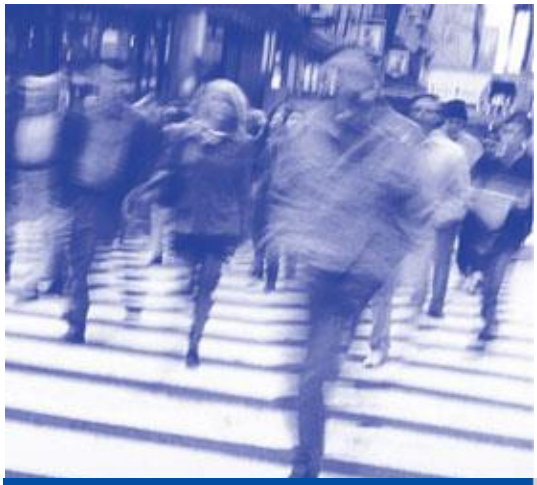

2020 CiViTAS
Cleaner and better transport in cities

SATELLITE

CIVITAS 2020 process and impact evaluation framework

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2020 CiViTAS
Cleaner and better transport in cities
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Abstract

As a result of the CIVITAS SATELLITE project and based on an analysis of recent research studies defining indicators for urban mobility, an intensive cooperation with the CIVITAS Innovation Action projects (2016-2020) and a screening of the evaluation approaches in the previous and current Research and Innovation Action projects, this report describes the CIVITAS 2020 impact and process evaluation framework for the evaluation of mobility related measures implemented in European urban environments. Detailed guidelines and practical advice is given, reporting templates and examples are presented to result in a solid, transparent and consistent CIVITAS evaluation approach.

Project Partners

Organisation	Country	Abbreviation
Transport & Mobility Leuven	Belgium	TML

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

Legal disclaimer

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CBA: Cost Benefit Analysis

CEM: CIVITAS Evaluation Manager

ECG: Evaluation Coordination Group

ELG: Evaluation Liaison Group

IA: Innovation Action

IP: Integrated Package of measures

LEG: Local Evaluation Group

LEM: Local Evaluation Manager

LEP: Local Evaluation Plan

MER: Measure Evaluation Results

ML: Measure Leader

PEM: Project Evaluation Manager

PEP: Project Evaluation Plan

PER: Process Evaluation Report

PET: Project Evaluation Team

RIA: Research and Innovation Action

SC: Site Coordinator

WBCSD: World Business Council for Sustainable Development

1 Introduction

1.1 Context and evaluation objectives

For many years, cities have tested and demonstrated innovative sustainable solutions for cleaner and better urban transport and mobility in the context of the CIVITAS Initiative. A wide range of CIVITAS measures – specific actions contributing towards clean urban mobility – were implemented in European cities. In September 2016, three new projects (ECCENTRIC, DESTINATIONS and PORTIS) called 'Innovation Actions' (IA projects) brought 16 new cities into the CIVITAS family. Additionally, since 2015, 27 other projects in the urban domain of the Horizon 2020 Mobility for Growth programme called 'Research and Innovation Actions' (RIA projects) work under the umbrella of the CIVITAS Initiative.

Since the start of the CIVITAS Initiative, it was clear that a well-structured, transparent and effective evaluation of the impacts of the demonstrated measures and the understanding of the implementation process are crucial to achieving the CIVITAS objectives. Indeed, evaluation is a powerful tool for learning what works, what does not, and the reasons for this. In other words, we evaluate because we want to measure the impacts, understand the story behind the figures, how measures were implemented and why we have the observed changes. This will allow to exchange experiences, learning from each other's successes and failures. In this way, evaluation helps public authorities to improve urban planning, make the best choices and allocate resources to measures which contribute the best to achieve the envisaged targets. A thorough evaluation will provide knowledge on the effectiveness of specific measures and packages of measures. This will make it possible to optimise measures and strategies and to identify good practices and optimal transferability options.

Considering all of its merits, it is an evidence that evaluation is a key part of all projects within CIVITAS, aiming to contribute to the European knowledge base of evidence-based solutions for urban mobility. For this it is crucial to understand the nature and extent of the impacts made by the measures introduced in the cities, as well as the processes involved.

To effectively achieve these positive results of a thorough evaluation it is important that evaluation is done in a consistent way all over the projects and sites where mobility related measures are implemented. Due the wide variation of projects, one fixed standard approach is not appropriate nor feasible but using the same terminology, the same categorisation of impacts, the same type of characteristics of the implementation processes and a similar reporting style, is crucial to make findings understandable for other interested parties.

1.2 The CIVITAS evaluation framework

To support all projects and involved partners to get this common understanding based on a consistent evaluation approach an overall **CIVITAS impact and process evaluation framework** has been developed to be used in all CIVITAS projects and in the involved cities or sites where mobility related measures are implemented.

During the consecutive CIVITAS phases this framework was improved and validated in cooperation with 18 IA projects, involving 80 demonstration cities or sites (Living Labs), implementing in integrated strategies over 800 mobility related measures. Also, the interaction

with more than 150 cities of the RIA projects evaluating their mobility solutions validated elements of the framework.

The last four years this work continued, from July 2016 on, as part of the coordination and support project CIVITAS SATELLITE. Work Package 2 ‘Evaluation’ of CIVITAS SATELLITE cooperated intensively with the IA projects to implement the CIVITAS evaluation approach in order to achieve a consistent, feasible and useful evaluation of the demonstrated measures in the new CIVITAS cities.

Additionally, the cooperation with the already running and new RIA projects helped the projects to strengthen their evaluation and make it more consistent with the CIVITAS approach but allowed also to include additional elements in the CIVITAS 2020 evaluation framework.

The main steps in the development of the framework were:

- initial main focus on impact evaluation: quantifiable targets, common indicators, extensive data collection campaigns
- additional focus on process evaluation: barriers and drivers, stakeholders, etc.
- new indicators and data collection methods

As part of the work of CIVITAS SATELLITE the framework was further strengthened and enriched in many ways:

- an improved description of the scope of the CIVITAS 2020 evaluation work, sharpening the basic measure evaluation activities and indicating additional evaluation work to come to better and more useful conclusions supporting the definition and choices in sustainable mobility strategies
- restructuring and extending the impact indicators using experiences of the International Association of Public Transport (UITP) on public transport, the Urban Mobility Scoreboard developed by the Advisory Group on Data and Statistics of CIVITAS CAPITAL, the indicators developed by the World Business Council for Sustainable Development (WBCSD) on mobility indicators and the indicators refined and validated in the SUMI project
- identification of specific (additional) requirements for an effective evaluation, e.g. clusters of measures, general attitude and travel behaviour analyses, upscaling, etc.
- an updated guidance for a financial analysis and a Cost Benefit Analysis especially focused on CIVITAS mobility related measures adhering to the European guidelines e.g. the DG Regio (2014) Guide to Cost-Benefit Analysis of Investment Projects, economic appraisal tool for Cohesion Policy 2014-2020
- a planning and monitoring tool covering all evaluating related activities (the implementation stages, the data and information gathering activities and reporting) which is also more generally usable to follow-up the progress of the project in a city
- a refining of the Measure Evaluation Results (MER) template and the Process Evaluation Report (PER) template taking into account the concerns of the IAs, making both reporting tools consistent and complementary
- A city level evaluation approach with a focus to understand the changes in the mobility situation and the contribution of the CIVITAS measures

This resulted in a new CIVITAS impact and process evaluation framework with the key elements of a consistent CIVITAS evaluation approach and a range of suggestions and tools to develop a feasible, efficient and focused evaluation and reporting approach.

1.3 Structure of this document

This document presents the 'CIVITAS 2020 process and impact evaluation framework', which is the updated version of the CIVITAS evaluation framework prepared in December 2020 including the lessons learned of the recent CIVITAS IA and RIA projects.

Chapter 2 describes the overall evaluation framework and explains the way all CIVITAS 2020 projects should set up a consistent and effective evaluation approach.

The next two chapters describe in more detail the two complementary aspects of the CIVITAS 2020 basic measure evaluation approach: Chapter 3 details the process of impact evaluation and Chapter 4 describes the process evaluation approach.

Chapter 5 brings all this information together; discusses how to integrate impact and process evaluation findings and perform an expert assessment and validation, presents the key elements of an effective city level evaluation with a reference to the CIVITAS measures, and outlines how cross-site analyses should be done.

Finally, Chapter 6 provides an overview of the reporting tools to be used to plan and to report the evaluation approach and findings and gives suggestions for an overall evaluation report presenting the evaluation findings on different synthesis levels.

Conclusions are drawn in Chapter 7.

2 The CIVITAS 2020 Evaluation Framework

This chapter describes the key elements of a consistent impact and process evaluation of mobility related measures in a complex urban environment. For Innovation Actions (IA projects) implementing integrated packages of measures, this framework is a strong guideline to be followed in order to achieve consistent and useful results, transparent and understandable by all interested parties. For Research and Innovation Actions (RIA projects) often focused on the developing and validation of one or more measures with a specific focus, this framework should give inspiration to develop a focused evaluation approach consistent with the CIVITAS Initiative in terms of terminology, impact categories, indicators and elements in the implementation process and reporting.

2.1 The scope of CIVITAS 2020 Evaluation

2.1.1 Core objectives of the CIVITAS 2020 evaluation

In most of the projects of the 'CIVITAS family' we have two types of activities we want to assess or evaluate.

On one hand we want to evaluate the **project performance**. For this we want to monitor and to check whether a project fulfils its objectives, whether the project and specific Work Packages have delivered the outputs promised in the proposal. We also want to understand the effect and efficiency of specific activities in the project e.g. the dissemination or take-up activities. This assessment of the project performance can be indicated as the **Project Performance Evaluation**.

On the other hand, we want to answer the question 'What are the impact and the important implementation process aspects of mobility related measures implemented in the cities or sites the projects work with?'. Indeed, in most of the CIVITAS projects mobility related measures are implemented in real urban environments by the city or other stakeholders. In the context of CIVITAS, the main objective of the CIVITAS 2020 evaluation is to **understand the process and impact of these mobility measures, to learn what works and what does not, and to understand the reasons why**. Since this **understanding of both successes and failures** is crucial for other cities and to build up an evidence-based European knowledge base, this is the core focus of this CIVITAS 2020 evaluation framework.

What is a measure in the CIVITAS context?

A measure is a mobility related action implemented by a city (by the government or other stakeholders) e.g.:

- New infrastructure
- A new service
- A new organisation of the travel to work
- Activities to change awareness, acceptance or attitude and behaviour of citizens or visitors

This knowledge will allow optimisation of measures, to upscale them in the best way possible and to have relevant information available to assess whether a measure can be successfully transferred to other cities or sites.

A clear and precise identification of the demonstrated and validated CIVITAS measures is crucial for a good and feasible evaluation. Already in the early proposal phase of a project it is recommended to use **evaluation as an important criterion to structure the integrated strategy in a city into well-defined measures** bearing in mind the reflexion which target groups are approached, which indicators are affected, etc. (see Section 2.2.3).

2.1.2 Extended analyses

In many cases the straightforward impact and process evaluation of one mobility measure in an urban environment (a city or a site) is neither possible nor sufficient.

A mobility measure implemented in a city will have an impact on the citizens and on other users of the city but in many cases the observed impact will be also the result of other measures and general evolutions. Moreover, an urban strategy mostly consists of a combination of different mobility measures that reinforce each other. For this reason, the evaluation approach should include good methods to deal with the challenge of not only the understanding of one specific measure but also the integration and interaction of this measure in the general urban evolution. This understanding is crucial to come to useful and correct conclusions.

For this reason, the CIVITAS 2020 evaluation framework includes further guidance to extend the basic comparison of the value of indicators in the before and after situation with analyses to complete the understanding of the before and after situation e.g. up-scaling of measures and their impact, cost benefit analysis (CBA), expert judgements, etc.

2.1.3 Additional project evaluation analyses

Furthermore, a range of additional evaluation analyses are important to support different activities or types of conclusions envisaged in a project, e.g. conclusions on the transferability potential of measures and choices in a roll-out strategy, understanding of the importance of specific aspects of a measure, design decisions to optimise a mobility product, best practice guidance, building up a business model, estimation of long-term effects, etc.

For this, different methods can be used e.g.:

- Land-use and multimodal traffic modelling
- Business model analysis (BMA)
- Transferability analysis
- System analysis

There are a wide variety of approaches available to be chosen by each project according to their needs. The CIVITAS 2020 evaluation framework will refer to some elements in these methods that are important to link with the core CIVITAS 2020 evaluation approach.

2.1.4 Project performance evaluation

For many projects it is important to assess the achievements and performance of the project itself, also in relation to the resources and funds used for it. It is not mandatory though to perform this evaluation if it is not included in the project Grant Agreement.

Specific objectives could be:

- To monitor and check whether a project fulfils its objectives, whether the project has delivered the outputs promised in the proposal
- To monitor and check whether a work package of a project fulfils its objectives
- To identify the effect(s) of specific activities in the project
- To identify the effect(s) of the project on the take-up of the measures

Examples are:

- Evaluation of the general dissemination activities of an IA or RIA project: was the dissemination of the project results effective to reach the target audience?
- Evaluation of the innovation activities (e.g. a work package about 'Innovation') to increase the quality of the measures: evaluation whether the innovation activities brought a measure on a higher level of innovation
- Assessing whether a project approached the planned number of cities to validate the measure they developed

This type of evaluation is of course very important to assess the efficiency and results of the project. However, to keep the conclusions clear, distinguishing the core CIVITAS 2020 evaluation, in which we try to understand the impact and process of the measures that are demonstrated, tested and validated, is crucial.

Project evaluation is not discussed further in this framework.

2.1.5 Scope of this evaluation framework

This evaluation framework describes the key elements of the core CIVITAS 2020 evaluation approach:

- A consistent straightforward basis measure **impact and process evaluation** of the CIVITAS mobility measures.
- The most important aspects of the **extended evaluation** activities needed to come to well-motivated conclusions on the role the mobility measures can have – individually or in a package of measures or as part of an overall sustainable development strategy.

Additional evaluation analyses and project performance evaluation are not further discussed here.

However, a crucial aspect in the approaches set up by all CIVITAS projects is that all additional and further extended evaluation analyses should be constructed based on the core CIVITAS 2020 evaluation approach: using the same basic terminology, the same categorisation of impacts, the same type of characteristics of the implementation processes, etc., eventually extended to include additional terms, categories, characteristics, indicators, etc.

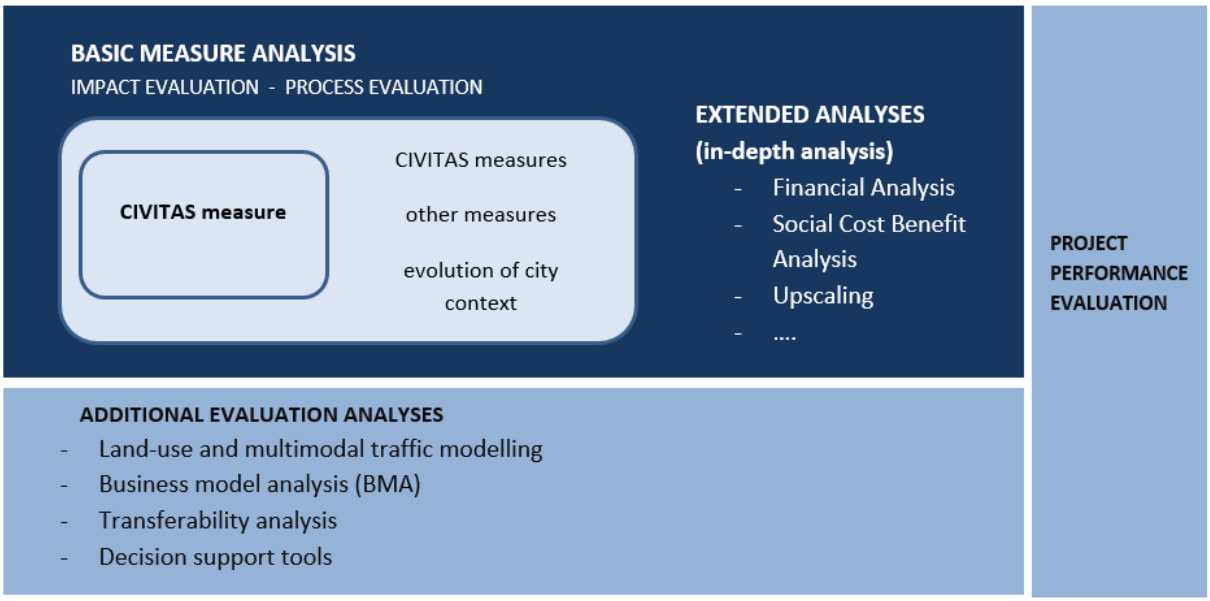


Figure 1: Scope of the CIVITAS 2020 evaluation framework in relation to the different evaluation activities.

2.2 Key elements of the CIVITAS 2020 evaluation approach

The focus of the CIVITAS evaluation work are the CIVITAS measures implemented in a CIVITAS city. Evaluation aims to describe the impact of the implemented measures in impact categories with quantitative measurements in relation to quantifiable targets set in advance and qualitative observations.

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

2.2.1 Efficient combination of impact and process evaluation activities

The evaluation work includes two complementary activities: impact evaluation and process evaluation:

- **Impact evaluation** includes the evaluation of a wide range of technical, social, economic and other impacts of the mobility related measures being implemented by the cities:
    - What is the impact of a measure or an integrated package of measures in the 6 CIVITAS impact categories based on before and after measurements of a selected set of indicators?
    - Why do we see the observed change of the selected indicators? What is the contribution of the specific measure and are there other influences affecting the observed change?
    - Which links are important between the different observed impacts as a basis for a useful and correct interpretation of the observed impacts?

- **Process evaluation** involves the evaluation of the processes of planning, implementation and operation, aiming to understand why measures have succeeded or failed, including the roles of information, communication and participation:
    - How was the measure implemented?
    - Which barriers and drivers do we observe during the implementation of the measure?
    - What was the effect of supporting activities in the implementation of the measure, to facilitate the implementation, to increase the envisaged impact and to avoid/reduce not-wanted impacts?

The integration and interpretation of the results from both aspects will provide the necessary comparative insights and understanding of the effectiveness of the measures in the context of the demonstration city.

Especially in the complex urban environment in which a range of factors influence changes, it is crucial to combine some quantitative measurements (the traditional impact evaluation) with specific efforts to validate and put the figures in the correct context. This validation effort then can be combined with the process evaluation efforts to evaluate the implementation process.

In practice the additional efforts to understand why we have the observed impacts (as part of the impact evaluation) can be done as part of the process evaluation activities when the process is analysed and discussed with decision makers, stakeholders and users. In this way also the observed impacts should be interpretated and validated. The scheme below (Figure 2: The integrated CIVITAS 2020 evaluation approach) summarises the evaluation efforts needed to come, in an efficient way, to useful evaluation results.

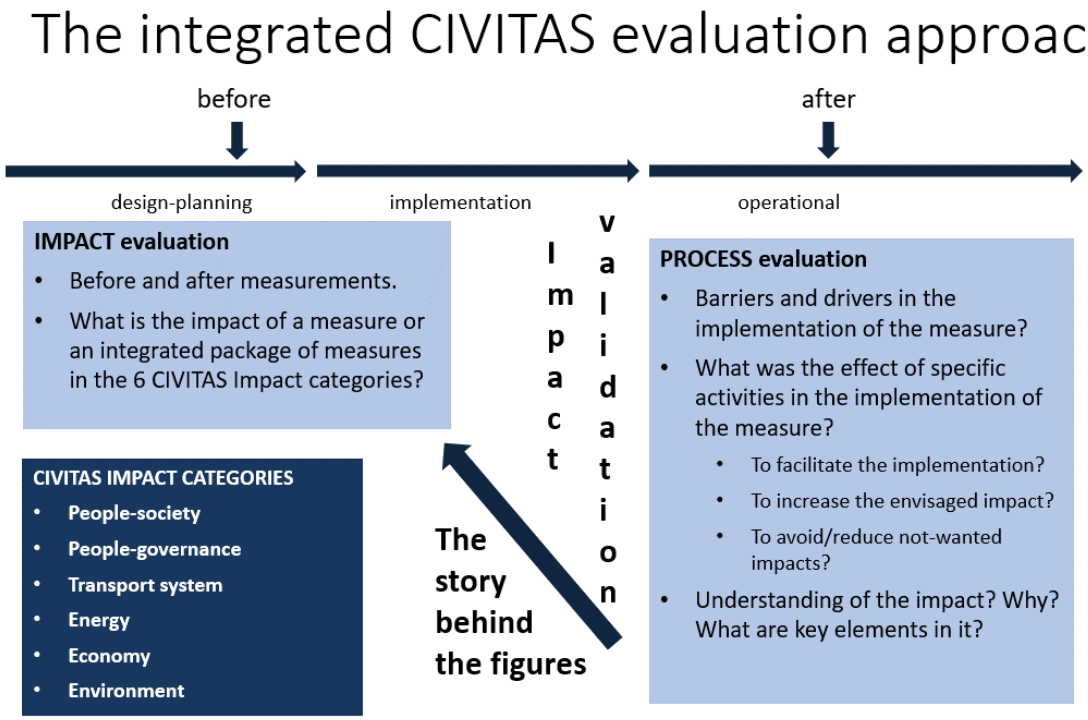


Figure 2: The integrated CIVITAS 2020 evaluation approach

2.2.2 Clear understanding of measures and their context

To achieve a transparent and thorough evaluation of the CIVITAS measures, it is crucial to have a clear and precise understanding of each measure. Since within CIVITAS projects measures are being implemented in a complex urban environment that is continuously evolving, with a lot of changing factors and other measures implemented, any evaluation work should start with the definition of the measures that need to be evaluated, clarifying the following aspects:

- What are **the objectives of the measure in terms of qualitative goals and, if applicable, quantifiable targets**? These objectives can be structured on local level, strategic level and city level in perspective of the CIVITAS goals, optionally indicating short and long-term goals.
- What is really done or realised as part of this measure in CIVITAS?
  - The **starting point (before situation)** for the measure (e.g. a fleet of 100 diesel buses)
  - Which **sub-measures** or **supporting activities** are part of the measure, e.g. citizens engagement or participation actions, measure related communication, etc.
  - **The output**: the immediate result of the measures (e.g. 20 new hybrid buses replacing diesel buses)
- What is the **expected impact** of the measure (outcomes)?
  - Envisaged impacts (see objectives)
  - Possible additional impacts (including negative undesirable impacts)
- What is the **target group** of the measure?
  - Whose attitude or travel behaviour is the measure trying to change?
  - Which part of the transport system is the measure trying to change?
- What is the **area** in which we expect an impact of the measure? (e.g. not only the reorganised transport corridor but also all surrounding parts of the city)
- What are **other factors (of the city context), other CIVITAS measures and non-CIVITAS measures** affecting the impacts in the CIVITAS impact categories in the area where the measure has been implemented?

This analysis is an important phase in the development of an efficient evaluation approach, and it is the basis for an intelligent and effective structuring of the measures to be evaluated.

2.2.3 Structuring measures for evaluation

In many projects the definition of ‘measures’ is not made from the point of view of evaluation. **This often results in a complex set of measures** with rather different sub-measures having a similar working theme but with different characteristics from the evaluation point of view and on the other hand different measures which work in practice closely together to affect the same target group with the same goal.

Looking at different projects, it can be observed that in one project a certain action is defined as one measure in one project (e.g. the construction of a bicycle lane with an intensive promotion campaign to change perception of the citizens in favour of the mode 'bike') and in another project the same action is split into a measure and a sub-measure of another measure (e.g. the construction of a bicycle lane and an intensive promotion campaign to change perception of the citizens in favour of the mode 'bike' as part of the measure changing the mind-set of citizens towards sustainable modes).

Additionally, **other factors (the evolution of the city context) and non-CIVITAS measures** will have also an effect on the impacts that are to be measured and understood.

Finally, the impacts of **measures which focus on the same target group with the same objectives** can hardly be disentangled. In that case, it is **better to evaluate these measures (partly) together for the impact categories they work together** and **use qualitative methods to understand the importance of each measure in the observed impact.**

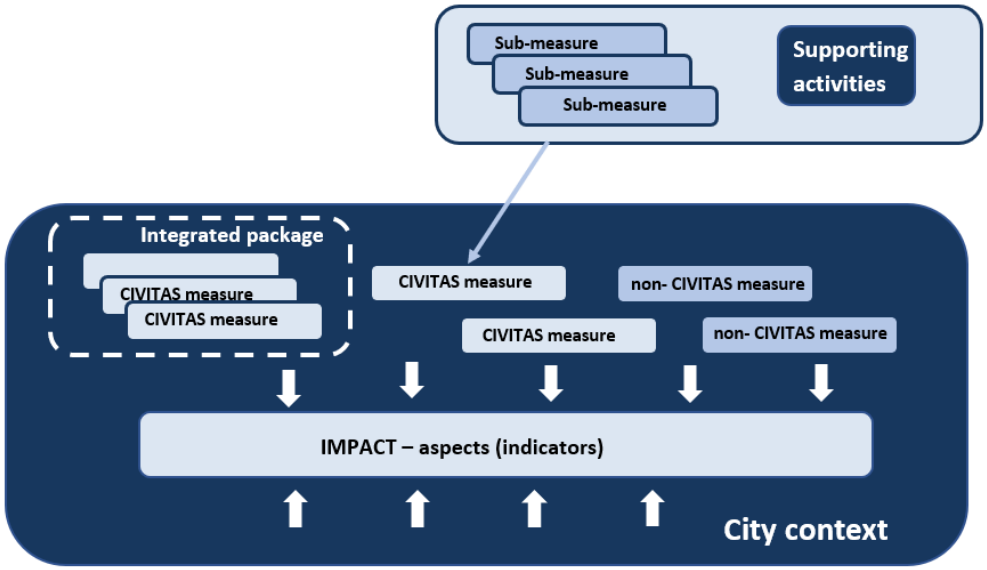


Figure 3: Structuring measures – sub-measures – supporting activities with impacts and indicators

In a project with integrated sets of measures implemented in the same area or towards the same target group, the ideal approach would be that the person responsible for evaluation agrees with the coordinator of the sites on the best structuring of the measures (without changing what is planned to be demonstrated) from the evaluation point of view.

For this reason, the initial analysis of the measures should be used to structure the evaluation approach in the best way, identifying the measures, the sub-measures and supporting activities. If there are measures that will be evaluated (partly) together, integrated packages (IP) of these measures can also be defined. Efficiency and feasibility will be two important criteria for doing this.

2.2.4 Further development of the evaluation plans

Based on this knowledge the evaluation of the measures should be developed in detail, defining e.g.:

- Which impact categories, impact aspects and indicators should be used?
- Which data will be collected, when and where?
- Which analysis methods will be used?
- Which process evaluation activities will be done?
- Which additional analyses will be done?
- How will we get all analyses to motivate evaluations on the envisaged levels (e.g. the measure, the city or site, the project, etc.) answering the research and operational questions on these levels.

In order to avoid a situation in which the evaluation resources are spread too thinly across all measures**, it is important to decide which key measures should be evaluated in depth.** How to choose these key measures is further explained in the following chapters. For the other measures the standard evaluation approach, as described in the next chapters of this document, should be followed.

The result of this work should be presented clearly in both local evaluation plans (LEPs) and the Project Evaluation Plan (PEP) explaining how the evaluation work – from data collection to final analyses – will result in evaluation conclusions on measure, integrated package of measures, city and project level.

2.2.5 Key measures with an in-depth evaluation

In order to avoid a situation in which evaluation resources are spread too thinly across all measures, it is better to identify some key measures that will be evaluated in depth, and to conduct a basic evaluation on the rest. The most important **criteria** to identify key measures for an in-depth evaluation are:

- measures expected to provide most useful output for policy conclusions
- crucial measures in the development of a city
- measures with a high potential for transferability
- measures for which the implementation process is very complex involving a lot of stakeholders, having a lot of barriers or measures that were even stopped because of serious problems

Other criteria are:

- promising results in the first phases of the measures
- expected impact on five pillars of the EU Green Paper on Urban Transport
- possibility to carry out a complete cost benefit analysis (CBA)
- degree of innovation of measure (technique, consortium, process, learning, etc.)

- number and kind of stakeholders
- manageability of the measures
- representative for a group of measures a specific context

Each project can agree on the most suitable criteria taking into account the characteristics of the project.

For the selected key measures higher efforts should be done to understand the impact and process of implementation of the measures, e.g.

- larger data collection campaigns, more frequent, larger samples, more indicators (part of impact evaluation)
- a cost benefit analysis or at least a clear financial analysis (part of the impact evaluation)
- extra meetings and discussions to evaluate the process and to understand the impact
- interviews and more intensive meetings with stakeholders analysing the process of the measure (part of the process evaluation)

Based on the initial analysis of the measures, these activities should be planned in detail in the evaluation plans. During the project, this planning should be updated based on the observations of barriers, drivers (part of the process evaluation), and other remarkable aspects. For example, for a measure that is failing to be implemented, efforts should be made to better understand the reasons. The lessons learned of a failing measure can help other cities to make the right choices in measure implementation.

2.2.6 City level monitoring and evaluation

The CIVITAS measures are implemented in complex urban environment which are in most cases under a continuous evolution with a range of actors effecting the mobility situation. If we want to draw correct conclusions on the impact and implementation process of these measures it is crucial not only to understand the urban context as it is at the start of the project but also to monitor and understand the changes in this urban context.

Therefore, it is crucial to analyse, monitor and (partly) evaluate the mobility situation of the greater area in which the CIVITAS measures are implemented, namely the whole city, the Functional Urban Area or a specific site, e.g. the part of the city acting as the demonstration area in which most of the measures are implemented. This will allow taking into account the context in the interpretation of the evaluation results of a measure putting figures in their local and regional perspective, making the interpretation more robust and reliable.

Also, this can help to overcome the limitations of the evaluation of measures in a complex urban environment with influences from other measures implemented in the project, other non-CIVITAS measures and general mobility related evolutions. Such an evaluation can start from the monitoring of some key city level indicators and can try to understand the contribution of different measures (CIVITAS and non-CIVITAS) in the observed changes.

2.2.7 Consistency of approaches in all cities

To have a transparent and correct understanding of the impact of the CIVITAS measures it is necessary that evaluation in each individual city or site is of high quality and produces good, clear results. For this to happen, the guidelines in this framework seem very helpful, especially:

- the general approach for evaluation
- the indicators used for measuring the impacts. However, this does not prevent cities from having their own additional local indicators for evaluation and assessment of important aspects of the impact.
- the methods of measurement; these must be in line with the guidance or at least be transparent, allowing the understanding of differences in results due to the method of measurement
- the monitoring of related information that might contribute to understanding the nature and extent of the results collected, especially for context-specific situations

As emphasised before, all CIVITAS projects should build up all additional and further evaluation analyses starting from the core CIVITAS 2020 evaluation approach to evaluate the mobility measures they want to demonstrate, test and validate. In general, they should use the same terminology, the same categorisation of impacts, the same type of characteristics of the implementation processes, etc. These elements can eventually be extended with extra terms, categories, characteristics, indicators, etc.

By using a common framework and terminology, the impact of measures reported in a city or site can be understood easily by others.

2.3 Evaluation levels and levels of conclusions

A solid and transparent evaluation approach should be clearly structured:

- the levels on which we **monitor and evaluate,** meaning collecting data, doing a basic analysis, observing changes and a first interpretation
- the levels on which we draw **conclusions,** meaning doing additional analysis on the information from the different levels of evaluation, bringing information together over different sites, for the whole city, focusing on specific themes (e.g. the CIVITAS policy fields), strengthening the interpretation of the observations on all levels.

2.3.1 Levels of monitoring and evaluating

Monitoring and evaluation of the changes should at least be done at the following levels:

- **Measure level**: monitoring indicators effected by the individual measure. This is the basic level of evaluation on which all other levels depend. The evaluation work will be done for the target group for which and in the area in which the measure is active.

- **Integrated package level**: evaluation of packages of measures implemented together. The measures in one package have (at least partly) the same objectives and target groups.

It is necessary that you try to understand which measures are most important, and which measures are important to support the other measures to make them more effective.

- **City level:** monitoring and evaluation of the city level indicators allowing to describe the changes in the mobility situation of the city, the Functional Urban Area or a specific site, e.g. part of the city. For many cities data can be used of existing data collection campaigns or surveys allowing to build not only a baseline but also to understand the trends in the mobility evolution of the city.

If CIVITAS measures are implemented in a specific **demonstration zone**, this overall evaluation can be done for this demonstration zone, making it more feasible to collect the data and precisely evaluate the affected area and approached target group. In such cases it is also important to check that the demonstration zone is not too small, as this can result in some negative side effects that are induced in the neighbouring zones but are not monitored and are not part of the evaluation.

2.3.2 Level of evaluation conclusions

Based on the evaluation findings at the different levels, conclusions can be drawn at different levels, trying to answer a range of policy questions, e.g.:

- **Conclusions at the level of one measure:**
  - What is the impact?
  - Which important elements were observed in the implementation?
  - Which supporting activities influenced the impact?
- **Conclusions at the level of one Integrated Package:**
  - What is the impact?
  - Which measures were crucial in the package and how did they interact?
  - Which supporting activities influenced the impact?
- **Conclusions at city level:**
  - Which approaches (which measures) seemed to be the most effective for a particular (type of) city?
  - Which combination of measures (packages) are most effective to implement to achieve the goals?
  - Are the observations for the evaluated demonstration zone in line with the objectives for the city?
- **Cross-sites conclusions at project level for the CIVITAS thematic areas or policy fields or for the project working areas:**
  - What can be learned from the evaluation of the effectiveness of the measures under a specific CIVITAS thematic area?
  - Which CIVITAS thematic areas are most effective to contribute to the general CIVITAS goal of ‘Cleaner and better urban transport in cities’?

In the course of the CIVITAS Initiative different lists of CVIITAS thematic areas were used structuring the type of mobility related measures in a way most appropriate to respond to the challenges at that time.

The CIVITAS thematic areas or policy fields used in the period 2016-2020

'Organisational and infrastructural mobility measures':

- **Car-Independent Lifestyles** – cycling, walking, car-sharing, bike-sharing, car-pooling, co-modality, ride-sharing
- **Clean Fuels and Vehicles** – electric mobility, fuelling infrastructures, hybrid vehicles, use of biodiesel, biogas and compressed natural gas, cleaner fleets
- **Collective Passenger Transport** – accessibility, intermodality, service improvements, ticketing systems, innovative PT systems, fleet management, procurement schemes
- **Demand Management Strategies** – congestion charging, access restrictions, parking management and strategies, low emission zones, car-free zones, priority lanes, mobility credits, financial incentives and disincentives
- **Urban Freight Logistics** – urban delivery centres, distribution schemes, fleet management, cycle logistics, freight partnerships, urban freight transport plans

General aspects of the mobility system

- **Safety and Security** – traffic calming, infrastructure design, shared space, cycle highways, secure school paths, anti-vandalism measures

Technological support of the mobility systems:

- **Transport Telematics** – intelligent transport systems, communication, routing, smartphone applications, plate recognition systems

Measures directly working on the users' acceptance and attitude and their travel demand:

- **Integrated Planning** – land-use, housing, new developments, sustainable urban mobility plans
- **Mobility Management** – marketing and communications, personal and company travel plans, mobility info centres
- **Public Involvement** – multi-stakeholder consultations, information campaigns, participatory processes

- **Cross-site conclusions at project level for integrated strategies in EU cities**

  Bringing all the observations and conclusions on the different levels together, conclusions should be drawn on the strategies that should be implemented in the European cities to respond to their mobility challenges.

  If a project consists of similar cities with specific characteristics and challenges (e.g. port cities, island cities, metropolitan cities with large suburban city districts) the conclusions can be focused on the specific challenges this type of cities or site have.

  Depending on the type of project different questions should be answered:

  - Projects demonstrating integrated mobility approaches:
    - Which measures are crucial in responding to the specific challenges of the cities of the IA project?
    - What impacts can be achieved with CIVITAS measures in this type of cities?
    - What are the policy recommendations for maximising positive impacts, and streamline planning and implementation processes?
  - Projects developing and validating specific innovative solutions:
    - Does the measure that was developed, tested and validated, fulfil the expectations resulting in the envisaged impacts?
    - Is the proposed solution an effective response on a specific type of challenge in such type of urban environment?
    - Cross-site conclusions for a specific type of cities

To come to a feasible, efficient and well-structured evaluation approach it is crucial that at the start of the project, beside a clear and sharp description and structuring of the measures, the evaluation questions are formulated in an explicit way. This will assure that the evaluation activities – e.g. data collection, knowledge gathering with involved partners and users, additional analyses – are defined and planned in a way that the questions by politicians, policy makers and even end-users of the mobility system can be answered in a strong way. Also, the resources needed for evaluation can be clarified using the research goals for evaluation as a criterion to make the best choices on what we want and can evaluate and how.

2.4 Organisation of the evaluation process

2.4.1 Roles and cooperation platforms in a CIVITAS project

Roles

For a consistent and effective evaluation work in a project with different sites and measures to evaluate, the following roles and responsibilities in the evaluation process are important:

- A **Project Evaluation Manager (PEM)** supports the cities in performing the evaluation in an efficient and consistent way and is responsible for the synthesis of all the evaluations

carried out in the project. Together with other actors in the project the project evaluation coordinator will also draw conclusions specifically related to the focus of the project.

- A **Local Evaluation Manager (LEM)** is responsible for the evaluation activities for a specific city or site, coordinating or even performing the data collection of all measures in the city or site. He will work together with the local **Site Coordinator (SC)** for the activities of the project or even with the persons specifically responsible for a measure (**Measure leader (ML)),** in order to monitor the implementation, to collect data for the impact indicators and gather knowledge for the process evaluation.

An important requirement is that the LEM has an independent position in relation to the measures allowing them to have a wide view over all the measures in the city and to have an efficient and objective interaction with the SC and MLs. The latter can have some responsibilities in collecting the basic data, but the analysis and interpretation of the data should be the first responsibility of the LEMs supported by the PEM.

Cooperation platforms

For an efficient organisation of the evaluation activities, the following cooperation platforms are recommended:

- **A Project Evaluation Team (PET)**
  - On the project level
  - Role: coordinating the evaluation activities in the project and the demonstration cities
  - Participants: Project Evaluation Coordinator and Local Evaluation Managers
- **A Local Evaluation Group (LEG)**
  - On the city or site level
  - Role: organisation of the evaluation activities in the city (data collection, data interpretation and information on the implementation of measures)
  - Participants: Local Evaluation Manager, Site Coordinator, Measure Leaders

2.4.2 The CIVITAS example of the 2016-2020 Innovation Action projects (IAs)

In the CIVITAS Initiative the following organisation of the evaluation activities of the three Innovation Action projects (IAs) and the 27 Research and Innovation Actions (RIAs) was implemented. For the IA projects also the roles of the responsible partners were defined in a structured way.

Roles (for the IAs)

- The **CIVITAS Evaluation Manager (CEM)** is responsible for coordinating all evaluation activities of the CIVITAS 2020 projects, mainly the IA projects. Together with the Project Evaluation Managers, the CEM coordinates the evaluation work in the CIVITAS cities of the IA projects, summarises the evaluation results of the RIAs and draws conclusions at the CIVITAS level.
- The **Project Evaluation Manager (PEM)** supports the cities in a specific IA or RIA project in performing the evaluation and is responsible for the end result of all the evaluations

carried out in the project. Together with other actors in the project the PEM will also draw conclusions specifically related to the focus of the IA or RIA project.

- The **Local Evaluation Manager (LEM)** is responsible for the evaluation of all measures in the city or site. The LEM should be a local partner who knows the language and who has local contacts and knowledge of the local situation.
- The **Measure Leader (ML)** is responsible for organising the preparation, implementation and operation of a specific measure in his/her city. The ML also has an important role in the evaluation of his/her measure, mainly in the collection of data and information on the implementation.
- The **Site Coordinator (SC)** is responsible for the general supervision of the implementation process of all measures in the city or site and provides support in evaluation as requested by the LEM and the ML.

For IA projects in which (integrated packages of) measures are implemented in different cities or parts of cities these roles seem clear and well-structured in this way for the different levels where evaluation activities are needed.

Cooperation platforms (for the IAs)

An intensive cooperation between CIVITAS SATELLITE and the IA projects and RIA projects was crucial to roll-out the CIVITAS message and knowledge. As a basis for this, a Memorandum of Understanding (MoU) has been agreed with all projects. The objective of this MoU was to define the responsibilities of CIVITAS SATELLITE as well as the CIVITAS 2020 projects within the cooperation between different stakeholders in the CIVITAS2020 group of projects. This document outlines for each CIVITAS SATELLITE work package of how Innovation and Research and Innovation Actions will be supported and coordinated, and how they should in turn contribute.

The different cooperation platforms on coordination, dissemination and evaluation are part of this cooperation.

For evaluation the following cooperation platforms were organised:

- The **Evaluation Coordination Group (ECG)**
  - On the CIVITAS 2020 level
  - Role: Exchange of experiences and approaches between IA and RIA projects; discussing the future CIVITAS 2020 Evaluation Framework
  - Participants: the PEMs of the IA projects and person responsible for evaluation in the RIA projects
- The **Evaluation Liaison Group (ELG)**
  - On the level of the current CIVITAS IA projects
  - Role: coordinating the evaluation activities of the IA projects; exchange of experiences and approaches between IA projects
  - Participants: the PEMs of the IA projects

For an efficient organisation of the evaluation activities in an **IA projects**, the following platforms were active:

- The **Project Evaluation Team (PET)**
  - On the project level
  - Role: coordinating the evaluation activities in the IA project and the demonstration cities
  - Participants: the PEM and LEMs of the cities
- The **Local Evaluation Group (LEG)**
  - On the city or site level
  - Role: organisation of the evaluation activities in the city (data collection, data interpretation and information on the implementation of measures)
  - Participants: the LEM, SC and MLs

Important elements in this cooperation structure were:

- The ELG worked as a team to coordinate the evaluation work in the cities in a consistent and effective way.
- The PEM monitored the evaluation activities in the IA project, performing quality control and drawing conclusions specifically related to the focus of the IA project. This was especially important for IA projects that focus on a specific type of urban mobility, e.g. the current IA projects focused on suburbs of large metropoles (CIVITAS ECCENTRIC), island cities (CIVITAS DESTINATIONS) and port cities (CIVITAS PORTIS).
- The links between the evaluation work and other tasks in the projects should be clearly defined showing how the evaluation teams interact with the implementation of the measures and with other activities in the project.
- CIVITAS SATELLITE guided, coordinated and coached the evaluation work, steered the ELG, and developed conclusions on CIVITAS level.

2.4.3 Resources

Since one of the key objectives of a CIVITAS project is to contribute to the knowledge base of evidence-based solutions to challenge the mobility challenges in our cities, it is crucial to spend a sufficient part of the project resources to the evaluation activities. It is important to realise that just implementing measures without evaluating them in a proper way, may help the city or a specific target group, but doesn't contribute to the overall learning of our EU cities. Even for the city itself it limits the benefit of measures if no information is available to make further optimisations and decisions on further implementations.

Taking into account the guidance in this framework, a clear list of activities should be made up identifying the efforts to collect data, to organise surveys, to analyse the information and to interact with partners and end-users. The share of budget for the evaluation activities both on local level and on project level depends on the type of the project, e.g. the balance between demonstration oriented activities and research activities and on the extent to which data of existing surveys can be used.

A good analysis of what we want to measure, which data we have to collect specifically and which data we can use from other data sources can help to use the budget as efficiently as possible. This should be done at an early phase of the project, preferably in the proposal phase, to avoid the situation that the budget is spent on implementations and additional research activities leaving no sufficient budget for a proper basic evaluation of what is implemented.

2.5 Key steps for a feasible, efficient and consistent evaluation

Later in this document, the elements for both impact evaluation and process evaluation are discussed, highlighting which factors are crucial and which less so.

A feasible, efficient and consistent evaluation requires that all evaluation efforts of both impact evaluation and process evaluation are combined in an optimal way and, even more important, carried out with the right timing. From the start of the project, it is important to **engage all stakeholders and responsible persons in these organisations to agree on the objectives and targets to be evaluated, on the indicators to be used and on the data to be collected**. During the project all partners should contribute to the collection of relevant data and participate in the validation and process evaluation activities to **understand the impacts and the reasons why making the story behind the figures clear to technicians and policymakers.**

The table below gives an overview of the main evaluation tasks indicating responsibilities and timing (based on a project period of 4 years). Of course, responsibilities between project and local evaluation mangers can shift depending on the agreements in the project.

<table>
<tr><th>Impact evaluation</th><th>Process evaluation</th><th>Main responsible actors</th><th>Indicative timing
Month since start of project</th></tr>
<tr><td colspan="2">Analysis of measures
• Precise definition with identification of sub-measures and supporting activities
• Target group, objectives and quantifiable targets

Structuring the measures with identification of ‘Integrated Packages’ of measures</td><td>Local Evaluation Manager
Site Coordinator
Measure Leader</td><td>1-2</td></tr>
<tr><td>• Identification of expected impact and indicators</td><td>• Clarifying timing of implementation</td><td>Local Evaluation Manager</td><td>3-5</td></tr>
</table>

Impact evaluation	Process evaluation	Main responsible actors	Indicative timing Month since start of project
• Identification of Integrated Packages of measures • Methodology for measurements and data collection • Responsibilities evaluation activities and resources	• Defining actors and roles • Planning surveys, actor meetings and interviews		
Production of evaluation plans • Local Evaluation Plan • Project Evaluation Plan		Local Evaluation Manager Project Evaluation Manger	4-6
Data collection baseline • First version of Measure Evaluation Results (MER) sheets		Local Evaluation Manager Site Coordinator Measure Leader Subcontractors	2-12
Data collection current situation and evaluation of available intermediate impact data	Monitoring of implementation process	Local Evaluation Manager Site Coordinator Measure Leader Subcontractors	6-42
Intermediate findings on the impacts	Intermediate observations on the implementation process	Local Evaluation Manager Local Evaluation Manager	12- 42
Impact evaluation on measure level and IP level • Processing collected data and calculation of quantitative indicators	Evaluation of implementation process • Actor meetings to analyse the process • Actor interviews	Local Evaluation Manager Site Coordinator Measure Leader	36-44

Impact evaluation	Process evaluation	Main responsible actors	Indicative timing Month since start of project
• Actor meetings to understand the impact • Interpretation of indicators (up-scaling)	• Identification of barriers and drivers • Understanding the implementation process		
In depth analyses e.g. cost benefit analysis (CBA) for key measures		Local Evaluation Manager Project Evaluation Manager	40-44
Final version of MERs • Impacts per measure or per IP • Findings on supporting stakeholders and supporting activities for the implementation		Local Evaluation Manager Project Evaluation Manager	40-44
Drawing conclusions at city level		Local Evaluation Manager Site Coordinator	40-42
Conclusions at project level • Conclusion in relation to the focus of the project • Conclusions per CIVITAS policy field • Conclusions on measures and combination of measures		Local Evaluation Manager Project Evaluation Manager All partners	44-48

Table 1: Overview of the evaluation activities

3 Impact evaluation

Impact evaluation is the assessment of the changes which are attributed to a specific measure or integrated package of measures. During this evaluation both the intended and unintended impacts of the measure are examined.

Since the measures are implemented in real complex urban environments, monitoring of the changes at city level is needed both to provide context data for the measure focused evaluation and to understand also the overall changes in the city. When CIVITAS projects focus on particular areas of the city, the scope outlined below refers to these specific areas. The term “cities” should be understood as these specific areas, taking care of providing context about the actual city containing the study area.

3.1 Monitoring and (partial) evaluation on city level

3.1.1 Description of the city context

Evaluating the implementation of measures in the complex situation of a real city requires a good understanding of the city. Therefore, the important characteristics of the city with an influence on mobility should be described. The list below gives an overview of relevant aspects:

- General characteristics city and region (if relevant):
    - Geographic
    - Governance
    - Population
    - Main activities: working, school, etc.
- Specific characteristics in relation to the project focus, e.g. port, tourism, etc.
- State of mobility: see also Section 3.1.2
- Provision of transport options: infrastructure for walking, cycling, car driving, public transport and other modes and services organised (e.g. public transport, car sharing, etc.)
- Current mobility management and traffic management initiatives including communication with the public
- Goods and freight: movements, infrastructure, services, etc.

