European Platform
on Sustainable Urban
Mobility Plans

Measure selection

Selecting the most effective packages of measures for Sustainable Urban Mobility Plans

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Planning for sustainable urban mobility in Europe

Dear reader,

The European Commission is committed to help national, regional and local authorities develop sustainable, people-focused urban mobility and have European actors take the global lead in this field.

Planning sustainable and effective transport systems for Europe is fundamental to reducing our impact on climate, and contributing to the emission reduction goals adopted in the 2015 Paris Agreement. More strategic and integrated planning approaches are required to transform the existing energy- and carbon-intensive transport systems into sustainable mobility networks and help reaching climate-neutrality before the end of the century. Providing effective, inclusive and climate-friendly urban transport infrastructure is crucial for achieving functioning, competitive cities in Europe and ensuring their resilience in the long-term.

Over the past several years, the European Commission has established a sound policy basis for the development of Sustainable Urban Mobility Plans with the Transport White Paper, Action Plan on Urban Mobility, and most recently, the Urban Mobility Package. We are aware of the demanding nature of sustainable urban mobility planning and planning authorities' need for further, practical support in integrating their long-term thinking into strategic transport planning frameworks.

Therefore, it is my great pleasure to present four freshly developed publications, which provide comprehensive guidance on four of the core pillars of sustainable urban mobility planning: actively engaging people and stakeholders in the SUMP development and implementation process; encouraging cooperation among institutional actors and addressing transport's interconnection with other aspects of urban life; selecting the most effective packages of measures from a wide range of sustainable mobility policies available; and finally, strengthening plan delivery through comprehensive monitoring and evaluation of SUMP measures and processes.

Cities across Europe are subject to a variety of contextual differences and therefore facing unique local challenges – what unites them is the overall aim to take sound and sustainable policy decisions that create vibrant urban landscapes, promote economic growth, foster social and cultural exchange, and offer residents the highest possible quality of life. Urban mobility is one of the cornerstones to achieve these aims. It will require joint efforts over the next years to pave the way for better and more integrated mobility planning in Europe. At all levels we will need to act together to steadily improve our transport systems, mitigate adverse impacts of transport and advance the environmental, social, and economic vitality of urban areas across Europe.

It is great to see you, as reader of these manuals, being part of our team and I am convinced that, together, we can deliver!

Violeta Bulc
European Commissioner for Mobility and Transport
March 2016

1 Introduction

1.1 About the manual

There is a strong interest from planners and decision-makers in applying the SUMP concept and initiating a paradigm shift towards sustainable urban mobility development.

A set of four manuals has been designed to support mobility practitioners in improving local transport planning processes and conducting quality SUMP preparation. They are targeted at transport planners who need to develop a SUMP and are looking for methods and approaches most appropriate in their given context.

Focussing on the planning process, the four manuals are dedicated to providing practical advice underpinned by city examples on: cooperating with institutional stakeholders; engaging the public in the SUMP development process; selecting measures and measure packages; and carrying out monitoring and evaluation tasks.

The manuals focus on the most relevant and challenging elements of each task. There is not a single 'correct' method, but a variety of approaches due to the different contextual conditions in which planning processes are taking place. In this sense this manual is not prescriptive but presents a wide range of solutions for the development of a Sustainable Urban Mobility Plan under different local and national planning frameworks.

As there are various approaches to improving sustainable urban mobility planning, the challenge addressed in this manual should always be considered in the context of the other three challenges detailed in the other supporting manuals.

The first part of the manual gives information on the understanding of the challenge in the context of sustainable urban mobility planning, its relevance in the SUMP development process and the barriers planning authorities face when identifying suitable policy measures and packages. The second and core part of the manual presents recommendations, methods and approaches as well as local case study examples of how best to tackle identified local "hot topics". The final section directs the reader to more interesting material for further reference.

We are convinced that a high-quality SUMP process increases the probability of high-quality transport planning solutions. This manual should contribute to more effective and efficient integrated planning processes, creating the basis for the transition to a more sustainable transport system in European cities.

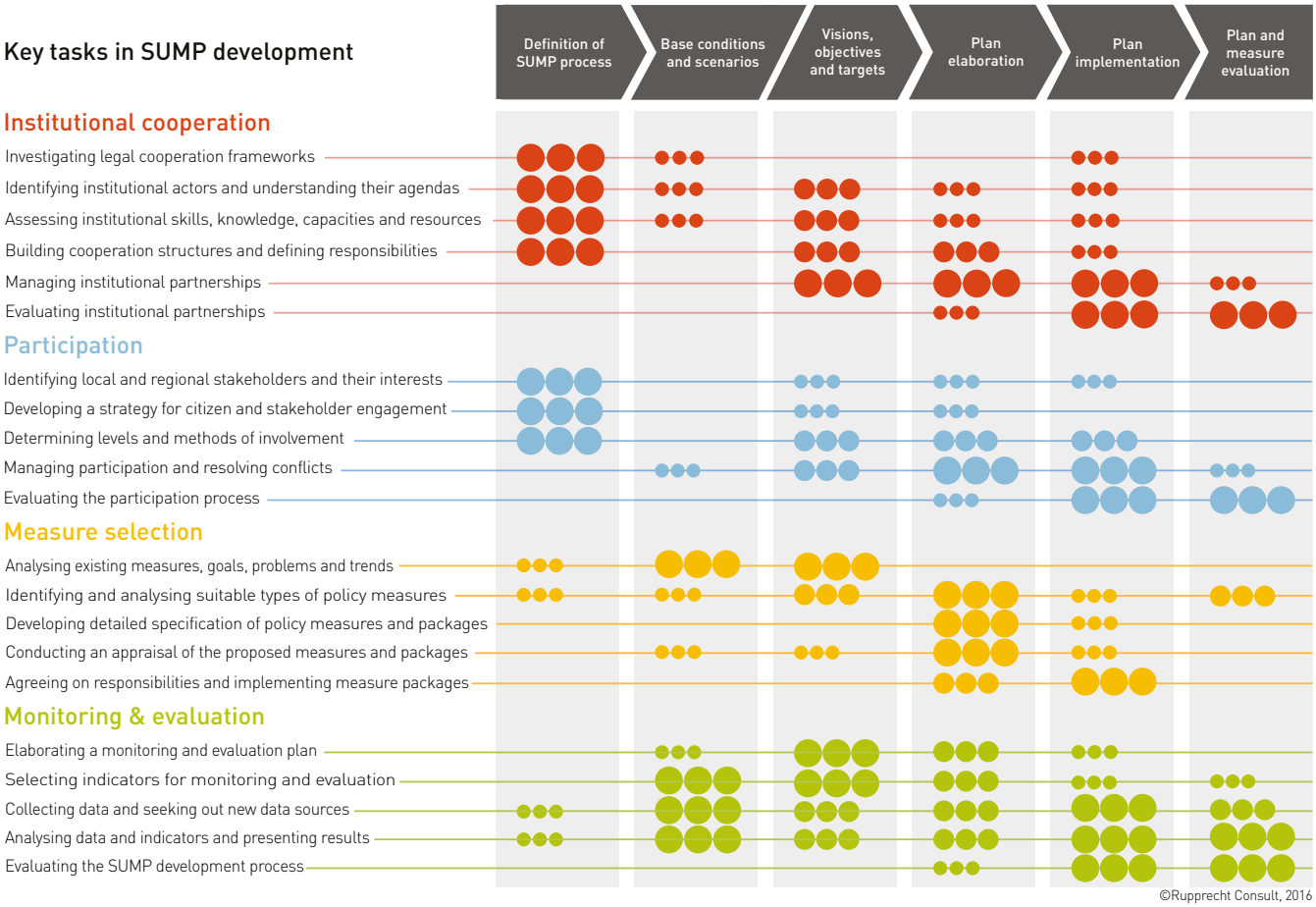
1.2 Planning for sustainable urban mobility

A Sustainable Urban Mobility Plan (SUMP) is a strategic planning instrument for local authorities, fostering the balanced development and integration of all transport modes while encouraging a shift towards more sustainable modes. A Sustainable Urban Mobility Plan aims to solve urban transport problems and contribute to reaching local and higher-level objectives for environmental, social and economic development.

Developing a Sustainable Urban Mobility Plan is a complex, integrated planning process requiring intensive cooperation, knowledge exchange and consultation between planners, politicians, institutions, local as well as regional actors and citizens. At all levels of government, activities have been deployed to support the concept, but several challenges currently inhibit the Europe-wide uptake of sustainable urban mobility planning. Making budgets available and addressing infrastructure issues are especially difficult in times of economic austerity. As a result, cities often face multidimensional challenges in delivering sustainable urban mobility planning. At the same time, there is no one-size-fits-all solution to increasing the number of SUMPs prepared, due to the great variety of local planning contextual conditions in Europe.

The development of a Sustainable Urban Mobility Plan is a multi-faceted planning process that involves various steps and activities, as for example presented in the SUMP cycle (see Eltis 2014, p. 15). The graph below illustrates that all planning activities of such a process are associated with cooperation, participation, measure selection as well as monitoring and evaluation. Some of these activities relate to specific phases of the plan development process, while others might be carried out once and then run continuously throughout the process, such as the identification of local and regional actors. Overall, practitioners need to be aware of the four challenges in order to conduct an effective and efficient SUMP process with the aim of achieving a high-quality SUMP.

Figure 1: Key tasks in the SUMP development process
Source: Rupprecht Consult, 2016



A SUMP process is a sequence of phases from process definition to plan and measure evaluation. The chart presents key SUMP tasks for planning authorities related to the four challenges. Institutional cooperation and participation are continuous, horizontal activities that should commence early, during the SUMP process definition phase. Measure selection as well as monitoring and evaluation activities are particularly relevant in the subsequent analytical and technical planning phases. The chart reflects first-time SUMP development; revision and updating of a SUMP should build on the already established structures.

1.3 Measure selection – the challenge in a nutshell

Measure selection is the process of identifying the most suitable and cost effective policy measures to achieve the SUMP's vision and objectives and overcome the identified problems. Logically, therefore, it comes after the processes of determining commitments, defining the SUMP process and developing a vision, objectives and targets, as shown in Figure 1. However, these earlier processes provide important inputs: the committed stakeholders and the public will have their own ideas of what should be done; the SUMP process will determine how measures are identified, appraised, selected and implemented; and the vision and objectives will point to existing and future problems, which will in turn help suggest solutions.

Measure selection is a challenge for five principal reasons. Firstly, cities have a very wide range of measures available to them; these include building new road and rail infrastructure, providing new public transport services, managing the road network more effectively, encouraging behavioural change, providing improved information, charging for use of the transport system, and modifying development patterns to reduce travel demands. It is all too easy to overlook solutions which would be more effective. Secondly, and reinforcing this, many stakeholders and politicians will have preconceived ideas as to what should be done, and evidence suggests that these solutions are often not the most cost-effective. Thirdly, the most cost-effective measures are often not the most easily implemented; split responsibilities, lack of funding, and public opposition can limit what is done. Fourthly, a SUMP is likely to draw on several measures, but the SUMP's performance, and implementability, will depend on how these measures are packaged. Finally, a SUMP needs to be more than a wish-list of measures, however they are packaged; prior to implementation each measure needs to be defined in detail, assessed in terms of its likely impact, and appraised in terms of it potential contribution.

In Section 2 we outline the current understanding of these specific challenges, and indicate why cities often fail to generate effective measures and packages. In Section 3 we look at each of these specific challenges in more detail, and suggest practical approaches to tackling them. In doing so, we start with the prior process of determining a vision and objectives, since this provides the context for successful measure selection.

1.4 Key recommendations for measure selection

The practical approaches in Section 3 can be encapsulated in ten key recommendations for successful measure generation. These are listed below with a reference to the sections in which each is addressed. But before reading these sections in detail, it is helpful to understand the context as set out in Section 2.

1. Before considering possible measures, make sure that you are clear on your study area, timeframe and your current measures and committed schemes (3.1.1, 3.1.2).

2. Avoid thinking about solutions before you have agreed on your vision and objectives. These will help you to understand what problems you face. Measures can then be thought of as ways of overcoming those problems (3.1.3, 3.1.4).

3. In looking at possible measures, cast your net as widely as possible. Look at the different types of measure and the information on them. Try to understand how each works and can thus contribute to your objectives (3.2.1, 3.2.2, 3.2.3).

4. Decide whether there are particular strategies that you want to pursue (like reducing the need to travel) (3.2.4).

5. Think about the principles of packaging the measures that you are interested in; packaging can help in achieving enhanced performance, but it can also help to overcome barriers to implementation (3.2.5).

6. Be clear as to the constraints that you face. Who is responsible for each of the types of measure that you are considering? What level of funding is available? How acceptable are different measures likely to be? But don't take these constraints as reasons for not pursuing a given measure; you can use packaging and careful design to overcome them (3.3.1, 3.3.2, 3.3.3).

7. Involve your stakeholders and public in selecting the measures and packages which you might adopt. But also consider using our Measure Option Generator, which may offer a tool for stakeholder and public involvement (see the CH4LLENGE Manual on Participation (3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.4.5).

8. Ensure that each shortlisted measure is designed in sufficient detail to ensure that it can be implemented, and that stakeholders and the public know what to expect (3.5.1).

9. Assess the likely impacts (on objectives and problems) of each of these detailed designs. This will require an ability to predict what might happen, and can be assisted by predictive models (3.5.2).

10. Use these predictions to appraise each detailed measure and package against your objectives. This will help you to prioritise the measures which you adopt, and may suggest ways in which individual designs can be enhanced (3.5.3).

