EVALUATION REPORT ROTTERDAM

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Abbreviations

ANT	Advanced Netherlands Transport, consultancy firm on innovative transport solutions
APM	Automated People Mover
CIVITAS	City – VITAlity – Sustainability
CNG	Compresses Natural Gas
CO_2	Carbon Dioxide
CPO	Catalytic Particulate Oxidizer
CRT	Continuously Regenerating Technology
DAF	Vehicle manufacturer
DNOx	Decreased Nitrogen Oxide
dS+V	Department for Urban development and Traffic of Rotterdam
e-bicycles	Electric bicycles
e-bikes	Electric bicycles
e-scooters	Electric scooters
E-TOUR	Electric Two-wheelers on Urban Roads, European project
EURO IV/ V	European Community Emission Requirements (HDV)
GPS	Global Positioning System
HDV	Heavy Duty Vehicle
ICT	Information and Communication Technology
ITEMS	Integrated Transport Effects Modelling System
IVAM	Environmental Research University of Amsterdam
LEM	Local Evaluation Manager
LEP	Local Evaluation Plan
MAESTRO	Monitoring Assessment and Evaluation of Transport Policy Option in Europe
METEOR	Monitoring and Evaluation of Transport and Energy Oriented Radical strategi for clean urban transport
P&R	Park and Ride
PMG	Project Management Group
PT	Public Transport
RegioTIC	Regional Traffic Information Centre
RET	Rotterdamse Electrische Tram (regional Public transport provider)
SCR	Selective Catalytic Reduction
TELLUS	Transport & Environmental aLLiance for Urban Sustainability
TEP	TELLUS Evaluation Plan
TIC	Traffic Information Centre
TPS	TeleParking System
UTC	Urban Traffic Control
VAT	Value Added Tax
VCC-R	Vervoers Coördinatie Centrum Rijnmond, mobility agency Rotterdam region
VMS	Variable Messaging Signs
WP	Workpackage

A INTRODUCTION

A.1 TELLUS Landscape in Rotterdam

Rotterdam is the second largest city of the Netherlands and part of the dense 'Randstad' area in the Western part of Holland. The city of Rotterdam with its 660.000 inhabitants has a modern city centre, resurrected after the destruction of the old centre during the Second World War. Within a 50-kilometre radius, several major urban centres can be found, adding up to a population well over 4 million people.

Traffic and transport management are important issues for Rotterdam. Due to the dense population, traffic flows in and off peak hours are very large. Furthermore, freight transport is considerable since a large percentage of goods entering the port is distributed further inland by freight trucks (e.g. 40% of all containers are distributed using trucks).

The air quality in Rotterdam is poor. For instance the level of nitrogen dioxide is 70% higher compared to rural areas in the Netherlands. For particulate matter this percentage was 25%. The air pollution alongside a total number of 45 urban roads currently exceeds the European guidelines. Noise levels in the urban areas also exceed the standards. The heavy industry in the harbour area, the heavy traffic on the Ring Road, the ships in the harbour and the dense population contribute to this situation. Local citizens use their cars for short trips. Currently 35% of all trips less than 5 km are made by car.

To improve air quality the development of a good spatial and mobility development framework is necessary as a good starting-point. Local, regional and national authorities should cooperate and invest in sustainable infrastructure. A congruent policy including a long-term investment program must form the bases for mobility measures.

Good mobility policy starts with good spatial planning. In 2001 the Spatial Plan 2010 was accepted by the City Council. The city centre will be developed and used more intensive as a residential and economic centre. The intention is to avoid sprawling, which is associated with an increase in car dependence. Urban development is aimed at those areas where good public transport in combination with Park and Ride facilities can be build.

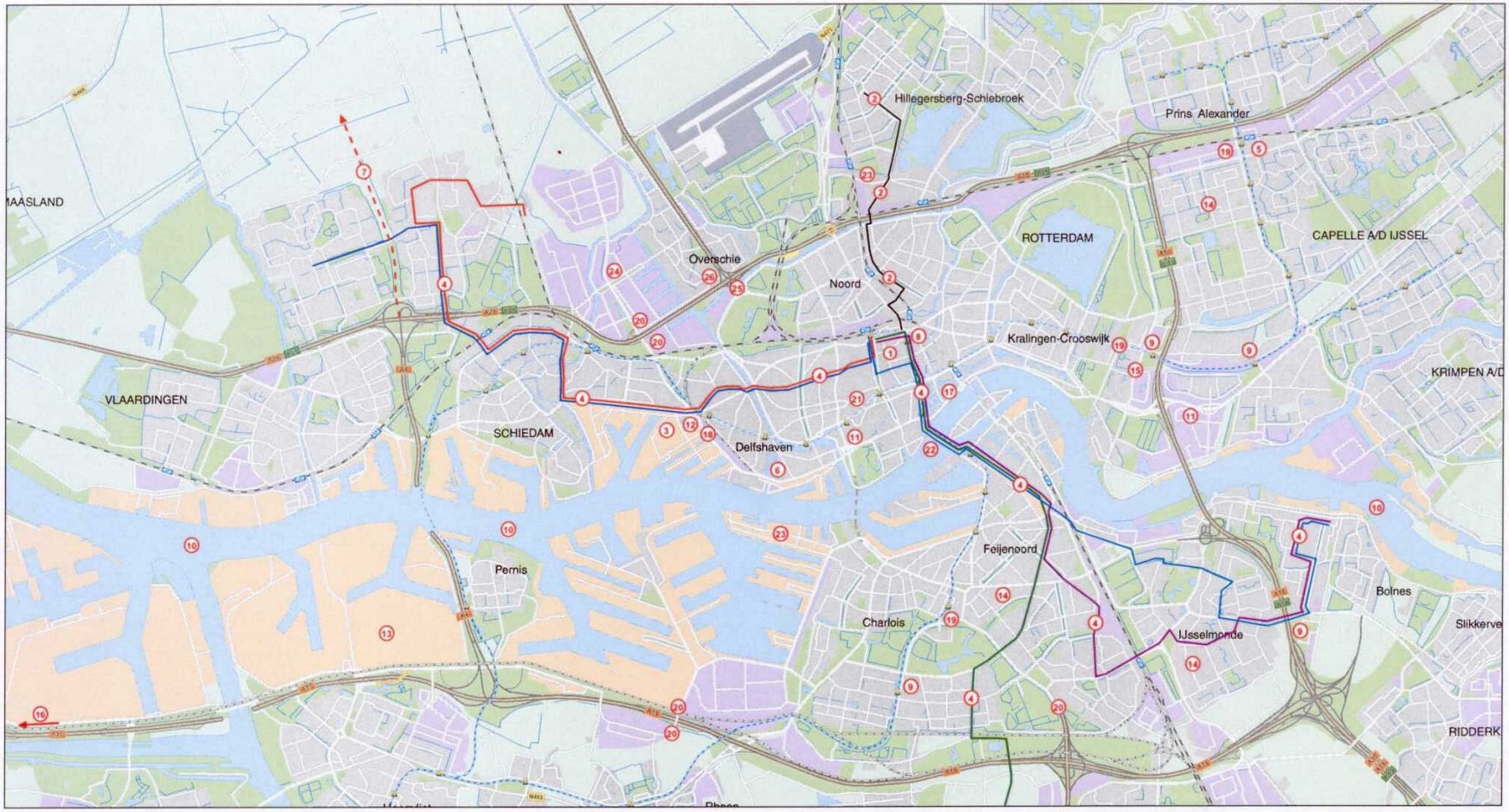
Other long-term measures are the improvement and extension of the local tram (now 106 km) and subway (now 46 km) system, a new light-rail system to The Hague and a new highway to divert through traffic away from urban areas. Also the clustering of the urban traffic at certain main distributor roads is under investigation.

For long-term measures large investments are necessary. Extra infrastructure in the region for public transport will cost more than € 2 billion the next 15 years. Most of which will be funded by the national government.

As a result of the HEAVEN project and after many years of intense local community pressure the national road authority lowered the maximum speed from 100 to 80 km/h on the A13 highway. Two digital cameras measuring the average speed of every car passing the A13

strictly enforce the maximum speed. A further enlargement of the 80-km measure is expected in the near future.

The TELLUS program is another major incentive to improve mobility patterns thus improve liveability by improved air quality and reduced noise levels. The 26 demonstration measures as planned at the beginning of the TELLUS are shown in table A.1.1 and in the map of Rotterdam (overleaf). They cover all CIVITAS themes and are of great variety concerning their type and underlying strategies. A further description of these measures as well as more information on objectives and milestones can be read in part B of this report.



1	wp5.1	Access time window
2	wp5.2	Dedicated bicycle route
3	wp5.3	Truck Parking Management
4	wp5.4	Transport priority and dedicated lanes
5	wp6.1	P+R pricing strategies for target groups
6	wp6.2	Demand depending strategies for paid parking
7	wp6.3	Private partnership road construction
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23	wp12.1	Clean and silent Public Fleet
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25	wp12.3	Cleaner vehicles for waste collection
26	wp12.4	Electric vehicles in Public fleets

Table A.1.1: TELLUS Demonstration measures in Rotterdam, as planned

Measure	Typ	Strategy
5.1 Access time window to promote clean commercial vehicles	C, I	Regulation of traffic
5.2 Dedicated bicycle routes	I	Support increased use of bicycles
5.3 Truck parking management for residential areas	I	Provide alternatives for long term parking
5.4 Public transport priority and dedicated lanes	I	Enforcement of public transport
6.1 P&R pricing strategies for target groups	I	Demand based pricing
6.2 Demand depending strategies for paid parking	I	Demand based pricing
6.3 Public private partnership regarding the construction and maintenance of new road infrastructure	C	New concepts for the mobility market
7.1 Integration of cycling and public transport	C, I	Parking management at PT-locations
7.2 Large scale expansion of P&R	I	Parking management at PT-locations
7.3 Public transport over water	I	New concepts for public transport
7.4 Automated people movers	I	Provide new and innovative vehicles
8.1 Electric two-wheelers	I	Provide alternatives for cars
8.2 Expansion of van-pooling for commuters	I	Provide alternatives for cars in areas with low PT service
8.3 Expansion of car sharing	I	Introduction support for car-sharing
9.1 E-commerce logistics	I	Traffic management for goods
9.2 Implementation of multi-core tube logistics	I	Provide an alternative for truck transport
10.1 Green commuter plans and mobility management	I	Mobility management for commuters
10.2 Integration of public and private transport initiatives	I	Supporting activities for traffic management
10.3 New approaches to integrated planning	C, I	Integrated planning
11.1 Integration of transport management systems	I	Dynamic information for traffic management
11.2 Intermodal Travel Information	I	Support co-operation. Improved information for the public
11.3 Dynamic public transport information	I	Dynamic information for traffic management in PT
12.1 Clean & silent public transport fleet	I	Support clean PT
12.2 Electric vehicles for the distribution of goods	I	Support clean transport of goods
12.3 Cleaner vehicles for waste collection	I	Support clean transport for collected waste
12.4 Electric vehicles in public fleets	I	Support alternative clean transport for cars

Types of measures: C = Concept development, I = Implementation

During the design of TELLUS, 6.2 was planned as a project on ‘road pricing’ and 6.3 as ‘express lane’. In the first half year 6.2 and 6.3 were replaced by projects as mentioned in the table and the map. In the year to follow however 6.3 became the ‘paid parking’ project and 6.2 was used to organise a seminar on road pricing. Therefore in other overview tables in this report, 6.2 is ‘road pricing’ and 6.3 is ‘paid parking’.

A.2 Evaluation of TELLUS

The actual evaluation can be divided in two (interrelated) parts; the process evaluation and the impact evaluation.

The process evaluation basically describes how the implementation process developed during the TELLUS period and explains why for instance certain milestones were delayed or cancelled. The process evaluation was based upon interviews with the demonstrators and on several other meetings that took place from 2002 to 2005.

The impact evaluation investigates whether the desired effects of the measures were reached. Therefore the measures were monitored using a set of indicators. The indicators were selected by the LEM (in close cooperation with the demonstrators) from a long list of indicators according to the MAESTRO approach. The indicators are divided into 5 evaluation areas: Society, Economy, Transport, Energy and Environment. To investigate the impact of TELLUS on city level, a set of key indicators (also according to the MAESTRO approach) was used. The indicators and key indicators were assessed by measurements, surveys and calculations.

Measurements consist of real time data or data gathered in retrospect (e.g. kilometres travelled, fuel used, costs and revenues, etc.).

Surveys were carried out as face-to-face interviews or as written questionnaires. The main objective of the surveys was to get insight in society related indicators like acceptance or awareness and in transport related indicators like changes that occur in the traffic behaviour patterns of citizens. Furthermore interviews and questionnaires were used to investigate if the intra-organisational and public private cooperation improved.

Calculations were made using the data from measurements and surveys. Calculated data are in particular used for environmental indicators such as emissions, noise impact and quality of air.

The ultimate goal of the evaluation is to determine if, and to what extend, the objectives of the demonstration measures are met.

Next to the evaluation of the 26 demonstration measures, IVAM UvA BV conducted in 2003 an ex-ante evaluation on the various TELLUS demonstration measures in Rotterdam[1]. The objective of this study was to predict impacts on forehand based on experiences in other cities throughout the world.

The results of the evaluation of the demonstration measures are described in separate evaluation reports B5 to B30.

[1] The impact of TELLUS. Research on the expected effectiveness of TELLUS measures in Rotterdam. Jan Duffhues, internal report, IVAM UvA BV, October 2003

A.3 Evaluation of the evaluation

The objective of this part of the report is to give a comprehensive overview of the TELLUS Evaluation, *i.e.* to 'evaluate the evaluation'. Such a meta-analysis tells if the evaluation is complete and provides information about the robustness of the conclusions. It also is a starting point for an assessment of the evaluation method.

The process evaluation was carried out for all 26 measures by October 2005. As three out of 26 measures were cancelled, and three projects were seriously delayed, the impact evaluation could be carried out for 20 measures. The rest of this paragraph focuses on these 20 projects.

IVAM developed a simple score for the 'success of evaluation' by comparing the number of indicators assessed to the number of indicators selected at the start of TELLUS. *I.e.* if all indicators selected would have been assessed by October 2005 the score for success would have been 100%.

Indicators

For the impact evaluation of these (20) measures 258 indicators were selected at the start of TELLUS. Figure A.3.1 shows the division of the indicators over the evaluation areas.

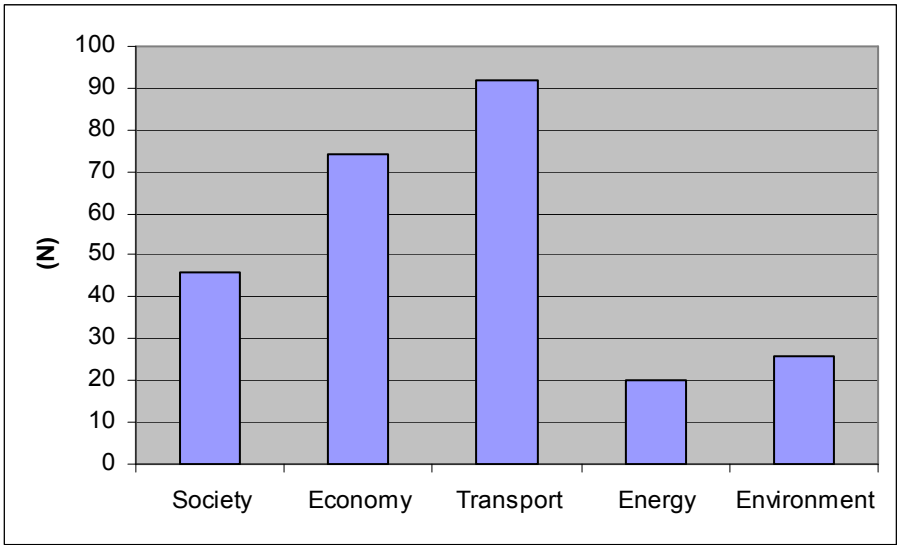


Figure A.3.1 Number of indicators selected, by evaluation category

The figure shows that for the evaluation category Transport many indicators were selected compared to the other areas, especially compared to Energy and Environment. This is partly explained by the evaluation methodology itself. For most measures a combination of Transport indicators is needed to assess the indicators for Energy and Environment. Besides, as transport is an important TELLUS issue, relatively more indicators were selected in that area.

In the final evaluation out of these 258 selected indicators, 172 indicators were assessed, a 'success' of 67%. Figure A.3.2 shows the division of the 'success' score over the evaluation areas.

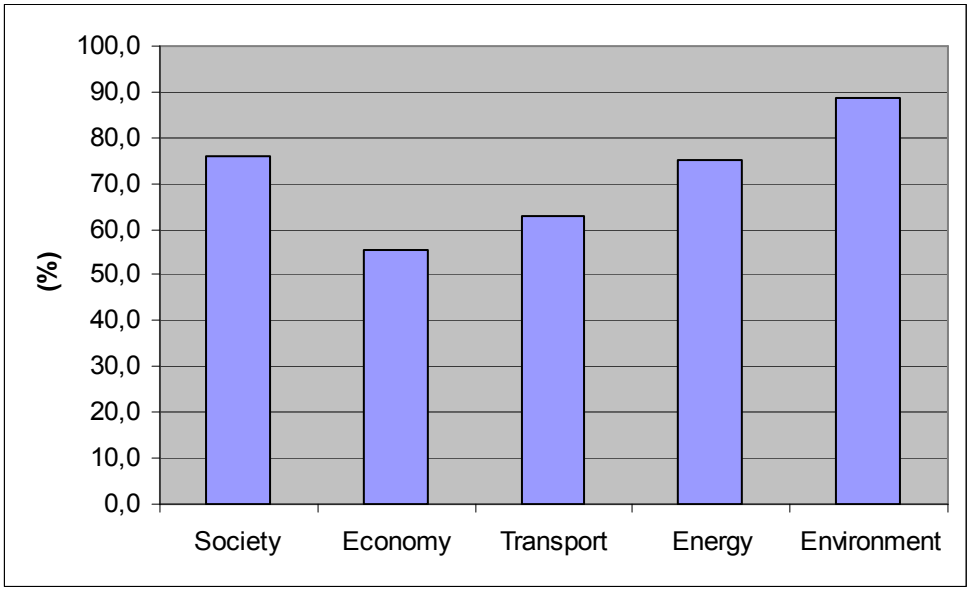


Figure A.3.2 Percentage of indicators evaluated by evaluation area

Figure A.3.2 shows that in the evaluation areas Society, Energy and Environment over 75% of the indicators was determined.

For the evaluation area Transport 62% of the indicators was determined. However, as indicators for Energy and Environment are often based upon indicators for Transport and 76% of the indicators for Energy and almost 90% of the indicators for Environment could be determined, apparently the most 'important' indicators for Transport were determined.

For the evaluation area Economy only 55% of the indicators could be determined. This mainly has three causes:

- Some of the indicators (costs for example) are difficult to allocate to the specific part of the measure that is TELLUS related
- Some of the indicators (the annual turnover for example) are confidential, especially those from the private partners.
- Moreover, if commercial measures like the water taxi or car sharing are successful, the impact on economy is by definition positive as far as the demonstrator is concerned. For those measures, the selected Economy indicators were replaced by one indicator, 'change in profit'.

Key indicators

For the impact evaluation of the 20 measures that could be evaluated a total of 70 key indicators were selected at the start of TELLUS. Figure A.3.3 shows the way these key indicators are divided over the evaluation areas. As there are no TELLUS objectives formulated in Rotterdam for which key indicators in Society and Economy are needed, no such key indicators were selected at the start of TELLUS.

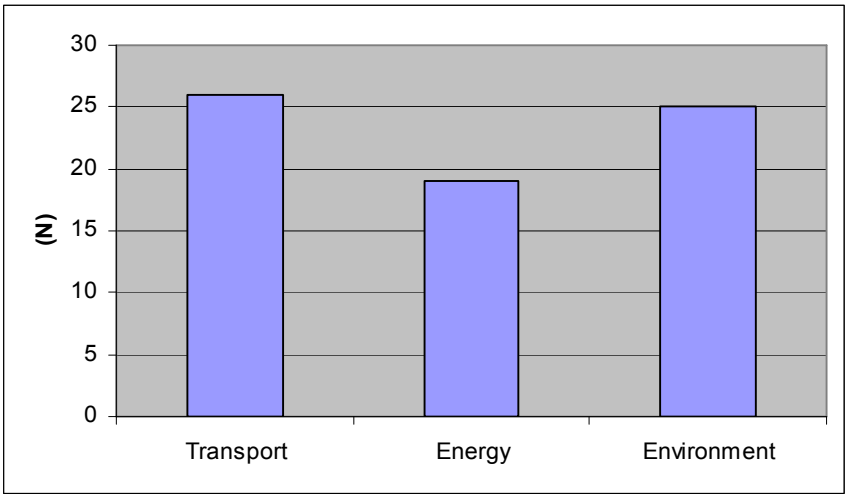


Figure A.3.3.Number of Key Indicators selected, by evaluation area

Out of these 70 key indicators, 56 key indicators were determined in the final evaluation, a 'success' of 80%. Figure A.3.4 shows the division of the success score over the evaluation areas.

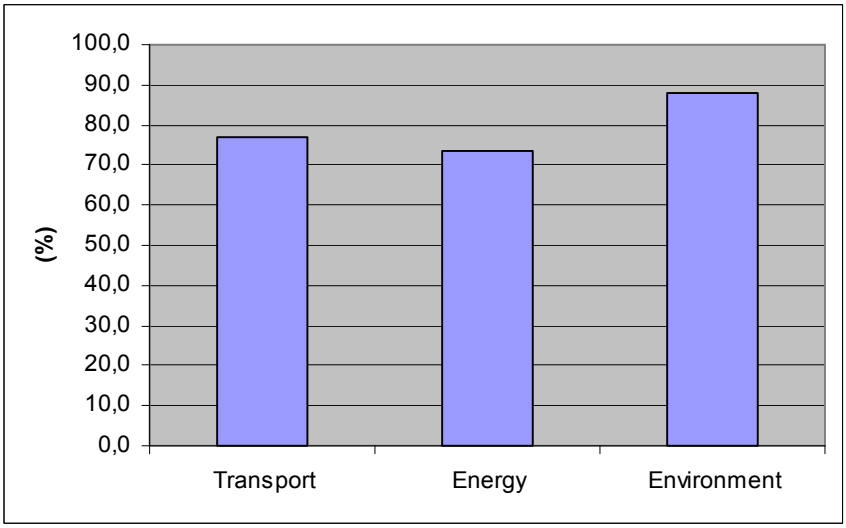


Figure A.3.4.Percentage of Key Indicators evaluated by evaluation area

As 67% of the indicators and 80% of the key indicators are evaluated, the evaluation can be regarded as successful by numbers.

However, it must be emphasized that the evaluation is less quantitative as planned. This is mainly due to the following aspects:

- For many measures the time between actual implementation and evaluation was too short to carry out extensive measurements. For that reason for instance counts could not be carried out. Without these counts also indicators expressed per passenger kilometre could not be calculated.
- Some measures consisted of only a few 'elements' (for instance vehicles). In that case it is unreliable to calculate impacts based upon one or two measurements as an input for an 'up-scaled' impact on city level.
- For some measures the effects due to TELLUS can not be separated from effects due to other circumstances. For instance public transport measures in an area were also new offices or shops are developed.
- The current evaluation method is not always suited for each measure.

Based upon this evaluation of the evaluation and the practical evaluation experiences of the LEM, some remarks can be made about the methodology proposed by METEOR.

For a large variety of measures the 'long-list' of indicators is sufficient to select a proper set of indicators for the evaluation. However, next to the selection of the proper indicators, the choice for the system boundary is very important. In other words; "Do we include the kilometres travelled towards the P&R or not, that's the question". It is evident that within small systems the impacts can be significant while on a higher level such as city level the impact could be negligible. As in practice the same indicator can be determined within different system boundaries for different measures, it will not be easy to compare the evaluation results. This may conflict with the objective of the proposed methodology to increase transferability between cities and their measures.

To make things more complicated, the aggregation method from indicators to evaluate area also plays an important role in the evaluation results. Can we simply add up the NOx emission and the CO_2 emission or is the CO_2 emission twice as important, *i.e.* of double weight? For some indicators assessment factors are available from other scientific areas. Within the domain of environmental life cycle assessment for instance several methods to assess the emissions to the environment are available. For the economy area also an aggregation seems possible as all indicators are expressed in a similar unit (euro). These methods at least are based on a certain objective (although usually not undisputed) methodology. Other aggregation methods are entirely built on subjective elements based on societal or other preferences. Therefore METEOR does not describe how to choose your system boundaries or what weights you should use in the aggregation of indicators.

Furthermore it appeared during the evaluation process that the top down selection of indicators sometimes conflicts the bottom up practice. In other words, although it is 'easy and obvious' to choose for instance the energy efficiency as an indicator, it might appear that measuring the total amount of passenger kilometres as well as the overall energy consumption within the same timeframe is impossible in practice. Again this is also related to the chosen system boundary. But even in smaller systems (e.g. the dedicated route) the incentive for measurement was not always present.

Last but not least, for complex integrated measures, an evaluation based upon separate indicators is less suited due to interference and/or synergy with other measures as well as with other circumstances that do have an influence on the impact but have nothing to do with TELLUS. The impact of NOx filters for instance can simply be determined by measuring the emission of NOx. The impact of a web site to stimulate the use of public transport is a far more complex process that can hardly be quantified.

So we conclude here that obviously there is potential for improvement of the proposed evaluation methodology. In this report some of the shortcomings were overcome with the support of aggregation methods thus making it possible to quantitatively evaluate on the level of measures (if sufficient data is available). On the city level the LEM decided to present evaluation results more on a qualitative scale since a summation of individual measures could not be realised in a consistent manner. Further elaboration is given in section B.

A.4 Evaluation team

The evaluation in Rotterdam was carried out by different actors – but mainly by the Local Evaluation Manager (IVAM) and the demonstrator contacts. The Municipality of Rotterdam (department for Urban Planning, Housing and Traffic) gathered further information e.g. for the baseline scenario and the do-nothing scenario.

The demonstration measures themselves were responsible for carrying out the monitoring and evaluation activities stated in the Local Evaluation Plan Rotterdam. Results of the monitoring were transferred from the demonstrator contact to the local evaluation manager. Furthermore regular meetings between LEM and demonstrator contacts took place as well as interviews and forums dedicated to the subject of evaluation.

B EVALUATION ON DEMONSTRATION MEASURE LEVEL

B.1 Introduction

In this part of the report the demonstration measures are outlined and elaborated in separate measure level evaluation reports that have been designed by the TELLUS evaluation team. The evaluation reports are also designed to meet the requirements set by METEOR[2].

The evaluation in general is shortly described in chapter A.2 of this report. The more specific working method however has been elaborated in the Local Evaluation Plan for Rotterdam[3]. Information for the evaluation reports has been retrieved from several sources such as measure fact sheets, inception report, progress reports and management reports. For the actual process and impact related evaluation the contact with demonstrator contacts was highly relevant.

The most relevant issues in the reports are

- The measure landscape
- Process related evaluation
- Impact related evaluation
- Conclusions and recommendations

Ad 1 Measure landscape (introduction, measure design, objectives)

Each Evaluation Report starts with an introduction on the background of the demonstration measures describing the situation before TELLUS and the rationale for the measure. Next to that an overview of the demonstration design and activities as described in the description of work is given. Note that this overview is based on the original plans at the start of the TELLUS project period.

The objectives of the demonstration measures are listed in two levels: immediate objectives and ultimate objectives. Immediate objectives are strongly related to the impact related evaluation whereas the ultimate objectives are related to the TELLUS objectives for Rotterdam. These demonstration measure level related objectives are taken from the description of work and are supplemented with information from interviews with the demonstrators. In the case of Rotterdam no intermediate objectives have been formulated (in contrast to some other TELLUS cities).

[2] METEOR. Guide for Completion of Evaluation Result Templates. 16 December 2004

[3] IVAM. Local Evaluation Plan Rotterdam. June 2003.

This section also describes the relationship with the overall transport plans and policies in the Rotterdam region. Finally the results of an ex ante evaluation for the 26 TELLUS measures in Rotterdam are elaborated here.

Ad 2 Process-related evaluation

This section starts with a description of the activities, which were carried out to implement the measure. Special attention is given to deviations from the original plan and the reasons for this deviation. This leads also to an overview of barriers and drivers for the measure implementation. This information will be particularly useful for determining the transferability potential of the measure.

An overview is given of the milestones of the demonstration measure. In some cases milestones have been altered during the project period. Both original and adapted milestones and the achievement of these milestones are listed

Ad 3 Impact-related evaluation

To get an answer whether the desired effects of a demonstration measure have been achieved an impact-related evaluation was carried out. The section starts with a description of the evaluation method used. For the evaluation of indicators preferably quantitative data based on measurements were taken.

Three types of measurements were conducted. Actual measurements consist of real time data or data gathered in retrospect (e.g. kilometres travelled, fuel used, costs and revenues). Surveys usually consist of face-to-face interviews or of written questionnaires. The main objective of these surveys was to get insight in changes that occur in the traffic behaviour patterns of citizens. It was expected that otherwise measured data would be insufficient to get a clear view on these patterns. Calculations were made using the data from measurements and surveys. Calculated data are in particular suited for environmental indicators such as emissions, noise impact and quality of air.

The results are presented in the measure level evaluation reports as impacts on indicators compared to the situation before the implementation of the measure and are shown as a simplified score (- to +). Score “+” can be interpreted as a ‘good’ or ‘positive’ effect on the indicator, *i.e.* a positive score is an ‘improvement’. Score “+/-“ is a ‘neutral’ effect. If no effect could be determined the score is “?”. The latter is caused by a lack of data. If an indicator that was originally selected proved to be irrelevant the impact is not considered in the evaluation. The underlying quantitative and qualitative results can often be found in the annex.

Next, in each measure level report the results of indicators (if available) are added up to results on evaluation areas. This is carried out by a simple rule: score “+” and score “–“, add up to “+/-“. Furthermore, “+” and “+/-“ add up to “+”, and “–“ and “+/-“ add up to “–“. A set of indicators therefore yields one specific result on evaluation area, regardless the sequence in which they are added up. If one of the indicators within an evaluation area has an unknown score (“?”) the result is determined by assuming both “+” and “–“ instead of “?”. For instance “+” and “?” add up

to “?” as the outcome could be either “+” or “+/-“. On the other hand “+”, “+”, “+/-“ and “?” add up to “+” as the outcome is always “+” regardless the value the question mark should be replaced by.

The values given to the evaluation areas are accompanied by and elaborated in the text above the evaluation table.

Ad 4 Conclusions and recommendations

Based on the experiences from the process and impact related evaluation a conclusion is drawn. For the ex post evaluation 2010 also an elaboration of future scenarios is given based on the up scaling potential for each measure. The up scaling potential mainly has been determined by the demonstrator contacts themselves during interviews with the LEM for the process evaluation. For each measure the up scaling potential is an element in chapter 6 (‘scenario’s’) of the measure evaluation reports.

The recommendations are primarily referring to the lessons learned as described in the process related evaluation.

B.2 Overview of results of the process evaluation

The process of individual measures is strongly measure specific. Therefore a comprehensive overview is difficult to make. However, IVAM asked the demonstrators during one of the meetings (“TELLUS Forum”) to give the main barrier and main driver for their project. To be able to produce an overview, the barriers and drivers were classified for this evaluation in five categories:

- Society (societal issues, e.g. drivers or barriers related to the people affected by the specific measure or drivers related to societal pressure for improved liveability);
- Finance (financial issues, e.g. drivers or barriers related to the projected revenues of the specific measure);
- Technique (technical issues, e.g. barriers related to the breakdown of specific measures or drivers related to smart solutions for knowledge infrastructure);
- Policy (political issues, e.g. barriers related to national policy for kilometer pricing);
- Process (e.g. barriers related to the complexity of the implementation process or drivers related to process management).

Table B.2.1 shows the result.

Table B.2.1 Major drivers and barriers

WP	Major Driver						Major Barrier				
	Society	Finance	Technique	Policy	Process		Society	Finance	Technique	Policy	Process
5.1 Access time window											
5.1 Dedicated bicycle routes											
5.3 Truck parking management											
5.4 Transport priority and dedicated lanes											
6.1 P&R pricing strategies for target groups											
6.2 Kilometre pricing											
6.3 Demand dependent paid parking											
7.1 Integration of cycling and public transport											
7.2 Large scale expansion of P&R											
7.3 PT over water											
7.4 Automated people movers											
8.1 Electric two-wheelers											
8.2 Expansion of van pooling for commuters											
8.3 Expansion of car sharing											
9.1 E-commerce logistics											
9.2 Multicore tube logistics											
10.1 Green commuter plans											
10.2 Integration of P-P transport Initiatives.											
10.3 New approaches to integrated planning											
11.1 Integration of transport management systems											
11.2 Intermodal travel information											
11.3 Dynamic PT information											
12.1 Clean and silent PT fleet											
12.2 Electric vehicles for the distribution of goods											
12.3 Cleaner vehicles for waste collection											
12.4 Electric vehicles in public fleets											
Total number of drivers and barriers per category	8	4	4	7	2		3	7	1	8	6

The table shows that most measures were society or policy driven. However for other measures policy appears to be the strongest barrier as well. Also finance and the implementation process itself appear to be strong barriers.

B.3 Overview of results of the impact evaluation

In order to obtain a clear overview of the results of the impact evaluation IVAM developed a colour-code system. For each measure the results per evaluation area are shown in table B.3.1.

Table B.3.1. Overview of evaluation results per evaluation area, based on all indicators

	Measure	SOCIETY	ECONOMY	TRANSPORT	ENERGY	ENVIRONMENT
5.1	Access time windows					
5.2	Dedicated bicycle routes	+	-	+	+	+
5.3	Truck parking management	+	-	+		+
5.4	Transport priority and dedicated lanes	?	+	?	+/-	+
6.1	P&R pricing strategies for target groups	+/-	-	+	+/-	+/-
6.2	Kilometer pricing					
6.3	Demand dependent paid parking					
7.1	Integration of cycling and public transport	+	-	+	+	+
7.2	Large scale expansion of P&R	?	?	?	?	?
7.3	PT over water	+	?	+	-	-
7.4	Automated people movers					
8.1	Electric two-wheelers	+	-	+/-	+	+
8.2	Expansion of van pooling for commuters	+	?	+	+	+
8.3	Expansion of car sharing	+	+	+	+	+
9.1	E-commerce logistics					
9.2	Multi core tube logistics	+	+/-	+	+/-	+
10.1	Green commuter plans	+	+/-	+		
10.2	Integration of P-P transport Initiatives.	+				
10.3	New approaches to integrated planning					
11.1	Integration of transport management systems	+	-	+	+/-	+/-
11.2	Intermodal travel information					
11.3	Dynamic PT information	+	?	?		
12.1	Clean and silent PT fleet: DNOx	+/-	-	-	+/-	+/-
12.1	Clean and silent PT fleet: SCR	+	-	+	-	+
12.2	Electric vehicles for the distribution of goods	+/-	-	+/-	+/-	+/-
12.3	Clean vehicles for waste collection: active filter	-	-	-	+/-	+/-
12.3	Clean sweeping machines: CPO filter system	+	-	+	+/-	+
12.4	Electric vehicles in public fleets	+/-	+/-	+	+	+

For measures that were cancelled (3) or seriously delayed (3) an impact evaluation could not be carried out. For these 6 measures the evaluation areas are 'grey' in table B3.1. One of these measures (7.4) is still expected to produce impact evaluation results during the TELLUS project. These results will be included in the TELLUS final report. Measure 12.1 is presented twice in the table as the first design (DNOx filters) showed too many failures and was therefore replaced by another approach, using SCR filters. Measure 12.3 is presented twice also as there are clean vehicles of two kinds involved; vehicles for waste collection and street sweeping machines. As each vehicle has its specific evaluation results the measure actually can be interpreted as two measures, from the evaluation point of view.

For the shaded cells in the table no indicators were selected at the start of TELLUS. The green cells are positive (+), *i.e.* the score is 'good'. The red cells are negative (-), *i.e.* the score is 'bad'. For the yellow cells the impact is neither negative nor positive (+/-), *i.e.* the score is 'neutral'. These scores were determined by adding up the individual scores per indicator[4]. For the cells with a question mark it was not possible to assess all indicators selected within the evaluation area.

Society

Table B3.1 shows that most measures have a positive impact on Society. The (only) negative impact for the active filter system in 12.3 is related to the low operators' acceptance due to the technical failures. The 'neutral' score of 12.2 is also due to low operators' acceptance as there were many breakdowns. The SCR filter in 12.1 has a better score on Society than the NOx filter due to the positive effect on human health. The neutral score on society for the P&R site (6.1) is the result of long waiting times (-) but nevertheless good acceptance (+).

Economy

Most measures have a negative score on economy due to the fact that costs (investment, maintenance, etc.) are not compensated by financial benefits. However, there are no MAESTRO indicators for long-term economic effects. Less air pollution (especially dust) for instance could easily result in lower national health costs for the future.

The impact on economy for car sharing (8.3) is positive as it is a commercial success. The impact for the water taxi (7.3) on Economy is for the same reason expected to become positive. However, this could not yet be proven in practice in the final evaluation, hence the question mark. The same holds for Van Pooling (8.2).

[4] Indicators are added by the following rule: score + and score –, add up to +/-. Furthermore, + and +/- add up to +, and – and +/- add up to –. As an example, the scores +, +/-, +/-, – , –, +/-, +/- add up to – regardless the sequence in which they are added up.

Transport

Most measures have a positive (or neutral) impact in the evaluation area Transport. The only two negative scores for DNOx filters and electric vehicles are caused by the many breakdowns.

Energy

In general, the table shows that the score on Energy is about the same as the score on Environment. This makes sense as the most important environmental indicator is the energy related emission of CO_2, NOx and dust. For only two measures the impact on Energy is negative. For the SCR filters (12.1) this is due to the energy consumption needed to produce its catalyst, urea. For the water taxi (7.3) the negative score on energy is caused by the relatively large number of people that use the water taxi just for fun.

Environment

Most measures have a positive impact on Environment. For the water taxi (7.3) the (only) negative effect on Environment is due to the negative effect on CO_2 (see Energy) as well as to the negative effects on dust and noise. These last two effects however could easily be overcome by using another kind of engine.

The clean vehicles (12.1 to 12.4) show a relatively large number of neutral scores because after the implementation several breakdowns occurred (DNOx filter, electric vehicles, active filter systems for waste collection vehicles). We consider here that because of these breakdowns no impact (neither positive nor negative) on environmental indicators could be established.

For the CPO systems considered in 12.3 the positive impact is due to reduced emissions of VOC and CO. The intended reduction of small particles (PM10) however was very small.

Ex-ante evaluation

In 2003 the LEM conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

For most of the measures (17 out of 26) it was possible to find comparable measures that have been undertaken in the past. The criteria used for assessing the quality of the data proved helpful. Due to large differences in socio-economic, cultural, political and even geographical structure it was expected that the accuracy and reliability of the comparison with the TELLUS measures (in Rotterdam) is relatively low. It seems more appropriate to predict the expected impacts in a qualitative way than in a quantitative way. This of course differs for various types of measures, i.e. straight forward technical measures are easier to predict compared to soft measures.

In retro perspective indeed we learned that the quantitative predictions could not be sustained in the TELLUS measures, due to quite diverging outcomes or due to a lack of quantitative data from the TELLUS measures. The category areas that could be compared on a more qualitative level showed better signs of comparability. From the 37 times such a comparison was possible, in 70% of the cases the ex-ante prediction met the ex-post outcome. This seems to confirm the idea that a qualitative ex-ante evaluation on the level of measures even if it is based on experiences in different cities. A quantitative ex-ante evaluation should be limited to tailor made approaches dedicated to the involved city itself.

More detailed information on indicator level can be found in the separate reports on measure level (B5-B30)[5].

[5] In the electronic version the demonstration measure numbers in table B.3.1 are linked to the evaluation reports on measure level.

B.4 Evaluation results on measure level

In B5 to B30 the individual reports on measure level are presented. A short description of the contents of these reports is given in B1. Each measure level report has the following structure:

1. INTRODUCTION
2. DESCRIPTION OF THE DEMONSTRATION MEASURE
   - 2.1 Demonstration design
   - 2.2 Rotterdam transport plan context
   - 2.3 Objectives
   - 2.4 Ex Ante evaluation
3. IMPLEMENTATION PROCESS
4. RESULTS
   - 4.1 Evaluation methods
   - 4.2 Impacts
5. CONCLUSIONS
6. SCENARIOS
7. RECOMMENDATIONS
8. ANNEX

B.5 Access time windows to promote clean commercial vehicles (5.1)

1. Introduction

At the start of the TELLUS project there were no time access restrictions for commercial traffic in the Rotterdam inner city, except for two streets. Such time access restrictions have been identified as possible solutions to fight air quality, noise and liveability problems related to goods distribution.

2. Description of the demonstration measure

2.1 Demonstration design

The measure aimed at designing a policy plan on Access Time Windows. Subsequently this policy should be implemented. A special focus was made for a policy (for decision making) on widening the time windows for clean commercial vehicles especially related to other TELLUS measures such as 12.2.

In the course of the project the design was altered into a more integrated approach by designing a so-called 'Quality Network'. First, a study for urban distribution in the city centre of Rotterdam was performed. This was requested by the key stakeholders who advised to start with a study of the process and then work on solutions. The results of this study and the discussion of the results with the key stakeholders have lead to the plan to design a Quality Network.

The Quality Network should be regarded as a fundamental condition for efficient sustainable regional distribution. A regional sustainable network contains requirements on safety, accessibility, traffic flow and liveability (noise, odour nuisance). The challenge is to find a good balance between those requirements. Liveability aspects will also be addressed in a separate study into the introduction of Low Emission Zones. This study is conducted outside the TELLUS project.

2.2 Rotterdam transport plan context

The access for city distribution vehicles in the city of Rotterdam at present is organised via special distribution areas, which are accessible all day long. Time-windows in the city centre are only in place in two streets. Surveys show the city centre of Rotterdam is regarded one of the best accessible city centres in The Netherlands by transport companies, and problems regarding city distribution are rather small and don't relate to the presence of time windows in just two streets. In the wider Rotterdam region only few city centres have time windows in place. The situation in Rotterdam and the wider region, in which city distribution is not a major problem, is not comparable with the situation in other Dutch cities and regions where city distribution can be a major problem.

2.3 Objectives

The immediate objectives of this measure were to design a policy on Access Time Windows (March 2003), to implement this policy (February 2004) and to design a policy (for decision making) on widening the time windows for clean commercial vehicles (February 2004).

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

The acceptance of the measure is usually measured among the transport companies. The measures have to be accepted to be successful: if the distributors will not cooperate the project fails. Distributors have a non-negative opinion of access time windows, as long as there is a need for time windows to avoid accessibility problems, time windows are not to narrowly defined and the specific rules about specific places are known to all.

In a survey by the Platform for Urban Distribution in the Netherlands, the distribution companies had a preference for 'moving windows' across a region because this enables a high level of vehicle utilization in regional transport[6].

The use of time windows requires extra staff for administration. In one case, 3-4 people were used on top of the existing facilities, which cost €275.000. However, in practice this was cost-neutral because of the extra revenues from the project.

In one case the city closed its centre for vehicles longer than 9 meters, heavier than 7,5 ton and with less than 80% of the load for inner city distribution. As a result the number of ton-kilometres rose by 17% in two years. This is partly due to the size restriction on the trucks: less tons per truck and therefore more trucks that had to drive more kilometres for the same tons. In another case around 20% savings in driven vehicle kilometres was reported due to the use of load consolidation and route planning applications.

In the case of moving time windows a decrease on a regional scale can be expected: there is no need for two separate trips on the same time to provide distribution in two cities. Impacts on energy consumption and emissions of energy-related substances are partly related to the change in vehicle kilometres. When time windows are combined with clean vehicles this effect could even be magnified. However no data was found on this issue.

In general several reports mention the lack of quantified data on the effects of access time windows on urban distribution, and state that "the nature of many road pricing or urban distribution projects makes them only limited transferable". All projects found in the ex ante

6 Several publications on www.venstertijden.nl and www.psd-online.nl.

evaluation have different specifications for the vehicles allowed (emissions, loading degree, length, weight etc.) so the results differ from city to city.

3. Implementation process

Actual implementation and deviations from the plan

In 2000 a stakeholder meeting with transport companies reached the conclusion that limitations for freight traffic – such as access time windows- in the region of Rotterdam were not compatible with the needs of the companies and would not yield the expected results. The results of some measures would even be an increased instead of decreased freight traffic. Moreover studies showed city distribution within Rotterdam and the Rotterdam region was not a major problem.

The focus for freight traffic shifted from a project aiming at city distribution towards the design of an integrated regional policy for sustainable freight traffic. The design should also identify and take into account the most important regional roads for handling large flows of freight traffic in between the most important regional centres.

In the course of the project several conclusions were drawn that affected the original plan of policy making for access time windows:

- Surveys showed that the accessibility of the Rotterdam city centre was relatively good. The (minor) problems regarding city distribution can not be solved by introduction of time windows. Moreover introduction of time-windows is likely to increase the number of freight vehicle trips into the city centre instead of decreasing freight traffic. At only two streets time windows are in place. This is with good reason; during peak-hour shopping there is not enough space for both city-distribution vehicles and pedestrians. Opening this time windows for clean vehicles is not a possibility in these crowded streets;
- The number of available clean commercial vehicles was very limited (see also 12.2). Only 2 vehicles remained the initial project period and these 2 vehicles also encountered several technical problems. As the clean vehicles were an important incentive for this project, an important pillar of the project had crumbled;
- Next to the availability of the clean vehicles there were some serious doubts about the safety of the clean vehicles for other traffic users. It was claimed that the silent vehicles could not be noticed in due time. However it was expected also that technical solutions could relatively easily help to overcome this problem;
- The goods transporters requested an integrated approach of the whole region where the time windows of the Rotterdam city centre were tuned up with other cities in the region.

Due to these developments the partners involved[7] decided to focus less on time windows but more on improving the accessibility for freight traffic towards major economic centres within the Rotterdam region.

It was decided to focus more on the integrated approach of the quality of the regional road network in relation to environmental thresholds. In dialogue with the key stakeholders the Quality Network was determined. The 1st phase has determined which roads within the Rotterdam region are part of the network for goods distribution and provide access to regional industrial areas and shopping centres. By the end of 2003 the key stakeholders appointed the most important economical destinations and routes in the region. These destinations and routes are the basis for the Quality Network.

The 2nd phase delivers a regional sustainable freight traffic policy including requirements for safety, accessibility and liveability. This policy forms a framework for future investments in road infrastructure, spatial planning of new industrial areas and specific measures for facilitating freight traffic. The plans have been communicated with key stakeholders including the Chamber of Commerce Rotterdam, TLN Transport, Logistics Netherlands, EVO (*Eigen Vervoers Organisatie)*, Port of Rotterdam, Province of Zuid-Holland which were consulted during the project. The idea of routing freight trucks via routes which are best capable of handling these volumes has been adapted by the regional body on Spatial Planning and Environment (*ROM Rijnmond*) and is part of the regional Master plan for air quality. The 2nd phase was hampered because the newly formed project team at first did not have sufficient capacity. Liveability aspects will also be addressed in a separate study on Low Emission Zones which is not in the TELLUS project.

Barriers and drivers

The **main barrier** has been the non-acceptance of the freight sector and other stakeholders of the original TELLUS measure 5.1. The original measure was designed before the structured discussions with the freight sector and the regional actors on this topic had started. The stakeholders had other, more urgent, problems that needed to be solved first before the city could start promoting clean vehicles and enforcing any type of access restrictions. The main effort during the first years of the measure was put in the organisation of the discussion among the stakeholders, finding a common starting point and formulating joint objectives. This resulted in the implementation of the Quality network. In this respect, it can be concluded that over time the co-operation with the stakeholders has become the **main driver** of the measure. It meant, however, that the original focus of the measure was changed to deal first with the most urgent problems of the freight sector. Only at the end of the TELLUS project, the discussion on Low emission zones and clean vehicles could be taken up again.

[7] Chamber of Commerce Rotterdam, TLN Transport, Logistics Netherlands, EVO ("Eigen Vervoers Organisatie"), Port of Rotterdam, Province of Zuid-Holland and the Rotterdam regional authority.

From the start of the measure the problem addressed has been considered as a regional issue, meaning that regional, provincial and neighbouring local authorities needed to be involved in the detailed design and in the application of the measure. The complexity of organising an integrated regional policy formed a **second barrier** for a swift introduction.

A **third important barrier** has been the project management at the city of Rotterdam. During the TELLUS project there have been a number changes in the responsible project manager and there have been several periods during which the project team was not at full strength. This has lead to additional delays, especially in this process where the consensus building between stakeholders was central and therefore the personal contacts with the various representatives of the stakeholders was very important.

Another, more technological barrier, was the non availability of clean commercial vehicles on the market and the poor performance of the electrical distribution vehicles demonstrated in TELLUS measure 12.2. This situation provided the stakeholders the arguments for reconsidering the idea of applying favourable conditions for clean commercial vehicles.

Achievement of milestones

Table B.5.1 Milestones for 5.1

Milestone (original)	Planned	Actual implementation
Policy on Time Windows designed	November 2003	-
Implementation of the Access Time Windows policy	September 2004	-
Design policy on widening the time windows for clean commercial vehicles	September 2004	-
Milestone (adapted)	Planned	Actual implementation
Design of a regional Quality Network – phase 1	December 2003	2004
Policy plan for Quality Network – phase 2	September 2005	July 2005

4. Results

Evaluation methods

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

Also a set of impact evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators cover all 5 evaluation areas. Acceptance among transport companies was considered a relevant indicator. The same goes for the impact on the number of trips and amount of transport kilometres and their subsequent impact on freight fuel efficiency and related environmental indicators. These indicators have also been addressed in the ex ante evaluation (§2.4). However due to alterations made during the project period of the measure, it was decided that an assessment of the selected impact indicators is not opportune.

Although the design of the measure eventually was changed to the development of a regional quality network, the implementation in the last stage of the TELLUS project made it impossible to obtain impact related results.

5. Conclusions

This measure was one of the few TELLUS measures that were not able to meet its original or adapted milestones. The main reasons for this were studies which showed accessibility for city distribution vehicles was not a major problem within Rotterdam as well as the poor availability of clean vehicles from 12.2. Also the need for an integrated regional approach hampered the introduction of time windows in the city of Rotterdam.

The project however did bring together some relevant stakeholders for goods transport in the region and paved the way to put the issue of goods transport in relation to environmental thresholds on the agenda. This is all the more relevant since the environmental burden by traffic and transport in general and goods transport in particular is likely to be a major issue for the coming years. Already the development of projects for spatial planning is affected by traffic related burden caused by noise and dust emissions.

6. Scenarios

It is unlikely that time windows related to clean vehicles will be implemented on a short term in the city of Rotterdam. Although this measure has a high interrelationship with the TELLUS measure 12.2, even a more successful outcome of the latter one would probably not be enough to gain sufficient acceptance for the introduction of time windows.

At the moment the process of policy making for the regional quality network is in its final stage.

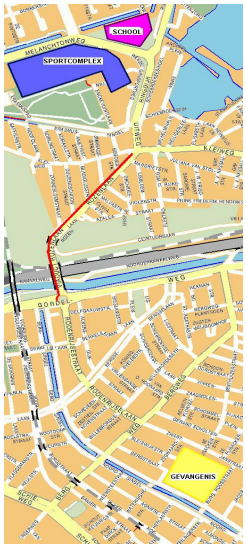
7. Recommendations

The main reason for introduction of time-windows for city distribution vehicles should be problems in the accessibility of the city and shopping-areas for city distribution vehicles. If time windows are already in place, it could be considered to widen them for clean vehicles if this does not affect the safety of pedestrians in the shopping streets. If time-windows are not in

place, as in the Rotterdam situation, introduction of time windows is not an effective instrument for stimulating the use of clean vehicles. Future studies will show if introduction of a Low Emission Zone, which addresses clean (freight)traffic directly, is a feasible option in Rotterdam.

B.6 Dedicated bicycle routes (5.2)

1. Introduction



In the year 2003, an inquiry showed that the number of people in Rotterdam who own a bike is relatively low compared to other Dutch cities. It also showed that for the inhabitants of Rotterdam, the lack of continuous high quality bicycle routes was an important reason not to buy a bike. As a result only 21% of the short trips in Rotterdam are made by bike (Fietsbalans 2003, www.fietsbalans.nl) whereas in the average Dutch large city 34% of the short trips are made by bike. To increase the use of the bicycle in Rotterdam as an attractive, cheap and clean means of transport, especially on distances between 3 and 7 km, four cycle routes to the central station and other public attracting places in the city centre were planned to be designed and realised within the TELLUS period.

2. Description of the demonstration measure

2.1 Demonstration design

Bicycle route 1 connects Schiebroek with Hofplein[8] in the centre of Rotterdam. On 8 places this route has to be adapted in order to improve the quality of the bicycle track and the road safety for bicyclists. The adaptations will consist of separation of the bicycle track from the motorway, improved quality of the road surface and of street lighting.

The complete route will be carried out in red coloured asphalt. The red asphalt will be continued on crossings, where the route has a right of way. About 40% of the route will be located in a so called 30 km/h zone for motorized traffic. On the rest of the route the maximum speed for motorized traffic is 50 km/h. In the 30-km/h zone, the route will not be physically guarded from other traffic as this is not allowed in the Netherlands. But the route and road will be designed in a way the cyclists do have their own space. At those parts where the route follows 50 km/h roads, the cyclists will be guarded with a physical barrier. The route has to become a part of the sign-posted bicycle network and the complete route will be carried out with street lighting.

For the routes 2, 3 and 4 a design will be made.

2.2 Rotterdam transport plan context

In most cities in The Netherlands it is usual to design (or adapt) bicycle lanes only on those moments that streets are ‘under construction’, for instance because of a sewerage

8 It follows the Kastanjeplein and Wilgenlei, Ringdijk, Uitweg, Rozenlaan, Gordelweg, Bergsingel, Noordsingel, Teilingerstraat and Schiekade to the Hofplein and back.

reconstruction. In Rotterdam the so called "*Fiets Actie Plan*" was set up in order to overcome this 'ad hoc' policy and to design and construct 10 to 12 dedicated bicycle routes, 4 of which were planned to be implemented within the TELLUS period.

2.3 Objectives

Immediate objectives:

- Design and realisation of Route 1 (Hofplein-Hillegersberg: 4,8 km);
- Design and realisation of Route 2 (stadscentrum-Carnisselande: 7,5 km);
- Design and realisation of Route 3 (to be determined);
- Design and realisation of Route 4 (to be determined);
- Demonstration of the effects of the individual routes and the four routes together.

The ultimate objective is to promote the use of the bicycle for trips to the city centre and central train station.

2.4 Ex-ante evaluation

In 2003 IVAM conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

The ex ante evaluation mentioned, showed that dedicated bicycle lanes have a positive effect on the evaluation areas Society, Economy[9], Traffic, Environment and Energy.