In this way the measures can be put in the right perspective improving the understanding of their impact.

3.1.2 Minimal quantitative mobility context indicators

A measure will have an impact at a specific scale within the mobility system of the city with its citizens, visitors and commuters. Sometimes the scale is more regional or more limited to a specific area of the city or restricted to a specific target group.

However, to achieve a good interpretation of the observed impact of the measures it is crucial to have a basic knowledge of the general mobility situation. An example of this is a measure to increase the level of carpooling of the commuters of a business park at the edge of the city. In the baseline situation the modal split of the envisaged target group should be measured and

after the implementation of the measure this modal split will be monitored again. For the understanding of these results, it is important to have knowledge of the general modal split figures in the city.

Therefore, a range of data should be collected in order to describe the baseline context of the mobility in the city or region. This way the obtained impacts due to the CIVITAS measures can be put in the right perspective, and can be understood by the whole CIVITAS community and compared across different CIVITAS cities and projects.

In most cases the context data should be gathered for the city as a whole, but depending on the scale of the project, it could be more reasonable to focus on a specific district or, on the other hand, to look at the wider region.

Below, the most important context parameters are listed that are needed with a level of priority which indicates how crucial a parameter is. At least the data with priority 1 should be available for each CIVITAS city, either through existing data collection campaigns or through specific CIVITAS measurements and surveys.

Indicator	Example of development of the indicator	Priority
Modal split of the trips made by citizens	Share of trips made by citizens using each mode, divided at least over the following modes: • Car driver • Car passenger • Public Transport • Cycling • Walking	1
Modal split of the trips made by commuters	Share of the trips made by commuters using each mode, divided at least over the following modes: • Car driver • Car passenger • Public Transport • Cycling • Walking	1
Car ownership citizens	Number of cars per 1,000 citizens	2
Car congestion level in the city	Weighted average travel times of car traffic during peak hours on up to 10 major corridors compared with free-flowing travel times	2
Public transport congestion level	Weighted average travel times of public transport during peak hours on up to 10 major corridors compared with free-flowing travel times	2
Parking situation	Number of parking spaces available and average occupancy rate of the parking spaces in different city areas	3

Table 2: Proposition of context parameters to be collected in a CIVITAS city

If during the project lifetime, an important change occurs, independent of the CIVITAS measures, an update of these parameters may be necessary. At the end of the project, it is necessary to have a critical look at these context parameters and check whether they must be updated.

3.1.3 Overall monitoring of the mobility related status of the city

To get an overall understanding of the functioning of the mobility system and to monitor and evaluate the changes in the city of the mobility related factors, cities can rely on a set of sustainable mobility indicators, such as the CIVITAS and SUMI indicators.

On top of the indicators mentioned above (see Section 3.1.2) other **CIVITAS indicators** can be selected from the detailed list already described in relation to the evaluation of the impact of the measures in the different impact categories (see Section 3.3). These indicators are used already by a range of cities to describe their mobility system and the links to the other domains, to monitor their general mobility evolution and to evaluate the impact of mobility related measures. Modal spilt is considered as an important indicator to monitor the evolution of the cities towards multi-modal sustainable mobility.

A more aggregated monitoring of the mobility status of a city can be achieved by using the set of **SUMI indicators** tested and developed in the SUMI project starting from the WBCSD indicators. The indicators give an overall view on the status of all relevant mobility related factors in a city describing both the impact of mobility on the quality of the urban environment and the characteristics that has a strong influence on the multi-modal mobility system. A set of 14 core indicators (see box below) are defined and calculation sheets are available to allow cities to bring in basic data to calculate the value of the indicators (see SUMI website[1]).

SUMI core indicators	
• **Affordability** of public transport for the poorest group • **Accessibility** for mobility impaired groups • **Air pollutant** emissions • **Noise** hindrance • **Road deaths** • **Access** to mobility services	• Emissions of **greenhouse gases** • **Congestion** and delays • **Energy** efficiency • Opportunity for **active mobility** • **Multimodal** integration • Satisfaction with **public transport** • Traffic **safety** active modes • **Modal split**

Table 3: SUMI core indicators

[1] https://ec.europa.eu/transport/themes/urban/urban_mobility/sumi_en

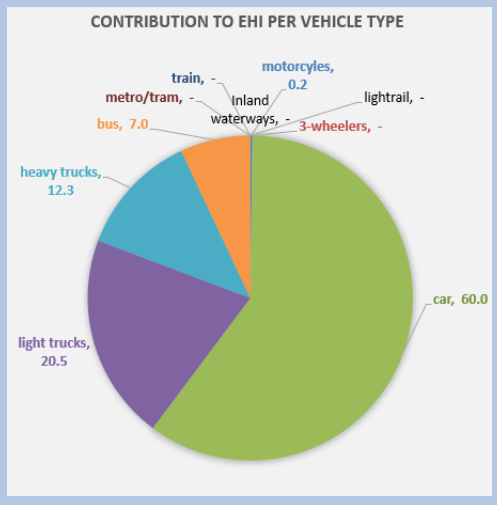
The indicators score the related aspect on a scale from 0 to 10 bringing data (e.g. of different modes) together. This is useful and interesting for a general overview of the evolution of the city and for a benchmarking in relation to other cities but to have a more detailed understanding of the mobility evolution of the city probably the calculated 'parameters' are also interesting and even more the calculated characteristics for the different modes, submodes and other units contributing to the overall parameter. In the box below an example of this is presented for indicator #3: Air pollutant emissions.

SUMI indicator #3: Air pollutant emissions.

Parameter value :	**0.39**	kg $PM2.5_{eq}$/capita per year
Indicator value:	**8.94**	Score 0-10

For each mode the EHI = Emission harm equivalent index [kg $PM2.5$ eq./capita per year] is calculated based on the type of engines and the kilometres driven. The parameter value is the sum of the values per mode.

Vehicle type	EHI (kg/cap/year)	EHI (%)
motorcyles	0.00	0.2%
3-wheelers		
car	0.24	60.0%
light trucks	0.08	20.5%
heavy trucks	0.05	12.3%
bus	0.03	7.0%
train		
metro/tram		
lightrail		
Inland waterways		
TOTAL	**0.39**	**100.0%**



In this way the values per mode and their share in the overall impact of mobility on the $PM_{2.5}$ emissions are more interesting to monitor and interpret the evolution of the cities, especially in relation to the mobility related measures.

It is expected that the SUMI indicators will be further optimised and simplified in the near future making it easier to use them to monitor and understand the mobility evolution in the city.

3.1.4 City level evaluation

Most cities formulate city-wide objectives to improve the mobility situation in their urban environment. In the development of a SUMP this is an important step, and it is recommended to concretise these objectives with quantifiable targets. Further on city-wide integrated strategies are developed to achieve these objectives and to reach the targets.

To evaluate these strategies a city level impact evaluation will monitor a selected set of indicators in relation to the objectives and targets. For this an efficient collection of data needs to be organised in a consistent way over the years.

However only the monitoring of the indicators is not enough to get a structured understanding of the impact of the strategies because in many cases different measures are implemented and also a range of other factors have an influence on the observed changes. Therefore, it is crucial to do further analyses to get a good insight in the reasons of the observed changes using qualitative and quantitative approaches linking also the different indicators describing the changes and using also 'process evaluation' technics, e.g.

- Workshops with mobility stakeholders synthesising expert views on measures and general factors contributing to the observed changes
- More scientific approaches as the Strategic Level Assessment Tool to aid the expert stakeholders in assessing and understanding the relative importance and influence of the measures to the observed change in city indicator values
- A cost effectiveness analysis (CEA) taking the viewpoint of one main impact. For example, for different measures the cost of reducing one ton of CO_2 can be compared. Or the cost of reducing one accident.

The IA project CIVITAS PORTIS (2016-2020) used such approaches to come to integrated findings on city level understanding the contribution of the project measures in the overall change.

A **Strategic Level Assessment Tool** or City Level Evaluation tool[2] was developed to aid expert stakeholders in a city in assessing and understanding the relative effect of clusters of measures on the observed change in city indicator values, and to account for the influence of external factors. Wright et al. (2019)[3] gives a full description of the tool.

Through the tool, expert **stakeholders give qualitative judgements by comparing two elements at a time**. This leads to an overall indication of the relative contribution of each measure to the impact achieved and to the change in indicator value. A visualisation of the output of the tool is shown in Figure 4 for the city of Klaipeda in the PORTIS project. For the city indicator 'number of public transport trips', an increase of 71% was observed at city level from 2017 to 2019. Based on the assessment of the expert stakeholders, 10-15% of the change in the indicator could be attributed to external factors, and 85-90% can be attributed to the cluster of PORTIS measures.

[2] Available here: https://civitas.eu/document/port-city-interaction-toolkit
[3] Wright, S., Brooke, S., Cottrill, C.D., Kollingbaum, M. and Nelson, J.D. (2019). Does clustering of transport measures enable effective evaluation?: An example from a Port City. UTSG Annual Conference, Leeds, UK, July 2019.

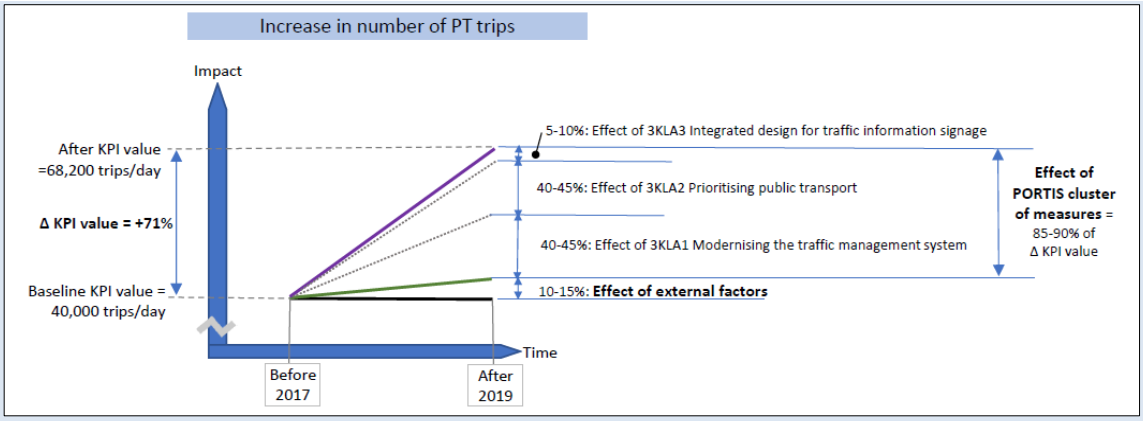


Figure 4: Example from the PORTIS Strategic Level Assessment Tool. Estimation of the contribution of PORTIS measures and external factors to the observed (71%) increase in the city indicator 'number of public transport trips' in Klaipeda

Stakeholder workshops can be organised to understand which measures or general trends were at the basis of the observed change of identified indicators at city level.

Ideally, workshops are organised with small groups – 3-5 participants – of different stakeholders, to ensure an interesting discussion**. Before the start of the workshop**, the participants receive a table with the list of selected indicators and possible measures or general trends which could explain a possible change in these indicators. The participants are asked to reflect on the evolution they expect for the different indicators and which measure or trend to have contributed to this change.

During the workshop, the organisers present the results of the temporal change of the different indicators, with a clear explanation on how each indicator was measured. Participants are then asked to **identify which measure(s) or general trends could be attributed to explain the observed evolution in the indicator**, based on their initial reflection and the results presented during the workshop. The discussion provides interesting insights and understanding of the observed change in mobility behaviour at city level.

3.2 Impact evaluation approach

3.2.1 General concept

In theory the impact evaluation of a measure is very easy:

- A **set of indicators** that describe the important characteristics of the situation is proposed,
- the value of these indicators **before and after** the implementation of the measure is observed,
- while **preventing other elements from influencing** the indicators or removing the impact of the other elements before assessing the "after" situation,
- then we **compare the** before and after situation
- and finally, we **draw conclusions** about the impacts induced by this specific measure.

However, in practice many elements can make impact evaluation difficult and even impossible, especially in a real, complex urban environment.

For this reason, it is important to agree on an evaluation approach that is both highly qualitative and practically applicable in each CIVITAS city. The following sections describe the building blocks for a feasible and effective impact evaluation.

3.2.2 Before and after comparisons

The impact evaluation in CIVITAS is based on 'before-and-after' comparisons and must be carried out consistently across the CIVITAS cities and projects to provide the opportunity to exchange experiences and learn from each other.

The evaluation design that should be followed as much as possible is the design that is described below and that is illustrated in Figure 5.

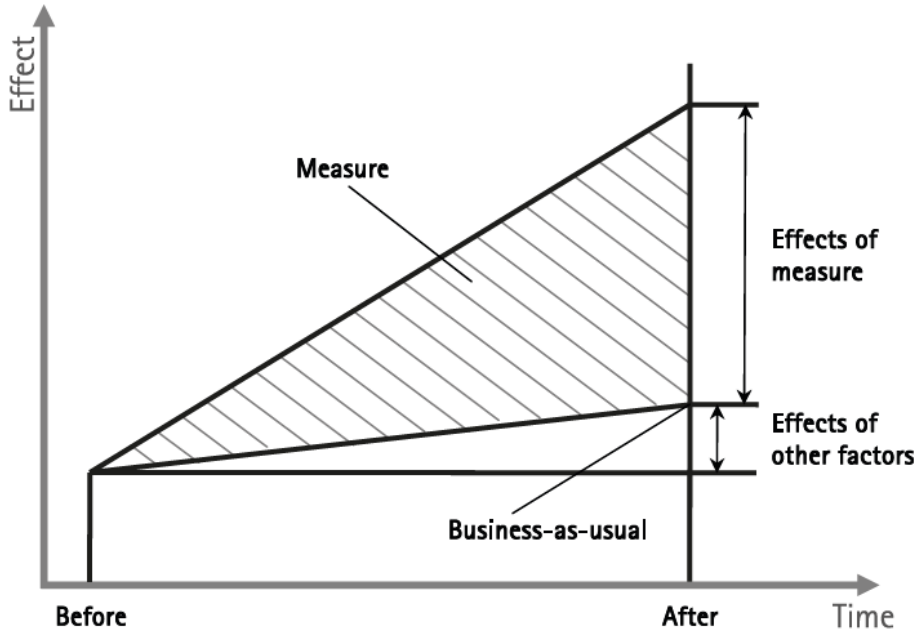


Figure 5: Before (Baseline), Business-as-Usual & After scenario. Source: "Evaluation Matters, A practitioners' guide to sound evaluation for urban mobility measures", 2013

- A first step in the evaluation approach is the measurement of the '**baseline'** or '**before**' situation. Baseline surveys and measurements are necessary to assess subsequent changes resulting from CIVITAS measures and are carried out *prior* to the introduction of the measures. The baseline measurements should be of sufficient scale to enable expected changes, both intended and unintended, to be judged statistically where this is appropriate and possible. It should encompass all measure-related indicators that may change. The baseline surveys may also help to fine-tune the design of the measures.

  It is recommended that also the trend towards this baseline is described and preferably quantified. This will result in a better understanding of the baseline and will help to define the business-as-usual scenario. Of course, also values of indicators for a wider scale (e.g.

on city level or on regional level) will result in a better understanding of the baseline situation.

- In order to draw conclusions, it is then necessary to identify what would happen if the measure was not introduced. Therefore, a **business-as-usual scenario** must be established. 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 (that can be provided by the baseline measurements), 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 **other factors** may be identified as other (CIVITAS or non-CIVITAS) measures that are implemented during the same time period, or context changes that occur over time (e.g. an increased car ownership or a decline in average family size). These effects may be adopted from other studies, 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. At least a critical check must be carried out that concludes whether an update of the business-as-usual predications is necessary.

- After implementation of the measures, an '**after' or 'ex-post' evaluation** needs to be carried out. This consists of 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.

  An important method to understand changes is the organization of **before and after end-user questionnaires** asking persons to report on their travel behaviour and explain their attitudes and reasons for change or no change. Such a survey can be organized on city level or on the level of the envisaged target group taking into account statistical requirements.
  Alternatively, **a transport panel** can be installed. A transport panel consists of a set of people (the larger, the better) who use the city's transport system and are contacted a number of times during the different phases of the measure to take part in a survey or to fill in a questionnaire. The benefits of a transport panel are that the shifting opinions based on the effects of a measure are well recorded. This is more accurate compared with different people that are contacted a number of times.

A project can also decide to organise a so-called '**after-only survey'** with questions on current behaviour but also **change** and the motivation for change. However, using only after surveys can have a high **risk of bias effects**, e.g. when the data are collected questioning (e.g. with an app) people who showed interested or are effectively using a new service. In that case other before and after data are needed as a reference for the more detailed information which are only valid for a part of the target group, i.e. the persons using the app. The survey is then an extra source of information to explain the change that occurred.

3.2.3 Ex-ante evaluation

In this document evaluation refers to **ex-post evaluation**. Indeed, CIVITAS aims to demonstrate measures and validate measures implemented in real urban environments using ex-post evaluation technics, contributing in this way to our knowledge base of evidence-based mobility solutions. However, evaluation can also take place before the implementation, the so-called **ex-ante evaluation**. If a CIVITAS measure is limited to a feasibility study, and nothing will be implemented yet during the project period an ex-ante evaluation can be useful.

In such a **feasibility study**, a problem or issue that needs to be tackled with a specific intervention is defined. Ex-ante evaluation will show what impact certain possible solutions are going to have, based on the analysis of similar implementations which were evaluated ex-post. Also, the related costs can be estimated. Based on this information of the alternative solutions, one can decide which solution to implement to reach the objective.

In this framework we will discuss mainly ex-post evaluation although some elements can be used for ex-ante evaluation too. If a measure is limited to a study the results of the ex-ante evaluation can be reported in similar ways as the ex-post evaluation.

3.3 Selection of impacts and indicators

For the evaluation of each measure, we need to agree on which expected impacts they are going to evaluate and what kind of indicators they will use in order to quantify the selected impacts.

In this section, an overview is presented of the impact areas to be assessed and relevant aspects to be analysed. Additionally, a list of indicators is discussed as a basis for the further improvement and completion of a standard CIVITAS list of indicators.

3.3.1 Identification of impacts of measures

The implementation of a measure is expected to have an impact on the different aspects of the complex mobility system in the city. Many approaches are available to structure this mobility system, identifying the relevant aspects of people and goods (the users), of the transport (sub)systems, and the environment in which these systems operate.

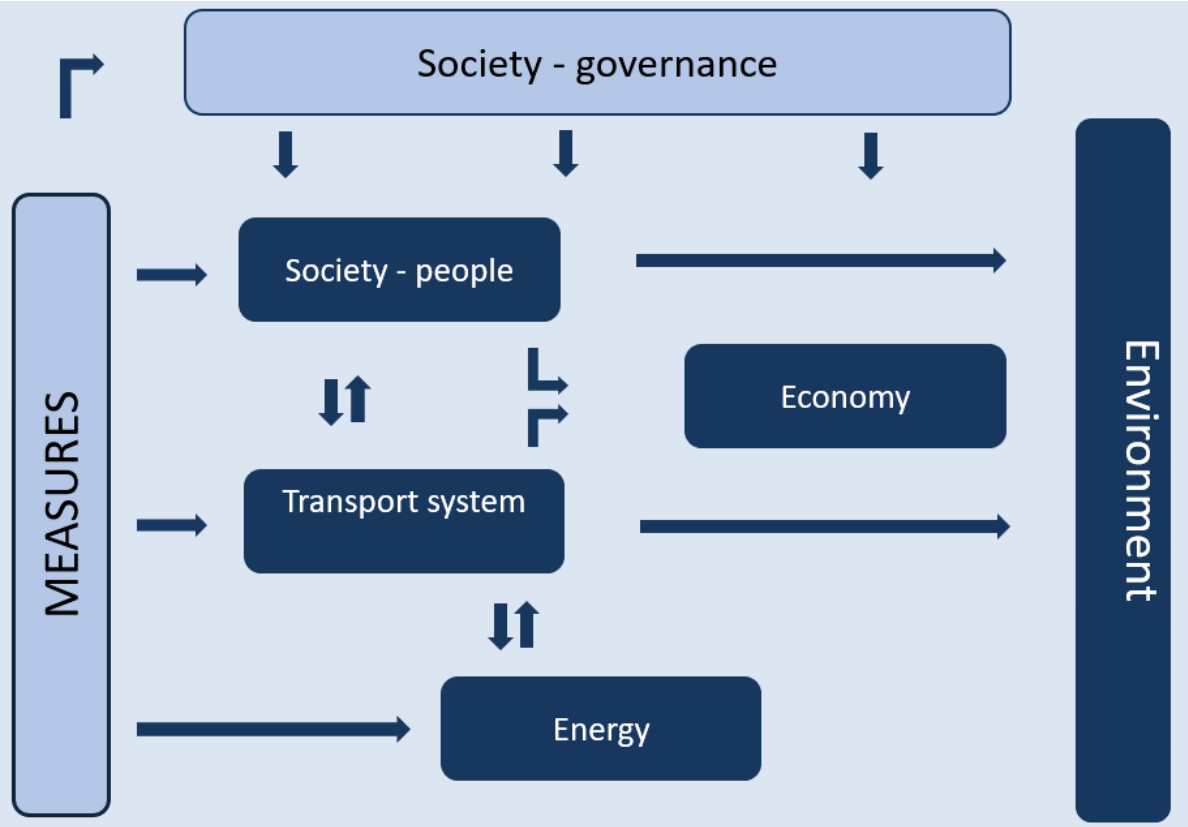


Figure 6: The mobility system with the main impact links

To make the understanding of the impact of measures clear and transparent it is important to start from a clear structured understanding of the way measures can affect the mobility system. The scheme in Figure 6 is a way to present the different categories of the mobility system showing the most important impact links. Although it is just one way to simplify the complex urban reality, it helps to structure the evaluation approach.

Measures can work directly on a specific impact category or indirectly through other categories. For example, if a bus fleet is converted to optimise the heating system by re-using the heat of the engine, there will be a direct impact on the energy usage but there may also be an indirect impact on the air quality in the bus corridor (the environment).

Impact indicators are also named **outcome indicators** but shouldn't be confused with **output indicators** which describe the elements (or sub-measures) of a measure.

e.g. awareness campaign to create acceptance for a new way of traveling to the city centre

output: number of flyers, neighbourhood meetings, etc.

impact or outcome: change in acceptance level in the target group

The following impact categories are identified:

- **Society** considers the people with their characteristics and mobility mind-set but also the organisation of society, which is crucial for the quality and effectiveness of the mobility policy.
    - **Society-people** covers all person-related aspects with a link to the mobility system. This includes for example characteristics of activity structures, accessibility levels to the transport system, but also health aspects linked to mobility behaviour.

      Effects on society may in turn have further effects on other factors such as employment opportunities, usage levels of the different modes, etc.
    - **Society-governance** includes the way society is organised both in terms of land-use (affecting the travel demand) and in terms of governance (affecting the way measures can be implemented and will be accepted).
- **Transport system** focuses on the performance of the mobility system in terms of usage and its technical characteristics. The emphasis here is on understanding how much the CIVITAS measures can contribute to improving the performance of the different modes of the mobility system.
- **Economy** focuses on the estimation of the effectiveness or benefits derived from a measure in relation to the costs associated with its preparation, implementation and operation. In economic efficiency terms, the balance between the impact of a measure and the willingness of users to pay the cost of achieving this impact has to be judged.

  This impact category also includes the effectiveness in increasing the income of citizens or creating jobs.
- **Energy** describes the consumption of energy. Using alternative fuels is one of the main measures proposed in CIVITAS. In addition, many other measures can also contribute to the reduction of fuel consumption (e.g. increasing public transport use) mainly through an impact in the other impact categories.
- **Environment** recognises that many of the CIVITAS measures aim to improve the environment by using clean vehicles and alternative fuels and reducing the modal share of private motorized transport. Environmental evaluation focuses on pollution/nuisance and resource consumption.

The impacts can be further described using:

- **Sub-categories** of the impacts e.g. the impact category ‘transport’ is further broken down into sub-categories: general, safety, car, public transport, etc.
- **Impact aspects** of the sub-area describing important characteristics of the sub-category

An example of this is shown in the table below (Table 4) for the impact area ‘Economy’. A similar structure is built up for the other impact areas as shown in Table 5.

IMPACT CATEGORY	SUB-CATEGORY	KEY IMPACT ASPECTS
ECONOMY	**Benefits**	Operating Revenues
		Economic development
	Costs	Investment costs
		Operating costs

Table 4: Areas sub-categories and impact aspects for the impact category 'Economy'

Deciding which impacts (category-subcategory-aspect) should or should not be included in the evaluation is not straightforward. In this process, both the measure objectives (with the intended impacts with quantified targets) and the measures itself (potential impacts) should be considered while reviewing the following questions:

- What (intended and unintended) impacts does the CIVITAS measure have?
- Do the impacts influence the achievement of the CIVITAS objectives?
- Are the impacts direct or indirect?

3.3.2 Selection of indicators

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

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

Table 5 below gives an overview of possible indicators to be used to describe the impact aspects in the different impact categories.

The indicators are classified into three types:

- **Key indicators**: important indicators to understand the impact of the CIVITAS measures in the six main CIVITAS impact categories; if possible at least these indicators should be used with the proposed definition, units and measurement methods to make the results transparent for others
- **Intermediate indicators**: indicators used to derive with further calculations, eventually using also other indicators, the impact in the CIVITAS impact categories; eventually these indicators are used to show the influence of the measure on an interesting aspect of the mobility system
- **Additional indicators**: additionally, other indicators can be used to understand specific aspects of the impact of a measure or as an alternative for the key indicators making use of available data.

Of course, the classification is a relative appraisal of the importance of the impact indicators since depending on the type of measure, the importance of the intermediate measures can be higher.

The table presents the following information:

- Impact category
- Impact sub-category
- Impact aspect
- Type of indicator
- Indicator
- Description of the indicator
- Availability of "Indicator Definition & Methodology Sheet" with more detailed description and guidance (see **Annex 1 Indicator Definition & Methodology Sheets**)

Apart from this list of indicators, also other **'local' additional or intermediate indicators** can be used to set up a fully useful evaluation responding to the specific objectives and to assess all important aspects of the implemented measure(s), e.g.

- to make an assessment at a more detailed level
- to focus on a specific user group, e.g. children
- to assess the impacts concerning a particular local problem
- to assess specific or exceptional impacts of a measure
- to evaluate technical performances

IMPACT CATEGORY & SUB-CATEGORY	IMPACT ASPECT	INDICATOR		Description	Sheet in annex
SOCIETY-PEOPLE					
Acceptance	**Awareness**	**Key Indicator no. 1**	**Awareness level**	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.	x
	Acceptance/ attitude	**Key Indicator no. 2**	**Acceptance level**	The percentage of the population who favourably receive or approve of the measure. 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.	x

IMPACT CATEGORY & SUB-CATEGORY	IMPACT ASPECT	INDICATOR		Description	Sheet in annex
	Satisfaction	Additional indicator	Citizens satisfaction with transport services	User/provider/stakeholder average reported satisfaction with • the overall quality of the transport system (public transport, cycling, walking, etc.) • the quality of a specific service It measures the experience of the user/provider, against its expectations.	x
Accessibility	**Physical distances between activities/ Land-use**	Intermediate indicator	Population density	Total population per hectare of urbanized land area.	
		Intermediate indicator	Land-use structure	Assessment of the structure of a city in relation to the fact that corridor structures and an urban structure with poles of high density have better opportunities to be served in a qualitative way by public transport.	
		Intermediate indicator	Mix of spatial functions in an area	Average presence (value 1) or not (value 0) of out of 10 spatial functions related to daily activities except for work in grids of 1km x 1km	
		Intermediate indicator	Accessibility to primary services	Percentage of population living within close distance of (public) primary services: nursery, primary school, doctor, pharmacy, food store, postal service and public meeting places	
	Physical accessibility of transport services	**Key Indicator no. 3**	**Perception of level of physical accessibility of service**	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.	x
		Additional indicator	Share of population with appropriate access to mobility services	Percentage of population living within walking distance of public transport (stop or station) or shared mobility (car or bike) system	x
		Additional indicator	Physical accessibility for deficiency groups to transport services	The average reported convenience of city transport for physical disabled persons	
	Operational accessibility of transport services	**Key Indicator no. 4**	**Operational barriers**	The operational accessibility to transport and transport services, as the average reported convenience of city transport.	x

IMPACT CATEGORY & SUB-CATEGORY	IMPACT ASPECT	INDICATOR		Description	Sheet in annex
		Additional indicator	Operational barriers for deficiency groups	The accessibility for deficiency groups (groups with training deficiencies or reduced knowledge) to transport and transport services, as the average reported convenience of city transport for target groups.	
	Economic accessibility of transport services	**Key Indicator no. 5**	**Relative cost of service**	Cost of service relative to average personal income	x
		Additional indicator	Relative cost of service for the poorest group	Share of the (public) transport cost for fulfilling basic activities of the household budget for the poorest quartile of the population.	
	Car availability	Intermediate indicator	Car ownership	All cars (including company cars) owned per 1,000 of the population aged 18 or over. Percentage of households that have no car, preferably disaggregated by city district.	x
		Intermediate indicator	Car share cars and stations per capita	This indicator is derived by dividing driving age population (18 and over) by the number of car share cars, that is, those cars in commercially or community run car share clubs that provide hourly hire of cars parked on street in local areas, bookable and payable by the hour, by club members only.	x
	Bike availability	Intermediate indicator	Bike ownership	Bikes (pedal cycles) owned per 1,000 population, disaggregated by city district if possible. Toy bicycles and those for children aged under 5 should not be counted.	x
		Intermediate indicator	Bike sharing bikes and stations per capita	This indicator is derived by dividing total population by the number of bike share bikes. Bike share bikes are those that are available on street for users (who sometimes have to go through a registration process and pay a registration fee) to hire, although often the first half hour of use is free of charge.	x
Mobility demand	**Total persons travel demand/need**	Intermediate indicator	Average number of trips per person	Average number of trips per day (weekday, week-end day) or per hour (peak hour, off-peak hour, etc.) of a target group or departing and arriving in an area	x
	Freight transport demand	Intermediate indicator	Number of goods movements	Total number of goods movements departing or arriving in a specific area	x

IMPACT CATEGORY & SUB-CATEGORY	IMPACT ASPECT	INDICATOR		Description	Sheet in annex
Health	**Health (physical activity)**	**Key indicator No. 6**	Average walking/cycling time per week	Average number of minutes that an adult between 20 and 74 years old is walking per week. Average number of minutes that an adult between 20 and 64 years old is cycling per week.	x
SOCIETY-GOVERNANCE					
Planning	**Planning process**	**Key Indicator no. 7**	**Quality of the Sustainable Urban Mobility Plan**	Qualitative check of the content and process of the Urban Mobility Plan verifying to which extent the content of the plan and the process of developing it corresponds with the EU guidelines on Sustainable Urban Mobility Plans.	x
		Additional indicator	Quality of policies, plans, and programs	Qualitative description of the change in the process to develop policies, plans, and programs (including SUMPs).	x
Operational cooperation structures	**Quality of cooperation structures with stakeholders**	**Key Indicator no. 8**	**Quality of cooperation structures with stakeholders**	Level of quality of cooperation structures between all public and private stakeholders to develop and implement sustainable mobility solutions	x
TRANSPORT SYSTEM					
General	**Modal split persons**	**Key Indicator no. 9**	**Modal split persons (trips)**	Percentage of trips using each mode for a specific target group during a day (weekday, week-end day) or per hour (peak hour, off-peak hour, etc.). For an area the model split of both the trips of the residents and the in- and outgoing people are analysed.	x
		Additional indicator	Modal split persons (passengers-km)	Percentage of passenger-km for each mode in an area during a day (weekday, week-end day) or per hour (peak hour, off-peak hour, etc.). Both the trips of the residents and the in- and outgoing people are analysed.	x

IMPACT CATEGORY & SUB-CATEGORY	IMPACT ASPECT	INDICATOR		Description	Sheet in annex
	Modal split freight	**Key Indicator no. 10**	**Modal split goods (trips)**	Percentage of goods (described in parcels, tons, etc) using each (sub) mode during a day (weekday, week-end day) or per hour (peak hour, off-peak hour for a specific target group or area.	x
		Additional indicator	Modal split goods (ton-km)	Percentage of ton-km for each mode during a day (weekday, week-end day) or per hour (peak hour, off-peak hour, etc.) for a specific area. Both the internal trips and the in- and outgoing trips are taken into account.	
	Total distances of vehicles	Intermediate indicator	**Km/type of vehicle**	Total distances driven in an area during a day (weekday, week-end day) or per hour (peak hour, off-peak hour, etc.) by different type of vehicles (private cars, trucks, public transport vehicles, etc.)	
Safety	**Transport safety**	**Key Indicator no. 11**	**Number of road collisions Number of road deaths and serious injured**	The number of collisions with serious injured and deaths and the resulting number of road deaths and serious injured caused by any means of transport. A road death is a death within 30 days after the road collision as a corollary of the event.	x
		Additional indicator	Number of road collisions Number of road deaths and serious injured for active modes	The number of transport injury collisions with active modes involved and the resulting number of road deaths and serious injured for cyclists and pedestrians. A road death is a death within 30 days after the road collision as a corollary of the event.	
		Intermediate indicator	Total number of transport accidents	Total number of collisions on the road in a period and an area.	
		Intermediate indicator	Percentage of vehicles speeding	The percentage of motor vehicles on a sample of urban roads that exceed the posted speed limit.	
Security	**Security**	**Key Indicator no. 12**	Perception of security	Perception of security when using service	x
Walking	**Opportunity for walking**	**Key Indicator no. 13**	**Quality of pedestrian infrastructure**	Percentage of the total distance of the city's streets (including squares: the "distance" of a square is the sum of the length of its sides) with a good quality for walking on the total length of the city road network (excluding motorways)	x
		Additional indicator	Quality of sidewalks	Calculation of the walkability index of all streets in an area describing in detail all aspects of quality for a sidewalk.	

IMPACT CATEGORY & SUB-CATEGORY	IMPACT ASPECT	INDICATOR		Description	Sheet in annex
	Number of pedestrians	Additional indicator	Number of pedestrians	Number of pedestrians passing at set of reference points in area during specific hours a day or during the whole day.	x
	Walking perception	Additional indicator	Image on the walking conditions (subjective)	Attitude towards walking conditions based on the answers of a survey among citizens and visitors or pedestrians on the street.	x
	Quality of public area	Additional indicator	Presence in the city of attractive areas such as pedestrian street or squares	Reported social usage of streets and squares and subjective appreciation of the public area quality	
Cycling	**Opportunity for cycling**	**Key Indicator no. 14**	**Quality of cycling infrastructure**	Percentage of the total distance of the city's streets (including squares) with a good quality for cycling on the total length of the city road network (excluding motorways)	x
		Additional indicator	Quality of bicycle paths	Calculation of the bikeability index of all streets in an area describing in detail all aspects of quality for a sidewalk.	
	Number of cyclists	Additional indicator	Number of cyclists	Number of cyclists passing at a set of reference points in area during specific hours a day or during the whole day.	x
	Cycling perception	Additional indicator	Image on the cycling conditions (subjective)	Attitude towards cycling conditions based on the answers of a survey among citizens and visitors or cyclists on the street.	x
Public transport	**Number of public transport users**	Additional indicator	Number of users	Number of passengers on public transport as a whole, for a specific sub-mode and/or passing at reference points for a given period.	
	Service reliability	**Key indicator no. 15**	**Accuracy of service**	Number and percentage of services arriving / departing on time	x
		Key indicator no. 16	**Commercial speed**	The average journey speed of public transport services between two points, including any delay at stops	x
		Additional	Peak/off-peak travel time difference	The percentage difference of travel times between peak hours, and off-peak hours. The peak and off-peak hours must be defined by each city to correspond with the local conditions.	
	Vehicle occupancy	Intermediate indicator	Average occupancy	Average number of persons per vehicle/day	

IMPACT CATEGORY & SUB-CATEGORY	IMPACT ASPECT	INDICATOR		Description	Sheet in annex
Car	**Vehicle Occupancy**	Intermediate indicator	Average occupancy	The average number of passengers per vehicle per trip.	x
	Traffic Flows	Intermediate indicator	Traffic flow by vehicle type (peak/off-peak)	The average daily vehicle flow during the peak and off-peak hours passing at well-chosen reference points, eventually divided per type of car e.g. type of fuel, electric, etc.	x
	Congestion Levels	**Key indicator no. 17**	**Average vehicle speed (peak/off-peak)**	The average network or route speed by vehicle type during the peak and off-peak	x
		Additional indicator	Delays in road traffic peak versus free flow traffic	Weighted average ratio of peak period travel times to free-flowing travel times with respecting rules in road traffic during peak hours on 10 reference routes	x
	Parking	Intermediate indicator	Parking demand	Number of parking places needed in an area	
		Intermediate indicator	Parking cost	Cost per hour of on-street parking in city's most expensive on-street spaces, as a percentage of gross monthly individual income.	x
		Intermediate indicator	Use of space for parking	Space devoted to parking (total, includes on street, off-street, private residential and non-residential) as proportion of the ground surface an urban area.	x
		Intermediate indicator	Turn-over	Number of cars parked per parking place during a day.	
		Additional indicator	Peak usage	Usage of the parking places at peak hours.	
Trucks	**Freight Movements**	**Key indicator no. 18**	**Number of freight movements**	The number of trucks passing at reference points (e.g. entering the city centre). divided over different type of vehicles: heavy trucks, light trucks, e-cargo bikes, etc.	x
	Optimal use of trucks capacity	Intermediate indicator	**Load factors**	Average loading percentage of the freight vehicles passing at reference points.	
	Optimal use of trucks	Intermediate indicator	Vehicle utilisation factor	Hours that vehicles are in service, e.g. deliveries, pick ups, transporting, weighting, loading/unloading over 24 hours	
	Service reliability	Additional indicator	Reliability of just-in-time freight deliveries	The number and percentage of just-in-time freight deliveries that arrive within an acceptable interval around the planned times	

IMPACT CATEGORY & SUB-CATEGORY	IMPACT ASPECT	INDICATOR		Description	Sheet in annex
New shared systems	**System usage**	Additional indicator	System usage	Average system usage (bookings, rentals, deliveries, users, passengers, etc.), in a given unit of time.	x
	Users perception	Additional indicator	Image on the user conditions (subjective)	Attitude towards user conditions based on the answers of a survey among citizens and visitors	
ECONOMY					
Benefits	**Operating Revenues**	**Key Indicator No. 19**	**Average operating revenue**	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).	x
	Economic development	**Key indicator No. 20**	**Job/sales impact**	Average monthly sales and yearly number of employees of businesses 100 meters around the transportation node (for public transport or station-based systems), along the intervened street (for roads/bike lanes/sidewalks, parking, etc.), or covered area.	x
Costs	**Investment costs**	**Key indicator No. 21**	**Capital investment costs**	The total capital costs for purchase of infrastructure, equipment and vehicles. It can also include the 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.	x
	Operating costs	**Key indicator No. 22**	**Average operating costs**	Operating costs including for example, the personnel costs, fuel, electricity and maintenance costs for the vehicle(s) involved.	x
ENERGY					
Energy Consumption	**Fuel Consumption**	**Key indicator No. 23**	**Vehicle fuel efficiency**	The energy consumption per unit of transport activity	x
		Intermediate indicator	Fuel mix	The percentage of the market share of transport fuel for each type of fuel used in a given period.	x
Energy resources	**Energy resources**	Additional indicator	Use of clean energy resources	The total volume of non-conventional energy resources. It can also be measured as a percentage of the total energy used.	

IMPACT CATEGORY & SUB-CATEGORY	IMPACT ASPECT	INDICATOR		Description	Sheet in annex
ENVIRONMENT					
Climate	Greenhouse gases	**Key indicator No. 24**	**CO_2 emissions**	The average CO_2 emissions per vehicle-km by vehicle and fuel type or by city resident/system user.	x
		Additional indicator	CO_2 level	The average hourly (or peak/off-peak) CO_2 concentration over a full year.	x
Air pollution	Air Quality	Additional indicator	CO emissions	the annual average CO emission per vehicle-km by vehicle and fuel type or by city resident/system user	x
		Additional indicator	CO level	The average hourly (or peak/off-peak) CO concentration over a full year.	x
		Additional indicator	NO_x emissions	NO_x per vehicle-km by vehicle and fuel type or by city residents / system users.	x
		Additional indicator	NO_x level	The average hourly (or peak/off-peak) NO_x concentration over a full year.	x
		Key indicator No. 25	**Small particulate emissions**	The annual average particulate matter (PM_{10} and $PM_{2.5}$) emission, or by city residents / system users.	x
		Additional indicator	Small particulate emissions	Number of people in zones with high pollution level	
		Key indicator No. 26	**Small particulate levels**	The average hourly (or peak/off-peak) PM_{10} and $PM_{2.5}$ (if possible) concentration over a full year.	x
		Additional indicator	Level of Hydrocarbons	The average hourly (or peak/off-peak) hydrocarbon concentration over a full year.	x
		Additional indicator	Number of residents affected	Number of residents in zones with a concentration of pollutants higher than the concentrations thresholds set in the EU guidelines.	
Nuisance	Noise	**Key indicator No. 27**	**Noise perception**	The percentage of people troubled by transport noise, based on people's perception.	x
		Key indicator No. 28	**Noise level**	Noise level (dB(A)) measured on-site in the area or corridor under study.	x

Table 5: CIVITAS SATELLITE list of indicators.

For **the selection of indicators**, the main criteria to follow should include:

- **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 **optimal selection and definition of the indicators is a crucial activity** in the evaluation work since this will influence strongly the efficiency of the work and the quality of the conclusions. **Not a high quantity of indicators** will be a precondition of a good evaluation **but the quality of the finally selected indicators**. In this perspective the quality of the indicator will depend on the relevance of the expected change described by the indicator, the availability of basic data, the potential to collect the data specifically in the project and the contribution the indicator gives in the general understanding of the impact of the measure(s).

Also, a good combination between output, intermediate impact indicators and core impact indicators can help a lot to assess and understand the effectiveness of the measures or integrated set of measures. Figure 7 shows the key elements in this exercise for safety related measures.

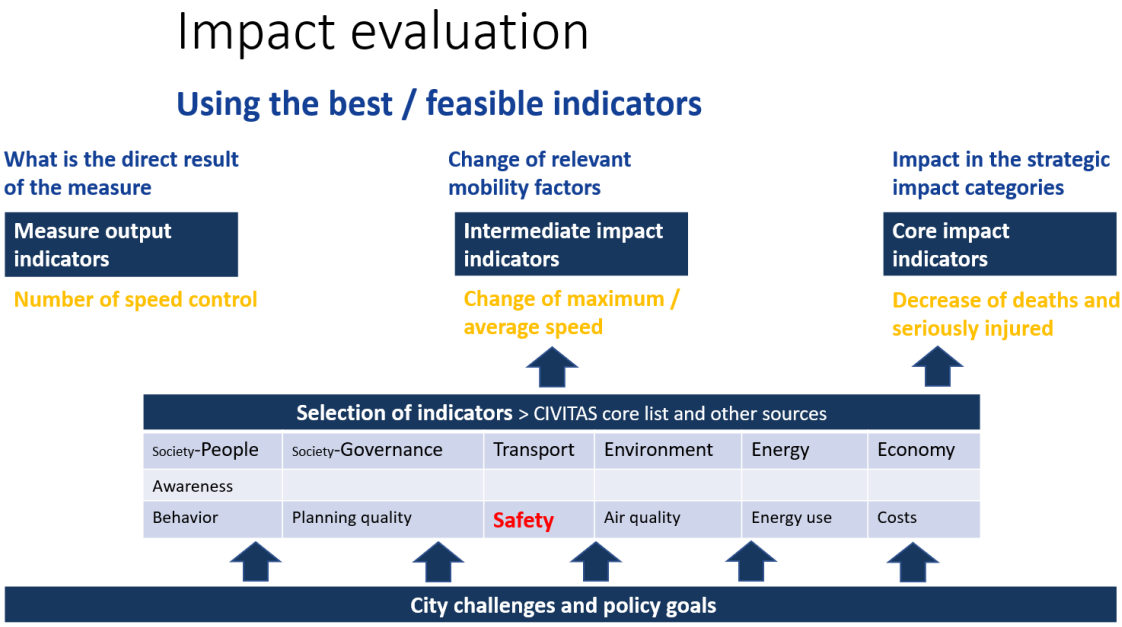


Figure 7: Selection of indicators for Safety policies.

3.3.3 Data collection

When deciding which indicators to select, an important consideration is how the indicator is measured and what data will be used for this. In general, there are two different kinds of data you can use for impact evaluation: data that is already available and data that must still be collected by additional measurements or surveys. It is always advisable to look for available data, because using high-quality existing data could save a lot of time and money. This data could include accident statistics, tickets sale numbers, periodic traffic counts and speed measurements, annual mobility surveys, etc.

When using available data, it is critical to ensure that this data is relevant and reliable. As this data may not be tailored specifically for the needs of one measure, it is important to avoid the trap of using secondary data just because it is available.

In most cases, the available data will not be sufficient for monitoring the effects of a measure for all selected indicators. Therefore, it will often be useful to collect data to fill in the missing information, or conduct a more detailed assessment. The advantage to collecting new data is that you can customise the measurement to the specific evaluation needs. It therefore is critical to think through what you are going to measure and in what detail, in order to get the best value with the available budget.

In general mobility-related data can be either behaviour-related and/or traffic-related. Behaviour-related data can be collected by asking people (e.g. interviews, questionnaires, focus groups) but also by observing behaviour (e.g. behaviour observations of pedestrians at crossings). Collecting traffic-related-data can be done by counts (e.g. vehicle counts, ticketing information) or measurements (e.g. emissions measurements).

Recently a lot of new data collection possibilities have emerged, using e.g. the location of mobile phone and other devices to track trips of people, routes of cars and bicycles. Taking

into account privacy regulations, these technics can provide much cheaper, more detailed data on travel behaviour covering in a better way the entire target group.

In some cases, these new data collection techniques can be used to calculate values for the existing indicators, in other cases the indicators need to be refined. In the latter circumstances, it is important to check that the desired impact categories are sufficiently covered.

Annex 8 Survey methodologies provides more background information on the methodology for surveys.

3.3.4 Indicator definition and Methodology sheets

Indicator definition and methodology sheets have been developed to serve as practical 'information and use guidelines' for each key 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 6.

Key indicator no. x **Additional indicator**	**Number and name of core indicator** or **Name of Additional indicator**
Category	**Impact category as described in Section 3.3.2**
Sub-category	Impact sub-category as described in Section 3.3.2
Impact aspect	Impact aspect as described in Section 3.3.2
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 and unit of measurement
Methods of measurement	Specific information on how to measure the indicator, with particular attention to: • Method of data collection • Frequency • Accuracy • Target group • Area of measurement
References	Examples of similar uses of the indicator based on the literature or projects

Table 6: 'Indicator Definition & Methodology Sheet' Structure

Annex 1 Indicator Definition & Methodology Sheets provides the full set of the Indicator Definition and Methodology Sheets for each of the key indicators, supplemented with the sheets of some of the additional indicators.

3.4 Up-scaling and long-term impacts

In many cases the demonstration and testing of a measure is only done on a small scale with an operational period too limited for evaluating the long-term impact. Therefore, it is important to perform additional analysis to get an understanding of the impact of the measure when it would be implemented on larger scale and when the measure is continued for a longer period.

3.4.1 Up-scaling

A measure can be implemented on a small scale, as a pilot, to test its effects and find out if there are any unforeseen side effects. In that case, **up-scaling can be a very useful method to show the real impact of the measure if implemented on a larger scale** and to understand whether it is feasible and sensible to implement such a measure on a larger scale. Also, to conduct an evaluation at city level in a consistent way, up-scaling can help to build up an overall image of the city in which the demonstrated measures are implemented at a city-wide scale.

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. Up-scaling is not limited to the city level, it can also take place within the region, e.g. if a public transport network covers not only a city but extends to the surrounding region, implementing a new ticketing system might be tested at city level and after successful implementation be scaled up to be used for the entire region.

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.

