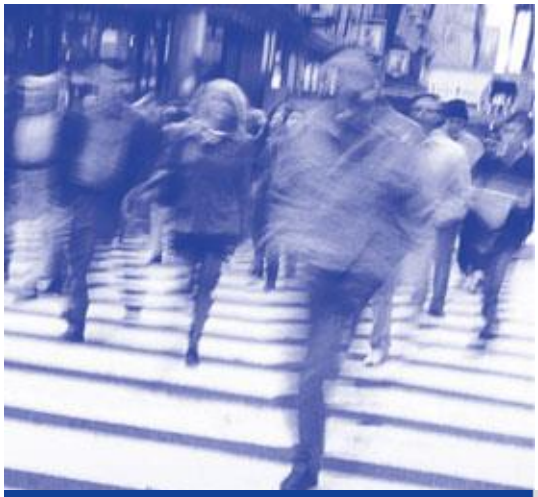


CIVITAS
Cleaner and better transport in cities

WIKI

Applied framework for evaluation in CIVITAS PLUS II

Deliverable No.:	4.10
Project Acronym:	CIVITAS WIKI
Full Title:	
CIVITAS WIKI – Coordination, evaluation and dissemination of CIVITAS PLUS II	
Grant Agreement No.:	296081
Workpackage/Measure No.:	WP4
Workpackage/ Measure Title:	
Tools and Analyses	
Responsible Author(s):	
Tariq van Rooijen & Nina Nesterova	
Responsible Co-Author(s):	
Don Guikink	
Date:	31/05/2013
Status:	Final

CIVITAS
Cleaner and better transport in cities
W I K I

THE CIVITAS INITIATIVE IS CO-FINANCED BY THE EUROPEAN UNION

Abstract

Based on the evaluation frameworks of earlier CIVITAS editions, this deliverable provides a framework for the evaluation activities on measure, city and project levels aiming at achieving a coordinated and consistent set of results. The evaluation task has been divided into impact evaluation and process evaluation.

This CIVITAS WIKI document is an adapted and simplified version of the CIVITAS POINTER document by Richard Hall, Mike McDonald (University of Southampton) on the evaluation framework of CIVITAS PLUS.

Project Partners

Organization	Country	Abbreviation
Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek	Netherlands	TNO
TRT Transporti e Territorio SRL	Italy	TRT
Inovamais – Servicos de Consultadoria em Inovacao Technologica S.A.	Portugal	INOVA
Intrasoft International SA	Luxembourg	INTRASOFT
Uniresearch BV	Netherlands	UNI

Document History

Date	Person	Action	Status	Diss. Level
02/03/2013	Tariq van Rooijen	First draft version	Draft	PP
02/04/2013	Nina Nesterova	Second draft version	Draft	PP
02/05/2013	Tariq van Rooijen	Third draft version	Draft	PP
17/05/2013	Tariq van Rooijen	Fourth draft version	Draft	PP
24/05/2013	Simone Bosetti	Final review and quality check	Final Draft	PP
31/05/2013	Tariq van Rooijen	Final version	Final	PP

Table of Contents

List of Figures

List of Tables

Executive Summary

The CIVITAS Initiative brings together cities that are introducing sustainable urban transport policy measures. The aim is to achieve a significant change in the modal split towards sustainable transport modes thereby providing cleaner and better transport in cities.

The CIVITAS WIKI project is the Support Action for Evaluation of the CIVITAS Plus II projects (DYN@MO and 2MOVE2), designed to assist the European Commission in the CIVITAS results evaluation.

Evaluation is a key part of all the projects within CIVITAS, since it is important to understand the nature and extent of the impacts made by the measures introduced by the cities. The aim of the evaluation task within CIVITAS WIKI is to support DYN@MO and 2MOVE2 projects in their evaluation process. Also needs to be ensured that the evaluation is undertaken in such a way that it is consistent with evaluation of previous CIVITAS editions and provides enough evidence for solid comparison.

Based on the evaluation frameworks of earlier CIVITAS editions, this deliverable provides a framework for the evaluation activities on measure, city and project levels aiming at achieving a coordinated and consistent set of results. The evaluation task has been divided into impact evaluation and process evaluation:

(1) Impact evaluation includes the evaluation of a wide range of technical, social, economic and other impacts resulted from the measures being implemented by the cities. It involves the selection of the quantitative indicators from the CIVITIAS list and their measurement through ‘before’ and ‘after’ surveys.

(2) Process evaluation involves the evaluation of the processes of preparation, implementation and operation of the measures including the roles of information, communication and participation. It includes the collation and analysis of activities engaged in throughout the whole process to understand more clearly why measures succeed or fail.

The results of both impact and process evaluations are then drawn together to provide a comprehensive evaluation on project level. This should provide the necessary knowledge to determine the effectiveness of specific measures and packages of measures and so help to identify good practice and the potential for its transferability to other cities across Europe.

This document describes the main steps for impact and process evaluation on the different levels, responsibilities within these evaluation processes and presents a number of templates that can be used when conducting the evaluation in order to ensure a consistent evaluation.

1 INTRODUCTION

The CIVITAS Initiative brings together cities that are introducing sustainable urban transport policy measures. The aim is to achieve a significant change in the modal split towards cleaner, sustainable transport modes.

These measures will be implemented in cities across Europe, but also the evaluation of these measures is very important. Evaluation is a powerful tool for learning what works, what does not, and the reasons for this. So basically, we evaluate because we want to measure the performance, learn for future projects and exchanges experiences. Evaluation delivers various benefits for everybody involved such as decision makers and citizens as it helps to improve future planning, better target measures on specific groups and optimise to allocation of resources (Dziekan et al, 2013).

This is why the European Commission needs to evaluate the results of the measures implemented by the CIVITAS cities. By performing an evaluation the insights will become clear on how the measures performed and the comparisons between different cities will provide knowledge on the effectiveness of specific measures and packages of measures. This will make it possible to identify good practice and transferability.

Evaluation is therefore a key part of all the projects within CIVITAS, since it is important to understand the nature and extent of the impacts made by the measures introduced in the cities and of the processes involved. A CIVITAS measure is defined as a specific application contributing towards clean urban mobility.

For each CIVITAS measure implemented by a city both impact and process evaluation have to be carried out and fully reported. In specifically agreed and selected cases, such as where implementation is too late for any sensible impact evaluation, process evaluation is the minimum output that may be accepted.

The CIVITAS Plus II edition has a different set-up than the previous editions as it has a smaller size with only eight cities participating. The need for a support action that coordinates all evaluation activities is therefore smaller and a full evaluation program is not needed. However, synchronisation and cooperation between the demonstration projects is necessary to achieve a common level of understanding of the results from the whole CIVITAS Initiative.

This adapted Framework for Evaluation of CIVITAS Plus II is based on the full Evaluation Framework developed consequently by CIVITAS support actions POINTER, GUARD and METEOR, and provides practical guidance for the measures evaluation within CIVITAS Plus II Collaborative projects: Dyn@mo and 2MOVE2. CIVITAS Plus II is built on the earlier CIVITAS editions for greater added value and to provide the appropriate continuity of understanding of the output for the European Commission (EC). This edition presents a reviewed evaluation approach of CIVITAS Plus, where a number of adjustments has been included based on comments and feedback from cities and collaboration projects.

The general overview CIVITAS Initiative projects is presented in figure 1.

CIVITAS initiative

CIVITAS Initiative	CIVITAS I	CIVITAS II	CIVITAS Plus	CIVITAS Plus II
Years	2002-2005	2005-2009	2008-2012	2012-2016
Collaborative projects	MIRACLES TELLUS TRENDSETTER VIVALDI	CARAVEL MOBILIS SMILE SUCCESS	ARCHIMEDES ELAN MIMOSA MODERN RENAISSANCE	DYN@MO 2MOVE2
Support Action	METEOR	GUARD	POINTER VANGUARD	WIKI

Figure 1: Overview of the CIVITAS Initiative projects

In CIVITAS Plus II, over 50 measures will be implemented by 8 cities to demonstrate how these measures can contribute to achieve the CIVITAS objectives.

Objectives of this document are:

- To explain the rationale of impact and process evaluation in the CIVITAS Initiative
- To explain the set of indicators developed by CIVITAS
- To lay down the principles of evaluation and cooperation in CIVITAS Plus II.

CIVITAS WIKI incorporates the core indicators as developed by earlier CIVITAS editions, and, as far as possible, will utilise the projects' own plans for the evaluation activities. The combination of a top-down approach from CIVITAS WIKI together with support for the bottom-up interests of cities is a crucial part of CIVITAS WIKI.

The deliverable is organised with the following sections:

- Section 1: Introduction;
- Section 2: Evaluation framework;
- Section 3: Impact Evaluation;
- Section 4: Process Evaluation;
- Section 5: Evaluation at project level;
- Annexes with additional background information or templates.

2 EVALUATION FRAMEWORK

In CIVITAS WIKI, the evaluation task has been divided into impact evaluation and process evaluation:

- **Impact evaluation** includes the evaluation of a wide range of technical, social, economic and other impacts of the measures resulted from the implementation by the cities.
- **Process evaluation** involves the evaluation of the processes of preparation, implementation and operation of measures, including the roles of information, communication and participation.

Impact evaluation deals with understanding of the practical/technical effects of measures within the city whereas process evaluation is concerned with understanding more clearly why measures have succeeded or failed. Both are being built upon a common framework approach to ensure a consistent high quality of outputs. The integration and interpretation of the results from both aspects will provide the necessary comparative insights and understanding of the effectiveness of the measures at the European level.

2.1 Levels of evaluation

As the scope of CIVITAS Plus II is smaller, the evaluation activities within it are considered at two different levels:

- **Measure Level**: evaluation of individual measures or packages/bundles of measures: such bundles can be identified where individual measures complement each other to the extent that a distinction between their implementation or impact does not make sense. In CIVITAS Plus II 50-60 measures will be evaluated.
- **Project level**: evaluation that aims at identifying and transferring good practices within the CIVITAS projects Dyn@mo and 2MOVE2. Also will be investigated what the effects are of CIVITAS and its measures for each of the four cities per project.

The European Commission recognises that it is important not to spread the evaluation resources thinly across all measures, but to focus particularly on those measures likely to provide the most useful evaluation outputs. Therefore, in the beginning of the projects a number of measures are identified where a detailed impact evaluation and process evaluation could be undertaken. These measures are further referred as ‘focused’ measures and are described further on in this document.

2.2 General outline of the evaluation process

The general outline of the evaluation framework within CIVITAS Plus II is illustrated in figure 2 describing main steps and responsibilities in the process. A core tenant of this approach is

that the Projects and Cities should have a common ownership of evaluation and, thereby, commitment to a process in which they see clear value for their cities.

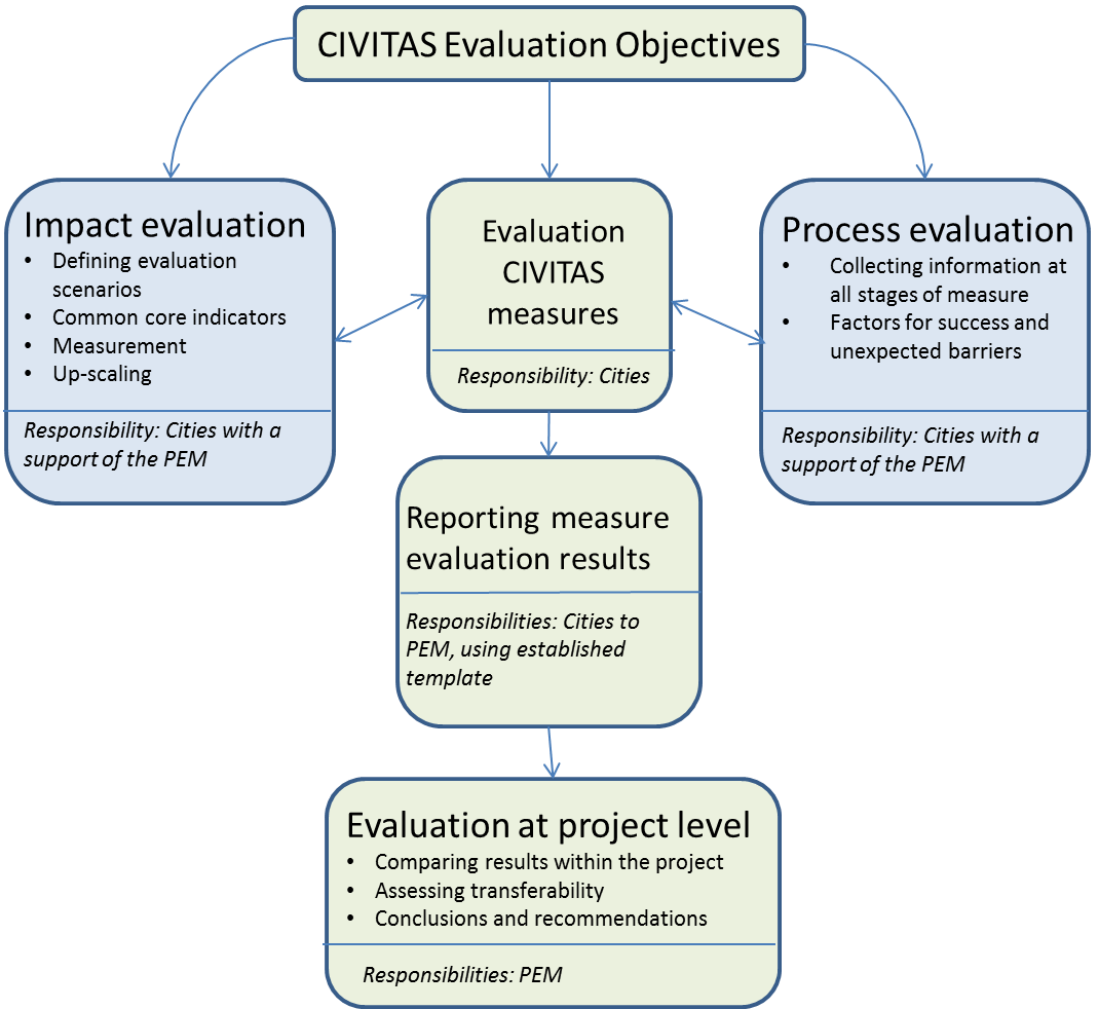


Figure 2: Evaluation process

To be able to compare the outcomes of the measures with similar measures of the other CIVITAS PLUS II project or previous CIVITAS projects it is needed that evaluation in each individual city is of high quality and produces good, clear results. For this to happen, the evaluation processes must be harmonised in several ways:

- The general approach for evaluation must be consistent across the CIVITAS measures. The before-and-after comparisons must be carried out consistently.
- The indicators used for measuring the impacts must be consistent across the CIVITAS projects. However, this does not prevent cities from having their own additional local indicators for evaluation and assessment at the local level.
- The methods of measurement must be consistent across the CIVITAS cities or at least produce rigorous comparable results.