3. Implementation process

Originally 4 new or adapted bicycle routes were envisaged but due to changing policies after the elections in 2002 the planned implementation of dedicated bicycle lanes was cancelled. For one of the bicycle lanes (route 1) however, the plans had already reached the point of no return at the time of the elections. The realisation of this route started in August 2002. The route consists of 13 parts, 12 of which were ready in the summer of 2005. The last part will be realised in August 2005. After that the signposts will be implemented. It is not yet clear when this work will be finalized. The implementation process was delayed by approximately 6 months because of appeals of citizens as well as (political) disagreements with local authorities. During the implementation process it appeared that some people are opposed to bicycle lanes because

[9] In the Ex Ante Evaluation, investment costs were not taken into account. The impact on Economy was only based on the costs of bicycle use compared to car use and the cost saving effect of avoided traffic jam's.

they find bicycles dangerous for their kids playing in the street, or because they fear a loss of parking space for their cars or they just don't want any changes in their street.

Barriers and drivers

The major, even fatal barrier in this measure turned out to be the changed policy, as three of the four bicycle routes were cancelled. However, recently the air quality became a 'hot issue' in The Netherlands. As a result there is a new initiative to design and implement route 2. It is aimed to start the implementation in 2006. Another barrier is the opposition of some people living in the streets where the dedicated routes are planned. The major driver for this measure is the bicyclists' appreciation for dedicated bicycle routes.

Achievement of target and milestones

Table 1 shows the Milestones as mentioned in the original inception report. As explained, only one of those milestones was met.

Table B.6.1Milestones for 5.2

Milestone (original)	Planned	Actual implementation
Realisation Route 1	July 2002	August 2005 (planned), except signposts.
Realisation Route 2	July 2003	Cancelled
Realisation Route 3	July 2004	Cancelled
Realisation Route 4	April 2005	Cancelled

4. Results

4.1 Evaluation methods

For the impact evaluation counts and face-to-face interviews were carried out. The counts were carried out yearly (2002, 2003, 2004, 2005). In 2006 there will be counts as well. This report is based upon the counts of 2002, 2003 and 2004. Some data (on emissions) were derived from the counts. The interviews were carried out in October 2003. Furthermore, a yearly, citywide survey was used.

The results are presented in this report as effects on indicators compared to the situation before the realisation of the bicycle route and are shown as a simplified score (- to +). Score + can be interpreted as a 'good' or 'positive' effect on the indicator or evaluation category, *i.e.* a positive score is an 'improvement'. The underlying quantitative and qualitative results can be found in the annex.

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators were not discussed with other demonstrator contacts since no immediate synergy with other measures was expected. The indicators used are listed in table 2.

4.2 Impacts

Table 2 shows the results of the impact evaluation. More underlying calculations and assumptions can be found in the annex.

General

So far the immediate objectives of this measure could not be met. Mainly due to shifting political priorities during the project period the introduction of more upgraded bicycle routes has been hampered.

Society

The results of the extensive survey can be found in the annex. In short it can be stated that the opinion about the attractiveness of the route has improved on most aspects, especially about the quality of the road surface. Only the opinion about street lighting has not improved. As the bicyclists are positive about the waiting time for traffic lights and positive about their right of way to other traffic it is assumed that they will experience shorter journey times.

Economy

As the investment cost for the dedicated bicycle route is not expected to be compensated by revenues[10] the impact on economy is negative. If cycling can substitute car use in congested areas cycle routes may reduce the amount of potentially unproductive time currently lost in congestion. Health effects of cycling may reduce expenses of health care and reduce long and short time absence.

A traveller that switches from car to bicycle gains €0.125 per passenger kilometre, or (on the average 4,8 km route) more than 1 € per trip.

Transport

The results of a questionnaire held in October 2003 seems to indicate that 6,5% more bicyclists used this route who formerly used the car or PT (tram). It is not completely sure whether this

[10] Revenues are based on saved costs for car use and avoided traffic jam's.

change in modal split will change in the future and whether it is directly related to the realization of the improved route.

The improved safety rating and the fact the improved route is well known to its users, could be accounted for with the help of the questionnaires.

Table B.6.2 Impact on indicators for 5.2

Evaluation Area	Indicator	Impact
Society	Acceptance rating	+
	Mean journey time	+
Economy	Investment costs	-
Transport	Vehicle capacity[11]	
	Total pkm travelled	+
	Average modal split	+
	Average route change	+
	Success of advertising	+
	Accidents	+/-
	Safety rating	+
Energy	Passenger fuel efficiency	+
Environment	All (CO2, NOx, SOx, dust)	+
	Average noise	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

Energy/environment

Based on the educated guess that the modal split on the improved routes has improved slightly, a positive effect on fuel consumption and emissions could be established.

Table 3 shows the results, aggregated per evaluation category and compared to the ex ante evaluation.

Table B.6.3 Evaluation area scores for 5.2 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex ante	+	+	+	+	+
Ex post	+	-	+	+	+

+ = area improved, +/- = no change or negative impact equals positive impact
- = area worsened , ? = unknown

[11] Remark reviewer: “indicator not useful”

5. Conclusions

Due to policy changes only one of the originally planned 4 dedicated bicycle routes could be implemented within the TELLUS period. The route was realized with some delay due to local inhabitants opposed to having a bicycle lane in their street. The bicyclist themselves however, are very satisfied. They find it an attractive and safe bicycle route with high quality road surface and less nuisance of other traffic. As a result the dedicated bicycle route has a positive effect on society, transport, energy and environment. The positive effect on energy and environment are important as in The Netherlands measures to improve the (local) air quality are vital in order to meet the European standards. As a result a second bicycle route will probably be implemented from 2006.

6. Scenarios

For the year 2010 a total of 10 to 12 dedicated bicycle lanes in Rotterdam (as originally planned in the “Fiets Actie Plan” see 2.2) would be a realistic scenario. This would yield a total of approximately 50 km’s of bicycle lanes. The actual realization however will depend on the attitude of the municipality and local politicians. Especially it appears of vital importance to have a councillor for traffic who has a large commitment for bicycle lanes in the city.

There is a large potential for dedicated bicycle lanes in large Dutch cities. As in countries outside The Netherlands there are hardly ‘regular’ bicycle lanes in cities, the potential for dedicates lanes in those countries is very high.

7. Recommendations

It is recommended to have Route 1 signposted as soon as possible and to carry out an extra evaluation afterwards. The positive effects of the bicycle route, especially on local air quality and safety, could then be used to further promote the implementation of more bicycle routes, not only amongst politicians but also amongst the inhabitants of Rotterdam in order to avoid opposition of local inhabitants against new routes.

8. Annex

8.1 Survey

A survey was held among bicyclists on the improved part of bicycle route 1 in Rotterdam[12].

The mean distance that is covered by the subjects (one-way) is 5,4 km. Over 67% of the participants travel 5 km or less, 26% between 5 and 10 km and 7% more than 10 km. Most

12 Survey bicycle route 1. Results of the survey on bicycle route 1 in Rotterdam. Tom Monné, IVAM UvA bv, Amsterdam, October 2003

participants use the bicycle route for commuter-traffic (32%), 16% use it for going to school, 24% for shopping and 28% for or other purposes (recreational, visiting friends, etc.). 82% of the participants covered the whole route and 18% covered only a part of it. The next table shows what the participants find important about bicycle routes in general.

Table B.6.4 Survey results (1) for 5.2

Which of the following aspects do you find important about bicycle routes in general?	%
Traffic safety	99
Quality of the road surface	95
Street lighting on the route	80
To have minimal nuisance of other traffic	78
Bicyclists having right of way on other traffic	68
Short waiting periods at traffic lights	63
Minimal noise from other traffic	17

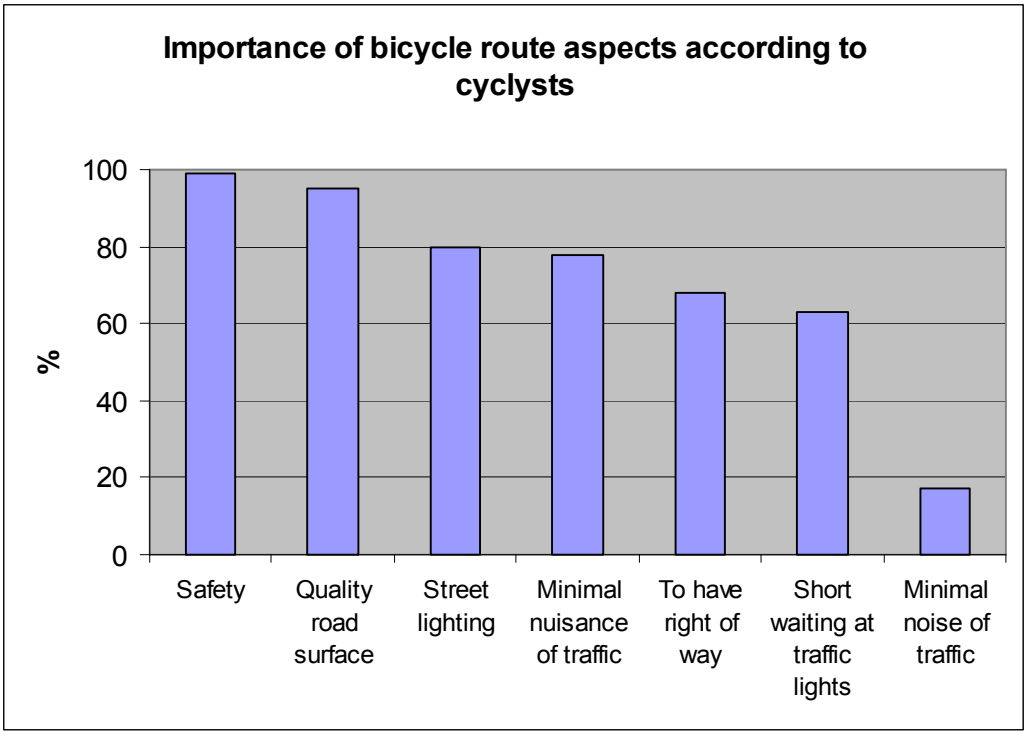


Figure B.6.1 Importance of bicycle route aspects according to cyclists

A similar survey was held before the route was altered. That survey included more school attending youth and somewhat less people who use the route mainly for shopping. The participants were asked to give their opinion about several aspects of the route in both surveys. The scores are presented below in a scale from - - to ++. Table 5 shows that the opinion is improved on most aspects, especially about the quality of the road surface. Only the opinion about street lighting has not improved.

Only 5% of the participants heard of the name TELLUS before. Almost 88% knew that the route has been altered recently. Those participants were asked how satisfied they are with the changes to different parts of the route.

Table 6 shows that participants have a stronger opinion (both positive and negative) about the changes to the roundabout at the Gordelweg compared to the changes to the other parts of the route. That could be explained by the behaviour of motorists who refuse to give way at the roundabout; some participants mentioned this. Other remarks were mainly about improving the situation at the intersection of the “Kleiweg” and the “Rozenlaan”.

Table B.6.5 Survey results (2) for 5.2

Question	Before changes	After changes
What is your general opinion about the attractiveness of this route?	+/-	++
What do you think of traffic safety on intersections on this route?	+/-	+
What do you think of traffic safety on the route in between intersections on this route?	+/-	++
What do you think of the quality of the road surface on this route?	-	++
What do you think of the street lighting on this route?	+	+
A bicyclist should have minimal nuisance of other traffic. What do you think about that on this route?	-	++
What do you think of bicyclists having right of way on other traffic on this route	+/-	+
What do you think of the waiting periods at traffic lights on this route?	+/-	+
What do you think about the noise from other traffic on this route?	-	+/-

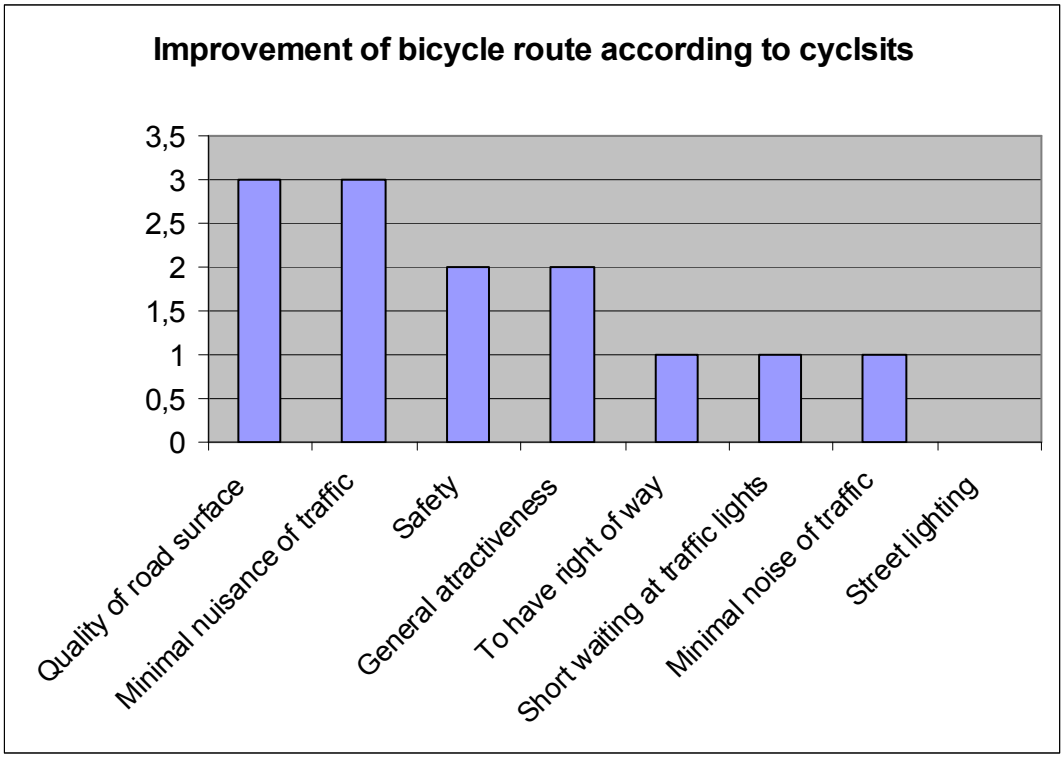


Figure B.6.2 Improvement of bicycle route according to cyclists

Table B.6.6 Survey results (3) for 5.2

Satisfaction of the participants with changes to …	Very satisfied (%)	Satisfied (%)	Neutral (%)	Unsatisfied (%)	Response (N)
De Gordelweg	33	54	7	6*	124
Het Rozenlaanviaduct	20	72	7	1	123
De Rozenlaan	10	72	15	3	118

* including 2% very unsatisfied

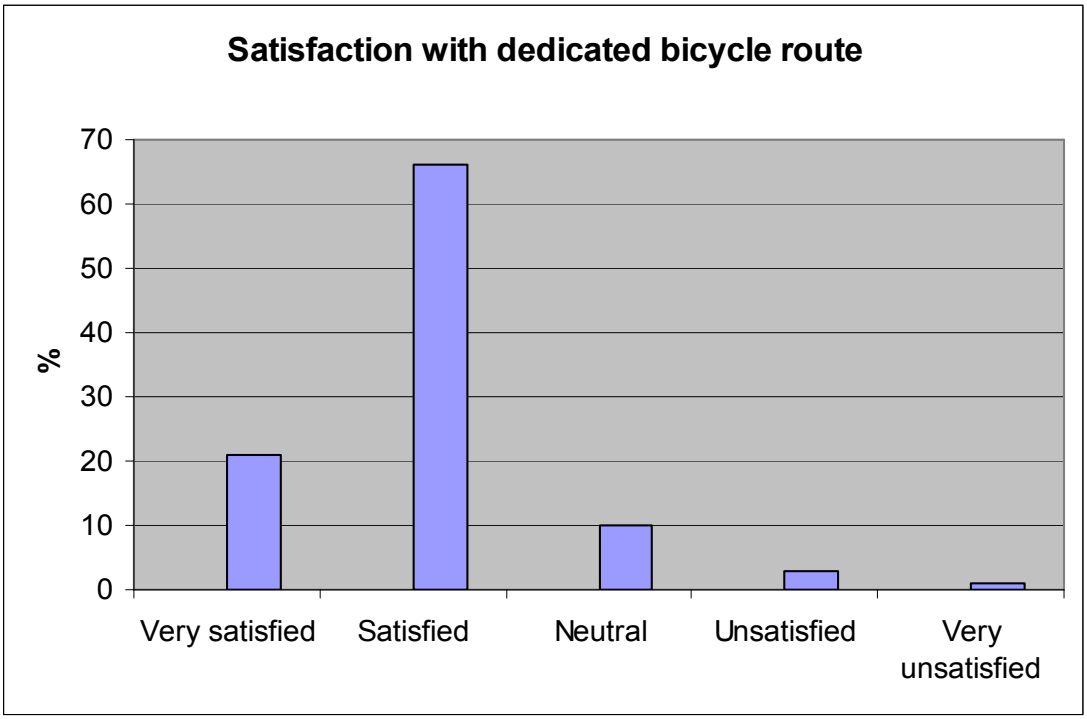


Figure B.6.3 Satisfaction with dedicated bicycle route

In a city wide survey ("Omnibus") it was determined that 13 % of the inhabitants of Rotterdam were aware of the bicycle route, which is a high percentage with respect to the limited target group of regular bicyclists.

8.2 Counts

Next to the survey, actual counts have been made by the city of Rotterdam. The results from these counts are presented in the tables below.

Table B.6.7 Survey results (4) for 5.2

	Passenger car	Van	Motor	Bicycles mopeds	Total
Rozenlaanviadukt	76,3	11,4	0,4	11,9	100,0
Alternative route	79,2	11,9	0,5	8,4	100,0

Reference: Rapport 'monitoring fietsroute 2003' (in Dutch)

Table B.6.8 Survey results (5) for 5.2

	Passenger car	Van	Motor	Bicycles mopeds	Total
Rozenlaanviadukt	64,7	10,4	1,0	23,9	100,0
Alternative route	72,1	11,0	0,9	16,0	100,0

Reference: Rapport 'monitoring fietsroute 2003' (in Dutch)

Calculation of passenger fuel efficiency:

Based on tables above the assumption could be made that on the new route 15,2% (11,6/76,3) less cars were used on this route. On the alternative (reference) route the decrease was 10,0%. So a net decrease of approx. 5,2% of the car use is measured. The results of a questionnaire held in October 2003 seems to indicate that 6,5% more bicyclists used this route who formerly used the car or PT (tram).

The increase in the absolute number of trips was 1.195 (+6,7%) since the average number of trips per week with bicycles at the Rozenlaanviaduct was measured at 17.944 (2002) and 19.139 (2003).

It is unsure whether this change in modal split is sustainable and directly related to the realization of the improved route. For instance: 2003 had less rainy days than 2002, which favours the use of bicycles in 2003. Indeed in the whole of Rotterdam more bicycle trips were counted compared to 2002 (+ 16,7%).

For the calculation we assumed that approx. 6,5% more bicycle trips led to 5% less car use due to the improved route. This means that 919 less car trips were made with an estimated trip length of 5 km. In total a number of 4.095 less car kilometres (or 5.733 pkm's) were driven thus decreasing the fuel use with 348 litre (8,5 l/100 km) per pkm. The emission of CO2 decreased with 26.658 kg (4,65 kg CO2-eq/pkm). The increase of the number of bicycle trips obviously does not lead to an additional fuel use. Therefore the overall impact on emissions will be positive.

B.7 Truck parking management in residential areas (5.3)

1. Introduction

The Rotterdam Fruitport is the only large part of the harbour that is located on the northern banks of the river. Approximately 80 companies make use of this harbour that, as the name states, deals for a significant part with the exchange of fruits and concentrated juice.

In the mid-nineties the Port of Rotterdam made plans for a large-scale restoration and upgrade of this harbour area. The objective was to make the harbour better suited to future needs and to create a better basis for efficient logistics. In these plans the whole area of the harbour is covered including its corridor to nearby highways. The Truckpark Fruitport is an important part in this chain.

The reason behind the introduction of Truck Park Management is the need to prevent parking of trucks in residential areas. As the Fruitport is located in the immediate vicinity of a residential area, many local truck drivers make use of this area to park their vehicles, especially in the weekends. Therefore the residents of urban areas close to the port district face safety, noise and accessibility problems because of the parking of truck-combinations.

To counteract the problems land in the port district has been designated to serve as a dedicated site for parking of truck combinations. The first designs were prepared in the years 1997-1998. In the following years some 40 dedicated spaces have been created.

2. Description of the demo

2.1 Measure design

The existing parking area will be extended (the number of parking spaces increases from 40 to 60) and the facilities will be improved. To improve the regulation and movement of lorries, a truck parking management system will be set up including a traffic circulation plan and traffic guidance systems. Special attention has been given to communication issues, especially to the truck drivers (EU and non-EU drivers) as main target group. The signing of the truck parking areas was realized.

Concrete results are that there are now 60 parking spaces and that the Fruitport Business Association has set up a trial for traffic circulation. The grounds have been adapted to better accommodate the trucks and special communication and safety systems have been installed.

Innovative aspects of this measure are providing a solution for traffic related safety and noise problems in residential areas as well as introducing a smart type of land use.

2.2 Rotterdam transport plan context

The regional Traffic and Transport Plan in general tackle the mitigation of nuisance and congestion problems due to goods transport for the greater Rotterdam area (RVVP). The issue of goods transport and its conflicts with residential areas however is not specifically addressed in the RVVP. The initiative for the truck parking management was taken by the Port of Rotterdam (*Havenbedrijf Rotterdam N.V.*). Port of Rotterdam is responsible for the management of the port area and surrounding industrial zone.

2.3 Measure objectives

The main goals of the measure Truckpark Fruitport are to better accommodate trucks and to better regulate the movement of lorries from the highways to the port area. An additional expected outcome is that the measure is thought to speed up the handling/ processing of orders.

The immediate objective of the measure was the expansion of the Truck Parking management concept with 20 new parking spaces. The ultimate objective is a reduction of truck parking in the residential areas.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

For this measure however it was not possible to find comparable measures which have been undertaken in the past and/or which have been reported in accessible literature.

3. Implementation process

Actual implementation and deviations from the plan

The measure has been designed and was implemented by the Port of Rotterdam. The first designs were made in 1997 and it took about 8 years to grow to the mature phase where it is now. This period was needed because of the place of the Truckpark project in the larger project of revitalising the harbour area and the necessary tuning with other parts of the main project.

In the design phase there was no necessity for specific cooperation with other public or private

bodies. In the implementation phase some cooperation was needed with both the municipality of Rotterdam and the administrative area *Delfshaven*. These bodies support the project with necessary permits.

Furthermore throughout the project the local police department has been informed and asked for increasing parking control in the residential areas. This operation ensured also an increasing acceptance of the truck parking area.

In the course of 2005 the maintenance and management of the truck parking area will be transferred to a foundation that has been founded amongst others for this purpose. The foundation is established by (a part of) the participating companies in the Fruitport area. The Port of Rotterdam will play an advisory role.

In the future the Truckpark Fruitport will be equipped with a centralized traffic management system. Furthermore the target group of truck drivers in other residential areas will be approached and stimulated to use the Truckpark.

Barriers and drivers

The main barrier for this measure was the acceptance by truck drivers to use to the Truckpark. It is essential to communicate with them and explain the benefits of the Truckpark in terms of safety, convenience and efficiency. Here the use of the Truckpark was stimulated and enforced by the companies that actually handle the cargo. There were no major other barriers from political/administrative, societal, economical, technical, or other factors.

Achievement of milestones

Table B.7.1 Milestones for 5.3

Milestone (original)	Planned	Actual implementation
60 new parking spaces at truck parking site	January 2003	January 2003
Fully operational truck park	July 2005	August 2005

4. Results

4.1 Evaluation methods

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators were not discussed with other demonstrator contacts since no immediate synergy with other measures was expected. The indicators used are listed in table 2 in §4.2.

The results are presented in this report as effects on indicators compared to the situation before the implementation of the measure and are shown as a simplified score (- to +). Score + can be interpreted as a ‘good’ or ‘positive’ effect on the indicator or evaluation category, *i.e.* a positive score is an ‘improvement’.

Port of Rotterdam retrieved the data. Occupation rates of the Truckpark and land of origin of the trucks are registered on a daily basis. Quarterly reports were available about the daily routine in the Truckpark Fruitport. Especially safety issues and cooperation with other authorities are addressed in these reports. Unfortunately only reports for the year 2001 were available, however it is expected that the results are valid for the present measure as well.

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

4.2 Impacts

Society

The implementation of the Truckpark Fruitport has led to less parking movements in the surrounding areas. Therefore the conclusion has been made that citizens in these areas will have a positive attitude towards this measure, although the acceptance amongst citizens has not been surveyed. The measure provided several jobs for the management of the Truckpark (1-2 fte) as well as personnel for surveillance activities. This concerns some 18 people working in daily shifts.

Economy

Investment costs to implement the Truckpark Fruitport mounted up to approximately 1 million euro. Although a gate fee might possibly be introduced in the future, it is not expected that these revenues will compensate for all of the variable and maintenance costs. Externalities such as fewer burdens due to decreased road noise or improved safety have not been accounted for.

Transport

In 2004 well over 9.000 trucks made use of the Truckpark Fruitport. The parking time is between 1 and 7 days. Trucks that are parked for more than 7 days, are directed to another area in the Eem/Waalhaven. The monthly occupation is nearly constant.

The trucks originate from both national and international haulage companies, whereas for the latter the Scandinavian, Central-European and Baltic States dominate.

The occupancy rate of the Truckpark (60 places) varies but on average is about 50-60%. The new parking space is vital to meet the extra demand for space during peak hours. The utilisation of Truckpark Fruitport has increased steadily from 2001 onward to the current stable level. It is assumed that an occupancy rate of 70-80% is an optimum. A higher occupancy rate could lead to more congestion in peak hours.

Communication with the truck drivers about the availability of the Truckpark is conducted

through the companies present in the harbour area. In the near future (but outside TELLUS) the signposts towards the Truckpark will be assessed and evaluated.

The increased effort of security employees parallel to the extension of the Truckpark Fruitpark has led to an improved safety situation for the truck drivers. Although not structurally surveyed the truck drivers generally expressed a very positive attitude towards the Truckpark as perceived by Truckpark management employees. The number of incidents in the area also decreased although the incidents involved were usually not traffic-related incidents.

Environment

The decrease of parking movements in the residential areas has shifted peak noise burden from populated areas to less populated areas. The (difference in) peak noise levels have not been measured. Impacts on land use and other traffic related emissions are expected to be minimal.

Table B.7.2 Impact on indicators for 5.3

Evaluation Area	Indicator	Impact
Society	Acceptance rating	+
	Long term jobs	+
Economy	Investment costs	-
	Maintenance costs	-
	Costs per tkm	+/-
Transport	Safety rating	+
	Incident levels	+
	Information sites	+
	Occupancy rate	+
Environment	Land lost	+/-
	Emissions (CO_2, NO_x, SO_x, dust)	+/-
	Peak noise	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

Table 3 shows the results, aggregated per evaluation category. For Energy no indicators were selected. Therefore the area is shaded.

Table B.7.3 Evaluation area scores for 5.3 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex post	+	-	+		+/-

+ = area improved, +/- = no change or negative impact equals positive impact
- = area worsened , ? = unknown

5. Conclusions

This measure has some recognizable success and failure factors. An evident success factor was the clear separation of tasks between the stakeholders. The Port of Rotterdam was only responsible for design and implementation. The Fruitport Foundation is responsible for maintenance and management of the truck parking area. This agreement both enhanced the positive attitude of Port of Rotterdam as did it enhance the acceptance and support of the companies in the Fruitport area.

The acceptance for the project in the residential areas was ensured from the start but positively influenced by the activities of the local authorities in parking control and therewith stimulate truck drivers to avoid the residential area.

A factor that clearly can disturb the project is insufficient communication with and encouragement of the truck drivers. An appropriate signing of the route to the truck parking area is necessary. Also the fees for the truck parking area should not be to high in order to avoid unwanted effects such as transfer of the initial problems to other areas.

6. Scenarios

In general the project described here is suited for any area where transport activities and residential areas lead to impacts beyond the levels of acceptance. The harbour area of Rotterdam is more situated in the vicinity of residential areas compared to other large and medium sized port cities. In Rotterdam this has lead to problems in another part of the harbour area, namely the *Waal- and Eemhaven* area. Here already in the mid nineties of the last century a form of truck parking management has been established, leading to significant less nuisance and safer and cleaner conditions for truck drivers.
At present no other ‘problem zones’ have been identified in the Rotterdam area. Therefore it is not likely that the concept of truck parking management will expand significantly in the coming decade.
In most other Dutch ports the distance between harbour area and residential area is larger than in Rotterdam. A large-scale transfer of this concept to other Dutch cities therefore doesn’t seem realistic. In the European area however some specific cities may find this approach a useful addition to their current policy measures. Furthermore this measure is not dedicated exclusively to harbour areas. In other residential areas close to industrial business a similar kind of friction between these functions can occur. Here also a form of truck parking management might prove useful.

7. Recommendations

There are several lessons learned from this measure. The most prominent one is that, although all relevant parties benefit from the measure, still a strong driver is necessary to set up the measure as described here. Here the internal policy intentions of the Port of Rotterdam acted as main driver. Another lesson is that clear communication to the main target group, the truck drivers, about the benefits of the measure is a necessity to reach the goals set.

These two lessons are also the main recommendations for other cities when they get involved in similar projects. It is expected however that the uptake potential of this measure is not very large. The situation of a harbour area in close vicinity of residential areas is not common in Europe. On the other hand the uptake potential could grow if truck parking management proves to be suited for other areas as well, i.e. industrial zones in the vicinity of residential areas.

B.8 Public transport priority and dedicated lanes (5.4)

1. Introduction

The RET (public transport company of Rotterdam) is responsible for the exploration of 8 metro lines (176 kilometres), 9 tram lines (93 kilometres), and 38 bus services (433 kilometres) and transports more than 600.000 passengers per day. Because the cities constant growth, public transport constantly needs to improve in order to maintain the necessary accessibility. Speed and reliability are crucial factors when promoting public transport and making it a more attractive option.

The objective of the high quality tramline concept (TramPlus) with dedicated lanes is to support this promotion of public transport. At the demonstration site an extensive network of PT-priority is already in place consisting of over 150 Urban Traffic Controls (UTC) with PT-priority and dedicated bus lanes at more than 25 locations. This network will be upgraded with the high quality tramline concept.

2. Description of the demo

2.1 Measure design

The high quality tramline concept (TramPlus) has recently been introduced in Rotterdam to increase both speed and reliability of public transport vehicles. This can be done by giving public transport vehicles priority over other road users at traffic lights; they then do not need to stop at junctions, or only stop for a short time. Also the introduction of special, separate lanes improves traffic flow; in this way public transport vehicles can follow their route without being hindered by other road users. Rotterdam already has an extensive network of traffic lights where public transport has priority over other road users. There are also special bus lanes at 25 places throughout the city.

The trams should carry the passengers more quickly and reliable to their destinations, with fewer delays. This is accomplished by their own separate route off the road, the priority at traffic lights (UTC) and the slightly longer distance between stops. In addition this concept offers more comfort due to improved waiting facilities and easier access as the vehicle doors are at platform level. The high-level tram stops (at 28 cm) give elderly and disabled people the opportunity to enter the low floor vehicle without the help of others.

The platforms are equipped with dynamic travel information panels, which show the remaining time till the next tram will arrive (see also TELLUS project 11.3).

Stop distances are about 500 m. Average speed of the vehicles will be 25 km/h. Frequency at start is 7,5 minutes during the rush hour and 10 minutes during the rest of the day.

The activities within the TELLUS-project consist of the design, planning and realization of 3 routes (from Central Station to Schiedam, Carnisselande and IJsselmonde), the realization of separate lanes, the implementation of tram timetables and an investigation into the impacts

The innovative aspect of this measure is the combination of public transport priority at UTC's and dedicated lanes along the full route of tramlines.

2.2 Rotterdam transport plan context

The plan for the TramPlus-concept is embedded in the regional Policy Plan for Traffic and Transport (RVVP). The Rotterdam City Region commissioned the TramPlus lines. The RET has been delegated to take care of the everyday affairs. For every line which is being developed, separate project organizations have been set up. These come under the strategic projects department of the RET. Decisions regarding the various plans have to be approved by municipal councils, which are advised by council committees. The Ministry of Transport and Public Works has a role in the whole process, considering it awards subsidies to the projects. For this reason, the plans are first put to the test by the Department of Public Works.

2.3 Measure objectives

The immediate objectives of this measure are the design and planning of three dedicated routes for high quality tramlines, realization of the dedicated lanes and assessment of the impacts. The routes are:

- route 1: Rotterdam Central Station to Schiedam-Vlaardingen;
- route 2: Rotterdam Central Station to Carnisselande;
- route 3: Rotterdam Central Station (via Feyenoord stadium) to IJsselmonde.

In the first three years of TELLUS 10 kilometre of new dedicated routes for TramPlus should be realised. Furthermore 12 kilometre of existing tram route will be upgraded into the TramPlus concept.

The ultimate objective is to increase the reliability of travel time of public transport (PT) by using PT-priority measures and thus make PT more attractive. Furthermore the aim is to increase the reliability, the number of passengers and the comfort.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

From this evaluation it appeared that in previous projects aiming at dedicated lanes for public transport, the journey times decreases significantly (10-50%). The passenger capacity and total number of passenger kilometres is growing considerably so that the modal share of public transport is rising. This will also lead to lower costs for rolling stock and lower personnel costs, leading to improved operational revenues. Pay back times of the initial investments are estimated between 1 and 5 years. As a result all projects addressing dedicated lanes report a positive effect on all evaluation areas (Society, Economy, Transport, Energy and Environment) It was must be stated however that the majority of the projects described dealt with bus lanes and not with dedicated lanes for trams. It is not sure how the outcomes of the ex ante evaluation hold for this measure.

3. Implementation process

Actual implementation and deviations from the plan

Following thorough research, the Masterplan TramPlus was introduced in 1993. In this plan, the tram network for the year 2010 was charted. In 1994, the Masterplan was approved by the City Council. In 1997, the update was issued in which priority was given to three TramPlus lines: the IJsselmonde line, the Carnisselande line and the Schiedam/Vlaardingen line.

Line 20 has been in use for some years already. At the end of 1999, the first new stop will be positioned in Beijerlandselaan. The introduction of new tram rolling stock from 2002 onwards will complete the TramPlus picture.

Schiedam/Vlaardingen line (route 1)

The Schiedam/Vlaardingen line (formerly line 1; will be line 21 in the future) has a total length of 18.9 kilometres, including the extension to the future NS station Schiedam Spaland. 42 stops are planned: eighteen in Rotterdam, twenty in Schiedam and four in Vlaardingen. The total journey time for the two connections will be about forty minutes. The preparations for Schiedam/Vlaardingen line were finalized in 2004. The line is not yet operational. For some parts construction work is running. For the other parts not yet under construction the specifications have been written.

Carnisselande line (route 2)

The Carnisselande line (line 25) will be 11.2 kilometres in length. The journey time between Carnisselande and the centre of Rotterdam is about 25 minutes and 19 stops are planned. With this new TramPlus connection, the new residential neighbourhood Carnisselande and the shopping area Boulevard-Zuidas been linked on the regional public transport network in 2004. The construction work ran until April 2005. The direct current power supply building was finished, after some delay, in February 2005.

IJsselmonde line (route 3)

The IJsselmonde line (line 23) will be 12.1 kilometres in length. The journey time between the starting point and the terminus is about thirty minutes and 21 stops are planned. As precursor of the IJsselmonde line, the Stadium line (line 23), was constructed specially for Euro2000.

According to the schedule, this line should be ready in 2003. In the MIT (Long-term Programme on Infrastructure and Transport) however the execution of the IJsselmonde line was only planned to start after 2005. First the direct current power supply building was finished in August 2004.

Barriers and drivers

The realization of these routes required intensive cooperation with other departments within the municipality of Rotterdam, for instance the departments of Spatial Planning and of Traffic and Transport. As a result in general the communication between the departments clearly improved at least on the short and middle long term.

There was also intensive communication with other stakeholders such as organizations for local shopkeepers or affected residents. The success of this communication varies with the impact of the intended work on these shopkeepers and residents. Sometimes satisfactory solutions and compromises were possible. In some other cases this did not happen and the subsequent legal disputes following this have led to a delay of the projects. The actual full implementation of three new and/or upgraded routes will be finalized after the TELLUS period.

Achievement of milestones

Table B.8.1 Milestones for 5.4

Milestone (original)	Planned	Actual implementation
First route realised	February 2004	July 2004 (partly)
New dedicated routes for trams realised	March 2005	> 2005

4. Results

4.1 Evaluation methods

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators were not discussed with other demonstrator contacts since no immediate synergy with other measures was expected. The indicators used are listed in table 2. The results are presented in this report as effects on indicators compared to the situation before the implementation of the measure and are shown

as a simplified score (- to +). Score + can be interpreted as a 'good' or 'positive' effect on the indicator or evaluation category, *i.e*. a positive score is an 'improvement'.

Some of the indicators have been assessed on the basis of the first TramPlus line (line 20) which is operational for a few years now. The success of advertising was derived from the annually city wide survey ('Omnibus') amongst more than 2000 respondents in the years 2003-2005 with one question specifically dedicated to the TramPlus concept.

4.2 Impacts

General

It is very difficult to predict concrete impacts such as a modal shift. In the TramPlus concept more people are using public transport, and a large share of those people has previously used the car for the trip now made by tram. The proportion of this share differs enormously over the various projects, and so is hard to predict. This is because of the multiplicity of factors involved: is it an entirely new tramline? Do the routes change? Were there new residential areas or offices build along the route during the process of upgrading? The new TramPlus line 25 for instance connects with a newly developed area making it impossible to compare with the situation before implementation. The same combination of effects occurs in the already existing TramPlus line 20 in Rotterdam. This line saves approximately 2 million car kilometres per year (Verkeerskunde magazine, 2003). This is however also due to the use of the new bridge across the river Meuse and the development of an urban residential area in this part of the city.

Society

For the TramPlus lines 1 and 25 an assessment of journey times is not possible. These lines are not operational yet respectively a new line so a comparison with 'old' journey times is not feasible.

TramPlus line 25 connects to a newly designed area and is worthwhile to explore the relationship with the vitality of the area. However because of the delay in the implementation an actual evaluation of this impact was not possible.

The effect on employment of this concept is considered of minor importance. Although the new efficient lines might lead to less working place, the development of new lines also leads to an increase of jobs. So indeed the overall effect will be close to neutral and if any impacts occur, the size will be fairly limited especially in relation to the substantial re-organization process currently taking place in the Rotterdam Public Transport Company.

Economy

The costs per pkm are mostly determined by labour costs and fuel (energy costs). Since the efficiency of the TramPlus is higher compared to the ordinary tramlines, the costs per pkm are

considerably lower. The first TramPlus line has a cost recovery, i.e. share of costs covered by passenger revenues, of 50%. The other tramlines usually have a cost recovery between 30% and 40%.

Transport

The first TramPlus concept led to a sustained growth of 10% in number of passengers. In general it is very difficult to assess the impact of the TramPlus concept due to a large number of other measures and developments taking place in public transport policy and public transport exploitation. However, most of these developments in recent years had a negative effect on PT. For instance changing political priorities, cut backs in the PT organization and increased prices for PT led to less use of PT. It is expected that the TramPlus concept at least *tempered* this negative effect. The same applies to the modal split. The use of PT overall has increased, partly due to new lines and partly due to the TramPlus concept, but the use of cars also increased. There are no clear signs of a modal shift. Only for the new line 25 an estimation can be made for the 'new' transport kilometres that otherwise would have been made by car.

One other positive effect was the increase in average velocity from 18 to 23 km/h (target is 25 km/h) indicating a more efficient use of the network. In the case of line 1 also a clear positive effect is foreseen for the integration with other transport modes especially due to the connection with the railway station Schiedam. For the other lines such clear advantages are not foreseen.

The safety has been improved on the lines, which is mainly due to the use of special trained employees accompanying the trams. This is a part of the TramPlus concept as well. However, no statistics on this aspect were available. This lack of data makes it also difficult to assess the anticipated increase in traffic safety.

The success of advertising is related to the citywide 'Omnibus' survey. The particular question about the TramPlus concept reveals that in the years 2003-2005 a constant part of 31% (± 3%) is familiar with the concept. About 61% (± 2%) never heard of the TramPlus concept. Also a lot of effort has been put in information sites about the new tram lines, in particular for line 25.

Energy/environment

The increased efficiency of the TramPlus concept leads to less fuel (energy) use per pkm in comparison with ordinary tramlines. On the other hand, the new trams are heavier and therefore take up more energy. This is *tempering* the overall effect per pkm. So only the emissions related to electricity production will be slightly decreased. The local emissions will not change much since a local modal shift with less car kilometres or even less bus kilometres is not expected. See also the header *transport*.

Table B.8.2 Impact on indicators for 5.4

Evaluation Area	Indicator	Impact
Society	Mean journey time	?
	Footfall	?
	Change in unemployment	+/-
Economy	Investment costs (purchase)	-
	Investment costs (support-infrastructure)	-
	Fuel cost per unit of revenue	+
	Staffing costs	+
	Maintenance costs	+
	Cost	+
	Subsidy	-
	Operating revenues per passenger	+
	Retail sales turnover	?
Transport	Passenger capacity	?
	Success of advertising	+
	Ease of interchange	?
	Accidents / Safety rating	+
	Total pkm travelled	?
	Average occupancy on a given route	?
	Average modal split (PAX)	?
Energy	Passenger fuel efficiency	+/-
Environment	All emissions (CO2, NOx, dust)	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

Table 3 shows the results, aggregated per evaluation category and compared with the ex ante evaluation.

Table B.8.3 Evaluation area scores for 5.4 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex ante	+	+	+	+	+
Ex post	?	+	?	+/-	+

+ = area improved, +/- = no change or negative impact equals positive impact
- = area worsened , ? = unknown

5. Conclusions

Only some parts of the routes could be realised during the TELLUS period. The full implementation was delayed, not unexpectedly for such large measures, because of time consuming negotiations with various stakeholders. Some technological barriers occurred as well

but had only a small impact on planning and implementation.

A major factor for success (or failure) is the amount of effort put in communication with local stakeholders. Due to the size and impact of this type of projects, many people are involved and affected. This requires much and early communication in order to gain acceptance and achieve a positive attitude towards the project. Surely this will not be realized in all cases. On the other hand will it smoothen the process and at least lead to less chances of major delays or deviations.

For the impact evaluation the conclusions are not so clear. Because of the delays mentioned earlier no evaluation data could be retrieved for this report. There is some evidence from the already existing TramPlus route that positive impacts can be realized in certain evaluation areas. But given the unique nature of each TramPlus route not all experiences with the existing route could be transferred to the new ones.

6. Scenarios

For the future it is expected that a further expansion of the TramPlus concept will be achieved. Until 2015 one new line and one upgrade of an existing line is envisaged. By then the TramPlus concept will have a significant market share. More than 50% of all tram passengers will make use of such a TramPlus line.

The remaining lines are predominantly situated in the inner city area. An eventual upgrade of these lines into the TramPlus concept is all the more difficult because it is unlikely that all desired functions of the corridors can be fulfilled in a satisfactory manner. Any spatial planning policy in this area will undoubtedly lead to much debate and opposition.

In the other cites in the Netherlands were tramlines are present, The Hague and Amsterdam, comparable initiatives as the TramPlus concept are in progress or finalized.

Indeed in many cities in Europe this concept has been adopted, sometimes even much earlier than in the city of Rotterdam. Actually the Rotterdam initiative was at least partly stimulated by successful projects in other European cities such as Grenoble. The concept of dedicated lanes for public transport has proven to be easily adoptable and transferable.

7. Recommendations

As the measure was not fully implemented within the TELLUS timeframe, no particular recommendations were formulated here.

B.9 P&R pricing strategy for target groups (6.1)

1. Introduction

In the Rotterdam region the P&R sites offer free parking for all users. The Rotterdam Alexander site is close to a metro/intercity train station and has 535 parking places. A lot of non PT-users make use of the P&R site to go shopping or working in the area instead of using the P&R for its main purpose. Due to this, it is possible that people, who do want to use the P&R for travelling with PT, cannot find a parking place. The aim of this measure is to ensure the availability of parking spaces for public transport (PT-)users at the P&R site "Rotterdam Alexander".

2. Description of the demonstration measure

2.1 Demonstration design

A pilot was introduced for the period of two years, from July 2004 to March 2006. In this pilot the city of Rotterdam implemented a parking management-system. It is a basic parking system. People who can show a public transport ticket (with correct stamp and date) will get a free parking ticket. People who cannot show a ticket will have to pay a parking tariff. Controllers who will be present from 7:00 – 20:00 will check the tickets. When the controllers are not present the P&R can be used without a ticket. In the future a pay-machine will be used to recognise a legal public transport ticket with stamp or a public transport ticket without one.

The measure had a number of internal objectives. Achieving these objectives is an important pre condition for the continuation of this measure. The objectives are:

- Achieving an average occupancy rate of 80% or more;
- The parking pressure in surrounding residential areas should increase with no more than 10%;
- The share of the non-target group should be less than 50%.

2.2 Rotterdam transport plan context

The stimulation and expansion of P&R sites in the Rotterdam region is an important item within the Regional Traffic and Transport Plan 2003-2020 (RVVP). The parking policy is primarily the responsibility of the local authority. The *Stadsregio* (Regional Authority) plays a co-ordinating role. One of the items is the development of pricing strategies as described in this measure. The

Stadsregio also wants to increase the number of P&R places by 18.000, to a total of 23.000 places in 2020 (see WP 7.2).

2.3 Objectives

The immediate objective of this measure was to make a P&R management system operational in January 2003. The ultimate objective was to regulate the use of the P&R-site.

The immediate objective of this measure was to make a P&R management system operational in January 2003. The ultimate objective was to regulate the use of the P&R-site and maintain a number of parking place available for public transport users. Within Rotterdam furthermore two preconditions were set to measure to success of the measure:

The measure had a number of internal objectives. Achieving these objectives is an important pre condition for the continuation of this measure. The objectives are:

- Achieving an average occupancy rate of 80% or more;
- The parking pressure in surrounding residential areas should increase with no more than 10%;
- The share of the non-target group should be less than 50%.

2.4 Ex-ante evaluation

In 2003 IVAM conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

Several sources of information have been found during this evaluation. The information used refers to the cities of Amsterdam and Munich in particular. Unwanted use is counteracted in both cities in the same way: a public transport ticket has to be shown when the P&R-facility is left. The P&R site is actually transferred into a transferium.

Many users express their acceptance for these kind of P&R facilities. But only between 11 and 14 % of the users of the P&R-sites and Transferia answer ‘yes’ when asked if they think frequency, speed and comfort are important and if they are willing to pay a further €1,15 if public transport improves. Many (potential) users state that is sufficient information signs should be available on both highways and urban roads, and well in advance of the P&R-site.

No information was found about the actual costs of these measures. Costs depend on the kind of system implemented and the number of information signs used. Some revenues will come from ticket sales. If the system will work automatically, there is no need for daily staff.

It is important to know where the non-public-transport-users will go now they won’t be able to park free anymore. Almost half of the users (47%) have ‘shopping/leisure’ as their purpose when they use the P&R-site. More than half of the users (51%) continue their trip on foot after

they have parked their car on the site. Combining these two figures, it seems likely that a large number of P&R-users (half of the users = maximum 240 cars at a time) uses the site to shop in the area. It is likely that the new approach will lead to lower occupancy rates. If one can only park on the P&R-site with a public transport ticket, these shoppers have the option to use another means of transport, stay home, shop in the city centre or park their car elsewhere. What these 'unwanted' users will do in the future can have an effect on retail sales turnover.

The transferia have lower vehicle occupancy than the P&R-sites. Considering there are more commuters (people who mention 'work' as their trip purpose) in the transferia than on the P&R-sites, it is to be expected that vehicle occupancy will decrease. 44% of the users indicate that they would have made the trip entirely by car if there was no P&R-site. This figure is close to the average of 48% for P&R-sites. There is no difference between transferia and P&R-sites in this figure, so ticket integration does not seem to have a very profound effect on modal split. On average, 36% of the user continue their trip by public transport for 'ordinary' P&R-sites and 60% on average for 'Transferia' that have ticket integration with public transport.

Transferia are more known through the media and through road signs (45%) than P&R-sites, which are mostly known through other people and hearsay and only for 27% through media and road signs.

Passenger occupancy rates are lower in transferia (with ticket integration) than in 'ordinary' P&R-sites (without ticket integration), a decrease from 1.44 to 1.30, so passenger fuel efficiency decreases also.

3. Implementation process

Actual implementation and deviations from the plan

The parking system was realised under supervision of the department for street supervision and parking enforcement (*Stadstoezicht*). Agreement was reached with the Rotterdam department for Public Works about future maintenance. Furthermore a communication plan was written.

The actual measure was implemented in May 2004. Subsequently a monitoring program was started. This program consisted of several actions. At first in March 2004 the pre-situation was monitored and evaluated. After the implementation actual counting's as well as interviews with users of the site took place. In March 2005 the first results of intermediate counting's were presented. Later on in 2005 a second result report will be presented in combination with the final evaluation for the city of Rotterdam.

Barriers and drivers

The main driver for the measure was the lack of parking spaces for public transport users because the P+R was used by users of the nearby shopping and office areas.

One of the main barriers was the uncertainty about the ownership rights of this public area. The

city districts (deelgemeenten) felt reluctant to taking up the ownership since this would also lead to additional efforts in relation to spatial planning plans as well as possible financial repercussions. Finally it was decided that the central city development department of the municipality would be owner and another central department (Stadstoezicht) would be responsible for control and management. The discussion about this issue caused some delay in reaching the milestones.

Another barrier related to the previous, is the question of maintenance of the P&R area. This is a question that is not only affecting this specific measure but is a general bottleneck for the P&R policy in the Rotterdam region. For this measure the district government demanded that the question would be solved before implementing the new system. The measure suffered several months of delay and finally it was decided that the city department Gemeentwerken is responsible for the maintenance of the area. A building permit was needed for the implementation of the system and the shelter of the control personnel. There were objections raised by neighbours leading to an additional barrier and delays.

Another barrier was formed by the search for a feasible technological solution. Time was invested in developing the functional specifications and tendering for a system that would be able to distinguish non PT-users from PT-users. Finally it was concluded that a visual control by the human controllers was the most efficient way to implement the system. In the near future when a PT smart card will be introduced in the Rotterdam region a more feasible technological solution could be found.

Achievement of milestones

Table B.9.1 Milestones for 6.1

Milestone (original)	Planned	Actual implementation
P&R management system operational	November 2003	June 2004
Evaluation results available	March 2005	> Summer 2005

4. Results

4.1 Evaluation methods

A set of impact evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators were not discussed with other demonstrator contacts. The results are presented in this report as effects on indicators compared to the situation before the implementation of the measure and are shown as a simplified score (- to +). Score + can be interpreted as a ‘good’ or ‘positive’ effect on the indicator or evaluation category, *i.e.* a positive score is an ‘improvement’.

The demonstrator contact conducted the monitoring and evaluation program. For the interviews a questionnaire was drawn up in cooperation with the LEM. The pre-situation measurement was supported by the results of 283 questionnaires (response of 44%). The first measurement was

supported by 151 interviews. The results were presented in a report in March 2005 that focused on the following issues:

- Occupancy rates at P&R and in surrounding (residential) areas;
- Survey on the type of users (target group and non-target group);
- Origin and destination of users;
- Acceptance. (Safety, ease of use, etc.).

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

4.2 Impacts

Society

Before this measure was implemented a lot of users (44%) were less satisfied with the number of parking places. The occupancy rates were close to 100% or even above this. After the implementation the occupancy rate dropped to 65%. Therefore this issue has not been dealt with in the interviews.

The acceptance rating related to maintenance of the site however clearly showed improvement. In the pre-situation 44% of the users gave a positive value to this item. After the implementation of the measure this increased to 90%.

The satisfaction rating for safety also increased, from 65% to 80%. Main reasons for this are the improved lighting and increased supervision.

The ease of use was also rated. The rating for the accessibility slightly decreased (from 93% to 83%) but is still very high. The electronic system was rated less favourable (65% satisfactory) because of a number of technical failures that occurred. In some cases this also led to considerable queue lengths.

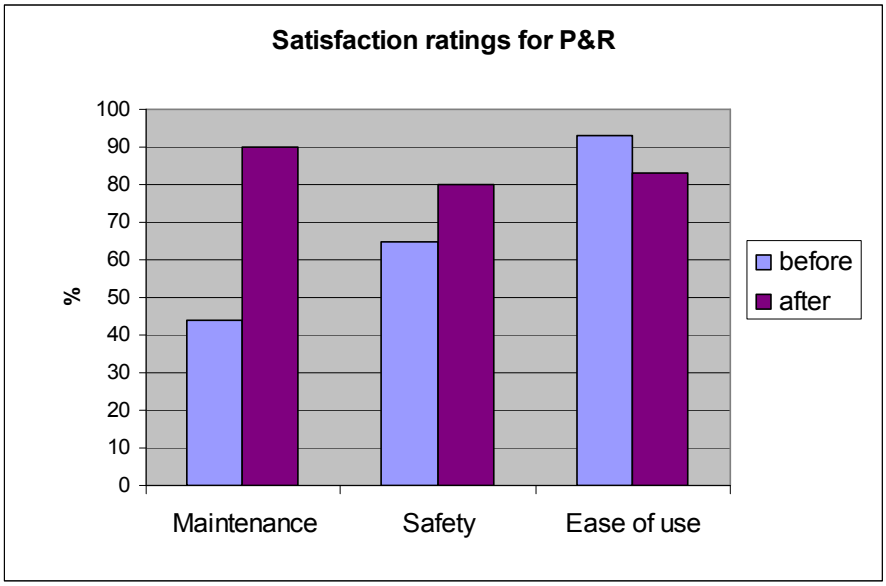


Figure B.9.1 Satisfaction ratings for P&R

Economy

The total costs for the altered design of the P&R facility are estimated at approximately 200.000 Euro. These are only the costs for hardware and not for personnel budgets. The maintenance costs of the facility seem reasonably low although higher than in the previous situation especially since the technical system encountered some problems at the start of the implementation.

Transport

The measured occupancy rate (here addressed by the indicator 'capacity/flow ratio') in 2004 was 64%. This was considerable lower than the 100% rate in the pre-situation and also lower than the stated objective of 80%. The measured occupancy rates in 2005 indicate that this situation is sustained. The extensive counting in residential and shopping areas in the vicinity (approx. 12.000 parking places) showed that the occupancy rates in these areas did not increase.

The target group for this measure (PT-users) clearly benefits from this measure. After the implementation approximately 95% of the users is actually using public transport to continue their journey. Before the implementation only 64% of the users actually belonged to this target group. In the pre-situation a considerable share of the users (35%) had its destination in the city district itself (Prins Alexander) and continued their journey primarily by foot. After the implementation the share of these users practically decreased to 0%. It was not measured whether these users represent a group of residents or for instance shoppers. In the latter case some impact on retail sales might be expected.

