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The Guidelines on-line

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Hypertext links: If you prefer to read the Guidelines on your computer, note that the table of contents and all cross-references within this document are hypertext links. Just click on the chapter or figure number to go to the text or graphic referred to.

Executive summary

The main purpose of the MAESTRO Guidelines is to aid decision-making for the selection, design and evaluation of pilot and demonstration (P/D) projects for transport in Europe. The Guidelines are intended to connect the different decision moments and evaluation phases throughout the entire lifecycle of a P/D project. They should be used in conjunction with other texts dealing with different stages in the process of carrying out P/D projects.

Four groups of users have been identified, not mutually exclusive: decision-makers; project managers; expert users; and stakeholders. The division reflects the role of the user in the P/D project process and the level of information they require in order to carry out their role more effectively and to assist others to fulfil their respective roles. The Guidelines have been designed to allow users either to identify themselves within a group, and thus decide which sections will be of relevance to them, or to read or skim through the Guidelines from a more general viewpoint. In order to illustrate the Guidelines in action, examples from the seven transport sectors classified by the European Commission are provided throughout the text.

It is intended that users of the Guidelines will be able to make use of them to assist with the development and evaluation of P/D projects. It is expected that the assistance will be provided at all stages of the project lifecycle. For example, project proposers will be able to utilise the checklists in the Guidelines when developing their project proposals, and active project participants will be able to use the more technical material to assist in conducting and developing particular project stages.

The Guidelines have been divided into five main sections—three for the guidelines proper, plus an introductory section and a final section containing additional information—with a set of appendices pertaining to the seven transport sectors separately: The three main evaluation phases, corresponding to sections 2 through 4 of this document, are:

Before the project begins, when users define their specific transport problem and decide whether a P/D project is the best way to try to solve the problem;

During the project (the methodology), when users address the issues associated with setting up the project, specifically defining the objectives, site selection, pre-design and initial evaluation, as well as considering the design and ex ante evaluation and concluding with implementation of the P/D and ex post evaluation;

After the project, when users consider how best to use the project results, and whether to proceed to full-scale implementation.

Section 2 of the Guidelines deals with the period before the project begins. The particular transport problem is defined. The problem is related to the existing policy context, and potential strategies and measures for addressing the problem are highlighted. The section concludes by considering whether a P/D project is an appropriate

way to tackle the problem and proposes possible alternative approaches.

Section 3 is dedicated to the core of the Guidelines: the methodology. The methodology consists of seven interrelated parts—four project stages and three evaluation phases. Each project stage is followed by an evaluation phase, which provides information for the next or the previous project stage. The feedback loop option ensures that a current project may be redirected at any point during its lifecycle.

The first stage of the methodology involves the definition of objectives. General transport and sector-specific objectives are first identified to set the context for the definition of the project objectives. The definition of the project objectives is vital: all other parts of the methodology depend on the accurate definition of the project objectives.

The site selection and pre-design are the two components of the same project stage and MAESTRO recommends running them simultaneously with information exchange between them. Within the site-selection process, important selection parameters are highlighted, together with issues to consider to ensure the process is transparent and that as far as possible, conflict is minimised. Pre-design is the process of specifying the functionality of the applications or systems to be demonstrated, based on the project objectives, the user needs and requirements (identified within this stage) and the site characteristics.

After the site selection and pre-design, the first of the three evaluation phases may begin. This initial evaluation is based on expected impacts of the project and is mainly qualitative. The identification of expected impacts, and indicators to describe the impacts, is addressed within this section. MAESTRO divides impacts into four categories: (1) transport system performance; (2) economic efficiency; (3) environmental; and (4) safety and security. During the initial evaluation, the choice of evaluation method for assessing the impacts in all three evaluation phases should be made. MAESTRO proposes four alternatives, to be used alone or in combination: cost-benefit analysis; cost-effectiveness analysis; multicriteria analysis methods; and goal achievement matrix.

The design stage will follow a successful initial evaluation. In this stage, the pre-design of the demonstration is refined and hardware, software and support items for the demonstration are defined. The design must be consistent with the project objectives and the user needs/requirements and budget and time constraints should be taken into consideration as important issues for the development of the design.

Once the detailed design of the project is in place, an ex ante evaluation should be carried out. This evaluation reviews the results of the initial evaluation following refinement of the pre-design. The detailed design of the P/D project is compared with the 'do-nothing' scenario. This evaluation will enable more accurate estimation of the detailed impacts of the project, as more data will be available by this time. The question of whether implementation of the P/D will meet the project objectives should be considered.

Where unfavourable impacts are estimated by this evaluation, the design may be refined in an attempt to reduce these impacts.

Implementation of the P/D project will commence only when those involved in the project are content with the design of the demonstration and happy that the estimated impacts are promising. The demonstration should be implemented as designed. A number of critical success issues are highlighted, together with advice on resource monitoring and verification and fine-tuning of the design if necessary.

The ex post evaluation phase completes the three evaluation phases. The success of the P/D project is evaluated in terms of how far it achieved its objectives and the actual impacts measured in the four impact categories. The outputs from this phase will feed into the evaluation method chosen during the initial phase. The outcome of this final phase will influence the decision whether or not to proceed to full-scale implementation.

Section 4 of the Guidelines addresses the time after the project has been completed, specifically the issue of how to utilise the results of the P/D project. This section assists in the interpretation of the project results and raises questions to consider before a decision is made about whether to proceed to full-scale implementation.

Preface

These Guidelines are the culmination of the 21-month MAESTRO Project, funded by the Transport Directorate (DG VII) of the European Commission. They are intended to provide a comprehensive tool to assist readers in the selection, design and evaluation of transport projects; in other words the authors hope that they will prove to be effective transport guidelines for the 21st century. Previous research projects have developed guidelines applicable to particular parts of the lifecycle of a project; we believe that this is the first set of guidelines that are readily applicable at all phases of a project lifecycle.

These Guidelines are to assist the full range of key actors involved in the selection, design, conduct and evaluation of Pilot and Demonstration (P/D) projects. These actors include the decision-makers, who develop transport policies and commission P/D projects; project managers, who develop project proposals, liaise with clients, and manage all stages of the P/D project; the expert users, who are the other active participants within P/D projects, for example, evaluation experts, technical experts, dissemination experts, quality control experts, and the stakeholders, who are not actively involved within the project, but who have an interest in its conduct or impacts.

The Guidelines will assist the key actors within all types and levels of transport projects. Although the Guidelines have been developed with European-level P/D projects in mind, the authors believe that they will be equally applicable to projects throughout Europe at the national, regional and local levels. We also hope that the Guidelines will have applicability beyond the European Union, especially within the countries of Central and Eastern Europe and the countries of the former Soviet Union.

The MAESTRO Consortium views these Guidelines very much as a living document, and expects that they will evolve as they are applied in the real world. They will be adapted to meet future changes and shifts in transport policies and programmes. They have been subjected to a rigorous four-stage usability testing programme, which has led to significant amendments to both the style and content of the document.

This document is also available on CD-ROM and may be accessed via the MAESTRO Web site:

http://www.europrojects.ie/maestro

We welcome comments on the Guidelines through the site or to:

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Lichfield, November 1999

MAESTRO project participants

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ARISE	European Economic Interest Grouping	BE/SE
VTT	Technical Research Centre of Finland	FI
NEI	Netherlands Economics Institute	NL
BPV	Beratung und Planung im Verkehrswesen	DE
DITS	University of Rome La Sapienza	IT
GSF	Gestionnaires sans Frontières	RO
CISR	Centre for Interdisciplinary Systems Research	GR
ETSU	AEA Technology	UK
ITS	University of Leeds	UK
Systema	Systems Planning and Management Cons.	GR
UTwente	University of Twente	NL
BTSA	Barcelona Tecnologia	ES
ETTS	European Transport and Telematics Systems	IE
IABG	Industrieanlagen Betriebsgesellschaft	DE
USE	University of Salford	UK

Abbreviations, acronyms and symbols

The following abbreviations and acronyms are used in the text and the appendices.

ATC	air traffic control
ATM	air traffic management
CBA	cost-benefit analysis
CEA	cost-effectiveness analysis
CEC	Commission of the European Communities
CNG	compressed natural gas
CO	carbon monoxide
CO_2	carbon dioxide
CTP	Common Transport Policy
dB	decibels
dBa	adjusted decibels
DME	dimethyl ether
EC	European Commission
EDI	electronic data exchange
EU	European Union
g	gram
GAM	goal achievement matrices
GDP	gross domestic product
gfa	gross floor area
GJ	gigajoules
GPS	geographical positioning system
ha	hectares
hcs	hydrocarbons
hr	hour(s)
Hz	hertz
ISO	International Standards Organisation
ITU	international transport unit(s)
IWT	inland waterborne transport
km	kilometre(s)
kWh	kilowatt hour
LNG	liquid natural gas
LPG	liquefied petroleum gas
MCA	multicriteria analysis
min	minute(s)
MJ	megajoules
n.	note
no.	number
NO_x	nitric oxides
PAX	passenger(s)
Pb	lead
pkm	passenger kilometres
ppm	parts per million
SO_2	sulphur dioxide
TEN	Trans-European Networks
TEN-T	Trans-European Networks-Telematics
thc	total hydrocarbons
tkm	tonne kilometres
vkm	vehicle kilometres
VMS	variable message signs
VOCs	volatile organic compounds
VOT	value of time
yr	year(s)

Section 1. Introduction

What is the purpose of the MAESTRO Guidelines?

Why are the MAESTRO Guidelines needed?

How do these guidelines relate to existing standards and codes of practice?

Who should use the Guidelines?

How are the Guidelines organised?

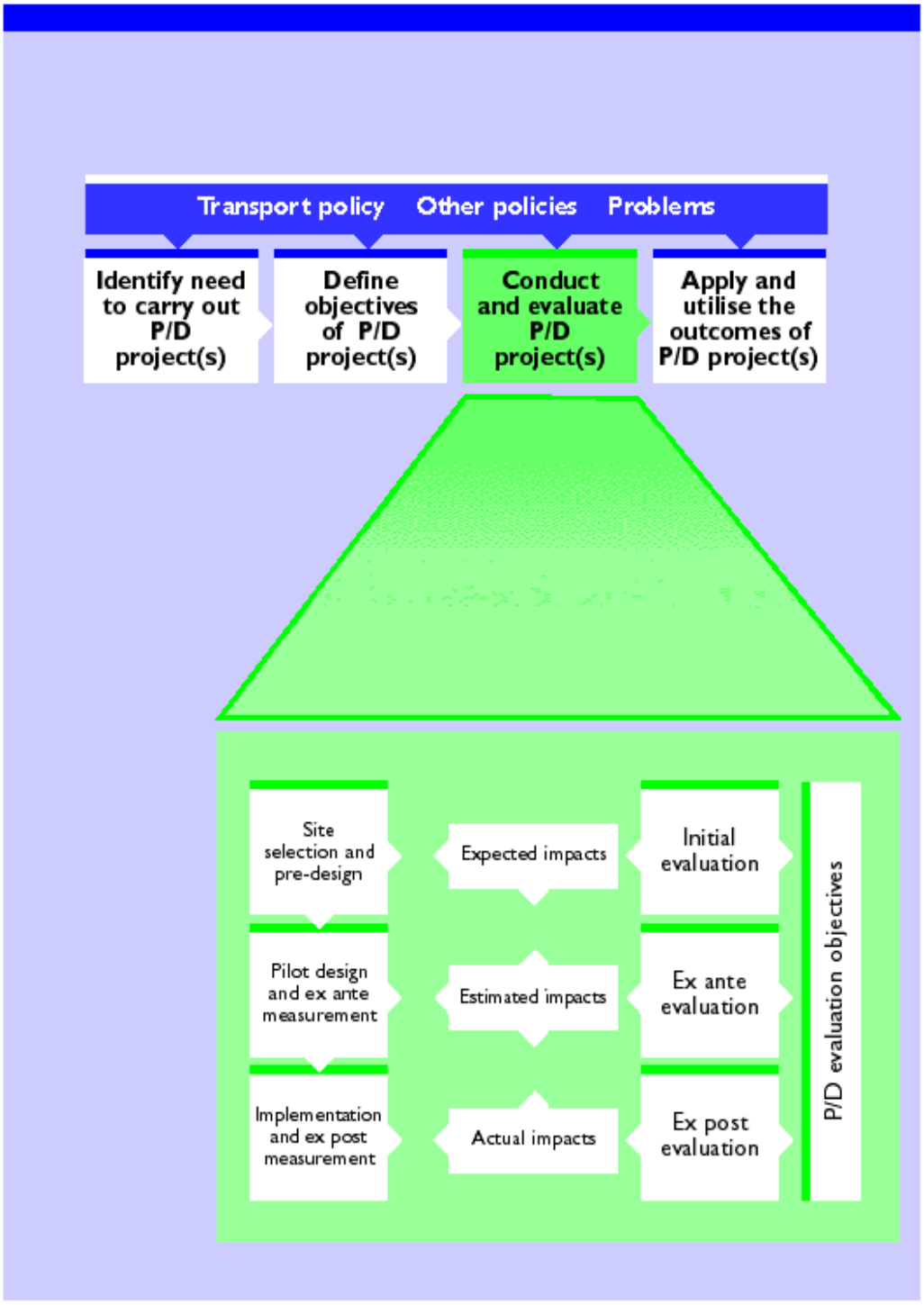


Figure 1. The MAESTRO framework

The MAESTRO framework follows the life of a P/D project from the beginning (the problem or the policy that pushes towards the P/D project) to its end (the utilisation and application of project outcomes). Of the four macro steps, the third, the evaluation process, is the most important. Within the third step (enlarged in the figure) are three project development and evaluation levels: (1) pre-design/site selection and initial evaluation, (2) design and ex-ante evaluation and (3) implementation and ex post evaluation. At each level evaluation and project development are linked by increased knowledge of the project impacts. Each level deals with the project objectives stated at the beginning.

What is the purpose of the MAESTRO Guidelines?

The main purpose of the MAESTRO Guidelines is to aid decision making for the selection, design and evaluation of pilot and demonstration (P/D) projects for transport in Europe. The Guidelines are intended to connect the different, interdependent decision moments and evaluation phases throughout the entire lifecycle of a pilot or demonstration project, from setting it up to evaluating the results. The MAESTRO Guidelines will also help address the links between the objectives, design, evaluation and utilisation of the results of the project.

A pilot or demonstration (P/D) project is the innovative application and assessment under real life conditions of a transport system or systems. In certain transport sectors simulation or modelling scenarios can take the place of P/D projects.

Although these Guidelines focus on EU-level research projects, they may be applied to P/D projects at all levels, down to the local level.

Example. What is a P/D Project?

An Urban sector project with six European demonstration sites developed packages of traffic management measures in the areas of: pedestrianisation, cycle measures, reduction in private road space, public transport priority, parking management and traffic calming. These measures were implemented within selected corridors and areas, to allow a full comparison of impacts between partner cities. This corridor/area approach, when conducted on a carefully defined basis, also allows an estimation of the likely impacts of such individual measures or packages of measures conducted on a city-wide scale. A P/D project of this type may act as a precursor to full-scale implementation.

Why are the MAESTRO Guidelines needed?

As a starting point for the formulation of these Guidelines, existing evaluation Guidelines were reviewed. The researchers discovered that available Guidelines either concentrated on specific stages and processes within P/D projects or else were very general. Clearly no comprehensive Guidelines existed to provide practical guidance throughout the entire lifecycle of P/D projects.

The three key parts of a P/D project:

- Before the project begins
- During the project
- After the project

The MAESTRO Guidelines bridge the gaps between the different parts of a P/D project. They are not, however, intended to be a stand-alone document to be used as a sole point of reference. Rather they should be used in conjunction with other texts dealing with different stages in the process of carrying out pilot and demonstration projects. The Guidelines are intended to complement any existing quality standards, not directly or explicitly related to transport, particularly the ISO standards.

A P/D project may consist of one or more individual demonstrations or pilots. It may also be conducted as part of a broader project or program. P/D projects range from the simplest type, with one project at a single test site, to complex examples with a number of P/D projects representing different concepts at a multiplicity of test sites.

Many practitioners may fear that the introduction of a new set of guidelines is likely to result in an increased workload. These Guidelines, however, should help to reduce the risks associated

with carrying out transport P/D projects, as they cover the entire lifecycle of a P/D project, provide case study examples of transport projects and recommend preventative actions to avoid potential problems. The Guidelines propose a strategy that should reduce the risk involved in conducting P/D projects.

The Guidelines follow a P/D project throughout its entire lifecycle. Before the project begins, users define their specific transport problem or problems and decide whether a P/D project could be appropriate for their needs. During the project, users will address the issues associated with setting up the project, specifically defining the objectives, site selection, pre-design and initial evaluation. The user will also consider design and ex ante evaluation and go on to examine the processes required within project implementation and ex post evaluation. After the project, users will be encouraged to consider how best to utilise the project results and whether they should proceed to full-scale implementation.

Three phases of evaluation:
- Initial
- Ex ante
- Ex post

As illustrated in Figure 1, different types of evaluation take place following the pre-design and site-selection stage and the more detailed design, as well as after implementation. The three phases of evaluation are known as *initial, ex ante* and *ex post*.

Because no measurements have yet been made, in initial evaluation, the impacts of the project can be expressed only as expected impacts. Once the design stage has been completed, it will be possible to estimate the impacts. This is the *ex ante evaluation*. Finally your project should be evaluated in terms of how it contributed to achieving the objectives and in terms of the actual impacts measured. This is known as *ex post evaluation.*

Example. Measuring the success of a P/D Project (1)
A project in the Urban sector was established to measure the impact of integrated packages of traffic management measures. A full multi-phased evaluation was undertaken. The project developed a set of recommendations for the future development of urban transport policies taking into account different urban environments, legal and institutional barriers, the need to improve the quality of life, the needs of different users of the public transport system, especially elderly and disabled persons and other vulnerable road users. It set the framework for a wider-scale deployment and implementation of the measures within the project partner cities. It enabled the future selection of those measures or packages of measures that show the best return in terms of positive impacts. It also allowed lessons to be learnt regarding the dropping of measures, or combinations of measures, that do not produce the required beneficial impacts.

Example. Measuring the success of a P/D Project (2)
A P/D project in the Intermodal sector (freight) is established with the objective of increasing the efficiency of freight transport between the different branches of an industrial enterprise. Some sites are served by an individual rail access, some are not; a combined transport chain has therefore been developed to allow the carriage of conventional containers on either train or truck, and to allow transfer of the containers between the modes.

Within a P/D project a new technology will be implemented and evaluated that will allow more efficient handling of the freight containers, allowing their transfer from train and truck without the need for either heavy external technology or lengthy, staff-intensive procedures. The project will be judged a success if the new technology is found:

- to be reliable;
- to meet the freight transport needs of the business;
- to be more efficient than the conventional technology used hitherto;
- to contribute to a reduction of costs in the production chain.

If these criteria are met, the decision may be made to move towards full-scale implementation.

How do these guidelines relate to existing standards and codes of practice?

A number of standards exist for quality control, project management and environmental management that may affect your project. The most commonly observed is ISO 9000. Observance of these standards and codes of practice will help to ensure that your project meets customer requirements, is completed on time and to budget, manages the environmental impacts and is benchmarked for comparison of performance. MAESTRO is designed to be consistent with these existing standards. MAESTRO does not provide detailed guidance on these areas but does give an indication of what would need to be done to be consistent with existing quality standards. Further information on these standards is provided in Section 5, page 88.

Who should use the Guidelines?

Four main user groups
- decision-makers
- project managers
- expert users
- stakeholders

The MAESTRO Guidelines have been designed to appeal to a wide range of users. It is recognised, however, that different users will have different needs and readers of the Guidelines may not necessarily need or want to look at every section. The design of the Guidelines addresses four main types of users—decision-makers; project managers; expert users; and stakeholders.

Decision-makers will be interested in the Guidelines in that they need to know that there is a dependable process underlying the P/D project process. This group merely need to understand the broad workings of the P/D project process.

Project managers need to know the steps to be taken in conducting P/D projects. They have to ensure that these steps are taken, mobilise the resources, assure the quality of the project, assemble the results, and present the options and recommendations to the Decision-maker(s). These individuals are likely to have a significant role in the preparation of objectives, the site selection process and in attempts to achieve consensus. They will need the Guidelines as a reference manual, supported by checklists, to help them to guide, instruct and monitor the expert users. Project managers and expert users form the actors within a P/D project.

Expert users will carry out one or more of the tasks, for example producing an evaluation plan and developing impacts and indicators to be measured. The Guidelines should provide the overall context and help them to understand other stages and evaluation phases, provide useful lists such as those in the appendices, reference texts, bibliography and case study examples. All active participants in a P/D project may be considered to be expert users.

The *stakeholders* are all those groups or individuals who are not directly engaged in the P/D project actions. The Guidelines will help them to understand the process and therefore be able to have dialogue with the direct actors. They will also understand the results and limitations of the process.

Who are the readers and users of the MAESTRO Guidelines?

