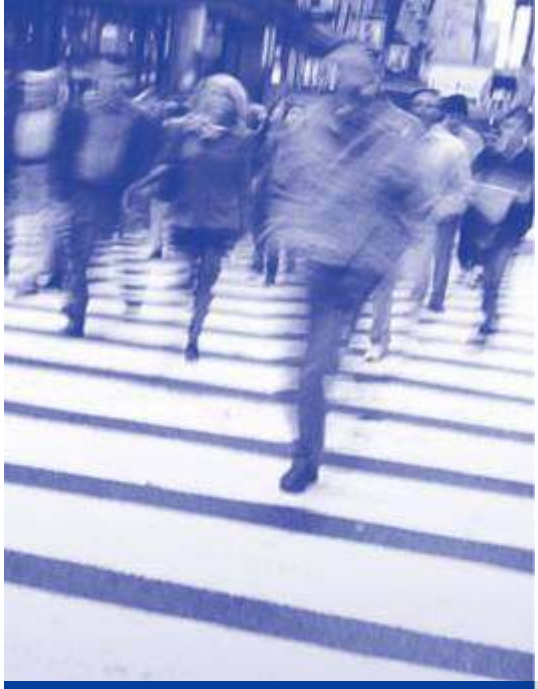

CiViTAS
Cleaner and better transport in cities

AALBORG

Aalborg

T20.1 New public Parking System in Aalborg

Aalborg Kommune
August 2012

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Contents

1. Introduction

1.1. Background CIVITAS

CIVITAS - cleaner and better transport in cities - stands for CIty-VITAlity-Sustainability. With the CIVITAS Initiative, the EC aims to generate a decisive breakthrough by supporting and evaluating the implementation of ambitious integrated sustainable urban transport strategies that should make a real difference for the welfare of the European citizen.

CIVITAS I started in early 2002 (within the 5th Framework Research Programme);
CIVITAS II started in early 2005 (within the 6th Framework Research Programme) and
CIVITAS PLUS started in late 2008 (within the 7th Framework Research Programme).

The objective of CIVITAS-Plus is to test and increase the understanding of the frameworks, processes and packaging required to successfully introduce bold, integrated and innovative strategies for clean and sustainable urban transport that address concerns related to energy-efficiency, transport policy and road safety, alternative fuels and the environment.

Within CIVITAS I (2002-2006) there were 19 cities clustered in 4 demonstration projects, within CIVITAS II (2005-2009) 17 cities in 4 demonstration projects, whilst within CIVITAS PLUS (2008-2012) 25 cities in 5 demonstration projects are taking part. These demonstration cities all over Europe are funded by the European Commission.

Objectives:

- to promote and implement sustainable, clean and (energy) efficient urban transport measures
- to implement integrated packages of technology and policy measures in the field of energy and transport in 8 categories of measures
- to build up critical mass and markets for innovation

Horizontal projects support the CIVITAS demonstration projects & cities by:

- Cross-site evaluation and Europe wide dissemination in co-operation with the demonstration projects
- The organisation of the annual meeting of CIVITAS Forum members
- Providing the Secretariat for the Political Advisory Committee (PAC)
- Development of policy recommendations for a long-term multiplier effect of CIVITAS

Key elements of CIVITAS

- CIVITAS is co-ordinated by cities: it is a programme “of cities for cities”
- Cities are in the heart of local public private partnerships
- Political commitment is a basic requirement
- Cities are living ‘Laboratories' for learning and evaluating

1.2. Background ARCHIMEDES

ARCHIMEDES is an integrating project, bringing together 6 European cities to address problems and opportunities for creating environmentally sustainable, safe and energy efficient transport systems in medium sized urban areas.

The objective of ARCHIMEDES is to introduce innovative, integrated and ambitious strategies for clean, energy-efficient, sustainable urban transport to achieve significant impacts in the policy fields of energy, transport, and environmental sustainability. An ambitious blend of policy tools and measures will increase energy-efficiency in transport, provide safer and more convenient travel for all, using a higher share of clean engine technology and fuels, resulting in an enhanced urban environment (including reduced noise and air pollution). Visible and measurable impacts will result from significantly sized measures in specific innovation areas. Demonstrations of innovative transport technologies, policy measures and partnership working, combined with targeted research, will verify the best frameworks, processes and packaging required to successfully transfer the strategies to other cities.

