A customer based implementation strategy for road pricing in the Netherlands

Analysis of several implementation scenarios for a national road pricing scheme in the Netherlands

Final Report / 4 August 2006

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Preface and acknowledgements

This report contains an elaboration on implementation scenarios for a national road pricing scheme in the Netherlands. It summarises the experiences, knowledge and vision of the organisations that participate in the Access consortium; NV Westerscheldetunnel, BRISA Access and NedMobiel. These three parties combined their expertise of the Dutch Road Pricing plans with their expertise of tolling and road pricing on a mondial scale, from an operator's point of view. We thank the participating employees of these organisations and their advisors for their contributions.

Furthermore we discussed our ideas with some NGO's to determine the most important elements in any implementation strategy from their points of view and to see whether our ideas would be acceptable for them. We thank the representatives from these organisations for their ideas.

An implementation strategy has many political consequences and its execution depends on political decision making and acceptance. We discussed our ideas with representatives from some political parties to check whether our ideas weren't too far away from theirs. We thank them for their time and cooperation.

During the writing of the report, we had two meetings with representatives of the Ministry of Transport. These meetings were used for brainstorming on the subject and for sharpening of our ideas and formulations. We thank our principal for these meetings.

In writing this report we have formulated our vision on the most suitable implementation scenario for road pricing in the Netherlands, more than we have fully analysed all possible variations and scenarios.

An important starting point for our analysis was the defined starting date for road pricing as stated in the Nota Mobiliteit. It defined, together with cost motives, our choice to introduce another technology to the road pricing scheme and was used as an important marking in the timepath for the implementation strategy.

We hope that, while writing the report, we have answered more questions than we have raised.

The authors.

Management Summary

After a discussion of decades, in 2005 the Dutch Parliament decided on a road pricing policy. This decision, however, included one restriction: both the implementation and operational costs of the road pricing scheme will have to decrease to an acceptable level.

In order to get the right estimations of the costs of a national road pricing scheme in the Netherlands, the Ministry of Transport has organized a 'Cost Monitor'. The 'Market Consultation' is part of the cost monitor. In the market consultation, the private sector is asked to contribute to the design of operational pricing per kilometre, including supporting information on cost, feasibility and risks that market parties can support.

Access, an operators consortium of Brisa Access S.A. (Portugal), NV Westerscheldetunnel and NedMobiel has been asked by the Ministry of Transport, Public Works and Water Management to undertake a analysis on possible implementation strategies for road pricing in the Netherlands, as part of the second phase of the Market Consultation.

This chapter summarises the conclusions of this analysis.

A big bang comes with too many risks

A 'big-bang' introduction of kilometre pricing in the Netherlands is very risky and should be avoided. In our opinion, these risks can be summarised as follows:

1. Technical risk: the system (front and / or backoffice) does not work well;
2. Transition risk: from owner based taxes to marginal pricing fails or is not accepted;
3. Car market risk: the effects on second hand car market (due to the abolishment of BPM) are underestimated;
4. Income risk: revenues are not as predicted;
5. Project cost risk: higher implementation costs;
6. Public acceptance risk: the road pricing scheme is not accepted by public;
7. Social nuisance risk: social costs and nuisance will be enormous;
8. Political acceptance risk: politicians turn themselves against the project.

Accordingly, the big bang introduces a lot of changes at once. These changes, especially when implemented all at once, introduce great risks in terms of acceptability, costs, revenue and technology. On forehand, the outcome is highly unpredictable.

Of course, whatever introduction strategy is set out, there will always be risks, mistakes, failures and unexpected developments. The majority of the 'big bang' risks is related to the reliability of technology and acceptability by the public. If these risks become reality in a 'big bang' implementation strategy, it will be too late to manage them. As a matter of fact, the risks can become a 'show stopper' then.

One of the ways to minimize the risk and maximize the manageability is the development of a more gradual implementation scenario. A scenario that takes into account a focus on risks involved with the implementation of new technology and acceptability of the public.

In order to keep the mentioned risks manageable, an implementation strategy for a national road pricing scheme in the Netherlands should be based on the following characteristics:

- The improvement and maximation of public acceptability of the scheme;
- A thorough analysis on the variables of change that are introduced gradually.

The suggested implementation strategy is based on choices on and elaboration of these characteristics.

Acceptability is the key factor for successful implementation

As stated before, a lack of public, political or social acceptability can kill the project. Several recent initiatives underline the importance of public acceptability from a theoretical point of view. One of them is the platform “Anders Betalen voor Mobiliteit”, which was lead by Mr. Nouwen. Compared with the historical approach of intended road pricing policy by former Transport Ministers, the approach that was at the basis of the installation this platform differs in the sense that the focus is on acceptable solutions instead of a focus on technical ones. The Ministers of Finance and Transport did not formulate a new policy themselves, but asked a platform in which most important or involved NGO’s were represented, to formulate one.

Also in literature, attention has been paid to public acceptability of road pricing. For example in MC-ICAM, an European Committee study on the implementation of marginal cost pricing in transport, criteria for a successful road pricing implementation were derived from dealing with barriers that obstruct this implementation. Three types of barriers were considered: technological or practical barriers; legal or institutional barriers and acceptability barriers. The study underlines that acceptability is the most important barrier (thus criterion) for implementation of road pricing and that the other barriers/criteria can be derived from it.

The conclusion that acceptability is the driving factor behind implementation success, puts a focus on the non technical-elements of an implementation strategy. Besides the system development (from no to all cars, from no to all roads, from present tax system to road pricing), thorough attention will have to be paid to the organisational an institutional developments that come with the introduction, as well as to boundaries to participate.

Based on the elaboration of acceptability in this report, and Access’ experience with the implementation of road pricing schemes, we have defined seven fundamentals for a successful implementation strategy:

1. Show benefits in an early phase: demonstrating benefits will lead to an increased acceptability for more comprehensive and sophisticated developments later on;
2. Start with a limited scope and focus on acute problem areas: a limited scope makes it possible for acceptability to grow in time;

3. Gradual differentiation of prices: the introduction of the scheme should be as less complex as possible, this includes no differentiation to start with;
4. Market development for future flexibility; the implementation strategy should be setting the right boundary conditions and institutional constellation, so that changes and variations in customer demands can be incorporated in the road pricing scheme.
5. Use existing structures and organisations: this minimises risks concerning fraud, database reliability, new registration, confidence, et cetera;
6. Communication, communication, communication: all elements are depending on how the reality is brought to the general public;
7. Easy access for the customers: introduction of road pricing should be kept simple, easy to explain, cheap and easy to access, this avoids extra barriers for the public to participate in the scheme.

Based on these fundamentals we have defined the following implementation strategy for a nationwide road pricing scheme in the Netherlands.

Key elements of the suggested implementation strategy

The implementation strategy that we have composed consists of the following elements:

1. Creation of a market for OBU's
2. Frontoffice technology
3. Use of the existing RDW database
4. Use of existing enforcement organisations
5. Introduction of a geographical growth scenario
6. Introduction of a functional growth scenario
7. Interoperability

Ad1. Creation of an OBU market
When a stable structure, with a backoffice that can handle all OBU technologies, is in place, there is no limitation at all for the market to introduce an OBU that is based on other technology than GPS or Galileo and to develop all kinds of extra individual services (such as navigation systems, interoperability with toll operators, parking facilities, etc). This makes the introduction flexible and thus sustainable for future developments. The costs of this basis structure will be much less than a big bang introduction of road pricing. The rest of the costs are a responsibility of the industry.

Ad2. Frontoffice technology
The OBU will be used to charge the customers. When using GPS to start with road pricing, the customer will be confronted with a costly OBU (around € 250,- based on present predictions), and with no direct benefits that come from that (a € 250 device to pay tax). That is hard to explain to the public, and thus a possible acceptability risk. A technology growth scenario from simple and cheap solutions towards more advanced and expensive solutions could reduce this risk, but above all it gives the customer a very easy access to road pricing. Implementing alternative technology (DSRC or RFID) first instead of the required GPS/Galileo could decrease costs and risks to a large extend. In case RFID technology would

be used the combination with EVI is possible. This could lead to great synergy between both projects.

Ad3. Use existing RDW database
The database of the Rijksdienst voor het Wegverkeer (RDW) is most suitable, because of the following elements:

- Every known car in the Netherlands is already registered;
- There is a legal obligation and procedure for customers to register mutations;
- RDW has experience with a nation wide database;
- RDW has connections with foreign colleges;
- The database can be used for enforcement.

Besides these advantages there is one other issue that is of great importance for a possible role for the RDW. The RDW itself is looking for a technology that can be used for an electronic license plate (EVI). In principle the technology behind tolling, road pricing and the electronic license plate could be the same. There will be a lot of synergy (introduction of EVI makes road pricing cheaper; road pricing makes the search for stolen cars easier) the moment both road pricing and EVI make use of the same technique, same OBU, same data base and same OBU or VIN number. From the point of view of road pricing implementation, this will reduce costs, create a bigger social benefit, creates public acceptability and reduces risks.

Ad4. Use existing enforcement organisations
Using existing structures is a reliable, easy and cheap way to introduce a system based on marginal costs. There are two different approaches to execute enforcement using existing structures:

- *Privately by hiring bailiff services* (like is done with petrol stations)
  Disadvantage of using the present private enforcement scheme is that still not every procedure is automated due to the low amount of violators. In case of road pricing a fully automated system is needed.
- *Publicly by the Centraal Justitieel Incassobureau* (CJIB)
  The CJIB is a department of the ministry of Justice and responsible for collecting all public fines (like a tax). The CJIB already works with big data streams and also works together with the RDW. Due to the fact that the CJIB is strictly bound to the enforcement of public laws, the CJIB is not used to working in a private environment.

Ad5. Introduction of a geographical growth scenario
Geographical growth means a gradual change from a situation with no roads that are kilometre charged, towards a situation where all roads are part of a marginal cost pricing system. It should be noted that geographical growth is not the same as (however depending on) the gradual installation of road side equipment. It has great advantages to follow a geographical growth scenario for the introduction of road pricing in the Netherlands.

- People get used to the system and to road pricing;
- The technical system can be improved and adapted based on experiences in real situations;
- The road pricing scheme can start cheap, simple and soon because well known and simple techniques can be used;

– It buys time to combine the technical installation of road side equipment with regular maintenance activities.

A geographic growth scenario would in our opinion consist of three steps:

1. pilot projects
2. road pricing on the main roads
3. road pricing on the entire network

The last step should be implemented in two phases: first an administrative price and later on marginal cost pricing on all roads. The figure below draws the scenario.

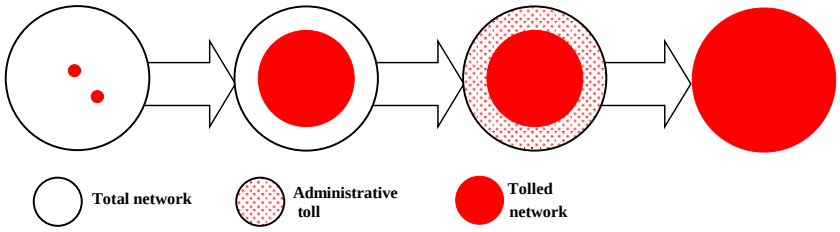

Figure: overview geographical growth scenario

Before this scenario starts, the technical implementation of all OBU's in all cars will have to be completed. The abolishing of MRB and BPM can only start after the geographical growth scenario moves into the second step (road pricing on all main roads).

We would not advice to combine the introduction of road pricing and the 'versnellingsprojecten' at all cost. When, however, these two processes can enforce each other, it is a real possibility to improve acceptability of the road pricing system.

Ad6. Introduction of a functional growth scenario
Functional growth means a gradual change from tax on possession (MRB) or acquisition (BPM) of vehicles to a marginal cost pricing system, in which is paid for each kilometre. Furthermore, it means a possible gradual change from a flat and steady kilometre price to a price that depends on the location, time and vehicle characteristics (type of fuel, weight, motor volume, etc).

– *Acquisition tax BPM*
An important problem for the abolishing of the BPM is the result on the market for second hand cars. As soon as the BPM on new cars is abolished, all second hand cars are too expensive in relation to the new ones. The old cars have been bought for a price including BPM. The effects on the second hand car market can be minimised by a very gradual phasing out of the BPM. The phasing out of the BPM will be linked to the phasing in of the road pricing scheme on the main network. As soon as all cars and all roads are equipped with OBU's and road side equipment, the transition can start.

– *Possession tax MRB*
  Because our vision is to start with a simple technology that is introduced on the main roads, followed by a full penetration of road pricing in the Netherlands when technology is ready; there are (at least) two moments on which road pricing is introduced to the people (first on the main roads, secondly on the secondary roads as well). Both moments, this introduction should be accompanied by reductions of present taxes for reasons of acceptability. This means that not all taxes should be reduced with the introduction of road pricing on the main roads, but that some taxes will have to be kept in force for an acceptable introduction of road pricing on secondary roads. We think that MRB is most suitable to do this, because BPM takes more time to be phased out and MRB has a stronger link with the secondary roads, due to the regional 'opcenten'.

– *Price differentiation*
  There is no technical restraint on differentiated road prices from the start of the introduction of the road pricing scheme, because differentiation will be managed in the back office, which is up and running from moment one. The main reason to introduce a gradual change from a flat price towards differentiation is that for reasons of acceptability, the system should start as simple and transparent as possible. On the other hand, price differentiation increases the possible positive effects on congestion and mobility. Therefore, we recommend to start with a flat price, but to introduce differentiation as soon as possible. It should be noted that a flat price as we define it, can be differentiated for vehicle classes (truck, cars, motorists, etc.)

Ad7. Interoperability
As stated before, acceptability of the road pricing scheme by the customers is essential. This means that road pricing will have to have an easy access based on a very cheap OBU. To make this possible the cost of interoperability should not be a part of the total costs of implementation, but has to be delivered as an added service for Dutch and European customers. Added services will be the responsibility of the operator / OBU issuer.

Planning and cost estimation of the suggested strategy

Next figure draws the timeline of the three main changes within the system development.

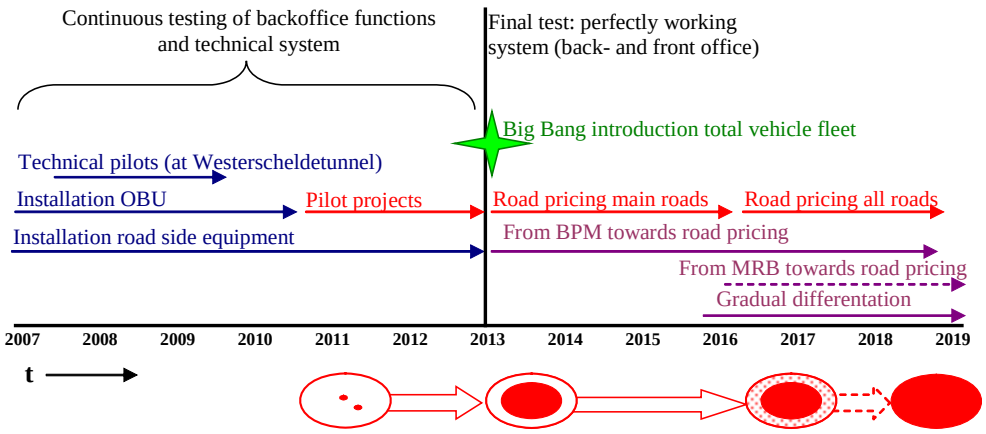

Figure: overview system development in time

The costs of this implementation strategy, consisting of capital expenditure (CAPEX), or investment costs and operational expenditure (OPEX) are given in the table below:

Cost overview in k€		**DSRC**	**RFID**
CAPEX (investment costs)	*OBU's*	239.701	171.821
	Road Side Equipment	374.000	92.400
	Back Office	10.000	10.000
	Miscellaneous	500	500
TOTAL CAPEX		**624.201**	**274.721**
OPEX (operational costs)	*OBU's*	11.455	6.194
	Road Side Equipment	35.600	22.220
	Back Office	50.000	50.000
TOTAL OPEX		**97.055**	**83.414**

It should be noted that the numbers in the table are the result of a rough estimation, based on standard cost parameters and standard statistics of the road pricing scheme in the Netherlands. Specific calculations may change the results (positively or negatively). Nevertheless, the costs as presented give a good idea of the order of magnitude of a national road pricing scheme in the Netherlands.

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1 Introduction

After a discussion of decades, in 2005 the Dutch Parliament decided on a road pricing policy. Instead of possession based taxes, a road pricing scheme based on consumption (driven kilometres) is to be introduced; approximately in 2012. The decision, however, included one restriction: both the implementation and operational costs of the road pricing scheme will have to decrease to an acceptable level. This acceptable level is set to be around half of the estimated cost for implementation (which is around 3 billion euro; as presented to the parliament in 2005) and the operational costs will have to be around 5% of the total revenues.

The restriction on the costs was based on a statement from the industry that the expected costs of implementation and operation, as mentioned in the reports of the government, were much too high. In order to get the right estimations the Ministry of Transport has organized a 'Cost Monitor'. This Cost Monitor is an initial decision-making document requiring information from and about the market. The Cost Monitor must reveal the relationship between possible cost reductions and the performance and reliability of the system or technical developments.

The 'Market Consultation' is part of the cost monitor. In the market consultation, the private sector is asked to contribute, based on draft requirement specifications, to the design of operational pricing per kilometre, including supporting information on cost, feasibility and risks that market parties can support. These insights will be incorporated in the Cost Monitor.

During phase 1 of the Market Consultation most parties stressed the fact that a 'big-bang' introduction of kilometre pricing in the Netherlands is very risky and should be avoided. As a result of this observation, an analysis of different implementation scenarios has to be conducted in the second phase. Access, an operators consortium of Brisa (Portugal), NV Westerscheldetunnel and NedMobiel has been asked[1] by the Ministry of Transport, Public Works and Water Management to undertake this detailed analysis, as part of the second phase of the Market Consultation. In this report, Access describes the results of this analysis.

The goal of the assignment is to derive more reliable insights in the effects of different implementation scenarios for kilometre pricing in the Netherlands, the associated risks and cost and benefits.

Before this analysis is undertaken, it is good to take a closer look at the decision to avoid a 'big bang' introduction.

1.1 The Big Bang Introduction strategy

The 'big bang' scenario can only be done:
- when the estimated costs of implementation as presented during the Market Consultation are in accordance with the wishes of government;
- laws making road pricing possible are adapted before the end of next year;

[1] See Appendix I for a detailed description of this question.

- The tendering process is going smoothly and is followed by a smooth roll out of nation wide road pricing.

This is difficult to achieve on such a short notice. There are however, some big advantages:

- Transparency towards politicians; what they have decided will be rolled out without any adaptation of their policy;
- Time table is clear, which is a constraint for effective project management including cost management;
- A big bang scenario will be easy and simple to communicate.

These advantages are clear, but fail to take into account the major risks that accompany this strategy.

1.1.1 Eight major risks to the big bang

We have determined 8 major risks (all most likely to occur) that make a gradual implementation strategy necessary:

1. Technical risk: the system (front and / or backoffice) does not work well;
2. Transition risk: from owner based taxes to marginal pricing fails or is not accepted;
3. Car market risk: the effects on second hand car market (due to the abolishment of BPM) are underestimated;
4. Income risk: revenues are not as predicted;
5. Project cost risk: higher implementation costs;
6. Public acceptance risk: the road pricing scheme is not accepted by public;
7. Social nuisance risk: social costs and nuisance will be enormous;
8. Political acceptance risk: politicians turn themselves against the project.

1. System (front and/or back office) does not work well
Customers (road users) will be confronted with road pricing on a daily base. The moment people are receiving wrong bills or getting the idea that the system is discriminating, acceptability will decrease. With the introduction of a never used on board technology on a nation wide scale and at same moment the introduction of a very advanced back office errors might occur. This would be disastrous for the public acceptability and trust in the system. A gradual introduction buys time to test and if necessary repair the system, before it will be used by everyone.

2. Transition from owner based tax to marginal pricing fails
The government has promised that the total revenues from road pricing would not exceed the current taxes. A major risk concerning the transition from taxes towards road pricing is that the whole transition is based on general models. When the models would prove to be wrong, and tolling revenues turn out to be higher than current taxes, this is disastrous for public acceptability and trust. The second problem is the micro-economic situation of each citizen. When road pricing revenues don't exceed the present revenues from taxes it doesn’t imply

every person pays less. The moment a substantial group of people is convinced to be treated unfair the resistance against the unknown system will grow.

3. Effects on second hand car market are underestimated.

One of the goals of road pricing is the replacement of BPM. BPM has to be paid the moment a new car is bought and is around 45% (some differentiation between petrol and diesel engines) of the net price of the vehicle. The moment this tax is going to be replaced, the market for second hand cars will collapse, because the price of a second hand car will decrease (in relation to new ones) around 45%. This effect concerns all car owners with a car younger than 5 to 7 years. It can only be guessed what the consequences in terms of social stress will be, despite any countermeasures. A gradual introduction gives more room for management and gives people the time to get used to the countermeasures.

4. Revenues are not as expected

Revenues from road pricing could be less then expected due to bad enforcement (like in Germany), a badly working system (front- or back office) or a sudden drop in the driven kilometres due to the introduction of marginal cost pricing (there is little experience with road pricing in the Netherlands, which makes it hard to predict the total amount of driven kilometres. Because a policy starting point for road pricing is that the total revenues will have to remain equal, this is introduces a great project risk). Raising the prices could result in great distrust by the public. On top of that, bad enforcement will cause people to fall into disbelieve and start trying to cheat on the system on a large scale. A gradual introduction buys time that will be used to double check the behaviour of the system and the customers.