Decision-makers will include strategic officers within the European Commission who are responsible for developing policy directions, and for developing calls for proposals; national government representatives who are responsible for developing strategic policy directions and for commissioning P/D projects are also included within this group. Regional government representatives are also included if they also fulfil the functions of the preceding two groups.

Project managers are taken here to mean those active project participants who have been designated to develop the project proposal, to liaise with the project sponsors, and to manage the P/D project after acceptance. The project manager is deemed to have extra and special responsibilities during the project development, project negotiation and project implementation phases, which necessitate the use of the Guidelines in a subtly different fashion.

Expert users are effectively the active project participants within a P/D project, excluding the project manager. The expert users are likely to make use of those parts of the Guidelines that conform to the individual expert user's area and level of responsibility within the P/D project, be that at local or European level.

Stakeholders have a particular interest in the applications contained within a P/D project or in the impacts of the P/D project, but without being actively involved within the project itself. They will include local authorities, transport undertakings, citizen's groups and the various categories of (potential) end users themselves.

The groups identified here are not mutually exclusive and the Guidelines have been designed to allow users to either identify themselves within a group and from this decide which sections of the Guidelines will be of relevance to them, or to read or skim the Guidelines from a more general viewpoint. The 'MAESTRO Methodology step by step', in Section 3, can assist you in this process, as well as in forming a checklist for the development of a P/D project plan and/or P/D project evaluation plan.

See Section 3, 'The MAESTRO methodology step-by-step', page 31.

How are the Guidelines organised?

The design of the Guidelines should help you to find your way quickly and easily to the sections to which you need to refer.

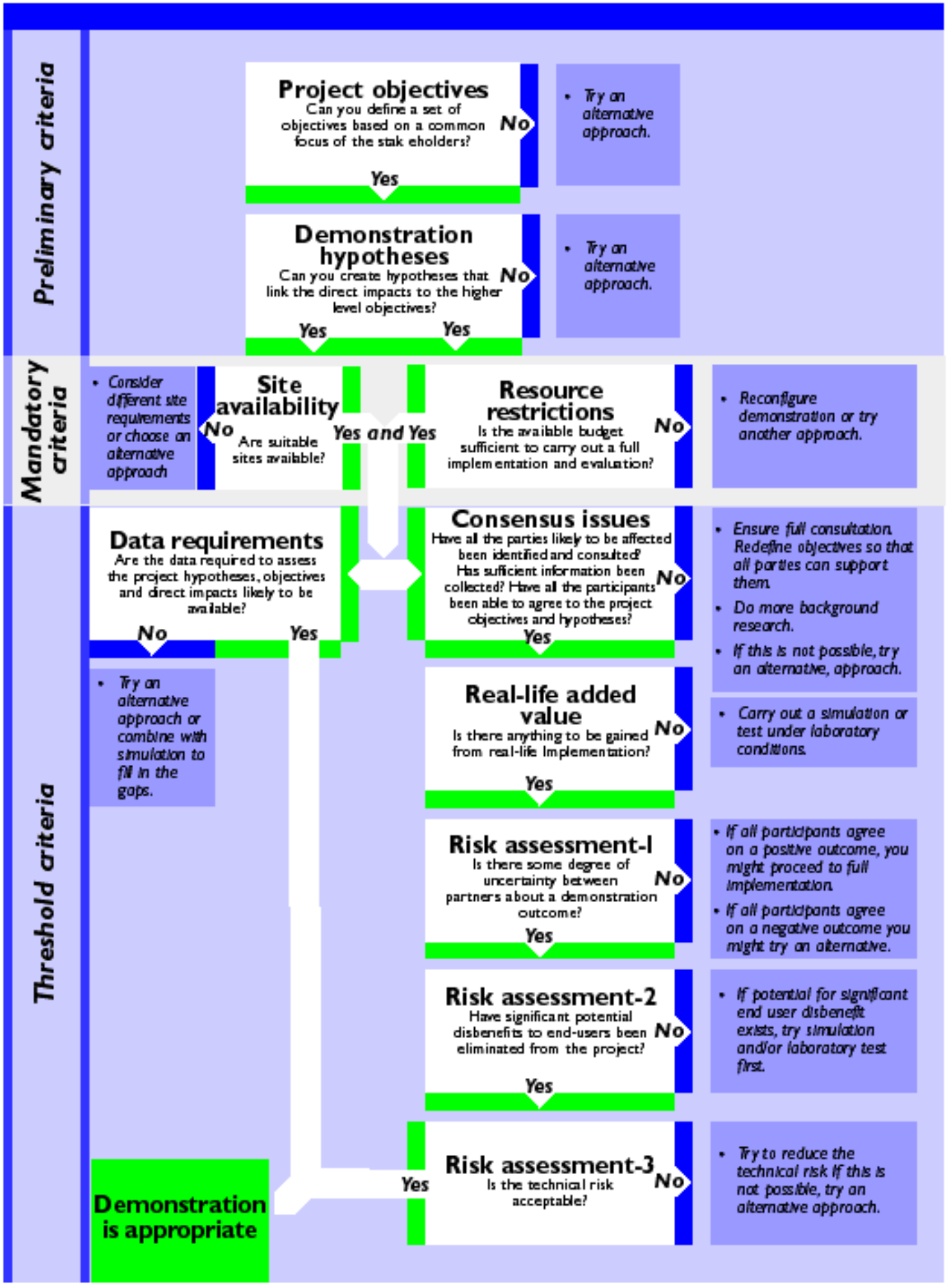
In order to illustrate the Guidelines in action, examples from different transport sectors are provided following the development of suitable sector-based examples. The sectors covered are those highlighted by the European Commission—air; intermodal; rail; road; urban; and waterborne. The strategic sector has not been included in the case study examples because it is a general category covered by the other sectors. Each transport sector has been allocated a symbol to indicate to which sector each case study example refers. Some examples provided illustrate specific parts/features of the guidelines without the necessity of linking with specific transport sectors. Within the MAESTRO Guidelines the seven sectors are always listed in alphabetical order and identified

by one of the symbols given on page **Errore. Il segnalibro non è definito.**.

Section 2.
Before the project begins

Figure 2. Decision flowchart (next page)

The chart illustrates the decision process you will follow to establish whether a P/D project is appropriate for your needs. MAESTRO has defined three criteria to be met sequentially. Two subsequent questions (Project objectives and Demonstration hypothesis) form the Preliminary criteria. If the answer to both is 'yes', you move to 'Mandatory criteria', consisting of two parallel questions (Site availability and resources restriction). Only if the answer to both the last questions is affirmative will you move on to the Threshold criteria, the third and last. 'Threshold criteria' has two parallel lines of questions, the first consisting only of a question on Data requirements, the second of five questions (Consensus issues, Real-life added value and Risk assessment one, two and three). A Pilot or Demonstration project is appropriate if you answer all the questions 'yes'.


Preliminary criteria
Project objectives
Can you define a set of objectives based on a common focus of the stak eholders?
No
Yes
Try an alternative approach.
Demonstration hypotheses
Can you create hypotheses that link the direct impacts to the higher level objectives?
No
Yes
Yes
Try an alternative approach.
Mandatory criteria
Consider different site requirements or choose an alternative approach
Site availability
No
Are suitable sites available?
Yes and Yes
Resource restrictions
Is the available budget sufficient to carry out a full implementation and evaluation?
No
Reconfigure demonstration or try another approach.
Threshold criteria
Data requirements
Are the data required to assess the project hypotheses, objectives and direct impacts likely to be available?
No
Yes
Try an alternative approach or combine with simulation to fill in the gaps.
Consensus issues
Have all the parties likely to be affected been identified and consulted? Has sufficient information been collected? Have all the participants been able to agree to the project objectives and hypotheses?
No
Yes
Ensure full consultation. Redefine objectives so that all parties can support them.
Do more background research.
If this is not possible, try an alternative, approach.
Real-life added value
Is there anything to be gained from real-life implementation?
No
Yes
Carry out a simulation or test under laboratory conditions.
Risk assessment-1
Is there some degree of uncertainty between partners about a demonstration outcome?
No
Yes
If all participants agree on a positive outcome, you might proceed to full implementation.
If all participants agree on a negative outcome you might try an alternative.
Risk assessment-2
Have significant potential disbenefits to end-users been eliminated from the project?
No
Yes
If potential for significant end user disbenefit exists, try simulation and/or laboratory test first.
Risk assessment-3
Is the technical risk acceptable?
Yes
No
Try to reduce the technical risk If this is not possible, try an alternative approach.
Demonstration is appropriate

2.1 Defining your problem

In this chapter:
- How to define your problem
- How to identify possible solutions

The clear identification of the particular transport problem or problems is vital for the success of a P/D project; it will be the focus for the formulation of project objectives and hypotheses. Consider too which aspects of the transport system you might want to examine. Unless the problem is clearly defined, it will be impossible to specify the project objectives.

Most transport problems can be traced to one of three origins or a combination of them: the introduction of a new policy; inadequacies in an existing transport system; technological innovation.

Examples. The three sources of transport problems
Most transport problems can be traced to one of three origins or, more likely, a combination: (1) the introduction of a new policy; (2) inadequacies in an existing transport system; (3) technological innovation.
The need for a P/D project in road pricing in a city with an attractive and historic city centre might be generated by a combination of origins:

- the European Commission's Common Transport Policy requests action in the field of internalisation of external costs and allocation of infrastructure costs to achieve efficient transport systems. Charges should not be too high in order to avoid the social exclusion of people who cannot pay; they should not be too low that they are unable to contribute to achieving a more rational use of infrastructure.
- A historic city centre might suffer because the visitors use cars, which cause higher costs for preserving the cultural heritage than the benefits brought by the visitors. Charges should not be so high as to discourage visitors or so low as to be unable to achieve a more balanced modal split.
- An innovative system has been developed allowing flexible charging for using the infrastructure, depending, for example, on: type of user (e.g. inhabitants, tourists, commuters); the current traffic load; existing environmental pollution.

Thus there are a number of origins, all supporting a P/D project in urban road pricing.

See Section 3. The policies related to each transport sector can be found in Table 1 of each of the appendices.

Does your problem relate to the existing policy context?

The European Commission's Common Transport Policy (CTP) and the directives of the European Union provide the background against which national and local transport policies are formulated. In defining your problem, look at it in relation to current policies and consider what might be done to solve it. Your problem is unlikely to be unique, and you are very likely to find where it fits under European transport policies.

Three sources of transport problems:
- a new policy
- existing inadequacies
- technological innovation

In this chapter:
- Why carry out a P/D project?
- How to choose between a P/D project and another option

2.2 When is a P/D project appropriate?

You can address your problem by choosing appropriate strategies and measures. Strategies and measures are linked hierarchically to policies.

Within the Guidelines, a *strategy* is a plan for putting policies into action to address a particular transport problem. A *measure* is an action designed to bring about a desired end. A group of similar measures may be classified as a strategy.

In relation to European transport, ten different types of transport strategy have been identified covering all transport modes, both passenger and freight (see box below).

The relationship between strategies and measures in relation to the seven transport sectors can be found in Table 2 in each of the appendices.

After the problem has been defined, it should be clearly recorded and referenced when setting the project objectives.

You have defined and described your problem in relation to current transport policies. You should now consider whether a P/D project is the most appropriate of the many possible ways of addressing your specific transport problem. Undertaking a P/D project can take a great deal of time and resources and it is therefore important at an early stage to ensure that a P/D is the right way forward.

Pilot or demonstration projects usually aim to test and collect information about the performance and effects of an application before it is implemented on a large scale. Also, some groups of people need to be convinced about the viability of a measure being tested before full implementation can take place.

The 10 types of transport strategy

1. Physical (i.e. infrastructure)
2. Control (i.e. flow control)
3. Pricing/financial
4. Organisational (i.e. parties and their respective roles and interrelationships and responsibilities)
5. Operational (procedures of transport network operations)
6. Legal/regulatory (standards which govern transport studies operations)
7. Marketing/information (e.g. information systems, marketing campaigns)
8. Vehicle stock
9. Land use (planning and development)
10. Telematics/trip substitution (e.g. remote teleworking, teleshopping)

Example. Strategies

A *physical* strategy such as the introduction of a bus priority scheme may be chosen to make public transport more competitive with private modes. The introduction of a bus lane or lanes onto a highway is one possible physical measure for implementing the bus priority strategy. An alternative strategy might provide bus priority at traffic lights; this would be a *control* strategy, with a bus filter arrow being the measure used.

Example. When is a P/D project appropriate?

A city intended to develop a new driverless light rail system to replace an existing urban rail system. The basic problem was that the existing rail system was not directly seen as the way to develop the city centre in a positive way in the future. Detailed discussions among politicians, experts, inhabitants had taken place, since it was not clear whether this new system, with its huge investment needs, was really so much better for the urban transport system than the old one.

A preliminary study to compare this plan with other existing options showed that similar positive effects on urban transport could be achieved by improving the existing rail and tram infrastructure and their links—at far lower cost.

In order to gain the maximal benefit from the driverless system the extension to the centre would definitely be needed, but it was far too expensive at that time. The final agreement was to develop the conventional systems further, but to respect the suggested route for the expanded light rail in coming urban planning to keep the option for the new system open in the future.

Why a P/D project?
The following general reasons for carrying out P/D projects have been identified:

- Advancing the state of the art
- Policy support
- Decision support
- Developing a new concept
- Evaluation and transferability
- Finding consensus
- Influencing transport decision makers
- Formally matching local, national and EU policies
- Learning
- Improving procedures
- Marketing
- Assessment of a commercial opportunity
- Testing new technologies

If not a P/D project, then what?
There are four main alternatives to undertaking a P/D project.

First there is the option to 'do nothing', i.e. leave the current transport system unchanged. This option is, however, unlikely to

solve your particular transport problem; it may become necessary later on to reassess whether this was in fact the most appropriate action.

A second option would be to carry out a preliminary study before deciding whether or not a P/D project is appropriate. This would save the time and resources needed for the P/D process and might help you to define the objectives and potential impacts of a similar P/D project in the future.

A third option is to conduct a literature review. You would thus find out how other similar P/D projects have been conducted and what their results were. This is an economical course of action and offers more than conservation of resources; it could also inform your thinking about what impacts you might expect from your own P/D project and full-scale implementation. This option may also form the preliminary stage of a P/D project.

The final option would skip the P/D project and proceed directly to full-scale implementation. This higher-risk option may be preferable if you have good reason to believe that your results will be positive and are fully confident of the direction and scale of the impacts.

The first three options may precede a decision whether or not to proceed with a P/D project, whereas the final option removes the need for a P/D project altogether.

Examples of the four alternatives to a P/D project
If a city considers conducting a P/D project involving an urban road pricing system, the four alternatives to a P/D project may be:

- ***Do nothing*.** The investment in technology (e.g. installation of toll points) or the follow-up costs (e.g. smart cards, information systems) are too high for the city. The plan might also be stopped if local politicians are not convinced that it will be successful.
- ***Conduct a preliminary study***: (a) to define the test area, (b) to find the best places for installation, (c) to define a methodology for handling different user groups, (d) to estimate likely impacts of the system.
- ***Review the literature*** to search for examples of how other cities have built a road pricing system for the inner city: for example, which corridors were chosen as test sites, how toll points were established. Experiences of the technology to be installed could be checked to establish how reliably the system works or how users experience the operation. This information provides a good starting point for a P/D project.
- ***Go straight to full-scale implementation*** if the technology has already proved to be reliable and there is little difference in investment costs between a P/D project version and the full-scale version.

How do you decide whether a P/D is appropriate for you?

There are three main sets of decision criteria to consider when deciding whether a P/D project is the appropriate way to tackle your specific transport problem or problems. The inputs to these decisions will become apparent over time as the planning and

See Section 4.

design of the P/D project proceeds. The MAESTRO Guidelines take account of this lag by offering, at several moments in the project lifecycle, the options to abort the project or to re-design previous stages.

See chapter 3.1.

Preliminary criteria must be met in advance, before the P/D project begins. For example:

See Figure 2, page 12.

Project objectives. A key to your project's success is the establishment of consensus among the project stakeholders to provide a common aim for the project.

Project hypotheses. Ensure that you are able to formulate appropriate hypotheses, linking the direct impacts of your proposed P/D project to the higher-level transport objectives.

Mandatory criteria must be met in full to enable you to conduct a P/D project.

Resource restrictions. Assess your needs (e.g. for data, equipment, staff) against the likelihood that they will be available and the implied budgetary requirement. If the funds available for the demonstration are considerably less than needed to meet the proposed expense, seriously consider from the outset redefining the demonstration. Other resource requirements, such as the costs and availability of staff and equipment, should also be considered here. If you find it impossible to reconcile the overall resources available with the probable cost of the P/D project, abandon the project in favour of a less demanding alternative.

Three MAESTRO decision criteria:

- Preliminary
- Mandatory
- Threshold

Site availability. Conduct a site audit to ensure that proposed site or sites is/are available and suitable. Unless (an) appropriate site or sites is/are available, or will become available for the implementation process, you will need to find alternatives in order to proceed to the definitive phase of the P/D project.

How to use the criteria in decision making

If you think that a P/D project approach could be appropriate for your suggested project, first determine the general purpose of your project and identify the possible alternative courses of action.

See chapter 3.1.

Threshold criteria must be partly or fully met before you can proceed to the P/D project.

Consensus issues. Ensure that the institutions and stakeholders that will be involved in and affected by the demonstration have been identified and consulted. All parties should agree that enough information has been collected for a decision to proceed. They should also consider the demonstration worthwhile and support the objectives that have been identified. At this stage you also need to take account of those individuals or groups who are affected by the proposed project but who are not actively involved in it. At the very least you should ensure that (potential) conflict is minimised if it is not possible to ensure (full) consensus.

Real life added value. Does the real life testing bring greater benefit than laboratory tests or a simulation would? If not, consider one or more of the alternative courses of action. It should be remembered

however that simulation might be the most realistic environment available for testing in some sectors.

Risk assessment. Identify the risks associated with the uncertainty, the end user impacts and user acceptance, as well as the technical risk of implementing the P/D project.

If all the parties involved in the project agree that the outcome is both certain and favourable, then a P/D may not be appropriate, unless there are objections from external actors who need to be convinced of the expected positive P/D impacts.

End user impacts and reaction must be gauged at an early stage of the project. This can be done by initial engagement of stakeholders through questionnaires, surveys and workshops. If this is not possible, an alternative approach or a preliminary study should be considered.

Ensure that the technical risk is acceptable in order to justify proceeding with the P/D project.

Data requirements. Compare the likely availability of data with the data requirements you have identified. If some of the data needed to evaluate a demonstration cannot be collected, the value of the demonstration is reduced. If the unobtainable data relates to the major objectives, or if the proportion of unobtainable data reaches a certain threshold level which threatens the project objectives, choose an alternative to demonstration.

Summing up

Does your project meet the two *preliminary criteria?*

- Can you define an appropriate set of *project objectives*?
- Can you establish *demonstration hypotheses* that link the impacts of your P/D project to the higher level?

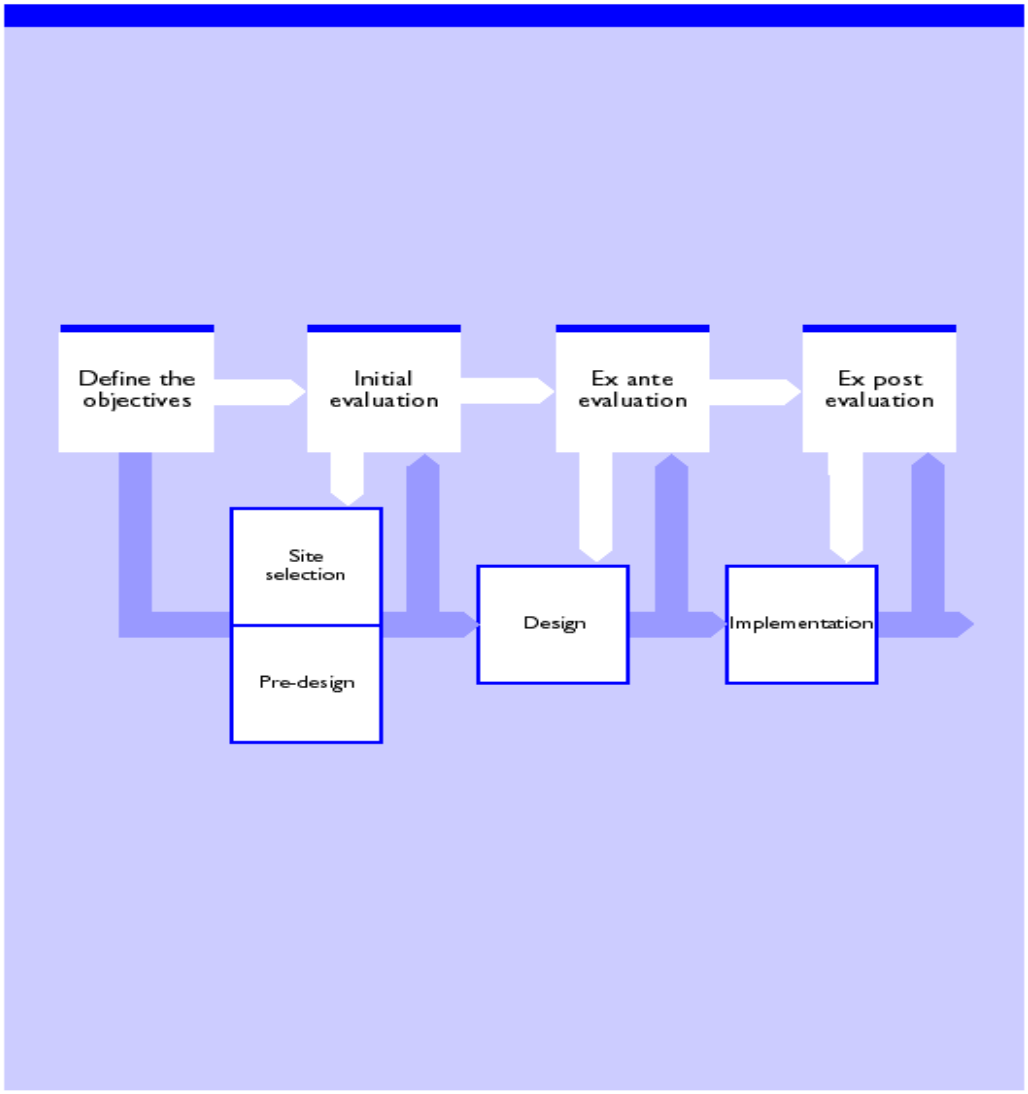
Are you sure your project does not fail to meet any of the *mandatory criteria*?