1.3. Participant Cities

The ARCHIMEDES project focuses on activities in specific innovation areas of each city, known as the ARCHIMEDES corridor or zone (depending on shape and geography). These innovation areas extend to the peri-urban fringe and the administrative boundaries of regional authorities and neighbouring administrations.

The two Learning cities, to which experience and best-practice will be transferred, are Monza (Italy) and Ústí nad Labem (Czech Republic). The strategy for the project is to ensure that the tools and measures developed have the widest application throughout Europe, tested via the Learning Cities' activities and interaction with the Lead City partners.

1.3.1. Leading City Innovation Areas

- The four Leading cities in the ARCHIMEDES project are:
- Aalborg (Denmark);
- Brighton & Hove (UK);
- Donostia-San Sebastián (Spain); and
- Iasi (Romania).

Together the Lead Cities in ARCHIMEDES cover different geographic parts of Europe. They have the full support of the relevant political representatives for the project, and are well able to implement the innovative range of demonstration activities.

The Lead Cities are joined in their local projects by a small number of key partners that show a high level of commitment to the project objectives of energy-efficient urban transportation. In all cases the public transport company features as a partner in the proposed project.

2. Aalborg

The City of Aalborg, with extensive experience of European cooperation and having previously participated in CIVITAS I (VIVALDI) as a 'follower' city, is coordinating the consortium and ensures high quality management of the project. The City has the regional public transport authority (NT) as a local partner, and framework agreements with various stakeholder organisations.

Aalborg operates in a corridor implementing eight different categories of measures ranging from changing fuels in vehicles to promoting and marketing the use of soft measures. The city of Aalborg has successfully developed similar tools and measures through various initiatives, like the CIVITAS-VIVALDI and MIDAS projects. In ARCHIMEDES, Aalborg aims to build on this work, tackling innovative subjects and combining with what has been learned

from other cities in Europe. The result is an increased understanding and experience, in order to then share with other Leading cities and Learning cities.

Aalborg has recently expanded its size by the inclusion of neighbouring municipalities outside the peri-urban fringe. The Municipality of Aalborg has a population of over 200.000, and the urban area a population of some 130,000. The ARCHIMEDES corridor runs from the city centre to the eastern urban areas of the municipality, see Figure 1, and forms an ideal trial area for demonstrating how to deal with traffic and mobility issues in inner urban areas and outskirts of the municipality. University faculties are situated at 3 sites in the corridor (including the main university site). The area covers about 53 square kilometres, which is approximately 5 % of the total area of the municipality of Aalborg. The innovation corridor includes different aspects of transport in the urban environment, including schools, public transport, commuting, goods distribution and traffic safety. The implementation of measures and tools fit into the framework of the urban transport Plan adopted by the Municipality.

Figure 1. The ARCHIMEDES corridor in Aalborg.

3. Background to the Deliverable

As many other urban areas, Aalborg is becoming more and more congested with vehicles as the demand for mobility grows. The increased number of vehicles in the city centre, and the traffic originating from their circulation searching for a free parking space, leads to an unpleasant environment for people in the area and associated health problems.

The City of Aalborg wants to reduce these negative consequences of car traffic searching for free parking spaces, but without introducing restrictions that would reduce the accessibility to the shopping areas in the city centre.

As a starting point for this demonstration, two different means to influence drivers' behaviour were considered.

- To design a revised parking charge structure based on a progressive price model making long-term parking more expensive per hour than short-term, and thereby reducing long-time parking in the city centre. This would free parking spaces for short-term parking and thus reduce the traffic from cars searching for a free parking space. In the risk part of the ARCHIMEDES technical specification (DoW) it was noted that the actual implementation of a changed charging structure would depend on the actual political situation at the time of decision.

- To design and implement a revised Parking Information System. A parking guidance system designed to limit the circulation by giving more targeted information to drivers, and by giving more comprehensive information including more car parks – compared to the existing information system.

3.1. Summary Description of Task

As one part of this measure a new price, and price-zoning, policy was elaborated. First input was a literature study by an associate professor at the University. The conclusion, based on the study and on the following considerations, was that if the City of Aalborg wished to change the demand for long-term parking in the attractive city centre, a real significant increase in parking charge would be required. Most likely the city would have to pass the revenue on to the national government. This prospect of having to 'collect more tax to the government' made a revised price policy political unacceptable on the local level. Furthermore a real significant increase in parking charge in the city centre would be contrary to the premise of not reducing the accessibility to the shopping areas in the city centre and, for this reason, politically unacceptable.