Dense development and trams in Vitoria Gasteiz
Photo: Harry Schiffer

2 State of the Art

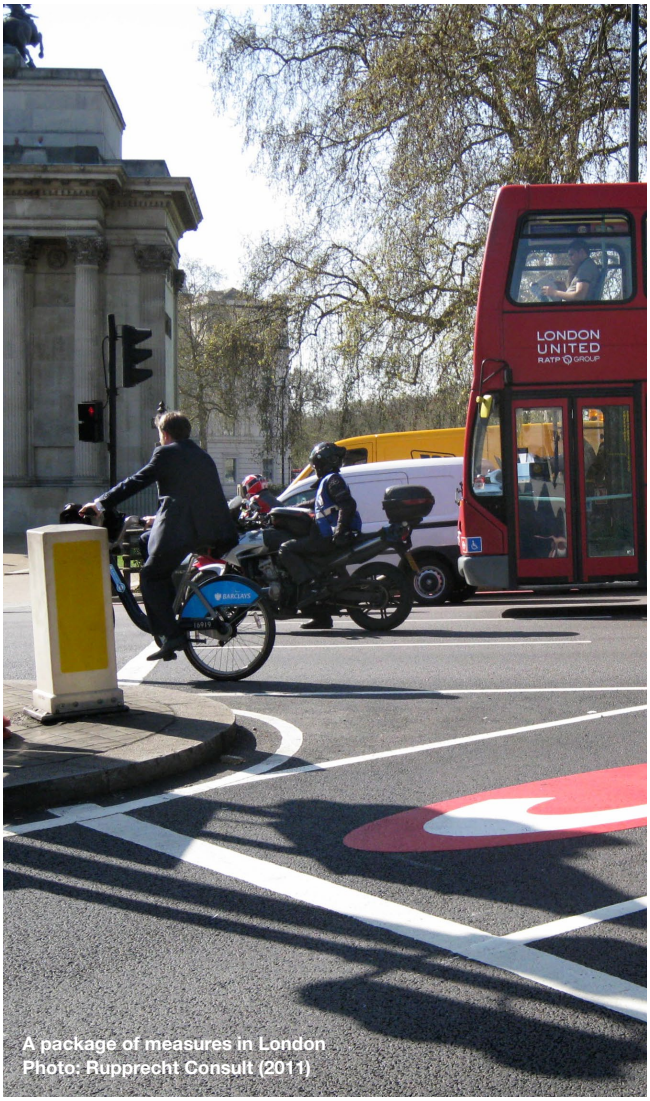
2.1 Measure selection in sustainable urban mobility planning

As indicated in Figure 1, the process of measure selection should start once a city has specified its vision and objectives and identified the problems to be overcome. The task involves identifying those measures (such as improved bus services or an awareness campaign) which might best help solve the identified problems. As noted in Section 1.3, one of the challenges in this process is that there is a very long list of possible measures which could be implemented, each of which could be applied in many different ways, and packaged with many other measures. The task of identifying possible policy measures, sometimes referred to as "option generation" (Jones et al, 2009), is thus not a trivial one. Figure 1 lists the main elements of this process. This section expands on them and summarises what is known about them.

Ideally a city will start with a long list of possible measures, which then need to be assessed for appropriateness, resulting in a shortlist of more promising measures. These then need to be specified in more detail as projects to be applied in the city in question and then assessed in more detail. These two stages involve a process of "option appraisal", which should consider effectiveness, acceptability and value for money. The most promising measures and projects will then be considered for implementation at a later stage in the SUMP process.

While individual measures may be implemented on their own, it is more common for a SUMP to result in a package of measures, in which individual measures reinforce the effectiveness, acceptability or value for money of one another. The development of packages can start in the option generation step, but is more commonly addressed once a shortlist of measures and projects has been developed. Potential packages can then be appraised using the same option appraisal procedures as for individual measures.

The requirements for developing effective measures and packages are described in Element 6 of the SUMP Guidelines, which provides a useful set of references and of good practice databases. This manual adopts the definitions shown in Boxes 1 to 5 (May et al, 2012).



A package of measures in London
Photo: Rupprecht Consult (2011)

Box 1: Measures

A measure is a broad type of action which can be taken to contribute to one or more policy objectives in a SUMP, or to overcome one or more identified problems. Examples range from building new transport infrastructure to managing the way in which that infrastructure is used, and from service provision to regulation and pricing.

Real time information as a policy measure
Photo: BKK Centre for Budapest Transport

Box 2: Projects

A project is a specific application of a type of measure. For example, the measure Bus Rapid Transit could have a number of projects to implement BRT in different corridors. The measure Bike Sharing could have a project to install sharing stations in one part of the city.

Box 3: Packages

A package is a combination of different measures or projects which have been grouped together in a package to contribute more effectively to policy objectives or to the resolution of problems. An example would be the combination of a measure to discourage car use, such as parking controls, with a measure to promote alternatives, such as improved bus services.

Box 4: Option generation

Option generation is the process by which possible measures, projects or packages are identified. The most common sources of suggestions are the existing knowledge and pre-conceived ideas of policy makers and professionals. However, there are a number of more formalised techniques for stimulating suggestions, including our KonSULT Measure Option Generator described in Section 3.4.

Box 5: Option appraisal

Option appraisal is the process by which a proposed measure or package is assessed in advance of its implementation. Effective appraisal involves assessing likely performance against each of the city's objectives (effectiveness), likelihood of being approved (acceptability), and implications for the city's budget (value for money). Appraisal involves an ex ante assessment, and needs to address acceptability, while evaluation involves ex post assessment, once an accepted measure or package has been implemented.

2.2 Why is measure selection important for SUMPs?

As noted above, a city should specify its objectives and identify its problems before embarking on measure selection. The next step is then to identify the policy measures, projects and packages which could contribute to achieving the objectives or overcoming the problems.

However, there is a wide range of policy measures available; in total, 64 different types of measure are identified in the Measure Option Generator (see Section 3.4). Each of these can be designed in a large number of different ways to meet local needs, and the number of possible combinations in packages is thus very large. The challenge of effective measure selection is thus one of focusing on a shortlist of measures, projects and packages which are likely to be the most cost-effective and acceptable.

By definition, a policy measure which more effectively meets a city's objectives will be able to generate greater benefits. One that is more acceptable will stand a greater chance of being implemented and thus actually producing benefits. One which offers greater value for money will be able to realise those benefits while making less demand on limited budgets.

An effective package can combine those policy measures which are themselves most effective in ways which achieve synergy – by making the whole more effective than the sum of the parts – and which overcome barriers to implementing them, such as lack of acceptability. Examples of both these concepts are described more fully in May et al (2012).

The benefits to the SUMP process, and to cities, of improved procedures for identifying effective measures, projects and packages are thus as indicated in Box 6.

Box 6: Measure selection can improve the SUMP process by:

- making the process of shortlisting options more efficient;
- making the policy content more acceptable and affordable; and, above all, in
- making the resulting strategy more cost-effective.

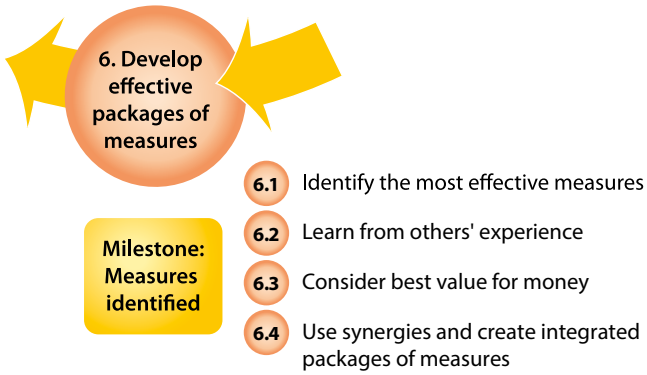
Several policy measures at work in Munich
Photo: Harry Schiffer

2.3 Measure selection for SUMPs in Europe

There is an increasingly wide range of policy measures available to European cities. The Eltis, CiViTAS and Evidence websites all provide a wide range of examples of individual policy measures. More recently the Evidence project has provided an assessment of the performance of 22 categories of policy measure (see Section 3.4.1). However, these information sources are limited by the lack of empirical evidence on many of the newer policy measures, and by a lack of understanding of the principles of transferability of performance from one context to another. The CH4LLENGE Measure Option Generator, which is described more fully in Section 3.4, provides information on 64 types of policy measure, with a number of case study applications for each.

There are fewer good examples of effective packages, but the SUMP Guidelines, under Step 6 (Figure 2), provides examples from London and Krakow. Other evidence comes from model-based assessment of policy options, as in the PROPOLIS project, described in more detail in Section 3.2.5 (Lautso et al, 2004).

Figure 2
Source: Rupprecht Consult (2014)



There are several sources which emphasise the importance of a considered approach to measure selection. These include the Decision Makers' Guidebook produced for the European Commission (May et al, 2005) and now included in our Measure Option Generator, and the advice in Section 6 of the SUMP guidelines.

Perhaps the most compelling argument for treating measure selection seriously comes from a report for the UK government in 2006 by Sir Rod Eddington, cited in Jones et al (2009) as summarised in Box 7.

Despite this advice, there is ample evidence that, in many cities, measure selection is not a rational process, but is often politically driven and led by sectional interests (May, 2013). The European Conference of Ministers of Transport (ECMT, 2002) surveyed 168 cities and found that, while they generally understood which measures they should ideally be using, including them in their strategies was "more easily said than done". A study by Atkins (2007) for the UK Department for Transport of its Local Transport Plan process suggests that local authorities, in England at least, tend not to innovate, but rather to pursue schemes which have been under consideration for a long period, and to focus on infrastructure projects and management-based improvements to the infrastructure, rather than considering enhancements to public transport or ways of managing demand. This Manual is designed to encourage a rational approach, based on evidence of best practice.

Box 7: The case for option generation

"Unless a wide range of appropriate options is considered, there is a risk that the best options are overlooked and money could be wasted. A good option generation process is crucial to ensure that the transport interventions that offer the highest returns can be found. The full range of options should look across all modes and include making better use of the existing transport system, including better pricing; investing in assets that increase capacity....; investment in fixed infrastructure; and combinations of these options."

2.4 Common challenges in the measure selection process

Cities face many challenges in effectively selecting a range of suitable measures and packages (May, 2013).

1. If cities do not start by identifying the problems to be overcome, they do not have a clear justification for identifying suitable measures. As a result, they may overlook appropriate solutions and may find it harder to justify their proposals to a critical public.

2. Many stakeholders, and some politicians, will have their own preconceived ideas of what should be done. There is a danger that, by focusing on these, cities overlook other potentially more cost-effective solutions.

3. There is a very wide range of types of policy measure, including providing new infrastructure, managing the transport system, providing new services, improving information, encouraging behavioural change and charging for use of the transport system. Choosing among these measures is thus difficult.

4. For many of these measures, information on their effectiveness and applicability in different contexts is limited.

5. For most measures there will be barriers to their implementation, including who is responsible, what funding is available and how acceptable they are. There is limited guidance on how to overcome these barriers.

6. One approach to overcoming these barriers is to use packages of measures, yet there is even less guidance available on how to design packages.

7. It is not sufficient to decide in principle to use a particular measure. Each measure will be implemented as a series of projects, which need to be specified to suit the particular context. Once again, there is relatively little guidance available on this design process.

8. Before deciding to implement a specific project or package, an assessment is needed of its likely impacts, and hence of how cost-effective it is likely to be. These processes of prediction and appraisal require specific skills.

Section 3 addresses ways of overcoming all of these challenges and focuses on the hot topics and sub-topics listed in Box 8.

Promoting a collaborative approach to measure selection in Krakow
Photo: Urzad Miasta, Krakowa (2007)

Box 8: Hot topics in measure generation

1. What is the context for measure selection?

1.1. What is the study area and time frame?
1.2. What is the starting point?
1.3. What are the vision and objectives?
1.4. What problems need to be overcome?

2. What is the evidence?

2.1. What is the range of policy measures?
2.2. How can their performance be assessed?
2.3. What is the knowledgebase on the performance of policy measures?
2.4. How do policy measures contribute to strategies?
2.5. What is known about the development of packages?

3. What are the principal constraints on measure selection?

3.1. What are the main barriers to implementing policy measures?
3.2. Who has responsibility for different measures?
3.3. What financial resources are available for implementing policy measures?

4. How can the most appropriate measures and packages be identified?

4.1. Where can ideas be obtained from?
4.2. How does the Measure Option Generator work?
4.3. How can the Measure Option Generator be used to identify possible measures?
4.4. How can the Package Option Generator be used to identify possible packages?

5. How can a detailed specification of policy measures and packages be developed?

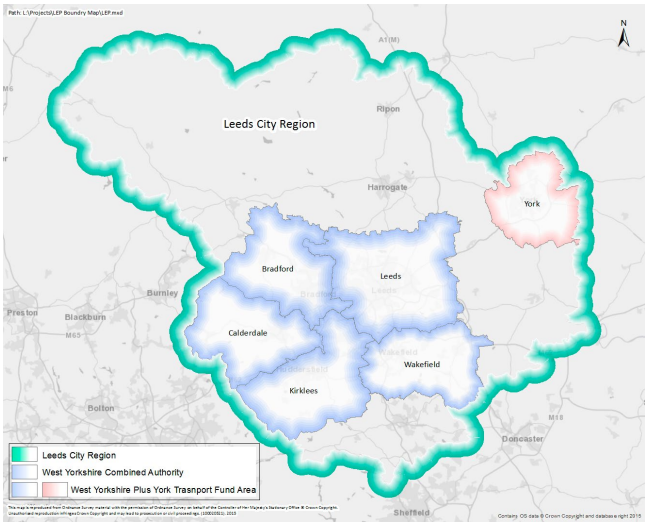
5.1. How can the detailed design of measures be specified?
5.2. How can the possible impacts of these detailed designs be assessed?
5.3. How can these detailed designs be assessed and a shortlist selected?

3 From theory to practice

3.1 What is the context for measure selection?

3.1.1 What is the study area and time frame?

Figure 3: The Leeds City Region
Source: WYCA



This question sets the context for any consideration of measure selection. It is in two parts.

Study area: A SUMP should cover (at least) the whole of your city, but you may want to consider some area (such as the city centre) in more detail. As discussed in Section 3.2.3 below, some measures will be more effective in some locations than others. For example, light rail is less likely to be useful in lower density suburbs.

If your SUMP is covering the whole city, are you defining the city just as the area for which you are responsible, or will you cover the whole travel-to work area (from which employees commute to work), or conurbation? The latter is preferable, but if the whole area is not within your jurisdiction, you will need to involve neighbouring authorities within the city region, and they will need to be consulted on the measures appropriate to them. Figure 6 shows an example of the Leeds city region, which includes several interconnected economic centres. Working with other authorities will form part of a wider process of stakeholder involvement which is considered more fully in the CH4LLENGE Manual on Institutional Cooperation.

Time frame: This may be determined by your national government. For example, French Plans de Deplacements Urbains are required to look ten years ahead (Cerema, 2013); UK Local Transport Plans were initially developed for a five year period within the context of a 15 to 20 year strategy, but the latest guidance provides greater flexibility (DfT, 2009). The SUMP guidance suggests that SUMPs might cover a ten year implementation period and be updated every five years (Rupprecht Consult, 2014). Dresden's SUMP is for a ten year period, Budapest's BMT covers 15 years, while West Yorkshire's new SUMP will cover a 20 year period (see CH4LLENGE report 'Cities' approaches to designing implementable strategies').

Longer term plans are appropriate where land use and infrastructure changes are being considered, since these may take time to implement, and will certainly continue to influence the way in which the city develops over a longer period. However, the further into the future a city predicts, the less certain will be the circumstances in which its plans will operate. There is therefore a trade-off between the need to consider longer term effects and the uncertainty in doing so. The next section discusses ways of dealing with such uncertainties.

3.1.2 What is the starting point?

The "starting point" involves both the measures in place, and the changes which are likely to take place over the period of the SUMP. These are considered in turn.

The measures in place: Before identifying which new measures should be considered, it is essential to be clear as to what is already in place, and what is already committed. This defines the base conditions against which any set of new SUMP measures can be assessed. This introduces two concepts, either of which can be used as that base.

A "do-nothing" strategy is literally one in which only those measures already in place are considered in the base. This concept is simple to understand, but it can be unnecessarily restrictive. For example, if a new bus rapid transit line is already committed, and due to be implemented, it makes little sense to spend time deciding whether to include it in the SUMP.