- Have you compared the likely *available funds and other resources* with the budgetary *requirements* and other needs for facilities?
- Have you audited the likely *available test sites* and their *suitability* for the purpose?

Does your project meet the necessary types of *threshold criteria*?

- Have you identified and consulted as many parties as possible who are involved in or affected by the demonstration (*consensus issues*)? Do they consider the demonstration to be worthwhile? Do they support the objectives you have identified?
- Does the *real life* experiment bring *added value* to your project?
- Have you identified possible *risks* associated with the uncertainty, the end user impacts, user acceptance and technical issues?
- Have you compared the likely *data availability* with the *data requirements*?

The process of site selection is introduced in chapter 3.2.



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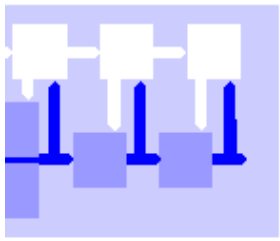


Section 3.
The MAESTRO methodology

This section is dedicated to the core of the MAESTRO Guidelines: the methodology to be followed *during the project*.

MAESTRO Guidelines have now helped you to identify your problem. Now we will help you to define the objectives of your project and use the MAESTRO methodology to evaluate it. You will also find guidance on making decisions based on this evaluation.

In this section the seven interrelated parts are analysed in detail, followed by a chapter on the evaluation tools to be used. A summary of the methodology is provided at the beginning of the section.

Figure 3. Methodology flow

MAESTRO defines three interlinked project development levels and three evaluation levels. The first activity, which feeds into all the others, is the definition of the project objectives. Once the objectives are defined, you can start site selection and pre-design. These activities help in definition of the expected impacts the initial evaluation. It is possible at any stage to stop the project or even to feed back one or more activities to iterate (though this very expensive procedure is used only when there is no alternative). Once the site is selected, the system pre-designed and the initial evaluation performed, the project proceeds with Design. The next evaluation (ex ante) is based on the impacts estimated during designing and fed by the results of the previous evaluation. It is another test to verify whether the project is in line with its objectives and whether it should continue, go back or stop. The next step, if the project has continued, is the implementation. After that a complete sets of measurements is made to assess the actual impacts, which are compared with the estimates in a before–after evaluation (ex post evaluation). This final stage provides results that can be used to decide whether to proceed towards full-scale implementation and that can be transferred to other sites with the same problems.

The MAESTRO methodology step-by-step

Defining objectives
- Consider the problem your P/D project is intended to address.
- Define your objectives according to this hierarchy: (1) transport as a whole; (2) sector; (3) area; (4) application objectives.
- Be prepared to refine the objectives as the project progresses.

Site selection
- Compile lists of potential sites.
- Consider important selection parameters.
- Involve all stakeholders.
- Minimise bias and ensure a transparent process
- Collect consistent information about alternatives.
- Rank the alternatives.
- Compare the alternatives.
- Crosscheck with pre-design results.

Pre-design
- Identify all project stakeholders.
- Identify user needs.
- Define both quantitative and qualitative elements of the application.
- Fine-tune project objectives.
- Identify project's building blocks.
- Build consensus among stakeholders and actors.
- Crosscheck with the results from site selection.

Initial evaluation
- Select the most suitable site or sites.
- Conduct a preliminary evaluation of the project based on existing knowledge and expert opinions.
- Identify the expected impacts and their respective indicators.
- Decide whether the P/D should continue. If yes…,
- Choose evaluation method(s) for the three evaluation phases.

Design
- Refine the pre-design.
- Produce a detailed specification.
- Consider the (desired) impacts of alternative designs.
- Consider constraints on the design.

Ex ante evaluation
- Review the initial evaluation results.
- Estimate the likely impacts of the P/D project.
- Identify further design modifications if necessary.
- On the basis of the results, decide whether the P/D should be implemented.

Implementation of the demonstration
- Identify project personnel to conduct and manage the process.
- Consider critical success issues.
- Implement the demonstration as designed.
- Monitor resources on a regular basis.
- Consider returning to the design stage if necessary.

Ex post evaluation
- Analyse the actual impacts of the project.
- Feed results into the chosen evaluation method.
- Consider whether the project has met its objectives.
- Consider whether to proceed to full-scale implementation.

In this chapter:
- How to define the P/D project objectives
- How to identify the P/D project stakeholders

3.1 Define the objectives

P/D project objectives describe what is to be learnt from the project and what is to be achieved by testing its application. The definition of the objectives serves as the basis for judgement in evaluating the system being demonstrated.

The project objectives should be determined on the basis of:

- the real world problem characteristics, i.e. what type of problem you are trying to solve by using the P/D project approach, and
- the needs of the stakeholders involved in and affected by the problem, such as local authorities or policy-making bodies.

Why define the objectives?

The definition of a complete and comprehensive list of objectives is a necessary stage on which all the other parts of the MAESTRO methodology depend. To check whether the project is on the right track, in each of the subsequent steps the results, expected or achieved, are cross-checked against the objectives. The list of objectives, the output of this phase, is input to every other. The project objectives may change over time, but they should always be recorded and clearly communicated to all involved.

The MAESTRO way to define the objectives

To help you define a complete, consistent and comprehensive list of objectives for your P/D project, MAESTRO suggests you follow a four-level classification of the issues, ranging from general to particular and detailed.

Four levels of transport objectives:
1 Transport
2 Sector
3 Area
4 Application

1. Transport objectives. These highest level objectives, outlined in the Common Transport Policy, are common to all transport sectors.[1] They can be clustered in three broad classes of objectives: economic efficiency, environmental protection and regional development.

2. Sector objectives. Second level objectives are pursued in all projects in the selected sector. They refer to a single transport sector and are independent from any particular innovative application or site. The P/D projects developed within the seven transport sectors fall within one or more of these objectives. Although the contribution of a pilot project to such general objectives is often negligible, these objectives are so important that they must be considered. The P/D project should give feedback on the extent to which the full implementation of the project will contribute to achieving these objectives.

See Table 4 in each of the appendices.

3. Area objectives. These third level objectives are common to all the projects developed under one area of major policy interest within each sector It was not possible in some areas to define objectives common to all applications in that area. Both second level and third level objectives. Cannot, however, be completely missing in the same sector. MAESTRO has selected a list of third level objectives, classified by the areas of major policy interest, for each of the transport. They are classified according to transport sectors and areas of major policy interest.

[1] The first level is drawn from the European *See Table 3 in each of the* per "The future development of the Common Transp *appendices.*

Areas of major policy interest are specific issues, problems and services within transport sectors, in which innovations (transport concepts, measures, system, service or a combination of these) are involved or needed. They are areas of work in which projects, aimed at solving specific issues and problems of the transport sector, take place. They concentrate most funding and research in the sector. The areas cluster common problems and interests and are useful in identifying P/D project objectives.

4. Application or P/D project objectives. Fourth level objectives are closely associated with the specific field trial or test site.

Your P/D project's objectives must be determined at each of these levels. During this activity, keep in mind that objectives at the first level are so general that any transport-related project should fulfil all of them. A screening process is therefore needed. The user is helped in this screening by choosing the second level objectives related to the transport sector in question and the third level objectives associated with the area of major policy interest. The choice of the project-related fourth-level objectives can be helped by considering the question 'what do the stakeholders expect from the project?'

Objectives of a P/D project

The project objectives identified for this project (which assessed strategies to reduce the need and demand for road travel) within the Road Transport research programme incorporated objectives on each of the four levels identified within these Guidelines:

- Transport objectives, although not explicitly stated, to further economic efficiency and regional development, together with environmental protection;
- Sector objectives, encompassing the project mission statement: "to identify strategies that would reduce the amount of travel to a necessary minimum, particularly during peak traffic periods, and to determine those journeys which have the greatest potential for reduction";
- Area objectives, include the desire to reduce congestion levels and improve the local environment;
- P/D project objectives, assessing the technical efficiency of the applications implemented to assist in the achievement of the higher level objectives.

How to make a list of objectives

MAESTRO provides lists of objectives for the first three levels, but they can become obsolete and need to be brought up to date. Use the following procedure to revise the list provided in each of the appendices of these Guidelines.

Check that the areas of major policy interest are still valid. If not, bring them up to date by looking for those areas where most funding and interest are concentrated.

Review the literature and the objectives of several sector projects, and compile a list of objectives. Then move the objectives common to all the projects in the sector up to the second level; those common to all the projects in the area become the third level objectives in which the 'evaluator' is interested. All objectives in other areas can be excluded from the evaluation.

Remember that a third level objective can be in more than one area of major policy interest at the same time but not in all the areas of the sector, otherwise it should be upgraded to the level of sector objective.

It has already been stressed that it is very important to identify the project stakeholders, that is, those who, though not necessarily directly involved in the P/D, are likely to be affected by its results at a very early stage of the P/D project. This need emerges because project stakeholders effectively define the specific field trial project objectives.

At this stage, when a project has not been formalised and a site or sites has not yet been selected, the stakeholders are simply broad categories of people with general needs. In the next stage of the project, site selection and pre-design, the stakeholder needs will be analysed and the objectives list produced here will be refined according to the specific needs of the stakeholders.

Six categories of stakeholders:
1 Public authorities
2 Operators
3 Users
4 Non-users
5 Product and service providers
6 Research institutes

Who are the stakeholders?

The main categories of stakeholders can be summarised as:

Public authorities: the part of the public administration authorised to issue directives, impose regulations and requirements, for the planning and financing of the transport infrastructure. They include European, national and local governments, government agencies and regional development agencies.

Operators: the body (public or private) which provides the transport service, collects information on traffic and exercises control, within the framework of directives and regulations, and sets the targets for service procurement and safety. They include operators of passenger, freight and emergency services.

Users: these constitute the basis for transport management and are the last link in the transport chain. They may be regarded collectively (traffic) or as single entities, for example individual drivers or passengers each with his/her need or needs.

Non-users: they are not necessarily involved directly with the P/D project but are exposed to its impacts, for example environmental impacts.

Product and non-transport service providers: Product providers include vehicle manufacturers and system integrators and consultants, construction businesses (as buyers of research products and technologies). Service providers could be related, for example, to the information infrastructure.

Research institutes: the research institutes involved in P/D projects have various roles in the process, and they are also often involved in the definition of objectives.

Although these six categories are referred to as 'stakeholders', it is possible that they may also be actors in a particular P/D project. The stakeholders identified here will provide substantial information on the definition of the project, by providing information on their

requirements concerning the problem that the P/D project is about to tackle. The needs and requirements of the actors involved in a transport P/D project may vary substantially or even be in conflict with those of the stakeholders. The stakeholders and their needs should be prioritised and a consensus among them should be sought. The stakeholders who are relevant in relation to particular transport sectors are highlighted in Table 5 in each of the appendices.

Reporting

When you have completed this stage of the P/D project lifecycle, you should compile a complete and consistent list of P/D project objectives to be refined and utilised in future project activities.

The following example illustrates what the different levels of objectives for a selected P/D project might be:

The three groups of first level objectives:

1 economic efficiency
2 environmental protection
3 regional development

Air Sector Example. Defining objectives

Within an EC call for proposals is a task addressing airports. A possible P/D project developed within this task could be a project aiming at the development of a new Airport Surface Management Guidance and Control System (ASMGCS). The aim would be to optimise airport capacity in order to meet the growth in air traffic demand in the European area. There is an Air Transport Sector Policy "Improvement of the efficiency, safety and environmental performance of the air transport system". Within the Air Transport sector there are areas of interest aiming to achieve the sector policy objectives. There is a call for proposals from the EU, which has developed the policy and identified the areas of interest necessary to address the relevant policy issues.

In this stage of objective formulation, you are building a list of possible objectives that will later be simplified. The first level objectives coincide with the Common Transport Policy objectives. MAESTRO has clustered them into three groups: economic efficiency, environmental protection and regional development.

The selection of second level objectives can be guided by the list in Table 3 of appendix A. In this example the three second level objectives addressed are the following:

- improve airport efficiency through the introduction of new ASMGCS system;
- increase safety;
- reduce environmental costs.

Before trying to identify your third level objectives, take the list of possible third level objectives provided in Table 4 in appendix A of these Guidelines and check that the areas of major policy interest that the third level objectives refer to are still valid. Furthermore, a literature review should be performed each time in order to fill out the set of third level objectives. The following third level objectives are applicable to the P/D project described here since the areas of policy interest are 'Improvement of Air Traffic Management and the 'Improvement of the airport efficiency and management':

- Increase in airport capacity,
- Reduction of delays owing to airport congestion,
- Reduction of operational and infrastructure cost,
- Reduction of airport accidents/incidents,
- Reduction of fuel consumption,
- Reduction of the noise levels.

The identification of the fourth-level objectives is based on the specific needs and requirements of the stakeholders involved in the implementation of the P/D project. Usually the fourth-level objectives refer to performance standards and users' expectations. For this example the stakeholders involved are:

- European authorities,
- National authorities,
- Airport operators,
- Airlines,
- Users of air transport.

Some of the fourth-level objectives for the P/D project could be:

- To increase the levels of capacity on site;
- To decrease the incidence of delays on site.

3.2 Site selection and pre-design

In this chapter:
- How to choose the site or sites
- How to execute the pre-design

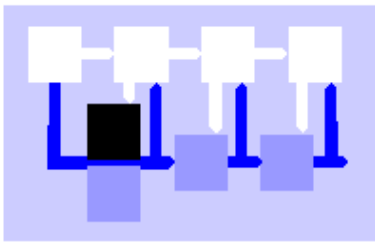
Pre-design and site selection are closely related. The pre-design influences the site choice, and the site choice influences the pre-design.

It is possible to begin with either pre-design or site selection. In many cases the project is conceived at a certain site because the site had problems and the project was developed to solve them (e.g. a certain zone of a city has great safety problems; since traditional measures seem not to work, a pilot experience with an innovative solution is made in situ). In other cases, when the new technology to test is believed to be as general as possible, the measures must fit every site and the site is chosen only after the measures have been designed.

To include both cases MAESTRO recommends that site selection and pre-design are run simultaneously and an information exchange takes place between the two parts of this project stage.

Site selection

Although projects differ in the technical details of implementation, the different steps in the selection process can be identified, classified and analysed in a general way on the basis of common factors.



Finding potential sites

To compile lists of appropriate potential sites, start with two parallel approaches:

- Carry out an active search for sites: desk research based on the requirements of the P/D project (objectives, criteria and indicators) using expert opinion, existing databases and possibly site visits.
- Send out questionnaires to an extended audience, targeting P/D project requirements and asking for proposals containing characteristics, consistent with respect to the pre-design stage.

Since a number of potential test sites will be needed, both approaches should begin in parallel. The latter approach offers the advantage of delegating responsibility to the proposers, backing potential sites. Their involvement in the selection process in this way may provide them with an opportunity to inject innovative solutions based on their local experience. Such positive involvement of a broad range of relevant actors at this early stage will improve the chances of a consensus emerging. The same principle of 'the sooner the better' applies to gaining public acceptance.

In this sub-chapter:
- Determine the potential sites for your P/D project
- Define important selection parameters
- Design a selection process
- Select appropriate site or sites for your P/D project

How many sites do you need?

The decision whether to have one or several test sites is the starting point for the site selection; it is closely connected to the objectives of your P/D project.

If the number of alternative sites is too large, an initial selection is needed before you will be able to consider in detail the merits of the most promising ones. What are the most important characteristics required from the site in the terms of the P/D project objectives?

The following four factors are of major importance in assessing a potential test site:

- Practicality;
- Data acquisition possibilities: the site or sites facilitate(s) the acquisition of reliable and transferable information;
- Validity of the circumstances and the location;
- Active presence of P/D project stakeholders.

Rail Sector Example. Site selection
A consortium of railway operators was interested in developing a methodology to draw conclusions for future railway operation scenarios. The basic problem behind the work was to find 'objective' ways to support operators in deciding whether or not to close selected rail services. The sites (in the different countries involved) were selected based only on the accessibility of data needed to support the narrowly oriented financial goals. No other impacts and needs for data reflecting other strategies were considered. This example highlights the fact that site selection procedures often do not follow the objective and transparent criteria established in these Guidelines.

Important selection parameters

Although the most important selection parameters can differ for different types of projects, they can be grouped according to the following sets of criteria: (a) national and local transport strategies and plans; (b) site-specific criteria; (c) financial criteria; (d) criteria related to the project consortium.

(a) National and local transport strategies and plans
Selected sites should accommodate:
- Consistency between local and national objectives and technologies;
- Need for the local P/D project implementation to align with the local transport strategy.

(b) Site-specific criteria
Selected sites should be able to facilitate the implementation of P/D projects: this should include concepts, techniques and technologies.

The P/D project implementation should not be hindered by:
- unavailability of data;
- reluctance of local stakeholders to support the demonstration;
- institutional and legal barriers.

(c) Financial criteria
Sites should be pre-assessed, even qualitatively, in terms of potential:
- commercial viability of the P/D project's application(s);
- ability and willingness of the local stakeholders to support additional funding if needed.

(d) Criteria related to the project consortium
The site or sites should be easily accessible and their characteristics (quantitative and qualitative) well known to potential P/D project partners.

Because the information relating to the basic site-selection parameters needs to be comparable between the alternatives, make sure that it is collected in a consistent and unbiased way, for example using a questionnaire designed for this purpose.

A qualitative analysis is essential throughout the site selection process. This analysis could include:

- a qualitative description of the suitability of the site,
- information on the history of the site, with an estimate of the circumstances in the future,
- an estimate of the expected changes potentially caused by the P/D project or any external factors.

Decision-making procedure(s)

Who is involved in the decision making?
The 'decision makers' involved in selecting a pilot and demonstration site will usually be representatives of the European Commission, national authorities, local authorities or experts (independent evaluators).

Road Sector Example. Site selection
Sites were chosen to test the impacts of physical measures on mainly the modal split between private cars and public transport, but also on other impact categories, such as environmental issues or traffic safety. The sites were chosen throughout Europe and covered corridor-related as well as area-related applications (or measures).

Regardless of the efforts put into this phase of preparing a P/D project, some aspects can never be controlled, for example, the political majority in a city council after an election, or policy decisions made at national government level during the project lifetime. In the end two desirable sites could not be used in the project and the results suffered from this incompleteness. Because of the type of measures to be demonstrated and the time available when the changes took place, no new sites could be introduced.

Why might a P/D project be halted?
A P/D project might end abruptly because of:
- weak public acceptance,
- lack of consensus among actors,
- mismatch with standards and regulations,
- legal and institutional barriers or
- failure to stick to budget.

Does the runner-up site fulfil all requirements as a backup option?
The stability of the conditions and characteristics is an important issue in comparing the potential test sites. If the circumstances of a site are expected to change, consider whether some other site would be more appropriate, even if it is ranked lower with respect to other characteristics.

How do you minimise bias in the site selection decision process?
It is extremely important to minimise bias in the site selection process, because both the credibility and the validity of the entire P/D project are at stake.

Bias is likely to occur for one of three main reasons:

- A presumption that a particular site will prevail, so that the alternative sites are not comprehensively researched;
- A competitive desire by the promoters of a site (for political, personal or commercial reasons) to gain the prestige and profile associated with the demonstration, even if the site is not the most suitable;
- Motivation to choose a site which may be more likely to give a desired positive or negative result (e.g. easy technical installation, known user acceptance, likely to provoke reaction against a concept) and perhaps distort the overall P/D project outcome.

For information on specific techniques for valuing, weighting and ranking the parameters, see MAESTRO project Deliverable 2 (The MAESTRO Evaluation Methodology), as well as the MAESTRO Guidelines on CD-ROM and the World Wide Web at http://www.europrojects.ie/maestro.