In the other part of the measure a new Parking Information System was designed, tendered and implemented. The system consists of:

- 65 displays on 38 signs of which 32 are dynamic and 6 passive.
- Two master controllers each able to run the complete information system.
- Communication lines between all units.
- Software, for running the information system. Database for dynamic and static data, and user software for maintenance of data.
- Data integration to private car parks.
- Statistical module
- As a part of Measure 9 'Modernising Travel Information in Aalborg' a webservice putting static and dynamical parking data at the disposal for external information systems.

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4. Changing Parking Behaviour in Aalborg

4.1. Description of Work Done

4.1.1. Developing a New Pricing Policy

As described in the DoW, the intention was to elaborate a new charge structure based on a progressive price model to make long-term parking more expensive per hour than short-term, and thereby reducing long-term parking in the city centre. This would free parking spaces for short-term parking and thus reduce the traffic from cars searching for a free parking space.

As a first input a background study was made to define the premises for a new pricing and price-zoning policy.

The study was done by an associate professor at the University and is included as Appendix A to this deliverable.

The main findings in the study are that generally a price elasticity of -0.15 to -0.30 is assessed as the most reliable estimate on the effect on parking demand from the parking charge level. But two important central conditions should be noted:

1. the more attractive a car park is the higher can the parking charge be, and
2. the more attractive a car park is, the less elasticity can be found between parking price and parking occupancy rate.

This implies that if the parking demand in a central part of a city shall decrease, a significant increased parking charge is required.

As a consequence, if the City of Aalborg wishes to change the demand for long-term parking in the attractive city centre, a real significant increase in parking charge is required.

Such an increase in charge level would result in a significant increase in revenue from parking payments. As there is a tax-stop in Denmark, most likely the city would not be allowed to keep this revenue, but would have to pass it on to the national government. This prospect of having to ‘collect more tax to the government’ made a revised price policy political unacceptable on the local level.

At the same time, a real significant increase in parking charge in the city centre would be contrary to the premise of not reducing the accessibility to the shopping areas in the city centre, and also for this reason politically unacceptable.

As a consequence, and in accordance with the risk part of the DoW, implementation of the new pricing policy was indefinitely postponed.

4.1.2. Implementing a New Parking Guidance System

The second part of the measure was to design and implement a revised Parking Information System. A parking guidance (P-guidance) system designed to limit the circulation by giving more targeted and more comprehensive information to the drivers.

The existing Parking Information System was implemented as part of the EU JUPITER-2 project (1996-1999) and has been of great use for the drivers since. In spite of technical renovation of the communication in 1999 and replacement of the displays in 2003, the

system has become technologically outdated and both software and hardware needed to be renewed. But the more important point is that the city and the parking structure have developed over time making the information level inadequate. The road structure and the traffic flow have changed; some car parks have lost importance and others have been established, but could not be integrated into the old information system.

As a consequence the most basic terms for the new system were more or less given before starting the design process:

- Supporting a division of the city centre into new parking zones, making it possible to target the information on the VMS on the different approach roads, to give information only on the nearest parking zone and thus limiting the search traffic crossing the city centre.
- A technical expansion of the system to include all relevant major car parks in, and around, the city centre, both private and public.
- As a consequence, a physical expansion of the system to give dynamic information on more roads.
- Use of new technology, software and hardware
- Giving information on alternative channels, such as the internet and on mobile devices and, in accordance with US president Barack Obamas 'New Digital Government Strategy', which is the new 'state of the art' in the ITS society, the system should be able to 'Unlock the power of government data'. That is, the system should have a standardized data interface, open for all.

The planning and design, the tendering and the implementation processes went through the following stages:

4.1.2.1. The planning and design process:

Stage 1: Identify the options – Finding out what is technological possible. A review of available systems for providing Parking Information was carried out. It was mainly based on literature reviews, scrutinising results presented at conferences and congresses in the area of urban traffic and mobility. Also networking with relevant experts in Denmark as well as across the EU was carried out.

This review resulted in a broad knowledge within the area of Parking Information Systems and highlighted which solutions would be preferable within the project period.

Stage 2: **Analyse the parking situation** – Analysis of the present parking situation, particularly where do people park and for how long.

The analysis of the parking situation in Aalborg was mainly based on 3 sources:

1. data from a central database containing parking registrations collected in recent years in Aalborg,
2. the Parking Strategy for Aalborg Municipality, and work done in relation to the on-going work with the development of the Parking Action Plan for Aalborg, and
3. surveys and registration of car park use, conducted for this project.