The core of the up-scaling is to take into consideration all the factors that will change if you implement your measure at a larger scale and what implications this will have for the impact of the measure, and in what direction the impact will change. Together with surveys, studies and statistics from the impact evaluation, these data are put into an empirical assessment using extrapolation or using a model, to estimate the total impact of the up-scaling. External data (e.g. historic data, data from previous surveys) might be included to get a more reliable picture.

Some important considerations regarding the up-scaling are:

- **Behaviour and technology**. Users of a pilot application may not be accustomed to the new technology or measure; the use of the technological tool and the impact in the demonstration project may thus be lower than in a full-scale implementation, or when time has been allowed for adjustments.
- **Acceptability**. If, for example, a shared space area is realised, and after a while people become used to it and there is overall acceptance, there is still the risk that the concept could be too radical to apply to the entire city; further experience will show whether it is practical at larger scales at all.
- 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.

- **Time** is sometimes a very relevant factor. Some measures will have impacts which take time to develop and the impacts of these should also be estimated at the larger scale.

3.4.2 Impact on long-term

Especially for measures that change the users' behaviour it will take some time, sometimes years, to achieve a significant change. Therefore, for a useful evaluation it is important not to consider only a before and after value of the indicators at one moment but collect additional **information on the new trend and the way different factors are influencing this**. This will allow, even in a more qualitative way, to give **a motivated indication how the observed short-term impact will further evolve**.

Of course, it is recommended that the monitoring campaigns set up in the framework of the project are continued in a more limited and optimised way, after the research and demonstration project. This will help the city further to validate and optimise the urban mobility policy.

3.5 Financial and Cost Benefit Analysis

To deepen further the understanding of the measure or a bundle of measures further analyses can be done, e.g. with a Social Cost Benefit Analysis or Financial Analysis.

A Social Cost Benefit Analysis (SCBA) puts all impacts to the same nominator (money) making it easier to see the trade-offs between different effects. With the help of one indicator one can assess if a measure/project is economically viable for society as whole. On the other hand, there are some impacts which are not easily monetised and hence might not be included in the SCBA. Therefore, an additional qualitative appraisal of the different impacts is always recommended to avoid that we miss crucial elements in the assessment of a measure or strategy.

A Financial Analysis (FA) focusses on the cash flows (costs and revenues) to determine if a project is financially viable from the standpoint of the operator. The FA also provides information on whether a project is financially viable with and without funding.

3.5.1 Financial analysis

A financial analysis is carried out in order to:

- Assess the project profitability for the project owner and some key stakeholders;
- Outline the cash flows which underpin the calculation of the socio-economic costs and benefits.

We follow the Discounted Cash Flow (DCF) method and focus on two[4] indicators:

1) Financial return on investment (FNPV(I) and FRR(I))

The financial return on investment takes into account

- Total investment costs (hence the cost of the land, the buildings, the equipment, etc.).
- Total operating costs and revenues.

Hence the financial net present value of investment (FNPV(I)) and the financial rate of return of the investment (FRR(I)) compare investment costs to net revenues. This is a measurement of the extent to which the project net revenues are able to repay the investment, **regardless of the sources or methods of financing**. A project with a positive financial net present value has enough revenue to cover the investment and the operating costs.

2) Financial return on capital (FNPV(K) and FRR(K))

The financial return on capital takes into account

- Cost of financing (hence the loan repayments, the interest, the private equity and public contribution).
- Total operating costs and revenues.

The objective of the return on national capital calculation is to examine the project performance from the perspective of the operator ('after the grant'). The idea being that a project might not be financially viable for a (private) operator (negative financial return on investment), but that a subsidy could overcome this problem. A subsidy could lead to a positive financial return on capital, making the project viable for a (private) operator. The reason is that, with a subsidy, the revenues would only need to cover part of the investment costs – the part not covered by subsidies.

The figure below (see Figure 8) shows which elements are taken into account for the two types of financial indicators.

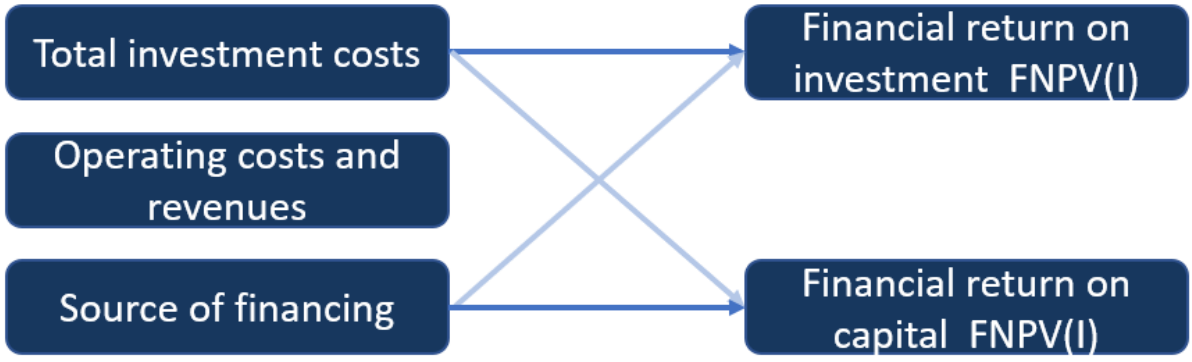


Figure 8: Main elements in the Financial Analysis

An extensive description of the recommended approach for a FA is discussed in **Annex 6 Financial and Cost Benefit Analysis.**

[4] A third indicator could be the "financial sustainability" of a project which focusses on the risk of running out of funds, both during the investment as well as in the operational stages.

3.5.2 Social Cost Benefit Analysis

In a SCBA the social costs and benefits connected to a project are inventoried in a systematic way. The word “social” indicates that the costs and benefits are being analysed and valued from the viewpoint of society as a whole. Hence, not only the financial-economic benefits are analysed. Other items which have a value for society, such as environment, mobility and safety are equally taken into account.

The result of a SCBA is an overview of the possible effects over time. These effects are discounted into their present value today. This way, different effects occurring at different times can be summed and the net benefit for society can be calculated using the economic net present value (ENPV) and the economic rate of return.

As probably not all elements can be quantified in monetary terms it is always beneficial to add a qualitative appraisal to a social cost benefit analysis. Within the CBA itself attention can be drawn to these elements by including them in the summary table as “pro memory”.

For the practical execution of a SCBA we propose to follow the different steps as shown in Figure 9 below. This is consistent with, but a more simplified approach than described in the EU guidelines and other national guidelines. We will, for example, not consider different background scenarios, propose corrections for shadow pricing of investment costs, etc.

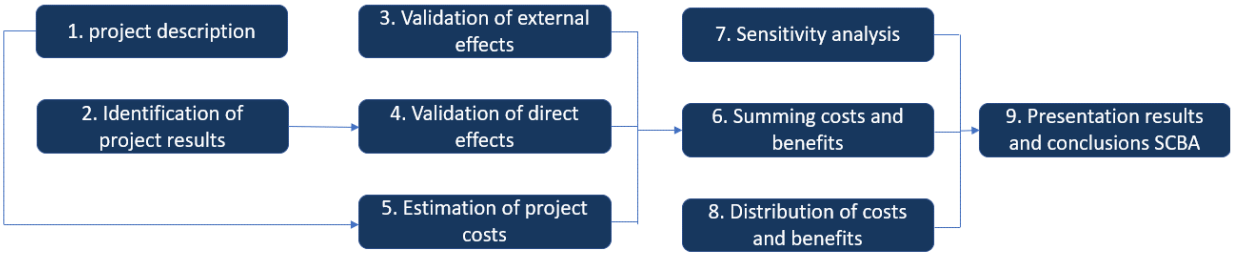


Figure 9: Main steps in the execution of a SCBA

An extensive description of the recommended approach for a SCBA is discussed in **Annex 6 Financial and Cost Benefit Analysis.**

4 Process evaluation

Complementary to the evaluation of the impact of a measure the analysis of the process of implementing the measure from idea to the operational stage is crucial. This so-called 'process evaluation' ensures a real understanding of the role the measure can have in a sustainable mobility strategy and provides insight into which elements are crucial to the observed impact.

In this chapter we discuss the key elements of developing an effective and efficient process evaluation approach. Of course, the process evaluation should be developed in interaction with the impact evaluation activities.

Especially in the phase of drawing evaluation conclusions on the level of a measure or an integrated package of measures, process evaluation should also improve the direct findings of the impact evaluation, by:

- Understanding why measures have succeeded or failed,
- Understanding the roles of supporting activities, e.g. information, communication and participation (citizen engagement, stakeholder involvement)
- Validation of the impact of the measures:
  - Support of interpretation of the impact indicators
  - Understanding the importance of sub-measures
  - Understanding the influence and importance of supporting activities

The main goal of process evaluation 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 outcome of the process evaluation will be the basis for the recommendations for other European cities, which is one common goal of the CIVITAS Initiative.

4.1 The concept of process evaluation

The success of a CIVITAS measure 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, and how the measure is then constructed or implemented.

In general, process evaluation is conducted for a measure, but depending on the way the CIVITAS work is structured, it can also be done for a sub-measure (if it has significant own characteristics) or for an integrated package of measures (if there are sufficient significant communalities between the measures).

4.1.1 Measure stages

Process evaluation is clearly linked to the different stages of a measure from first idea into the operational stage. In general, we can identify stages:

- **The design stage** including idea development, planning, preparation, and design efforts: 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.

- **The implementation stage** including the construction, introduction, announcement efforts to get the measure operational to the users: 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 operational stage (awareness and information campaigns). At the end of this phase the measure starts operation.
- **The operational stage:** The measure is opened to the public, i.e. users are able to use the measure or are affected by the measure. 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 timeframe of the CIVITAS Initiative. The long-term running is the outstanding time (beyond CIVITAS 2020) 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.

In some cases, it is difficult to distinguish between the three stages: design, implementation, operational. For example, does the design of an app (i.e. the functional structure of the software, the requirement analysis, etc.) to inform tourists about new mobility services refer to the design phase or to the implementation one? To which phase does the design of a questionnaire for a survey pertain? And again, in the case of a survey, which is the difference between the implementation and the operational phase? In that case the most logical name for the stage should be used and the other stages can be left out. For example, for an awareness campaign, the following stages can be defined:

- the design stage: developing the campaign, defining the actions, analyse the target groups
- implementation: doing the awareness-raising activities

Thus, the operational stage is omitted for this measure.

The subdivision of the measure implementation process in three stages is just a formal requirement, to which we should adhere as closely as possible to provide a required common communication standard for all CIVITAS projects. Furthermore, it is especially important to indicate the measure's milestones within each measure timeline. The milestones represent points of control of the measure's implementation roadmap and are critical information for both the process management and the evaluation.

4.1.2 A measure from the process evaluation point of view

As emphasised before, a well-structured understanding of a measure is crucial to do the evaluation in an efficient and high-quality way. This is also the case for process evaluation.

The following characteristics of a measure should be clearly identified:

- Has the measure sub-measures with a specific target group and implementation area?
- Are there supporting measures implemented as part of the measure which are expected to have a significant influence?
- Which is/are the target group(s) and implementation area(s) of the (sub-)measure(s)?
- Which are the stakeholders with a significant role in the implementation of the measure and what is their specific role?

The scheme below shows how these elements work together in relation to the impact of the measure and the implementation process.

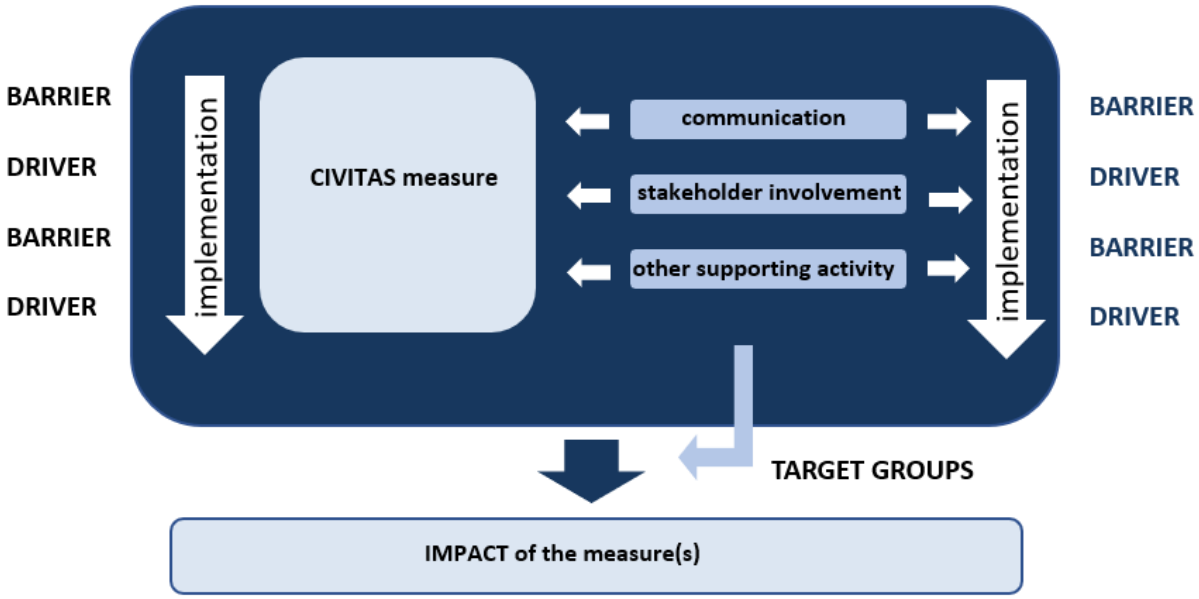


Figure 10: The different elements in a measure that are crucial for process evaluation

Supporting activities are activities implemented together with the measure aiming to make the implementation of the measure better, easier, more efficient and/or increasing the impact of the measure in the CIVITAS impact categories.

Examples of such activities are measure communication, introduction of a new design method, planning or decision making methods, stakeholder involvement and citizen engagement activities.

For example, if a measure consists of the construction of a new bicycle lane with the objective to motivate citizens to cycle more and replace the car by the bike for their commuting trip, involving the citizens living along the road in the design of the bicycle lane, will have a positive influence to get a building license, especially when some parking places have to be removed to make space for the bicycle lane (positive influence on the implementation of the measure). Promoting the usage of the bike with a strong communication campaign emphasising the benefits of cycling, will increase the number of user (positive influence on the impact of the measure).

4.2 Process evaluation activities

To plan and organise the process evaluation work, a pre-analysis of the measure should be done in order to have a clear view on the elements important for the implementation of the measure, e.g. the stakeholders, the risks for barriers, the possible drivers.

During the different stages of the measure, it is essential to monitor all relevant events and reflect regularly and critically to understand what has happened and why.

For IA projects, formal reporting on the implementation process is expected, linked to the progress reporting of the project. Most projects have a local reporting on a more regular basis, facilitating the management of the project by providing insights on mitigating actions and suggestions for optimisation of the implementation of the measure, based on a structured understanding of all elements of the implementation process.

At the end of the project lifetime, we have to bring all observations together and make a final reflection on what happened: how did we get where we are now? What was the importance of all elements and the role of all stakeholders? What were the drivers, barriers, the role of supporting activities, etc.?

4.2.1 Pre-analysis of measures

As part of the general understanding and structuring of the measures, some key elements for process evaluation should be identified in order to decide at the beginning of the project on the best approach to understand the implementation of the measure.

The following items are important:

- Responsible stakeholders (CIVITAS project partners and other important actors) and their roles for the implementation of the measure, including existing relationships and possible tensions between them
- Specific target groups and/or people living in the affected part of the city or region
- Detailed description of the supporting activities to approach the target group(s):
    - Type of activity
    - Target group
    - Methods used to approach the target group
- (Limited) risk analysis per measure: possible specific barriers in the implementation process in relation of reaching the objectives

In most cases this information can be collected through an interview with the Site Coordinator (SC) and the Measure Leaders (MLs).

Based on this information e.g. the following decisions can be taken:

- For which measures do we need to organise a focus group meeting (see Section 4.2.3 for more information), inviting stakeholders to the discuss the implementation process
- Will we evaluate supporting activities in more detail?
- Depending on the complexity of the implementation process and the expected risks, which activities will we organise to understand the implementation process (frequency, number of meetings, persons/stakeholders involved)?

Depending on the observations during the implementation process, the approach can be further optimised. For example, if the implementation slows down or fails, a higher effort can be made to understand the reasons why, as well as which actions are needed to overcome the barriers.

4.2.2 Monitoring the implementation process

To make it possible to look back to the implementation process and to discuss how and why things have happened, it is helpful to have a log of all relevant events in the implementation process. Especially for more complex measures this will result in a better understanding, instead of relying only on the memory of the involved actors.

Different techniques can be used for organising this monitoring, e.g.:

- A record of communications (e.g. emails, telephone records, notes from face-to-face meetings) that have contributed to or inhibited the implementation of the measure
- A logbook of all relevant events in the implementation process with comments on how they supported the process
- A follow-up of relevant milestones set before
- The recording of other project management information

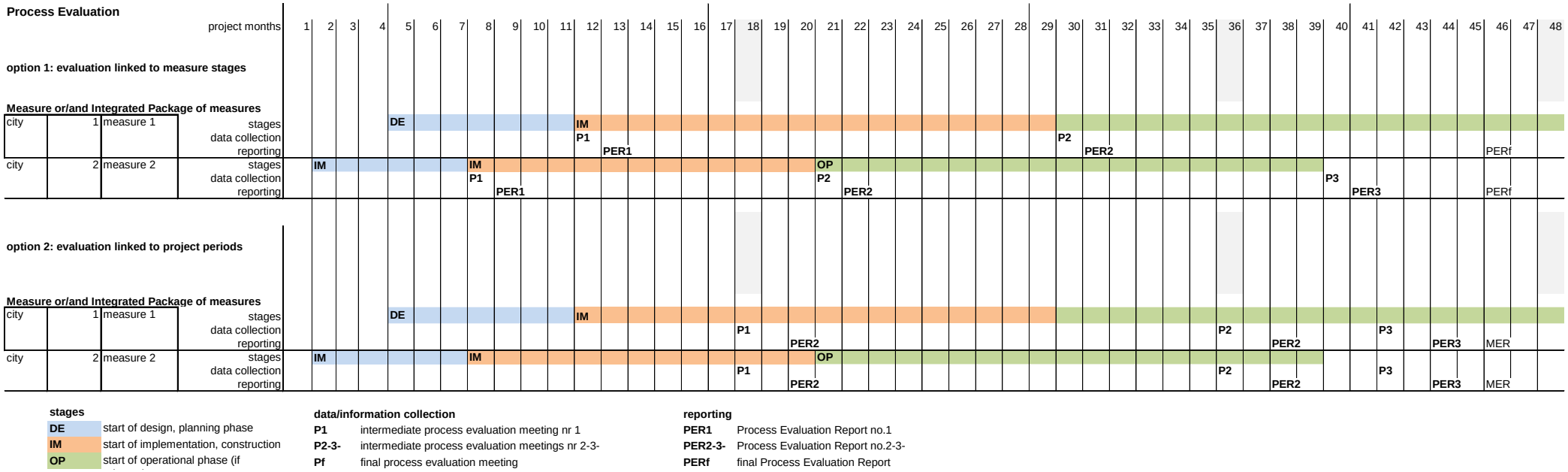
The way this information is gathered and synthesised can depend on the local project management habits. The effort to monitor this should be in balance with the added value for the process evaluation of the measure.

4.2.3 Periodical evaluation of the implementation process

Timing

At specific moments during the project, we can assess the implementation process of a measure. There are two options:

- These moments can be linked to the stages of the measures focusing on the process in a specific stage.
- However, to get a general overview of all measures in a project at a specific moment, the assessment can also be done at a pre-agreed moment looking back to a specific period of the lifetime of the project. In this way the process evaluation reporting can be linked to the (more administrative) progress reporting of the project.



stages

DE	start of design, planning phase
IM	start of implementation, construction
OP	start of operational phase (if

data/information collection

P1	intermediate process evaluation meeting nr 1
P2-3-	intermediate process evaluation meetings nr 2-3-
Pf	final process evaluation meeting

reporting

PER1	Process Evaluation Report no.1
PER2-3-	Process Evaluation Report no.2-3-
PERf	final Process Evaluation Report

Figure 11: Options of periodical evaluation

The CIVITAS 2020 IA projects agreed to follow the second option at the general CIVITAS level: a formal process evaluation reporting will be done after 20, 38 and (if relevant) after 44 months of the project. Finally, the general findings on process evaluation are reported in the Measure Evaluation Results (MER).

At city level and project level, more frequent evaluation and reporting can be planned (as most projects do). These approaches at the different levels are helpful both in terms of using the results of the process evaluation to optimise the implementation of the measures and having a better recording and understanding of all crucial elements that are influencing the implementation process.

RIA projects were allowed to decide on their own approach taking into account the specific characteristics of their project.

Process evaluation questions

Understanding the implementation process up to the moment of evaluation can be structured in different items which are important for a successful implementation:

- Which **barriers** have been encountered during the reporting period while trying to reach the objectives of the measure? Which actions have been taken by one or more measure partners to overcome the barriers?
- Which **drivers** might have been encountered during the reporting period in trying to reach the objectives of the measure? Which actions have been taken by one or more measure partners to make use of the drivers to reach the measure objectives?
- Which influence do we observe on the **risks** in the implementation of the measure? Which are the risks in the remaining process to reach the objectives?
- What is the quality and influence of the supporting activities during the reporting period?
    - Which events did determine the current status of the implementation of the measure?
    - What was the quality of the supporting activities?
    - What was the influence of the supporting activities on the implementation process?
    - What was the influence of the supporting activities on the impact of the measures?
    - What are the current 'lessons learned' on the supporting activities?

In many cases these questions cannot be answered in a quantitative way. For example, in a real urban environment it is not possible to ascertain the influence of an information campaign on the usage of a new cycle lane.

For this reason, the CIVITAS evaluation approach proposes at least a qualitative assessment, categorising e.g. the influence of supporting activities as

- no influence
- limited
- significant
- high

motivated with observed aspects and eventually available results of surveys of the users.

For the IA projects a standard reporting template (the process evaluation report or PER) is available. This is included in **Annex 4 Measure Process Evaluation (PER) template** with detailed guidelines to use it.

The RIA projects can also use the PER as inspiration to develop their own approach.

Process evaluation data gathering

A range of activities can be done to gather the information needed to understand the implementation process and assess the status of the implementation, e.g.

- Info from SC and ML
- Stakeholder survey
- Stakeholder interview
- User survey
- Focus group meeting
- Learning history session
- Expert (validation) meeting

For a measure with a straightforward and simple implementation process, the information needed to assess the process can be available in a direct discussion with the Site Coordinator and the Measure Leader. They will be able to identify barriers and drivers, and assess the implementation period, based on their observation in their management and coordination work.

If many stakeholders are involved, it can be useful to know their opinion on the implementation of the measure and their role in it as well. A survey of these stakeholders asking for their appraisal of different aspects and their feedback on pre-formulated observations, can complete the view on the implementation process.

If one or two stakeholders have a major role in the implementation of the measure, it can be relevant to have a bilateral contact with these stakeholders allowing them to clarify their point of view more clearly and to bring forward delicate matters more openly.

For some measures, a survey of the users of the measure (the target group affected by the measure) can be organised. Such a survey can help to better understand some aspects of the implementation process. Besides, if such survey is already planned for impact evaluation, some questions helpful for process evaluation can be added. Especially, to assess the influence and importance of supporting activities approaching these users, questions such as ‘what did convince you to use the measure’ can result in motivated conclusions about the influence of a specific supporting activity.

More complex measures a more intensive discussion with the stakeholders is appropriate. In this case techniques from management and social sciences can help, such as focus group meetings and learning history sessions. In **Annex 7 Learning history sessions** guidelines for organising a learning history session are available.

Additionally, a meeting with mobility experts or experts in related domains not directly involved in the implementation of the measure can be helpful in getting better insights into the

implementation process. Moreover, an expert with good knowledge of the local administrative and juridical procedures can contribute to understand the process.

These activities, especially an expert meeting, can also help to understand why the measure has the impact observed in an ex-post measurement as part of the impact evaluation. Therefore, it is relevant that in the different type of meetings also the interpretation of the observed impact (if already known) is a point of discussion.

Reporting

A possible template for the periodically reporting is discussed in Section 6.3.2 and the template is available in **Annex 4 Measure Process Evaluation (PER) template**.

4.2.4 Process evaluation findings

Finally, all the periodical process evaluation observations should be summarised in a final assessment of the implementation process of the measure discussing at least the following aspects:

- The important events during the implementation of the measure
- Identification of implementation barriers
- Identification of implementation drivers
- Reporting on activities to overcome barriers and/or to make use of the drivers to reach the measure objectives
- Supporting activities: activities – penetration – quality – influence on implementation and impact of the measure
- Identification of lessons learned in the period

For some measures a meeting, survey or interview can be organised overlooking the whole implementation process.

In practice it is recommended that drawing final conclusion on the implementation process is combined with the validation/interpretation of the impacts. This is discussed in Chapter 5.

5 Evaluation conclusions

5.1 Bringing all knowledge together

Evaluation is not worth the effort if we can't draw meaningful conclusions on measures and more general, on mobility strategies contributing to the envisaged mobility evolution of our (urban[5]) environment.

To achieve this, it is not sufficient to collect data on measure level but we need also to combine this insight with the understanding of the mobility evolution of a city or site both as the context of the measures and as the main level on which mobility policies should work. Therefore, it is crucial to plan and manage a range of activities including consultation, expert group meetings, additional analyses, etc., to come to well-motivated conclusions and recommendations on different levels.

The scheme below (Figure 12: Bringing all knowledge together) gives an overview of the way these activities can be structured for a project in which integrated packages of measures covering different CIVITAS thematic areas, are implemented, tested and evaluated in different cities or sites.

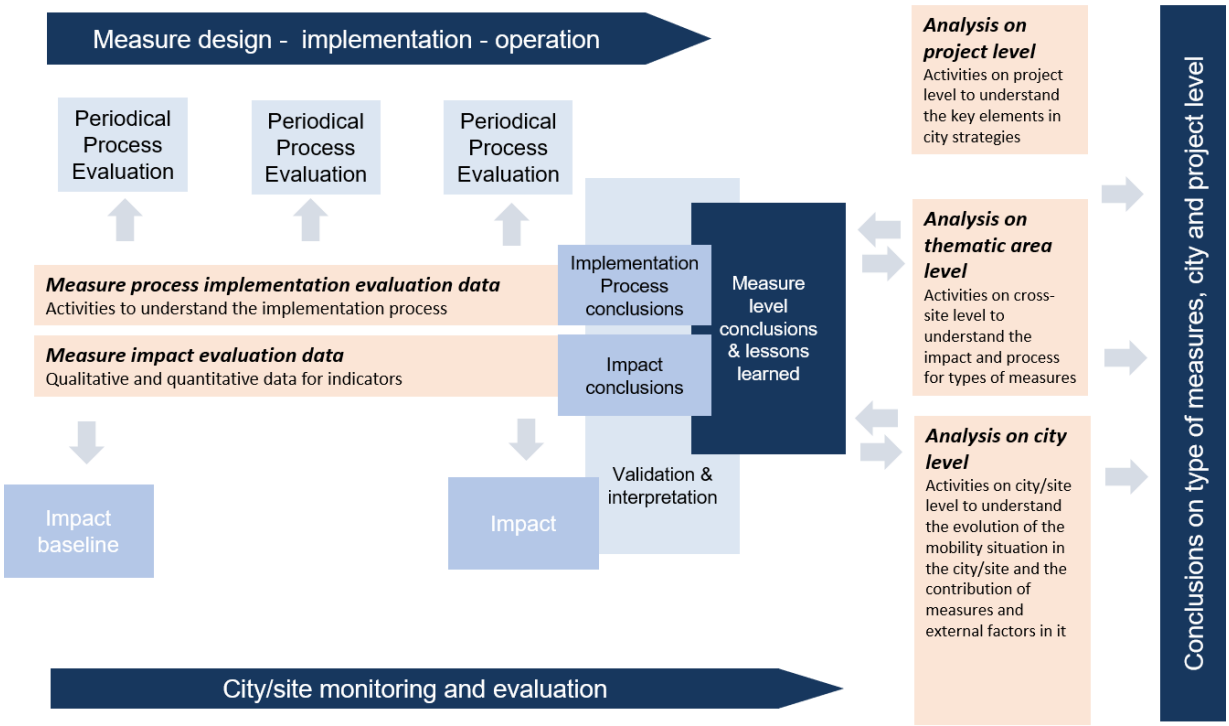


Figure 12: Bringing all knowledge together

[5] The focus of the CIVITAS Initiative.

Of course, depending on the overall structure of the project, the type of measures implemented, and city or site involved, other elements and other analysis and synthesis activities can be included.

The presented approach combines the efforts to come to well-motivated conclusions at different levels while using the findings on each level to strengthen and enrich the conclusions on the other levels e.g. good conclusions and lessons learned for a specific measure will be much stronger and interesting if it uses also the observations for the whole city (as a context and reference) and the conclusions of the analyses and findings for the thematic area (to understand common aspects and synergies with other measures).

Bringing all evaluation findings together in a structured way is an important task in each project aiming to contribute to our knowledge base of evidence-based solutions. Only with significant efforts to do this, the added value of good evaluation work on measure and city level will be clear and results of evaluation will fully support decision making and optimisation, up-scaling and take-up of strategies.

These integrated efforts should be planned already from the start of the project and should start already during the project not leaving it as an additional ‘emergency‘ effort at the end of the project.

In the next Sections each level is discussed further.

5.2 (Integrated package of) Measure(s) level conclusions

5.2.1 Integrating impact and process evaluation findings

The integration and interpretation of the results from both the impact and implementation process evaluation will provide the necessary comparative insights and understanding of the effectiveness of the measures at city level showing also the importance of such measures at a European level.

Especially in the complex urban environment in which a range of factors influence changes, it is crucial to combine the quantitative measurements (the traditional impact evaluation) with specific efforts to validate and put the figures in the correct context. Here also the findings of the process evaluation will contribute **to understand the story behind the figures**. Especially a good understanding of the contribution of the so-called ‘supporting activities’ on the impact observed is important to draw useful conclusions on the role measures can play to achieve the overall objectives for the urban environment.

Further, a strong understanding in barriers and drivers to implement the measure(s) is crucial to assess the value of the measure(s) and especially to assess take-up possibilities.

5.2.2 Expert assessment and validation

Measuring the impact using quantitative approaches is crucial in order to objectify the results of the measures. However, taking into account the limitations of data collection efforts and the

complex environment in which the measures are implemented, additional efforts are needed to validate the observations and to complete the understanding of the impacts.

At a basic level this can be done by **validation by the responsible person for evaluation with the local coordinator and the person responsible for the implementation of the measure**. In such an interactive analysis the responsible person for evaluation should question all significant aspects of the observed impact, trying to understand how, why and how much change occurred because of a specific measure. Based on this, decisions can be made to analyse some aspects in greater detail, even collecting additional data or launching additional (after) surveys. For the IAs, a meeting with the LEM, ML and SC can have this goal.

For more complex situations it will be very helpful to have an **expert meeting** with experienced people active in mobility, such as the mobility team of the city, and other working fields, such as land-use and spatial planning. In this meeting the observed impact aspects are discussed in the context of the city, taking into account the key elements of the measures that could affect the initial situation and the impacts of similar measures observed elsewhere. The expert meeting will validate initial conclusions and fill in the gaps in the understanding of the impacts and the role of supporting activities such as communication, citizens' engagement actions and stakeholders' involvement.

To further extend the scope of input, **a multi-stakeholder meeting** with all involved actors can be organised. In this meeting the whole implementation process can be discussed (as part of the process evaluation) considering also the role of each of the stakeholders and a consensus can be achieved on the impact of the measure(s) in the different impact areas taking into account the appraisal of the stakeholders. Techniques, such as those developed in the BYPAD[6] and QUEST[7] projects, can be used to structure the meeting and obtain generally accepted conclusions. Involvement of an even wider assortment of actors involved or affected by the measure can assure a balanced conclusion.

In practice **the activities to understand why we have the observed impacts (as part of the impact evaluation) can be done as part of the process evaluation activities** when the process is analysed and discussed with decision makers, stakeholders and users. In this way also the observed impacts should be interpretated and validated.

5.2.3 Interaction with the city level evaluation

As discussed above (see Section 3.1.4) the city level evaluation should result in a synthetic understanding of the changes in the city with an indication of the contribution of measures in the observed changes. When drawing conclusions for the measure also these findings should be included allowing to enrich the measure related conclusions putting the observed impacts in the correct perspective of the overall change in the city and clarifying the importance of other measures and the interaction with these measures to achieve the observed impacts.

[6] https://bypad.org/
[7] https://www.quest-project.eu/

5.2.4 Synthesis of evaluation conclusions

To present the main conclusions in a structured way informing other technicians and policy makers in a way they get sufficient insight in the measure(s) and the reasons why this works or not, at least the following aspects should be discussed:

- **Validated impacts**

List the key results regarding the impact of the measure referring to quantitative observations and qualitative appraisals (e.g. This measure has been effective in achieving a 1% modal change towards car sharing). Here also the different factors should be explained important to understand how observed impacts were achieved e.g.

  - the importance of supporting measures in achieving the impacts
  - a reference to observed overall impacts in the urban environment indicating the contribution of this measure
  - combination with other measures (part or not part of the project)

- **Long term impact** (if relevant)

List the potential long-term impacts that can be expected for this measure.

- **Implementation issues**

List the key barriers and drivers and mitigating actions for the implementation of this measure, explaining also the role of supporting activities to easy the implementation.

- **Main lessons learned**

List the main lesson learned for this measure as an integrated conclusion of the impact and process evaluation findings (the previous points).

Additionally, further considerations and advices can be added on the up-scaling of the measure in same the city or take-up in other cities.

5.3 City level conclusions

As discussed above (see Section 3.1.4) the city level evaluation should result in a **synthetic understanding of the mobility changes** in the city or (part of) the functional urban area (or the region).

Of course, making the link with the measures analysed and evaluated in the project is important to understand the **importance of these measures to contribute to the sustainable evolution** envisaged in our general policy goals on city, regional and European level. To do this, the technics discussed in Section 3.1.4 are very helpful.

Additionally, the city level conclusions should present the **main lessons learned on which integrated packages of measures** in combination with the evolution of specific mobility

related factors, **are the most effective solutions** and which are key elements to take into account when implementing strategies to overcome barriers, avoid failure and have the highest impacts envisaged.

5.4 Cross-site analyses and conclusions

A project in which one type of measure or a range of measures are implemented in different cities or sites can use this diversity of sites and contexts to bring the general evaluation conclusions on a higher level.

5.4.1 Conclusions per thematic areas

The CIVITAS thematic areas (see are 2.3.2) are a useful classification of types of mobility related measures to discuss and present evaluation findings. Eventually these areas can be taken together in further aggregated working areas in the projects.

Bringing together the findings in the different cities and sites will allow to draw more **general conclusions on the impacts and implementation aspects of a type of measure** referring also to the context of each of the cities or sites in which measures can be more or less efficient and where implementations should be done in different ways to use drivers and overcome barriers.

In general, a simple comparison of the (changes of the) value of indicators in different sites is not recommended since the context of the cities is often different. More useful is a **qualitative discussion on the effectiveness of measures in different contexts illustrated with the observed impacts** in these cities.

A risk of discussing measures classified in thematic areas is that we see the measures as self-standing actions forgetting the **interaction with other measures (under other thematic areas) and the integration of measures to efficient strategies** in the urban environment. Therefore, it is crucial to include also these aspects in the conclusions for each thematic are.

5.4.2 Responding to the specific focus of the project

Finally, all evaluation findings can be brought together to give general recommendations on the mobility strategy (the integrated packages) for cities with similar characteristics or facing similar challenges as the cities in the project. This doesn't mean that the experiences and findings in the project are not interesting and helpful for other cities, but it is obvious that cities in line with the focus of the project will be more inspired by the general findings and advices from the project.

Strong examples for this are the CIVITAS IA projects (2016-2020) each with a specific focus: CIVITAS DESTINATIONS with a focus on island cities, CIVITAS PORTIS with a focus on port cities and CIVITAS ECCENTRIC with a focus on suburbs of large metropoles.

6 Evaluation reporting

All efforts to perform a good evaluation are useless if the evaluation isn't reported in a transparent and clear way informing colleagues how we evaluated, what our observations and findings are and presenting policy makers the conclusions on impacts and implementation processes and our insights and advices.

However, reporting is also important internally in the project to agree with all partners on the data to be collected and the evaluation activities to be done, to inform other partners on observations and findings allowing discussions on it and the validation of conclusions, and finally to monitor the implementation of measures allowing to plan the evaluation work in relation to it.

This chapter presents an overview of useful reporting documents that can be used in the different stages of the evaluation work. Basically, they are developed for demonstration projects testing integrated packages of measures in different cities or sites. More focused projects can extract the useful part of it in relation to their needs.

The basic evaluation reporting for the implemented measures or integrated packages of measures should be done using the **Measure Evaluation Results (MER)** sheet. Especially for this document it is important that at least a similar structure using the CIVITAS terminology is followed to make it easy for other partners in the city and from other cities internally and outside the project to understand in a clear way the evaluation findings allowing them to get a deeper insight in the way the measure was evaluate and the basic findings.

6.1 The evaluation plan

The evaluation plan describes in detail how the evaluation will be organised in order to draw well motivated conclusions with all the envisaged focuses throughout and after the project.

The main challenge is to build up **a feasible and effective evaluation approach** in each city or site and to develop the best approach for all further analyses and making conclusions.

In practice it is more efficient to have on the one hand Local Evaluation Plans referring to the activities and conclusions to be drawn on measure and city level and on the other hand a Project Evaluation Plan synthesising the local approach and describing all cross-site and project level activities. Of course, taking into account the specific characteristics and concept of the project these structures can be optimised and additional aspects can be added. The structure of a Local Evaluation Plan and a Project Evaluation Plan are shown in Figure 13 and Figure 14.

Local Evaluation Plan

1. Introduction

Reference to the CIVITAS project and its specific focus.
Reference to the global evaluation objectives and approach.

2. The city (site)

- General characteristics city and region (if relevant)
  - Geographic
  - Governance
  - Population
  - Main activities: working, school,
- Specific characteristics in relation with the project focus, e.g. port, tourism, etc.
- State of mobility: modal split figures, counts
- Provision of transport options: infrastructure and services
- Current mobility management and traffic management initiatives including communication with the public
- Goods and freight movements: movements, infrastructure, services, …

3. The CIVITAS measures

3.1 Overview

General description of CIVITAS measures in the city indicating the way they work together to achieve the general CIVITAS objectives: main expected impact area and target groups (no need to do this per work package)

3.2 Detailed evaluation info per measure

Per measure (in a table):

- Specific objectives and quantifiable targets
- Specific target groups and/or effected part of the city or region
- Supporting activities to approach the target group(s)
- Link with other measures
- Responsible stakeholders and their roles
- Main expected impacts: textual description of the impacts (the ‘story’ of the measure)
- Implementation timing

3.3 Structuring measures for evaluation

Overview of measures, sub-measures and integrated packages (IPs) of measures and main impacts to be evaluated for each measure or an integrated package of measures (in an IP some impacts can be evaluated for one of the measures)

4. Impact Evaluation

4.1 Evaluation on city level

Description of the evaluation work on city level:

- Mobility evolution in the city, available data sources to be used, additional surveys to be organised.
- Impacts to be evaluated on city level: expected impacts, indicators, data collection methods
- For specific cases the level of a site (part of a city or regional level) can be taken or added.

4.2 Measure evaluation choices

Per measure or IP:

- Impacts to be evaluated: impact area, impact sub-area and aspects
- Indicators to be used to measure the impacts: data/unit of measurement, calculation of indirect indicators, etc.
- Methods of data collection: method, frequency, quantity, sample size, area and/or target group
- Responsibilities
- Upscaling approach (if relevant)

4.3 Synthesis of data collection

General overview of data collection activities indicating synergies for the different measures

4.4 Additional analyses and activities towards conclusions

Data analysis work including eventually upscaling towards first conclusions per measure and IP level and activities to validate the conclusions: validation meeting of ML, LEM and SC, expert meeting, stakeholder validation meetings

5. Process evaluation

Overview of all basic information to choose the best process evaluation activities for each measure and first version of a plan of activities for this (on measure level, city or project level):

- Responsible stakeholders and their roles for the implementation of the measure, including possible or tensions links between them
- (Limited) risk analysis per measure: possible specific barriers in the implementation process
- Detailed description of the Supporting activities to approach the target group(s): Type of activity - Target group - Approach of the target group
- Planning of process evaluation activities taking into account the agreed periodically reporting
- Planning other activities to understand the process of implementation: expert meetings, focus groups, learning history, end user surveys

6. Conclusions

6.1 Overall planning local data collection and knowledge gathering activities

Scheme (Gantt chart) with timing of the main implementation stages and evaluation activities and reporting per measure towards conclusions per measure and/or IP

6.2 Planning of activities to validate and integrate conclusions on measures and city level

- Activities on measure (and IP level) to come to integrated conclusions
- Activities on city level towards conclusions on city level in general and linking to the implemented measures

Figure 13: Structure of a Local Evaluation Plan

To work in the most efficient way, it is recommended that in the Local Evaluation Plan the tables as proposed for the MER and PER are used, allowing to copy the information directly in both templates and to work further on this reporting during the project. Of course, in the Local Evaluation Plan additional tables can be added.

Because the Local Evaluation Plan is also a working document at the local level to agree with all local partners on the evaluation related activities, this document is preferably a self-standing document with clear reference to the CIVITAS and project context. As part of the formal reporting of a project the Local Evaluation Plan can be added as an annex to the Project Evaluation Plan.

Project Evaluation Plan

1. Introduction

Explaining the purpose and content of this document.

2. The Project

2.1 The CIVITAS Initiative

Situating the project in the CIVITAS Initiative

2.2 The project

Focus and specific objectives of the project

Structured overview of the measures referring to the specific objectives of the project and the CIVITAS themes.

2.3 The demonstration cities/sites

Overview of the key characteristics of the demonstration and validation cities/sites such as area, population, density, trips/day, modal split, etc.

2.4 Strategies and measures

Structured overview of the measures referring to the specific objectives of the project and the CIVITAS themes.

3. General approach to Evaluation

3.1 Goals of the evaluation

What type of conclusions we want to draw, which objectives we want to evaluate, e.g. specific objectives of the measures, objectives for the city, objectives of the project, conclusions on the CIVITAS themes, etc.

Links whit others work packages in the project

3.2 Overall organisation of evaluation in the project

Overall structure of the evaluation in the project

Roles and responsibilities

Interaction between the evaluation work on different levels (local, project, etc.)

3.3 Methods and evaluation activities

Which activities are planned on the level of the cities/sites and on the level of the project

3.4 Building conclusions on different levels

Interaction between the evaluation work on different levels (local, project, etc.)

How we come to conclusions on city, project, CIVITAS thematic areas and project level.

4. Timing and reporting

Which reports are planned and what will be the content.

General timing of the evaluation activities and reporting.

5. Related elements and actions

Discussion of related issues to evaluation, e.g. ethical aspects, allocation of resources, risks, etc.

6. Conclusions

Figure 14: Structure of a Project Evaluation Plan

Updating the evaluation plans

An evaluation plan should have the flexibility to respond to new elements and observation during the project. Especially for larger demonstration projects as the IA projects, a lot of changes can take place concerning the measures and the context of these measures over the course of the project.

To handle this, an update mechanism should be foreseen to revise the plans over time. A possible approach can be that changes in the approach of the evaluation of the measures are reported in the MER and changes in evaluation on a higher level (e.g. city level evaluation, project level activities, etc.) are described in the evaluation progress reporting during the project and reported in the final evaluation reports.

6.2 The CIVITAS measure evaluation planning and monitoring scheme (Gantt chart)

Planning all activities to get the needed data on the right moment – linked to the implementation timing – is crucial to achieve a high-quality evaluation in an efficient way. The basis for this is the work that needs to be done on measure level because at this level the basic data are gathered.

In addition to the planning, the monitoring of this work during the project lifetime is also important.

Therefore, an easy planning tool (Excel-based) has been developed by CIVITAS SATELLITE to be used for monitoring the progress and possible changes. This tool can also be used to report the status of the work on the level of the measure towards the city, the project and CIVITAS SATELLITE.

With this tool the evaluation can be planned and monitored per city presenting all measures of the city eventually grouped in Integrated Packages or split into sub-measures. For each measure (or IP or sub-measure) 3 types of information are presented:

- implementation stages and (possibly) important milestones,
- the evaluation data and information gathering activities and
- the reporting.

At regular intervals the sheet can be updated showing the changes in the progress and the planning of the future steps.

The tool is added in **Annex 2 The CIVITAS measure evaluation planning and monitoring scheme (Gantt chart).** The CIVITAS measure evaluation planning and monitoring scheme (Gantt chart) with more detailed instructions including a list of events with standard notation to be used:

Activities M = mandatory O=optional	Abbreviation to be used in the scheme	
stages		
M	**DE**	start of design, planning phase
M	**IM**	start of implementation, construction phase
M	**OP**	start of operational phase (if relevant)
O	**MS1**	milestone 1: explain in comments
O	**MS2-3-**	milestone 2,3,..: explain in comments
data collection		
M	**B**	baseline data
O	**I1**	1st intermediate data
O	**I2-3-**	intermediate data 2-3-
M	**F**	final data: data at the end of the CIVITAS operational period
M	**V**	validation meeting
O	**P1**	intermediate process evaluation meeting nr 1
O	**P2-3-**	intermediate process evaluation meetings nr 2-3-
M	**Pf**	final process evaluation meeting
M	**Pf**	final process evaluation meeting
reporting		reporting to your Project Evaluation Manager
M	**M1**	MER - version with evaluation method and baseline
O	**M2-3-**	MER - intermediate versions (version with intermediate results or draft version of the final MER)
M	**Mv**	MER- version with validated conclusions (impact & process)
M	**Mf**	MER - final version
M	**PER1**	1st process evaluation reporting
M	**PER2**	2nd process evaluation reporting
O	**PER3**	3rd process evaluation reporting
O	**PERf**	final process evaluation reporting

Figure 15: Overview of events to be used in the CIVITAS planning and monitoring tool

A similar planning and monitoring can be built-up to plan and monitor the evaluation activities on city and project level.

6.3 Measure level reports

To harmonise the reporting, increasing the transparency and understanding of the findings on the implementation of each measure in the different cities (or sites) a set of templates were developed to structure all information in a standard way.

These reports mainly present all the data and information collected on measure level. However, if some conclusions specifically relating to the reported measure are drawn on city or project level, they should also be included in the MER. For example, the contribution of the measures in the overall changes observed on city level are helpful to fully understand the importance of a measure.

The following templates are available:

- The Measure Evaluation Results (MER)
- The Process Evaluation Report (PER)

These templates are briefly explained below. The templates are also added in **Annex 3 Measure Evaluation Results (MER) template** and **Annex 4 Measure Process Evaluation (PER) template**, together with detailed guidelines on the usage of the PER and MER templates in **Annex 5 Guidelines for the usage of MER and PER**.

6.3.1 Measure Evaluation Results (MER)

The Measure Evaluation Results (MER) is the main basic report containing all information related to the evaluation of the implemented measures. It will be built up during the project lifetime, updating and adding new information in each stage.

It serves multiple purposes including:

- Ensures reporting of all evaluation-relevant information (“completeness”);
- Ensures a common reporting style;
- Facilitates analysis of evaluation results for the CIVITAS IAs and CIVITAS SATELLITE;
- Enables evaluation conclusions at the level of the city, the CIVITAS IAs, the CIVITAS themes and the CIVITAS program;
- Helps to provide information for dissemination of evaluation results, in particular measure results, in a clear and concise manner.

The scheme below (see Figure 16) gives an overview of the main information flows to build up the MER including the findings reported in the periodical PERs and other activities to validate and widen the findings on the implemented measures.