A "do-minimum" strategy overcomes this problem by including all schemes that are already committed, even if it may be some years before they are implemented. This means that all the measure options which are developed are truly optional, and avoids unnecessary discussion of policies already agreed. Most cities adopt this approach, but it is important to include in the "do-minimum" only those measures on which there is final agreement. If any stakeholder argues that a particular measure needs further discussion, it should be left out of the "do-minimum".

Changes over the planning period: As noted in Section 3.1.1, the further ahead a city plans, the more uncertain are the factors which influence the transport system. The principal uncertainties typically relate to changes in economic and demographic factors, which are largely external to the transport system. In an earlier survey, 80% of cities identified economic growth and changes in employment location as important or very important, 70% population growth and size of the urban area, and 60% changes in car ownership. To allow for these uncertainties, it is sensible to develop a number of scenarios, which reflect a range of levels of economic growth, changes in population and household size, and income and car ownership. These can be grouped into perhaps three scenarios which reflect combinations which place more, or fewer, demands on the transport system. Each strategy can then be tested against the different scenarios, with the best being that which performs most robustly in the differing contexts. Spotlight 3.1 describes West Yorkshire's approach to scenario testing.

LOCAL SPOTLIGHT 3.1:
Scenario testing in West Yorkshire

The Integrated Sustainability Appraisal (ISA) process requires the testing of different potential strategic investment scenarios to consider their relative impacts on health, the economy, environment and society. For the West Yorkshire Single Transport Plan (SUMP), WYCA developed a do-minimum scenario (minimal investment) and two alternative strategic investment scenarios to support economic growth.

The first scenario involved a high level of expenditure which facilitated road based and congestion relief investment to support growth. The second scenario involved lower expenditure with greater emphasis on changes in planning, multi-modal investment, and low carbon and walking/cycling solutions. The scenario assessment showed likely impact and helped to identify mitigation measures to reduce the negative impacts of preferred investment strategies.

3.1.3 What are the vision and objectives?

Vision: A vision describes how you would like your city to be by the end of the study period. Such vision statements may well not mention transport at all, but instead focus on aspirations such as economic competitiveness and opportunities for all. However, they prompt the all-important question of how a transport strategy can contribute to such a vision. The answers to this question should help in specifying the objectives of the transport strategy. Spotlight 3.2 offers an example from Budapest.

Objectives: Objectives are broad statements of the improvements which a city is seeking in its transport system. They specify the directions for improvement, but not the means of achieving them. In setting objectives, it is therefore important to avoid including indications of preferred solutions (e.g. 'improving the environment through better public transport'); this may cause other and potentially better policy measures to be overlooked.

It is important that local decision-makers, rather than professionals, determine the vision and objectives which they wish to pursue, in discussion with other stakeholders and the public. In some countries, local objectives are specified by national government (e.g. DfT (2009)); even so, cities should check whether these represent the full range of their stakeholders' aims.

In practice many cities adopt rather similar objectives, as reflected in Box 9, which lists the objectives used in our Measure Option Generator, KonSULT, which is described in Section 3.4. Fuller definitions of each of these objectives can be found in Section 7 of the Decision Makers' Guidebook (May et al, 2005).

In practice different stakeholders will have different objectives and priorities, which may be in conflict with one another, and compromises may be needed, as discussed in the CH4LLENGE Manual on Institutional Cooperation. It may help to adopt a hierarchy of objectives, so that if conflicts arise, decisions can focus on the priority objectives. This may lead to objective statements of the kind: "improving the environment so long as doing so does not adversely affect the city's economy". The Measure Option Generator encourages users to specify not only the objectives which are important to them, but also their relative importance (see Section 3.4.2).

Box 9: Objectives in KonSULT

- Efficiency
- Liveable streets
- Protection of the environment
- Equity and social inclusion
- Safety
- Economic growth

LOCAL SPOTLIGHT 3.2:
Vision and objectives in Budapest

In 2014, the BKK Centre for Budapest Transport developed the Balázs Mór Plan (BMT), to replace the former plan of 2011. The transport development strategy, based on sustainable urban mobility principles, defines the main directions of development for the period 2014–2030.

The future vision was taken from the Budapest 2020-30 Urban Development Concept, which was approved by the city council in 2013 following extensive consultation. It in turn was used to formulate an overall transport goal that "The transport system of Budapest should improve the competitiveness of Budapest and its region and contribute to a sustainable, liveable, attractive and healthy urban environment". This in turn was used to define three strategic objectives against which all the possible policy interventions were assessed.

This clear objective structure was accepted by all stakeholders and formed the core for development of the BMT.

3.1.4 What problems need to be overcome?

A clearly specified list of problems is the most suitable basis for identifying potential solutions. Problems can be identified, both now and in the future, as evidence that objectives are not being achieved. However, objectives are often rather abstract, and it may be easier for members of the public to understand a strategy based on clearly identified problems.

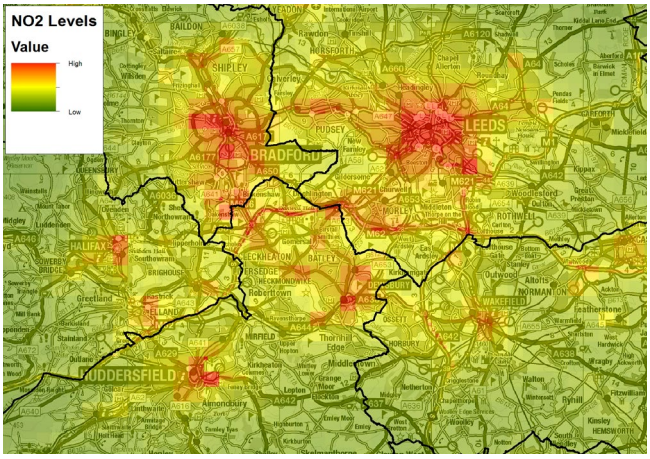
One of the easiest ways of specifying problems is by reference to the set of objectives in the previous section. This enables the question "how do we know we have got a problem?" to be answered more easily. For example, the efficiency objective relates to problems of congestion and unreliability; the safety objective to accidents and casualties. The two concepts, objectives and problems, are two sides of the same coin. Box 11 shows the problems which are considered in the Measure Option Generator.

Problems may be identified in a number of ways:

Consultation: Transport users and residents can identify the problems that they encounter when travelling and which result from other people travelling. Transport providers can be consulted about the operational problems which they face. This is a key element of the participation process, as discussed in the CH4LLENGE Manual on Participation. Users and residents will be well placed to identify current problems, but may find it harder to envisage problems which might occur at some future date. Problem identification through consultation is therefore of most use for current problems.

Objective analysis: Objective analysis of problems requires the adoption of an appropriate set of indicators and targets, as discussed in the CH4LLENGE Manual on Monitoring and Evaluation. When a condition is measured or predicted to differ from a target, then a problem is said to exist. When targets are defined, they can be used, with current data, to identify current problems. Given an appropriate predictive model, a similar exercise can be conducted to estimate problems in a future year. Figure 4 is an example of a pollution map from West Yorkshire.

Figure 4: A pollution map for West Yorkshire
Source: WYCA (2015)



Monitoring: Regular monitoring of conditions, using similar indicators and targets, is another valuable way of identifying problems, and is covered further in the CH4LLENGE Manual on Monitoring and Evaluation. As well as enabling problems, and their severity, to be specified, a regular monitoring programme enables trends to be observed, and those problems which are becoming worse to be singled out for treatment. Box 10 summarises the approach recommended for Local Transport Plans in England (DfT, 2009).

Spotlight 3.3 illustrates how Dresden used consultation to identify objectives, and hence problems.

If problems are identified through consultation, the city authority is able to determine the areas of concern for citizens. This will in turn help to confirm that they have selected the right objectives, and to indicate the basis on which targets might be set. Identification through objective analysis and monitoring enables cities, and citizens, to compare problems in different areas and in different years on a consistent basis.

As with objectives, it will be important to consider the relative importance of different problems, since it may not be possible to reduce one problem without aggravating others. These priorities may differ between stakeholders; equally they may differ by area of the city. In our Measure Option Generator users are able to specify the relative importance of the problems listed in Box 11.

In a survey of the five advancing cities in CH4LLENGE, four saw congestion as a serious and growing problem; only in Budapest was it thought to have become marginally less severe. Despite congestion, most cities considered public transport unreliability to be only a minor problem. The five cities generally considered accessibility to be satisfactory, though they all accepted that they would benefit from introducing formal accessibility standards. Only Budapest and Krakow considered that they had a serious air quality problem; conversely all five cities considered noise a moderate to serious problem. Accidents were generally thought to be a less serious problem, although it was suggested that cities could do more to collect and analyse accident statistics (see CH4LLENGE reports on local mobility situation in partner cities).

It is important to bear in mind that problems are symptoms of inadequacies in the transport system, but do not immediately point to a preferred solution. An analysis of the underlying causes of the problems should always be carried out. For example, it would not be safe to assume that a congestion problem should be solved by adding extra capacity at the location concerned. It may be that land use patterns are encouraging longer distance travel, or that inadequate public transport is forcing people to drive. Other solutions, such as travel demand management or public transport improvements, may be more appropriate and may only be revealed by analysis of the causes of the problem.

Box 10: Problem identification for Local Transport Plans (DfT, 2009)

Cities "should identify problems and priorities on the basis of clear evidence and data, e.g. on:

- demographic and socio-economic trends
- environmental issues
- economic circumstances
- existing transport infrastructure capacity
- travel patterns and trip rates
- connectivity of existing networks
- stakeholder views".

Box 11: Problems in KonSULT

- Congestion
- Community impacts
- Environmental damage
- Poor accessibility
- Social and geographic disadvantage
- Accidents
- Suppression of economic activity

LOCAL SPOTLIGHT 3.3: Identifying objectives and problems through consultation in Dresden

Dresden's SUMP objectives were developed in a consensual discussion of the 43 stakeholders in a Round Table. The discussion took about five months with several meetings of the Round Table and of four interest groups. The four groups proposals were combined with help of the neutral moderator and scientists from Dresden University. The resulting consensual document was then adopted by the politicians with some modifications.

The 43 stakeholders, together with institutional partners and the city administration, were then asked to make an analysis of problems and deficiencies of the Dresden urban transport system. The city administration made a synopsis of all reported problems and deficiencies and gave this material to its consultants as a basis for identifying SUMP measures.

This structured approach helped Dresden to ensure that all identified measures were contributing to agreed objectives and to the resolution of identified problems.

3.2 What is the evidence?

3.2.1 What is the range of policy measures?

A "measure" is an action which can be taken to contribute to one or more policy objectives in a SUMP, or to overcome one or more identified problems. Examples range from building new transport infrastructure to managing the way in which that infrastructure is used, and from service provision to regulation and pricing. There is a growing range of measures available to transport professionals. A total of 64 measures are included in the Measure Option Generator (see Section 3.4.2). Some of these, such as low emission zones, bike sharing and crowd sourcing are relatively new. In all, planners have access to around twice as many measures as they did 30 years ago.

There are several ways of categorising these measures. One is the distinction between "supply-side" and "demand-side". On the supply side are measures which add to the capacity of the transport system to move people and freight. On the demand side are measures which affect how people and freight operators use the transport system. Demand-side measures are often grouped under the title Transport Demand Management (VTPI, 2015).

Another categorisation considers the type of impact which the measure has. This is the approach which is adopted in the Measure Option Generator, which distinguishes between the measures shown in Box 12. The CiViTAS-CATALIST project adopted a similar approach, but with a different categorisation.

Unfortunately evidence on the performance of many of these policy measures is very incomplete. Some measures are novel, and experience is still limited. Unfortunately, cities have often failedto collect the evidence on impacts. This is particularly true of new roads; the realisation, too late, that they generate additional demand is one reason for the abrupt change in policy on them. It is important to take the opportunity to measure and evaluate the impacts of new measures, and make that information available to others. In particular information on policies which have been less successful than planned can help others avoid making the same mistakes.

Even where experience is available it may not be directly relevant in another context. Light rail will work better in larger cities than in smaller ones. Walking and cycling provision are more important in high density areas than in lower density ones. Parking controls are likely to be more effective in city centres than elsewhere. Regulatory controls will be more acceptable in some cultures than in others. For all of these reasons it can be difficult to judge how transferable experience with successful policy measures will be. This is a further reason for encouraging as much experience as possible to be recorded.

Spotlight 3.4 illustrates how Krakow used objectives to identify possible policy measures.

LOCAL SPOTLIGHT 3.4:
Measures considered in Krakow

Krakow used each of the objectives from KonSULT (see Box 9) to propose a number of possible policy measures. For example, the objective of liveable streets led to the following list:

- removal of barriers for pedestrians and cycling;
- adequate sidewalk widths and pedestrian crossings;
- additional traffic calming areas;
- reduced on street parking spaces downtown;
- entry restrictions for heavy goods vehicles;
- coordination of spatial development to reduce car use;
- new developments close to rail or tram links to employment and services;
- redesign of housing units to ease movement for pedestrians, bicycles and people with disabilities.

Box 12: categories of measure in KonSULT

- land use measures
- infrastructure measures
- management and service measures
- attitudinal and behavioural measures
- information provision; and
- pricing measures.

3.2.2 How should we assess their performance?

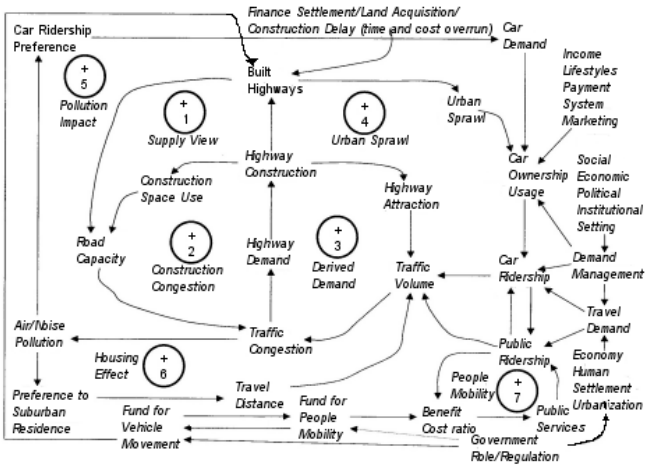
All of these policy measures will affect the performance of the transport system in one or more of three ways:

- by changing the demand for travel;
- by changing the supply of transport facilities;
- by changing the cost of provision and operation of the transport system.

Initial responses (e.g. changes in mode) may lead to secondary ones (e.g. increases in overcrowding). Each of these types of change will in turn affect performance against the objectives and hence reduce (or increase) problems. Tracing all these impacts can be difficult, and causal chain diagrams (Figure 5) can help to understand them, as discussed further in Section 3.5.2. A first principles assessment of this kind can help to assess the potential contribution of a measure, and our Measure Option Generator is structured on this basis.

