



CURACAO

Promoting progressive pricing



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CURACAO

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Coordination Action

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1.6.2 Sustainable Surface Transport

Final Report

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1 Introduction

Urban road user charging is at the same time uniquely capable of reducing the problems of urban travel, and uniquely difficult to implement. Those cities which have implemented urban road user charging have all achieved reductions in traffic entering the charging zone in the range of 14% to 23%. This represents a change in travel patterns which cannot be approached by any other available transport policy instrument. Yet over the last five years, in which schemes have been implemented successfully in Milan, Stockholm and Valetta, ten UK cities and two US cities have decided to abandon plans for charging, despite substantial government grants designed to encourage such schemes. In Edinburgh and Manchester these decisions were made in the public glare of referenda which rejected charging proposals by majorities of 70% to 80%. It is clear that there are serious barriers to the pursuit of urban road user charging, and that cities need guidance if they are to make better use of this potentially powerful transport policy tool.

This shortfall, between the potential of urban road user charging and the progress of its actual implementation, has been the focus of a three year project funded by the European Commission: CURACAO - Coordination of Urban Road User Charging Organisational Issues. The aim of CURACAO has been to support the implementation of urban road user charging as a demand management tool in urban areas. The project did this by working with a user group of 20 cities interested in pursuing road user charging to identify the barriers to their doing so, and providing evidence on ways of overcoming those barriers. Evidence was provided both through a State of the Art Report, which reviewed international evidence on each of 14 themes of interest to the cities, and through a set of 16 case studies of successful implementations, current plans and abandoned proposals.

In addition to the State of the Art Report and the Case Study Report, results have been disseminated through a set of 30 fact sheets and a “guiding presentation” which presents the key messages in a flexible PowerPoint presentation. Drawing on these findings, a series of policy recommendations have been developed for cities, for national governments and for the European Commission. Throughout the project, user group cities have been directly involved in designing and commenting on the project’s outputs. Working closely with particular European cities in this way has established a positive cycle of knowledge growth and development amongst the decision makers and technical experts in these cities.

In this report we summarise the main findings and messages from the study. Section 2 outlines the approach to developing the State of the Art Report, while Section 3 summarises the key findings for each of its 14 themes. Section 4 describes the approach adopted in reviewing the case studies, and provides advice on the design of an effective evaluation procedure. Section 5 outlines the key findings of the case studies of implemented schemes. Section 6 summarises the approach adopted to dissemination of our findings. In Section 7 we present our policy recommendations for government and regulatory authorities, and in Section 8 we identify some areas in which further research is needed. Some conclusions are drawn in Section 9.

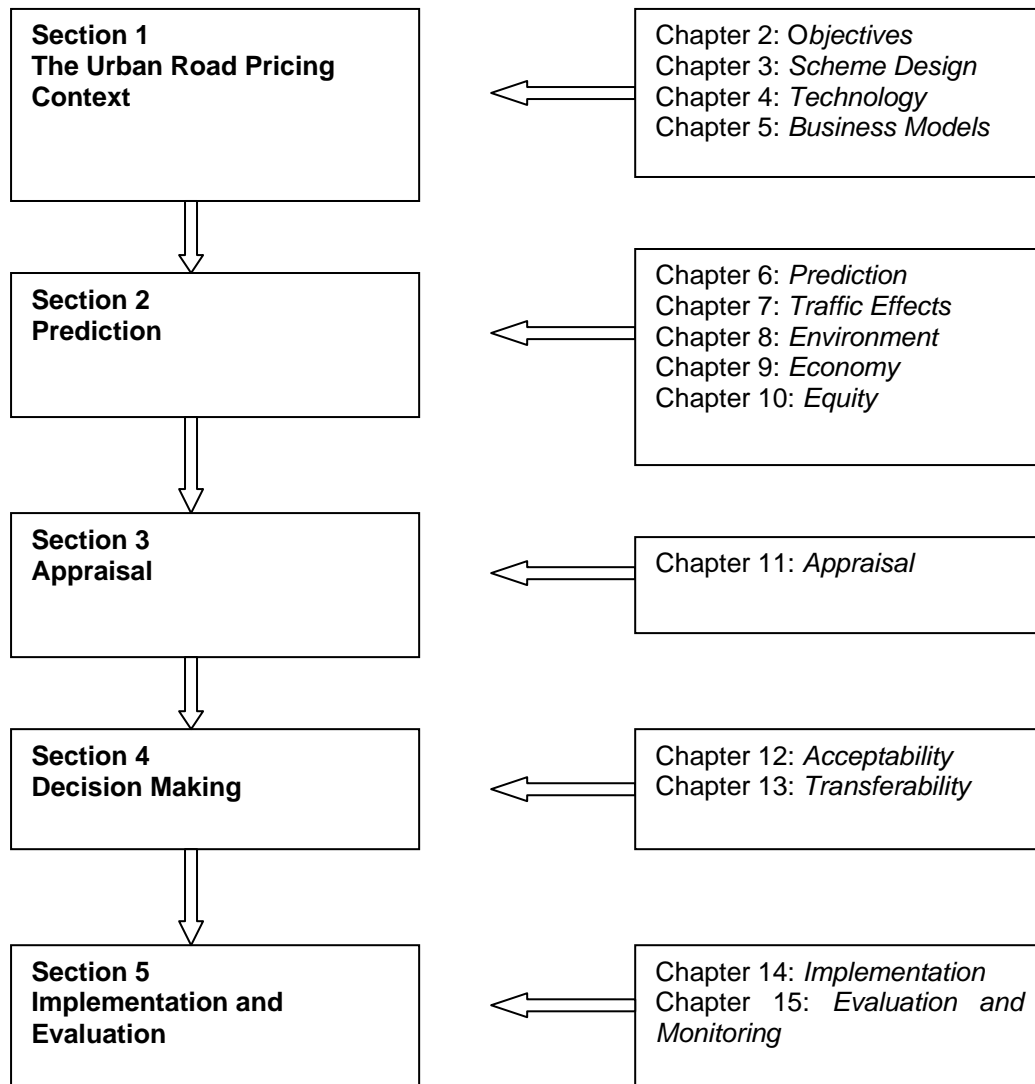
2 Developing the state of the art report