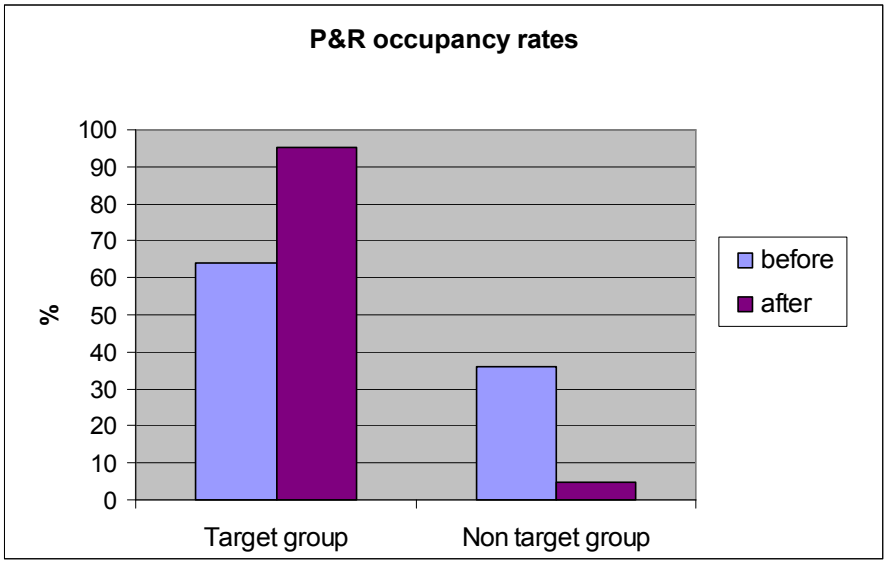


Figure B.9.2 P&R occupancy rates

From the data given in annex 8 it could be concluded that the number of PT users has increased and therefore a modal shift has been established. On the other hand the absolute number of P&R users has decreased significantly. These commuters seem not to make use of other parking facilities in the area as the occupancy rates of these facilities did not change much or even decreased. Therefore we conclude here that although the relative number of PT users increased there was probably no concrete shift of transport modes (car to PT).

Energy/environment

Changes in fuel efficiency and environmental impacts (emissions, noise) in this case relate to changes in modal split. As we concluded here that is not enough prove that a modal shift took place, also these indicators will not be affected.

Table B.9.2 Impact on indicators for 6.1

Evaluation Area	Indicator	Impact
Society	Acceptance rating	+
	Mean waiting times	-
Economy	Investment costs	-
	Maintenance cost	-
	Retail sales turnover	?
Transport	Mean no. persons per vehicle	+/-
	Average modal split – trips	+/-
	Capacity/flow ratio	-
	Information sites	+
	Success of advertising	+
	Ease of use	+
Energy	Vehicle fuel efficiency	+/-
	Passenger fuel efficiency	+/-
Environment	Emissions (CO2, Nox, SOx, dust)	+/-
	Average noise	+/-

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

Table 3 shows the results, aggregated per evaluation category and compared with the ex ante evaluation.

Table B.9.3 Evaluation area scores for 6.1 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex ante	+	?	+/-	-	-
Ex post	+/-	-	+	+/-	+/-

+ = area improved, +/- = no change or negative impact equals positive impact
- = area worsened , ? = unknown

5. Conclusions

The implementation of this measure clearly affected the use of the P&R site. After implementation the share of the dedicated target group (public transport users) increased considerably. Although slightly delayed by discussions about ownership rights of the area, the measure was implemented well within the TELLUS project period.

As the measure encountered some technical problems in its early stage user acceptance is not yet at the level which was accepted. Moreover the impact on transport indicators deservers more attention. Although several indicators were rated positive (ease of use, number of information sites) the impact on occupancy rates was still ambivalent. Although the relative number of users from the target group (PT users) increased, the absolute number of users

declined. Because of this, and because the behaviour of the non target group is unclear, it was not possible to make final conclusion about modal shifts.

The general conclusion is that the measure so far has reached its objectives but also that this evaluation needs continuation in the future to see whether these objectives are maintained and to get more insights in the actual impacts.

6. Scenarios

Before the TELLUS-project started there were 23 P&R car parks in the Rotterdam region with a total of 4.700 parking spaces. The occupancy of most of the P&R car parks was high, in some places there was clearly a shortage of parking capacity. In the period up to 2006, more than 1.100 new P&R parking spaces will be created. In the regional policy document a long-term development of 18.000 P&R-places is planned, spread out over 40 P&R-sites in the whole region.

As the Alexander site consists of just over 500 parking places, there is a clear potential for the uptake of this measure in Rotterdam. Final decisions for such an uptake are expected after the internal evaluation report.

The development of P&R sites also relates to other measures as there is possible interrelationship with improvement of public transport services (see WP5.4 and WP11.3), the introduction of clean vehicles for public transport (see WP12.1), the development of urban transport management (see WP10.1) and the introduction of technical innovations (see WP7.4).

7. Recommendations

Although some barriers have been identified (e.g. property ownership), there were no major obstacles to implement this measure. The most relevant recommendation would come from the fact that measures of this kind affect many parameters. Therefore an extensive analysis and assessment is needed for several years to really understand the impact of these type of measures.

8. Annex

In 2004 both an ex-ante measurement (February) and an ex-post measurement (November) was held. In the latter case the measurement was accompanied with a questionnaire for the designated target group. The results of this questionnaire are partly presented in this annex.

Since the objective of the measure was to improve parking facilities for users of public transport, the questionnaire paid much attention to the target group of PT users.

Table 4 below indicates that before the measure was operational 63% of the P&R users would

continue their journey with PT. Another 36% the P&R facility was used by people (mostly commuters) that will continue their journey by foot.

After the implementation of the measure only 4% of the P&R users uses continued their journey by foot. The other 96% of the users continue their journey with PT.

Table B.9.4 Survey 6.1: Travel modes used after P&R parking[1]

	February 2004	November 2004
By foot	101 (36%)	6 (4%)
Train	164 (58%)	137 (91%)
Metro	14 (5%)	8 (5%)
Other	4 (1%)	0 (0%)
Total	283 (100%)	151 (100%)

[1] Data in absolute numbers. The relative numbers are given between brackets.

So overall the implementation of the P&R facility for the target groups was effective. The pre-condition that a maximum of 50 users would belong to the non target group has been met.

However the absolute number of users that will continue their journey with PT has decreased with some 18%. This despite even the fact that PT users can make use of the P&R facility for 24 hours per day, contrary to the former situation. There is no satisfactory explanation for this decline. Possibly the PT users need more time to get familiar with this measure.

The relative rise of the target group of PT users in the P&R facility can also be illustrated by the origin and destination of the P&R users.

Table B.9.5 Survey 6.1: Origin of P&R users

	February 2004	November 2004
Inside Rotterdam	121 (43%)	81 (54%)
Outside Rotterdam	162 (57%)	70 (46%)
Total	283 (100%)	151 (100%)

Table B.9.6 Survey 6.1: Destination of P&R users

	February 2004	November 2004
Inside Rotterdam	130 (46%)	31 (21%)
Outside Rotterdam	153 (54%)	120 (79%)
Total	283 (100%)	151 (100%)

The tables 5 and 6 seem to indicate that more people originating from Rotterdam make use of the P&R facility and continue their journey (outside Rotterdam) with PT. Also the number of P&R users with a destination within Rotterdam decreased, indicating again that the non target group is diverted to other areas or transport modes.

From the data given above it could be concluded that the number of PT users has increased and therefore a modal shift has been established. On the other hand the absolute number of P&R users has decreased significantly. These commuters seem not to make use of other parking facilities in the area as the occupancy rates of these facilities did not change much or even decreased. We conclude here that although the relative number of PT users increased there was probably no concrete shift of transport modes (car to PT). In the future data should be gathered about the non target group and how the new P&R facility influenced their travel and parking behaviour.

B.10 Kilometre pricing (6.2)

1. Introduction

Congestion is a major problem in the densely populated Rotterdam region. This could negatively affect the accessibility of the region and therewith the position of Rotterdam as an important mainport.

A frequently proposed approach to transportation problems in urban areas is congestion pricing. This policy would impose variable tolls on congested stretches of roadway at a level high enough to reduce the number of automobiles attempting get through the roadway. According to standard economic accounts, charging drivers for the use of infrastructure in congested times would help rationalize travel decisions and reduce the wasteful "queuing" on over-crowded roads. The idea of road pricing as a function of congestion costs already was put forward for several decades. The failure to implement congestion charging up till now mainly has political reasons. Currently every owner of a car is taxed equally. The tax is not related to the use of the car. Owners are not confronted with costs for the use of the car, except by the fuel they have to pay.

2. Description of the demonstration measure

2.1 Demonstration design

At the national highways leading towards the city centre, a system of kilometre pricing will be introduced. Traffic will be priced per kilometre instead of present taxation. By making the taxes variable drivers will be confronted with the costs of using their car. The overall strategy and the implementation is the responsibility of the National Ministry of Traffic and Transport. Rotterdam is participating in the project to define the strategy and monitor the effects. A specific point of attention is the strategy regarding measures on the regional network. The following tasks were included in the TELLUS project:

- Define demand management and revenue strategies for Kilometre pricing
- Implementation of kilometre pricing
- Demonstrate the use of kilometre pricing and monitor its effects
- Investigate variability in pricing (e.g. per region and time of the day)

2.2 Rotterdam transport plan context

The congestion problem and subsequently the measures to decrease the problems in the Rotterdam region are an important item within the Regional Traffic and Transport Plan 2003-2020 (RVVP). The measure of kilometre pricing is strongly related to this item. The regional authority (*Stadsregio*) plays a co-ordinating role in the implementation.

2.3 Objectives

The immediate objectives of this TELLUS measure were to reduce congestion during peak hours, influence modal split and prevent trips during peak hours

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

At the time the ex ante evaluation was carried out however it was clear that this measure would not be implemented within TELLUS and therefore no further effort has been put into the ex ante evaluation.

3. Implementation process

Actual implementation and deviations from the plan

The measure on Kilometre Pricing depends on national policy decisions about road pricing. Since the start of the TELLUS project, the composition of the national government changed twice. The position of road pricing in the new national policy document on Mobility for long remained unclear. In the course of 2005 the policy document was published in which final decisions about road pricing again were postponed, at least till after the first elections in 2007.

Because of these developments TELLUS management and the European Commission agreed stop to the original measure to take up a new measure on demand depending strategies for paid parking. Until the decision on the national level the focus of the Kilometre Pricing measure has changed from implementation to preparation. A seminar on kilometre pricing was organised by VVC-R (see WP 10.1) for stakeholders in the Rotterdam region. A representative for Transport from the city of London here elaborated on the Congestion charging scheme and a representative of the Dutch National Transport Council spoke on proposals for kilometre pricing in the Netherlands. A panel that included politicians (i.e. the Rotterdam alderman responsible for traffic and transport) discussed the possible impact of the introduction of kilometre pricing and ways to cope with it.

Kilometre pricing was herewith put on the agenda before the discussion on a political level will possibly result in new policy plans. In this way resistance towards introduction of kilometre pricing in the local business community can be diminished.

Barriers and drivers

The main driver and main barrier for this measure has been the policy making on national level. The national initiative to introduce kilometre pricing was the direct cause for the development of

this measure that was direct on the local impact and accompanying measures. During the TELLUS project the kilometre pricing initiative on national first suffered serious delays and was then stopped. The possibility emerged of an alternative road pricing policy on national level but in the end it became clear that this was not being implemented during the lifetime of the TELLUS project.

Achievement of milestones

Table B.10.1 Milestones for 6.2

Milestone (original)	Planned	Actual implementation
Implementation of kilometre pricing strategy	October 2003	-
Final evaluation results	February 2005	-
Milestone (adapted)	Planned	Actual implementation
Seminar on kilometre pricing, organised for the local business community (100 participants)	April 2004	April 2004

4. Results

A set of impact evaluation indicators was established based on the METEOR approach and in cooperation with the Rotterdam site management. Since the impacts could not be measured these indicators have not been used in this report and an impact evaluation has not been made.

5. Conclusions

The original measure on Kilometre Pricing depended heavily on national policy decisions about road pricing. At the moment it is evident that road pricing has a high level of attention in the political arena but an actual implementation on the short tem is not within reach.

6. Scenarios

Although the implementation of kilometre pricing has not succeeded in this TELLUS project there is evidence that such strategies do have effects on congestion and traffic behaviour.

On the national political level there seems to be consensus that some sort of pricing strategy is inevitable in the future given the still growing flows of traffic and transport.

7. Recommendations

No specific recommendations were identified for this measure.

B.11 Demand depending paid parking (6.3)

1. Introduction

Expansion of paid parking in residential areas is one of the strategies Rotterdam uses to improve the local living conditions. Also similar to WP6.2 demand depending paid parking strategies are proposed to help to overcome congestion problems. Congestion is a major problem in the densely populated Rotterdam region. This could negatively affect the accessibility of the region and therewith the position of Rotterdam as an important mainport.

2. Description of the demonstration measure

2.1 Demonstration design

The borough "Nieuwe Westen" is a neighbourhood which suffers from extensive parking problems. Because of this, paid parking per street will be introduced. It was expected that this per street measure (compared to area-wide paid parking) will have a positive effect on the efficient use of parking places and will reduce the "displacement effect", the parking shifts to the cheap side of the border of a parking area.

In the Netherlands, paid parking is a local tax. The national government has set rules to use this instrument. The most important part of the implementation consisted of setting the rules for paid parking in the area by the local government. Implementation phases planned:

Expansion of paid parking to one or more residential areas outside the city centre

The parking tickets machines are installed and hiring and educating of parking wardens took place. This process took about 6 months. Since November 2003 paid parking is effective in "Nieuwe Westen". The tariff that is used is 24 minutes for € 0,50. This is the lowest tariff used in Rotterdam. The payment is by chip or by mobile phone. Inhabitants can buy a permit. All the parking places can be used by visitors as well by permit users. In December 2003 the monitoring of the occupancy rate started.

Demand dependent tariff

Based on the monitoring outcomes of the introduction of paid parking in the area, a tariff per street could be introduced, depending on the demand for parking space. This must lead to an optimised use of public space which minimises the "displacement effects". The effects of an area based tariff system will be compared with the system per street by measuring the occupancy rates and the effects to the surrounding areas.

2.2 Rotterdam transport plan context

The congestion problem and subsequently the measures to decrease the problems in the Rotterdam region are an important item within the Regional Traffic and Transport Plan 2003-2020 (RVVP). Both the measure of kilometre pricing as the measure of demand depending paid parking (see later on in this report) are strongly related to this item. The regional authority (*Stadsregio*) plays a co-ordinating role in the implementation. Paid parking strategies are also mentioned in the Action Plan on Air Quality as a measure to improve air quality next to improving the traffic flows and reducing the parking pressure in an area.

2.3 Objectives

The immediate objectives of this TELLUS measure were:

- The expansion of paid parking to one or more residential areas outside the city centre;
- Introduction of demand dependent tariffs for street parking;
- Comparing the effects of an area based tariff-system, with the use of a demand dependent tariff-system, by measuring the occupancy-of parking places and effects to the surrounding areas.

The ultimate objectives were to optimise the use of public space and to improve the local environment by expansion of paid parking and the use of demand dependent parking strategies.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

As almost at the start of the TELLUS project it became clear that this measure would focus more on ‘Demand dependent strategies for paid parking’, this measure was subjected to an ex ante evaluation.

From the evaluation several relevant information sources were found for similar measures in Western European areas. These sources also contain information about the evaluation areas depicted for this evaluation.

Within the society area the picture is not all that clear. Especially shopkeepers are sometimes opposed to parking pricing, out of fear that their customers will go elsewhere, since parking policy can have more drastic consequences for the choice of shopping centre than for the mode of transport chosen. Also residential areas can become more appealing to shoppers as they can find a space, leading to increasing congestion in those areas. Residents are less accessible to visitors if the neighbourhood has paid parking. A 15% reduction in traffic volume can be measured since parking prices in residential areas were doubled.

On the other hand the accessibility of the city centre usually improves. In one case some 67% of citizens from the inner city affirmed parking area management.

Some information is found in economy area. For instance in Graz (Austria), revenues out of fees and fines are more than twice the maintenance costs. In general however net revenues will be limited as control and maintenance systems consume most of the turnover.

In the transport evaluation area there was displacement of commuters out of residential areas, but in the short run there is little modal shift. Parking schemes can have an effect on modal split locally by virtue of changing the locations where traffic goes to reach parking spaces. This, in itself, will not affect the modal split on a corridor, but of small areas around parking provision, where the very localised effect could be quite profound. In Linz, Austria, traffic was reduced due to free parking places: there were less people searching for a free place, so less traffic, so less pollution. 38% of the parkers that used to park their cars on the public roads where pricing was introduced, parked their car in a neighbouring area. 5% of the parkers that used to park their cars in the areas which are now subject to parking management, parked their car in a non-managed area. In Vienna, after introducing parking management, the number of vehicles with a 'non-Vienna' registration number decreased by two thirds.

The peak vehicle capacity related to the maximum time allowed for parking. After the introduction of parking management in Vienna, parking space occupation decreased between 19% and 38%. So in the new situation between 71 and 89% of parking spaces was occupied, compared to between 102 and 108% in the old situation. It also decreased in most of the neighbouring districts, indicating a shift from the car to another mode of transport.

As a modal shift is likely to occur also the energy and environmental indicators will show positive signs, not in the least because noise burden in the inner city should decrease. This confirmed by the Vienna case which indicates that the share of vehicles from outside the city declines so the longest trips will be relatively the most replaced, perhaps by public transport, perhaps by park and ride.

In general it is clear that the benefits of this measure are highly dependent on the local traffic system and strongly related to other measures already taken or planned.

3. Implementation process

Actual implementation and deviations from the plan

In the first half of the TELLUS project period the paid parking area was extended to the district of Delfshaven. Also a start was made to monitor the use and effects of the paid parking area to determine how the demand depending pricing strategies should be further implemented.

Although a first investigation took place, it must be considered as not representative since the situation in a neighbourhood has to settle after the introduction. The citizens who live and work in the area, were informed and permits were distributed. Parking meters and signs were placed in the streets. The necessary regulations were decided on by the local government.

It was planned to start in 2005 with the implementation of demand depending tariffs. Due to the fact that there were too little visitors by car in the area after introduction of paid parking, the plans were changed. In April 2005, additional counting in the area has taken place. It was decided that if the amount of visitors would be higher than in fall 2004, the demand depending tariffs would be introduced. Since this was not the case the final decision on the introduction of demand depending tariffs was postponed.

Drivers and Barriers

The main driver for the measure was the previous successful implementation of demand dependent parking pricing in other (central) areas in Rotterdam. Like the other areas, also the "Nieuwe Westen" area suffered from a high volume of on street parking. The idea was to better regulate the parking introducing a pricing strategy that differentiates between streets/sub-areas.

The main barrier has been the large reduction of parked cars after introduction of the generalized paid parking in the area. It seems that a large number of visitors who parked in the area, had a destination in the city centre and found out that parking in "het Nieuwe Westen" was a convenient and cheap alternative. For the city Rotterdam this outcome is quite good. It shows that paid parking is a positive instrument to increase the accessibility of an area, reduce the use of cars and increase the liveability of a neighbourhood. For the measure as such, however, it proved to be a fatal barrier. Because of the small amount of parked cars after the introduction of the generalized paid parking the planned sophisticated pricing policy (differentiating among streets) was not feasible.

Achievement of milestones

Table B.11.1 Milestones for 6.2

Milestone (original)	Planned	Actual implementation
Expansion of paid parking area	November 2003	November 2003
Demand depending tariffs	December 2004	> 2005

4. Results

4.1 Evaluation methods

A set of impact evaluation indicators was established based on the METEOR approach and in cooperation with the Rotterdam site management. Since the impacts could not be measured so far these indicators have not been used in this report.

The demonstrator contact conducted the monitoring and evaluation program. A first survey was held in early 2004 but not considered representative for the actual impacts. Other more representative surveys were held in October 2004 and in the Spring of 2005.

4.2 Impacts

General

Before the introduction of paid parking the number of cars parked in the area was considerably high. After the introduction of paid parking, a (unexpected) large impact on the number of visitors occurred. It was estimated that a majority of visitors had the city centre as its destination but was now using a nearby facility (*Het nieuwe westen*) as a cheap and convenient alternative. For the municipality of Rotterdam this outcome was acceptable since it showed that paid parking is an effective instrument to increase the accessibility of an area, to reduce the use of cars and to increase the liveability of a neighbourhood.

On the other hand however from both surveys in 2004 and 2005 it was concluded that the amount of visitors in the area was to low to justify the launching of demand depending parking tariffs. So the ultimate consequence of paid parking could be the demand depending tariffs will not be introduced in this particular area.

Because the introduction of demand depending tariffs was not implemented until now there is no impact evaluation on the level of evaluation areas.

For the sake of completeness table 2 shows the results, aggregated per evaluation category and compared with the ex ante evaluation.

Table B.11.2 Evaluation area scores for 6.2 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex ante	+/-	+/-	+	+	+
Ex post					

+ = area improved, +/- = no change or negative impact equals positive impact
- = area worsened , ? = unknown

5. Conclusions

The introduction of paid parking caused a large decrease in the number of parked cars but mainly because a nearby cheap and convenient alternative was available. It can be concluded therefore that paid parking is an effective instrument to increase the accessibility of an area, to reduce the use of cars and to increase the liveability of a neighbourhood.

The backside of this medal was that the success of paid parking hampered the introduction of demand depending tariffs in this particular area.

Because the introduction of demand depending tariffs was not implemented there is no impact evaluation on the level of evaluation areas.

6. Scenarios

Although the implementation of demand depending parking strategies has not succeeded in this

TELLUS project there is evidence that such strategies do have effects on congestion and traffic behaviour. In annex 8 an overview is given on several strategies in Dutch cities including differentiation in fees and charges.

So there is clear uptake for these kind of measures in Rotterdam although certainly the local circumstances determine the actual implementation which was proven once more during the course of this measure.

7. Recommendations

No specific recommendations were identified for this measure.

8. Annex

Source:

Parking Policy Measures and their Effects on Mobility and the Economy: Dutch cases. Management Committee COST Action 342, report COST342/18 (rev. 1), May 2001, Brussels

A: restricted car access: making considerable parts of the town centre a car free area

T: substantial change in parking charges

V: large scale for your measures (adding or removing substantial part of the parking facilities)

O: other

Table B.11.3 Dutch experiences with parking policies

Type	Measure	Traffic effects	Effects on the local economy
V	The addition of 450 parking places peak traffic hours (Arnhem)	Short term Facts: Parking pressure before and after is the same. Public transport moved from 30% to 35%. A disruptive factor was the execution of the Arnhem central project. Opinions: Visitors judged the accessibility as being a bit less impressive	Short term Facts: On Saturdays 6.5% more visitors were attracted. The average amount spent was f 138,- i.e. f 15 more than previously. Despite this there was a noticeable shift of shoppers to other centres, however the effects cannot necessarily be ascribed to the parking measure
A/V	Restricted access to town centre and extra parking elsewhere (Culemborg, Groningen, 's-Hertogenbosch)	Short term Facts: Parking pressure in centre decreases and increases at other location Opinions: Positive opinions. (In G.) use of bicycles and public transport increased	Short term Facts: (in G.) turnover has increased by 5% per year due to shoppers staying longer and more visitors. The development in the south east of the city centre has not been as good. (In H.) the turnover dropped slightly however Opinions: (in H.) businesses have good expectations for turnover in the future. (in C.) businesses have the idea that turnover drops and that shops are less busy. Long term

			Facts: however (in both C. and G.) there is an increase in sales surface area (slight in C. and 12% per year in G.)
A/T/V	Making the market area a car-free zone, expanding fee parking, introducing parking charge increases in the town centre, opening two multi-storey car-parks (Middelburg)	Short term Facts: Parking pressure in the town centre decreased. Newly opened multi-storey parking was well used. Parking pressure on the periphery of the town centre increased.	Short term Facts: About one third of businesses indicate having noticed a decrease in the number of visitors and turnover. Visitors said they visited Middelburg less than previously Long term Facts: The surface sales area increases by 16%within 2 years.
A/T	Car-free zone in town centre + restricted car access to surrounding area, increasing charges for street parking (Leiden) + introduction of fee parking (Venray)	Short term Facts: No significant effect on the modal split. (In V) shift in parking from the town centre to the periphery. Opinions: mainly positive (in L.)58% of passers-by think that having restricted car access is an improvement. They also believed that access to the centre had improved. (In V.) Visitors can more easily find a parking place (88%). Half the visitors had positive feelings about the system of fee parking Long term: After 6 years the parking system complied with existing requirements (V.).	Short term Facts: (In L.) no negative effects on the retail trade. Shoppers have shifted away from Leiden centre somewhat (in V.) visitor frequency increased, with more decisive shopping behaviour Opinions: The opinion of visitors about the planning of the town centre is less positive (large empty public squares) Long term Facts: (in L.) the surface sales area has remained almost the same
A	Making twin centre area car-free or restricted car access by closing it off by means of access barriers (Enschede)	Short term facts: The number of illegal parking offences just outside the centre increased. Number of cars in the town centre was drastically reduced.	Short term facts:The image of a busy town centre has not changed Opinions: shopping has become perceived as a more pleasant experience. Long term facts: surface sales area has increased by 4% per year since the measure was introduced.
A	A trial period closing off the town centre on Friday and Saturday evenings (Bergen op Zoom, Heemskerk)	Long term: Trial was terminated Short term Facts: In Heemskerk measures had no noticeable effect. In Bergen op Zoom less traffic in closed-off part. Less traffic in test area: quieter. Less short-stay parking places available Opinions: Consumers (B.o.Z.) were on the whole positive though motorists were less satisfied. The distance from multi-storey parking was too great	Short term Facts: (in B.) There is no evidence of a shift in shopping orientation. (In H.) the loss of turnover is between 10 and 20% Opinions: (in B) Businesses claim to have a greater drop in turnover than might be expected from figures known on national developments (in H.) 23% of respondents claim to have altered their buying pattern, 45% of respondents claim to spend less time in the town centre
T	Fee parking for free places and increasing charges at some fee parking locations (Breda)	Short term Facts: No effect on the modal split. Street parking declined, multi-storey parking increased	Short term Facts: The frequency of visitors decreased due to the negative perception of parking options and higher parking charges. The incidence of visits to shops increased in percentage terms. The sales area decreased slightly in terms of square metres.

T	expansion of fee parking and introduction of permit system (Purmerend)	Short term Facts: reduction in overall parking pressure, through drop in parking occupancy rates on late shopping evenings alone from 104% to 87%. Decrease in parking pressure in city centre. Increase in parking pressure on the periphery of the centre from 55% to 65%. No change in choice of mode of transport. Dissatisfaction of visitors regarding the parking situation remained the same	Short term Facts: The effects of turnover are unknown, 20% of car users go into town less often Long term facts: In 10 years there has been an increase in surface sales area of 10,000 square metres.
T	rearranging the parking places, increasing charges and new traffic circulation (Utrecht)	Short term Facts: The proportion travelling by public transport increased drastically (42%>52%). 15% travel into the centre less due to poor access, 14% due to difficulties with parking, 10% due to the expense of parking.	Short term Facts: Scale expansion and increase by 11,000 m2 surface sales floor area and 30% more visitors. The proportion of visitors from outside the region has risen from 30% to 45%. The city centre of Utrecht has lost ground to other shopping areas in the region Long term facts: The surface sales floor area increased during implementation of the measure as well as subsequently by 10%.
T	Introducing fee parking/increasing parking charges and different allowable parking periods (Harderwijk/ Leeuwarden) Introduction of a system of entirely fee parking (Tilburg)	Short term Facts: About 20% of consumers (H.) no longer travel to town by car or they park a long way from the centre. (L+T) Sharp reduction in length of parking period (only in Tilburg) Drop in occupation rate of parking spaces Even distribution of parking pressure Drop in occupancy of city centre parking spaces by local workers due to opting for alternative modes of transport or opting to park elsewhere Shorter walking distances for short-term parking places and longer walking distances for long-term parkers; Longer familiarisation period by combining with traffic circulation measures (only in Leeuwarden).	Short term Facts: (in H.) less money spent and shorter shopping duration. Compared to national trends the development of turnover has not been unfavourable. (in L.) 25% of visitors come less often. 86% indicated that the parking measures were a reason for this change. (It is unknown whether the assumed reduction in turnover was equal to the poor national development around 1980) Opinions: (in H.) Consumers and businesses have a negative image. The regional position has deteriorated. The extent of the effect was limited. Long term facts: (in H.) Over a 17 year period the surface area of sales space has increased by 75% about 12,000 m2 (in L.) The surface sales area has remained almost the same over the last 20 years (average increase of 0.5% per year). (In T.) In the recession period surface sales floor area dropped by 10% and in contrast to that it has almost doubled over the last 19 years.
T/V	Introducing fee parking in town centre area. Introducing a maximum parking stay allowable of 1 hour. Shift in parking places. (Dokkum)	Short term Facts: Parking places in the town centre were used for short-stay parking rather than long-term parking. Parking places with a maximum allowable parking time were little used. Opinions: Some nuisance was caused to residents by parallel parking on streets adjacent to the town centre. Visitors found the maximum staying time of 1 hour just	Short term Facts: Drop in turnover for businesses in town centre. People from neighbouring municipalities visit Dokkum less than previously Long term facts: The surface area for sales has increased by 2% per year since the measure was introduced

		too short.	
T/V	Reduction of the number of parking places and the introduction of fee parking (Nijmegen)	Short term Facts: Consumers value good quality parking. Use of bicycles and public transport increased.	Short term Facts: Local economy has remained at the same level as the national average. Long term facts: The shopping facilities in Nijmegen have remained at the same level over the last 18 years.
O	Parking regulation: information campaign, increasing controllers, infrastructural measures (e.g. signs), varying control strategy. Changing free parking places into paid or fee parking (Utrecht)	Reduction in the incidences of illegal parking at places with traffic signs. They were many parking offences committed at places where no signs were placed. No changes were noted for the spatial functioning Little change noted for time spent in looking for a place to park, walking distances the proportion of shoppers and length of stay. - Changing free parking places into paid or fee parking led to a reduction in the number of shoppers occupying parking spaces for longer periods. The contrary was the case on Saturdays when the parking times increased. It is particularly important to retailers that the number of shoppers per car does not decrease.	

B.12 Integration of cycling in public transport (7.1)

1. Introduction

An inquiry showed that the number of people in Rotterdam who own a bike is lower than in comparable cities in Holland. The inquiry also showed that the lack of continuing high quality bicycle routes was an important reason not to buy a bike. As a result only 21% of the short trips in Rotterdam are made by bike (Fietsbalans 2003, www.fietsbalans.nl) whereas in the average large Dutch city 34% of the short trips is made by bike.

The increase and improvement of bicycle parking sites is one of several measures aiming at a higher modal share for bicycle trips.

2. Description of the demo

2.1 Measure design

Good quality bicycle parking is relevant in the Netherlands because of the considerable risk for bicycle theft (especially in inner city areas) and the disturbance caused by uncontrolled bicycle parking. Therefore a lot of thought has been given to this subject, looking at the whole 'bicycle parking cycle'. This was the basis of the Bicycle Parking actions. The aim of bicycle parking in this measure is to encourage the use of bicycles and the combination with public transport. To stimulate the use of bicycles, the bicycle parking should first of all be well taken care of in the street. Therefore special safe boxes for bicycles are placed throughout many streets/living areas in the city. These bicycle boxes are a big success. A total of over 400 boxes were installed by September 2005. Secondly, the bicycle lanes from home to the public transport location need to be of good quality (See TELLUS measure 5.2 on Dedicated bicycle routes).

Third, when the user arrives at a PT location, a bicycle parking should be available too. With this approach the whole 'bicycle chain' for cyclists using PT is provided for.

This measure consisted of several actions:

- Set up strategy for location and exploitation;
- Realise 3 guarded bicycle parking spaces;
- Assessment of bicycle parking facilities at 30 public transport locations;
- Realise extension of bicycle parking places at 20 public transport locations;
- Demonstration of use and effects

The innovative aspect of this project is the integration of public transport and cycling.

2.2 Rotterdam transport plan context

In 1999 the city council approved the action program called *'Fietsparkeren'* ('Parking bikes'). In this program several intentions were described such as the availability of subsidies, more communication with the Rotterdam public transport company (RET) and implementing facilities for bicycle parking. At metro stations the bicycle parking should preferably be a guarded one. In a later stage the council again decided to improve parking facilities with two guarded bicycle parkings in the inner city area. The action program is dedicated to local public transport facilities. For the larger railway stations in the national network a national program was established in 1999 *('Ruimte voor de fiets'*) in which the extension of (guarded) bicycle parking facilities was described.

2.3 Measure objectives

The immediate objectives of this measure were to set up a strategy for parking locations and exploitation, to realise 3 guarded bicycle parking stands, to realise an extension of bicycle parking at 20 public transport locations and to demonstrate the use and effects of bicycle parking. The ultimate objective was to stimulate the use of the bicycles in combination with public transport.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

The integration of cycling and public transport is an initiative that is carried out throughout Europe but also in Australia and the United States. Most cyclists travelled to and from a train station with bicycle parking facilities because it was 'convenient' (over 70%). Other reasons mentioned were 'cheap', 'healthy' and 'quicker than by car'. The introduction of bicycle shelters led to a significant increase in the percentage of cyclists that perceived the quality of bicycle parking facilities as 'good'. 'Social control' is mentioned as an important aspect for the success of bicycle parking facilities: a bicycle shelter needs to be transparent and illuminated.

Costs per parking space are estimated at €100,- for uncovered parking and between €250,- and €400,- when the parking space is sheltered. A bicycle locker costs about €600,- per piece.

Between 30-40% of train passengers arrive at the station by bike. The distance to a public transport stop is the most relevant parameter for the share of bicycles used to get there. The 'ideal' distance is between 1 and 5 kilometres. Although relevant to sustain the share of bicyclists the improved public transport services such as bicycle parkings do not necessarily lead to a modal shift. On the other hand after introduction of bicycle parking facilities (along a bus line) the number of bicycles parked rose with approximately 50%. The capacity of bicycle parking facilities needs to be 10-20% higher than maximum occupancy. The reason for this is

that almost full bicycle racks often seem completely full and in that case many cyclists park their bikes elsewhere. Communication to inform potential users is mentioned as an important incentive together with dedicated actions such as one free bus ticket for every household to try the service once.

Based on the ex ante evaluation it is expected that integration of PT and bicycle parking will have a positive impact on Society and Transport. The impacts on Economy, Energy and Environment are not clear.

3. Implementation process

In the first phase of the project the existing facilities at metro and train stations where examined on occupancy rate, safety and maintenance status.

As a result, a strategy for the location and exploitation of bicycle parking facilities was set up. For all locations implementation plans were prepared. The unguarded bicycle parking facilities at 23 public transport stations needed extension and/or improvement. Near crowded places like the city centre and the football stadium ('De Kuip"), there was demand for three large scale guarded bicycle facilities. The unguarded bicycle parking facilities at the metro stations have been extended. At each station 30 up to 200 bicycle parking places are now available. The parking standards called "Tulip" were selected because they have proven to be easy for cyclist to connect their bicycle lock, maintenance proof and are fancy looking.

Barriers and drivers

The intended progress as described in the action program 'Parking bikes' was delayed several times. An important barrier was the ongoing discussion about the exploitation of (guarded) bicycle stands and more concrete about the responsible municipality department. The Departments of Traffic initiated the measure but at first it was not clear which department should be responsible for exploitation (either Public works, Districts or City Surveillance).

The priority within the individual districts to provide safe and convenient bicycle parking proved a sufficient driver however for the continuation of the process. Indeed if the communication with the districts had started earlier, some of the delay could have been avoided.

Achievement of milestones

The following verifiable results were listed for this measure.

- Strategy for the location and exploitation of guarded bicycle stands.
- Three new guarded bicycle places in the city center or at PT locations
- Extension of bicycle parking for at least 20 public transport locations
- Monitoring and evaluation of the use of bicycle parking

In table 1 the milestones and the planned and actual dates of implementation are gathered.

Table B.12.1 Milestones for 7.1

Milestone (original)	Planned	Actual implementation
Location and implementation plan for 3 guarded bicycle-parking stands	September 2002	January 2003
Opening of 1st extension of bicycle parking facility at public transport locations	March 2003	September 2003
Opening first guarded bicycle parking facility	January 2004	2 parking facilities: Football stadium De Kuip and Walenburgerweg November 2004
Opening additional 2 guarded bicycle parking facilities (city centre)	May 2005	3rd parking is planned: approx. September 2006
Opening of 20th extension of bicycle parking facility at public transport locations	July 2005	Planned: end of 2005.

4. Results

4.1 Evaluation methods

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators were not discussed with other demonstrator contacts since no immediate quantitative synergy with other measures was expected. The indicators used are listed in table 2.

For the impact evaluation a survey was carried out in September 2005 at the location *Oosterflank*. The results are presented in this report as effects on indicators compared to the situation before the implementation of the measure and are shown as a simplified score (- to +). Score + can be interpreted as a 'good' or 'positive' effect on the indicator or evaluation category, *i.e.* a positive score is an 'improvement'.

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

4.2 Impacts

General

The impact of this measure could only be evaluated for the Oosterflank location. However, it is expected that the impact of a similar parking, *i.e.* close to a metro station and (partly) sheltered, will not differ much from the Oosterflank evaluation.

Society

The majority of people (96%) use the bicycle parking in combination with the metro. People have a strong preference for using the covered racks. They only use uncovered racks when the covered ones are full.

In general people are satisfied with the bicycle parking. Most people (47%) say that it has improved and 29% say that it has even improved a lot. People are very satisfied about the distance from the parking to the metro.

The people themselves feel (very) secure. However, they are not so sure about the safety of their bicycle when it is in the parking. This is also reflected in the suggestions for improvement of the parking. Some people mention that the bikes should be better guarded, for example by cameras, surveillance or closed parking, although some people mention that they don't want to pay for parking.

Economy

The investment costs (approx. € 1000 for sheltered and € 250 for unsheltered parking places) and maintenance costs will not be covered by revenues as the parking is free. The parking has no surveillance. Therefore there are no staffing costs. Maintenance is covered by the regular funds for maintenance of the district.

Transport

There was no publicity campaign for the Oosterflank bicycle parking. Hence the negative score on information sites (see table 2). Nevertheless 82% of the respondents knows that the bicycle parking has been renewed in 2003. From the people that are familiar with the renewal, a quarter says that this caused them to use the bicycle parking more (12 respondents). Because of that, 3 respondents (25%) use their cars less, 2 respondents walk less and 7 respondents used to park their bicycle somewhere else. So the average modal split has improved a little.

Most people that use the bicycle parking are regular users. In summer as well as in winter, about 65% of the respondents uses the bicycle parking at least four times per week and about 20% uses it two to three times a week.

The mean distance that people bike from the bicycle parking to their homes is around 2 km.

Many people are satisfied with the neatness, the covering, the ease of attaching the lock and the ease of getting the bicycle in and out of the rack. People are least satisfied with the number of (covered) spaces. People that are unsatisfied with that want to have more spaces available.

Energy/environment

As the modal split improved in favour of public transport and bicycle the impact on Energy and Environment is assumed positive. For each person that uses the bike instead of the car to get to the metro station, it is estimated that yearly about 67 litres of fuel is saved. For the average user of the bicycle parking this results in approximately 17 litres of fuel saved. This last figure is highly indicative. Table 2 shows the results of the impact evaluation.

Table B.12.2 Impact on indicators for 7.1

Area	Indicator	Impact
Society	Acceptance rating	+
	Safety rating	+
	Change in unemployment	+
Economy	Investment costs	-
	Staffing costs	+
	Operating revenues	-
Transport	Average modal split	+
	Information sites	-
	Success of advertising	+
	Ease of use	+
	Capacity/flow ratio	+
Energy	Passenger fuel efficiency	+
Environment	Emissions (CO2, NOx, SO2, dust)	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

Table 3 shows the results, aggregated per evaluation category and compared with the ex ante evaluation.

Table B.12.3 Evaluation area scores for 7.1 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex ante	+	?	+	?	?
Ex post	+	-	+	+	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

5. Conclusions

The renewal of 2003 has made the bicycle parking more attractive which caused the average modal split to improve a little. Four-fifth of the users knows about the renewal.

It can be concluded that users are satisfied with the bicycle parking now, except that there is not enough room. Although most people feel secure in the parking, they are not so sure about the safety of their bike. Concerning ease of use, people are highly satisfied about the distance from the parking to the metro. There are some complaints about the cramped spaces and difficulty of attaching the lock to the rack.

6. Scenarios

Although the original action program has been delayed and the political priorities shifted away somewhat from the promotion of bicycle use (leading to less budget), in the future next to the current activities at least 30 metro stations will be provided with some form of bicycle parking facilities.

In general the use of bicycles is an important feature of the TELLUS program in Rotterdam. In at least five other measures a high interrelationship with WP 7.1 can be seen: dedicated bicycle routes (WP 5.2), large scale expansion of P&R (WP 7.2), electric two-wheelers (WP 8.1), green commuter plans and mobility management (WP 10.1) and new approaches to integrated planning (WP 11.3). Although related, the possible synergy effects could not be measured in a quantitative way. The cooperation in and between the several measures did lead to higher degree of consciousness and motivation as was indicated by several stakeholders.

7. Recommendations

The best improvement would be to add some covered racks and to regularly remove old bikes. Furthermore it is recommended to better guard the bikes, for instance by camera. Concerning the ease of use, people are highly satisfied about the distance from the parking to the metro. For a future renewal or a renewal of another bicycle parking it is recommended to choose for a wider covering that better protects against rain and to choose for wider spaces.

8. Annex

People that use the bicycle parking near metro station Oosterflank were asked to participate in a questionnaire about the bicycle parking facilities. Only people were questioned that used the covered bicycle parking spots or one highly used uncovered rack opposite to a covered one. People have been asked according to the "next to pass" principle. Most people have participated in the questionnaire orally and some have filled it in on paper.

The survey took place on September 6th (a sunny day) and on September 15th (a rainy day).

Results

In total, 56 respondents have participated in the survey. 64% of the respondents was female and 36% male (this is representative for the users of the bicycle parking). Their age varied from 15 to 68, with a mean age of 34.

Most people that use the bicycle parking are regular users. In summer as well as in winter, two thirds of the respondents uses the bicycle parking 4 or more times per week and one-fifth uses it 2 to 3 times a week.

The mean distance that people bike from the bicycle parking to their homes is around 2 km. The majority of the respondents (96%) uses the bicycle parking in combination with the metro. People have a strong preference for using the covered racks. They only use uncovered racks when the covered ones are full.

82% of the respondents know that the bicycle parking has been renewed in 2003. From the people that are familiar with the renewal, a quarter says that this caused them to use the bicycle parking more (12 respondents). Because of that, 3 respondents use their cars less, 2 respondents walk less and 7 respondents used to park their bicycle somewhere else. So the average modal split has improved a little.

It is analysed that for each person that uses the bike instead of the car to get to the metro station, yearly about 67 litres of fuel is saved. This is based upon 4 times per week for 50 weeks per year and an average distance of 2 kilometres. This yields a yearly travelled distance between home and parking and vice versa of 800 (car) kilometres. Assuming a fuel consumption of 1 litre per 12 kilometres, a total volume of 67 litres is saved. As 3 out of 12 people who use the parking because of TELLUS use their bike instead of their car, the average user of the bicycle parking saves 17 litres. Due to the low number of respondents this last figure is highly indicative.

The respondents that knew about the renewal of the bicycle parking were asked whether they think that the quality of the parking facilities has improved, see table 4. Most people say that it has improved and some say that it has even improved a lot.

Table B.12.4 Survey results (1) for 7.1

“Do you think that the quality of the parking facilities has improved?” (N=45)	%
Improved a lot	29
Improved	47
Hardly improved	18
Not improved	0
Don't know	7

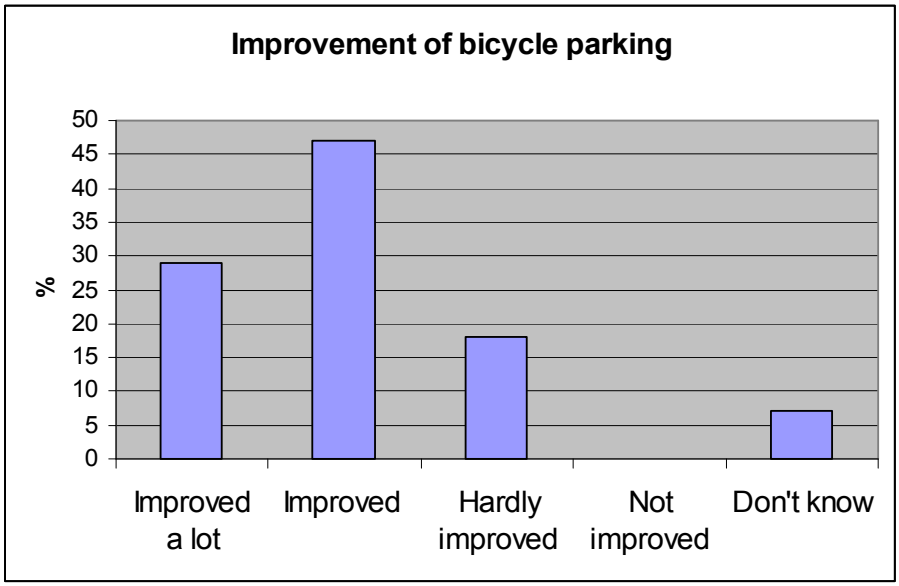


Figure B.12.1 Opinions about the level of improvement of the bicycle parking

In general people are satisfied with the bicycle parking (see table 5). People are very satisfied about the distance from the parking to the metro. Many people are satisfied with the neatness, the covering, the ease of attaching the lock and the ease of getting the bicycle in and out of the rack. People are least satisfied with the number of (covered) spaces. People that are unsatisfied with that want to have more spaces available.

Table B.12.5 Survey results (2) for 7.1

	Very unsatisfied	Unsatisfied	Neutral	Satisfied	Very satisfied
Distance parking to metro (N=54)				48%	52%
In general (N=56)		4%	4%	79%	14%
Neatness (N=56)		4%	11%	70%	16%
The covering (N=56)	4%	7%	9%	64%	16%
Ease of attaching bicycle lock (N=53)	2%	9%	11%	51%	26%
Ease of getting bicycle in and out of rack (N=56)	2%	7%	25%	46%	20%
Number of covered spaces (N=56)	4%	34%	21%	38%	4%
Total number of available spaces (N=56)	5%	34%	23%	29%	9%

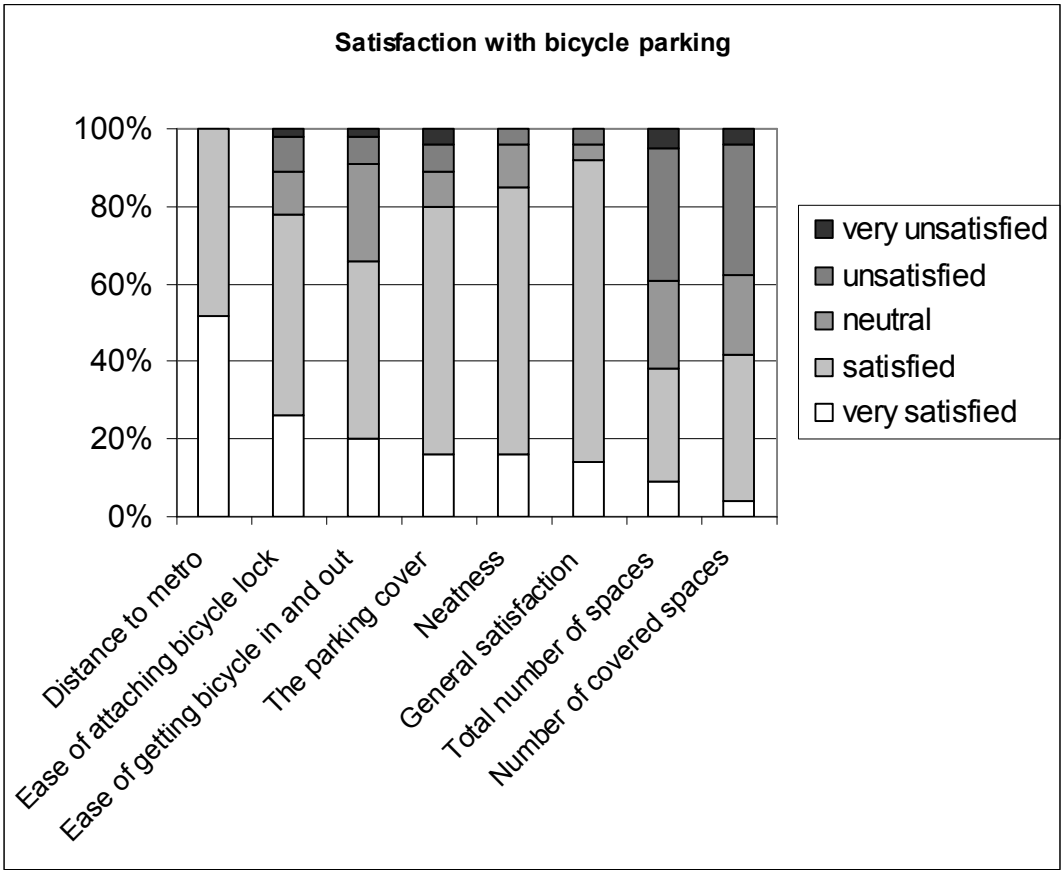


Figure B.12.2 Satisfaction with bicycle parking

This score on aspects of the bicycle parking is also reflected in the suggestions that people give for improvement. Mentioned most is more (covered) spaces (19x). Removal of old bicycles (3x) gives extra spaces and contributes to neatness of the parking. There are suggestions to improve the covering (10x), because when it rains bicycles still get wet. People want to have wider spaces (8x) which makes it easier to get their bicycle in and out of the rack and some people make the remark that it is difficult to attach the lock to the rack for some types of bikes (4x).

People are not so sure about the safety of their bicycle when it is in the parking (see table 6). This is also reflected in the suggestions for improvement of the parking. Eight respondents mentioned that the bikes should be better guarded, for example by cameras, surveillance or closed parking (although some people mention that they don't want to pay for parking). The people themselves feel (very) secure (see table 7).

Table B.12.6 Survey results (3) for 7.1

"Do you think that your bicycle is safe in the bicycle parking?"	%
Yes, certainly	13
Yes, probably	34
Don't know	14
No, probably not	18
No, certainly not	21

Table B.12.7 Survey results (4) for 7.1

"Do you feel secure in the bicycle parking?	%
Yes, certainly	70
Yes, mostly	23
Don't know	4
No, mostly not	2
No, certainly not	2

B.13 Large scale expansion of P&R (7.2)

1. Introduction

P&R is an important part of the traffic and transportation policy in Rotterdam. With the expansion of P&R car travellers are offered an opportunity to transfer to public transportation instead of travelling the whole trip by car. Before the start of this demonstration the P&R capacity (23 P&R sites with 4700 parking places) within the region was fully occupied. Because of the increasing mobility there is a necessity to expand the available P&R-places. This P&R-demand has lead to a regional P&R policy document that describes the strategy to expand the available P&R-places in the next 15 years.

The TELLUS demonstration involves the short-term execution (until 2006) of the P&R policy document; therefore the realisation of 1600 new P&R-parking places in Rotterdam.

2. Description of the demonstration measure

2.1 Demonstration design

Before the TELLUS-project “Large scale expansion of P&R” started there were 23 P&R car parks in the Rotterdam region with a total of 4.700 parking spaces. The occupancy of most of the P&R car parks was high, in some places there was clearly a shortage of parking capacity. In the period up to 2006, 1.600 new P&R parking spaces should be created. In the regional policy document a long-term development of 18.000 P&R-places is planned, spread out over 40 P&R-sites in the whole region.

The project concerns both the expansion of existing P&R car parks as well as the creation of new P&R car parks. At the same time the quality of sub-standard car parks should be improved.

The short-term expansion and upgrade of P&R takes place at several locations in Rotterdam:

- P&R Slinge: 780 upgraded P&R places at the Slinge subway station.
- P&R Wilgenplas: expansion with 24 P&R places, in 2002.
- P&R Beverwaard: 500 new P&R places planned for 2006/2007.
- P&R Lombardijen: 600 new P&R places integrated in the master plan for a new medical centre next to the station. Completion is planned for 2009.
- P&R Kralingse Zoom: 750 new P&R places near the subway station Kralingse Zoom as part of the urban development plans in this area. Completion is planned for December 2006. See also TELLUS project 10.3.

- P&R Zuidplein. Only during big events at the Ahoy leisure centre, the full parking capacity of the parking garage of the Zuidplein shopping centre is being used. The rest of the time the parking capacity can (partly) be used as P&R-site with 300 places (see also TELLUS project 10.3).
- P&R Noorderhelling: 350 new P&R places integrated by 2005 in the existing car park. On the longer term 600 parking places integrated in the development of a new shopping centre.
- P&R Nesselande: in 2005 46 new P&R place at new metro station in newly built residential area.

Because the recognition of the P&R facilities in Rotterdam by the general public is minimal and no communication strategy for P&R has been drawn up, the promotion of P&R in the Rotterdam region has to be improved. A P&R website will be created and integrated in the RegioTIC (Regional Traffic Information Centre).

The innovative aspect of the measure is the integration of planning and quality upgrade in combination with the simultaneous promotion of P&R, including the P&R website for the whole Rotterdam region.

2.2 Rotterdam transport plan context

The stimulation and expansion of P&R sites in the Rotterdam region is an important item within the Regional Traffic and Transport Plan 2003-2020 (RVVP). The parking policy is primarily the responsibility of the local authority. The Stadsregio plays a co-ordinating role. The Stadsregio wants to increase the number of P&R places (Park and Ride further by public transport) by 18.000, to a total of 23.000 places in 2020. This will help prevent the urban area from becoming clogged with increasing car traffic

2.3 Objectives

The immediate objectives of this project are:

- Policy making, planning and design of new parking spaces at P&R sites and upgrade these sites;
- Demonstration and monitor the use and effects of 1600 new parking spaces;
- Measuring of occupancy rates with an electronic counting system;
- Promote the use of P&R sites with a regional P&R website that is integrated in the RegioTIC (see measure 11.2).

The ultimate objective is to stimulate intermodal trips, using public transport to enter the Rotterdam city centre, i.e. to combine the advantages of car use and of public transport.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

Several sources of information have been found during this evaluation. The information used refers to 5 European sources of information (study reports, websites) and one Canadian source. The information is mostly dedicated to transport indicators such as occupancy and modal split.

The modal split changes in favour of public transport within the urban area in which the P&R site is located. This trend is found in all reports and studies. Moreover, the figures are rather similar: in Munich, 38% of the users previously used their car. In England this percentage varies between 17 and 59%, *i.e.* an average of 38%. For Rotterdam Alexander, this percentage is 44%. Based on these results it is assumed in this evaluation report that approximately 44% of the 1600 new parking spaces will be used by cars that would otherwise have entered the city. In other words, it is assumed that approximately 700 cars are 'intercepted' by the new P&R space (when fully occupied).

P&R will divert traffic from the centre of Rotterdam. It will therefore have positive effects on sustainability and liveability in the centre, because there will be less traffic. On a citywide scale, however, it is not clear if there will be a positive effect on sustainability. Although parking places intercept trips into the centre, they also generate trips that would not have been made, or would have been made with another mode of transport (e.g. by bicycle or public transport).