- How the impacts are measured needs to be monitored, and related information that might contribute to understand the nature and extent of the results collected, especially for context-specific situations.
- Transferability of the results must be assessed in order to draw conclusions at the European level. Annex E proposes a general evaluation time schedule to be filled in by the PEM in the beginning of the project.

2.3 Organization of the evaluation process

Evaluation of the measures according to a common CIVITAS methodology involves a number of different people and projects. There are three main roles with different responsibilities in the evaluation process:

- The Project Evaluation Manager (PEM) is responsible for the end result of all the evaluations in the project and supports the cities in performing the evaluation. The PEM is a part of the CIVITAS Plus II Dyn@mo and 2MOVE2 projects.
- The Local Evaluation Manager (LEM) is responsible for the evaluation of all measures in his/her city. The LEM is a city representative.
- The Measure Leaders (ML) are responsible for organising the preparation, implementation and operation of a measure in his/her city. The ML also has an important role in the evaluation of his/her measure. The ML is a city representative.
- The Site Coordinators (SC) are responsible to provide a general supervision of the evaluation process from a city perspective and provide support in evaluation where requested by LEM and ML.

The role of the CIVITAS cities is to:

- Undertake the evaluation of impacts from the implementation of measures; including a detailed Cost Benefit Analysis for a number of selected measures.
- Collect information about the process of preparation, implementation and operation of the measures.
- Report the evaluation results for each individual measure to the Project Evaluation Manager (PEM).

Within CIVITAS Plus II the evaluation process in cities and projects is supported by the CIVITAS Wiki Support Action. This support is provided:

- For impact evaluation, through provision of guidelines, templates and workshops.
- For process evaluation, through provision of guidelines, templates and workshops and the establishment of a mechanism for collecting information about the progress of planning, implementation and operation of the measures.

All aspects of evaluation will be discussed at the Evaluation Group that will meet on a regular basis, normally once a year, but at other times as necessary. The project evaluation managers and the city evaluation managers will be invited to this meeting. The Evaluation Group will act as a platform to advise the DYN@MO and 2MOVE2 projects and to

synchronise the evaluation activities between these projects. The Evaluation Group will provide a forum for discussion of the issues concerning evaluation.

2.4 CIVITAS Initiative, project- and city objectives

The understanding of the general CIVITAS objectives as well as specific objectives on the project and city levels are essential for the efficient conduct of evaluation.

The overall objective of the CIVITAS Initiative is to provide cleaner and better transport in cities by introducing ambitious transport measures and policies towards sustainable urban mobility. The goal is to achieve a significant shift in the modal split towards sustainable transport, an objective reached through encouraging both innovative technology and policy-based strategies.

Within CIVITAS, nine thematic categories of measures, further referred as “themes” have been identified as the basic building blocks of an integrated strategy for sustainable mobility. Project objectives and concrete measures are organized along these nine main themes, presented in the figure 3.

The theme ‘Sustainable Urban Mobility Plans’ has been added as a theme in this CIVITAS edition and a corresponding indicator (indicator 30) has been added to the list of indicators presented in Annex A.

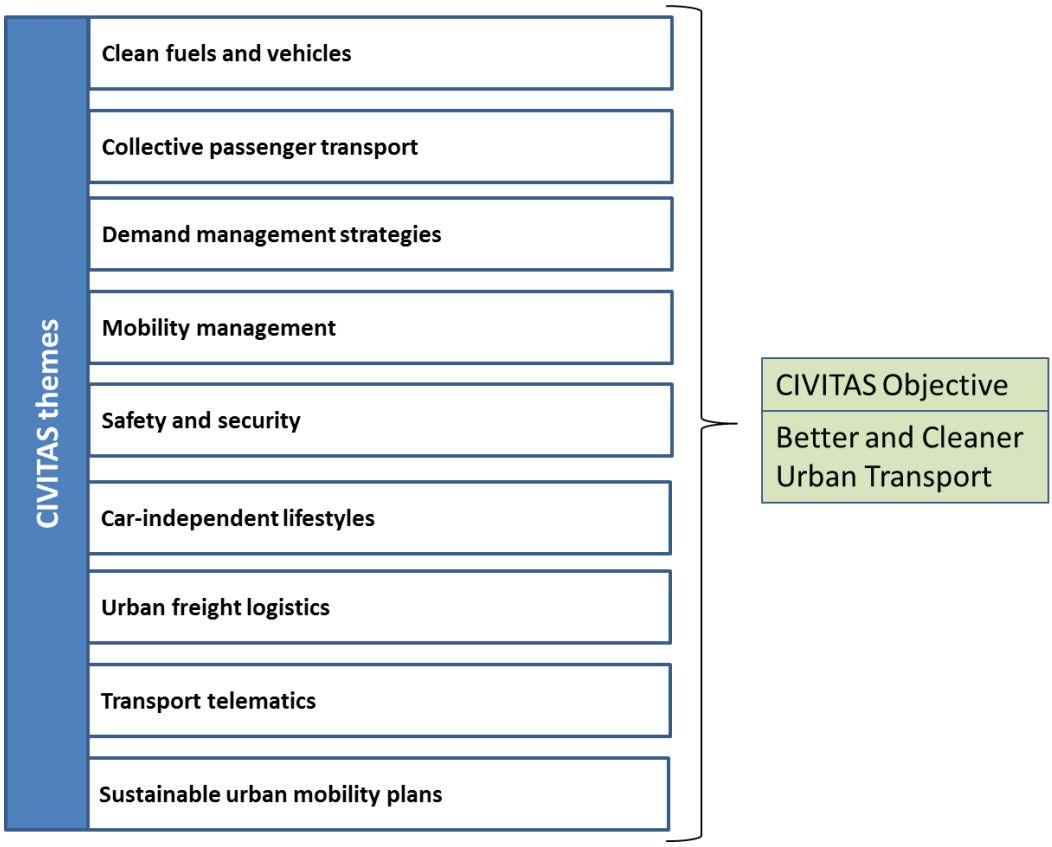


Figure 3: CIVITAS themes

For projects and cities, one important objective is to demonstrate, through a sound evaluation, how much the measures can contribute to better and cleaner urban transport. In addition, projects and cities have their own objectives, e.g. to assess how much the measures can solve their local problems. Analysis of the individual measure objectives and plans then leads to the identification of the likely impacts or effects of the measures and subsequently to the indicators are required for the evaluation.

3 IMPACT EVALUATION

Impact evaluation is an assessment or estimate of the impacts or effects of a measure (for example concerning safety, environmental conditions or transport efficiency) on the particular target groups (drivers, system operators, society, etc.) that are affected. For this, a set of indicators is proposed which describe important characteristics of the situation and which can be quantified or estimated both before and after the implementation of the measure, so that appropriate comparisons can be made of any changes or with any alternative(s).

3.1 Impact evaluation steps

The impact evaluation is performed by the cities (LEM and ML) with a support of the projects (PEM) and SCs and consist of the following activities:

1. Agree on common measures and “focused” measures for impact and process evaluation (PEM, LEM, ML, SC);
2. Define and agree on common indicators from the proposed CIVITAS list (and on additional indicators if necessary) and methodologies for measurements (PEM, LEM, ML);
3. Produce evaluation plans containing detailed measure description, agreed list of indicators to assess and a plan how to perform measurements (ML, MEL);
4. Provide guidance on using indicators, measurements, scenarios, up-scaling, and analysis etc. (PEM to LEM, ML);
5. Collect data for impact evaluations (ML, LEM);
6. Perform impact evaluation (ML, LEM with PEM, SC support);
7. Perform “focused measures” impact evaluation (ML, LEM with PEM, SC support);
8. Report to the PEM in the form of the Measure Evaluation Results Template (ML, LEM to PEM);

The process together with general approach are illustrated in the figure 4. Sections below describe more in detail impact evaluation approach and some specific steps which need to be undertaken.

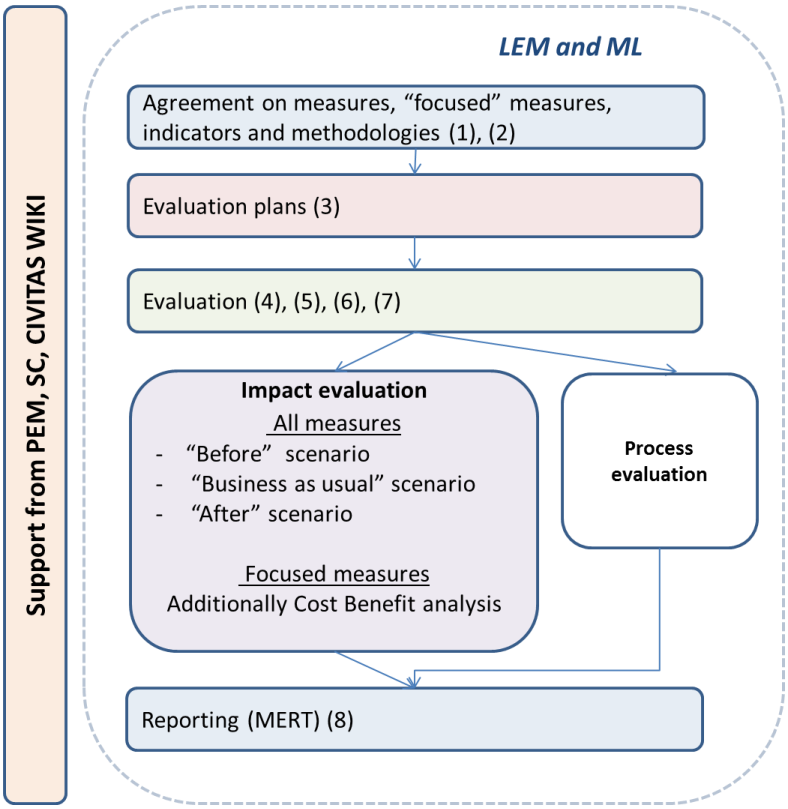


Figure 4: **Outline of Impact Evaluation Framework**

3.2 Impact evaluation approach

Impact evaluation in CIVITAS is based on 'before-and-after' comparisons, and must be carried out consistently across the CIVITAS cities and projects to give the added value gained from being part of a Europe-wide initiative. The Before (Baseline), Business-as-Usual and After situations provide a common structure for the conduct of surveys and other measurements needed to provide such consistent comparisons. These situations are explained below and the relationship between them is illustrated in Figure 5.

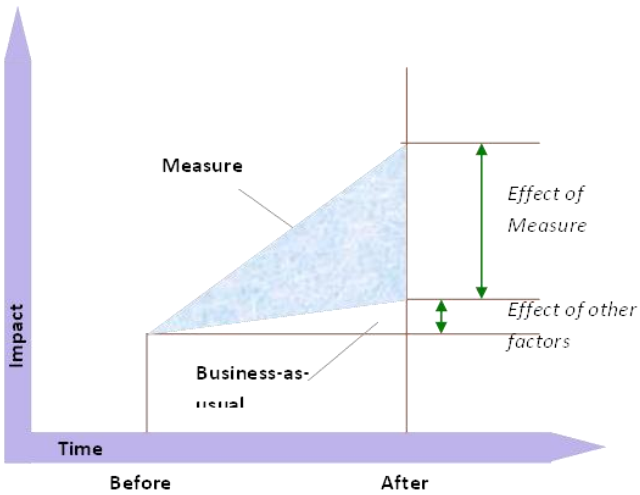


Figure 5: Before (Baseline), Business-as-Usual & After scenarios

Baseline surveys are necessary to assess subsequent changes resulting from CIVITAS measures and are carried out *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. 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 scenario** is 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 to determine the impacts of the measures by comparing results between scenarios with and without the measures.

Possible ways to estimate the 'business-as-usual' situation include forecasting from historical data, modelling (where appropriate local models are available) or monitoring a parallel 'control' site with the same characteristics without applying the project measures to it. In transport projects, this latter solution is often very expensive and not always very precise or appropriate.

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. This will depend on the data and models available on a city-to-city basis. Each city must propose a credible approach.

At the end of the study, it may be necessary to update the business-as-usual predictions in the light of actual changes in other factors which are different from what predicted.

The '**after' or ex-post situation** provides a final set of measurements for evaluation which can be compared with baseline and business-as-usual measurements to assess the effectiveness of the measures implemented. With the measures having been implemented, it is possible for many impacts to be measured directly in real conditions. However, such measurements have to be statistically sound to ensure the high quality of the evaluations.

When the opinion of the general public needs to be asked on certain measure or topics, it is advisable to install a transport panel in a city. 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 opinion 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.