The State of the Art Report was designed to summarise the evidence, collated from research and practice, on a series of themes of concern to cities. Three editions were produced, in 2007, 2008 and 2009, with the final version including all evidence available up to December 2008. Each was based on the identified needs of the user group cities. This led to an initial set of eight themes, on which the first edition was based. Each edition was reviewed with the city partners, who were asked for suggestions of additional themes. In this way the final edition was based on a longer list of 14 themes:

1. the possible objectives of urban road user charging schemes
2. the ways in which road user charging schemes can be designed to meet those objectives
3. the technologies available to support such scheme designs
4. the business systems affecting the technology choice and operation of the scheme
5. techniques for predicting the effects of road user charging schemes
6. specific evidence on traffic effects
7. specific evidence of impacts on the environment
8. specific evidence of impacts on the economy
9. specific evidence of impacts on equity
10. techniques for appraising the effects of road user charging schemes
11. factors affecting the acceptability of road user charging schemes
12. the potential transferability of experience from one city to another
13. good practice in the implementation of urban road user charging schemes
14. techniques for monitoring and evaluating the effects of road user charging schemes.

Figure 1 illustrates the structure of the final version of the Report, and the linkages between the themes.

Figure 1 Organisation Structure of the State of the Art Report



Each section of the report is based on a series of questions which cities might ask, and answers to those questions based on available evidence. Cities were asked to comment on an initial list of these questions in November 2006. The resulting list of questions reflects their suggestions and concerns. Each section concludes with four standard sub-sections:

- implications for policy
- implications for each of the other 13 themes
- future research needs
- suggestions for further reading.

The production of the Report was overseen by a scientific committee involving experts from seven countries and six disciplines who contributed individual sections and critically reviewed the material provided by others. The requirement for each section to discuss implications for other themes provided a valuable check on the consistency and coverage of the Report. The first edition was critically reviewed by

four international experts from Australia, Hong Kong, Singapore and the US. Their role was to ensure that the structure and findings were sound and that evidence from outside Europe was being accessed. As a result, significant modifications were made to the second edition. All three editions were also reviewed by the user group of cities to ensure that the focus was relevant to their needs, and the opportunity was taken to present and test each section in one of the series of six public workshops. The production of the fact sheets and guiding presentation, both of which needed succinct summaries of complex material, provided a final check that the key policy implications were being drawn and justified.

3 The key findings of the state of the art report

Possible objectives and strategy The report has identified a set of nine possible objectives, listed in Table 1, which appear to reflect the full range of objectives for which urban road user charging is likely to be pursued by cities. Among these, efficiency, environment and revenue generation remain the dominant objectives.