Ideally, the comparison should be carried out by unbiased experts, without any personal links to any of the sites, but with full knowledge of the project and the alternative sites. However, in many cases this may not be practical, or may be deemed too expensive or too time-consuming.

To minimise the influence of bias in the process, the process should be transparent and documented. The following steps should be taken:

- Develop and document the procedures to be used for site selection.
- Make explicit the selection criteria, scoring system and any weighting to be applied.
- Minimise the use of subjective criteria.
- Ensure that all reasonable efforts have been made to gather relevant, accurate data for every site.
- Document the results of the selection process, making explicit the basis for both the acceptance of the selected site and the rejection of other sites.
- Let all participants know that the process is being documented, and may be inspected at a later date.

By establishing clearly the 'rules of the game' and documenting the process, there should be little scope for bias even if some participants in the decision-taking process favour a specific site.

What subsequent actions are needed to establish the P/D project?
Actions to be considered to ensure a smooth transition to the design and implementation stages of a P/D project might include:

- establishment of a transparent public information action to attract target groups and to maintain public acceptance;
- early nomination of an experienced local project manager;
- keeping the runner-up site in reserve until the variable conditions are fulfilled;
- commitment to resolve (at least on a temporary basis) institutional, licensing and/or organisational barriers;
- formal commitment of the necessary human, technical and financial resources by the various actors.

Reporting

At this point you would need to record the decision and the decision criteria relating to your selected site or sites according to the quality assurance procedures defined for your organisation. It may be that

the specific characteristics of your chosen site or sites have an influence on the final outcome of your P/D project. Accurate recording of the important features of the site may assist those involved in P/D project design in the future and enable those conducting site searches to seek out or avoid sites possessing particular characteristics.

Project pre-design

Time and resources invested up front in the early design processes, can save resource inputs on a substantial scale further down the line by helping to avoid future problems.

In this sub-chapter:
- stakeholders
- other groups affected by implementation
- expected attitude(s) of the stakeholders towards the proposed application(s)
- how to actively involve the various partners, actors and user groups in the P/D project
- functionality of the design to match the needs/requirements of user groups

Pre-design is the process of specifying the functionality of the applications or systems to be demonstrated, based on: the project objectives, the user needs and requirements and the site or sites characteristics.

In a non-P/D project this stage is usually called a feasibility study, a part of which may be a P/D project. Such a study requires considerable knowledge about the effects produced by the measures to be implemented. A P/D project is a process of learning what the unknown effects of certain measures are in a controlled experimental situation.

In a P/D project the pre-design stage is dedicated to making functional specifications of the design and to forecast impacts of the measures to implement.

Project objectives, the selected sites (information coming from the site selection), stakeholder needs and requirements and the set of anticipated project impacts are the basic inputs for the pre-design stage.

Input parameters and pre-design procedures

At this stage, taking into account your knowledge of the demonstration site or sites, the project stakeholders and the affected user groups (end and intermediate), do the following:

- Identify all project stakeholders and users.
- Define the quantitative and qualitative elements of the application based on the elaboration of the user and stakeholder requirements and needs (application functionality). (Depending on the potential applications, this step may require expert advice.)
- Fine-tune the project objectives.
- Identify the building blocks of the P/D project: what will be done, how it will be done, where it will be done and by whom.
- Build consensus on the application(s) characteristics among project stakeholders and users.

Who are the project stakeholders?

The definition of the stakeholders is the key activity of the pre-design stage, since all the other activities involve, more or less directly, the stakeholders identified here.

Inputs for pre-design:
- project objectives
- the selected sites (information from site selection),
- stakeholder needs

Two inputs:
- objectives already defined
- stakeholders/user needs

User involvement is an iterative, or repetitive, process that begins when the project is conceived. The P/D itself is undertaken to show that overall the project has a positive benefit for users. Stakeholders and their needs are first analysed during definition of the objectives. A detailed specification of the needs of the users populating the chosen project site must follow.

Until this stage it is sufficient to talk about the 'average' user, but now it is necessary to specify identifiable groups sharing common behaviour patterns and to understand how to meet their needs.

Unfortunately an all-purpose technique for identifying users does not exist. The MAESTRO Guidelines provide some suggestions for how to consider the behaviour of most stakeholders affected by the project.

To be useful a user-needs analysis must highlight the different behaviour of the various users. Where the broad categories of users indicated are not sufficiently detailed, they must be subdivided. These can be stratified even further by, for example, age, sex, origin/destination and purpose and time of trip. Allowing for budgetary and time constraints, the more detailed the stratification, the more complete the representation.

Urban Sector Example. Pre-design
In this project the stakeholders were defined in terms of those who were likely to be affected by the implementation of the project measures and to have (strong) opinions on the project applications. The groupings defined were:

- End-user groupings (public transport users, car drivers, pedestrians, cyclists)
- Operator groupings (public transport operators, traffic/transport departments)
- Authority groupings (local, regional, national, European)
- Destination groupings (shopkeepers, residents, other destinations, e.g. medical facilities, leisure facilities.)

Public consultation and user needs acceptance surveys were conducted in order to build consensus on the application characteristics among the project stakeholders and users; and, indeed, to develop an understanding of users needs, and thus to fine-tune the project objectives.

How do you identify the user needs?
Traditionally two different approaches to user-needs analysis exist. The first is application-oriented; once an application(s) is chosen the user-needs analysis investigates how useful it is. In the second approach the needs of the end users determine the design of the technical application.

MAESTRO recommends the second approach. User acceptance is a key element in the success and marketability of any proposed application.

Once the groups of users have been identified, traditional user-needs analysis techniques can be used. Input can be provided through interviews or questionnaires, focus groups, surveys, group discussions or information sessions.

Such innovative techniques as an interactive Web site, e-mail, a post box and a hotline, where comments and suggestions can be received, might also have a role to play here depending on the level of knowledge of the users.

How do you refine the objectives list?
The question can be rephrased: Does the list of objectives defined originally match relevant user needs and requirements?

There are two inputs to this activity: the defined project objectives and the stakeholder/user needs identified in the previous activity.

Since both elements have been defined, the question can be easily answered through a crosscheck between the lists. Where user needs form a superset of the initial objectives, before you accept it, answer the following:

- Can the additional needs be accommodated within the available time frame?
- Can the additional needs be met through the available state of the art knowledge?
- Is the expertise available to the P/D project team adequate?
- If the project is technology-dependent, does the availability of the technology itself provide acceptable answers?
- Can the additional needs be met within the available budget?

Each of the above factors is in itself a filter before the fine-tuning of the objectives. The decision maker(s) may need expert advice to address issues related to state of the art knowledge and technological maturity. If the objectives are changed, these changes should be recorded according to your quality assurance procedures.

Where the identified needs and requirements are a subset of the initial objectives, answer the following:

- Are the additional objectives realistic, taking into account application/technology maturity and available expertise?
- Is there an identifiable added value?
- Can consensus be achieved among the stakeholders or users of the application?

How do you carry out the pre-design?
MAESTRO cannot give detailed guidance on how to make a preliminary design in every transport sector; the field of transport is too broad and the sectors differ greatly from one another.

These Guidelines suggest a general approach to ensure that the pre-design is consistent with the user needs, the site and the budgetary constraints.

The realisation of the pre-design is also an iterative procedure. Each design step is followed by a corresponding verification resulting in

the P/D project pre-design. The iterative process consists of the following steps:

- Describe domain(s) of application (e.g. intermodal terminals).
- Identify the functional elements of the application domain (e.g. buffer zone, transhipment area).
- Allocate one or more objectives (user needs/requirements) to each of the identified elements.
- Define the types of applications required to meet the foreseen impacts.
- Identify interfaces and links between the various building blocks.
- Draft the architecture of the P/D project (building blocks, functional characteristics, interfaces/links, input, output).

The final step concerns the presentation of the preliminary design to a sub-panel of actors selected during the user-needs analysis (every kind of media can be used) for comments and suggestions; effectively a verification process.

It should be noted that innovation plays a large part in many P/D projects and often they are carried out in order to learn. If, therefore, innovation rather than imitation is the aim of P/D projects, this seven-step approach should be referred to as a guide for pre-designing your project, rather than a rigid set of rules which must be followed.

How do you build consensus for the project among the users?
Consensus building starts an interaction with the actors, which continues during the entire project life.

Ways to build the actor consensus include making the actors aware of what is happening, having experts available to provide explanations and involving the actors in the decision making process of the project.

A continuing dialogue is essential. Available tools for such a structured dialogue include conferences, newsletters, information sessions, interactive designing, information points and Web sites.

The best way to ensure consensus among the actors in a project is to involve them from its very beginning.

However, it must be recognised that the approach towards consensus building varies across Europe, and reflects the cultural and societal values in the area(s) within which the P/D project is proposed. Within some Member States, it is the norm that consensus will be achieved, and all participants work towards that goal. Once consensus is reached, the support of the various participants can be relied on downstream in the project.

By contrast, in other Member States the mechanisms for consensus building are not well developed. There may not be strong obligations on the promoters of the P/D project, or there may be a tradition of a more directive or confrontational approach. In these situations, it is recommended that the actions of outreach, dialogue and inclusion be used to understand the diversity of views, and to create the basis for a future consensus. P/D project promoters

should review relevant case studies from Europe and North America to identify good outreach and dialogue methods.

The results of the pre-design phase will be:

- User and non-user needs
- Refined objectives (according to site and user groups)
- Functional specification of P/D project
- Development of consensus

Intermodal Sector Example. Pre-design

The Common Transport Policy includes the support of intermodality for people. In this case a telematics solution for door-to-door trip planning is to be introduced in four sites. This solution would not be introduced alone but together with other measures such as restricted traffic in a city centre, improved linkage between private cars and public transport (park and ride), reducing costs for using public transport. Different additional measures would be used depending on the type of site chosen, city centre, inner city, and hinterland areas.

The hypothesis to be tested was the same for all sites: the telematics application for door-to-door trip planning will be necessary to increase the level of multi-stage trip-making involving public transport by 100%. Surveys are planned on a site-by-site basis, and based on what questions are identified as general and what as site specific a survey instrument has to be developed, incorporating also the local characteristics of the different sites, e.g. the local modal split.

In this chapter:
- Creating an evaluation plan
- Selecting impacts and indicators
- How to forecast expected impacts
- Consideration of evaluation methods

3.3 Initial evaluation

Once the pre-design stage is complete, you should be in a position to carry out an initial evaluation. This first phase of evaluation is a safeguard against using time and resources ineffectively and inefficiently, or performing an evaluation of poor quality and limited usefulness.

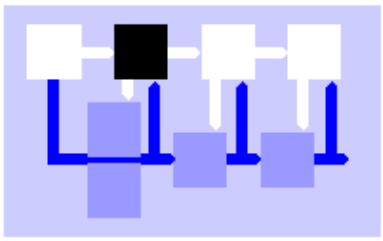
Initial evaluation is characterised by how:

- the objectives of the project are defined and presented;
- the pre-design for meeting those objectives is developed.

The goals of the initial evaluation are to:

- provide a preliminary brief evaluation, in mostly qualitative terms, of the project or alternative projects and sites;
- select between any alternative solutions in the project: technical, methodological or organisational, and decide whether the project should continue.

If the project continues, the initial evaluation must develop an evaluation plan for the remainder of the project with:



- a methodology for the project based on available state of the art evaluation procedures and tools;
- a procedure to produce and collect appropriate data for the evaluation of the project outcome.

Your evaluation plan should reflect the activities that will be carried out in order to implement your P/D project.

1. The plan for the initial evaluation will contain the experimental design and sampling related to the expected effects of the project, the measures, data collection sources and requirements, and analysis/derivation techniques needed properly to assess the costs, functional characteristics, efficiency, effectiveness, and other impacts of the equipment, service or other measure to be implemented. The evaluation plan will contain a list of relevant measures to be considered in order to perform a thorough evaluation of the operational test. Through an examination of these measures, the evaluation will be able to determine the extent to which the implementation in the field test has attained the initial objectives.

2. The ex ante evaluation takes place after the detailed design stage with the project ready for implementation at a defined site. It is still a prospective (forward-looking) evaluation, and the emphasis is on what is likely to happen with and without the project. It represents a review of the initial evaluation and provides the basis for an ex post evaluation.

3. The ex post evaluation, in contrast, is retrospective (backward-looking). The emphasis is on what has actually been observed, not on what is likely to happen. The process is focused on the observed results of a completed or ongoing project. The results are compared with the estimated results and the situation without the project provided by the ex ante evaluation. The

findings of the ex post evaluation will be the basis for projecting the likely effects of a full implementation.

A well-designed initial evaluation will strengthen all the subsequent stages. Less time will be lost on *ad hoc* decisions about what to do next. It can substantially reduce the many uncertainties of an evaluation; it can provide a clear sense of direction and purpose to the effort. It is more cost effective because it prevents:

- 'down time', caused by sporadic or episodic decision making;
- waste of staff time on the collection and analysis of data that are irrelevant to the questions addressed;
- duplication of data collection;
- unplanned data analysis in a search for relevant findings.

Urban Sector Example. Evaluation plan
A detailed evaluation plan was developed within this project, concerned with the application of integrated packages of physical traffic management measures. The evaluation plan contained the following sections:

- Project objectives and background
- Policy context
- Measures implemented
- Assessment objectives
- Assessment methods
- Evaluation indicators
- Strategic level assessment
- European level assessment
- Liaison and cooperation with similar projects
- Development of guidelines
- Evaluation timescales
- Summary
- References

A series of appendices provided local evaluation plans for each of the partner cities. This evaluation plan did not discuss sample sizes and data collection procedures in detail, although these Guidelines recommend that your evaluation plan should contain this information.

Inputs to the initial evaluation phase

The evaluation collects information about specific conditions or events both before and after the implementation—for example, the number of people who used public transport in a particular year, the construction cost of a variable message sign, car speed before and after a traffic-calming measure, and so on.

Data will be needed for a comparison between an expected performance level and the actual outcome observed. An example might be a comparison between airline safety violations and the safety standard set within that sector.

Analysis of the data will reveal whether the observed conditions or events can be attributed to the project (cause and effect). For

Elements of initial evaluation:
- kind of information
- sources of information
- sampling methods
- information collecting methods
- timing and frequency of information collection

example, if we observe changes in the use of transport, what part of those changes is the effect of a new user information system?

The most important elements of the initial evaluation, then, are:
- the kind of information to be acquired,
- the sources of information (site and pre-design),
- the methods to be used for sampling sources (for example, random sampling),
- the methods of collecting information (for example, structured interviews, traffic counts, self-administered questionnaires), and
- the timing and frequency of information collection.

At this stage the data will usually be gathered by market research, for example, by interviewing or surveys, or by measurements, for example current speed and traffic flows. The opinions gathered must provide a representative overview of all actors involved or else the subjective choices of the dominant actors will prevail. Any measurements should be representative of the general transport conditions in the chosen study area.

Procedures in the initial evaluation phase

In this sub-chapter:
- which impacts you should consider
- how to address them
- what their specific attributes are

In this phase you will translate the project objectives into impacts. You will make a first forecast of the impacts to expect and then evaluate whether the expected impacts justify the P/D implementation.

The main steps in this phase are:

- to derive a list of impacts to observe and monitor with the necessary associated indicators;
- to forecast impacts on the basis of the project's functional specification and user expectations assessed during the pre-design stage;
- to choose an appropriate evaluation method;
- to evaluate whether the expectations justify the P/D implementation;
- to establish an evaluation plan for the remainder of the project.

Defining project impacts and indicators

The choice of impacts and indicators is the core of the evaluation. The effects of the project that will be measured strictly depend on it. For this reason, the analysis here is thorough.

The impact definition has been placed here because this is the first evaluation phase. The inputs to this activity are the P/D project objectives, the site or sites selected and the functional specifications of the project.

MAESTRO suggests you use the following procedure in selecting the impacts to consider:

- Derive from your objectives and functional specifications the possible impacts the project may cause, building structural relationships of causes and effects.
- Take the list of impacts MAESTRO has provided for your sector and merge it with the one you have just derived.

- Simplify the list by excluding all impacts that cannot be directly attributed to your P/D.
- Use the impact classification MAESTRO provides (Figure 4) to organise your impacts and to check the completeness and consistency of your list.
- Match one or more indicators to every impact.

Impacts from objectives and measures

The objectives and the expected impacts of a P/D project are closely related.

The objectives define the desirable direction of performance of the indicators that the project aims to influence. They also represent the areas of progress to be furthered by the field trial and its individual components.

Road Sector Example. Defining impacts

The definition of impacts belongs within the initial evaluation phase; this example is drawn from the **road** sector, relating to the estimation of the impact of variable message signs on traffic safety when designed and developed to meet the objectives of traffic and network efficiency. The safety questions to be answered within the project, and which effectively determined the impacts to be studied were:

- Does driver behaviour change when a warning is displayed?
- Does driver behaviour change between the location of the warning and the location of the incident?
- Does driver behaviour change at the site of the incident?
- Does the existence of a warning system change driver behaviour when no warning messages are displayed?
- Does the existence of a warning system change driver behaviour on other sections of the same road?
- Does the content and coding of the message affect the driver?
- Does the warning system affect the route choice of the driver?
- Does the warning system affect the level and distribution of accidents?
- Do support systems for operator decision-making affect the rate of false alarms and errors generated by the system?
- Do automatic incident warning systems influence operator workload?

The development of such a series of questions and subsequent impacts is a crucial element of this phase of the initial evaluation procedures. One impact that may result from a number of these questions is 'do the measures introduced reduce driving speed?'

A first list of desired and expected impacts can be derived from objectives. To assist you, MAESTRO suggests two impact identification techniques to allow a first rough list of impacts to be derived.

Impacts are **changes or effects** brought about by the implementation of the project. The direction of impacts or at least part of them should be in parallel with the project objectives in order to be able to consider a project successful.

Using the first technique, you should try to link the measures carried out as part of your P/D project with the impacts, which may result from those actions. In other words, this technique involves establishing a cause and effect relationship between actions and

impacts. The results of this process may be represented graphically in a tree diagram.

Merge the MAESTRO list with your own
MAESTRO provides a list of impacts for each transport sector. Combining the list, which corresponds to your particular sector with that obtained from the objectives and measures, you obtain a first long list.

The second technique enables you to reduce the long list you created as part of the first impact identification process. Now you need to identify all likely impacts from a wide range of potential impacts. Consider all possible impacts to minimise the chance that significant impacts will be overlooked. You should check the listed impacts one by one to verify whether they are likely to result from the measures proposed for your P/D project. Those impacts that are not expected to be produced should be removed from the list.

Compare the list with the MAESTRO classification
You will need to check the revised list of impacts that you have created for consistency. By organising your list according to the classification provided by MAESTRO, you will be able to check whether you have missed any important impacts.

MAESTRO impact classification

The MAESTRO classification is organised on a number of levels (see Figure 4).

Transport system performance assesses the performance of a system in terms of its technical characteristics. The emphasis of this type of evaluation is on determining whether the proposed system can function properly from a technical point of view and can perform its intended functions satisfactorily.

This type of evaluation can be seen as a prerequisite for any other type, since systems that fail the technical standards and criteria cannot be further developed and used.

The objective of the *socio-economic evaluation* is to estimate the effectiveness or benefits derived from a project in relation to the costs associated with its development, implementation and operation. The P/D application(s) are evaluated in terms of the following:

- transport system,
- economic efficiency,
- environmental impacts,
- safety and security.

The next classification level is found in the second column of Figure 4. The 'impact categories' come from literature reviews and transport sector expert opinion.

Transport system

Initial evaluation focuses on the following transport system dimensions:

See Table 6 in each of the appendices.

Capacity: The maximum possible transport units (e.g. vehicles, passengers) which can be accommodated by the system during a given time-period.

Efficiency and effectiveness: The performance of the system against set targets (efficiency reflecting narrow operational aspects of system performance; effectiveness reflecting (usually) wider aspects of system performance e.g. societal, economic and environmental objectives.

Travel pattern(s): The volume of travel or movement of goods by modes, and the routes and timing of this travel define the travel patterns.

Transport costs: The direct costs of the transport pilot can be broadly divided into:

- construction costs and installation costs;
- operating costs;
- research and development costs;
- external costs (transport system congestion).

Transport system dimensions:

- Capacity
- Efficiency and effectiveness
- Travel pattern(s)
- Transport costs

In economic efficiency terms, the balance between the impact a P/D project has and the willingness of users to pay the cost of achieving this impact has to be judged. This applies to both passenger and freight transport.

Economic efficiency

Economic efficiency mainly relates to the travel time component of the total travel costs, whereas all the direct costs of the pilot are considered in the 'transport system' evaluation. The key question is how much the final user is prepared to pay for lower travel time. Economic efficiency may also relate to reliability, for example whether freight hauliers are able to deliver their customers goods on time at the right price.

Analysis of the economic efficiency evaluation together with that of the transport system performance reveals the total change in the internal costs due to the P/D project. The *environment* and *safety and security* evaluation areas on the other hand consider the external costs. These costs need not necessarily be expressed in monetary terms. While this would be ideal, sometimes it is neither possible nor desirable.