3. Implementation process

Actual implementation and deviations from the plan

The expansion of P&R sites is primarily an internal process within the city of Rotterdam. Although the regional authorities have made P&R an important spearhead for their transport and traffic policy, the actual implementation is in the hands of several departments within the Rotterdam organization.

In this case the Traffic and transportation department, public transportation company Rotterdam (*RET*), parking company Rotterdam (*Stadstoezicht*) and Rotterdam Development Corporation (*OBR*) have been working together for several years now.

An electronic counting system on the highway A16 was anticipated to give information about occupancy rates of several P&R sites. Due to several hardware problems this system however is not operational yet. The current planning is that the system will be operational in the near future.

Barriers and drivers

Several issues have had effect on the speed and impact of the process:

- Realisation of P&R sites in many cases is related to spatial planning projects (for instance P&R Beverwaard is related to the realisation of a new tram depot). Any delay in these spatial planning projects leads to a delay in the P&R sites.
- The process of getting agreements with other stakeholders (internal or external) often takes more time than anticipated.
- In many cases the identification of ownership as well as delegation of management and maintenance is unclear. This however is a relevant issue for the further exploitation of the site. Currently steps have been undertaken to get more clarity on this issue.
- In a number of cases it proved necessary to integrate parking management systems in the P&R site. These systems lead to additional problems because of their technical and financial feasibility.

Achievement of milestones

Table B.13.1 Milestones for 7.2

Milestone (original)	Planned	Actual implementation
Regional P&R website integrated in the RegioTIC-website	September 2003	> summer 2005
1.600 New P&R parking places established	July 2005	-
Evaluation results for 1.600 new parking places	November 2005	-
Milestone (adapted)	Planned	Actual implementation
1.150 New P&R parking places established	July 2005	July 2005 (partly!)
Evaluation results for 1.150 new parking places	November 2005	> 2005
780 P&R parking place renovated (P&R Slinge)	July 2005	?

4. Results

4.1 Evaluation methods

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators used are listed and assessed in table 2. The results are presented in this report as effects on indicators compared to the situation before the implementation of the measure and are shown as a simplified score (- to +). Score + can be interpreted as a ‘good’ or ‘positive’ effect on the indicator or evaluation category, *i.e.* a positive score is an ‘improvement’.

Occupancy rates of all P&R sites in Rotterdam are measured twice a year. These results are integrated in the impact evaluation. However although a lot of effort has been put into the design

of new and upgraded P&R sites, none of the large P&R sites became available for representative measurements and survey. Only one large P&R site (Noorderhelling) was completed in due course in 2005 but the occupancy rate in the first months was too low to justify any survey to be held among users.

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

4.2 Impacts

General

Within the TELLUS project period the expected expansion and upgrade of P&R place has been partly realized. Next to some smaller new P&R sites the realization mainly was dedicated to the upgrade of existing P&R sites. Designs for large new P&R sites have been completed but the implementation will take place after 2005. The electronic counting system on the highway is not functioning yet due to several hardware problems.

The one large P&R site (*Noorderhelling)* that was completed in 2005 so far showed a very low occupancy rate of less than 10%. This at least partly can be explained with the fact the completion took place just before summer holidays. The awareness for the new facility therefore might be low. An in-depth evaluation of the low success of this site so far has not been made.

Due to the low occupancy rate no surveys could be carried out. Therefore no impacts could be established. For the sake of completeness table 2 shows the results, per evaluation category and compared with the ex ante evaluation.

Table B.13.2 Evaluation area scores for 7.2 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex ante	?	?	+	+/-	+
Ex post	?	?	?	?	?

+ = area improved, +/- = no change or negative impact equals positive impact
- = area worsened , ? = unknown

5. Conclusions

The stimulation and expansion of P&R sites in the Rotterdam region is an important item within the regional traffic and transport policies. In this TELLUS measure the design of new or upgraded P&R sites has been realized. Also a partial implementation has been realized. The implementation was hampered however mainly due to the close relationship with spatial planning projects. Any delay in these spatial planning projects, which often occur, leads to a delay in the P&R sites. In a number of cases it proved necessary to integrate parking management systems in the P&R site. These systems lead to additional problems because of

their technical and financial feasibility.

Because the implementation was hampered, the conclusion here is limited to the process evaluation. An impact evaluation could not be established. The first results of a large new P&R site are not promising although this site might not be representative for the whole region.

6. Scenarios

Before the TELLUS-project started there were 23 P&R car parks in the Rotterdam region with a total of 4.700 parking spaces. The occupancy of most of the P&R car parks was high, in some places there was clearly a shortage of parking capacity. In the period up to 2006, more than 1.100 new P&R parking spaces will be created. In the regional policy document a long-term development of 18.000 P&R-places is planned, spread out over 40 P&R-sites in the whole region.

So the uptake potential of P&R sites as a measure to improve public transport already has been recognized and addressed in policy plans.

The development of P&R sites also relates to other measures as there is possible interrelationship with improvement of public transport services (see WP5.4 and WP11.3), the introduction of clean vehicles for public transport (see WP12.1), the development of urban transport management (see WP10.1) and the introduction of technical innovations (see WP7.4).

7. Recommendations

As the uptake potential for these type of measure is clearly available, and the ex ante evaluation overall is showing positive impacts from the introduction of P&R sites, an ongoing effort for the implementation of P&R sites is recommended. However, planning and foreseen implementation moments should be related more strongly to regional and local spatial planning initiatives which are being initiated.

B.14 Public transport over water (7.3)

1. Introduction

Before TELLUS there were two modes for transport over water in Rotterdam; the Waternet and a Fast Ferry. The Waternet project consists of a network of 18 Waternet landing stages for tourist transport over water. All landing stages are near public attractions. The Fast Ferry service is introduced as a new high quality public transport mode in November 1999. The Fast Ferry connects Rotterdam to Dordrecht, a city 20 kilometres to the southeast of Rotterdam.

2. Description of the demo

2.1 Measure design

The idea behind this measure was to optimise the use of the river Nieuwe Maas by introducing a water taxi. The service of the water taxi had to be similar to the service offered by regular taxis; passengers point out at which landing stage they want to embark and to which landing stage they want to be taken. Some landing stages of the water taxi were planned on the same sites as the landing stages of the Fast Ferry. Furthermore it was aimed to make a design for a new Waterbus system on the river.

The aim was to have 5 fast boats, with maximum speed up to 70 km/h, connecting a network of 30 landing stages, including 8 Waternet landing stages, situated on both sides of the river.

The speed of the boat, the direct connection over water and the lack of traffic congestion result in an innovative and time saving means of individual public transport.

The task to perform within CIVITAS consists of two parts:

Ferry

The ferry project starts with design studies for three new ferry connections (which should connect residential areas on the north bank of the river to an industrial area on the south bank).

Resulting from the design study, ferry connections which are needed and exploitable will be realised. Under investigation will be ferry connections for Hoek van Holland/Maasvlakte; Hoek van Holland/Landtong en Heijplaat/Rechtermaasoever.

The ferry will be accessible for cyclists and pedestrians and connects to dedicated bicycle lanes on both banks. During peak hours the ferry service can be used by commuters who are working

in the south bank industrial areas. To increase the number of passengers on off-peak hours, the ferry service will also connect to a recreational information centre on waterworks. By combining commuter traffic with recreational trips the possibilities for a profitable exploitation of the service are increased.

Watertaxi

Watertaxi: the network of 30 Watertaxi landing stages includes 8 Waternet landing stages. The Watertaxi landing stages are being constructed and connected to the quays. The total project is a close co-operation between the city of Rotterdam and a private entrepreneur (Maastaxi). The city authorities will design the infrastructural works, *i.e.* the landing stages and pontoons. Maastaxi will operate 5 boats in the first year and 10 boats the following year (provided a sufficient market volume will be generated).

2.2 Rotterdam transport plan context

The Municipality supports the water taxi. Main reason for this support is the promotional effect it has for the city.

2.3 Measure objectives

Immediate objectives:

- adaptations to Fast Ferry landing stage to include Watertaxi stop
- Watertaxi operational with 30 landing stages
- design study and business case into a new Waterbus system on the river Maas

The ultimate objective is to optimize the use of the river Nieuwe Maas/ Nieuwe Waterweg by enhancing the passenger transport systems over water.

Contribution to TELLUS objectives:

- Reduce congestion (Watertaxi only if used for commuter traffic)
- Reduce car kilometres (only Watertaxi)
- Improve intra-organisational co-operation at the city level
- Increase bicycle kilometres (only waterbus)
- Improve public-private co-operation

2.4 Ex-ante evaluation

In 2003 IVAM conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

The ex ante evaluation showed that Watertaxi's have a positive effect on Society. For the other evaluation area's (Traffic, Economy, Energy and Environment) no results were found.

3. Implementation process

Due to the number of actors the implementation process is rather complex. The taxis are exploited by a private company (Maastax BV). The Municipality is responsible for management and finances. The Port Authority has to approve the landing stage locations and supports the building and maintenance of the landing stages. Besides, the locations have to be approved by the district authorities.

It appeared that implementing a landing stage is a project in itself. Each landing stage has its own technical and nautical location dependent requirements. Therefore, the realization of 30 landing stages should be considered as 30 subprojects, each demanding considerable time and effort to implement.

Also maintenance of the landing stages is time consuming and costly. Extra effort for instance was needed to replace rubber fenders at the landing stages. One landing stage was relocated from 'Persoonshaven' to 'Heijsekade' because the occupancy rate of the landing stage at Persoonshaven was too low. Furthermore an additional landing stage was planned at Pernis. The landing stage in Pernis will probably be operational from the 15th of November A number of meetings with the company Unilever have lead to the agreement to place a landing stage in front of the new office. This new landing stage will be operational early spring 2006. Companies in the near area of Unilever will also use the landing stage for their staff transport.

The design study for a new Waterbus-system on the river Maas has been conducted. The study identified chances for an extended waterbus-network west of the city centre; the 'Stadshavens' area. However, it was decided by the Municipality that the Waterbus network would not be extended.

Barriers and drivers

Costs are the most important barrier for this measure. Investment costs for an average landing stage for instance are 150 k€. Nevertheless Maastax expects to have a positive cash flow in the coming years after the initial phase with relatively high development costs. However, at this moment (2005) the taxi captains still earn a low hourly wage. The annual turn over will grow when more people travel by water taxi. Problem is that it is difficult to attract passengers. Especially visitors in Rotterdam are not aware of the Watertaxi as long as they do not have the

river in sight.

Weather conditions are also a barrier. It is not comfortable to wait for a Watertaxi on a landing stage in bad weather conditions.

The major driver for the water taxi is 'fun'; the Watertaxi is fun to travel by and fun to look at.

Achievement of target and milestones

Table B.14.1 Milestones for 7.3

Milestone (original)	Planned	Actual implementation
Watertaxi operational with 30 landing stages	December 2002	December 2002
Adaptations to Fast Ferry landing stage to include Watertaxi stop	October 2002	October 2002
Design study and business case into a new Waterbus system on the river Maas	July 2004	July 2004? (still has to be confirmed)
Evaluation results on use and effects	January 2004	?

4. Results

4.1 Evaluation methods

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators were not discussed with other demonstrator contacts since no immediate synergy with other measures was expected. The indicators used are listed in table 2. The results are presented in this report as effects on indicators compared to the situation before the realisation of the Watertaxi and are shown as a simplified score (- to +). Score + can be interpreted as a 'good' or 'positive' effect on the indicator or evaluation category, *i.e.* a positive score is an 'improvement'. The underlying quantitative and qualitative results can be found in the annex.

For the impact evaluation, a survey was held by IVAM in October 2003 among 139 passengers of the water taxi. (see annex)

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

4.2 Impacts

Society

Most passengers are very satisfied with the Watertaxi. (Annex: table A.2). The aspect of 'fun' (to travel by) is proven as the survey shows that 85% of the travellers take the Watertaxi for recreational visits. Almost all passengers are satisfied with the waiting time, the travel time and the comfort. Apparently people find the Watertaxi a fast and comfortable way to travel. People

are less satisfied with the price. However, as the passengers share the cost per trip, the price per passenger will decrease as the passenger load factor will increase. Therefore, attracting more people will improve the passengers' satisfaction with the price.

The accessibility of the Watertaxi for the disabled is low.

Economy

A positive cash flow is expected in the years to come. Therefore the effect on indicators (both costs and revenues) could show a positive (+) score in the future. However, as the positive cash flow is not confirmed (yet), the score is represented in table 2 by a question mark.

Transport

In 2003 280.000 passenger kilometres were travelled by Watertaxi. If the water taxi had not been available, 40% of the passengers would have taken the car or a normal taxi. For those passengers the effect on the modal split is positive as the occupancy of the average water taxi is higher than the occupancy of the average car. On the other hand, 13% of the passengers would not have travelled at all, had there been no water taxi.

Interesting aspect is that 7% of the passengers take the water taxi for business visits, 4% for commuter traffic and 3% for shopping.

Energy & Environment

Impacts on Energy and Environment are strongly related to the impacts on transport mentioned. As the overall effect on modal split is positive the effects on energy and CO2 are positive as well. However due to the boat engine the effects on dust and noise are negative. As a result the overall score on Environment is negative.

Table 2 shows the results of the impact evaluation. More underlying calculations and assumptions can be found in the Annex.

Table B.14.2 Impact on indicators for 7.3

Evaluation Area	Indicator	Impact
Society	Operator acceptance	+
	Acceptance rating	+
	Mean journey times	+
	Conflict rating	+
	Change in unemployment	+
	Access rating	-

Economy	Investment costs	?
	Investment costs	?
	Fuel cost per unit revenue	?
	Staffing costs	?
	Maintenance cost	?
	Cost	?
	Operating revenues	?
	Retail sales turnover	?
Transport	Total pkm travelled	+
	Increase in no. trips	+
	Mean persons per vehicle on given route	+/-
	Average modal split - PAX	+
	Average modal split - trips	+
	Average route change trips	?
	Passenger capacity	+
	Passenger load factors	+/-
	Information sites	+/-
	Success of advertising	+/-
	Comfort rating	+
	Average headway	+
	Accuracy of timekeeping	?
	Time lost	+
Energy	Passenger fuel efficiency	-
Environment	All (CO_2, NOx, SOx, dust)	-
	Peak noise	-

+ = area improved +/- = no change or negative impact neutralizes positive impact
- = area worsened ? = unknown

Table 3 shows the results, aggregated per evaluation area and compared to the ex ante evaluation.

Table B.14.3 Evaluation area scores for 7.3 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex ante	+	?	?	?	?
Ex post	+	?	+	-	-

+ = area improved +/- = no change or negative impact neutralizes positive impact
- = area worsened ? = unknown

5. Conclusions

The Watertaxi has been a successful demonstration of public transport over water. The harbour and the broad river passing the city centre of Rotterdam create perfect scenery for high-speed boats. As a result people enjoy watching the boats. This is an important driver for the municipality to support the project. The major barriers for this measure are the costs and the rather complex process to implement a new landing stage. Drawback, at this moment is the poor environmental quality of the boat engines.

6. Scenarios

The potential for financial participation of other companies in the Watertaxi is being investigated. Companies, restaurants, etc. might be interested to create (larger) landing stages to attract visitors. Also there is potential to use the water taxi in the same way as 'van pooling', *i.e.* for commuters. The Port of Rotterdam is interested in this option. Unilever even has planned to have a water taxi connection between the 'Nassaukade' and their office in Vlaardingen. The new landing stage at Nassaukade will be operational early spring 2006. Companies in the near area of Unilever will also use the landing stage for their staff transport.

For the future, attempts will be made to create landing stages near the Zoo ('Blijdorp'), the Euromast tower and a site from where tourists can make a helicopter flight over the City. The Municipality of Hoogvliet considers a landing stage near the bridge ('Spijkenissebrug')

The present boats have a capacity of 8 persons. A more light and environmental sound 12-person boat will be developed. For the year 2010 it is estimated that there will be six of those boats connecting a network of 40 landing stages.

The high-speed boats are only suitable on broad waters like the river and harbour of Rotterdam. For Amsterdam for instance a water taxi could connect several landing stages in the city centre and Amsterdam North along the 'IJ-river'.

In general, the high-speed boats are not suited for (narrow) city canals. However, silent and clean boats (for instance driven by solar electricity) would be suited for city canals.

In other European countries the potential for Watertaxi projects is similar. The city of Bristol for instance is interested to have Watertaxi's. Also a Turkish company (Teknoloji Holding) is interested in bringing the concept of Watertaxi's to Istanbul.

7. Recommendations

It is recommended to replace the boat engines by clean and more silent engines. Furthermore it is recommended to create some shelter on the landing stages in order to improve the passengers' comfort, especially during bad weather conditions. In order to attract more passengers' signposts could be placed in the area around the riverbanks.

8. Annex

Table B.14.4 Measurement of Evaluation Indicators for 7.3

Indicator	Measurement
Operator acceptance	High
Acceptance rating	High (see table 5)
Mean journey times	6'30''
Conflict rating	None (see table 5)
Change in unemployment	± 7 people (drivers, staff)
Investment costs	Turnover in 2003: € 405.000. A positive cash flow is expected in the coming years after the initial phase where the costs are relatively high.
Investment costs	
Fuel cost per unit revenue	
Staffing costs	
Maintenance cost	
Cost	
Operating revenues	
Total pkm travelled	280.000
Increase in no. trips	4.810
Passenger capacity	8
Passenger load factors	3,5
Information sites	?
Success of advertising	?
Comfort rating	+ (see table 5)
Time lost	n.a.
Passenger fuel efficiency	+
Emissions (CO2, dust)	+ (CO2), - (dust)
Peak noise	-

Results of survey

Most participants in the survey took the water taxi for recreational visits (85%). Other reasons for taking the water taxi are business visits (7%), commuter traffic (4%), shopping (3%) and visiting family or friends (1%). These figures are influenced somewhat by the choice of locations for interviewing on shore. When considering only the participants that were interviewed on the Watertaxi, the percentages for business visits and commuter traffic increase a little at the expense of recreational visits.

Table B.14.5 Survey results for 7.3

Aspect	Very satisfied (	Satisfied	Neutral	Unsatisfied (	Response (N
Waiting time	65	28	4	2*	138
The captain	59	39	2	0	138
Distance between stop and destination	57	42	2	0	125
Travel time	55	41	1	4*	134
Comfort	41	56	4	0	138
Connection with other means of public transport	32	59	9	0	34
Price	15	51	25	10**	122

* including 1% very unsatisfied ** including 2% very unsatisfied
Reference: Survey water taxi, IVAM, October 2003

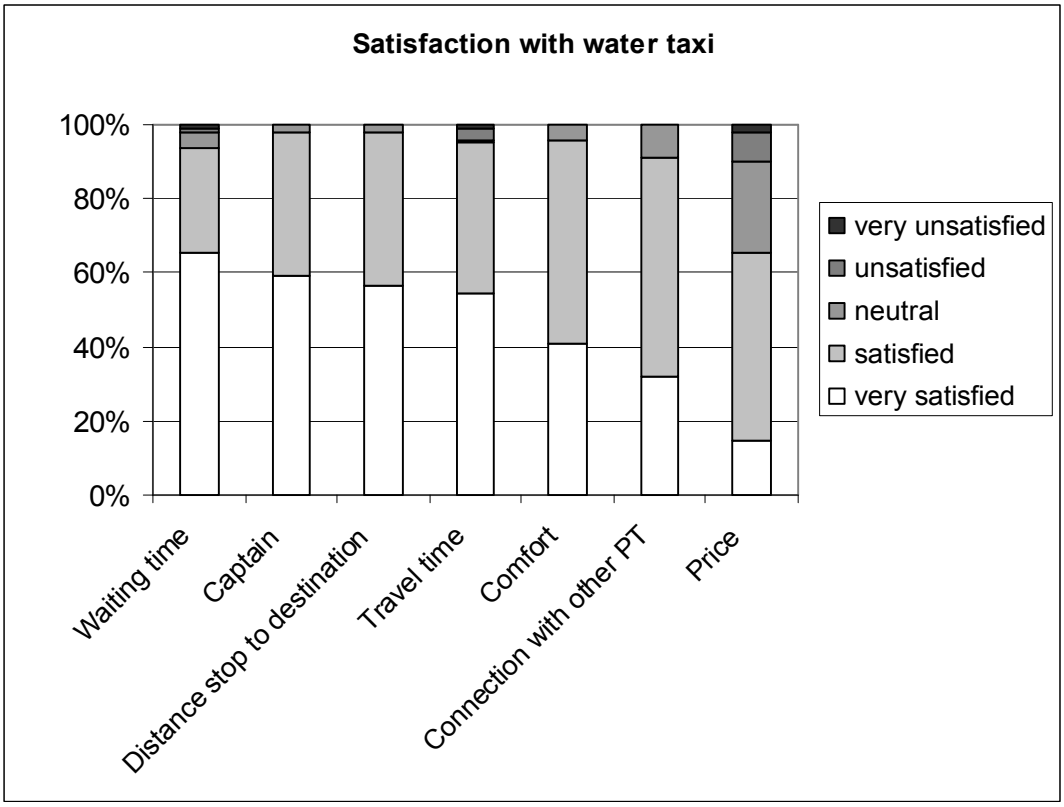


Figure B.14.1 Satisfaction with water taxi

When asked what the most important reason is to take the water taxi (compared to other means of public transport), most participants answered; because it is a special means of transport (73%). The other answers are: I reach my destination faster (13%), it is typically Rotterdam (5%), the distance between destinations is shorter over water (4%), other (5%).

If the water taxi was not available, 40% of the participants would have taken the car or a normal taxi. Other participants would use other forms of public transportation (22%), walk (22%) or go by bike (3%). The rest (13%) would not have gone at all. These figures are influenced

somewhat by the choice of locations for interviewing on shore. When considering only the participants that were interviewed on the water taxi, the percentage of passengers who would have taken the car or a normal taxi decreases to 30%, mainly at the expense of “other forms of public transportation”.

Most participants know about the water taxi because they have seen it (44%). 26% of the participants heard about it through family or friends, 12% through the media, 6% at Hotel NY and 12% in another way.

In 2003 the water taxi’s made 37.000 trips. The average fuel consumption (diesel) is 28 litre/ hour. The total number of working hours was 8.500 so the total fuel consumption amounts 23.800 litres.

Although the maximum speed of the boat is known to be 65 km/hour, the average speed of the boat is unknown. Certainly the variation in velocity is large due to external factors such as other traffic and weather conditions. For this evaluation we assume a average trip velocity of 20 km/hour.

The total number of pkm travelled is estimated as the quotient of the number of trips, the trip duration, the average speed and the passenger load factor.

The increase in the number of the trips due to the introduction of the water taxi is derived from the total number of counted trips (37.000) and the percentage of people who said that the projected trip would not have been made when the water taxi was not available (13%). Those 4.810 trips create a negative impact on Energy and Environment

For the passenger fuel efficiency we consider a scenario with and without the availability of water taxis.

- Scenario 1: with Watertaxi
  - The total fuel consumption is 23.800 litres. The number of pkm travelled is 280.000. The passenger fuel efficiency is 0,085 l/pkm or 3,11 MJ/pkm (1 litre diesel = 36,6 MJ).
- Scenario 2: without Watertaxi
  - If the Watertaxi was not available 40% of the trips would be made by car or normal taxi. We assume here an average passenger load of 1,4 and a longer trip distance of 25%. This means a total number of 56.000 pkm. We assume also an average fuel efficiency per vkm of 12 l/100 km. This leads to a fuel efficiency of 0,086 l/pkm.
  - Another 22% of the people would have used PT, mainly metro and tram. We assume here a fuel efficiency of 0,035 MJ/pkm.
  - For the other 38% of the trips it is assumed that no additional fuel or energy use occurs.

The scenario with the Watertaxi leads to a lower passenger fuel efficiency and therefore also to a higher emission of CO_2. Furthermore it is assumed (not measured) that the boat engines lead to higher emissions of dust (soot) and volatile organic substances. Also the peak noise of the boats is higher than for cars and PT although the impact of noise was not measured.

B.15 Automated people movers (7.4)

1. Introduction

An Automated People Mover (APM) is an automated electric vehicle without driver that moves on a dedicated infrastructure. The general idea behind the APM is that it offers a high frequency connection from one place to another. When the APM connects for instance a Public Transport station to a busy city area it is supposed to stimulate people to use the Public Transport.

The 'ParkShuttle' started in 1997 as a first trial with an APM in Rotterdam connecting the subway station and P&R site 'Kralingse Zoom' to the business park Rivium in 'Capelle aan den IJssel'.

The user acceptance was good but the most important disadvantages were the low technical quality of the shuttles, their low speed, the long waiting times due to the single track and in the end insufficient capacity due to the growth of Rivium. The experiment was finished at the end of 2001 and it was decided to establish a full scale and improved APM project at this location within CIVITAS.

2. Description of the demo

2.1 Measure design

The idea behind this measure is to promote the use of Public Transport and to improve the accessibility of Public Transport by integrating Automated People Movers in a business district and future residential area. Therefore it was planned to replace the Rivium single-track infrastructure by a double track infrastructure. Also it was planned to extend the infrastructure by one kilometre and to have 5 instead of 2 stops. Furthermore it was planned to implement a travel information system, camera monitoring system and smart vehicle dispatching software in order to improve overall service to passengers. The existing three shuttles with a capacity of 12 persons each, were to be replaced by six 20-person shuttles.

Furthermore it was aimed to integrate an APM in the planning of the redevelopment and building of a medical and university complex at Hoboken.

2.2 Rotterdam transport plan context

The Automated People Mover at the Rivium location will connect the business and future residential area with the Public Transport station. Therefore this project fits the local policy to support projects that contribute to a modal shift from private cars to public transport. The Hoboken location was not supported by the Municipality as there the APM was supposed to transport people within the medical and university complex. It was not expected that this application of APM would contribute to an increased use of Public Transport.

2.3 Measure objectives

Immediate objectives:

- Establishment of 1 km new dedicated infrastructure
- Introduction and testing of six electric 20 person vehicles
- Investigation into the possibilities for integration of an APM in the municipal plans for redeveloping the Hoboken and Parkhaven area.

Ultimate objectives

- Promote the use of Public Transport and improve the accessibility of Public Transport by integrating Automated People Movers (APM) in a business district and future residential area and in the planning of the redevelopment and building of a large medical complex.

Contribution to TELLUS objectives:

- Increase modal share in favour of public transport
- Increase public transport use
- Achieve extensive political and public awareness for TELLUS
- Improve public-private co-operation

2.4 Ex-ante evaluation

In 2003 IVAM conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

The Ex Ante evaluation showed that Automated People Movers have a positive effect on the evaluation area's Society, Transport, Energy and Environment. However, the effect on Economy is negative.

3. Implementation process

Until the full-scale implementation is realized, man operated buses serve transport on the APM track. In the meantime ParkShuttle II is being developed to overcome the technical barriers of the first generation of vehicles. The vehicles have an attractive design, are highly accessible and have a capacity of 20 persons. The first vehicles were ready for testing in November 2004.

A double lane track was realized from the Kralingse Zoom to the Rivium 4th street. The track contains 4 barrier secured crossings with public roads, one (single lane) bridge over a highway and a small bridge over water. There are 5 stops, one at the subway station, one in the residential area and three in the business area. Also a travel information system, consisting of displays in the vehicles and at the stops, is implemented. For security, cameras are placed inside the vehicles and along the track. A garage where the vehicles are stored, cleaned and recharged is build, as well as the control room.

The implementation process of the civil infrastructure was delayed by approximately two years. Main barriers that caused the delay were financial problems and the difficult coordination with other infrastructural projects. For the APM infrastructure within the Rivium business district, the ground level had to be elevated by several meters. Also two bridges in the infrastructure had to be constructed. One of the bridges had to be partly financed out of another budget that is not directly related to the ParkShuttle.

In general it is a complex process as many parties are involved. The realization of the system and the system infrastructure is managed by ANT. During the process there was a strong cooperation with the Municipality of Capelle a/d IJssel, OBR (Development Corporation City of Rotterdam) , the public transport company (Connexxion) and the suppliers of goods.

The project is basically financed by Connexxion, the municipality and the city district. The system and civil infrastructure is managed by Capelle a/d IJssel and financed by the city district. The Public Transport Company (Connexxion) is responsible for the realisation of system infrastructure and the shuttle system itself.

Both Capelle and Connexxion needed extra budget. The municipality and Connexxion have put a lot of effort in getting extra budget, which solved the financial problems, but was a major reason for a delay in the project.

After the delay the following adapted planning was made:

- September 2005 Implementation of the remaining (3) vehicles. (milestone 7.4.1)
- September 2005 Final integration and completion of all infrastructure and system elements.
- September / October 2005: Testing and evaluation of system / Passenger evaluation
- November 2005: Formal opening of system
- December 2005: Final evaluation of the system by the Demonstrator Contact.

Barriers and drivers

The main driver was the success of the pilot system on the same location. It was decided to move to a full scale implementation with a longer infrastructure and new and more vehicles.

An important barrier was caused by problems of both the municipality of Capelle aan den IJssel and Connexxion for financing this large project. The delay in building the new bridge, financed by the municipality, lead to a delay in the implementation of the whole system.

The difficult coordination with other infrastructural projects especially the large intervention planned by the city of Rotterdam at the Kralingse Zoom metro station formed another barrier and reason for delays. In general it is a complex process as many parties are involved.

The main barriers described above, left only little time for testing the full scale system during the TELLUS project. In the final stage of the project a number of technological problems had to be solved leading to an additional delay.

Achievement of target and milestones

Table 1 shows the Milestones as planned and implemented.

Table B.15.1 Milestones for 7.4

Milestone	Planned	Actual implementation
Establishment of 1 km new dedicated infrastructure and introduction of 6 electric vehicles.	July 2003	Infrastructure delayed until June 2005 Vehicles operational September 2005
Investigation results concerning an APM at the Hoboken/ Parkhaven location	January 2005	Cancelled

4. Results

4.1 Evaluation methods

For the process evaluation, the LEM organised a meeting with the demonstrator contact to conduct an in depth interview based on a checklist. The checklist was harmonised with the other LEM's within TELLUS.

Also a set of impact evaluation indicators was established based on the METEOR approach and in close co-operation with the demonstrator contact. For the impact evaluation the LEM has already developed a questionnaire for users of the APM shuttles. However due to the delay of the implementation no impact evaluation could be made for this report.

5. Conclusions

Financial constraints and the complexity of the local situation where several infrastructural measures are combined, led to a serious delay in the implementation of the APM. As the

implementation was finalized at the very end of the TELLUS project no conclusions on the performance of the concept could be drawn. In theory there is a lot of potential for the concept on other sites in the public domain. Main factors that will determine a future success are the decision-making process and finances but also the technical performance has to prove itself in the coming years.

6. Scenario's

In theory there is a lot of potential for APM's. Strong point of the concept is the high frequency. It is specially suited for parking at long distances, tourist attractions, industry, office and business parks and transport from and to public transport junctions.

For 2010 there is potential that the project can be extended into the 'Brainpark' office park. This means a double size compared to the present Rivium location. In the long run 10 of those projects could be possible in Rotterdam.

Main factors that will determine a future success are the decision-making process and finances. Furthermore the capacity of the shuttles has to be (and remain) sufficient. Last but not least the Rivium project has to prove the technical quality of the Automated People Mover. The prototype (ParkShuttle I) suffered too many failures. It is of vital importance that the high frequency transport between the Public Transport station and the Rivium area is guaranteed.

ANT carried out a feasibility study for the APM potential in The Netherlands and concluded that there is a potential of at least 300 locations with a total number of over 1100 shuttles.

In other EU cities there will be a high potential for APM's as well.

7. Recommendations

No specific recommendations have been formulated for this measure.

B.16 Electric two-wheelers (8.1)

1. Introduction

At this moment, the electric two-wheeler is still not commonly known as a suitable means of transport, neither in the Netherlands, nor in other countries. The demonstration is a prolongation of the local site E-Tour project in Rotterdam. This will make it possible to extend the dissemination's activities regarding the introduction, demonstration and evaluation of the e-bikes and e-scooters in Rotterdam.

2. Description of the demo

2.1 Measure design

In order to achieve the introduction of an additional number of e-bikes, cooperation was set up with both importers of e-bikes and bicycle shops. This cooperation was based on financial agreements (with the importers) as well as on practical agreements with bicycle shops on sales and maintenance. The e-bike offers assistance to the normal pedal power. There are three modes of operation: no assistance, eco assistance and full assistance.

Based on the first experiences with electric bicycles, also in the local site E-TOUR project in Rotterdam, the most interesting groups for the procurement and introduction of electric two-wheelers are large employers, where the vehicles are shared by the employees for business and commuting trips within the city or for small goods distribution (like postal services) and the group of physically weakened persons. Contrary to the common expectations, frequently cycling on an electric supported bike can improve physical performance (1st results of physiological study). In this respect the electric supported bicycle can also be of great importance as a contribution to a healthier society, as is the case with normal bikes.

The measure can be considered as an important element of the integrated CIVITAS approach, to strive for a more environmental friendly transport system, a healthier environment and a healthier society.

2.2 Rotterdam transport plan context

The introduction of environmentally friendly means of transport is one of the targets from the Environmental Action Program (EAP) of the city of Rotterdam. Although the EAP is not specifically addressing e-bikes as one of the implementation options, the Environmental Policy Department of Public Works Rotterdam has started its contribution to the E-Tour project as well as the TELLUS-project from this programs perspective.

2.3 Measure objectives

The immediate objective was to introduce another 80 electric bicycles (August 2002) and prepare a marketing and introduction plan for electric two-wheelers (August 2003). Together with the 20 bicycles from the E-Tour project this will lead to a total of 100 bikes.

In the course of the project the objective was downsized to the introduction of approximately 50 e-bikes. In March 2004 the evaluation of these 50 e-bikes and the introduction and marketing plan should be completed.

The ultimate objective is the (large scale) introduction of electric two-wheelers as a clean, energy-efficient and reliable alternative for the car.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

Several sources of information have been found during this evaluation. The information used here refers to studies in Italy, Switzerland and The Netherlands.

The user acceptance for e-scooters was rated very high (92%). For e-bikes no data were found. E-bikes and e-scooters do have influence on modal split as approximately 30% of the users states they formerly used cars to perform the trips. On the other hand e-bikes replace conventional bikes or even lead to an increase of the number of trips.

Both e-bikes and e-scooters require higher initial investment than conventional bikes and scooters. The variable costs however are lower: € 0,07 per km for e-bikes and € 0,56 per km for e-scooters (conventional scooters have a factor 6 higher variable costs).

The energy use is calculated as 1 kWh / 100 km for e-bikes and 8 kWh / 100 km for e-scooters. For both vehicles a clear benefit on primary energy use and subsequently emissions could be calculated even for e-bikes where additional trips and substitution of conventional bikes were taken into account.

3. Implementation process

Actual implementation and deviations from the plan

As part of the European E-TOUR project, 20 e-bicycles and 5 e-scooters were in function from TELLUS month 1 (February 2002). In February 2002 an agreement has been made with a Dutch importer of electric bikes (MP Products), making it possible for interested people to buy a subsidized e-bike in a bicycle store under the condition that the e-bike will be used for commuting. This approach resulted in May 2002 in 8 extra e-bikes for municipal use; in October 2002 16 extra e-bikes were introduced at a private company and in July 2003 one extra e-bike

was introduced. So in total some 45 e-bikes were in use. The fact that less e-bikes were purchased than expected is probably due to the high investment costs. Even with subsidy the purchase price is about €1300, which is considerably higher than for a conventional bicycle.

This result has been discussed with suited bicycle manufacturers, in order to seek other solutions to get the commuting target groups interested in this fairly new means of personal transport. The outcome of this discussion was to make efforts for promoting the e-bikes (newspaper) and make it possible to subsidize the e-bikes until 1st of August 2003.

Based on the experiences described, the plan was readjusted to the introduction of approximately 50 e-bikes.

Barriers and drivers

Although e-bikes were subsidized the investment costs are still considerably higher than conventional bicycles. This was a major barrier for the measure. The purchase price, in combination with already existing attractive alternatives for commuting (e.g. public transport, company cars and private-bike arrangement), made the e-bikes a less favourable mode for the target group of commuters.

However, for another target group, the group of less-mobile people, which originally was not included in this project, the e-bike appeared to be most successful. The fact that the e-bike has positive impact on health and increases the mobility of this group of people is an important driver for increased implementation.

Other barriers also exist and should be overcome such as the weight of the e-bikes (convenience), the relatively high efforts for maintenance that are currently necessary, range and speed of the e-bikes and the risk of theft.

Achievement of milestones

Table B.16.1Milestones for 8.1

Milestone (original)	Planned	Actual implementation
20 electric bicycles and 5 electric scooters introduced	February 2001	February 2001
Another 10 electric bicycles introduced	July 2002	July 2002
Another 70 electric bicycles introduced	July 2003	-
Marketing and introduction plan for electric two-wheelers	January 2004	Summer 2005
Milestone (adapted)	Planned	Actual implementation
Another 20 electric bicycles introduced	July 2003	August 2003

4. Results

4.1 Evaluation methods

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators used are listed in table 3. The results are presented in this report as effects on indicators compared to the situation before the implementation of this measure and are shown as a simplified score (- to +). Score + can be interpreted as a 'good' or 'positive' effect on the indicator or evaluation category, *i.e.* a positive score is an 'improvement'.

Questionnaires have been sent to all 45 participants that have used an electric two-wheeler in this measure. The objective of this questionnaire is to get insights in the user acceptance of electric two-wheelers. Their experience will result into an introduction and marketing plan aimed at potential user groups. The results of this questionnaire have been used for this impact evaluation but are not stated otherwise.

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonised with the other LEMs' within TELLUS.

4.2 Impacts

General

In August 2003, 45 e-bikes and 5 scooters had been introduced. The total number of 100 e-bikes to be tested in this project could not be reached. The interest of private persons in the procurement of subsidized e-bikes for commuting purposes is much lower then originally expected. The main reasons are the often more attractive alternatives e.g. public transport, company cars and private-bike arrangements (subsidized\compensated by the employer).

Society

The overall opinion of the participants is that the electric bicycle is suitable for trips in the range of 5-7,5 kilometres and longer. The main reasons for using this type of bicycle are avoidance of congestion, avoidance of parking fees and physical benefits.

Although congestion avoidance is an often-mentioned reason to use the e-bike, it is unclear whether its leads to improved journey times. At least this not seems to be the most important incentive to use e-bikes.

Economy

Although e-bikes were subsidized the investment costs are still considerably higher than conventional bicycles. The purchase price of e-bikes was about €1.300 (€2.000 without

subsidy), while the average price of an good quality conventional bicycle is in the order of €600.

Furthermore for many users the e-bikes are not replacing their conventional bikes but rather are an additional investment to their bikes, motorized two-wheelers and four-wheelers.

It is likely that the fuel costs are less than before the introduction of e-bikes. A certain (but unknown) percentage of these users is not using motorized two-wheelers or four-wheelers any longer and therefore has less energy costs. Table 2 gives an overview of estimated fuel consumption and energy costs for some modes of transportation.

Table B.16.2 Consumption of energy-carriers and energy costs for 8.1

	Consumption per 100 km	Energy cost (€/100 km)
Conventional 50 cc scooter	3,6 l.	3,9
Advanced 50 cc scooter	2,0 l.	2,2
Small city car (petrol)	6,2 l.	6,7
Electric scooter	8 kWh	0,96
Electric bicycle	1 kWh	0,12

Variable costs for maintenance are not higher compared to motorised vehicles. But compared to conventional bicycles the maintenance costs seem considerable higher. Also for e-bikes the insurance costs are higher compared to conventional bicycles.

Transport

The e-bike is considered as a reliable transportation mode. Although the e-bikes are using the separate bicycle lanes available in the city, the level of accidents has not changed significantly (personal comment demonstrator contact).

It is likely that the modal split has slightly changed since several users have switched from motorized vehicles to e-bikes, however a concrete number could not be measured.

Environment/energy

The e-bikes contribute to the reduction of primary energy consumption and emissions. These can be compared with the energy consumption of alternative transportation modes (see table 2). The study in Rotterdam showed that e-bikes are not mainly replacing conventional bicycles. Another advantage of the e-bike is its lower noise ‘emission’, compared to motorized vehicles.

In conclusion an assessment of the considered indicators is given in table 3. The outcome given there is largely comparable with the outcome of the ex-ante evaluation. This is partly explained by the fact a part of the ex ante evaluation was based on the E-Tour project as conducted in Rotterdam. The main point of focus for the ex-ante evaluation is the number of kilometres driven by the electric vehicles and the share of kilometres substituted from other modes of transport. If

e-biking substitutes only biking and not a conventional car or scooter, it will be considered a less sustainable mode of transport.

Table B.16.3 Impact on indicators for 8.1

Evaluation Area	Indicator	Impact
Society	Acceptance rating	+
	Mean journey times	+/-
Economy	Investment costs	-
	Fuel cost per unit output	+
	Maintenance cost	-
Transport	Accidents	+/-
	Total no. trips	+/-
	Average modal split - PAX	+
	Cancellations	+/-
Energy	Passenger fuel efficiency	+
	Life cycle energy use	+
Environment	All (CO2, NOx, SOx, dust)	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

Table 4 gives an overview of the results by evaluation area.

Table B.16.4 Evaluation area scores for 8.1 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex ante	+	+	?	+	+
Ex post	+	-	+/-	+	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

5. Conclusions

E-bikes are not an alternative to the normal bikes but a new mobility means that still has to conquer its own market share. Lower purchase prices, possibly supported by subsidy, and emphasis on the new target group of less mobile people can increase the market share. This will increase also the transferability potential of the measure. The acceptance amongst the original target group of commuters is at the moment not sufficient for large-scale market penetration.

In general the e-bikes have a positive assessment in the evaluation areas, although the high (and additional) purchase and maintenance costs are still a barrier for a larger market penetration.

The assessment of the evaluation areas energy and environment is depending on the actual replaced transportation modes. In this case it is assumed that a part of the users is replacing their motorized vehicles. In case the e-bikes are an additional transportation mode, for instance for less active or less mobile persons, the assessment should be rather negative. On the other hand this measure then leads to less social exclusions of this target group.

6. Scenarios

Although the interest for electric two-wheelers is increasing, an intensive communication and promotion strategy is necessary to gain further acceptance and increase market shares. Test drives for instance are an effective promotion method.

Since e-biking is health improving, the medical society and health insurance companies should recognize and promote the use of power assisted bicycles which is especially health improving for rheumatic patients, less physical active, stressed and overweight people.

The e-bikes would become even more attractive when the financial gap between e-bikes and conventional bikes is smaller. Although e-bikes are not replacing the conventional bicycles, the purchase price of the latter is still the benchmark for e-bikes. Financial support will stimulate the use of e-bikes.

7. Recommendations

The interest of organizations/employers to purchase subsidized e-bikes for commuting purposes is also much lower then originally expected. The main reasons are the recession (organizations are cutting in expenses), subsidized e-bikes are more expensive than normal bikes, there are no lease-constructions available and the product is at this stage too fragile for company bikes, the bikes need a lot of maintenance, insurance, good care during use and change of battery every 4 years.

Product improvement is necessary (more reliability, not easily damaged and less maintenance) to be able to implement the e-bikes as company bikes. The e-bike have found to be most successful, even without the subsidy, in the group less-mobile people which was not included in this project. The important lesson learned from this project is that careful consideration of the expected target group is a necessity for implementation and the choice of implementation instruments.

Furthermore other barriers have to be overcome in order to increase the use of e-bikes:

- Decreasing the rate of theft. All bicycles should be stored inside which not always feasible in the urban areas of Rotterdam;
- Safe public storage facilities are needed to store the bikes during trips;
- At the moment the insurance costs are higher than for mopeds. This is affecting the acceptance of e-bikes;

- The quality of the batteries is still insufficient and the costs of replacement are to high;
- The weight of the e-bikes (30 kg) should decrease.
- The range and speed of the e-bikes is still considered as a barrier. The availability of battery charge points, possibly in combination with storage facilities, would enhance the range of the e-bikes;
- Local bike retailers should pay more attention to after sales services.

B.17 Expansion of van-pooling for commuters (8.2)

1. Introduction

In the city of Rotterdam, cars used by commuters have an occupancy rate of 1.14. Some companies in remote areas like the harbour use Touring Cars for their employees to travel from the inner city to their work. In those areas Vipre introduced the concept of Van-Pooling, *i.e.* a maximum of 9 employees share a (luxury) van with one of the employees acting as driver. Vans have the advantage to be cheaper than Touring Cars and they allow more flexible logistics. Before the start of TELLUS, Vipre had three successful projects in the harbour area for employees of three large companies. In total, 20 Vans were in operation.

2. Description of the demo

2.1 Measure design

The general idea behind this measure is to offer commuters the possibility to use a Van to travel from their homes to their work and vice versa. However, in contrast to the period before TELLUS, the aim of the Van Pooling project within TELLUS is to replace the use of private cars instead of Touring Cars. By sharing a Van with 9 employees instead of using separate cars a considerable amount of fuel will be saved. Therefore Van Pooling is expected to have a positive effect on Energy and Environment. Also, as one van replaces 7 to 8 cars it will have a positive effect on Transport. Besides it is expected to be good for Society as it is comfortable for the commuters. They can read the newspaper, have coffee or tea or have a conversation with their colleagues while they are going to work.

The objective of this measure was to have 24 vans in operation.

To establish this, the following tasks had to be performed:

- Procurement of Vans
- Formation of new user groups, based on a special selection procedure
- Demonstration of new Van-Pools in operation and monitor its effects

The innovative aspect of this measure is that it aims to replace the use of private cars instead of Touring Cars. Therefore, a completely different approach is necessary.

2.2 Rotterdam transport plan context

In general the city of Rotterdam encourages measures that reduce the use of private cars in favour of bicycles and public transport. However, Vipre was seen by the Municipality as competitive to the public transport. As a result it had to face several problems.

2.3 Measure objectives

The immediate objective of this measure was to have 24 new vans in operation with a high occupancy rate. The ultimate goal is to offer an alternative for the car on routes where a regular public transport is lacking.

The contributions to the TELLUS objectives are:

- Reduce car kilometres
- Reduce congestion
- Reduce traffic related CO_2 emissions and energy use
- Reduce air pollution and noise to levels below national and EC directives
- Improve intra-organisational co-operation at the city level

As Vipre encountered severe fiscal and legal problems during the implementation process it had to introduce an additional milestone to overcome these problems.

2.4 Ex-ante evaluation

In 2003 IVAM conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

Several literature references from Europe and the United States were found addressing this measure. Only for the evaluation area 'Economy', the effect could not be assessed. The ex ante evaluation showed that Van Pooling is positive for the Evaluation area's Society, Transport, Energy, and Environment.

Companies that opt for vanpooling for their employees have the following characteristics: 'a combination of regular working hours, bad quality of public transport and large distances to the workplace'. The most important reason to go vanpooling was the lack of public transport. Vanpooling is preferred over carpooling by the employees because it is cheaper (for them): but Vanpooling has to take less time than public transport to be successful.

Two sources reported a reduction of vehicle kilometres travelled by commuters of 8,6 % resp. 7,5 %. The reduction of energy consumption and emissions of substances to the environment is assumed to be linear with the reduction of vehicle kilometres.

3. Implementation process

Except for two vans for the Ministry of Public Affairs (RWS) Vipre has to overcome fiscal and legal problems before it will be able to implement 24 vans as planned. For companies in The Netherlands, the use of Vans is relatively expensive as the VAT for vans is 19% and not deductible while the VAT for company transport is only 6% and tax-deductible. Also compared

to regular cabs, vans have a financial disadvantage. In contrast to vans, for cabs no taxes for ownership have to be paid. As a result companies are reluctant to use the Vipre concept for their commuters.

Next to these tax problems, Vipre also encountered legal problems. The municipality regards vans as competitive to the Public Transport. The Vans have to drive within the concession of the public transport company (Connexxion). In order to offer a fast commuter transport mode Vipre would like to use the dedicated bus lane. As a result Vipre had to introduce a more fundamental 'milestone'; to overcome the legal and fiscal problems.

After many negotiations and much debate Vipre was allowed to use the bus lane and the Ministry of Economic Affairs has approved Vipre as a new kind of Public Transport. The last obstacle to tackle however, is the tax problem. To solve this problem Vipre charges the van user 19% VAT and pays only 6% VAT to the Dutch government. This way they hope to command and win a lawsuit. Once this last barrier is removed the measure can actually be implemented[13].

Barriers and drivers

The main driver for this measure was the market opportunity perceived by the private company VIPRE.

Legal and fiscal problems were the main barriers for this measure. Due to the fact that the costs of Vanpooling are comparable with the current travel-allowances paid by the employers, there are no direct financial benefits for the employers to use Vanpooling. To trigger employers to facilitate Vanpooling for their employees it is essential to reduce the costs of the concept. During the TELLUS period VIPRE realised that Vanpooling only could be a great success if the costs for Vanpooling would be comparable to Public Transport. After many increased lobbying efforts they finally have achieved a better fiscal climate. The national Finance and Traffic Department decided that Vanpooling could be given the same status as Public Transport. For Vanpooling the road tax has been adjusted to the tax paid by Public Transport, being nil. With another section of the Finance Department the lobby to decrease costs for VAT and BPM (tax to be paid for every registered motorised vehicle intended for passenger transport) is still going on.

Moreover the economic situation was a barrier as for companies the commuters' transport did not have the highest priority in the past years.

[13] The ore container port has the intention to transfer their fleet of 45 vans to Vipre. However these vans can not be interpreted as a TELLUS result. Furthermore Vipre has been ordered by the Ministry of Public affairs to introduce a daily transport with vans on the free bus lane of the A9 in the Amsterdam Region during the reconstruction period of the highway.

Achievement of milestones

Table B.17.1: Milestones for 8.2

Milestone	Planned	Actual implementation
2 new vans in operation	August 2002	2 vans for RWS, March 2002
+ 7 new vans in operation	April 2004	Delayed
+ 6 new vans in operation	February 2005	Delayed
+ 6 new vans in operation	July 2005	Delayed
Milestone (adapted)	Planned	Actual implementation
To obtain the Public Transport Licence	-	January 2005
Overcome fiscal problems	June 2005	Pending
7 new vans in operation for Shell Pernis	August 2005	Pending

4. Results

4.1 Evaluation methods

For the process evaluation the LEM organized a meeting with the demonstrator contacts to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators have not been discussed with other demonstrator contacts since no immediate synergy with other measures was expected. The indicators are listed in table 2. The results are presented in this report as effects on indicators compared to the situation before the implementation of this measure and are shown as a simplified score (- to +). Score + can be interpreted as a 'good' or 'positive' effect on the indicator or evaluation category, *i.e.* a positive score is an 'improvement'. The underlying quantitative and qualitative results can be found in the annex.

As only two vans are implemented within the TELLUS period it did not seem efficient to carry out a survey amongst these commuters. Therefore a student's report of July 2001 was used for the impact evaluation. The students report is based upon a survey amongst commuters that used to travel by company bus, by private car or by public transport. Out of this report only the results of commuters that used to travel by car were used for the TELLUS impact evaluation as this measure especially focuses on this type of commuter.

4.2 Impacts

Society

People are very satisfied with Vanpooling. For people who used to travel by car before Vanpooling, the mean journey time is longer by vanpooling. However, they don't mind, mainly because Vanpooling is cheaper than travelling by car.

Economy

Investment costs, Fuel cost per unit output, Staffing costs, Maintenance cost, Cost, Operating revenues per passenger and change in profit were replaced by the LEM by the most generic indicator; change in profit. As long as the discussion on VAT and BPM is ongoing the impact on this indicator is unclear.

Transport

As Vipre is not yet able to implement Vanpooling at full strength, nothing can be said about the traffic flow in relation to the potential flow. The average occupancy is about 90%. A lot of effort was put in marketing activities such as direct mail action and a new website. Next to these marketing activities, the vanpooling concept also 'sells itself' as it appears that 86% of the commuters recommend Vanpooling to their colleagues.

Energy and Environment

Based upon an average occupancy of approximately 8 persons, energy and energy related emissions will have a positive score.

Table B.17.2 Impact on indicators for 8.2

Evaluation Area	Indicator [1]	Impact
Society	Operator Acceptance	+
	Acceptance rating	+
	Mean journey times	-
	Conflict rating	+
Economy	Change in profit	?
Transport	Capacity/flow ratio	?
	Average occupancy	+
	Success of Advertising	+
Energy	Passenger fuel Efficiency	+
Environment	All (NOx, CO2, dust)	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

Table 3 gives an overview of the results by evaluation area.

Table B.17.3 Evaluation area scores for 8.2 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex ante	+	?	+	+	+
Ex post	+	?	+	+	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

5. Conclusions

It is concluded that the implementation is seriously delayed due to legal problems and tax problems. However, Vipre managed to overcome the legal problem as it received the Public Transport Licence by January 2005. Once the tax problem is solved, implementation of the Vanpooling concept in Rotterdam is possible. Unfortunately the evaluation of these new vans cannot take place within the TELLUS period. Based upon an evaluation of 2001 it is expected that the Vanpooling concept will positively contribute to sustainable urban traffic.

6. Scenarios

In Rotterdam approximately 75 vans can be implemented in the future. For other (EU) cities with remote industrial area's the Vanpooling concept will also be suited. Major precondition is that the vans can operate under Public Transport conditions.

7. Recommendations

For the authorities it is recommended to make clear regulations about the status of vanpooling. If vanpooling is organised in area's not covered by regular public transport, it should be regarded as custom-made public transport.

8. Annex

A survey[14] amongst vanpooling commuters was carried out at the beginning of 2001. From this survey the relevant results are gathered in this Annex.

191 commuters out of 626 were asked to fill out the questionnaire. The number of respondents was 113 (59%)

The average Van transports 8.1 passengers. The occupancy rate is 8,1/9 = 90%

17 commuters travelled by private car before Vanpooling. 13 out of 17 have longer journey times by van then by car. However, they do not mind. The same holds for 8 passengers that used to organise carpooling before vanpooling.

Commuters that used to go by company bus (a majority of 60) have shorter journey times. As a result, the average journey time has improved. However, for this TELLUS measure, that especially aims at replacing the private car by vanpooling, the score on the indicator "journey times" is negative. Nevertheless, people that used to travel by car before vanpooling are satisfied with vanpooling, mainly because the relatively low travel costs.

[14] R. de Jong, "Vanpool – een hele boel", NHTV, Breda University, July 2001

In general, commuters are very satisfied with Vanpooling. The average score (on a 10-point scale) is 7,6. As a result 87% of the commuters is willing to proceed vanpooling in the future and 86% would recommend Vanpooling to their colleagues. Commuters that hesitate about vanpooling in the future or even want to stop vanpooling mention the impossibility of flexible working hours as main cause. The major disadvantage people mention is the temperature inside the van. Furthermore people are annoyed if their fellow travellers are too late.

The report does not give information about the operators' acceptance. As a rather large part of the respondents (25%) was van driver and the average satisfaction score is high, it is assumed (by the LEM) that the drivers' acceptance is positive as well.