Table 1 Possible Objectives of Urban Road User Charging schemes

- | |
|--|
| <ol style="list-style-type: none">1. Congestion Relief2. Environment3. Revenue Growth4. Economic growth5. Health6. Liveability7. Safety8. Equity/Social Inclusion9. Future Generations |
|--|

Road user charging design should follow a logical sequence, in which the overall strategy is determined first, and the role of road user charging determined as part of that strategy. This will help to demonstrate that road user charging is needed. Road user charging will be more effective if integrated with policies to promote public transport, to reallocate road space and to manage land use. These measures are also likely to reduce the adverse impacts of urban road user charging on those travellers who are most disadvantaged by it, and increase its acceptability. However, the best combination of these policy instruments will depend critically on the city context in which they are being applied.

Scheme design Road user charging should be designed in the context of the selected complementary policies. It can be implemented in a number of ways, using point charges, cordons, area pricing or distance-based pricing. There is increasing evidence that distance-based pricing is the most efficient, and the technology on which it relies is rapidly becoming available. However, it appears that many cities will wish to rely on cordon and area-based schemes. Selecting the correct boundaries for these is critical to their success.

Whatever the charging system, the design will need to determine the level of charge, variations by vehicle type, location and time of day, and exemptions and discounts.

All these elements of charge specification will affect both the effectiveness of the scheme and its acceptability. Trade-offs will almost certainly be needed between these two objectives. There is a strong case for keeping the overall design as simple as possible. The important role of exemptions and discounts in increasing acceptability should not be overlooked, but care is needed to avoid these imposing excessive costs.

Technology and Business systems Technology and business systems should be specified in terms of the scheme design, rather than imposing constraints on it. Technologies are required for charging, payment and enforcement. The principal technologies are automatic number plate recognition, dedicated short range communications and global navigation satellite systems. The last of these, in particular, is experiencing rapid development and should in due course enable a wider range of pricing systems, including distance-based charging. However, automatic number plate recognition remains the principal tool for enforcement. Protection of privacy should be feasible with all technology options.

Business systems are needed to manage the complex and interacting requirements of monitoring, payment, accounting and enforcement. While such systems are widely available in the private sector, they are still being developed for complex public sector applications such as road pricing.

Prediction The performance of urban road user charging schemes will depend critically on the behavioural responses induced. It is important to identify the full range of both first and second order responses, and to understand their likely levels. In particular, motorists can be expected to change mode, route, destination, timing and number of journeys. Those who use bus and rail or walk or cycle may make similar changes. Similar types of response can be expected from freight operators and drivers. Second order effects will include changes in vehicle ownership and fleet composition, as well as in the location of economic activity, homes and jobs. More empirical evidence is needed on all of these responses, and particularly the second order ones.

There is now increasing experience of methods for predicting these impacts of urban road user charging schemes. However, the complexities of road user charging make conventional prediction methods less reliable. The prediction of economic, distributional and equity impacts remains a significant challenge. Despite all of this, experience in Stockholm suggests that it is possible to predict the effects of urban road user charging on traffic levels reasonably reliably.

Traffic effects Those urban road user charging schemes which have aimed to reduce traffic have typically reduced traffic entering the charged zone by between 14% and 23%. Changes in the Norwegian Toll Rings, which aimed to generate revenue rather than reduce traffic, have been much smaller. Effects on speeds and congestion have been more variable. The London scheme reduced congestion by 30% initially, but this has since been eroded by extraneous factors which have temporarily reduced road network capacity.

Environment Road user charging will have a wide range of impacts on the environment, some of which are easier to quantify than others. Most impacts, arising from reduced traffic, will be beneficial. Effects will be particularly large where reductions in traffic occur in densely populated areas. However, redistribution of traffic may have negative impacts. Road user charging and the policies which complement it can be designed to focus the benefits more directly on environmental enhancement.

Economy While the evidence remains limited, it is increasingly clear that the impacts of road user charging on the urban economy are likely to be small and, in particular, much smaller than the business community predicts.

Equity The assessment of equity implications relies on the clear identification of the relevant impact groups, and on assessment of the extent to which each is likely to be affected. Good practice on the listing of such groups is now available. However, for many such groups the prediction of impacts remains uncertain. Evidence suggests that inequities are more likely to arise from “horizontal” factors such as location, demography and transport needs rather than from “vertical” factors related to income. Potential inequities can be reduced by modifying the scheme design, revising charge levels and exemptions, and using the revenues to provide alternatives and complementary policies.

Appraisal Appraisal of urban road user charging proposals should reflect the full range of objectives adopted by the city concerned. It is important to specify clearly whether the appraisal is limited to the road user charging scheme itself, the scheme together with any complementary measures, or also any measures financed from surplus revenue. Appraisal requirements are in many ways similar to those for any transport policy intervention, but the scale of the changes induced by road user charging, and its role in generating revenue make appraisal more complex.