Five key environmental assessment tools:

- descriptive
- ranking
- judgmental assessment
- physical measurement
- monetary valuation

Environmental standards

The range of environmental aspects include:

- local air pollution;
- global warming;
- noise/vibration;
- pollution of water courses;
- geology and soils;
- ecology and nature conservation;
- landscape/visual intrusion;
- severance and amenity.

The European Union's Directive 85/337/EEC on Environmental Assessment establishes that an environmental impact assessment should be undertaken for all projects within the European Union that might generate significant environmental impacts.

Impacts on the environment may fall into one of two categories. Improvements are sought and positive impacts are among the primary objectives of the P/D project; or, alternatively, where this is

The tools for analysing the information collected during the evaluation are presented in detail in MAESTRO Deliverable 2, The Evaluation Methodology and will be available on the MAESTRO Web site (http://www.europroject s.ie/maestro) and CD-ROM.

not the case, environmental impacts may be subsidiary impacts, essentially positive or negative side effects from the project.

The environmental impacts of pilot projects may be positive or negative. If overall project evaluation is to be meaningful and credible, it is essential that you consider any negative impacts objectively.

In general terms, the purpose of the evaluation of environmental impacts in P/D projects does not differ from the intent of any environmental impact assessment in the context of conventional project appraisal. In order to carry out a more comprehensive evaluation of pilot projects, environmental impacts should be taken into account, although many such impacts are intangible.

You must take environmental impacts into account before projects are approved and implemented. Thus, generally speaking, there is little difference between the conduct of environmental assessment of pilot projects and that of more conventional projects.

MAESTRO suggests that five tools may be used to assess environmental impacts and it is envisaged that these tools will often be used in combination. The tools are: Descriptive; Ranking; Judgmental Assessment; Physical Measurement; and Monetary Evaluation. The level of detail and sophistication of the assessment of these impacts will be different at the different stages of the project's lifecycle.

Safety and security aspects

The most common use of the word *safety* is with reference to accidents. However, transport safety may also refers to travellers' feelings of safety while using a new transport system. It is possible for some transport developments to promote a false sense of safety. Security relates to the user's perception of their personal security while using a transport system. In the freight sector, security may also relate to the perception of whether goods are likely to reach their destination. Different terms are used for the *objective* measurement of accidents and the *subjective* perception of how secure people/goods are while being carried by a new transport system.

For the purposes of these Guidelines, *safety* is manifest in the occurrence of accidents. Indeed, for the purpose of socio-economic evaluation, transport safety is simply the prevention of deaths, injury and property damage from transport accidents.

A further level of complexity must be addressed. Safety is difficult to define in absolute terms and will have different operational meanings depending on the goals of the system. Is a system 'safe' if it is better than an accepted predecessor, or is the term reserved for a system that has zero risk of failure?

In these Guidelines the focus is on the conversion of measurable safety data, and the ways to make use of it in socio-economic terms. As such it deals with accident data, as measured in terms of property damage and severity of human injury.

Impact sub-categories

The evaluation areas identified in Figure 4 are often interrelated, and sometimes the distinction between them is rather blurred. The objectives of a P/D project can be presented in the form of its

impacts. The impacts used to evaluate a transport P/D project can be derived from the evaluation areas listed in Figure 4.

Development of indicators

In order to measure the impacts of your P/D project, a number of indicators should be identified. Indicators will be used for measuring how far the project objectives will be achieved by the measures implemented within the P/D. Indicators are quantitative units of measurement of the expected impacts of a P/D project. They represent the measures of effectiveness for the P/D Project. Some flexibility is permitted in the choice of indicators.

You should match your expected impacts with the correct indicators so that you can assess the impacts. To help you to choose the right indicators for the impacts you have selected, MAESTRO suggests that you assign attributes to the impacts:

1. **Temporal scope:** Can the impact be measured during the P/D project lifecycle, or must it be forecast?
2. **Geographic scope:** Can the impact be measured locally, or does it pertain to a wider context?
3. **Importance:** The impact must be measured so that the results of the entire project will not lose their meaning. Is the impact in question 'core' or 'non-core'?
4. **Permanence:** Will the impact continue to exist after project implementation or not?

Remember that the indicators must be:

- able to reflect clearly the related performance or impact;
- reliable in assessment (with the chosen evaluation methods).

See Table 7 in each of the appendices.

The MAESTRO Guidelines provide lists of indicators that are applicable within transport P/D projects. These indicators correspond to the list of possible project impacts recorded.

If an impact is not included in the list, check that the indicators chosen correctly represent the associated impact.

You should describe an indicator as follows:

- Name of indicator;
- Measurement unit;
- Type of measurement (quantitative, qualitative);
- Method of obtaining measurement (collected, derived, proxy);
- Sources of data.

Quantitative measures are expressed in terms of counts (e.g. number of buses per hour), measurements (e.g. time taken to travel between two points) and other physical units (e.g. distance in km or tonne km travelled).

Qualitative measures are measures to which it is difficult to give a value. These include attitudes and opinions, perceptions and observations. This type of data is collected via surveys, questionnaires and interviews.

Impact attributes:
- temporal scope
- geographic scope
- importance
- permanence

Forecasting P/D project impacts

During this evaluation phase the forecast project impacts are mostly qualitative.

The quantification of these expectations will be achieved after the design stage when a detailed project specification is available and precise forecasting tools can be applied. At this stage a rough forecasting exercise should be done.

An expected 'direction' for the impacts contained in the list produced earlier needs to be forecast.

In the initial evaluation phase, the capacity, efficiency and effectiveness, travel patterns and costs of the transport system being developed are unknown. The opinions of sector experts and knowledge of other P/D projects may be drawn upon to create a list of expected impacts.

Collected—obtained by instrument measurements (vehicle travel time), counting (number of passengers), surveying (perceived reliability), or from records (daily revenue),

Derived—calculated from collected measures either by simple arithmetic procedures (passenger miles per seat mile) or through use of analytic models where the variable to be measured (e.g., reduction in air pollution or fuel consumption) is function of other collected independent variables, and

Proxy—focus on phenomena believed to be related to the impact whose true value is sought.

In assessing economic efficiency during this phase, the key variable is travel time in relation to travel costs. Whether the project is then attractive depends on the value of time (VOT). The important question is how many users will pay at least for the costs of the travel time saved.

In the initial evaluation it is unlikely that accurate figures for travel time will be available. No measurements will have been performed as the system in question is not yet operational. Many of these details will be filled in during later stages of the project. Nevertheless, attention should be paid to travel time and costs. The key success factor is that travel time should be at least as attractive as other alternatives, and that the (extra) costs for users should be minimised in order to attract as many users as possible.

In the initial phase, the descriptive environmental impact assessment tool is very useful as much of the available data is likely to be qualitative. If a number of alternative P/D projects or sites are being considered, the ranking tool may be useful. The other three tools—judgmental assessment, physical measurement and monetary valuation—may have a role in this phase, but given their resource intensiveness, it is less likely to be the case.

In the initial evaluation phase, a preliminary safety analysis may be carried out. This involves producing a model of the pre-designed system, checking the model for completeness and consistency and undertaking a hazard analysis. This modelling process cannot be a formal process due to the lack of detailed information. More detailed analysis will follow during a later phase of the process. In addition to this analysis of the safety of the system, literature reviews may reveal the safety figures recorded by other similar (P/D) projects and experts may be able to suggest expected accident figures in relation to the proposed project.

The output of this phase of evaluation will be an indication of the expected impacts: positive or negative. The traditional steps for producing this output are:

- Summarise expected impacts.
- Classify the impacts as 'core' (vital) and 'non-core' (less important).

- Match each of the expected impact element(s) with one or more stakeholders or user groups.
- Classify stakeholders or user groups as affected directly or indirectly by the impact.
- Define the type of impact for each of the stakeholders/user groups in qualitative terms. Use a matrix approach and give each cell in the matrix a value as they affect stakeholders. A scale with the following values is advised: ---, --, -, +, ++, +++.

These methods are discussed in more detail in chapter 3.8.

Introduction to the evaluation methods

During the initial evaluation phase, the choice of evaluation methods for all three evaluation phases should be made. The choices are dictated by the improvement stage by stage in information and data collection. The method to be applied for the initial evaluation phase now has to be chosen. During the initial evaluation, you will define the project background elements and describe the functionality of the project pre-design, the site characteristics and potential external influences. You consider alternative projects and sites. Initial evaluation is based on expected impacts, which are probably expressed in qualitative terms. They are drawn from existing knowledge, research, and expert opinion about assessing the potential success of a new project. The bases for judging the project are the objectives, which correspond to the requirements and preferences of the decision-makers.

Which methods does MAESTRO suggest?

You will choose your evaluation methods respecting the different goals and levels of detail of each stage of the P/D project.

Several kinds of evaluation methods exist. A theoretical distinction can be made between methods for choosing from a limited number of possible alternatives (called *discrete methods*) and those for a continuum of alternatives (called *continuous methods*).

In discrete evaluation methods:
- the alternatives are not mutually dependent;
- the number of alternatives is limited.

In continuous evaluation methods:
- the alternatives are mutually dependent;
- the number of alternatives is unlimited.

The MAESTRO guidelines do not, however, cover continuous evaluation methods and no further reference will be made to them in this document.

Within the discrete evaluation methods a distinction can be made between monetary and non-monetary methods. Monetary methods may be used when the effects of an alternative can largely be expressed in monetary terms. Examples of monetary evaluation methods are cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA).

Non-monetary discrete evaluation methods can be used when the majority of the effects of the relevant alternatives cannot be expressed in monetary terms. Examples of non-monetary evaluation methods are multicriteria analysis (MCA) methods and survey table methods such as goal achievement matrices (GAM).

The factors on which the choice of a suitable evaluation method depends can be classified under three headings.

Institutional factors are procedures or directives that are mandatory in certain evaluations, such as those of very large projects. One might say that the kind of evaluation method is prescribed.

Characteristics of the method must be considered against such factors as the time available, the desired depth of research, the availability of data and the availability of the expertise required. For example, CBA calculations are not applicable if most of the efficiency-related effects cannot be expressed in terms of money.

The characteristics of the problem and the decisions to be taken must be considered against such factors as the objectives of the study and the quality and availability of information.

In general, the purpose of your P/D project will influence the choice of evaluation method. For example, studies aimed at determining the profitability or value added of alternatives can only use a CBA; other evaluation methods cannot determine the profitability of projects. For studies seeking only to reduce a number of alternatives or to structure the available information, it would be better to use an alternative to CBA.

The choice of an evaluation method depends on:

- institutional factors;
- characteristics of the method;
- characteristics of the problem and decisions to be taken.

Reporting

The initial evaluation involves an analysis of a project in its pre-design stage and with regard to potential sites. The credibility of the results depends in part on the procedures being easy to follow in terms of how the findings have developed. The reporting is in two parts. The first is concerned with the decision of whether to continue the project or not and on the site or sites selected. The report begins by setting out the problem and the important objectives set at different levels, together with the primary sources of information, such as documents, statistical data, interviews, observations, opinion surveys, prior research and 'expert' opinion. A description of the analytical work follows. This will mainly be qualitative but in some cases will include simulation, modelling, and information syntheses in relation to the project's conceptual and operational assumptions, all to analyse the likely impacts. This first section of the report concludes with the evaluation results, expressed in terms of whether the project and the site selected 'performed better' than the others, illustrated with appropriate graphics and tables and necessary technical appendixes (for example, details on procedures used to judge the quality and reliability of the results).

The second part develops a structured plan for conducting the design and evaluation in the following stages. Throughout, the key criteria and decision points should be recorded according to your organisation's quality assurance procedures.

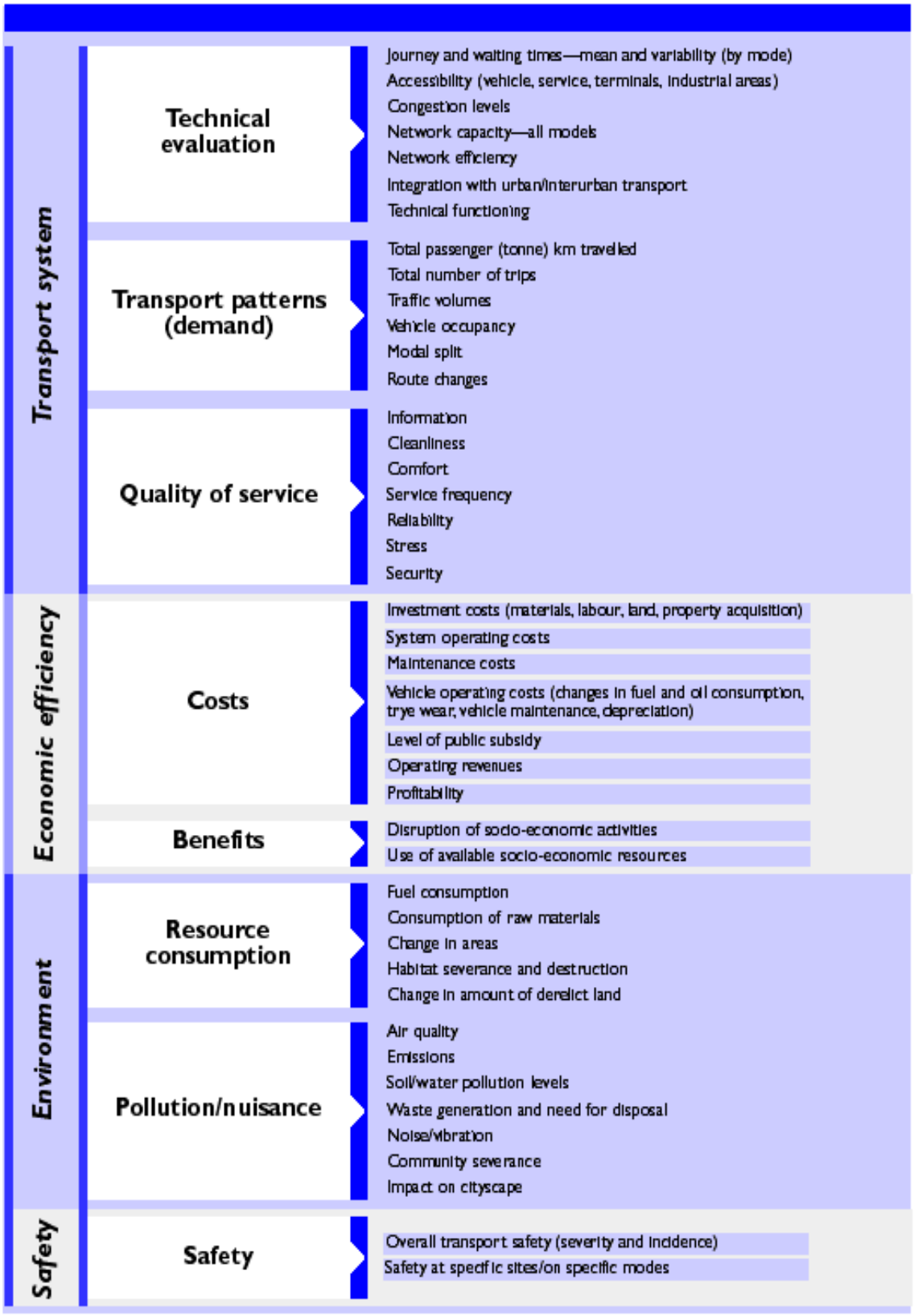


Figure 4. Impact classification

The impacts of a transport project can be classified in three levels. The first division is between evaluation areas: (1) transport system, (2) economic efficiency and (3) environment. Each evaluation area is subdivided in impact categories and sub-categories. At least one impact (listed in table 6 of each of the appendices) corresponds to each sub-category. MAESTRO provides this classification to help you to understand whether the list of expected impacts you are compiling is consistent, complete and comprehensive.

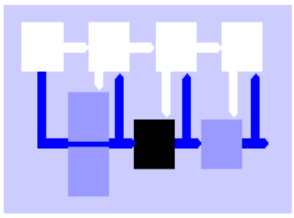
In this chapter:
- suggestions on how to design your P/D project consistently and efficiently

3.4 Design

You will perform the detailed design of the scheme starting from the general description you made in the pre-design stage and based on the decisions you made after performing the initial evaluation. In the pre-design stage, you established an overall system design configuration with a minimal set of functional specifications. You will now have to convert that configuration to the definition of hardware, software and support items for the implementation.

The design must be consistent with the objectives (both general and specific), with the user requirements and should have general acceptance by transport service providers and other institutions formally involved (e.g. police, local authorities, and national government). All the technical elements must be designed in accordance with the standards in force and the overall project objectives.

Another important issue is the aesthetic aspect (for examples, vehicles and infrastructure), which you should take into account, but within the context of the constraints set by the concepts of functionality and economics.



This is the point in the project lifecycle when you must carefully take into account all aspects of the project and their implications in order to create a well-structured scheme. Poorly designed schemes can induce opposition to the expected impacts. The importance of a complete definition of the system you have to design is also related to its complexity. When measuring the effectiveness of one component of the system, the other components may be regarded as attributes of the overall technical, transport and environmental contexts.[2] In the design stage, the system may be regarded as either an indivisible whole or a composite of more than one component. It is extremely important to identify the interdependencies between the components of the system.

The design must develop the data production and collection strategy established in the initial evaluation. It must include the type of data, the best methods of data collection, how large the sample size has to be and the options for data analysis.

Four types of data collection instruments:
- instrumentation
- observation
- surveys
- existing records

Four main sources are employed in the data collection process: instrumentation, observation, surveys and existing records. In defining appropriate variables and specifying sample populations, it is also necessary to consider the accuracy and the cost of this operation compared with the total budget of this stage in order to make the optimal choice. As part of the design process you will have to define the overall technical, transport and environmental contexts within which your system will operate (the transport block) and their interaction with your system.

External conditions can influence the results of the measurements or surveys designed to assess the impact of a P/D project. In this sense, a block is defined as a particular grouping of similar transport

[2] These latter contexts may be referred to as the overall transport block context; for a full discussion of this see Guidelines for Field Trials of Road Transport Informatics Systems, DRIVE Project V1049.

contexts, for example, a set of external characteristics (time, weather, socio-demographics) that, when combined, will ensure a consistent basis for comparison. Each transport sector block has its own particularities, although there are also common aspects.

Site characteristics must be carefully considered because they might influence the local impacts of the scheme with consequent implications for transferability. The level of detail for specifying the transport blocks depends upon the overall resources. In other words your system will be affected by external circumstances, the external context; in order to ensure that you may fully assess the impact(s) of your system, especially when multi-site comparison is to take place, it is necessary to define all these external circumstances, in order to ensure that you are measuring 'like with like', or at the very least are aware that the external circumstances are different, which may lead you to apply weighting factors, in order to restore a 'level playing field' for comparison.

See 'Site selection and pre-design', chapter 3.2.

For example, the most common time context (period) in the urban sector takes into account the peak periods, split into morning and afternoon peak periods (if directional factors are important for the analysis), night time and daytime; also taken into account are differences between weekdays and the weekend and seasonal differences.

When choosing between alternative design parameters, you should consider what the impacts of each design are likely to be. A balance between technical functioning and aesthetic appeal should be sought which is expected to produce the most positive impacts. Comparing the likely impacts in a general way before the next phase of evaluation is embarked upon may provide an insight into the design(s) which is/are expected to deliver the desired impacts to meet the project objectives.

The design stage is generally conducted within a set of constraints that may determine the extent of the project itself. The constraints are different in nature from information available on financial restrictions and the legal framework involved. In order to ensure proper design within the defined limits, it is essential to determine from the beginning of the design stage exactly what are the nature and scale of constraints. These will necessarily differ from P/D project to P/D project, but would certainly include time and resource constraints, which may be seen as key issues affecting the development of the design stage within the P/D project.

Reporting

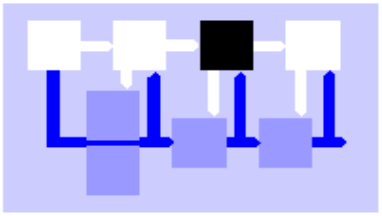
The reporting function of the design stage must provide the background documentation needed to justify the design adopted in terms of its relationship to the P/D objectives at all levels and in terms of its aesthetic considerations within the context of budget, resources and time scale.

In this chapter:
- How to prepare the background for the next evaluation steps
- Should you go ahead and implement the project?

3.5 Ex ante evaluation

After you have completed your (first) detailed design of your project, you will be in a position to carry out an ex ante evaluation. The goal of this phase of evaluation is to review the results of the initial evaluation following refinement of the pre-design. In this phase, you will compare your detailed design with the do-nothing scenario—one of the four alternatives to a P/D project (see chapter 2.2). There are four main reasons for the comparison with the do-nothing scenario:

- to confirm the validity of the project by comparing the predicted project results with the do nothing alternative;
- to prepare the ex post evaluation;
- to compare the future do-nothing situation with the situation after implementation;
- to optimise the design by a critical evaluation of the expected results.