The Parking Action Plan is made on the basis of registrations and according to the set targets in the Parking Strategy from 2009. The Parking Action Plan analyses the parking situation in Aalborg City carefully, and highlights the future challenges regarding parking and parking-searching traffic, which the future Parking Information System will minimise.

Stage 3: Plan the new Parking Information System – Decide what system Aalborg needs.

The old Parking Information System was based on the idea that the car parks in Aalborg City were located in 3 static zones. See Figure 2.

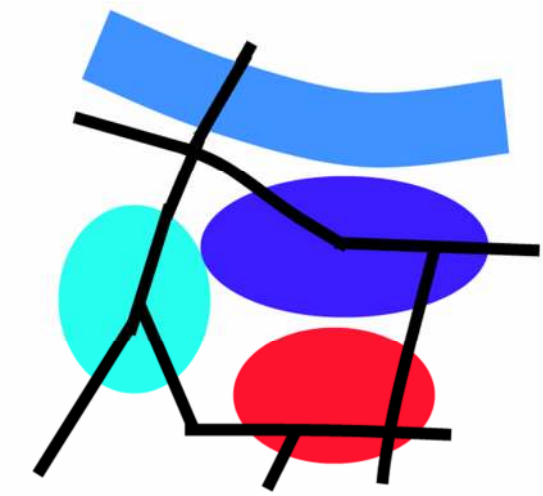


Figure 2 The principles of the old Parking Information System. The red, light blue and dark blue circles represent the 3 static parking zones. The black lines mark the overall road structure, while the light blue shape represents the fjord.

The signs and the structure of the system appeared to be increasingly obsolete. Also, in recent years the zones became unequal in size because the importance of the south-eastern zone (red) diminished over time, and in reality it only consisted of a single car park.

Significantly more car parks, both privately and publicly owned, should be included in the new Parking Information System. Cruising around in search for a parking spot is further discouraged when drivers are aware that the Parking Information System includes all parking spaces, including privately owned ones.

The new system uses variable areas to inform the driver about available parking spaces depending on the location. The information is restricted to the nearest car parks to avoid unnecessary traffic crossing the city centre, where most pedestrians are; e.g. if a driver comes from south looking for parking possibilities in the central part of city, he will be presented with a different number of available spaces in the central part of the city, than if he come from east – i.e. specifically only those located in the southern part of the city centre.

As it is very difficult to put a sharp limit between the parking zones included in the overall parking areas, variable zones makes the Parking Information System more intuitive and easy for parking-searching drivers to use. Figure 3 shows the car parks, together with the established and planned information signs included in the new Parking Information System.

Figure 3 : Map indicating the placement of the signs in the new Parking Information System. The green areas are present or future car parks. The blue dots are signs that will be established now, while the red dots marks planned signs to be established in the future

As the final output from this stage a set of tender materials was compiled.

The tender material described the total system to be delivered:

- In total 65 displays on 38 signs of which 32 were to be dynamic and 6 passive.
- Two master controllers / servers, situated at two different places in the city, mirrored and each able to control and run the complete information system.
- Communication lines between all units, using more different technological solutions depending on the local conditions.
- Software, for running the information system. Database for dynamic and static data, and user software for central maintenance of all static data. As an extension, user software allowing each private car park to maintain static data on own car park.
- Data integration to a number of private car parks. More different solutions for the different parks.
- Statistical module
- As a part of Measure 9 ‘Modernising Travel Information in Aalborg’ a webservice putting static and dynamical parking data at disposal for all external information systems as interment display, SMS services and APPs.

The complete redesign of the Parking Information System appeared to be more time consuming than expected. In particular, the zoning, that is the position of the signs and which car parks that should be represented on each variable sign, caused a lot of

complicated, although fruitful, discussion. However, without this procedure it might have been difficult to reach a sufficiently user-friendly and intuitive Parking Information System.

The process also included a baseline study with the purpose of evaluating the effect of the final decided Parking Information System. The baseline study included surveys, traffic counts, parking counts, and data retrievals from parking databases. The periods for data collection were chosen so that any changes in driving and parking behaviour due to weather, holidays etc. would be minimized compared to the planned after study period.

4.1.2.2. The tendering Process.

Stage 4: Tender of the new system. The supplier of the new system was found via a competitive tender among 6 potential suppliers. The tender was judged following a '**most economically advantageous tender** (MEAT) process. The selection was done based on the bidder's total weighted score on these criteria:

1 Price (40 %).
2 Functionality and quality (30 %).
3 Design and aesthetics (15 %).
4 Staffing and implementation (15 %).