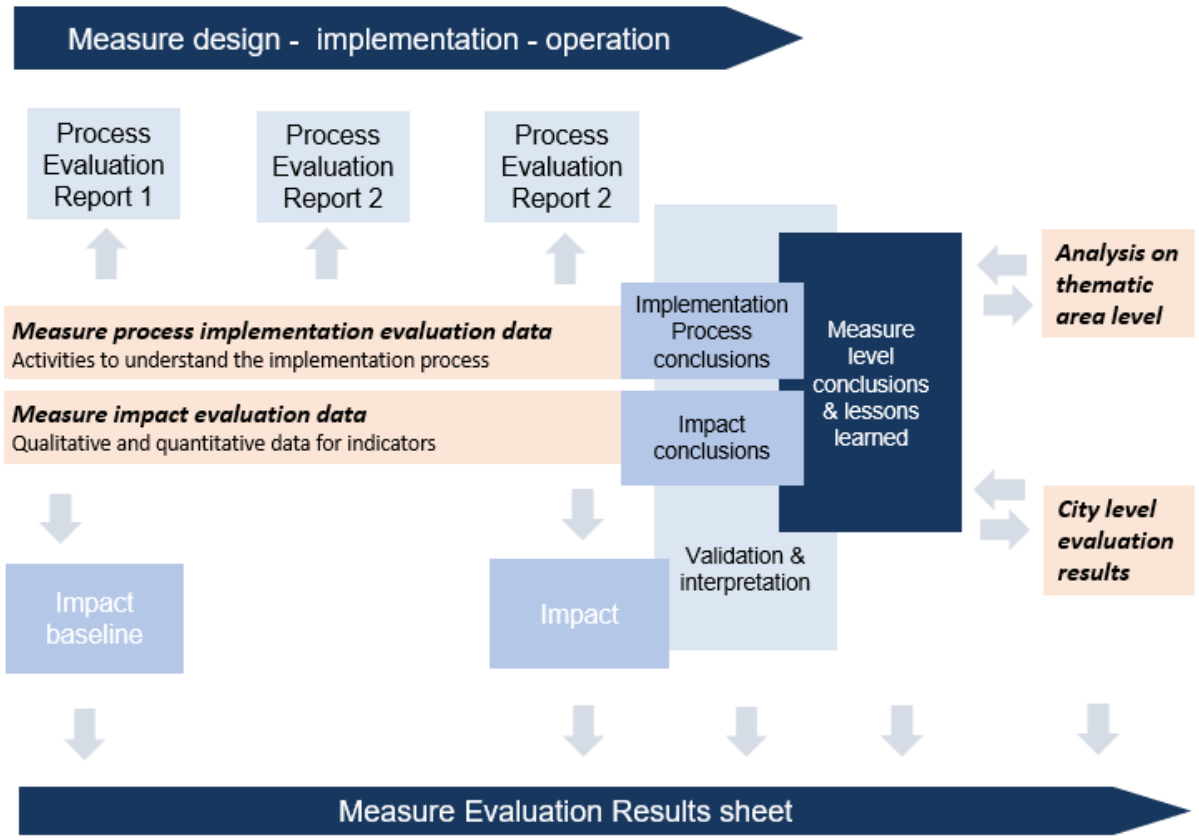


Figure 16: Information flows to build up the MER

The main inputs for this report are on one hand the impact measurements and surveys processed by the evaluation team into quantitative and qualitative descriptions of selected indicators and conclusions on the assessment aspects of the impact categories. On the other hand, also the process evaluation findings (see the PER) are crucial inputs to validate and understand the findings and the implementation process.

To keep the report accessible and manageable it is not the idea to include any “raw data” in the sheet, but only the results of the data analysis done by the evaluators.

To make it usable as the basic informative document on the measures, e.g. for dissemination purposes, findings should be reported in a comprehensible and well-structured manner. In addition, a summary will be added explaining the key elements of the findings and conclusions in a synthetic way. This summary can be the first view interested persons can get when consulting the measure through the different CIVITAS channels.

To optimise the efforts, it is the idea that individual sections (or building blocks) of the completed Measure Evaluation Results can be used for other project reports, for example final project reports and recommendations. Likewise, elements of such reports that are available early on can be included in the MER.

6.3.2 Process Evaluation Report (PER)

Complementary to the MER a **Process Evaluation Report (PER)** can be used to report the key findings on the implementation process of the measure on regular basis. In the last phase of the evaluation work (eventually also in an intermediate phase) these findings will be combined with the findings of the impact evaluation to come to a well-motivated understanding of the measure. The conclusions of the process evaluation will be also included in the MER.

The PER starts with the same general information as presented in the MER but focuses further on the specific aspects of the implementation of the measures, e.g.

- the barriers and the actions to overcome the barriers
- the drivers and the actions to make use of the drivers
- the specific findings on the supporting activities (if relevant)
- the lessons learned

The main input for this report are the findings out of the different efforts of the evaluation team to understand the implementation process, e.g. discussions with Measure Leaders and Site Coordinators, meetings with experts and stakeholders.

This reporting template will be filled in for each reporting period.

This reporting can also be organised in the format of an Excel sheet or a database in which the same information is collected and presented.

6.4 The evaluation report

As discussed in Chapter 5 a project will produce evaluation findings on different levels and with a different focus on measures that can be taken to achieve our European, national/regional and local goals for sustainable urban environments. In a final comprehensive evaluation report these findings should be structured and presented in a clear way.

At least the following topics should be discussed in such a final report:

- A quantified assessment of the impacts of the CIVITAS measures across individual cities covering the CIVITAS impact categories.
- 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.
- Conclusions on the impacts and implementation process of different type of measures clustered in the CIVITAS thematic areas or more aggregated.
- General conclusions about the impacts of the CIVITAS measures in each of the cities in the project.
- General conclusions about the impacts of the CIVITAS measures for cities with characteristics comparable as the cities in the project.
- General conclusions about the specific challenges of the project (in the cities and in general) and the envisaged objectives (with quantified targets).

Measure Evaluation Result sheets can be considered as an annex to this report to which references can be made in a synthetic overview of thematic or city-wide conclusions. Eventually the Summaries of the MERs can be part of the report itself.

Finally, also an appraisal of the evaluation approach itself with relevant information and advices for other projects, will have an added value.

6.5 Presentation of evaluation results

Clear and detailed reporting of the way measures are evaluated and the observations we do combined with a good interpretation is crucial to contribute to our general knowledge base on innovative sustainable mobility solutions. To do this in an efficient and effective way, during and at the end of a project, the advices and reporting templates in previous chapters will help to do this in a structured and transparent way.

However, as part of the policy process in cities and regions, we **need to explain our findings also to technicians and policy makers in an optimised way shaping the obtained insights and advices** in a way that it fits in the decision processes and the way discussions are organised between policy makers of different stakeholders, technicians and citizens. Therefore, evaluation **needs also a good dissemination strategy taking into account the expectations and characteristics of the target audiences in order to find the best ways to reach them.**

Furthermore, **a participatory interpretation of the evaluation results** with stakeholders and policy makers will validate the evaluation conclusions more thorough and will create a higher acceptance for the evaluation findings. In this way such an interaction between evaluation specialists and policy makers can contribute a lot in a performant presentation of the evaluation results.

7 Conclusions

As a result of CIVITAS SATELLITE and based on an analysis of recent research studies defining indicators for urban mobility and an intensive cooperation with the CIVITAS Innovation Actions (2016-2020) and a screening of the evaluation approaches in the previous and current Research and Innovation Actions, this report describes the **CIVITAS 2020 impact and process evaluation framework for the evaluation of mobility related measures implemented in the European urban environments**. Detailed guidelines and practical advice is given, reporting templates and examples are presented to result in a solid, transparent and consistent CIVITAS evaluation approach.

It is obvious that for each project an appropriate evaluation approach needs to be developed taking into account the specific focus of the project and the type of measures and additional research activities. Also, the available datasets and resources for the evaluation activities need to be considered to achieve a feasible and effective evaluation approach. However, even with more limited resources, **the minimum requirement for a useful evaluation is that we use a consistent terminology and that the motivation of the evaluation findings are done in a transparent way** referring to the reliability of the information we use. In this context, a good balance between measurements, surveys and countings of the mobility system, the behaviour of its users and stakeholders and efforts to get a solid qualitative understanding of what the impacts are and why, **understanding the story behind the figures**, is crucial.

Finally, an intensive effort is needed to inform all involved partners, technicians and policy makers on the evaluation findings allowing them to use the knowledge obtained in their decisions and activities.

For more information and any interaction on the evaluation approaches in the context of CIVITAS one can contact CIVITAS SATELLITE with the main contact persons for evaluation:

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ANNEXES

ANNEX 1
Indicator Definition & Methodology Sheets

1 Society – people

1.1 Acceptance

Key Indicator no. 1	Awareness level
Category:	**Society - people**
Sub-category:	Acceptance
Impact aspect:	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 dis benefits 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. • **Observed group**: general public (including residents and visitors), operators, PT customers, etc. • **Area of measurement:** demonstration area and/or city
References:	CIVITAS WIKI - Core Indicator 13: Awareness level ECCENTRIC 19; DESTINATIONS 34

Key indicator no. 2	Acceptance level
Category:	**Society - people**
Sub-category:	Acceptance
Impact aspect:	Acceptance
Context and relevance	Key indicators 1 and 2 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 the measure. 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. **Unit**: %
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. • **Observed group**: general public (including residents and visitors), operators, PT customers, etc. • **Area of measurement:** demonstration area and/or city
References:	CIVITAS WIKI - Core Indicator 14: Acceptance level ECCENTRIC 20 DESTINATIONS 35

Additional indicator	Citizens satisfaction with transport services
Category:	**Society - people**
Sub-category:	Acceptance
Impact aspect:	Satisfaction
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 for instance, is in continuous competition with other transport modes, particularly the private car, and the general perception of the overall PT satisfaction 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, and satisfaction of other stakeholders beyond the users. The perception of the quality of a service is a key measure related to its success or failure.
Definition	User/provider/stakeholder average reported satisfaction with • the overall quality of the transport system (public transport, cycling, walking, etc.) • the quality of a specific service It measures the experience of the user/provider, against its expectations. **Unit**: % of shares with a qualitative score (1-5) of the perception of quality
Measurement	• **Method**: User satisfaction can be assessed through surveys (e.g. questionnaires by mail or by face-to-face interviews). It can be part of a household survey. An alternative will be to piggy back onto any general survey about quality of public services. A question in either survey should be “How satisfied are you with the quality of your regular walk/cycle/bus/train/metro/car journeys in the city?” and the answer can be given on a five point scale of “very satisfied” to “very dissatisfied”. • **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. • **Accuracy**: The samples chosen for the survey should be sufficient in size and distribution (e.g. age, gender, disabled people) to give a good representation of acceptance levels in the areas investigated. • **Observed group**: general public (including residents and visitors), operators, PT customers, etc. • **Area of measurement:** demonstration area and/or city
References:	CIVITAS WIKI - Core Indicator 14: Acceptance level CIVITAS CAPITAL 22 ECCENTRIC 21 DESTINATIONS 36

1.2 Accessibility

Key indicator no. 3	Perception of level of physical accessibility of service
Category:	**Society - people**
Sub-category:	Accessibility
Impact aspect:	Physical accessibility of transport services
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. • **Observed group**: Service users • **Area of measurement:** city or demonstration area
References:	CIVITAS WIKI - core indicator 15: Perception of service accessibility DESTINATIONS 37 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

Additional indicator	Share of population with appropriate access to mobility services
Category:	**Society - people**
Sub-category:	Accessibility
Impact aspect:	Physical accessibility of transport services
Context and relevance	To have a node of access to a transportation system is the minimum condition to make use of it. The proposed parameter analyses accessibility to mobility services in terms of "the percentage of population living within a public transport service area in the demonstration area". This is the percentage of people living within walking distance meters from a given system. This distance is measured considered the topology of the network available for pedestrians. The indicator attempts to measure the share of population with appropriate access to mobility services.
Definition	Percentage of population living within walking distance of public transport (stop or station) or shared mobility (car or bike) system. 300 meters has been used as standardized waking distance for buses and trams, while 500 meters is common for subways and regional railways.
Measurement	• **Method**: Surveys and literature provide thresholds for walkable distances for different user groups in each city. Street-network catchment areas, and corresponding population within, can be calculated using GIS tools. Geographic distribution of population is normally available for most of the cities, but depending on the scale it might be necessary to localize it more precisely in blocks or even buildings. • **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**: Street networks in CAD and GIS geo**d**atabases is normally available. On the other hand, georeferenced population and jobs is not that largely widespread. Correlating inhabitants with other variables such as use, constructed area, etc., should provide enough precision. • **Observed group**: Households • **Area of measurement:** city or demonstration area
References:	WBCSD 6 ECCENTRIC 6

Key indicator 4	Operational barriers
Category:	**Society - people**
Sub-category:	Accessibility
Impact aspect:	Operational accessibility of transport services
Context and relevance	Having a node of access is not sufficient condition to access a transportation system. Other barriers have still to be overcome to make use of it, or prefer it over other (less sustainable) transportation modes. Certain knowledge is necessary to operate or make use of transportation systems and technological platforms. Training and information should help to overcome this barrier and enable real equal accessibility for all citizens.
Definition	The operational accessibility to transport and transport services, as the average reported convenience of city transport.
Measurement	• **Method**: Survey • **Accuracy**: For data collected through surveys, the sample chosen should be sufficient to give a good representation of the typical mobility patterns of the system users. A standard error of 5% with a probability of 95% is acceptable. • **Observed group**: Citizens • **Area of measurement:** City or demonstration area
References:	WBCSD 2

Key indicator 5	Relative cost of service
Category:	**Society - people**
Sub-category:	Accessibility
Impact aspect:	Economic accessibility of transport services
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. • **Observed group**: commuters • **Area of measurement:** 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”. CIVITAS WIKI 16 ECCENTRIC 19

Intermediate indicator	Car ownership
Category:	**Society - people**
Sub-category:	Accessibility
Impact aspect:	Car availability
Context and relevance	A measure of the degree of diversity of mobility options, and an extremely important determinant of the use of other modes of transport.
Definition	All cars (including company cars) owned per 1000 of the population aged 18 or over. Percentage of households that have no car, preferably disaggregated by city district.
Measurement	• **Method**: This piece of information can be gathered from a household survey, but if not available, the national statistics department in your country will most likely have data on car ownership at a lower level of spatial resolution. • **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. • **Accuracy**: The samples chosen for the survey should be sufficient in size and distribution (e.g. age, gender, disabled people) to give a good representation of accessibility level in the areas investigated. • **Observed group**: citizens/households • **Measurement area:** city or demonstration area
References:	CIVITAS CAPITAL 20 ECCENTRIC 18 DESTINATIONS 38

Intermediate indicator	Car share cars and stations per capita
Category:	**Society - people**
Sub-category:	Accessibility
Impact aspect:	Car availability
Context and relevance	Each car share club car may replace several individually owned cars. Car sharing reduces the mileage driven and increases the use of other modes such as walking, cycling and public transport.
Definition	This indicator is derived by dividing driving age population (18 and over) by the number of car share cars, that is, those cars in commercially or community run car share clubs that provide hourly hire of cars parked on street in local areas, bookable and payable by the hour, by club members only.
Measurement	• **Method**: Driving age population is available from national censuses. The number of car share club cars in a city is available from the operator(s) of those car clubs. • **Frequency**: Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. • **Accuracy**: • **Observed group**: freight transport service and delivery service for large shops. • **Area of measurement**: city or demonstration area
References:	CIVITAS CAPITAL 21 Examples: www.cambio.be, www.citycarclub.co.uk. DESTINATIONS 33

Intermediate indicator	Bike ownership
Category:	**Society - people**
Sub-category:	Accessibility
Impact aspect:	Bike availability
Context and relevance	A measure of the degree of diversity of mobility options. Bikes owned, if used, support an active healthy lifestyle. In some cities, extensive bike share systems perform a similar function, and should be monitored as well.
Definition	Bikes (pedal cycles) owned per 1000 population, disaggregated by city district if possible. Toy bicycles and those for children aged under 5 should not be counted.
Measurement	• **Method**: If a household survey of travel behaviour is carried out (see indicator on Modal Split) then this indicator can be gathered at the same time. If not, a smaller sample survey of residents should be carried out, preferably of a random sample of households by telephone, or if not, by an on-street survey in two to three locations in the city (e.g. city centre, out of town shopping centre), aiming for a sample of 200 households. Only bikes that actually function should be counted. • **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. • **Accuracy**: The samples chosen for the survey should be sufficient in size and distribution (e.g. age, gender, disabled people) to give a good representation of accessibility level in the areas investigated. • **Observed group**: citizens and tourists • **Area of measurement:** city or demonstration area
References:	CIVITAS CAPITAL 12 DESTINATIONS 39

Intermediate indicator	Bike sharing bikes and stations per capita
Category:	**Society - people**
Sub-category:	New shared systems
Impact aspect:	Bike sharing availability
Context and relevance	Bike sharing adds to and diversifies the existing set of mobility options within a city. It can contribute to increased levels of cycling, and to changing motor vehicle driver attitudes and behaviour towards cyclists.
Definition	This indicator is derived by dividing total population by the number of bike share bikes. Bike share bikes are those that are available on street for users (who sometimes have to go through a registration process and pay a registration fee) to hire, although often the first half hour of use is free of charge.
Measurement	**Method**: The method is defined in the indicator definition. The bike share operator in a city can supply data on the number of bikes. The population is derived from national statistics. **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: **Observed group**: freight transport service and delivery service for large shops. **Area of measurement:** city or demonstration area
References:	There is an interesting study done in Spain by Alberto Castro and Esther Anaya https://bicicletapublica.wordpress.com https://bicicletapublica.wordpress.com/datos CIVITAS CAPITAL 13 DESTINATIONS 32

1.3 Mobility demand

Intermediate indicator	Average number of trips per person
Category:	**Society - people**
Sub-category:	Mobility demand
Impact aspect:	Total persons travel demand/need
Context and relevance	As a basis for living people need to get access to activities and services. Our mobility system is trying to fulfil this need for all persons. However if we want to limit the negative impacts of the mobility system, some measures can work on the need for this physical mobility both in replacing the physical way into a digital way or bringing activities and services together with housing locations. In this way the number of trips can be decreased or the distances to travel can be reduced having an influence on energy usage and environmental impacts. To understand this process this indicator is an important intermediate indicator making the final impact of the measure transparent.
Definition	Average number of trips per day (weekday, week-end day) or per hour (peak hour, off-peak hour, …) of a target group or departing and arriving in an area
Measurement	• **Method**: The data can be collected through surveys, asking persons living in an area to record their travel modes and route each day in a travel diary. This survey can be combined with a modal-split survey and be organised on the level of households. If we want to evaluate the impact of measures on the need with a specific purpose (as part of the all the trips persons are doing) a more focused survey can be organised questioning the travel behaviour for that purpose e.g. home-work travels. • **Frequency:** Measurements should be made preferably 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. If a before survey was not possible, an 'only-after' survey can be organised asking for the change in travel behaviour caused by the CIVITAS measure. • **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**: persons living in an area or participating in a specific activity • **Area of measurement:** city or demonstration area
References:	/

Intermediate indicator	Number of goods movements
Category:	**Society - people**
Sub-category:	Mobility demand
Impact aspect:	Freight transport demand
Context and relevance	In many cities freight traffic have an important impact on the congestion levels and the quality of life in the urban area. For this reason cities started to limit freight transport in the cities. This indicator tries to make the impact of measures transparent describing the intermediate figure of the goods to be transported.
Definition	Total goods to be transported departing or arriving in a specific area during a chosen period: hour, day, year (for all modes together). Unit: goods can be quantified in different ways: parcels, tons, etc. depending on the way the impact can be described.
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 and small items: - For small item delivery, data may be collected by a survey of goods delivery services (web shopping), counts or modelling. - For mass freight transport, a survey of arrival or starting points (companies, …) - Other specialised freight (e.g. waste) should be identified and described in a good quantitative way • **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 delivery services, attraction poles • **Area of measurement:** city or demonstration area
References:	/

1.4 Health

<table>
<tr><th>Key indicator No. 6</th><th>Average walking/cycling time</th></tr>
<tr><td>Category:</td><td>Society - people</td></tr>
<tr><td>Sub-category:</td><td>Health</td></tr>
<tr><td>Impact aspect:</td><td>Health from physical activity</td></tr>
<tr><td>Context and relevance</td><td>Leading an active lifestyle may contribute to maintaining and improving health; using active travel modes helps to support sustainable transport objectives. There are also huge financial benefits in terms of health costs saved. Ideally all physical activities would be measured in total, with walking and cycling being assessed as part of the total. Since these are transport related indicators, the focus on the amount of walking and cycling only is justified.
The relative risk data for cycling is 0.90 for regular commuter cycling for 100 minutes per week for 52 weeks of the year (equivalent to 87 hours of cycling per year). In any given year, regular cyclists receive a protective benefit of 10% (1.00 minus 0.90) – that is, they are 10% less likely to die from any cause than non-cyclists. Assuming a linear relationship between cycling and mortality (like the HEAT model does), the benefits of other cycling volumes can be calculated. If the user enters a cycling volume equivalent to 29 hours per year (i.e. three times less), the protective benefit of this amount of cycling will be roughly 3%. If the user enters 174 hours (twice the time cycled in the reference population), the resulting protective benefit is 20%. This is twice the protective benefit of the reference population. The same calculation can be made for walking, but with a relative risk data of 0.89 for regular walking for 168 minutes per week. To avoid inflated values at the upper end of the range, the risk reduction is capped. Inspection of the data points of the new meta-analyses suggested that, after about 45% risk reduction for cycling and 30% for walking, no significant further risk reductions were achieved. For more information: see Health economic assessment tools (HEAT) for walking and for cycling.
Summary of basic values used for HEAT
<table>
<tr><th>Mode</th><th>Applicable age range</th><th>Relative risk</th><th>Volume</th><th>Benefits capped at</th></tr>
<tr><td>Walking</td><td>20-74 years</td><td>0.89 (CI 0.83–0.96)</td><td>168 minutes/week</td><td>30% (458 minutes)</td></tr>
<tr><td>Cycling</td><td>20-64 years</td><td>0.90 (CI 0.87–0.94)</td><td>100 minutes/week</td><td>45% (450 minutes)</td></tr>
</table>
CI: confidence interval.</td></tr>
<tr><td>Definition</td><td>Average number of minutes that an adult between 20 and 74 years old is walking per week.
Average number of minutes that an adult between 20 and 64 years old is cycling per week.</td></tr>
<tr><td>Measurement</td><td>• Method: The following data are needed:
- an estimate of the average time spent walking or cycling in the observed population, which can come from surveys or estimates and can be entered in a number of ways:
▪ duration (average time walked or cycled per person, e.g. 30 minutes walked on average per day), which is the most direct data entry route;</td></tr>
</table>

Key indicator No. 6	Average walking/cycling time
	▪ distance (average distance walked or cycled per person, e.g. 10 km cycled on average per day); ▪ trips (average per person or total observed across a population, e.g. 250 bicycle trips per year); or ▪ steps (average number of steps taken per person, e.g. 9000 steps per day). If a household survey of travel behaviour is carried out then this indicator can be gathered at the same time. Some cities and countries have also health surveys besides their travel surveys with relevant data collection. If not, a smaller sample survey of residents should be carried out, preferably of a random sample of households by telephone, or if not, by an on-street survey in two to three locations in the city (e.g. city centre, out of town shopping centre), aiming for a sample of 200 people. • **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). • **Accuracy**: The main concern with short-term counts is that they do not accurately capture variations in walking or cycling over time (i.e. time of the day, day of the week, season or weather). If counts are done on a sunny day, larger numbers may be seen than on a rainy day. Cycling also typically declines in the winter months compared with spring and summer in many countries. This issue will affect single-site evaluations (such as a footpath or a bridge) where counts are conducted at the site itself, or community- wide evaluations that are based on surveys conducted only during a certain time of the year. Short-term counts may also be adjusted for temporal variation to better reflect long-term levels of walking or cycling. Spatial variation, particularly in walking, may affect evaluations that are based on counts at a single or a few locations. The choice of location may strongly influence the count numbers, which may not be representative of the wider level of walking (or cycling). Results need to be interpreted carefully, and should in general not be extrapolated beyond the locations where actual data were collected. Not affected by this issue are evaluations based on surveys that sample subjects randomly from a defined area (such as large household surveys) and, to a lesser extent, count-based evaluations on linear facilities such as trails. • **Observed group**: citizens/commuters • **Area of measurement:** city or demonstration area
References:	CIVITAS CAPITAL 23 Health economic assessment tools (HEAT) for walking and for cycling

2 Society – governance

2.1 Planning

Key Indicator no. 7	Sustainable Urban Mobility Plan (SUMP)
Category:	**Society - Governance**
Sub-category:	Planning
Impact aspect:	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. Also the process of developing the plan is crucial and should be assed here. This indicator is also strongly linked with key indicator 8 on the cooperation structures with stakeholders because in many case the introduction of a Sustainable Urban Mobility Plan according to the EU guidelines will also effect in general the way the city is working together with all other stakeholders in urban mobility.
Definition	Qualitative assessment of the Sustainable Urban Mobility Plan and the level of its conformity to EU standards of the content and process to develop it.
Measurement	• **Method**: The content and process of the existing transport plan should to be compared with the content and process of 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) This analysis can be done using a questionnaire in which these aspects are assessed filled in by the mobility department or more widely by different stakeholders.

Key Indicator no. 7	Sustainable Urban Mobility Plan (SUMP)
	• **Frequency:** The comparison can be conducted at the end of the project • **Accuracy**: / • **Target group**: Local/Regional government • **Area of measurement:** city or demonstration area
References:	CIVITAS WIKI 30 CIVITAS DYN@MO

Additional indicator	Quality of policies, plans, and programs
Category:	Society - governance
Sub-category:	Planning
Impact aspect:	Planning process
Context and relevance	CIVITAS measures are not expected to remain as a one-time implementation. Through the dissemination and cross-fertilization activities it is expected that they influence future decisions, impacting planning tools at different levels. In some cases the measure is expected to have an impact during the lifetime of the measure, or during the duration of the CIVITAS project. This indicator measures the outreach of the measure, considering the influence of Sustainable Urban Mobility Plans (SUMP) as the maxim
Definition	Qualitative description of the change in the process to develop policies, plans, and programs (including SUMPs).
Measurement	• **Method**: Surveys and interviews to decision makers. • **Accuracy**: / • **Target group**: decision makers • **Area of measurement:** Demonstration area/stakeholders
References:	CIVITAS ECCENTRIC 22

2.2 Operational cooperation structures

Key Indicator no. 8	Quality of cooperation structures with stakeholders
Category:	Society - governance
Sub-category:	Operational cooperation structures
Impact aspect:	Quality of cooperation structures with stakeholders
Context and relevance	The feasibility and the efficiency with implementing sustainable mobility measures as CIVITAS measures depends strongly on the quality of the cooperation structures in the city (in the city services and with external stakeholders) and between the city and the regional/national level. For this reason this indicator wants to assess in a qualitative way the change in the quality of these cooperation structures thanks to actions as part of CIVITAS.
Definition	Level of quality of cooperation structures between all public and private stakeholders to develop and implement sustainable mobility solutions
Measurement	• **Method**: Surveys and interviews with decision makers and stakeholders • **Accuracy**: / • **Target group**: all partners in the city • **Area of measurement:** City and region
References:	/

3 Transport system

3.1 General

Key Indicator no.9	Modal Split persons (trips)
Category:	**Transport system**
Sub-category:	General
Impact aspect	Modal split persons
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). **Modal shift** is derived from model spilt indicating the change of modal spit because of the implementation of the CIVITAS measures.
Definition	Percentage of trips using each mode for a specific target group during a day (weekday, week-end day) or per hour (peak hour, off-peak hour, …). For an area the model split of both the trips of the residents and the in- and outgoing people are analysed. **Unit:** % of trips Modes: walk, bicycle, bus, tram, metro, train, car (driver and passenger), motorcycle, .. Further details can be added in relation to the mode e.g. pets, scouters,…, in relation to the type of the vehicles e.g. e-cars or e-bikes, or in relation to the ownership of the vehicles e.g. shared bikes or shared cars
Measurement	• **Method**: The data can be collected through surveys, e.g. asking travellers or citizens in the considered area to record their travel modes and routes 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. For a specific target group the modal-split can also be measured for trips with a specific purpose e.g. home-work. • **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. If a before survey was not possible, an 'only-after' survey can be organised asking for the change in travel behaviour caused by the CIVITAS measure. • **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**: Citizens or travellers • **Area of measurement:** City or demonstration area
References:	CIVITAS WIKI 28

Key Indicator no.9	Modal Split persons (trips)
	DESTINATIONS 17

Additional indicator	Modal Split persons (passenger km)
Category:	**Transport system**
Sub-category:	General
Impact aspect	Modal split persons
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). **Modal shift** is derived from model spilt indicating the change of modal spit because of the implementation of the CIVITAS measures.
Definition	Percentage of passenger-km using each mode in an area during a day (weekday, week-end day) or per hour (peak hour, off-peak hour, …). Both the trips of the residents and the in- and outgoing people are analysed. **Unit:** % of passenger km Modes: walk, bicycle, bus, tram, metro, train, car (driver and passenger), motorcycle Further details can be added in relation to the mode e.g. pets, scouters,…, in relation to the type of the vehicles e.g. e-cars or e-bikes, or in relation to the ownership of the vehicles e.g. shared bikes or shared cars
Measurement	• **Method**: The data can be collected through surveys, e.g. asking travellers or citizens in the considered area to record their travel modes and routes 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. For a specific target group the modal-split can also be measured for trips with a specific purpose e.g. home-work. For the calculation of the modal-split in passenger-km the use of traffic modelling is common. • **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. If a before survey was not possible, an 'only-after' survey can be organised asking for the change in travel behaviour caused by the CIVITAS measure.

Additional indicator	Modal Split persons (passenger km)
	• **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**: Citizens or travellers • **Area of measurement:** City or demonstration area
References:	CIVITAS WIKI 26 DESTINATIONS 16

Key Indicator no.10	Modal Split goods (trips)
Category:	**Transport system**
Sub-category:	General
Impact aspect:	Modal Split in freight transport
Context and relevance	In many cities freight traffic have an important impact on the congestion levels and the quality of life in the urban area. For this reason cities started e.g. to work on the distribution traffic entering the city to deliver to shops and – more and more – to citizens trying to limit this traffic and/or replace heavy trucks into smaller and more environmental trucks (electric, hybrid, gas,..) and into other modes e.g. bike and even boats. Also an optimisation of the freight movements combining deliveries from more manufactures and to more shops is envisaged by distribution centres. This indicator tries to make the impact of measures transparent describing the intermediate figures. Possibly this indicator is only used to give more details on the split over different submodes e.g. heavy trucks and light trucks and other road related modes as cargobikes. **Modal shift** is derived from model spilt indicating the change of modal spit because of the implementation of the CIVITAS measures.
Definition	Percentage of goods (described in parcels, tons, etc) using each (sub) mode during a day (weekday, week-end day) or per hour (peak hour, off-peak hour, **Unit:** % of goods (measured in number of parcels, tons, etc. depending on the way the impact can be described) transported by the different modes and submodes Modes: heavy and light trucks, tram, train, cargobikes, etc.
Measurement	• **Method**: The data can be collected through surveys, e.g. asking companies in the considered area to record their transport each day in a freight diary. Samples should be chosen appropriately to cover those areas where CIVITAS measures are likely to have an impact on modal split. • **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. If a before survey was not possible, an 'only-after' survey can be organised asking for the change in travel behaviour caused by the CIVITAS measure.

Key Indicator no.10	Modal Split goods (trips)
	• **Accuracy**: Taking into account the strong variation in the organisation of transport of different companies in area samples are only in exceptional cases possible, preferable a full analysis of all actors in an area is done • **Target group**: Companies, shops, households (if focus on home deliveries) • **Area of measurement:** City or demonstration area
References:	/

3.2 Safety

Key indicator No. 11	Number of road deaths and serious injured caused by transport collisions
Category:	**Transport system**
Sub-category:	Safety
Impact aspect:	Transport safety
Context and relevance	The chance of getting involved in a traffic collision provides a direct contribution to measuring the quality of life. Death and serious injured caused by traffic collisions are one of the most important social costs associated with transport systems. At a first level we don't take into account all injured but only the serious injured and road deaths since this is the focus of the 'Vision Zero' recently put on the foreground by the EU commission. Collision 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. This indicator is used because the numbers deaths and serious injured provide an important view of the traffic safety situation and are normally recorded by city police departments. The focus is on the resulting number of deaths and serious injured. 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 collisions with serious injured and deaths and the resulting number of road deaths and serious injured caused by any means of transport. A road death is a death within 30 days after the traffic collisions as a corollary of the event. **Unit**: number of collisions, number of road deaths and serious injured.
Measurement	• **Method**: deaths and serious injured are related to the number of vehicle-km or person km, so such data also need to be obtained to provide relative rates. The collisions data will need to be obtained from the police or city authorities as appropriate. Police and preferably hospital records can normally provide total

Key indicator No. 11	Number of road deaths and serious injured caused by transport collisions
	numbers. Hospital records are useful because police records normally underreport the number of collisions. • **Frequency:** Collision 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 collisions and their status (death 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. • **Observed group**: Road users • **Area of measurement:** The area covered must be sufficient to understand the changes occurring and may need to include a 'control' area.
References:	CIVITAS WIKI 20 WBCSD 5 CAPITAL 8 ECCENTRIC 10

3.3 Security

Key indicator No. 12	Perception of security
Category:	**Transport system**
Sub-category:	Security
Impact aspect:	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. • **Observed group**: PT or other service users • **Area of measurement:** city or demonstration area
References:	CIVITAS WIKI 17

3.4 Walking

Key indicator no. 13	Quality of pedestrian infrastructure
Category:	**Transport System**
Sub-category:	Walking
Impact aspect:	Opportunity for walking
Context and relevance	If walking should be an important urban mode, the facilities for walking should be of a high quality including the reduction of the negative impact of other modes. This needs a combination of optimal infrastructure and traffic regulation. This indicators makes an synthesis of 4 important ways to assure a good quality for walking in the street of and area or the whole city combining infrastructural measures and traffic calming: • Street with good sidewalks • Streets with a 30 km/h (or 20 mph) speed regime or below • Car free streets • Dedicated paths and links of at least 50m in length that are off-street These measures also makes walking more competitive in terms of journey time. Traffic calming is a key measure in cities that are recognised to be leaders in sustainable transport in making these cities more liveable and welcoming with a higher quality of life and safety for their residents.
Definition	Percentage of the total distance of the city's streets (including squares: the “distance” of a square is the sum of the length of its sides) with a good quality for walking on the total length of the city road network (excluding motorways) Good quality means that the streets meets at least one of the following requirements: • good sidewalk (minimum 1.5 meters without mayor obstacles) • a 30 km/h (or 20 mph) speed regime or below • car free • dedicated paths and links of at least 50m in length that are off-street
Measurement	**Method**: Most easily done via GIS. Otherwise it is recommended to conduct a manual survey. The gathering data is not technically difficult but could be moderately resource-hungry when first measured. Manual surveys can survey around 4 km of streets per hour. Another low cost option is to use Google Earth for pedestrianised streets. A prequisite is to know the entire length of streets in the city but this is a basic piece of data that all cities should have **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**: / **Area of measurement:** city or demonstration area
References:	CIVITAS CAPITAL DESTINATIONS WBCSD

Additional indicator	Number of pedestrians
Category:	**Transport system**
Sub-category:	Walking
Impact aspect:	Number of pedestrians
Context and relevance	Walking can play an important role in the accessibility of activities in the city. For this reason also the evolution of this mode should be monitored and evaluated.
Definition	Number of pedestrians passing at set of reference points in area during specific hours a day or during the whole day.
Measurement	• **Method**: First a well-structured set of reference points should be defined which are representative for the walking movements in the city. Also routes with important growth possibilities should be taken into account. Then the pedestrians should be counted manually or automatically during a reasonable period to give a representative view. Eventually different periods can be identified to show variations due to different weather conditions. • **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**: pedestrians • **Area of measurement:** City, demonstration area or corridor.
References:	CIVITAS ELAN

Additional indicator	Image on the walking conditions (subjective)
Category:	**Transport system**
Sub-category:	Walking
Impact aspect:	Walking perception
Context and relevance	The renewal of the walking infrastructure combined with the promotion of walking as a interesting mode might contribute to a more positive image of walking in general. This will have an positive impact on the level of walking in the city.
Definition	Attitude towards walking conditions based on the answers of a survey among citizens and visitors or pedestrians on the street.
Measurement	• **Method**: Significant factors of the quality of walking will need to be identified. Based on this a compact survey can be developed both for citizens or specific target groups or walking people on the street. Examples of relevant aspects are: - Most sidewalks are wide enough - Pedestrians have enough time to cross the street at traffic lights - Most sidewalks are well maintained - I'm not hindered (by bicycles, waste, bollards, …) Respondents can answer with totally agree, agree, neutral, disagree, totally disagree. • **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**: pedestrians, citizens, commuters,visitors • **Area of measurement:** City, demonstration area or corridor.
References:	CIVITAS ELAN

3.5 Cycling

Key indicator no. 14	Quality of cycling infrastructure
Category:	**Transport System**
Sub-category:	Cycling
Impact aspect:	Opportunity for cycling
Context and relevance	In many cities cycling still have a high growth potential. This indicators makes an synthesis of 4 important ways to assure a good quality of cycling facilities combining infrastructural measures and traffic calming: • Street with good bike lanes • Streets with a 30 km/h (or 20 mph) speed regime or below • Car free streets • Dedicated paths and links of at least 50m in length that are off-street These measures also makes cycling more competitive in terms of journey time. Traffic calming is a key measure in cities that are recognised to be leaders in sustainable transport in making these cities more liveable and welcoming with a higher quality of life and safety for their residents.
Definition	Percentage of the total distance of the city's streets (including squares: the “distance” of a square is the sum of the length of its sides) with a good quality for cycling on the total length of the city road network (excluding motorways) Good quality means that the streets meets at least one of the following requirements: • good bike lanes (minimum 1.5 meters one-way and 2.5 meters two ways) • a 30 km/h (or 20 mph) speed regime or below • car free • dedicated paths and links of at least 50m in length that are off-street
Measurement	**Method**: It is important to define clearly the area for which te survey is done. Most easily done via GIS. Otherwise it is recommended to conduct a manual survey. The gathering data is not technically difficult but could be moderately resource-hungry when first measured. Manual surveys can survey around 4 km of streets per hour. Another low cost option is to use Google Earth. A prequisite is to know the entire length of streets in the city but this is a basic piece of data that all cities should have **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**: / **Area of measurement:** city or demonstration area
References:	CIVITAS CAPITAL DESTINATIONS WBCSD

Additional indicator	Number of cyclists
Category:	**Transport system**
Sub-category:	Cycling
Impact aspect:	Number of cyclists
Context and relevance	Cycling plays an important role in the accessibility of activities in the city. Counting the number of cyclists in the city is an important indication of the importance of cycling in the city.
Definition	Number of cyclists passing at set of reference points in area during specific hours a day or during the whole day.
Measurement	• **Method**: First a well-structured set of reference points should be defined which are representative for the cycling movements in the city. Also routes with important growth possibilities should be taken into account. Then the cyclists should be counted manually or automatically during a reasonable period to give a representative view. Eventually different periods can be identified to show variations due to different weather conditions. • **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**: cyclists • **Area of measurement:** City, demonstration area or corridor.
References:	CIVITAS ELAN

Additional indicator	Image on the cycling conditions (subjective)
Category:	**Transport system**
Sub-category:	Walking
Impact aspect:	Walking perception
Context and relevance	The improvement of the cycling infrastructure combined with the promotion of cycling as a interesting mode might contribute to a more positive image of cycling in general. This will have an positive impact on the level of cycling in the city.
Definition	Attitude towards cycling conditions based on the answers of a survey among citizens and visitors or cyclists on the street.
Measurement	• **Method**: Significant factors of the quality of cycling will need to be identified. Based on this a compact survey can be developed both for citizens or specific target groups or cycling people on the street. Examples of relevant aspects are: - Most bike lanes are wide enough - I feel safe when cycling here - Cycling lanes are well maintained - The city has a cycle-friendly policy - I take a detour to a more cycle-friendly route Respondents can answer with totally agree, agree, neutral, disagree, totally disagree. • **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**: cyclists, citizens, commuters,visitors • **Area of measurement:** City, demonstration area or corridor.
References:	CIVITAS ELAN

3.6 Public Transport

Key indicator No. 15	Accuracy of service
Category:	**Transport system**
Sub-category:	Public Transport
Impact aspect:	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 or frequency (in case of a high enough frequency) in order to 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 in case of a low frequent PT service, or that the frequency of the service is as high as expected in case of high frequent PT service (an average headway of 10 minutes or less). 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. However, for public transport lines with a headway of 10 minutes or less, the frequency is more important than the timetable, because it is generally assumed that passengers arrive at transit stops independent of the timetable. Therefore, the deviation of the headway is measured for these cases. 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. If the number of stops is large, a sample of 10 key stops can be used for the evaluation. • **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. • **Observed group**: PT services • **Area of measurement:** demonstration area or city

Key indicator No. 15	Accuracy of service
References:	Wilson, N., Nelson, D., Palmere, A., Grayson, T.H., Cederquist, C. (1992) “Service quality monitoring for high frequency transit lines”, Transportation Research Record 1349, http://onlinepubs.trb.org/Onlinepubs/trr/1992/1349/1349-001.pdf CIVITAS WIKI 18 DESTINATIONS 25 ECCENTRIC 14

Key indicator No. 16	Commercial speed
Category:	**Transport system**
Sub-category:	Public Transport
Impact aspect:	Service reliability
Context and relevance	Commercial speed is a key factor in the operation of public transport systems because it represents a direct measure of the quality of service provided to users and also considerably affects system costs. Commercial speed refers to the average speed of buses over stretches, including all operational stops. Evaluating system performance by monitoring the commercial speed provided by bus services is highly desirable; however, in dense networks, it becomes a difficult task because of the amount of information required to implement such a monitoring procedure.
Definition	Commercial speed is defined as the average journey speed of public transport services between two points, including any delay at stops. **Unit**: km/h
Measurement	• **Method**: The introduction of GPS technology in buses can overcome the difficulties in the past in terms of information availability, although it presents the challenge of processing huge amounts of data in a systematic way. GPS-generated data allows to systematically monitor average commercial bus speeds. The framework can be applied to each bus route as a whole, as well as over segments of arbitrary length, and can be divided into time intervals of arbitrary duration. (Cortes et. al. 2011) • **Frequency:** • **Accuracy**: Widespread use of GPS on-board equipment enable full sampling and very detailed information. Precise values of the indicators are expected. For data collected through surveys, the sample chosen should be sufficient to give a good representation of the typical speed in the corridors targeted. A standard error of 5% with a probability of 95% is acceptable. • **Observed group**: Fleets • **Area of measurement:** Road section or demonstration area
References:	ECCENTRIC 12

3.7 Car

Intermediate indicator	Average occupancy
Category:	**Transport system**
Sub-category:	Car
Impact aspect:	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: carpooling, 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 • **Area of measurement:** city or demonstration area
References:	CIVITAS WIKI no.29 DESTINATIONS 23

Intermediate indicator	Traffic flow by vehicle type (peak/off-peak)
Category:	**Transport system**
Sub-category:	Car
Impact aspect:	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 passing at well-chosen reference points. The peak and off-peak hours must be defined by each city to correspond with the local conditions. The city must choose relevant reference points; the trajectories between these points are measured. Cars can be further detailed per type of car e.g. type of fuel, … **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 • **Area of measurement:** city or demonstration area
References:	CIVITAS WIKI no.21-22 DESTINATIONS 19-20

Key indicator No. 17	Average vehicle speed (peak/off-peak)
Category:	**Transport System**
Sub-category:	Car
Impact aspect:	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 about 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 the previous indicator (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 **Area of measurement:** city or demonstration area
References:	CIVITAS WIKI no.23-24 DESTINATIONS 21-22

Additional indicator	Delays in road traffic peak versus free flow traffic
Category:	**Transport System**
Sub-category:	Car
Impact aspect:	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.
Definition	Weighted average per trip of the ratio of peak period travel times to free-flowing travel times with respecting rules inroad traffic and travel time adherence of public transport during peak hours on up to 10 major car routes. **modes. Unit**: minutes
Measurement	**Method**: the travel time measured during morning and evening peak hours (averaged peak travel time per route) as opposed to the travel time for these routes under free flow conditions. Floating car measurement method for car traffic can be used. An easier way is to use the data obtained for travel times during peak hours versus travel times in off-peak conditions obtained with online route planners (apps) which are based on realtime traffic conditions. **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). **Accuracy**: **Target group**: cars **Area of measurement:** city or demonstration area
References:	WBCSD 14

Intermediate indicator	Parking costs
Category:	**Transport System**
Sub-category:	Car
Impact aspect:	Parking
Context and relevance	In the short and long term, the cost of parking has a very significant impact on how many people choose to travel by car (price elasticities of demand are around -0.3, meaning that for example a 10% increase in parking charges can lead to a 3% reduction in car use if real incomes do not also increase). Therefore, it is important to gather data to show whether parking is becoming more or less affordable.
Definition	Cost per hour of on-street parking in city's most expensive on-street spaces, as a percentage of gross monthly individual income. Cost per hour of off-street parking in city's most expensive off-street spaces, as a percentage of gross monthly individual income.
Measurement	**Method**: Average gross monthly income for city or region is usually available from national statistics departments. The cost of parking on street should be easily available from the City's own parking operator, whilst for off-street, rates will be published online or can be established from visiting the car park concerned. It is important to choose the on-street spaces and the car park with the highest hourly rate in the city. **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: **Target group**: **Area of measurement:** city or demonstration area
References:	CAPITAL 19

Intermediate indicator	Use of space for parking
Category:	**Transport System**
Sub-category:	Car
Impact aspect:	Parking
Context and relevance	This measure is a driver behind mode shift away from car, has the potential to reduce congestion and parking search and improves street space and therefore quality of life.
Definition	Space devoted to parking (total, includes on street, off-street, private residential and non-residential) as proportion of an urban area. Off-street parking means parking your vehicle anywhere but on the streets. These are usually parking facilities like garages and surface car parks. Off-street parking can be both indoors and outdoors. On street parking means parking your vehicle on the street, anywhere on or along the curb of streets, in contrast to parking it in a parking garage. In some streets you can always park your vehicle on the street, but sometimes there are restrictions. There are also on-street parking situations where you need a parking permit to park. To make sure people follow these rules and restrictions, cities may employ enforcement officers, or enforcement may be the responsibility of the police. Private residential parking refers to areas for short-term and long-term storage of cars and other private vehicles which is not open to the general public. Most commonly these are only available to owners and tenants. Private non-residential parking (PNR) is generally associated with parking at a workplace which is reserved for the use of employees and is not available to the general public; or at shops and other facilities, where it is reserved for their customers and visitors. PNR parking can affect mode choice by encouraging workers to continue to travel to work by private car.
Measurement	**Method**: Requires count of parking spaces. There may be problems counting private non-residential (e.g. workplace, shopping centre) spaces as they are on private land. **Frequency:** Measurements should be made at least twice during the project, i.e. before CIVITAS measure is introduced (baseline) and at the end of the project (ex-post). Where appropriate, data could also be collected on an annual basis. **Accuracy**: Data collected should be sufficient to give a good representation over the year. A standard error of 5% with a probability of 95% per transport mode is acceptable. **Target group**: passenger cars **Area of measurement:** city or demonstration area
References:	CAPITAL no. 18 DESTINATIONS 24 ECCENTRIC 17

3.8 Trucks

Key indicator no. 18	Number of freight movements
Category:	**Transport system**
Sub-category:	Trucks
Impact aspect:	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 passing at reference points (e.g. entering the city centre) divided over different type of vehicles: heavy trucks, light trucks, e-cargo bikes, … **Unit**: number of movements per day or per hour.
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. • **Area of measurement:** city or demonstration area
References:	CIVITAS WIKI no.25 DESTINATIONS 31

3.9 New shared systems

Additional indicator	System usage
Category:	**Transport System**
Sub-category:	New shared systems
Impact aspect:	System usage
Context and relevance	The implementation of new shared systems changed the transportation patterns by attracting users to sustainable transportation modes. A measurement of the success of these new systems is the number of users of the system, whether it be a technologic platform (websites, apps, etc.), a transportation system (bikes, electric vehicles, public transport, etc.), or a complementary services (delivery support, training, etc.). The number of users in fixed units of times allows to track the demand along the evaluation periods.
Definition	Average system usage (bookings, rentals, deliveries, users, passengers, etc.), in a given unit of time. Passengers, bookings and deliveries are standard users units to measure performance of infrastructures and transportation systems. Bookings, visitors, registers, attendees, etc. can be used as user units for complementary services or virtual platforms. One day is recommended as the standard measure of time, although for some measures targeting specific periods of the day, hours can be more appropriate. Unit: Frequency (users/unit of time)
Measurement	• **Method**: Household or on-site surveys can provide the necessary data if the sample can be expanded with parallel measurements. On-site counts might be suitable for closed systems. In technology-enabled systems, operation logs can provide complete information for the system/group under study. • **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**: Precise values can be retrieved from operation logs and counts. If data is inferred from household surveys, the sample must be representative. For data collected through surveys, the sample chosen should be sufficient to give a good representation of the typical mobility patterns of the system users. A standard error of 5% with a probability of 95% is acceptable. • **Target group**: Users/passengers/commuters/deliveries • **Area of measurement:** System
References:	ECCENTRIC 5

4 Economy

4.1 Benefits

Key indicator no. 19	Average operating revenue
Category:	**Economy**
Sub-category:	Benefits
Impact aspect:	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 (carpooling 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. • **Observed group**: transport services operators • **Area of measurement:** demonstration area and/or city
References:	WIKI 1 DESTINATIONS 1

Key indicator no. 20	Jobs/sales impact
Category:	**Economy**
Sub-category:	Benefits
Impact aspect:	Economic development
Context and relevance	Accessibility and mobility patterns have an impact on retail sales and other economic activities on the area of influence of measures. The sustainable approach implies to have a balance between economic performance, society, and the environment. CIVITAS measures therefore should increase or at least maintain in current levels the economic performance of those businesses which rely on the transport system to attract and provide services to their communities.
Definition	Average monthly sales and yearly number of employees of businesses 100 meters around the transportation node (for public transport or station-based systems), along the intervened street (for roads/bike lanes/sidewalks, parking, etc.), or covered area.
Methods of measurement	• **Method of data collection**: Surveys to retail and service businesses within the buffer area • **Frequency:** • **Accuracy**: For data collected through surveys, the sample chosen should be sufficient to give a good representation of the typical businesses in the areas targeted. A standard error of 5% with a probability of 95% is acceptable. The risk in this case is to have distorsioned figures due to biased answers. Official databases might be used as well. In this case availability, confidentiality and detail of reports might be an issue. • **Observed group**: Businesses • **Area of measurement:** Buffer, road section or demonstration area
References:	DOT, The Economic Benefits of Sustainable Streets ECCENTRIC 16

4.2 Costs

Key indicator no. 21	Capital investment costs
Category:	**Economy**
Sub-category:	Costs
Impact aspect:	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. It can also include the 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. • **Observed group**: transport services providers • **Area of measurement:** demonstration area and/or city
References:	/

Key indicator no. 22	Average Operating costs
Category:	**Economy**
Sub-category:	Costs
Impact aspect:	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 • **Area of measurement:** demonstration area and/or city
References:	/

5 Energy

5.1 Fuel consumption

Key indicator No. 23	**Vehicle fuel efficiency**
Category:	**Energy**
Sub-category:	Energy consumption
Impact aspect:	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.