3.3 'Focused' measures impact evaluation

In the beginning of the CIVITAS Plus II edition a selection of 'focused' measures that should be studied more in-depth will be performed. The PEM is responsible for the selection process and he will do this together with the LEM and the ML. The selection is based on the following criteria:

- Promising results in the first phases of the measures;
- Relevancy for city policy;
- Expected impact on five pillars of EU Green Paper on Urban Transport;
- Expected impacts on CIVITAS evaluation categories (transport system, environment, economy and/ or society / people);
- Possibility to carry out a complete Cost Benefit Analysis;
- Innovativeness of measure (technique, consortium, process, learning, etc.);
- Number and kind of stakeholders;
- Manageability of the measures;
- Potential for Transferability;
- Representative for a group of measures a specific context.

It is important to make it explicit in the evaluation report, why the measure was selected to be "focused". A detailed Cost Benefit Analysis has to be undertaken for the 'focused' measures.

In Annex G information on how to set up a Cost Benefit Analysis is given.

3.4 Selection of impacts and indicators

For the evaluation of each measure, cities (LEM and ML together) and PEM have to agree on which impacts they are going to evaluate and what kind of indicators they will use in order to quantify selected impacts.

To be able to compare measures between different cities and different CIVITAS editions a set of common impacts and common measurement indicators has to be used. CIVITAS Plus II is therefore using a list of impacts and a set of indicators that were continuously developed through CIVITAS I, CIVITAS II and CIVITAS Plus projects and resulted in 31 common indicators.

3.4.1 Selection of impacts

Within previous CIVITAS support actions a list of possible impacts was defined. The understanding of these impacts and of their background is essential in order to perform a proper selection and evaluation process. For each impact the CIVITAS team has further developed a list of indicators and proposed measurement methods as described later in this chapter.

The impacts were developed using a three level approach:

- Main areas of the impacts (economy, energy, environment, society and transport);

- Sub-areas of the impacts (e.g. the main category of transport is further broken down to transport system performance, service quality and safety);
- Impact categories.

The following impact areas were selected for the evaluation: economy (costs and benefits), energy consumption, environment, society and transport system performance (including safety).

Economic impact evaluation 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.

Energy impact evaluation is concerned with an impact of measures on the energy consumptions. 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). It is important to understand how these measures can contribute to better and cleaner urban transport.

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

Society impact evaluation is focused on assessing 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, including their feelings about security (see below). These may in turn have further effects on, for example, such factors as health and employment opportunities.

Transport system performance evaluation assesses the performance of a system in terms of 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.

The likely impacts identified for evaluation are summarized in Table 1.

Table 1: **Classification of the impacts for evaluation**

Impact area	Impact SUB-area	IMPACT category
ECONOMY	**Benefits**	Economic development Operating revenues Profitability
	Costs	Preparation/design costs Investment costs Maintenance costs Operating costs

Impact area	Impact SUB-area	IMPACT category
ENERGY	**Energy Consumption**	Fuel consumption Fuel Mix
ENVIRONMENT	**Pollution / Nuisance**	Air quality Emissions Impacts on cityscape Noise/vibration
	Resource Consumption	Change in areas
SOCIETY	**Acceptance**	Awareness Business acceptance Co-operation Operator acceptance Political acceptance User acceptance/satisfaction
	Accessibility	Economic Accessibility Spatial Accessibility
	Employment	Long term indirect employment
	Equity	Fairness
	Health	Impacts on health
	Security	Security
TRANSPORT	**Quality of Service**	Comfort Ease of use Service frequency Service integration Service reliability User Information Technical reliability
	Safety	Transport safety

Impact area	Impact SUB-area	IMPACT category
	Transport System	Congestion levels Freight movements Journey times Modal split Network capacity Network efficiency Parking demand Passenger movements Route changes Traffic levels Vehicle occupancy Vehicle speed Waiting times
GOVERNANCE	**Planning**	Planning process

As with other transport measures, most of the CIVITAS measures have a wide range of impacts on many aspects of a city transport system. The following situations need to be considered:

- Impacts within and beyond the CIVITAS scope;
- Direct and indirect impacts; for example if a bus fleet is converted to run on bio-diesel; there will be a direct impact on the emissions produced, but there may also be an indirect impact on the numbers of passengers using the buses if they are more attractive;
- Short-term (i.e. that can be measured within the lifetime of CIVITAS evaluation) and long-term impacts (e.g. on land use and planning).

As implied above, deciding which impacts should or should not be included in the evaluation is not straightforward. To assist in this process, both the evaluation objectives (desired impacts) and the measures (potential impacts) should be considered through considering the following questions:

- What impacts does the CIVITAS measure have?
- Do the impacts have influence on achieving the CIVITAS objectives?
- Are the impacts direct or indirect?
- Will it be feasible to measure the impacts within the lifetime of the CIVITAS Plus II evaluation process?

For CIVITAS evaluation, one of the key criteria for identifying impacts is whether the impacts can contribute to the achievement of the CIVITAS objectives (directly and indirectly), but it is also important from a practical perspective to understand how feasible it is to measure the impacts.

3.4.2 Selection of indicators

Once impacts have been identified, appropriate indictors to quantify the impacts must be selected. 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. CIVITAS Plus II is using a set of 31 indicators gradually developed through the previous editions of CIVITAS Initiative. Table 2 presents this indicators.

In selecting common indicators, the main criteria to follow should include relevance, completeness, availability, measurability, reliability, familiarity 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 issue of whether, where and when the indicators should be measured is a critical one as it strongly affects the uniformity and the ultimate comparability of the evaluation results. These may vary with the measurement scale, sampling, unit, time of day, etc. For example, one of the challenges for evaluation will be the achievement of a common spatial level reflecting the different extents of impact of the various measures. Whilst some indicators can be appraised at the city level, others are meaningful and/or reliable only if measured at specific locations. In general, the cities should take into consideration the specification of the indicators and adhere to them as much as possible. Whenever this proves infeasible, the cities should supply the same relevant data collected for their own evaluation, without further adaptations.

Table 2: CIVITAS Plus II Common Core Indicators

NO.	EVALUATION CATEGORY & SUB-CATEGORY	IMPACT	INDICATOR	DESCRIPTION	DATA /UNITS
	ECONOMY				
1	**Benefits**	Operating Revenues	Operating revenues	Revenues per pkm or vkm	Euros/pkm or Euros/vkm, quantitative, derived or measured
2A	**Costs**	Costs	Capital costs	Capital cost per system or unit	Euros, quantitative
2B			Operating costs	Costs per pkm, vkm or time period	Euros/pkm, Euros/vkm or Euros/time period quantitative, derived or measured
	ENERGY				
3	**Energy Consumption**	Fuel Consumption	Vehicle fuel efficiency	Fuel used per vkm, per vehicle type	MJ/vkm, quantitative, derived or measured
4			Fuel mix	Percentage of fuel used by type	Percentage, quantitative, derived or measured
	ENVIRONMENT				
5	**Pollution and Nuisance**	Air Quality	CO levels	CO concentration	Ppm or g/m3, quantitative, measured
6			NOx levels	NOx concentration	Ppm or g/m3, quantitative, measured
7			Particulate levels	Particulate PM10 and/or PM2.5 concentration	Ppm or g/m3, quantitative, measured
8		Emissions	CO2 emissions	CO2 per vkm by type	G/vkm, quantitative, derived
9			CO emissions	CO per vkm by type	G/vkm, quantitative, derived
10			NOx emissions	NOx per vkm by type	G/vkm, quantitative, derived
11			Particulate emissions	PM10 and/or PM2.5 per vkm by type	G/vkm, quantitative, derived
12		Noise	Noise perception	Perception of noise	Index (%), qualitative, collected, survey
	SOCIETY				
13	**Acceptance**	Awareness	Awareness level	Awareness of the policies/measures	Index (%), qualitative, collected, survey
14		Acceptance	Acceptance level	Attitude survey of current acceptance of the measure	Index (%), qualitative, collected, survey
15	**Accessibility**	Spatial Accessibility	Perception of accessibility	Perception of physical accessibility of service	Index(%), qualitative, collected, survey
16		Economic Accessibility	Relative cost of service	Cost of service relative to average personal income	Index(%), quantitative, measured
17	**Security**	Security	Perception of security	Perception of security when using service	Index, qualitative, collected, survey
	TRANSPORT				
18	**Quality of Service**	Service reliability	Accuracy of timekeeping	Number and percentage of services arriving / departing on time	No and %, quantitative, collected, measured
19		Quality of service	Quality of service	Perception of quality of service	Index, qualitative, collected, survey

NO.	EVALUATION CATEGORY & SUB-CATEGORY	IMPACT	INDICATOR	DESCRIPTION	DATA /UNITS
20	**Safety**	Transport Safety	Injuries and deaths caused by transport accidents	Numbers of accidents, fatalities and casualties caused by transport accidents	No, quantitative, measured
21	**Transport System**	Traffic Levels	Traffic flow by vehicle type - peak	Average vehicles per hour by vehicle type - peak	Veh per hour, quantitative, measured
22			Traffic flow by vehicle type - off peak	Average vehicles per hour by vehicle type – off peak	Veh per hour, quantitative, measured
23		Congestion Levels	Average vehicle speed - peak	Average vehicle speed over total network	Km/hr, quantitative, derived
24			Average vehicle speed - off peak	Average vehicle speed over total network	Km/hr, quantitative, derived
25		Freight Movements	Goods vehicles moving in demo areas	Daily number of goods vehicles moving in area	No, quantitative, derived or measured
26		Modal split	Average modal split-passengers	Percentage of passenger-km for each mode	%, quantitative, derived
27			Average modal split-vehicles	Percentage of vehicle-km for each mode	%, quantitative, derived
28			Average modal split- trips	Percentage of trips for each mode	%, quantitative, derived
29		Vehicle Occupancy	Average occupancy	Mean no. persons per vehicle/day	Persons/vehicle, quantitative, derived, measured
30	**Governance/planning**	Planning process	Sustainable Urban Mobility Plan	Existence of the sustainable urban mobility plan and its comformity to EU standards	Qualitative

Apart from the common indicators described in the table 2, some cities/projects may wish to use additional indicators for their evaluation. Such indicators may be used:

- To make an assessment at a more detailed level;
- To assess the impacts concerning a particular local problem; and
- To assess the impacts of the special characteristics of a local measures.

The results from the use of local indicators for such evaluation will add to the understanding of CIVITAS impacts provided by the common core indicators. However, it is important that any additional indicators are as consistent as possible across the different cities, so that unnecessary differences between similar indicators can be minimised.

3.4.3 Indicator definition and Methodology sheets

Indicator definition and methodology sheets have been developed to serve as practical 'information and use guidelines' for each common indicator. The aim of these sheets is to assist cities in understanding specific methods, to help ensure data uniformity and to provide assistance with data collection. The structure of the sheets is shown below in Table 3.

Table 3: 'Indicator Definition & Methodology Sheet' Structure

Core indicator:	Number and Name of core indicator
Category:	Evaluation category according to the table of common core indicators (Economy, Energy, Environment, Society, or Transport).
Sub-Category:	Evaluation sub-category according to the table of common core indicators.
Impact:	Impact according to the table of common core indicators.
Context and relevance:	Description of the wider context surrounding the problem area which the indicator seeks to evaluate and consideration of the relevance of the indicator within the CIVITAS context and of the appropriateness in measuring the impact.
Definition:	Definition of the indicator through the use of key terms, Area of use, and Unit of measurement
Measurement:	Specific information on how to measure the indicator, with particular attention to: ▪ Method of measurement ▪ Frequency of measurement ▪ Accuracy of measurement ▪ Target Group for measurement (e.g. PT users) ▪ Domain for measurement (e.g. demonstration area or city)
References:	Examples of similar uses of the indicator based on the literature or previous projects.

Annex A provides the full set of the Indicator Definition and Methodology Sheets for each of the current 31 common indicators proposed for CIVITAS Plus II, as defined in table 2.

3.5 Impact evaluation data collection

The planning and conduct of all the surveys and data collection are the responsibility of the cities and projects. Whilst CIVITAS WIKI will try to provide as much advice and support as required, it is completely reliant on the cities and projects to provide the high quality and consistent data required for the evaluation. So a number of general points concerning surveys and data collection should be helpful.

Before embarking on any survey, whether by direct measurement or questionnaire, it is always useful to consider a number of basic points (Cochran, 1963):

- **Objectives of the survey**. A clear statement is always helpful, as it easy to get involved in the detail and make decisions at variance with the 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.
- **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.

Annex B provides more background information on research methodologies for:

- Sample size
- Data collection methodology
- Measurement conditions

3.6 Up-scaling

Cities (LEM and ML) are required to perform up-scaling. Up-scaling refers to the estimation of the effects of a measure (or group of measures) if it/they were applied fully throughout the city (where appropriate). It provides guidance to the city concerned about the potential for further deployment and is also useful to other cities in Europe which may be considering implementation of such a measure. Possible methods of up-scaling include:

- empirical assessment with extrapolation, or
- modelling, where appropriate local models are available.

Some issues to be considered regarding the up-scaling:

- In some cities, some measures will be applied in a sufficiently coherent manner and widely enough that the effects will not need to be scaled up to a city level. However, most measures will not be of such a scale, and the effects of wider application must be estimated.
- Users of a pilot application may not be used to the new technology or measure; the use or impact in the demonstration project may thus be lower than in a full-scale implementation, or when time has been allowed for adjustments.
- There may be network effects if the project is implemented at full scale. For instance, the introduction of a single bus lane and a reduction of road capacity at that section may have limited impact, since cars will probably divert from their regular routes and the travel time gains for the bus are limited. If, however, bus lanes are constructed full-scale as a network, diversions will be much more difficult, while the bus travel time gains are likely to be more substantial. Therefore the impacts on the modal split and congestion are different, resulting in scaling-up problems.
- Some measures will have impacts which take time to develop and the impacts of these should also be estimated. Cities will be assisted by the PEM in the process of up-scaling.

3.7 Evaluation plan & Reporting of the results

In the beginning of the project an evaluation plan will be written containing for each measure:

- a detailed measure description;
- an agreed list of indicators to assess;
- a plan about how to perform which measurements.