5. Higher implementation costs

The project of introducing road pricing is subject to the constraint of a time table, a lot of uncertainties and most likely changing requirements. This complexity of the project will probably result in increasing costs (in the past all big projects with a very few exceptions have underlined this). The manageability of these costs is less during a big bang than when road pricing is introduced more gradually. Besides that, a big bang introduction of one predefined technology does not give an incentive to the industry to make this technology cheaper.

6. The road pricing scheme is not accepted by public

Due to system failures, high costs for an OBU, increasing costs of implementation, etc. acceptability of the system could decrease. There already is distrust in the government regarding vehicles and taxes. For years the vehicle has been seen as a cash cow and every change in the system will feed this distrust. The facts that the costs of an OBU will probably be more than € 200 (based on GPS) and the OBU is used for receiving money by the government, will be a high threshold for acceptability. Every citizen in the Netherlands will have his private opinion about this and opinion leaders who are against the road pricing policy will use and feed this feeling. Social distress can easily grow and endanger the project. A gradual introduction gives people the time to get used to the system and to understand how it works.

7. Social costs and nuisance will be enormous

The technical implementation will be an enormous project. OBU's will have to be installed in all vehicles and the road side equipment (for pricing and/or for enforcement) will have to be

installed in, above and besides the road. This will cause a large distress and nuisance for the road users and car owners. A gradual implementation makes it possible to plan the installation together with regular maintenance of the roads and repairs or safety checks of the cars.

8. Politicians turn themselves against the project
Until the planned introduction of road pricing at least two elections for parliament will take place. If at that moment the public and the politicians are turning themselves against the road pricing scheme for some reason the elections could be a show stopper. A gradual introduction can start relatively early and will make people familiar with road pricing. This way, political resistance is less likely.

Accordingly, the big bang introduces a lot of changes at once. These changes, especially when implemented all at once introduce great risks in terms of acceptability, costs, revenue and technology. On forehand, the outcome is highly unpredictable.

1.1.2 Gradual introduction makes the risks manageable

Of course, whatever introduction strategy is set out, there will always be mistakes, failures and unexpected developments. The majority of the risks in the previous paragraph is related to the reliability of technology and acceptability by the public. If these risks become reality in a 'big bang' implementation strategy, it will be too late to manage them. As a matter of fact, the risks can become a 'show stopper' then. We look for ways to reduce the risks prior to the implementation.

One of the ways to minimize the risk and maximize the manageability is the development of a more gradual implementation scenario. A scenario that takes into account a focus on risks involved with the implementation of new technology and acceptability of the public.

Not all implementation strategies, however, make sure the risks that occur during the introduction of a national road pricing scheme, can be managed properly. The implementation strategy should be designed in such a way that risks are allocated to the proper organizations (those who manage them best) and in a way that public acceptability of the scheme is stimulated.

A detailled overview of risks that occur during the implementation of a national road pricing scheme in the Netherlands is given in appendix III. In this appendix, for each risk, possible mitigation or management measures are defined. These measures are used as a starting point for the definition of the implementation strategy as described in this report. Furthermore they were at the base of deciding between possible growth scenarios in chapter 3.

1.2 Characteristics of an implementation strategy

In order to keep the mentioned risks manageable, an implementation strategy for a national road pricing scheme in the Netherlands should be based on the following characteristics:

– The improvement and maximation of public acceptability of the scheme;
– A thorough analysis on the variables of change that are introduced gradually.

1.2.1 Acceptability is the key factor

All actors and stakeholders that take part in road pricing in the Netherlands will be affected by, and confronted with, implementation scenarios in different ways. For them, most of the time, road pricing is not about the technical system, but about transparency (they want to understand what is happening), fairness (they don't want to be exploited), simplicity (no bureaucracy) and cost effectiveness (value for money).

Because the road pricing scheme is in an early phase, a lack of public, political or social acceptability can kill the project. Experience of Access in other European countries such as Portugal and the Czech Republic underlines this. Besides that, history proves that during last decades, road pricing projects in the Netherlands were often terminated due to a lack of acceptability. The introduction of the 'Commissie Nouwen' in an earlier phase of this project was based on the attempt to improve acceptability of a road pricing scheme by the NGO's and several studies of the EU (among others MC-ICAM) underline the importance of public acceptability from a theoretical point of view.

Our vision on a good implementation scenario therefore pays thorough attention to the acceptability and use of the system, by confronting the implementation scenario's with criteria such as fairness, honesty, complexity, et cetera.

Acceptability is important and applicable to three types of actors within the road pricing scheme:

– Private users
– Business users
– Decision- and policy makers

Criteria for acceptability and therefore for a good implementation scenario will be analyzed using the points of view of these groups. Of course there is a lot of interaction between them, a lot of which is streamlined by NGO's. The moment customers will turn themselves against the project, for example, a political risk occurs because support of pressure groups decreases.

1.2.2 Analysis of system development variables

The Ministry's question focuses on the system development in respect to the possible implementation scenarios. In the end the most favourable scenario will describe how to grow from the present situation to the final road pricing scheme: an autonomous toll system in which Galileo satellites communicate with an on board unit (OBU) to determine how many kilometres were driven at what time and on which location.

This question is based on the assumption that before the start of the project, there is a clear and detailed vision on the characteristics of the final road pricing scheme. Some requirements that were developed by the Ministry are a good example of this assumption. In our opinion, however, this approach is very risky, for the following reasons:

- During the implementation technology, policy, public opinion and institutional constellation will change. What seems to be the best suited solution now, might not in a few years;
- It neglects the fact that individual customers (road users) might ask for different and tailored specifications and requirements. Ignoring this could lead to less acceptability;

To tackle this, the implementation strategy should be aiming at setting the right boundary conditions and institutional constellation, so that changes and variations in customer demands can be incorporated in the road pricing scheme. The most important consequence of this is that the implementation strategy should aim at the development of a market for OBU's that can all be used within the road pricing scheme, instead of predefining the requirements of the OBU for all customers a long time before they can use the OBU.

Notwithstanding this approach, there still has to be an implementation strategy for other parts of the road pricing system. The three main axes by which the system development must be obtained can be seen in figure 1 below.

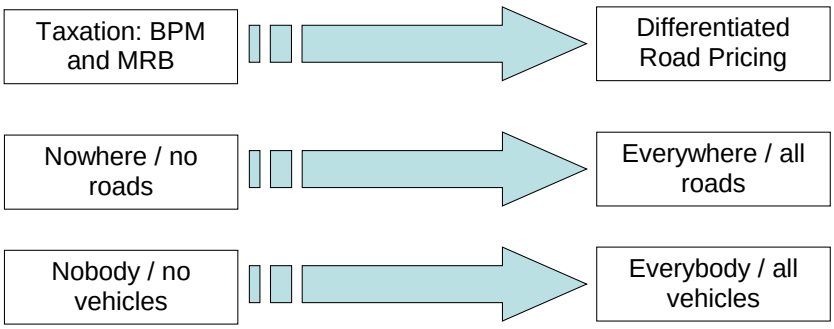

Figure 1: three main system changes

Implementation scenarios will have to take into account these three axes of change and the interdependencies between them. Analyses include the effects of this change on possible pricing concepts, techniques, acceptability, implementation time, implementation costs and risks. It should be noted that this analysis might conclude that, as an exception on the general approach, a big bang strategy for some of these axes is the best strategy.

1.3 Report structure

Our vision on the implementation strategy, as expressed in paragraph 1.2 is used as the backbone of the structure of this report.

Because the acceptability of the road pricing scheme is the key factor for a successful implementation strategy, we elaborate on this subject more in chapter 2. The result of this chapter is an overview of criteria for a successful implementation strategy that can be used to

define a favourable scenario later in this report. Besides this overview the chapter aims at providing more insight in, and awareness about, the 'soft criteria' that are so important for a successful implementation of the national road pricing scheme.

Chapter 3 describes the system development in terms of the three major changes as stated in Figure 1. Special attention will be paid to the interdependencies between these axes of change. Each axis results in one or more scenarios with its own characteristics, strengths, weaknesses and effects on applicable techniques, necessary development on other axes, implementation costs, risks and acceptability.

Chapter 4 describes a favourable implementation scenario, based on the criteria that were derived in chapter 2 and insight from chapter 3. This scenario will be described in detail, including a timeline and cost calculations, and including some detailed graphs of the institutional constellation. These details are based on experience and research of the Access members and describe the way in which we think the implementation of a national road pricing scheme in the Netherlands can be successful. This chapter 4 will also elaborate on some legal issues such as necessary changes in the Wet Bereikbaarheid en Mobiliteit (WBM), compliance with EU directives and some privacy issues.

Chapter 5 will shortly confront the presented favourable implementation strategy with the fundamentals for a successful implementation.

The report ends with some appendices, among which the review of relevant requirements of the (updated) requirement specification and a description of some critical success factors for the implementation and describes the results of a thorough risk analysis that was performed by the Access participants.

As a consequence to this report structure, the report incorporates deliverables[2] D2, D3, D4 and D5, as requested by the principal, The Ministry of Transport.

[2] D2: Analysis of possible implementation scenarios.
D3: Formulation of favourable implementation scenarios.
D4: Risk analysis
D5: Review of relevant requirements of the (updated) requirement specification.

2 Acceptability: key factor for implementation success

The goal of this chapter is to define a set of criteria and starting points (fundamentals) for a good implementation scenario for a national road pricing scheme in the Netherlands. Paragraph 2.2 discusses these criteria. Access' vision on the implementation strategy sets acceptability as a key factor for a successful implementation of road pricing in the Netherlands. This vision was underlined, among others, at the OECD Road Charging Convention in Paris (June 2006): "(social) acceptation of road charging was found to be a critical success factor for implementing road charging". Before the implementation criteria can be derived, paragraph 2.1 starts with an elaboration on acceptability, based on practical experience, developments within the project 'Anders Betalen voor Mobiliteit' and several theoretical EU studies.

2.1 A closer look at acceptability

As stated before, a lack of public, political or social acceptability can kill the project. Several recent initiatives underline the importance of public acceptability from a theoretical point of view.

2.1.1 National Platform "Anders Betalen voor Mobiliteit"

Road pricing in the Netherlands has a history of more than 20 years. During this time, road pricing has been discussed as a solution for increasing accessibility and congestion problems for the Randstad. Due to the fact that the intended schemes for implementation were never accepted by the public and some NGO's (often stimulated by the press), until 2005 a final decision on road pricing policy had never been made.

As problems with mobility and related environmental problems were increasing, accessibility of the Randstad became more and more a constraint for economical growth. Due to environmental constraints, extensions of the road network were postponed. Industry and NGO's such as the representatives of employers, logistic organisations and car owners asked the government for a new policy to stimulate mobility in the Netherlands.

As more and more people were getting frustrated with the mobility problem, public awareness raised that new policy was needed to create a way out. Known with the formal road pricing policies in other countries the Minster of Transport asked (together with the Minister of Finance) several NGO[3]'s to take part in a platform called "Anders Betalen voor Mobiliteit". The chairman of the Platform was Mr. Nouwen, former chairman of the national organisation of car owners. The assignment of the Platform was to formulate an advice how road pricing could be introduced in a way that it would be accepted by the public and NGO's.

The Platform suggested a nation wide road pricing scheme that now is the fundament of the current road pricing policy as accepted by the parliament in the end of 2005. The idea of a

[3] See Appendix IV for an overview of participating NGO's

nation wide road pricing scheme was accompanied by the advice of the Platform to start with some local toll projects, with the following arguments:

- The toll for the local projects is used to speed up improvement of infrastructural bottlenecks. That way, every car driver understands the allocation of the money he/she is paying for using a road.
- The local toll projects could be initiated by regional governments and industry. Parties, which are confronted with the tolling, have influence on the choice of solution for the bottleneck.

Compared with the historical approach of intended road pricing policy by former Transport Ministers, the approach set out above differs in the sense that the focus is on acceptable solutions instead of a focus on technical solutions.
The Ministers of Finance and Transport did not formulate a new policy themselves, but asked a platform in which most important or involved NGO's were represented, to formulate one. Also the Platform formulated an advice with only one focus, acceptability by the public.

2.1.2 Implementation of road pricing according to MC-ICAM

MC-ICAM is a European Committee study on the implementation of marginal cost pricing in transport. In their study "Implementation of Marginal Cost Pricing in Transport" criteria for a successful road pricing implementation are derived from dealing with barriers that obstruct this implementation.

To generate criteria for a successful implementation of road pricing, one needs to understand what "barriers" can keep road pricing from being successfully implemented. Three types of barriers were considered:

- technological/practical;
- legal/institutional;
- acceptability barriers;

Table 1 describes the barriers in more detail.

Barrier Type	**Barrier**
Technological and practical barriers	– insufficient charging technology – practical problems
Legal and institutional barriers	– insufficient policy framework and supportive legislation at European level – contradictory policy objectives and insufficient supportive legislation at national level – insufficient co-ordination/co-operation and non-optimal organisational structures – contradictory legislation and policies in other areas and sectors – opposition by stakeholder/interest groups and opposition parties
Acceptability barriers	– low public acceptability – low business acceptability – low political acceptability

Table 1: Barriers on implementing road pricing

Acceptability is the key factor

Acceptability barriers are strongly influenced by elements of technology, and practical, legal and institutional barriers. Two specific conclusions from the MC ICAM study are interesting for this concern:

– Acceptability, public and political, appears to be the greatest source of barriers to marginal social cost pricing in road transport;
– There are strong linkages and overlaps between the individual barriers and barrier types. In particular, as for the interdependencies between barriers (and barrier types), it is evident that acceptability depends on both the existing technology and the legal and institutional status quo.

These conclusions underline that acceptability is the most important barrier (thus criterion) for implementation of road pricing and that the other barriers/criteria can be derived from it. As can be derived from table 1, acceptability criteria can be divided into three groups:

1. low public acceptability
2. low business acceptability
3. low political acceptability

These groups are elaborated in table 2.

Focus group	Barrier
Public acceptability	– Public dislike of complex charging structures – Public opposition to the idea of new charges to pay for road use (when the use has traditionally been for free); – Public opposition to road charges on the grounds that they are regarded as another and new tax; – Public concern about equity within, and honesty of, the system
Business acceptability	In contrast to political actors, business actors may not pursue conflicting objectives (e.g. fairness vs. efficiency). Therefore it can be concluded that business acceptability is mainly motivated by expected benefits and costs. A key factor behind low business acceptability is: – Concerns of businesses that they are treated unfairly compared to their competitors (spatial distributional impacts of charges)
Political acceptability	– Politicians do not consider marginal cost pricing principles the most effective approach to addressing transport problems; – The efficiency goal of marginal cost pricing is hard to 'sell' at the local level where the decisions on urban road pricing policy would be made; – Politicians believe that any benefits which might arise will not be attributed to them.

Table 2: Acceptability barriers

Appendix V gives an overview of acceptability criteria that were derived from the barriers in table 2.

2.2 Fundamentals for a successful implementation strategy

Based on the elaboration of acceptability in the previous paragraph, the criteria in appendix V and Access' experience with the implementation of road pricing schemes, the following fundamentals for a successful implementation strategy can be derived.

- Show benefits in an early stage
- Start with a limited scope and a focus on acute problems
- Gradual differentiation of prices
- Market development for future flexibility
- Use existing structures and organisations
- Communication
- Easy access for customers

These fundamentals will be elaborated in the following paragraphs.

2.2.1 Show benefits in an early phase of implementation

Sensible phasing and packaging of simple pricing measures with limited scope, relatively low charges and minimal differentiation can lead to substantial benefits already in early phases. Demonstrating these benefits will lead to an increased acceptability for more comprehensive and sophisticated developments later on.

To demonstrate the benefits during initial implementation steps the results on consumer prices, fairness and accessibility are crucial for the public. The decision maker is interested in fairness and accessibility too, but also wants information on environmental and safety impacts. Benefits on these subjects will increase confidence in next steps during this period. It is essential:

1. to prove the beneficial character of the measure; and
2. to communicate this to public and decision makers.

2.2.2 Start with a limited scope and focus on acute problem areas

The limited scope is necessary because acceptability for a big bang release comes with certain risk. A limited scope makes it possible for acceptability to grow in time (paragraph 3.2 elaborates on this issue in detail).

The limited scope should focus on specific problem areas, such as areas with heavy congestion and bottlenecks in the network. On these places, societal acceptability can be foreseen, because results and benefits are likely to appear on short notice.

The intention of the Ministry of Transport to use “versnellingsprojecten” for implementation of local road charging projects can be a very useful step towards creating the right climate of acceptability for the introduction of road charging.[4]

2.2.3 Gradual differentiation of prices

The introduction of a national road pricing scheme in the Netherlands is a big and complex project that is not easy to understand by the road users. From acceptability point of view it is absolutely decisive for success that the changes road users will encounter can be explained and rationalised easily. Beside a transparent implementation project and a thorough communication strategy this means that the introduction of the scheme should be as less complex as possible. The same price, for all similar users on all roads is easy to explain and to understand. Differentiation can be introduced when the system is in operation and accepted.

Counterpart of this fundamental is that price differentiation can increase the benefits that come from road pricing, which is especially important in the early phase of introduction.

[4] However, the present structure and definition of these project do not favor the execution of the projects because: 1) they can’t be fastened substantially (so there’s no real gain) and 2) the km price will be higher than expected on normal trajects. This is not good for acceptability.

2.2.4 Market development for future flexibility

The implementation takes a long time in which technology, policy, public opinion and institutional constellation will change a lot. Besides that, customers (road users) might ask for different and tailored OBU and service (levels). To tackle this, the implementation strategy should be aiming at setting the right boundary conditions and institutional constellation, so that changes and variations in customer demands can be incorporated in the road pricing scheme. The most important consequence of this is that the implementation strategy should aim at the development of a market for OBU's that can all be used within the road pricing scheme, instead of predefining the requirements of the OBU for all customers a long time before they can use the OBU.

Besides this, the creation of a market for OBU issuers will give an incentive to keep the prices as low as possible, and to add services to the OBU that increase the benefits. This way, customers won't be forced to pay much for an OBU without getting any benefits from it, but will pay for extra service or requirements. This is a huge stimulus for acceptability.

2.2.5 Use existing structures and organisations

The heart of the road pricing scheme[5] consists, among others, of a database with information about vehicles and their drivers. For public acceptability it is extremely important that this data base is very reliable and accurate. Creating this database from scratch comes with some risks and disadvantages:

- A new data base will always start with distrust of the public. Starting with a known and reliable data base is important for the acceptability of implementation road pricing;
- Starting a new data base with new input creates the risks of fraud;
- At the moment a new data base is going to be created, the unique number of an OBU will be connected with the only reliable and known information namely name and address (by identification). At the same time a new problem is created, namely the unreliable relation between the car and unique number of the OBU. Enforcement will most likely take place based on Optical Character Recognition (OCR); the moment the relation between license plate and OBU number is not reliable (due to fraud or mutation of car ownership), enforcement will be a problem;
- Creating a new data base means a possible conflict with other data bases (how do you manage to keep the contents of the databases equally;
- Starting a new data base means customers will have to register, which they won't like (taking part in an unknown road pricing scheme, with all kinds of distrust involved).

The risks as mentioned above could endanger (political and public) acceptability, but could be diminished by using an existing data base

Similar arguments can be stated for the use of existing enforcement structures and organisations. A road pricing scheme without enforcement is doomed to become a disaster. Certainly in the beginning everyone has to be convinced that they have to take part in the

[5] See appendix VI for an overview of the whole scheme

scheme or will be fined. And even more important, they will have to be convinced that other people cannot exploit the system either. Enforcement has the following features:

- Non discrimination; there must be a high level of enforcement; exclusion of some groups must be avoided. This means for example that foreign drivers will have to pay for using Dutch motorways as well;
- Enforcement does not end with sending a fine. There must be a juridical backbone that makes it possible to follow up the fine;
- The costs made for enforcement must be in relation with the total cost of operations;
- The fine must be high enough (in London and Austria fines are very high as well) to encourage customers to behave conform the rules and take part in the road pricing scheme.

To minimize risks and maximize public acceptation, existing structures are the best way to execute enforcement. Even more while considering the database and enforcement will have to have a strong relation with each other.

2.2.6 Communication, communication, communication

Almost all elements of acceptability have to do with understanding the road pricing scheme. Therefore this scheme should be transparent, not too complex, create benefits for the users, etc. But all these elements are depending on how the reality is brought to the general public. Here, an honest, decent and clarifying communication strategy is the magic word.

2.2.7 Easy access for customers

As stated before, acceptability is a key factor for a successful implementation of a national road pricing scheme in the Netherlands. And acceptability by the general public (the customers of the scheme) is specifically important, because political acceptability is very much depending on it. That is why the introduction of road pricing should be kept simple and easy to access; this avoids extra barriers for the public to participate in the scheme.

This easy access starts with a low price for the OBU, but does also mean that at first prices for road use should be kept low (this can only be done, when investment and operational costs for the system are low).

Furthermore the road pricing scheme should be kept simple and easy to explain. This means that as little as possible changes in legislation and laws should be introduced and that differentiation should be kept at a minimum at first. It also means that the used techniques shouldn’t be too complex and that customer care services are up and running from the beginning.

Finally, bureaucracy related to driving (in the Netherlands as well as trough Europe) has to be decreased to almost zero. This means one contract, one OBU and one invoice for driving trough whole Europe. Therefore, it is important that the implementation scenario gives an answer to European interoperability as well.