Key indicator No. 23	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 power source) should be kept as complete as possible. Additional efforts are required to estimate energy equivalents of the different sources of power used (by type of fuel, electric power required including electric energy losses, etc.) • **Observed group**: commercial vehicles (PT and freight transport) • **Area of measurement:** demonstration area and/or city
References:	CIVITAS WIKI no.3 DESTINATIONS 3 ECCENTRIC 26 - 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

Intermediate indicator	Fuel mix
Category:	**Energy**
Sub-category:	Energy consumption
Impact aspect:	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 as appropriate.

Intermediate indicator	Fuel mix
	• **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. • **Observed group**: transport operators or city • **Area of measurement:** 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. CIVITAS WIKI 4 DESTINATIONS 4

6 Environment

6.1 Climate

Key Indicator No. 24	**CO_2 emissions**
Category:	**Environment**
Sub-category:	Climate
Impact Aspect:	Greenhouse gases
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 or by city resident/system user **Unit**: g/vkm or tonnes of CO2 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. This data can be also derived from operational data, or surveys for private transportation. It is required data on trip distances but also the details of vehicles used for motorized trips, including the bus fleet in the city, electric vehicles and the fuel mix, including source and equivalent emissions of electric power. • **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

Key Indicator No. 24	CO_2 emissions
	• **Observed group**: vehicles in demonstration area • **Area of measurement:** 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. CIVITAS WIKI no.8 DESTINATIONS 11 ECCENTRIC 23 CIVITAS CAPITAL

Additional indicator	CO_2 level
Category:	**Environment**
Sub-category:	Climate
Impact aspect:	Greenhouse gases
Context and relevance	Directly and indirectly, fossil fuels provide the energy for almost all transport activities. Transport is the fastest growing energy consumer in the EU. Carbon dioxide emissions (CO_2) are also a surrogate for the use of fossil fuels (EEA). Transportation CO_2 emissions account for more than 24% in total 2014 emissions in European Union. (EU) Many of the measures included in the CIVITAS projects aim either directly (through incentives to promote the use of cleaner fuels or vehicles or more 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_2 level** is defined as the average hourly (or peak/off-peak) CO concentration over a full year. **Unit**: ppm or g/m^3
Methods of measurement	**Method of data collection**: For data collection through monitoring stations, the measurement points should be located where CIVITAS measures should have an impact on the environment. Other approaches such as simulation can also be used. For local models used, a full description of the assumptions would be needed. In addition, the simulation models used should be validated to increase the credibility of the results. **Frequency:** At monitoring stations, average hourly concentration levels need to be collected daily over a year. Calculation of the average concentration levels should be made once a year until the end of the project **Accuracy**: Results from monitoring stations will be affected by many factors such as sites and weather conditions etc. Therefore, care must be taken in planning such measurements. In order to obtain more reliable and accurate data, cities which already use a traffic and dispersion model should apply them. **Target group**: population of city or demonstration area **Area of measurement:** city and/or demonstration area
References:	EEA (2001) p.14 EU Energy in Figures European Commission Statistical Pocketbook 2016 p.164 CIVITAS WIKI no.7 DESTINATIONS 8 (TUC)

6.2 Air quality

Additional indicator	CO emissions
Category:	**Environment**
Sub-category:	Air pollution
Impact aspect:	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, or by city resident/system user **Unit**: g/vkm or tonnes of CO 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 • **Area of measurement**: city and/or demonstration area
References:	Kyoto Protocol targets for emissions on a national level (no targets set on a city level). CIVITAS WIKI no.9 DESTINATIONS 12

Additional indicator	CO level
Category:	**Environment**
Sub-category:	Air pollution
Impact Aspect :	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 the average hourly (or peak/off-peak) CO concentration over a 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 • **Area of measurement:** 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). CIVITAS WIKI no.5 DESTINATIONS 6

Additional indicator	NO_x emissions
Category:	**Environment**
Sub-category:	Air pollution
Impact aspect:	Air quality
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 or by city residents / system users. **Unit**: g/vkm or Tonnes of Nox 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. This data can be also derived from operational data, or surveys for private transportation. It is required data on trip distances but also the details of vehicles used for motorized trips, including the bus fleet in the city, electric vehicles and the fuel mix, including source and equivalent emissions of electric power. • **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 • **Area of measurement:** 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). CIVITAS WIKI no.10; DESTINATIONS 13; ECCENTRIC 24; CIVITAS CAPITAL

Additional indicator:	**NO_x level**
Category:	**Environment**
Sub-category:	Air pollution
Impact aspect:	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 • **Area of measurement:** 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). CIVITAS WIKI no.6; DESTINATIONS 7; CAPITAL no.27

Key indicator No. 25	Small particulate emissions
Category:	**Environment**
Sub-category:	Air pollution
Impact aspect:	Air quality
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, or by city residents / system users. **Unit**: g/vkm or tonnes of PM 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. This data can be also derived from operational data, or surveys for private transportation. It is required data on trip distances but also the details of vehicles used for motorized trips, including the bus fleet in the city, electric vehicles and the fuel mix, including source and equivalent emissions of electric power. **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.
References:	Kyoto Protocol targets for emissions on a national level (no targets set on a city level). CIVITAS WIKI no.11 DESTINATIONS 14 ECCENTRIC 25 CIVITAS CAPITAL

Key indicator No. 26	Small particulate levels
Category:	**Environment**
Sub-category:	Air pollution
Impact aspect:	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 • **Area of measurement:** 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 $40\mu g/m^3$ ($50\mu g/m^3$ on 24h av.). Before 1-1-2010 the target threshold is $20\mu g/m^3$ on an annual mean. CIVITAS WIKI no.7 DESTINATIONS 8

Additional indicator	Level of Hydrocarbons
Category:	**Environment**
Sub-category:	Air pollution
Impact aspect:	Air quality
Context and relevance	"The transport sector is a major source of air pollution, and the dominant source in urban areas. Exposure to air pollution can cause adverse health effects, most acute in children, asthmatics, and the elderly, and can damage vegetation and materials (notably, the cultural heritage). Within the transport sector, road traffic is the most important contributor to urban air pollution. While national and EU regulations aimed at automobile emission reductions have resulted in considerably lower emissions per vehicle, the continuous expansion of the vehicle fleet is partly offsetting these improvements." (EEA) Emissions of hydrocarbons occur when there is combustion of carbon compounds. Emissions are the result of incomplete combustion, spillage or evaporative emissions. Hydrocarbons contributes to ozone formation, has direct toxic effects on humans and animals, including carcinogenesis and neurotoxicity, and is harmful to plants. (CIVITAS TELLUS). Level of Hydrocarbons is an optional indicator.
Definition	**Hydrocarbons level** is defined as the average hourly (or peak/off-peak) hydrocarbon concentration over a full year. **Unit**: ppm or g/m^3
Measurement	**Method of data collection**: For data collection through monitoring stations, the measurement points should be located where CIVITAS measures should have an impact on the environment. Other approaches such as simulation can also be used. For local models used, a full description of the assumptions would be needed. In addition, the simulation models used should be validated to increase the credibility of the results. **Frequency:** At monitoring stations, average hourly concentration levels need to be collected daily over a year. Calculation of the average concentration levels should be made once a year until the end of the project **Accuracy**: Results from monitoring stations will be affected by many factors such as sites and weather conditions etc. Therefore, care must be taken in planning such measurements. In order to obtain more reliable and accurate data, cities which already use a traffic and dispersion model should apply them. **Target group**: population of city or demonstration area **Area of measurement:** city and/or demonstration area
References:	EEA (2000), p. 27. Civitas TELLUS Indicator Fact Sheets BERLIN DESTINATIONS 9 (TUC)

6.3 Noise

Key indicator No. 27	Noise perception
Category:	**Environment**
Sub-category:	Nuisance
Impact aspect:	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. • **Observed group**: inhabitants and visitors (split by age, where possible) • **Area of measurement:** 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 CIVITAS WIKI no.12; DESTINATIONS 15

Key indicator No. 28	Noise level
Category:	**Environment**
Sub-category:	Nuisance
Impact aspect:	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 aggregated 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 level** measured on-site in the area or corridor under study **Unit**: dB(A)
Measurement	• **Method**: The indicator is evaluated based on field measurement at locations along the corridor. The difficulty to measure traffic noise in a city is that: Ideally a large number of noise measurements is needed, the measurements should cover a sufficiently long period (ideally at least 24 hours), Noise is often a result of many activities but here only the impact of traffic noise should be included. During the measurements, other sources of noise that might be disturbing the measurements are noted (e.g. person mowing the lawn, …). This allows checking and correcting of possible disturbances afterward. As this previous issue requires the permanent presence of a surveyor at the noise measurement location, long-term measurements are not attainable. The minimal duration is determined by the possibility to filter out occasional events from the total measurement period. The measurements should be executed during the daytime period (traffic noise is more important during the daytime, higher risk of other noise sources in night time). The measurements are weighted depending on the density of the measurement points. • **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**: • **Observed group**: road sections • **Area of measurement:** evaluated corridor/area
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 WIKI, WBCSD, CAPITAL; ECCENTRIC 27; WBCSD 3

ANNEX 2

The CIVITAS measure evaluation planning and monitoring scheme (Gantt Chart)

Project CityName

Activities per measure orland Integrated Packages of measures

			project months	2016 Sep 1	Oct 2	Nov 3	Dec 4	2017 Jan 5	Feb 6	Mar 7	Apr 8	May 9	Jun 10	Jul 11	Aug 12	Sep 13	Oct 14	Nov 15	Dec 16	2018 Jan 17	Feb 18	Mar 19	Apr 20	May 21	Jun 22	Jul 23	Aug 24	Sep 25	Oct 26	Nov 27	Dec 28	2019 Jan 29	Feb 30	Mar 31	Apr 32	May 33	Jun 34	Jul 35	Aug 36	Sep 37	Oct 38	Nov 39	Dec 40	2020 Jan 41	Feb 42	Mar 43	Apr 44	May 45	Jun 46	Jul 47	Aug 48	update date	comments
ANT	IP2	Implementing commuter travel plans	stages																																															
			data collection																																																		
			reporting																																																		
ANT	2.1	Elaborate full commuter plans for (bigger) companies	stages					DE				MS1				IM				OP																																	
			data collection														IB			I																				A					P-V									
			reporting																	M1				M2																		M6				Mv				Mf					
ANT	1.2	Evaluating the low emission zone in the city centre	stages	IM		MS1-2		MS3-4	OP																																													
			data collection	IB																I1														I2						A			P	V											
			reporting	M1																M2														M3											Md	Mv			Mf					

Activities

	Abbreviation to be used in the scheme
M	Mandatory activities: these activities should be indicated (except if not relevant)
O	optional activities

stages

M	DE	start of design, planning phase
M	IM	start of implementation, construction phase
M	OP	start of operational phase (if relevant)
O	MS1	milestone 1: explain in comments
O	MS2-3	milestone 2,3,... explain in comments

data collection

M	B	baseline data
O	I1	1st intermediate data
O	I2-3-	intermediate data 2-3-
M	A	after data: data at the end of the CIVITAS operational period
M	V	validation meeting
O	P1	intermediate process evaluation meeting nr 1
O	P2-3-	intermediate process evaluation meetings nr 2-3-
M	Pf	final process evaluation meeting

reporting — reporting to your Project Evaluation Manager

M	M1	MER - version with evaluation method and baseline
O	M2-3-	MER - intermediate versions (version with intermediate results or draft version of the final MER)
O	Md	MER- draft version of the final MER (fdf)
M	Mv	MER- version with validated conclusions (impact&process)
M	Mf	MER - final version

INSTRUCTIONS

This tool is meant to be used by the Local Evaluation Managers (LEMs) to plan all the evaluation activities in their city. Activities are planned at measure level and at the level of an Integrated Package (IP) of measures (if relevant).
In addition, the main stages of the measure/IP are indicated on the timing scheme since the evaluation activities are closely linked to them. In this way, the tool should give a clear overview of all evaluation activities assuring a well-balanced planning to get the right data at the right time, allowing to draw - in time - well motivated conclusions at the end of the project. The scheme will complete the information in the Local Evaluation Plan.

Please, take into account the following points:
- each measure/IP has a bundle of 3 lines each containing specific elements: stages of the measure or IP, data collection activities including process evaluation activities and reporting moments towards your Project Evaluation Manager (PEM).
- as shown in the example, the first cells with the information for an Integrated Package are given a grey background colour. If also specific activities for the measures of such an IP must be indicated, these measures are also put in the scheme, below the information of the Integrated Package.
- activities should be indicated either on measure level or on IP level . Use the abbreviations provided (in **bold**). Activities indicated as mandatory elements should be indicated, optional elements can be added to detail the planning or to make it more complete. If needed also additional elements can be added (to be decided by your PEM) and explained in the comments.
- the first line shows the stages of the measure (or IP): the design or planning stage (started with **DE** and coloured in blue), the implementation or construction stage (started with **IM** and coloured in orange) and the operational stage (started with **OP** and coloured in green). If helpful additional milestones can be added and explained in the comments.
- the second line shows all data collection activities including process evaluation activities and meetings. A minimum requirement is the collection of baseline data (**B**), after data (**A**) at the end of the CIVITAS operational period, a final process evaluation meeting (**Pf**) and a validation meeting (**V**). Additional activities can be planned e.g. intermediate data collection (**I1**, **I2**, ...) and intermediate process evaluation meetings (**P1**, **P2**, ...).
- the third line shows the reporting moments to the PEM with additional versions of the MER. The reporting of the MER with the evaluation method and baseline (**M1**), the MER with the validated conclusions (**Mv**) and the final version of the MER (**Mf**) is mandatory. Other MER versions can be added (to be decided by your PEM).
- if there is a month with more than 1 activity, use a '-' to make it clear (e.g. **V-Pf** in 1 cell means both a validation meeting and the final process evaluation meeting in that month)

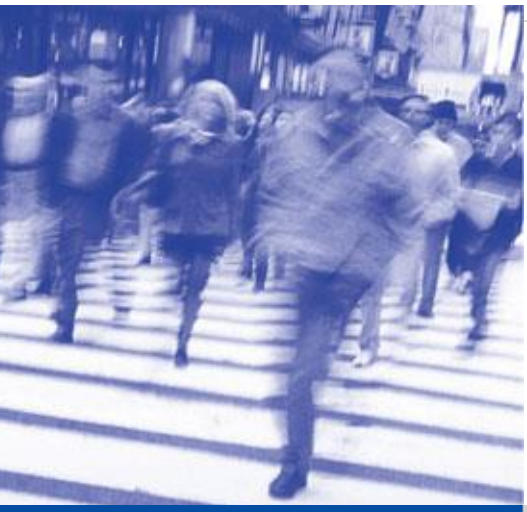
- you can add comments to the table using 2 different ways: either by cell (the EXCEL function "insert comment") or using the last column of the table

- if you need to add other elements for the measure that are not specified in the manual, or if there is other information, which cannot be put into the scheme, please use the comment box to report about this.

update date	comments
	MS1: approvement by city council
	MS1: start of info campaign, MS2: start of registration of admitted cars, S3: placement of traffic signs, MS4: installation of ANPR cameras B: reference years 2014-2015

ANNEX 3

Measure Evaluation Results (MER) Template



2020 CiViTAS
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SATELLITE

Measure impact and process Evaluation Results (MER)

Measure	
Short description	
Report developed by	
Project:	
City/cities	
Author(s)	
Mail address	
version	
date	
***Template** by*	*CIVITAS SATELLITE*
Authors:	*Dirk Engels, Evelyn De Wachter*

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Cleaner and better transport in cities
SATELLITE

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List of Tables

Project	City	
Measure code	**Measure name**	
Last update	**Author**	**E-mail**

Executive Summary

Present the key elements of the findings and conclusions in a consolidated text. In this way this summary can be used also as a self-standing text to be included in other reports or provided for communication purposes.

Make sure you include the following elements:

Measure description
Short description of the measure and how the measure was implemented.

Key impact results
Present the impacts observed (before, after, BAU) and key impact findings

Key insights implementation process
Summarise the main barriers and drivers and relevance of supporting activities

Main lessons learned
Highlight the main lessons learned including long-term expectations.

1 Measure description

1.1 Objectives of the measure

The objectives of the measure at city level (Table 1) and at measure level (Table 2) are:

*List, in order of importance, the objectives at **city policy level** in perspective of the CIVITAS goals (e.g. improve the air quality in the city).*

Ranking	Objective
1	
2	
3	
Ranking: most important objective is described first.	

Table 1 : Objectives at **city level**.

*List, in order of importance, the objectives at **measure level** (e.g. increase the number of electric vehicles in the taxi-flee). If possible quantify the target.*

Ranking	Objective	Quantifiable target
1		
2		
3		
Ranking: most important objective is described first.		

Table 2 : Objectives at **measure level**.

1.2 Description of the measure

1.2.1 Situation before

Describe the situation in the city or site before the implementation of the measure, including any problems and challenges in relation to the measure.

1.2.2 General description

Give a description of the main elements of the measure.

1.2.3 Measure outputs

List the direct results of the measure (e.g. the acquisition of 5 electric buses, ...)

1.2.4 Supporting activities *(if applicable)*

Discuss the supporting activities of the measure. Examples of such activities are measure communication, introduction of a new design method, stakeholder involvement and citizen engagement activities.

1.2.5 Interaction with other CIVITAS measures

Describe how this measure interacts with other CIVITAS measures, including the possible influence on the impact and implementation process.

1.2.6 Interaction with other non-CIVITAS measures

Describe how this measure interacts with other non-CIVITAS measures, including the possible influence on the impact and implementation process.

1.3 Target groups and/or affected part of the city or region

List and describe the different target groups and the affected areas (e.g. residents of suburban area).

Target group	Affected area	Description

Table 3 : Target groups and affected area.

1.4 Stakeholders: CIVITAS project partners and other important actors

Complete the following table, listing the different stakeholders involved and clearly describe their role.

No.	CIVITAS Partner / other actors	Type P-S	Type of organisation C-PT-KI-NG-PR-other	Level of activity L-P-O	Role

Type: P:CIVITAS partner - S: other stakeholder
Type of organisation: C: City - PT: Public transport company - KI: Knowledge institution (e.g. university) - NG: Non-Governmental Organisation - PR: Private company - Other
Level of activity: L: Leading role - P: Principle participant - O: Occasional participant

Table 4 : Stakeholders.

2 Impact evaluation

2.1 Evaluation approach

2.1.1 Impacts and indicators

For each relevant impact category, indicate the impacts we expect from this measure, and the indicators to be used to measure this impact.

Impact category / aspects	Expected impact	Indicator
Society-people		
Society-governance		
Transport system		
Economy		
Energy		
Environment		

Table 5 : Expected impacts and indicators per **impact category**.

List the different indicators, its units, when the data will be collected (B-I(xx)-A), the data collection method (DC-E-S-C) with further details (e.g. DC: The number of park and ride tickets sold, S: online survey send to the registered members, etc.) and the observed group and area (this should be in line with Section 1.3).

No.	Indicator	Data units	**Frequency** B – I(xx) – A	**Method** (DC-E-S-C)**: Description**	Observed group	Area of measurement

Frequency: B: Before - I: Intermediate - I(x): Intermediate(frequency) - A: at the end of the CIVITAS operation period
Method: DC: Data collection - E: Estimation - S: Survey - C: calculation using intermediate indicators

Table 6 : Measure's indicators.

2.1.2 Baseline

Report in detail how the baseline data was calculated and the results for the different indicators (include figures, graphs and tables). If possible add also the observed trends (in the past) leading to the baseline values. Summarise the results in Table 7, with the business-as-usual and after results.

2.1.3 Business-as-usual (BAU)

Report how the BAU data was calculated and the results for the different indicators (include figures, graphs and tables). The BAU scenario is an estimate of the future situation if the CIVITAS measures were not implemented (e.g. measure implementation: renewal of the bus fleet with electric buses. BAU scenario: the bus fleet would have been renewed with the latest diesel/petrol buses). It is possible that no changes are expected with respect to the baseline situation. Summarise the results in Table 7, with the baseline and after results.

2.2 Impact of the measure

2.2.1 Measure results

Report in detail how the indicator data after the implementation of the measure was calculated and the results for the different indicators (include figures, graphs and tables). Summarise the results in Table 7, with the baseline and business-as-usual results.

Indicator	Unit	Baseline		BAU		After		Difference: After - Baseline	Difference: After - BAU
		Value	Date	Value	Date	Value	Date		

Table 7 : Results of the measure's indicators.

2.2.2 Results for each of the CIVITAS impact categories

For each of the relevant impacts in the impact categories (as indicated in Table 5), give a an assessment of the observed impacts, i.e. describe the main results for each of the relevant categories, illustrated with the quantitative information of Table 7.

- **People – society**
  - **Impact**
- **People – governance**
  - **Impact**
- **Transport system**
  - **Impact**
- **Energy**
  - **Impact**
- **Economy**
  - **Impact**
- **Environment**
  - **Impact**

Discuss the relevant impacts taking into account additional information to allow a correct interpretation of the observed changes e.g. the BAU trends, the indicators value for the wider area (whole city, region) and the results of the city level evaluation estimating the contribution of this measure in the overall observed impacts.

2.3 Summary: achievement of objectives

Describe whether the envisaged objectives were achieved in the course of the project.

For the objectives at measure level, defined in Table 2, give a rating on the level of achievement. Explain in a few sentences how you came to this rating (comments).

Ranking	Objective and Target	Rating	Comments

NA = Not Assessed	O = Not Achieved	★ = Substantially achieved (at least 50%)
★★ = Achieved in full	★★★ = Exceeded	

Table 8 : Achievement of objectives.

2.4 Long-term impacts and up-scaling

If useful to draw proper conclusions on the impact of the measure, further analyses can be done to estimate the impacts on the longer term or when the measure would be up-scaled on a larger scale (larger target group or area).

The long-term impacts and up-scaled results can be described in a similar way as the measure results (Section 2.2.1). Report also the hypothesises used to make the estimations.

3 Process Evaluation Findings

This Section is a synthesis of the findings reported in the Process Evaluation Reports (PERs).

3.1 Implementation process

Give a structured description of the (design, implementation and operational) stages already in progress and any possible deviations to the planning, installation or execution of the measure.

3.2 Process evaluation activities

Describe the evaluation activities which were undertaken to achieve a good understanding of the implementation process (e.g. stakeholders consultation workshop to identify problems and opportunities).

3.3 Barriers

List the different barriers which have been encountered and the actions taken to overcome these barriers.

3.4 Drivers

List the different drivers which have been encountered and the actions taken to make use of these drivers.

3.5 Supporting activities

Summarise the main lessons learned regarding the supporting activities both to optimise the implementation process and to increase the envisaged impacts.

3.6 Recommendations on the implementation process

Which recommendations would you make concerning the implementation process? List and explain.

4 Evaluation Conclusions

This section combines all the findings of the impact and process evaluation.

4.1 Validated impacts

List the key results regarding the impact of the measure referring to quantitative observations and qualitative appraisals (e.g. This measure has been effective in achieving a 1% modal change towards car sharing). Here also the different factors should be explained which are important to understand how observed impacts were achieved e.g.

- *the importance of supporting measures in achieving the impacts*
- *a reference to observed overall impacts in the urban environment indicating the contribution of this measure*
- *combination with other measures (part or not part of the project)*

4.2 Long term impacts

List the potential long-term impacts that can be expected for this measure.

4.3 Implementation issues

List the key barriers and drivers and mitigating actions for the implementation of this measure explaining also the role of supporting activities to ease the implementation.

4.4 Main lessons learned

List the main lesson learned for this measure as an integrated conclusion of the impact and process evaluation findings (the previous points)

4.5 Potential for up-scaling in the city

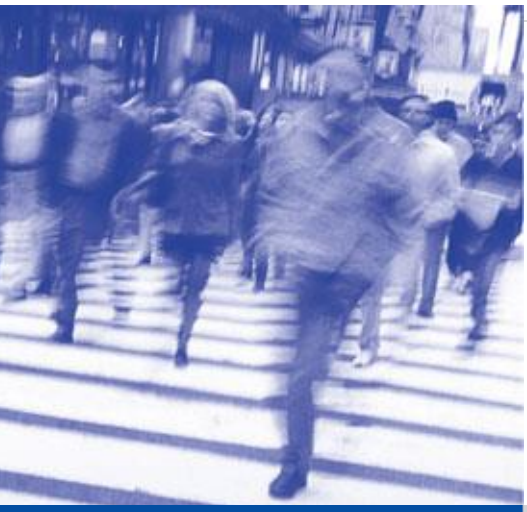
Discuss the possibility of this measure to be up-scaled in the city.

4.6 Potential for take-up in other cities

Discuss the main conclusions on the transferability potential of the measure.

ANNEX 4

Measure Process Evaluation (PER) Template



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Process Evaluation Report (PER)

Measure	
Short description	
Reporting period	
Report developed by	
Project:	
City/cities	
Author(s)	
Mail address	
version	
date	
***Template** by*	*CIVITAS SATELLITE*
Authors:	*Dirk Engels, Evelyn De Wachter*

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List of Tables

Project	City	
Measure code	**Measure name**	
Last update	**Author**	**E-mail**

1 Measure description

This Section is a copy of the first chapter of the Measure Evaluation Results (MER).

1.1 Objectives of the measure

The objectives of the measure at city level (Table 1) and at measure level (Table 2) are:

*List, in order of importance, the objectives at **city policy level** in perspective of the CIVITAS goals (e.g. improve the air quality in the city).*

Ranking	Objective
1	
2	
3	
Ranking: most important objective is described first.	

Table 1 : Objectives at **city level**.

*List, in order of importance, the objectives at **measure level** (e.g. increase the number of electric vehicles in the taxi-flee). If possible quantify the target.*

Ranking	Objective	Quantifiable target
1		
2		
3		
Ranking: most important objective is described first.		

Table 2 : Objectives at **measure level**.

1.2 Description of the measure

1.2.1 Situation before

Describe the situation in the city or site before the implementation of the measure, including any problems and challenges in relation to the measure.

1.2.2 General description

Give a description of the main elements of the measure.

1.2.3 Measure outputs

List the direct results of the measure (e.g. the acquisition of 5 electric buses, ...)

1.2.4 **Supporting activities** *(if applicable)*

Discuss the supporting activities of the measure. Examples of such activities are measure communication, introduction of a new design method, stakeholder involvement and citizen engagement activities.

1.2.5 **Interaction with other CIVITAS measures**

Describe how this measure interacts with other CIVITAS measures, including the possible influence on the impact and implementation process.

1.2.6 **Interaction with other non-CIVITAS measures**

Describe how this measure interacts with other non-CIVITAS measures, including the possible influence on the impact and implementation process.

1.3 Target groups and/or affected part of the city or region

List and describe the different target groups and the affected areas (e.g. residents of suburban area).

Target group	Affected area	Description

Table 3 : Target groups and affected area.

1.4 Stakeholders: CIVITAS project partners and other important actors

Complete the following table, listing the different stakeholders involved and clearly describe their role.

No.	CIVITAS Partner / other actors	Type P-S	Type of organisation C-PT-KI-NG-PR-other	Level of activity L-P-O	Role

Type: P:CIVITAS partner - S: other stakeholder
Type of organisation: C: City - PT: Public transport company - KI: Knowledge institution (e.g. university) - NG: Non-Governmental Organisation - PR: Private company - Other
Level of activity: L: Leading role - P: Principle participant - O: Occasional participant

Table 4 : Stakeholders.

2 Progress of implementation

2.1 Overview planned implementation stages

Indicate the planned stages of the implementation process.

No.	Stages	Relevant milestones
1	Design, planning, preparation	
2	Implementation	
3	Operation	

Table 5 : Implementation stages

2.2 Actual process during the reporting period

Describe the actual implementation process for the reporting period and discuss any possible changes with respect to the initial planned implementation process, as outlined in Table 5.

2.3 Process evaluation activities

Discuss the different evaluation activities undertaken to achieve a good understanding of the implementation process (include figures, graphs and tables).

3 Barriers and drivers

3.1 Barriers

Describe and list (Table 6) the different barriers which have been encountered during the reporting period and the actions taken to overcome these barriers.

No.	Barrier field	Description	Action to overcome the barrier

Table 6 : Identified barriers and planned/taken actions

3.2 Drivers

Describe and list (Table 7) the different drivers which have been encountered during the reporting period and the actions taken to make use of these barriers.

No.	Driver field	Description	Action to make use of the driver

Table 7 : Identified drivers and planned/taken actions

4 Observations on the supporting activities

4.1 Quality of the Supporting Activities

Give a qualitative assessment of each supporting activity. See the Guidelines for additional details.

No.	Activity	Target group	Description	Qualitative score			
				Relevance information	Timing	Relevance target group	+

Scores: * = Poor ** = Satisfactory *** = Excellent + Add extra score if needed

Table 8 : Qualitative assessment of each supporting activity.

4.2 Influence of the Supporting Activities on the implementation process

Assess, based on a set of qualitative indicators, the influence of the supporting activities on the implementation process.

No.	Qualitative indicators	Qualitative score	Motivation
	Useful comments and suggestions made by citizens, leading to changes in design		
	Useful comments and suggestions made by stakeholders, leading to changes in design		
	Influence on decision-making and measure implementation		
	Increased acceptance of the measure		
	Increased awareness and knowledge of citizens on the subject		
	Increased public trust		
	+		

Scores: O = None * = Limited ** = Significant *** = High + add other indicators if relevant

Table 9 : Assessment of the influence of the supporting activities on the implementation process

4.3 Influence of the Supporting Activities on the impact of the measure

Assess, based on a set of qualitative indicators, the influence of the supporting activities on the impact of the measure.

Ranking	Impact category	Impact aspect	Quantitative data	Qualitative score	Motivation
1					
2					
3					

Scores: O = None * = Limited ** = Significant *** = High

Table 10 : Assessment of the influence of the supporting activities on the impact of the measure.

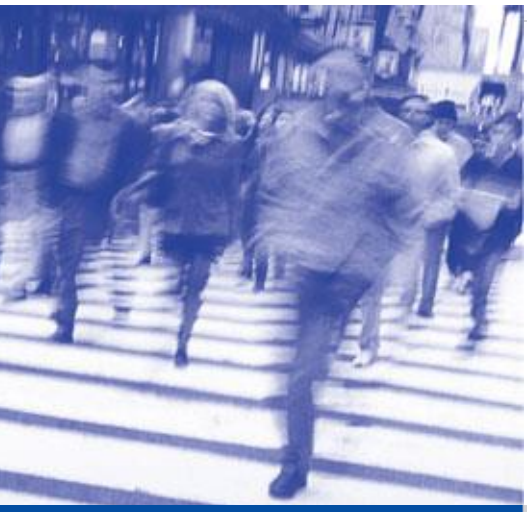
4.4 Lessons learned on the Supporting Activities

Draw conclusions on the influence of supporting measures on the impact and implementation process of the measure.

5 Lessons learned during this reporting period

List the main lesson learned in relation to the implementation process.

ANNEX 5
Guidelines for the usage of MER and PER



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Guidelines Measures Evaluation Results (MER) and Process Evaluation Report (PER)

Measure	
Short description	
Report developed by	
Project:	
City/cities	
Author(s)	
Mail address	
version	
date	
***Template** by*	*CIVITAS SATELLITE*
Authors:	*Dirk Engels, Evelyn De Wachter*

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List of Tables

Introduction

These guidelines are an updated and simplified version of the Measure Evaluation Results (MER) and Process Evaluation Report (PER) Guidelines published in 2017 as Annex 5 of the Refined Evaluation Framework.

The goal of these simplified guidelines is to provide a quick and clear overview of the content needed in the MER and PER, to ensure a harmonised way of evaluation reporting. The report will give a short description of each (sub)section of the MER and PER templates, clarified by examples of good practice from previous and ongoing CIVITAS projects.

Measure Evaluation Results (MER)

Start the MER with an informative table which included the basic information of the measure.

Example

Project	**City**	
CIVITAS FUTURA	Megapolis	
Measure code	**Measure name**	
M2.3	Making cycling the first urban mode	
Last update	**Author**	**E-mail**
21.01.2021	xxx	xx@xx

Executive Summary

In maximum 2 pages, describe the main findings and conclusions. By reading the Executive Summary, the reader should have a first understanding on what measure is implemented and how, how its impact is evaluated and the main results and lessons learned of the impact and the implementation process of the measure. Therefore, make sure you include the following elements:

- **Measure description:** Short description of the measure and how the measure was implemented.
- **Key impact results:** Present the impacts observed (before, after, BaU) and key impact findings
- **Key insights implementation process:** Summarise the main barriers and drivers and relevance of supporting activities
- **Main lessons learned:** Highlight the main lessons learned including long-term expectations.

1 Measure description

1.1 Objectives of the measure

List the objectives of the measure at two levels, 1) at city level and 2) at measure level.

City level objectives are the high-level objectives of the city to which this measure contributes. The city level objectives should be related to the CIVITAS objectives[1].

Measure level objectives are the objectives the measure is envisaged to achieve. These objectives should be well defined at the start of the project.

Ideally - mainly at measure level - a quantifiable target is set for these objectives. List the objectives in the two given tables in order of importance, with the most important objective ranked first.

The objectives of the measure at city level (Table 1) and at measure level (Table 2) are:

Example

Ranking	Objective
1	Guarantee accessibility of city and port by sustainable transport modes
2	Increase liveability and health in city and port area
3	Reduce congestion in the city centre

Ranking: most important objective is described first.

Table 1 : Objectives at **city level**.

Example

Ranking	Objective	Quantifiable target
1	Increase new tailor-made public charging infrastructure for electric vehicles	By 2018: 50 e-charging points in port and city By 2020: 100 e-charging points in port and city
2	Increase the number of electric vehicles in the taxi-fleet	By 2020: 10% of the fleet e-vehicles

Ranking: most important objective is described first.

Table 2 : Objectives at **measure level**.

1.2 Description of the measure

1.2.1 Situation before

Describe, in one or two paragraphs, how the situation in the city or site was before the implementation of the measure. This description should include the challenges the city or site is facing in relation to the measure.

[1] To promote and implement sustainable, clean, and (energy) efficient urban transport measures, to implement and evaluate integrated packages of technology and policy measures in the field of energy and transport, to build up critical mass and markets for successful innovative concepts and packages (source)

Example

ECCENTRIC, MAD 2.3 - Adaptive parking management based on energy efficiency and occupancy

Contrary to the city centre, parking is poorly regulated in the peri-central districts of Madrid. This translates in the occupation of sidewalks and other public space by illegally-parked cars, and potentially hazardous situations for pedestrians, cyclists and drivers.

The introduction of smart parking management measures and strategies in Madrid has been limited, thus far, and applied only in the central districts: on-street parking fares are higher for older vehicles, parking fares are higher in areas with high demand, and residents benefit from lower fares.

The demonstration site (EMT headquarters) provides 149 parking places, assigned to some of their 1357 employees (2018 data) with disparate criteria by the different departments hosted in the building.

1.2.2 General description

Give a comprehensive, non-technical description of the measure of half to maximum one page. Describe what the measure is about, why it is implemented, which activities have been carried out and the main actors involved in realising the measure.

1.2.3 Measure outputs

List the direct practical results of the measure with numbers if possible, e.g. 4 bike rental stations, 20 electric buses, etc.

Example

ECCENTRIC, MU2.9a - Neighbourhood oriented marketing of sustainable multimodal mobility services: Direct and dialogue marketing

The expected outputs from this sub-measure will be:

- A concept for direct and dialogue marketing for sustainable mobility in the Living Lab is developed.
- About 3.000 households in the laboratory area receive personalized information, guidance and motivation in form of the marketing campaign (by mail and telephone contact).

ECCENTRIC, MUC 2.7 - Community information and participation portal

The output of the measure is a web portal (www.domagkpark.de) that serves residents and visitors of Domagkpark, Munich.

1.2.4 Supporting activities (if applicable)

If relevant, identify the activities that support the design of the measure and increase the acceptance level of the measure and ultimately its impact, e.g. specific communication of the measure, citizens engagement, stakeholder involvement, etc.

Example

DESTINATIONS, MAD 4.1 – Promote the uptake of clean vehicles by fleet operators

In order to enhance the impacts of the measure, some supplementary activities were carried out:

- Application to unlock additional European funding to reinforce the pedestrian network connectivity within the target area.
- Development of awareness campaigns to foster inter-modality within the target area, namely pedestrian mobility, cycling and electric mobility.
- Conferences focused on presenting the integrated system that combines energetic efficiency with road safety, including a display of the equipment that will be deployed.
- Discussion session focused on presenting the project “Monumental Acessível” that highlights the interventions that will be carried out.

1.2.5 Interaction with other CIVITAS measures

If other CIVITAS measures have an influence on the implementation process and/or the expected impacts, mention it here to be able to take this into account during the interpretation of the findings. If the measure is part of an integrated package of measures, explain here how they are integrated.

Example

DESTINATIONS, MAD 5.1 - Smart and clean urban freight logistics at tourist destinations

This measure has a tight relation with MAD 4.1, which aims to promote the uptake of clean vehicles by fleet operators. Specifically, it is intended to create a mechanism for joint procurement to obtain greater competitiveness in the final price, to promote the purchase of electric and hybrid vehicles for fleets of public and private organizations, including regional and local administration, rent-a-cars, tourist services, taxis and logistics. Fostering electric mobility among distributers can improve the urban quality in Funchal.

1.2.6 Interaction with other non-CIVITAS measures

As in Section 1.2.6 describe any relevant interactions with any non-CIVITAS measures, to be able to take this into account during the interpretation of the findings.

Example

PORTIS, 2ANT 4.2 - Implementing commuter travel plans

The EU funded project EMPOWER supports the development of the bike discount scheme. Antwerp took part in this project as a ‘take-up city’. The purpose of the project in general is to give positive incentives towards people to change their travel behaviour. The city of Antwerp included their bike discount scheme: http://empowerproject.eu/take-up-city/antwerp/

1.3 Target groups and/or affected part of the city or region

Indicate the target group(s) of the measure (e.g. residents of suburban area, public transport users, commuters...), the area of interest and add a short description. Any possible changes during the lifetime of the CIVITAS project should be mentioned.

Example

Target group	Affected area	Description
Public Transport users	Turku city and suburban area	This measure involves the bus line which runs in the centre and the suburban area of Turku between the harbour, market place and the airport

Table 3 : Target groups and affected area.

1.4 Stakeholders: CIVITAS project partners and other important actors

List and describe the main partners and actors involved during the different stages of the measure by completing Table 4. Include details on the role of the different actors.

Example

No.	CIVITAS Partner / other actors	Type P-S	Type of organisation C-PT-KI-NG-PR-other	Level of activity L-P-O	Role
1	Turku Region Traffic Föli	S	PT	P	Main partner providing public transport services in the Turku region.
2	Regional Council of Southwest Finland	P	Other	P	Regional authority providing e.g. regional promotion of PT
3	The City of Turku	P	C	L	Organization and management of the measure
4	Turku University of Applied Sciences	P	KI	P	Data monitoring and analysis, measure evaluation
5	Linkker Ltd	S	PR	P	Manufacturer of the electric buses procured
6	Turku Energia Ltd	S	Other	P	Charging infrastructure provider

Type: P:CIVITAS partner - S: other stakeholder
Type of organisation: C: City - PT: Public transport company - KI: Knowledge institution (e.g. university) - NG: Non-Governmental Organisation - PR: Private company - Other
Level of activity: L: Leading role - P: Principle participant - O: Occasional participant

Table 4 : Stakeholders. Example from **ECCENTRIC, TUR 5.7 - Introduction of Electric Public Transport**.

2 Impact evaluation

2.1 Evaluation approach

2.1.1 Impacts and indicators

For each relevant CIVITAS impact category of this measure, describe the expected impacts and list all indicators used to describe the expected impacts.

Example

Impact category	Expected impact	Indicator
Society-people	Increase awareness of implemented measures by target population.	**Awareness level**
	Increase acceptance of implemented measures by target population.	**Acceptance level**
Society-governance	Development of a Sustainable Urban Mobility Plan conform with EU standards.	**Quality** of the **SUMP**: qualitative check content and process SUMP to verify that it corresponds with the EU guidelines on Sustainable Urban Mobility plans.
Transport system	Increased usage of Public Transport in target area.	**Modal share** Public Transport in city centre and suburban area.
	Increased passage of cyclist in target area.	**Number of cyclists** at 4 reference points in target area.
Economy	We expect the investment costs to have increased	**Investment costs**
	Reduced operating costs	**Operating costs**
Energy	Reduced fuel consumption	**Average energy consumption**
Environment	Reduced CO_2 emissions	**CO_2 emissions**
	Reduced NOx emissions	**NOx emissions**

Table 5 : Expected impacts and indicators per **impact category**.

In line with Table 5, list the different indicators which will be assessed with clear details on the method and timing of data collection, its units and the observed group and area.

Example

No.	Indicator	Data units	Frequency B – I(xx) – A	Method (DC-E-S-C): Description	Observed group	Area of measurement
1	Awareness level	Scale 1 to 5	B-A	S: Online survey at the start and 2 months before the end of the project.	PT users	City centre and suburban area
2	Acceptance level	Scale 1 to 5	B-A		PT users	
3	Modal share PT	%	B-A	S: Yearly survey conducted by the city.	PT users	
4	Number of cyclists	number/day	B-I(M10)-I(M20)- A	DC: Data from 4 bicycle counters (2 in city centre, 2 in suburban area)	Commuters to/residents city centre	
5	Investment costs	€	B-A	DC: Data from PT company	PT company	
6	Operating costs	€	B-A	DC: Data from PT company	PT company	
7	Average energy consumption	TJ/year	B-A	C: Calculation energy consumption and pollutant emissions based on estimate of city fleet from city statistics. Emission ratios per pollutant per car trip from COPERT v5.1 model.	Car owners	
8	CO_2 emissions	Tons/year	B-A		Car owners	
9	NOx emissions	Tons/year	B-A		Car owners	

Frequency: B: Before - I: Intermediate - I(x): Intermediate(frequency) - A: at the end of the CIVITAS operation period
Method: DC: Data collection - E: Estimation - S: Survey - C: calculation using intermediate indicators

Table 6 : Measure's indicators.

2.1.2 Baseline

Give a detailed description of the baseline situation, i.e. calculate the values of the different indicators before the measure was implemented. This may require some assumptions to be made. For each indicator or impact category, describe the method(s) used, how the data was obtained (data sources, details on the surveys etc) and how the calculation was done. Include figures, graphs and/or tables and give details of the year of data collection. Summarise the results in Table 7, with the business-as-usual and after results.

2.1.3 Business-as-usual (BAU)

Give a detailed description of the BAU situation, i.e. calculate the values of the different indicators in a future scenario where the measure was not implemented. For each indicator or impact category, describe the method(s) used, how the data was obtained (data sources, details on the surveys etc) and how the calculation was done. Include figures, graphs and/or tables**.** If no changes are expected if the measure is not implemented, just mention this. Summarise the results in Table 7, with the baseline and after results.

Example

ECCENTRIC, MAD6.2 - Test fleets, policy incentives and campaigns for the uptake of electric vehicles

The business as usual (BAU) scenario assumes that, in the absence of the measure, the Municipality would have continued its previous leasing scheme requesting internal combustion engine (ICE) vehicles for its fleet. It can be assumed that Euro 5 gasoline cars would have been replaced by Euro 6 cars of similar size.

The services provided by the fleet are not expected to change, in terms of distance or traffic conditions. Each vehicle follows different routes from day to day, in accordance with the inspection needs, following mostly primary and secondary streets. Average traffic conditions are 50% off-peak (average speed, 50 km/h), and 50% peak (average speed, 20 km/h). The table below provides the relevant indicators on emissions and energy consumption in the BAU scenario (i.e. for a small Euro 6 gasoline car).

Indicator	Unit	Average Car	Whole Fleet
CO_2 emissions per year (ICE Euro 6)	ton/year	3.9458	74.970
NOx emissions per year (ICE Euro 6)	ton/year	0.001689	0.0321
PM emissions per year (ICE Euro 6)	ton/year	0.000528	0.0100
Energy consumption (ICE Euro 6)	TJ/km	0.05471	1.0394

Table: Emission BaU values for the city's test fleet (19 cars).

Yearly energy consumption would be 918 TJ/year for each car, or 17,447 TJ/year for the whole fleet.

2.2 Impact of the measure

2.2.1 Measure results

Give a detailed description of the 'after' situation, the situation after the implementation of the measure. For each indicator or impact category, describe the method(s) used, how the data was obtained (data sources, details on the surveys etc) and how the calculation was done. Include figures, graphs and/or tables. Indicate where any observed differences are statistically significant. Summarise the results in Table 7, with the baseline and BAU results. Discuss these results per impact category in Section 2.2.2.