The ex ante evaluation will help you to estimate better the detailed impacts of the P/D project, as in this phase much more data is available than was the case in the initial phase. The data gathered for evaluation will be based upon experience with other projects and evaluations, literature reviews and more specific interviews and surveys and will be more detailed and extensive. The data you decide are needed should consist preferably of the same variables that you will use in the ex post evaluation, so that you will be able compare the ex ante estimations and the ex post outcomes of the project. Effectively, this is a classic 'before and after' evaluation.

In this phase, you should estimate what the impacts of your P/D project will be, in order to answer the question whether implementation of your proposed project design will meet your objectives. The estimated results will highlight areas where the impacts were found to be less favourable than you anticipated. You can thus use the results to either explore modifications of the proposed design before implementation of the project or justify proceeding to implementation of the P/D project.

Waterborne Sector Example. Ex ante evaluation
The demand for fast sea transportation and fast passenger/car ferries is high and increasing in Europe. A basic question for operators (and policy makers) is what will the effects (both negative and positive) of such 'new technology' be?

Different approaches are foreseen and could be demonstrated. The first is to increase the sailing speed by using faster vessels, and the second is to improve the overall performance of the system (i.e. make investments in harbours and handling systems in the necessary infrastructure and not to focus only on the speed at sea). For the operators it is important to find ways to determine when to select one of the approaches proposed.

An ex ante estimation of the effects (based on historical data and desk analysis work) reveals that in one of the ferry systems to be tested, 70% of the total time requirements is sailing time and the remaining 30% is related to terminal operations. A reduction of the check-in time, for

example by 15 minutes, would reduce this latter figure by half due to the loading factor of the ferries. If the sailing speed is doubled, the result will be an index-based 'frequency improvement' from 100 to 152, something the operators would welcome. However, although negative effects can be estimated on the environment, the scale must be determined from real life demonstrations.

It is always possible for you to influence the more detailed design of the project until you are satisfied that you have the best possible design to produce the desired impacts. Even the most likely design should be tested and weighted against various alternative design options.

As in the initial evaluation phase, during the ex ante phase both the technical and socio-economic performance of a P/D project should be evaluated. A technical performance evaluation to assess the performance of the system in terms of its technical characteristics will be carried out during the ex ante phase. As adjustments are made to the detailed design, new technical performance evaluations should be carried out. Until the system designers are happy that the design of the project will produce the desired results, it would be a waste of time and resources to begin to carry out a socio-economic ex ante evaluation.

Once the detailed design of the project has been finalised, the socio-economic evaluation should be conducted based on the same four factors discussed in chapter 3.3, transport system; economic efficiency; environmental impacts; and safety and security.

By this phase in the evaluation, a detailed design is in place and its potential success as an operational system should be estimated. The likelihood that the chosen design(s) will meet the project objectives needs to be assessed. If it becomes apparent that the design will not sufficiently meet the objectives, it may be necessary to reconsider or modify the design.

The assessment of economic efficiency becomes more accurate during this phase. As sites have been selected, it should be easier to identify the potential market for the system. The choice of site or sites also offers more detailed information about the travel time to various destinations and therefore offers more insight into the market potential of various options. The evaluation in this phase should focus on both the estimated impact on the travel time and on the user costs. In this way, the economic efficiency of the chosen design can be estimated, as can alternatives.

As the project design is more fully established now, environmental impacts may be estimated more accurately. Depending on the resources available for the P/D project and the importance placed on in-depth assessment, the tools employed may range from the descriptive tool through to monetary valuation. It is perhaps more likely, however, that tools other than monetary valuation are used at this point.

A detailed safety analysis is possible in this phase as the system transport system is now more clearly defined. This analysis would

examine the system requirements and architecture in relation to safety objectives. Ex ante safety evaluations may also be carried out before the system has been implemented with samples of the potential user population and the opinions of these users may also provide valuable input.

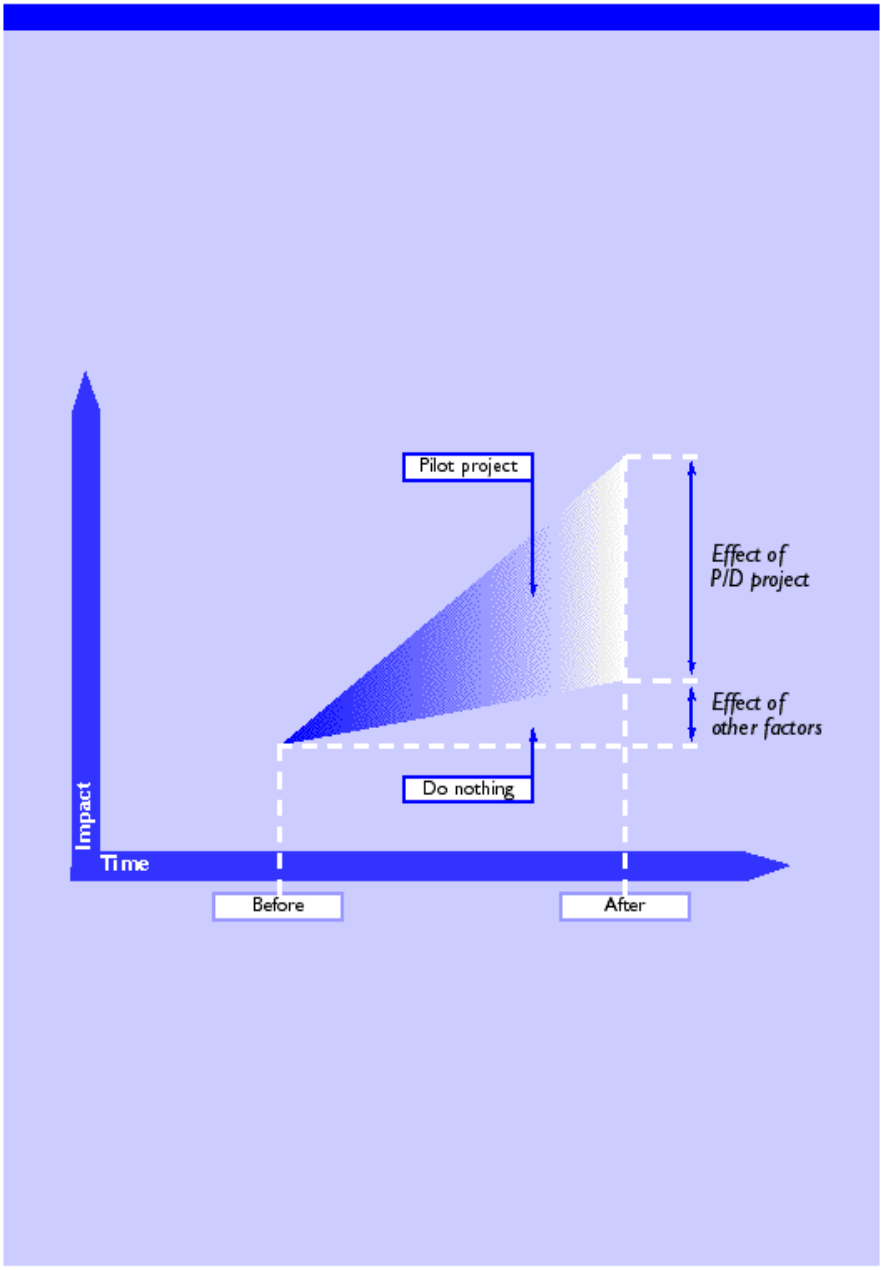


Figure 5. The 'do nothing' scenario

The diagram illustrates a comparison between the situation before and that after the project. If the project was not conducted ('Do nothing'), you would also have found some changes in the indicators you are measuring. This is due to other factors and to the time flow. To know the real effects of the project you need to subtract from the measured effect those effects due to other factors.

There are two ways to find out the 'do nothing' after situation. You can forecast it from historical data, or you can monitor a parallel site with the same characteristics, without applying the project to it. In transport projects, this last solution is very expensive and not always very precise. However, highly reliable forecasting techniques exist today.

In this chapter:
- How to plan the implementation of the demonstration
- What are the critical issues for success?

3.6 Implementation of the P/D project

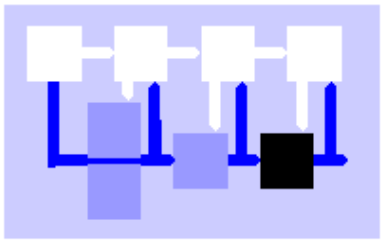
You are now content with the design of your project and happy that the estimated impacts resulting from the ex ante evaluation are promising. You will now have to implement the project you designed, conduct the data collection exercise and derive the 'real' impacts produced by the measures you are implementing.

To obtain correct results, those you expect, the system must be implemented following a number of elementary rules.

MAESTRO has organised them in the following list:

- Forecast the total duration of the P/D project and produce a schedule for when progress of the project will be checked.
- Draft a list of activities to perform and arrange them in the time frame you devised.
- Identify all the people, not just the professionals, who will carry out the activities.
- Allocate responsibility to the identified people for carrying out the activities in the project time frame.

Critical success issues



A number of critical issues must be taken into account in implementation of a pilot or demonstration project.

- Provide and install infrastructure, equipment and computer hardware/software. It is essential to satisfy the required technical specifications, time schedule and actual costs.
- Create a network and integrate different components of the demonstration. In particular, you must establish appropriate communication facilities and integrate the selected hardware and software. Again, the decisive factors here are satisfying the required technical specifications, time schedule and actual costs.
- Ensure that all project partners are willing to collaborate actively and play their respective roles. This is crucial.
- Establish a management team.
- Appoint a named project coordinator for the entire demonstration project and establish quality control, reporting and resource control tools.
- Involve the evaluation team in monitoring the project implementation and start the verification process to ensure quality results (regular monitoring of progress; identifying needs for necessary modifications of the P/D design over time; regular reporting to the project coordinator identified above. Information on monitoring activities and tools should be set out.
- Verify the project facility and site (operational test, fine-tuning).

Setting up a P/D project:
- install infrastructure, equipment, hardware, software;
- create network, integrate demonstration components;
- form a team;
- name a supervisor, set up quality control
- call evaluation managers, start verification;
- verify facility and site.

Even at this advanced stage, if you experience difficulties in establishing the demonstration project as required, return to the design stages and request the necessary modifications. The options to return to the detailed design and even the project pre-design are always available to you. Taking the decision to return to previous stages in the process should not be considered to be a negative step, but rather a conscious attempt to produce the best possible results from your P/D project. Taking a step back in the process to reconsider design issues may increase the length of time taken to

implement the project, but may well result in resource savings in the longer term.

Urban Sector Example. Implementation of P/D
A project drawn from the urban Sector was set up largely in conformity with the definition of the critical success issues as outlined within these Guidelines:

- Physical traffic management equipment was ordered, purchased, installed, commissioned and implemented.
- This was largely undertaken in conformity with the project timescale and budget, and satisfied the technical specifications drawn up within an earlier project stage.
- Hardware and software compatibility was established, and factory and site acceptance tests were undertaken; the equipment was not signed off until these tests had been satisfactorily undertaken.
- Management teams were established at the beginning of the project at the European level to cover and coordinate all the horizontal project activities; and at the local partner site level to cover all the vertical activities.
- Regular consortium and steering committee meetings ensured that the locals projects were being conducting in conformity with the project and evaluation objectives, and that they were making their proper contribution to the European level project.
- All the quality control procedures, the reporting and the resource control tools were concentrated in the hands of the Project Coordinator, the project manager and the Technical Coordinator, who liased closely through a regular series of Project Coordination meetings.
- A European level Evaluation Coordinator ensured that the evaluation activities were carried out at the local level in conformity with the project evaluation plan; similarly the technical coordinator ensured that the local applications were developed and implemented in conformity with the project objectives, and on a consistent basis.

Reporting

To obtain up-to-date and concise feedback in the implementation stage of a P/D project, draw on the defined structures and responsibilities.

- Project operators should report any difficulties in the P/D design to the evaluation team (e.g. by regular progress reports, feedback concerning building and verification of the demonstration, time schedule and resource issues).
- The evaluation team should report regularly to the project coordinator.

Monitoring resources

Keeping the demonstration on schedule and within budget will greatly depend on:

- regular monitoring and control of resource usage;
- prompt remedial actions when needed (particularly highlighting resource problems that could affect the P/D project results).

Verification and fine-tuning

You should carry out the following activities to verify the P/D project's set-up before proceeding to a full-scale implementation:

Operational test of the demonstration. The appropriate operation of the integrated project must be tested and verified before it is used in data collection activities. Verify that all required technical specifications are met by the actual performance of the P/D project. This test run should confirm that your key objectives are met.

Fine-tuning. You may have to fine-tune the P/D project to satisfy originally defined technical specifications. A redesign of the demonstration should be considered and modifications applied if clear verification is not possible.

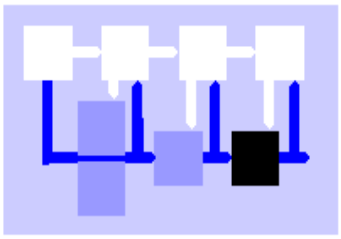
3.7 Ex post evaluation

In this chapter:
- Has your P/D project been successful?
- What is different now with respect to the earlier evaluation stages?

The third and final of the three phases of evaluation is the *ex post evaluation*. The success of your project will now be evaluated both in terms of how far it achieved its objectives and the actual changes observed in the four evaluation areas (transport system performance; economic efficiency; environmental; and safety and security). The outcome of the ex post evaluation will influence your decision whether or not to proceed to full-scale implementation.

- Do the early assumptions hold?
- Has the project been conducted as planned?
- What are the impacts?
- What are the lessons?

During the ex ante evaluation you will have made a number of assumptions, because that phase is carried out before implementation of the P/D project. Some (perhaps many) of the issues to be included in the evaluation will not have been investigated during the ex ante stage because it was too early to make accurate estimations of the effects of the project on the measurement indicators. The ex post evaluation phase may provide the first opportunity to see whether the assumptions on which the P/D objectives were based actually hold. Next comes a review of whether the project has been conducted as planned, followed by the calculation of the individual impacts in the various evaluation areas, together with any combination of these results to give an overall measure of success. Finally, the evaluation should draw lessons from the outcome of the project for full-scale implementation (see Section 4).



Most of the analysis within the ex post evaluation phase involves the indicators you designated earlier and the processing of the data collected following implementation in order to calculate the impacts. It will be possible to compare the results with those of the ex ante situation in order to determine how accurate the assumptions made at the ex ante stage were. This may provide useful lessons for the formative stages of future P/D projects.

Urban Sector Example. Ex post evaluation
The questions addressed in the demonstration of different IT-mediated information services in urban public transport are related to the impacts on the passengers' (1) perception of public transport, (2) attitudes towards public transport, and (3) behaviour in public transport.

Evaluation studies were performed using questionnaire surveys (4000 distributed on two occasions 10 months apart), focus group interviews (19 used between 25 and 70, 10 women and 9 men) and field evaluations at selected stops (observations and interviews, in total 80, and after 10 months 60). The main results were as follows: real-time information on displays and monitors at bus/tram stops holds a value for all categories of passengers. However, it is not believed to dramatically change the choice of means of transport and attract new categories of customers, but rather to probably decrease the movement of customers 'out from' public transport.

Services over the Internet also have a value for all categories of passengers, but as in the other case no dramatic increase of the number of public transport customers can be seen. Nevertheless, as the Internet users will increase in the future, such services are believed to reach new types of potential customers, and in the long run the movement of customers into public transport may increase.

Issues for the ex post phase

The questions that will have to be addressed during the ex post phase will now be examined in more detail.

The overriding question to be asked about a P/D project is whether it has met its objectives that were defined at the outset. The answer to this question will be based on:

- the successful implementation of the project, and
- the results achieved in each of the evaluation areas,
- how easily the results can be drawn together to make recommendations both for potential future full scale implementation of the project and the conduct of similar P/D projects.

Has the project been conducted as planned?

The issue here is whether the design of the project has been followed, the costs were as expected, and the operation of the service was as planned. If not, you should evaluate why the project was conducted in another way, why there are exceptions and what the consequences have been.

What are the impacts of the project?

One of the main roles of the ex post evaluation is to calculate the impacts of the implementation. At this point, the estimated impacts should be compared to the actual impacts of the project. In particular the behaviour of the users and their expressed opinions (gathered, for example, by means of a survey) regarding the project must be taken into account.

Do the outcomes match your assumptions?

The evaluation provides the opportunity to compare the results with the assumptions made in the ex ante evaluation. For example, although the assumption was that within a range of five kilometres there were 5,000 potential customers, the number may actually have been the lower. Hence, project usage and income may have been less then expected. The evaluation should also address the question of why the initial assumptions were wrong .

What lessons can you learn?

The ex post evaluation should also focus on learning lessons for the future, both for conducting similar P/D projects and for full-scale implementation of projects. These lessons can be drawn from the exploitation of the project, the opinions of the users and other actors and the actual impacts of the project.

Before the project is implemented the type of data needed will be known as it should ideally be the same as the initial and ex ante evaluation. The data sources are opinions of users but also information on actual costs, actual time savings and comfort levels. It may be possible to quantify much of the data collected, but qualitative data is still a valuable input to the evaluation process in this final phase.

Ideally as much data as possible should be collected. It should be objective and unambiguous and provide all the necessary information. In practice a trade off has to be made between the cost of data collection and the quality of the data. The same variables as in the ex ante evaluation are used, as this allows a direct comparison between the two evaluations, making clear before implementation which variables have to be measured. This will reduce the costs significantly. Nevertheless, there has to be a trade-off between cost and quality in every project and this depends on the budget and

type of project (e.g., political sensitivity, technology used, acceptance by various actors). Again, the trade off has to be explicit and be acceptable to all relevant actors.

What impacts do you need to consider?

You will need to consider the same four key impacts you considered in the two previous evaluation phases when carrying out the ex post evaluation. transport system performance; economic efficiency; environmental impacts; and safety and securit.

In this final evaluation phase, the impacts will no longer be forecasts but the actual impacts measured during and immediately after implementation of the project. The data are mainly quantitative at this stage. The evaluation is concerned with both the achievement of objectives and the appropriateness of the scheme.

Evaluation of transport systems

Following implementation of the P/D project, you will have to analyse what the impacts of the project were and synthesise these impacts into a useful framework before final evaluation. It will be possible by this time to assess how well the transport system implemented actually performs in an operational environment. The estimations made in the ex ante phase can now be compared with the actual measurements in this phase to discover whether the system designed is likely to meet its objectives. It will be useful to inform key decision makers whether they are likely to receive a return on their investments at this point.

Economic efficiency

There is no fundamental difference in the evaluation of economic efficiency within the different phases of evaluation. However, the available data at this level will be of a higher quality and aggregation.

In the ex post phase, you should measure the change in travel time by using the difference between the situation before the transport project has been carried out and the situation after implementation of the transport project. These measurements should be compared with the modelled outputs from the ex ante evaluation.

Differences in measured travel times can be valued using the VOT tool. In your analysis, you should exercise caution in trying to identify the cause(s) of any differences. Effects other than the P/D project may have influenced the measurements. These may include factors such as different origin/destination relationships, other projects running simultaneously or unexpected changes in traffic levels.

Environmental impacts

At the ex post phase, the level of detail and sophistication of the environmental impact evaluation will be greater than in previous stages; often the data are of better quality and greater quantity than earlier.

During this phase, you may use any or all of the five key environmental assessment tools: descriptive; ranking; judgmental assessment; physical measurement; and monetary valuation. The descriptive tool is suitable for use in the ex post phase as well as in the initial and ex ante phases of evaluation. The descriptive tool

provides a sound starting point for evaluation in the ex post phase as the output will be a list of impacts with a qualitative assessment for each. But by the time you have reached this phase, your data will ideally be in quantitative form and can be more rigorously assessed. You should now be in a position to use the physical measurement tool, which quantifies individual impacts, or the monetary valuation tool, which expresses impacts in money terms. If, however, environmental impacts are not expected to be of importance in comparison with other scheme impacts, or if resources are very limited, use of the descriptive tool will remain an important aspect of assessment of the scheme.

Safety

You must attempt to extract information from a system that is not open to direct experimental manipulation in the form of varying input variables and making repeated observations. Instead you will have to perform the evaluation mainly using data collected for purposes other than those you had in mind. For example, historical accident data might be available, but it has not been collected with a view to the evaluation of a particular pilot site and it is unlikely that the full range of contextual information required for full analysis and comparison of a new transport system implementation will be to hand.

Two approaches to safety evaluation are relevant in this phase:

For further analysis of these techniques, see the appropriate Appendices within MAESTRO Deliverable 2, the Evaluation Methodology, as well as the MAESTRO Web site.

- accident evaluation using data gathered during the ex ante phase and subsequently and making comparisons with other sites during a matched time frame, and with historical data from the pilot and other matched sites;
- analyses of near accidents (conflicts). The benefit of this approach will be the availability of much more data to evaluate.

Both behavioural studies and conflict studies may be carried out to assess safety in this evaluation phase, as you will have access to real behaviour data and should be able to make use of accident and near accident (conflict) data.

In the ex post evaluation phase, it is likely that local authorities will have a particular interest, as they will have a certain degree of responsibility for road safety. They may be able to provide the historic data necessary and will be concerned that the P/D project does not increase the incidence of accidents, but helps to reduce it.