Changes in demand: When faced with a new policy measure, or with a change in an existing one, such as a fare increase, the individual traveller has a number of options as shown in Box 13. The scale of response will depend on the circumstances. Those who are directly exposed to a change will respond more strongly than those for whom the impact is indirect. Those who have fewer alternatives will be more reluctant to change. Longer term responses may well be stronger, as people have more time to respond. People are more likely to change when they experience life cycle changes, such as having a baby or changing jobs. Elasticities of demand are often used to understand the scale of such responses (e.g. Paulley et al (2006)).

Figure 5: A causal chain diagram for highway construction
Source: May et al (2005)



Changes in supply: Changes in the supply of transport can take a number of forms, as shown in Box 14, some of which will have a direct influence on travellers, while others will only affect them if they are perceived. For most policy measures, it will be clear how they affect supply, but the scale of this impact may be difficult to assess.

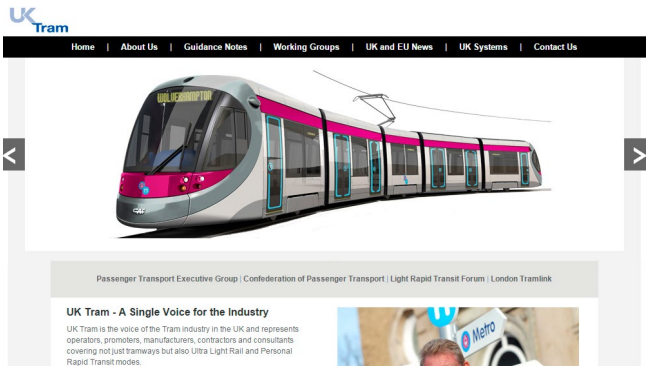
Changes in costs: The principal types of financial cost are capital costs of new infrastructure, operating and enforcement costs, and costs of maintenance and replacement. Pricing measures will, in addition, generate a revenue stream which will reduce the net cost of the measure and influence demand. Changes in these costs and revenues are crucial in determining whether an individual policy measure, or the overall strategy, provides value for money. Low cost measures typically offer greater value for money than major infrastructure projects. We discuss this further in Section 3.3.3.

Box 13: Possible user responses to a new measure

- Continue as before
- Change the number of journeys made
- Combine journeys
- Change destination
- Change departure time
- Change mode (including mixing modes)
- Change route
- Change ownership of vehicles
- Change home

Box 14: Possible supply changes resulting from a new measure

- Changes in the capacity of the road or public transport network
- Changes in the allocation of road capacity
- Changes in permitted speeds
- Changes in the access cost or time to public transport
- Changes in the costs of use
- Changes in the information available



A promotional website for light rail
www.uktram.co.uk

3.2.3 What is the knowledge base on the performance of policy measures?

There are typically three sources of information on these effects, which are used in deciding whether a particular measure might be suitable: advocacy, empirical evidence and predictive computer models. Each of these has its limitations.

Advocacy is the approach adopted by campaign groups, providers of services and technology, and city enthusiasts. A group campaigning for cycling, for example, will promote the advantages of cycling, but may not admit to its limitations. A commercial body which constructs light rail lines will want to promote its benefits, but may not indicate the locations for which it is suitable. A city which has a reputation for car sharing may be interested in promoting the city's image rather than in considering the alternatives. Claims from such organisations should be treated with caution. What is needed is objective evidence to support the claims that they make as well as for the alternatives which they do not highlight.

Empirical evidence can be collected from before and after studies of the implementation of a particular measure or a package. Ideally such studies will be carried out whenever a new type of measure is implemented, or a measure is implemented in a different context. However, cities are often reluctant to spend scarce resources on such studies, and national governments rarely invest in them. Even where studies are conducted, they are often less than comprehensive. As discussed in Section 3.2.2, information is needed on resulting changes in demand, supply and costs of travel, as well as on changes in outcome indicators for each of the objectives of interest to other cities. Moreover, as noted in Section 3.2.1, performance will be affected by context, and may not be transferable.

Predictive models can in principle overcome these constraints by enabling impacts on demand, and hence on outcome indicators, to be predicted in a number of different contexts. But models themselves have limitations, as discussed in Section 3.5.2.

There are several useful sources of evidence from those studies which have been conducted, including CiViTAS (2015), Eltis (2015) and Evidence (2015) projects. Eltis case studies are added at the rate of perhaps ten per month and cover both policy measures and planning practice. The case studies on policy measures are a valuable source of additional information on specific measures.

We have collected as much evidence as we can find in our Measure Option Generator, which now covers 64 measures and over 200 case studies (see section 3.4.2). But more evidence is needed, so if you do something that is novel, please measure its effects and let us know!

The Evidence website
www.evidence-project.eu

3.2.4 How do policy measures contribute to strategies?

Cities may find it easier to think about the overall strategy which they wish to pursue than to list the measures which they want to use. At its simplest, a strategy is simply a combination of measures to address a city's objectives. More specifically, a strategy can be a direction of change which we want to achieve in the transport system. Such strategies are not objectives in their own right, but changes which should contribute to the city's chosen objectives.

For example, a city might wish to reduce car use. Presenting this as an objective is likely to attract criticism that the city is "anti-car". But demonstrating that reducing car use should help to improve the environment, liveability and safety links the strategy directly to objectives, and hence helps justify it.

Within the KonSULT knowledgebase, we distinguish between the six strategies shown in Box 15. Figure 6 indicates how each of these strategies contributes to the objectives in Box 9.

Figure 6: Contribution of strategies to objectives
Source: May (2015)

	Efficiency	Liveability	Environment	Equity	Safety	Economy
Reducing need to travel	●●●	●●●●●	●●●●	●●●	●●●●	●
Reducing car use	●●●●●	●●●●	●●●●●	●●●	●●●●	●●
Improving public transport	●●●	●●●●	●●●	●●●●●	●●●	●●●●
Improving road use	●●●●●	●●●	●●●	●●●	●●●●●	●●●●
Improving walking + cycling	●●●	●●●●●	●●●●	●●●●●	●●●	●●●
Improving freight	●●●●	●	●●●	●	●●	●●●●●

Cities may wish to pursue many or all of these, and the Measure Option Generator allows the user to do so, and indicate priorities among them. Identifying strategies of these kinds is an important role for stakeholders and the public, as discussed in the CH4LLENGE Manual on Participation.

For each strategy, it is then possible to identify the measures which potentially contribute to it. Some measures will contribute directly to one strategy (e.g. bike sharing is clearly linked to improving walking and cycling). Others may contribute to several; for example mixed development will reduce the need to travel, but may also make it easier to provide for public transport, walking and cycling. Section 11 of the Decision-Makers' Guidebook (May et al, 2005) illustrates how different types of measure contribute to four of the strategies. Spotlight 3.5 illustrates the strategies adopted in Ghent.

We can develop the measures for one or more of these strategies into a package of measures designed to achieve a given change in the direction of the transport system. We refer to these as packages and consider them in Section 3.2.5 below. As noted in Section 3.1.2, if the future is uncertain, it may help to test each strategy, or each package, against a range of future context scenarios. The preferred strategy or package is then the one which contributes to the objectives most robustly in the range of possible future scenarios.

Box 15: strategies in KonSULT

- reducing the need to travel;
- reducing car use;
- improving public transport;
- improving road network performance;
- improving walking and cycling;
- improving freight operations.

LOCAL SPOTLIGHT 3.5: Strategy development in Ghent

Ghent has synthesised its SUMP under ten broad "lines of force":

1. Mobility as the driving force for sustainability and accessibility
2. Protection of the historic centre from through traffic and for pedestrians
3. A strengthened bicycle network
4. Free circulation of public transport, with more tram routes
5. Parking management to achieve desirable mobility
6. Speed control throughout the city with more 30 km/h zones
7. Sustainable and liveable alternatives to existing major roads
8. A dynamic traffic control centre to optimise traffic
9. Extending mobility management to the city region
10. Co-creation as a dynamic to help design mobility.

3.2.5 What do we know about the development of packages?

No one measure on its own will be sufficient to achieve a city's objectives or overcome its problems. Indeed, any of the strategies considered above will typically involve more than one measure. Most cities will include several policy measures in their SUMPs, and need to think about how these different measures might interact. This is the concept behind creating a policy package. Constructing such policy packages is often referred to as adopting an integrated approach. Indeed, Budapest, in documenting its SUMP, suggests that its keyword is integration (see CH4LLENGE report 'Cities' approaches to designing implementable strategies').

The key to developing a package is to identify which policy measures will work well together, or may be needed to make other measures viable. Thus, within a policy package, policy measures can interact in one of two different ways:

- they can achieve more together than either would on its own; this is the principle of synergy;
- they can facilitate other measures in the package by overcoming the barriers to their implementation.

Strictly, synergy means that the effect of two measures together is greater than the sum of the individual effects of the two of them alone. To take the London example in Box 16, congestion charging might reduce congestion by 20%, and increasing bus services might reduce congestion by 10%. Synergy would require the two together to reduce it by over 30%. In practice, there is little evidence of true synergy occurring in this way (May et al, 2012), but several examples of complementarity, in which the two measures achieving more than either on its own (e.g. a 25% reduction in this example).

Barriers can include lack of funding, lack of political support and lack of acceptability among the public. We consider these barriers in more detail in Section 3.3.1. To take the London example again, congestion charging helped overcome the financial barrier to increased bus services, while increased bus services made congestion charging more acceptable.

It is difficult to find empirical evidence on the performance of packages given the problems of needing to implement several measures together and of isolating their effects from external changes. An alternative approach is to use predictive models (Section 3.5.2) to assess how measures might operate together. Box 17 is an example.

Box 16: congestion charging and bus improvements in London

London offers a good example of both principles of packaging. Congestion charging was unpopular, and was expected to affect lower income car users. However, its revenue was used to finance an increase in bus services in inner London. These bus services helped overcome the barriers to congestion charging, while congestion charging overcame the financial barrier to increasing bus services. Moreover, the two together achieved a greater switch away from car use than either would have done on its own.

Box 17: The PROPOLIS study

The study (Lautso et al, 2004) tested a common set of policy measures in seven European cities, using each city's own model to produce a standard set of sustainability indicators. The two most effective policy measures were improvements to public transport, through faster, more reliable services and lower fares, and charges for car use, through road pricing or higher parking charges. Land use measures, tested on their own, had little impact, but helped to intensify the effect of the transport measures and to reduce their potential contribution to urban sprawl. Few of the infrastructure projects being planned by the cities were as cost-effective as these public transport, pricing and land use measures.

3.3 What are the principal constraints on measure selection?

3.3.1 What are the main barriers to implementing policy measures?

A barrier is an obstacle which prevents a given policy measure being implemented, or limits the way in which it can be implemented. As a result, some measures may be rejected, making the SUMP less effective. For example, demand management measures in larger cities can control congestion and improve the environment. But cities may be tempted to reject them simply because they will be unpopular. The emphasis should therefore be on how to overcome these barriers, rather than simply how to avoid them.

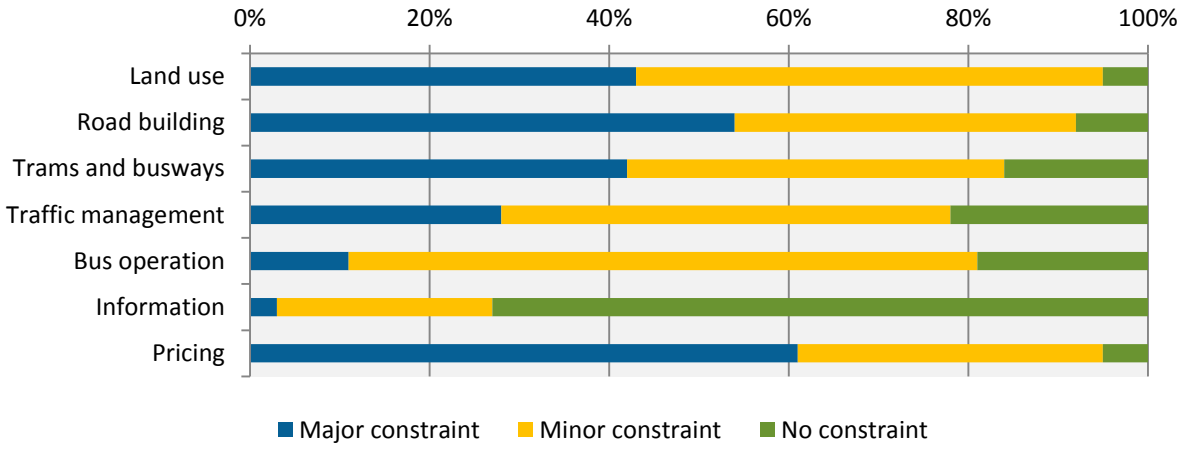
Within the KonSULT knowledgebase we identify six types of barrier, as shown in Box 18. We consider governance and financial barriers in Sections 3.3.2 and 3.3.3 below.

Legal barriers include lack of legal powers to implement a particular measure, legal responsibilities which are split between agencies, and regulations which require involvement of the private sector. A survey of European cities in PROSPECTS (May and Matthews, 2007) indicates that land-use, road building and pricing are the policy areas most commonly subject to legal and institutional constraints.

Political acceptability barriers arise where politicians fear of lack of public acceptance, when different political parties hold opposing views, or where pressure groups or the media oppose measure. Public acceptability may be different if politicians have not kept in touch with changes in the public's views. It may well differ by socio-economic group, and can be influenced by cultural attributes, such as attitudes to enforcement. The surveys in PROSPECTS (May and Matthews, 2007), summarised in Figure 7 show that road building and pricing are the two policy areas which are most commonly subject to constraints on political acceptability. Public transport operations and information provision are generally less affected by acceptability constraints.

Technical barriers are more obvious. For land use and infrastructure these may well include land acquisition. For management and pricing, enforcement and administration are key issues. For infrastructure, management and information systems, engineering design and availability of technology may limit progress. Generally, lack of key skills and expertise can be a significant barrier to progress, and is aggravated by rapid changes in the types of policy being considered and the emergence of new technologies. Among CH4LLENGE cities, the principal barriers are summarised in Box 19 (see CH4LLENGE reports on local mobility situation in partner cities).

Figure 7: The scale of political barriers to different types of policy measure (% of cities)
Source: May et al (2005)



Acceptability and governance barriers can be reduced by effective participation and cooperation, as discussed in the CH4LLENGE Manuals on Participation and Institutional Cooperation. Effective packaging, as outlined in Section 3.2.5 above, can reduce acceptability, financial and governance barriers. The Measure Option Generator assists with this, as described in 3.4.4 below. Legal and technical barriers are harder to overcome in the short term.

Box 19: Barriers in CH4LLENGE cities

The cities surveyed in CH4LLENGE particularly highlighted governance, acceptability and finance as barriers. Key governance issues included lack of autonomy from national government, inconsistent policies across government boundaries and a mismatch of public and private sector objectives. Lack of acceptability was a particular problem with demand management and pricing measures. Finance was particularly a problem for public transport, aggravated by a reluctance to increase fares.