Acceptability Acceptability remains the principal concern of cities considering urban road user charging. Acceptability is mainly based on personal outcome expectations, which are typically negative. The roles of complementary policy instruments and of the use of road user charging revenue are critical to increasing acceptability. Acceptability can also be increased by the provision of alternatives and by the use of discounts and exemptions. There is potentially a conflict between pursuit of acceptability, through lower charges and increased use of discounts, and pursuit of effectiveness, which may require higher charges and fewer exemptions. More work is needed on this issue.

More generally, acceptability can be influenced by pro-social values, and appeals to concerns over the environment or social justice may help to increase acceptability. There is increasing evidence that levels of acceptability are highly dynamic, and in particular are likely to decline as the proposal becomes more concrete and more imminent, and increase again after implementation. This helps explain why referenda held immediately before implementation are particularly unsuccessful.

Transferability Transferability of results from one city to another remains a little understood aspect of urban road user charging policy, not least because of the lack of empirical results.

Implementation Implementation processes, including legislative frameworks and political structures, differ substantially from one city and country to another. Political commitment is crucial, and the timing of implementation needs to be matched closely to the electoral cycle. Ideally a consensus should be developed at a regional level to avoid conflicts between adjacent authorities. It will be important not to underestimate the timescale needed for the full implementation process.

Monitoring and evaluation Effective monitoring of all impacts of a scheme will be important in sustaining and enhancing the scheme, and in increasing the body of empirical evidence on urban road user charging. Cities should be encouraged to carry out a comprehensive evaluation of implemented schemes in order to provide evidence for other cities considering such policies. Such evaluations should consider the full range of nine possible policy objectives identified in Table 1, so that lessons can be learnt by other cities, using the evaluation indicators listed in Table 2 below.

4 Evaluating the case studies

The Case Study Results Report is based on the collection of case studies from real life in the leading cities in the field of urban road user charging. The good practices gathered concern three types of involved cities:

- The “core” case study cities represented by project partners: Bristol, Edinburgh, The Hague, Rome, Oslo, Trondheim and Stockholm.
- The CURACAO User Group cities, including for example London and Cambridge, whose progress has been monitored throughout the project and whose representatives have been invited to attend workshops.
- Other cities that have begun to study or to actively develop road pricing schemes, such as Milan and Manchester.

Based on the structure of the State of the Art Report the Case Studies Report focuses among other things on pricing objectives, scheme design, implementation process and scheme results.

The original methodology was to establish a set of baseline indicators and collect data on these indicators from the core cities. The starting point was to develop a simple but solid common indicator-based framework, although recognising that the core city case studies are quite diverse in nature and stage of implementation. The framework, including both quantitative and qualitative indicators, is shown in table 2.

Table 2 Proposed Evaluation Indicators for Urban Road User Charging schemes

	Impact area*	Indicator	Quantitative indicator	Qualitative indicator
	Efficiency			
1		Change in Average vehicle speed		
2		Feeling about traffic conditions		
3		Traveller perception of RUC system reliability		
4		Change in number of vehicles entering the zone		
5		Modal split		
	Equity			
6		Level of user acceptance		
7		Level of perception of fairness		
8		Index of opinions from the different user groups		
9		Index of opinions on ease of access		
10		Level of user awareness		
	Environment			
11		Change on CO2 emissions		
12		Change on CO emissions		
13		Change on NOx emissions		
14		Change on particulate emissions		
	Scheme Finances			
15		Investment cost		
16		Operational and maintenance system costs		
17		Revenue from charges		
18		Revenue from fees		
	Safety			
19		Level of perception of security condition changes		
	Health			
20		Level of perception of air quality into the zone		
	Liveability			
21		Level of perception of on-street liveability		
	Land Use			
22		Change in housing location		
23		Change in activities' locations		
24		Change in used parking places		
25		Change in trips' destinations		

* "Urban Economy" should be added as an additional impact area in future evaluations. Although it has been reviewed in the CURACAO case studies there is a lack of reliable data on which to base firm

conclusions other than that any impacts appear to be small. Despite this, it is regarded by users (local authorities) as a key impact area.

The individual nature and characteristics of the case studies, coupled with the fact that they were at different stages of road user charging implementation, called for a pragmatic approach considering that the project had no resources to collect new data.

The next step was to establish a baseline by collecting common indicator data for the time period preceding the operation of the URUC schemes. Then, the second phase of data collection was performed to achieve a resulting picture of each case study characterised by a mix of quantitative and qualitative information to be used when trying to evaluate the schemes' results.