At the end of the impact evaluation cities are filling in for each measure a Measure Evaluation Results Template (MERT). The template is described more in detail in section 5.2 and given in Annex D.

4 PROCESS EVALUATION

Success of the CIVITAS measures is influenced not only by its technical solution but also by optimising the process of preparation and implementation including accompanying activities such as information, communication, engagement and participation of stakeholders**. Process evaluation is concerned with the process of how initial proposals for a measure are developed into a feasible design, how the measure is then constructed or implemented.** The process evaluation task is to analyse the implementation process activities for CIVITAS Plus II measures within individual cities and projects.

The main goal of the process evaluation procedure is to develop new findings about factors of success, and strategies to overcome possible barriers during the implementation phase by analyses of all relevant information. Together with the results of the impact evaluation the documentation of the process evaluation will be the basis for the information and recommendations for other European cities, which is one common goal of the CIVITAS Initiative.

4.1 Process evaluation steps

The process evaluation is performed by the cities (LEM and ML) with support of the Project Evaluation Manager (PEM) and SC and consist of the following activities:

1. Agree on common measures and “focused” measures for impact and process evaluation (PEM, LEM, ML, SC);
2. Produce evaluation plans containing a time planning when process evaluation surveys and interviews will take place (ML, MEL);
3. Provide guidance on process evaluation (PEM to LEM, ML);
4. Collect data for the process evaluation (LEM and ML);
5. Perform process evaluation on preparation, implementation and operation phases (LEM, ML with PEM, SC support);
6. Perform “focused” measures process evaluation (LEM with PEM, SC support);
7. Report to the PEM in the form of the Measure Evaluation Results Template (ML, LEM to PEM)

Process and impact evaluation have several steps in common, as illustrated in figure 6. For more information on the common steps please refer to the previous chapter.

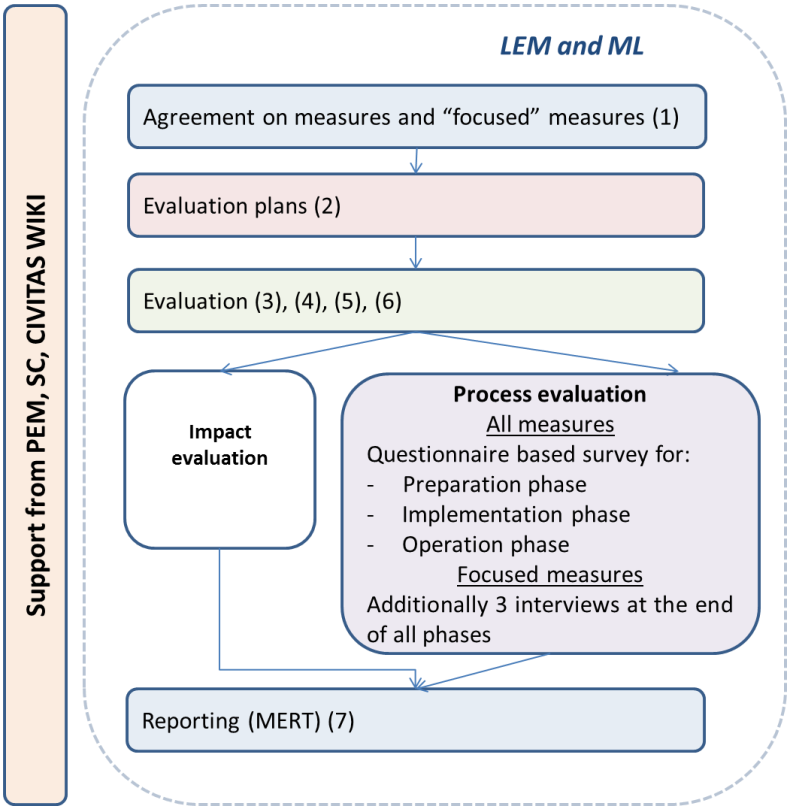


Figure 6: Outline of Process Evaluation Framework

Sections below describe more in detail process evaluation approach and some specific steps which need to be undertaken.

4.2 Process evaluation approach

The process evaluation will mainly take place at the measure level. It is linked with the typical phases of a measure (or bundle of measures), known as the investment life cycle, which can be classified in three time periods:

- **Planning, Preparation and Design phase.** Options for possible measures are discussed in order to select one at the end of this phase. The selected measure is developed in detail and design work for the measure is conducted. If appropriate during the preparation phase, engagement activities for stakeholders are organised to manage potential barriers at an early phase of the measure and to achieve a high level of acceptance. 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 (construction) phase.** The measure will be implemented in real life. This phase can be accompanied by information activities for the public providing

information about the implementation phase, if transport users are affected, and providing information about the upcoming operation phase (awareness and information campaigns). At the end of this phase the measure starts operation.

- **Operation phase.** The measure is opened to the public, i.e. users are able to increase their utility. It might be appropriate to conduct specific information and communication campaigns to bridge possible information gaps of users or potential users of the measure. The first phase of operation lies within the time-frame of the CIVITAS Initiative. The long-term running is the outstanding time (beyond CIVITAS Plus II) 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.

Data collection for the process evaluation and performance of the evaluation itself are the responsibilities of the cities. The Project evaluation manager will assess the results with regard to the project level and will support the measures and the cities with their evaluation work.

4.3 Process evaluation design and data collection

In order to translate the theoretical framework into a practical way of collecting and analyzing data there are several things to consider:

- There is a tendency with ex post evaluation to overemphasize highly visible and evident barriers and drivers and to underestimate the more subtle and complex ones.
- It has to be taken in account that measure aspects during the preparation, implementation and operation are changing.
- It is important to realize that different stakeholders have different views on the barriers and drivers and that information will be filtered and biased.
- The approach must reduce variations in the quality of the data as much as possible and must not lead to carrying out the same work twice for the reporting persons.
- Special attention has to be paid to the ‘stories behind the figures’ and the principles of deepening, broadening and scaling-up.

In Figure 7 the CIVITAS PLUS II Process Evaluation design is shown.

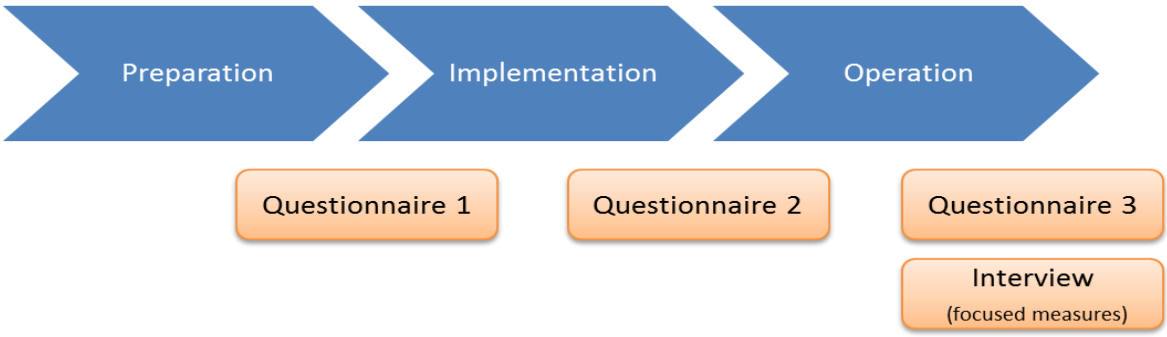


Figure 7: CIVITAS PLUS II Process Evaluation Design

All measures have to be assessed in the same way after the end of each of the three phases, with information gathering based on a semi-closed questionnaire, which is to be found in Annex C and called is the Measure Process Evaluation Form. The questionnaire is to be completed by ML. The LEM will collect and coordinate the questionnaires. The responsibility of the PEM is to steer the MLs and LEMs and to analyse the forms. The Measure Process Evaluation Form (= filled in questionnaire) is divided in 3 parts:

- General administrative information. This information has to be completed in the first reporting period (end of preparation phase) and can be copied to the following reporting periods. Changes have to be amended in each reporting period.
- General content information. Here the three levels of objectives have to be described. If there are no changes the objectives can be copied to the following reporting periods.
- Content - reporting phase: This is the part that contains information and statements concerning barriers/drivers and success /failure.

4.4 'Focused' measures process evaluation

In general, same 'focused' measures will be selected for the impact and process analysis. Though, it is possible that PEM together with LEM and ML will consider that for some regular measures additional focus should be put for impact or process evaluation.

The process evaluation of the 'focused' measures will consist of additional interviews at the end of each project phase. This will result in three in-depth interviews with main stakeholders. Using interviews will lead to more insight in the 'stories behind the figures'.

4.5 Evaluation plan & Reporting of the results

In the beginning of the project an evaluation plan will be written in which there will be described for each measure when the process evaluation surveys and interviews will take place during the project.

At the end of the process evaluation cities are filling in in for each measure a Measure Evaluation Results Template. The template is described more in detail in section 5.2 and given in Annex D.

5 EVALUATION AT PROJECT LEVEL

The evaluation at project level addresses the impacts of the CIVITAS measures within the DYN@MO and 2MOVE2 projects. Each project is focused on implementation and evaluation of the measures in four different CIVITAS cities. The main purpose of the project evaluation is to assess the extent to which the demonstration measures can contribute to better and cleaner urban transport systems. The results and insights gained by both the impact and the process evaluation exercises in the projects will be interpreted when producing the project evaluation report.

Evaluation on the city level is also part of the project evaluation: here will be investigated what the effect of CIVITAS and its measures is for each of the four cities per project.

To perform evaluation on the project level, the following main tasks are identified:

- Set-up a project evaluation plan in which is described how all the evaluations in the project will be carried out (PEM, with input from the LEM for the city parts);
- Identify the cities and measures where comparisons can be made (PEM);
- Collection of results from cities (PEM);
- Assess what the effects of the package of measures in a city are for each of the cities (PEM together with LEM);
- Make comparisons between outcomes of certain measures and cities (PEM);
- Undertake a transferability study of the results (PEM).

The results of the city and project evaluation are presented in the project evaluation report (PEM with input from the LEMs and MLs).

5.1 Project evaluation plan

The Project Evaluation Plan should be written in the starting phase of the project. Annex F provides guidelines for the Project Evaluation plan, indicating the structure, expected general content and level of detail.

Parts of the evaluation plan (the parts that describe the planned measure evaluation) can be used later directly in the measure evaluation result template (MERT, see 5.2).

The Project Evaluation Plan comprises two main parts.

1. The Project plan aspects including:
    - Introduction to the Project
    - The general approach to evaluation
    - The evaluation process – how the plan will be taken forward

- The results

2. The City evaluation plans – one plan for each City including:
    - Introduction to the city
    - Objectives and overview of the Measures
    - Details of each Measure, how it will be evaluated and planning.
    - Overlapping and interdependencies of the different measures.

The Project Evaluation Plan will be repeated for each Measure within the City and repeated for each City within the Project.

It is a responsibility of the LEM and ML to collect information and fill in the city evaluation plan. Evaluation plans are submitted to the PEM who bundles the city sections and completes the project part.

5.2 Project evaluation process

The evaluation at project level will be based on evaluations of individual measures, bundles of measures and an evaluation at the city level. Earlier in this document, the general approach for impact evaluation and process evaluation is described how to ensure the comparability at the measure level and transferability of the evaluation results at the city level. Assuming all the evaluations in cities are performed as planned and good quality evaluation results are obtained, the outcomes and findings of the project can be described.

To achieve the objectives, the following approach might be considered:

- Grouping of measures within the work packages, the objectives and the potential impacts of the measures will be one of the main factors to be considered. In addition, other factors will be considered:
    - Timing for implementation
    - Methods of measurements
    - Strategies defined by each of the projects.
- Impact evaluation will be performed based on “before-and-after” data provided by each individual city (the same as that used for evaluation at measure level). Where possible evaluation data and results from CIVITAS Plus II measures would be included or compared. The results of the Cost Benefit Analyses of selected measures will be included to provide a consistent cross-site output.
- Assessment of transferability (section 5.4) will be based on results from both impact evaluation and process evaluation.

5.3 Collection of results from cities

A template for collection of results from evaluation activities was created to ensure a uniform and high level of consistency of results across the evaluation and across the CIVITAS projects. The template of the Measure Evaluation Results Template is presented in Box 1 and is presented in detail in Annex D. It serves multiple purposes:

- Facilitates information “storage”;
- Re-assures reporting of all evaluation-relevant information (“completeness control”);
- Ensures a common reporting style;
- Facilitates analysis of evaluation results for the Projects and CIVITAS WIKI;
- Disseminates measures evaluation results in a clear and concise manner.

Box 1: Measure Evaluation Results Template

Section A: Introduction

- A1: Objectives
- A2: Description

Section B: Measure implementation

- B1: Innovative aspects
- B2: Research and Technology Development
- B3: Situation before CIVITAS
- B4: Actual implementation of the measure
- B5:Inter-relationships with other measures

Section C: Impact Evaluation Findings

- C1: Measurement methodology
- C2: Measure results
- C3: Achievement of quantifiable targets and objectives
- C4: Up-scaling of results
- C5: Appraisal of evaluation approach
- C6: Summary of evaluation results
- C7: Future activities relating to the measure

Section D: Process Evaluation Findings

- D1: Deviations from the original plan
- D2: Barriers and drivers
- D3: Participation of stakeholders
- D4: Recommendations

Information collected by MLs and LEMs in the process and impact evaluation databases will be imported to the results template. Measure Leaders and Local evaluation managers are responsible for completing these Measure Evaluation Result Templates. The completed templates are than sent to the Project Evaluation Manager who will perform a basic quality and completeness check (data validation).

This will be used as input when the Project evaluation manager summarize the project findings in the project evaluation report.

5.4 Transferability

A concluding task of the evaluation at project level is to identify those measures which have been successful in achieving the CIVITAS objectives and which could also be successful in other cities across Europe.