3 System development

The three main axes, as defined in chapter 1, by which the system development must be obtained, are once again drawn in figure 3 below. In comparison with figure 1, the three main system development scenarios are defined in this figure.

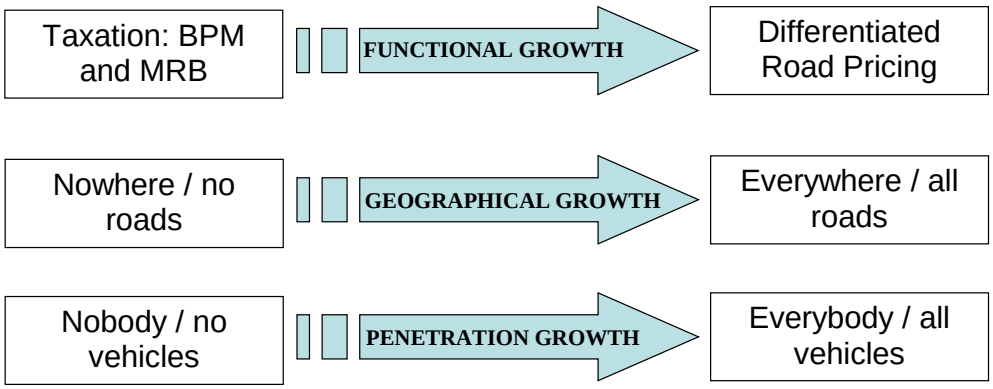

Figure 2: three main scenarios

Functional growth scenario
Functional growth means a gradual change from tax on possession or acquisition of vehicles to a marginal cost pricing system, in which is paid for each kilometre. Furthermore, it means a possible gradual change from a flat and steady kilometre price to a price that depends on the location, time and vehicle characteristics (type of fuel, weight, motor volume, etc).

Geographical growth scenario
Geographical growth means a gradual change from a situation with no roads that are kilometre charged, towards a situation where all roads are part of a marginal cost pricing system. It should be noted that geographical growth is not the same as (however depending on) the gradual installation of road side equipment.

Vehicle penetration growth scenario
Vehicle penetration growth means a gradual change from a situation in which no cars are submitted to a road pricing scheme, towards a situation where all cars are part of the scheme. It should be noted that vehicle penetration growth is not the same as (however depending on) the gradual installation of On Board Units (OBU's) in the cars.

All axes of change together will finally result in the end-objective: a GPS-based solution to cater for all requirements set by the Ministry and commented on in appendix II.

3.1 Functional growth scenario

The basic principle behind the functional growth scenario is that there is a gradual change from tax on possession or acquisition to a marginal cost pricing system, in which people pay an amount of money for each kilometre they have driven. Furthermore, it means a possible

gradual change from a flat and steady price to a price that depends on the location, time and vehicle characteristics (type of fuel, weight, motor volume, etc).

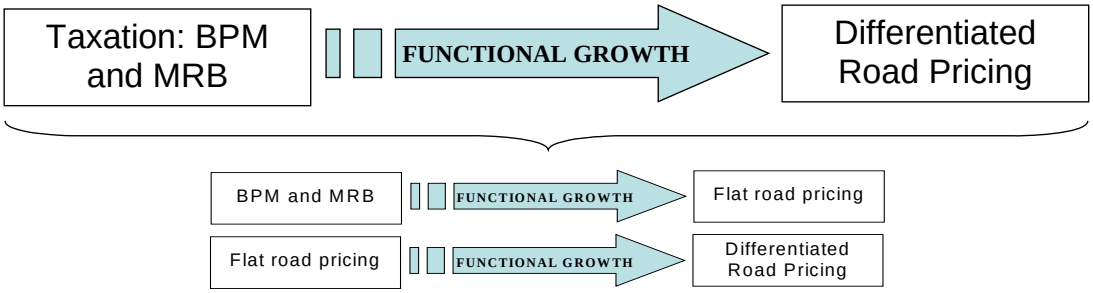

Figure 3: principle of functional growth scenario

NB it should be noted that the two changes in figure 3 should not necessarily be executed parallel; it is possible to first make one change, followed by the other.

3.1.1 From MRB and BPM towards flat road pricing

An important starting point for this scenario is that the total revenues for the government and the total expense of road users will remain constant during the transition.

Honesty and equity will put a big bang in favour, since it introduces road pricing for (almost) all vehicles and on (almost) all (main) roads at the same time. There are, however, heavy arguments (chapter 1) that ply against this big bang and in favour of a more gradual introduction: a big bang conflicts with some arguments that focus on acceptability, and that state that it is better to start with small scale projects and this kind of big bang implementation comes with the risk that it is very hard to predict the total revenues, and therefore to set the right prices.

A gradual BPM/MRB transition will keep risks of revenue and costs to a minimum and will be best acceptable to the public (since people are naturally opposed to big changes). Therefore, ways to hold on to honesty and equity are to be sought in a gradual road and/or vehicle coverage and/or functional penetration.

BPM is a once-only tax on the acquisition of a car, and MRB is a periodical tax on the possession (and use) of a car. This causes a big difference in the transition to road pricing. For these reasons, BPM and MRB will be discussed separately.

Acquisition tax on cars and motor vehicles (BPM)

A big problem for the abolishing of the BPM is the effect on the market for second hand cars. As soon as the BPM on new cars is abolished, all second hand cars are too expensive in relation to the new ones. The old cars have been bought for a price plus BPM. The effects on the second hand car market can be lowered by the introduction of a compensation fee (at once, or as a discount on the road price). The costs for compensation, however, are very high

(in the magnitude of 20 billion Euro). A second way to deal with the second hand car market is to introduce road pricing for only new bought cars. These cars will not pay their BPM at once, but will pay a price for each kilometre they have driven. After a couple of years, depending on the amount of new cars compared to the amount of used ones, road pricing will be introduced for all cars (appendix VIII elaborates on this scenario). Because this way of dealing with the problem comes with the simultaneous use of different taxing systems (legally difficult and complex, hard to explain) this solution is not favourable. Finally, we choose to solve the problem by spreading it out in time. This will not solve the problem, but diminishes the effects of it. A very gradual phasing out of the BPM makes sure that the devaluation of the cars that is caused by the phasing out of the BPM is very gradual, especially in comparison with the devaluation of the technical value of the vehicle

The phasing out of the BPM will be linked to the phasing in of the road pricing scheme on the main network (see paragraph 3.2). As soon as all cars and all roads are equipped with OBU's and road side equipment, the transition can start. The transaction works as follows: BPM is 45% of the net price; this could be lowered in steps of (for example) 5% to zero (or to the final percentage), in 4 to 9 years. In the meantime the prices within the road pricing on the main network will be raised to the amount that total revenue stays equal. The road pricing scheme starts with low prices, which gives people the possibility to get used to the system. Because the transaction focuses on the main network only, all pricing technologies are applicable.

The transition is financed at the expense of the second hand car owners, but the effects are gradual. It might be possible to introduce discounts on the kilometre prices for second hand cars[6], to minimise this.

Alternative solutions for abolishment of BPM are found in appendix VII

Tax on the possession and use of a vehicle (Motorrijtuigenbelasting - MRB)

Because (see following chapters) our vision is to start with a simple technology that is introduced on the main roads, followed by a full penetration of road pricing in the Netherlands when technology is ready; there are (at least) two moments on which road pricing is introduced to the people (first on the main roads, secondly on the secondary roads as well). Both moments, this introduction should be accompanied by reductions of present taxes. This means that not all taxes should be reduced with the introduction of road pricing on the main roads, but that some taxes will have to be kept in force for an acceptable introduction of road pricing on secondary roads. We think that MRB is most suitable to do this, because BPM takes more time to be phased out and MRB has a stronger link with the secondary roads, due to the regional 'opcenten' (see paragraph 4.4).

The scenario works as follows. At day zero, for the total revenue of pricing (on the main roads as in scenario 2 or at all roads as in scenario 3) in year 1 and the total revenue of MRB, a prognoses is made. The MRB will be lowered with the prognoses of extra income from road

[6] i.e. cars that were bought before the first introduction of road pricing

pricing. Every user pays a lower MRB and a price for the use of the road (a further elaboration is given in appendix VII).

A possible variant to this scenario is that the MRB at first will not be lowered. The MRB will be considered as a discount on the road price. The MRB will be distracted from the bill for the driven kilometres. If positive, the customer is billed for the outcome; if negative, the customer will get no bill for the driven kilometres. Apart from this discount, the variant is equal to the scenario mentioned above. This variant gives the possibility to sell a credit note (electronic vignette) to foreign cars, because the back office can sustain this option. On the other hand, the scenario per definition doesn't comply with the starting point that total revenue has to remain constant during the introduction.

3.1.2 From flat towards differentiated road pricing

Differentiation will be managed in the back office. Within the back office each stretch of road will be assigned several prices (depending on vehicle characteristics), that may vary in time. Detection of a vehicle on that particular stretch will add that price to the car owners' invoice.

For this reason, technically there is no restraint on differentiated road prices from the start of the introduction of the road pricing scheme, because differentiation will be managed in the back office. The back office, as the back bone of the system, is up and running from moment one. Differentiation is independent from the pricing techniques.

The main reason to introduce a gradual change from a flat price towards differentiation, instead of starting with differentiated prices from the start is that for reasons of acceptability, the system should start as simple and transparent as possible. On the other hand, price differentiation increases the possible positive effects on congestion and mobility. Therefore, we recommend to start with a flat price, but to introduce differentiation as soon as possible.

NB A flat price means that there is no differentiation in time, place or environmental characteristics of the vehicle. It leaves the possibility for different prices for different vehicle classes (trucks, cars, motorbikes, etc)!

3.1.3 Conclusions on functional growth scenario

A functional growth scenario is the baseline of road pricing. Gradual reduction of MRB/BPM is advisable to reduce implementation risks and negative side effects of the change.

The MRB/BPM can at first best be replaced by a flat road charge, but differentiation should be introduced as soon as public comprehension allows it (because it increases the positive effects of road pricing and therefore the acceptability of it)..

It should be noted that following our strategy would mean that MRB will only be abandoned when a nationwide road pricing scheme on all roads is up and running. When this will happen is depending on technology and market developments.

3.2 Geographical growth scenario

The basic principle behind the geographical growth scenario is that road pricing starts at a limited amount of roads and grows further towards full coverage of the entire road network in the Netherlands.

Figure 4: principle of geographical growth scenario

It should be noted at forehand that however the technical installation of road side equipment on a specific location should be finished (including the testing phase) before that specific location can be incorporated into the road pricing scheme, this technical implementation can be done in another timeframe. The geographical implementation of road pricing, in other words, is not the same as the installation of road side equipment.

Not withstanding this conclusion, a geographical growth scenario has several advantages for the technical installation project, because the first buys more time for the latter. Because of this the technical installation can be integrated with regular and already planned maintenance works, and this way social costs and distress can be minimized.

The principle of the geographical growth scenario can logically be put into 4 steps:

1. pilot projects
2. road pricing on a limited amount of roads
3. road pricing on the main roads
4. road pricing on the entire network

For the elaboration of these steps, we assume that the introduction of the OBU in the cars has been finished, before the first pilot project starts (see also next paragraph). This way, all customers that use the specific road that is incorporated into the system, will be confronted with road pricing.

Furthermore we assume that, at least until the third of the above mentioned 4 steps has been executed, the price per kilometre will not be differentiated (as a function of time, place or other dimensions)[7]. As elaborated in the previous paragraph, this is for reasons of acceptability; technically this will not be a problem, because differentiation will be managed in the back office.

3.2.1 Pilot projects

This first step, pilot projects, is introduced to test the used technique and the back-office but moreover to let people get used to road pricing. Furthermore it enables the government to get

[7] Of course a differentiation between vehicle classes (trucks, cars, motorbikes) will be allowed.

to know the behaviour of Dutch people under a system of road pricing, which is important information for the estimation of revenues, when taxes will be phased out.

It is important at this stage to pick a location for these projects that have the following characteristics:

- A congestion problem that can be solved significantly by the introduction of road pricing. This increases acceptability by the road users, because they can directly see the benefits (less congestion) that can come from road pricing.
- A busy part of the network, so that the backoffice and the technical equipment can be tested on the volume of transactions that will have to be carried out.
- A part of the network that a large percentage of all customers will use within a year. This is because the real test for the backoffice is not in the total amount of transactions, but in the total amount of customers that have to be served. Furthermore it is important for the acceptability of the system that as many people as possible are confronted with it and can get used to it.

For a successful pilot project it is not necessary to use a GPS based technique for road pricing. Much cheaper and simpler technologies like Infrared, DSRC and RFID can be used (of course in combination with technologies for enforcement). It is however of great importance that the backoffice is already up and running for all users.

One problem that has to be solved is the fact that during this pilot phase, people will pay a marginal cost price, without being compensated with lower taxes. This may lead to a low grade of acceptability. To avoid this, prices should be low in this phase, and invoices could be made tax-deductible (from income tax or MRB).

Another solution for this problem could be to link the pilot project to the so-called ‘versnellingsprojecten’, as mentioned in the ‘Nota Mobiliteit’. This way, not only decreasing congestion can be a direct and visible result of the road pricing scheme, but new roads as well. Of course this can contribute greatly to the acceptability of the system and it is compliance with government policy. However, the present definition of these ‘versnellingsprojecten’ can obstruct this acceptability, as prices on these new roads will be significantly higher than prices on the rest of the network. Furthermore there is a time risk involved, because the environmental and spatial procedures that come with these projects can postpone the introduction of road pricing. Overall, we conclude that the pilots for the introduction of road pricing should be selected separately from the ‘versnellingsprojecten’ (based on other criteria), but on the other hand they might be the same projects.

The pilot phase should typically last for one to two years, plus a half year for adaptation and improvement of the system. Of course it is possible to do more than one pilot project at the same time, but we would advise to limit the amount of pilot projects to three. This way this phase will be kept manageable and focussed on the main goals: testing and improvement of the system and letting users get used to road pricing.

Besides pilots for the introduction of road pricing, technical pilots should be developed to test the back-office and the road pricing technology. Such pilots should be done on roads were

prices are already levied such as the Kiltunnel or the Westerscheldetunnel. For these pilots it is not necessary to have installed OBU's in all cars already, so they can start much earlier.

3.2.2 Road pricing on a limited amount of roads

From the pilot phase on, road pricing could grow gradually by adding one road at the time. Advantages of this step are:

- Cautious extension of the system;
- More time for the installation of road side equipment.

But the introduction of this step in the geographical growth scenario has also the following disadvantages:

- Confusion about what roads are part of the road pricing scheme and what not;
- Difficult and arbitrary decision on the moment MRB and BPM will be abandoned and marginal cost pricing will take over.

Both mentioned disadvantages will put a risk on the acceptability of the system. Furthermore the introduction of this step doesn't add much possible risk deduction to the implementation. For these reasons we would suggest not to incorporate this step into the scenario.

3.2.3 Road pricing on the main roads

In our vision, the pilot phase should be directly followed by a road pricing scheme on the main roads. To avoid rat-run traffic this phase should not be limited to the Highway network (or 'Hoofdwegennet'), but should also include the important entrance and exit roads from the cities and the important regional roads. A rough estimation concludes that this means that about as much kilometres of road as the main network should be included, resulting in 600 extra gantries or measure points. An estimation of the implementation costs for this phase is given in chapter 4 (the cost calculations in paragraph 4.3, work with 600 to 1200 extra gantries or measure points).

The main reason that this step is introduced to the geographical growth scenario is that it makes other techniques for road pricing than GPS possible (e.g. Infrared, DSRC, and RFID). Our estimation is that GPS will not be ready to deliver adequate and secure enough information at the time road pricing will be introduced nationwide, especially in urban areas. Furthermore, GPS based pricing techniques are expensive at present and come with certain risks (no proven and complex technology) and a possible suspicion by the users. The introduction of this step (road pricing on the main roads, with other technology), causes the technical impact of nationwide road pricing to stay within limits of time, costs, manageability, complexity and social nuisance.

It should be noted that in this phase of the implementation it *is* possible to move on towards a GPS based technique. It hasn't, however, been made obligatory. Customers can decide for

themselves what kind of OBU to use; a cheap one based on a simple technology or the more expensive GPS based one, with a possible range of additional services.

The nationwide implementation and coverage (all be it on the main roads only) of the road pricing scheme makes it possible to reduce the BPM at the same time as the introduction of road pricing (when MRB will not be exclusively connected to road pricing on secondary roads –see paragraph 3.1-, this tax can be lowered immediately as well). People, who will have to pay for each kilometre they drive, will immediately notice that other taxes are being cut down. This is a major factor for the acceptability of the system.

During this phase, a gradual differentiation of the road price (as a function of the time, location or environmental characteristics of the car) can be introduced. The introduction of differentiation has its own characteristics, which are elaborated in the previous paragraph.

This phase of the scenario starts as soon as the installation of all road side equipment has been concluded and the pilot phase has been finished. There is no time limit on the duration of this phase; progression towards the next phase is depending on the following factors:

- Technical and price development of GPS technology;
- Acceptability of marginal cost pricing in road transport by the public;
- Acceptability of the system of road pricing in the Netherlands;
- Penetration of GPS OBU's as a percentage of the whole vehicle fleet (and thus the magnitude of technology migration cost).

3.2.4 Road pricing on the entire network

This final phase has two possible steps that can be introduced sequentially (the first step, however could be left out of the implementation strategy when technology is ready for the second at start):

1. Marginal cost pricing on the main network in combination with a administrative pricing methodology on the other roads;
2. Marginal cost pricing on all roads.

The first step is the introduction of a payment for the use of all roads based on the driven kilometres for the main network combined with a fee for the other roads. This fee can be a steady amount of money. It also may be a steady tax, for instance a (decreased) MRB.

Big advantage of this step is that it makes it still possible to use several different techniques, while people get used to paying for each and every kilometre they drive. The costs of this step, in relation to road pricing only on the main road network, are minimal (organisation and administration). This phase could last as long as it takes and ends, based on the same criteria as the previous phase:

- Technical and price development of GPS technology
- Acceptability of marginal cost pricing in road transport by the public
- Acceptability of the system of road pricing in the Netherlands

– Penetration of GPS OBU's as a percentage of the whole vehicle fleet

When the criteria above are fulfilled, the introduction of a marginal cost price for all kilometres on all roads can be introduced. Within this phase, only GPS based or similar technologies will be used.

3.2.5 Conclusions on geographical growth scenario

It has great advantages to follow a geographical growth scenario for the introduction of road pricing in the Netherlands.

– People get used to the system and to road pricing;
– The technical system can be improved and adapted based on experiences in real situations;
– The road pricing scheme can start cheap, simple and soon because well known and simple techniques can be used;
– It buys time to combine the technical installation of road side equipment with regular maintenance activities.

A geographic growth scenario would in our opinion consist of three steps:

1. pilot projects
2. road pricing on the main roads
3. road pricing on the entire network

Where the last step should be implemented in two phases: first an administrative price and later on marginal cost pricing on all roads. In Figure 5, the scenario is set out.

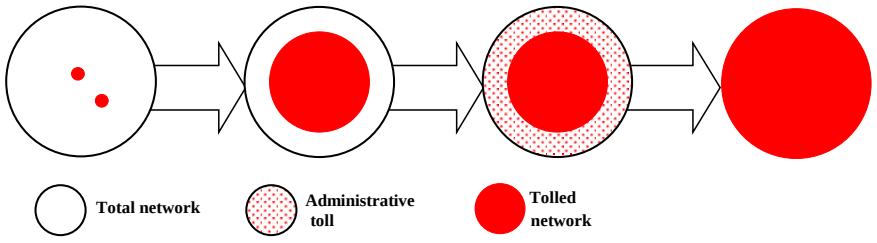

Figure 5: overview geographical growth scenario

Before this scenario starts, the technical implementation of all OBU's in all cars will have to be completed. The abolishing of MRB and BPM can only start after the geographical growth scenario moves into the second step (road pricing on all main roads).

We would not advice to combine the introduction of road pricing and the 'versnellingsprojecten' at all cost. When, however, these two processes can enforce each other, it is a real possibility to improve acceptability of the road pricing system.

It should be noted that in introducing this geographical growth scenario to the implementation strategy, requirements 1 and especially 5 (as stated by the Ministry and in appendix II) will not be met untill the last phase of the scenario.

The third alternative scenario in Appendix VIII draws a possible extension of the geographical growth scenario by introducing the road pricing scheme province by province.

3.3 Vehicle penetration growth scenarios

The basic principle behind the vehicle penetration growth scenario is that road pricing starts with a limited amount of vehicles and grows towards the enclosure of all vehicles that drive on the Dutch roads in the system.

Figure 6: principle of vehicle penetration growth scenario

Similar to the geographical growth scenario, it should be noted at forehand that however the technical installation of OBU's in the specific user groups that can be defined within this scenario should be finished (including the testing phase) before that specific user group can be added to the road pricing scheme, this technical implementation can be done in another timeframe. The gradual vehicle penetration of the road pricing scheme, in other words, is not the same as the installation of the OBU's in all cars.

Not withstanding this conclusion, a vehicle penetration growth scenario has several advantages for the technical installation project, because the first one buys more time for the latter. Furthermore, when the user groups are selected carefully, they might be easy to reach, which makes the technical installation easier and les complex. Because the installation of OBU's in the vehicle fleet is a manageable project in our opinion, it would not be a decisive argument to introduce a vehicle penetration growth scenario to the implementation strategy of a national road pricing scheme.