The competitive tendering was carried out in two steps. Each offer's scores for items 2-4 were decided and published before the price information was opened, thus making sure that a low / high price would not influence the score for item 2-4. This process guaranteed that the price would only influence the result with the decided 40%.

The tendering resulted in three bids of which the most economically advantageous bid was selected.

4.1.2.3. The Implementation Process

Stage 5: Implementing the new Parking Information System. After selecting the supplier implementation of the Parking Information System started.

As a result of the postponed tendering[1] it was planned for the Parking Information System signs to be installed in the period August – October 2011. However, as a result of a delay from the Italian supplier of the signs the implementation was foreseen to be delayed by a further two months so that operation would start in the middle of December 2011. As the signs and foundations from the old system had to be removed before the foundation to the new system could be laid, this would cause a period of approximately one month without any P-guidance system. Furthermore any likely delays in the implementation would prolong this period. A long period during Christmas sales without any P-guidance system in the city centre was not acceptable. As a result it was decided that the implementation of the signs had to be postponed to January-February 2012.

Instead the freed time was used to design and develop the database and software solution.

During and after the installations, tests on the network and the databases were carried out. The Parking Information System was in operation by the end of April 2012.

[1] See section 4.1.3 Hurdles in the Planning and Implementation Schedule

Dynamic displays:

65 LED displays were mounted on 38 signs, and further 6 signs with static information were installed. This was a major extension compared to the previous system, and included possibilities for supporting new planned car parks.

Figure 4 Dynamical sign in the periphery of the city centre showing free parking spaces in two different parking zones of the city centre.

Figure 5 Dynamic sign, showing free parking spaces in three different car parks. All these private.

Controllers

Master Controllers were installed in two different places in the city, mirrored and each able to control and run the complete information system.

Software:

Based on an existing product the supplier modified and extended the software to fulfill the requirements in the tender material.