The main objective of the transferability analysis is to assess whether the success of measures in a city are dependent on any particular conditions, and whether the success achieved and the lessons learnt in one city can be transferred to other cities.

Successful implementation of a measure or a package of measures in a given city should provide ground for transferring the experience to other cities, if the right conditions are met. Transferability addresses the possibility of transferring/adopting in a given city successful measures that were previously adopted elsewhere. Once a measure (or a package of measures) has proved successful in a city, the same measure may prove to be successful elsewhere. However, the replication of a success in a different context is subject to certain conditions.

There are no cities with exactly the same conditions. Cities can be different from each other in many aspects of transport and traffic conditions (demand, supply, infrastructure, traffic control and management, etc.), geographical, environmental, demographic, socio-economic, cultural backgrounds, and institutional and legal frameworks. Therefore, it is a challenging task to make sure that success in one city can be replicated in another city.

The hypothesis underlying transferability is that if a measure or package of measures has been successfully implemented in an area, comparable results can be achieved in areas characterised by a similar setting. To achieve the objective of transferability assessment, the following tasks have been identified:

- Collect all related information about the measure, implementation, evaluation and background
- Understand cause-effect relationships which explain the successful/unsuccessful measure
- Assess the dependence of the results on local conditions
- Understand to what extent the differences across settings have caused variations in the success of the measures.

The knowledge collected during the process evaluation will be particularly relevant for these tasks.

5.5 Project evaluation report

The demonstration cities will produce a series of building blocks of knowledge that must be combined to form a clear interpretation to appropriately promote sustainability applications across Europe. The results and insights gained by both the impact and the process evaluation exercises in the projects will be interpreted when drafting the project evaluation report.

The project evaluation report will include:

- A quantified assessment of the impacts of the CIVITAS measures across individual cities covering the areas of economy, energy, environment, society and transport;
- An analysis and interpretation of the results in relation to context-specific situations that might contribute to explain the nature and extent of the results obtained;

- General conclusions about the impacts of CIVITAS for each of the cities in the project;
- Lessons learned about CIVITAS measures and evaluation;
- Recommendations to the interested stakeholders: the European Commission, cities and local authorities, governments and regional authorities.

6 REFERENCES

- Dziekan, K. et al (2013), Evaluation Matters: A practitioners' guide to sound evaluation for urban mobility measures. Waxmann, Berlin.
- CIVITAS POINTER (2009), Framework for Evaluation in POINTER.
- CIVITAS GUARD (2006), Framework for Evaluation.
- Cochran W.G. (1963), Sampling Techniques. Wiley & Sons.
- METEOR Deliverable D2 (2003), Assessment Framework and Evaluation Guidelines for Data Collection.
- Piao, J. and J. Preston (2010), CBA Recommendations for CIVITAS Evaluation, TRG University of Southampton.

Annex A: Indicator Definition & Methodology Sheets

Core Indicator 1:	**Average operating revenue**
Category:	Economy
Sub-category:	Benefits
Impact	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 where: 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	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 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	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” and indicator 2A “Capital costs”.
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
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 buses 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 the operating costs 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 3:	**Vehicle fuel efficiency**
Category:	Energy
Sub-category:	Energy consumption
Impact	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) B = Total energy consumed for the vehicle(s) (by type and fuel) considered, unit: (MJ) C = Total 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.

Core Indicator 3:	**Vehicle fuel efficiency**
	• **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) • **Domain:** demonstration area and/or city
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	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**: %
Methods of measurement	• **Method of data collection**: Data about fuel mix can be collected at 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

Core Indicator 4:	**Fuel mix**
	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 • **Domain:** demonstration area and/or city
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:	**CO level**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact	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 environmental 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 6:	**NO_x level**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact	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 environmental 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 $\mu g/m^3$ (8 hour average) and 40 $\mu g/m^3$ (year). WHO guidelines for Europe (1996) set the target values of 200 $\mu g/m^3$ (1 hour average).

Core Indicator 7:	**Particulate levels**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact	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 environmental 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 8:	**CO_2 emissions**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact	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 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 environmental 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 9:	**CO emissions**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact	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 engine, type and quality of fuel used, average fuel efficiency, age of 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 environmental 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 10:	**NO_x emissions**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact	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 environmental friendly behaviours) 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 11:	**Small particulate emission**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact	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 environmental 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 - or because their impact on health has not yet been fully demonstrated (VOC).
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 bio-fuels
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 12:	**Noise perception**
Category:	Environment
Sub-category:	Pollution/Nuisance
Impact	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

Core Indicator 13:	**Awareness level**
Category:	Society
Sub-category:	Acceptance
Impact	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 14:	**Acceptance level**
Category:	Society
Sub-category:	Acceptance
Impact	Acceptance
Context and relevance	Core indicators 13 and 14 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 15:	**Perception of service accessibility**
Category:	Society
Sub-category:	Accessibility
Impact	Spatial accessibility
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**: 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 16:	**Relative travel cost**
Category:	Society
Sub-category:	Accessibility
Impact	Economic accessibility
Context and relevance	This core indicator provides useful information in the context of transport and social inclusion. There are many categories of social inclusion, namely physical, geographical, exclusion from facilities, time-based exclusion, fear-based exclusion, economic exclusion and spatial exclusion. In terms of social inclusion and accessibility, this indicator concentrates on economic accessibility. PT fares are usually not directly adjusted to the personal available income. Frequent exceptions are children, students, senior citizens, welfare recipients and unemployed who can usually use PT at reduced fares in order to compensate for their anticipated lower personal income. Under the assumption of fixed fares, the lower the income of a PT user the higher the share (percentage) of their personal income that has to be spent on PT. The pricing regime in conjunction with the personal income of a potential PT or other service user can be a major obstacle to using PT or the other service (and thereby to getting access to some factors of social well-being, such as employment, education, health care provision, etc.). Many CIVITAS measures may have impacts on travel mode choice, and then on travel costs. These include access control, road pricing, parking control, and promotion of bicycle use and walking. The core indicator can be used to addresses the travel cost in proportion to average personal income. It also provides insights to indicator 26-27 “modal split”.
Definition	**Relative travel cost** is defined as the average travel cost (for the PT or other service) as a percentage of the average personal available income. **Unit**: % or percentage based index
Measurement	• **Method**: Travel modes on which CIVITAS measures are likely to have significant impacts on cost will be identified first (road charging, parking control, promotion of bicycle use and walking). Information about personal travel cost and income may best be collected through questionnaires, since this gives anonymity which is important for obtaining personal financial information. • **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 personal travel cost in the areas investigated. • **Target group**: commuters • **Domain:** demonstration area and/or city
References:	The Social Exclusion Unit (SEU) of the UK government on “Transport and Social Exclusion”, Interim Report “Making the Connections – Transport and Social Exclusion”.

Core Indicator 17:	**Perception of security**
Category:	Society
Sub-category:	Security
Impact	Security
Context and relevance	The perception of security is critical to the improvement of the attractiveness of PT particularly and social inclusion in general. In PT, there are some concerns (and even fear) among passengers for their personal security, health and general well-being. Fears for personal security can lead to reluctance or actual avoidance of using PT. This is particularly evident at specific times of the day (at night or during darkness) or in specific areas perceived as being "dangerous". In general, fear of personal safety is particularly articulated by women and elderly people, and for people travelling during the evening or early morning. It is difficult to obtain an indication of security by relying solely on quantitative measurements, since incidents that occur are often not reported. Reasons for not reporting a large portion of incidents may include a reluctance to delay the journey, a lack of confidence that the offender will be caught, the absence of someone to report to, and the belief that a report will not be taken seriously. Incidents such as abuse, harassment and intimidation are in general even less likely to be reported. Often only a limited number of security incidents are reported. However, PT passengers still (may) reveal their perception of fear for their personal security when asked by means of an anonymous questionnaire. Therefore, subjective measurements (perceptions) are necessary in order to obtain an indication of security This core indicator evaluates the changes in terms of the perception of security rather than focussing on quantitative data that is nearly impossible to collect (e.g. number of attacks). A higher degree of perceived security may result in increased attractiveness of PT, while a lower number of reported incidents may not be a sufficient indication of increased security (e.g. because of reluctance to report an incident).
Definition	**Perception of security** is defined as the perceived security of a service by its users. For PT this concerns PT vehicles as well as at and around the PT stops. **Unit**: index
Measurement	• **Method**: CIVITAS measures having significant impacts on security will need to be identified. In the sites/areas, perceived PT security can be assessed though a survey which take the form of mailed questionnaires, face-to-face interviews, telephone interviews etc. • **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 sample chosen should be sufficient in size and distribution (e.g. age, gender, disabled people) to give a good representation of the user opinions on PT security in the areas investigated. • **Target group**: PT or other service users • **Domain:** city or demonstration area
References:	

Core Indicator 18:	**Accuracy of time keeping**
Category:	Transport
Sub-category:	Quality of service
Impact	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 19:	**Quality of service**
Category:	Transport
Sub-category:	Quality of service
Impact	Service quality
Context and relevance	The overall quality of transport services encompasses a variety of aspects - comfort, travel time, reliability, safety, privacy, etc. - but travellers usually share a holistic concept of quality, which this indicator seeks to measure. Public transport is in continuous competition with other transport modes, particularly the private car, and the general perception of the overall PT quality is one of the aspects influencing individual choices. This indicator feeds directly into the formulation of PT policies aimed at attracting more users and at avoiding further shifts from public transport users to other means of transport. However, the indicator may also be used to assess the quality of other innovative services. Many CIVITAS measures will have impacts on public transport services including PT information, electronic ticketing systems, PT priority, bus lane control, using telematics for PT monitoring and control etc. The perception of the quality of a service is a key measure related to its success or failure.
Definition	**Quality of service** is defined as the user's perception of the overall quality of the service provided. **Unit**: index of the "perception" of service quality.
Measurement	• **Method**: The perception of service quality should be measured on a five-point scale, such as: very dissatisfied, somewhat dissatisfied, very satisfied, somewhat satisfied and neither satisfied nor dissatisfied. The answer depends very much on the formulation of the question adopted. The question to be asked could be for instance "How do you rate the quality of public transport in your city?" Each target group must be represented by the survey. • **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**: sufficient data should be collected to give a good representation of the target groups identified. • **Target group**: PT or other service users • **Domain:** city or demonstration area
References:	

Core Indicator 20:	**Transport safety**
Category:	Transport
Sub-category:	Safety
Impact	Transport safety
Context and relevance	The chance of getting involved in a traffic accident provides a direct contribution to measuring the quality of life. Fatalities and injuries caused by traffic accidents are one of the most important social costs associated with transport systems. Accident rates are known to vary with the quality of road infrastructure, the technology of vehicles, the behaviour of drivers, traffic regulations, vehicle density, enforcement, etc. While policies must address each and every such aspect, this indicator provides an aggregated measure of the overall policy performance with regard to safety. This indicator is used because the numbers of accidents, fatalities and casualties provide an important view of the traffic safety situation and are normally recorded by city police departments. The focus is on the number of transport accidents causing injury and the resulting number of fatalities and casualties. The underlying reasons for an accident can vary considerably and are not directly addressed by this indicator. Many CIVITAS measures aim at increasing transport safety directly (e.g. safe access for pedestrians, monitoring centre for road safety and accident prevention) or indirectly (e.g. reducing traffic demand by access control, road pricing, car pooling, car sharing, promotion of using PT etc.)
Definition	**Transport safety** is defined as the number of recorded transport injury accidents and the resulting number of fatalities and casualties caused by any means of transport. A recorded injury accident is any transport incident causing death or injury which is recorded by the police. **Unit**: number of accidents, number of fatalities and number of casualties.
Measurement	• **Method**: - The numbers of accidents, fatalities and casualties are related to the number of vehicle-km or person km, so such data also need to be obtained to provide relative rates (see indicator 21). The accident data will need to be obtained from the police or city authorities as appropriate. • **Frequency:** Accident records will need to be maintained for the full period of the project for subsequent analysis. To understand changes statistically some historic data records for the previous 2-3 years may also need to be used. • **Accuracy**: Since the dependence on external sources for collecting the data cannot be avoided the accuracy of these databases has to be accepted. It is therefore important to understand the basis of collection and accuracy of the databases to be used. Police authorities of different countries use different criteria to include accidents and their status (fatality and injury) in their reports. This can lead to difficult comparisons. Thus, for reasons of accuracy and comparability it is important to detail the criteria and describe the way they are used in practice when recording the data. • **Target group**: Road users • **Domain:** The area covered must be sufficient to understand the changes occurring and may need to include a ‘control’ area.
References:	

Core Indicator 21: **Core Indicator 22:**	**Traffic flow (peak)** **Traffic flow (off-peak)**
Category:	Transport
Sub-category:	Transport system
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 23: **Core Indicator 24:**	**Average vehicle speed (peak)** **Average vehicle speed (off peak)**
Category:	Transport
Sub-category:	Transport system
Impact	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 25:	**Freight Movement**
Category:	Transport
Sub-category:	Transport system
Impact	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 26: **Core Indicator 27:** **Core Indicator 28:**	**Average Modal Split (vehicle km)** **Average Modal Split (passenger km)** **Average Modal Split (trips)**
Category:	Transport
Sub-category:	Transport system
Impact	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 (vehicle km / passenger km)** is defined as the percentage of vehicle km or passenger km by transport mode over the year. **Unit**: % of vehicle km <u>or</u> passenger km <u>or</u> trips <u>Modes:</u> 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 • **Domain:** city or demonstration area
References:	

Core Indicator 29:	**Average occupancy**
Category:	Transport
Sub-category:	Transport system
Impact	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. On the other hand, occupancy rates of PT services also contribute to their economic performance. 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 Vehicles: Buses, trams, metro and cars
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**: Public transport vehicles and passenger cars • **Domain:** city or demonstration area
References:	

Core Indicator 30:	**Sustainable Urban Mobility Plan (SUMP)**
Category:	Governance
Sub-category:	Planning
Impact	Planning process
Context and relevance	EU encourages cities to develop Urban Mobility Plans, bringing together a set of elements which were previously parts of separate planning processes (e.g. land-use planning, pricing schemes, infrastructure provision, etc.). Within CIVITAS several cities will develop a Sustainable Urban Mobility Plan. This indicator can be used in order to assess whether the plan produced goes further than the traditional transport planning process and includes areas necessary for the sustainable long term planning in the cities.
Definition	**Sustainable Urban Mobility Plan** **Unit**: regional/municipal transport plan, sustainable urban mobility plan
Measurement	• **Method**: The Existing transport plan should to be compared with the developed SUMP. This Comparison has to cover the following areas: - Strategic level vision (often short-term perspective without strategic vision of the traditional plans versus a long term/strategic vision of a SUMP - Geographic scope (focus on practical city in the traditional plan versus the functional city concept in the SUMP) - Level of public involvement (limited input from operators and other local partners in traditional plan versus high citizen and stakeholder involvement as an essential characteristics of the SUMP) - Types of measures (proposed measures in SUMP should balance social, environmental and economic development characteristics) - Sector integration (flow transport and infrastructure focus in traditional plan versus integration of practices and policies between policy sectors) - Institutional cooperation (non-mandatory cooperation between authority levels in the traditional plan versus integration between authority levels in SUMP) - Monitoring and evaluation (often missing in the traditional plan versus regular monitoring process focus on the achievement of measurable targets and outcomes in the SUMP) - Finance (type of financing schemes, inclusion of PPP schemes, etc.) - Implementation (mainly led by government in traditional plans versus high involvement of industry in the SUMP) • **Frequency:** The comparison can be conducted at the end of the project • **Accuracy**: - • **Target group**: Local/Regional government • **Domain:** city or demonstration area
References:	

Annex B: Research methodologies

B.1 Sample Size

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 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, *n*, 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. This approach was followed for large-scale travel questionnaires and diaries

in Winchester for the MIRACLES project in CIVITAS I. The process that was used for determining the sample size is shown in Figure B.1.