Two possible schemes of vehicle penetration growth are elaborated here (a third scenario, to implement road charging for new cars only –on a obligatory basis- is set out in appendix VIII):

1. A scheme based on vehicle characteristics (trucks, cars, motor cycles)
2. A scheme based on road use (heavy users, light users)

Both schemes generally share the same (dis-) advantages and characteristics, as set out in the next paragraph.

3.3.1 Further analysis of the scenarios

During a vehicle penetration growth scenario, prices should not be differentiated. Differentiation has no specific advantages in terms of congestion and mobility when only a small group of users is included in the system and differentiation increases the complexity of the system. This means that acceptability will not improve and risks will be higher when differentiated prices will be incorporated into this scenario.

The scenario sets no specific conditions or requirements on the road pricing technique.

Three main possible advantages can be derived when introducing a vehicle penetration growth scenario to the implementation strategy:

- When the first user groups that are incorporated into the system are selected carefully, these first users could encounter specific advantages that come from road pricing (e.g. people who drive less than 20.000 kilometres a year will pay less under the road pricing scheme than they do now). This is a stimulant for acceptability of the system;
- Starting with trucks can make the collection of the road price from foreign users easier, because most international trucks already have a German Maut OBU in their cars, which could be used in the Dutch system as well (see our comments on interoperability in paragraph 4.2.5). This might be good for international acceptability and publicity of the system, as well as for the national acceptability (all foreigners have to pay as well). Because the real problem with the collection from foreign users (collection from private cars) is only postponed in this way, this advantage is, in our opinion, not decisive for the introduction of a vehicle penetration growth scenario into the implementation strategy;
- Customers can gradually get used to the use of an OBU. Word of mouth marketing (buzz marketing) can contribute to the public acceptability.

On the other hand, the introduction of a vehicle penetration growth scenario comes with certain disadvantages as well:

- The scenario implies that before the vehicle penetration growth scenario can start, all roads will have to be incorporated into the system at once. Besides great social nuisance from the technical installation project, this comes with substantial planning risks and high costs;
- When the introduction starts with a small percentage of the vehicles, on only a few kilometre of road, the advantages of the geographical growth scenario disappear (no broad testing of the database and back office, no testing of the system on a large scale, people are only rarely confronted with the system).
- Because road side equipment costs are made for only a small group of vehicles, the costs of this scenario are high in comparison with the income that it generates and in comparison with the amount of users that are confronted with the system.
- The scenario is still far away from the final road pricing scheme;
- We believe that starting with a specific group of road users will always lead to a decrease in acceptability of the system. For example starting with trucks will result in decreasing acceptability within this sector and the powerful NGO's that represent them, or starting with light users will result in a 'cash cow syndrome' with the heavy users. Interviews with representative NGO's underline this.

3.3.2 Conclusions on vehicle penetration growth scenario

We would not recommend including a vehicle penetration growth scenario in the implementation strategy. There are no significant technical, acceptability or risk factors that have to be addressed or can be solved with this scenario.

Advantages of the geographical growth scenario (which we favour) are best utilized when all vehicles are included into the system from the start. The gradual geographical introduction of road pricing is favourable above the vehicle penetration growth scenario, because reliable and cheap (compared to other technologies) GPS technology is not available yet and therefore alternative technology is needed. Furthermore, combining vehicle penetration growth and geographical growth will introduce new risks in terms of costs, time and acceptability. Especially when the implementation of road pricing can be combined with a possible introduction of Electronically Vehicle Identification (EVI), there are no cost-, efficiency-, risk-, or other arguments to include this scenario.

Before starting with the geographical growth scenario, all cars will have to be provided with a basic OBU (DSRC or RFID based). This will take 3 to 5 years, depending on developments concerning policy on the periodic safety check (APK; the installation will become part of this check). Depending on demands and wishes of the customer, a more sophisticated OBU can be obtained for travelling in other European countries or for added services.

3.4 Overview of conclusions

As discussed before in this chapter, the three main axes of change cannot be analyzed without taking into account the interdependencies between them. This paragraph concludes the chapter summarizing the most important conclusions:

- It is useful to introduce a functional growth scenario in the implementation strategy, by means of a gradual change from BPM and MRB towards road pricing;
- It is useful to introduce a functional growth scenario in the implementation strategy, by means of starting with a flat price and introducing price differentiation later in the process;
- A geographical growth scenario is depending on, but not the same as, the technical installation of road side equipment
- It is useful to introduce a geographical growth scenario to the implementation strategy, by starting with one or more pilot projects, followed by road pricing on the main roads. The scenario finishes with road pricing (administrative or marginal) on all roads;
- The moment at which BPM and MRB can be phased out in favour of road pricing is depending on the status of the geographical growth scenario;
- A vehicle penetration growth scenario is depending on, but not the same as, the technical installation of OBU's in the vehicle fleet
- It is not useful to introduce a vehicle penetration growth scenario to the implementation strategy. OBU installation is however still apparent.

4 Implementation strategy

This chapter describes the implementation strategy that is, in our opinion, most suitable for a manageable introduction of a national road pricing scheme in the Netherlands that will be accepted by the general public and road users. Table 3 gives an overview of the technical characteristics of this scenario. In our opinion a good implementation scenario does not only consist of a thorough elaboration of the axes of change that are described in the previous chapter, but also (and even more important) on a good constitutional development and organisation, make sure the scheme will be accepted by the public. In this chapter this will be elaborated further.

The scenario is based on choices that were made and elaborated in the previous chapters, and finalised by organisational aspects and aspects of acceptability. Although we believe this scenario is the most appropriate one, it is good to consider the fact that other people may disagree with our choices in the previous chapter. Because other choices will lead to other implementation scenarios, appendix VIII gives a short description of the characteristics and effects of four alternative scenarios (wait for GPS, vehicle penetration, geographical scenario that grows on a regional basis, only new cars are obliged to carry OBU).

	Phase 0	**Phase 1**	**Phase 2**	**Phase 3**
Functional growth scenario	MRB/BPM	MRB/BPM, road pricing on pilot project	Flat or differentiated rate on main roads, phasing out of BPM	Differentiated road pricing, phasing out of MRB
Geographical growth scenario	No road pricing Technical installation and testing road side equipment (technical pilot)	Pilot Projects (max 3)	Road pricing on main roads	Road pricing on entire network
Vehicle growth scenario	No vehicles No OBU Technical installation and testing of OBU (technical pilot)	All vehicles RFID or DSRC OBU	All vehicles RFID or DSRC OBU	All vehicles GPS, RFID or DSRC (first step); GPS (second step)

Table 3: characteristics of implementation phases

First, this chapter will describe the timeline of this scenario, followed by an elaboration of key elements and the calculation of costs. The chapter also elaborates on some legislative and juridical issues.

4.1 Implementation strategy timeline

Figure 7 draws the timeline and interdependencies of three main changes within the system development, based on the starting points that were formulated in paragraph 3.4.

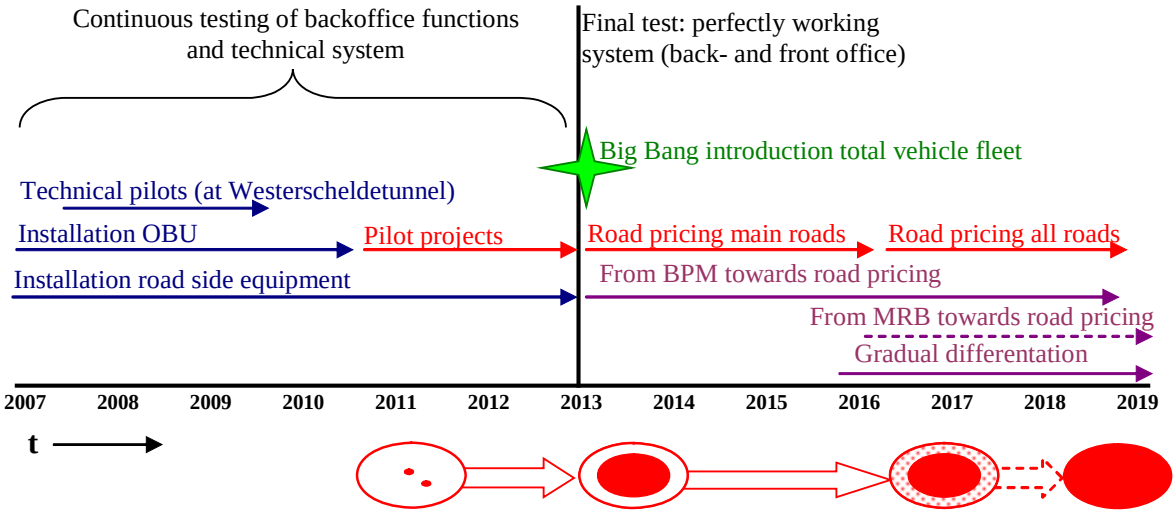

Figure 7: overview system development in time

4.2 Key elements of the implementation strategy

An acceptable implementation strategy is not determined by an acceptable system development as elaborated in the previous chapter alone. Much more than that, acceptability is determined by the installation of the right organisations and structures, as well as low boundaries for using the system.

The technological development of GPS based front office technology is a very important issue when discussing an implementation strategy for road pricing. However, GPS technology at present is not suitable to be implemented and also very expensive. Developments indicate that in the future GPS will be the best technology for road pricing, but mobility problems and congestion are very urgent and need solutions very soon. Other technologies than GPS are very suitable for introducing road pricing sooner (technically suitable and much cheaper); and can, in the future, be used besides GPS techniques.

We have chosen to introduce road pricing, using these other technologies, while leaving all the possibilities for GPS systems open. This way road pricing will not be depending on one technology, which will reduce risks and costs.

This strategy, thus, comes with the following key elements:

– Front Office Technology;

- Creating a market (for OBU's);
- Use of existing RDW database;
- Enforcement organisation;
- Interoperability.

Apart from tax constellation the story on the key elements doesn't really differ from phase to phase. The elaboration in the upcoming paragraphs is based on the philosophy that to end up in phase three properly, an integrated solution for all phases has to be presented (and therefore, the key elements will not be discussed for each phase separately).

4.2.1 Front office technology

The OBU will be used to charge the customers. When using GPS to start with road pricing, the customer will be confronted with a costly OBU (around € 250,- based on present predictions) and with no direct benefits that come from that (a € 250 device to pay tax). That is hard to explain to the public, and thus a possible acceptability risk. A technology growth scenario from simple and cheap solutions towards more advanced and expensive solutions could reduce this risk.

This approach asks for a separate and flexible backoffice that can handle all kinds of front office technologies, a back office that operates separately from the front office. Such databases are already available in the market. Such a backoffice could be used for the introduction of EVI as well, thus creating even more synergy. As already stated, the RDW wants to introduce EVI, but an in-car solution based on GPS or Galileo is not ready yet. Other possible technological solutions are RFID or DSRC.

Both RFID and DSRC technology are based on the radiographic communication waves. The main difference between these two, besides the wave-length, is that RFID doesn't need a battery in the OBU and DSRC does. The RFID OBU will be activated trough a loop in the asphalt and will be read by another loop, where the DSRC OBU is constantly active. Because no battery is needed, the price of a RFID OBU can be set between 1 (one) and 2 (two) Euros (excluding a box of about €5).

For both DSRC and RFID road side equipment is needed; it will be advisable to include a geographical growth scenario into the implementation strategy, to minimize social nuisance. To avoid rat run traffic, road pricing on the main roads should include the main urban and regional roads as well (in other words, the geographical growth scenario's second phase includes not only highways, but also main urban and regional roads). This is incorporated in the cost calculations in paragraph 4.3.

When a further development of GPS technology allows the registration of kilometres in the car to be more reliable and cheaper, the last growth phase of the geographical scenario can be started, and road users pay for driving on secondary roads as well.

RFID technology has one big disadvantage in comparison with DSRC and GPS technology. It is not mentioned in the EU directive regarding interoperability of OBU's. This item will be elaborated in paragraph 4.4.

To summarize this paragraph the following can be concluded:

- An independent back office gives a lot of flexibility during the implementation of road pricing;
- Implementing alternative technology first instead of the required GPS/Galileo (DSRC or RFID) could decrease costs and risks to a large extend;
- The end scheme and objective remains a complete distance based price, in which GPS is used to measure these travelled distances.
- In case RFID technology would be used the combination with EVI is possible. This could lead to great synergy between both projects.

With the elements mentioned in this paragraph a structure that is flexible for future use is designed (it makes the development of an OBU market possible), but above all it gives the customer a very easy access to road pricing.

4.2.2 Create a market for OBU's

When a stable structure, with a backoffice that can handle every OBU, is in place, there is no limitation at all for the market to introduce an OBU that is based on other technology than on GPS or Galileo (as defined in the requirements of the government). The industry can offer all kinds of features, requirements or added services (such as navigation systems, interoperability with toll operators, parking facilities, etc) to seduce the customers to buy their OBU for road pricing. In case of this approach the Government will be responsible for a basic structure that makes road pricing possible. The costs of this basis structure will be much less than a big bang introduction of road pricing. The rest of the costs are a responsibility of the industry.

To keep a focus on the final phase of the road pricing scheme, the government could stimulate or enforce the industry to incorporate a GPS / Galileo based OBU's in every new vehicle. Also, the government can make the private acquisition of GPS based OBU's more attractive (discounts) or obligate. This means an implementation scenario as drawn in figure 8.

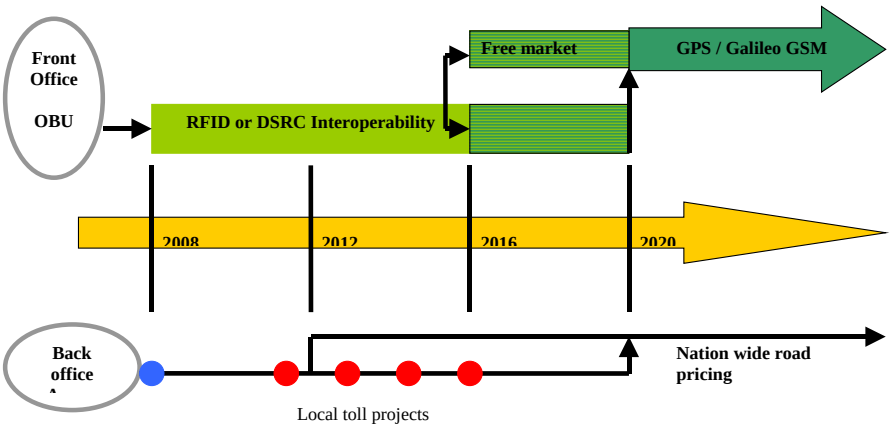

Figure 8: development of an OBU market

A good example of how the creation of a market can boost a project can be found in the development of GSM/GPS techniques for inland shipping. Around 1996 the Rijkswaterstaat wanted to introduce a new system (BICS) for inland barge-skippers, that would make it possible to send information about ship, cargo, destination etc. to the authorities with GSM technology. Within a very short time, almost all ships volunteered to participate, because the system could also be used for sending messages to the children and other family (an added service). Together with (in the first phase of the project) the provision of free software, this gave a big boost to the project and to the use of computers and internet on board; in a few years almost all ships participated. Nowadays the inland barges almost all have GSM/GPS devices with several services, all developed by the market of hardware and software providers. In the meantime this market also provided cheaper electronic navigation devices, with many features, for pleasure yachts. The government didn't need to stimulate these developments.

4.2.3 Existing RDW database

As stated in chapter 2, it is useful to start with an existing database. The data base of the Rijksdienst voor het Wegverkeer (RDW) is most suitable, because of the following elements:

- Every known car in the Netherlands is already registered;
- There is a legal obligation and procedure for customers to register mutations;
- RDW has experience with working with a nation wide data base;
- RDW has connections with foreign colleges;
- The data base can be used for enforcement (will be elaborated in the next paragraph).

Besides these advantages there is one other issue that is of great importance for a possible role for the RDW. The RDW itself is looking for a technology that can be used for an electronic license plate (or Electronic Vehicle Identification; EVI). This electronic device must be unbreakably connected with the vehicle, and has to be read with road side equipment. Due to RDW's responsibility for the search of stolen cars or so called CAT Catchers, the effectuation of EVI is priority number 1 for this organization. In the electronic devise needed for EVI a number is stored that probably will be the same as the unique chassis number of the vehicle (so called Vehicle Identification Number; VIN).

In principle the technology behind tolling, road pricing and the electronic license plate could be the same. Certainly when the unique number of an OBU used for road pricing is the same as the VIN number. There will be a lot of synergy (introduction of EVI makes road pricing cheaper; road pricing makes the search for stolen cars easier) the moment both road pricing and EVI make use of the same technique, same OBU, same data base and same OBU or VIN number. From the point of view of road pricing implementation, this will reduce costs, create a bigger social benefit, creates public acceptability and reduces risks.

The moment both developments will be put together there is even a possibility to start with a pilot for EVI within a few years and use this pilot to test the road pricing scheme (technical pilot).

There is one constraint regarding EVI which could conflict with the requirements for road pricing. The OBU used for EVI must be unbreakably connected to the vehicle. A removable OBU as is used for example for electronic tolling in the Westerscheldetunnel will not be usable for EVI. A suitable solution is provided by Galileo/GPS application that is expected to be built in from factory. But these onboard applications are not expected widespread before the second half of next decade. Other technologies, based on DSRC or RFID might provide a solution for this (see also paragraph 4.2).

Using the RDW database does not mean that the RDW has to be responsible for the road charging itself. The database used for road pricing must be separated from the RDW data base, mirroring the database with another one. If not it is possible that the data used for road pricing disturbs the usage of the RDW application for its own use. Risk and privacy are also arguments in favour of this. Based on the elements and comments mentioned above, a possible structure for using the RDW database could be drawn as seen in figure 9.

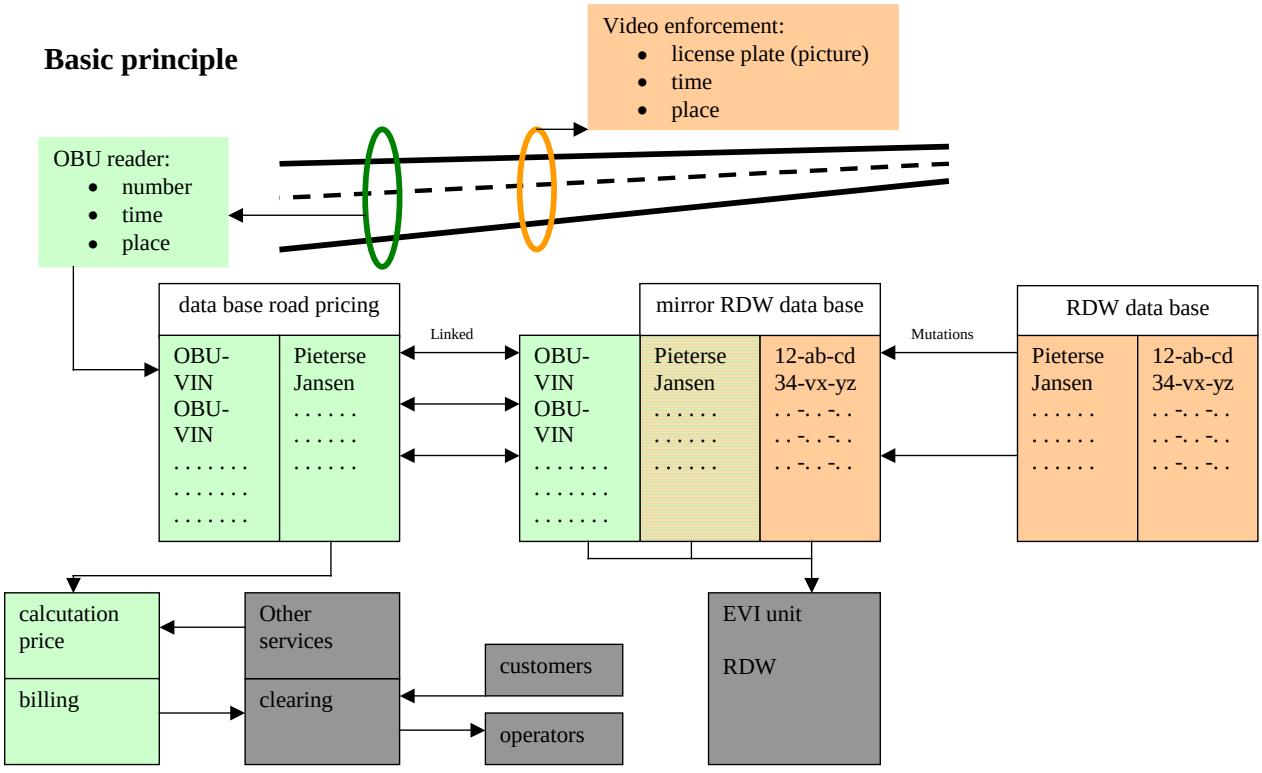

Figure 9: Use of RDW database

4.2.4 Existing enforcement organisation

Using existing structures is a reliable, easy and cheap way to introduce a system based on marginal costs. There are two different approaches to execute enforcement using existing structures:

– Privately by hiring bailiff services;

– Publicly by Centraal Justitieel Incassobureau (CJIB).

Private by hiring bailiff services

For the benefit of petrol stations, bailiffs elaborated a private enforcement scheme for violators who make use of services of petrol stations without paying. A picture is taken of every license plate, including of course those of violators. The bailiffs have the right to make use of the RDW data base and to verify the owner belonging to a license plate. If the owner is known the bailiffs present the violator a fine. The fine consists of two parts: the first one is an invoice for the purchased petrol; the second part represents the costs of the bailiffs. To assure the fine is a realistic fine in relation to the verdict, the bailiffs must work very effective to keep the cost of enforcement low.