What are the outputs of the impact evaluations? How will they be used?

The output of the impact evaluations will be the calculated indicators which will then be fed into the evaluation process. As highlighted in chapter 3.8, a range of methods may be used to evaluate whether a P/D project has been a success. Four methods are discussed briefly in these Guidelines—cost-benefit analysis (CBA); cost-effectiveness analysis (CEA); multicriteria analysis (MCA); and goal-achievement matrix (GAM).

Your choice of what to do with the output from your impact assessment will depend on the objectives set at the beginning of the project. If for example efficiency was the main objective of the

project in terms of trying to weigh up the costs of the project against the benefits, you could use CBA, CEA, or MCA. If, however, your objective was to ensure effectiveness, then GAM is probably more appropriate.

Road Sector Example. Relation of results to objectives

For a road pricing P/D project the following questions could be discussed:

- Has a balance been achieved regarding the number of cars in the city centre, the damage caused to the cultural heritage and the revenues collected?
- Are there fewer vehicles in the city centre, resulting in a more pedestrian-friendly environment?
- Does the system work reliably without charging mistakes, and with minimum effort to maintain it?

Such a discussion could contribute to amendments to the system developed, as well as to recommendations for similar projects elsewhere.

In this chapter:
- Monetary evaluation methods
- Non-monetary methods
- Goal-achievement matrix (GAM)

3.8 Evaluation tools

Monetary evaluation methods

Monetary evaluation methods provide better insight into the costs and effects of alternatives. An assessment can be made balancing costs and effects, of and between competing alternatives. Monetary methods can be used only when the effects of alternatives can be expressed mostly in monetary terms.

CBA and CEA compared

Cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA) are the most well known and most widely applied monetary evaluation methods. Other less common monetary methods are *threshold analysis* (developed by planners to evaluate city-development plans) and the *shadow-project* method (developed to take account of environmental effects in evaluation of alternatives).

In a CBA, the costs and benefits (effects) of alternative P/D projects or measures are expressed in monetary terms and are systematically presented in a balance sheet. Costs can be subtracted from the benefits, the result of which will indicate whether the P/D project should be implemented or not. CBA should be selected if:

- all effects (costs and benefits) are known and can be expressed in monetary terms;
- policy makers emphasise efficiency criteria;
- a recommendation is needed whether or not to approve a P/D project.

CBA and CEA can be:
- financial
- socio-economic

CEA has all the features of CBA but one; it does not require all costs and benefits to be expressed in monetary terms. It is usually applied if valuation of benefits is problematic. CEA can be described as an analysis to decide:

- which alternative, given a fixed number of intended (societal) effects, can be realised as efficiently as possible (cost minimisation);
- how, given a fixed budget, as many intended (societal) effects can be realised (effect maximisation).

CEA should be selected if:
- several project alternatives are available;
- valuation of effects is uncertain;
- no recommendation to approve a P/D project is required.

Both CBA and CEA may be financial or socio-economic in nature.

Financial CBA and CEA measure efficiency from the *private* point of view, for example that of an individual or company such as a transport operator. This means that only the costs and benefits for the actor 'investor' are taken into account. The key question is whether a P/D project would have a sufficient return to justify the investment for a firm, a bank or perhaps an organisation in charge of public utilities. A positive outcome means that a P/D project is evaluated as being a profitable investment.

For more information on these tools, see Appendix A in MAESTRO project Deliverable 2 and the CD-ROM edition of the MAESTRO Guidelines.

Socio-economic CBA and CEA measure the efficiency of a P/D project from a *national* point of view. All benefits and costs to society (including 'third parties') are taken into account.

The socio-economic approach takes the costs and benefits of all actors in an economy into account. To make sure that all relevant costs and benefits are considered, they should be classified separately for each of the actors and stakeholders affected by the P/D project. Bear in mind that the negative effects to one actor or stakeholder can be positive effects for another. If a P/D project leads to higher public bus fares, it is a negative benefit for the group 'users public transport', because they have to pay more. But for the group 'public transport companies', the additional profit makes the effect a positive benefit. For the society as a whole, the positive and negative benefits compensate each other and nothing changes from an overall socio-economic point of view. However, the costs and benefits are distributed very differently between the various actors and stakeholders and will affect the way the change is perceived.

Although CEA can also be financial and socio-economic, unlike CBA, neither type of CEA can help decide whether benefits outweigh costs and hence which alternative is most desirable from the point of view of efficiency. They only provide a ranking of the alternatives.

Advantages, disadvantages and limitations

CBA has the following advantages:

- expression of effects in monetary terms aids the process of calculating overall project impacts;
- decision-makers may respond more favourably to monetary assessments of project efficiency.

CEA has the following advantages:

- not all costs and benefits have to be expressed in monetary terms;
- CEA is less demanding and therefore more practical than CBA if time and funds for the appraisal are limited.

The disadvantages of CBA include:

- most effects must be expressed in monetary terms which is often not possible;
- it is a tool to measure efficiency, but decision makers may have a range of other objectives that have nothing to do with efficiency.

CEA's disadvantages are:

- It is applicable only if several P/D project alternatives are available;
- It provides only a ranking of alternatives rather than a recommendation whether or not to approve a P/D project (do benefits outweigh costs).
- As far as possible, a CEA focused on effect-maximisation ought to express the desired effect in one dimension: for example, the increase in the number of people travelling by bus as a result of an advertising campaign, or the reduction in the number of accidents resulting from a vehicle speed reduction scheme. This implies that the possibility of using a CEA effectively depends on the possibility of developing useful standards. If more than one goal is pursued they must also be weighed against each other, which is a subjective matter. Such goals as environmental protection and safety are thus not always easy to make operational in a CEA.

Advice on use of CBA and CEA

A characteristic of CBA is that it is focused on the evaluation of a single alternative. As a general rule, apply CBA if:

- efficiency is the only appraisal criterion;
- all effects can be estimated in monetary terms;
- adequate return on investment is a key objective.

If only minor effects cannot be expressed in monetary terms, it may be useful to apply CBA partially. You might choose to use another method, such as CEA or MCA, in addition to or instead of CBA.

A combination of CBA and MCA is recommended if:
- efficiency is among the range of criteria;
- all efficiency attributes are known in monetary terms;

The CBA outcome (for example an internal rate of return) is used as an input (the score on the efficiency criterion) into the MCA.

The objectives that can be evaluated with a CEA are of a general form: "is this project effective in contributing to the objectives?". The question can be formulated either as a matter of discovery or learning or as a support to a decision making process.

CEA should be applied if:
- several P/D project alternatives are available;
- a ranking of alternatives is needed;
- expected outlays for each alternative for investments, recurrent costs and any other cost element (including external effects) are available in monetary terms;
- benefits of the different alternatives are known in quantitative, physical terms (for example cubic metres, hectares, kilograms).

It should be borne in mind that based on a CEA it is *not* possible to give a recommendation whether or not to approve a P/D project.

Methodology, timescale and actors

CBA and CEA can play a role at several times during a P/D project lifecycle, namely:

Before the project begins: In determining the need to conduct a pilot; CBA can answer the question whether a P/D project will be profitable;

- Before the project begins: In determining the need to conduct a pilot; CEA answers the question which alternative is likely to be effective to achieve a certain goal.
- Ex ante evaluation phase: Before implementation of the P/D; CBA answers the question whether a P/D project will be profitable before it is implemented.
- Ex ante evaluation phase: If there are several alternatives with a detailed technological design, a CEA can answer the question which alternative can be realised as efficiently as possible.
- Ex post evaluation phase: CBA gives guidance on whether the P/D project has been successful.

It is recommended that only suitably qualified staff should apply the CBA and CEA techniques.

Non-monetary methods

Multicriteria analysis (MCA)

Multicriteria evaluation or multicriteria analysis (MCA) methods are designed to provide a flexible way of dealing with qualitative

multidimensional effects of transport projects. These methods attempt to take into consideration the multiple impacts of a project in a balanced manner. Impacts are weighted depending on their relative importance or priority in terms of meeting the objectives of the P/D project(s) being considered.

How to use MCA

What is common in almost all MCA techniques is the need for the decision maker to determine initially not only the list of alternative projects to be evaluated, but also the evaluation criteria that will be taken into account for that purpose. The performance of all projects will be measured against these criteria either on a physical or on an artificial scale, depending on the method selected. The majority of MCA techniques also require the decision maker to rank the evaluation criteria selected in order of their importance, either qualitatively or quantitatively. The output of an MCA technique may be a global ranking of alternative projects relative to their performances, or a group of acceptable projects, or even the establishment of some assumed superiority–inferiority (dominance) relationship among projects within pairs under comparison.

These methods have the following advantages:

- They are able to take account of an entire range of differing yet relevant impacts, even if these impacts cannot be related to monetary outcomes.

- Assumptions are made that impacts will be estimated on different measurement scales. MCA methods place all impacts, monetary and non-monetary, quantitative and qualitative, economic and environmental on an even footing for evaluation.

- The methods work on the basis of making a preference decision, whether that be prioritisation, selection or general evaluation, so the project which is overall the most attractive becomes obvious.

- Although multicriteria evaluation has a number of advantages, it is not a panacea and cannot be used in all circumstances without difficulties. The main shortcomings of multicriteria evaluation stem from the fact that no one solution can optimise all the impacts at the same time. The decision maker must therefore find compromise solutions. For example, a decision between whether to prioritise economic or environmental impacts may need to be made when both are considered important.

Goal-achievement matrix (GAM)

The **goal-achievement matrix** evaluates alternative options within a matrix format on the basis of how well each achieves a set of pre-determined goals or objectives. The method thus gives a potential decision maker the opportunity to select, from a series of alternative projects, the most appropriate one for implementation, in terms of each project's rate of success in the pre-defined goals. As this method has evolved from cost benefit methods, the estimation of costs and benefits is central to the method. However, both costs and benefits are defined in terms of goal achievement rather than in monetary terms.

Epilogue: Evaluation management and organisation

When making preparations for carrying out a P/D project, you should thoroughly plan the evaluation process. The plan should be robust and consider the evaluation requirements for all three phases of evaluation. It is hoped that the MAESTRO Guidelines will help you to develop a robust evaluation framework for your P/D project.

You should make sure that those responsible for carrying out the design and implementation of the project are not also involved in its evaluation because the process of carrying out a P/D project should be transparent. Clearly, ensuring that different parties carry out different activities through the course of the project will help to ensure impartiality.

When designing and implementing your project, you should ensure that there are feedback loops to make it possible at any stage to retrace your steps in order to make amendments or refinements to your project design. The steps you take should be reported regularly and thoroughly in order to allow others to refer to and learn from your experiences of designing and implementing a P/D project.

Section 4.
After the project: utilising the results

You have now successfully completed a P/D project. How will you use its results? The MAESTRO Guidelines cannot, of course, tell you what to do with your results, but this section is intended to raise questions and issues that are important to consider in this crucial 'after' stage of a P/D project—deciding what to do next.

In this chapter:
- How do your results relate to the original problem/hypothesis?
- Are the results consistent with other P/D projects addressing the same problem?

4.1 Interpretation of the P/D project results

How do your results relate to the original problem or hypothesis?

Having completed and evaluated your P/D project, you should examine your results against the original problem. It is important to evaluate your results against both a broad definition of the original problem and more specific definitions and assess which of your findings are relevant to which definition. It is important to establish whether your P/D project achieved impacts in the areas you expected, or whether there were additional impacts within other unforeseen areas. You should also review whether the impacts were achieved at the level you anticipated. Overall you need to assess whether the results of the P/D project suggest a full-scale implementation would address the original problem.

The MAESTRO Web site http://www.europrojects.ie/maestro provides some links as a starting point.

Are the results consistent with other P/D projects addressing the same problem?

Because the findings of your localised P/D project are by definition limited in scope, it is useful to compare them with those of others which have addressed similar problems. This process can boost confidence in your own results, if they reflect those of other P/D projects, or alternatively make you question why your results differ from those of similar projects, if that is the case. If your results are not consistent with those of other similar P/D projects, you may wish to examine the differences between the projects and try to determine why the inconsistencies exist. It may be the comparison project(s) differ in detail; they may have been established to address different problems, and peculiar local circumstances may have influenced the results. You should bear in mind the differences as well as the similarities between your P/D project and those with which you are comparing it before you reach conclusions regarding the consistency of your results. Comparison of the findings of your own P/D project with those of other projects actually enhances the quality of your results, if only because you will become more aware of and therefore able to account for any differences.

Where can you find P/D projects suitable for comparison? There is a range of sources to obtain comparable P/D project findings. Since many projects have Web sites, a good start can be made on the Internet. Your work colleagues may also be another good source of relevant information. Alternatively, you could approach policy makers involved in P/D projects at different levels or call in expert advice.

4.2 Recommendations

In this chapter:
- Does your P/D project provide additional benefits?
- How do you make your findings transferable?

Does your P/D project provide additional benefits?

Whenever you carry out a P/D project, you should consider what its wider relevance could be. The results of your P/D project will be of interest to others outside your organisation. Make efforts to publicise your results—whether you considered the project successful or otherwise—so that others may learn from it. This is particularly true at the European level. The European Commission gains 'added-value' on its funding of P/D projects by supporting projects in cities across Europe, in preference to choosing single projects or leaving them to national authorities. Bear in mind during and after your P/D project how it can best provide added value at the European level, for example, by:

- producing transferable results, possibly through comparison of sites within the project;
- contributing to the development of a common set of performance indicators to enhance existing evaluation frameworks and models;
- disseminating your results to countries across Europe as an example of best practice;
- helping to increase awareness of the barriers to certain measures by comparing your results with those of other countries with different institutional arrangements;
- providing results that can be drawn upon by countries on the EU periphery;
- contributing to the testing of innovative technologies for comparison across a range of locations and circumstances;
- assisting in attempts to standardise transport technology throughout the EU.

You might offer your P/D project as a comparison case for the analysis of different P/D projects at different sites. Because the new site may have a different set of objectives, requiring different indicators, use of as wide a set of indicators as possible is essential in P/D projects, both in assessment modelling and during on-site trials. This will make the delivery of impacts relating to objectives more transparent, and will also allow the accuracy of models/predictions to be tested in a wider range of conditions.

Urban Sector Example. Additional benefits

The urban road pricing project considered earlier is likely to have additional benefits; by monitoring the project impacts directly (e.g. reduction in number of cars, modal shift) and indirectly (e.g. increased number of inhabitants as the living conditions in the centre are improved) experience can be gained which will be useful for any similar city in Europe.

The technology implemented can be improved during this real life test to correct any weaknesses that are uncovered.

A very important additional benefit has been achieved if the decision is

taken to collect the charges separately, and to spend them separately for reconstruction measures at the cultural heritage sites. This transparent process (hypothecation) would contribute to increasing public awareness about the balance between charges paid and the costs of cultural preservation. It would contribute to a public realisation of the indirect costs caused by traffic in general, and the private car in particular.

How do you make your findings transferable?

In the same way that you seek out other project results for comparison with your own, that is, to seek evidence that they are correct, you should also consider whether others could use your own results. The transfer of results from your P/D project can take place at many different levels both within and outside the project. Certain characteristics of the project which probably only became apparent during its lifecycle should be made public to those who wish to draw upon your results or attempt to replicate your project.

Your findings will become more transferable if you provide practical guidance about key factors which you considered and questions you addressed during the design and implementation phases of the project. These can be disseminated through a wide range of media. These should include:

- the approximate costs of implementing the chosen scheme (were certain parts of the project more costly than others? were there any unforeseen costs? was the scheme implemented in a single operation, or was it built up in stages?);
- the approximate running costs of the project (were they as anticipated? did delays lead to unexpected additional costs?);
- any changes required to the transport infrastructure and the amount of cooperation required for scheme implementation (were services significantly interrupted when the scheme was implemented? are there ways of ensuring early consensus between partners, e.g. ensuring minimal service disruption?);
- identification of appropriate models to use for assessment of any of the schemes (should an assignment model be used, or would a simulation model or a behavioural model be more appropriate?);
- provision of information on the level of accuracy produced by different models for a wide range of performance indicators (are different degrees of interpolation or extrapolation necessary depending on the model used?);
- provision of information on the data requirements of the models (were data easily accessible? are certain sources more reliable than others?);
- provision of a methodology for analysing model results and testing for sensitivity and robustness (were other methods considered? why was this considered most appropriate for testing sensitivity and robustness?);

- production of recommendations for the design of schemes (which design aspects should be avoided? what are the components of a good scheme design? Are aesthetic and environmental considerations suitably addressed?);

- identification of barriers to implementation, and proposed methods of resolution (were there institutional barriers to implementation and how were they overcome? were negotiations entered into to resolve problems?).

See 'Site Selection', chapter 3.2.

Urban Sector Example. Transferability
Since each city is different, the impacts of the urban road pricing project cannot be exactly replicated. However, in addition to the costs and benefits of the project, a number of basic experiences may be transferred:

- The reliability of the technology depends only to a limited extent on its geographical location; maintenance problems and user-interface problems are valid for any other location.
- The user acceptability of the system and the charges provides useful insight for any city considering setting up a similar system, in order to ensure that the best scheme for public information and involvement is developed.
- Another important experience is the impact the pricing system had on the urban transport system as a whole; if more people now prefer to leave their car outside the pricing zone, parking infrastructure and parking schemes need to be available to prevent inhabitants of other parts of the city suffering the impacts of reduced traffic in the centre.

Positive experiences from the P/D project could be an incentive for a follower project or a full scale implementation elsewhere; but errors must also be discussed to allow the next city to be better prepared, taking into account all available experience from the given P/D project.

Although providing such information is unlikely to be your main priority, it is, however, vital for anyone attempting to achieve similar results with a similar project in the future, and indeed, from the point of view of your own project it is a valuable exercise in analysing why the impacts were not 'exactly' as anticipated in terms of scope and level of measurement.

What factors are specific to your site?

Because many aspects of your site are unlikely to be replicated elsewhere, it is important that those who wish to use your results know which factors are specific to your site and which are general site characteristics. At an early stage in the project, you will have carried out a site selection process and eliminated those sites whose characteristics were less favourable than the site you finally selected. Those wishing to replicate your project would then be able to carry out more informed site searches.

How do you extract the general elements of the results?

Since resources are always limited, it is not likely that you will be able to make a complete general assessment of your results to make them directly useful to others, as your loyalty is to your own P/D stakeholders. Because your final evaluation will be tuned to your own needs, those who might want to use your results will probably not be able to do so optimally. You will probably also have drawn

on prior knowledge not made explicit in the evaluation. An attempted listing of at least some elements that may be relevant to others wishing to use your results, could be a useful exercise. This may encourage others to look deeper than would be possible merely on the basis of your evaluation report. Some of these elements could include:

- An indication of how site specificity may have influenced certain results;
- Findings you believe can be generalised;
- Issues for potential further research.

Ideally, all actors involved within P/D projects would analyse and codify their results in this fashion, so that a general comparison of results may take place, and P/D projects will be able to be of assistance to one another. In the real world this is not likely to happen in a comprehensive fashion, but it is nevertheless good practice to reflect upon one's own P/D project and analyse the causes and effects contained within, and naturally to prepare a written record in order to replicate/avoid certain situations.

4.3 Full-scale implementation

In this chapter:
- Should you proceed to full-scale implementation?
- What about scaling-up problems?
- What policy impacts can be foreseen from your P/D project as conducted?
- What can be learnt on European level from P/D projects?

Should you proceed to full-scale implementation?

Before you can answer this question, you need to consider whether your P/D project solved the problem for which it was designed. You should return to your original specific objectives to see which of them have been met. There are three possibilities: that none or your objectives have been met; that some of them have been met; or that all of them have been met.

If none of your objectives have been met, proceeding to full-scale implementation would be inappropriate. Although your objectives have not been met, the project may still be considered a success if lessons have been learnt for the future. It is recommended that you return to the pre-design stage and re-examine your objectives, the site or sites and the indicators you chose to measure and ask whether changes could be made. You may decide as a result of this process that a revised P/D project may not be the best way to proceed in tackling your specific problem. You may need external help and know-how to advise you about other, more suitable methods.

Urban Sector Example. Lessons learnt

The decision process in the city about the full scale implementation of the urban road pricing system was not easy, but finally the city seems to be satisfied with its decision and this provides useful experience for any follower city in Europe.

The plan to implement a system similar to the one demonstrated needs careful consideration as high investment costs have to be anticipated.

There appears to be a size threshold for the successful implementation of road pricing schemes; small cities for example might achieve similar results with pedestrianisation and traffic restraint, at a lower level of investment.

If a city decides to implement a similar scheme, this could be achieved on a stepwise basis, but in any event the planning process should cover the complete system, as the effort of data collection and design should not be undertaken twice; it is far more efficient to plan the full scale version from the outset.

The idea of collecting charges from the public in a transparent fashion for a specific reconstruction measure was well accepted by users, as it was clear what they were paying for, and how they benefited from it.