During 2007 and 2008, the project partners collected together all available indicator data, but it proved to be insufficient as a basis for drawing detailed conclusions about the impacts of urban road user charging and in particular for a 'compare and contrast' exercise between the cities. For instance, out of the six core cities, only four had actually implemented schemes, and there were difficulties in obtaining certain categories of data from Rome and Oslo.

In spite of these difficulties, data was also becoming available from cities outside of the original six core cities with implemented schemes, such as Bologna and Milan, which was also of interest for analysis although it was generally limited in nature. Therefore a revised methodology that would collate available data from the 16 case studies to provide a set of key indicators was agreed. Having collated the case studies and the corresponding key indicators, it has been possible to produce a comparative Impact Assessment of the main results, subdivided by seven key "headline" areas of impact (see section 5).

5 Principal findings from the case studies

The context for road user charging in urban areas varies considerably between countries owing to variations in legal and administrative frameworks and also to different historical backgrounds. In the five countries that have been the focus for the CURACAO case studies the differences are marked.

During the course of the CURACAO project the situation with road pricing in Great Britain has been (and continues to be) very fluid, with a number of cities studying road pricing as a tool to combat traffic congestion. Although Durham and then London introduced schemes in 2002/3, the future at the end of December 2008 is very unclear following the failure of planned schemes in Edinburgh and Manchester. Plans for a national road pricing scheme, announced by the UK government in June 2005, have effectively been shelved.

In complete contrast, the Dutch government has brought forward plans to introduce a national scheme based on charges per kilometre differentiated by time, place and environmental characteristics of the vehicle, in place of the current system of road and vehicle taxes. Also in 2006 the city of The Hague introduced an experimental scheme in which commuters received monetary incentives not to drive during the peak period.

Italian municipalities have for some years explored access control methods in city centre *Limited Traffic Zones (LTZ)*. The controlled zones usually cover the historic centres that suffer from serious pollution caused by congested traffic. Only residents of the area and a limited number of permit holders are allowed to access the zones. The city of Bologna pioneered the policy in the mid/late 1980's, and despite initial difficulties, this prompted a widespread adoption of the measure. The policy is gradually evolving to a hybrid form of road pricing by requesting LTZ permit holders to pay an annual fee.

Norway has a long tradition of financing public road infrastructure through tolls, dating back to 1929. Today, three of the four largest cities in Norway, as well as several smaller cities, have toll cordons, their purpose being not to control traffic congestion or pollution in the city but to raise revenue for investment. More than one third of the investment in public roads is currently financed by tolls.

In Sweden road pricing has become a more frequent element in the last decade. The Swedish government has announced plans to widen the financing of transport infrastructure through Private-Public Partnership (PPP), which includes different toll and user charges. Regarding urban pricing, a Stockholm congestion tax trial was introduced in 2006 and permanently reinstalled in August 2007. Investigations on an urban pricing scheme will also be carried out in Gothenburg.

The full list of case studies reported in CURACAO is shown in Table 3.

Table 3 CURACAO Case Studies

Country	City	Scheme Type	Status at December 2008
Great Britain	Bristol	Area or Cordon	Planning Phase
	London	Area	Implemented
	Durham	Area	Implemented
	Cambridge	Cordon	Planning Phase
	Edinburgh	Cordon	Not implemented
	Manchester	Cordon	Not implemented
Netherlands	The Hague	Incentives Trial	Concluded
	National Scheme	Distance based	Planning Phase
Italy	Rome	Area	Implemented
	Milan	Area	Implemented
	Bologna	Area	Implemented
Norway	Oslo	Cordon	Implemented
	Trondheim	Cordon	Implemented
	Bergen	Cordon	Implemented
	Nord-Jæren	Cordon	Implemented
Sweden	Stockholm	Cordon	Implemented

There are seven key 'headline' impacts that can be drawn from an analysis of the case study data, showing that URUC is a demand management tool which can deliver the following benefits:

Traffic Network:

- A reduction in the **number of vehicles** entering the zone, of 14¹-23²%.
- A reduction in **delays** in the zone, of up to a third³.

Environment:

- A reduction in **CO₂ emissions** in the zone, of 13⁴-21⁵%.
- A reduction in **pollutant emissions** in the zone, of 8⁶-18⁷%.

Safety:

- A reduction in the number of **accidents** in the zone, of 14⁸% in the one city which recorded clear results.

Financial and Economic Impacts:

- Additional **finance for investment**, although this varies according to the scale of the scheme and the pricing structure⁹.
- Despite the difficulty in evaluating the impact of URUC scheme on **urban economy**, we can state that no negative effects can be generally related to road charging implementation.