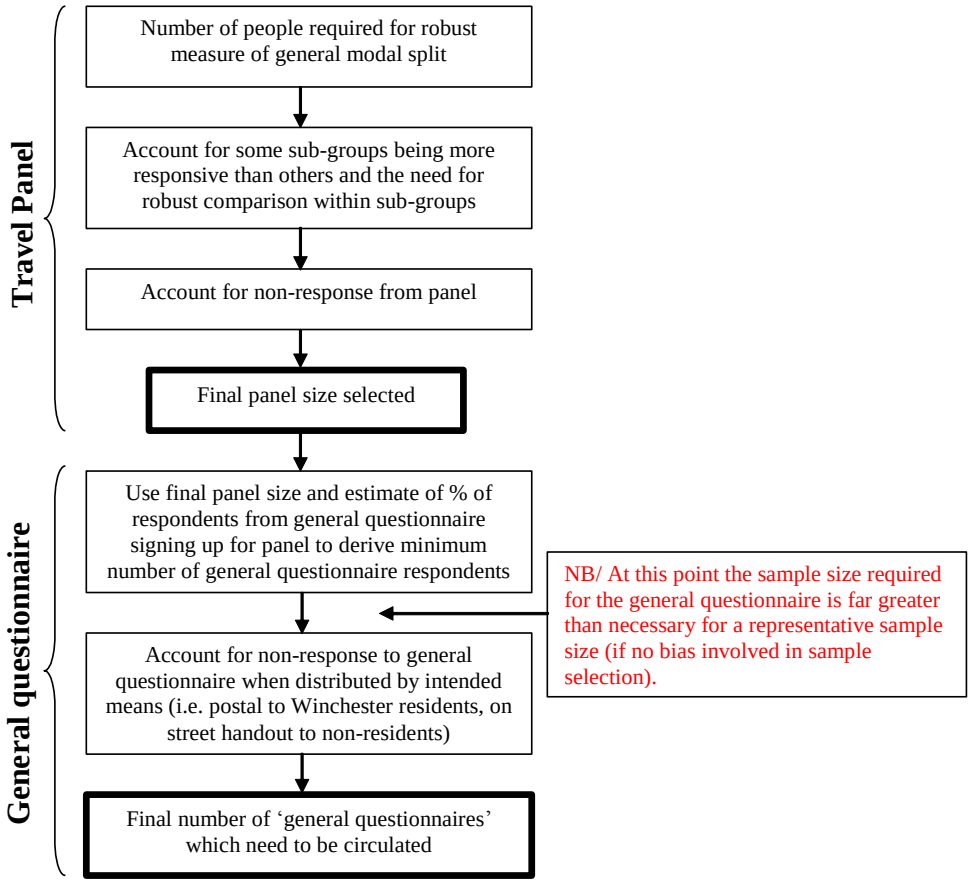


Figure B.1: Flow diagram showing how sample sizes for large scale questionnaires in Winchester were developed

B.2 Data collection methodology

For questionnaire surveys, the main methods of collecting information include face-to-face interviewing, telephone, mail, and internet. Each method of the data collection has inherent advantages and disadvantages.

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-recognised 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. Compare 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 socio-economic groups and younger people who do have access to the internet and miss out other groups.

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. Table B.1 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 B.1: 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)

B.3 Measurement conditions

The conditions surrounding (and influencing) the data collection should as far as possible be controlled and homogeneous. Thus the time of day, traffic and weather conditions etc. must be chosen so that a group of measurements or simulations take place under more or less the same conditions (blocking).
Special considerations to bear in mind include:

- the measure may perform differently from the reference case for particular conditions of measurement; for example, an enhanced UTC measure may perform much better than the reference case when traffic flows are at or near the capacity, so monitoring conditions of measurement is important.
- specification and calibration of a simulation model may vary in adequacy over the range of conditions being simulated.
- measured indicators may be strongly correlated with parameters which describe the measurement conditions; a good example is the relationship between travel time through a road network and the level of traffic on that network. So, if average travel time through a validation site is being measured as an indicator for a number of peak periods, it is necessary to allow for any variations in traffic flow from one peak period to the next in comparing the performance of a measure with a reference case (here traffic flow would be called a “confounding variable”, which may mask or counteract the main variable of interest).

The usual response to such considerations is to measure or simulate indicators for conditions which are as well-defined as possible (that is, as homogeneous as possible) but this approach may still leave the problem of confounding variables and it has obvious resource implications for validation.

Annex C: Measure Process Evaluation Form

Part A. General administrative information

- *It is important to know who the compiler – the one who filled in the form – of this form is. This way the Project Evaluation Manager (PEM) is able to refer directly to the compiler for questions or comments.*
- *Please fill in the answers in the boxes with the question marks.*
- *If there are no changes compared with the previous period the information can be copied from the previous reporting period.*

Project	????????
City	????????
Measure number	????????
Measure title	????????
Reporting period	From dd-mm-yyyy To dd-mm-yyyy
Measure leader coordinates	
Name	????????
Telephone	+ ?? ?????????
Fax	+ ?? ?????????
E-mail	????????
Compiler of the Measure Process Evaluation Form coordinates *Only to be filled in if this is someone other than the Measure Leader*	
Name	????????
Telephone	+ ?? ?????????
Fax	+ ?? ?????????
E-mail	????????

Part B. General content information

B1.
What are the objectives of the measure?

- *Three levels are distinguished: High level (Longer term), Strategic level and Measure level.*
- *Please fill in the answers in the boxes with the question marks. It is advisable to copy the objectives described in the Measure Evaluation Sheets in part 3 of the Local Evaluation Plan (LEP) as long as there have not been any changes to the measure.*
- *If there are no changes compared with the previous reporting period, the objectives can be copied from the previous reporting period.*

High level / Longer term *Please describe the high level / longer term objective of the measure in one or two sentences. This should be the latest version of the objective. An example is 'to reduce the congestion and pollution in the city centre'*	????????
Strategic level *Please describe the strategic level objective of the measure in one or two sentences. This should be the latest version of this objective. This refers to the way of achieving the high level objective. An example is 'to reduce private car use in the city centre in the rush hour'*	????????
Measure level *Please describe the measure level objective of the measure in one or two sentences. This should be the latest version of this objective. This refers to the contribution to achieving the strategic objective. An example is 'to design and implement a bike-sharing scheme to transfer 3% of car trips to bikes'*	????????

B2.

Which groups have been targeted with the measure?

- *There are predefined answers.*
- *Please put a 'X' in the open box before the number. It is advisable to compare the target groups described in "Stakeholder involvement" in the Measure Evaluation Sheets in part 3 of the Local Evaluation Plan (LEP) and mark the corresponding group in the table below. If there are other target groups than the ones mentioned in the table it should be made use of line 10 "other".*
- *More than one answer is possible.*
- *If there are no changes compared with the previous reporting period, the answers can be copied from the previous reporting period.*

	1	Residents
	2	Car drivers / motorists
	3	Public transport users
	4	Cycle / walking groups
	5	Mobility impaired people
	6	Commuters
	7	Visitors (shops / leisure)
	8	Local businesses
	9	General public
	10	Other, *please describe* ??????

B3.

Who are the measure partners and what is their level of activity in the measure?

- *Please fill in one table for each measure partner. Partners are participants in the measures. Only one can have a leading role: the participant that have signed the measure contract as the measure leader. Principle participants are the partners that have co-signed the measure contract. Occasional participants did not have co-signed the measure contract, but somehow are involved in the measure.*
- *Please give the name of the measure partner in the box with the question marks.*
- *Where there are predefined answers please put a 'X' in the open box before the number.*
- *Only one answer is possible for each item.*

- *If there are no changes compared with the previous reporting period, the answers can be copied from the previous reporting period.*

Measure partner 1					
Name	?????				
Type of organisation			Level of activity		
	1	City		1	Leading role
	2	Public transport company		2	Principle participant
	3	Knowledge institution (e.g. university)		3	Occasional participant
	4	Non-Governmental Organisation (e.g. consumer organisation)			
	5	Private company			
	6	Other, *please describe* ????			

Measure partner 2					
Name	?????				
Type of organisation			Level of activity		
	1	City		1	Leading role
	2	Public transport company		2	Principle participant
	3	Knowledge institution (e.g. university)		3	Occasional participant
	4	Non-Governmental Organisation (e.g. consumer organisation)			
	5	Private company			
	6	Other, *please describe* ????			

Measure partner 3					
Name	?????				
Type of organisation			Level of activity		
	1	City		1	Leading role
	2	Public transport company		2	Principle participant
	3	Knowledge institution (e.g. university)		3	Occasional participant
	4	Non-Governmental Organisation (e.g. consumer organisation)			
	5	Private company			
	6	Other, *please describe* ????			

Measure partner 4					
Name	?????				
Type of organisation			Level of activity		
	1	City		1	Leading role
	2	Public transport company		2	Principle participant
	3	Knowledge institution (e.g. university)		3	Occasional participant
	4	Non-Governmental Organisation (e.g. consumer organisation)			
	5	Private company			
	6	Other, *please describe* ????			

Measure partner 5					
Name	?????				
Type of organisation			Level of activity		
	1	City		1	Leading role
	2	Public transport company		2	Principle participant

	3	Knowledge institution (e.g. university)		3	Occasional participant
	4	Non-Governmental Organisation (e.g. consumer organisation)			
	5	Private company			
	6	Other, *please describe* ????			

Measure partner 6					
Name	?????				
Type of organisation			Level of activity		
	1	City		1	Leading role
	2	Public transport company		2	Principle participant
	3	Knowledge institution (e.g. university)		3	Occasional participant
	4	Non-Governmental Organisation (e.g. consumer organisation)			
	5	Private company			
	6	Other, *please describe* ????			

Part C. Content information for this reporting period

C1.

What was the phase of the measure during the reporting period?

- *There are predefined answers.*
  - ✓ *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.*
  - ✓ *Operation phase: the measure is opened to the public, i.e. users are able to increase their utility. The first phase of operation lies within the time-frame of the CIVITAS Plus Initiative and can be analysed and evaluated by CIVITAS POINTER. The long-term running is the outstanding time (beyond the CIVITAS II Initiative) 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.*
- *Please put a 'X' in the open box before the number.*

	1	Preparation phase.
	2	Implementation phase
	3	Operation phase
	4	Transition from preparation phase to implementation phase
	5	Transition from implementation phase to operation phase

C2.

Process barriers are events or overlapping conditions that hampers the process to obtain measure objectives/goals. In the checklist below you will find a number of barrier fields and examples of barriers which might have been encountered during the reporting period in trying to reach the objectives as given in question B1.

Barrier fields and examples of possible barriers

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 believes 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 life style 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 (policy) key 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**	?????????

What are the three most important barriers encountered <u>during the reporting period?</u>

- *Please fill in the number of the barrier field from the checklist above in the open box according to importance.*
- *Please fill in a specification of the barrier in one sentence.*
  This is important to make the barrier more understandable for people outside the cities - without detailed knowledge of the measure - the barriers should be described with more detail. Questions to be answered in this part are: Which impact did the barrier have on the process of the measure and How did it occur? What exactly happened?
  <u>Example:</u> *If a (institutional) barrier is described just with "Impeding administrative structures, procedures and routines" it is not clear what happened in the city and what negative impact this factor had on the measure. It would be better to additionally write in one sentence a more specific explanation such as "The new complex legislation of procurement for the purchasing of goods and services has caused delays in the process of the public tender necessary for purchasing the automatic control system"*

NR	Specification of barrier (max one sentence)		
		1	Most important barrier
		2	Second most important barrier
		3	Third most important barrier

C3.

Process drivers are events or overlapping conditions that stimulates the process to obtain measure objectives/goals. In the checklist below you will find a number of driver fields and <u>examples</u> of possible drivers which might have been encountered <u>during the reporting period</u> in trying to reach the objectives as given in question B1.