The following recommendations for improvement of the van were determined in the report:

- Install individual air conditioning
- Improve possibility to adjust the seats next to the driver
- Improved suspension
- Improved engine noise
- Install litter tray

Based upon the occupancy rate of 8.1 persons the impact on passenger fuel efficiency will be positive. Also the overall energy consumption must be lower for vanpooling than for private car use. Therefore the impact on environment (energy related emissions) will also be positive.

B.18 Expansion of car-sharing (8.3)

1. Introduction

The Greenwheels concept creates regional networks of car-sharing locations throughout the Netherlands and currently provides over 700 car-sharing locations within 42 cities. A car-sharing location is a dedicated parking space at which one or more shared cars are parked. It is possible to 'subscribe' to a shared car. The subscriber is not the owner of the car but has a 24-hour per day access to any shared car. Reservations can be made by Internet in addition to a 24-hour call-centre service.

Furthermore, chip cards, onboard computers and GSM data communications are introduced to improve the service to the customers and to make the concept of car-sharing an attractive alternative for car-ownership.

At present, the situation in some identified difficult areas of Rotterdam, especially in the northern, southern and eastern part of the city, is not favourable for the viability of a car-sharing system.

2. Description of the demo

2.1 Measure design

Up to now car sharing has only been possible in the city centre and some surrounding districts. As long as there are enough potential users living in the neighbourhood of the parking location (at least 15 per square kilometre) the shared car is cost effective. The project aims however to expand the network of parking locations with 50 new sites in relatively difficult areas of Rotterdam. The main issue for the project therefore was to look for suited sites within those difficult areas

The innovative aspect for car sharing in general is that one car is used by several people. The average car in the Netherlands is only used for approx. 1 hour a day. Therefore it is possible to have several people using the same car, one after another. Car sharing is based on this precondition. A car sharing member doesn't own a car, but he or she has 24 hours and 7 days a week access to a fleet of cars. This guarantees almost 100% availability when one needs a car.

Within this measure an extra innovative aspect is to develop a methodology to find locations, suited for a cost effective exploitation within commercially difficult areas.

Tasks to perform within CIVITAS:

Extending of the Car-sharing service according to the one-car-one-location strategy, which means that for every new location added to the already existing network, one extra car is needed to guarantee almost 100% availability. During the period 2002 until 2004 the Car-sharing service will take the risk to expand the network, with special attention for the identified difficult areas in the northern, southern and eastern parts of Rotterdam, with 50 parking spaces (distribution portals) and therefore add 50 cars to the fleet. This way, it is planned to attract an additional 750 inhabitants from the city of Rotterdam to the car-sharing programme.

Several tasks were identified for this measure:

- Planning, assigning and realisation of dedicated parking spaces for shared cars
- Introduction of 50 extra vehicles in the Car sharing fleet
- Promotion campaign
- Demonstration of the extended use of car sharing in a identified difficult area

Verifiable results:

- 50 new vehicles
- 50 dedicated parking spaces
- 750 new members of the car-sharing service

Offering a reliable car-sharing service necessarily means high investments, due to the one-car-one-location principle. On the other hand, market forecast indicators show that car-sharing isn't viable in large areas of the Rotterdam municipality, especially in the northern, southern and eastern parts of the city. Therefore, introduction of this service in these area's is hindered which, of course, means that a major part of the population is deprived of this service. CIVITAS makes it possible to test the economical viability of the car-sharing service in these specific areas.

2.2 Rotterdam transport plan context

In general Rotterdam encourages projects aiming at a decreased use of private cars. As car sharing is a commercial product, the City of Rotterdam does not have to invest in this measure and therefore is not expected to have any objections. However, if the Greenwheels parking space is situated in a paid parking area, this means a loss of income for the City.

2.3 Measure objectives

Immediate objectives:

- 50 new vehicles
- 50 dedicated parking spaces
- 750 new members of the car-sharing service

Ultimate objectives

- Expand the network of car-sharing locations by 50, throughout the city but also specifically aiming at the identified difficult areas within the city, and have 750 extra citizens adopt car-sharing.
- Contribution to TELLUS objectives
- Increase the modal share in favour of public transport
- Reduction of CO2
- Reduction of car kilometres
- Improve public-private co-operation

2.4 Ex-ante evaluation

In 2003 IVAM conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

From the ex ante evaluation it was concluded that car sharing has positive effects on Economy, Transport, Energy and Environment. On Society no results were found.

3. Implementation process

At the beginning of TELLUS it was planned to have 50 new parking spaces in July 2005 and then attract 750 new members over a period of 2 years. As this method was on second thoughts commercially too dangerous, Greenwheels first looked for new (potential) members and then realized new parking spaces. By doing so, Greenwheels succeeded to introduce 13 new parking spaces, and therefore added 13 cars to their fleet. As a result, the total number of members increased by 130: 51 in “Prins Alexander”, 31 in “Hillegersberg” and 48 in “Kop van Zuid”.

To search for suitable locations for new parking spaces Greenwheels uses a GIS computer program. The addresses of people asking for information about Car-sharing are visualized on a map of Rotterdam. Next, areas of 1 square kilometre are searched in which at least 15 potential members are located.

The area's outside the three mentioned had not enough potential for a commercially sound exploitation. Therefore Greenwheels could at first not realize more than 13 parking spaces. Another barrier for Greenwheels is to claim a parking space. First of all, if the parking space is situated within a paid parking area, the City will have no income out of this parking space. In the three areas mentioned there is no paid parking but some local residents were opposed to the Greenwheels parking space as they had to sacrifice their parking space.

It all depends, sometimes, on the attitude of one city councillor. In Hillegersberg for instance, one of the councillors was strongly opposed to rendering parking space to Greenwheels. Once he had left, 5 more parking spaces could be realized by September 2005.

To advertise for the car sharing concept, Greenwheels cooperates with the Netherlands Railways. A parking place next to a railway station appears to be a commercial success. However, in the three areas mentioned there is no railway station. The subway stations in the areas are not suited as a location for a Greenwheels parking space. For obvious reasons people do like to change from train to car but not from subway (or any other public transport) to car.

To realize more members and parking spaces, Greenwheels does not consider other car types. Their philosophy is that car sharing people are not interested in the status of the car, *i.e.* the number of members will not increase in a commercially attractive way by using a "Mercedes Benz" or sports cars. For that reason, the German car sharing company that did use different cars, was no commercial success.

The milestones planned and implemented are shown in table 1.

Table B.18.1. Milestones for 8.3

Milestone	Planned	Actual implementation
50 dedicated parking spaces and 50 new vehicles introduced.	July 2002	13 parking spaces and 13 cars by March 2005 5 more parking spaces and 5 cars by September 2005
750 new members	January 2005	130 new members* by March 2005

* The number of new members for the other 5 parking spaces of September 2005 was not available at the time of this evaluation report.

4. Results

4.1 Evaluation methods

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators were not discussed with other demonstrator contacts since no immediate synergy with other measures was expected. The indicators used are listed in table 2. The results are presented in this report as effects on indicators compared to the situation before the realisation of the 13 new vehicles and are shown

as a simplified score (- to +). Score + can be interpreted as a 'good' or 'positive' effect on the indicator or evaluation category, *i.e.* a positive score is an 'improvement'. The underlying quantitative and qualitative results can be found in the annex.

For the impact evaluation a survey was carried out amongst members of Greenwheels in august 2005. Furthermore, a data file containing car usage (hours used and kilometres driven) was used. To measure if the inhabitants of Rotterdam in general are aware of the new Greenwheels cars, a citywide survey was used.

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

4.2 Impacts

Table B.18.2 Impact on indicators for 8.3

Evaluation Area	Indicator	Impact
Society	Acceptance rating	+
	Mean journey times	+
	System access distance	+
	Change in unemployment	+/-
Economy	Change in profit	+
Transport	Total no. trips	+
	Total pkm. Travelled	?
	Average modal split (trips)	-
	Success of advertising	+
Energy	Energy use	+
Environment	All (CO2, NOx, Sox, dust)	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

General

Within TELLUS 50 new Greenwheels cars were planned. For the company commercial success is a vital precondition. Therefore, at first only 13 new cars with a total of 130 new members could be implemented within the TELLUS period. After the evaluation had been carried out another 5 cars were introduced and one more is expected before the end of the TELLUS period. In the survey (focussed on the first 13 cars) people were asked to estimate their kilometres travelled for each travelling mode. Unfortunately the number of people who gave answers to these questions was too low to make a reliable analysis. Therefore it was not possible to assess the impact on Modal Split (PAX) and passenger fuel efficiency. These indicators were replaced

(by the LEM) by modal split (trips) and energy use.

Society

Most users (very) satisfied about their subscription to Greenwheels. 91% of the households is satisfied up to very satisfied about the ease of reservation, 95% is satisfied up to very satisfied about the availability and 82% is satisfied up to very satisfied about the distance to the Greenwheels car. The quality of maintenance and the costs of Greenwheels cars are relatively less satisfying for households. Nevertheless, still a majority is satisfied up to very satisfied about these aspects.

Mean journey times have not been measured. It is however assumed that for the 20% of households that have given up their car mean journey times have increased. For the other households it is most likely that mean journey times have decreased, as they used a bike, moped or public transport before the used Greenwheels cars. Therefore the total effect will be a decrease of mean journey times.

Greenwheels is mainly used for social purposes. Households that have given up their car, formerly used it for social purposes and now use a Greenwheels car instead.

The impact on 'unemployment' (see table 2) is assumed to be neutral. A decrease in private cars causes less employment. On the other hand, an increase in Greenwheels cars will cause more employment.

Economy

The 7 evaluation indicators on economy that were originally selected were replaced by one indicator; 'change in profit'. As Greenwheels looked (only) for new parking places that are commercially attractive it is by definition clear that the overall score on Economy for Greenwheels is positive.

Transport

The total number of trips has decreased. The total person kilometres travelled however could not be determined. The modal split (trips) was changed in favour of cars and therefore the impact is determined as 'negative'. This is due to the new Greenwheels subscribers without private car. They replace public transport trips by trips in Greenwheels cars. As people without car outnumber the car owners, the overall score on the modal split indicator is negative. Success of advertising was measured in a citywide survey. 8% of the inhabitants of Rotterdam were aware of the introduction of new Greenwheels cars. As the introduction of new Greenwheels cars had a relatively small target group (only people with drivers licence in 3 districts of Rotterdam, a total of approximately 12 % of the inhabitants of Rotterdam) 8% awareness in a citywide survey can be considered as 'good'.

Energy and Environment

The impacts on energy and environment appear to be strongly related to the car ownership of Greenwheels subscribers. For people without car and for car owners who keep their private car after subscription to Greenwheels the impacts on energy and environment are neutral. Their overall number of 'energy consuming trips', *i.e.* public transport trips and car trips, decreases but they replace public transport trips by trips in Greenwheels cars. For people who give up their car the impacts are positive. They make less trips by car and more by public transport while the total number of energy consuming trips decreases.

A study amongst Greenwheels users in the city centre of Amsterdam showed that the average Greenwheels user travels approx. 7.000 kilometers as the average car user travels for 17.000 kilometers[15].

In table 3 the results are shown by evaluation area, compared to the results of the Ex Ante evaluation.

Table B.18.3 Evaluation area scores for 8.3 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex ante	?	+	+	+	+
Ex post	+	+	+	+	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

5. Conclusions

The Greenwheels project is evaluated as being positive for all evaluation areas. However, it must be emphasized that the positive score on economy is inherent to the way new locations for Greenwheels parking sites were obtained. Only for those locations for which a positive financial result was foreseen, new parking spaces were implemented. Furthermore the impact on Energy could not be based upon the most suited indicator; passenger fuel efficiency.

6. Scenarios

As this CIVITAS project looked for the less favourable, yet commercially attractive locations for parking spaces, 13 parking places were evaluated within the TELLUS period. However, by September 2005 another 5 parking places and cars were added and it is expected that at the end of 2005 another new parking space can be realized. Therefore, a total of 19 new cars will be in operation. This number will approximately be the maximum number possible in the less favourable area's of Rotterdam. *I.e.,* for the future no substantial new potential is expected.

[15] H. Nanninga, L. Lutje Schipholt, D. Eerdmans, De deelauto in Amsterdam Centrum – terug- en vooruitblik. Inno-V adviseurs, Amsterdam, to be published November 2005.

With respect to the transferability of this measure to other (EU) cities it must be emphasised that the potential is highly dependent upon the parking situation in the city. In cities with paid parking (also for inhabitants) and where people have to wait a long time before they get a parking permit, car sharing is very popular.

7. Recommendations

With respect to 'energy and environment' it is recommended to advertise for new members for the car sharing concept amongst car owners. In case people give up their car the impact of the Greenwheels concept is optimal. For a more reliable analysis of the environmental impact it is recommended to make people keep a diary in which they write their daily movements (vehicle used, kilometers traveled and occupancy), both amongst car sharing people and car owners.

8. Annex

In august 2005 130 surveys were send and 57 surveys were returned, a response of 44%. The respondents were asked to answer questions about their use of Greenwheels' cars as well as about their situation before.

People that filled out the questionnaire had been subscribed to Greenwheels for an average period of 17 months. The mean household size is 2,4 persons.

Due to the subscription to Greenwheels 11 out of 57 households gave up their car. Nine of those households owned one car; two households owned two cars before they subscribed to Greenwheels. The cars that have been given up were petrol driven (7) and diesel driven (3)[16].

Households were requested to estimate the number of trips per month for each mode of transportation before and after their subscription to Greenwheels. 45 respondents answered these questions.

People were also asked to estimate the number of kilometres per mode. However the number of households that filled in these questions was too low to make a reliable analysis

Therefore it was not possible to assess the impact on Modal Split (PAX) and passenger fuel efficiency. These indicators were replaced (by the LEM) by modal split (trips) and energy use.

To gain good insight in the changes in behaviour an analysis was made of the change in the number of trips for the following 4 groups of respondents:

A households without car (before and after subscription to Greenwheels). [n=25]
B households with one car before and after. [n=12]
C households with one car before and no car after. [n=6]
D households with two cars before and one car after. [n=2]

[16] One car unknown.

The table 4 and 5 show the number of trips per month for each mode for households in which the number of cars has not been changed due to Greenwheels.

Table B.18.4 Survey results (1) for 8.3

Number of trips per travel mode in households with unchanged car ownership			
N = 25	Group A: no car before and no car after		Impact on N of trips
	Before	After	
GW car	0	54	+ 54 GW trips
Public transport	616	564	- 52 PT trips
Moped/motorbike	20	0	- 20 Moped trips
Private Car	0	0	
Bike	1437	1438	+ 1 Bike trips

Table B.18.5 Survey results (2) for 8.3

Number of trips per travel mode in households with unchanged car ownership			
N = 12	Group B: 1 car before and 1 car after		Impact on N of trips
	Before	After	
GW car	0	26	+ 26 GW trips
Public Transport	216	166	- 50 PT trips
Moped/motorbike	15	11	- 4 Moped trips
Private Car	337	346	+ 9 Car trips
Bike	286	284	- 2 Bike trips

The tables 6 and 7 show the number of trips per month for each mode for those 2 groups of households in which the number of cars changed due to Greenwheels.

The tables show that in these two groups of households public transport trips were replaced by Greenwheels trips. As a result for these households the modal split changed in favour of the car. The impacts on Energy and Environment are estimated as 'neutral[17]'. The 'negative' effect of replacement of PT trips by car trips will approximately be compensated by the lower number of moped trips. Besides, the overall number of 'energy consuming' trips has decreased.

The tables above show that in these two groups of households the number of public transport trips increased as the number of car trips decreased. As a result for these households the modal split changed in favour of public transport. The impacts on Energy and Environment are estimated as 'positive'. There is a 'positive' effect due to the decrease in car trips. Although some private car trips were replaced by trips in Greenwheels cars, the effect of this will be positive as some private cars had diesel engines.

[17] In this report a 'good' impact (i.e. for instance 'good' for the environment or energy saving) is called positive, a bad impact is called negative and an impact that is neither good nor bad is called neutral.

Table B.18.6 Survey results (3) for 8.3

Number of trips per travel mode in households with changed car ownership			
N = 6	Group C: 1 car before and no car after		Impact on N of trips
	Before	After	
GW car	0	11	+ 11 GW trips
Public Transport	96	127	+ 31 PT trips
Moped/motorbike	0	0	
Private Car	84	0	- 84 Car trips
Bike	168	161	- 7 Bike trips

Table B.18.7 Survey results (4) for 8.3

Number of trips per travel mode in households with changed car ownership			
N = 2	Group D: 2 cars before and 1 car after		Impact on N of trips
	Before	After	
GW car	0	3	+ 3 GW trips
Public Transport	8	22	+ 14 PT trips
Moped/motorbike	0	0	
Private Car	58	45	- 13 Car trips
Bike	24	30	+ 6 Bike trips

It can be concluded that for 37 households the impact on the modal split is negative, as for 8 households the impact on modal split is positive. Therefore, the overall impact on the modal split is negative.

Furthermore it can be concluded that for 37 households the impacts on energy and environment (energy related emissions) are neutral as for 8 households the impacts on energy and environment are positive. As a result the overall impacts on energy and environment are assumed to be (slightly) positive.

Furthermore tables 4 to 7 show that the total number of trips has decreased. The tables also 'prove' the relation between car ownership and bicycle use. People without car use bicycles most.

Table 8 shows that Greenwheels cars are mainly used for social purposes.

Table B.18.8 Survey results (5) for 8.3

Purposes for using Greenwheels (N=55)	%
Social	64%
Work	22%
Recreation	18%
Shopping	18%

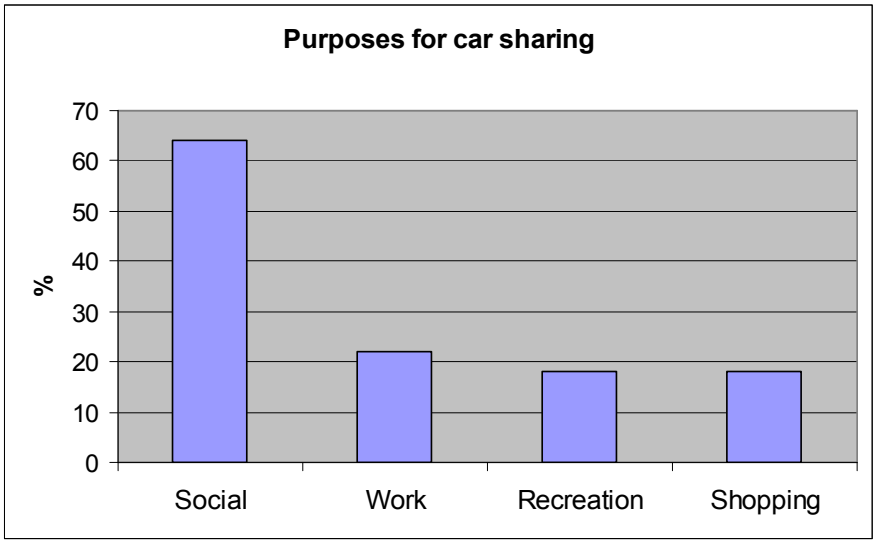


Figure B.18.1 Purposes for car sharing

Some respondents have used the opportunity to comment on when and why they use Greenwheels:

- if public transport costs too much time and one has to change too often (especially if with children);
- for trips shorter than 100 km in a short period of time (otherwise it is too expensive);
- in with bad weather conditions instead of the bicycle or when the own car is not available;
- to have municipality workers make duty trips instead of with their own car (which has insurance advantages).

Mean journey times were not measured. It is however assumed that for the 20% of households that have given up a car, mean journey times have increased. For the other households it is most likely that mean journey times have decreased. Therefore the total impact will be a decrease of mean journey times.

The respondents were asked to judge the Greenwheels service on several aspects to get an overview on customer satisfaction, see table 9 (N=56).

Table B.18.9 Survey results (6) for 8.3

	Very unsatisfied	Unsatisfied	Not unsatisfied, not satisfied	Satisfied	Very satis
Ease of reservation	2%		7%	28%	63%
Availability Greenwheels car	2%		4%	53%	42%
Distance to Greenwheels car	2%	4%	12%	40%	42%
Quality of Maintenance	2%	7%	21%	48%	21%
Costs	2%	9%	40%	44%	5%

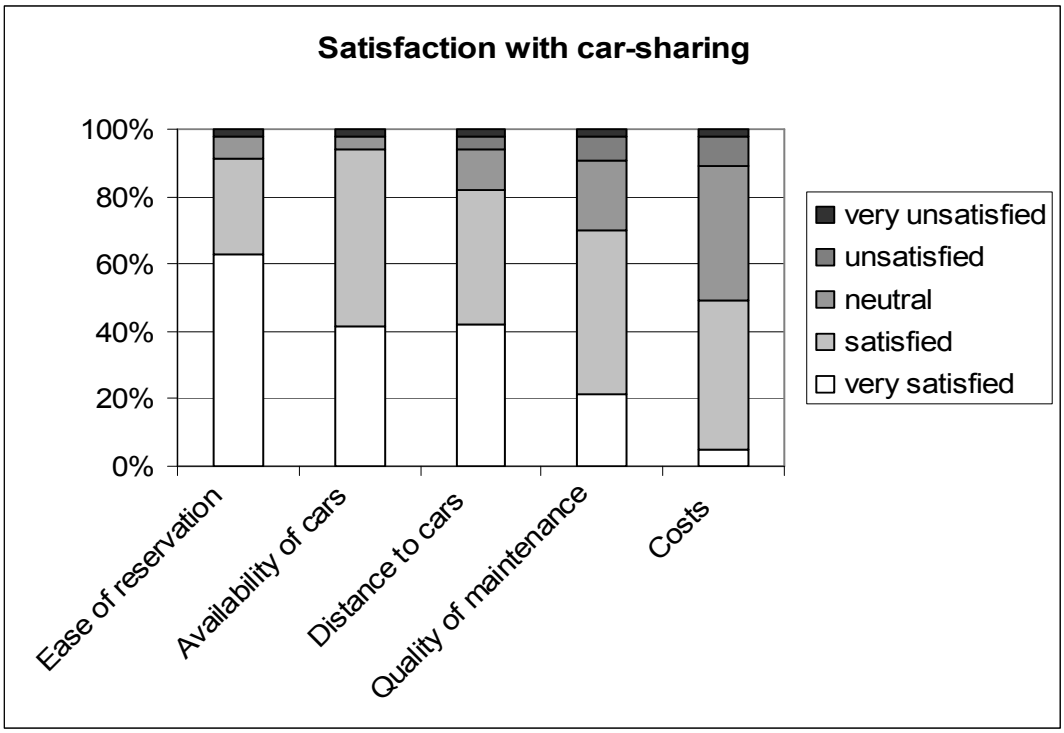


Figure B.18.2 Satisfaction with car sharing

Most users are satisfied up to very satisfied about their subscription to Greenwheels. They are most satisfied with the ease of reservation: 63% is very satisfied about that. 42% is very satisfied with the actual availability of the Greenwheels car and 53% is satisfied. The distance to the nearest Greenwheels car is also valued well. Users are less satisfied about the quality of maintenance and the costs of Greenwheels. Some respondents have used the opportunity to suggest improvements for the Greenwheels service:

- make Peugeot 206 cars available, because Peugeot 106 cars have too little luggage space[18]
- shorter waiting times for the helpdesk;
- make the new public transport chip card, to be introduced soon in Rotterdam also available for Greenwheels;
- make the internet reservation system free of technical disorders;
- improve the quality of maintenance of the Greenwheels cars: clean the inside and outside of the car, refill screen washer liquid.

[18] Since October 2002 Greenwheels switched to Peugot 206 cars as the production of Peugot 106 stopped. By the end of 2005 Greenwheels will have a 100% Peugot 206 fleet. However, in Prins Alexander, a rather quit area, from this type of car several times valuable parts (like airbags) were stolen. Therefore Greenwheels replaced in this district the 206 type by the 106. This solved the problem but customers were less satisfied.

One respondent suggests an improvement that goes a little further than Greenwheels: to make it possible to take bicycles into the metro. For this household the combination of metro and bicycle would be a better alternative than Greenwheels for longer distances.

B.19 E-commerce logistics (9.1)

1. Introduction

A lot of traffic in the city is related to the distribution of goods. Companies pick up needed parts and components from parked service vans. This is often carried out during the night in residential areas where it causes noise and search behaviour of drivers. This search behaviour is due to the changing position of parked service vans which is caused by scarce parking space. Furthermore there is business to consumer distribution. This type of distribution causes extra urban traffic as the customers are frequently not at home at the time of delivery. Before the kick off of TELLUS the preparations for an innovative distribution system to overcome the distribution related traffic problems were in an advanced stage.

2. Description of the demo

2.1 Measure design

Introduction and demonstration of an innovative 24-hour “last-mile” distribution system serving the business-to-business (B2B) and business-to-consumer (B2C) parcel delivery market. The goal was to realise eight distribution portals located at strategic locations near the major access and slip roads of highways as well as near public transport facilities of a city (e.g. P&R and carpool facilities). Via Collect aim was to provide a collection point for users and consumers were they could collect their ordered goods in efficient, reliable, flexible and convenient way.

In the B2B sector for example service and maintenance vehicles could, on their way to work, pass by and collect the required parts and components, and on their way back home drop-off their returns. At this moment the distribution to the service engineers is carried out during the night in residential areas into the vans of the service engineer, causing noise and search behaviour by the delivery companies. This search behaviour was due to the unpredictability of the position of parked service vans caused by the limited availability parking space.

In the business-to-consumer segment the portals aimed at the distribution of e-commerce ordered goods who have difficulty in effectively organise the home delivery. One of the problems the parcel distribution companies face is the fact that customers are frequently not at home at time of delivery. As a result additional distribution attempts are made causing extra urban traffic. Another important target in the B2C segment were down-town shoppers. Today many shoppers choose to use their own car for shopping down-town since it is considered more convenient for taking home their shopping’s. The portals would allow the clients to park their cars at the P&R facilities, go to the shopping area by public transport, do their shopping and pick-up their articles after they have collected their vehicles at the portals.

To facilitate the communication with clients and users an e-commerce portal was prepared for. Additional services such as payment and communication systems to schedule pick-up times and manage payment were envisaged. An extra benefit from this system was increased safety of P&R lots due to continuous presence of a person in the portals.

2.2 Rotterdam transport plan context

In general Rotterdam encourages projects aiming at a decreased use of private cars. As e-commerce logistics is a commercial product, the City of Rotterdam does not have to invest in this measure and therefore is not expected to have any objections. The item is not addressed in specific policy plans however.

2.3 Measure objectives

The immediate objectives of this measure were to have all distribution portals operational within the TELLUS period. The ultimate objective is to exploit a 24-hour distribution system in order to limit the distribution traffic in residential areas and private car traffic into the inner city. As a result the measure will contribute to the reduction of CO2 and other traffic related emissions and to the reduction of noise.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world. For E-commerce logistics however, no comparable results were found.

3. Implementation process

Actual implementation and deviations from the plan

The concept for the distribution system was developed and prepared for in 2001, before the kick-off of TELLUS. For the preparation Via Collect obtained the support of various leading organisations like the Netherlands Distribution Council (NDL) who endorsed the concept by actively promoting the initiative to its members. In close co-operation with the Center, the knowledge transfer department of the University of Brabant, expert sessions were conducted to assess the acceptance of the concept with potential users and prospective clients and to device the marketing strategy. Another part of the preparation was the operational process and systems design. For this purpose TNO-FEL conducted a comprehensive study and systems to model the ICT requirements, design the information architecture and ensure that existing standards and solutions would be used as much as possible. The business plan aimed at opening a number of portals in (preferably) the Rotterdam area during 2002 with the aim to gain experience, to facilitate the marketing and sales efforts and to attract venture capital for a future roll-out. Rotterdam was approached to support the launch of Via Collect.

From the moment the TELLUS project was confirmed in 2001, Via Collect started with the implementation. First a communication website was established and actively used to promote and sell the concept. Next, they embarked a publicity and sales campaign with the aim to

acquire a group of launching clients to test the concept commercially and operationally, to give credibility and to launch the operations. Simultaneously the building of the first two portals was commissioned and an invitation to tender was submitted for the provision of the ICT solution, based on the design and requirements as described by TNO-FEL. The target was to have the ICT system operational before the end of 2002.

The results were encouraging but revealed a clear need to have quickly a further 3 sites operational, as a prerequisite to attract volume and justify internal operational adjustments for the clients.

Following the formal endorsement of the project by CIVITAS and the obtained support from prospective clients the ABN-AMRO bank provided Via Collect with a credit facility to finance the implementation. The joint efforts resulted in the opening of the first portal in March 2002 and the commissioning of the ICT solution to CGE&Y. The second distribution portal was meanwhile commissioned and prepared for, however due to delays in obtaining licenses and the simultaneously emerging financial problems as ABN-AMRO unexpectedly withdrew the credit facility the site could not be realised. The other locations were located in other boroughs. In spite of support from senior people at the department of Housing and Planning in selecting the best locations, contacting the appropriate contact persons within the different city departments the pace at which licenses could be obtained was too low. Because building permits can only be obtained after approval of these local boroughs the whole process of explaining and detailing the plan was as intensive and time-consuming as the planning process for the first portal. The department of housing and planning helped as much as possible but legal procedures could not be speeded up further.

Concerning the market acceptance, the initial optimism that the larger distribution service providers and home delivery distributors would rapidly embrace the concept and actively participate was not justified. These problems were hardly experienced on managerial level but specifically at the lower organisational levels. Furthermore requirements became visible as to the minimum number of sites. This in combination with the previously indicated problems on permits caused a very slow development of the volume. Since no clients were prepared to give volume guarantees it also affected the ability to attract venture capital.

The major problem for this measure emerged when the ABN-AMRO bank withdrew its credit facility. At the beginning the situation looked fine, since Via Collect managed to obtain a bridging credit facility from the ABN-AMRO Bank. The purpose of the facility was to enable Via Collect to continue the development and demonstrate its support which would enhance Via Collect ability to attract further venture capital. The consequence of the withdrawal of the credit facility was that Via Collect was confronted with severe liquidity problems and the operations had to be stopped. Although a claim was put forward to the bank, no funds were available to open a legal battle. The reason for this action by the bank is not known but we suspect that due to the worsening economic situation (the venture capital market collapsed almost completely in 2002 following the September 11th events of 2001) and the internal reorganisation at the bank,

credits were reviewed. Unfortunately on the base of the agreed credit facility further personnel was hired, sales campaigns designed and subcontracts already commissioned.

The difficulties in speeding up the process of getting building permits to introduce more distribution portals led to a weakening market acceptance and kept volumes and revenues too low.

Via Collect undertook a set of actions to deal with the problems. An aggressive campaign to attract venture capital was launched with the help of an external consultant financed by the foundation of "*Nieuwe bedrijvigheid Rotterdam*" of the Rotterdam Chamber of Commerce. Prospective strategic partners were approached with the request to support and co-finance Via Collect. Further prospective launching clients were approached with the request to support the initiative. Netherlands Distribution Council gave its active support to this effort. For various reasons, such as the worsening economic and financial climate, Via Collect was not successful.

The financial problems were too large to coop with for this small company which completely dependant on the success of the pilot. Since the project was considered sound and well prepared it was decided to keep the company "sleeping" until a time with a more favourable (economic and political) climate for this type of ventures. For this reason it was decided to prevent bankruptcy, restructure the debts and maintain the assets. If and when at that time sufficient venture capital can be raised the company and project might be revived. A calculated possibility for a revival in 2003 could then not be given. Via Collect explored the following alternatives to revive the project:

- A merger with a similar business venture, which would enhance the ability to raise new funds.
- Aggressive campaign to alternative sources for venture capital.
- To sell the concept to a strategic buyer, such as foreign postal firms.

At a certain moment it looked that based on a merger new funds could be raised provided Via Collect could obtain within a short period a "solid" commitment from the municipality to provide the necessary licenses. While time collapsed on discussing this, the changes to conclude the discussion successful vanished. For (private) financial reasons the entrepreneur could not afford to put in more time and money to pursue a revival of the project. To avoid a personal bankruptcy he decided in 2004 to stop actively pursuing the option and to refocus his efforts.

Barriers and drivers

The main driver of the measure was the entrepreneur and director of the Via Collect company who had developed the concept and developed a feasible business case for its implementation. Also when the barriers to implementation continued to grow larger he continued to look for possible solutions.

There were two main, interlinked and critical barriers which lead to the stopping of the measure. The first was the too slow process of obtaining building permits for a sufficient number of

P+R sites to roll out the system. Although the city, at central level, was supporting the swift implementation of the system it has not been able to speed up the process of building permits which takes place at a more decentralized level. On the other hand it can be argued that the private company under-estimated the length of this process. The second barrier was the lack of (venture) capital. The bank withdrew the credit because it argued that the projected financial contribution from the 5th Framework Programme was insufficiently secured since it was linked to a performance obligation. The demonstrator faced with the other barrier of the insufficient roll out was unable to find other sources of venture capital.

A more structural barrier that influenced both the users of the system and the financial institutions was the unfavourable general economic climate in the Netherlands during the TELLUS demonstration period.

Achievement of milestones

Table B.19.1 Milestones for 9.1

Milestone (original)	Planned	Actual implementation
Opening first 2 distribution portals	January 2004	-
5 distribution portals operational	July 2004	-
8 distribution portals operational	July 2005	-

4. Results

4.1 Evaluation methods

Because no distribution portals were implemented until now, no impact evaluation was carried out.

5. Conclusions

Via Collect has been an active TELLUS contract partner right from the start of the TELLUS initiative. Its key personnel participated in all TELLUS meetings and Via Collect had an active role at the opening session in Rotterdam. The concept did go live and the process of further implementation was started with great enthusiasm and overall support. The concept as such was demonstrated and Via Collect did actively disseminate the concept (and the support of the EU) in different media, such as local and national television, newspapers, magazines and presentations at congresses. The e-commerce portal (payment and communication) was introduced. These tasks were proposed within the TELLUS project and were all finalised. Due to external factors Via Collect could not implement the 8 distribution portals as planned.

6. Scenarios

The reasons for choosing the Rotterdam area for distribution portals were:

- The Rotterdam area is one of the most populated regions of the Netherlands with a good infrastructure and sufficient interfaces between the various modes of transport (P&R).
- The peripheral roads in Rotterdam are used intensively for both B2B and B2C traffic.
- To demonstrate the concept Via Collect needed a region which would provide them with the largest opportunities to generate volume.
- The knowledge of the area by the company
- The “do” culture of the city
- The attitude of the city council and the central staff of the municipality.
- The opportunity offered by the city council to participate in CIVITAS

The systems and operations of Via Collect was set-up in such a way that it could be rolled out, with little efforts to other cities and urban areas in the Netherlands. A number of cities showed a clear interest in the project once the pilot proved to be successful in Rotterdam. The Dutch cities who did were: Amsterdam, Arnhem, Eindhoven, Enschede, s’Hertogenbosch and Utrecht, Following discussion with other entrepreneurs in other EC countries (amongst other within the context of CIVITAS exchange programs) Via Collect came to the conclusion that their initial views that the concept could even be transferred to other European cities seemed feasible. However a straight forward copying of the concept was not the way to go, it would require a certain translation to the local situation and above all knowledge of the behaviour of local users and clients. That assessment can be supported by the fact that today a similar initiative is tried in Paris, while other entrepreneurs in e.g. Berlin, Gothenburg and Belgium are reviewing the opportunity.

7. Recommendations

In reviewing this project it became clear that a revival of the project required the continued support of the launching clients in combination with:

- quick acceptance by the users;
- availability of strategically attractive locations;
- availability of sufficient seed capital from informal investors and/or venture capital funds;
- pace at which licenses/permits can be obtained.

To realise the above momentum, once the project would be revived, needs to be maintained in terms of marketing & sales efforts, new opening and expansion of service offerings. To achieve this, enough capital need to be raised to continue the pilot for at least another two years and

therefore patience by the providers of the funds. This requires a different type of venture capitalist then can be found today.

The existing economic climate caused companies to review their business. Under these circumstances innovative ventures such as Via Collect had no longer priority, unless the bring immediate cost savings. Looking back from this perspective Via Collect became the victim of the sudden change in the economic climate in the world and specifically the Netherlands.

Innovative concepts like Via Collect have often a small entrepreneur as a founder. This is strength as well as a weakness depending on the circumstances. Small companies often demonstrate creativity, unconventional solutions, drive and the will to get things done. However for projects like Via Collect where a certain minimum coverage is vital for the launch the concept, the interdependence of the success factors require a certain level of control. Once the control over a single factor fails, a chain reaction will be triggered with severe implications. In the case of Via Collect two key factors failed: the first was the availability of sufficient venture capital from the start and secondly the slow pace at which licences could be obtained for further openings. In these cases where one had to deal with authorities and large institutions like banks a small company simply lacks the muscle to influence the decision making.

Therefore a small company must think twice before it enters a venture where such organisations are vital to the success. Too often one has to deal with people who have very little affinity with entrepreneurs in stead they are bureaucrats who seek reports and non-risk ventures. Once headwinds are experienced the relative implications for a small company are significant and if not backed by significant funds there is too little flesh on the bones to sit the storm long enough.

Finally governments need to rethink the way they deal with entrepreneurs of such projects once their venture fails. Unlike employees who are sacked these people have no social base to fall back on in spite of the fact that they have social security charges for most of their working live. The fact that they have been an entrepreneur dismisses them completely. This is the reward society has for these men and women who dare to stick their neck out by launching a project of which the society benefits.

B.20 MultiCore tube logistics (9.2)

1. Introduction

For many years now the port of Rotterdam has been the largest in Europe and even, until recently, of the world. The size of this area comes with a huge transfer of goods. The repeated handling of chemical fluids and gasses poses a potential safety risk and has a considerable handling time. The introduction of a system of underground tube transport of chemicals in the industrial zone in the port area can contribute to a reduction of transport by road over a distance of 25 km and more efficient use of underground space in the port's industrial zone.

The goal of these concepts was to develop flexible, safe and cost-competitive means of transport. In 2001 the first phase of the MultiCore tube system has been implemented, partly financed by a Dutch CO_2-reduction plan. Within the scope of TELLUS an expansion of the MultiCore tube system was planned and realized.

2. Description of the demo

2.1 Measure design

The MultiCore Tube is an underground distribution system that consists of a bundle of 4 pipelines with a distance in between of 0,25 meter. The pipelines were developed to transport and distribute chemicals and gasses between businesses in the harbour areas. Businesses are able to acquire transport capacity by leasing a pipeline from MultiCore over the required distance and by connecting it up to their own installations. The system is built to provide businesses with a reliable, cost effective and time saving alternative to lorries or inland shipping and to provide a positive effect on the environment and the accessibility of the harbour area.

Within TELLUS considerable attention is paid to marketing in order to win new clients. There is also attention for framework conditions: an umbrella construction for licenses has been created. This implicates that the MultiCore CV has obtained a license that the MultiCore Tube pipeline system is equipped for the transport of several gasses and fluids an that in case of a change this only has to be reported to the licensing authority and then there is no need to obtain a new license procedure. This so called umbrella license saves cost and money. In the normal situation a new license is needed for the transporter in case of any change in the transported gas or fluid.

Innovative aspects of this project include the techniques used and the sharing of the infrastructure by several parties. Most other pipelines are considerably lengthier and do not

consist of multiple cores, so therefore only one commodity each time can be transported.

2.2 Rotterdam transport plan context

The specific problems occurring in the harbour area that are relevant to this project are also addressed in the regional Traffic and Transport Plan for the greater Rotterdam area (RVVP). The RVVP states that the harbour area should remain accessible for all modes of goods transport including road transport, water transport and pipeline transport. The initiative for the MultiCore tube system was taken by the Port of Rotterdam (*Havenbedrijf Rotterdam N.V.*) and based on the market incentive for this transport mode as well as based on the policy support given by the RVVP. Port of Rotterdam is responsible for the management of the port area and surrounding industrial zone.

2.3 Measure objectives

The immediate objectives of the measure are to make 13,5 km of tube operational (phase 1), to increase market participation and to obtain a significant volume of goods transported by the tube system.

The ultimate objective is to operate an alternative for truck traffic on the road, leading to less congestion and less air pollution.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

Although the concept of the MultiCore tube is unique in the sense that it is the only tube in the world that uses this technique, in the ex-ante evaluation some considerations have been made about the foreseen impacts of this measure.

The main expected effects will be in the reduction of accidents on the roads in and around the Rotterdam port area, and the reduction of emissions through the reduction of road and water transport. Furthermore, there will be less congestion if road transport is replaced by transport through the MultiCore tube.

The University of Delft states that in traditional pipeline transport major technical innovations, which will improve the competitiveness, are not envisaged, although the development of multi-core pipelines could give cause for lower investment costs. They also state that the main strength of pipelines in the future will be the invisibility and good environmental performance.

A study on the possibilities of an underground transportation system in Tokyo states that about 36 % of freight traffic can move to the new system. This system consists of tubes under the city forming a network of 201 kilometres.

Table 1 states some figures that are found for the energy consumption of several modes of transport.

Table B.20.1 Energy consumption per transport mode (9.2)

Mode	MJ/tkm
Road	2,05
Rail	0,34
Inland Shipping	0,47
Pipelines	0,564

It is to be expected that most movements through the MultiCore tube will replace truck and water transport rather than rail transport, due to the relatively short length of the tube. Since the energy consumption of road transport is exceeding the energy consumption of pipelines considerably, the final impact on energy consumption (and accompanying emissions) is determined by the amount of avoided road transport or water transport.

3. Implementation process

Actual implementation and deviations from the plan

The measure has been designed and was implemented by the Port of Rotterdam. The first designs were made in 1994 so it took more than 10 years to grow to the mature phase where it is now.

At the moment (October 2005), MultiCore CV has four contracting parties who are in operation. In phase 1 (Europoort – Botlek) 14 km pipeline bundle was realised and commissioned in January 2003 for the transport of 250.000 tons of oxo-alcoholics, which was transported before by inland barge, and which took approx. 25 hours of transport time with approx. 150 charters a year. Now the transport time has been reduced up to approx. 6 hours and is far more flexible. By then Exxon Mobil started the use of one pipe in the system. In phase 2 (Botlek – Pernis) 6 km pipeline bundle was realised and commissioned in October 2003, Air Products has two tubes operational for the transport of approx. 24.000 kg O2 per hour and approx. 4000 kg. N2 per hour to Shell Pernis on a regular basis.

In September 2005 Hoek Loos (a gas producing company) started the transport of CO_2 from Shell Pernis (min. 100.000 tons a year up to 170.000 tons a year) to its plant in Europoort by leasing a 15 kilometre 8 “inch pipeline

From its own plant Shell transports the CO_2 to the green houses via a former army pipeline (not in use anymore) to both national centres of the green house industry. One centre is located between Amsterdam and Rotterdam (in the north-west region – the so-called Westland) and use the pipeline under the river Rhine over a distance of 30 km. The other centre is located in the

north-east region,.

In August 2005 Shin Etsu started the transport of approx. 400.000 up to 450.000 tons of Vinyl Chloride Monomer *VCM) to its own new plant, which could be founded because of the existence of the MultiCore tube.

Phase 3 of the MultiCore tube (Europoort – Maasvlakte) is being studied upon.

In the design phase there was no necessity for specific cooperation with other public or private bodies. In the implementation phase some cooperation was needed with both the Environmental Protection Agency Rijnmond (DCMR) and the municipality of Rotterdam. These bodies support the project with necessary permits.

The most important cooperation however was realized with other private companies. For the maintenance and management of the MultiCore tube system an alliance was built with Vopak. Royal Vopak provides tank terminal capacity to the chemical and oil industries for the storage of liquid chemical products and oil products. Related to this, Vopak also provides a range of logistic services.

Two other companies, ExxonMobil and Air Products already make use of the MultiCore Tube. A third company (Hoek Loos B.V.) leases some capacity for the transport of CO_2. The use of the system for the transport of CO2-overflows of the Shell company to nearby agricultural companies is realized via the CO_2 OCAP-pipeline (joint venture of Hoek Loos, the gas producing company and Wessels, a contractors company).

Barriers and drivers

There were no obvious legal or policy barriers. Prerequisites for success mainly are the involvement of private companies willing to share the financial risk with the Port of Rotterdam. In this case Vopak agreed to participate and take care of maintenance and management. Furthermore on forehand two large companies supported the project ('launching customers'). so that an start could be made. The contacts with some public bodies in the region have also led to a better acceptance of underground pipeline transport in general. They also form a sound basis for further cooperation in the future.

Achievement of milestones

Table B.20.2 Milestones for 9.2

Milestone (original)	Planned	Actual implementation
Underground tube system operational (Phase 1 = 13,5 km)	January 2003	January 2003
Completion of testing (phase 1 of tube system in operation)	February 2003	January 2003
Milestone (adapted)	Planned	Actual implementation
Underground tube system operational (Phase 2 = 6 km)	October 2003	October 2003

4. Results

4.1 Evaluation methods

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators were not discussed with other demonstrator contacts. The indicators used are listed in table 4. Data were gathered and retrieved by the Port of Rotterdam.

The results are presented in this report as effects on indicators compared to the situation before the realisation of the 13 new vehicles and are shown as a simplified score (- to +). Score + can be interpreted as a 'good' or 'positive' effect on the indicator or evaluation category, *i.e.* a positive score is an 'improvement'.

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

4.2 Impacts

Society

The acceptance amongst the three participants is not measured in the timeframe of the TELLUS project. Data for such small population would be rather meaningless. It is expected that these (large) companies have decided for a long term participation in the system after careful considerations. So acceptance at management level would be sufficient. On the level of operators this is unknown.

There are a few people involved in operational and maintenance aspects of the system, leading to less unemployment.

Economy

The investment costs for phase 1 and 2 (20 km of tube bundle + company connections) amounted to some € 14 million. Subsidies accounted for some € 2 million of this amount. These costs have not been compared with the investment cost for other transport modes (road, water) because of a lack of data.

Table B.20.3 Overview of transported quantities for 9.2 (data 2005)

Customer	Amount (t/y)	Distance (km)	Total (tkm/y)
Exxon	150.000	13	1,95 E6
Air Products	24.000 (O2)[1] 4.000 (N2) [1]	2 5,5	4,80 E4 2,20 E4
Hoek Loos OCAP	100.000 100.000	15 30	1,50 E6 3,00 E6
Shin Etsu	400.000	6,5	2,60 E6
			∑ 9,12 E6

[1] Estimated by LEM.

In case of yearly transport of 9,12 E6 tkm and the transported good amount 780.000 ton the average energy consumption is 3,25 kWh based on an average consumption of 0,564 MJ/tkm as stated in table 1. Actual measured data on the energy consumption were not available. The fuel (energy) costs for the tube system then are approx. 0,26 eurocent, based on energy use of 3,25 kWh per ton goods transported (or 0,16 kWh/tkm) and an estimated electricity price of €0,08 per kWh.

On the other hand companies make savings on their former transport modes (i.e. water or road transport). The average fuel cost per 1000 tkm for water based good transport and road transport is estimated at €6,75 and €27 respective. This is based on an energy consumption of 0,0075 l/tkm for water transport and 0,024 kg/tkm (= 0,03 l/tkm) for road transport. Fuel costs (diesel oil) are assumed at €0,90 per litre. The costs for the MultiCore tube (± €13 per 1000 tkm) are in between.

Other costs have been classified as confidential information. Port of Rotterdam indicates that in the first years of the exploitation it is unlikely that the tube system will create positive operating revenues. In the near future however revenues are expected. The break-even point is expected to be reached in 2006.

Transport

Before January 2003 the first launching customer Exxon transported annually ca. 250.000 tons products with more than 150 barges on a 26 km. boat trip one way from its main production plant up to one of its other plants in the Rotterdam port area. This took 25 hours incl. trans-shipment. Since January 2003 the same transport runs via pumping the product as much as needed at the moment needed via a 14 km. pipeline, which takes approx. 6 hours transport time and decreased water transport with about 6,0 E6 tkm annually.

For the other customers the offset is unclear or, in case of large scale CO2-transport, the transport should be regarded as new transport in stead of substituting other transport modes.

Since a major offset of the tube system goes to water transport, the use of the system itself is expected to have little impact on the number of transport related accidents. Water transport is

(per tkm) much safer than road transport. There is no report of incidents during the transfer of goods. On the other hand the number of incidents before 2003 is also minimal. The capacity of the MultiCore cube is not yet fully exploited. In October 2005 the occupancy reached a level of approximately 50%.

Table B.20.4 Impact on indicators for 9.2

Evaluation Area	Indicator	Impact
Society	Acceptance rating	+
	Low journey speed	+/-
	Change in unemployment	+
Economy	Investment costs	?
	Interest payments	?
	Fuel cost per unit output	+/-
	Staffing costs	+
	Maintenance costs	+/-
	Operating revenues	+ (after 2006)
Transport	Accidents	+/-
	Capacity/flow ratio	+/-
	Total tkm travelled per mode	+
	Success of advertising	+
Energy	Freight fuel efficiency	+/-
Environment	Emissions of CO2, NOx, SOx, dust	+
	Average noise	+/-

+ = improved, +/- = no change or negative impact equals positive impact, ? = unknown.

Energy/environment

The freight fuel efficiency is changing since the energy consumption of the tube system per tkm is different compared to water and road transport (see also the item *transport*). Here not only the direct fuel use but the primary energy consumption. For water transport this is estimated at 0,47 MJ/tkm[19]. For road transport the estimation is 2,05 MJ/tkm[20]. Since most of the offset is related to water transport there is no clear energy advantage for the MultiCore tube. Such an advantage would mainly be reached if more road transport would be substituted.

One aspect worth mentioning is that the MultiCore tube played a vital role in the decision making for the project for CO2 transport to industrial greenhouse facilities. It is estimated that the connection with approx. 500 industrial green house could save up to approx. 75 mio. m^3

[19] Based on IVAM LCA database version 4.1 (barge vessel; ETH-data)

[20] Based on IVAM LCA database version 4.1 (truck 40t; ETH- and Dutch statistics data)

natural gas by not heating the green houses in the summer. Certainly these benefits can not all be attributed to the MultiCore tube but even with a small attribution the benefits are substantial.

Noise levels are expected to have only marginal changes due to the prevailing offset of water transport that doesn't affect noise levels so much.

In table 5 the results are shown by evaluation area, compared to the results of the Ex Ante evaluation

Table B.20.5 Evaluation area scores for 9.2 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex ante	?	+	+	+	+
Ex post	+	+/-	+	+/-	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

5. Conclusions

This measure was both successful in the process as in the impact. The milestones were delivered according to plan without deviations. There appear to be no major obstacles for implementation, although probably many of the more troublesome preparation stages have been conducted prior to the TELLUS period.

The impact for most indicators is either neutral or positive. Especially the improved energy efficiency contributes to positive impacts but there is also a modal shift. Since the modal shift for road transport is rather limited, a significant contribution to decreased congestion problems cannot be expected. The investment costs are rather high and the break-even point for the operational revenues is not reached in a short period of time.

Because of the success of the measure, an uptake potential in other industrial areas is present but careful considerations are necessary to determine whether the market conditions are suited for a tube system. Suited market conditions amongst other are the availability of companies involved in chemicals (and energy).

6. Scenarios

In the harbour area of Rotterdam there is a potential for expansion of the MultiCore tube system. Other companies involved in processing and transfer of chemicals and gasses are present which are not connected to the system. Furthermore a considerable expansion of the harbour area is expected in the coming decades. It is estimated that a theoretical maximum size of the system might have a length of 40 km. Currently approximately 20 km have been implemented. The actual expansion of the tube system is depending on market demands. Currently there are no concrete plans for such an expansion in the future.

It is also unlikely that other projects dedicated to traffic and transport will affect the development of the MultiCore tube. This project is very much a stand-alone measure with low interrelationship with other measures within or outside TELLUS.

Otherwise it might be considered an example project, because of its new transport mode, its acceptance in the market, its sustainability ands the way of coping with private (sometimes competing) parties. In that way it can be considered a good example of public-private partnership, in which at first local government (Port of Rotterdam) took the lead.

Outside Rotterdam it is considered that the conditions for the development of other MultiCore tube system are the availability of a certain critical mass of companies involved in chemicals (and energy carriers). This is needed because of the high initial investment costs. Other conditions are sufficient possibilities for exchange of goods and an actual need for land and space.

Currently these conditions do not seem available in other Dutch harbour areas. Comparable situations as in Rotterdam should be found abroad, such as the harbours of Antwerp, Le Havre, Marseille and Gothenburg. The latter one already showed their interest in the Rotterdam system.

7. Recommendations

The most prominent lessons learned from this measure is that a successful implementation of underground transport is only feasible in areas with companies of sufficient size and suited activities that are able to commit to long term investment and operational agreements. Next to that attention should be paid to communication beforehand with landowners because of the impact of construction activities on their land as well as overcoming initial hesitation for this relatively unknown means of transportation.

Finally an important driver for this project was the focus on safety issue. Underground transport is less vulnerable for accidents and calamities compared to road and water transport. This advantage should be used developing similar measures elsewhere.

B.21 Green commuter plans and mobility management (10.1)

1. Introduction

Congestion is a major problem in the densely populated Rotterdam region. This could negatively affect the accessibility of the region and therewith the position of Rotterdam as an important mainport. One of the target groups to relevant for the congestion issue is commuters. Dedicated mobility management could raise awareness among employers and employees and have a positive effect on sustainable transport of commuters. At present, mobility management is done by providing information to local employers about Traffic Demand Management (TDM) and by setting up temporary committees with local public authorities, public transport agencies and major employers for selected areas.

2. Description of the demo

2.1 Measure design

VCC-R (*Vervoer Coördinatie Centrum Rijnmond*), is the mobility advice centre for the greater Rotterdam region. VCC-R is known as an intermediary between the local business community and public authorities and is specialized in helping employers and employees reduce car dependency.

Before TELLUS, VCC-R did not offer an information service through the internet. Now an internet site is available (www.vccrijnmond.nl) for information on mobility management in the region. VCC-R will use the internet and e-mail to appeal to employees. Before TELLUS employers were the only target group for mobility management. VCC-R hopes that this new service will stimulate employers to implement mobility management and will stimulate employees to adopt sustainable ways of transport.

Within TELLUS an information centre for employees will be created and operated. The introduction of this new service will be accompanied by an extensive publicity campaign to ensure information provision to target group (employees within the region). Finally, an on-line information point will complement the actual information centre.

2.2 Rotterdam transport plan context

The development of this measure has not been specifically addressed in municipal or regional policy plans. However commuter traffic has been identified as one of the major sources for congestion problems during peak hours. In general the city of Rotterdam encourages measures that reduce the use of private cars in favour of bicycles and public transport.

2.3 Measure objectives

The TELLUS measure defined several immediate objectives:

- Opening of actual and virtual information points.
- Number of information requests (e-mail, telephone, mail): 1000 per year.
- Number of approached employees: 10.000 a year according to the following scheme:
- Year 1: 10 companies with 1000 employees or more
- Year 2: 12 companies with 500 – 1000 employees
- Year 3: 30 companies with 200 – 500 employees
- Year 4: 100 companies with 50 – 200 employees
- Number of visited companies: minimum of 10 companies a year.

The ultimate objective is to integrate supply and demand of new and sustainable transport concepts from employees in the region and finally to contribute to reduced congestion.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

For this measure however it was not possible to find comparable measures which have been undertaken in the past and/or which have been reported in accessible literature.