Disadvantage of using the present private enforcement scheme is that still not every procedure is automated due to the low amount of violators. In case of road pricing a fully automated system is needed.

Public by CJIB

The CJIB is a department of the ministry of Justice and responsible for collecting all public fines (like a tax). The CJIB already works with big data streams and also works together with the RDW. Furthermore, RDW already has good contacts and contracts with their foreign counterparts, to include foreign road users into the system.Due to the fact that the CJIB is strictly bound to the enforcement of public laws, the CJIB is not used to working in a private environment. This implies:

1. When the business model of the road pricing scheme makes private involvement possible in operating the road pricing scheme it must be made possible for the CJIB to become involved.
2. Instead of the cost effective approach of bailiffs as a private entity, the CJIB has a public responsibility, and a fiscal (discrimination is not allowed) approach which means that 100% of the invoices must be collected.

The involvement the CJIB (or Bailiffs) in the road pricing scheme is drawn in figure 10.

The working of this scheme is very simple. At the moment a car is identified, but no OBU is detected, the picture taken from the license plate of the vehicle is stored. If the license plate is found in the data base, together with a name and OBU number, video tolling will be applied. If one of these elements isn’t known CJIB will take care of enforcement. In case of a foreign license plate the process starts with the RDW to verify the foreign owner (contacts between CJIB and foreign colleague organisations for clearing and settlement of the fines already exist).

The enforcement scheme must be designed to scare off people. This is done by introducing a high fine, as a first step. Next, a tight enforcement regime establishes a tight paying regime. If one doesn’t pay the fine, one receives extra penalties.

A fiscal or economical approach of enforcement does not differ very much. When the total amount of costs of enforcement equal the revenues of the enforcement, economical break even is reached. But to make it work, the main goal is not to get break even, but to raise awareness that enforcement is effective. An enforcement scheme based on a fiscal approach would be effective for (almost) the fully 100%.

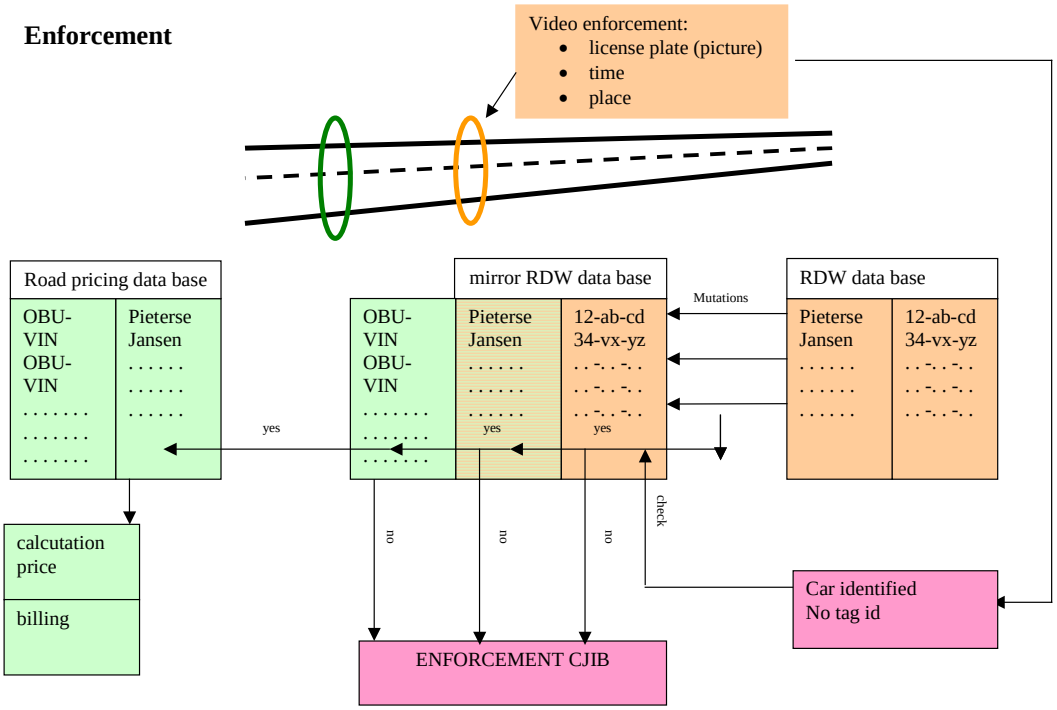

Figure 10: enforcement scheme

The entrepreneurial and the economical / fiscal approach don't differ so much in the end; CJIB has a better track record when it comes to large data streams and automated procedures, but in the end the question remains whether Bailiffs and CJIB are willing to provide the service and are able to provide this service in a cost effective way.

Figure 11 shows some pictures of the enforcement scheme database.

Figure 11: enforcement scheme database applications

4.2.5 Interoperability

The European Commission and Parliament already accepted an EU directive concerning Interoperability. According to this directive the following three technologies are allowed:

- Satellite based technology;
- Mobile communication based on GSM-GPRS technology;
- 5.8 GHz Microwave technology (DSRC).

Towards an Interoperable Europe two projects have been started to make interoperability possible:

- Pista: concerning the technological interoperability. Analysis of the technological constraints for an interoperable OBU;
- Cesare: concerning the commercial interoperability. Analysis of European wide contractual constraints to make it possible to have one contract and one invoice while making use of the services of different toll operators.

The objectives of Cesare could be compared with the mobile phone market. A customer has a contract with one provider and gets one invoice, regardless where the customer has used his mobile phone in the Netherlands, Belgium, USA, etc. In this case the provider takes care of interoperable contracts with other providers. The comparison with the mobile phone industry also stresses the need for a commercial business case for interoperability. The European Commission can stimulate interoperability but the industry has to make it possible. This means that interoperability with an acceptable price will only be possible based on a Europe wide commercial business case. Until that moment, only regional initiatives will have an acceptable business case, like in the Nordic countries, Alpine countries and between Spain

and Portugal. A European wide business case is not expected before the introduction of Galileo (the introduction of a bigger market).

Interoperability could also be of great importance for the acceptability of the Dutch road pricing scheme. With interoperability we separate two possibilities:

1. Interoperability could mean for the Dutch customers an added service which gives the customer the possibility to use his Dutch OBU and contract in France when driving south for a holiday.
2. Interoperability could mean for a German truck driver that he could use his Maut as legal device on the Dutch roads.

These possibilities are elaborated below.

The moment the Dutch toll operator has an agreement with, for example the French Liber-T (French OBU) organisation on how to settle the cost of services from French organization, interoperability comes down to a readable OBU. In case the Dutch scheme will be based on DSRC this is no problem, in case the Dutch scheme will be based on RFID technology, the customer can buy, borrow or lease a Dutch OBU that has European standard technology incorporated in it, as well as RFID.

Interoperability of foreigners on Dutch roads can be handled the same way. Once again this is more a contractual than technical question. Foreign and Dutch operators make an agreement that settles the costs of using each others toll roads. The Dutch operator makes sure his road side equipment can read EU standard techniques (in case the Dutch scheme will be based on RFID, he makes sure the equipment can read this as well). The costs of this will not cause the implementation of the road pricing scheme to be much more expensive, because the price of OBU's (80% of the original total price) has been taken out of the implementation.

Both examples show that interoperability is more a contractual or commercial question than a technical one. It should be noted that whatever technology will be chose, interoperability can always be managed by cash payments.

As stated before, acceptability of the road pricing scheme by the customers is essential. This means that road pricing will have to have an easy access based on a very cheap OBU. To make this possible the cost of interoperability could be delivered as an added service for Dutch and European customers. Added services will then be the responsibility of the operator / OBU issuer. Instead of an obligated expensive OBU which makes interoperability possible, a voluntary OBU (presented by the market) gives the customers much more satisfaction.

4.3 Cost calculations

The presented implementation strategy is not only more reliable, but also cheaper than starting with a GPS based OBU at once. This paragraph will elaborate on the costs of the suggested implementation strategy and the costs of some variations on this scenario. It will take into account several frontoffice technologies and two possible scenario's for the avoidance of rat-run traffic. All statistical information is based on the input from the Ministry

of Transport. All calculations are based on 2006 prices. We consider both capital expenditure (CAPEX; or investment costs) and operational expenditure (OPEX).

It should be noted that the numbers presented in this paragraph are the result of a rough estimation, based on standard cost parameters of road pricing projects in Europe and standard statistics of the road pricing scheme in the Netherlands. Specific calculations and measuring may change the results (positively or negatively). Nevertheless, the costs as presented give a good idea of the order of magnitude of a national road pricing scheme in the Netherlands.

4.3.1 Pilot phase (and installation of OBU's)

Because the implementation strategy doesn't imply a vehicle penetration growth scenario, the installation of OBU's will have to be completed, before the start of the pilot phase. Depending on the chosen technology the costs for this operation are as described in table 4 (based on 8.485.000 vehicles, prices GPS OBU from 'clarifications on price per kilometre cost estimates 2005, version 12042004'of the Ministry of Transport).

As can be seen in table 4, there is a great difference in the OBU costs, for different front office technologies. For installation costs we have assumed that it takes 15 minutes to install an OBU and the hourly fee for this work is € 45,-. The reason RFID and DSRC are less expensive than GPS is explained by both the price of GPS and the installation costs.

It should be noted that the installation costs can be reduced to almost zero, when the OBU is attached to the front window screen by the customer itself. Experiences in Portugal, Austria, the Czech Republic and other countries outside Europe underline that with a good enforcement organisation, fraud will be very low and all customers will place the OBU in their vehicles. Because in the Netherlands prices will be differentiated based on (among others) vehicle characteristics, and to avoid fraud we will assume that installation will not be done by customers. Furthermore, joining forces with EVI for cost and risk synergy requests that the OBU will be installed irremovably on the cars.

Prices in k€	**acquisition**	**Installation & distibution**	**Total**
GPS	2.600.000		**2.600.000**
DSRC	127.275	112.426	**239.701**
RFID	59.395	112.426	**171.821**

Table 4: OBU CAPEX (Investment costs)

In time these costs will be as described in table 5 (in this example based on RFID, including installation costs), assuming the installation can start in 2007.

The operational costs for the OBU consist of replacements of broken OBU's (RFID and DSRC) and the replacement of empty batteries (DSRC). On a yearly base around 4% of the RFID OBU's will have to be replaced (a mean time between failure of 25 years is realistic or even conservative, because it is a noncomplex technology). The battery of the DSRC OBU is the weakest link for operational costs. About every 5 years (3 to 9 years) this battery will have to be replaced (total operation costs € 6,-). On the other hand replacements of the OBU itself are only necessary for less then 1% of the OBU's (based on experiences in Portugal). Yearly operational costs for the OBU's are:

- DSRC: € 11.455.000
- RFID: € 6.194.000

Prices in k€	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Equipment	16.970	16.970	16.970	8.485	0	0	**59.395**
Installation	27.273	27.273	27.273	13.637	0	0	**95.456**
Registration	0	0	0	0	0	0	**0**
Distribution	4.849	4.849	4.849	2.424	0	0	**16.970**
TOTAL CAPEX	**49.092**	**49.092**	**49.092**	**24.546**	**0**	**0**	**171.821**

Table 5: RFID OBU CAPEX in time

It should be noted that OBU that are attached to a car (and cannot be taken into other cars) will result in other operational costs, because cars usually don't last for 25 years (the mean time between failure of the OBU). This means that for every new car a new OBU will have to be installed. When industry will install them their selves, these costs can be left out of the project costs (lower OPEX); otherwise the OPEX will be higher.

Besides the costs for the acquisition, installation and maintenance of OBU's, for the pilot phase the costs for the back office will be important. Experience from other European countries prove that the CAPEX for this backoffice are about € 10.000.000,-. This includes the development of a backoffice organisation, mirroring the existing RDW database, equipments (computers, cables, etc) and information systems (software). Operational costs of this backoffice are only calculated for the next phase of the implementation strategy.

In this phase road pricing is introduced at only one or two locations. This means that the costs for road side equipment can be very low in principle (depending on the amount of road stretches and that are included into the pilots). For planning reasons (transition to road charging on the main roads), however, it is necessary to start with the installation of all road side equipment from the moment you start with the installation of OBU's. This means that in

this phase already a great part of the road side equipment has been installed. Paragraph 4.3.2 shows the costs that have been made for road side equipment the moment the pilot phase starts.

4.3.2 Road pricing on the main roads

For the introduction of a road pricing scheme on the main road network all road side equipment will have to be in place. Road side equipment is used for road pricing and for enforcement purposes. In case the OBU is based on DSRC technology, equipment for both purposes is attached to gantries above the road. In case a RFID OBU is used, the road pricing technology will use tubes within the pavement; enforcement equipment will use gantries as well. Figure 12 shows the working of the DSRC system.

Enforcement is carried out using (at least) two gantries and works as follows (see figure 13):

1. a vehicle is detected by the system;
2. the system checks whether it gets a signal from the OBU
3. if not, pictures will be taken (from the front and from the rear) and video enforcement will commence.

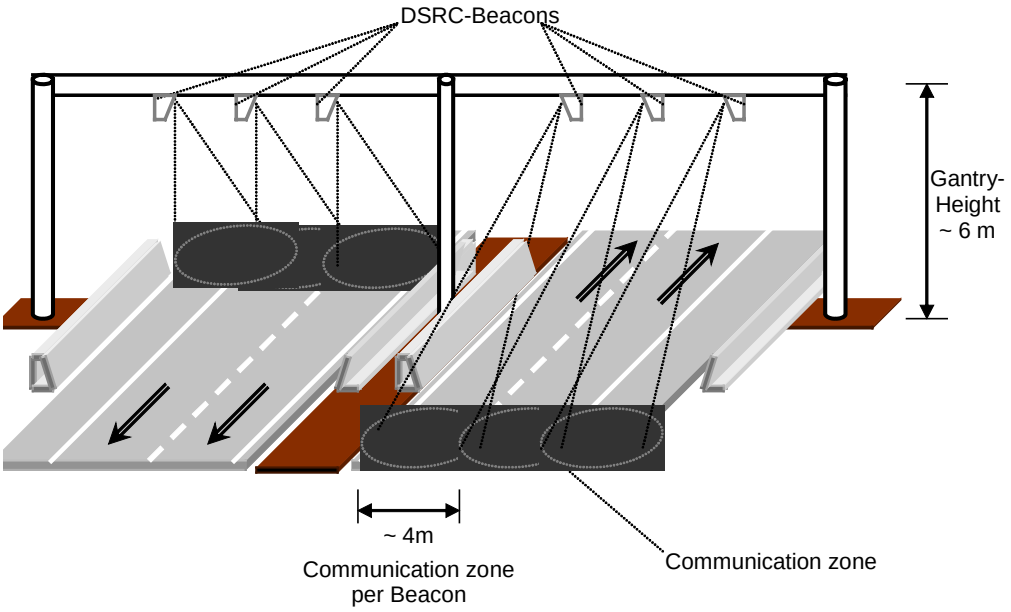

Figure 12: Road pricing with DSRC (excluding enforcement equipment)

Because both front office technologies depend on different techniques (gantries or tubes) the CAPEX for the road side equipment will differ as well.

Figure 13: Enforcement

For a DSRC based system, on each stretch of road a gantry will have to be installed (cost including installation and power € 100.000,- each). In the Netherlands already a lot of gantries are in place. All gantries will have to carry antenna's (beacons) for the road pricing (€ 50.000,- each, including installation, etc.). Enforcement can be executed using less measuring points, depending on the suitable strength of the enforcement system. Each point costs € 200.000,- (equipment, including installation, excluding the gantry). Based on 600 stretches of highway, with an average of 5 lanes (in two directions), road pricing on another 600 stretches of urban and regional roads to avoid rat-run traffic, and an enforcement point every 5 stretches, the CAPEX for the road side equipment will be € 374.000.000,-. This is including the development of 200 mobile enforcement teams[8]. These CAPEX will become € 554.000.000,- when, instead of 600, 1200 stretches of road will have to be equipped to avoid rat-run traffic. The CAPEX will be € 734.000.000 when enforcement equipment will be installed on all stretches.

The calculation of the OPEX for the road side equipment is based on the assumption that every year 6% of the equipment will have to be replaced. This percentage is based on experiences in other countries. The yearly costs for the road side equipment will then become € 35.600.000,-.

The operational costs for the backoffice consist of the processing of transactions and the billing. Furthermore, here should be a customer care centre (call centre and helpdesk). Our estimations set the price for this on € 50.000.000,- a year.

In total the CAPEX and OPEX, as a function of time, for DSRC and for RFID are given in tables 6 and 7.

[8] The costs for enforcement could be very low when road pricing joines forces with EVI. EVI will require a 100% secure identification of the vehicle, road pricing could use this methodology as well. Enforcement will still be necessary (to make sure this system works and for foreign users), but can be done with smaller budgets and efforts.

DSRC technology (600 + 600 gantries)	Total	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CAPEX	**624.201**	**132.486**	**132.486**	**132.486**	**98.243**	**64.000**	**64.000**	**0**	**0**	**0**	**0**
OBUs	**239.701**	**68.486**	**68.486**	**68.486**	**34.243**	**0**	**0**	**0**	**0**	**0**	**0**
Equipment	127.275	36.364	36.364	36.364	18.182	0	0	0	0	0	0
Installation	95.456	27.273	27.273	27.273	13.637	0	0	0	0	0	0
Registration	0	0	0	0	0	0	0	0	0	0	0
Distribution	16.970	4.849	4.849	4.849	2.424	0	0	0	0	0	0
Road Side Equipment	**374.000**	**62.333**	**62.333**	**62.333**	**62.333**	**62.333**	**62.333**	**0**	**0**	**0**	**0**
Gatries (including installation)	360.000	60.000	60.000	60.000	60.000	60.000	60.000	0	0	0	0
Mobile Enforcement	14.000	2.333	2.333	2.333	2.333	2.333	2.333	0	0	0	0
Back Office	**10.000**	**1.667**	**1.667**	**1.667**	**1.667**	**1.667**	**1.667**	**0**	**0**	**0**	**0**
Equipments (computers, comunications,...)	5.000	833	833	833	833	833	833	0	0	0	0
Information Systems	5.000	833	833	833	833	833	833	0	0	0	0
Miscellaneous	**500**	**500**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Organization Development	500	500	0	0	0	0	0	0	0	0	0
OPEX	**0**	**97.055**	**83.055**	**83.055**	**83.055**	**83.055**	**83.055**	**83.055**	**83.055**	**83.055**	**83.055**
OBUs		**11.455**	**11.455**	**11.455**	**11.455**	**11.455**	**11.455**	**11.455**	**11.455**	**11.455**	**11.455**
Repair/substitution of OBUs		1.273	1.273	1.273	1.273	1.273	1.273	1.273	1.273	1.273	1.273
Batery Repair		10.182	10.182	10.182	10.182	10.182	10.182	10.182	10.182	10.182	10.182
Road Side Equipment		**35.600**	**21.600**	**21.600**	**21.600**	**21.600**	**21.600**	**21.600**	**21.600**	**21.600**	**21.600**
Maintenance Costs		21.600	21.600	21.600	21.600	21.600	21.600	21.600	21.600	21.600	21.600
Mobile Enforcement		14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000
Back Office		**50.000**	**50.000**	**50.000**	**50.000**	**50.000**	**50.000**	**50.000**	**50.000**	**50.000**	**50.000**
Call Center/Helpdesk		6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000
Processing and Billing Costs		44.000	44.000	44.000	44.000	44.000	44.000	44.000	44.000	44.000	44.000
TOTAL COSTS	**624.201**	**229.541**	**215.541**	**215.541**	**181.298**	**147.055**	**147.055**	**83.055**	**83.055**	**83.055**	**83.055**

Table 6: cost overview DSRC front office

RFID technology (1200 Lanes)	Total	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CAPEX	**274.721**	**66.158**	**66.158**	**66.158**	**41.613**	**17.067**	**17.067**	**0**	**0**	**0**	**0**
OBUs	**171.821**	**49.092**	**49.092**	**49.092**	**24.546**	**0**	**0**	**0**	**0**	**0**	**0**
Equipment	59.395	16.970	16.970	16.970	8.485	0	0	0	0	0	0
Installation	95.456	27.273	27.273	27.273	13.637	0	0	0	0	0	0
Registration	0	0	0	0	0	0	0	0	0	0	0
Distribution	16.970	4.849	4.849	4.849	2.424	0	0	0	0	0	0
Road Side Equipment	**92.400**	**15.400**	**15.400**	**15.400**	**15.400**	**15.400**	**15.400**	**0**	**0**	**0**	**0**
Lane Tubes and Devices	15.000	2.500	2.500	2.500	2.500	2.500	2.500	0	0	0	0
Road Side Equipment Room	17.400	2.900	2.900	2.900	2.900	2.900	2.900	0	0	0	0
Gantries (Enforcement)	60.000	10.000	10.000	10.000	10.000	10.000	10.000	0	0	0	0
Back Office	**10.000**	**1.667**	**1.667**	**1.667**	**1.667**	**1.667**	**1.667**	**0**	**0**	**0**	**0**
Equipments (computers, comunications,...)	5.000	833	833	833	833	833	833	0	0	0	0
Information Systems	5.000	833	833	833	833	833	833	0	0	0	0
Miscellaneous	**500**	**500**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Organization Development	500	500	0	0	0	0	0	0	0	0	0
OPEX	**0**	**83.414**	**83.414**	**83.414**	**83.414**	**83.414**	**83.414**	**83.414**	**83.414**	**83.414**	**83.414**
OBUs		**6.194**	**6.194**	**6.194**	**6.194**	**6.194**	**6.194**	**6.194**	**6.194**	**6.194**	**6.194**
Maintenance Costs		6.194	6.194	6.194	6.194	6.194	6.194	6.194	6.194	6.194	6.194
Road Side Equipment		**22.220**	**22.220**	**22.220**	**22.220**	**22.220**	**22.220**	**22.220**	**22.220**	**22.220**	**22.220**
Maintenance Costs (excluding gantries)		4.620	4.620	4.620	4.620	4.620	4.620	4.620	4.620	4.620	4.620
Gantries Maintenance Costs		3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600
Mobile Enforcement		14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000
Back Office		**55.000**	**55.000**	**55.000**	**55.000**	**55.000**	**55.000**	**55.000**	**55.000**	**55.000**	**55.000**
Costs Data Communication		5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000
Call Center/Helpdesk		6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000
Processing and Billing Costs		44.000	44.000	44.000	44.000	44.000	44.000	44.000	44.000	44.000	44.000
TOTAL COSTS	**274.721**	**149.573**	**149.573**	**149.573**	**125.027**	**100.481**	**100.481**	**83.414**	**83.414**	**83.414**	**83.414**

Table 7: cost overview RFID front office

4.3.3 Road pricing on all roads

There are no significant extra costs involved in the transition from road pricing on the main roads to road pricing on all roads. Costs for GPS based OBU's are for the market and backoffice and road side equipment is already in use.