Driver fields and examples of possible drivers

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) believes 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 life style 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 policy key stakeholders, constructive and open consultation and involvement or 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**	?????????

What are the three most important drivers encountered <u>during the reporting period?</u>

- *Please fill in the number of the driver field from the checklist above in the open box according to importance*
- *Please fill in a specification of the driver in one sentence.*
  This is important to make the driver more understandable for people outside the cities - without detailed knowledge of the measure - the drivers should be described with more detail. Questions to be answered in this part are: Which impact did the driver have on the process of the measure and How did it occur? What exactly happened?
  ***<u>Example</u>**: If a (political) driver is described only with "strong commitment of local authorities", it is not clear to the outside reader which impact on the measure process this driver is causing. It is necessary to write in one sentence which local authority or person is concerned and what has changed concerning the process of the measure due to this commitment. An example is: "The alderman for city development has promoted the measure in such a way that also business became interested in the measure and this now company XXX is an principal partner"*

NR	Specification of driver (max one sentence)		
		1	Most important driver

		2	Second most important driver
		3	Third most important driver

C4.
Activities are actions taken by one or more measure partners to handle the barriers and / or to make use of the drivers to reach the measure objectives. In the checklist below you will find a number activity fields and examples of possible activities taken during the reporting period to overcome the barriers or to make use of the drivers

Checklist of activity fields and examples of possible activities

NR	Activity field	Examples of activities
1	**Political / strategic**	(Co-)development of vision on sustainable development or sustainable mobility, (Co-)development of a program towards sustainable development or sustainable mobility, discours with key stakeholders (politicians etc) about the sustainability problems to be solved
2	**Institutional**	Analysis of and/or proposals to change impeding rules, structures, legislation, organisational structures etc.
3	**Cultural**	Facilitating cultural circumstances and life style patterns
4	**Problem related**	Thoroughly analyzing problems towards sustainable mobility to be solved, activities to explain the pressure of the problem, all activities towards sharing the sense of urgency among key stakeholders to sustainable mobility
5	**Involvement, communication**	Consultation of target groups by workshop, conference, focus group, expert meeting, face-to-face interviews or questionnaires, telephone interviews or questionnaires or web based questionnaires, public awareness campaign about the sustainability problems to be solved, bringing together key stakeholders to discuss the sustainability problems to be solved (sharing different viewpoints), public awareness campaign about the measure through media activities, involvement of key stakeholders (politicians etc) in the measure
6	**Positional**	Put the measure concerned into a running sustainability program (combined with the strategic actions), activities to exchange experiences with other measures / cities (workshop, conference, focus group etc)
7	**Planning**	Raising or attempting to raise additional 'time budget' for the measure , (re)conduct the economic and technical planning as well as analysis to determine requirements of measure implementation, (re)conduct market analysis to determine requirements for measure implementation, thoroughly analyzing user needs analysis to better understand the user requirements
8	**Organizational**	Activities to raise the competences of the measure partners (for example special courses etc), activities to raise the motivation of the measure partners (for example extra measure meetings)
9	**Financial**	Raising or attempting to raise additional financial budget for the measure, developing a context which is attractive to the business community to contribute financially
10	**Technological**	Raising or attempting to raise additional technical resources for the measure (all kind of equipment), all kind of actions to solve technological problems
11	**Spatial**	(Attempts) Adjusting the construction permissions, creating experimental and /of investment zones / city parts / corridors
12	**Other**	?????????

What are the three most important activities taken during the reporting period?

- *Please fill in the number of the activity field from the checklist above in the open box according to importance. Please bear in mind that there should be a link between the barriers and drivers as mentioned before.*
- *Please fill in a specification of the activity in one sentence.*
- *This is important to make the activity more understandable for people outside the cities - without detailed knowledge of the measure and to link them to the barriers and drivers as mentioned before.*
  - the drivers should be described with more detail.
  ***Example**: The (political) driver is a strong political commitment in the participation in the campaign to raise awareness for sustainable mobility. The (involvement) activity taken (to make use of the driver) may be described as: "Involvement of committed politicians in the awareness raising campaign activities such as: Conferences, Meetings, Public discussions"*

NR	Specification of the activity (max one sentence)		
		1	Most important activity
		2	Second most important activity
		3	Third most important activity

C5.

Regarding the barriers, drivers and activities undertaken how do you estimate the risk to reaching the objectives (question B1) on the high, strategic and measure levels at this moment?

- *There are predefined answers.*
- *Please put a 'X' in the open space before the number.*
- *Only one answer for each level is possible.*

High level / Longer term		1	Very low risk
		2	Low risk
		3	Moderate risk
		4	High risk
		5	Very high risk
Strategic level		1	Very low risk
		2	Low risk
		3	Moderate risk
		4	High risk
		5	Very high risk
Measure level		1	Very low risk
		2	Low risk
		3	Moderate risk
		4	High risk
		5	Very high risk

Part D. Any other comment

- *If you have any other comment you can note this in the box below.*
- *If there are any ambiguities in the previous parts of the form, it is advisable to make use of this box for explanations. This might be for instance be applicable if there are mentioned several barriers in part C2 but no actions taken by a measure partner to overcome them in part C4. Why have there been no actions taken?*

THANK YOU VERY MUCH FOR YOUR COOPERATION

Annex D: Measure Evaluation Results Template

Measure title: **Measure Name**

City: **City name** *Project:* **Project name** *Measure number:* **xx.yy**

A Introduction

A1 Objectives

The measure objectives are:

(A) High level / longer term:

- To …

(B) Strategic level:

- To …

(C) Measure level:

(1) To ……..in order to (*give target where possible*)

(2) To ……..in order to (*give target where possible*)

(1) Etc..

A2 Description

Body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text

B Measure implementation

B1 Innovative aspects

Select one or more innovative aspects from the list below (see Guidance notes for further explanation), then describe each in more detail with a few sentences:

Innovative Aspects:

- New conceptual approach
- Use of new technology/ITS
- New mode of transport exploited
- Targeting specific user groups
- New economic instrument
- New policy instrument
- New organisational arrangements or relationships
- New physical infrastructure solutions
- Other – *please describe*

The innovative aspects of the measure are:

- **Innovative aspect 1 –** Bullet text bullet text bullet text bullet text bullet text bullet text bullet text bullet text bullet text bullet text bullet text bullet text bullet text
- **Innovative aspect 2 –** Bullet text bullet text bullet text bullet text bullet text bullet text...

....

B2 Research and Technology Development

Body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text

B3 Situation before CIVITAS

Body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text

B4 Actual implementation of the measure

The measure was implemented in the following stages:

Stage 1: Title title title title *(Date from - Date to)* **–** *Stage description text stage description text stage description text stage description text stage description text ….*

Stage 2: Title title title title *(Date from - Date to)* **–** *Stage description text stage description…*

……………….

Where possible include diagrams and maps to aid understanding.

B5 Inter-relationships with other measures

The measure is related to other measures as follows:

- **Measure 1 no. –** Description of relationship description of relationship description of relationship description of relationship description of relationship
- **Measure 2 no. –** Description of relationship description of relationship description ….

……….

C Impact Evaluation Findings

C1 Measurement methodology

C1.1 Impacts and Indicators

Table C1.1: Indicators. *Insert your own table where available, use landscape layout as necessary*

No.	Impact	Indicator	Data used	Comments
	Table text	Table text	Table text	Table text

Provide detailed description of the indicator methodologies, of all impacts from measures and how each will be dealt with. Explain how it is linked to indicators.

- **Indicator 1** (*Name of indicator*) – Bullet text Bullet text Bullet text Bullet text Bullet text Bullet text Bullet text Bullet text Bullet text Bullet text Bullet text Bullet text
- **Indicator 2** (*Name of indicator*) – Bullet text Bullet text Bullet text Bullet text …..
- **….**

C1.2 Establishing a Baseline

Body text body text …

C1.3 Building the Business-as-Usual scenario

Body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text …

C2 Measure results

The results are presented under sub headings corresponding to the areas used for indicators – economy, energy, environment, society and transport.

C2.1 Economy

Body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text …

Table C2.1.1: Title….

Indicator	Before (date)	B-a-U (date)	After (date)	Difference: After –Before	Difference: After – B-a-U
No. and name					
No. and name					

C2.2 Energy

Body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text …

Table C2.2.1:

Indicator	Before (date)	B-a-U (date)	After (date)	Difference: After –Before	Difference: After – B-a-U
No. and name					
No. and name					

C2.3 Environment

Body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text …

Table C2.3.1:

Indicator	Before (date)	B-a-U (date)	After (date)	Difference: After –Before	Difference: After – B-a-U
No. and name					
No. and name					

C2.4 Transport

Body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text …

Table C2.4.1:

Indicator	Before (date)	B-a-U (date)	After (date)	Difference: After –Before	Difference: After – B-a-U
No. and name					
No. and name					

C2.5 Society

Body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text …

Table C2.5.1:

Indicator	Before (date)	B-a-U (date)	After (date)	Difference: After –Before	Difference: After – B-a-U
No. and name					

No. and name					

C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	Table text Table text Table text Table text Table text Table text Table text Table text Table text Table text Table text Table text Table text Table text	
2		
3		
4		
NA = Not Assessed O = Not Achieved ★ = Substantially achieved (at least 50%) ★★ = Achieved in full ★★★ = Exceeded		

C4 Up-scaling of results

Body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text …

C5 Appraisal of evaluation approach

Body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text body text …

C6 Summary of evaluation results

The key results are as follows:

- **Key result 1** – description text description text description text description text description text description text description text
- **Key result 2** – description text description text description text description text…

.....

C7 Future activities relating to the measure

Body text body text …

D Process Evaluation Findings

Comment may be inserted here describing any different or additional elements used for process evaluation if there were changes from the standard approach

D1 Deviations from the original plan

The deviations from the original plan comprised:

- **Deviation 1 title** – Deviation description text deviation description text deviation description text deviation description text deviation description text
- **Deviation 2 title** – Deviation description text deviation description text deviation .....

.....

D2 Barriers and drivers

D2.1 Barriers

- **Barrier 1** – description text description text description text description text description text description text description text
- **Barrier 2** – description text description text description text description text ….

……

D2.2 Drivers

- **Driver 1** – description text description text description text description text description text description text description text
- **Driver 2** – description text description text description text description text ..

.....

D3 Participation of stakeholders

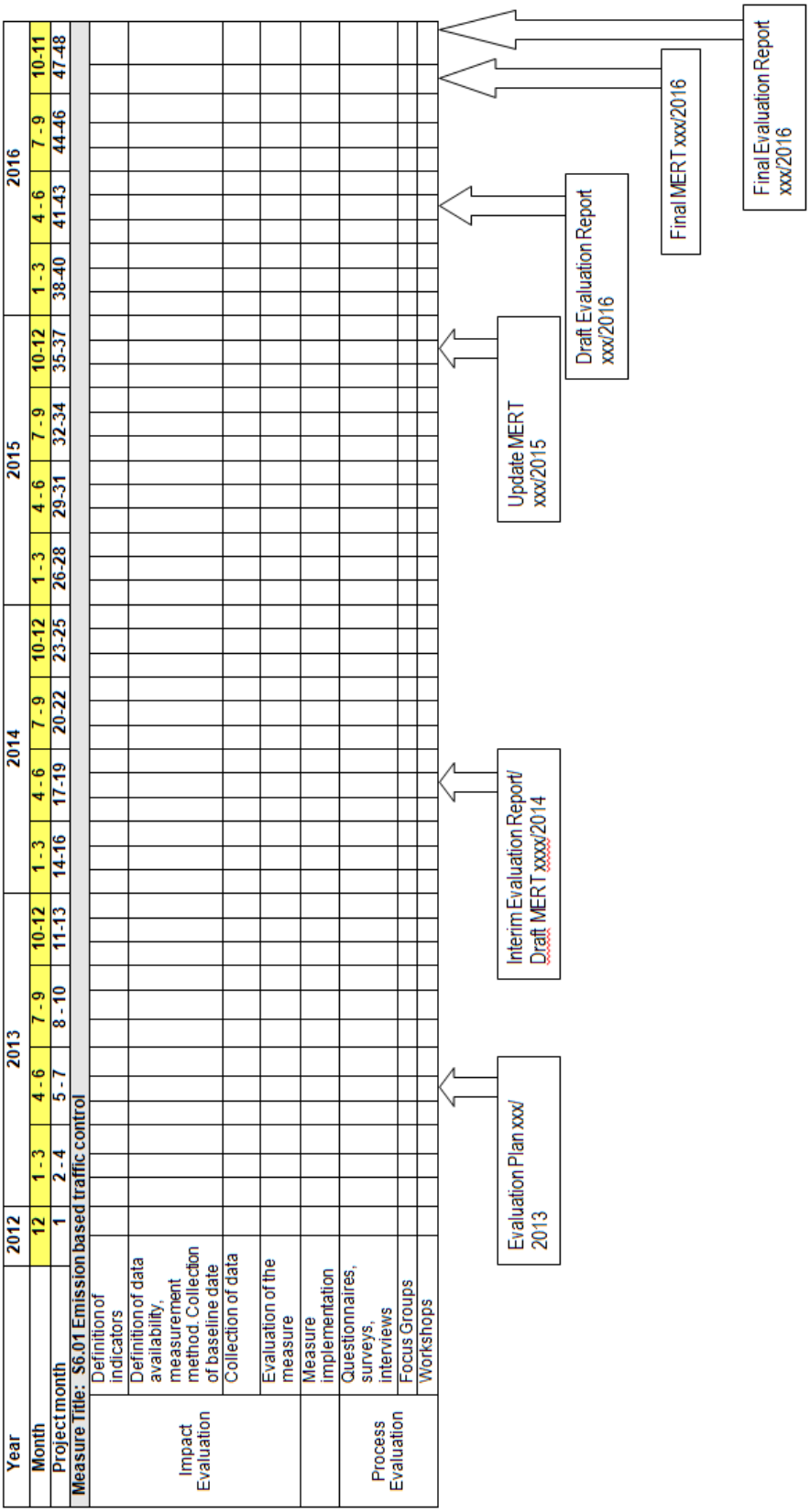
- **Stakeholder 1 -** Description text description text description text description text description text description text description text
- **Stakeholder 2** – Description text description text description text description text ….