3. Implementation process

Actual implementation and deviations from the plan

An internet site has been built incorporating information on several aspects of mobility management. The site will focus on projects in the region aimed at improving durable transport modes and will invite employers and employees to react on the information given and to ask questions. In order to get employees acquainted with the site a number of companies have been selected where this new service-concept of VCC-R will be intensively communicated. The selection of companies including implementation of direct linking of their internet- and intranet sites to VCC-R started at the end of 2002.

Employees in 273 companies have been directed to the VCC-R website for information and registering as part of special employee-directed projects of VCC-R. VCC-R aims at a 1000 visits to its website on a yearly basis including information requests. The feedback from employers and their employees has been used to adapt the VCC-R-site. In case employees of a selected company do not have access to the Internet and/or e-mail, VCC-R telephone- and fax services

were offered.

In 2003 and 2004 the dissemination efforts for the VCC-R website continued. In 2004 more than 9.000 employees were reached bringing the total to approximately 45.000. The website gained attractiveness by including special pages dedicated to a new bicycle contest for the winter and to major road works in region. Additional to the website also leaflets, posters and newsletter were prepared and published.

To increase the usefulness of the website VCC-R has undertaken five projects catering specifically for employees and all five have been put on the website for information and registration purposes:

- The annual bicycle contest allowing employees to have the number of kilometres they cycle to/from work registered on the VCC-R website in exchange for the possibility of winning a prize.
- The promotion and distribution of free public transport weekly tickets in a rural area severely hit by congestion following major road works.
- The integration of a carpool database in the website covering one of the main port areas to the west of Rotterdam.
- The inclusion of specific information on the website relating to the use of scooters in commuter transport and where to buy or lease them on special terms agreed on by VCC-R with a national scooter company.
- A promotion campaign for scooters was held in Rivium, a big business park to the east of Rotterdam.

Barriers and drivers

No significant barriers occurred for this measure. It was not always possible to adhere to the scheme given in the description of work according to which companies are approached in order of number of employees, starting with the bigger companies. This has no serious effect, since only the order of companies to be approached was changed.

Achievement of target and milestones

Table B.21.1 Milestones for 10.1

Milestone (original)	Planned	Actual implementation
Opening of the actual and virtual information points	February 2003	February 2003
Start of publicity campaign, directly approaching 10.000 employees a year	October 2003	January 2004

4. Results

4.1 Evaluation methods

For the process evaluation the LEM organized a meeting with the demonstrator contacts to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

Also a set of impact evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators are listed in table 2. The results are presented in this report as effects on indicators compared to the situation before the implementation and are shown as a simplified score (- to +). Score + can be interpreted as a 'good' or 'positive' effect on the indicator or evaluation category, *i.e.* a positive score is an 'improvement'. The underlying quantitative and qualitative results can be found in the annex.

The indicators were measured by using a web-based questionnaire prepared by the LEM in cooperation with the demonstrator contact.

4.2 Impacts

General

The web-based questionnaire gave a good overview of the amount of commuters that are familiar with the website of VCC Rijnmond and their satisfaction rating. Especially the action "Biking works better!" attracted visitors to the website. From the information items that could be added to website most of them were related to bicycle routes. It seems also that for other, more general, information about public transport people use other websites.

Society

The acceptance for the website is positive. Some 69% of the respondents (N = 35) gave a positive rating. A minority of people gave a poor rating.

Economy

Investment costs were made earlier outside TELLUS to build the website and prepare sufficient content. The additional investment costs to reach the objectives of this measure were fairly small.

Transport

As some 50% of the respondents were familiar with the website of VCC Rijnmond, the success of advertising is overall positive. Some 69% of the respondents (N = 35) gave a positive rating to the user-friendliness of the website. A minority of people gave a poor rating.

Energy/environment

There were no indicators in this area identified for this measure. As the results of the questionnaire show there might be a slight impact through people who change their transportation mode but even more likely the action "Biking works better!" created more impact. There were not enough respondents however to make clear statements about this issue.

Table B.21.2 Impact on indicators for 10.1

Evaluation Area	Indicator	Impact
Society	Acceptance rating	+
Economy	Investment cost	+/-
	Staffing cost	+/-
	Subsidy	+/-
Transport	Information accessibility	+
	Success of advertising	+
	Information service quality	+
	Ease of use	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

In table 3 the results are shown by evaluation area. For Energy and Environment no indicators were selected. Therefore these areas are shaded.

Table B.21.3 Evaluation area scores for 10.1 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex post	+	+/-	+		

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

5. Conclusions

The results of the questionnaire show that the website of the VCC Rijnmond is recognized by a considerable amount of respondents. The main reason for this is the success of the action "Biking works better!'. The majority of people give a positive rating to the website and its content. It seems however that most of the visitors relate the website to information about biking. As more than 45.000 employees have been approached about the website there is a great potential for a larger exposure when these visitors will use the website to retrieve more information about commuting alternatives.

6. Scenario's

There is no clear uptake for these type of measures in the Rotterdam region. Obviously it is sufficient to have one website dedicated to information for commuters. Outside Rotterdam there seem to be more opportunities for these kinds of websites. The action "Biking works better!" shows that commuters, to a certain extent, are open to use more environmentally and healthy modes of transportation such as biking. The activities of the VCC Rijnmond such as presenting information on their website and approaching companies to work on commuter traffic plans encourages the commuters to think about alternatives for driving the car.

7. Recommendations

As it seems that the website of VCC Rijnmond is mostly known for its action about biking and information about bicycle routes, the organisation might have to look for a broadened scope of the website. For example success stories of individual companies working with commuter plans (e.g. examples about vanpooling, use of public transport) could help to make the scope broader and attract people with various interests.

8. Annex

7 companies were requested to send an invitation to their employees to participate in the internet questionnaire. In total 70 questionnaires have been filled out. In this ANNEX the results are described.

The respondents were asked whether they had heard from the name "TELLUS" before. Only 9% knew the name "TELLUS" before filling out the questionnaire. Of the respondents 50% is familiar with the website of VCC Rijnmond, and 50% is not familiar.

For comparison the question was also asked which other websites on public transport respondents regularly use. 53% uses the website about the Dutch Railways and 49% uses the 9292OV website (information site for public transport), see table 4.

Table B.21.4 Regularly visited websites on public transport (10.1)

	% (N=70)
Dutch Railways	53
9292OV	49
RET website	23
Connexxion website	11
Other PT website(s)	9

The main reason for hearing about the website was via the action "Biking works better!", see table 5. A quarter of the respondents learnt about the website via colleagues.

Table B.21.5 Survey results (1) for 10.1

How did you learn about the VCC Rijnmond website	% (N=30)
Via the action "Biking works better!'	63
Heard from it via colleagues	27
Heard from it via employer	3
Does not know any more	3
Other	3

The respondents that are familiar with the website have been asked their opinion about it. More than two thirds of the respondents generally valued the website as good (see table 6) and half of the respondents experience that the website is fairly user-friendly (see table 7).

Table B.21.6 Survey results (2) for 10.1

General appreciation of VCC Rijnmond website	% (N=35)
Very good	0
Good	69
Not good/not bad	23
Poor	9
Bad	0

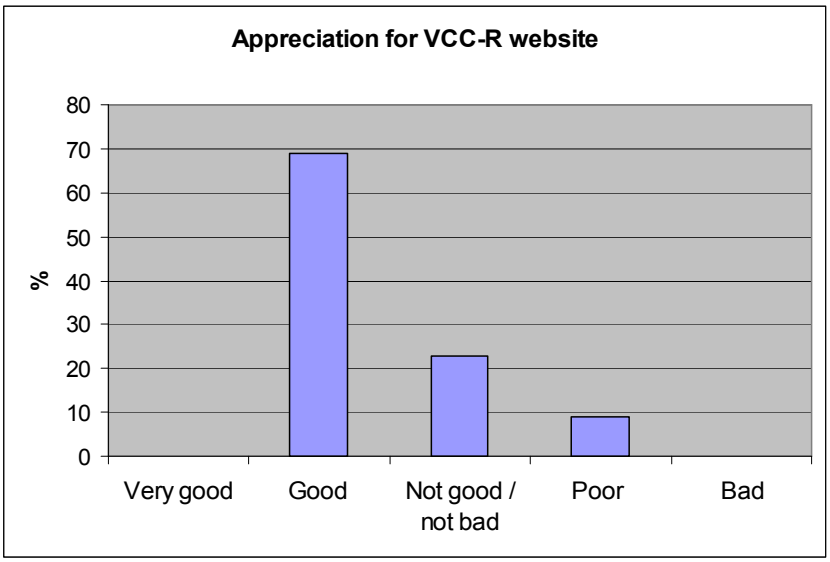


Figure B.21.1 Satisfaction with the website

Table B.21.7 Survey results (3) for 10.1

User-friendliness VCC Rijnmond website	% (N=35)
Yes, good	0
Yes, fair	69
Not good/not bad	23
No, poor	9
No, bad	0

The respondents were asked why they visit the VCC Rijnmond website. The main reason is to participate in the action "Biking works better!" (see table 8), which was also the main reason of getting to know the website.

Table B.21.8 Survey results (4) for 10.1

Reasons for visiting VCC Rijnmond website	% (N= 35)
To participate in the action "Biking works better!"	94
For information about the specific projects	9
For fiscal information	3
For information about public transport possibilities	3
For information about work on the roads	0
Other	0

The respondents were asked whether they feel that some information is missing on the VCC Rijnmond website. Only a few respondents declared that some information is missing. The subjects they identified are shown in table 9. Most remarks are related to biking.

Table B.21.9 Survey results (5) for 10.1

Subjects missing on VCC Rijnmond website
Work on or near bicycle lanes
Plans on improvements of bicycle lanes
Route planner for bicycles
Information about special biking actions
A listing of dangerous spots where accidents with bikers occur
Information about recreational bicycle routes
About other traffic than person and commuter traffic
Information about what kind of organisation VCC Rijnmond is

It is checked whether respondents have changed their mode of transportation between 2003 and now. People that have changed jobs or have moved in the meantime are excluded. Of people visiting the VCCR website five respondents (14%) have changed their mode of transportation, of which 2 people have started to bike (on a distance of 6-15 km and 16-30 km) by participating in the action "Biking works better!" while they did not bike before. Of two respondents that first drove a car, one started to car pool and 1 started to use public

transport. One visitor of the website changed public transport for driving a car. From respondents that do not visit the VCC Rijnmond website three respondents have changed their mode of transportation, of which one environmental beneficial change from driving a car to biking, one stopped car pooling and started driving alone and one changed from public transport to driving a motor. The net effect of changes in commuter behaviour of visitors of the VCC Rijnmond website seems to be slightly environmentally beneficial although it is even more likely that action “Biking works better!” itself created most of the impacts.

Most people participating in the action "Biking works better!" already biked in 2003 and this action has recently attracted only a small number of new bikers.

B.22 Integration of public and private transport initiatives (10.2)

nexus spil in een bereikbare regio Rotterdam

1. Introduction

One of the spearheads of the Regional Plan for Traffic and Transport in the Rotterdam Region (RVVP) is the enforcement of the current mainport position. Congestion plays an important role in maintaining this position. The congestion is measured as the product of both the length and duration of traffic jams. In recent years the congestion has decreased after several years of strong increase and is now (2002) at the same level as it was in 1998. Still the congestion poses an important burden on the accessibility of the region. The Fileplan concept is one of the measures to improve this accessibility.

2. Description of the demo

2.1 Measure design

This specific organisation within the Rotterdam region is called 'Fileplan' and facilitates an intensive co-operation between regional government, private companies and institutions and the national Ministry of Traffic and Transport. Main function is the coordination and support of all relevant organisations in the region working on a reduction of congestion, including public and private partners.

Yearly an activity overview of projects to reduce congestion in the coming year is presented. The organisation supports the promotion of the projects and stimulates new ideas and initiatives.

"The user heard" is an instrument used in the past years to establish a dialogue with road users, in order to get an overview of bottlenecks and possible solutions. This forms a basis for short-term activities carried out by partners of the Regional Corporation to introduce solutions for the problems mentioned by the specific user group. Yearly a 'Fileplan-breakfast' featuring the Minister for Traffic and Transport and the Rotterdam Alderman for Traffic and Transport takes place.

2.2 Rotterdam transport plan context

One of the spearheads of the Regional Plan for Traffic and Transport in the Rotterdam Region (RVVP) is to strengthen its position as European main port. Congestion plays an important role in maintaining this position. In recent years the congestion has decreased after several years of strong increase and is now (2002) at the same level as it was in 1998. Still the congestion

poses an important burden on the accessibility of the region. The Fileplan concept is one of the measures to improve this accessibility.

2.3 Measure objectives

The immediate objectives of this measure were:

- To organise (2) interactive workshops with users and with road authorities;
- To stimulate a change in modal split and behaviour of road users by communication campaigns and upgrading of web-sites;
- To stimulate structural measures to enhance the accessibility of the region based on the research into bottlenecks within the road network;
- To facilitate the accessibility of the region by reducing the negative effects caused by the transport sector (by a working group on the Transport sector);
- To improve co-operation of relevant actors in city-region, jointly working on accessibility and safety

The ultimate objectives of this measure were to stimulate the co-operation of all relevant actors in the city-region to jointly work on improved accessibility and safety and finally also to reduce congestion.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

For this measure however it was not possible to find comparable measures which have been undertaken in the past and/or which have been reported in accessible literature.

3. Implementation process

Actual implementation and deviations from the plan

Several activities have been conducted in the course of this measure:

- Network meeting (February 2004) on congestion problems attended by more than 200 representatives of road authorities, national, regional and local governments, lobby groups and private companies;
- Preparation of a reference manual about surroundings of train and metro stations including an assessment tool for the quality of these sites;

- Start-up meetings with relevant knowledge institutes;
- Launch and upgrade of the website (www.fileplanregiorotterdam.nl);
- Coordination of stakeholders for the Luteijn pilot project in the northern part of the Rotterdam region (milestone 6).

Since the Fileplan was extended with more stakeholders and was becoming more and more a platform for knowledge exchange and communication, it was decided to develop a successor of Fileplan with these features. This new organisation was called Nexus and was launched in February 2005.

Barriers and drivers

Major driver for this measure is the policy objective to secure the role of Rotterdam as main port by maintaining its accessibility and ensuring the liveability for its inhabitants. Because the objective is shared by the different levels of authority and the private sector this provides a basis for the co-operation within Fileplan/nexus.

A first important barrier concerns the complexity of the process of cooperation, between national ministry, province, region, municipalities and private actors. In this context the decision making process takes time. The province, one of the important road authorities in the region, only became an official member at the end of the TELLUS project.

A second barrier is the difficulty of communication about a co-operation process between road authorities and private stakeholders. While successful meetings were organised and objectives were achieved on the level of the individual projects, it is hard to communicate the added value of the Fileplan organisation. A new brand name (Nexus) and a new communication strategy were launched to overcome this barrier.

Achievement of milestones

Table B.22.1 Milestones for 10.2

Milestone (original)	Planned	Actual implementation
First demonstration of results from workshops with users and road authorities	January 2003	January 2003
Second demonstration of results from workshops with users and road authorities	January 2004	April 2004
First section of joined communication actions and progress in the field of accessibility and safety completed	July 2003	
Third demonstration of results from workshops with users and road authorities	January 2005	

Second section of joined communication actions and progress in the field of accessibility and safety completed	January 2005	
Solving bottlenecks for accessibility and safety in the road network	January 2005	> 2005

4. Results

4.1 Evaluation methods

For this measure the list of evaluation indicators based on the METEOR approach has been reviewed. In cooperation with the demonstrator contact however it was decided that an extensive assessment of potential impacts would not be opportune. One indicator was dedicated as a relevant one, namely the issue of 'user acceptance'. This indicator would give a reasonable insight in the success of this measure. Furthermore, since the Fileplan measure covers almost all relevant stakeholders dealing with traffic and transport, it would also give relevant information on the issue of intra-organisational cooperation. This measure is one of the few that explicitly addresses this TELLUS key indicator.

A survey was held to give bitter insight in the satisfaction rating. This took place in November 2002 during the Fileplan meeting.

4.2 Impacts

In general, the survey of November 2002 shows a positive attitude of the participants of the Fileplan meeting on November 26th 2002. 32 road managers attended this meeting and 27 questionnaires have been returned; a response of 84%.

Two-third of the participants were satisfied and one-third was rather satisfied with the Fileplan meeting. More than 40% was satisfied with the Fileplan programme in general, almost 50% is rather satisfied and 7% is rather unsatisfied.

A majority of the participants (63%) thinks that Fileplan contributes to finding new ideas and initiatives for their organisation; one third thinks that it rather contributes. Only one respondent had the opinion that it hardly contributes.

Another 63% thinks that Fileplan contributes to improve co-operation between the different parties within the city region. The other participants think that it rather contributes. The participants are less definite on whether Fileplan contributes to solving congestion problems: 37% thinks it contributes, 48% thinks it rather contributes and 15% thinks it hardly contributes.

The general conclusion is that the impact on user acceptance is 'good'.

5. Conclusions

The Fileplan initiative and its successor called Nexus provide a good platform to improve co-operation of relevant actors in city-region, jointly working on accessibility and safety. The co-operation improves the process of decision making in various complex situations although still the complexity of projects in general is mentioned as a barrier for co-operation.

From the process evaluation it was learned that especially the current political attention for integrated traffic and transport solutions to reduce problems with congestion, air quality and liveability in general is a major driver for this measure. From the impact evaluation it was learned that a majority of the participants is positive about this measure. Other impacts such as the intended reduction of congestion could not be evaluated for this particular measure.

6. Scenarios

The Fileplan measure, as well as its successor Nexus, already covered almost all of the relevant stakeholders in the Rotterdam Region. From that perspective there is no incentive for a further uptake within the region. In other parts of the country and especially in the western part the same congestion problems occur leading to less accessibility. A structured approach for communication between stakeholders as demonstrated here would probably have a positive influence on actions undertaken to fight these problems.

7. Recommendations

No specific recommendations have been identified for this measure.

B.23 New approaches to integrated planning (10.3)

1. Introduction

Urban development projects often are complex projects. Such projects deal with many functions and just as many stakeholders causing a heavy burden on the integration of spatial planning, traffic and environment. This project develops a new approach to the integral city policy for three strategic transport interchanges. For these locations public and private partners will apply integrated planning. Such an integrated planning should lead to synergy effects affecting and improving financial, technical and communication conditions.

2. Description of the demo

2.1 Measure design

The work in this policy measure is directed at three strategic locations in Rotterdam. The first is the train station located at Alexander located near a large shopping centre, a P&R facility and several leisure functions. The second site is the traffic and transport node on the location Kralingse Zoom. The third, the area surrounding Ahoy-Zuidplein, an area with large conference and leisure centre, a metro station and an important part of the urban road network

The innovative aspects of these measures are the combination of smart land use and public-private co-operation in several areas where integrated planning is necessary. More specific the design of a sheltered P&R site including target lane is an innovation. Such a concept is unique in the Netherlands and provides a significant role as pilot study for similar developments in the future.

The first site is the Alexander location. The Alexander location is a transport node combining national highways, local roads, inter-city train station, metro-station, regional and city bus lines and a P&R facility. The area has various functions: offices, a large shopping centre and recreational areas (including a new cinema). An increase of the economic activity in the area is envisaged (offices, shopping and leisure). Short-term developments are anticipated in the eastern part of the area, as the city government has decided to intensify and develop similar locations Laag Zestienhoven and Kralingse Zoom first, before intensifying the west side of the Alexander area. The western part will be intensified and developed later.

The Masterplan Alexander will describe the area, the current developments and the integration of various functions. The focus will be on combining economic functions close to transport infrastructure taking restrictions on accessibility, external safety and traffic related air & noise pollution into account. The master plan will be used for further work on the area. At first instance, a smaller part of the area (the eastern part) will be further developed in the coming years. This implies that more detailed plans will be made for this part of the transport node. In the meantime, occurring market developments in the other parts of the node together with political priorities will be evaluated against the master plan.

The Kralingse Zoom area (Brainpark Centre) is located strategically near highway A16 as well as metro- and bus station. The area plays a major role in the spatial planning and infrastructure policy of the city of Rotterdam with a primary focus on the development of offices on the one side and P&R places and public transport on the other side. The objective for this area is to develop a program where these several functions will be developed. More specific the program aims to develop:

- 2.200 P&R places;
- 120.000 square meter of office space;
- a revitalised public transport station;
- 5.000 square meter of space for retail functions.

Relevant features of the development plan are the sheltered P&R parking and the design of a target lane to improve direct accessibility from the highway into the P&R and office area. Studies show that the target lane helps to solve the major part of future traffic problems. Without severe adjustments the local roads would get serious congestion problems.

This integrated approach directly relates to some other TELLUS projects such as the large-scale expansion of P&R and the automated people movers in the same area (see TELLUS measures 7.2 and 7.4).

For Ahoy Zuidplein an expansion of the offices and sport/leisure functions is foreseen. The focus of the planned integrated design study will be on accessibility, smart land use and combined use of parking facilities. There is a better chance for renewal of the location when the projects and the functions can profit from each other (synergy) within a development strategy for the whole location.

The measure consists of an analysis and scenario's study, a report for a development strategy, a study for the preconditions of the bus station and its surroundings and finally a design study for the bus station (and its surroundings).

Also a study will be undertaken to analyse different models for the future of the leisure centre and the integration in a renewed Zuidplein area. Subjects to discuss are the program, the traffic and parking solutions, the spatial models, the costs and benefits.

2.2 Rotterdam transport plan context

The development of public areas combining several functions has been addressed in several policy documents. The most relevant here is the Rotterdam Plan for Spatial Development (RPR 2000-2010) in which development opportunities and potential of several areas has been described and recognized.

From the policy plan a more concrete program for Spatial Development has been drawn up. In a later stage the new city council altered the policy plan leading to less priority for certain areas

such as the western area of the Alexander area.

In the case of Kralingse Zoom (later called: Brainpark Centre) the development of the P&R site was supported by the policy plan for P&R laid down by the regional authority for Rotterdam.

2.3 Measure objectives

The immediate objectives of this measure were the:

- Design of a target lane for Kralingse Zoom and Success-Fail factors for Large-scale P&R implementation
- Master plan for the Alexander area
- Integrated Design study for Ahoy (Leisure and sport centre) and Zuidplein (Metro/bus station and shopping centre) area containing accessibility, smart land use and combined use of parking facilities.

The ultimate objective is to demonstrate the benefits of organisationally innovative integrated approaches to urban planning at traffic and transport nodes.

The measure contributes to three TELLUS objectives:

- congestion reduction,
- improvement of intra-organisational co-operation,
- improvement of public-private co-operation.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

For this measure however it was not possible to find comparable measures which have been undertaken in the past and/or which have been reported in accessible literature.

3. Implementation process

Alexander area

The overall master plan for the Alexander area made in 2002 describes how an area around the described transport node with a low building density (two to three storey company buildings, private gardens, car demolition areas) can be transformed into a lively sub-urban city centre. This as a logical development, after realising the Alexandrium shopping malls and superstores on the south-eastern side of the transport node.

As the city government has decided to concentrate first on the eastern side, in 2005 a short term and more detailed master plan will be made for the eastern side of the area, because initiatives for office buildings and a cinema have to be fit in into the existing built area. Preparations for the translation of the overall master plan into more detailed plans will start together with further studies concentrating on safety risks in the area as well as traffic studies. The overall conclusion is that the eastern part will be further developed based on more detailed studies whereas the western part will be developed once market forces become more prominent and this area gets priority by the city government.

Kralingse Zoom area (Brainpark Centre)

Due to new insights in the office market and legislation on external safety, a re-orientation on the former Masterplan (2001) of Kralingse Zoom was needed. Based on this re-orientation a new master plan with a time horizon of 4 years was finished in May 2004, followed by positive decision-making.

Many parties are involved in the project development. For the government(s), both national, provincial and local, the development of the area is relevant to improve traffic flows on nearby highways (A16) and create positive impacts on congestion. On a local level several departments of the municipality, the RET (public transport company) and local districts cooperated on issues as the allocation of investment costs and exploitation costs. Commitment of the local districts was also important to build on a level of acceptance and smoothen the legal processes (i.e. licenses). Finally the involvement of a large real estate developer was essential to overcome initial financial barriers. This developer was responsible for the integration and exploitation of parts of the large office buildings.

Part of this master plan is how to realise large scale P&R implementation. The choice how to implement was based on a survey on fail and success factors for realising P&R places on this location. The master plan foresees in speeding up a part of the long term planned P&R increase by building a parking garage earlier then planned. This plan for a short-term P&R garage includes a pre-solution for the target lane, which will connect the highway A16 with Kralingse Zoom.

The building plan for the first phase of the increase of P&R at Kralingse Zoom is ready. This plan covers the amount of P&R parking places, the precise height, the amount of parking layers under the ground, the architecture and the surrounding public space. A construction license is requested and the goal is to build the P&R garage in 2005 and 2006. A large study ‘Kralingse Knoop’ on the traffic effects of the realization of the master plan will influence the final design and decision-making on the target lane.

Ahoy/Zuidplein area

In 2002 a study ‘analysis and scenario’s’ was finished for the Ahoy/Zuidplein area. Based upon

this study the project team in 2003 finished a report on the preconditions for a development strategy. A separate study is made for the preconditions of the bus station and its surroundings. The local government concluded that the bus station is the first project to be undertaken because in the present situation this is the weakest link in appearance and safety in the project area.

For the future a design study is planned for the bus station and surroundings, commissioned by the local and the regional government. This study has to produce the requirements and costs of a new integrated bus station to make a decision on a commission for the design and realization. The local government wants to start the realization as soon as possible. In 2004 the city Council also decided to approach the area with individual projects instead of an integrated master project. This didn't mean that an integrated approach was undesired but represent the overall opinion that a sound progress benefits from individual projects more than it does from a long-term master project. The development of the metro station and the bus station (financed by the Regional Authority) are examples of such individual projects.

Even so after the TELLUS period a study will be undertaken together with Ahoy' to analyse different models for the future of the leisure centre and the integration in a renewed Zuidplein area. Subjects to discuss are the program, the traffic and parking solutions with regard to the surrounding residential areas, the spatial models, the costs and benefits.

Barriers and drivers

Due to the nature of these integrated, complex projects and their subsequent impact on spatial planning issues the projects are vulnerable to resistance and hesitance (not-in-my-backyard attitude). In the case of the Kralingse Zoom area the effects of the P&R activities on the residential areas are relevant. The local people feared that even the introduction of a small daily fee for the P&R (€2 per day) could lead to increasing parking pressure in the residential areas. In the other areas this hesitation was less present because the impact is expected to be less significant. Furthermore the primary function of the Kralingse Zoom area is an office function with relatively small direct benefits for local residents while the Alexander area for instance contains shopping as a primary function which has more (visible) benefits for residents and therewith increases the acceptance.

An important driver is the continuous attention for the motivation of the stakeholders and target groups and to communicate intensively with them, even when the long term planning of the project seems to lead to fading attention and momentum.

Certainly the magnitude of these projects causes serious financial risks thus making some financing bodies hesitant even until a late stage of the project. In the end this however didn't pose a serious threat to the projects. On the other hand initiatives of private enterprises willing to take financial risks are often the most important drivers to development programs, such as the case of the Ahoy/Zuidplein area. If the pressure from the private market is sufficiently strong the policy makers usually will create the necessary preconditions for new developments.

Finally the cooperation of several government and private partners proved to be an important driver for the progress and acceptance of the projects. Especially when dedicated steering groups are installed, this leads to more continuity and smoother communication processes.

Achievement of milestones

In contrast to most other TELLUS-measures not the implementation of the milestone is considered but the finalization of the milestone. The actual implementation of these integrated planning processes requires several years and lies well outside the scope of the TELLUS program.

Table B.23.1 Milestones for 10.3

Milestone (original)	Planned	Actual finalization
Masterplan Alexander	June 2002	June 2002
Design of target lane to Kralingse Zoom and presentation Success-Fail factors of large scale P&R implementation	July 2003	Autumn 2005 (design target lane)
Design study for Ahoy and Zuidplein	November 2004	?
Milestone (adapted)	Planned	Actual finalization
Masterplan Alexander eastern side	Mid 2005	Late 2005
Masterplan Kralingse Zoom (Brainpark Centre)	May 2004	May 2004
Preconditions study Ahoy/Zuidplein busstation	?	?
Design study Ahoy/Zuidplein busstation	?	?

4 Results

4.1 Evaluation methods

For the process evaluation the LEM organized a meeting with the demonstrator contacts to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

Also originally a set of impact evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators are listed in table 2 in §4.2. However since the implementation of the integrated projects is far from completed, it was decided that an assessment of most of the impact indicators is not opportune.

4.2 Impacts

As mentioned in §4.1 there was no point in relating (changes in) dedicated indicators to the projects described in this measure. Even when the projects will be finalized the causal relationship between (changes in) indicators and projects will be difficult to establish.

There is some data available on the safety rating in the Ahoy/Zuidplein area. In this case the

'safety monitor'[21] showed an improvement due to the implementation of the renewed bus station. It could be argued that the individual project here was responsible for this improved safety. Hence the causal relationship with the integrated approach described in this report is questionable. On the other hand it seems fair to conclude that the integrated approach at least led to a prioritization of the project and therefore did accelerate its implementation.

From a more general point of view it is expected that these type of projects create positive impacts. The project are located in the vicinity of public transport locations thus encouraging the use of public transport. This again will have a positive impact to health and environmental issues. Furthermore the development of large scale projects attracts other investors and creates an economic impulse in the region. The potential local drawbacks (safety risks, nuisance by noise) should be assessed against such general issues.

For this evaluation we did not attempt to elaborate on such an integrated assessment as such work was outside the scope of the evaluation team.

Table B.23.2 Impact on indicators for 10.3

Evaluation Area	Indicator	Impact
Society	Low journey speed	?
Transport	Total no. trips	?
	Total pkm. travelled	?
	Average modal split – trips	?
	safety rating	+

5. Conclusions

In general it is not easy to estimate the impact of 'soft measures' as described in this report. Although essentially aiming to improve the traffic and transport situation by reducing congestion, the actual impact can hardly be measured let alone related to the actual measure of integrated planning. It is however possible to describe positive impacts from the approach of integrated planning. Indeed the fact that all relevant stakeholders are involved in a long term relationship and structure to smoothen the often complex processes has brought a positive attitude amongst many parties.

An important condition to maintain this relationship is ongoing communication and the presence of key people to (re-)stimulate the process. In that respect the approach of integrated planning, although possibly not so innovative as many other measures, has helped to overcome hesitations and obstacles encountered during these complex processes. Finally once again it

[21] A regular survey held among citizens in the area.

shows that initiatives from the private market are conducive for the policy making process. If the market pressure is strong enough, policy makers will soon follow to create necessary preconditions.

6. Scenarios

It is not easy to predict the future developments for these kinds of integrated planning activities for development projects. On a short-term basis the number of development projects is bounded according to the policy plan for Spatial Development. But in the longer term ongoing developments to fulfil functions such as traffic and transport, offices, shopping, leisure, etcetera will lead to the need for some kind of integration.

This measure therefore has a high interrelationship with other projects such as the integration of cycling and public transport (7.1), the large scale expansion of P&R (7.2), the automated people movers (7.4) and the integration of public and private transport initiatives (10.2). Such interrelationships will certainly occur as well in future integrated projects. Usually one of the individual activities then acts as the exemplary project where the other projects benefit from. This was the case for instance in the Kralingse Zoom area where the projected P&R site attracted a lot of attention and thus enhance the other projects as well.

7. Recommendations

While this measure actually describes a certain *modus operandi* instead of a specifically designed measure, the lessons learned here are of a more generic nature and applicable to many situations. In general two main conditions have been identified to smoothen the process of integrated planning:

- All levels of policy makers (city districts, municipality, regional authority) and politicians should be committed to the policy plan;
- Pressure from the market or market opportunities should be exploited to enforce the planning process.

Although probably well known and understood, these recommendations are of particular interest for complex measures such as these planning processes. The rationale behind this is that the invested energy in gaining commitment beforehand is only a fraction of the energy that is needed to restore acceptance after an undesired (policy) plan has been established. The pressure of stakeholders from the market can be very useful to gain such political commitment and therewith accelerate the process.

B.24 Integration of transport management systems (11.1)

1. Introduction

In the Rotterdam region there are two main road managers that gather real time traffic information. These are the national road authorities for the national highway network (for the ring-road) and the city administration for the city roads. Before TELLUS there was no exchange of any traffic information and no cooperation regarding (real time) traffic management between these two organisations. The information gathered by the highway authority was being used just by them – on their roads - to inform travellers about congestions.

2. Description of the demonstration measure

2.1 Demonstration design

The idea behind this measure is to place 5 Dynamic Route Information Panels (DRIPs)[22] at main city roads leading towards the highway ring road in order to give information about the flow of traffic on the ring-road. Based on this information, road users can choose to follow the ring-road either right or left way. This will lead to a better flow of traffic on the ring road in both directions and therefore less congestion on the city roads leading towards the ring road. One of the five DRIPs is positioned on the Vaanweg, and informs the drivers about the routes to the south of the country (via A29 or A16) and to the harbour of the city (A15).

This measure should lead to a better flow of traffic leaving the city and entering the ring road and a better flow on the ring road itself. The number of vehicles looking for alternative routes through the city to avoid (supposed) congestion on the ring road will be reduced.

Tasks

- To establish this, the following tasks have to be performed:
- Establishing information-exchange between the two road authorities by:
- Creating a technical infrastructure
- Design of interfaces
- Design of software that can receive, gather, aggregate and send back information

[22] Also called: variable message signs (VMS)

- Procurement and installation of 5 DRIPs by:
- Design of software that can receive, handle and send text propositions
- Design of user interfaces needed for the communication between server and DRIPs
- Demonstration of the transport demand management strategy and its effects (evaluation)

Innovative aspects

- Information-exchange between road managers
- Institutional co-operation
- Converting traffic information into text on DRIPs

2.2 Rotterdam transport plan context

Information for road users is an important issue in national, regional as well as local policy.

The Ministry of Public Works (RWS) is responsible for gathering data on the traffic flow on Dutch highways. In this measure the Municipality determines what information is shown on the DRIPs, located at city roads leading towards the ring road. Therefore the project supports the policies as it combines (information on) the traffic situation on high roads and on city roads.

2.3 Objectives

The immediate objectives of this measure were to get 5 DRIPs operational and to establish information-exchange between the responsible road managers (Department of Public Works and Municipality of Rotterdam).

The ultimate objectives were to:

- Achieve a better flow of traffic leaving the city and entering the ring-road and better flow on the ring-road itself to reduce the number of vehicles looking for alternative routes through the city to avoid (supposed) congestion on the ring-road.
- Reduce congestion
- Reduce traffic related CO_2 emissions and energy use
- Reduce air pollution and noise to levels below national and EC directives
- Reduce NO_x emissions from heavy traffic

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration

measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

For this particular measure however, no data for the ex ante evaluation was found.

3. Implementation process

In 1999 the idea was born to have DRIPs on urban roads leading to the ring road. In February 2000 the first preparations started. The actual contracting took place in 2001, before the start of TELLUS in February 2002. In June 2003 the five DRIPs were realized. Also a website (www.drips.nl) with an explanation about the DRIPs was created. Altogether, the process from idea to realization had lasted 4 years. The situation on the ring road at the time the DRIPs were realized had substantially changed compared to time the measure was planned. In 1999 differences in congestion in one direction compared to the other often occurred. Nowadays, these differences are much smaller. Hence the effect of the DRIPS on congestion is limited.

However, the increased cooperation with the Department of Public Works is experienced as a very positive and lasting spin-off of this demonstration measure. The cooperation is important as traffic on high roads and traffic in the city have a strong interaction (like 'arteries and capillaries'). Therefore it is expected that for the future, the exchange of information will improve the traffic situation in and around the city.

Table 1 shows the milestones as they were planned and actually met. As the (physical) implementation of the DRIP's as well as (thereafter) the implementation of the supporting software were each delayed by a few month's the DRIPs became operational in June 2003.

It was decided to add another measure to this project: Dynamic parking information in the city centre by the so called "Parkeer Geleidings systeem" (PaGe), or "Parking Guidance system". The objective of this initiative is to optimise traffic flows within the city centre, to reduce the number of vehicles looking for a parking space (and the nuisance they cause doing this) and to spread vehicles over the (paid) parking facilities using real time information systems and dynamic access restrictions.

On main roads leading to that specific destination the available spaces of all the garages linked to that destination are shown. In total 150 signs and panels are placed, of which 90 show very specific dynamic information with available spaces for each garage. Further from the centre, on the main roads leading into the city, message signs have been placed that give more generalised information. The garages gather the information on occupancy rates and sent it to a central system. This central system then places the information on the panels.

The system also gives information on garages and the opening of bridges. Also there is a possibility to change the routes in case of events or incidents.

The basic part of the information (full/free) has been in service since the end of July. The extra information on routes in case of events and opening of bridges will be realised in November 2005, after some small technical problems are solved.

Table B.24.1 Milestones for 11.1

Milestone	Planned	Actual implementation
Information-exchange between the two authorities	April 2002	April 2002
5 DRIPs operational	June 2002	June 2003
Demonstration results available	October 2003	August 2004

4. Results

4.1 Evaluation methods

In 2002, prior to the introduction of the DRIPs, dS+V contracted a consultant to evaluate the impact of the DRIPs[23]. In a pre-measurement, carried out in June 2003, before the implementation of the DRIPs, traffic was counted. After the implementation of the DRIPs two post-measurements were carried out, one in September 2003 and one in April 2004.

To examine the hypotheses that the DRIPs do have an impact on the division of the traffic, counting took place at the traffic lights near the connections to the Ring. Also, traffic volumes were counted at the Vaanplein. This data was collected by the Department of Public works. Furthermore, measurements of congestion and the division of cargo traffic were carried out as well as a survey of road users in order to examine their opinion.

In a survey, the opinion of road users was investigated. The questionnaire was handed out to road users at the connections to the ring. Road users were asked if they were going to drive to the other side of the ring road, before they were handed a questionnaire. This means that only the road users taking the Van Brienenoordbrug or the Beneluxtunnel received a questionnaire. The first results of the PaGe system could not be assessed in this evaluation report.

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators have not been discussed with other demonstrator contacts since no immediate synergy with other measures was expected. The indicators (and impacts) are listed in table 2.

The results as presented in this report are determined as effects on indicators compared to the situation before the DRIPs. In this report the effects are shown as a simplified score (- to +). Score + can be interpreted as a 'good' or 'positive' effect on the indicator or evaluation category, i.e. a positive score is an 'improvement'.

23 Mouwen, A., Martens, G.J.and Weiland P.IJ. *Gemeente Rotterdam. Evaluatie stedelijke DRIPs.* AGV and Arane, final report, August 2004 (in Dutch)

4.2 Impacts

Table 2 shows the results of the evaluation. It appeared that no indicator except user acceptance was quantifiable. A qualitative assessment however was feasible.

Table B.24.2 Impact on indicators for 11.1

Evaluation Area	Indicator	Impact
Society	Acceptance rating	+
Economy	Investment cost	-
	Staffing cost	-
Transport	Total pkm travelled	+/-
	Improved journey time	+/-
	Information sites	+
	Cancellations	+
Energy	Passenger fuel efficiency	+/-
Environment	Emissions CO_2, NO_x, SO_x, dust	+/-

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

Society

The road users are very positive about the DRIPs. Almost 95% of the interviewed people understand the information on the DRIPs. Dependent on the travel motive and the number of times a person sees the DRIPs, this share is even higher. Three-quarters of the interviewed people do trust the information and 80% understand the meaning of the truck symbol[24] on the DRIPs near the Reeweg.

Next to the positive reactions, also some (suitable) suggestions were given for improvement of the DRIPs. Some road users are interested in the specific location of the congestion ('where is the tail of the traffic-jam' and 'can I reach my junction'), others would like information about the bridges on the ring (are they open or not) and information about congestion on the long distance connections, *i.e.* highways A12 / A15.

Economy

For the evaluation area 'economy' the assessment outcome was negative. The costs of the DRIPs are well known. The investment costs are approx. 1,1 M€, costs for labour are 75 k€.

[24] The truck symbol is used on 2 DRIPs, because the traffic situation shown on those DRIPs is regarding trucks. This is because on the Van Brienenoordbrug, a truck lane is positioned and (more then) 50% of the traffic on the Reeweg consists out of trucks.

The benefits due to reduced congestion however are only marginal. However, most benefits are to be expected when accidents on the ring road occur and traffic has to be rerouted. For this purpose, the DRIPs can be used also. But, since no big accidents occurred during the evaluation period, it is not possible to determine economical benefits in those cases. It is expected to be larger then the investment costs (at least on the long run).

Transport

The evaluation proved that the DRIPs do have a quantitative impact on the route choice of road users. However, the route choice is no indicator within the METEOR framework and as a consequence not rated in table 2. Usually the average inequality in congestion length between the two routes (left versus right way) was 2 kilometres. If the inequality in congestion length changed with 1 kilometre in regard to the normal congestion length inequality (e.g. from 2 kilometres to 3 or 1 kilometres), then 0.15% to 0.3% of the road users changed their route.

The second post-measurement, six months after the first post-measurement, did not indicate that the (longer) acclimatisation period has led to a greater impact. Relative to the location, the impact during either the morning peak, or the evening peak, is greater. However, in many cases the impact during the peak periods could not be statistically determined.

The DRIP on the Vaanweg appeared to be a comfort DRIP as no statistical significant effect of the information shown on the DRIP on the route choice was found.

A preliminary analysis using a static traffic model showed that only a group of approximately 5% of the road users really does have a choice between the two routes as they are driving to the point where both routes come together again. The questionnaire implicates that 45% of this group is willing to change their route based on the information shown on the DRIPs. This means that the potential of drivers to be redirected by the DRIPs in normal traffic situations (not while accident occur) is almost 2,5%.

Energy and environment

The assessment showed that transport patterns are only marginally changed by this measure. This means also that the impact on the evaluation areas ‘energy’ and ‘environment’ will be marginal.

Table 3 gives an overview of the results by evaluation area.

Table B.24.3 Evaluation area scores for 11.1(aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex post	+	-	+	+/-	+/-

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

5. Conclusions

The basic principle of DRIPs giving information on city roads about the traffic on high ways is good. Although no significant effects on traffic could be established it will be of use in case of for instance accidents or road works on the ring road. In that case all traffic can be adequately redirected. At those moments the effect on Transport, Energy and Environment will certainly be positive. Especially on city roads leading to the ring road as on those moments there will be less congestion and therefore less pollution and noise for the people in the neighbourhood.

The increased cooperation with the Department of Public Works is experienced as a very positive and lasting spin-off of this demonstration measure. The cooperation is important as traffic on high roads and traffic in the city have a strong interaction. Therefore it is expected that for the future, the exchange of information will improve the traffic situation in and around the city.

6. Scenarios

There is a potential for (at least) another 4 DRIPs in Rotterdam. The 'theoretical' scenario for 2010 therefore is 9 DRIPs. It is however not expected that the extra 4 DRIPs will be implemented within one or two years. Main reason is that the effect on congestion is limited and the prize of DRIPs is going down. In other words, it is worth wile to wait some time. At the same time however, the use of in-car GPS systems increases, especially in trucks. This technique will become strongly competitive with DRIPs. The advantage of DRIPs however is that the information is more compulsory. People can easily ignore their in-car system but they can hardly overlook a DRIP. Nevertheless, as the average DRIP will last for approx. 15 years, they will only be successful if implemented within the next 5 years. As a result the number DRIPs in 2010 will probably lie somewhere between 4 and 9. In other Dutch cities there will be a potential for DRIPS, but for the same reason as in Rotterdam only for a limited period. Besides, the city must have a full ring road, *i.e.* a 'closed circle'. Moreover, in order to obtain data to be displayed on the DRIPs, it is also vital to have some automatic counting system. The same conditions will hold for other (European) countries.

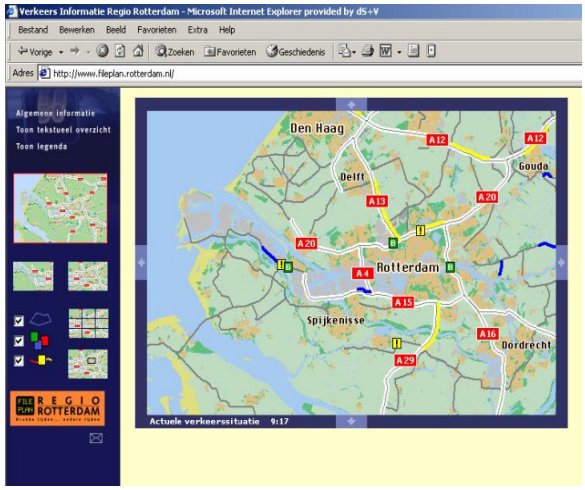
7. Recommendations

The lesson learnt in this measure is that the idea behind DRIPs on city roads leading to the ring road is somewhat superseded by other developments such as the introduction of in-car GPS systems and the changed traffic situation on the ring road. At the same time however, the insight has grown that the DRIPs will be of great use in case of accidents or road works on the ring road. However, as such situations did not occur yet it is recommended to assess the effect of the DRIPs in case of accidents or road works as soon as they do occur. If the assessment proves the DRIPs value added, it is recommended to implement DRIPs on the other city roads leading towards the ring.

B.25 Intermodal travel Information (11.2)

1. Introduction

The Regional Traffic Information Centre (RegioTIC) has been developed since 1996. It was an initiative of the City of Rotterdam (sponsored by the region) and it provides information of the Department of Public Works on the traffic and transport situation in and around Rotterdam by several distribution channels. For instance information on traffic jams and road works can be found on the internet. Also information on the available parking space is provided by RegioTIC.



2. Description of the demonstration measure

2.1 Demonstration design

The demonstration measure consists of adding real time information on public transport to the RegioTIC. The emphasis lies on the information concerning the metro and the TramPlus lines (dynamic route information, frequencies, travel time to the city centre, and problems with the service). The reason for this choice is that for the metro as well as for TramPlus the travel time between stops can be predicted rather accurately.

The activities to be carried out were:

- Designing hardware, software, interfaces, connections and adjusting the RegioTIC for communication with the local PT company.
- Including real time public transport information in RegioTIC about operational disruptions, frequencies, travel time to city centre and parking places at stations. The focus will be on information about train, metro and high quality tramlines.
- Demonstration of inter modal travel information via RegioTIC

This project includes two innovative aspects. The first is the cooperation between the public transport organizations and the RegioTIC. The second innovative aspect is the software used. This is not only capable of processing information from the various systems but it will also be able to convert the information into forms suitable for the different information channels available to the general public.

2.2 Rotterdam transport plan context

Information for road users is an important issue in national, regional as well as local policy. The Ministry of Public Works (RWS) is responsible for gathering data on the traffic flow on Dutch highways. In RegioTIC this information was already combined with information on city level about the available parking space. To give also information on public transport within the city Rotterdam will therefore contribute to the Rotterdam transport plan.

2.3 Objectives

The immediate objectives of this demonstration measure were:

- Designing hardware, software, interfaces, connections and adjusting the RegioTIC
- Including real time public transport information in RegioTIC about operational disruptions, frequencies, travel time to the city centre and parking places at P&R facilities.

After implementation the measure aims at better informed public and better use of the information services. The final TELLUS objective of this measure was to reduce congestion.

2.4 Ex-ante evaluation

In 2003 IVAM conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world. However, no comparable project could be found for the ex ante evaluation.

3. Implementation process

The Regional Traffic Information Centre (RegioTIC) was implemented by the Municipality of Rotterdam in 1996. RegioTIC provides information from several road authorities on the traffic and transport situation in and around the region of Rotterdam. For instance information on traffic jams and road works can be found on the internet. Also information on the available parking space in car parks in the city centre is provided by RegioTIC. Within TELLUS it was planned to add real time public transport information to RegioTIC. After the start of TELLUS, RegioTIC was transferred from OBR (Development Corporation City of Rotterdam) to dS+V (Department of traffic and transport). However, by that time the perception was that real time Public Transport information had no surplus value for internet purposes as internet applications are mainly used before the trip. For obvious reasons, real time information on public transport is better suited for mobile phones than for personal computers at home. Besides, the best place to give this kind of information is at tram and metro stops, which is already the objective of measure 11.3.

So integration of real time public transport information in RegioTIC on operational disruptions and information in frequencies, (real time - travel time to city centre, (real time) parking places at

stations was not realized. The original work for this demonstrator has been changed from expansion of the RegioTIC with more dynamic information towards an integral and actual Internet website on accessibility. The real time information of the RegioTIC will be used in the new regional website on accessibility.

In 2005 a feasibility study for a regional Internet website on accessibility was made. In this website integral –public transport, road, static and dynamic- information for motorists in the region of Rotterdam will be made available. The focus is information on the accessibility of locations and regional transport nodes. This is a consumer friendly approach. The information is presented or is assembled free from municipal boundaries. Also the website will be given a prominent position on the Internet. It will be a separate Internet site on accessibility not bonded to a specific municipality or a specific public transport provider.

The feasibility study was approved by the city council and the work on the site was started. However, the site will not be completed within the TELLUS project period making an impact evaluation impossible.

Barriers and drivers

The main driver of this measure was a technological opportunity: the existence of a Regional TIC developed in a previous European project by the Rotterdam city development corporation and the possibility of including dynamic public transport information that was going to be gathered for TELLUS measure 11.3.

An important barrier for the implementation of the measure was the lack of future funding for the exploitation of the integrated information service. When the responsibility for the existing Regio-TIC system was transferred from the development corporation to the traffic and transport department it became clear that the latter did not have sufficient budget available for the full scale continuation of the operations. A number of distribution channels for the region-TIC were cancelled.

A related barrier was the perceived (non-) acceptance of the PT-users because the information would only be distributed through channels that can be consulted at home (internet and teletext). Therefore a major reorientation of the provision of traffic information was undertaken by the traffic department. The focus shifted towards an internet portal on accessibility that will receive funding from the region.

Achieved milestones

Table B.25.1 Milestones for 11.2

Milestone (original)	Planned	Actual implementation
Integration of real time public transport information in RegioTIC on operational disruptions and information frequencies, travel time to city centre, parking places stations.	January 2005	Cancelled
Website integration of travel times to centre (not automated)	January 2005	> 2005

4. Results

4.1 Evaluation methods

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

For the impact evaluation a set of evaluation indicators was established for the evaluation areas Society, Economy and Transport, based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators have not been discussed with other demonstrator contacts since no immediate synergy with other measures was expected. However, as no evaluation was carried out, the indicators selected are not further discussed in this report.

4.2 Impacts

As the integration of one of the objectives, publishing real time public transport information in RegioTIC was not accomplished, and because there's a delay in the other objectives, no impacts could be assessed.

5. Conclusions

For this measure it can only be concluded that it was not implemented due to changed perception of its practicability. A new, more comprehensive approach was chosen that will lead to results in 2006.

6. Scenario's

There are no scenario's to be discussed for this specific measure.

7. Recommendations

It is recommended to investigate the possibilities to give real time information on public transport on mobile phones.

B.26 Dynamic public transport information (11.3)

1. Introduction

In the last years several new systems to supply real time information to passengers have been introduced in the public transport sector. Actual information on the timetable on Internet and SMS-services are common tools for several public transport companies. Reliability of travel time and convenience for passengers is also a requirement of the so-called Tram Plus-concept (see also TELLUS project 5.4). The same applies to the metro-network. From this perspective the RET (Rotterdam Transport Company) has decided to introduce real time arrival/departure information at the tram-stops of the high quality tramlines and at the metro stops.

2. Description of the demonstration measure

2.1 Demonstration design

In October 2003 the RET started a test-period for a dynamic passengers information system. In the beginning of 2004 the system was put into use at the stops of the (RET) metro-system (100 information panels). The information shown contains the number of minutes to wait and information about delays and the number of wagons used.

The dynamic public transport information at high quality Tramline 20 became operational in October 2002 at 36 tram stops. For the high quality tramlines the RET bought 60 new (Citadis) tramcars. These new trams should offer more comfort, a higher speed, a higher passenger capacity and lower maintenance cost. The new trams had to be adapted to fit in the actual travel time system.

The innovative aspect of this measure is that passengers of the Tramplus and the Metro get real time information.

2.2 Rotterdam transport plan context

The realization of the real time information system was highly related to the developments of the TramPlus-concept. The plan for the TramPlus-concept is embedded in the regional Policy Plan

for Traffic and Transport (RVVP). The Rotterdam City Region commissioned the TramPlus lines. More information can be found in the evaluation report of WP5.4.

2.3 Objectives

The immediate objectives were to install real time arrival and departure information at, at least 70 High Quality tram stops and metro stops. Also 60 on-board communication systems should be installed on trams

The ultimate objective of this project is to increase the reliability of information about travel and departure times, and possible delays or special situations in order to make public transport more attractive.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

From this ex ante evaluation it appeared that the real time information systems are received very well by the public and there is even an indication that people will use the public transport more often if more DRI's are put in place. However, since only one comparable project was found for the ex ante evaluation, the accuracy and reliability of this outcome is rather small for this measure.

3. Implementation process

Actual implementation and deviations from the plan

The dynamic public transport information at high quality Tramline 20 became operational in October 2002 at 36 tram stops. For the high quality tramlines the RET had bought 60 new tramcars (Citadis). The new trams had to be adapted to fit in the actual travel time system. Originally the new trams were not detected by the system and hence wrong data was shown on the information panels at the tram stops. When this problem was solved, RET carried out a successful test run in the period October-December 2002.

In January 2004 the dynamic information system was already implemented at more than the originally planned 70 stops of the metro- and tram-system. Next to the 36 panels at the tram stops all 49 metro stops by that time were provided with information panels. The total number of panels at metro stops is 247. The information shown contains the number of minutes to wait and information about delays and the number of wagons used. The design of this demonstration is closely related to the recently introduced TramPlus-concept (WP5.4).

The implementation of on-board communication systems was successful as well. By April 2004

the first 44 systems were installed and by January 2005 74 trams were already provided with on board communication systems.

The realization of these routes required intensive cooperation with other departments within the municipality of Rotterdam, for instance the departments of Spatial Planning and of Traffic and Transport. Especially data from the traffic and transport is required to maintain a reliable real time information system.

The system was built in close cooperation with Strukton Systems company. They provided the specific knowledge necessary to design as well as construct the system.

Barriers and drivers

The implementation process was established without major barriers or obstacles. At the start of the measure the actual detection of trams in the system was problematic and led to false data on the panels. This technical problem however, could be solved later on in the process.

An obstacle for ex post evaluation is the difficulty in the determination of impacts especially due to other (non-TELLUS) measures that were taken simultaneously such as higher tariffs, smaller distance zones (both contributing to increased travelling costs) and the introduction of controllers on the trams

Achievement of Milestones

Table B.26.1 Milestones for 11.3

Milestone (original)	Planned	Actual
Real time arrival/ departure information available at first 30 High Quality Tram or metro stops	November 2002	October 2002: 36 panels at 36 HQ-tram stops
Result assessment	April 2003	October 2002
Real time arrival/departure information available at another 40 High Quality Tram, bus or metro stops	May 2005	January 2004: 247 panels at 49 metro stops.
Installation of on-board communication systems on 60 trams	May 2004	By April 2004: 44 By January 2005: a total of 74 systems installed.