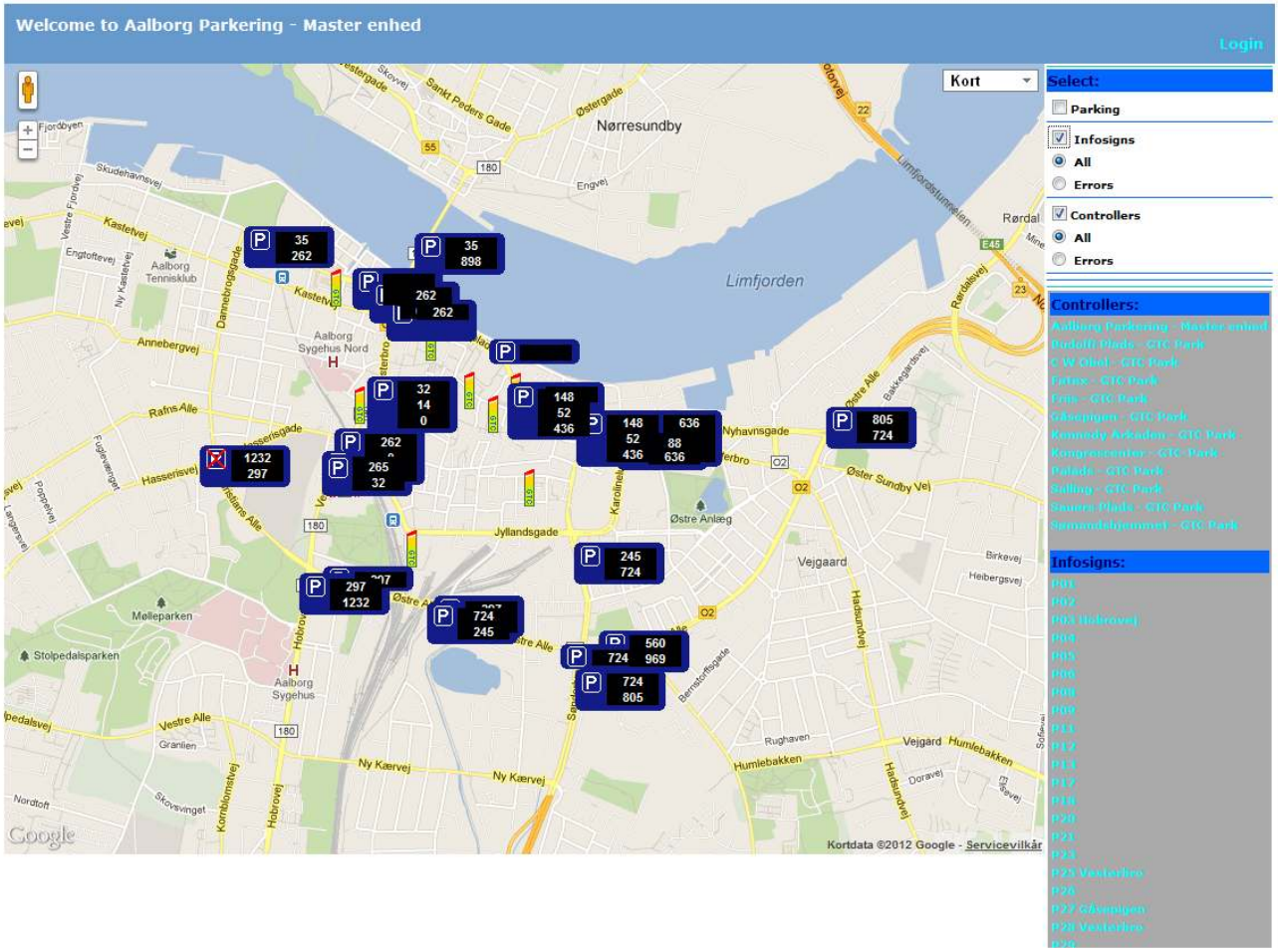


Figure 6 Example of operators System Supervision Screen in the back offices system