The presented strategy introduces a new and temporary technology to the road pricing scheme in the Netherlands, which might drive up the costs (after this first phase, GPS will have to be introduced still). This sunk costs are relatively low, because RFID and DSRC technologies are, at present, much cheaper than GPS technology. After GPS based OBU's are introduced, the main parts of the installations for RFID or DSRC can still be used for EVI and enforcement. The cost of depreciation and technology migration will be relatively low because of this and because the strategy relies on the development of a market for (GPS based) OBU's, which takes the costs for these OBU's out of the project (see BICS example in paragraph 4.2.2). Finally, the costs for the development of the back office will not be depreciated, because the backoffice can be used in all implementation phases.

4.4 Juridical aspects

This report has proposed several elements for a successful introduction of a road pricing scheme in the Netherlands. Some of these elements are impossible for the moment in the light of present legislation and laws or are influencing or influenced by legislation in another way. This paragraph discusses some of these aspects.

4.4.1 Fading out taxes, fading in road pricing.

All scenarios as mentioned in subparagraph 3.1.1 will need adapted legislation to ensure that the fading out of taxes is possible, in relation with the fading in of road pricing. The taxes that are involved are MRB, BPM and the provincial and waterschap taxes. Constraint for the MRB is the euro directive 1999/62/EG, that states that the MRB for heavy trucks over 12 tons will be bound to a minimum. A decrease under this minimum is not allowed. The implementation scenario's can follow this constraint, because of the possibility of different tariffs for different categories.

Before giving a legal basis for the fading in of road pricing, it must be decided what institutions and organisations are involved, and how responsibilities and work is distributed among those entities. The following aspects must de settled:

- Legal grounds for road pricing (update WBM);
- Legal grounds for the Back Office (private billing of public tariffs);
- Privacy aspects;
- Gearing plans to European regulations (including interoperability);
- Enforcement of road pricing.

The work to be done differs hardly for the different implementation scenarios. The most important feature is the choice what institutions are needed, and how the government will divide the responsibilities. The sooner this is decided, the more time for elaboration of the legislation, and to start with the building of the executive organisation(s).

Regional and local taxes
The "provinciale opcenten op de motorrijtuigenbelasting" is a tax that varies regionally and is levied as an extra amount on top of the MRB. It has a yearly revenue of about € 1 billion (MRB sec about € 2.3 billion); this delivers on average 25% of the total revenues of the provinces. As long as the MRB is not abolished altogether, it will be possible to gather the "provinciale opcenten", but as soon as it has been diminished, there should be another system in place to levy this regional tax. As with other taxes, the starting point is that total revenue remains equal. Because present policy states that road pricing revenue will be used in total for the national infrastructure fund, replacing "provinciale opcenten" by the road pricing, whereas the revenues go to the provinces is not possible. Another solution might be to put all revenues into the national infrastructure fund, and allocate a percentage of this to the provinces. Then the provinces will lose, however, the right to determine the magnitude of their taxes.

The third alternative scenario in appendix VIII draws some changes that occur from the regional 'opcenten'.

4.4.2 Privacy Issues

These issues are covered by the "Wet Bescherming Persoonsgegevens". This law gives the possibility to work with private data such as an address or name. Art 8 gives the opportunity to work with private data in case that the owner has given his consent (for instance by contract) and in case that the data processing is necessary because of a public interest. This article gives sufficient ground for processing of private data in relation to road pricing.

An extra fact is that the back office principle that is submitted uses a copy (mirror) of the RDW file for the processing of data for the road pricing as such. This mirror can be cleaned of the unnecessary private data. Possible other services that are provided by the market will be ruled by contracts between the service provider and the customer. In these contracts the privacy elements are covered.

4.4.3 EU directives

The proposed scenario's are more or less in line with the existing EU directives and plans. It is advisable to incorporate the EU directives in the implementation as much as possible. If not, there will be a serious risk of procedures from private persons and organisations against aspects of the national road pricing system. The EU directives have not all been crystallised yet. So it is difficult to assess the risks yet.

For passenger cars there are no EU directives as yet. For freight traffic the existing directive 1999/62/EG gives constraints and possibilities for the heavy trucks (> 12 tons) on highways. These constraints will have to be met (werkprogramma "anders betalen voor mobiliteit,

DGP/WV/AbvM/U.06.00220"). This means for instance that for this category the MRB shall not decrease under a defined minimum, and road pricing is not allowed on roads other than highways. The proposed implementation scenario's make this possible. A special feature is the Eurovignet treaty, this forbids an extra road pricing for the area where a Eurovignet counts. With the proposed implementation scenario this extra road pricing is necessary. The Netherlands will have to follow Germany, and cancel the Eurovignet treaty.

In proposal 2003/0175 (COD) it is recognised that road pricing, only for trucks >12 tonnes on highways, has unwanted side effects. So it is proposed to make it possible to impose road pricing on all trucks > 3,5 tonnes on TEN highways and lateral main roads. Also it will be possible to set up a pricing system for all vehicles on all (other) roads.

Also of interest is the proposal 2003/0081 (COD) about the developments on financing and on interoperable tolling. The proposal about financing agrees with the general line of the plans for "anders betalen voor mobiliteit", and gives no constraints so far. The proposal about interoperable tolling states that only three technologies will be used: satellite navigation, GSM-GPRS communication and microwave technology (band 5,8 GHz). This means that the use of RFID is not allowed if this proposal will become a directive. A possible solution to this constraint is, as stated before:

- The front office can read all European technology;
- The back office can handle all information from foreign (European) OBU holders;
- Dutch customers who use only RFID technology can hire, borrow or buy an OBU for use in Europe from the service providers.

4.4.4 Wet bereikbaarheid en Mobiliteit

The existing law "Bereikbaarheid en Mobiliteit" only covers the possibility of pricing in three cases:

- Toll: only for new roads or for works to increase capacity;
- Express- lane tariff: a tax in relation with the traffic-intensity. The tariff is valid on a special lane, the "express lane";
- Pricing per kilometre, to be regulated by further detailed regulation.

At present, no pricing has been based on this law. Recently plans have been developed to update the WBM to new insights. The proposal gives somewhat more possibilities for road pricing, but it still is not enough to make the plans of "anders betalen voor mobiliteit" possible. Most important features are:

- The proposal incorporates only instruments for financing new infrastructure, not for road pricing on existing roads;
- The existing law and proposal define the mobility tariff (all sorts of road pricing) as a tax. This means that the tax laws are applicable. This means, among others, 100% enforcement. It is preferable that the mobility tariff is defined as a toll or fee that is regulated by the government. In this way there are more possibilities for the organising of billing and enforcement;

- The proposal gives no possibility for payment afterwards (service contracts); the possibilities are: payment in advance, on passage and immediate after passage;
- Stationing of the pay points need a joint decision of the ministers of V&W, VROM and finance;

In order to open the possibility for road pricing the WBM must be changed. In this process also the necessary institutional decisions can be made, like the regulation of the responsible institutions, regulation of decision processes like determination of tariffs. All in all (preparation, political decision, formulation of the law and rounding off), this will take at least 3 to 4 years.

5 Conclusion, acceptability of the presented strategy

This chapter will briefly confront the presented implementation scenario with the fundamentals for a successful implementation that were derived in chapter 2.

Show benefits in early phase of implementation

In the first phase of implementation benefits have to be seen by users to create acceptability. This means that the pilot projects will have an enormous influence on the national acceptability of road pricing. A suggestion was made to use a traffic bottleneck. Better accessibility might be a strong driver for positive feedback. From this point of view the introduction of road pricing could be linked to the 'versnellingsprojecten' as well.
Another positive driver for acceptability is a low price of goods. Since pilot projects are no substitutes for current taxes, another solution to explain the extra costs needs to be given. One is a private finance of the project and clear communication that the project is not financed by tax payers' money. Another is to decrease taxes a bit to substitute the higher income by toll. It might also help to execute these projects as an alternative for highly congested roads. Pay for time or be in a traffic jam!

Start with a limited scope and focus of implementation

The suggested (technical and functional) pilot projects have a limited scope. Since these projects don't discriminate between user- or vehicle types (limited or no differentiation to start with) the focus is on everybody. This implies that the OBU has to be working (technical pilot) and accepted as a way of paying (functional pilot). It has been set out that this is possible in a cheap and simple manner.

Gradual differentiation of prices

The differentiation of prices is not executed before the third phase (with the exception of differentiation between vehicle classes such as trucks, cars and motorists). In our implementation strategy the scope will grow from local to national projects. Before prices will be differentiated users have had the possibility to get used to the system of road charging. It would be the element of unfamiliarity with road charging (or lack of benefit) that makes it less acceptable to differentiate prices. Of course, creating acceptability by gradual differentiation of prices also means it might be wise to introduce congestion charges and other price differentiation measures slowly.

Create a market for managing changes and costumer satisfaction

It has been set out that by the development of a flexible backoffice that can handle all kinds of frontoffice technologies, it is manageable to implement (technological) changes, since these kinds of changes only have an effect on the front office. Also, by giving the market the space for creating state of the art solutions (i.e. GPS) or combining them with other solutions, important cost drivers are related to the market and commercial interesting solutions will be implemented quickly.

Use existing structures and organizations

The point was stressed before to use existing structures and organizations, mainly because existing structures and organizations reduce the risks and costs that new and non proven solutions hold within. Two concepts were launched in this implementation strategy. One is to use the database of RDW to combine user information with vehicles and OBU's. The other is the use of the CJIB organization for enforcement.

Communication, communication, communication

A communication plan is beyond the scope of this document. However, communication is a key element in creating acceptability. Apart from ways to communicate, which we will not elaborate on here, it is important that a message can be brought clear and transparent. We believe that a strategy that is implemented in phases, using existing structures, organization and simple technology at the start and makes no distinction between users is.

Easy to access for customers

The presented implementation strategy focuses on low costs, by introducing an OBU technology based on RFID or DSRC. The presented implementation scheme furthermore starts with low, non-differentiated prices.

The system is relatively simple and easy to explain and the creation of a market for OBU's makes it possible to fulfil individual wishes and demands on the technology and services of the OBU.

As explained in the former paragraph interoperability is opportune from the first phase on. The pilot projects are used as a platform for testing interoperable solution of OBU reading. The OBU reading portals are provided with interoperable reading systems. International users are billed by connecting several backoffices. Bureaucracy is kept to a minimum.

Appendices

Appendix I: The Principal's question

'This task aims at performing a detailed analysis with respect to different implementation scenarios of Anders Betalen voor Mobiliteit in the Netherlands'

The analysis shall take into account[9] existing institutional and legal context and policy. Besides that, the following aspects are to be addressed:

- user acceptability,
- high-level technical/organisational concept and how this may evolve in time,
- Cost and time schedule issues.

The assignment should cover different implementation scenarios, including, but not limited to:

- Implementation by vehicle characteristics (e.g. trucks, motorcycles, cars etc)
- Implementation by different locations (e.g. main roads, cities, regions, toll projects etc.)
- Implementation by user groups (e.g. 'heavy users', voluntary basis etc.)
- gradual introduction of differentiation (e.g. starting with a flat rate)

Besides that, Access is asked to work out 3 favourable implementation scenarios with a detailed analysis of the pro's and con's of each different implementation scenario, including financial risks/benefits.'

Finally Access is asked to perform a risk analysis to identify and prioritise the major risks in relation to the different implementation scenarios and to provide comments on the parts of the Requirements Specifications related to the implementation of road pricing in the Netherlands.

<u>Elements that have to be addressed</u>

Within the analysis, at least the following elements should be taken into account:

Different User Groups:
- Vehicles with Dutch licence plates and foreigners will the treated equally within the same system;
- Vehicles with Dutch licence plates and foreigners can be treated on different ways to achieve cost benefits;
- All vehicles with Dutch licence plates will be treated equally within the same system;
- Vehicles with Dutch licence plates can be treated on different ways to achieve cost benefits;

[9] The scope of the assignment is set out by DGP in the following documents and meetings:
- the document "scope phase 2 marktconsultatie";
- the document "statement of work subject 4";
- The meeting between DGP and Access on June 9th.
- Email : 'Update information on phase 2 assignments consultation "anders betalen voor mobiliteit"' of 19th of June 2006

Distance travelled:
- The use (kilometres) of the public roads (not the private roads)
- All the kilometres (number of kilometres) driven on all the roads in The Netherlands

Tariff differentiation on the basis of location accuracy:
- differentiated on the basis of location with an accuracy of 10 metres in urban areas
- differentiated on the basis of location with an accuracy of 50 metres in urban areas
- differentiated on the basis of location with an accuracy of 10 metres on highways/expressways
- differentiated on the basis of location with an accuracy of 50 metres on highways/expressways

Tariff Structure:
- A structure of tariffs with 3 different kinds of prices
- A structure of tariffs with 20 different kind of prices
- A structure off tariffs with more than 550 different kind of prices

Other:
- Inclusion of receiving money through the system besides paying for KM-price: Is it possible to give discount on the prices per kilometre or to pay back a part of the taxes that have already been paid on new cars, but which have not gone through the full depreciation cycle yet?
- Are there additional costs when there is an additional requirement (25) that all the ownership of all traffic information remains with the Dutch government.
- Are there additional costs to structure the traffic information to make it useful for dynamic traffic management?

The points above are to be analysed and consequences should be given in terms of costs, complexity, user acceptability and functionality.

Appendix II: Review on requirements

Since the conclusion of this report is to introduce road charging in phases, our advise is that requirements for all phases are set. In our opinion the introduction of road charging is divided in three phases: pilots, main roads and all roads.

Furthermore, we wouldn't advise to set the requirements and constraints for future technology too tight. With time, technology, policy and customer demand will change and requirements that were stated in 2006 will not apply in 2012. Preferably, requirements will have to set boundary conditions that stimulate developments like the forming of an OBU market.

Table 4 describes some comments on individual requirements as set by the government.

System functionality		
Requirement [1]	Road user charging shall be based upon the **distance travelled** with a vehicle in the Netherlands.	This requirement is a fundament of road charging and should be maintained through all phases, however not necessarily on all roads when introducing a technology and geographical growth scenario to th eimplementation strategy.
Requirement [2]	Road user charging shall be differentiated on the basis of **time**.	This requirement is evident in the second and third phase, but only *gradually*. After flat road charging is implemented for instance congestion charges between 4.30 pm and 6.30 pm can be set.
Requirement [3]	Road user charging shall be differentiated on the basis of the **location** of the vehicle.	This requirement is evident in the second and third phase, but only *gradually*. After flat road charging is implemented for instance areas with bottlenecks can be charged heavier than areas where there is no heavy traffic.
Requirement [4]	Road user charging shall be differentiated on the basis of **vehicle characteristics**.	When the strategy is followed and the OBU is coupled through a VIN number with the RDW database, vehicle characteristics differentiation is possible. The drawback however, is that the OBU has to be connected irremovably to the car.
Requirement [5]	Road user charging shall be introduced on **all roads** in the Netherlands.	This requirement is a fundament of road charging and should be maintained, but only to be applied in the last phase. Requirements in second phase would be "main roads".

Requirement [6]	The road pricing system shall have adequate **flexibility in its design** to allow changes in the parameters for road user charging as mentioned in requirements [1] to [5].	This requirement should be maintained through all phases. Prices are set in the back office. Information about distance is available through road side equipment (or coupling OBU with km counter), information about the vehicle is available by using for instance the RDW database and the coupling of OBU and VIN number. For distance, different times, locations and vehicle types the back office can set and change prices.
Requirement [7]	The road pricing system shall be **'free-flow'**.	This requirement should be replaced by 'free-flow or autonomous' to include a GPS based system, and is to be maintained through all phases.
Users		
Requirement [8]	**All road users** shall be charged for road use.	This requirement is a fundament of road charging and should be maintained, but with exception of the pilot projects. Foreign users are also included.
Requirement [9]	The road pricing system shall include possibilities/facilities to charge **occasional road users.**	This requirement is a fundament of road charging and should be maintained. The most easy way of living up to this requirement is to allow for cash payments. Another possibility is a cheap and accessible OBU, or an inbuilt OBU in cars, plus enforcement that can recognise foreign users and users without OBU as well.
Requirement [10]	The road pricing system shall include possibilities/facilities to charge road users with **foreign number plates**.	This requirement should be maintained. Joining forces with EVI will create synergy on this, because the RDW already has data-transfer contracts with their foreign counterparts. Before interoperability is a fact, it is possible to make OBU available cheaply (and on demand when entering our country) and to read standard EU OBU's with the front office technology.

Technological requirements		
Requirement [11]	The road pricing system shall comply with the **European directive** on the interoperability of electronic road toll systems (EU-directive 2004/52/EC)	As set out in paragraph 4.4, for personal vehicles no European legislative is existing. The RIFD technology does not comply with the EU-directive on interoperability, however is provides a cheap and simple solution for OBU's. Solutions are provided in 4.4.
Requirement [12]	The road pricing system shall be sufficiently **reliable** to ensure correct and adequate road user charging.	This requirement is a fundament of road charging and should be maintained. In our model, we centralized techniques that are known, simple and reliable. The pilot projects are proof of the pudding.
Requirement [13]	The road pricing system shall be sufficiently **reliable** to ensure correct and adequate road user charging. In particular: • the road pricing service organisation shall be adequately protected against loss of income due to system failure	This requirement should be maintained. In our model, we centralized techniques that are known, simple and reliable. The pilot projects are proof of the pudding. Of course, equipment can always break down. When the service organisation is made responsible for the reading equipment they protect themselves from loss of income.
Requirement [14]	The road pricing system shall adequately protect its users against **discomfort.**	This requirement could be maintained, but should be more specific. Cheap and accessible OBU's (especially when supplied by the market), free-flow and transparent costs can make this happen. Privacy issues can also be a part of this requirement.
Requirement [15]	The actual costs for driving (road charge) shall be **visible in the vehicle**.	By definition, this requirement will lead to high costs. Furthermore, it can be doubted if all users want this. This requirement will in our opinion be an added service to an OBU. In our analyses we described how a market can be created for OBU's, in the actual situation most likely resulting in GPS applications. It could be argued that these developments should also contain road charging applications, and if so, the costs should be visible.

Requirement [16]	The road pricing system shall be sufficiently safe and easy to use (human machine interaction) to avoid dangerous behaviour and social exclusion.	The OBU will be built in the car, without the owners' efforts. Contract design and customer care services provide accessible facilities.
Costs		
Requirement [17]	The **costs for development and initial implementation** of the road pricing system shall not exceed € 2,200 million	See cost calculations. The limit could be less then € 2,200 million
Requirement [18]	The annual **costs for operation and enforcement** of the road pricing system shall not exceed **5%** of the system revenue	Other European Experiences in Europe prove this requirement to be ambitious. However, by using existing structures and a flexible back office costs can be kept to a minimum. Be careful, during a pilot phase or other phases in which the system isn't fully operational yet, these percentages might be higher!
Implementation		
Requirement [19]	System developments for **acceleration scenarios** shall be able to migrate into the general road pricing system.	This requirement should not be maintained. The selection of pilot projects is based on other arguments then the selection of acceleration projects. There might be synergy in coupling pilots and acceleration projects, however this is not always necessary.
Requirement [20]	The road pricing system shall be designed, developed and built In such way that **different implementation scenarios** can be supported.	This requirement should be maintained. The proposed strategy is strongly designed on flexibility. The backoffice technology can support several strategies.
Requirement [21]	The road pricing system shall be designed, developed and built in such way that **future developments** can be incorporated.	This requirement should be maintained. Creating a market makes future development and changes in requirements possible. An independent back office in relation to the front office creates possibilities to implement future developments in the road pricing system
Requirement [22]	The road pricing system shall have adequate capacity to charge the road use of **8,159,000** vehicles	This requirement should be maintained. Accessibility of OBU's, front office choices and an open back office are key factors
Security and privacy		

Requirement [23]	The road pricing system shall have adequate **security measures** to: • Prevent fraudulent use of the system • Detect fraudulent use of the system • Recover from fraudulent use of the system	This requirement should be maintained. Enforcement is elaborated in the proposed strategy.
Requirement [24]	The road pricing system shall comply with national and international **privacy** regulations (Wet Bescherming Persoonsgegevens (WBP) and EU-directive 95/46/EC)	The "WBP" gives no constraints to the proposed strategy.