Box 18: Barriers in KonSULT

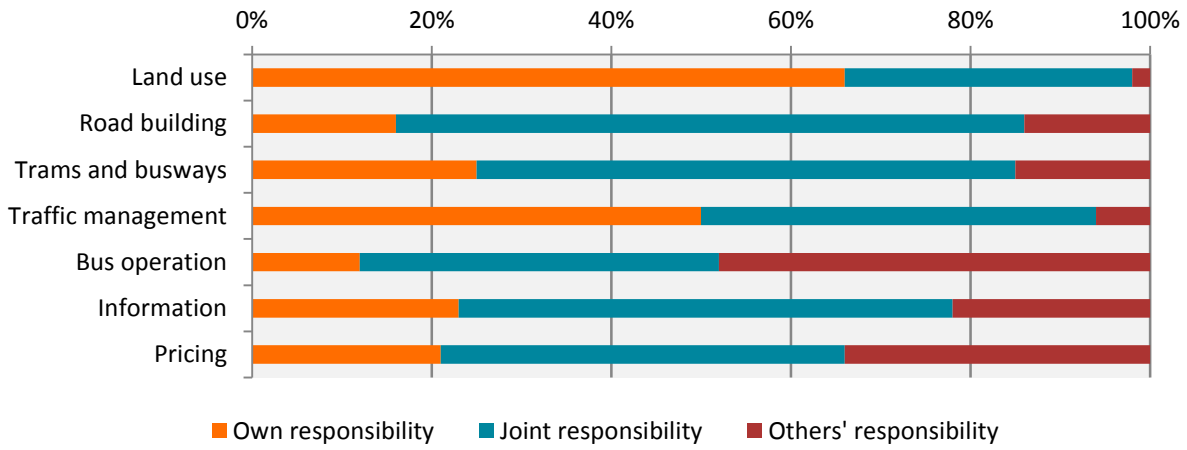
- legal and regulatory
- financial
- governance and institutional
- political acceptability
- public acceptability
- technical.

3.3.2 Who has responsibility for different policy measures?

Cities are rarely able to make decisions on land use and transport strategies on their own, but the constraints on them differ from city to city. The PROSPECTS project (May and Matthews, 2007) identified three types of constraint, and found that it is typically medium sized cities which suffer most from them; smaller cities often have more freedom, while larger ones often have more power.

Lack of direct control: While many cities have exclusive responsibility for land-use and for traffic management, most share responsibility for road building, public transport infrastructure and information provision. However, a significant number do not have direct responsibility for public transport operations or pricing measures (see Figure 8). In some cases it is the private sector which determines public transport and pricing

Figure 8: Cities' responsibility for different types of policy measure (% of cities) Source: May et al (2005)



decisions. Within cities there is the further problem that responsibilities, particularly for land use and transport, are often split between departments. This problem is becoming more serious as the interactions between transport and other policy sectors such as health and social policy become more important. Spotlight 3.6 illustrates the complexity of responsibilities in Amiens.

Intervention from other levels of government: Even where cities have direct responsibility, they may well be influenced strongly by adjacent authorities (see Section 3.1.1), by regional bodies, and by national or European government. In all cities surveyed in PROSPECTS (May and Matthews, 2007), decisions are influenced to some extent by other governmental authorities. The strongest influence comes from adjacent authorities; that from the European Commission is much the weakest.

Involvement of other stakeholder groups: While other stakeholder groups such as business, pressure groups, the general public and the media are not usually directly responsible for transport measures, they have a considerable influence on what can be implemented.

The process of measure selection will be strongly influenced by such splits of responsibility, with cities with less control over the range of transport modes needing to collaborate more intensively to achieve an effective SUMP. The CH4LLENGE Manual on Institutional Cooperation provides guidance on how to do this effectively, and the CH4LLENGE Manual on Participation offers advice on interacting with a wider set of stakeholders.

3.3.3 What financial resources are available for implementing measures?

Finance for implementing SUMPs will typically come from five sources:

- national and regional government (and the EU);
- local taxation;
- transport users;
- developers; and
- other sources such as bonds, bank loans and private investment.

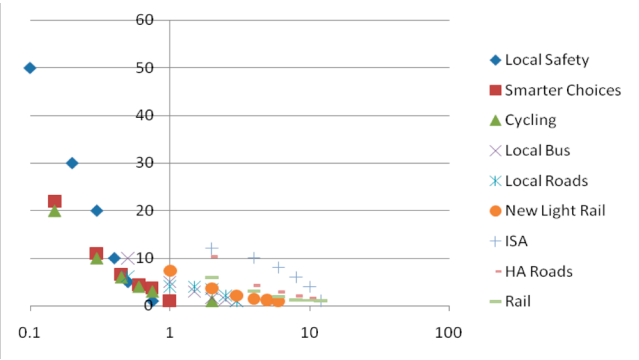
LOCAL SPOTLIGHT 3.6:
Split responsibilities in Amiens

Sustainable Urban Mobility Plans in France were established by the "LOTI" law of 1982, which divided transport skill responsibilities into four territorial levels. With 11 legal obligations, developing and implementing a SUMP requires strong collaboration of all local authorities.

- Cities and urban communities: Public transport, urban network pricing, mobility centres, SUMP development, municipal roads and parking, car sharing spaces, mobility management, bicycle paths.
- Département (county): intercity public transport, bus stations, county roads, "greenways", road safety initiatives.
- Regional level: TER (Regional Express Train) services and pricing, rail infrastructure funding, harbours and local airports.
- State (via State-owned public transport operators): Rail infrastructure, security and technical controls.

Some of these sources of funding will be assigned to certain types of project; for example, the French Versement Transport charge on local firms can only be used to improve public transport (Cerema, 2015). Some will be for infrastructure (capital funding) rather than management measures (revenue funding). Both of these constraints are likely to lead to less cost-effective strategies. As shown in Figure 9 (Goodwin, 2010), infrastructure projects typically have much lower benefit/cost ratios than management projects.

Figure 9: Capital costs and benefit/cost ratios for different types of policy measure
Source: Goodwin (2010)



Since funding will inevitably be limited, cities need to attract as much un-constrained third party funding as possible, focus their SUMP funding on the most cost-effective measures and ensure that the overall package can be funded from within the financial resources available. Charges on transport users can be used as a source of revenue; but care is needed since higher fares may reduce the effectiveness of the SUMP (see Box 17, Section 3.2.5).

In some cases, cities are not free to make such decisions themselves; in others they can increase the funding available by involving other stakeholders. The development of an effective funding stream is a key role for institutional collaboration, as discussed in the CH4LLENGE Manual on the topic.

Where legislation permits, developer contributions can be justified where a development is expected to create a burden on existing infrastructure, or to require new infrastructure. Value capture, where existing businesses contribute in relation to their benefit from new transport investment, is widely used in the US, and in London 25% of the costs of the €20bn Crossrail project have been met in this way.

Cities are often unaware of the full range of third party funding opportunities, and they can be aided by guidance on what is available. The DISTILLATE Funding Toolkit (Binsted and Paulley, 2009), while specific to UK practice, is an example of such guidance. Spotlight 3.7 illustrates the range of sources of finance used in West Yorkshire.

LOCAL SPOTLIGHT 3.7:
Financing the implementation of West Yorkshire's SUMP

WYCA has a capital budget for its SUMP of £90m per year, of which £39m comes from allocated government grants. WYCA has successfully supplemented this by £50m per year through bids to a number of national funding competitions, including £30m p.a. Growth Deal funding to support economic objectives, a £15m p.a. Cycle City Ambition Grant and around £6m p.a. for promoting electric vehicles and active travel. WYCA is also seeking funding from sources such as rail industry investment and developer contributions. WYCA also spends an annual revenue budget of £120m funded from a levy on the District Councils and supplemented by government grants and other sources. WYCA is developing a new SUMP to collect the full range of funding sources into one single plan, to ensure that they work together to deliver the objective of sustainable growth.

3.4 How can the most appropriate measures and packages be identified?

3.4.1 Where can ideas be obtained from?

Given the large number of policy measures available, it is difficult to find consistent and comprehensive empirical evidence on their performance. As a result, cities are often unaware of the full range of measures available to them, and may as a result develop less effective strategies. The process of choosing measures is called "option generation".

Option generation has been highlighted as one of the weaknesses of urban transport policy formulation. As noted in Section 2, a failure to consider the full range of possible measures can lead to:

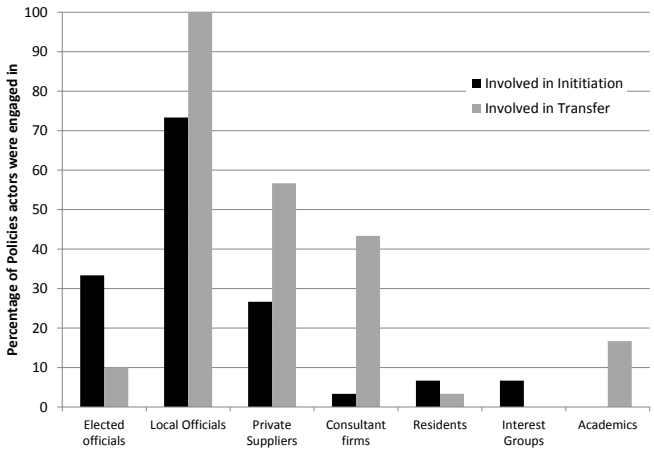
- an over-reliance on preconceived ideas;
- a tendency to focus on supply-side measures rather than demand-side measures;
- lack of experience of the wider range of policy measures available; and
- lack of evidence of the performance of those measures in other contexts.

Cities can broaden their awareness of the measures available in a number of ways, including:

- seeking the views of the public and other stakeholders; this is a key role for public participation and institutional cooperation, as discussed in the relevant CH4LLENGE Manuals;
- studying the evaluation results in the Evidence project http://www.evidence-project.eu/.
- participating in policy networks such as POLIS http://www.polisnetwork.eu/, and Eurocities http://www.eurocities.eu/;
- keeping abreast of developments reported in CiViTAS http://www.civitas.eu/ and Eltis http://www.eltis.org/;
- using knowledgebases such as KonSULT http://www.konsult.leeds.ac.uk/.

A study of eleven cities in Europe and North America (Marsden et al, 2011) found that, while local officials dominated the search for policy measures, politicians and private suppliers often helped initiate a search for new measures, while private suppliers and consultants were often involved in the search. The general public and interest groups were much less frequently involved (Figure 10).

Figure 10: Involvement in the search for policy measures
Source: Marsden et al (2011)



When it came to sources of ideas, peer to peer contacts dominated, followed by the use of policy networks. Several cities also frequently used private suppliers and consultants. The general literature, including guidance documents and search engines, was less frequently used, often because they contained too much information, and because claims were often unsubstantiated. Spotlight 3.8 illustrates how three of our CH4LLENGE cities have used experts and the public as sources of new ideas.

The Measure Option Generator (Section 3.4.2) is designed to bring together the most useful and substantiated evidence on a range of policy measures.

LOCAL SPOTLIGHT 3.8:
Identifying policy measures in CH4LLENGE cities

Several CH4LLENGE cities have used consultation to expand the list of measures which they are adopting:

- Amiens established a Citizen Workshop in which volunteers completed a travel diary, trained with experts in urban mobility and then developed an action programme; the new measures which they proposed are identified as such in the SUMP;
- Budapest set up an expert group and a public and institutional consultation; between them they added three new measures to the SUMP and proposed modifications to a further 16;
- Dresden organised a public consultation in which 2200 citizens participated; they made some 450 proposals, of which 140 were not already in the SUMP; of the 64 types of new measure suggested, 21 were incorporated into the SUMP.

3.4.2 How does the Measure Option Generator work?

As illustrated in the simplified version of the SUMP cycle (Figure 1), identifying suitable types of policy measure is the first stage in plan preparation for a SUMP. To this end, CH4LLENGE has developed a Measure Option Generator (May, Khreis and Mullen), which has been incorporated into the Knowledgebase on Sustainable Urban Land use and Transport (KonSULT). KonSULT, in turn has been developed, with support from the UK government and the EC, with the aim of assisting policy makers, professionals and interest groups to understand the challenges of achieving sustainability in urban transport, and to identify appropriate policy measures and packages for their specific contexts. It consists of three elements: a Measure Option Generator, which is described more fully in the following section, a Policy Guidebook, which contains the information on each of the policy measures in the knowledgebase, and which is described more fully here, and a Decision-Makers' Guidebook, which can be thought of as a longer version of this Manual.

In the Policy Guidebook, policy measures are grouped into six high level categories of: land use interventions, infrastructure projects, management and service measures, attitudinal and behavioural measures, information provision and pricing interventions (see section 3.2.1).

Each measure is described following a standard structure:

- Summary: a one page summary of the description and findings;
- Taxonomy and description, which describes what the measure is, how it works, what it tries to do, and how it contributes to different strategies;
- First principles assessment, which assesses from first principles how it affects demand, supply and finance; how, through these impacts, it might contribute to policy objectives and the resolution of policy problems, and what the barriers are to its implementation;
- Evidence on performance, which summarises a series of case studies, and empirical evidence on their contribution to policy objectives and problem resolution;
- Policy contribution, which combines the findings of the previous two sections to summarise the measure's contribution to policy objectives and the resolution of policy problems, and identifies the areas of a city in which it might most usefully operate; and
- References.

To ensure consistency of treatment, a standard eleven-point scoring method is applied, ranging from +5 (a highly positive contribution) to -5 (a highly negative contribution) throughout the knowledgebase. These scores underpin the operation of the Measure Option Generator, which is described in the following section. Each of the concepts used, including objectives, problems, strategies and barriers, is more fully described in the Decision-Makers' Guidebook. The content of the Policy Guidebook was thoroughly reviewed in the CH4LLENGE project, expanded to cover 64 policy measures and now provides around 200 case studies.