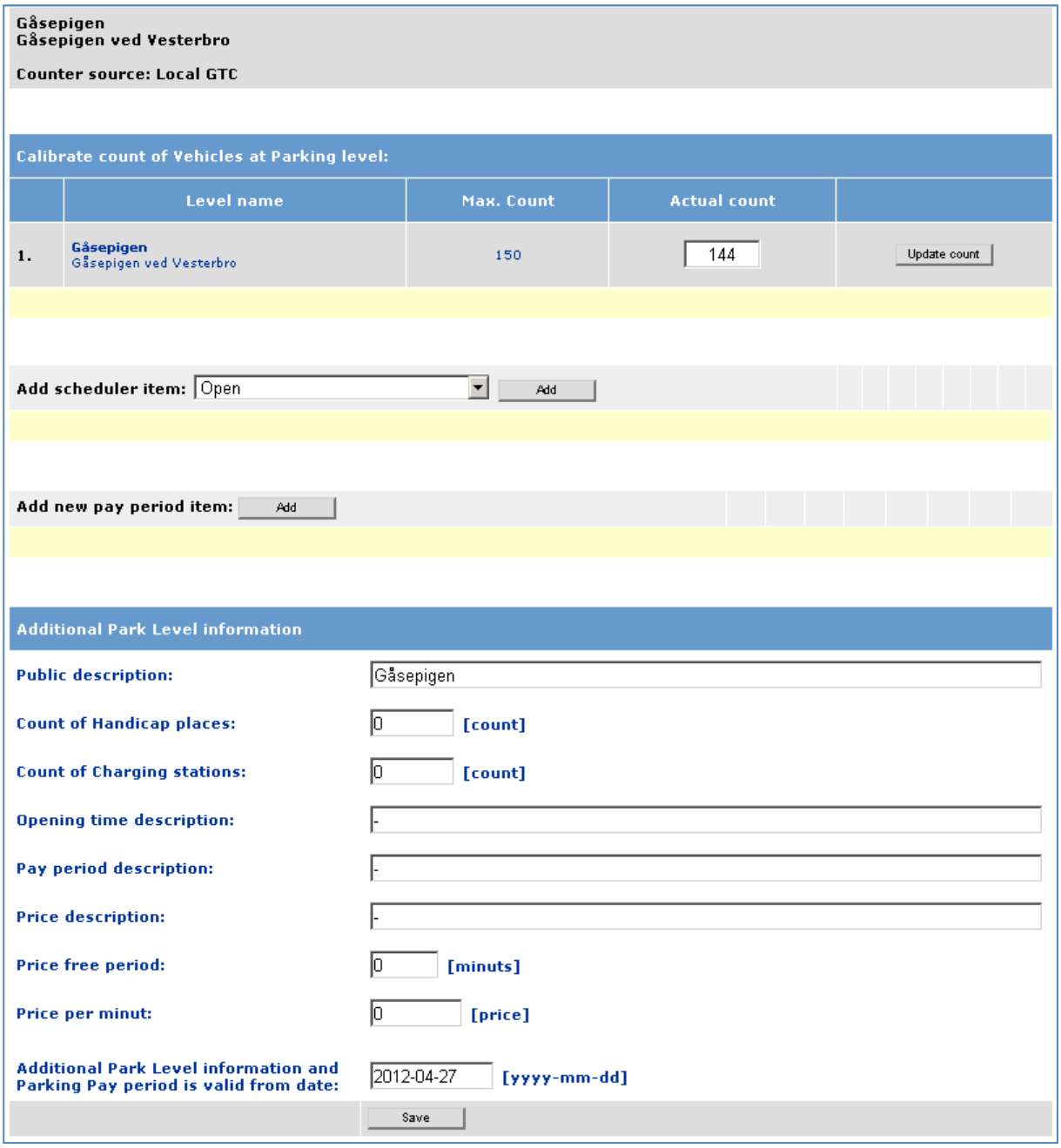


Figure 7 Example of screen dialog for entering data in the back offices system

Data interface:

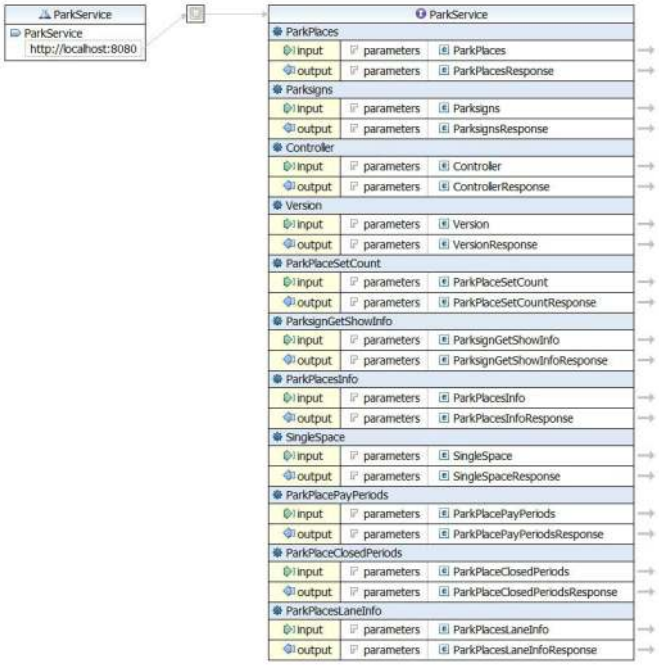
As a part of ARCHIMEDES Measure 9 'Modernising Travel Information in Aalborg' a web services interface has been developed.

The purpose of the interfaces is to make all parking data, static and dynamic, publicly available for all potential users, and thus make it possible for everyone to use these parking data to create information services to the public, via the internet or as apps.

This approach is in accordance with 'state of the art' in ITS, and is further supported by Obamas New Digital Government Strategy.

2 Webservice ParkService

Webservicen ParkService består en række servicekald:



Figur 1 ParkService

Følgende services er tilgængelige:

1. **ParkPlaces**
   Information om antal ledige pladser for et givent parkeringsområde.

2. **Parksigns**
   Liste over aktive henvisningstavler der er i systemet.
   Med information om visning og status.

3. **Controller**
   Information om GTC Park controller

4. **Version**
   Liste med tilgængelig services
   Versionsnummer og udgivelse for hver service.

Figure 8 Example of page from the public web service description.

The presentation of free parking spaces and the prognosis for free parking spaces in the next hours, on the Measure 9 'Modernising Travel Information in Aalborg' Traffic Information Internet site (www.trafikken.dk/nordjylland) has been redeveloped to use the open web service interface as data source.