Example Table 6

Indicator	Unit	Baseline		BAU		After		Difference: After - Baseline	Difference: After - BAU
		Value	Date	Value	Date	Value	Date		
Awareness	%	0	2017	0	2018	3.9	2018	3.9	3.9
Acceptance	score (1-5)	0	2017	0	2018	3.6	2018	3.6	3.6
Satisfaction	score (1-5)	0	2017	0	2018	3.7	2018	3.7	3.7
CO_2 emissions	tons/year	13.92	2017	10.86	2018	6.38	2018	-7,54	-4,48
NOx emissions	tons/year	0.0771	2017	0.0092	2018	0.0048	2018	-0,0723	-0,0044
PM emissions	tons/year	0.0047	2017	0.0033	2018	0.0018	2018	-0,0030	-0,0015
Energy	TJ/year	0.187	2017	0.146	2018	0.0859	2018	-0.102	-0.060
Investment costs	€	0	2017	155000	2018	155000	2018	155000	0.00
Operational costs	€/year	-	2017	-1418.10	2018	-4026.78	2018	-4026.78	-2608.68

Table 7 : Results of the measure's indicators. **Example from ECCENTRIC, M7.1 - Consolidation centre with EVs and local regulations for clean urban freight logistics**

2.2.2 Results for each of the CIVITAS impact categories

For each of the relevant impact categories (as indicated in Table 5), give an assessment of the observed impacts. Give a textual explanation of the achievements, illustrated with the quantitative information of the indicators, to understand the impact of the measure in each impact category. Compare and discuss the 'after' results to those obtained from the baseline and the BAU situation (where appropriate).

2.3 Summary: achievement of objectives

In the following table, give a rating to the different quantified targets defined in Table 2, and describe how you came to this rating (comments). Explain why targets have or have not been achieved. If quantifiable targets have been changed over the course of the project, please indicate these changes and explain why.

Example

ECCENTRIC, MAD6.2 - Test fleets, policy incentives and campaigns for the uptake of electric vehicles

Ranking	Objective and Target	Rating	Comments
1	At least 20 electric vehicles in the municipality fleet (to be translated into energy, emission reduction)	***	The number of e-cars in the city fleet reached 130 in January 2019.
2	Deployment of at least 3 new fast charging stations	***	5 fast charging stations opened by EMT 9 on-street fast charging stations (ChargeMaster) opened by the municipality
3	Agreement with 5 companies to procure electric vehicles for their fleets	O	In spite of the measure team efforts, none of the companies approached added e-cars to their fleets

NA = Not Assessed O = Not Achieved ★ = Substantially achieved (at least 50%)
★★ = Achieved in full ★★★ = Exceeded

Table: Achievement of objectives.

This measure has exceeded two of its three initial objectives, in both cases due to the commitment of the municipality: the number of electric cars added to the municipal fleet reached 130 units in January 2020, well above the initial objective of 20. The commitment of the municipal company EMT resulted in 5 fast-charging stations opened in different EMT-managed public parking facilities during 2018, to which 9 on-street fast-charging stations managed by the municipality as part of its own public charging network should be added.
In spite of frequent contacts with different companies (and particularly with COOLTRA and Pascual), none of them engaged in the procurement of electric vehicles as a result of this measure.

2.4 Long-term impacts and up-scaling

In order to have a more realistic view on the actual impacts of the measure it's interesting to estimate the expected impact if the observed results were to be up-scaled; i.e. if the measure were to be implemented in a larger area or for a larger target group. This estimate of the expected impact will be based on a number of assumptions that need to be clearly explained. The up-scaled results should be described in a similar way as the measure results (Section 2.2.1) while being clear about the limitations and assumptions made during the up-scaling methodology. Do this exercise only if it's useful to hereby draw proper conclusions on the impact of the measure.

Example

ECCENTRIC, MAD2.8 - Mobility Management strategies for vulnerable groups

It seems that a programme on school mobility could mobilise 3 additional schools per year or 1110 pupils, considering the average size of schools in Madrid (370 pupils). Considering the average project achievements in terms of modal split and emissions, the annual results expected from up-scaling are summarised in the table below. The results from up-scaling would add, every year, to those obtained from ECCENTRIC.

	Car trips avoided	CO2 saved (t/year)	NOx saved (t/year)	PM saved (t/year)
ECCENTRIC	68	23,95	0,0509	0,0112
Upscaling (1100 pupils)	19	6,67	0,0142	0,0031

Table: Expected annual results from up-scaling (children)

Concerning elderly mobility, further action in Elderly Community Centres is envisaged. There are 89 of such centres in Madrid. Keeping the current resources, it would be possible to add 2 additional Centres to the programme every year. However, the significant impact achieved on elderly mobility should be coupled with some actions improving walking conditions for the elderly within the area of influence of each Centre.

Considering the population in Madrid (667,714 above 64 years old or 20.4% of the total population) and the number of Elderly Community Centres in the city (89), the average population per Centre is 7,500. Based on existing mobility surveys, ECCENTRIC considered that 54% of that population was making daily trips (resulting, in the case of the ECCENTRIC living lab in a “mobile” elderly population of 30,000 persons in the living lab). Modal change occurred mainly from motorised trips to walking (8.6 percentage points). Applying these values to the average elderly population covered per Centre, the impacts expected from up-scaling are presented in the table below.

	Car trips avoided	CO2 saved (t/year)	NOx saved (t/year)	PM saved (t/year)
ECCENTRIC	1548645	540,00	0,7700	0,0497
Upscaling (2 Centres)	418106	13,34	0,0283	0,0062

Table: Expected annual results from up-scaling (elderly)

3 Process Evaluation Findings

This Section is a synthesis of the findings reported in the Process Evaluation Report (PER). Summarise for each Subsection what has been explained in detail in the PER (see Page **Error! Bookmark not defined.**).

3.1 Implementation process

Give a structured description of the (design, implementation and operational) stages already in progress and any possible deviations to the planning, installation or execution of the measure.

Example

ECCENTRIC, MAD2.6 – Park and Ride in the peripheral district

The “Research and planning” phase was performed in the period 01.12.2016 – 28.02.2018. It took a longer period than what was initially planned because it was necessary to find the convenient terrain owned by the municipality and to obtain the approval by the City Council and the local citizens. During this phase we had meetings with local transport experts and with experts from other municipalities who have been implementing Park and Ride (P&R) strategies. We promoted the idea of P&R among the local population and stakeholders during a series of training and discussion events. The results of this phase were detailed technical specifications (ToR) necessary to start the public procurement procedures for the implementation of the measure.

Phase 2: “Procurement and implementation” started in March 2018 and was completed by the end of April 2019. During this stage, after the public procurement procedures, the design and building of 41 parking slots were performed and the software system for ticketing was elaborated and installed as a special machine.

Phase 3: “Demonstration and monitoring” of the P&R started with the official opening of the P&R facility in May 2019. The station is successfully functioning until present reaching more and more clients. In parallel an intensive promotional and information campaign was conducted in Ruse and other cities (Varna, Dobrich, Shumen).

Currently we are implementing the last Phase 4: “Conclusions and recommendations” by evaluating the impact of this first initiative.

3.2 Process evaluation activities

Describe the evaluation activities which were undertaken to achieve a good understanding of the implementation process (e.g. stakeholders consultation workshop to identify problems and opportunities).

3.3 Barriers

Describe in a few paragraphs the main barriers which have been encountered during the reporting period as described in detail in the PER, and the actions taken to overcome these barriers.

Example

ECCENTRIC, MAD7.1 - Consolidation centre with EVs and local regulations for clean urban freight logistics

The following main barriers were identified, and are presented in more detail in the Process Evaluation Report.

Financial barrier: Location of the consolidation centre

The optimal location of the consolidation centre was jeopardised by financial constraints, as central locations are significantly more expensive than peripheral ones. The final location of the consolidation centre - outside the living lab and at a significant distance from the potential final destinations in the city centre - did not compromise the achievement of the measure main objectives, even if it has probably resulted in lower impacts.

Positional barrier: Low visibility of the project

The Consolidation Centre is sharing a larger facility with many other operators and activities. Not having an exclusive or independent centre has weakened the identity and visibility of the project.

Planning barrier: Vehicle selection

The selection of hybrid 7.5-t trucks for last mile distribution was not supported by a comprehensive analysis of options, in particular to use electric vehicles for these operations.

3.4 Drivers

Describe in a few paragraphs the main drivers which have been encountered during the reporting period as described in detail in the PER, and the actions taken to make use of these drivers.

Example

ECCENTRIC, MAD7.1 - Consolidation centre with EVs and local regulations for clean urban freight logistics

The following main drivers were identified, and are presented in more detail in the Process Evaluation Report.

Cultural driver: Increasing interest in clean logistics

The project has created increasing interest in sustainable urban logistics (consolidation centres, clean vehicles, share logistics…) concepts from logistics operators and their clients, partly as a result of the new regulations adopted by the municipality within the Air Quality Plan.

Institutional driver: Support to clean vehicles

The measure has been successful in being aligned with the new Air Quality Plan, through the municipal experts involved in the measure. The new regulations adopted by the municipality within the Air Quality Plan encourage the use of cleaner vehicles for urban delivery.

3.5 Supporting activities

Summarise the main lessons learned regarding the supporting activities.

Example

Citizens participation

The activities to involve the citizens of the corridor in the planning process were crucial to raise the acceptance for the reorganisation of the urban space and reducing the parking places.

Involvement of employees

It is important to involve the employees and companies as much as possible. They know better than anybody else which mobility issues are experienced in the area. Within this measure, a peer to peer approach is more effective and produces better results than the top down approach.

3.6 Recommendations on the implementation process

Summarise the main recommendations concerning the implementation process.

Example

ECCENTRIC, MAD2.8 - Mobility Management strategies for vulnerable groups

Build upon previous experience and projects

The excellent results achieved by this measure with children has been facilitated by the previous experience gained by the measure team in the EU-funded project STARS. Building upon that experience, ECCENTRIC could establish a robust planning cycle with the participating schools, imbed its activities within the school activities and create strong partnerships with teachers and other key stakeholders.

Anticipate the bureaucratic procedures for investment approval and design your co-creation activities accordingly

Approval procedures for investments, big or small, may be cumbersome and rigid. When engaging vulnerable groups in co-creation processes, as ECCENTRIC did with the elderly in the living lab, there is a risk of not getting things done, and raising frustration and scepticism about public action. The boundaries of the project (what was feasible to get done and what was not or too difficult) were clearly identified and communicated to the participants, so that - nevertheless with considerable effort - the agreed proposals were implemented by the municipality.

4 Evaluation Conclusions

This section combines all the findings of the impact and process evaluation. Based on the results of the previous sections and by well-structured discussions with Measure Leaders, Site Coordinators, external experts, stakeholders, etc, formulate the evaluation conclusions.

For each subsection, report the conclusions in different bullet points to make the key elements of the evaluation conclusions clear.

4.1 Validated impacts

List the key results regarding the impact of the measure.

Example

ECCENTRIC, MAD2.3 - Adaptive parking management based on energy efficiency and occupancy

Based on the observed impacts and the interpretation and comments provided in this report, the measure has achieved the following key results:

- This measure has been effective in achieving some modal change towards car-pooling and in increasing average car occupancy.
- This measure has also been effective in reducing the average occupancy of the Empresa Municipal de Transportes de Madrid S.A. (EMT) parking facility.
- The influence of this measure on vehicles' characteristics has not been demonstrated: plug-in hybrid and electric cars remain marginal within the staff's cars.
- The environmental impacts (emissions and energy consumption) of car-pooling are likely to be modest compared to the resources required to support car-pooling, as modal change is more likely to happen in shorter than in longer trips (probably due to the difficulties to find a trip partner and the more rigid conditions (e.g. timing) associated to long trips).
- The reliability of the automated system for car occupancy control has not been sufficiently demonstrated, and remains a technical challenge.

4.2 Long term impacts

List the potential long-term impacts that can be expected for this measure.

Example

ECCENTRIC, MAD2.3 - Adaptive parking management based on energy efficiency and occupancy

Two long-term impacts can be anticipated for this measure, if maintained by Empresa Municipal de Transportes de Madrid S.A. (EMT) management:

- EMT can make a more effective use of the available parking space. Establishing more rational parking access rules, EMT has reduced the parking occupancy rate, as some non-qualifying employers (probably with long daily stays and daily car-use) have found alternative solutions (public transport, paid parking outside the premises), liberating space for employees with more flexible travel behaviour (occasional car users, flexible working routines, including trips outside the EMT premises…). The

additional space liberated opens an opportunity to further explore more environmentally efficient parking access in future (e.g. without attributing fixed parking places to particular employees), or to look for alternative use of the liberated space (e.g. storage, basic equipment…).
- Car-poolers could expand in the future, if the incentives to them are strengthened (e.g. full access to the parking facility, instead of the current bonus in the allocation of fixed spaces), considering the favourable results obtained. However, the environmental benefits of such trends remain uncertain, considering the results obtained in this project.

4.3 Implementation issues

List the key barriers and drivers and mitigating actions for the implementation of this measure explaining also the role of supporting activities to ease the implementation.

4.4 Main lessons learned

List the main lesson learned during the implementation of this measure, integrating the impact and process evaluation findings.

Example

ECCENTRIC, MAD2.3 - Adaptive parking management based on energy efficiency and occupancy

The main lessons learned are linked to the measure impacts identified in Section 4.1 above:

- Parking management measures are effective in encouraging modal change; this includes changes in the criteria to grant access to parking facilities in a company's premises. In particular, car-pooling can be promoted through parking management measures.
- A priority parking access measure in itself does not provide an incentive strong enough to change users' car choice: the staff is not likely to change their car purchase decisions at the light of the new parking access policy.
- The environmental impacts (emissions and energy consumption) of car-pooling are likely to be modest compared to the resources required to support car-pooling, as modal change is more likely to happen in shorter than in longer trips (probably due to the difficulties to find a trip partner and the more rigid conditions (e.g. timing) associated to long trips).
- Automated control of car occupancy remains a technical challenge, that cannot provide fully-satisfactory control of parking access.

4.5 Potential for up-scaling in the city

Discuss the possibility of this measure to be up-scaled in the city.

Example

ECCENTRIC, MAD2.3 - Adaptive parking management based on energy efficiency and occupancy

The potential to up-scale this measure at the city level is low. Although car-pooling could be encouraged through it, the project has shown that the environmental benefits of such trend is uncertain, as at least

some car-poolers can be former public transport or non-motorised users. Furthermore, car-poolers tend to travel short-distance trips, as long-distance commuters are less likely to find a suitable ride partner; this reduces the environmental impact of the modal change achieved.

Lack of technical reliability is another reason preventing upscaling. The automated system has not provided a sound evidence about its ability to effectively control the number of car occupants. This prevent this technology to be expanded in the network of Empresa Municipal de Transportes de Madrid S.A. (EMT) public parking facilities in Madrid.

4.6 Potential for transferability to other cities

Discuss the main conclusions on the transferability potential of the measure.

Process Evaluation Report (PER)

Start the PER with the informative table and Chapter 1 of the Measure Evaluation Results (MER).

Example

Project	City	
	Brussels	
Measure code	**Measure name**	
BXL1.2		
Last update	**Author**	**E-mail**
15.04.2020	Marie Vermeersch	m.vermeersch@bxl.org

1 Measure description

This chapter is a copy of the first Chapter of the MER. See Section 0 of this document for guidelines.

2 Progress of implementation

2.1 Overview planned implementation stages

Describe the different stages of the implementation process. We have **3 main stages** for a measure:

- **Design, planning, preparation stage**: the measure is developed in detail. 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 stage**: the measure will be implemented in real life. At the end of this phase the measure starts operation.
- **Operation stage**: 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 project and can be analysed and evaluated.

Example

No.	Stages	Relevant milestones
1	Design, planning, preparation	A new concept of e-car sharing is being investigated in the city of Antwerp. The city helps the private stakeholders by being open for discussion and providing charging infrastructure in preferred areas.
2	Implementation	The charging infrastructure is added to the smart travel planner (3ANT1).
3	Operation	An online request tool for charging infrastructure becomes available. A company is tendered to do technical installation and exploitation.

Table 8 : Implementation stages**.** Example from **PORTIS, 3ANT2 - Developing smart charging infrastructure**

2.2 Actual process during the reporting period

Describe the **current stage** of the implementation process for the **reporting period** and discuss any possible changes with respect to the initial planned implementation process as outlined in Table 8.

2.3 Process evaluation activities

Discuss the different evaluation activities undertaken to achieve a good understanding of the implementation process (include figures, graphs and tables).

Example

PORTIS, 3ABZ3 - Enhancing Demand Management

- A workshop was organised to engage the local partners and stakeholders in the problem defining and solution finding aspects of the measure and to improve the measure implementation and outcome.
- An online survey was distributed to citizens who make use of the parking facilities in the city centre, to gather data on the current parking habits within the city centre, to get an understanding of the public perception of the current city centre parking policies and to inform on the preparation of this measure. Data collected from the survey will inform the design, planning and ultimately implementation of the measure.

3 Barriers and drivers

3.1 Barriers

Describe and list (Table 9) the different barriers which have been encountered during the reporting period and the actions taken to overcome these barriers. Process barriers are events or overlapping conditions that hamper the process in obtaining the objectives of the measure. Possible examples of different **barriers** are:

- **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 ideas.
- **Institutional**: Impeding administrative structures, procedures and routines, impeding laws, rules, regulations and their application, hierarchical structure of organizations and programs.
- **Cultural**: Impeding cultural circumstances and life style patterns.
- **Problem related**: Complexity of the problem(s) to be solved, lack of shared sense of urgency among key stakeholders to sustainable mobility.
- **Involvement, communication:** Insufficient involvement or awareness of (policy) key stakeholders, insufficient consultation, involvement or awareness of citizens or users.
- **Positional:** Relative isolation of the measure, lack of exchange with other measures or cities.
- **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.
- **Organisational**: e.g. Failed or insufficient partnership arrangements, lack of leadership, lack of individual motivation or know-how of key measure persons.

- **Financial:** e.g. Too much dependency on public funds (including CIVITAS funding) and subsidies, unwillingness of the business community to contribute financially.

Possible examples of actions to overcome these barriers are:

- **Political / strategic**: (Co-)development of a vision on sustainable development or sustainable mobility, (co-)development of a program towards sustainable development or sustainable mobility, discourse with key stakeholders (politicians etc) about the sustainability problems to be solved.
- **Institutional:** Analysis of and/or proposals to change impeding rules, structures, legislation, organisational structures etc.
- **Cultural:** Facilitating cultural circumstances and life style patterns.
- **Problem related**: Thoroughly analysing 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.
- **Involvement, communication:** Consultation of target groups by workshops, conferences, focus groups, expert meetings, face-to-face interviews or questionnaires, telephone interviews 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.
- **Positional:** Place the measure into a running sustainability program (combined with the strategic actions), activities to exchange experiences with other measures / cities (workshop, conference, focus group etc).
- **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 analysing user needs analysis to better understand the user requirements.
- **Organisational:** Activities to raise the competences of the measure partners (special courses etc), activities to raise the motivation of the measure partners (extra measure meetings).
- **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.

Include a clear description of the barrier understandable for people of other cities who don't have detailed knowledge of the measure.

Example

No.	Barrier field	Description	Action to overcome the barrier
1	Institutional	To make a full mobility analysis, personal data of each employee is necessary (address, etc). Due to privacy reasons it takes some companies longer to deliver the necessary data.	Legal departments of participating companies look into the framework before handing over the data.

Table 9 : Identified barriers and planned/taken actions**.** Examples from **PORTIS, 2ANT2.2 - Implementing commuter travel plans (Approach to employers),**

3.2 Drivers

Describe and list (Table 10) the different drivers which have been encountered during the reporting period and the actions taken to make use of these drivers. Process barriers are events or overlapping conditions that stimulate the process in obtaining the objectives of the measure. Possible examples of different **drivers** are:

- **Political / strategic:** Commitment of key actors based on political and/or strategic motives, presence of a sustainable development agenda or vision, positive impacts of a local election, coalition between key (policy) stakeholders due to converging (shared) believes.
- **Institutional:** Facilitating administrative structures, procedures and routines, facilitating laws, rules, regulations and their application, facilitating structure of organisations and programs.
- **Cultural:** Facilitating cultural circumstances and life style patterns.
- **Problem related:** Pressure of the problem(s) causes great priority, shared sense of urgency among key stakeholders to sustainable mobility.
- **Involvement, communication:** Constructive and open involvement of key stakeholders, constructive and open consultation and involvement or citizens or users.
- **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 from other measures or cities.
- **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 analysis of user needs and good understanding of user requirements.
- **Organizational:** Constructive partnership arrangements, strong and clear leadership, highly motivated key stakeholders.
- **Financial:** Availability of public funds (including CIVITAS funding) and subsidies, willingness of the business community to contribute financially.
- **Technological:** New potentials offered by technology, new technology available.
- **Spatial:** Space for physical projects, experimentation zones.

Example

No.	Driver field	Description	Action to make use of the driver
1	Operational	Increase in congestion results in employers having difficulties in hiring and keeping staff	Employers feel the need to act, there is a sense of urgency. Hence employers are very keen on any measure that might relieve the traffic issues around Antwerp.
2	Operational	The support given by the city of Antwerp towards employers and employees makes them aware of the sustainable alternatives, which gives in turn a boost to the measure	Both employers and employees are getting concrete support with the help of the products and services of *Slim naar Antwerp*, such as mobility scans (i.e. a mapping of the current travel behaviour of a company's employees).

Table 10 : Identified drivers and planned/taken actions. Examples from **PORTIS, 2ANT2.2 - Implementing commuter travel plans (Approach to employers),**

4 Observations on the supporting activities

This chapter evaluates the supporting activities of this measure. If no significant supporting activities are taken, this chapter can be left out of the report.

4.1 Quality of the Supporting Activities

Give a qualitative assessment of each supporting activity. First, give a description of the activity and target group. Then, assess the activity with a qualitative score. Complete the table with the following information:

- **Activity:** e.g. public discussion, workshop, event, presentation, info-material, leaflets.
- **Target group:** the target group of the activity.
- **Description**: Short description of the activity with a quantification of the size of the target group (e.g. 1000 children of a primary school), the number of activities organised, the response rate of the target group, etc.
- Give a **qualitative score** (* = Poor ** = Satisfactory ***= Excellent) for the following elements:
  - **Relevance information**: is the information or discussion relevant in relation to an effective and efficient implementation of the measure?
  - **Timing**: was this the appropriate moment to do this activity ?
  - **Relevance target group**: was this the correct target group that has an influence on the implementation process and the impact of the measure ?
  - **+**: Any other aspect you find relevant.

Give additional comments if needed.

Example

No.	Activity	Target group	Description	Qualitative score		
				Relevance information	Timing	Relevance target group
1	Focus groups	Citizens	3 focus groups were held in Nov. 2017 with 26 participants: • group 1: 8 people • group 2: 9 people • group 3: 9 people	**	**	**
2	Workshop	Key stakeholders in project	Workshop for 20 representatives of key stakeholders (bus companies, freight companies and cycle forum)	***	**	***
3	Interviews	Stakeholders and representatives of key organisations	Interviews were conducted by a third party consultant on behalf of Aberdeen City Council with: • ScotRail (train operator) • Aberdeen Harbour Board • Freight Transport Association • Aberdeen Airport	***	**	**
Scores: * = Poor ** = Satisfactory *** = Excellent				+ Add extra score if needed		

Table 11 : Qualitative assessment of each supporting activity. Example from **PORTIS, 2ABZ2 - Redesigning Collective Travel.**

4.2 Influence of the Supporting Activities on the implementation process

Complete Table 12 to assess, based on a set of qualitative indicators, the influence of the supporting activities on the **implementation process**.

Examples of qualitative indicators are:

- Useful comments and suggestions made by citizens, leading to changes in design
- Useful comments and suggestions made by stakeholders, leading to changes in design
- Influence on decision-making and measure implementation
- Increased acceptance of the measure
- Increased awareness and knowledge of citizens on the subject
- Increased public trust

Give a score per indicator (O = None * = Poor ** = Satisfactory ***= Excellent) and motivate your choice. Give additional comments if needed.

Example

No.	Qualitative indicators	Qualitative score	Motivation
1	Useful comments and suggestions made by citizens, leading to changes in design	**	The activities were deemed to be satisfactory in the sense that they directly address the requirements of the measure by seeking to understand from key stakeholders (bus companies, freight, cycle forums) measures that could/they would like to see be implemented to improve the corridor, improving active and sustainable travel. In ensuring it is fit for purpose and therefore more likely to be accepted by stakeholders and the wider public, and it is what would be expected as a course of conduct in a robust project.
2	Increased awareness and knowledge of citizens on the subject	**	The activities were deemed to be satisfactory in the sense that they directly address the requirements of the measure by seeking to understand challenges, barriers and opportunities that citizens face along the corridor and take this into account when completing the study and considering works to be implemented.
Scores: O = None * = Limited ** = Significant *** = High + add other indicators if relevant			

Table 12 : Assessment of the influence of the supporting activities on the implementation process. Example from **PORTIS, 2ABZ2 - Redesigning Collective Travel**.

4.3 Influence of the Supporting Activities on the impact of the measure

Complete Table 13 to assess, based on a set of qualitative indicators, the influence of the supporting activities on the **impact of the measure**. The difference between this aspect and the previous aspect (Section 4.2) can be illustrated by the following example:

> Meetings with citizens living in a heavy road corridor in which parking places are replaced by a good cycling lane can help to make it acceptable to construct the cycling lane and avoid negative reactions on the building permit (= influence on the implementation of the measure) but can also motivate people to start cycling more using the measure (with a positive influence on the impact of the measure).

Complete Table 13 with the following information:

- Ranking: put the influences in order of importance
- Impact category: society-people, society-governance, transport system, economy, energy and environment.
- Impact aspect: e.g. awareness, bike availability, transport safety, economic development, noise, etc.
- Qualitative data: if available any data showing the influence of the supporting activities on the impact of the measure can be added here in bullet points.
- Qualitative score: O = None * = Poor ** = Satisfactory ***= Excellent
- Motivation: explain in bullet points the qualitative score.

Give additional comments if needed.

Example

Ranking	Impact category	Impact aspect	Quantitative data	Qualitative score	Motivation
1	Society-people	Awareness, Acceptance	Focus group (26 participants)	**	The discussion during the focus groups led to an increased acceptance of the measure by the participants and motivation to change their transport behaviour by leading a more car-independent lifestyle
Scores: O = None * = Limited ** = Significant *** = High					

Table 13 : Assessment of the influence of the supporting activities on the impact of the measure. Example from **PORTIS, 2ABZ2 - Redesigning Collective Travel**.

4.4 Lessons learned on the Supporting Activities

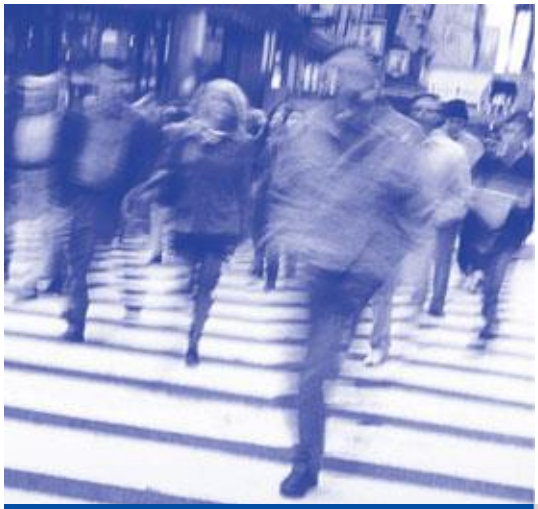
Draw conclusions on the importance of supporting measures to have a positive influence on the implementation process and the impact of the measure. Synthesise the findings and highlight some specific key elements.

5 Lessons learned during this reporting period

Based on the previous chapters of the PER, summarise the main lesson learned in relation to the implementation process.

ANNEX 6

Financial and Cost Benefit Analysis (FA – CBA)



2020 CiViTAS
Cleaner and better transport in cities

SATELLITE

CBA guidelines

Quick scan financial and cost benefit analysis

Deliverable No.:	Annex of D2.4
Project Acronym:	SATELLITE
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2020 CiViTAS
Cleaner and better transport in cities
SATELLITE

THE CIVITAS INITIATIVE
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Abstract

This document describes the methodological guidelines which are proposed for the financial and/or social Cost Benefit Analysis (CBA) for selected Civitas measures. The goal of this document is threefold:

- Firstly, it gives an insight in **how a financial analysis/CBA can be made**. It explains the different steps and methodology; and provides some key values which can be used;
- Secondly, it gives an **overview of the different effects** which should be included when making a CBA;
- Thirdly, we provide some **key examples of typical Civitas measures** which can serve as a source of inspiration.

The objective of this document is to provide a **practical guide** which can be used by different project partners or city administrations. Given the setting of the measures, we propose to rely on EU guidelines and key values as much as possible. **These guidelines are not intended to be prescriptive**. If national guidelines and/or practices or key values exist, these are also a valid option.

Project Partners

Organisation	Country	Abbreviation
Transport & Mobility Leuven	B	TML

Document History

Date	Person	Action	Status	Diss. Level
20.1.18	Eef Delhaye	Draft version	draft	
26.1.18	Dirk Engels	Review	draft	PEM
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06.4.20	Evelyn De Wachter	Update Final draft	draft	

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

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

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List of abbreviations

B/C ratio	Benefit Cost ratio
CBA	Cost Benefit Analysis
CNG	Compressed Natural Gas
CO_2	Carbon Dioxide
DCF	Discounted Cash Flow
ENPV	Economic Net Present Value (ENPV)
ERR	Economic Rate of Return
FNPV(I)	Financial Net Present Value of Investment
FNPV(K)	Financial Net Present Value of Capital
FRR(I)	Financial Rate of Return of the Investment
FRR(K)	Financial Rate of Return of Capital
GHG	Greenhouse Gas
HDV	Heavy duty vehicles
IWW	Inland waterways transport
LDV	Light duty vehicles
LPG	Liquefied Petroleum Gas
NOx	Nitrogen Oxides
NPV	Net Present Value
O&M	operate and maintain
PM	particulate matter
pkm	passenger-kilometre
PPP	public-private partnership
SCBA	Social Cost Benefit Analysis
SOx	Sulphur Oxides
tonkm	tonne-kilometre
vkm	vehicle-kilometre

1 Introduction

1.1 Reading guide

This document is structured as follows. First, we briefly discuss the goal and idea of conducting a financial analysis/social cost benefit analysis and the difference between both. Next, we discuss the different steps needed to conduct a financial analysis. In section 3, we provide the road map for accomplishing a social cost benefit analysis. Possible key values to use are included within this road map. The annexes provide three examples of typical CIVITAS measures which could be subject to a financial analysis/CBA. For one of the examples, the Excel used to perform the analysis is also provided.

1.2 Introducing the concepts

This work fits within the evaluation framework developed within SATELLITE. Different evaluation frameworks and concept exist next to each other, each with their own merits.

Earlier work focussed mainly on evaluating measures using different sets of indicators. The advantage of such a set is that a broad range of impacts can be taken into account. The drawback is that it is more difficult to make a trade-off between impacts.

A cost effectiveness analysis (CEA) takes the viewpoint of one main impact. For example, for different measures the cost of reducing one tonne CO2 can be compared. Or the cost of reducing one accident.

A social cost benefit analysis (CBA) puts all impacts to the same nominator (money) making it easier to see the trade-offs between different effects. With the help of one indicator one can assess if a measure/project is economically viable for society as whole. On the other hand, there are some impacts which are not easily monetised and hence might not be included in the CBA.

While a CBA looks at society as a whole, a financial analysis focusses on the cash flows (costs and revenues) to determine if a project is financially viable from the standpoint of the operator. The financial analysis also provides information on whether a project is financially viable with and without funding.

The general idea behind the evaluation framework is that all CIVITAS measures be evaluated using a set of indicators. For most measures, given the European support is involved, a financial analysis would be a further necessary evaluation. For a selection of measures, a more detailed analysis using CBA would be recommendable. The figure below gives an overview of this idea.

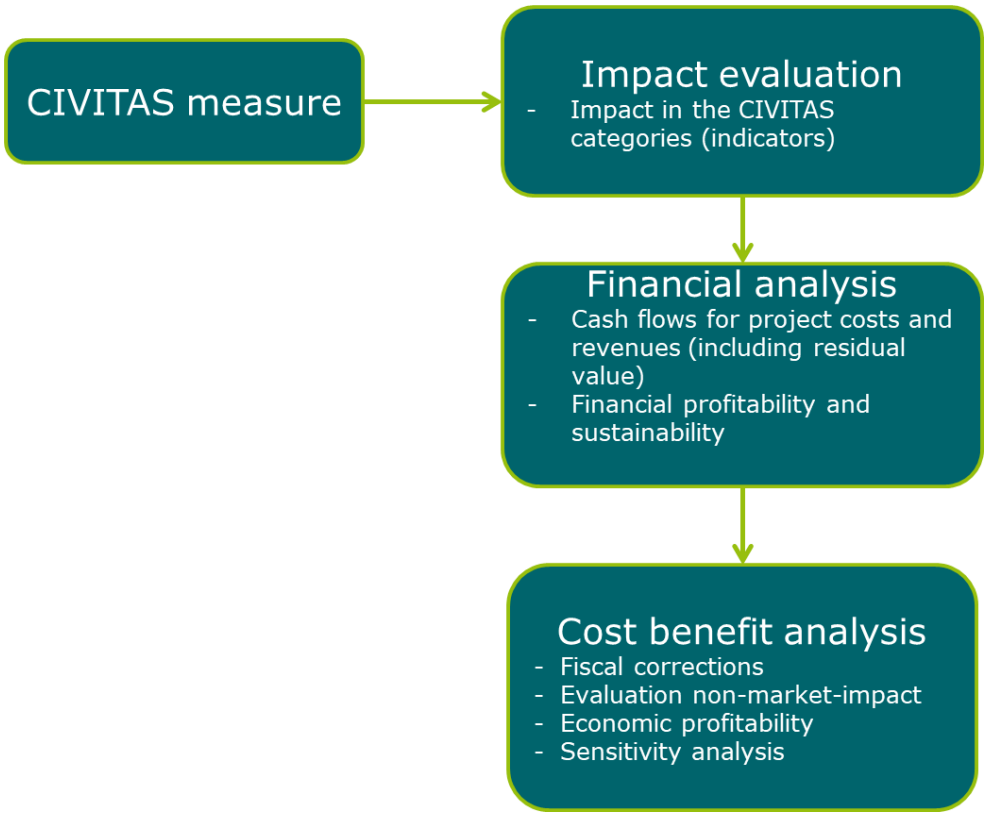

Figure 1: Different steps possible within the evaluation process

1.2.1 Financial analysis

A financial analysis is carried out in order to:

- Assess the project profitability for the project owner and some key stakeholders;
- Outline the cash flows which underpin the calculation of the socio-economic costs and benefits.

We follow the Discounted Cash Flow (DCF) method and focus on two[1] indicators:

1) Financial return on investment (FNPV(I) and FRR(I))

The financial return on investment takes into account

- Total investment costs (hence the cost of the land, the buildings, the equipment, etc.).
- Total operating costs and revenues.

[1] A third indicator could be the "financial sustainability" of a project which focusses on the risk of running out of funds, both during the investment as well as in the operational stages.

Hence the financial net present value of investment (FNPV(I)) and the financial rate of return of the investment (FRR(I)) compare investment costs to net revenues. This is a measurement of the extent to which the project net revenues are able to repay the investment, **regardless of the sources or methods of financing**. A project with a positive financial net present value has enough revenue to cover the investment and the operating costs.

2) Financial return on capital (FNPV(K) and FRR(K))

The financial return on capital takes into account

- Cost of financing (hence the loan repayments, the interest, the private equity and public contribution).
- Total operating costs and revenues.

The objective of the return on national capital calculation is to examine the project performance from the perspective of the operator ('after the grant'). The idea being that a project might not be financially viable for a (private) operator (negative financial return on investment), but that a subsidy could overcome this problem. A subsidy could lead to a positive financial return on capital, making the project viable for a (private) operator. The reason is that, with a subsidy, the revenues would only need to cover part of the investment costs – the part not covered by subsidies.

1.2.2 Social Cost Benefit Analysis

In a CBA the social costs and benefits connected to a project are inventoried in a systematic way. The word "social" indicates that the costs and benefits are being analysed and valued from the viewpoint of society as a whole. Hence, not only the financial-economic benefits are analysed. Other items which have a value for society, such as environment, mobility and safety are equally taken into account.

The result of a CBA is an overview of the possible effects over time. These effects are discounted into their present value today. This way, different effects occurring at different times can be summed and the net benefit for society can be calculated using the economic net present value (ENPV) and the economic rate of return.

As probably not all elements can be quantified in monetary terms it is always beneficial to add a qualitative appraisal to a social cost benefit analysis. Within the CBA itself attention can be drawn to these elements by including them in the summary table as "pro memory".

1.3 Goal of this work and main sources

The goal of this work is to provide a set of practical guidelines which can be used in the field to conduct this financial and/or cost-benefit analysis for the CIVITAS measures selected for an in-depth evaluation. These guidelines don't prevent the use of other (national) methodologies or key values. They are simply guidelines.

Three examples are provided, but no excel template. The reason for this is that we expect that the type of information available will be very different among the different projects. If there is a need to use a template or to build up your own, we propose to use or start from the one provided by INEA at

http://ec.europa.eu/inea/sites/inea/files/cba_template_cef_blending_call.xlsx

Different countries do have different habits when executing a CBA and several countries have national or even regional guidelines. Given the EU setting – CIVITAS measures receive European support – we will adhere to the European guidelines as closely as possible. These are:

- DG Regio (2014) Guide to Cost-Benefit Analysis of Investment Projects. Economic appraisal tool for Cohesion Policy 2014-2020[2]
- CPB (2013), Algemene leidraad voor maatschappelijke kosten-batenanalyses[3]
- OECD (2011), Improving the Practice of Transport Project Appraisal, ITF Round Tables, No 149, OECD Publishing[4]
- Ricardo-AEA (2014) Update of the Handbook on External Costs of Handbook[5]
- CE Delft (2008) Handbook on estimation of external costs in the transport sector[6]. An updated 2019 version[7] is now also available.
- HEATCO- FP6: Harmonised European Approach for Transport Costing and Project Assessment[8]

[2] https://ec.europa.eu/regional_policy/en/information/publications/guides/2014/guide-to-cost-benefit-analysis-of-investment-projects-for-cohesion-policy-2014-2020
[3] https://www.cpb.nl/sites/default/files/publicaties/download/cpb-pbl-boek-10-algemene-leidraad-voor-maatschappelijke-kosten-batenanalyse.pdf
[4] https://www.oecd.org/publications/improving-the-practice-of-transport-project-appraisal-9789282103081-en.htm
[5] https://ec.europa.eu/transport/sites/transport/files/handbook_on_external_costs_of_transport_2014_0.pdf
[6] https://ec.europa.eu/transport/sites/transport/files/themes/sustainable/doc/2008_costs_handbook.pdf
[7] https://ec.europa.eu/transport/sites/transport/files/studies/internalisation-handbook-isbn-978-92-79-96917-1.pdf
[8] https://trimis.ec.europa.eu/project/developing-harmonised-european-approaches-transport-costing-and-project-assessment#tab-results

2 Road map financial analysis[9]

In this section we describe the different steps needed to calculate the financial indicators. In order to help the understanding of these steps, we illustrate the different steps with some examples.

2.1 Financial indicators and steps to calculate

As mentioned, we focus on two types of financial indicators. The figure below shows which elements are taken into account for these two indicators.

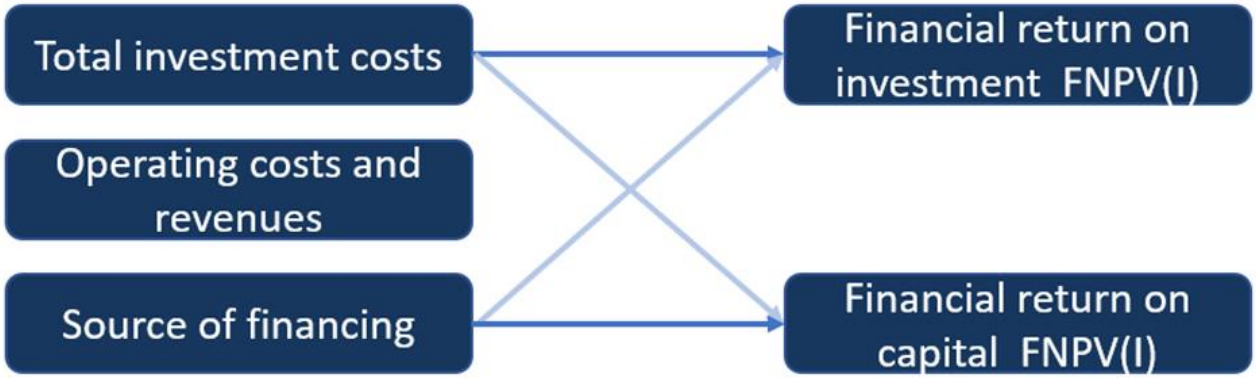

Figure 2: Elements part of the financial indicators

An incremental approach is considered. This means that **only additional** costs and revenues- which would not happen without the project- should be taken into account.

Hence, **five steps** have to be taken to calculate the two financial indicators:

1. Development of a reference scenario
2. Determination of the total investment costs
3. Calculation of operating costs and revenues
4. Determining the sources of finances.
5. Calculation of the indicators.

[9] This section relies heavily on the input provided by the DG Regio guidelines and hence should be seen as citation (although summarized).

2.2 General rules

Before discussing these steps into more detail, we point out some general rules which should be adopted:

- **Only cash inflows and outflows are considered in the analysis**. All elements which do not correspond to an actual money flow such as depreciation, reserves, price and technical contingencies or other accounting items are disregarded.
- Financial analysis should, as a general rule, be carried out **from the point of view of the "owner" of the measure** – this is the identity investing in the measure. This can be the city, a public transport operator, etc. If there are multiple investors, a consolidated financial analysis, which excludes the cash flows between the investors, should be carried out to assess the actual profitability of the investment, independent of the internal payments. This is also relevant in the case of concessions.
- An **appropriate Financial Discount Rate (FDR)** is adopted in order to calculate the present value of the future cash flows. The financial discount rate reflects the opportunity cost of capital. The European Commission's reference parameter (in real terms) suggested for this is **4%**. Values differing from the 4 % benchmark may, however, be justified on the grounds of international macroeconomic trends and conjunctures, the Member State's specific macroeconomic conditions and the nature of the investor and/or the sector concerned.
- Project cash-flow forecasts should cover **a period appropriate to the project's economically useful life** and its likely long term impacts. The number of years for which forecasts are provided should correspond to the project's time horizon (or reference period). The choice of time horizon affects the appraisal results. The proposed reference periods are shown in Table 1. These values should be considered as **including the implementation period**. In the case of unusually long construction periods, longer values can be adopted.
- The financial analysis should usually be carried out in **constant (real) prices**, i.e. with prices fixed at a base-year.
- The analysis should be carried out **net of VAT**, both on purchase (cost) and sales (revenues), if this is recoverable by the project promoter. On the contrary, when VAT is not recoverable, it must be included.

Sector		Reference period (years)
Infrastructure	Railways	30
	Roads	25-30
	Ports and airports	25
	Urban transport	25-30
	Cycling infrastructure	20
Energy		15-25
Connections	Broadband	15-20
	Apps/internet	5
Research and innovation		15-25
Other sectors		10-15

Table 1: Reference period for different sectors. Source: based on ANNEX I to Commission Delegated Regulation (EU) No 480/2014[10].

2.3 Discussion of the calculation steps

2.3.1 Reference scenario

A financial analysis (as does the SCBA) compares a scenario with-the-project with a counterfactual baseline scenario without-the-project. The incremental approach requires that a **counterfactual scenario is defined as what would happen in the absence of the project**. In cases where a project consists of a completely new asset, e.g. there is no pre-existing service or infrastructure, the without-the-project scenario is one with no operations. In cases of investments aimed at improving an already existing facility, it should include the costs and the revenues/benefits to operate and maintain the service at a level that it is still operable (Business As Usual (BAU)) or even small adaptation investments that were programmed to take place anyway (do-minimum). This can be based on, for example, historical cash-flows (at least previous three years), where relevant.

The choice between BAU or do-minimum as counterfactual should be made case by case, on the basis of the evidence about the most feasible, and likely, situation. If uncertainty exists, the BAU scenario shall be adopted as a rule of thumb. If do-minimum is used as counterfactual, this

[10] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0480&from=en

scenario should be both feasible and credible, and not cause undue and unrealistic additional benefits or costs.

For example, a current urban bus fleet consists of 80% diesel vehicles and 20% hybrid vehicles. In the project scenario electric busses will be bought. Possible reference scenarios could be

- *Keeping a stock of 70%/30% hybrid busses*
- *A gradual increase of hybrid busses in the stock.*

An incorrect assumption would be that only diesel busses are bought in the reference scenario. Such reference scenario would overestimate the environmental benefits of the project.

2.3.2 Determination of the total investment costs

The first step in the financial analysis is the analysis of **the amount and breakdown over the years of the total investment costs**. Investment costs include both the initial investment and the replacement costs.

The initial investment includes the capital costs of all the fixed assets (e.g. land, constructions buildings, plant and machinery, equipment, etc.) and non-fixed assets (e.g. start up and technical costs such as design/planning, project management and technical assistance, construction supervision, publicity, etc.). Cost breakdown over the years should be consistent with the physical realisations envisaged and the time-plan for implementation.

*Given that we consider an incremental approach, only the additional investment costs need to be taken into account. For example, when buying an electric bus only the additional costs compared to buying a hybrid/diesel bus should be taken into account. This is, an electric bus costs about 700,000 euro and a hybrid bus about 450,000 euro and a conventional diesel bus 280,000 euro. Assuming a reference scenario of 70% diesel and 30% hybrid busses, this means that we need to take into account an additional investment cost of 700,000-(0.7*280,000+0.3*450,000)=700,000-331,000=369,000 euro.*

Replacement costs includes costs occurring during the reference period to replace short-life machinery and/or equipment, e.g. engineering plants, filters and instruments, vehicles, furniture, office and IT equipment, etc. It is however preferable **not** to include large replacement costs close to the end of the reference period. When a specific project asset needs to be replaced shortly before the end of the reference period it is recommended to shorten the reference period to match the end of the lifetime of the large asset that needs replacing.

A residual value of the fixed investments must be included within the investment costs account for the end-year. The residual value reflects the capacity of the remaining service potential of fixed assets whose economic life is not yet completely exhausted. The latter will be zero or negligible if a time horizon equal to the economic lifetime of the asset has been selected. This residual value should be calculated as the net present cash flows in the remaining life years of operation. If there is no revenue or if the expected lifetime of the project is very long (as is the case for some transport infrastructure), the residual value of an asset should be calculated using standard accounting depreciation formulas.

The easiest way to calculate the residual value is to assume a linear depreciation. Assume that an electric bus cost 700,000 euro and has a lifetime of 15 years. If the analysis takes place with a reference period of 10 years, a residual value of (15-10)(700,000/15) = 5*46,666=233,333 euro should be included in year 10 if in the reference no bus would have been bought. If in the reference a hybrid bus would have been bought, only the difference in residual value has to be taken into account. With the example of above and assuming an equal lifetime for the three bus types: (15-10)*(369,000/15) = 5*24,600=123,000 euro.*

2.3.3 Calculation of operating costs and revenues

The second step in financial analysis is the calculation of the total operating costs and revenues (if any).

The operating costs include all the costs to operate and maintain (O&M) the project. Cost forecasts can be based on historic unit costs, when patterns of expenditures on operations and maintenance ensured adequate quality standards. Although the actual composition is project-specific, typical O&M costs include: labour costs for the employer; materials needed for maintenance and repair of assets; consumption of raw materials, fuel, energy, and other process consumables; services purchased from third parties, rent of buildings or sheds, rental of machinery; general management and administration; insurance cost; quality control; waste disposal costs; and emission charges (including environmental taxes, if applicable). Cost of financing (i.e. interest payments) must **not** be included within the O&M costs.

The project revenues are defined as the 'cash in-flows directly paid by users for the goods or services provided by the operation, such as charges borne directly by users for the use of infrastructure, sale or rent of land or buildings, or payments for services'.

Transfers or subsidies (e.g. transfers from state or regional budgets or national health insurance), as well as other financial income (e.g. interests from bank deposits) shall not be included within the operating revenues for the calculations of financial profitability.

