here: http://www.heatwalkingcycling.org/#assumptions. - **Important note2**: the data required to assess the walking and cycling activities are rather detailed (i.e. average duration of walking/cycling per day, number of people involved, investment made to promote these activities). It could be difficult to collect these data for the walking activity so, in case you are not able to measure or estimate in a reliable way these data, focus only to the cycling activity. For both types of activities, the tool proposes also a set of parameters used for this assessment (average travelling speed, value of life, etc.). These data are referred to your country but, if you would like, you can edit default values to better reflect your local settings. • **Procedure:** The HEAT tool is composed of 5 main steps: 1. defining your assessment, 2. providing input data, 3. providing information for data adjustments; 4. review of calculation parameters; and 5. results. The procedure is friendly and explanations are provided for each step. The calculation can be referred to a given city of your country and, to this end, for each country the tool provides a list of cities. If your city is not included in this list or cannot be represented by one of them for climate and pollution situation, it is preferable that you refer to the country level. To start the assessment go here: http://www.heatwalkingcycling.org/tool/ • **Frequency:** it is sufficient to carry out this calculation only once during the project
References:	http://www.euro.who.int/en/health-topics/environment-and-health/Transport-and-health/activities/guidance-and-tools/health-economic-assessment-tool-heat-for-cycling-and-walking