.....

D4 Recommendations

- **Recommendation 1 -** Description text description text description text description text description text description text description text
- **Recommendation 2** – Description text description text description text description text...

Annex E: Evaluation time schedule



Annex F: Guidelines for Evaluation Plans

Part 1: The General Project Plan

1. INTRODUCTION to the PROJECT

An introduction to the XXXX Project including:

- Project Objectives
- The Cities involved in a nutshell (Overview of the key characteristics of the cities, such as area, population, density, trips/day, modal split, etc..)
- List of measures by Work Package

2. APPROACH TO EVALUATION

This section will summarise the evaluation methodology to be used. WIKI will come with a proposal for this section, most probably the executive summary of the Evaluation Framework.

3. EVALUATION PROCESS

- **Roles and responsibilities**

  The persons or organisations responsible for each of the evaluation tasks in the project should be made clear. This could be set out within a table or a flow diagram illustrating the connections within the evaluation process

- **Timetable**

  Please indicate when what which evaluation activities will happen within the project

4. RESULTS

- **Reporting**

  The method for reporting on the outcomes of the evaluation using the Measure Evaluation Results Template should be made clear. Guidelines for completion of the Template will be provided in a separate document. Any other forms of (internal) reporting on the measure planning, implementation and operation may also need to be detailed.

  A final project evaluation report will also be produced at the end of the project.

Part 2: The Evaluation Plans for each City

A1 INTRODUCTION to the CITY

- General description
- State of mobility and environment, transport (and wider) issues, current initiatives to address the problems
- The CIVITAS measures in the city and their objectives.

A2 THE MEASURES

Separately for each measure:

- **Description** of the measure including the involved partners and its extent (i.e area affected, target population). Include maps showing locations as appropriate.

- **Objectives** of the measure.

- **Impacts and Indicators**

  A table detailing:

  - impacts of the measure,
  - indicators to be used to measure the impacts,
  - methods of data collection for impact evaluation plus frequency, quantity, etc.
  - who is responsible for each element

- **Roles and responsibilities**

  The persons or organisations responsible for each of the evaluation tasks for this measure should be made clear.

- **Timetable** showing stages of preparation implementation and operation of measure, timings of process evaluation questionnaires/interviews and for each indicator timings for data collection, analysis, reporting. Show interactions (inputs/outputs from other measures etc.).

- **Resources**

  Describing the resources available for the evaluation of this measure.

- **Results**

  Describing how the results will be reported: a completed measure evaluation result template (MERT).

A3 OVERLAPPING AND INTERDEPENDENCIES

A matrix of measures and external developments indicating the most important overlappings and interdependencies.

Annex G: Framework for Cost Benefit Analysis

This annex is based on the CIVITAS GUARD Framework for Cost Benefit Analysis developed by John Preston of TRG, University of Southampton. From the outcomes of CIVITAS I it was clear that the European Commission wanted evaluation that provided quantified conclusions and added value to project/city reports. Within CIVITAS II this was felt to be best provided through the use of Cost Benefit Analysis (CBA), although this approach could be supplemented by other economic assessment approaches such as multi-criteria analysis (MCA) where appropriate.

Within CIVITAS PLUS II, the use of Cost Benefit Analysis has been firmly endorsed by the European Commission with the expectation that this will be used for economic assessment of at least about one third of all measures.

This short Note aims to scope the form of CBA that could be adopted.

1. Scope of Cost Benefit Analysis

CBA would focus on a sub-set of the quantitative indicators. These are listed in Table 1. The expected impacts are indicated by ✓. Some other indicators include parking costs (could be incorporated into operating revenue) and access/egress time (typically walk time) for public transport.

It should be noted that in most cases the measures are assumed to affect either the passenger sector (WP1, 2, 4, 5, 6, 8) or the freight sector (WP7). Only one set of measures is assumed to affect both sectors (WP3). WP1 assumes no impact on demand, whilst WP3, 4, 5 and 8 assume no changes in public transport frequencies (in other words any modal shift can be accommodated by existing spare capacity).

With respect to the environment, it is assumed that the emphasis will be placed on emissions except for WP3 where air quality should also be considered.

The key indicators include measures of:

- Capital costs.
- Changes in operating and maintenance costs.
- Changes in transport demand (measured in terms of final outputs (passenger kms, freight tonne kms) or intermediate outputs (vehicle km)).
- Changes in transport costs (fares for public transport, operating costs and parking costs for private transport).
- Changes in transport journey times (including out of vehicle time, in-vehicle time and delay time).
- Changes in vehicle emissions.

- Changes in transport related accidents.

Table 1: CBA Indicators

	WP 1 Alternative Fuels & Clean Vehicles	WP2 Collective Passenger Transport	WP3 Demand Management Strategies	WP4 Mobility Management, Marketing, Communication & Education	WP5 Safety & Security	WP6 Energy-efficient Vehicle Use	WP7 Energy-efficient Freight Distribution	WP8 Innovative Transport Telematics Systems
Operating revenues		✓		✓ (profitability)		✓ (profitability)	✓ (profitability)	
Operating Costs	✓	✓	✓	✓	✓	✓	✓	
Maintenance Costs	✓	✓	✓	✓	✓	✓	✓	✓
Investment Costs	✓	✓	✓	✓	✓	✓	✓	✓
Fuel Consumption	✓	✓	✓	✓		✓	✓	
Emissions	✓	✓	✓	✓		✓	✓	✓
Air Quality			✓					
Noise			✓	✓		✓	✓	
Transport safety		✓	✓	✓	✓	✓	✓	✓
Passenger movements		✓	✓	✓	✓			✓
Freight movements			✓		✓	✓	✓	
Modal split		✓	✓	✓	✓	✓	✓	✓

Traffic levels		✓		✓	✓	✓	✓	✓ (Congestion)
Journey times		✓	✓		✓			✓
Waiting times				✓	✓			
Service frequency		✓			✓			
Service reliability					✓(Waiting time)	✓(Waiting time)	✓(Waiting time)	✓
Vehicle occupancy		✓						
Vehicle Speed			✓	✓ (Congestion)	✓	✓ (Congestion)	✓ (Congestion)	✓ (Congestion)
Parking demand		✓	✓					

2. Form of Analysis

This would be based on a standard social cost benefit analysis of the following form.

$$NPV_s = \sum_{a} \sum_{i=0} \frac{(R_{ia} + UB_{ia} + NUB_{ia} + E_{ia} - OC_{ia} - K_{ia})}{(1 + r)^i}$$

where

NPV_s = Net present value summed over all agents
R_{ia} = Revenue in year i to agent a,
UB_{ia} = User transport benefits in year i accruing to agents a,
NUB_{ia} = Non user transport benefits in year i accruing to agents a,
E_{ia} = External benefits in year i accruing to agents a,
OC_{ia} = Operating (and maintenance) costs in year i to agent a and
K_{ia} = Capital costs accruing to agent a in year i (with the usual assumption being that capital costs begin to be incurred in year 0).

It is suggested that five agent groups are considered: transport operators, authorities, users of the measure, other transport users and households. This would require impacts to be disaggregated by these groups. Particular attention should be paid to tax streams, particularly where there are transfers from highly taxed car to low taxed (and subsidised) public transport and vice versa. Information will be required on transport tax rates in each partner city.

The project life would vary from measure to measure (based on either the technical, market or economic life of the technologies being introduced – although this could be standardised e.g. to 10 years). The interest rate would be determined by the European Commission (currently 4%).

Table 2: Example of CBA (stimulation of public transport)

Agents	Costs	Benefits
Public Transport Operator	Construction Costs Operating Costs	Additional Revenue (Grants) (Subsidy)
Public Transport Users		Reduced time of travel Reduced costs of travel net of tax savings (Tax savings) Reduced accidents
Car Users		Reduced time of travel Reduced cost of travel net of tax savings (Tax savings) Reduced accidents
Local Authorities	(Grants) (Increased subsidy) (Tax savings	
Householders	Environmental Costs	Environmental Benefits

The NPV calculations would be undertaken by Projects/Cities using the information obtained by cities in Table 1, modified to form a cost-benefit impact matrix of the form shown by Table 2, which shows an example of the stimulation of public transport which also leads to reduced road congestion.

The measurement of user benefits would be based on the concept of generalised cost. Generalised cost would be calculated as:

$$GC = OPC + T + v_1\, IVT + v_2\, OVT + v_3 DT$$

where

OPC = Out of Pocket Cost Net of Tax

T = Tax

IVT = Expected In-vehicle time

OVT = Out of Vehicle Time (based on walk and wait time. For frequent services wait time
can be assumed to be half the service headway).

DT = Delay Time (based on reliability measure).

v_1 = the value of in-vehicle time,

v_2 = the value of out-of-vehicle time (often assumed to be twice v_1),

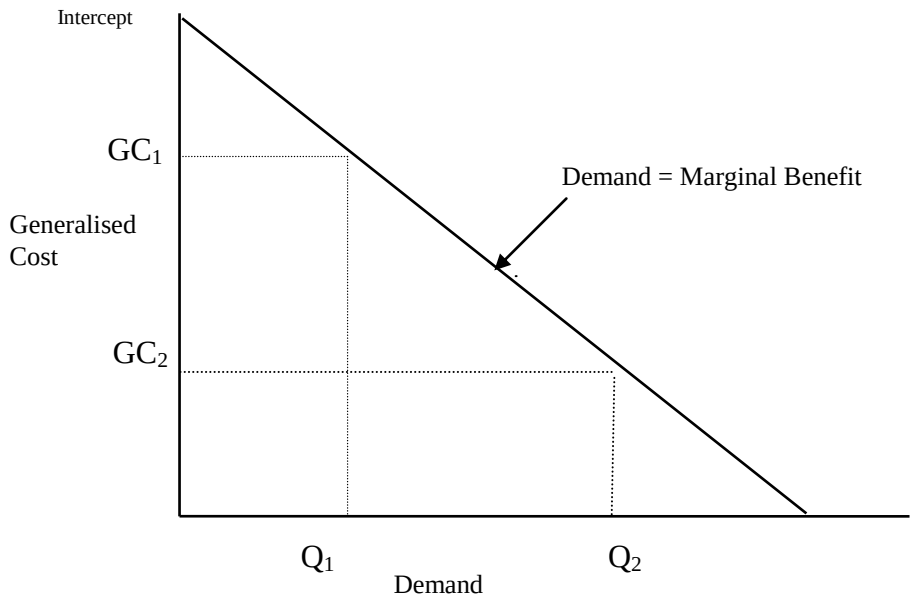
v_3 = the value of delay time (sometimes assumed to be three times v_1).

Meta-analyses will be needed to establish European wide values of time, as well as values of accidents and values of air and noise pollution. With respect to air pollution, emphasis would be on both global impacts (carbon) and local impacts (NOx, PM_{10}). Noise could only be included where it is quantified (e.g. in terms of DbA)

The generalised cost measures will be used to determine user and non user benefits using variants of the rule of half. For example, from Figure 1 below user benefits (UB) could be computed as:

$$UB = Q_1 (GC_1 – GC_2) + ½ (Q_2 - Q_1) (GC_1 – GC_2)$$

Figure 1: Illustration of the Rule of Half.



Where there are changes in the generalised cost and usage of existing modes, user benefits may be estimated by direct measurement, assuming a linear demand curve. Where a new mode is introduced, this will require knowledge of the (inverse) demand curve (and in particular the intercept that determines the maximum willingness to pay). However, given knowledge about price and/or generalised cost elasticities, this can be inferred. Knowledge of the entire demand curve will also be required when there are shifts in the

demand curve (for example due to changes in external factors) rather than movements along the demand curve.

Where there is knowledge of modal diversion, estimates of non-user benefits can be made through the use of indicators such as the value of congestion relief, safety benefits and environmental benefits per passenger kilometre abstracted from car to other modes.

Evaluation could be undertaken by developing a **spreadsheet model** in which sensitivity analysis could be undertaken with respect to key parameters.

An important issue that will need to be considered is the level of spatial resolution as some measures will be localised to a particular corridor or neighbourhood, whilst others will have a city wide impact. This may be exacerbated by the variation in the number of measures being considered by cities.

An important priority is for partner cities to each identify measures (or groups of measures) that they believe will be amenable to such quantitative analysis.

An Example

The proposed methodology has been applied to a Winchester case study examined by TRG as part of the CIVITAS I MIRACLES project. An example is given by Table 3, which examines the impacts of a quality bus partnership.

Table 3: An Illustrative Cost-Benefit Analysis applied to a CIVITAS I Project

	Change in revenue	Change in capital costs	Change in operating costs	Change in user benefits	Change in non-user benefits[1]	NPV	Overall total
1	116484	1395594	16663	145606	5500	-1144667	-1144667
2	135375	0	4993	169219	8204	307805	-836863
3	130797	0	4824	163497	7926	297396	-539467
4	126374	0	4661	157968	7658	287339	-252127
5	122101	0	4504	152626	7399	277622	25495

[1] Benefits from congestion relief and reduced noise and air pollution.

Table 3 shows that this scheme breaks even in social terms after five years. This scheme involves the provision of new vehicles and a project life of 15 years could be assumed. Given the then UK test discount rate of 3.5%, the social Net Present Value of the scheme

is over £2.3 million and the benefit:cost ratio is 2.59. Indeed this scheme appears to be a success in commercial terms, with a financial Net Present Value of £0.178 million and a benefit:cost ratio of 1.12. This is reassuring given that the bulk of the investments were made by a commercial bus operator.