6 The dissemination process

The objective of **Dissemination** in CURACAO was to facilitate the exchange of information, raise awareness and disseminate and promote research results and best practice at a European, national, regional and local level. This focused on the transfer of best practice from the leading cities to other cities across Europe.

The first priority was to make the target audiences aware of the project and its outputs. Therefore a package of dissemination tools was designed that would be accessible to the audiences of CURACAO during the life of the project and beyond. The *website* <http://www.curacaoproject.eu> launched in July 2006 provides all information related to the CURACAO project and is used as the principal reference site for the CURACAO project. A project *brochure* and *poster* were created for distribution at conferences attended by members of the project consortium. A project *newsletter* was developed for circulation by email and for distribution at conferences. A *contact database* was created and regular bulletins sent out on project progress. *Press releases* were regularly sent to national press and trade press, and information

¹ Decrease in vehicles accessing the Ecopass Zone (2007 versus 2008) – Milan Ecopass Report, February 2009.

² Access reduction in LTZ during charging hours on a working day, 2004-2006 – Bologna, PGTU Report.

³ Reduction in delay time for inbound traffic during morning peak – Stockholm trial result. Also London – a 30% reduction in congestion.

⁴ Throughout the trial period, Jan-July 2006, Inner City – Stockholm.

⁵ Change in mean values between 2001 and 2004 – Rome, ATAC.

⁶ Throughout the trial period, Jan-July 2006, Inner City – Stockholm..

⁷ Before and After implementation values within Ecopass Area – Milan Ecopass Report, February 2009.

⁸ Accidents within the Ecopass area after first year of operation – Milan Ecopass Report, February 2009.

⁹ Estimated net revenues: London €140m, Rome €1m, Stockholm €52m

about CURACAO was distributed through existing *networks* such as ELTIS and POLIS. Furthermore in order to present the key messages and information in a proactive way, three main approaches were adopted: the publication of articles, the delivery of presentations, and the holding of meetings. These activities have helped to make decision makers and technical experts aware of the usefulness of the CURACAO deliverables, and their availability on the CURACAO website from summer 2009.

In order to create opportunities for knowledge transfer and to put together concrete project outputs, an **Online Knowledge Base** has been developed and is available on the website. The database aims at offering users the opportunity to easily access knowledge and compare experiences, thereby promoting good practices with local policy makers, practitioners and researchers alike. In that way the main findings of the State of the Art Report and the Case Studies have been translated into a simple web-based dataset providing the user with the possibility to perform thematic and cross-related searches. This Online Knowledge Base contains up-to-date information on two different but inter-related areas. On the one hand information on individual topic areas relevant to URUC is provided. On the other hand information on live URUC schemes in European cities as well as on schemes planned but not yet implemented is given. In the future CURACAO members and parties outside the project will have the possibility to further enrich the database by uploading new case studies and updating the existing information.

A series of **Fact Sheets** has been produced as a condensed version of the State of the Art Report, Case Studies and Policy Recommendations. The design, subject matter, format and contents are based upon feedback from a number of stakeholders. More precisely within two pages the Theme Fact Sheets answer the questions of why the particular theme is important for road user charging, what is currently known about the theme, what further research is needed and what can be concluded at present. Moreover a brief list of the most important DO's and DON'Ts is given. The Case Study Fact Sheets use the headings Why, What, How and Impacts to present information about a city scheme.

A **Guiding Presentation** has been developed in the form of a PowerPoint presentation. This gives a general introduction to URUC and CURACAO and summarises all project results in an accessible format. It is based on the outcomes of the State of the Art Report, the Case Studies, the Online Database and the Fact Sheets. The aim of this presentation or "how-to" guide is to support decision makers in the process of planning and implementation of an urban road user charging scheme.

The **CURACAO User Group (CUG)** was a select but open gathering of around 20 EU cities with a great interest in urban road user charging strategies. The group met six times throughout the project period to gather exchange and generate knowledge that enabled its members to start the discussion on RUC, spread know-how and manage RUC projects and preparatory research within the authority they represent. The CUG members actively steered the CUG process, indicating meeting topics and formats of their preference. This resulted in the co-organisation of User Group events with three User Group members, Amsterdam, Barcelona and the German Associations of Cities. Newcomers in the RUC field were guided in their search for information,

through in depth explanations of the CURACAO findings as well as presentations of road user charging experts. CUG members actively shared their own experience with RUC and should try to become partners in research projects in this field in the future.