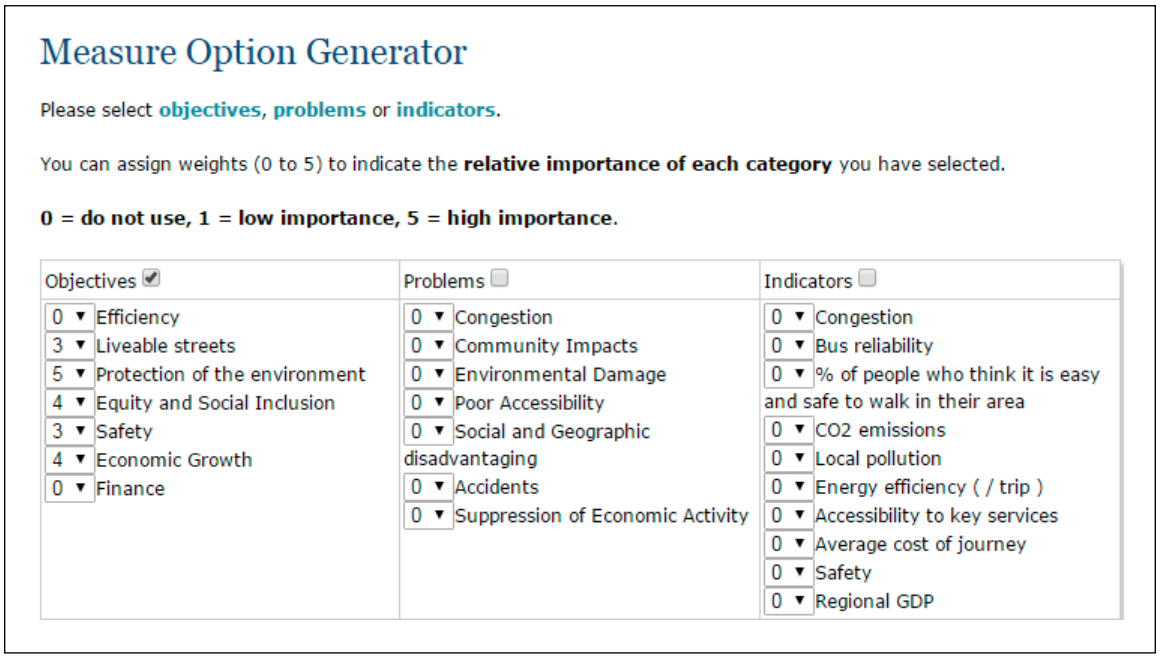
3.4.3 How can the Measure Option Generator be used to identify possible measures?

The Measure Option Generator (KonSULT) allows cities quickly to identify those policy measures which may be of particular value in their context. Users specify their context, including their objectives and strategy, and the measure option generator provides an ordered list of the 64 measures contained in the knowledgebase (the Policy Guidebook).

In this section, we illustrate the use of KonSULT's Measure Option Generator to create a list of ranked policy measures for user-specified contexts, using a worked example. From the Measure Option Generator screen, the user begins this process by specifying the type of area they are concerned with (corridor, town centre, outer suburb, etc.).

The next screen then prompts the user to decide whether to base their search on objectives or problems or indicators. As noted in Section 3.1.4, an objective-led search and a problem-oriented one should lead to the same overall strategy, provided that the problems identified are consistent with the objectives set. The user is required to adopt one of these approaches, to avoid double counting. The user can also assign weights ranging from 0 to 5 to the each of the chosen objectives (or problems) to indicate their relative importance in the user's local context. This addresses the comment, in Section 3.1.3, that objectives may be in conflict, and that it may help to specify a hierarchy of objectives (or problems). This stage is one to which stakeholders might usefully contribute, and the Measure Option Generator is designed to be used interactively. In this example, the search was based on "objectives", assigning 5 points to the subcategory "protection of the environment", 4 points to "equity and social exclusion" and "economic growth", and 3 points for "liveable streets" and "safety", as shown in Figure 11.

Figure 11: Specification of objectives in KonSULT
Source: www.konsult.leeds.ac.uk



The third screen prompts the user to select the strategies they envisage adopting. As described in Section 3.2.4, the strategies included in the Measure Option Generator describe broad directions of policy, such as reducing the need to travel, or improving walking and cycling. Users can reflect a mixed approach by assigning weights from 0 to 5 to indicate the relative importance of each selected strategy.

Based on these input values which describe the context described by the user, KonSULT's Measure Option Generator produces a list of the 64 available policy measures ranked according to their potential relevance and ability to contribute to the specified context (Figure 12). The first six ranked measures include pedestrian areas and routes (under the "infrastructure" category), land use to support public transport (under the "land use measures" category), cycle networks (under the "infrastructure" category), accident remedial measures (under the "management and service measures" category), road user charging (under the "pricing" category), and intelligent transport systems (under the "management and service measures" category).

On the same screen shown in Figure 12, the right-hand column shows the score for each measure on a scale from 0 to 100, derived using the the scores described in section 3.4.2. Although these scores are arbitrary, they should aid the user to understand the relative potential contribution of the listed measures in this specified context. A different specification of context will generate a different ranking, and this can be used to check on the robustness of any given policy measure.

The output in Figure 12 also provides a broad indication of the cost for each measure and the timescale for implementation. Users can thus limit their search to low cost or rapidly implemented measures.

The output as in Figure 12 is not intended to be prescriptive, but to prompt the user to investigate measures which might not previously have been

Figure 12: Ranking of policy measures in KonSULT
Source: www.konsult.leeds.ac.uk

Measure Option Generator

The list below shows all the policy measures within KonSULT in rank order based on their ability to contribute to the context which you have specified.

The absolute scores are arbitrary, but by comparing them you can judge the relative contribution of different measures.

To find out more about any of the measures listed, simply click on it.

By clicking on the Package Option Generator button you can investigate how these policy measures can combine with one another. The process is explained in subsequent screens.

Previous Screen
Package Option Generator...
Save results

rank	code	category	cost	timescale	measure	score
1	209	Infrastructure	medium	medium	Pedestrian areas & routes	83
2	102	Land Use Measures	neutral	long	Land use to support public transport	60
3	208	Infrastructure	medium	medium	Cycle networks	52
4	305	Management and service measures	medium	short	Accident remedial measures	51
5	605	Pricing	neutral	medium	Road user charging	45
6	304	Management and service measures	medium	medium	Intelligent transport systems	45

considered. Once again, this feature can be used interactively with stakeholders, who may be prompted to debate the relative merits of the more highly ranked measures. At any stage the user can click on any of the measures listed and transfer immediately to the fuller information on each measure in the KonSULT Policy Guidebook.

The KonSULT Measure Option Generator thus provides an innovative approach, which stimulates the user to specify his or her requirements, and to consider a wider range of solutions. It is, however, left to the user to decide whether to pursue any of the shortlisted solutions. Spotlight 3.9 summarises how Timisoara used KonSULT to identify appropriate policy measures (see CH4LLENGE report "SUMP measures catalogue").

LOCAL SPOTLIGHT 3.9:

Using KonSULT to identify policy measures for Timisoara

Timisoara tested one context reflecting its emphasis on efficiency and liveability and its strategy of promoting sustainable modes. Timisoara was already using seven of the measures suggested by KonSULT, and considering a further eight. KonSULT suggested one measure (cycle parking and storage) which it had not previously considered. In all cases KonSULT was consistent with the city's understanding of these measures, but provided valuable additional information which helped all members of the team to have a common understanding both of concepts and of the performance of individual measures. It was for them their first exposure to a facility of this kind.

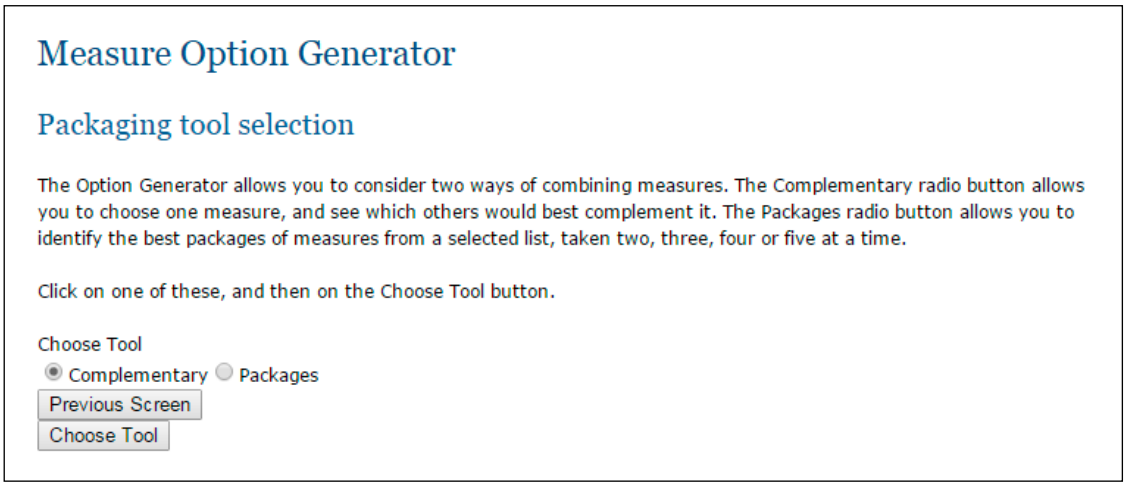
3.4.4 How can the Measure Option Generator be used to identify possible packages?

As indicated in Section 3.2.5, individual measures on their own are unlikely to be effective in meeting the needs of a SUMP. Instead, cities need to adopt an integrated approach, by developing packages of measures. The KonSULT Package Option Generator assists with this process. In discussion with cities, it has become clear that users may want to consider packaging in one of two ways. The first involves taking a preferred policy measure (such as Bus Rapid Transit) and identifying other measures which might support it. These are referred to as complementary measures. The second involves true packaging, where several measures are chosen which work well together. Computationally, assessing packages of several measures from a long list can rapidly become complex, so the packaging option is limited to packages of up to five measures chosen from a list of up to ten measures.

As explained in Section 3.2.5, measures can work together in one of two ways, by achieving synergy or by helping to overcome barriers. Users can choose either of these approaches in searching for complementary measures or packages. The calculation of synergy is based on detailed research using predictive models to assess the interaction of different pairs, and sets, of policy measures (May et al, 2016). The assessment of the overcoming of barriers is based on the scores for each measure against the barriers of governance, political acceptability, public acceptability and finance in the Policy Guidebook.

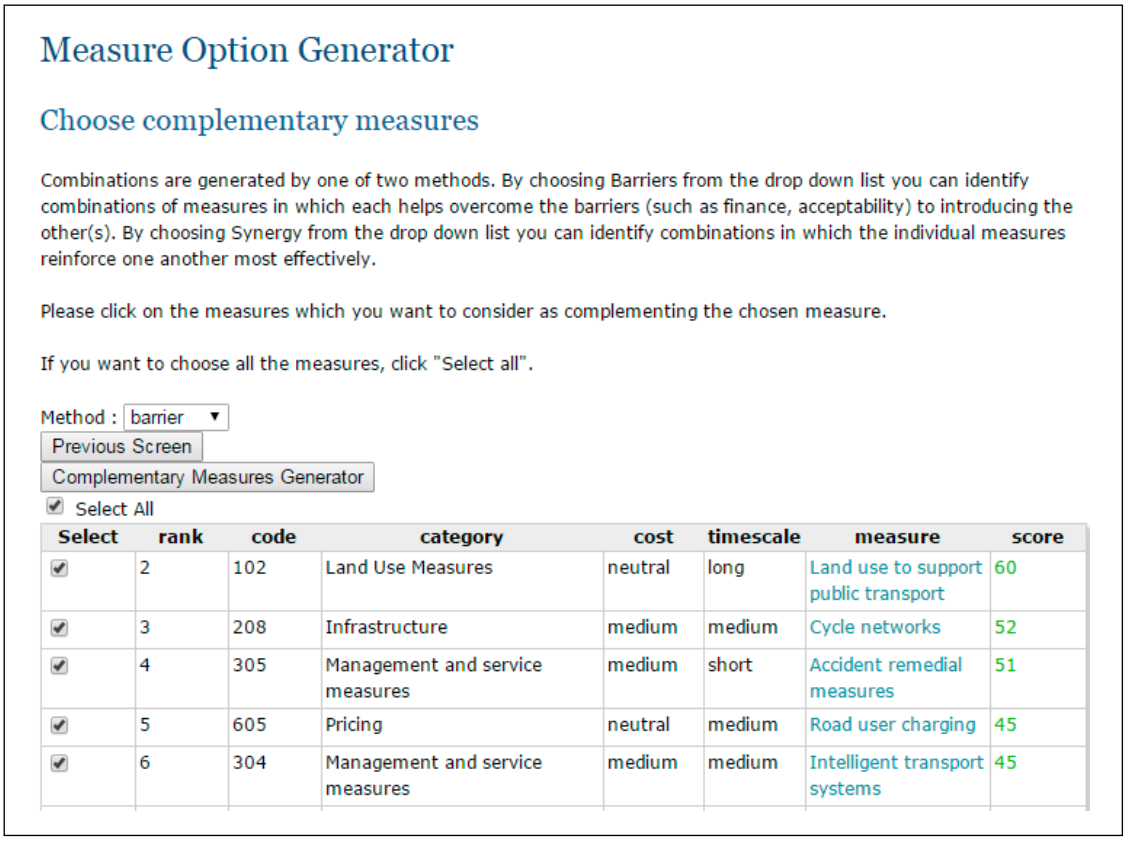
The starting point for the Package Option Generator is the final screen of the Measure Option Generator (see Figure 12 in Section 3.4.3). By clicking on "Package Option Generator" the user reaches a screen which provides the choice between the "complementary" approach (choosing a single measure and finding which others complement it best) and the "package" approach (identifying the best packages of measures from a selected list) (Figure 13). All the subsequent steps are based on the context specified by the user in the Measure Option Generator, and the resulting ranked list of measures in Figure 12.

Figure 13: Choosing between complementary measures and packages in KonSULT
Source: www.konsult.leeds.ac.uk



Firstly in this example, the complementary tool was selected. After choosing this tool, the user is prompted to select the one measure for which they wish to identify complementary measures. The first ranked measure of this example: "pedestrian areas and routes" was selected for this purpose. The next screen prompts the user to choose one of the two methods to generate combinations: "barrier" or "synergy". In this example, the barrier method was chosen. Also, the user can select certain measures they wish to consider, or can "select all", as selected in this example (Figure 14).

Figure 14: Specifying the search for complementary measure in KonSULT
Source: www.konsult.leeds.ac.uk



Select	rank	code	category	cost	timescale	measure	score
☑	2	102	Land Use Measures	neutral	long	Land use to support public transport	60
☑	3	208	Infrastructure	medium	medium	Cycle networks	52
☑	4	305	Management and service measures	medium	short	Accident remedial measures	51
☑	5	605	Pricing	neutral	medium	Road user charging	45
☑	6	304	Management and service measures	medium	medium	Intelligent transport systems	45

The result of these selections is that the Package Option Generator will show all the other 63 policy measures in a ranked order based on their ability to complement the single chosen measure; pedestrian areas and routes in this case. This is shown in Figure 15 for the first seven generated measures, and shows that land use to support public transport, followed by accident remedial measures and cycle networks, best complement pedestrian areas and routes, to overcome barriers. Once again, the user can click on any of these to find out more about the measure from the Policy Guidebook.

Alternatively, in Figure 13, the user can choose the "packages" rather than the "complementary" tool. This option will generate the best packages of measures from a selected list of up to ten measures, taken 2, 3, 4 or 5 at a time. When the user chooses this option, they will again be prompted to select either "barrier" or "synergy" to generate the output combinations. In this example, the synergy method was chosen, the size of the desired package was set to 5 measures (the maximum), and the first 10 ranked measures from Figure 12 were selected for possible packaging. The package option generator produced 252 ranked packages of size 5 in this case, the first five of which are shown in Figure 16.