4. Results

4.1 Evaluation methods

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators were not discussed with other demonstrator contacts since no immediate synergy with other measures was expected. The indicators used are listed in table 2.

The results are presented in this report as effects on indicators compared to the situation before the realisation of the bicycle route and are shown as a simplified score (- to +). Score + can be interpreted as a 'good' or 'positive' effect on the indicator or evaluation category, *i.e.* a positive score is an 'improvement'.

The success of advertising was derived from the annually citywide survey ('Omnibus') amongst more than 2000 respondents in the years 2003-2005. This survey was dedicated to the TramPlus concept (WP5.4) but it is assumed here that the people should also be familiar with passenger information as important feature of the TramPlus concept.

The acceptance by the public was derived from a study by RET in November 2002[25] which has been prepared in cooperation with the LEM. This study was conducted for TramPlus line 20 but the assumption here is that the results are also valid for the new TramPlus lines.

4.2 Impacts

General

The impact of the measure on the number of passengers (occupancy) could not be quantified as at the same time the measure was introduced the total number of public transport passengers in the city of Rotterdam has fallen. The main causes for this decline in passengers are: higher tariffs, smaller zones (both contribute to increased travelling costs) and the introduction of controllers on the trams (to avoid fare dodgers).

Society

From the survey in 2002 it was learned that the acceptance amongst users is high. From the 258 people that answered the question if the information on waiting time is important, 47% fully agreed, 32% agreed and only 14% (fully) disagreed. On the question if it seems to make waiting time shorter 47% agreed and 27% disagreed.

[25] Passagiersonderzoek DRI (Passengers Survey Dynamic Travel Information). RET, November 2002, in Dutch.

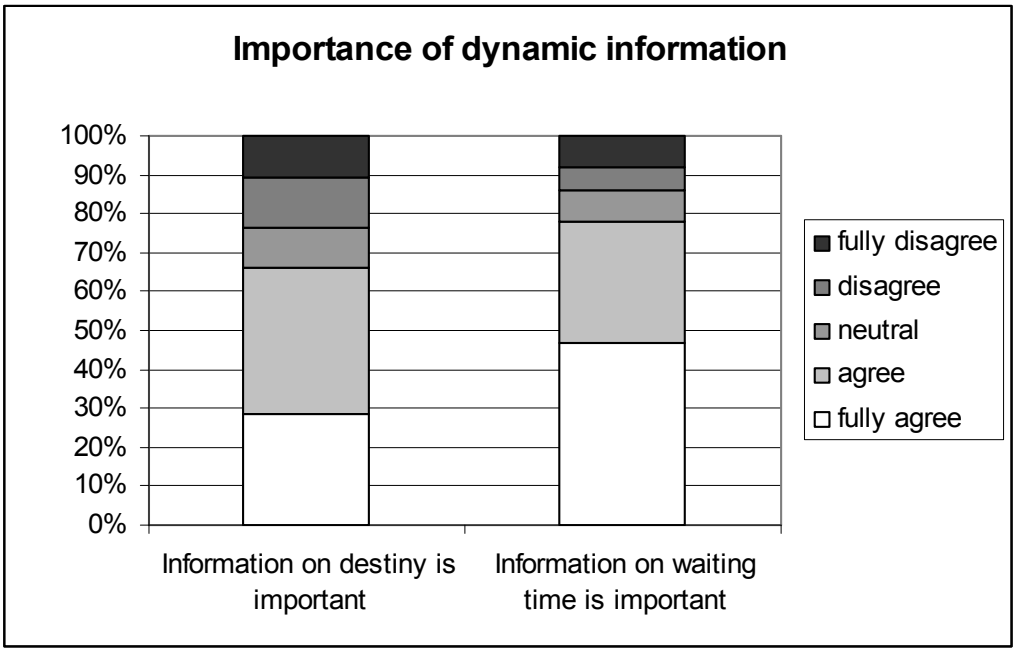


Figure B.26.1 Importance of dynamic PT-information

Concerning the statement that dynamic public transport information increases the use of public transport 45% agreed and 28% disagreed. Of course an actual change in mobility behaviour is subjected to many more factors so these numbers cannot account for such changes but rather are a confirmation of the positive attitude towards passenger information. It is noteworthy to mention that women have a more positive attitude than men.

Economy

It is obvious that compared to the situation before implementation the costs have 'increased' and therefore show a negative impact. Whether there is or will be an increased number of passengers due to the information system, large enough to compensate for the costs, could not be assessed within the time frame of TELLUS.

Table B.26.2 Impact on indicators for 11.3

Evaluation Area	Indicator	Impact
Society	Acceptance rating	+
Economy	investment cost	-
	Staffing cost	?
	Subsidy	?
Transport	Average occupancy on a given journey	+/-
	Information sites available	+
	Success of advertising	-
	Percentage of services cancelled	?

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

Transport

More than 100 PT stops have been equipped with passengers information systems. The readability of the information is satisfactory to 77% of the respondents. The 13% who are not satisfied primarily refer to small symbols as main drawback. From the respondents 47% feels that the given information is correct, 23% think the opposite and 30% do not know. This result is mainly due to the fact new trams in 2002 were not detected by the system and hence sometimes wrong data were shown on the information panels at the tram stops. This problem was solved in 2004.

The success of advertising is related to the citywide 'Omnibus' survey. The particular question about the TramPlus concept reveals that in the years 2003-2005 a constant part of 31% (± 3%) is familiar with the concept. About 61% (± 2%) never heard of the TramPlus concept. We assume here that the same percentages apply to the dynamic passengers information. So in contradiction to the good acceptance and growing passengers numbers on the TramPlus lines, the people in Rotterdam do not get more familiar with the concept. Of coarse, people that already use this form of public transport can hardly overlook the information panels. But apparently the other people in Rotterdam

Whether the number of passengers actually changed due to the information system could not be measured. As it is hard to imagine that a decrease in the number of passengers would occur, the impact on occupancy is supposed to be 'neutral'.

Table 3 shows the results per evaluation category. As in the ex-ante evaluation only one comparable measure was found, the results for the ex ante evaluation are not presented in the table.

Table B.26.3 Evaluation area scores for 11.3 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex post	+	?	?		

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

5. Conclusions

From the existing information system it was learned that there is a high acceptance amongst passengers as it leads to (a perception of) shorter waiting times. However the information delivered should be correct right away to avoid a false start. These results could not be sustained in this measure.

6. Scenarios

Currently most of the metro system and TramPlus systems have been equipped with the real time information system. In the future all tram systems will be equipped with this system. Therefore most of the passengers using public transport in Rotterdam, except for the bus system, will benefit from this system. The system reached already almost its theoretical maximum size.

In other Dutch cities however these kinds of systems are not common yet, leaving room for some expansion in that direction.

Europe wide, real time information systems are commonly known and also implemented in many cities and regions. The innovative aspect of an information system in combination with the comfort and speed of the TramPlus-concept probably is a novelty.

7. Recommendations

The high acceptance amongst passengers is a clear incentive for the introduction of passengers information systems. However the information delivered should be correct right away to avoid a false start. So a major recommendation is to the start a system only when it is fully operational and without initial start up failures.

B.27 Clean & silent public transport fleet (12.1)

1. Introduction

At the start of the TELLUS project the bus-fleet in Rotterdam consisted of 181 buses in EURO I standard and 42 buses with CRT filter in EURO II/III standard. This leads to emissions of hazardous substances such as small particles (dust, soot) and NOx. Although emissions of both small particles and NOx have decreased in recent years, traffic is still the main polluter for these emissions. Currently the air quality levels in Rotterdam for these substances are only just compliant with national directives.

Converting of the whole bus-fleet to EURO IV/V standard using the DNOx filter technique would be a step to decrease emissions to air and improve urban air quality.

Furthermore the city of Rotterdam prepared policies to decrease the burden by road noise. Approximately some 38.000 dwellings[26] suffer from road noise up to level of 65 dB(A). A study in 2002 on health impacts learned that 100.000 inhabitants in the Rotterdam region are disturbed by noise from road traffic. A significant part of these people suffer from sleeping disorders or elevated blood pressure because of this burden.

The introduction of silent vehicles by using hybrid electric techniques could be a first step to address this policy issue. At the start of the TELLUS project 1 prototype light weight hybrid bus with EURO IV standard was available for testing purposes but not yet ready for operation.

2. Description of the demonstration measure

2.1 Demonstration design

The measure aims to convert the whole bus-fleet to EURO IV/V standard using the DNOx filter technique; 138 existing buses will be converted with a complete DNOx system and 74 new buses will be improved with an additional DNOx system. Such a system consists of three parts, an oxidizing catalyst, a particle filter and a low-pressure Exhaust Gas Regeneration system.

The demonstration design was to retrofit 7 buses with DNOx filters. The 7 buses should been put into normal operation by the Rotterdam Public Transport Company (RET). The filter system supplier Erland Nilsson (EN) was responsible for the monitoring of the DNOx filter. After this first operation, the filters should be evaluated and assessed in order to prepare a decision for the conversion of the remaining bus-fleet.

In the course of 2004 the design was changed into installing active SCR (Selective Cathalytic Reduction) filter systems supplied by ETG (Emissions Technology Group, formerly Erland Nilsson) in 7 new buses.

26 Deltaplan Wegverkeer. ROM Rijnmond, 2000.

The lightweight hybrid bus should be tested for 3 years in this project. The evaluation and dissemination of this bus experience will have to result in further improvement for new developments in this field.

The innovative aspects are the introduction of DNOx filters (and especially SCR filters), lightweight hybrid bus concept and extremely silent and energy efficient rail vehicles.

2.2 Rotterdam transport plan context

In both the Policy Plan for Transport and Traffic in the region of Rotterdam and the Rotterdam Environmental Action Program attention has been paid to clean and silent modes of transfer. One of the measures coming from this is to equip all new buses in the region with features enabling Euro V emission levels.

2.3 Objectives

The immediate objective of this measure was to convert 7 test-buses with a complete DNOx system (EURO IV/V standard). Depending on test results the other (205) vehicles could be converted to EURO IV/V standard. Later on in the project this objective was changed into the introduction of SCR filters in all procured new buses.

The ultimate objective is to establish a clean public transport fleet to reduce emissions and to increase the attractiveness of public transport in a whole, by using special developed filter systems.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world. From this evaluation some information was found. One of the conclusions found is that the ‘user’ in this case is not the driver of the vehicle, but the mechanics and maintainers of the vehicle. If the filters are difficult to install, or the maintenance will take extra time and effort, the overall opinion of the vehicle will fall.

The costs of one filter (from ErlandNilsson) are estimated at €22.000. The maintenance costs are not yet clear. Maintenance has to take place either once per three months, per 40.000 kms driven or per 400 working hours. It is likely that 400 working hours will be reached first: the vehicles will not travel more than 100 km/hour and are also likely to be used more than three hours a day. It is as yet unclear whether the use of a filter will influence the fuel use.

The oxidation filter mentioned in the literature led to reduction potentials for VOC (100%), NO_x (49%), CO (81%) and particulates (82%). However, this type of filter was not a SCR types as has been used in the TELLUS measure.

3. Implementation process

Actual implementation and deviations from the plan

Several partners participated in this measure: the Environmental department and Public Transport company RET of the City of Rotterdam, Berkhof Heerenveen (bus building company), DAF Netherlands (OEM for diesel engines), Erland Nilsson Benelux BV (supplier for DNOx filter systems), ETG Emissions Technology Group (currently supplier for SCR filter systems) and SenterNovem (Dutch organization for innovation and sustainability).

Within TELLUS, 7 buses have been fitted with a complete DNOx filter system. The 7 buses have been put into normal operation by the RET in the first half of 2003 and the filter system supplier Erland Nilsson (EN) has executed the controls (monitoring) of the DNOx filter. At the end of the period 6 out of 7 DNOx filters were already defect. In the next period all filters were broken down.

Based on this experience it was decided to allocate the budget to the installation of SCR systems in new buses. This is also in line with conclusions of the European automotive industry for buses and trucks that passive DNOx filter technology would not be the right solution for clean diesel vehicles in the near future. For these manufacturers, the new technology with an after burning application (SCR) is considered the best solution for the moment to reach Euro IV level[27]. The RET also favoured this option because of the reported benefits of the SCR systems. Recent developments even have enhanced these benefits as new SCR systems are not only suited for new buses but also for retrofit buses.

The RET agreed to retrofit 80 buses with the new SCR systems. Before TELLUS, 38 new buses were already ordered with CRT filters in order to evaluate the viability of such PM 10 reducing filters in daily public transport use. These buses also were retrofitted with SCR filters.

The first 7 systems were installed in January 2005. However, by then the systems were not yet fully provided in order to start a new test period. Main reasons for this were the missing base-line measurement (emission figures without filter) and the missing satellite monitoring system.

In the course of 2005 however these problems have been solved. During the summer of 2005 the total of 80 filters were retrofitted in the buses. The remaining 130 buses of the fleet will be replaced by new buses in the period from 2006 until 2009. The first 60 buses, to be delivered in 2006 and 2007 will be equipped with SCR filters as well. The procurement of the first 60 new buses with an SCR filter system, replacing the old part of the fleet, has now been planned with the support of the regional authority. The procurement procedure starts in September and delivery of those 60 buses if foreseen for September 2006. For the remaining part of the fleet developments in the hybrid electric technology could still lead to another approach.

The planned discussions with the industrial partners for finding solutions in improving the technical performance of the hybrid bus have led to a completely other solution then foreseen.

[27] First measurements on the 7 buses have shown that this SCR system is even able to reach the Euro V levels.

An altered technical adaptation was planned and eventually the bus was procured by the Dutch company e-Traction Europe in order to provide it with hub-motors and to test this solution in real practice at the RET in Rotterdam. In the course of 2004 the bus was technically adapted by that company and made ready for testing "on the road". However, the vehicle really must be considered a prototype and is not suitable for operation in the regular public transport service.

The actual in company testing of this prototype has (spring 2005) delivered sufficient data to make preliminary conclusions about it's potential to reduce fuel consumption and polluting emissions. The vehicle is, as a prototype, capable of improving those aspects with a factor 3, which is very hopeful for this kind of technology in future configurations. With this in mind negotiations were started with industrial partners to work on a break through of this promising technology.

Barriers and drivers

Obviously the technical problems with the original DNO_x filters as well as the hybrid bus influenced the measure in a negative way. Initially also the regional authority (Stadsregio Rotterdam), responsible for granting the concessions for the regional and local public transport, was still working on policy preparations to make clear in which way they will promote or award the use of more environmental friendly buses in the concession granting system. This situation did not enhance the introduction of DNO_x-filters. Other major problems with political/administrative, societal or economical factors were not encountered in the TELLUS period. In fact the ongoing communication between partners made it possible to deviate from the original plan and find other feasible solutions.

With respect to the SCR filters it should be mentioned that the ultimate decision of the regional authority (*Stadsregio*) to procure new buses only when they comply with Euro V standard, supported the decision to procure vehicles with SCR techniques.

Due to the technical adaptations the hybrid bus needed to be re-approved by the RDW, the national type-approval institute. This took much more time than foreseen by e-Traction Europe.

Achievement of milestones

Table B.27.1 Milestones for 12.1

Milestone (original)	Planned	Actual implementation
Retrofit 7 buses with DNOX filter	December 2002	March 2003 (old system) January 2005 (new system)
Evaluation results of test with 7 converted buses	December 2003	Late 2005
1 Hybrid bus in service	July 2004	-
all 212 buses converted to EURO IV/V	January 2005	> 2005
Milestone (adapted)	Planned	Actual implementation
Retrofit another 73 buses with SCR filter	March 2005	June - July 2005 (25)
		September–November '05 (48)

4. Results

4.1 Evaluation methods

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators were not discussed with other demonstrator contacts since no immediate synergy with other measures was expected. The indicators used are listed in table 2 in §4.2. Data were gathered and retrieved by the Environmental Department of the Municipality of Rotterdam.

The results are presented in this report as effects on indicators compared to the situation before the implementation and are shown as a simplified score (- to +). Score + can be interpreted as a 'good' or 'positive' effect on the indicator or evaluation category, *i.e.* a positive score is an 'improvement'.

Health related impacts from (decrease of) emissions can be derived from other impact assessment methods such as life cycle impact assessment. In such tools the emissions can be transformed in health related indicators such as potential toxicity impact or DALY's ('Disability-Adjusted Life-Years'). See the annex (chapter 8) for a short description.

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

4.2 Impacts

Society

Since the NO_x emissions did not decrease due to the breakdown of the initial DNO_x filters, no positive impacts could be measured.

For the SCR filters data are available based on on-line measurements in the first half of 2005. The data showed that an efficiency in NO_x removal of 95% in the Euro II buses could be established. The efficiency is only slightly hampered by the cold starts during the first 5 minutes. The overall efficiency is larger than some other studies show (60-85%).

For the calculations it is assumed that 38 Euro III buses convert to Euro V and create a reduction of 3 g NO_x per kWh, which is on average around 9 g NO_x per kilometre. The other 42 Euro II buses convert to Euro V and create a reduction of 5 g NO_x/kwh, on average 15 g NO_x km. Given an average distance of 60.000 km per bus the total reduction would mount up to around 58 tonnes per year.

For comparison an alternative calculation was made based on the efficiency of 95% on NO_x and an average emission of 500 mg NO_x/pkm[28] . Given an average occupancy of 24[29] a reduction of 54,3 tonnes was calculated. This is obviously a very similar outcome.

In some studies on CRT an increase in NO_2 is reported due to oxidation of NO. This could have a negative effect on the buses. On the other hand some reports mention the absence of additional NO_2 emissions. As an in-depth research on this issues lies outside the scope of TELLUS, we assume here that no additional NO_2 emissions occur.

The same kind of calculation can be made for the reduction of particles (PM10). The conversion from Euro II to Euro V creates a reduction of 0,13 g per kWh, on average 0,39 g per kilometre. The other 42 Euro II buses convert to Euro V and create a reduction of 0,08 g/ kWh, on average 0,24 g/km. Here the total reduction would mount up to 1.500 kg PM10 per year.

The SCR filters have an impact on reduction of NO_x and PM10 emissions but on the other hand they lead to higher emissions of CO_2 (132 tonnes) due to the consumption of urea (see section energy/environment).

When calculated with the DALY approach (see chapter 8) however there still is a considerable positive effect on human health.

Economy

Three types of cost indicators were identified here: investment costs, maintenance costs and (change in) fuel costs. The investment costs for the DNO_X filters amounted some 20.000 Euro per filter. The investment costs of the SCR filters are approx. 23.000 euro per filter with an average life span of 4-5 years. Since the DNO_x filters did not led to change in fuel efficiency, the fuel costs didn't change either.

For the SCR filters no sufficient data are available on change in fuel consumption. In some literature sources an impact on fuel efficiency of zero to less than 1% has been reported.

Transport

For the original DNO_x-filters the number of breakdowns was very high (100%). The defect of the DNO_x filter is (most likely) caused a combination of too low average engine temperatures and by pollution (oil particles) from the diesel engine into the DNO_x filter. This failure led to the decision not to fit such a system on the rest of the bus fleet. The experiences with the 38 CRT filtered buses were better, the maintenance period is now extended from 90.000 to 180.000 km.

[28] Taken from IVAM LCA database 4.0.

[29] Taken from ECN, 2001 *Verificatie CO_2-meter voor de stichting FACE* (tabel 3.3, average 40% occupancy on 60 passenger seats)

For the SCR-technology, which implementation started in January 2005, the testing period hasn't been long enough. To date there were no serious breakdowns of the systems.

Energy

Although not on-line monitored, the general impression was that the use of DNOx-filters did not lead to additional fuel consumption.

In the case of SCR-filters the addition of urea is needed for the reduction. Typically some 1,5 liter of urea per 100 km will be needed. In this case (80 buses, 60.000 km/y) this will lead to a consumption of 72 m3 urea. We assume here that urea is not a by-product and is produced with natural gas as feedstock. The natural gas consumption for the production of urea is estimated at approx. 0,6 m3 per kg of urea or 21 MJ per kg. The density of urea is about 1,32 kg/l. The total energy consumption therefore is some 2.000 GJ.

Table B.27.2 Impact on indicators for 12.1

Evaluation Area	Indicator	Impact (DNOx filter)	Impact (SCR filter)
Society	Health impacts	+/-	+
Economy	Investment costs	-	-
	Fuel cost per unit revenue	+/-	+/-
	Maintenance cost	-	+/-
Transport	Number of breakdowns	-	+
Energy	Vehicle fuel efficiency	+/-	+/-
	Life cycle energy eff.	+/-	-
Environment	All (CO2, NOx, SOx, dust)	+/-	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

Environment

Since the original DNO_x filters did not function, obviously no environmental impacts could be obtained here.

The SCR filters had a clear impact on reduction of NO_x and PM10 emissions but lead to higher emissions of CO_2 (132 tonnes) due to the consumption of urea. Expressed in daly's however, which is an useful tool to compare emissions with different impacts, the outcome is still positive.

The reduction with 58 tonnes of NO_x and 1,5 tonnes of PM10 leads to a reduction of 5,7 daly (see chapter 8). The calculations are based on various assumptions and not on in-depth research but it is expected that the conclusion would remain similar even when some assumption might alter.

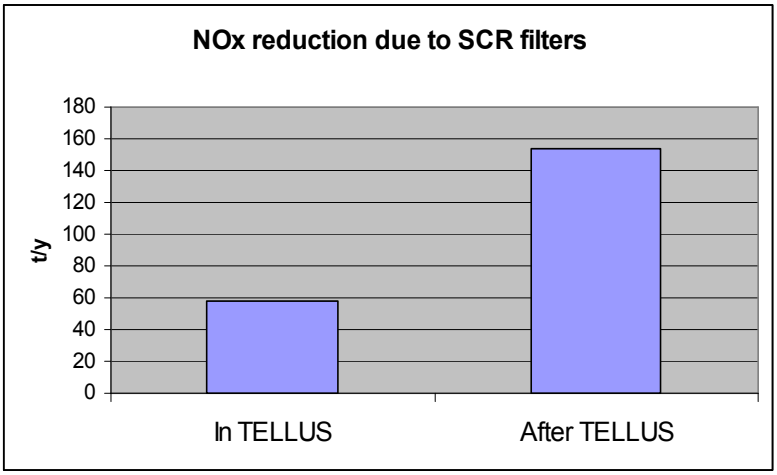


Figure B.27.1 NOx reduction due to SCR filters

Table 3 shows an overview of the results by evaluation area.

Table B.27.3 Evaluation area scores for 12.1 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex post DNOx	+/-	-	-	+/-	+/-
Ex post SCR	+	-	+	-	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

5. Conclusions

In Rotterdam there appear to be no obstacles for the introduction of buses with euro IV/V standard in the public fleet, other than the technical feasibility of filter techniques. Even financial barriers can be overcome, at least when a clear policy statement is made for the procurement of such buses.

The originally selected DNO_x filter clearly had a negative impact due to the large number of breakdown. The later on selected SCR filters have a more promising profile. The late implementation of these filters, however prevent a well documented overview of benefits and costs.

This conclusion also holds for the hybrid bus where technical failures prevented a quick implementation. The revised version only became operational as a prototype test bus in the last year of the TELLUS project period. Nevertheless a future extension of the number of hybrid buses in public transport fleets is foreseen, providing the industry is capable of converting the working prototype into a real feasible market product.

Since NO_x related health and environmental problems occur in many European cities, there is large potential for NO_x emissions mitigation measures. The introduction of sound SCR filters is one of the applicable short term measures, certainly since the Rotterdam measure didn't come to any obstacles for transferability.

Points of attention still are the technical feasibility of the now tested SCR filters and the cost effectiveness of the NO_x mitigation measure compared to other mitigation measures and prevention options.

6. Scenarios

As stated earlier in this report, the introduction of a small number of vehicles with SCR filters is only a first step towards establishing the whole public bus fleet with such devices. New buses will have to meet the Euro IV standards which lead to a decrease in NO_x emissions per km of more than 50%. Based on the same assumptions as the calculations the conversion of the whole fleet to Euro V will decrease emissions with approx. 150 tonnes per year. This is approximately 2% of the total traffic based NO_x emission in the Rotterdam area.

So a scenario for up-scaling is there but an expansion to other types of vehicles outside the public fleet is even more relevant, especially heavy duty vehicles.. Here also the new heavy duty vehicles have to meet the Euro IV standard. In private companies however the investment costs for retrofit will be a more significant barrier.

The separate scenario of implementing feasible hybrid electric traction technology in buses (both new and retrofitted) is at the moment in the stage of exploration, but could reach a real breakthrough within 1 or 2 years from now. The basic technology is there, but needs to be supported in providing a proven track record, before the “market” will believe in its viability and trustworthiness and become potential customers. The regional public bus transport companies belong to the parties able to play a supportive role in this respect.

So the introduction in the future of buses and other vehicles with electric traction technology remains promising. Some test results of the manufacturer (gained outside TELLUS) showed significant improvements on energy consumption and emissions, not only on the prototype of the light weight hybrid bus, but also on their heavier hybrid standard city bus. Tests show an energy consumption of approx. 6,5 kilometres on 1 litre of diesel, which is almost 3 times less than the energy consumption of a standard diesel bus.

Based on these very promising results the construction of more buses and other heavy duty vehicles with this hybrid electric technology will be considered, in order to start a more serious scale demonstration in the region. In this conceptual thinking also the development of sortlike hybrid and electric drive trains for waste collection trucks and large vans for urban distribution and city maintenance will be taken into consideration. These developments will not take place on the short term, but require a time span of several years.

The interrelationship with other measures in Rotterdam is assessed to be rather low. There are no other measures specifically addressing the problem of NOx emissions by heavy duty vehicles, although the MultiCore tube (TELLUS measure 9.2) could affect NOx emissions when waterway transport and road transport are displaced by the MultiCore tube.

7. Recommendations

In this paragraph the most noticeable lessons learned are identified. When these recommendations are met, there clearly is potential for replication and take up by other cities. Three main recommendations with positive impacts should be mentioned:

- Make sure that all stakeholders are involved in the implementation process. In this case not only the environmental department of the municipality was involved but also suppliers of filter techniques, vehicle producers and the Rotterdam public transport company;
- Furthermore a clear policy incentive to procure clean vehicles is eminent to gather sufficient financial budgets;
- As the benefits on NOx emissions from merely the bus fleet is fairly limited, this measure should be up-scaled to level of goods distribution vehicles in both the urban and the harbour area.

8. Annex

The damage to human health caused by several interventions such as emissions to air, noise burden and UV-radiation can be ranked with the help of the DALY approach. The approach of Daly Adjusted Life Years (DALYs) was first described by Murray and Lopez in 1996 on behalf of the World Health Organisation. They developed the DALY approach in order to asses the global disease burden and consequently health policy priorities in different regions of the world. This health impact measure combines years of life lost and years lived with disease and disability that are weighted according to severity. Such a measure can serve as a sort of 'thermometer' for the general trends in health in a population, or as a 'geographic map' providing an integrated view on the most important health problems and their causes, thus facilitating the setting of priorities

In several countries including the Netherlands the (adapted) approach is used for instance by RIVM to describe the public health status, to give input for policy preparations or used as tool to compare human health burdens in so called life cycle assessments.

For this TELLUS measure the DALY approach is used to gain insight in impact on human health as a result of decreasing NO_x emissions. Also it is used to compare several types of emissions occurring in different stages of the life cycle of a product (here: a SCR filter).

The value for NO_x is 8.9 E^{-5} DALY per kg, for PM10 is 3,75 E^{-4} DALY per kg and for CO_2 is 2,1 10^{-7} DALY per kg.

It was calculated that the introduction of 80 SCR filter leads to a reduction in NO_x and PM10 of 58 resp. 1,5 tonnes per year. On the other hand an increase of 132 tonnes of CO2 per year could occurs due to the consumption of urea. The overall health related impact therefore would be a reduction of 5,7 DALY per year. For comparison: an average petrol driven passenger car (12.000 km per year, occupancy of 1,4) has a score of 0,0036 DALY per year mainly due to

emissions of CO_2 and NO_x. So the measure of retrofitting 80 buses with SCR filter has the same impact as reducing the car fleet with some 1.500 vehicles.

B.28 Electric vehicles for commercial distribution (12.2)

1. Introduction

Before TELLUS, the small-scale demonstration in the local site ELCIDIS project in Rotterdam could only be performed till August 2002. The foreseen extension of the demonstration period enables a better understanding of using this new technology. A successful use of this technology will create more understanding for policy measures like “access restrictions” and for the use of clean vehicle technologies in common, also at private companies. Three transport companies are responsible for the distribution of 70% of all parcels & packages in Rotterdam. Small trucks and vans are used for the distribution of goods in and out of the city.

2. Description of the demonstration measure

2.1 Demonstration design

After consulting different companies it has been decided that the only suitable vehicle that could fulfil the needs was the Mercedes-Benz 308 E Sprint, with ZEBRA Z5B batteries. The range of the vehicles is 50 km with two batteries and 75 km with three batteries.

Seven electric vehicles for urban distribution were introduced for deliveries of parcels & packages. The vehicles had to prove themselves in the existing logistic systems of the three participating companies. A vehicle serves up to a hundred addresses a day in one single trip, which demands a payload of 1000 - 1500 kg.

Collecting monitoring data from the remaining two vehicles to gain insight in the impact on energy-use and environment is also a part of the measure. Based on the experiences with the seven vehicles an introduction plan for clean vehicle procurement in private fleets will be realised. The introduction plan will support the further deployment of clean vehicles in the fleets of distribution companies.

Within the TELLUS period also beneficial measures to support users of clean vehicle technologies will be promoted. Especially the relationship with access time windows for clean vehicles (see also the Evaluation report on WP5.1) is relevant.

The innovative aspect of the measure is that this type of electric vehicles (with ZEBRA battery technology) has not yet been widely tested in practice, which means that TELLUS offers an opportunity for doing so.

2.2 Rotterdam transport plan context

In both the Policy Plan for Transport and Traffic in the region of Rotterdam and the Rotterdam Environmental Action Program attention has been paid to clean and silent modes of transfer.

2.3 Objectives

The immediate objectives of this measure were to introduce 7 electric vehicles and to prepare an introduction plan for the procurement of clean vehicles for urban distribution at private companies. Furthermore CIVITAS makes it possible to arrange political support for the necessary measurements regarding the introduction of cleaner vehicles in commercial distribution.

The ultimate objective was to demonstrate the viability of using clean, quiet and energy efficient vehicles for urban distribution and stimulate further spin of in commercial fleets.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

During the evaluation 5 relevant reports were assessed where cases for the use of electric vehicles have been described. The experiences with electrical vehicles are manifold. There has been a considerable amount of European projects, and usually with different results. There are some important general characteristics, however. All reports mention that electric vehicles have a positive image on the public, and they are perceived as clean and friendly for the environment. Users of the vehicle are more ambivalent: if vehicles tend to break down, user acceptance declines fast.

Other points of concern are the limited range of electric vehicles and in some cases the limited loading capacity. The ELCIDIS project found that the overall opinion of electric vehicles is determined by a limited amount of issues (manoeuvrability, engine noise, suitability for the organization).

The high investment costs for the vehicles remain an obstacle, partly related to the low market availability and product diversity. The variable costs are lower than internal combustion engine-vehicles. In countries with low electricity and high petrol prices (i.e. Norway) this is even more pronounced. It is not yet clear whether the break-even point always can be reached. In one case the economic break-even point was estimated >80.000 km/year, and such yearly distances can not be reached with an electric vehicle capable of running 80 km per day.

When looking closer at the effects on the environment, it becomes clear that the replacement of combustion engine vehicles with electrical ones saves a considerable amount of primary energy consumption, measured in kWh. Between 12 and 25% of primary energy consumption can be saved.

The crux is in the way those kWhs are generated: in other words, how sustainable is the national electricity production? If the electric vehicles replace only trips done previously on foot or by bike, sustainability obviously decreases, but there can be positive effects on both transportation (easier, faster, more efficient) and maybe even health (less exposure to the

weather, but on the other hand less exercise).

The relative short lifetime of the batteries (2-3 years, lead and nickel) is sometimes mentioned as a drawback because this leads to an increase in heavy metal waste.

From the ex ante evaluation it was concluded that this measure has positive impact on Society, Energy and Environment. The impact on Economy is negative and neutral on Transport.

3. Implementation process

Actual implementation and deviations from the plan

The first implementation of electric vehicles has been carried out in the framework of the ELCIDIS-project (ELectric vehicles in CIty DIStribution). In the period of April 2001 – January 2002 7 vans were delivered with ZEBRA battery technology. However due to several technical problems after their delivery, a satisfactory testing period could not be reached during the ELCIDIS-project. It was decided then that the TELLUS project would lengthen the testing period to gain better insights in the performance of the vehicles[30].

Within TELLUS only one participant (Van Gend & Loos, now DHL) decided to continue the project with two vans in operation. The technical problems experienced in the ELCIDIS project also occurred within the TELLUS project. There were especially technical failures of the electric system, controlling the battery management. Also the data collection for energy measurements and other evaluation material was not working as a result of the breakdowns. All involved parties including the manufacturer of the vehicles (DaimlerChrysler - DC) made efforts to overcome the problems and continue the test. However in the course of 2004 DC decided not to extend the contract with DHL after the agreed testing period of 36 months. The demonstrator contact and DHL then decided that prolonging the testing period would not be feasible without the maintenance efforts of DC. It was not quite clear what caused the malfunctioning of the vans and both the supplier of the ZEBRA batteries (MES/DEA) and DC disagreed on the subject. According to DC the malfunctioning was caused by wrong material from the ZEBRA battery manufacturer, but afterwards the latter claimed that DC had made a serious mistake in the wiring of the system, mixing ground and zero in a 3 phase system, without notifying the project leader. It appears anyway that wrong installation of the electric system overall is the main cause for the encountered difficulties and because of those problems the original plan was deviated. It appears that the wrong installation of the batteries is the main cause for the encountered difficulties. Because of the problems the original plan was deviated.

The introduction plan for procurement of electric vehicles has been postponed. Due to the severe technical problems the plan will be altered and will focus less on the current combination of van and battery technology. In stead several other developments occurred during the TELLUS period, which could be useful input for the introduction plan, such as the newly

[30] ELCIDIS Final Report. Prepared by Ton Vermie, city of Rotterdam, 2002. Commissioned by the EC (DG TREN).

developed hybrid electric vehicles and the English Electric Mercury Van in combination with possible transport regulating systems.

In cooperation with the remaining participating company the pressure has been built up towards the traffic department, to arrange favourable time windows for using their two electric vehicles. However, a positive outcome has not been reached, although it was supported by a positive advice from Rotterdam's Environmental Policy Department

Barriers and drivers

Obviously the technical problems occurring with the vehicles are an important barrier for the introduction of electric vehicles for distribution purposes. Even the 2 out of 7 vehicles that were still in operation with DHL at the start of the project are not in function anymore. There is no sound base for a more extended implementation of such vehicles, especially since the investment costs are considerably higher than for conventional vehicles.

The need for beneficial measures to support users of clean vehicle technologies has been made part of the new Environmental Plan (approved October 2002). Within the city of Rotterdam however no agreement on access time windows was reached so beneficial measures have not been implemented.

An important driver remained the satisfaction of both distribution managers and drivers of the vans. When not hampered by technical breakdown, the vans performed satisfactory regarding to the transport performance (acceleration), comfort and positive attitude of the public.

Achievement milestones

Table B.28.1 Milestones for 12.2

Milestone (original)	Planned	Actual implementation
Introduction of 7 electric vehicles	February 2002	January 2002
Introduction plan for clean vehicle procurement	January 2005	July 2005

4. Results

4.1 Evaluation methods

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators were not discussed with other demonstrator contacts. The indicators used are listed in table 2 in §4.2.

The results are presented in this report as effects on indicators compared to the situation before the implementation and are shown as a simplified score (- to +). Score + can be interpreted as a 'good' or 'positive' effect on the indicator or evaluation category, *i.e.* a positive score is an 'improvement'.

Data was gathered and retrieved by the Environmental Department of the Municipality of Rotterdam. Since the testing period did not gave additional testing data, most of the evaluation is based on experiences from the ELCIDIS project.

Please note that since all electric vehicles showed failures and breakdown no indicator is given a 'green' score.

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

4.2 Impacts

Society

The operators' acceptance would clearly be positive when the breakdown would not have occurred. In this project however the acceptance was hampered by the number of breakdowns. When technical failures occur, the user acceptance declines fast.

Potential positive influence on health impacts due to less emissions and less noise could not be assessed due to a lack of testing results.

Economy

Three types of cost indicators were identified here: investment costs, maintenance costs and (change in) fuel costs. Investment costs typically are much higher for electric vehicles compared to the conventional ones. In one report prepared for the EC the purchase price is twice that of a conventional vehicle, even excluding the purchase of a spare battery pack[31]. For the TELLUS measure the investment costs for this type of van and battery system were 4 times higher than for a conventional van.

The variable costs for fuel (or better: energy carrier) are typically much lower per km, respectively €2,04 and €7,47 per 100 km[3]. With these data, the break-even point was calculated at approx. 80000 km per year. Such calculations could not be made in this project.

The maintenance costs were much higher compared to conventional vehicles. This was mainly caused by the ongoing efforts to restore the technical problems.

Transport

An index measurement of safety issues could not be established. In previous projects no quantifiable impact on safety was measured although the low noise level of the vehicles raised

[31] Electric Vehicles Deleveries in Postal Services. Produced by Peter Sonnabend, Deutsche Post, 2001. Commissioned by the EC (DG TREN)

some concern. In those projects the vehicles sometimes were not detected by the public (pedestrians and bicyclists) which could lead to possible dangerous situations. In this measure however all vehicles were equipped with small devices with beep noise to warn the pedestrians.

The major problem occurring was the technical reliability of the vehicles, which could not be improved, despite all efforts from DaimlerChrysler.

Energy/Environment

Again the energy balance of the vehicles could not be established in this project. In most of the previous projects, the overall energy performance was improving leading to primary energy savings of approximately 15% . As the implementation of electric vehicles in this measure so far was not very successful, the impact here is regarded as neutral.

Table B.28.2 Impact on indicators for 12.2

Evaluation Area	Indicator	Impact
Society	Operator acceptance	+/-
	Health impacts	+/-
Economy	Investment costs	-
	Fuel cost per unit revenue	?
	Maintenance cost	-
Transport	Safety rating	+
	Number of breakdowns	-
Energy	Freight fuel efficiency	+/-
	Life cycle energy use	+/-
Environment	Emission CO2, NOx, SOx, dust	+/-
	Peak noise	+/-

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

Table 3 gives an overview of the results by evaluation area.

Table B.28.3 Evaluation area scores for 12.2 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex ante	+	-	+/-	+	+
Ex post	+/-	-	+/-	+/-	+/-

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

5. Conclusions

This measure encountered severe problems during its operation. Critical malfunctioning of the battery management system led to a considerable number of breakdowns. None of the 7 vehicles are still in operation and that is no sound base for a more extended implementation of electric vehicles. A probable cause of the problems could be a bad installation of the battery system but both the supplier of the battery system as the supplier of the vehicles did not agree on this issue. Therefore the positive results in several other projects with electric vehicles could not be sustained here.

Even more the expected synergy with 5.1 (access time windows) failed as the acceptance for access time windows proved to be to low.

When the technical problems are overcome there would be no clear obstacle for the introduction of electric vehicles for city distribution. The attitude amongst distribution companies, both managers and drivers, is basically positive. The initial costs are high but could be compensated by lower variable costs. The introduction of complementary measures such as access time windows for clean vehicles would be an useful incentive but probably not decisive for the final decision.

6. Scenarios

Although the introduction of full electric vehicles as tested in this measure didn't prove to be successful relevant developments in Europe take place with regard to the market introduction of promising hybrid electric van concepts. Especially the development of a plug-in hybrid electric Mercedes Sprint (comparable to the full electric tested in Wp12.2) and the Electric Mercury van in England have been followed. So far, the developments in England seemed to be the most promising, especially based on the prognosis of the prices. Next to that the combination with transport regulating systems like the London congestion charging system, gave extra body for such developments, but despite the good will, the introduction of these vehicles in the market still did not took place.

The youngest developments at e-Traction Europe BV, the Dutch developer of a special hybrid electric drive train technology, see also the evaluation report on WP 12.4, are evolving to a promising option for all heavy duty vehicles.

In Rotterdam also scenario's for implementation will be described in the forthcoming introduction plan scheduled for the end of 2005. The TELLUS experiences as well as experiences in other cities will play a role in this plan. Also the Rotterdam Action Plan for air quality addresses the introduction of clean electric vehicles, for instance in relation to the implementation of environmental zones.

7. Recommendations

In this paragraph the most noticeable lessons learned are identified. The main recommendation obviously is that the technical problems must be solved for both vehicles and battery packs. Furthermore the investment costs for electric vehicles remain an obstacle. All efforts to decrease the costs, by either product and market developments or subsidy programs would improve this situation and lower the barriers for procurement.

In France for instance, electric vehicles are less expensive than internal combustion engine vehicles because of governmental subsidies on fixed costs, leasing contract of batteries and involvement of the manufacturer through a network of service stations[32] but even with these solutions the EV market remains a small niche.

When these recommendations are met, there clearly is potential for replication and take up by other cities. On the other hand many European cities[33] have been engaged in projects concerning the use of electric vehicles for distribution and postal services. The transferability issue therefore hardly seems relevant anymore.

Obviously the used technology should be improved. The most likely step in that direction is the development of suitable hybrid electric driving trains for this type of vehicles. That approach is at the moment in the stage of exploration, but could reach a real breakthrough within 1 or 2 years from now. The basic technology is there, but needs to be supported in providing a proven track record, before the “market” will believe in its viability and trustworthiness and become potential customers. The applicable urban distribution companies belong to the parties able to play a supportive role in this respect.

[32] EVDPOST Final Report, by Peter Sonnabend of Deutsche Post AG, for DG TREN (TR0140/97), 2001.

[33] E.g. Stockholm, La Rochelle, Erlangen, Milan, Stavanger. Furthermore 15 demonstration sites were testing postal services with electric vehicles.

B.29 Cleaner Vehicles for Waste Collection (12.3)

1. Introduction

Traffic and transport are a major source of air pollution, and the dominant source in urban areas. Expo-sure to air pollution can cause adverse health effects, most acute in children, asthmatics, and the elderly, and can damage vegetation and materials (notably, the cultural heritage).

Within the transport sector, road traffic is the most important contributor to urban air pollution. While national and EU regulations aimed at automobile emission reductions have resulted in considerably lower emissions per vehicle, the continuous expansion of the vehicle fleet is partly offsetting these improvements.

Particulate matter is primarily emitted by diesel engines. Because of the adverse health effects particulate matter is the most severe air pollution problem affecting large cities. Particulate matter irritates the membranes of the respiratory system, causing increased respiratory symptoms and diseases like cancer. Depending on the measuring point the actual PM10 concentrations in the Rotterdam area are just below or well above the limit value of 40 ug/m3.

In the present situation, no waste collection vehicles with particle filters are in use in the city of Rotterdam, due to the fact that until very recently for such use no working (CRT-)filters were available. Also new waste collection vehicles had to be introduced for emptying a new system of underground containers. That would be a suitable moment to introduce particles filters in these vehicles.

2. Description of the demo

2.1 Measure design

At the introduction and demonstration of a waste collection system using underground containers the new waste collection vehicles are introduced to empty the containers, replacing the weekly waste collection with plastic bags

Originally 20 new waste collection vehicles should be equipped with special filters working at very low exhaust temperatures, typical for waste collection trucks. However, DAF trucks found out that the original system would not work. The reason is that the system will only work if exhaust gasses are heated with an electric heating system. Such a system would require a huge battery pack, thus also needing a strengthened chassis. Technically this system was unacceptable. Consequently another filter system had to be developed. Conclusion was that for this typical vehicle use in urban areas the application of an active regeneration system of diesel particulate filters is inevitable. Due to the high price of the new developed active system, it has been decided to only introduce 2 new clean waste collection trucks in Rotterdam to test the specially developed filter system in real-life circumstances.

Another demonstration introduced is installing a specially developed filter system for smaller diesel vehicles in 20 existing sweeping vehicles. This Catalytic Particulate Oxidizer (CPO) filter system has already been tested in real life circumstances and has proven its suitability to realize a Euro IV level, especially regarding particulates reduction (guaranteed 80% efficiency). Since the sweeping vehicles are not bound to the road vehicle Euro emission regulations, this part of the test is also interesting for a large unexplored market.

The innovative aspects are the new logistic service for waste collection, reducing the total vehicle kilometres of waste trucks in the inner city, combined with clean vehicles (Euro IV) with special developed filter system for this type of truck use (working at low exhaust temperatures).

2.2 Rotterdam transport plan context

In both the Policy Plan for Transport and Traffic in the region of Rotterdam and the Rotterdam Environmental Action Program attention has been paid to clean and silent modes of transfer. The attention for measures that aim at the reduction of emissions of particulate matter has been growing even since the raised awareness for urban concentrations and its impact on health and spatial planning. The actual plan to install filters on waste trucks has been developed by Roteb itself.

2.3 Measure objectives

The immediate objectives of this measure were the introduction of new clean filter system for waste trucks and conducting a feasibility test for the Euro IV standard for this specially developed filter system (working at low exhaust temperatures).

The ultimate objective was to combine clean vehicles with a new waste collection system in order not only to reduce the total vehicle kilometres of waste trucks in the inner city, but also reaching an extra reduction in air polluting emissions.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

For this measure however it was not possible to find comparable measures which have been undertaken in the past and/or which have been reported in accessible literature.

3. Implementation process

Actual implementation and deviations from the plan

The measure was a co-operation of the city of Rotterdam (Public Works department) with a waste management company in Rotterdam (Roteb, including Roteb-lease), DAF trucks Netherlands and Erland Nilson Benelux (supplier CPO filter).

Soon after the first meetings it became clear that the original plan of delivering 20 vehicles with filters would not be feasible. The reason for this was that the system would only work if exhaust gasses were heated with an additional electric heating system. This was an undesirable option. Therefore a new filter system was proposed by the truck manufacturer DAF. European truck manufacturers are now all focusing on the optimization of diesel engines for heavy-duty vehicles by means of active filter systems, in order to attain the environmental standards for the next decades. This active filter technology is generally acknowledged in Europe as being the best solution for the moment to reach the Euro IV or even Euro V standards.

Therefore a new milestone has been formulated within the measure aiming at the procurement of 2 waste collection vehicles with an active filter system. After receipt of the final offer from the truck manufacturer DAF, the waste collection trucks have been ordered in December 2003 and were delivered in early 2005. According to DAF the delay was caused by insufficient testing results of the whole filter system. This filter system is more sophisticated than other active systems due to its active temperature control needed for this specific kind of application. The waste trucks and the applicable active filter system were developed and provided by DAF trucks with an 8 years warrantee. This warrantee time made it essential for DAF that the efficiency of the filter system is satisfactory.

The efficiency of the active filters will be compared with retrofitted E-CRT filters that are mounted for the same purpose. The E-CRT filters are addressed in the evaluation report of measure 12.4.

Next to that a new development took place from September 2003, when discussions started with another filter supplier, regarding the introduction of a recently developed system of particulate filter for smaller diesel engines (< 120 kW). This Catalytic Particulate Oxidizer (CPO) filter is completely maintenance free and works already at exhaust temperatures from 180°C, making it more widely suitable than a standard CRT filter. In consultation with Roteb, also the municipal owner of the waste collection trucks, it was concluded that sweeping machines would be the best application for introducing this new filter system, because those vehicles have very special use and impact in the inner city. It has therefore been proposed to the Commission to extend this measure 12.3 with retrofitting 20 RAVO sweeping machines with this filter and to monitor the effects in the coming project periods.

After approval from the Commission regarding this alteration in the workpackage, the 20 CPO filters have been ordered in December 2003 at the supplier Erland Nilsson Benelux and were mounted in the Spring of 2004.

Barriers and drivers

Like other technical measures from work package 12 (see the evaluation reports for 12.1 and 12.2) the technical barrier was the most imminent factor for the success of the implementation. After the identification of a new and feasible technical solution, there were no major obstacles anymore of either political/administrative, societal or economical nature.

Achievement of milestones

Table B.29.1 Milestones for 12.3

Milestone (original)	Planned	Actual implementation
Introduction of 1 clean waste collection vehicle with special developed filter (Euro IV) for testing purposes	July 2003	-
Introduction of 3 extra clean waste collection vehicles (Euro IV) for the underground containerisation system	July 2004	-
Milestone (adapted)	Planned	Actual implementation
First waste collection truck with SCR filter	March 2004	January 2005
Second waste collection truck with SCR filter	September 2004	March 2005
20 sweeping vehicles with CPO filters in use	April 2004	March – April 2004

4. Results

4.1 Evaluation methods

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators were not discussed with other demonstrator contacts. The indicators used are listed in table 2 in §4.2. Data were gathered and retrieved by the Environmental Department of the Municipality of Rotterdam.

The results are presented in this report as effects on indicators compared to the situation before the implementation and are shown as a simplified score (- to +). Score + can be interpreted as a 'good' or 'positive' effect on the indicator or evaluation category, *i.e.* a positive score is an 'improvement'.

For the waste collection trucks equipped with active filter systems to date (October 2005) no suitable monitoring and testing results arre available, due to system failures. However monitoring is ongoing and at the end of 2005 results will be presented, providing that system failures will not happen again

The measurements on the CPO systems were conducted by both Roteb and TNO. The Roteb measurements were merely taken for own internal assessments, the TNO measurements are considered as the official results.

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the

other LEMs' within TELLUS.

4.2 Impacts

Society

In many cases the acceptance of technical measures is strongly related to the reliability of the system, and this measure is no exception to that rule. As the CPO system on the sweeper machines operated without any failures or breakdowns and also led to a reduction of particle emissions, the acceptance of operators appeared to be rather positive.

For the active filters the opposite occurred. The overall testing results here showed considerable technical problems which led to less acceptance.

Economy

The investment costs for the CPO system mounted at the sweeper machines are around € 3.000 each, which possibly makes it worthwhile for a lot of smaller diesel vehicles. Roteb reported that no alterations in fuel use were detected.

The investment costs for the active filters in this TELLUS measure were approx. 110.000 euro per filter. In case of large scale implementation (sufficient demand) and ongoing development of the filters, it is expected that the market price could be reduced to approx. 25.000 euro.

Transport

Roteb reported that all CPO systems on sweeping machines operated without any failures or breakdowns. The active filters had severe technical problems however.

Energy/environment

The CPO filter system is dedicated especially to decrease the emission of particles (dust, but mainly soot). The first preliminary measurements of Roteb showed an efficiency of some 90%. The official measurements from TNO were taken in the first quarter of both 2004 and 2005. These measurements also showed an effect on reduction of particles but much less namely between 5 and 25 %. A strong reduction in CO and VOC concentrations could be measured of 90% and 60% respectively.

Since the fuel use of the sweeping machines did not change after installing the CPO systems, the emissions of CO_2, SO_2 and NO_x are expected to be unchanged.

For the active filters no measurements could be gathered due to the technical malfunctioning. Thus we consider here that the impact on this area was neutral.

Table B.29.2 Impact on indicators for 12.3

Evaluation Area	Indicator	Impact (active system)	Impact (CPO-system)
Society	Operator acceptance	-	+
Economy	Investment costs	-	-
	Fuel cost per unit revenue	+/-	+/-
	Maintenance cost	-	+/-
Transport	Number of breakdowns	-	+
Energy	Vehicle fuel efficiency	+/-	+/-
Environment	Emission CO2, NOx, SOx, du	+/-	+
	Average noise	+/-	+/-

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

Table 3 gives an overview of the results by evaluation area.

Table B.29.3 Evaluation area scores for 12.3 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex post active system	-	-	-	+/-	+/-
Ex post CPO system	+	-	+	+/-	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

5. Conclusions

The results of the CPO systems clearly showed a positive result on the reduction of particle emissions, although the official measurements by TNO were somewhat disappointing. The systems also proved to be robust and reliable and did not lead to an increase of maintenance costs. Also the fuel use did not show any negative side effects. The systems are suited for retrofit and although there are still significant investment costs, the purchase costs of €3000 per filter systems are not necessarily a major obstacle. However, with the aim of firmly reducing particle emissions, the search for more effective systems remains important.

The active filters encountered serious technical problems probably caused by the extra features required to operate such a filter in waste trucks. Other active filters, like the SCR systems installed in the buses in 12.1, did not encounter these problems. Logically due to the technical malfunction no positive impacts were gained. It is obvious that in the future the E-CRT systems from 12.4 have a higher potential for this kind of application.

6. Scenarios

The potential for up scaling of this measure is considerable. Although 20 out of 50 sweeping machines have been equipped with filter systems, it was estimated that some 3.000 vehicles in total with small diesel engines could be suitable for retrofit CPO-filters. At the moment however the CPO filters have to show a better efficiency to fulfil this promise. Otherwise other future systems will have better chances for large scale implementation.

As the Roteb has a fleet of 75 waste collection vehicles there is room for up scaling here, although not with the tested active filters but with E-CRT filters. The impact on city level will remain limited. However outside the city of Rotterdam there is still sufficient room for an uptake by other cities.

In general the measure had a low interrelationship with other measures within the TELLUS project. In the future also these technical measures can be conducted on a ‘stand alone’ basis and are not necessarily depending on other supporting measures.

Finally, the approach of implementing feasible hybrid electric traction technology in waste collection trucks (both new and retrofitted) is in the stage of exploration, but could reach a real breakthrough within 1 or 2 years from now. The basic technology is there, but needs to be supported in providing a proven track record, before the “market” will believe in its viability and trustworthiness and become potential customers. The applicable regional waste collection companies belong to the parties able to play a supportive role in this respect.

7. Recommendations

In this paragraph the most noticeable lessons learned are identified. When these recommendations are met, there clearly is potential for replication and take up by other cities.

The most relevant recommendation, next to availability of feasible technical innovations, is to create conditions for cooperation between manufacturers and suppliers on the one hand and users of the equipment on the other hand. Surely here the cooperation between the truck manufactures and filter supplier and the demands of the waste collection company proved to be vital for a satisfactory outcome of the measure, even when the initial objectives could not be met due to technical problems.

B.30 Electric vehicles in public fleets (12.4)

1. Introduction

At this moment 15 electric vehicles are in operation in Rotterdam's public fleet, partially as a result of the PREVIEW project, supported by the National Government. So far a large extension of that number has been out of the question, due to a very poor market supply in this field in the Netherlands and the fear of technical shortcomings at potential users. In the municipal fleet, at least a number of 100 vehicles can potentially be replaced by (hybrid) electric vehicles.

2. Description of the demo

2.1 Measure design

Based on the good technical experiences in the PREVIEW project, it is decided in the framework of the new environmental policy plan, to introduce a large number of (hybrid) electric vehicles extra in the municipal fleet. This decision is partially based on the coming availability of the Renault Kangoo EV extend range, provided with a very small ICE engine and generator (the range extender) in order to charge the batteries in case the on-board energy supply becomes insufficient (a psychological advantage). Furthermore the use and the availability of hybrid electric vehicles are becoming more and more generally accepted. The price of these vehicles however, will remain a high barrier for potential customers in a long term and can only be directed in the right way with the support of successful large-scale demonstrations like this project. This measure therefore consists of several steps:

- Procurement and introduction of 50 (hybrid)electric vehicles and charging infrastructure;
- Advise and training of the drivers;
- Demonstration of the use of these vehicles in the municipal fleet;
- Apart from CIVITAS, the city of Rotterdam will also take action for a possible extension of the municipal fleet with 50 extra vehicles in a national program.