7 Policy recommendations

Based on the evidence collated in the State of the Art Report and the Case Studies a series of Policy Recommendations have been developed. Urban road user charging will typically be the responsibility of city and regional authorities, but national governments and the European Union have important enabling roles. The recommendations are thus aimed at City and Regional Authorities, National Governments, and the European Union.

City and Regional Authorities Before considering urban road user charging as a sustainable urban transport strategy, City and Regional Authorities should specify their objectives clearly, briefly and simply, and should adhere to them consistently. Although we identified 9 possible objectives in Table 1, there is a case for keeping the list short and simple, while not omitting objectives to which road user charging could effectively contribute. A road user charging scheme should not be designed in isolation but in the context of the full range of complementary policies that will support it. City and Regional Authorities should be flexible and dynamic in their approach to scheme design and development, while ensuring that scheme performance is as effective as possible. The scheme design should not be technology driven. Technology and business systems should be carefully selected with a close eye to system costs.

City and Regional Authorities designing a road user charging scheme should allocate resources for establishing baseline conditions, for collection of traffic and other data for analysis, and for continuous monitoring of performance after implementation. Cities which implement road user charging schemes are strongly encouraged to evaluate them against the full set of objectives listed in Table 1 and the list of indicators in Table 2.

Acceptability should be addressed at the outset in all its different aspects. Acceptability can be enhanced by demonstrating that there is a serious problem to be overcome, that a measure as dramatic as road user charging is needed, and that it is likely to work. It is essential that the impacts, both positive and negative, are clearly identified and effectively communicated. A continuing dialogue is needed with the public, pressure groups, politicians and the media. In particular politicians need to understand, but not over-estimate, the concerns of the public.

The use made of road user charging revenues is critical to determining the acceptability and effectiveness of the scheme. Most charged drivers will initially be made worse off by road user charging, and it is only when the revenues have been channelled into transport (or other) improvements that they begin to appreciate the personal benefits. It is thus particularly important that the costs of operating road user charging schemes are kept as low as possible. It is also essential that the surplus revenues are available to the city authorities to use in support of their overall strategy.

Before implementing road user charging, city and regional authorities should pay careful attention to the planned implementation process and endeavour to establish a consensus among all the agencies involved. Wherever possible, the normal planning process should be used to judge the URUC scheme and its complementary instruments. Unless there is a legal obligation to hold a referendum, authorities should be cautious in using this method to determine whether or not road user charging is introduced.

National Governments National governments have a responsibility to develop a clear national transport strategy, to explain it clearly and consistently, to indicate who is likely to gain and lose from that strategy, and to take steps to compensate those who are likely to lose. As part of that strategy they should recognise the potential benefits of road user charging as a means of demand management at both local and national levels. The application of road user charging should be seen as part of a wider strategy involving the internalisation of external costs and the adjustment of road and vehicle taxation systems so that user charges vary according to location, time and type of vehicle.

National governments also need to ensure that appropriate legislation exists to allow local authorities to plan and implement schemes, to provide the governance which enables city and regional authorities to implement both road user charging and the policy instruments which will complement it, and to stimulate strong political leadership at local levels. Finally they need to provide support to ensure that implemented schemes are effectively monitored and their results disseminated.

The European Commission The Commission should publish guidance for authorities interested in considering road user charging as a policy option based on the work of CURACAO. They should give financial support to:

- cities to finance feasibility studies addressing ways to reduce congestion and improve the environment including road user charging options and to support research and demonstration projects in provincial cities that specifically address key issues: acceptability, governance requirements for effective implementation, economic and equity impacts,
- educational campaigns, training schemes and toolkits explaining the rationale for urban road user charging as one option in the panoply of measures available to transport planners, and encouraging citizen and stakeholder involvement in discussion of approaches to tackling sustainable mobility issues,
- research into standardisation and interoperability of RUC systems and technologies.

In any consideration of institutional structures and governance issues, the European Commission should bear in mind the need for governance structures which enable city authorities both to implement road user charging and the policy instruments which complement it, and to collect and use scheme revenues in accordance with policy objectives.

8 Further research needs

The CURACAO State of the Art Report has reviewed, synthesised and summarised the evidence available from implemented URUC schemes on their characteristics and impacts. The final version of the report contains a wealth of information on the 14 themes that have been studied. The number of implemented schemes is still quite small and the availability and quality of data varies considerably, however, which inevitably means that there are a number of gaps in our knowledge and understanding of the subject. These are summarised in Table 4, which indicates the contribution that CURACAO has made in each area, and suggests a priority ordering of the different topics.