Figure 15 Ranking of measures to complement Pedestrian Areas in KonSULT
Source: www.konsult.leeds.ac.uk

Presentation Options

Number of complementary policy measures: 100
Minimum score: -100
Apply Changes
Save results

Rank	Measure1	Measure2	Total
1	Pedestrian areas & routes	Land use to support public transport	65
2	Pedestrian areas & routes	Accident remedial measures	64
3	Pedestrian areas & routes	Cycle networks	61
4	Pedestrian areas & routes	Bike sharing	57
5	Pedestrian areas & routes	Intelligent transport systems	56
6	Pedestrian areas & routes	Regulatory restrictions	56
7	Pedestrian areas & routes	Parking standards	55
8	Pedestrian areas & routes	Promotional activities	55
9	Pedestrian areas & routes	School travel plans	55
10	Pedestrian areas & routes	Concessionary fares	55

Figure 16: Ranking of packages in KonSULT
Source: www.konsult.leeds.ac.uk

Presentation Options

Number of packages policy measures: 100
Minimum score: -100
Apply Changes
Save results

Rank	Measure1	Measure2	Measure3	Measure4	Measure5	Total
1	Cycle networks	Intelligent transport systems	Road user charging	Pedestrian areas & routes	Land use to support public transport	61
2	Cycle networks	Road user charging	Pedestrian areas & routes	Land use to support public transport	Bike sharing	59
3	Intelligent transport systems	Road user charging	Pedestrian areas & routes	Land use to support public transport	Bike sharing	59
4	Cycle networks	Intelligent transport systems	Road user charging	Pedestrian areas & routes	Bike sharing	59
5	Cycle networks	Intelligent transport systems	Pedestrian areas & routes	Land use to support public transport	Bike sharing	59

It is interesting to note here that the measures selected for the top five packages involve a mix of types of measures from five of KonSULT's six categories: land use, infrastructure, management and service, attitudinal and behavioural, and pricing. Information provision measures did not appear in the top ten measures produced for this specific context by the Measure Option Generator. The first package, with cycle networks, intelligent transport systems, road user charging, pedestrian areas and land use to support public transport, is a logical combination, given the emphasis on environmental, social and economic objectives selected in Figure 11. Road user charging reduces car use and hence supports the environment; measures to support walking and cycling reinforce this and provide alternatives available to all; intelligent transport systems improve the efficiency of the transport system; and, as outlined in the PROPOLIS study (Section 3.2.5), land use measures help avoid road user charging leading to relocation of activities.

Spotlight 3.10 indicates how Zagreb used the packaging facility in KonSULT (see CH4LLENGE report "SUMP measures catalogue".

LOCAL SPOTLIGHT 3.10: Using KonSULT to develop packages in Zagreb

Zagreb tested one context for its city centre which pursued the objective of liveable streets and the strategy of improving use of road space. It developed a set of packages taken five at a time from a set of eight measures selected from the top 20 in the list from KonSULT. Its preferred measure catalogue was one of these packages, including cycle networks, pedestrian areas and routes, pedestrian crossing facilities, regulatory restrictions and road user charging. Zagreb was already using four of its shortlisted measures, and actively considering a further two: off street parking and traffic calming measures. KonSULT was very useful in helping understand the supporting evidence and related references, and prompted the city to explore the concept of packages and the particular contribution of road user charging.

3.5 How can a detailed specification of policy measures and packages be developed?

3.5.1 How can the detailed design of individual measures be specified?

As indicated in the introduction and Figure 1, measure selection does not end with the identification of possible measures and packages. Each measure needs to be specified in detail, often by defining one or more projects. In doing this, cities need to consider:

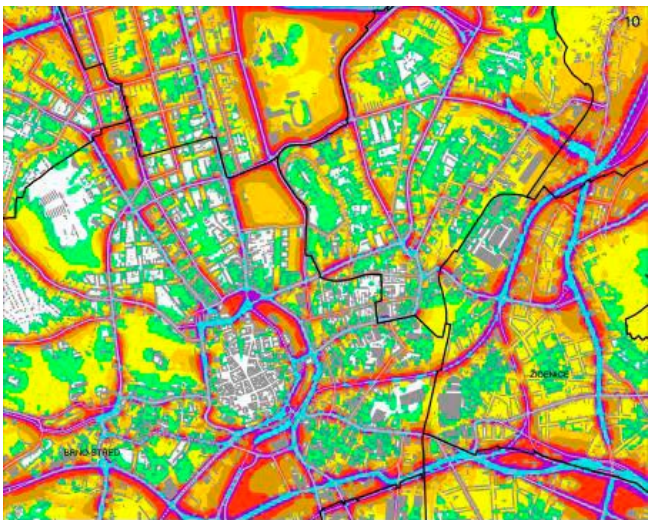
1. where the measure should operate
2. when it should operate
3. who will use it
4. how intensively it should be used.

These questions are considered in this section. Section 3.5.2 then looks at how the possible impacts of each project can be assessed, while Section 3.5.3 discusses how these impacts can be appraised to assess the value for money of each project. Only once the city has defined a series of specific projects which contribute to the city's objectives, represent best value for money and are acceptable to stakeholders will it have an agreed SUMP which can be implemented.

Where it should operate: The obvious answer to this is that a measure should be implemented in the locations where the problems it is designed to overcome are most serious. So the first step is to map these problems (Figure 17) and decide how best to apply the measure throughout the affected area, and far enough outside it to avoid simply transferring the problem.

However, some measures are probably better applied throughout the city or the travel to work area (see Section 3.1.1). These will include measures such as bus regulation, information provision, fare structures and smart fare cards.

Figure 17: A problem map: Noise levels in Brno (2004)
Source: Brno City Municipality (2004)



Most other measures will be more expensive to implement the larger is the area of coverage. For these it may make sense to consider two or three different areas of operation, and decide which is the most cost-effective.

When it should operate: This is only a relevant question for management and pricing measures and to a lesser extent for behavioural and information measures, all of which could in principle be used at certain times of day.

Management measures such as bus priorities, pedestrian areas and parking controls should be applied when the problems are most serious, which will usually be the peak periods, and extended sufficiently into the shoulders of the peaks to avoid simply transferring problems to these times. But care has to be taken to ensure that users, such as those needing to deliver goods, can carry out their activities at other times. For pricing measures such as bus fares, parking charges and road pricing, charges will again typically be higher in the peaks and in the shoulders of the peaks. They may be lower or zero at other times.

Users need to be clear when they cannot use the section of road, or would incur higher charges. Care is needed also to avoid people queuing to enter an area later in order to avoid high charges or specific restrictions.

Who will use it: Most land use and infrastructure measures will be designed to provide for all users who potentially need the facility. They may need to be designed to allow for access for freight as well as passenger traffic. They will need to be designed to meet the needs of those with differing types of mobility difficulty or disability.

Many management measures are designed to restrict the movement of certain classes of vehicle. Thus bus priority lanes permit use by buses, but should they allow taxis and cycles as well? Pedestrian areas are for pedestrians, but should they permit buses, trams or cycles? It will also be necessary in these cases to specify exemptions – e.g. for emergency vehicles and perhaps disabled drivers. Where exemptions are needed, misuse will need to be effectively enforced.

Behavioural and information measures can be targeted on those whose behaviour the city particularly wants to influence. The challenge here is typically how to influence hard to reach groups who do not use a particular communication technology, or find information hard to understand, as discussed in the CH4LLENGE Manual on Participation.

Pricing measures will typically apply to all users, but there may need to be exemptions. For example, lower fares for elderly passengers and lower congestion charges for residents. Again, these exemptions need to be enforced effectively.

How intensively it should be used: This is a rather more complex question, which needs to be answered differently for different types of measure. The design process should consider a number of options, assess their strengths and weaknesses, and produce a shortlist for more detailed assessment.

Provision for disabled travellers
Photo: www.eltis.org/resources/photos

High density development and public transport in Vitoria Gasteiz
Photo: www.eltis.org/resources/photos

For most land use measures, intensity clearly relates to how dense the development should be. Higher densities reduce travel distances, but increase the capacity needed in the transport facilities which serve it. For mixed development, intensity will concern the number of types of land use which are mixed. For parking standards, the question is simply how restrictive the standard should be. For developer contributions the question is the rate at which contributions should be levied. For all of these questions, there will be a trade-off between transport benefits and discouragement of development.

For infrastructure measures intensity will be a question of the capacity provided, applicable design standards, the length of the facility and the places (junctions, stations) served. Increases in capacity and length will increase accessibility but also cost more. Closer junctions and stations will increase accessibility, but may increase travel time and costs.

For management measures such as bus priorities and pedestrian areas, intensity is typically related to area of coverage (how many roads have bus lanes; how many streets are pedestrian-only). For measures such as traffic calming it may be a question of how low a speed limit is imposed.

For behavioural and information measures intensity will relate to how many users are targeted and how often the measures are applied. A travel awareness campaign may need to be repeated annually to maintain its effectiveness; an information system may need to be updated as conditions change. A real-time information measure will be more effective than a static one, but will cost more.

For pricing measures the question is typically how much should be charged, with benefits of different kinds for higher and lower charges. Higher bus fares will increase revenue and make the service more financially sustainable, but will reduce patronage. Higher parking charges will help reduce car use further and generate more revenue, but may reduce activity in the area.

For many of these questions, the principal input will be professional judgement, including that of stakeholders, and detailed design will often benefit from stakeholder involvement and public consultation, as discussed in the CH4LLENGE Manuals on Participation and institutional Cooperation. But there are also an increasing number of design tools to help with the process. Jones et al (2009) summarise a number of them, and give an example of an interactive tool used successfully in the reallocation of street space in a shopping centre.

Spotlights 3.11 and 3.12 illustrate approaches to detailed design in Ghent and West Yorkshire.

LOCAL SPOTLIGHT 3.11: Detailed design for Ghent's B401 replacement project

As a part of its SUMP, the City of Ghent is developing a project to transform the B401-viaduct to the city centre into a more sustainable transport corridor by replacing it by park and ride infrastructure with bike and public transport connections to the city centre. Project start-up commenced by:

Engaging with stakeholders, which

- enables cooperation between local and regional authorities within the planning process
- exposes stakeholders to the realities, constraints and compromises of potential options.

Defining advisory and stakeholder groups, which aim to

- identify local and detailed issues through strategy development and analysis
- enable designs to be appraised by experts and people with local knowledge
- empower 'non-local authority' parties in decision making
- reduce potential for media criticism by including critics.

LOCAL SPOTLIGHT 3.12: Detailed design for West Yorkshire's Cycle Challenge project

WYCA is developing a £30m programme to improve cycle facilities between the cities of Leeds and Bradford. Detailed designs were developed through:

Public participation with communities, which

- created project advocates by involving communities from an early stage
- allowed users to identify local and detailed issues
- generated improved scheme design based on users' needs
- minimised the level of public objections in the statutory approval process
- provided a wealth of local knowledge for application beyond the project;

Establishing advisory and stakeholder groups, which

- enabled designs to be appraised by technical experts and user representatives with local knowledge
- empowered 'non-local authority' parties in decision making
- reduced potential for media criticism by including critics within governance groups
- exposed stakeholders to the constraints and compromises of project delivery.

3.5.2 How can the possible impacts of these detailed designs be assessed?

As explained in Section 3.2.2, measures can be expected to influence demand, supply and costs, and hence the contribution to objectives. Some impacts, like a change in route, may be immediate; others like land use changes may take a considerable time to occur as an indirect effect of more immediate changes. All of these changes will depend on the detailed design and the context in which the measure is implemented.

Because these interactions are complex, it can be difficult to predict the effects of a specific project. Models are often used for this purpose. A model should be a representation of the real world. It could represent how people's travel behaviour responds to changes in the transport system provided; how the performance of the system changes as patterns of use change; how these changes in turn affect where people choose to live and work and where developers choose to build; and how these land use changes in turn affect demand. It will need to represent changes across the city; for example whether shoppers switch from city centre to out of town shops. It will also need to reflect changes over time from the immediate to the long term. Finally it needs to generate the outcome indicators needed for appraisal (see Section 3.5.3).

However, at the same time a model needs to be a simplification of the real system, to keep the costs of building and validating it within bounds and to make it easy and, ideally, quick to use. There is thus a trade-off between complexity and ease of use.

What types of model are available?

The PROSPECTS methodological guidebook (Minken et al, 2003) identifies five types of model:

1. Policy explorers provide a very simplified representation of a hypothetical city and help users understand the types of impact which a measure might have. TRL's Strategic Transport Model (TRL, 2015) is an example.

2. Sketch planning models represent the main interactions between demand, supply and land use at a strategic level over a period of several years, without providing detail of the transport networks. The MARS model, a systems dynamics model used in developing the Package Option Generator, is an example (Pfaffenbichler et al. 2010); so is the Urban Dynamic Model employed by West Yorkshire Combined Authority (Swanson, 2008). They can typically test a package of measures in a matter of minutes.

3. Land Use Transport Interaction (LUTI) models provide more detailed representations of transport networks and distribution of development. There are several available in the market, but all take much longer than sketch planning models to construct and use.

4. Four stage transport models reflect the generation of travel demand as a result of land use. They are of a similar level of complexity to LUTI models, but omit the interaction between transport and land use over time.

5. Network models simply represent the way in which a given demand for travel is distributed over a network. They are typically too limited to be of much help in assessing a SUMP.

Any model will first need to be calibrated to a given city's current conditions. This will require data on current land use patterns, travel demands, traffic flows and speeds. Once calibrated, the model should be tested to see how well it reflects current conditions, by validating it against a separate data set.

The next stage is to define a horizon year in which the measures are to be tested and a "do minimum" against which the SUMP measures or packages are to be tested. As explained in Section 3.1.2, the "do minimum" should reflect all policies which are already committed. This "do minimum" test can also be used to indicate how much more serious the problems will be in the horizon year than currently if no new policies are implemented (see Section 3.1.4).

At this stage the measures can be tested, alone or in packages, to assess how well they overcome the problems in the "do minimum". It will also be helpful to compare the predicted outcomes with the current situation.

What are the limitations of models?

Models can lose respect if they appear to misrepresent reality, are presented as "black boxes" or seem too complicated. One approach to mitigating these limitations is to invite those who doubt a model's outputs to suggest alternative assumptions, and re-run the model with these assumptions to see how sensitive the results are to them. This is much more easily done with models of types 1 and 2.

Another limitation of particular relevance to SUMPs is the inability of models to represent certain policy measures. This is particularly the case with freight, walking and cycling, and some behavioural measures. Finally, models may be less well able to predict some indicators. Changes in journey reliability and distributional impacts are particularly difficult to model.

Spotlights 3.13 and 3.14 outline the modelling approaches adopted in Dresden and West Yorkshire.