Table 8: comments of requirements

Appendix III: Risk analysis

The following instructions were set out by the Ministry:

Project: "Anders Betalen voor Mobiliteit"
Subject: Format for reporting Risk Inventory & Assessment, Consultation phase 2.
Date 15 June 2006

Introduction

As part of the Phase 2 assignment of the market consultation process, a report on risks is to be produced. In order to fit the different contributions into an overall Risk Assessment it is requested to follow the format described below. Contributions of each party involved and of the Principal's team shall be analysed with the objective to compose an overall and meaningful list of risks and derive a potential allocation between the public and private sector, as a preparation for a possible business model. The Risk Inventory & Assessment exercise is at this instant no more than a first action to create an overall description in the process of developing the first Cost Monitor for parliament. We do not foresee quantification studies at this point in time.

Which Risks and how to report?

A balanced and stable introduction of a Kilometre Pricing System that complies with the Functional Requirement Specification is the objective of the project. The system shall be operational in 2012.

Any risk that prevents the implementation of such a system requires due attention. Parties are invited to approach the risk analysis from different viewpoints or **Risk Sources**, such as*: technology, market developments, societal acceptability, politics and policy* (including the wider European scope). The risk is to be described as an **Event** that prevents the objective of the project to be met, along with a **Consequence** (time, cost, loss of functionality, other) to occur if the risk is not mitigated. A severity index is to be indicated by multiplication of probability of occurrence and Mitigation measures are to be described along with an indication of the Party best capable of managing that risk **(Risk Owner)**. Risk should be categorised along the different risk sources and there should be an indication of the **Project Phase** during which the risk is most likely to occur.

Severity index

A **Risk Probability** is to be estimated:

1 = very low
2 = low
3 = medium
4 = high
5 = very high

A **Consequence** is to be estimated:

Investment Cost: 1 = range € 5 M
2 = range € 20 M
3 = range € 50 M
4 = range € 100 M and more

Operational Cost: 1= range € 5 M/year
2 = range € 10 M/year
3 = range € 20 M/year
4 = range € 50 M/year

Time: 1 = range 3 months delay
2 = range 6 months delay
3 = range 1 year delay
4 = range 2 year and more delay

Functionality loss: 1 = all KM's, time dependent but no fine mesh place differentiation
2 = all KM's, time but no place differentiation
3 = all KM's but no time and place differentiation
4 = not all KM's, no time or place differentiation

The severity index is the multiplication of **Risk Probability** and **Consequence.**

The Risk Assessment Table

Risks are to be reported into the following format, to be prioritised along the number of the Severity Index:

Risk Event	**Risk Source**	**Consequence**	**Severity Index (RP * C = SI)**	**Project Phase**	**Mitigation Measure**	**Risk Owner (Public – Private)**

Table 9: risk analysis format

The table below describes the input from Access members for this assessment.

Risk Event	Risk Source	Consequence	Severity Index (RP * C = SI)	Project Phase	Mitigation Measure	Risk Owner (Public – Private)
SYSTEM PERFORMANCE						
Underestimation of fall out in driven kilometres	Traffic modelling and user behaviour	Revenues from road pricing are less than expected and less than MRB and BPM	12 (3*4)	Operational	Pilots for behaviour estimation; user surveys	public
No change in behaviour against prediction: still traffic Jams	User behaviour	System rejection	4 (1*4)	Operational	Price policy and differentiation	Public
Operation not cost effective for users, very expensive system	User behaviour, cost effectiveness	Search for alternatives, system rejection	4 (1*4)	Operational	Business case, Price policy and differentiation	Public / private
Benefits for users are less then predicted – more traffic jams and higher user costs	Acceptability	Rejection of system	4 (1*4)	Operational	Price policy and differentiation	Public
Road maintenance on low level	Cost effectiveness	Low accessibility and safety, acceptability of system decreases	6 (3*2)	Operational	Contractual agreement on level of quality of roads, safety and accessibility	Private
Market growth falls short of expectance	1 Frontoffice technology 2 Business (back office, clearing house, extra services) 3 Hardware penetration (no GPS/GSM on nearly every vehicle within time	1 No market push to the transition 2 Extra efforts in communication and enforcement 3 Time delay 4 No benefits in early stage 5 Acceptance low	8 (2 x 4)	Operational phase.	1 Laws (prescription for electronic registration of car, European interoperability, possibilities to provide services with the new techniques) 2 Standards	Public and private
Occasion car market devaluates by tax reforming	Legislative	Acceptability decreases, rejection of system	15 (5*3)	(Pre) Operational	One of the countermeasures that were presented in this document (par. 3.2)	Public
Not able to abolish BPM	Legislation	BPM still on, more administration	5 (5*1)	Pre-operational	BPM as low as possible	Public

PILOT PROJECT PERFORMANCE						
Implementation pilot projects more expensive than planned	Multiple	Acceptability decreases	9 (3*3)	Pilot	project management	Public
Implementation pilot later than planned	Multiple	Acceptability decreases	9 (3*3)	Pilot	project management	Public
TECHNOLOGY PERFORMANCE						
Front office does not work well	1 Hardware pay points 2 Readability RFID/DSRC	1 revenues stay behind 2 administration not in order 3 acceptability diminishes	1: 12 (3 x 4) 2: 12 (3 x 4) 3: 16 (4 x 4)	Operational phase	Implementation after severe tests and pilots	public
Back office has starting problems/ is not stable	Software, system management, difficulty and sheer number of transactions, specials and fraud	1 revenues stay behind 2 Time delay's 3 acceptation and payers discipline 4 costs of the system	12 (3 x 4)	Operational	1 Organisation and management 2 extra capacity at start 3 competent helpdesk (technical and financial), 4 bailiff	private
Not possible to irremovably put OBU in car (before pilot phase)	Technological / cost effectiveness / legislation	EVI not possible, RDW doesn't cooperate	8 (4*2)	Pre operational	Use of RFID tags, GPS, etc. / still use RDW database or create new database	Public
Different technology in operational phase (compared to pilots)	Technological / acceptability	Low acceptability for new method	12 (3*4)	Pre operational	Administrative implementation first before really using / transparent communication	Public
GPS OBU not provided on time	Technological	Strategy can't be based on GPS	0 (5*0)	Pre operational	Use RFID or other technology that does work and create market for new solutions	Public and later private
Market doesn't provide new OBU solutions (or not with right requirements)	Technological / Cost effectiveness / legislative	Delay	1 (1*1)	Operational	Keep using existing technologies	Public / market
OBU doesn't work or is easy to crack	Technology	Acceptability system decreases / increasing fraud and question for enforcement increases	4 (1*4)	Operational	Pilots / enough rights for CJIB	Public

Reading equipment doesn't work well	Technology	Acceptability system decreases	4 (1*4)	Operational	Pilots	Public
New technology not possible or reliable to read	Technology	Acceptability system decreases	4 (1*4)	Operational	Pilots with new technology	Public
Not possible to combine OBU with VIN	Technological / organisational	Constraint on enforcement (EVI)	4 (1*4)	Pre operational	Other way to connect OBU to car / connect OBU to personal characteristics	Public
Camera's don't work properly (EVI)	Technological	Enforcement not effective, fraud, etc.	3 (1*3)	Operational	Pilot projects	Public / private
Cheap and reliable technology after project start	Technology	Demand for implementation new technology	3 (3*1)	Operational	Open backoffice that can work with future development	Public
ORGANISATIONAL PERFORMANCE						
No timely start with necessary laws and institutions (incl. attribute new tasks and competences)	Organisational / legislative	Time delay, no political decisions because of unfinished preparation, diminishing of acceptance.	12 (3x4)	Preparation	Active management of the total process of road pricing needs political agreement, and a decision about how to start and organise.	Public
Problems of competence between existing governmental institutions	Organisational / legislative	Time delay, Setback to risk management, Less acceptance	8 (2 x 4)	Preparation	Decision process: governmental decision, not only from the departments of transport and finance. One minister is responsible.	Public
RDW database not accessible	Organisational / legislative	Cost effectives decreases	4 (1*4)	Pre operational	Make new database (find out fast whether RDW's database is accessible)	Public
Backoffice can't keep up with transactions	Organisational (bad management)	No income for private party, system rejection & fraud	4 (1*4)	Operational	Tax collection by market, clear agreements, incentive for private party to perform well	Public/ private
Backoffice breaks down	Organisational (bad management)	No income for private party, system rejection when it happens a lot, small fraud	1 (1*1)	Operational	Tax collection by market, clear agreements, incentive for private party to perform well	Public / private

Collector goes bankrupt	Cost effectiveness, use of the system, Organisational (bad management)	No income, system rejection	3 (1*4)	Operational	Business case, pilots, involve RDW, clear contract if private party	Public / private
Higher project costs / time delay than expected	Uncertainties, Changing requirements Changing surrounding	Costs, acceptability, negative effect on economy	9 (3x3)	Preparation and operational	Project management, risk management	Public and private
ACCEPTABILITY OF SYSTEM						
Side effects of big bang were underestimated	Complexity of the transition	1 revenues behind 2 costs rise 3 time delays	16 (4 x 4)	Preparation and Operational phase	Gradual growth, continuous risk analysis and management, pilots, tests.	public
Public turns against billing system; no faith in back office	Acceptability / organisation	Rejection of system	4 (1*4)	Operational	Pilots / Transparent communication on basis of pilots, benchmarks and business case / show benefits	Public
Public turns against pilot projects	Acceptability	Rejection of system	9 (3*3)	Pilot projects	Set up business case first, pilot on bottleneck, Transparent communication on basis of pilots, benchmarks and business case / show benefits	Public

Public turns against plans for road charging	Acceptability	Rejection of system	12 (3*4)	Operational	Pilots / Transparent communication / communication on facts, risks, advantages and drawbacks / on basis of pilots, benchmarks and business case / show benefits / Implementation of proven technology only / Project management directly responsible to minister / Timely start of necessary laws, institutions and authorities	Public
Politics turn against plans for road charging	Acceptability	Rejection of system	12 (3*4)	Operational	See "public turns against…"	Public
Unwanted effects on regional roads (the voice of local politicians on local mobility problems)	Acceptability	Rejection of system, time delay	12 (3*4)	Preparation	Decision process: the pro's and contra's of road pricing in relation to the existing system must be clear, and the effects on local policymakers must be assessed	Public
NGO's turn against project (Resistance of groups and institutions with different interest)	Acceptability	Rejection of system	12 (3*4)	Operational	See "public turns against…"	Public
INTEROPERABILITY AND EUROPEAN REGULATION						
European law governs vehicle taxes	International regulation	Possibly no freedom to implement optimal scenario for BPM/MRB abolishment	8 (4*2)	Preparation	Active influencing of regulation process, anticipate on EU jurisprudence	Public
European regulation hinders road pricing or gives reason to adaptation.	International regulation	Time delays, less acceptability	12 (3*4)	Preparation	Active influencing of regulation process, anticipate on EU jurisprudence	Public

Foreign users don't have interoperable OBU	International agreements	National acceptability, less income to collect	6 (3*2)	Operational	International agreements on interoperability / alternative simple OBU system for foreign user	Public
Foreign users don't get bill	International agreements	National acceptability, less income to collect	8 (4*2)	Operational	International agreements between collectors (collection is own responsibility if collector is private party)	Public / private
Foreign users don't pay bill	International agreements	National acceptability, less income to collect	2 (1*2)	Operational	International legislation on enforcement	Public / private
RFID not interoperable	Legislation	Dutch car users need other OBU for abroad and don't like that	8 (4*2)	Operational	1) try to get RFID in European legislation 2) do not use RFID 3) accept (when car users buy market products with interoperable system the problem diminishes)	Public / private
ENFORCEMENT PERFORMANCE						
CJIB can't sign in for market release enforcement	Organisational	Maybe less cost effectiveness	2 (1*2)	Pre operational	Give CJIB possibilities to sign in	Public
Enforcement not successful: Too little enforcement manpower or not enough rights to enforce, malfunctioning of frontoffice or back office	Organisation / cost effectiveness / Legislative / Technological	Getting away with fraud leads to more fraud, rejection of the system, decline of revenue	8 (2*4)	Operational	Clear requirements to enforcement organisation, Give enforcement organisation rights to enforce, existing structures and proven technology, tested systems	Public
Users don't use OBU	Acceptability / enforcement	Fraud becomes standard, system rejected	8 (2*4)	Operational	Campaigning, heavy enforcement	Public
Enforcement organisation goes bankrupt	Cost effectiveness, Organisational (bad management)	No enforcement, system rejection	4 (1*4)	Operational	Business case, pilots, involve CJIB, clear contract if private party	Public / private

Table 10: risk analysis

Appendix IV: Overview NGO's

NGO	Interest/role
Environmental pressure groups (such as Stichting Natuur en Milieu)	Environment (less cars or environmental measures)
Safety pressure groups	Safety (less cars or safety measures)
ANWB	Interest group for public transport
TLN (transport & logistiek Nederland):	Branch organisation for transport (freight) sector
EVO	Branch organisation for transport (freight) sector
KvK (Kamer van Koophandel);	Branche organisation for entrepreneurs
VNO/NCW:	The Confederation of Netherlands Industry and Employers (known as VNO-NCW) is the largest employers' organisation in the Netherlands. VNO-NCW represents the common interests of Dutch business, both at home and abroad and provides a variety of services for its members.
BOVAG:	BOVAG is an organisation for car- and truck dealers and related companies such as petrol stations and traffic education centres. It is a branch organisation that functions as a platform, information centre and lobbyist.
FNV:	Comprising fourteen unions jointly representing the interests of 1.2 million members, the FNV, acting on behalf of their interests, is by far the largest and strongest trade union confederation in the Netherlands.
ASECAP	ASECAP is the European professional Association of operators of toll road infrastructures. It gathers and represents 126 organisations that manage a toll network of over 25,000 km in 16 countries. ASECAP's mission is to promote toll as the most efficient tool to finance the construction, operation and maintenance of motorways and other major road infrastructures

Table 11: NGO's involved in road pricing

Appendix V: Elaboration acceptability criteria

This appendix elaborates conditions for the implementation strategy, based on acceptability.

Criteria

Three groups of actors are responsible for the barriers of acceptability:

- Public users;
- Business users;
- Decision Makers

Public and business users can be subdivided into heavy users, light users, foreign users, etc. Also, decision makers are not a homogenised group. They operate on a different level of scale (European, national, regional or local) or with a different political program/agenda

Non Governmental Organisations (NGO's) and the media play a role in the relation and communication between users and decision makers during the implementation of road pricing. Also in the feasibility phase, NGO's were involved in the public acceptability studies, as set out before.

The following criteria will influence the acceptability and therefore, these criteria will influence the acceptation of implementation scenarios. The criteria are the result of a brainstorm by "access" in combination of the former information:

1) Acceptability by costs (of implementation) of road charging;
2) Acceptability by consumer price of road charging;
3) Acceptability by effectiveness of the solution[10];
   a) fairness,
   b) accessibility and
   c) environmental and safety consequences;
4) Acceptability by technical conditions of the solution:
   a) Technical reliability;
   b) Technical feasibility;
   c) "Return on Investment" of enforcement;
5) Acceptability by conceptual conditions of the solution:
   a) Simplicity of the concept;
   b) Transparency of the concept;
   c) Accessibility of the concept;
   d) Flexibility of the concept

These criteria were analysed per focus group and the reaction of the focus group to the criterion is set out. The results are found in table 12.

[10] According to "www.andersbetalenvoormobiliteit.nl"

Focus groups			
	Public user	**Business user**	**Decision maker**
1 Implementation Costs	Public user dislikes high budgets	Business user dislikes high budgets	Decision maker will react positively on low implementation costs
2 Consumer price	Public user will compare consumer price RP with actual price. Public user doesn't want to pay more than he does now.	Business user will compare consumer price RP with actual price. Business user doesn't want to pay more than his gains from the system and doesn't want to pay more his competition	Decision maker will react to users´ opinion
3a Equity (effectiveness)	Public user will compare personal costs RP with costs of other public users. Public user doesn't want to pay more than his neighbour with same behaviour (horizontal equity) or relatively more than user with other behaviour pattern (vertical equity).	Business user will compare personal costs RP with costs of other business users. Business user doesn't want to pay more than competition	System needs to be balanced by horizontally and vertically equity.
3b Accessibility (effectiveness)	Public user doesn't want to pay for traffic jams	Business user wants to pay for less traffic jams	Decision maker wants overall accessibility improvement
3c Environmental impact (effectiveness)	Public user has individual preferences on this subject	No interest	Decision maker wants overall environmental impact to be positive
4a Technical Reliability	Public user believes proven technology and/or simple solutions to be more reliable. Public user interest is getting the right bill for the right services	Business user believes proven technology and/or simple solutions to be more reliable. Business user interest is getting the right bill for the right services	Decision maker believes proven technology and/or simple solutions to be more reliable.
4b Technical feasibility	Public user believes proven technology and/or simple solutions to be more feasible. Complex adaptations to cars will lead to public dislike.	Business user believes proven technology and/or simple solutions to be more feasible. Complex adaptations to trucks will lead to business dislike.	Decision maker believes proven technology / simple solution to be less risky (in terms of time and money)
4c Enforcement	Public user disapproves fraud. Public user wants neighbour to get caught when he frauds	Business user disapproves fraud. Business user wants neighbour to get caught when he frauds	Decision maker wants everybody to pay and reacts positively on low enforcement costs
5a Simplicity of concept	Public user wants to understand how it works	Business user wants to understand how it works	Decision maker wants to understand how it works and wants to be able to explain it
5b Transparency of concept	Public user wants to be able to oversee personal consequences. Public user wants to trust there is no hidden agenda	Business user wants to be able to oversee personal consequences. Business user wants to trust there is no hidden agenda	Decision maker wants to feel believable when he explains the concept
5c Accessibility of concept	Public user wants to have the trust it is easy to find information and to participate in the system	Business user wants to have the trust it is easy to find information and to participate in the system	Decision maker wants to have the trust (information about) the system is easy accessible
5d Flexibility of Concept	Public user wants to have a choice in mobility	Business user wants to have a choice in mobility	Decision maker wants to have the trust (information about) the system is flexible

Table 12: acceptability criteria per focus group

Results in orange are key factors.

Appendix VI: Road pricing system

The road pricing system generally contains the elements as stated in Table 13. Figure 14 draws the relationships between these elements graphically.

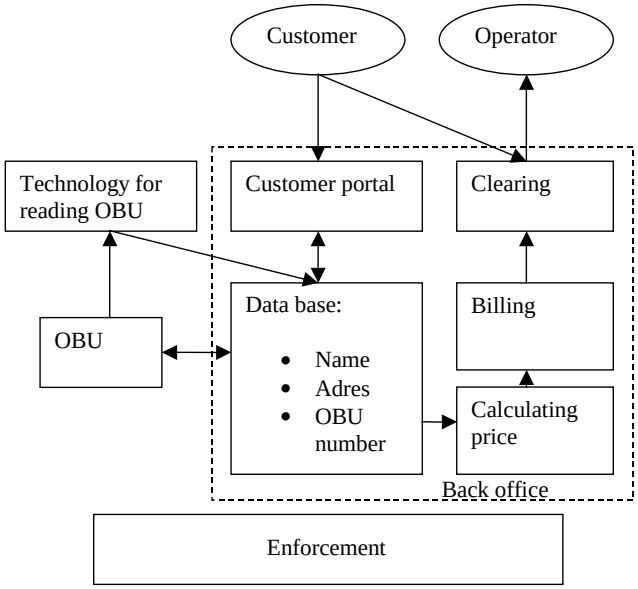

Figure 14: Road pricing system; elements and their relations

Element	Description
Customer	Person that will get the invoice for tolling or road pricing
Operator	Organisation that will receive the revenues of tolling or road pricing; this could be the national government.
Customer portal	This portal has different functions: – Subscription – Customer service – Maintenance OBU
Data base	In the data base al information about the customer will be registered. There is strong relation with the customer portal. In the data base unique OBU numbers will be linked to name or license plate of subscriber.
OBU	Unit which has a unique number and can be read by technology which makes clear where the OBU is on which moment.
Technology for reading OBU	This technology must make it possible to read the OBU's and (together with soft ware in de OBU) making possible that a price can be calculated based on time and place.
Back Office	Computer system that might contain the Database and handles the Calculation of the price and/or the Billing and or/ the Clearing.
Calculating price	Based on information from the OBU the price of a ride can be calculated.
Billing	In this element the invoice to the client is prepared.
Clearing	Clearing is the name of the unit in which the actual transaction is taking place. Form the account of the customer to the account of the operator
Enforcement	The elements mentioned are needed in case everything is going well. At moment something is not going well an enforcement unit is needed.

Table 13: Road pricing system; elements

Critical for a successful implementation of road pricing is the proper design of the road pricing organisation. The next figure draws the main tasks for this organisation.