The net revenues of the project equal to revenues minus the operating costs. Note that these might be negative. Net revenues are calculated for each year until the time horizon.

Again an incremental approach is taken.

In the example of buying an electric bus this means that the revenues from operating the bus will not change as we can assume that the electric bus as such will not lead to an increase in demand. Operational costs will change as

- *Maintenance costs might change*
- *Energy costs will change*

We assume that the maintenance and energy cost of an electric bus is 3,000 euro/year lower than for a conventional diesel bus/hybrid bus.

Note that elements such as additional training of the staff (if applicable) should be included in the investment costs.

2.3.4 Determining the sources of finances.

The determination of the sources of financing is important to calculate the financial viability of the capital. Hence the next step is the identification of the different sources of financing that cover the investment costs. Within the framework of EU co-financed projects, the main sources can be:

- Union assistance;
- national public contribution;
- project promoter's contribution (loans or equity), if any;
- private contribution under a public-private partnership (PPP), (equity and loans) if any.

Here, the loan is an inflow and it is treated as a financial resource coming from third parties.

For the example we will assume that 20% of the purchase cost of the bus is subsidised.

2.3.5 Calculation of the indicators.

1) Financial Return on Investment

The financial net present value on investment (FNPV(I) is defined as the sum that results when the expected investment and operating costs of the project (discounted) are deducted from the discounted value of the expected revenues:

$$FNPV(I) = \frac{S_1}{(1+i)^1} + \frac{S_2}{(1+i)^2} + \frac{S_3}{(1+i)^3} + \cdots + \frac{S_n}{(1+i)^n}$$

where: S_t is the balance of cash flow at time *t and i* is the financial discount rate.

In our example of buying one electric bus this becomes:

	Year1	Year2	Year3	Year4	Year5	Year6	Year7	Year8	Year9	Year10	
Investment cost	-369000										additional cost of buying an electric bus
Residual value										123000	residual value assuming linear depreciaton and lifetime of 15 y
Operational revenues	0	0	0	0	0	0	0	0	0	0	assume no impact on demand
Operational costs	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	assume saving of 3000 euro/year
St	-366000	3000	3000	3000	3000	3000	3000	3000	3000	126000	Sum of above

With FNPV(I) equal to -247 380 euro if i=4%.

One could also calculate the financial rate of return on investment. This is defined as the discount rate that produces a zero FNPV, i.e. FRR is given by the solution of the following equation:

$$0 = \sum \frac{St}{(1+FRR)^t}$$

The FNPV(I) is expressed in money terms (EUR), and must be related to the scale of the project. The FRR(I) is a pure number, and is scale-invariant. Mainly, the examiner uses the

FRR(I) in order to judge the future performance of the investment in comparison to other projects, or to a benchmark required rate of return.

In excel one uses the formula “IRR” which you apply to the series of S_i.

In our example the FRR(I) equals -10% making this a financially not viable project.

2) Financial return on capital

The return on national capital is closely related to the return on investment. The difference is that instead of the investment costs, the sources for financing - with the exception of grants - are taken into account. The financial net present value of capital, FNPV(K), is the sum of the net discounted cash flows that accrue to the national beneficiaries (public and private combined) due to the implementation of the project. The corresponding financial rate of return on capital, FRR(K), of these flows determines the return in percentage points. Subsidies granted to cover operating costs shall be **excluded** because they are transfers from one to another national source.

*In our example, we assumed that 20% of the cost of an electric bus was subsidized. The other 80% is paid with own equity. This means that 20%*700,000 euro = 140,000 euro should not be taken into account. We subtract this amount from the incremental investment cost of 369,000 euro and are left with a cost of 229,000 euro for the operator.*

	Year1	Year2	Year3	Year4	Year5	Year6	Year7	Year8	Year9	Year10	
Investment minus subsidy	-229000										additional cost of buying an electric bus minus the subsidy
Residual value										123000	residual value assuming linear depreciaton and lifetime of 15 y
Operational revenues	0	0	0	0	0	0	0	0	0	0	assume no impact on demand
Operational costs	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	assume saving of 3000 euro/year
St	-226000	3000	3000	3000	3000	3000	3000	3000	3000	126000	Sum of above

The FNPV(K) (at 4%) equals -112 765 euro and the FRR(K) -5%. Hence the financial indicators improved, but even with funding the project is still not financially viable.

While the FRR(I) is expected to be very low, or negative for the public investments to be financed with EU funds, the FRR (K) will be higher and, in some cases, even positive. On the other hand, for public infrastructure, a negative FNPV(K) after EU assistance does not mean that the project is not desirable from the operator’s or the public’s perspective and should be cancelled. It just means that it does not provide an adequate financial return on national capital employed, based on the benchmark applied (i.e. 4 % in real terms). This is actually a quite common result, even for revenue generating projects receiving EU assistance. In such cases it is particularly important to ensure the **financial sustainability** of the project.

2.4 Summary elements financial indicators

Table 2 summarizes which elements are included in each of the indicators and which are not.

- ‘-‘ represents a cost (negative)
- ‘+” represents an income (positive)
- n.i. means “not to be included”

		FNPV (I)	FNPV (K)
Investment cost	Start-up and technical costs	-	n.i.
	Land	-	n.i.
	Buildings	-	n.i.
	Equipment	-	n.i.
	Machinery	-	n.i.
	Replacement costs	-	-
	Residual value	+	+
Operating costs	Personnel	-	-
	Energy	-	-
	General expenditures	-	-
	Intermediate services	-	-
	Raw materials	-	-
Other outflows	Loan repayments	n.i.	-
	Interests	n.i.	-
	Taxes	n.i.	n.i.
Inflows	Revenues	+	+
	Operating subsidies	n.i.	n.i.
Sources of financing	Public contribution	n.i.	-
	Private equity	n.i.	-
	Grant		n.i.

Table 2: Summary elements financial analysis

3 Road map CBA

As discussed in the Introduction we propose one common methodology – which is as close as possible to the European guidelines such as "Guide to COST-BENEFIT ANALYSIS of investment projects, Economic appraisal tool for Cohesion Policy 2014-2020" and „Better Regulation Guidelines and Toolbox" van de EC[11].

For the practical execution of a CBA we propose to follow the different steps as shown in the figure below. This is consistent with, but a more simplified approach than described in the EU guidelines and other national guidelines[12].

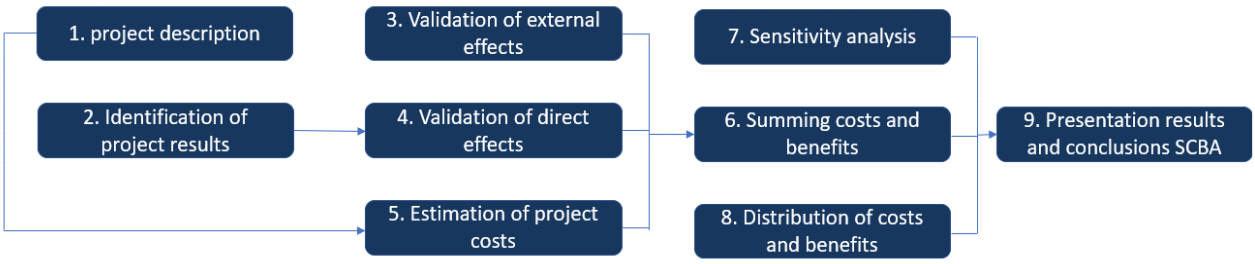

Figure 3: Road Map CBA

For the CBA we do not provide an example for each step as the calculations may vary according to the information available for a project. For examples we refer to Annex 1.

3.1.1 Step 1: Project description

As in the financial analysis an incremental approach is taken for the CBA. As we are dealing with projects which have been implemented, the project scenario is clear. Hence more importantly is to have a good definition of the reference scenario. This counterfactual scenario describes what would happen in absence of the project. It can either be a business-as-usual scenario or a do-minimum (cf. Section 5.1).

3.1.2 Step 2: Identification project effects

The goal of this step is to list the expected effects with and without the project. Within this step no calculations are made. The goal is to identify the most important effects and to describe them qualitatively. This list can be based on the indicators listed in the CIVITAS Evaluation Framework.

[11] http://ec.europa.eu/smart-regulation/guidelines/index_en.htm
[12] We will, for example, not consider different background scenarios; propose corrections for shadow pricing of investment costs, etc.

Given that we are dealing with transport projects, we can classify most of the project effects (which can be taken into account in a SCBA) into the following four groups

- Direct effects
- (Indirect effects)
- External effects
- Project costs

The **direct effects** on the transport system follow from the differences in flows and costs (time and monetary) of transport in the reference and the project alternative. For most projects the following direct effects could be relevant:

- Changes in monetary transport costs
- Changes in travel time
- Changes in travel time reliability

The **indirect effects** are the effects of the reactivation on the wider economy. The idea is that some projects lower the transport costs, which on their turn increase the competitiveness of companies, increasing sales, production and employment. Goods and services become cheaper, increasing the purchasing power of the consumer. Note that these wider economic effects also include shifts in economic activity between regions/cities. Sometimes employment effects are also included in this group. However, this should only be taken into account as a benefit if it is a new activity, and hence not replacing another project (private or public). Given the scale of the projects and the danger of double counting when including indirect effects, we propose **not to include indirect effects** in the analysis.

The **external effects** describe the impact of the project on the human environment and nature. They are called external as they are not compensated for. One can distinguishes between three types of external effects

- The external effects of the infrastructure itself (use of space, visual intrusion, etc.)
- The external effects linked to the use of the infrastructure and the changes in transport flows (air pollution, noise, traffic safety, etc.)
- The impact on the environment caused by possible changes in location of economic activity

For this type of CBA we will only take into account external effects linked to the use of the project, this is,

- Change in emissions: air pollutants and greenhouse gasses (CO_2, NOx, SOx, PM)
- Change in noise
- Change in accidents

The **project costs** are the difference between the project alternative and the reference in

- investment costs
- operating costs
- residual value

This information should be **consistent** with the information used in the financial analysis.

For the example of buying an electric bus we expect the following effects

- *Direct effects: we assume that there is no impact on the fare price, nor on the time schedule and the reliability. Hence there are no direct effects*
- *External effects: the most important external effects are the reduction in emissions (air pollutants and greenhouse gasses) and in noise. Given our reference scenario we should compare emissions with the weighted average of the emissions of a diesel and a hybrid bus. We assume that there is no effect on accidents.*
- *Project costs: the electric bus requires a higher investment cost. On the other hand there is a saving in maintenance and fuel cost.*

3.1.3 Step 3: Valuation direct effects

In transport projects the main direct benefits are measured by the change in consumer and producer surplus.

The **consumer surplus**, defined as the excess of users' willingness-to-pay over the prevailing generalised cost of transport for a specific trip. The generalised cost of transport is usually computed as the sum of monetary costs borne (e.g. tariff, toll, fuel, etc.) plus the value of the travel time calculated in equivalent monetary units. Any reduction of the generalised cost of transport for the movement of goods and people determines an increase in the consumer surplus. The main items to be considered for the estimation of the consumer surplus are:

- fares paid by users;
- travel time;
- road users Vehicle Operating Costs.

The **producer surplus**, defined as the revenues accrued by the producer (i.e. owner and operators together) minus the costs borne. The change in the producer surplus is calculated as the difference between the change in the producer revenue (e.g. rail ticket income increase) less the change in the producer costs (e.g. train operating costs increase). This might be particularly relevant for public transport projects or toll road projects, especially if the project is expected to feature significant traffic (generated or induced) or a substantial change in fares. One should be careful for double counting changes in operating costs. The change in operating costs related to the investment itself (for example, higher maintenance cost due to a new fuel technology) are

included in the project costs. The operating costs which change **due to changes in demand** are included in this element. For example, if the investment leads to such a high demand that frequencies have to increase. The main items to be considered for the estimation of the producer surplus are:

- fares paid by users (and received by the producer); and
- producer operating costs.

This implies that the economic analysis of transport projects can be structured differently depending on two main situations:

- In cases where the project is not expected to change traffic volumes, there is no need to estimate the changes of the consumer and producer surplus because the fares paid by users will always be cancelled out (the cost for the consumer is the income for the producer). A simplified approach can therefore be adopted and the analysis will just rely on the estimation of the net effects on users, in terms of travel time savings and, for road projects, Vehicle Operating Cost savings.
- In cases where the project is expected to change traffic volumes or when transport pricing strategies are introduced or expected to be changed, the fares paid by users will not be cancelled out. The analysis will therefore consist of estimating the net impacts on both the consumer and producer surplus. This implies that fares need to be separately accounted for, as well as all the changes in the producer operating costs (if not already captured in the financial analysis - as it happens when the analysis is not consolidated).

In practice, the producer surplus will often be assumed to be zero and the focus will be on changes in consumer surplus due to improvements in travel time/reliability/…

Figure 4: Graphical representation of the consumer surplus shows how the consumer surplus can be calculated if traffic volumes change. Firstly, the measure causes a decrease in the generalised price from P0 to P1 (vertical axis). Hence either there is a time gain or a cost reduction. This leads to a corresponding increase in volume from Q0 to Q1 (horizontal axis). The direct benefit for the users then equals the grey area: the benefit for the current users (P0P1AB) and the benefit for the new users (ABC).

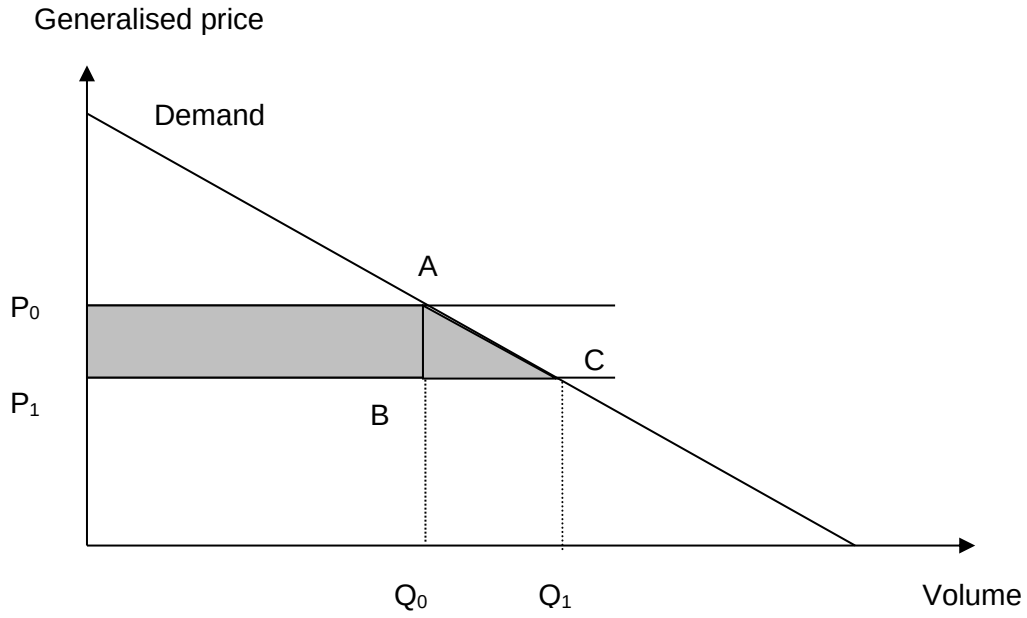

Figure 4: Graphical representation of the consumer surplus

If the generalized cost on other transport markets remains more or less the same, there is no need to calculate the effects on the other transport markets. The idea is that due to the decreased generalized costs in one mode, transport will shift from other modes. The benefit of this modal shift is included in the above described rule of half. We assume that this will always be the case for the CIVITAS measures.

In our example the direct effects are zero.

Input needed

Changes in travel "behaviour" (vehicle km for all modes by preference) and changes in travel time

- from project

Private costs different vehicle types and the value of time

- from project
- EU default values (but deviations possible)

Table 3 shows the average operating costs for different modes. These are EU averages but can be transferred to national values using the conversion factor presented in Annex 3. To come to a national value one simply has to multiply the number in the table below with the national factor. This way differences in purchasing power are accounted for. Note that the fares can be different from the operating costs, but we assume that these will be known by the project.

Mode (euro/vehicle km*)	Euro/ vkm – EU25	Euro/pkm or euro/tonkm	Occupancy rate (passengers/vehicle)
Passenger cars	0.51	0.33	1.55
Buses	2.15	0.24	16.18
Coaches	1.47	0.08	13.55
HDV[13]	1.03	0.17	6
LDV[14]	1.25	6.10	0.2
Rail (passenger and freight)	30.21	0.21 (passenger)	147 passengers
IWW[15]		0.13 (freight)	227 tonnes

Table 3: Average transport operating cost per vehicle kilometres (vkm), passenger kilometres (pkm) and ton kilometres (tonkm) for 2015**.** Source: http://ec.europa.eu/ten/transport/studies/doc/compete/compete_report_en.pdf - updated to 2015 prices. * for rail: euro/trainkm

To come to a monetized time costs, the time gains and losses are valued using a value of time. This value of time is usually based on willingness-to-pay studies. Table 4 shows some average key values.

[13] Heavy duty vehicles
[14] Light duty vehicles
[15] Inland waterways transport

		Euro/hour
Passenger transport (euro/hour/passenger)	Business	47.56
	Commuting	10.13
	Other	8.96
	All motives	**13.55**
Freight transport (euro/hour/vehicle)	Truck	41.04
	Rail	1188.03
	Inland waterways	75 (waiting for quay) 324 (waiting for lock/bridge)

Table 4: Value of time in euro per hour, prices 2015 – for freight based on de Jong, G. et al (2014)[16].All motives calculated as weighted average using pkm from TREMOVE per modi and trip purpose as a weight.

3.1.4 Step 4: Valuation external effects

External effects are those effects for which there is no market and which are external to the user. In the end the society as a whole pays. For this quick scan SCBA we only consider external effects related to the use of the project/infrastructure:

- Emissions
- Noise
- Accidents

Hence not land use, influence water household, intrusion of space, etc. These could be included in the CBA table as a pro memory post. Note that congestion is already taken into account when calculating the direct effects.

For the calculation of external costs different approaches can be taken, depending on the information available.

Input needed

[16] de Jong, G. et al (2014), New SP-values of time and reliability for freight transport in the Netherlands. Transportation Research E 64: 71-87 – prices updated to price level 2015

Changes in travel “behaviour” (vehicle km for all modes by preference)

- from project

Marginal external costs for different vehicle types

- from project: change in fuel/energy consumption, change in emissions/emission factors, change in accident risk, change in noise level
- EU default values (but deviations possible)
  - defaults for valuation of emissions, accidents and noise
  - defaults for marginal external costs (directly related to vkm)

We first give some default values for the valuation of the different external costs. Next, we give default values for the marginal external costs per vkm.

Emissions

Different sources are possible as an input to calculate the effect on emissions. Dependent on the information available, different valuations have to be used.

- Changes in fuel/energy consumption for different fuel types. If this information is available, it is possible to calculate the effect on greenhouse gasses. However, it would not be possible to calculate easily the emissions of air pollutants as no key figures are available as this depends too much on the fuel technology used.
- Changes in emissions in tonnes/year. If this information is available, the emissions in tonnes/year should be multiplied with the respective valuations in euro/tonne.
- Changes in vehicle km/year of all relevant modes. The effect on emissions can then be calculated by multiplying the change in emissions with the marginal external emission cost per vkm.

We provide some possible default values below.

Energy consumption

If the change in energy consumption is known, the effect on CO_2 can be calculated. Table 5 provides the kg of CO_2 emitted per unit of consumption. Note that for 100% biofuels it is agreed that the CO_2 emissions are zero. This is not the case in reality.

Fuel type	Kg of CO_2 per unit of consumption
Natural gas	3142 per tonne

Diesel fuel	2.68 per litre
Petrol	2.31 per litre
LPG	1.51 per litre
100% biofuel	0

Table 5: CO_2 emissions per unit of fuel consumed. Source: based on https://people.exeter.ac.uk/TWDavies/energy_conversion/Calculation%20of%20CO2%20emissions%20from%20fuels.htm

For electric vehicles the following emission factors can be used. The emission factors differ between countries as the electricity mix is different. Hence, over time, these figures will also change. The standard emission factors in tCO_2/MWh_e for the different Member States is given in the Covenant of Mayors Technical Annex[17], and shown in Table 6.

Ricardo-AEA (2014)[5] provides emission factors for air pollutants in g/GJ and their valuation (which is different as they happen at higher altitudes than transport) in annex F of its Handbook.

[17] https://www.eumayors.eu/IMG/pdf/technical_annex_en.pdf

Country	Standard emission factor (t CO_2/MWh_e)
Austria	0.209
Belgium	0.285
Germany	0.624
Denmark	0.461
Spain	0.440
Finland	0.216
France	0.056
United Kingdom	0.543
Greece	1.149
Ireland	0.732
Italy	0.483
Netherlands	0.435
Portugal	0.369
Sweden	0.023
Bulgaria	0.819
Cyprus	0.874
Czech Republic	0.950
Estonia	0.908
Hungary	0.566
Lithuania	0.153
Latvia	0.109
Poland	1.191
Romania	0.701
Slovenia	0.557
Slovakia	0.252
EU-27	**0.460**

Table 6: CO_2 emissions for electricity consumption. Source: the Covenant of Mayors Technical Annex[17].

Valuation pollutants

For the valuation of Greenhouse Gases, Ricardo-AEA (2014) proposes a central value of **90 euro/t CO_2 equivalent**.

The valuation of air pollutants from electricity production in euros per tonne, for different Member States, is listed in Table F-4 of Ricardo-AEA (2014), and given in Table 7 for 2015 price levels. See Annex 2 on how to update these (2015) price values to the year of interest.

	NOx	NMVOC	SO2	PM2.5 (exhaust and non-exhaust)	PM			
Country	**All areas**	**All areas**	**All areas**	**Urban**	**Suburban**	**Interurban**	**Motorway**	**All areas**
Austria	18,668	2,187	13,672	232,292	73,268	40,788	40,788	46,963
Belgium	11,801	3,486	14,712	224,265	65,241	37,572	37,572	72,662
Bulgaria	15,611	817	13,606	229,911	70,888	37,652	37,652	40,184
Croatia	16,361	1,965	13,303	225,488	66,464	34,182	34,182	37,058
Cyprus	6,982	1,212	13,602	214,321	55,298	27,044	27,044	27,044
Czech Republic	17,052	1,780	15,241	232,927	73,903	46,472	46,472	52,143
Germany	18,403	2,007	15,678	238,105	79,081	52,471	52,471	69,712
Denmark	7,239	1,654	7,869	203,046	44,022	14,337	14,337	21,255
Estonia	5,639	1,204	9,117	212,969	53,945	16,588	16,588	18,285
Spain	5,361	1,226	7,616	210,878	51,854	15,584	15,584	24,224
Finland	3,594	844	4,868	206,542	47,518	8,956	8,956	10,095
France	14,097	1,831	13,297	228,745	69,721	35,968	35,968	43,482
Greece	4,159	922	8,867	213,679	54,655	20,876	20,876	26,322
Hungary	21,147	1,695	15,496	239,638	80,615	50,983	50,983	55,130
Ireland	6,143	1,510	7,516	210,239	51,215	17,833	17,833	20,099
Italy	11,690	1,341	10,665	213,156	54,132	26,528	26,528	41,409
Lithuania	11,654	1,632	11,821	219,003	59,979	24,914	24,914	27,287
Luxembourg	20,102	3,787	16,312	236,038	77,015	49,344	49,344	62,769
Latvia	8,758	1,619	10,800	216,954	57,931	21,091	21,091	22,985
Malta	2,142	1,088	6,934	105,986	#VALUE!	#VALUE!	#VALUE!	105,986
Netherlands	12,500	2,975	18,078	211,245	52,222	31,813	31,813	77,360
Poland	14,509	1,812	15,590	239,178	80,154	51,292	51,292	56,567
Portugal	2,114	1,132	5,346	212,048	53,024	19,841	19,841	28,574
Romania	24,725	1,940	18,926	250,157	91,133	60,919	60,919	63,755
Sweden	5,667	1,052	5,820	213,252	54,228	15,745	15,745	17,481
Slovenia	17,353	2,133	13,416	232,109	73,086	42,805	42,805	46,755
Slovakia	23,211	1,846	18,505	244,638	85,614	58,354	58,354	60,501
United Kingdom	7,102	1,922	9,928	210,337	51,313	15,149	15,149	45,244
EU	**11,492**	**1,691**	**11,061**	**291,800**	**75,881**	**30,357**	**30,357**	**42,774**

Table 7: Valuation pollutions (euro/kg – prices 2015). Source : Ricardo-AEA, 2014 - updated to price levels 2015.

Marginal external emission costs

Ricardo-AEA (2014) also provides marginal external emission costs for different vehicle types – for different types of roads– including engine and Euro-class (page 39 to 48 for pollution and page 58 to 61 for greenhouse gasses). We provide figures with less detail for cases in which the Euro-class is not known in Table 8. Note that the figures presented in Ricardo-AEA (2014) only take into account direct emissions (exhaust and non-exhaust from tyres, brakes, etc.). The

figures below take into account both direct and indirect (from the production of the fuel) emissions.

		Marginal external emission cost (euro/100 vkm)
Bicycle	traditional	0.00
	electric	0.01
Motorcycle	gasoline	3.09
Car	gasoline	3.39
	diesel	3.42
	CNG	3.14
	LPG	3.07
	electric	0.28
	hybrid	2.09
LDV	gasoline	4.95
LDV	diesel	5.48
HDV 3,5-12 t	diesel	10.67
HDVn +12 t	diesel	15.61
bus	diesel	22.14
coach	diesel	12.99
Passenger train	diesel	142.55
	electric	31.05
Freight train	diesel	603.99
	electric	42.40

Table 8: Marginal external emission costs – euro/100 vkm, prices 2015.
Source: calculations TML

Noise

The valuation of noise is in general very difficult. Information is often not available and noise hindrance can depend not only on the dBA but also on source of the noise. If detailed information is available, the effect on noise can be calculated using the number of households/individuals exposed to different noise levels for the reference and the project scenario. Typical cost factors for noise exposure can be found in Table D-5 of Ricardo-AEA (2014) and shown in Table 9. See on how to update these (2010) price values to the year of interest.

L_{den}, dB(A)	euro/person/year
=51	11
=55	56
=60	114
=65	171
=70	229
=75	379

Table 9: Cost factors (central values) for noise exposure (2015 prices, euro per year per person exposed).Source: based on Ricardo-AEA (2014) – France choses as central EU value, updated to 2015 prices. L_{den}: Level day-evening-night – a measurement of noise exposure. L_{den} is a logarithmic average of the noise levels during the day, the evening and the night.

If this information is not available, the effect on noise can be calculated using the effect on the vkm and the noise cost per vkm. Table 10 provides marginal external noise costs for different vehicle types, different times of the day and traffic type. See Annex 2 on how to update these (2015) price values to the year of interest.

Unfortunately, no default values were found which differentiate according to fuel type. Overall diesel vehicles produce more noise than gasoline and Heavy Goods vehicles (HGV) more than cars. The literature on the noise levels of electric vehicles is mixed. From a certain speed on, electric vehicles will produce the same sound levels as conventional ones (as the sound of the tyres becomes more important). However the threshold found back in literature varies from 50 km/h to even 20 km/h. Hence, it is still not clear what the effect on noise of electric vehicles would be.

Mode	Time of day	Traffic type	Urban	Suburban	Rural
Car	Day	Dense	9.5	0.5	0.1
		Thin	23.1	1.5	0.2
	Night	Dense	17.4	1.0	0.1
		Thin	42.0	2.7	0.4
Motorcycle	Day	Dense	19.1	1.2	0.1
		Thin	46.1	2.9	0.4
	Night	Dense	34.7	2.1	0.2
		Thin	84.1	5.5	0.6
Bus	Day	Dense	47.5	2.6	0.4
		Thin	115.6	7.3	0.9
	Night	Dense	86.7	4.9	0.8
		Thin	210.3	13.7	1.6
LDV	Day	Dense	47.5	2.6	0.4
		Thin	115.6	7.3	0.9
	Night	Dense	86.7	4.9	0.8
		Thin	210.3	13.7	1.6
HGV	Day	Dense	87.5	4.9	0.8
		Thin	212.3	13.7	1.6
	Night	Dense	159.6	9.0	1.4
		Thin	386.9	24.9	2.8
Passenger train	Day	Dense	295.3	13.1	16.2
		Thin	583.4	25.7	32.1
	Night		973.8	43.0	53.6
Freight train	Day	Dense	523.6	25.8	32.3
		Thin	1263.2	50.0	62.4
	Night		2135.9	84.6	105.5

Table 10: Marginal external noise costs, € per 1 000 vkm – 2015 values. Source : Ricardo-AEA (2014) Table 28 - updated to price levels 2015.

Accidents

There are two approaches to calculate the monetary effect on a change in the number of accidents.

If the change in risk is known, this can be multiplied with the valuations for accidents. Default values for the EU or per Member State can be found in Table 10 of Ricardo-AEA.

Alternatively, changes in transport activity (for example due to modal shifts) can be multiplied with the marginal external cost per vkm.

For accidents, marginal external accident cost per country and mode are provided in Table 12 of Ricardo-AEA. We have updated them to prices 2015. They can be found in Table 11 below.

	Car			HDV			Motorcycle		
	Motorway	Other roads	Urban roads	Motorway	Other road	Urban roads	Motorway	Other roads	Urban roads
Austria	0.5	0.4	1.0	6.3	1.9	4.1	0.4	6.0	13.1
Belgium	0.3	0.3	0.4	3.2	1.6	1.0	1.7	3.2	6.5
Bulgaria	0.1	0.1	0.3	0.5	0.5	1.2	0.0	0.0	0.1
Croatia	0.3	0.2	3.1	1.0	0.6	17.7	0.0	0.2	1.7
Cyprus	0.9	0.1	2.3	2.2	0.3	49.9	0.3	0.1	6.0
Czech Republic	0.1	0.2	0.2	1.2	0.6	1.1	0.0	0.2	0.2
Denmark	0.1	0.1	0.1	1.2	1.1	0.8	0.3	1.3	4.1
Estonia		0.4	0.2		0.5	0.9		0.2	0.2
Finland	0.1	0.1	0.1	0.2	0.5	0.3	0.3	1.2	2.3
France	0.1	0.2	0.2	0.4	0.5	0.8	1.0	2.5	8.4
Germany	0.2	0.4	0.6	2.6	1.4	1.6	0.6	3.6	9.2
Greece	0.2	0.2	0.2	1.0	1.4	1.4	0.1	0.1	0.4
Hungary	0.1	0.3	1.4	0.9	1.3	7.3	0.0	0.1	2.6
Ireland	0.1	0.2	0.1	1.8	1.5	0.6	0.2	0.4	0.3
Italy	0.1	0.2	0.6	2.3	1.1	4.3	0.1	0.2	1.6
Latvia		0.3	0.2		0.4	0.5		0.1	0.3
Lithuania		0.2	0.3		0.3	1.0		0.2	0.2
Luxembourg	1.0	0.0	0.1	1.9		0.1	25.7		3.8
Malta			3.9			18.7			0.8
Netherlands	0.0	0.1	0.1	0.3	2.5	1.3	0.2	4.9	12.5
Poland	0.1	0.2	0.5	0.6	0.6	2.1	0.0	0.1	0.4
Portugal	0.1	0.1	0.3	2.3	2.9	10.0	0.1	0.2	1.0
Romania	0.0	0.2	2.3	0.1	0.6	13.0	0.0	0.0	1.6
Slovakia	0.1	0.3	0.5	0.9	0.8	13.2	0.0	0.2	0.5
Slovenia	0.1	0.2	0.2	0.5	0.8	1.8	0.0	0.3	0.1
Spain	0.2	0.1	0.1	1.9	1.0	0.3	1.1	0.9	1.7
Sweden	0.3	0.3	0.3	1.3	1.1	1.0	1.1	3.7	8.7
Great Brittain	0.1	0.1	0.2	1.0	0.5	0.3	0.4	1.4	2.3
EU average	**0.1**	**0.2**	**0.3**	**1.3**	**0.9**	**1.2**	**0.2**	**0.5**	**2.1**

Table 11: Marginal accident cost estimates, €ct/vkm (prices 2015). Source: Ricardo-AEA (2014) – updated to prices 2015.

3.1.5 Step 5: calculation project costs

The calculation of the project costs should be consistent with financial analysis. There is one main difference: for the CBA the VAT costs should be excluded.

In theory one should also correct for shadow pricing but given the framework of a quick scan SCBA we propose not to do so. The interested reader can find all relevant information in DG Regio (2014)[2].

3.1.6 Step 6: summing all costs and benefits

In the previous steps all the costs and benefits were quantified and monetarised. In this step the discounted costs and benefits are summed to come to one number (economic net present value - ENPV) indicating the social benefit of the project. Other possible indicators are

- the Economic Rate of Return (ERR). This is the rate that produces a zero value for the ENPV
- the benefit/cost ratio (B/C) . This is the ratio between the discounted economic benefits and costs.

A project has an economic benefit if

- ENPV>0
- ERR > than the social discount rate
- B/C>1

Following the DG Regio guidelines we propose to use a discount rate of 5% in Cohesion countries and 3% for other Member States. The expected lifetime should be consistent with the one used in the financial analysis.

3.1.7 Step 7: Sensitivity analysis

Sensitivity analysis enables the identification of the 'critical' values of the project – these are the values which has the largest impact on the economic performance. The analysis is carried out by varying one variable at the time and determining the effect of that change on the NPV. We propose that all projects assess at least the sensitivity of the outcome of the following two elements

- Capital costs +25%
- Operating costs +25%

Other elements (such as estimated demand, expected environmental benefits, etc.) can of course also be subject to a sensitivity analysis.

3.1.8 Step 8: Distribution of costs and benefits

In this step the costs and benefits are distributed over the different groups (and regions). Most relevant are

- Government
- Operator(s)
- Users
- Society

Other actors such as infrastructure managers or a distinguishing between different operators are of course also possible.

Where relevant a distribution over regions could also be added.

3.1.9 Step 9: Presenting the results of the SCBA

The presentation of the results of the SCBA is crucial for understanding and accepting the results. Therefore the management summary must include a clear and logical description of

- Presentation of the project alternatives, the reference and the economic background scenarios
- A qualitative description of the effects
- An overview of the main inputs
- The resulting table and graphs

Annex 1: Examples

We discuss three examples of previous CIVITAS measures:

- Eco-driving
- Introduction of articulated hybrid busses
- Energy savings for heating in trams.

For each example we first briefly describe the information available. Next, we discuss the financial analysis and the CBA. Note that while we rely on the information given we have made the analyses again. Hence the outcomes might not 100% correspond to the initial calculations.

1 Example 1: Eco-driving

The goal of this project was to improve the private fleet management for employees of the City of Ghent by

- Reducing the number of cars (removing 45 cars and 38 light freight vehicles)
- Introducing cleaner cars (14 electric cars and 1 hybrid truck)
- Promoting car sharing by introducing a car sharing system into the city fleet
- Eco-driving for a selection of employees

Note that a CBA was only made for the case of Eco-driving. Hence in this example we also only focus on this measure.

Given that the effect did not linger, the reference period used is only 1 year.

1.1 Financial analysis

We follow the five steps set out in chapter 5.

Step 1: Development of the reference scenario

In the reference scenario (sometimes also called the business-as-usual scenario) there would be no course “Eco-driving” for the employees of the city of Ghent.

Step 2: Investment costs

The table below shows the total investment cost. All costs take place in the same year. Replacement costs are not relevant in this case. It is mentioned that this is rather expensive due to the fact that a lot of data was measured and reported.

Description	Unit price	Amount	Total (year 1)
D-logger before/after training	1.25 euro /day/car	6*7 days for 54 cars	2 835 €
E-learning + refreshment calls	59 euro /trainee	54 trainees	3 186 €
Practical trainings	422 euro /half day	20 half days	8 440 €
Report	600 euro fixed cost + 30 euro/trainee	54 trainees	2 220 €
		Total:	16 681 €
		Total without extra efforts on data collection and report:	**11 626** €

Table 12: Total investment costs, euro.

Step 3: Operating costs and revenues

There are no direct operating costs or revenues for Eco-driving. There are savings in operating costs in the form of saved energy expenditures

	Total	Year 1	Year 2
Total Revenues	**-**	**-**	**-**
Personnel	-	-	-
Energy	-4 073 euro	-4 073 euro	0 euro
General expenditures	-	-	-
Total operating costs	**-4 073 euro**	**-4 073 euro**	**0 euro**

Table 13: Operating Revenues and costs, euro

Step 4: sources of financing

From the information available, it is not clear what the sources of financing are. Hence it is assumed that it is paid by the city of Ghent – and hence public money. Note that the total sources of financing should always match the initial investment costs.

	Total	Year 1	Year 2
Union assistance	**-**	**-**	**-**
Public contribution	16 681 euro	16 681 euro	-
Private equity	-	-	
Private loan	-	-	-
Total resources	**16 681 euro**	**16 681 euro**	**16 681 euro**

Table 14: Sources of financing, Euro

Step 5: Calculation of the indicators

Given that the reference period is only one year, it is straightforward to calculate the main financial indicators

- Financial Return on Investment in this case equals the savings in operating costs minus the investment cost. Discounting is not needed.

Return on investment	NPV @ 4%		2018
Project investment cost	-16 681		-16 681
Replacement cost	-		-
Project O&M costs	4 073		4 073
Total revenues	-		-
Residual value of investment	-		-
FNPV(I)	**-12 608**		-12 608

Table 15: Financial return on investment.

Given the negative FNPV, the financial rate will also be negative. Given that no information is given on the source of the investment, it does not make sense to calculate the financial return on capital nor the financial sustainability.

1.2 CBA

As with the financial analysis we describe the different steps – given that this is only an example we will not elaborate on step 9.

Step 1: Project description

The goal of this project was to improve the private fleet management for employees of the City of Ghent by

- Reducing the number of cars (removing 45 cars and 38 light freight vehicles)
- Introducing cleaner cars (14 electric cars and 1 hybrid truck)
- Promoting car sharing by introducing a car sharing system into the city fleet
- Eco-driving for a selection of employees.

The SCBA made only focussed on the Eco-driving.

In the reference scenario there would be no Eco-driving course.

Step 2: Identification of the project effects

The expected impacts are:

- Direct effects
  - Decrease in energy consumption and hence fuel costs. Note that in the project description one only took into account the savings in fuel costs for the city of Ghent, while it is likely that the people following the course would also save fuel in their private trips.
- External effects
  - Decrease in emissions
- Project costs
  - Investment costs of 16 681 euro (see above)

Step 3: Valuation direct effects

There is a fuel saving following the course of Eco-driving. Hence there is a decrease in the monetary transport costs. During this project the fuel used was measured – the average fuel price was 1.4 euro/litre. The table below summarizes the results.

	Total (NPV@4%)	Year 1	Year 2
Fuel use savings (litre)		2 909	0
Fuel use savings (Euro)	4 073	4 073	0

Table 16: Savings in fuel use (litre and euro per year)

Step 4: Valuation external benefits

The main external benefits are the savings in emissions related to the decrease in fuel use. In the original assessment only the effect on CO_2 was taken into account, while there would also be an effect on the other pollutants (NOx, PM,…). A distinction was made between petrol and diesel. The table below summarizes the results.

	Total (NPV@4%)	Year 1	Year 2
Fuel use savings (litre)		2 566.6 litre diesel 342.6 litre petrol	0
CO_2 (tonnes) – using 2640 g CO_2/litre diesel and 2392 g CO_2/litre petrol		6.78 (diesel) 0.82 (petrol)	0
Total Value (Euro) – using 90 euro/tonne CO_2	684	684	0

Table 17: External benefits of Eco-driving – euro/year

Step 5: Calculation project costs

The table below shows the total investment cost. All costs take place in the same year. Replacement costs are not relevant in this case.

Description	Unit price	Amount	Total (year 1)
D-logger before/after training	1.25 euro /day/car	6*7 days for 54 cars	2 835 €
E-learning + refreshment calls	59 euro /trainee	54 trainees	3 186 €
Practical trainings	422 euro /half day	20 half days	8 440 €
Report	600 euro fixed cost + 30 euro/trainee	54 trainees	2 220 €
		Total:	16 681 €

Table 18: Total investment costs, euro.

Step 6: Summing all costs and benefits

The table below summarizes all costs and benefits. It is clear that the economic net present value is negative. Note that in contrast to the financial analysis a social discount rate of 3% is

used. For this project this does not have an effect as only a one-year reference period is considered.

	NPV @ 3%		2018	2019
Project investment cost	-16 681		-16 681	-
Replacement cost	-		-	-
Project O&M costs	-		-	-
Residual value of investment	-		-	-
Total economic costs	-16 681		-16 681	-
Revenues/Direct benefits	4 073		4 073	-
Time savings - commuters	-		-	-
Time savings - business	-		-	-
Accident savings	-		-	-
GHG emission savings	684		684	-
Pollutant emission savings	pro memory		pro memory	pro memory
Noise emission savings	-		-	-
Total economic benefits	4 757		4 757	-
ENPV / Net benefits	**- 11 924**		-11 924	-
B/C RATIO	**0.29**			

Table 19: CBA table Eco-Driving

Step 7: Sensitivity analysis

As a sensitivity analysis we proposed to increase the capital cost and the operating costs with 25%. As there are no operating costs, we only increased the capital costs with 25%. The ENPV then decreases to -16 094 euro.

Step 8: Distribution of costs and benefits

In this simple example the distribution of costs and benefit is less important. The table below shows a possible division

NPV	Government	Society
Project investment cost	-16 681	
Operational savings	4 073	
GHG emission savings		684
Total	**-12 608**	**684**

Table 20: CBA table – distribution of cost and benefits

2 Example 2: Introduction of articulated hybrid buses

The aim of this measure is to introduce articulated hybrid buses instead of replacing the old high-floor trolley buses by standard buses as a transitional measure between the present old trolley buses and the future tramcars foreseen on a part of the present trolley line.

2.1 Financial analysis

We follow the five steps set out in chapter 5.

Step 1: Development of the reference scenario

In the reference scenario (sometimes also called the business-as-usual scenario) the old busses would be replaced by new standard busses (on diesel).

Step 2: Investment costs

The busses were going to be replaced anyway hence only the additional costs of buying hybrid buses instead of traditional busses is relevant. This difference is 150 850 euro per bus. One bus was bought in 2009, the other 19 busses in 2010. In addition to the purchase costs, there was also an investment cost for training the bus drivers which is necessary as there is a difference in driving technique. These costs consist of the cost for the trainer (280 euro for 2 drivers) and the personnel cost (200 euro per driver for 4 hours) of the driver. In 2009, 4 bus drivers were trained, in 2010, 80 drivers.

The table below shows the total net investment cost.

	Total	2009	2010
Buying a bus type AG300H instead of AG300	**3 017 000**	150 850	2 866 150
Education bus drivers	**28 560**	1 360	27 200

Table 21: Total investment costs, euro.

Step 3: Operating costs and revenues

It is claimed that the operational costs (e.g. maintenance) do not change. There are savings in operating costs in the form of saved energy expenditures. We assume that the fuel prices remain constant. It is assumed that the number of km will not change over the years. Hence for the other years we take the savings from 2010. In the original analysis a lifetime of 14 years is assumed. The savings in fuel were monetised by multiplying the expected fuel savings with an

average price of 1.10 euro/litre. A positive number represents a saving, a negative number a cost.

	Total	2009	2010	Year 2-20
Total Revenues (euro)	**-**	**-**	**-**	
Personnel (euro)	-	-	-	
Energy (euro)		4 463	113 352	113 352
General expenditures (euro)	-	-	-	
Total operating costs (euro)	**1 478 039 euro**	**4 073 euro**	**113 352 euro**	**113 352 euro**

Table 22: Operating revenues and costs, euro

Step 4: Sources of financing

From the information available, it is not clear what the sources of financing are. Hence it is assumed that it is paid by the operator – and hence public money. Note that the total sources of financing should always match the initial investment costs.

	Total	Year 1	Year 2
Union assistance	**-**	**-**	**-**
Public contribution	3 045 560	152 210	2 893 350
Private equity	-	-	
Private loan	-	-	-
Total resources	3 045 560	152 210	2 893 350

Table 23: Sources of financing, Euro

Step 5: Calculation of the indicators

Financial Return on Investment in this case equals the discounted savings in operating costs minus the investment cost. Note that this project has a negative return on capital. Hence the savings in fuel costs are not large enough to cover the initial additional investment costs.

Return on investment	NPV @ 4%	2009	2010	2011	2012-2022
Project investment cost	-2 934 277	-152 210	-2 893 350	-	-
Replacement cost	-	-	-	-	-
Project O&M costs	1 136 356	4 463	113 352	113 352	13 352
Total revenues	-	-	-	-	-
Residual value of investment	-	-	-	-	-
FNPV(I)	**-1 797 921**	- 147 747	- 2 779 998	113 352	113 352
FRR(I)	**-10.1%**				

Table 24: Financial return on Investment of hybrid busses

Given the negative FNPV, the financial rate will also be negative.

Given that no information is given on the source of the investment, it does not make sense to calculate the financial return on capital nor the financial sustainability.

2.2 CBA

As with the financial analysis we describe the different steps – given that this is only an example we will not elaborate on step 9.

Step 1: Project description

The aim of this measure is to introduce articulated hybrid buses instead of replacing the old high-floor trolley buses by standard buses as a transitional measure between the present old trolley buses and the future tramcars foreseen on a part of the present trolley line. In total 20 hybrid buses have been bought.

In the reference scenario traditional diesel busses would have been bought.

Step 2: Identification of the project effects

The expected impacts are:

- Direct effects
  - Decrease in energy consumption and hence fuel costs.
- External effects
  - Decrease in emissions (greenhouse gasses and air pollutants)
  - Decrease in noise (pro memory)
- Project costs
  - Investment costs (see above)

Step 3: Valuation direct effects

There is a fuel saving following the use of hybrid busses. Hence there is a decrease in the monetary transport costs. During this project the fuel used was measured – the average fuel price used was 1.102 euro/litre. We assume that fuel prices remain constant. The table below summarizes the results. Note that these could also be put in operating savings. Also note that the NPV is different than in the financial analysis. The reason for this is that the CBA uses 3% as a discount factor and the financial analysis 4%.

	Total (NPV@3%)	2009	2010	2011-2022
Fuel use savings (litre)		4 050	102 860	102 860
Fuel use savings (Euro)	1 209 956	4 463	113 352	113 352

Table 25: Fuel savings hybrid bus (litre and euro per year)

Step 4: Valuation external benefits

The main external benefits are the savings in emissions related to the decrease in fuel use. The table below summarizes the results. The valuations used are for Belgium (see *valuation pollution* of Section 3.1.4, or Table F-4 of Ricardo-AEA (2014)).

	Total (NPV)	2009	2010	2011-2022
Fuel use savings (litre)		4050	102 860	102 860
CO_2 (tonnes)		10.7	271.6	271.6
NOx (kg)		71	1 726.3	1 726.3
PM (kg)		0.8	18.5	18.5
Total Value (Euro)				
– 90 euro/tonne CO_2	260 876	963	24 440	24 440
- 11.8 euro/kg NOx	217 475	838	20 370	20 370
- 224.26 euro/kg PM (city)	44 302	179	4 149	4 149

Table 26: Valuation effect emissions hybrid busses

Step 5: Calculation project costs

The table below shows the total investment cost. As the reference period is set to the expected lifetime of the buses, a residual value is not relevant.

	Total	2009	2010
Buying bus type AG300H instead of AG300	**3 017 000**	150 850	2 866 150
Education bus drivers	**28 560**	1 360	27 200

Table 27: Total investment costs, euro.

Step 6: Summing all costs and benefits

The table below summarizes all costs and benefits. It is clear that the economic net present value is negative.