The innovative aspect of this measure is to demonstrate that a large fleet of (hybrid) electric vehicles is possible when the procurement and introduction is sufficiently accompanied with communication activities, training and awareness campaigns.

2.2 Rotterdam transport plan context

In both the Policy Plan for Transport and Traffic in the region of Rotterdam and the Rotterdam Environmental Action Program attention has been paid to clean and silent modes of transfer.

2.3 Measure objectives

The immediate objective of this measure was the introduction of 50 (hybrid) electric vehicles in the municipal fleet. The ultimate objective is the large-scale demonstration of (hybrid) electric vehicles (clean, quiet and energy efficient) in public fleets. The measure therewith contributes to the TELLUS objectives of reducing CO_2-emissions and reducing air pollution/noise to levels below national and EC directives.

2.4 Ex-ante evaluation

In 2003 IVAM UvA BV conducted an ex ante study on the various TELLUS demonstration measures in Rotterdam. The objective of this study was to assess whether a prediction of impacts on forehand is possible based on experiences in other cities throughout the world.

For this particular measure however it was not possible to find comparable measures which have been undertaken in the past and/or which have been reported in accessible literature.

3. Implementation process

Actual implementation and deviations from the plan

As the decision was made to procure the new Renault Kangoo with range extender it was important to get the approval of the national type-approval institute RDW. The RDW however needed much more time than expected to issue such an approval. Meanwhile the information campaign was ongoing and at least 70 possible clients within the municipality were interested to use this vehicle in near future.

In early 2004 it became clear that the Renault Kangoo electrique with and without range extender would not be delivered anymore, since Renault France decided to stop the delivery of these vehicles for the market outside France, based on foreseeable maintenance problems for the small numbers of vehicles.

In between contact with Toyota and Honda was made for their respective hybrid vehicles Toyota Prius 2 and Honda Civic IMA. Introduction of the possible hybrids from Toyota and Honda technically and financially seemed a very good option, but they are not the most suitable vehicles for performing as municipal service cars. It was expected that for 10 of these vehicles a suitable use in the municipal fleet could be found.

Due to these developments it was foreseen that an extension of the municipal electric vehicle fleet with 50 vehicles would be impossible. In all there has been a major deviation of the original description of work. The following activities have been assigned to this measure in the course of the TELLUS period:

- Procurement of 50 Ford FFV;
- Procurement of 2 Toyota Prius;

- Procurement of 6 electric service vehicles in Spijkenisse (neighbouring municipality within the City region);
- Procurement of 1 electric shuttle bus for the inner city;
- Regional communication and awareness campaign for electric vehicles;
- Installing 2 retrofit electronic CRT systems on waste collection trucks (and compare the results with the active systems addressed in WP12.3). As a part of the TELLUS project another 30 E-CRT systems will be installed in the second half of 2005;
- Testing electric scooters at the Roteb lease department.

A new option was proposed to change partially from electric vehicles to bio-fuel. Contact was made with Ford Netherlands for the use of the ethanol (E85) Focus FFV in Rotterdam. The first ideas from Ford would be the implementation of around 50 vehicles in one regionally based car park, so on one hand the Rotterdam car park would be very suitable for that purpose and on the other hand it would fit well in the number of cars foreseen to be demonstrated in this work package. However, at the moment these vehicles are not yet available on the Dutch market, since the decision of the national government how to deal with the taxes for the E85 fuel is still pending and not expected before the end of 2005. This decision is crucial for the success of deploying these vehicles and to realize a start of the desired mass procurement later on.

Meanwhile actions were undertaken to realize bio fuel filling stations in the area. Here also the pending decision of the national government prevents market parties to actively participate. Commitment from the City council was gained however to support at least one bio fuel filling station.

The Roteb-lease department has arranged a testing of electric scooters for use in their own and other Roteb departments. The performance of the scooters however was not satisfactory due to the insufficient driving range (40 km max.) and the applicable department at Roteb decided not to procure the scooter after all.

Barriers and drivers

A major barrier proved to be the lacking availability of clean electric vehicles due to the relative minor attention that is paid by manufactures to this part of the market. Therefore this measure was not able to meet his initial objective.

But even the adapted objectives/milestones of bio fuelled vehicles proved difficult to reach. This time, not (only) by the lack of available vehicles from the manufacturers, but due to tax regulations. The current regulations are setting a high barrier for expansion of the bio-fuel market as no incentive is given to trade and sales or to the users of bio-fuel.

For the moment these barriers seem stronger than the drivers which are the future demands of EU directives to increase the share of bio-fuel and, in the case of electric vehicles, the ongoing discussion about urban air quality being dominated by traffic related emissions.

Achievement of milestones

Table B.30.1 Milestones for 12.4

Milestone (original)	Planned	Actual implementation
50 (hybrid) electric vehicles introduced in phases in the municipal fleet	January 2004	-
Milestone (adapted)	Planned	Actual implementation
Procurement of 50 Ford FFV	March/April 2005	> June 2005
Procurement of 2 Toyota PriusII	-	April 2004
Procurement of 6 electric vehicles in Spijkenisse	-	2005
Procurement of 1 electric shuttle bus for the inner city	June 2005	Late 2005
Installing 2 E-CRT systems on waste collection trucks	February/March 2005	February/March 2005
Testing electric scooters at the Roteb lease department	2004-2005	First half of 2005
Installing another 30 E-CRT systems on existing waste collection trucks	-	Late 2005

4. Results

4.1 Evaluation methods

A set of evaluation indicators was established based on the METEOR approach and in close cooperation with the demonstrator contact. The indicators were not discussed with other demonstrator contacts. The indicators used are listed in table 2 in §4.2. When the objectives and milestones of this measure changed considerably it proved difficult to assess the indicators for a range of different sub measures (see in table 1). The assessment of indicators therefore should be handled with care and not without taking notice of the text in chapter 4.2.

Data were gathered and retrieved by the Environmental Department of the Municipality of Rotterdam. The now procured 6 electric and 6 hybrid electric vehicles are monitored constantly. Data from this are used for this evaluation.

For the waste collection trucks equipped with E-CRT systems to monitoring and testing results will be gathered in the timeframe from February to August 2005. This data will be compared with the results of waste collection trucks with active systems in WP12.3.

For the process evaluation the LEM organized a meeting with the demonstrator contact to conduct an in-depth interview based on a checklist. The checklist was harmonized with the other LEMs' within TELLUS.

4.2 Impacts

Society

The users of the Toyota Prius II all gave high satisfaction rankings to the vehicles mainly due to their ease of use and comfort in stop- and go city traffic.

On the other hand the testing of the electric scooters showed less acceptance because of the fairly limited working range of only 40 km. This is actually the same outcome as in WP 8.1.

Economy

Three types of cost indicators were identified here: investment costs, maintenance costs and (change in) fuel costs.

The investment costs for the E-CRT system amounted some 21.600 Euro per system. For comparison the investment costs of the active filters as stated in WP12.3 are foreseen at market prices of approx. 25.000 euro per filter.

Transport

No major breakdowns to any of the technical measures within WP12.4 have been reported. Also the ease of use was described positively. Accidents which sometimes can occur due to the use of silent electric vehicles in pedestrian areas also have not been reported.

Energy

The Toyota PriusII was subjected to monitoring for well over 10.000 kilometres. The average fuel consumption was measured at 5,6 litres per 100 km, but depending on the users and the type of trips with a spreading from 4,3 to 6,0 litres per 100 km. This is much lower than the fuel consumption of similar sized petrol driven cars (i.e. Peugeot 407, VW Passat) of 7,9 litres per 100 km[34].

For the other vehicles within WP12.4 no such data were available. For the waste trucks with E-CRT systems no change in fuel consumption occurred.

Environment

No calculations have been made for all types of measures within WP12.4. However due to the low fuel consumption of the hybrid cars, the introduction of more electric service vehicles and the success of the E-CRT filters surely a positive impact is expected here.

[34] Taken from: Environmental and health impact from modern cars. Ecotraffic, Swedish National Road Administration, publication 2002:62.

Only for the E-CRT systems some relevant calculations have been made. The waste trucks on average drive 15.000 - 20.000 km per year. The application of an E-CRT system leads to a decrease of the emission of particulate matter (PM10) with 0,13 g/kWh, or on average 0,39 g/km. The assumption is that the emission changes from Euro II (0,15 g/kWh) to Euro IV/V (0,02 g/kWh). The total load would therefore decrease with approx. 250 kg per year based on the installation on 32 waste trucks in total.

Table B.30.2 Impact on indicators for 12.4

Evaluation Area	Indicator	Impact
Society	Operator acceptance	+/-
Economy	Investment costs	-
	Fuel cost per unit revenue	+
	Maintenance cost	+/-
Transport	Number of breakdowns	+
	Ease of use	+
	Accidents	+
Energy	Vehicle fuel efficiency	+
	Life cycle energy use	+
Environment	Emission CO2, NOx, SOx, dust	+
	Average noise	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

Table 3 gives an overview of the results by evaluation area.

Table B.30.3 Evaluation area scores for 12.4 (aggregated from indicators)

	Society	Economy	Transport	Energy	Environment
Ex post	+/-	+/-	+	+	+

+ = improved, +/- = no change or negative impact equals positive impact
- = worsened , ? = unknown

5. Conclusions

The initial objective of introducing electric vehicles in the public fleet could not be met. The main reason for this was the manufacturers' decision not to deliver the type of vehicle that was projected here. As an alternative, a set of technical measures was introduced which in all turned out quite successfully with the exception of the planned introduction of bio-fuelled vehicles due to the uncertainty of bio-fuel tax incentives from the Dutch government. In all evaluation areas the measures had a positive impact except for the economic area. The introduction of clean vehicles still requires higher investments than regular vehicles.

6. Scenarios

Although most of the measures turned out to be quite successful the potential for up scaling is fairly limited. The introduction of electric or hybrid vehicles still requires the availability of sufficient vehicles. It is unlikely that a large scale introduction of middle class cars like Toyota Prius or Honda Civic takes place in the public fleet, but extending the scope to private fleets and households would elevate the up scaling potential because these vehicles have acquired a fair market share in The Netherlands.

The E-CRT system, dedicated to reduce the emissions of particulate matter, also showed positive results and still has a potential for up scaling as not all 75 waste trucks were equipped with this system.

Although the introduction of bio-fuel driven vehicles failed in this measure, the potential for up scaling is still alive. The Dutch government has decided to apply tax exemptions to bio-fuel in 2006 and a mandatory regulation for the years thereafter Moreover a special arrangement is in sight for sound projects dealing with bio-fuels for a period of 5 years (2006-2010). This will probably enhance the bio-fuel market (trade and sales) together with the ongoing introduction of bio-fuelled vehicles (i.e. Ford, Volvo, Saab). In Rotterdam itself the plan was raised to use bio ethanol in a larger part of the public fleet and in private fleets. This plan is integrated within a new European project BEST (Bio Ethanol for Sustainable Transport). Next to that, the approach of implementing feasible hybrid electric traction technology in all heavy duty public vehicles (both new and retrofitted) is in the stage of exploration, but could reach a real breakthrough within 1 or 2 years from now. The basic technology is there, but needs to be supported in providing a proven track record, before the “market” will believe in its viability and trustworthiness and become potential customers. The applicable municipal services belong to the parties able to play a supportive role in this respect.

7. Recommendations

The recommendations here are strongly related to the barriers mentioned earlier in this WP12.4 evaluation report. A major barrier proved to be the lacking availability of clean electric vehicles due to the relative minor attention that is paid by manufactures to this part of the market. This asks for strong and harmonised pressure on manufacturers to develop the market for clean vehicles.

Finally, the recommendations stated in WP12.1, 12.2 and 12.3 here are valid also as WP12.4 was designed as a mix of individual measures who at least partly occur also in these other three measures within WP12.

C EVALUATION ON CITY LEVEL

C.1 Introduction

The objective-related evaluation aims at assessing the overall contribution of the measures to the ultimate goal of achieving more sustainable urban transport on city level. The assessment of the results achieved by all of the demonstration measures will be compared with the TELLUS objectives identified for Rotterdam. Most of these objectives are quantified and relate to two periods of time. The first period is from 2002 until 2006, the second from 2006 until 2010.

According to the Inception Report the reduction of NOx -emissions from heavy traffic is not an objective on city level for Rotterdam. However since it proved to be an issue addressed by some Rotterdam demonstration measures (particularly the freight transport measures) it will be included in the evaluation at a measure level.

The following table outlines the TELLUS objectives for Rotterdam with their quantification.

Table C.1.1: TELLUS quantified objectives 2006 / 2010 for Rotterdam

TELLUS OBJECTIVES	Quantification for 2006	Quantification for 2010
Increase the modal share in favour of public transport	3%	5%
Reduce congestion	5%	10%
Reduce traffic related CO2 emissions and energy use	5%	10%
Reduce car kilometres	3%	5%
Reduce air pollution and noise to levels below national and EC directives	several limit values	several limit values
Improved intra-organisational co-operation at the city level	not quantified	not quantified
Achieve extensive political and public awareness for TELLUS	not quantified	not quantified
Increase public transport use	5%	10%
Increase bicycle kilometres	15%	30%
Improved public-private co-operation	not quantified	not quantified

Each TELLUS city adopted the common methodological approach to the analysis of the impacts of the implemented packages of measures. This approach has been set out by METEOR[35] and is also further elaborated in part 1, section 5. METEOR is responsible for the cross-site evaluation of the impacts of the integrated measures implemented by the 4 CIVITAS Projects.

The CIVITAS Initiative, upon specific indication of the European Commission (EC), will be evaluated according to the guidelines set out by the MAESTRO Project. In compliance with the outlined approach, METEOR defined the foregoing activities for the city level evaluation:

[35] *Evaluation Guidelines* METEOR WP4 Project Impact Evaluation Task 4.1, November 2002

- An Ex-ante Evaluation aimed at estimating the likely impacts of the CIVITAS Projects prior to their implementation;
- An Ex-post Evaluation aimed at analysing the actual impacts of the CIVITAS Projects comparing the estimated and real life results, feeding results into the chosen evaluation methods and consider whether the project has met its objectives.

An Initial Evaluation, aimed at the definition of the expected impacts, and originally also a defined activity in the MAESTRO project was not required since the CIVITAS cities had already completed such exercise at the time of METEOR inception.

For the ex ante evaluation for 2006 an evaluation has been carried out by the LEM (see chapter B.3). This evaluation addressed the individual demonstration measures but also formed the starting point for a summative evaluation on city level. The study showed however that it is difficult to give a conclusion about all the TELLUS measures put together. Synergy effects for instance could not be quantified. Furthermore the measures vary considerably, in both scope and range. Therefore, and because of the uncertainty in the quantitative data, the summative evaluation has not been conducted.

The ex ante evaluation for 2006 ultimately was limited to a do-nothing level that can be derived from the indicator fact sheets for key indicators. As this level could not be compared with predicted outcomes of TELLUS measures, no further effort was put in deriving actual data for 2006.

The evaluation on city level is thus carried out in two steps:

- Ex post evaluation for 2006;
- Ex ante evaluation for 2010.

C.2 Ex post evaluation for 2006

The ex post evaluation will be discussed along the next two issues:

- TELLUS Key Indicators
- Contribution of TELLUS

C.2.1 TELLUS Key Indicators

The assessment of the results of the set of demonstration measures achieved on city level is taken out against the TELLUS objectives identified for Rotterdam. Most of these objectives are quantified and relate to two periods: from 2002 until 2006, and from 2006 until 2010.

In the inception report, the objectives “reduction of NOx emissions from heavy traffic” and “reduction of road casualties and injured persons” are not stated for Rotterdam.

Key indicators have been identified to evaluate and assess the TELLUS objectives and have

been described in the Local Evaluation Plan for Rotterdam[36] The key indicators are tailor made to the TELLUS objectives and therefore differ from the pan-European core indicators described by METEOR. Some core indicators did not cover any of the TELLUS objectives (e.g. operating revenues, CO emissions, accuracy of PT time keeping). Some other key indicators were not covered by core indicators at all (e.g. public transport passengers and co-operation strategies to improve intra organisational co-operation). The majority of key indicators however was congruent with METEOR core indicators.

Table C.2.1.1 gives an overview of the TELLUS key indicators, the objectives for which they are used and the units by which they are expressed. For each key indicator a fact sheet was composed. The TELLUS Key Indicator Fact Sheets have the following structure:

- Context, impacts
- Unit of the indicator
- Indicator related objectives
- Methods of measurement
- Source of data and analysis
- Legal basis, standard values, political objectives
- Time table to collect and analyse the data
- Development of the indicator value
- Relation to other indicator systems

[36] Local Evaluation Plan Rotterdam, table 6. IVAM University of Amsterdam, 2003.

Table C.2.1.1 List of key indicators

TELLUS objective	Key Indicator	Unit of the indicator
Reduce congestion	Mean journey times between given locations	Minutes per journey
	Average vehicle speed between given locations	Km/hr (derived)
Reduce NOx emissions	NOx emission	Tons p.a.
Reduce air pollution	level of CO	milligram/m³
	level of NO2	µg/m³
	level of PM10	
	level of benzene	
Reduce traffic related CO2 emissions	CO2 emissions	Tons p.a.
Reduce noise	Noise level	dB(A) road length
Reduce traffic related energy use	Primary energy use	TeraJ/a
	Final energy use	TeraJ/a
	Type-specific final energy use	TeraJ/a
Reduce road casualties and injured persons	fatalities, road accident-related injuries	Total number
Increase the modal share in favour of public transport	Average modal split	Percentage of trips (or vehicle kilometres or passenger kilometres)
Reduce car kilometres	Car kilometres	Total number
Increase of public transport use	Passenger kilometres	
	Passengers	
Improvement of intra-organisational co-operation at the city level	Quality of intra-organisational co-operation	Qualitative terms
Improvement of public-private co-operation	Quality of public-private co-operation	Qualitative terms
Achievement of political and public awareness	Media exposure	Qualitative and quantitative terms
	Events organised	
	Presentations given	

For some of these indicators quantitative data are available for both the base year (typically 2001) and the baseline value for the year 2010. The latter value is of interest for the ex ante evaluation 2010 in chapter C.3. There an interpretation of trends and scenario's is also given.

The data are presented in the tables C2.1.2 and C2.1.3. See for more information also the indicator fact sheets in Annex 2.

Table C.2.1.2 TELLUS Key Indicator – Transport

TELLUS Key Indicator	Unit	Specification	Base year value (2001)	Do nothing baseline value (2010)
TRANSPORT				
Fatalities	Number of fatalities		40	29
Road accident-related injuries	Number of injured persons within admission to hospital		561	319
Average vehicle speed	Km/h	all vehicles evening peak	24	22
Car kilometres	Car-km/a		6.293.000.000	8.132.800.000
Public transport passenger movement	Number of passengers/a	including light-rail, subway, bus, tram	908.000.000	1.136.200.000
Average modal split	Number of trips (%)		car: 65% train: 3%, bus/tram/metro:3%, moped: 1% bike: 26%	car: 66% train:3%, bus/tram/metro:3%, moped: 1%, bike: 25%

Table C.2.1.3 TELLUS Key Indicators – Environment and Energy

TELLUS Key Indicator	Unit	Specification	Base year value (2001)	Do nothing baseline value (2010)
ENVIRONMENT				
PM10 levels	µg/m³	annual mean (roadside)	37	Decreased
		annual mean (40 µg/m3)	Exceeded mainly in the harbour and around de river. But also around the main roads.	
NO2 levels		annual mean (roadside)	39,7	Decreased
		1h average (200 µg/m3)	The hourly limit of 200 µg/m³ in the last years hardly was exceeded.	
		annual mean (40 µgm3)	Exceeded in several areas in the region: the harbour (industry and shipping traffic), around the main roads and parts of the city Rotterdam	
Benzene		annual mean	1,8 (4 locations).	Stable
CO		annual mean	n.a.	
CO2 emissions	t/a	Primary energy related	1.806	Slight increase
NOx emissions	T/a	Primary energy related	11.218	Decreased
Noise level dB(A) road length	Equivalent noise level Laeq in dB(A)	Number of inhabitants	roads: >65dB(A) n =189.000 rail: >65dB(A) n = 1.000	roads: >65dB(A) n = 216.000, rail: >65dB(A) n = 3.000
ENERGY				
Final energy use by traffic	Terajoule/a	urban traffic		Slight increase

C.2.2 Contribution of TELLUS

The overview of evaluation results on city level is given in table C2.2.1 For this table the same method was used as for table B.3.1.

For measures that were cancelled (3) and seriously delayed (3) no key indicators could be assessed. Therefore they show 'grey' evaluation areas. For measure 12.1 two alternatives were used. One of the alternatives (SCR filter) was successfully implemented the other (DNO_x) was no success. Only the successful alternative is considered in this evaluation. Measure 12.3 (Clean vehicles for waste collection) addresses two kinds of vehicles, namely the vehicles for waste collection and sweeping machines. Therefore WP 12.3 counts as two measures.

For the shaded cells in the table no key indicators were selected at the start of TELLUS. The green cells in the table are positive, *i.e.* the score is 'good'. The red cells are negative, *i.e.* the score is 'bad'. For the yellow cells the impact is neither negative nor positive, or 'neutral'. These scores were determined by adding the individual scores per key indicator[37].

As no TELLUS objectives for Rotterdam were formulated within the area's Society and Economy, no Key Indicators were selected in these areas. However, according to table C2.1.1 on city level an assessment was made of the intra organisational cooperation, the public private cooperation and the awareness. This is elaborated in the Annex: key indicator fact sheets.

Table C.2.2.1 shows that for many measures no key indicators were selected for the Transport area. This is mainly because no impact on modal split was expected. This is often the case in 'technical measures' like clean vehicles. It was for instance not expected that people will use the bus more because of the filter system. The impact in this evaluation area in most cases is related to the indicator 'success of advertising' which gives information on the quality of service. We attributed this indicator as key indicator for the awareness of people for the availability of new and innovative transport options.

[37] Indicators are added by the following rule: score + and score –, add up to +/-. Furthermore, + and +/- add up to +, and – and +/- add up to –. As an example, the scores +, +/-, +/-, – , –, +/-, +/- add up to – regardless the sequence in which they are added up.

Table C.2.2.1 Overview of evaluation results per evaluation area, based on Key Indicators

WP	Measure	TRANSPORT	ENERGY	ENVIRONMENT
5.1	Access time window			
5.2	Dedicated bicycle routes	+	+	+
5.3	Truck parking management			+
5.4	Transport priority and dedicated lanes	?	+/-	+
6.1	P&R pricing strategies for target groups	+	+/-	+/-
6.2	Kilometer pricing			
6.3	Demand dependent paid parking			
7.1	Integration of cycling and public transport	+	+	+
7.2	Large scale expansion of P&R	?	?	?
7.3	PT over water	+	-	-
7.4	Automated people movers			
8.1	Electric two-wheelers	+	+	+
8.2	Expansion of van pooling for commuters	+	+	+
8.3	Expansion of car sharing	+	+	+
9.1	E-commerce logistics			
9.2	Multi core tube logistics	+	+/-	+
10.1	Green commuter plans	+		
10.2	Integration of P-P transport Initiatives.			
10.3	New approaches to integrated planning	?		
11.1	Integration of transport management systems		+/-	+/-
11.2	Intermodal travel information			
11.3	Dynamic PT information	-		
12.1	Clean and silent PT fleet DNOx		+/-	+/-
12.1	Clean and silent PT fleet SCR		-	+
12.2	Electric vehicles for the distribution of goods		+/-	+/-
12.3	Cleaner vehicles for waste collection: active filter		+/-	+/-
12.3	Cleaner sweeping machines CPO filter system		+/-	+
12.4	Electric vehicles in public fleets	+	+	+

For the evaluation on city level, for each evaluation area the scores were gathered in a pie diagram (figures C2.2.1, C2.2.2 and C2.2.3). Evaluation areas with unknown scores (“?”) were left out in this overall evaluation.

Transport:

TELLUS can be regarded as 'good' for transport. All evaluated measures but one have a 'good' score on Transport. For 11.3 the negative score is due to the negative score on the key indicator 'success of advertising'. This indicator is defined in the methodology of METEOR as the percentage of people who know about service thus the availability of information for target groups.

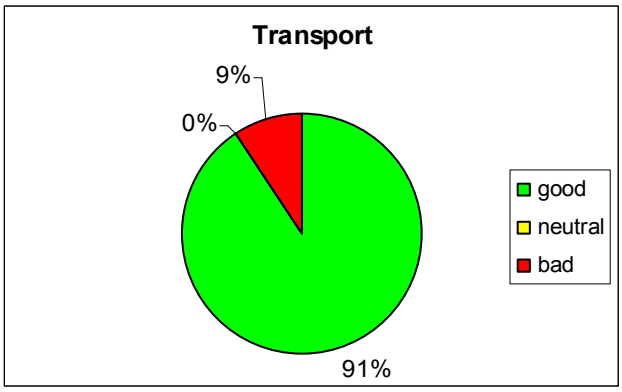


Figure C2.2.1 Evaluation of Transport on city level

Energy and environment:

The overall impact on energy and environment of TELLUS is also 'good'. Indeed some measures had a positive impact on modal split in favor of bicycles and public transport. In these cases the impact on energy and environment was evaluated as positive. Exception is the water taxi that has a bad score on energy because a lot of people use the boat for 'fun' and because it has a noisy diesel engine. The measures that are specially focused on clean alternatives, especially within work package 12, should have a positive score on the area of Environment, however their contribution is somewhat disappointing due to the poor technical performance that occurred in some cases. When the introduction of cleaner vehicles succeeded (hybrid cars, filter systems on sweeping machines), these measures also showed good performance in this evaluation area.

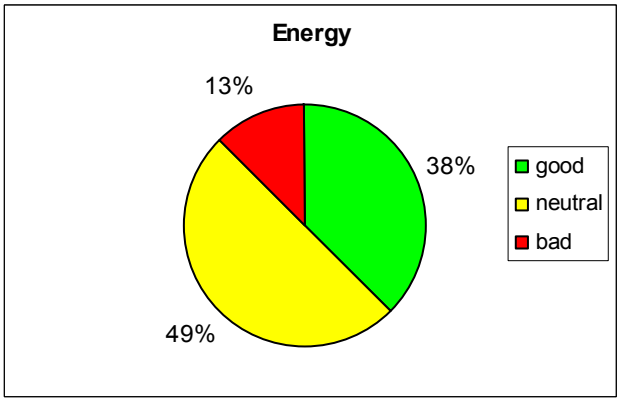


Figure C2.2.2 Evaluation of Energy on city level

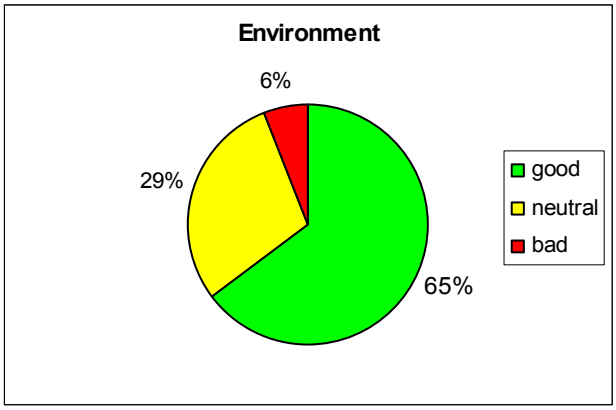


Figure C2.2.3 Evaluation of Environment on city level

Society

On city level a positive impact in the area of *Society* was identified based on an improved intra organizational cooperation. A majority of respondents indicated that this cooperation had improved due to TELLUS. From this majority also most people expect a lasting improvement even after the TELLUS project.

In general we conclude that the TELLUS measures had positive impacts in all evaluation areas considered. Only for the area of Economy no such evaluation could be made. In the section below we will address the contribution of TELLUS to the objectives formulated (see table C.1.1).

C.2.3 Clean Urban Transport

For Rotterdam the major goal of TELLUS was to create clean urban transport of people. The major corresponding (and interrelated) objectives for Rotterdam concerning Transport, Energy and Environment were formulated as:

- Increased modal share in favour of public transport.
- Reduced congestion
- Reduced CO_2 emission and energy use
- Reduced car kilometres
- Reduced air pollution and noise
- Increased public transport use
- Increased bicycle kilometres

Basically this can be accomplished in two ways; by a modal shift in favour of public transport and bike and by clean alternatives. In total, 15 out of the 20 measures that were implemented in Rotterdam were designed to meet this goal. The figure overleaf shows that four measures

are aimed to shift car use to bike use. Eight measures are aimed to shift car use to the use of public transport and five measures offer a clean alternative, four of which for the car and one for the regular public transport. Some measures work in two ways:

- Integration of cycling and public transport, *i.e.* bicycle parking near metro stations, make people use the bike and public transport instead of their car.
- Automated people movers make people use public transport and the shuttle. As a result car kilometres are partly replaced by public transport kilometres and partly by a clean alternative, the shuttle.
- Expansion of car sharing make people use a smaller and cleaner car (petrol instead of diesel) and make people use public transport instead of the car, at least for those people who get rid of (one of) their own car(s).
- Green commuter plans stimulate people to choose for PT and/or the bicycle.

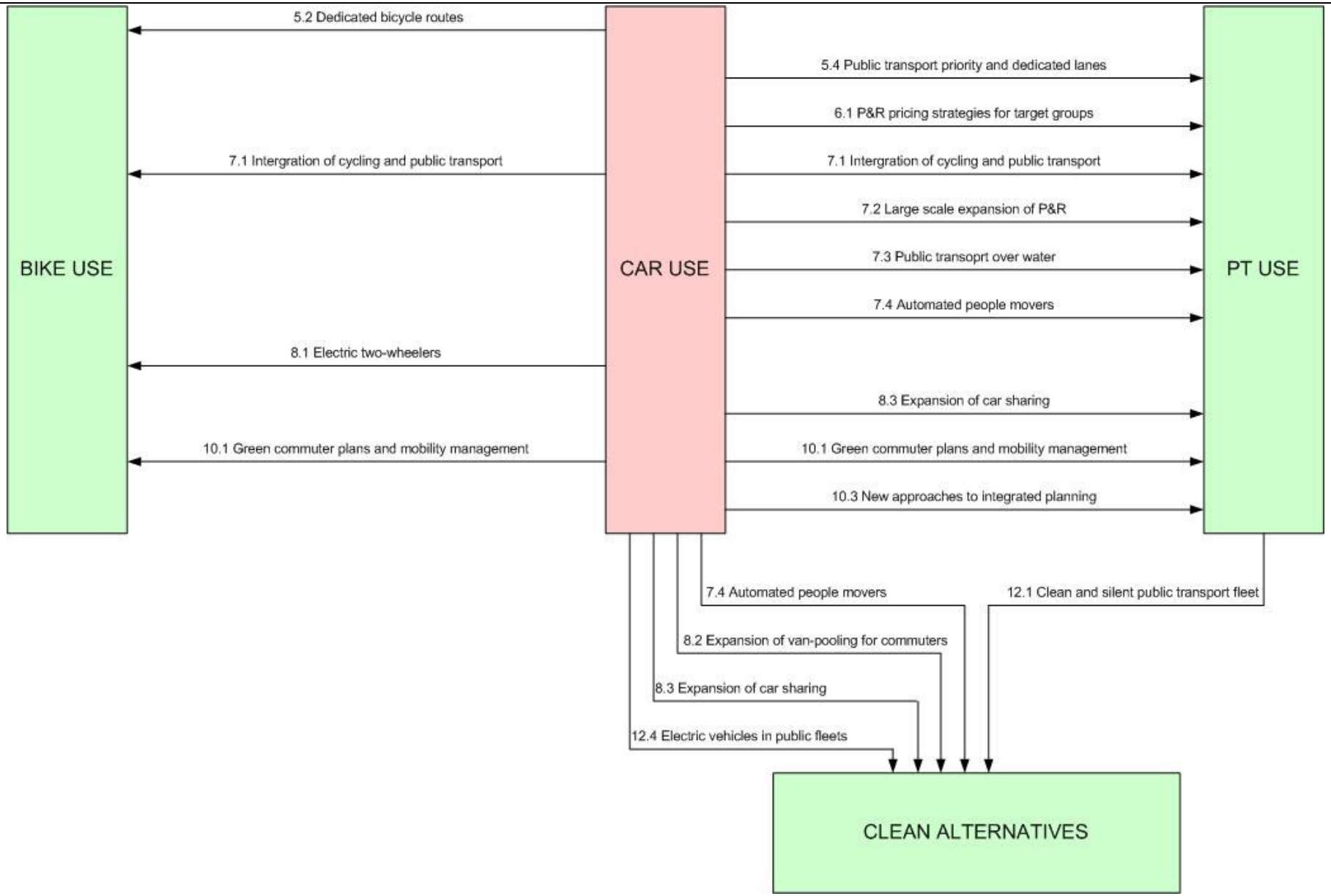
It must be emphasized that road pricing and express lane, two measures with good potential for modal shift in favour of public transport were cancelled and therefore are not presented in the figure. However they will be part of the ex-ante evaluation for 2010, discussed in C.3.

Although it was not possible to carry out quantitative evaluations of the measures shown in the figure, it was yet possible to obtain qualitative results. Only for the automated people movers no results were obtained, due to delayed implementation. However, by the time this report was written, the shuttles were about to be used for transport of people. As it is expected that they will attract commuters who traveled by car before using the shuttle it is expected that the impact of the automated people movers will be positive in 2006.

Considering the trend in Rotterdam for some key indicators the objectives for 2006 will not be met. The reduction of car kilometers, the reduction of congestion (higher vehicle speed), reduction of CO_2 emissions and higher share of PT are not likely to occur or at most will remain stable. Other objectives however are more likely to be met such as an increased public transport use, reduction of noise levels and improved intra-organizational cooperation. Also a reduction of NO_x emissions is expected although this is not formulated in an objective for Rotterdam.

The overall impact of the measures in the figure (next page) with respect to the TELLUS objectives can be estimated by the impact on the key indicators modal split and emissions.

From the considerations above we conclude that the majority of TELLUS measures have a positive contribution to the specific TELLUS objectives for Rotterdam. However, a quantitative analysis of the contribution was impossible and therefore it is unsure to what extent the TELLUS measures were able to slow down negative trends or to enforce positive trends.


BIKE USE
CAR USE
PT USE
CLEAN ALTERNATIVES
5.2 Dedicated bicycle routes
7.1 Intergration of cycling and public transport
8.1 Electric two-wheelers
10.1 Green commuter plans and mobility management
5.4 Public transport priority and dedicated lanes
6.1 P&R pricing strategies for target groups
7.1 Intergration of cycling and public transport
7.2 Large scale expansion of P&R
7.3 Public transoprt over water
7.4 Automated people movers
8.3 Expansion of car sharing
10.1 Green commuter plans and mobility management
10.3 New approaches to integrated planning
7.4 Automated people movers
12.1 Clean and silent public transport fleet
8.2 Expansion of van-pooling for commuters
8.3 Expansion of car sharing
12.4 Electric vehicles in public fleets

C.3 Ex ante evaluation for 2010

As mentioned earlier an ex-ante evaluation aims at predicting impacts of projects before they are actually implemented. As we consider here the ex-ante evaluation for the year 2010, the evaluation here deals with the expected impacts of TELLUS measures prior to their *full* implementation. The potential for implementation is considered in the evaluation reports for individual measures (section B) where the up-scaling of measures has been addressed.

The ex ante evaluation for the year 2010 originally consisted of several steps:

- The identification of a Baseline (a snapshot of the situation prior to the implementation);
- The production of estimations through an appropriately custom-tailored model (ITEMS) for a do-nothing Scenario (e.g. a scenario projecting the estimated situation without the CIVITAS Initiative);
- and for a CIVITAS Scenario, projecting the estimated situation with the CIVITAS Initiative.

In the course of the TELLUS project the use of the ITEMS model has been the subject of debate. This issue has been addressed during several workshops and meetings (i.e. June 2004 in Brussels and September 2004 in Berlin). The outcome of these discussions was the recognition of the different models already employed by the cities. ITEMS was recognized as a suitable model for the up-scaling of evaluation results.

In the case of Rotterdam a considerable amount of data has been gathered and used as input for the ITEMS model. It was learned from there that the basic indicators on mobility and traffic for the base year were reasonably comparable. On the other hand the basic indicators on energy and related emissions seemed less realistic for the Rotterdam situation although a quantitative comparison could not be made.

On the level of the trend scenarios there were also large differences. The scenarios from ITEMS differed substantially from the validated Rotterdam trend model: It was concluded from here that the Rotterdam model would be used for baseline and trend scenarios instead of the ITEMS model.

C.3.1 Baseline and trend scenarios

A full description of the baseline situation and trends in key indicators is given in the indicator fact sheets for Rotterdam. These sheets describe amongst others the definition of the indicator and the method of measurement. Baseline situation data usually are based on monitoring of relevant parameters. Some indicators have been estimated with the help of model tools, for instance the spatial variation in air quality throughout the region of

Rotterdam. Trend scenario's mostly have been depicted with the help of the Rotterdam trend model for traffic and transport (*RVMK*) which also is fed by actual monitoring data.

This paragraph only gives a short overview of the status for relevant indicators within the areas of transport and environment.

Transport

Since 1998 the average speed on the city roads has decreased indicating a growing congestion problem. The decrease is caused by a risen car possession and subsequently a larger number of cars on the roads especially in the periphery. In the inner city the average speed data show a stable level. Since 2000 the average speed seems to be stabilized all together and experts think that the average speed will be stable for the coming years or show just a slight decrease.

The amount of car kilometres has risen also since 1998 in the region of Rotterdam and is expected to rise further to 2010. The number of passengers kilometres made by public transport will also increase till 2010. The number of injured persons in traffic decreased over the last years. The number of people killed in traffic strongly fluctuates over the years, but also there a decreasing trend is visible. These trends are expected to continue till 2010.

Environment (air quality and noise)

The air quality in the region Rotterdam is influenced by many sources, both regionally located sources as sources further away (e.g. sources outside the Netherlands). The most important source categories comprise of road traffic, shipping, industry and households.

The emission of by traffic is decreasing, despite of the risen number of vehicle kilometres. The NO_2 level of 40 µg/m³ is exceeded in several areas in the region: the harbour (industry and shipping traffic), around the main roads and parts of the city Rotterdam. The annual limit value is since several years around the 40 µg/m³. The hourly limit of 200 µg/m³ in the last years hardly has been exceeded. The PM10 (small particles) level of 40 µg/m³ is exceeded mainly in the harbour and around the river, but also around the main roads. The emission of CO_2, the most relevant greenhouse gas emission, is expected to be stable as car kilometres might grow but the emission factor per kilometre will be reduced due to technical improvements.

Calculations have been made for both 2002 and 2010 for the noise nuisance caused by road traffic, rail traffic, air traffic and industry. Between 2002 and 2010 the number of residents that will be exposed to noise from road traffic, rail traffic and industry will rise. The increases are caused by: a general increase of road traffic and rail traffic. But also the increasing number of residents themselves plays an important role here making it inevitable that in a densely populated area conflicts between functions will occur.

C.3.2 CIVITAS scenario

In principle the impact of a number of measures on key indicators in 2010 could be quantified with the available Rotterdam trend model for traffic and transport (*RVMK*). This especially holds for the larger sized measures such as the large scale implementation of environmental zones, P&R, kilometre pricing, new PT concept (TramPlus) or clean vehicles. The quantification obviously is only possible when a sufficient number of input data with sufficient quality is available. Even then however the use of model outcomes should be considered carefully given the number of uncertainties accompanying the model. In this study we found an even less ideal situation as the amount of data of sufficient quality is too little to justify a model based quantification. Instead we opted for a qualitative approach where the results from the TELLUS measures were used in combination with expert judgment values of the evaluation team.

For the ex ante evaluation for 2010 all 26 measures are involved. Table 3.2.1 shows the result of this ex ante evaluation. For each measure based upon the scenario as described in the individual measure level reports, the potential ‘size’ for 2010 is listed in the table. Based upon this size and the overall outcome of the evaluation of measures the potential impact on city level of individual measures for 2010 was estimated on a 3-point scale, ranging from “Small” to “Medium” to “Large”.

It is expected that several key indicators towards 2010 show a positive trend. Although the number of car kilometers will grow even further, indicators such as air quality and use of PT will improve. TELLUS measures play a significant role in policy plans to support these trends.

Some measures with an expected large impact (priority for PT, kilometre pricing, large scale expansion of P&R, clean vehicles in public and private fleet) are not yet considered in this trend analysis. An implementation of these measures could help to enforce the positive trends and, just as important, slow down negative trends such as growing car kilometres or CO2 emissions.

Table C.3.2.1 Ex ante evaluation for 2010.

Nr	Measure	Potential "size" in 2010	Potential Impact on City level
5.1	Access time window	Quality network operational	M
5.2	Dedicated bicycle routes	network of 10-12 lanes, total of 50 km	M
5.3	Truck parking management	2 sites operational	S
5.4	Transport priority and dedicated lanes	Over 50% of passengers (2015)	L
6.1	P&R pricing strategies for target groups	Several P&R sites Mutual support with 7.2	*
6.2	Kilometre pricing	Operational	L
6.3	Demand dependent paid parking	Several sites operational	M
7.1	Integration of cycling and public transport	Parking sites at 30 Metro stations	M
7.2	Large scale expansion of P&R	18.000 places, 40 P&R sites (region)	L
7.3	PT over water	6 12-person boats connect 40 stages	S
7.4	Automated people movers	10 locations of 12 20-person shuttles	M
8.1	Electric two-wheelers	Limited number (50-100)	S
8.2	Expansion of van pooling for commuters	75 9-person vans	M
8.3	Expansion of car sharing	73 cars (total)	M
9.1	E-commerce logistics	Several portals operational	S
9.2	Multi core tube logistics	40 kilometer tube	S
10.1	Green commuter plans	Website Operational	S
10.2	Integration of P-P transport Initiatives.	Operational	M
10.3	New approaches to integrated planning	At several locations	M
11.1	Integration of transport management systems	6 drips	S
11.2	Intermodal travel information	Operational on mobile	S
11.3	Dynamic PT information	At all stops	M
12.1	Clean and silent PT fleet DNOx	Not to be implemented	
12.1	Clean and silent PT fleet SCR	Whole public bus fleet (200-300)	L
12.2	Electric vehicles for the distribution of goods	Several vehicles. Mutual support with 5.1	*
12.3	Cleaner vehicles for waste collection active filter system	75 clean vehicles for waste collection	M
12.3	Cleaner sweeping machines: CPO filter system	50 sweeping machines	S
12.4	Electric vehicles in public fleets	Electric public fleet	S

* For this measure no separated potential impact for 2010 was predicted as it is part of another measure

The impact of some of the measures can be verified by reviewing policy documents developed or under development in Rotterdam. The draft Action plan Air Quality (October 2005) describes some measures from the TELLUS family and assesses the size of their impacts. This is done by means of expert judgement and usually on a semi-quantitative scale. The following items are presented in this Action plan:

- Implementation quality network (see 5.1): 'Impact on NO_x and PM10 within the city to a maximum of a few percent depending on the design. On regional scale only a minor impact';
- Implementation of environmental zones (see 5.1): 'The PM-level could decrease with 1-2 $\mu g/m^3$, depending on the design of the measure';
- Dedicated bicycle routes (see 5.2): impact not assessed;
- Expansion of paid parking (see 6.2): impact not assessed;
- Expansion of P+R (see 7.2): impact not assessed;
- Pipeline transport of fluids (see 9.2): impact not assessed;
- Cleaner vehicle in the PT fleet (see 12.1): 'Impact on NO_x and PM10 till 1% respectively 0,5% reduction';
- Cleaner vehicles general (see partly 12.4): 'Impact on NO_x and PM10 till 5% reduction'.

This overview shows that some TELLUS measures already have been identified to support policy for a better air quality in the future. It also shows the difficulties in predicting future scenarios and their quantitative impacts. Note that these measures relate to the Action plan Air Quality. Other measures are identified also for future implementation but within other policy documents (e.g. the TramPlus concept from measure 5.4 has been identified in the Regional Traffic en Transport Policy Plan 2003-2020).

D FINAL CONCLUSIONS

During the four years TELLUS period and with 26 measures to focus on, a lot of information about the measures, their implementation and their impacts was gathered. As the large amount of information is unsuited for a simple set of conclusions, in the first paragraph of this chapter only the most striking conclusions are presented. Next, the conclusions are elaborated in paragraphs on the process, the impact and the methodology.

D.1 Conclusions

- In general, the implementation process was successful.
- Policy is a strong prerequisite for successful implementation.
- To have strong and enthusiastic persons in charge of a project is a strong driver.
- The presence of private stakeholders is a strong driver.
- The integral TELLUS approach resulted in an improved cooperation.
- The implemented measures will be continued and will grow to their full size.
- Most measures are good for society, transport, energy and environment.
- Most measures have a negative economic impact on measure level.
- Measures with innovative techniques suffered from many technical breakdowns.
- In general, the METEOR indicators and evaluation areas are useful for evaluation.
- The methodology could be improved by rules for aggregation and system boundaries.
- The evaluation period should be longer than the demonstration period.

D.2 Process Evaluation

Within TELLUS 26 demonstration measures were planned. By October 2005 20 measures were actually implemented, three measures will be implemented in the near future and three measures were cancelled. Based upon these figures it can be concluded that the overall implementation process was successful.

In order to evaluate the implementation process of individual measures more in-depth the local evaluation manager organized interviews with the demonstrators. Several aspects of the implementation process were discussed during these interviews: the milestones, the cooperation between stakeholders and the barriers and drivers that occurred in the four year TELLUS period. For the sake of simplicity barriers and drivers can be divided into categories

like; policy related, financial, technical, societal and process related. However, in practice they are often intertwined.

The most common factor that can be identified is the complexity of the implementation process. Therefore it is important to have one or more strong and enthusiastic person(s) in charge of the project. Another important driver is the presence of private stakeholders with commercial interests. As policy makers rely more on market parties to initiate and implement measures the participation of these stakeholders gets more relevant. Finally also new developments can create a sense of urgency amongst politicians, e.g. when air quality becomes a more important parameter in the decision making process. This has certainly boosted some measures dedicated to this parameter.

For the successfully implemented measures however it is difficult to find a general principle for success as the barriers and drivers are strongly measure specific. For each and every measure a variety of drivers and barriers can occur. Of course technical measures like clean vehicles have greater chance to meet a technical barrier then measures that focus on integrated planning. Nevertheless, in general it can be concluded that for the implemented measures apparently the drivers were stronger then the barriers.

An important conclusion is that the implementation of so many demonstration measures in one integral TELLUS project did result in an improved intra organisational cooperation and did create a breeding ground for future clean urban transport initiatives, supported by the people and politicians of Rotterdam. As a first result all implemented demonstration measures will be continued after TELLUS and many measures will grow to full size implementation.

Three measures were cancelled: kilometre pricing (5.1), demand dependent parking (6.3) and E-commerce logistics (9.1). Furthermore, the bicycle lanes (5.2), although implemented and impact evaluated, can be regarded as ‘cancelled’ as at the very start of TELLUS it was cut down from four dedicated bicycle lanes to one lane, only because this lane was already beyond the point of no return. Three of these measures (5.1, 6.3 and 5,2) were cancelled due to chance in policy, after the elections. The failure of E-commerce logistics was due to financial problems.

Three measures were seriously delayed: access time windows (5.1), automated people movers (7.4) and intermodal travel information (11.2). For two of these measures (5.1 and 11.2) the changed political view was an important barrier. For the automated people movers the financial barrier was the cause of delay.

Therefore, it can be concluded that political and financial barriers could not be overcome (yet) for these cancelled and delayed measures. As mentioned above however an interesting development is that due to European directives, traffic related emissions of dust and air quality recently have a high priority on the political agenda in the Netherlands. As a result new initiatives are expected for road pricing and access time windows for clean commercial

vehicles (environmental zones). For the same reason the dedicated bicycle routes will get a new start.

D.3 Impact Evaluation

The impact of TELLUS has been evaluated along the lines of five category areas: society, transport, economy, energy and environment. The evaluation methodology was proposed by METEOR and has been adopted by the LEM. In this report impacts were evaluated on two levels namely on the level of measures and on the level of the city. The evaluation on measure level was conducted with a variety of indicators covering all five areas. The city level impact evaluation was conducted solely on the basis of so-called key indicators. The conclusions from both levels of evaluation are discussed below.

Impact evaluation on measure level

For measures that were cancelled (3) or seriously delayed (3) an impact evaluation could not be carried out. For the other 20 measures an impact evaluation has been carried out.

The majority of measures have a positive impact on the area of *Society*. The most significant indicator here is the acceptance amongst various stakeholders (e.g. PT users, car commuters, bicyclists) for the measures as they improve their transport situation. Neutral or negative impacts are mostly related to technical failures especially within the workpackage on clean vehicles.

Most measures have a negative score on *Economy* due to the fact that costs (investment, maintenance, etc.) are not compensated by financial benefits. It must be stated however that the discussion about system boundaries considered is of particular importance here. Long-term economic effects for society, e.g. due to lower health costs when air quality improves, are not taken into account.

Most measures have a positive (or neutral) impact in the evaluation area *Transport*. There are various indicators responsible for this outcome, i.e. dedicated to either the quality of service or modal shares, which contributed similarly. Only the DNOx filters and electric vehicles have a negative score on Transport because of the many breakdowns.

In general the score for the category *Energy* is about the same as the score for *Environment*. This makes sense as the most important environmental indicator is the energy related emission of CO2, NOx and dust. Most measures have a positive impact on both Energy and Environment.

The clean vehicles (12.1 to 12.4) show a relatively large number of neutral scores as after their implementation several breakdowns occurred (DNOx filter, electric vehicles, active filter systems for waste collection vehicles). Because of these breakdowns no impact (neither

positive nor negative) on environmental indicators could be established although from the perspective of eco-efficiency (performance related to costs) this is not a good result.

For the CPO systems considered in 12.3 the positive impact is due to reduced emissions of VOC and CO. The intended reduction of small particles (PM10) however was very small.

For only two measures the impact on Energy is negative. For the SCR filters (12.1) this is due to the energy consumption needed to produce its catalyst, urea. For the water taxi (7.3) the negative score on energy is caused by the relatively large number of people that use the water taxi just for fun.

Impact evaluation on city level

The impact on city level was based upon the key indicators. On city level, the base line scenario was determined, *i.e.* the values of key indicators were determined for the year 2001 and 2010 without taking the implemented TELLUS measures into account. This base line scenario indicates only a very small change in modal split as both the use of private cars and public transport will increase. However, traffic in Rotterdam will be safer and cleaner. On the other hand, the number of people that will be exposed to noise from road traffic will rise.

For measures that were cancelled (3) and seriously delayed (3) no key indicators could be assessed. The impact evaluation on city level for 2006 therefore consists of the sum of the remaining 20 measures as far as key indicators were attributed to these measures. The impact evaluation on city level due to these 20 measures was hampered by a lack of quantitative data. However, a qualitative evaluation related to the TELLUS objectives could be carried out.

For Rotterdam the major goal of TELLUS was to create clean urban transport of people. Basically this can be accomplished in two ways; by a modal shift in favor of public transport and bike and by clean alternatives. In total, 15 out of the 20 measures that were implemented in Rotterdam were designed to meet this goal. Four measures are aiming to shift from car use to bike use. Eight measures are aiming to shift from car use to the use of public transport and five measures offer a clean alternative, four of which for the car and one for the regular public transport. Some measures work in two ways.

It must be emphasized that road pricing and express lane, two measures with good potential for modal shift in favor of public transport were cancelled and therefore are not considered in this evaluation.

Based on this qualitative evaluation TELLUS can be regarded as ‘good’ for *Transport*. All measures (but one) with key indicators assigned to the area of *Transport* have a positive impact. The overall impact on *Energy* and *Environment* of TELLUS is also ‘good’. Indeed several measures had a positive impact on modal shares of bicycles and public transport. In

these cases the impact on *Energy* and *Environment* was evaluated as 'good'. The same also applies to the successful implementation of clean vehicles.

As no TELLUS objectives for Rotterdam were formulated within the area's *Society* and *Economy*, no key indicators were selected in these areas. However on city level an assessment amongst demonstrators was made of the intra organizational cooperation as this parameter was identified as suited for the *Society* area. A majority of demonstrators indicated that this cooperation had improved due to TELLUS. From this majority also most people expect a lasting improvement even after the TELLUS project.

The identified impacts on key indicators helped to evaluate the possible contribution to future objectives. For this so called 'ex ante evaluation for 2010' all 26 measures are involved. Based upon their size and the overall outcome of the evaluation of measures the potential impact on city level of individual measures for 2010 was also estimated on a qualitative scale. It is concluded here that although some individual measures have the potential to generate a large impact it is also expected that the combination of all measures will have the most significant impact. Not only will the combination of measures lead to a synergy effect, also a broad implementation of measures will enhance the awareness for sustainable traffic and transport and increase the sense of urgency to undertake this type of measures.

The large scale implementation of TELLUS measures thus is expected to contribute to diminishing the problems of congestion and air pollution.

Finally the impact of TELLUS measures on city level perhaps is illustrated most firmly with the recently formulated policy document called Action plan Air Quality (draft October 2005). In this plan 8 TELLUS measures already have been identified to support policy for a better air quality in the future.

D.4 Evaluation methodology

For a large variety of measures the 'long-list' of indicators is sufficient to select a proper set of indicators for the evaluation. However, next to the selection of the proper indicators, the choice for the system boundary is very important.

As in practice the same indicator can be determined within different system boundaries for different measures, it will not be easy to compare the evaluation results. This may conflict with the objective of the proposed methodology to increase transferability between cities and their measures.

The aggregation method from indicators to evaluation area also plays an important role in the evaluation results. For some indicators assessment factors are available from other scientific areas. Within the domain of environmental life cycle assessment for instance several methods to assess the emissions to the environment are available. For the economy area

also an aggregation seems possible as all indicators are expressed in a similar unit (euro). Other aggregation methods are entirely built on subjective elements based on societal or other preferences. Therefore METEOR does not describe how to choose your system boundaries or what weights you should use in the aggregation of indicators.

Furthermore it appeared during the evaluation process that the top down selection of indicators sometimes conflicts the bottom up practice. Again this is also related to the chosen system boundary.

For complex integrated measures, an evaluation based upon separate indicators is less suited due to interference and/or synergy with other measures as well as with other circumstances that do have an influence on the impact but have nothing to do with TELLUS.

It can therefore be concluded that there is potential for improvement of the proposed evaluation methodology. In this report some of the shortcomings were overcome with the support of aggregation methods thus making it possible to quantitatively evaluate on the level of measures (if sufficient data is available). On the city level the LEM decided to present evaluation results more on a qualitative scale since a summation of individual measures could not be realised in a consistent manner.

As several demonstration measures suffered from delayed implementation the evaluation for those measures could not be carried out properly. Therefore the local evaluation manager experienced that it would have been better if the evaluation period had been prolonged by at least three months, *i.e.* if the evaluation period would have been three months longer than the demonstration period.

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