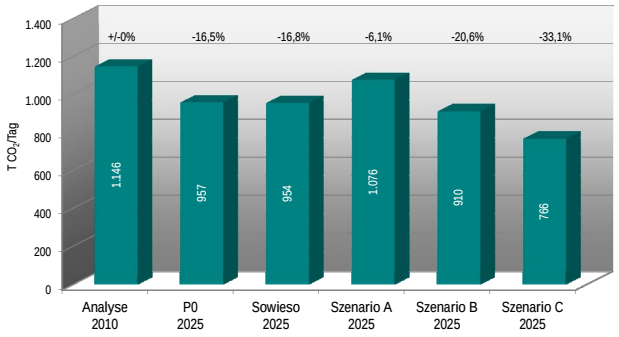
LOCAL SPOTLIGHT 3.13: SUMP modelling in Dresden

The City of Dresden uses a detailed integrated traffic model based on the VISUM software. In order to appraise the alternative SUMP strategies, the City's consultant developed a simplified version of this model, without detailed description of specific areas or calibration of routes. This strategy appraisal model was used to generate citywide results, such as the impact of different strategies on CO_2 emissions (see Figure 18). Its outputs were subsequently used to modify the inputs to the detailed integrated traffic model (including all adopted measures in the SUMP, updated structural data and forecasts for the period to 2030, and resulting revised trip matrices). This modified detailed model could then be used to design the specific measures in the SUMP and assess their local effects.

LOCAL SPOTLIGHT 3.14: Strategic modelling in West Yorkshire

WYCA has used the Urban Dynamic Model to attract nearly £800m from the UK government for the West Yorkshire Transport Fund, for 30 transformational transport improvements. The UDM was fundamental to appraising and prioritising the transport measures that would maximise economic objectives. It is dynamic, and simulates how transport, land-use, population and employment interact as an urban area evolves over time. The model replicates events in the real world using simplified econometric representations of how people perceive their circumstances and decide to react, how property developers provide new infrastructure, the inward and outward migration of households, and the start-up and closure of businesses. It includes internal models of highways, bus and rail services, walk and cycle, all connecting places together and influencing their relative advantages as places to live or work.

Figure 18: Predicting CO_2 emissions in Dresden
Source: City of Dresden



Grafik 22: Entwicklung der CO_2-Emissionen aus Kfz-Verkehr in Dresden (in t/ d; Anmerkung: die Berechnungen basieren auf Strukturdatenprognosen aus 2010)

3.5.3 How can these detailed designs be assessed and a shortlist selected?

What is meant by appraisal?

Once individual measures and projects have been designed and modelled, it is possible to assess their likely effectiveness. This is the process of appraisal. Appraisal is the ex ante process of assessing how well a measure or package will perform. It is thus different from evaluation which is the ex post process of deciding how well a measure or package has performed in practice. While evaluation can use empirical before and after data, appraisal has to use predictive data from models. However, in both cases the question "how well?" should be assessed in terms of an agreed set of performance indicators.

Further guidance on the selection of performance indicators is given in the CH4LLENGE manual on monitoring and evaluation but some key pointers (Marsden et al, 2009) are:

- outcome indicators, like noise levels and accidents, which reflect resulting changes in chosen objectives, are of most value in appraisal; but it is important to identify outcome indicators for every chosen objective;
- intermediate outcome indicators, like changes in modal shares, are of less direct use, and should not be used on their own, but can help explain how the transport system is operating;
- output indicators which indicate what has been implemented, and input indicators of the resources used are of less value;
- it may also help to determine the relative importance of different indicators, in case it proves difficult to achieve improvements against all objectives.

How can appraisal be conducted?

The process of detailed design will lead to a number of design options for each measure and potentially a number of packages. Appraisal can be used to:

- reduce a long list of possible measures and projects to a sensible shortlist
- choose the best option for a particular measure
- choose between measures
- choose between packages
- identify weaknesses in any of these which could be overcome by returning to the design stage.

The last of these is a particularly important element in the design process, and can help ensure that the final measures and projects in the SUMP are as effective as possible.

It is important that any such assessments consider all objectives, and hence all performance indicators. An appraisal framework is, at its simplest, a table in which each option forms a column and each row an indicator. The first column can be the "do-minimum"; alternatively each entry in each column could show the difference between the "do-minimum" and the option being tested. The user can then check the table to identify which option, or measure, or package, performs best against each indicator, and which performs best overall.

The simplest way to use an appraisal framework is to identify the indicators against which each option performs better than the "do-minimum", and then to decide which option performs best among those being compared. However, it often happens that an option will perform well against some indicators (such as congestion) and badly against others (such as pollution). In such cases the user needs to assess how much worsening in pollution can be justified by a given reduction in congestion, or vice-versa.

A common way of doing this is Multi-Criteria Appraisal (MCA) in which the user first assigns weights to each indicator, and then calculates a weighted total score across all indicators for each option. The option with the highest score is then the best performing. It is common to ask stakeholders to contribute to setting weights for an MCA. Simplified MCAs are often used for sifting a long list of options to produce a sensible shortlist.

However, even the best performing option may not be affordable. This can be assessed using Cost Benefit Analysis (CBA) in which the weights are money values, the weighted total is the total benefit, and it is compared with the cost of implementation and operation. The option with the highest Net Present Value (NPV) or Benefit/Cost Ratio (BCR) is best.

How can uncertainty be dealt with?

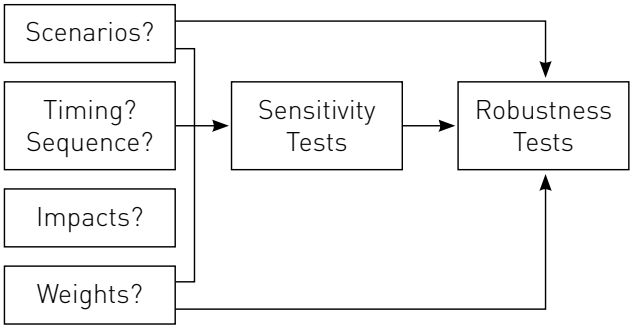
Uncertainty can arise in appraisal in a number of ways:

- the future conditions in which the options are tested;

- the timing of implementation of each measure in a package;
- the impacts of the option(s) on some indicators;
- the ability to model some measures;
- the weights used in an MCA;
- the costs used in a CBA.

As indicated in Section 3.1.2, one way of tackling such uncertainties is to use sensitivity tests (see Figure 19). The appraisal (and in some cases the model) is re-run with a range of assumptions. If the preferred option remains best under a number of assumptions, it can be assumed to be worth adopting. If its performance is variable, then it is less robust, and less obviously worth pursuing. Once again, this may suggest trying to redesign it to improve its performance.

Figure 19: Appraisal under uncertainty
Source: May et al (2005)



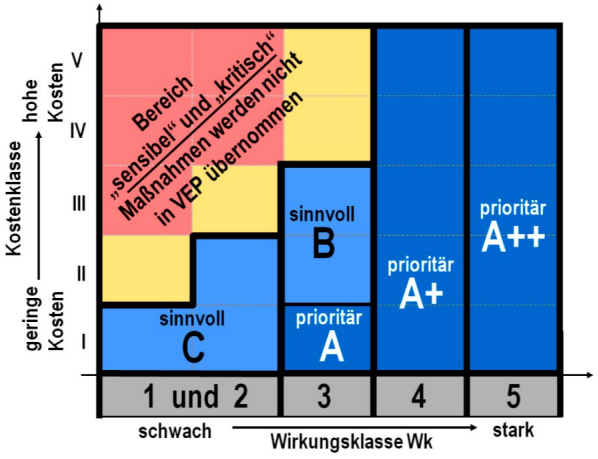
Spotlights 3.15 and 3.16 illustrate the approaches to appraisal adopted in Dresden and Krakow.

LOCAL SPOTLIGHT 3.15: Appraisal in Dresden

Dresden used a detailed appraisal method to categorise its long list of measures:

1. experts used the Delphi method to assess each measure against each of the 12 criteria on a 0-3 scale
2. the resulting sum of these scores was then weighted by a factor (1, 1.5 or 2.5) to reflect the extent of its potential application
3. the resulting impacts were assigned to five categories of effectiveness (Wirkungsklasse in Figure 20)
4. the cost of implementing the measure was then assigned to five categories (Kostenklasse in Figure 20)
5. Figure 20 then shows how each measure was assigned to one of eight implementation categories (prioritär = priority; sinnvoll = sensible; the area in red is measures which are not to be included given their low impact and/or high cost).

Figure 20: Appraising types of measure in Dresden
Source: City of Dresden



LOCAL SPOTLIGHT 3.16:
Appraisal in Krakow

Krakow carried out an initial appraisal of nine types of existing policy measure in three stages:

- the scale of current implementation of the measure (low, medium, high)
- the performance of the measure as implemented
- the combination of these to assess the proportion of the maximum potential performance actually achieved.

This final appraisal metric was used to identify those types of measure which should not be implemented or continued, those where there would be a risk in implementation, and those which were performing well in current circumstances and should be included in the SUMP.

Policy measures in use in Krakow
Photo: City of Krakow

4 Expand your horizon

We hope you found this manual a helpful resource to learn more about measure selection in sustainable urban mobility planning. If you want to expand your horizon even further we recommend having a look at the following material that complements this manual and is available on the CH4LLENGE website:

- **Quick facts brochure:** a concise summary of reasons for measure selection and approaches to identify cost-effective measures, projects and packages
- **Online learning course:** an interactive online course on how to select measures, projects and packages for use in a SUMP
- **Deliverable 4.2:** a fuller explanation of the development of the Measure Option Generator and of its use by CH4LLENGE cities.

Many sections of the other three CH4LLENGE Manuals are also relevant, as indicated at several points in Section 3. These three manuals are listed at the start of Section 5.

If you are interested in even further material on measure selection for SUMPs, you might wish to look at the following practice-based resources:

- **The CiViTAS website** http://www.civitas.eu which includes a large number of case studies of good practice in measure selection
- **The Eltis website** http://www.eltis.org whose case studies on policy measures are a valuable source of additional information on specific measures
- **NICHES+** http://www.niches-transport.org which reports the results of a number of peer-to-peer projects which have compared and contrasted the implementation of several types of policy measure
- **The Evidence project** http://www.evidence-project.eu which has collated evidence on the performance of 22 types of policy measure.

Furthermore, CH4LLENGE has developed a great number of helpful resources on sustainable urban mobility planning that aim to assist mobility planners to initiate SUMP development and further optimise their mobility planning processes.

- **SUMP Self-Assessment:** a free, online tool that enables planning authorities to assess the compliance of their mobility plan with the European Commission's SUMP concept
- **SUMP Glossary:** a brief definition of more than 120 specialist words, terms and abbreviations relating to the subject of sustainable urban mobility planning
- **CH4LLENGE Curriculum:** an outline of key elements to be taught when organising training related to SUMP and the four challenges
- **Online course "SUMP Basics":** a comprehensive e-learning course for practitioners on the SUMP concept and the procedural elements of the SUMP cycle
- **Wikipedia article:** Join the Wikipedia community and contribute to the SUMP article that CH4LLENGE has published!

For more information join us on
www.sump-challenges.eu

5 References

The other three CH4LLENGE manuals

Gühnemann (2016) SUMP Manual on Monitoring and Evaluation: Assessing the impact of measures and evaluating mobility planning processes. Available from **www.eltis.org** and **www.sump-challenges.eu/kits**

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Rupprecht Consult (2016) SUMP Manual on Participation: Actively engaging citizens and stakeholders in the development of Sustainable Urban Mobility Plans. Available from **www.eltis.org** and **www.sump-challenges.eu/kits**

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6 Key terminology

Term	Definition
Appraisal	Option appraisal is the process by which a proposed measure or package is assessed in advance of its implementation. Appraisal involves an ex ante assessment, and needs to address acceptability, while evaluation involves ex post assessment, once an accepted measure or package has been implemented.
Barrier	Any obstacle which delays or prevents a project or activity from being implemented, or limits the ways it can be implemented.
Governance	The way decisions are made, and policies formulated and implemented within a state government.
Indicator	A clearly-defined set of data that can be measured to monitor progress towards the achievement of a particular target
Measure	A measure is a broad type of action which can be taken to contribute to one or more policy objectives in a SUMP, or to overcome one or more identified problems.
Modelling	A mathematical representation of transport demand and resulting trips, using formalised behaviour hypotheses and assumptions.
Objective	A broad statement describing the improvements a city is seeking. Objectives specify the directions for improvement, but not the means for achieving it.
Option generation	Option generation is the process by which possible measures, projects or packages are identified. The most common sources of suggestions are the existing knowledge and pre-conceived ideas of policy makers and professionals. However, there are a number of more formalised techniques for stimulating suggestions, including our KonSULT Measure Option Generator described in Section 3.4
Package	A package is a combination of different measures or projects which have been grouped together in a package to contribute more effectively to policy objectives or to the resolution of problems.
Project	A project is a specific application of a type of measure. For example, the measure Bus Rapid Transit could have a number of projects to implement BRT in different corridors. The measure Bike Sharing could have a project to install sharing stations in one part of the city.
Scenario	A description of possible developments in the future which influence the transport system, such as demographic and economic conditions.
Strategy	A plan of action, comprising a combination of measures, designed to meet specified objectives.
Synergy	Synergies occur when the simultaneous use of two or more measures gives a greater benefit than the sum of the benefits of using each of them alone.
Target	The expression of a goal or aim in relation to an indicator.
Vision	A qualitative description of a desired urban future to guide the development of objectives and targets and the selection of suitable measures.

About CH4LLENGE

The EU co-funded project "CH4LLENGE- Addressing key challenges of sustainable urban mobility planning" (2013-2016) addressed four significant barriers for the development of Sustainable Urban Mobility Plans (SUMPs) in Europe.

Participation	Actively involving local stakeholders and citizens in mobility planning processes
Cooperation	Improving geographic, political, administrative and interdepartmental cooperation
Measure selection	Indentifying the most appropriate package of measures to meet a city´s policy objectives
Monitoring and evaluation	Assessing the impact of measures and evaluating the mobility planning process

Nine European partner cities were involved in CH4LLENGE and 30 cities outside of the consortium, all committed to improving their mobility planning and representing a diversity of cultures and contexts engaged in sustainable urban mobility planning. The CH4LLENGE cities were supported by a group of organisations with extensive experience of working on mobility planning and SUMPs.

For each challenge, the project cities analysed their local mobility situation, developed new strategies on how to tackle their urban mobility problems and tested solutions in pilot projects to overcome their barriers in participation, cooperation, measure selection and monitoring and evaluation.

Cities with extensive experience in integrated transport planning as well as cities aiming to initiate their first SUMP process should all benefit from the results of CH4LLENGE.

The CH4LLENGE Kits

Four CH4LLENGE Kits have been developed building on the results from CH4LLENGE training activities with local and national planning authorities, experience from further national and European SUMP initiatives, and from the CH4LLENGE pilot schemes conducted in the participating partner cities. Each kit addresses one challenge and consists of a comprehensive manual, a brochure and an interactive-learning course. Manuals and brochures are available in English, Czech, Croatian, Dutch, French, German, Hungarian, Polish and Romanian. (Note that it is not currently intended to translate this manual.)

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