	NPV @ 3%		2009	2010	2011-2022
Project investment cost	-2 961 288		-152 210	-2 893 350	-
Replacement cost	-		-	-	-
Project O&M costs	-		-	-	-
Residual value of investment	-		-	-	-
Total economic costs	-2 961 288		-152 210	-2 893 350	-
Revenues/Direct benefits	1 209 956		4 463	113 352	113 352
Time savings - commuters	-		-	-	-
Time savings - business	-		-	-	-
Accident savings	-		-	-	-
GHG emission savings	260 876		963	24 440	24 440
NOx	217 475		838	20 370	20 370
PM	44 302		179	4 149	4 149
Noise	pro memory		pro memory	pro memory	pro memory
Total economic benefits	1 732 610		6 443	162 311	162 311

ENPV / Net benefits	**-1 228 678**		-145 767	-2 731 039	162 311
ERR	**-5.5%**				
B/C RATIO	**0.59**				

Table 28: CBA table hybrid busses

Step 7: Sensitivity analysis

As a sensitivity analysis we proposed to increase the capital cost and the operating costs with 25%. As there are no operating costs, we only increased the capital costs with 25%. The ENPV then decreases to -1 969 000 and the ERR to -8.5%.

Step 8: Distribution of costs and benefits

In this simple example the distribution of costs and benefit is less important. The table below shows a possible division.

NPV@3%	Operator	Society
Project investment cost	-2 961 288	
Operational savings	1 209 956	
Emission savings		522 653
Total	**-1 751 332**	**522 653**

Table 29: Distribution of costs and benefits.

3 Example 3: Energy savings for heating in trams

The public transport company De Lijn wanted to reduce the electricity consumption needed for heating the trams. First, an energy audit using a “measuring” tram was made. The results of this energy audit lead to a proposal of a consistent package of new actions as reducing cold air import, defining variable set point for inside temperature, defining variable intake of fresh air, and reducing ventilation in function of outside temperature and when doors are open, towards less energy consumption on trams.

3.1 Financial analysis

We follow the five steps set out in chapter 5.

Step 1: Development of the reference scenario

In the reference scenario (sometimes also called the business-as- usual scenario) no changes would be made to the current practices (e.g. Heating until 19°C regardless the temperature outside).

The lifetime of a tram is 35 years, but the trams are already riding for more than 10 years. Hence a reference period of 23 years was chosen.

Step 2: Investment costs

The table below shows the total investment cost. These costs consist of

- The audit costs – the study was funded for 50% by CIVITAS. The study itself had a cost of 60 500 euro; De Lijn provided technical support with a value of 19 578 euro. Total cost for the audit were 88 078 euro.
- The investment costs for changing the existing trams
- The additional costs when buying a new tram (1 000 euro/tram). Using assumptions on replacement rates the following costs are used.

Year	No trams	Extra costs trams
2015	15	15 000
2016	11	11 000
2017	6	6 000
2018	6	6 000
2019	8	8 000
2020	4	4 000
2021	6	6 000
2022	5	5 000
2024	20	20 000
2035	29	29 000

Table 30: Incremental costs trams

This leads to the following investment costs.

	Total	2011	2012	…	2015	…
Audit costs	88 078	88 078				
Adjustment of heating and ventilation systems of 41 trams	176 199		176 199			
Additional cost when buying new trams	110 000				15 000	

Table 31: Total investment costs, euro.

Step 3: Operating costs and revenues

It is assumed that the changes do not lead to changes in operating costs or revenues. There are savings in operating costs in the form of saved energy expenditures. It is assumed – both in the reference as in the project scenario – that the number of km driven will increase due to the extension of some lines and the replacement of certain bus lines. The energy cost assumed is 0.12 euro/kWh. The table below shows the savings in energy costs

	Energy use BAU (3.86 kWh/km)	Energy use scenario (3.51 kWh/km)	Savings (kWh)	Savings (Euro)
2011	6 384 228	6 384 228	0	0
2012	6 384 228	5 805 347	-578 881	-69 465.7
2013	6 384 228	5 805 347	-578 881	-69 465.7
2014	6 561 391	5 966 446	-594 945	-71 393.4
2015	8 132 956	7 395 512	-737 444	-88 493.3
2016	9 155 864	8 325 669	-830 195	-99 623.4
2017	10 306 988	9 372 417	-934 571	-112 149
2018	12 884 947	11 716 623	-1 168 324	-140 199
2019	14 065 822	12 790 424	-1 275 398	-153 048
2020	14 720 047	13 385 327	-1 334 720	-160 166
2021	14 683 701	13 352 377	-1 331 324	-159 759
2022	15 167 595	13 792 295	-1 375 300	-165 036
2023	15 167 595	13 792 295	-1 375 300	-165 036
2024	18 474 527	16 799 376	-1 675 151	-201 018
2025	18 474 527	16 799 376	-1 675 151	-201 018
2026	18 474 527	16 799 376	-1 675 151	-201 018
2027	18 474 527	16 799 376	-1 675 151	-201 018
2028	18 474 527	16 799 376	-1 675 151	-201 018
2029	18 474 527	16 799 376	-1 675 151	-201 018
2030	18 474 527	16 799 376	-1 675 151	-201 018
2031	18 474 527	16 799 376	-1 675 151	-201 018
2032	18 474 527	16 799 376	-1 675 151	-201 018
2033	18 474 527	16 799 376	-1 675 151	-201 018
2034	18 474 527	16 799 376	-1 675 151	-201 018
2035	21 191 109	19 269 635	-1 921 474	-230 577

Table 32: Operating Revenues and costs

Step 4: sources of financing

From the information available, it is clear that 50% of the study was paid by Civitas. We assume that the other costs were born by the operator and hence are public money.

	Total	2011	2012		2015-2035
Union assistance	**30 250**	**30 250**	**-**		
Public contribution	344 027	57 828	176 199		110 000
Private equity	-	-			
Private loan	-	-	-		
Total resources	**374 277**	**88 078**	**176 199**		**110 000**

Table 33: Sources of financing, Euro

Step 5: Calculation of the indicators

Given that the reference period is only one year, it is straightforward to calculate the main financial indicators

- Financial Return on Investment in this case equals the discounted savings in operating costs minus the investment cost. It is clear that this is a very beneficial project.

Return on investment	NPV@ 4%		2011	2012	2013	2014	2015	…
Project investment cost	-257 500		-88 078	-176 199	-	-	-	
Replacement cost	-		-	-	-	-	-	
Additional costs new trams	-70 447		-	-	-	-	-15 000	
Savings energy use	2 279 639		-	69 466	69 466	71 393	88 493	
Residual value of investment	-		-	-	-	-	-	
FNPV(I)	**1 951 692**		-88 078	-106 733	69 466	71 393	73 493	
FRR(I)	**39.6%**							

Table 34: Financial return on investment

The financial return on capital provides information taking into account the contribution by CIVITAS. It is actually the same exercise, but removing the support from CIVITAS from the investment costs. It is clear that the financial return is then even higher.

Return on investment after support	NPV@ 4%		2011	2012	2013	2014	2015	…
Project investment cost	-257 500		-88 078	-176 199	-	-	-	
CEF contribution	30 250		30 250	-	-	-	-	
Replacement cost	-		-	-	-	-	-	
Project O&M costs	-70 447		-	-	-	-	-15 000	
Total revenues	2 279 639		-	69 466	69 466	71 393	88 493	
Residual value of investment	-		-	-	-	-	-	
FNPV(K)	**1 981 942**		-57 828	-106 733	69 466	71 393	73 493	
FRR(K)	**45.7%**							

Table 35: Financial return on capital

3.2 CBA

As with the financial analysis we describe the different steps – given that this is only an example we will not elaborate on step 9.

Step 1: Project description

The public transport company De Lijn wanted to reduce the electricity consumption needed for heating the trams. First, an energy audit using a “measuring” tram was made. The results of this energy audit lead to a proposal of a consistent package of new actions as reducing cold air import, defining variable set point for inside temperature, defining variable intake of fresh air, and reducing ventilation in function of outside temperature and when doors are open, towards less energy consumption on trams.

In the reference scenario this investment would not be made.

Step 2: Identification of the project effects

The expected impacts are:

- Direct effects
  - Decrease in energy consumption and hence energy costs
- External effects
  - Decrease in emissions
- Project costs
  - Investment costs

Step 3: Valuation direct effects

There is a large savings in energy use and hence in energy costs. This was calculated in detail in the financial analysis (cf. above).

Step 4: Valuation external benefits

The main external benefits are the savings in CO_2. In the analysis it is assumed that the production of 1 kWh Belgian electricity creates 276 kg/MWh CO_2. Using a valuation of 90 euro/ton this leads to large benefits.

	Energy use BAU (3.86 kWh/km)	Energy use scenario (3.51 kWh/km)	Savings (kWh)	Savings (Euro)	CO_2 savings (tonnes)	Mio euro
2011	6 384 228	6 384 228	0	0	0	0.0
2012	6 384 228	5 805 347	-578 881	-69 465.72	-159 771	-14.4
2013	6 384 228	5 805 347	-578 881	-69 465.72	-159 771	-14.4
2014	6 561 391	5 966 446	-594 945	-71 393.4	-164 205	-14.8
2015	8 132 956	7 395 512	-737 444	-88 493.28	-203 535	-18.3
2016	9 155 864	8 325 669	-830 195	-99 623.4	-229 134	-20.6
2017	10 306 988	9 372 417	-934 571	-112 148.52	-257 942	-23.2
2018	12 884 947	11 716 623	-1 168 324	-140 198.88	-322 457	-29.0
2019	14 065 822	12 790 424	-1 275 398	-153 047.76	-352 010	-31.7
2020	14 720 047	13 385 327	-1 334 720	-160 166.4	-368 383	-33.2
2021	14 683 701	13 352 377	-1 331 324	-159 758.88	-367 445	-33.1
2022	15 167 595	13 792 295	-1 375 300	-165 036	-379 583	-34.2
2023	15 167 595	13 792 295	-1 375 300	-165 036	-379 583	-34.2
2024	18 474 527	16 799 376	-1 675 151	-201 018.12	-462 342	-41.6
2025	18 474 527	16 799 376	-1 675 151	-201 018.12	-462 342	-41.6
2026	18 474 527	16 799 376	-1 675 151	-201 018.12	-462 342	-41.6
2027	18 474 527	16 799 376	-1 675 151	-201 018.12	-462 342	-41.6
2028	18 474 527	16 799 376	-1 675 151	-201 018.12	-462 342	-41.6
2029	18 474 527	16 799 376	-1 675 151	-201 018.12	-462 342	-41.6
2030	18 474 527	16 799 376	-1 675 151	-201 018.12	-462 342	-41.6
2031	18 474 527	16 799 376	-1 675 151	-201 018.12	-462 342	-41.6
2032	18 474 527	16 799 376	-1 675 151	-201 018.12	-462 342	-41.6
2033	18 474 527	16 799 376	-1 675 151	-201 018.12	-462 342	-41.6
2034	18 474 527	16 799 376	-1 675 151	-201 018.12	-462 342	-41.6
2035	21 191 109	19 269 635	-1 921 474	-230 576.88	-530 327	-47.7

Table 36: CO_2 savings

Step 5: Calculation project costs

The table below shows the total investment cost. Replacement costs are not relevant in this case.

	Total	2011	2012	…	2015	…
Audit costs	88 078	88 078				
Adjustment of heating and ventilation systems of 41 trams	176 199		176 199			
Additional cost when buying new trams	110 000				15 000	

Table 37: Total investment costs, euro.

Step 6: Summing all costs and benefits

The table below summarizes all costs and benefits. It is clear that the economic net present value is positive.

	NPV@3%		2011	2012	2013	2014	2015	2016..
Project investment cost	-259 145		-88 078	-176 199				
Replacement cost								
Costs new trams	-78 931						-15 000	-11 000
Residual value of investment								
Total economic costs	-338 076		-88 078	-176 199			-15 000	-11 000
Energy savings	2 586 116		-	69 466	69 466	71 393	88 493	99 623
Time savings - commuters								
Time savings - business								
Vehicle operating cost savings								
Accident savings								
GHG emission savings	535			14	14	15	18	21
Noise								
Total economic benefits	2 586 651		-	69 480	69 480	71 408	88 512	99 644
ENPV / Net benefits	**2 249 444**		-88 078	-106 719	69 480	71 408	73 512	88 644
ERR	**39,6%**							
B/C RATIO	**7.67**							

Table 38: CBA table

Step 7: Sensitivity analysis

As a sensitivity analysis we proposed to increase the capital cost and the operating costs with 25%. As there are no operating costs, we only increased the capital costs with 25%. The ENPV then decreases to 2,184 658 euro and the ERR to 32,5%.

Step 8: Distribution of costs and benefits

In this simple example the distribution of costs and benefit is less important. The table below shows a possible division

NPV	Government	Society
Project investment cost	-338 076	
Operational savings	2 586 116	
GHG emission savings		535
Total	**2 248 040**	**535**

Table 39: Distribution of cost and benefits

Annex 2: Update price levels

Ricardo-AEA and other sources provide cost figures for 2010 prices or other reference years. To update this to the 2019 prices or your year of interest, calculate the consumer price inflation for the European Union (EU) or a Member State, based on the Eurostat Harmonised Index of Consumer Prices (HICP)[18], see Table 40. Multiply the 2010 costs with the consumer price inflation to update the costs to your year of interest.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
EU-28	92.49	95.35	97.87	99.35	99.90	100.00	100.25	101.96	103.89	105.42

Table 40: Eurostat Harmonised Index of Consumer Prices [prc_hicp_aind] for the EU-28, for 2010 to 2019.

For example, the European consumer price inflation based on the HICP in 2015 compared to 2010 corresponds to 8.1% or 100.00/92.49=1.081197967.

Multiply the marginal external costs or other cost figures of 2010 by 1.081197967 to update the costs to the 2015 prices.

[18] https://appsso.eurostat.ec.europa.eu/nui/show.do

Annex 3: PPP conversion

To transform the EU valuation to country valuations the following conversion should be used: value*conversion factor PPP.

Belgium		1.18
Bulgaria		0.49
Czech Republic		0.88
Denmark		1.24
Germany		1.23
Estonia		0.75
Ireland		1.83
Greece		0.68
Spain		0.92
France		1.04
Croatia		0.6
Italy		0.97
Cyprus		0.83
Latvia		0.65
Lithuania		0.75
Luxembourg		2.58
Hungary		0.67
Malta		0.96
Netherlands		1.28
Austria		1.28
Poland		0.68
Portugal		0.77
Romania		0.58
Slovenia		0.83
Slovakia		0.77
Finland		1.09
Sweden		1.23
United Kingdom		1.07
Iceland		1.28
Norway		1.48
Switzerland		1.61
Montenegro		0.45
Former Yugoslav Republic of Macedonia, the		0.37
Albania		0.29
Serbia		0.37
Turkey		0.64
Bosnia and Herzegovina		0.32

Table 41: Conversion factor PPP

ANNEX 7 - Reflective evaluation by the learning histories method

1 Introduction

How do we organize the preparation, implementation and operation of the CIVITAS measures, and how can we improve the way we learn from our experiences? These are important questions. Looking back can be very helpful in finding some answers; to build new perspectives and find ways for new strategies to improve the process of the measures and to learn about transferability.
Making a learning history together with involved project partners is a process of creating collective memory and of sense making. It stimulates reflection in a natural way: by story telling, and looking for emerging patterns in the stories.

"If people want to share meaning, then they need to talk about their shared experience in close proximity to its occurrence and hammer out a common way to encode it and talk about it. They need to see their joint saying about the experience to learn what they jointly think happened" (Karl Weick).

The aim of the Learning History method within CIVITAS is getting insight to the:

- drivers and barriers during the preparation, implementation and operation of the measures;
- role of information communication & participation during the preparation, implementation and operation of the measures;
- the 'stories behind the figures' by collecting learning experiences.

1.1 Background Learning History

The concept learning history is developed by researchers at the American research institute MIT (Kleiner & Roth, 1997). A learning history is a way for organizations to learn from experience and consequences of their own learning and change. It is a way of recording learning experiences. Characteristic of a learning history is not only the lesson drawn from the experience being told, but also the experience itself and the context within which it was obtained. In this way the context-specific insights can be made transferable to another setting.

In fact a learning history is a process that results in a jointly told tale in multiple narratives, with illustrations and reflections on strategies, noticeable results, what happened and why. It gives insight to organizational dynamics, the internal logics on dealing with change. Workshops and training can be part of this process. A learning history is also a product: a document, or any other form of (multimedia) presentation, to be spread and discussed on a large scale. A learning history can have the form of an ongoing story, continuously renewed, in the form of a collective journal or learning log, or as a website. The history is performed by people who were/are involved in the central issue of the history, preferably also external people, like trainers, partners, stakeholders. So, a learning history is not only a product, but primarily a process of making sense of (learning) experiences. (www.learninghistories.net).

1.2 What does a Learning History looks-like?

A learning history is one story about a process with 3 layers:

1. The first layer describes the main actual measure events that occurred during the reporting period, in a chronological way.
2. The second layer shows the perception of internal/external project partners why they believe these main actual events happened as they happened and what the role/impact was of barriers and drivers. These perceptions are shown as statements of different (anonym) project partners.
3. The third layer contains critical reflection, concerning issues like: what could we learn from the process so far; how did we handle barriers and make use of drivers and was that the right way? Or should we have done it in another way? How can we make use of these learning experiences for transferability?

The figure below shows an example of a Learning History structure.

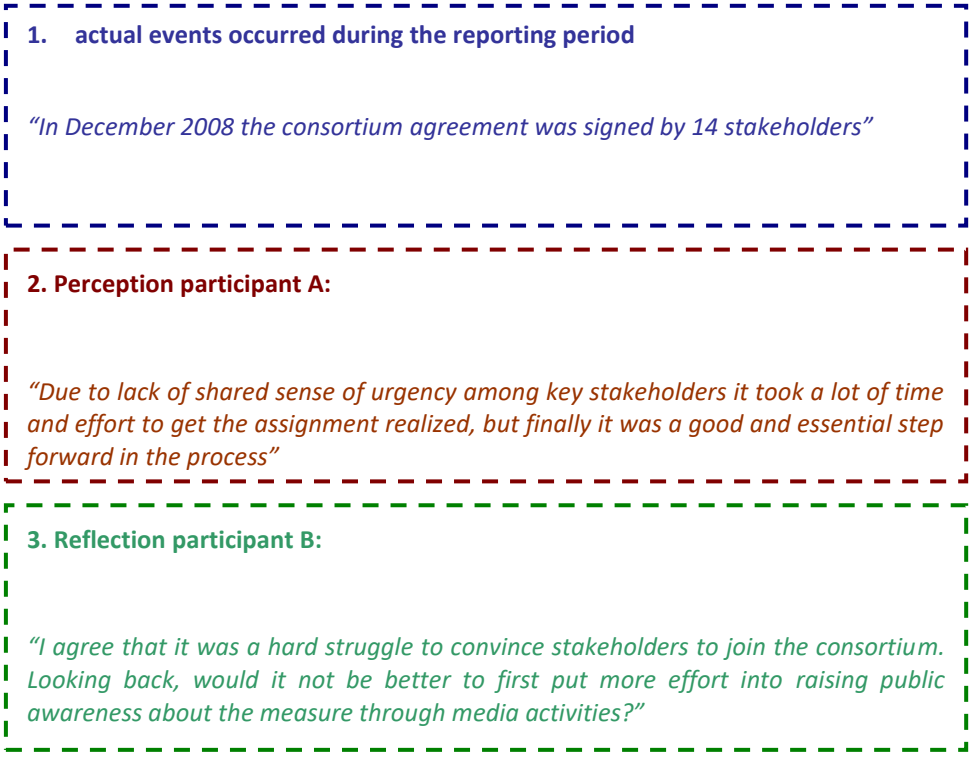

Figure 1: Learning History structure

1.3 Why use the Learning History method?

Because of the 3 layered structure, the Learning History offers an added value on the evaluation process on several aspects:

- It clearly states the various (learning) experiences and opinions of different stakeholders and reports these inputs in a structured manner in the context of the project. This makes it easier to discuss them with colleagues or outsiders who were not involved in the specific process; the last point is of importance for the transferability of learning experiences.
- The open-minded joint reflection process should create a safe space to have a critical reflection on a participant's own role and the group's role as a whole. In this way, the Learning History approach contributes to the process of building common confidence, understanding and trust; which are terms for change and innovation.
- This method facilitates a process to speak up about things that went well in the process, but also to share and to discuss hot issues. This could 'clear the air' and gives new energy and insights to continue the measure process.

2 How to set up a Learning History in CIVITAS?

2.1 General overview of steps

For setting up a Learning History within the CIVITAS measures, the following approach (see figure 2 below). Starting with the practical organization of a Learning History workshop, followed by the performance of the workshop aiming to gather process information on barriers, drivers and learning experiences, and finally reporting the results in Section II of this part of the Focused Measure Process Evaluation Form. The sub paragraphs 4.1 to 4.4 in this text will explain the following steps more in detail.

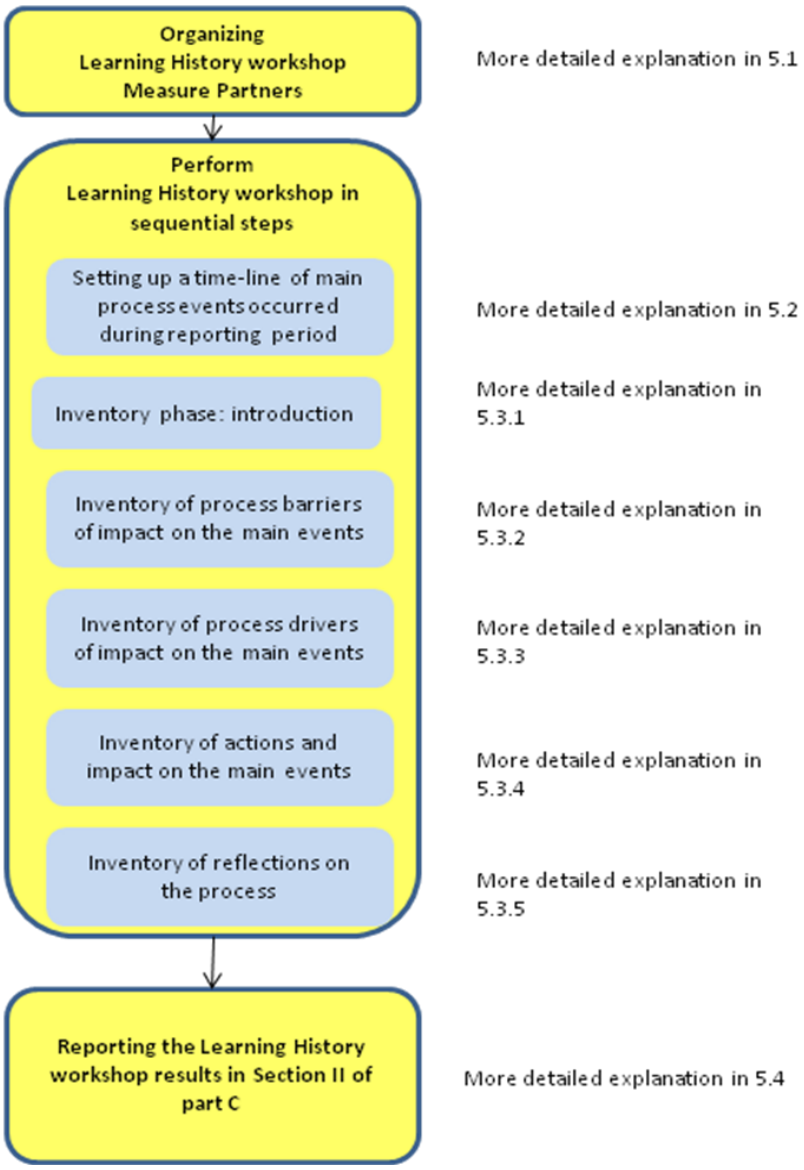

Figure 2: Setting up a Learning History for a CIVITAS measure

Box 1

As there are many countries and cities involved in CIVITAS Plus it is obvious that there is a great variety in the context in which the measures are to be carried out. To a large extent this is due to cultural aspects, differences in daily routines etc. Therefore, the Learning Histories approach is to be regarded not as a blueprint, but as a framework. This framework provides a basis to collect the information on barriers, drivers etc which is necessary to complete Part C. The way one uses this framework depends on the context of the measure. In this clarification on how to set up a Learning History attention will be paid to different ways of using the framework. However it is necessary to bear in mind that:

- It is impossible to pay attention to all the different circumstances of the various measures. This implies that the here mentioned remarks, 'tips and tricks' etc. are based on the outcome of the workshops on Learning Histories in Porto and Delft.
- In addition to the aforementioned point the Measure Leaders (ML's) and Local Evaluation Managers (LEM's) have to rely also on their own inventiveness and creativity. Of course it is always possible to contact TNO for advise how to deal with special circumstances: Martin van de Lindt (E: martin.vandelindt@tno.nl, T: + 31 15 2695487), Sophie Emmert (E: sophie.emmert@tno.nl, T: + 31 15 2695483).
- Regardless of the way that the Learning Histories concept is used, the retrieved information must be qualitative and quantitative sufficient to fill in Part C.

2.2 Organizing a Workshop

Box 2

The goal of the Learning History (LH) workshop is to get as much relevant information as possible about the measure process by combining facts, perspectives and reflections on barriers, drivers, actions etc., and to use this information to complete part C in an efficient way. A workshop like this requires that the attendees speak frankly and bring forward not only positive matters, but also process related problems. Sometimes this can be a very serious barrier to organize the workshop.

The alternative is to do structured interviews with the relevant persons, based on the questions to be answered in the parts of the Focussed Measure Process Evaluation Form. The results of the interviews are used anonymously to complete the Focussed Measure Process Evaluation Form.

This seems an attractive alternative to the workshop, but it is necessary to bear in mind that there are some great disadvantages. The first is that the information is one dimensional (no reflection at all on the facts and perspectives) and therefore qualitative not as rich as information from the workshop. Secondly, structured interviewing and converting the results into (in this case) Part C of the form is a very time consuming process. It is expected that it is far more time consuming then a well organized Learning History process as suggested in this clarification. Above this, the Learning History process as suggested in this clarification has the advantage for the Measure Leader that he gathers the required information in a very structured way, that he is not doing everything by his own and gives him the opportunity to bind persons / organizations around the measure.

- *Inviting Measure Partners*

In view of the fact that communication is an important matter, it is suggested that clear contact is made with the partners and they are invited in good time for the workshop. It is also important to be clear what will be expected from the project partners during the workshop. For that reason we would recommend the Measure Leaders to compose an invitation letter or email on a personal level for the project partners, including:

- ✓ why and for which purpose the measure process is evaluated;
- ✓ the frequency of evaluating, which is once a year;
- ✓ when and where the LH workshop will take place;
- ✓ expectations of the LH workshop participants in terms of contributing to the open-minded reflection on the measure process and the collection of learning experiences;
- ✓ the program of the workshop and the questions to prepare themselves for the workshop by reading in advance the draft 'time-line actual events' of the measure.

Box 3

Sometimes the problem arises that the Measure Leader is not in a position to invite the possible attendees of the LH workshop. Often this is caused by his or her position within the organization in relation to hierarchical structures. One way to handle this problem is to speak to the right person, explain the problem, make clear agreements with him or her and prepare the invitation procedure. Then send the invitation on behalf of the right person or let him or her send the invitation.

Normally it should be not a big problem, but sometimes it will be difficult to motivate possible attendees to come to the workshop. There is really not a blueprint solution for this. Sometimes it is suggested to give people who are attending the workshop a (financial) incentive, but this is rather unusual because the attendees in fact have a stake in the measure. Moreover it is very doubtful if one gets the best motivated people for the LH workshop. A better way of motivating people is, beside putting together an attractive workshop program, for example putting forward that:

- ✓ They get a chance to put forward their own perspectives, stakes, opinion about barriers, drivers etc and make these clear to the other attendees
- ✓ The input of all the attendees will be used anonymous in the report and will not be lost
- ✓ The aim of the LH workshop is not to judge each other but to learn from each other
- ✓ Team spirit and working together are essential conditions for the success of the measure. The workshop will contribute to these conditions.

Since the character of Learning History workshops is very much an interactive process, we would recommend not involving too many participants just to be able to facilitate an open dynamic group process. A number of participants between 7 and 9 seems to be ideal. Not only is the number of participants of influence on the quality of the workshop process and the results, but also the persons who are invited. It is best to invite the specific persons of the measure partners who have a clear view on the measure process from their perspective.

Box 4

It is often a question who to invite for the workshop. In this case it is useful to make a distinction between core measure partners and others. The core measure partners are those organizations that signed the measure contract. Normally representatives of these organizations are always invited to the workshop. However it is important that these representatives are really involved with the measure so they can bring forward relevant information. The questions who else to invite is not unambiguous to answer. It depends to a large extend on the phase and / or ultimate objective of the measure. If the measure is, for example, in the preparation phase it can be a good reason for inviting only the core measure partners. However, when one of the main goals of the measure is scaling up, transferring it to other parts of a city or even to other cities, it might be very useful to invite representatives of other city departments and/or organizations. Sometimes it is useful to invite someone who is relatively an outsider because he or she can reflect in a very open way and might bring forward some new perspectives, ideas etc. This might be useful when there are circumstances that are hampering the process in a way that a lock-in situation has been occurred (or are likely to occur).

Although there is no one single answer who should be invited for the workshop there are some general tips to work with:

- ✓ Think very carefully about who is to be invited. Relate this not only to the purpose of the workshop to be organized, but also to the phase and objective of the measure. Think strategically!!
- ✓ Although the people who are invited are part of organizations, it is important to realize that ' people are making the workshop and are defining the results'. Therefore it is very helpful to make a profile of the people who are to be invited. For example the type of organization they work, the position within the organization, the relation to the measure, the power and willingness to influence the measure process, relations with other measures or (city) programs, the willingness and capability to listen and learn etc.
- ✓ To be sure that all organizations are represented sufficiently it is recommended to have two persons of an organization on the invitation list. One that seems the best, and one that is a good replacement. If the first one will not be present, the second one can be invited. You may also invite both, assuming that one of them will not attend the workshop.

- *Example Workshop program*

Time	Activity
8.30 – 8.45	Walk in and coffee
8.45 – 9.00	Opening, introduction intention of the session
9.00 – 9.15	Presentation time-line actual events (Measure Leader)
9.15 – 9.30	Discussion and completion time-line actual events
9.30 – 10.00	Inventory barriers and reflections
10.00 – 10.15	Coffee break
10.15 – 10.45	Inventory drivers and reflections
10.45 – 11.15	Inventory actions and reflections
11.15 – 12.00	Reflections and learning experiences
12.00 – 12.30	Lunches
12.30 – 12.50	Learning experiences and transferability
12.50 – 13.00	Closing

- *Moderating the workshop*

The moderation of the workshop could be done by the Measure Leader, together for instance with the Local Evaluation Manager, since the Measure Leader is asked to fill in the Evaluation form part-C based on the outcomes of this workshop. However, the moderator should keep in mind at least the following aspects:

- ✓ Time slots and aimed results
- ✓ Balanced contribution from participants (not only of those with the loudest voice)
- ✓ Doing a first rough analysis (clustering) of results during the workshop to steer the discussion

Box 5

Although it is the most easy way to let the workshop be moderated by the ML and/or LEM it is preferable to use / hire an external moderator, if possible. There are some good reasons for this:

- ✓ Generally speaking the ML and LEM do not have a lot of experience with moderating workshops. This is rather normal because moderating workshops is a profession.
- ✓ Mostly it is an advantage to let the workshop be moderated by an outsider: he can ask questions and lead the process with a fresh view.
- ✓ A good moderator is able to create an atmosphere of trust, in which the attendees feel free, respected and speak openly. In this case it is an advantage that the moderator has no interest in the measure
- ✓ It is very important that the ML and LEM provide the right information to the moderator on subjects like the measure itself, the attendees of the workshop, the objective and expected results of the workshop, possible delicate aspects / questions / problems / stakeholders etc.
- ✓ If there are really delicate matters it is advised that the moderator contact the attendees concerned to get information on these matters. He can bring forward the information unanimously during the workshop in several ways.

- *Practicalities*

Based on our own experience with organizing (Learning History) workshops, we have the following issues on our checklist of practicalities:

- ✓ Determine and communicate 'Rules of the game' (see Box 6)
- ✓ Well aired room with enough space
- ✓ Suitable line up of participants
- ✓ Beamer + laptop
- ✓ Flip-overs
- ✓ A1 (or A0) forms (see section 4.4)
- ✓ Sticky notes, tape, markers (writing different colors) etc.
- ✓ Catering

Box 6

A very important practicality is to start the workshop with a number of rules: 'rules of the game'. Sometimes they are already mentioned in the information about the workshop communicated to the attendees, but in that case it is necessary to repeat 'the rules of the game'. An example of such rules is:

- ✓ Be relaxed: there's no right or wrong, it's your perspective
- ✓ Be active: don't sit back, but speak for yourself
- ✓ Be positive: try to understand and be cooperative
- ✓ Be respectful: listen to each other carefully

It is also very important to stress the fact that the results of the workshop(s) are NOT reported to the City or the EU. The results of all the workshops will be anonymously reported to the EU on a higher aggregation level. It is preferable to give this message not only at the beginning of the workshop, but also during the invitation phase of the workshop.

2.3 Time-line actual events

The first step in creating a Learning History is to conduct a chronological time-line of main actual events that occurred during the reporting period. The results of this step are used in C2 of the Focussed Measure Process Evaluation Form
We would like to suggest that the Measure Leader makes this draft event time-line in advance and sends it in advance to the workshop participants. Ask them to read through the document and let them review whether this time-line of events is complete from their perspective or not; and of course if not, what is missing or incorrect from their point of view.
During the workshop the Measure Leader could first present the draft event time-line, after that discuss and complete the event time-line with input from the participants. This will result in a shared perception of what actual happened in the reporting period
The time-line of the process could be presented in an illustration, e.g. see figure 3, however this is not essential. The construction of the draft time-line should take the Measure Leader not more than two hours.

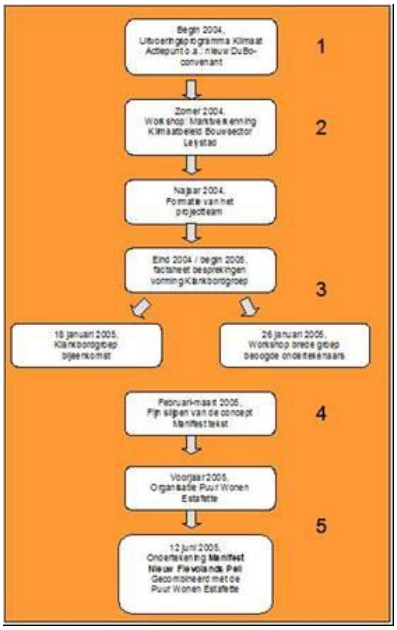

Figure 3: Illustration of a Dutch project on Sustainable Construction; time-line of main actual events that occurred in the reporting period between 2004 and 2005 (Emmert en Roelofs, 2008)

Box 7

Remember that only the real important events have to be taken in account. So it necessary to limit the timeline to these: don't come up with too much events. In most cases four or five will do.

2.4 The inventory phase of the workshop

2.4.1 Introduction

After the defining the time line, the inventory part of the workshop starts. In this phase an inventory of barriers, drivers, actions and lessons learned is to be made. In general everyone can do this on his own way as long as the questions of C3 to C6 of Part C of the Focussed Measure Process Evaluation Form can be completed

However, based on the experiences with this kind of inventories it is highly recommended to make print outs of the C3, C4, C5 and C6 items on A1 size papers and follow the next steps during the inventory:

- ✓ Stick the A1 form on the wall
- ✓ The attendees of the workshop are sticking their notes on the form
- ✓ The moderator clusters the notes, gives the clusters a name and starts the discussion.

An illustration of A1 print outs with clustered sticky notes is seen below.

Figure 4: The A1 size form with clustered sticky notes on barriers (Learning History Workshop Delft, 7th and 8th of July 2009)

The next paragraphs will focus on the various topics of the inventory part of the workshop in more detail.

2.4.2 Inventory of barriers

The second step, after the agreement on the main events that happened, is a plenary inventory of barriers encountered in reaching the objectives as described in B1 that occurred during the reporting period. The results of this step are used in C3 of the Focussed Measure Process Evaluation Form.

Box 8

Process barriers are events or overlapping conditions that hampers the process to obtain measure objectives/goals

The moderator could first explain and inspire the participants about what is meant by 'process barriers' by showing the table below (see figure 5).

After that, the participants are asked to write down barriers they experienced during the reporting period on sticky notes. These written down barriers could be straight from the table (see figure 5), or would be formulated by the participants themselves after consideration of the possible areas in which barriers may be have occurred. The moderators collect all the notes and put them on one board or large paper.

This will result in a collection of anonymous sticky notes, with all kinds of process barriers faced by different project partners.

The moderator(s) roughly clusters the sticky notes and starts facilitating the discussion; central questions are:

- ✓ Why were these (clusters of) process barriers experienced as barriers to reach the objectives?
- ✓ What was the impact of these barriers on events that occurred in the way they occurred?

Political / strategic barriers, for example: 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
Institutional barriers, for example: impeding administrative structures, procedures and routines, impeding laws, rules, regulations and their application, hierarchical structure of organizations and programs
Cultural barriers, for example: impeding cultural circumstances and life style patterns
Problem related barriers, for example: complexity of the problem(s) to be solved, lack of shared sense of urgency among key stakeholders to sustainable mobility
Involvement / communication barriers, for example: insufficient involvement or awareness of (policy) key stakeholders, insufficient consultation, involvement or awareness of citizens or users
Positional barriers, for example: relative isolation of the measure, lack of exchange with other measures or cities
Planning barriers, for example: 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
Organizational barriers, for example: failed or insufficient partnership arrangements, lack of leadership, lack of individual motivation or know-how of key measure persons
Financial barriers, for example too much dependency on public funds (including CIVITAS funding) and subsidies, unwillingness of the business community to contribute financially
Technological barriers, for example: additional technological requirements, technology not available yet, technological problems
Spatial barriers, for example no permission of construction, insufficient space

Figure 5: Examples of possible areas and barriers

This discussion will probably result in a pallet of different beliefs why these (clusters of) process barriers were barriers and what the impact was on the process and the objectives. The moderator will rank the most important barriers.

Box 9

To structure this pallet of barriers and initiate the discussion the moderator together with the attendees may rank the three barriers with the highest impact and determine for example which barriers are within or without control of the measure partners.

Note that it is not necessary that all participants of the workshop agree upon the barriers. As long as the overview is recognizable to the participants

The moderator will rank the most important barriers.

2.4.3 Inventory of drivers

The third step is a plenary inventory of drivers to reach the objectives as described in B1 that occurred during reporting period. The results of this step are used in C4 of the Focussed Measure Process Evaluation Form.

Box 10

Process drivers are events or overlapping conditions that stimulates the process to obtain measure objectives/goals

The moderator could first explain and inspire to the participants about what is meant by 'process drivers' by showing the table below (see figure 6) or would be formulated by the participants themselves after consideration of the possible areas in which drivers may be have occurred.

After that, the participants are asked to write down drivers they experienced during the reporting period on sticky notes. These drivers could be from the table (see figure 6),

The moderators will collect them on one board or large paper.

This will result in a collection of anonymous sticky notes, with all kinds of process drivers faced by different project partners.

The moderator(s) roughly clusters the sticky notes and starts facilitating the discussion; central questions are:

- ✓ Why were these (clusters of) process drivers experienced as drivers to reach the objectives described in B1?
- ✓ What was the impact of these drivers on events that occurred in the way they occurred?

Political / strategic drivers, for example: 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
Institutional drivers, for example: facilitating administrative structures, procedures and routines, facilitating laws, rules, regulations and their application, facilitating structure of organizations and programs
Cultural drivers, for example: facilitating cultural circumstances and life style patterns
Problem related drivers, for example: pressure of the problem(s) causes great priority, shared sense of urgency among key stakeholders to sustainable mobility
Involvement / communication drivers, for example: constructive and open involvement of policy key stakeholders, constructive and open consultation and involvement or citizens or users
Positional drivers, for example: 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
Planning drivers, for example: 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
Organizational drivers, for example: constructive partnership arrangements, strong and clear leadership, highly motivated key measure persons, key measure persons as 'local champions'
Financial drivers, for example: availability of public funds (including CIVITAS funding) and subsidies, willingness of the business community to contribute financially
Technological drivers, for example: new potentials offered by technology, new technology available
Spatial drivers, for example: space for physical projects, experimentation zones

Figure 6:Examples of possible areas and drivers

This discussion will probably result in a pallet of different beliefs why these (clusters of) process drivers were drivers and what the impact was on the process. The moderator will rank the most important ones.

Box 11

To structure this pallet of barriers and initiate the discussion the moderator together with the attendees may rank the three drivers with the highest impact and link the with the barriers.

Note that it is not necessary that all participants of the workshop agree upon the drivers. As long as the overview is recognizable to the participants

2.4.4 Inventory of actions taken

The fourth step is a plenary inventory of actions taken to handle the barriers and to make use of the drivers to reach the goals as described in B1 during the reporting period. The results of this step are used in C5 of the Focussed Measure Process Evaluation Form.

Box 12

Actions are activities undertaken by one or more measure partners to handle the barriers and / or to make use of the drivers to reach the measure objectives

The moderator(s) could first explain to the participants about what is meant by 'actions taken' by showing the table below (see figure 7).

After that, the participants are asked to write down the actions taken during the reporting period on sticky notes. These actions could be from the table (see figure 7), or would be formulated by the participants themselves after consideration of the possible areas in which actions may be have taken.

The moderator(s) will collect them on one board or large paper.

This will result in a collection of sticky notes, with all kinds of taken actions.

The moderator(s) roughly clusters the sticky notes and start facilitating the discussion; central questions are:

- ✓ What actions were taken?
- ✓ Why were these actions taken regarding the objectives to reach as described in B1 and regarding the drivers and barriers?
- ✓ What was the impact of these actions on the objectives to reach as described in B1 and on the process?

Political / strategic actions, for example: (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
Institutional actions, for example: analysis of and/or proposals to change impeding rules, structures, legislation, organisational structures etc.
Cultural actions, for example: facilitating cultural circumstances and life style patterns
Problem related actions, for example: 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
Involvement / communication actions, for example: 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
Positional actions, for example: 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)
Planning actions, for example: 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
Organizational actions, for example: 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)
Financial actions, for example: raising or attempting to raise additional financial budget for the measure, developing a context which is attractive to the business community to contribute financially
Technological actions, for example: Raising or attempting to raise additional technical resources for the measure (all kind of equipment), all kind of actions to solve technological problems
Spatial actions, for example: (attempts) adjusting the construction permissions, creating experimental and /of

investment zones / city parts / corridors

Figure 7: Examples of possible areas and activities

This discussion will probably result in a pallet of different beliefs why these actions were taken and what the impact was on the process and the goals to reach (B1). The moderator will rank the most important ones.

Box 13

To structure this pallet of barriers and initiate the discussion the moderator together with the attendees may rank the three actions with the highest impact and link the with the drivers and/or barriers. It might also be interesting to look at actions that are not taken, but that that have should have been taken.

Note that it is not necessary that all participants of the workshop agree upon the actions. As long as the overview is recognizable to the participants

2.4.5 Reflections and learning experiences

At this stage we have an overview of events, barriers, drivers and actions taken as well an insight to 'why things happened as they happened' during the reporting period. The last step is a reflective discussion on learning experiences; looking back at the time-line of events that occurred, the barriers and drivers that were faced and actions that were taken. The results of this step are used in C6 of the Focussed Measure Process Evaluation Form

To illustrate this overview and give it central place in the discussion the moderator may for example tape the used flip-over sheets side by side on the wall (figure 8). This will support the moderator(s) in his (their) facilitation of the discussion. Central questions to structure the discussion are:

- ✓ Which of the actions can be regarded as a success and which as a failure and why?
- ✓ What have we learned? What are the do's and don'ts in terms of the process and actions?
- ✓ What actions do we want to undertake?

Figure 8: The A1 size forms with clustered sticky notes on barriers, drivers and actions (Learning History Workshop Delft, 7th and 8th of July 2009)

Box 14

It is highly recommended to collect the A1 wall papers after the workshop and use them as as basis to report the results in the evaluation form. To secure that the sticky notes remain on the right place while taken them away for reporting it is advised to stick them on the form with strips of adhesive tape.

2.4.6 Reporting

Based on the outcomes of this Learning History workshop, the Measure Leader is asked to complete section C of the Focused Measure Process Evaluation Form. Since this part of the form is complementary to this suggested workshop program, it should take the Measure Leader not longer than 2 hours to complete this section of the Focused Measure Process Evaluation Form.

Box 15

After the workshop and after filling in the C-part of the form it is recommended to send the report (at least the C-part) to the attendees for a final feedback on the results. There are at least five reasons for this:

- ✓ It gives people a last chance to bring forward delicate matters anonymously
- ✓ It stimulates a sphere of trust for the measure partners / attendees
- ✓ It demonstrates that the opinion of the measure partners is taken seriously
- ✓ It shows that there is accurate way of working on the measure and its process evaluation
- ✓ It contributes to the comprehensiveness of the form

ANNEX 8: Survey methodologies

1 General considerations

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

plans may be possible so for each a rough estimate of the sample size (based on the degree of precision required) will help to provide comparative costs.

- **Pilot test.** A pilot test of the questionnaire and approach is always useful to identify problems of understanding/interpretation of the questions and of the method of conducting the survey.
- **Fieldwork organisation.** Staff will need special training for administering the survey. Adequate supervision is required and early checking of the quality of the collected information is invaluable.

2 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.

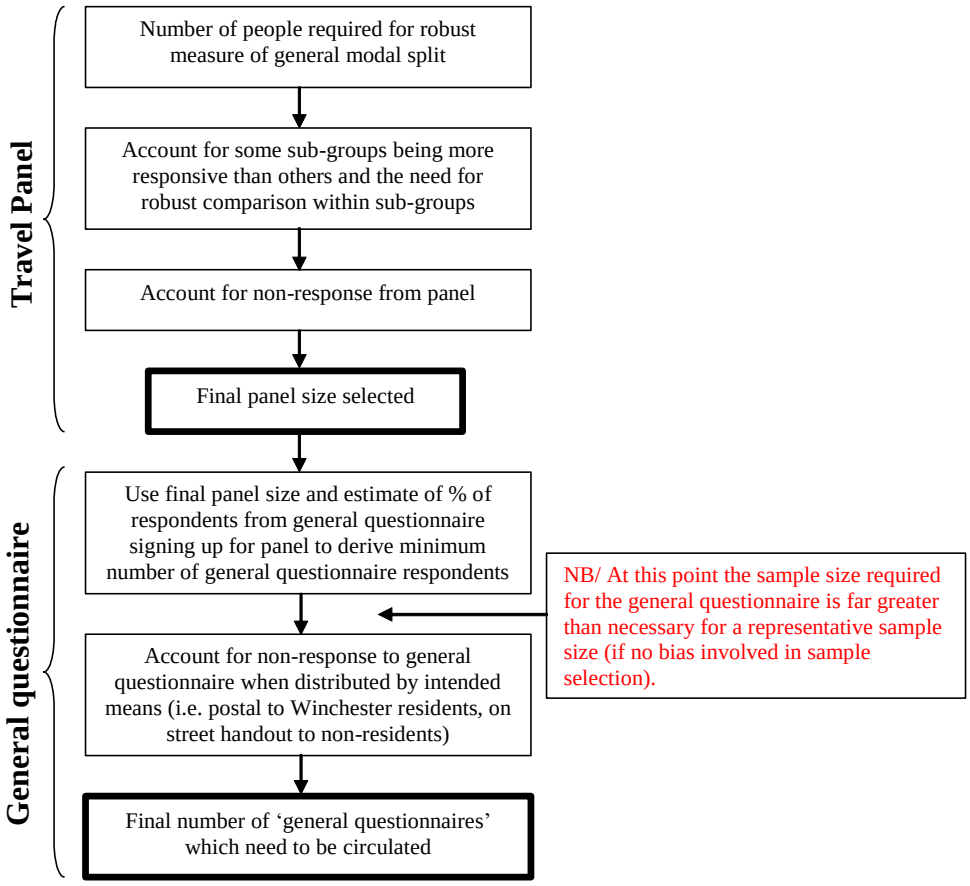

Figure 2.1: Flow diagram showing how sample sizes for large scale questionnaires in Winchester were developed

3 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.

Recently also a more innovative internet concept is possible using an app on a mobile phone combining location data with additional information introduced by the user. Of course, similar concerns on bias effects remain valid.

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 2.1: 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)

2.3 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.