If some of your objectives have been met, deciding what to do next in light of your results is more difficult. You probably ordered your original objectives according to a hierarchy, and you should now refer back to that list to check which objectives have been met and what their relative position is in the hierarchy. Even if a hierarchy

See chapter 2.2, 'If not a P/D project, then what?'.
See chapter 3.1, 'Define the objectives'.

was not established, it is still likely that certain objectives were considered more important than others. If your P/D project has failed to meet its objectives, full-scale implementation may not be a good option. If only some of the objectives have been met, the problem you set out to solve has only partially been solved. Will full-scale implementation go further towards solving the problem, or will it merely result in the same partial solution of the problem but on a larger scale? If the latter, you must decide whether you are willing to settle for only a partial fix and whether you can convince the others involved that it is acceptable.

If all your objectives have been met, the decision whether to proceed to full-scale implementation is easier but still not without risk. You should not assume that because your project had a favourable outcome and met all its objectives, that this will also be the case at full scale. All that the results of your P/D can do is help you to be more confident that your positive results will be repeated if you take the project to full-scale implementation. Inevitably, there is a certain degree of risk involved in progressing to full scale. In essence you would be translating the specific conditions of your P/D site to the general conditions of a full-scale implementation environment. As a result of this, corrections are often needed. For example, site location may have been a key factor influencing the success of your P/D project, but if the characteristics of the specific location cannot be translated into general conditions, it is unlikely that your positive P/D project results will be repeated if you go to full-scale implementation.

Urban Sector Example. Should you proceed to full-scale implementation?

The urban road pricing system in its demonstration version has now been operated successfully for some time, and the decision must be taken whether or not to implement it at full scale.

The investment costs for further equipment must be considered as negative factors; also the relatively high effort that is linked with convincing the public of the benefits of a road pricing scheme.

But on the positive side, the public became accustomed to the scheme during the P/D project, the technology proved to work reliably, and the first limited cultural preservation measures have been undertaken with the revenues collected. The flexible charging did slightly reduce the overall number of cars, but owing to its dependence on the actual flow of traffic, it mainly contributed to cutting down peak traffic, thus relaxing the parking situation in the centre and improving the situation for pedestrians.

The establishment of staffed stations at the edge of the city providing visitors with the smart-card required had a positive impact on the employment situation in the city.

Since the planning phase for the system covered the whole city centre, a simple refinement of the planning documents is needed, with some minor changes in the road network (access limited to public transport, for example); and the toll to be levied will be lower than expected as it turns

out that a remarkable share of visitors prefers to leave the car outside the centre and to continue with public transport.

Weighing the benefits and dis-benefits of implementing the pricing scheme the city might conclude that the system proved to be a good way of sharing the costs of preserving cultural heritage with those who come to visit it, and thus contribute to its damage.

What about 'scaling-up' problems?

Are the impacts measured as part of your isolated project likely to be achieved if the project is implemented at full-scale? The problems involved in 'scaling up' a project, from P/D to full-scale, deserve careful consideration before important decisions are made. For example:

- Users of a pilot may not be used to the new technology or measure; the use or impact in the P/D project may thus be lower than in a full-scale implementation, or when time has been allowed for adjustment.
- There may be network effects if the project is implemented at full scale. 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.

If the impacts of your P/D project have been evaluated using such techniques as CBA or MCA, the scaled-up impacts can also be used as inputs to provide insight into what the impacts of full-scale implementation might be.

What policy impacts can be foreseen from your P/D project as conducted?

It is highly unlikely that the results/impacts of an individual P/D project will have such wide-ranging influence that they instantly lead to an amendment to policy at the European, national or local level. Nevertheless, the results or impacts of your P/D project, especially if reviewed in conjunction with similar results from 'sister' P/D projects are likely to confirm or partially validate the value of an overall policy; naturally the converse may be true, in which case an ultimate shift in policy may result.

What can be learnt on a European level from P/D projects?

P/D projects have an important contribution to make at the European level, as they allow similar measures or applications to be designed, implemented and evaluated under rigorously controlled conditions, but within different social, legislative and financial frameworks. The differential nature of the results may well have

important contributions to make to an assessment of barriers to implementation at the national or local level. It is possible to examine and evaluate under which political, legislative, legal and financial frameworks a particular P/D project may have most significant impacts; it is possible to trade-off the particular national characteristics inherent within these frameworks against the likely success of a P/D project.

Section 5.
Additional information

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Quality control standards

How does MAESTRO relate to external standards for quality control, project management and environmental management?

A number of sets of standards exist and are used internationally for quality control, project management and environmental management. The most commonly observed standard is ISO 9000. MAESTRO is designed to be consistent with standards already in place, not to replace them.

Many organisations use ISO 9000 to define the basic procedures to ensure that work is done according to plan or design. MAESTRO, in contrast, is concerned with the content of decisions made within that process. For example, where MAESTRO will guide you on the methods that can be used to evaluate the impacts of the P/D project, ISO 9000 will specify how the calculations must be recorded and checked. The two sets of guidelines are therefore complementary.

MAESTRO adheres to project management good practice as embodied, for example, in guidelines issued by organisations both within and outside the transport sector. These project management guidelines tend to be generic, covering the whole project lifecycle (including, where appropriate, a pilot phase), whereas MAESTRO provides particular detail relating to P/D projects. For example, MAESTRO highlights the P/D project's particular need to design the evaluation process in such a way that the potential for scaling the project up, or transferring its results to another context, can be assessed at the end.

Does good practice for the management of P/D projects differ from that for other projects?
From industry experience and those involved in project management the consensus is 'No'. Most guidance on project management splits a project's lifecycle into stages, one of which is the P/D project. The same principles of project management apply throughout the project lifecycle.

What will MAESTRO tell me about good practice?

The MAESTRO guidelines signal where action is needed to keep the P/D project consistent with external standards and generally accepted good practice are pointed out, for example:

- key decision points that would require documentation under ISO 9000
- choices that will require environmental assessment as part of ISO 14000.

Existing standards and codes of practice

There are a number of existing standards and codes of practice that complement the advice provided in these guidelines. The Appendix provides further information on the key existing standards.

What is ISO9001

ISO 9000 is the international quality management standard. It is a widely accepted, practical tool to assist users in business and government to assure the quality of their products and services. It provides you with a model to follow in setting up and operating the management system. ISO 9000 certification is voluntary, but it is often required by customers as a reassurance of quality management.

Who can use it?

The ISO 9000 Standard is generic and independent of any specific industry or economic sector. It can be applied to any product and is equally applicable to both small and large companies.

What is ISO 9000, and what is it not?

ISO 9000 is actually a family of standards which are referred to under a generic title for convenience. The family consists of standards and guidelines relating to management systems, and related supporting standards on terminology and specific tools, such as auditing (the process of checking that the management system conforms to the standard).

ISO 9000 is primarily concerned with 'quality management', but everyone may have his or her idea of what 'quality', like 'beauty', is. In plain language, the standardised definition of 'quality' in ISO 9000 refers to all those features of a product (or service) which are required by the customer. 'Quality management' means what the organisation does to ensure that its products conform to the customer's requirements.

ISO 9000 concerns the way an organisation goes about its work, and not directly the result of this work. In other words, it concerns processes, and not products. ISO 9000 states requirements for what the organisation must do to manage processes influencing quality.

The philosophy is that these requirements are generic. No matter what the organisation is or does, if it wants to establish a quality management system then such a system has a number of essential features which are spelled out in ISO 9000.

The ISO family

ISO 9001 sets out the requirements for an organisation whose business processes range all the way from design and development, to production, installation and servicing;

ISO 9002 and 9003 refer to parts of business processes, but do not refer to design and development.

ISO 9000 is currently being updated, a new standard is due out soon and will be referred to as 9000/2000. This standard will focus more on customer satisfaction and continuous improvement.

What are ISO14000 and EMAS?

ISO14000 and EMAS are environmental management systems (EMS). While not as widespread as ISO 9000, organisations are increasingly adopting EMS in order to facilitate improvement in environmental performance.

What is an EMS?

An environmental management system provides a company with an integrated approach to managing and monitoring its environmental impacts and complying with environmental regulations. An organisation that has achieved a good standard of environmental management can then gain competitive advantage from communicating this information to customers, employees, shareholders, potential investors, and neighbours.

What is ISO 14001?

ISO 14001 'Environmental Management Systems—Specification with Guidance for Use' is part of the international ISO 14000 family

of standards. It specifies the requirements for an environmental management system. Fulfilling these requirements demands objective evidence which can be audited to demonstrate that the environmental management system is operating effectively in conformance with the standard.

It standardises worldwide environmental management systems and tools in the areas of environmental management systems (EMS), environmental auditing, environmental labelling, environmental performance evaluation, life cycle assessment, terms and definitions, and environmental aspects in product standards. ISO 14000 is appropriate for companies whose materials, processes, or products impact our environment.

ISO 14001 is a tool that can be used for internal purposes: to provide assurance to management that companies are in control of their processes and activities having an impact on the environment. Employees, in turn, may be happier if assured that they are working for an environmentally responsible organisation.

ISO 14001 can also be used for external purposes: to provide assurance to interested parties—stakeholders—such as customers, the community and regulatory agencies.

In other words, conformance to ISO 14001 can be used to support what organisations claim about their environmental policies, plans and actions. It is suitable for both suppliers' declarations of conformity, assessment of conformity by an external stakeholder, such as a business client, and for certification of conformity by an independent certification body.

ISO 14000 is primarily concerned with 'environmental management'. In plain language, this means what the organisation does to minimise harmful effects on the environment caused by its activities.

ISO14001 is similar to ISO 9000 in that it is also a process standard, rather than a product standard. It specifies the processes that you need to go through to reduce the environmental impacts associated with your company. It is designed to be generic, applying to any company.

The key elements of ISO 14001 are interlinked are established at different phases of the implementation process.

EMAS requirements

EMAS is a the European Commission's Eco-Management and Audit Scheme. It differs from ISO 14001 in a number of requirements, including the production of a public environmental statement, which is third party audited and the need for an initial environmental review.

To achieve more consistency with the ISO standards and the associated certification and accreditation process, a revised version of EMAS (generally being called EMAS II) is due to be operational in 2000. The changes will ensure more consistency with the ISO standards and the associated certification and accreditation processes.

ISO 14001 will be recognised as the basis of the Management System element of EMAS II. As a result organisations rather than a site will be the normal basis for registration, emergency response will be included and an initial review conducted under ISO 14001 shall be acceptable to the EMAS verifier.

Should I be aware of other project management standards?

To ensure that your project is completed to time and budget it is important that it is managed well. Quality management and environmental management are part of project management and have been covered. In addition guidance is available on project management from a number of sources.

MAESTRO does not provide guidance on project management, but it is implicit in these guidelines that good practice in project management is adhered to. Most of the key project management principles will form part of your quality management system, especially if you have an ISO9001 compliant system. Additional guidance on good practice in project management is available from organisations such as the Project Management Association. In the UK there is a British Standard, BS6079—Guide to Project Management. BS6079 may be adopted by ISO as an interim Standard while a new ISO Technical Committee is formed to take on the work of turning BS 6079 into an International Standard.

How do I get further information on these external standards?

For further information on ISO 9000, ISO 14001 and ISO 14031, contact:

International Organization for Standardization (ISO)
1, rue de Varembé
Case postale 56
CH-1211 Genève 20
Switzerland
Tel. +41-22-7490111
Fax +41-22-7333430
E-mail central@iso.ch
Web http://www.iso.ch

ISO/IEC Information Centre
Telefax+41-22-7490155
E-mail mbinfo@iso.ch

For further information on BS 6079 Guide to Project Management:

British Standards House
389 Chiswick High Road
London W4 4AL
United Kingdom
Tel: +44-(0)208-9969000
Fax: +44-(0)208-9967400
Email: info@bsi.org.uk
orders@bsi.org.uk
Customer Services:

Tel: ++44-(0)208-996 9001
Fax: +44-(0)208-996 7001

For further information on EMAS:

European Commission,
Directorate General XI
http://europa.eu.int/comm/emas

Reference: Community Eco-management and Audit Scheme, Council Regulation (EEC) No. 1836/93 of 29 June 1993.

Glossary

The following list contains terms used in this document with definitions as they are used in the MAESTRO Guidelines and generally in the transport sector in the context of P/D projects.

active participants individuals or groups who play a part in the conducting of a P/D PROJECT, including all participants in the project who fulfil management, technical and/or evaluation roles

actor an individual actively involved in the conducting of a P/D PROJECT

actual impacts See IMPACTS.

attribute a characteristic that describes a person, thing or event

best practice processes, practices or systems identified in public and private organisations widely recognised as improving an organisation's performance and efficiency in specific areas. Successful identification and application of best practices can reduce expenses and improve organisational efficiency.

bias the extent to which a MEASUREMENT or a sampling or analytic method systematically underestimates overestimates a value

consensus issues matters that can influence the likelihood that a group will reach agreement on the purpose and direction of a P/D PROJECT

continuous variable a quantitative variable with an infinite number of attributes

cost-benefit analysis (CBA) a monetary evaluation method where the costs and benefits of a P/D PROJECT are expressed in monetary terms and presented in a balance sheet

cost-effectiveness analysis (CEA) a monetary evaluation method in which not all of the benefits can be monetarised. This method provides a ranking of alternative projects.

data groups of observations or measurements, either quantitative or qualitative, used as a basis for assessment.

decision criteria a set of factors to examine and compare the costs, risks and benefits of projects and systems

decision moments any of a number of interdependent points during the project lifecycle when decisions regarding future actions are made.

decision-makers individuals or groups who influence aand/or formulate transport policy, allocate funds and provide the administrative basis for transport projects. As the first of the three specified user groups of the MAESTRO Guidelines, merely need to understand the broad workings of the P/D project process and to know that there is a dependable process underlying the project.

design the STAGE of the PROJECT LIFECYCLE in which the detailed design of the system is developed and the necessary requirements for implementation of the system are specified and met

direct impacts See IMPACTS.

discrete evaluation methods methods for choosing from a limited number of possible alternatives where the alternatives are not mutually dependent

estimated impacts See IMPACTS.

European added value The extra benefits the European Union gains by funding P/D PROJECTs in cities across Europe, rather than choosing single projects or leaving them to national authorities.

evaluation assessment of a P/D project in terms of its objectives—whether they have been or will be achieved

evaluation methods techniques for assessing the IMPACTS of a P/D PROJECT

evaluation plan a scheme devised during the early STAGEs of a P/D PROJECT to guide the evaluation process through the PROJECT LIFECYCLE

evaluation phases See PHASE.

ex ante evaluation the second of the three evaluation PHASES, consisting of the assessment of the ESTIMATED IMPACTS of a P/D PROJECT, with emphasis on what is likely to happen if the project is implemented and if it is not

ex post evaluation the last of the three evaluation PHASES, consisting of the assessment of the actual, measured IMPACTS of a P/D PROJECT. It provides the basis for forecasting the probable IMPACTS of FULL-SCALE IMPLEMENTATION.

expected impacts See IMPACTS.

expert users will carry out one or more of the tasks, for example producing an evaluation plan and developing impacts and indicators to be measured. The Guidelines should provide the overall context and help them to understand other stages and evaluation phases, provide useful lists such as those in the appendices, reference texts, bibliography and case study examples. All active participants in a P/D project may be considered to be expert users.

full-scale implementation the undertaking of a scaled-up version of a P/D PROJECT. This option could be a logical next step following successful completion of a P/D PROJECT.

functional specification detailed description of the construction and operation of a system to be implemented

functionality The operational characteristics of a transport system, i.e. what it will do and how it will do it.

goal achievement matrix (GAM) a NON-MONETARY EVALUATION method to measure the extent to which a transport project achieves its stated goals

group consensus agreement among the members of a group about issues related to a P/D PROJECT.

impacts effects of or changes brought about by the implementation of a P/D project. **Expected impacts** are those considered likely on the basis of existing knowledge, research and expert opinion on assessing the potential success of particular types of P/D PROJECT; they are important in the INITIAL EVALUATION phase. **Estimated impacts** are formulated by educated guesswork; they are important in the EX ANTE EVALUATION phase. **Actual impacts** are measurable changes resulting from the implementation of a P/D PROJECT; they are assessed during the EX POST EVALUATION phase. Impacts may also be **direct**, if they result directly from the IMPLEMENTATION of a P/D PROJECT, or **indirect** (or **secondary**), if they occur as a consequence of direct impacts. Indirect impacts are not addressed within the MAESTRO Guidelines.

implementation of the P/D the STAGE of the PROJECT LIFECYCLE at which the system that has been designed is put into operation and data are collected on the performance and IMPACTS of the system

important selection parameters characteristic features of a site that should be present before it is considered for inclusion in a P/D PROJECT

indicators quantitative units of measurement of P/D PROJECT IMPACTS i.e. the description of the impacts

measures of effectiveness a synonym of INDICATORS

indirect impacts See IMPACTS.

initial evaluation the first of the three EVALUATION PHASES, consisting of the assessment of the expected IMPACTS of the P/D PROJECT

iterative process a process undertaken repeatedly at STAGEs throughout the P/D PROJECT LIFECYCLE

mandatory criteria conditions that must be met before you proceed with a P/D project; one of the three main sets of decision criteria.

measurement a procedure for assigning a number to an observed object or event; also the act of measuring and the number itself

measures actions designed to bring about a desired end. A group of similar measures may be classified as a 'strategy'.

model a representation of a set of components of a process, system or subject area. A model is generally developed for understanding, analysis, improvement and/or replacement of the process.

monetary evaluation methods a group of discrete evaluation methods for use when the IMPACTS of an alternative can largely be expressed in monetary terms

multicriteria analysis (MCA) a NON-MONETARY EVALUATION method providing a flexible way of dealing with qualitative multidimensional IMPACTS of transport systems

non-monetary evaluation methods a group of discrete evaluation methods for use when the majority of IMPACTS cannot be expressed in monetary terms

parameters characteristics that can be measured or quantified

P/D project See PILOT/DEMONSTRATION (P/D) PROJECT.

phase a period during the PROJECT LIFECYCLE when the process of EVALUATION takes place. For the purposes of MAESTRO three such phases have been identified: INITIAL; EX ANTE; and EX POST.

pilot/demonstration (P/D) project the innovative application and assessment under real life conditions of a transport system or systems. In certain transport sectors, simulation or modelling scenarios can also be regarded as P/D PROJECTs.

policies principles for action proposed or adopted by local, national or European governments

policy goals general aims towards which policies are intended to contribute

pre-design the STAGE of the PROJECT LIFECYCLE when the functionality of the system to be implemented is specified, based on project objectives, user needs and site characteristics

preliminary criteria initial factors to be considered before reaching a decision to proceed with a P/D PROJECT

project lifecycle the time period from the inception of the project, beginning with the decision whether a P/D is appropriate and ending with the decision, after implementation of the P/D, to proceed or not to full-scale implementation of the project

project managers those who need to know the steps to be taken in conducting P/D projects. They have to ensure that these steps are taken, mobilise the resources, assure the quality of the project, assemble the results, and present the options and recommendations to the decision-maker(s). These individuals are likely to have a significant role in the preparation of objectives, the site selection process and in attempts to achieve consensus. They will need the Guidelines as a reference manual, supported by checklists, to help them to guide, instruct and monitor the expert users. Project managers and expert users form the **actors** within a P/D project.

qualitative to be expressed in words rather than numerical values; used of data or measures pertaining, for example, to attitudes, opinions, perceptions and observations

quality control design and review procedures to validate and document that the project is in keeping with specifications

quantitative to be expressed as a numerical value; used of data or measures pertaining, for example, to frequency, speed and time

range a measure of spread; a statistic used primarily with interval-ratio variables

real-life added value the benefits achieved by carrying out a P/D PROJECT in preference to more artificial study environments

reliability The quality of a measurement process that would produce similar results on (1) repeated observations of the same condition or event

or (2) multiple observations of the same condition or event by different observers.

risk analysis a technique to identify and assess factors that may jeopardise the success of a project or the achievement of a goal. This technique also helps define preventive measures to reduce the probability of these factors' occurring and to identify countermeasures to address these constraints when they develop

risk uncertainty, or the potential for loss resulting from uncertainty

site selection the STAGE of the PROJECT LIFECYCLE when potential sites are considered for inclusion in the P/D PROJECT and decisions are made regarding the suitability of each for implementing the system.

stage A period during the PROJECT LIFECYCLE when decisions are made and activities carried out in order to conduct a P/D PROJECT. There are four formal STAGEs within the MAESTRO Methodology: Defining the Objectives; Site Selection and Pre-Design; Design; and Implementation.

stakeholders all those groups or individuals who are not directly engaged in the P/D project actions but who are likely to be influenced by its results. The Guidelines will help them to understand the process and therefore be able to have dialogue with the direct actors. They will also understand the results and limitations of the process.

strategies plans for putting policies into action in order to address particular transport problems. Strategies are a convenient way of grouping together similar types of actions (or MEASURES) to address problems in a certain way

structured interview an interview in which the questions to be asked, their sequence and the information to be gathered are all predetermined; used where maximum consistency across interviews and interviewees is needed

threshold criteria factors which must be either fully or partially met before reaching a decision whether to proceed with a P/D PROJECT.

transferability the property of a project's results that enables them to be generalised from one project and applied to another.