Table 4 Research Gaps

<u>Research gap</u>	<u>Priority*</u>	<u>What CURACAO has contributed</u>
The interaction between acceptability and effectiveness	5	Review of evidence, demonstration of the importance of this trade-off (Chapter 12 of the State of the Art Report)
The extent to which results in one city can be transferred to another	5	Limited by evidence available (Chapter 13)
The implications of design and technology for enforcement	4	Limited by evidence available (Chapter 4)
The performance of new developments in technology and in business systems	4	Limited by evidence available (Chapters 4 and 5)
Ways of reducing the costs of technology and business system applications	4	Limited by evidence available (Chapters 4 and 5)
The impacts on the urban economy, and in particular the differential effects by economic sector and size of firm	4	Limited by evidence available (Chapter 9)
The effects of road user charging on different impact groups	4	Limited by evidence available (Chapter 10)
The interaction between acceptability and equity and in particular the impact of scheme design on perceived inequity which engender acceptability issues	4	Review of evidence, identification of areas of uncertainty (Chapter 12)
The requirements for sustaining and adapting road user charging schemes once implemented.	4	Limited by evidence available (Chapter 14)
Comparisons between	4	Review of evidence, including that from

predicted and actual impacts, including impacts in cities where URUC was proposed but has not been introduced.		case studies, demonstration of the need for additional evidence (Chapters 14 and 15)
Approaches to the design of overall strategies which include road user charging	3	Review of evidence, demonstration of the key role of URUC (Chapter 2)
Methods for the design of road user charging schemes	3	Review of evidence, demonstration of sensitivity of performance to design (Chapter 3)
Prediction methods	3	Review of evidence, including that from case studies, identification of areas of uncertainty (Chapter 6)
Understanding of behaviour, and particularly second order responses and the behaviour of users of other modes	3	Review of evidence, including that from case studies, identification of areas of uncertainty (Chapter 6)
The impacts of road user charging on liveability and health	3	Limited by evidence available (Chapter 8)
The dynamics of acceptability over time and the particular role of referenda in testing and promoting acceptability	3	Review of evidence, including that from case studies, explanatory description of the process (Chapter 12)
The specification of appropriate timescales and sequences for the implementation of urban road user charging schemes	3	Limited by evidence available (Chapter 14)
The measurement of congestion and travel time reliability	2	Summary of approaches adopted (Chapter 7)
Development of best practices for evaluation of RUC schemes	2	Review of evidence, preparation of model evaluation framework, identification of weaknesses (Chapter 15)
Methods of appraising second order effects	1	Summary of approaches adopted (Chapter 11)

*5 = highest priority, 1 = lowest priority

9 Conclusion

Over the 3-year period from April 2006 to March 2009, CURACAO has monitored developments in Urban Road User Charging in Europe and has extended the knowledge base established by previous projects in order to provide tools to support decision-making and integration of research results into policies. During this period there were some significant developments:

- Stockholm implemented a full-scale trial of congestion charging and introduced a permanent scheme following a positive referendum result.

- A trial giving monetary incentives to drivers who did not use congested roads at peak hours took place in The Hague.
- A second toll ring was introduced in Bergen.
- The scheme in Rome was extended to new areas and to evenings and weekends.
- In London, a Western Extension to the original charging zone was introduced but is now almost certain to be withdrawn.
- The Dutch government brought forward proposals for a national scheme to change the existing road and vehicle taxation system in favour of a scheme in which charges will vary by time, place and the pollution class of the vehicle.
- The UK Department for Transport funded feasibility studies in a number of cities embracing packages of measures including a charging element. Manchester was the first city to receive Government approval for a scheme but failed to attract public support, leaving other potential schemes in limbo.
- The Milan Ecopass scheme was introduced.
- The Oslo toll ring was extended and prolonged for another 20 years.
- A number of cities began studies of URUC schemes. Among them: Amsterdam, Copenhagen, Gothenburg, Helsinki, Bath, Ljubjana, Riga and Zagreb.

CURACAO documented developments up to the end of December 2008, and produced a range of products to meet the needs of cities as expressed by the User Group. The interaction between the consortium and the User Group was a key element, with six meetings held over the course of the project at which the content and conclusions of the CURACAO State of the Art Report were debated, and seminars were held focussing on in-depth analysis of Case Studies. Arising from these discussions:

CURACAO attempted to draw comparisons between schemes, but this proved to be extremely difficult. Although at first sight schemes may appear to be similar, when considered in detail scheme objectives and designs vary widely from city to city, and the available data on impacts is often inconsistent. The project identified a number of research gaps highlighting topics where information is difficult to find or is inconsistent, and which could usefully be pursued in future projects.