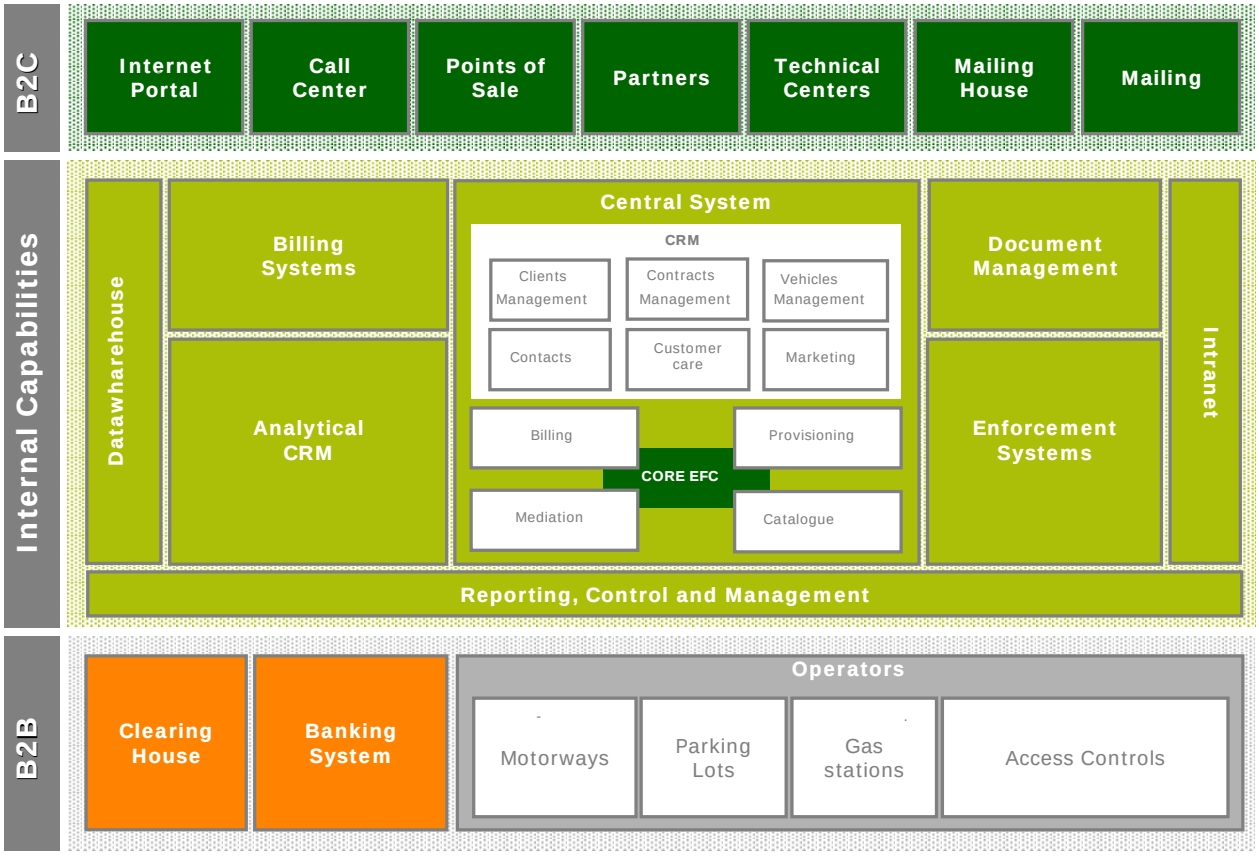

Figure 15: Organisation tasks

Organisation of governmental institutions.
In addition to the road pricing organisation, it must be decided what governmental institutions and organisations are foreseen, and how responsibilities and work is distributed among those entities. At least the following aspects must de settled:

- Independent Road Supervisory Authority to ensure good functioning of the tariff system, to ensure that the “total revenue” will be attributed to infrastructure and related costs, and to enhance synergy between different sources of finance. (EC, COM(2003)448 def.)
- Executive authority, to assess (or advise about) tariffs and level of taxes, to manage and distribute the total revenue, to execute the necessary administrative actions for proper working of the market (regulation, concession for road pricing, standards for safety, back office and clearing house, …)
- Project organisation to manage the implementation process. This organisation will be responsible for the implementation, such as planning, risk management, communication, providing regulation and so on.

It should be noted that the risks of implementation of road pricing are many. Not at least the political risks. The institutions, stated above must have the necessary responsibilities. Because of the involvement of many departments, one responsible minister should be appointed, and given responsibility for the implementation on all fields: political, juridical, tax reform, market incorporation, communication, technology and project management.

Appendix VII: Elaboration on BPM and MRB transition

The "nota mobiliteit" gives the possibility that all fixed taxes will be changed to variable road pricing per km. Maybe this is not reachable; so in the working program "anders betalen voor mobiliteit" the minister speaks of "(partial) lowering of the BPM and abolishing the MBR….". Possible reasons for maintaining a partial fixed administrative fee or flat tax are:

- Roads provide general benefits to everybody. For instance the use of ambulances. This argument eventually also could lead to contributions from general taxations.
- It is possible to distinguish a category "general costs" that can be attributed to the user. In the publication JT00143709 (reforming taxes…) of the EC ministers of transport, this category is presented as capital costs that cannot be recovered through optimal road pricing. It is stated that in places without congestion this may be the case. "In cases where governments seek to recover some or all of these costs directly from users it is most efficient to do this through fixed charges (such as annual road taxes) not to exclude beneficial use from the capacity available". According to this publication international traffic should only pay the marginal costs.
- Road pricing also has (relatively low) fixed costs: administration, standards, enforcing, research id.
- Maybe in some fields the costs of collection through road pricing are too high compared with the yield. In those cases it is advisable to prefer fixed taxing.
- Acceptation is a key factor. Maybe from the point of acceptation (getting used to the new system) it is preferable to maintain (temporarily and/or partially) fixed pricing. The alteration to road pricing can grow in time.

For this reason possible fixed charges have been reviewed in the scenarios, where applicable.

Tax transformations

In order to achieve a controlled growth of road pricing and a controlled decrease of MRB/BPM an additional institution could be necessary. This institution is in charge of the implementation, it calculates the overall revenues of road pricing and tax, and governs the decisions that must be made during the implementation faze with respect to tariffs, revenues, laws and ministerial decisions, organisation, communication and instruction id.

This institution can be seen as a project managing institution, and should be temporarily, preferably constructed as a separate service of the government (agency). As the introduction of road pricing will be a growth process for many years, may be there will evolve a need to continuation of an executive authority, related to the RDW or Bureau Motorrijtuigenbelasting. This institution can play a role in covering of political risks, by providing data and facts, communication, continuity and risk control.

analysis on transition of MRB (as suggested in paragraph 3.1.1)

Aspect	**Conclusion**
Acceptation	This scenario coincides with the advice of the platform “anders betalen voor mobiliteit” and with government policy. A good management of the transition is crucial for the acceptation of the customer.
Time of implementation	Growth scenario: as fast as developments allow.
Compliance	100%, except in the phase of implementation and for foreign users and specials.
Transition problems	Besides problems of implementation no special circumstances
Foreign vehicles, specials	Need special treatment, not 100% compliance. Compliance with EC regulation possible except Eurovignet.
Enforcement	No special details. Preparation crucial.

Table 14: analysis on MRB transition

Acceptability
This scenario is based on the existing government policy and the advise of the platform. The scenario assumes that the MRB will not be changed into road pricing in one “Big Bang”, this sudden change has many risks, but fast implementation, almost instantaneous, is possible if technology, number of pay-points, organisation and administrative systems make it possible. The scenario gives the possibility that the customer gets one bill for MRB and road pricing together. The inequality between congested area’s and rural area’s, which may cause that the inhabitant of the congested area probably will use more and more expensive infrastructure on his trip than the inhabitant of the rural area, can roughly be compensated by the lowering of the MRB. The compensation possibilities (acceptability) can be improved with discount possibilities, but this has also negative effects (complicated regulations causing lower acceptability). In the end total road pricing is possible (GPS/GSM), and no compensation is needed.

Time of implementation
The length of time of the implementation depends on the developments in technology, in the market, the back office, the building of the necessary organisations, the laws and so on. These, not yet predictable, developments will determine the possible starting time. Given the uncertainties at present, the principal choice is a growth scenario. The present expectation is that a start in 2012 is feasible.

Compliance
This scenario is compliant with the requirements. In the implementation period it is not possible to have 100% road pricing; also for foreign vehicles maybe deviation of the 100% road pricing is possible.

Transition problems
All implementation scenarios demand very big efforts on the field of technology, market development, back office, regulation, structuring institutions and organising. Apart from this, the scenario has no special features.

Foreign vehicles and specials
It is assumed that the OBU technology and the back office support the use of foreign OBU's (EU regulation), and also simple forms of payment, e.g. by vignette. In that case the foreign vehicles with OBU can be charged pro km in the same way as the inland vehicles.
If the foreign car has no OBU, a fixed tariff pro period (vignette?) seems more appropriate.
The implementation must follow the development of European regulation.
For specials (e.g. antique cars) the same routines are applicable.

Enforcing
Managing of the road pricing system on the basis of total revenue demands a managing executive organisation with specific tasks and competences. The front office must be equipped with necessary tools (e.g. reconnaissance of licence numbers); and there should be a enforcing organisation for random checks, fining and prosecution. When these constraints are met, sufficient enforcement is possible.

Other possibilities for BPM transformation

Another way of dealing with the transaction from BPM towards road pricing is to abolish the BPM completely at once, combined with the introduction of a new periodic tax, which changes gradually into road pricing. The owners of second hand cars get compensation for the BPM (minus depreciation) at the moment they sell their car (license number). Variant on this scenario is that the compensation on old cars is given through discount on the new tax or km tariffs (free miles). In this variant the financial problem is financed through less revenue for the government in the first years of road pricing. In this scenario the government has to finance the total compensation of about € 20 billion in three to four years. (Estimation with the following assumptions: car park 8 million, average BPM € 6670 (CBS, 2006), BPM compensation is depreciated with the age of the car). This is deadly for the political acceptability and therefore we will not suggest incorporating it into the implementation scenario.

Appendix VIII: Alternative scenario's

In this document an implementation strategy has been defined, based on basic choices of the system. This Appendix elaborates on (effects of) alternative scenarios for the implementation strategy.

The alternative choices are:

1. Instead of implementing RFID or DSRC technology, road pricing is entirely based on GPS and can only be implemented when GPS OBU solutions are available;
2. Instead of a focus on geographical growth, the vehicle penetration scenario is centralized in the strategy. Scenarios that are elaborated:
    a. start road charging with trucks (like in Germany), followed by road charging for cars
    b. start road charging with lease cars (business users), followed by road charging for other vehicles;
3. Instead of a geographical growth scenario based on a transition from local project to main roads, a geographical growth scenario that grows from regional (one province) to national (all provinces) is chosen. In this scenario the part of the MRB ("opcenten" / one third of the total MRB) that is allocated to the province is replaced by road charging.
4. Instead of providing all cars with an OBU only new cars are obliged to carry an OBU.

For all these scenario's effects are elaborated in terms of:

- Functional growth, geographical growth and vehicle penetration;
- Time;
- Money;
- Technology;
- Organisation, legislation & interoperability;
- Acceptability;

Scenario 1: GPS-only scenario

(Reliable) technology for GPS is not available yet, or expensive. Alternative technologies that are proven technology or less expensive were carried forward in this document and the suggested strategy is based on the use of these kinds of technology. In this scenario GPS technology is the only way road charging will be implemented.

Consequences of the scenario:
- Functional growth: GPS does not give specific arguments to apply the functional growth scenario differently;
- Geographical growth: a pilot phase is evident given the complex and non proven technology of GPS. When a reliable GPS solution exists it becomes possible to charge for every kilometre. The phase of charging all roads, including urban and regional ones,

becomes within reach and the phase in which road pricing will be in place on only the main roads can be abandoned. The defined strategy in this report is not contradicting with this advantage (the duration of the main roads phase can be reduced to 0). When transiting from main roads to all roads a cost benefit analyses can be made to chose the best technology option (key factors being OBU costs for GPS and road side equipment for other technologies; were the latter is also needed in case GPS technology is introduced, because of enforcement purposes). In fact, now is the time to challenge the market to come with good solutions by the time road charging for every kilometre becomes apparent. The reason for a second phase for main roads is based on the assumption that GPS would not be ready to be used for a full introduction of road pricing in 2012.

GPS technology not completely ready yet..

…And while GPS is frequently seen as the most logical and straightforward technology to use in pricing schemes, recent experiences in Germany raise questions about implementation. Here, a charging scheme has been postponed, with E730 million already spent, but with no clear indication yet of what has been going wrong with it. The onboard units have been presenting problems, and there have been reports of trucks being charged when on non-toll roads, and not charged when on toll roads. As the German scheme is also intended to be wide-ranging, it could be seen as a cautionary tale for those who view a nationwide scheme as a simple, 'magic bullet.' [source: http://www.theregister.co.uk/2003/10/14/think_tank_recommends_satellite_road/]

…However, Toll Collect, the private-sector operator, has found that GPS is not accurate enough to say on which road a vehicle is where two roads run side by side.
[source: http://technology.guardian.co.uk/online/story/0,3605,1501796,00.html]

- Vehicle penetration: since a geographical transition from local pilot projects to nation wide road charging is possible with GPS, other gradual up scaling than geographically needs to be given attention for reasons of acceptability. Vehicle penetration growth could be one. This is elaborated in the next scenario.
- Time: the onboard applications like Galileo/GPS are not expected widespread before the second half of next decade. Also, GPS might lead to project delay like the German case shows, given the complex and non proven status.
- Money: on a positive note, no road side equipment other than enforcement equipment is needed for a GPS-only-scenario. However, from the current perspective the GPS OBU is a very expensive solution (€2 billion). Creating a market for creating less expensive solutions might cut on costs in time (integrated car solutions, etc.).
- Technology: as explained in the box above, GPS is not completely ready as a solution for road charging yet. Waiting for GPS be improved and cheap enough contradicts with the starting date of 2012.
- Organisation, legislation & interoperability: GPS is interoperable according to the EU directive. The question however is whether other European countries will apply this technology to provide “real” interoperability. In any case it is advisable to keep the back office flexible to assure that if the GPS scenario does not work as planned, or DSRC will be maintained as standard, other applications can be applied as easily as possible.
- Acceptability: When using GPS to start with road pricing, the customer will be confronted with a costly OBU with no direct benefits that come from that (a € 250 device to pay tax). That is basically not explainable to the public. Even if the government carries the costs the tax payer still pays. For this moment, acceptability will be problematically.

Conclusion: from the current perspective this scenario demands patience and a big wallet. It demands patience, because GPS is not fit for use yet. It demands a big wallet, because GPS based OBU's are expensive (€2 billion to provide every vehicle with an OBU). When despite these arguments and the alternative technologies (like RFID or DSRC) this scenario would be chosen, one does best to give room to the market to provide cheaper solutions in time.

Scenario 2: vehicle penetration scenario

Scenario description: in this document we concluded that "advantages of the geographical growth scenario are best utilized when all vehicles are included into the system from the start". In this scenario, instead of a geographical growth scenario a vehicle penetration scenario is chosen to implement road charging. At the start that means that the system of road charging is only applicable on a group of vehicles or users. In the basic strategy road charging starts with trucks (penetration through vehicle type). In an alternative strategy road charging starts with lease cars (penetration through user type).

Consequences of the scenario:

- Functional growth: different tax systems run simultanuously in this scenario. This might lead to high administrative costs, complexity of he system and inequity of users (all bad for acceptance). Especially in the lease car scenario equality is an issue. Since lease car users are often heavy users, they will (in the end) have to pay relatively more (if on the other hand light users are involved in road charging first, apart form the practical difficulties on how to seclude this group, this might increase the cash cow syndrome for heavy users). The risk of decrease of total tax collection (state income) becomes less apparent, since the new tax (possibly spreading costs of BPM) will apply only on a small group;
- Geographical growth: Combining a vehicle growth scenario with a geographical growth scenario will result in a start that is very far away from the end scheme. Besides that, the vehicle penetration scenario does not give specific arguments to apply the geographical growth scenario differently. The other way around, a geographical scenario is best utilised without a vehicle growth scenario. When the GPS-only scenario is not chosen the phase of implementing road charging on main roads is from a technology point of view still apparent;
- Vehicle penetration: as explained. For reasons mentioned before, pilot projects still are evident. Since only a small group of vehicles/users is involved in the first phase a new (extra) arising possibility is to implement road charging for this group administratively first, before effectuation.
- Time: because extra steps are introduced before road charging is effective, the time before the project arrives at the last phase, increases.
- Money: one of the big disadvantages of this scenario is that the costs are high, compared to the income and compared to the advancement of the scheme, because road side equipment costs are only made for a small group of vehicles. In the GPS-only scenario however, the main costs are related to the OBU and therefore to the amount of users.
- Technology: The vehicle penetration scenario does not give specific arguments to apply different technology, with the exception of starting with trucks, because then GPS can be used more easily because of the Maut system. The other way around it does: if GPS is

proven a good solution, costs would be spread in time when gradually introducing road pricing (and OBU's) among users.
- Organisation, legislation & interoperability: the vehicle penetration scenario has advantages for organisation such as enforcement, because the enforcement organisation can slowly get used to bigger amounts of users. When the truck scenario is applied, interoperability is easier accessed because of international use (Maut). Also, these experiences can be used to learn.
- Acceptability: as set out [see former point of functional growth], it is hard to gain acceptability from heavy as well as light users.

Conclusion: this scenario demands a solid GPS solution because the phase of introducing road charging only on main roads is not useful and a gradual introduction can be provided in a different way. Too many steps of introduction put a time constraint on the project. The second reason is that in the case of alternative technology more road side equipment is needed, leading to relatively high costs and relatively low income (given the small group). This scenario has risks of terms of costs, time and acceptability.Finally, the geographical growth scenario, which we favour, is best utilisd when no vehicle penetration scenario is included in the implementation strategy.

Scenario 3: provincial road charging scenario

Scenario description: Instead of a geographical growth scenario based on a transition from local project to main roads, a geographical growth scenario that grows from regional (one province) to national (all provinces) is chosen. In this scenario the part of the MRB ("opcenten" / one third of the total MRB) that is allocated to the province is replaced by road charging income.

Consequences of the scenario:
- Functional growth: this scenario foresees in gradual decrease of MRB by abolishing the part of the MRB that is beneficial to provinces first. Road pricing on the secondary roads in the province will provide as much income as is necessary to cover the provincial "opcenten" from MRB. Inhabitants of the province pay on an average as much for road pricing as they did for the part of the MRB that is beneficial to the province. The rest of MRB will be phased out while raising and differentiating road charging prices. This scenario will cause inequity between citizens from different provinces.
- Geographical growth: this scenario applies in the last phase of the geographical growth scenario. BPM is already being phased out in return for road charging on the main roads, and MRB will be used for introduction of road charging on the other roads.
- Vehicle penetration: along with the geographical expansion in one province the OBU's are built in the vehicles that are registered in that province. Vehicle penetration and geographical growth are aligned;
- Time: since proven technology and a relatively small amount of users are used the pilot province could start relatively fast. No delay is needed to implement this strategy;
- Money: this scenario is cost neutral for government and users. No different costs for technology are made than in the favourable scenario.
- Technology: since this scenario is linked to road charging on all roads, it can only be applied when GPS technology for road charging is ready for use;

- Organisation, legislation & interoperability: this scenario has advantages (risk reduction) for the back office and enforcement organisation, because they only have to deal with smaller amounts of users in the first place;
- Acceptability: since the changes are relatively small (geographical and personal) no enormous resistance is expected. On th other hand this scenario comes with great inequity between users.

Conclusion: this scenario comes with great in equality for road users and is depending on GPS technology. On the other hand it is good for acceptance by the provinces, because it explicitly pays attention to their taxes.

Scenario 4: new-cars-only scenario

Scenario description: Instead of providing all cars with an OBU only new cars are obliged to carry an OBU. In this way, the scenario is a form of vehicle penetration growth.

Consequences of the scenario:
- Functional growth: existing cars still use the existing tax system of MRB (BPM is already paid). New cars are provided with an OBU and money is collected via road charging. There is a opportunity to abolish both MRB and BPM for these new cars and to collect the same money with road pricing (however, for BPM the income for the state is spread in time, so less income at the start when not so much new cars are used is inevitable – the money will be there in the end). A big advantage is that the second hand car market is not influenced (directly), despite the fact that new cars become cheaper. Results of this scenario might be that heavy car users will keep using old cars longer (because buying a new car means paying more). Also, light users buy a new car faster. A temporary drop in the states benefits from taxes because of personal behaviour might occur. This scenario comes with great inequity between road users, and the simultanuous existance of different taxing systems for different users.
- Geographical growth: not different;
- Vehicle penetration: all new cars from moment X on are provided with an OBU;
- Time: a different, and probably much longer, time schedule is apparent. It might be difficult to predict effects on the car market and road pricing revenues when price differentiation is effectuated early in the process;
- Money: see functional growth;
- Technology: no different technology needed (however, gradual process of building in OBU's), because of the long introducton period, OBU technology of the first cars might be old, when the scenario is completed;
- Organisation, legislation & interoperability: This scenario has advantages (risk reduction) for the back office and enforcement organisation, because they only have to deal with smaller amounts of users in the first place;
- Acceptability: since in this scenario is in sense of behaviour relatively complex, it's hard to predict the acceptability. Uncertainties for the state (revenues) are present but dependant on the way tax changes are introduced.

Conclusion: this scenario asks for more elaboration, since individual behavioural patterns and market behaviour are influencing each other. Uncertainties for state revenues might be

apparent and the implementation time will be longer. Furthermore, there will be two diffreent taxing systems and acceptability is uncertain.