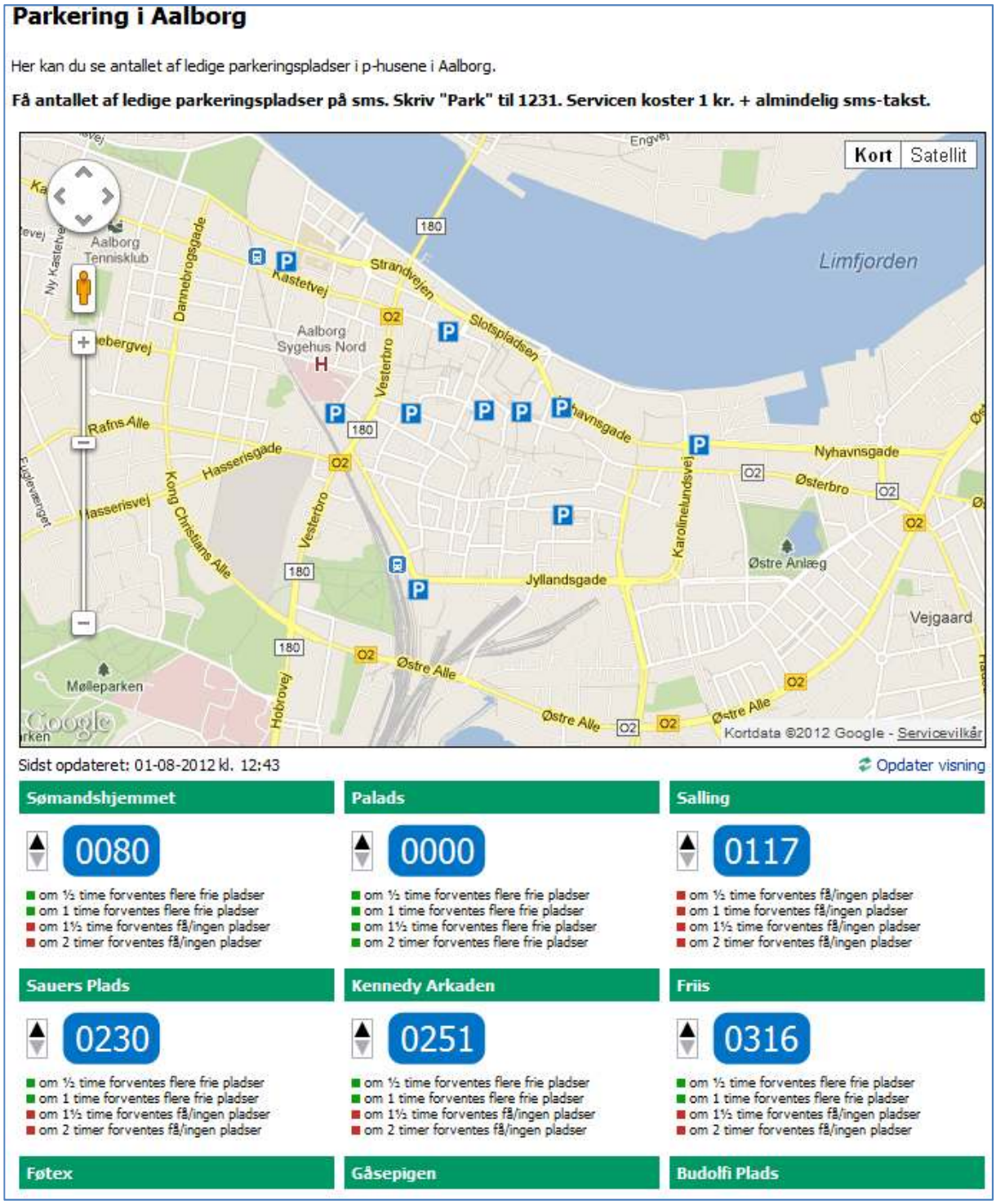


Figure 9 Internet presentation of free parking spaces and the prognosis for free parking spaces

Besides, the University and more private companies have started to develop APPs, which use the web service.

Stage 6: Operation of the new Parking Information System.

The new Parking Information System has been in operation from late April 2012 and onwards.

After passing the Site Acceptance Test with some minor errors and outstanding issues, according to normal practice the Operational Test Period was started. During this period most of the out standings from the Site Acceptance Test have been solved.

The Operational Test is running without major problems, and it is expected that the test will be passed without major comments.

In the same period data collection for the after study, with the purpose to evaluate the effect of the new Parking Information System, have been done. Evaluation will be based on surveys, traffic counts, parking counts, and retrievals from parking databases. The after study will be based on data collected in the summer 2012, but outside the holiday period.

4.1.3. Hurdles in the Planning and Implementation Schedule

Whereas most of the measures in the ARCHIMEDES project in Aalborg have been implemented according to the original time schedule from the first version of the DoW, the internal time schedule for this measure has been postponed several times, and the final implementation date is late in the project period compared with the original expectations.

This delay is the aggregated effect of many independent factors.

- Besides the drivers described in section 3, *Background to the Deliverable*, an important premise for redesigning the Parking Information System was the anticipated change in traffic and parking behaviour as the result of the construction of a new Music Hall at the old Harbour Front in the centre of the city. Shortly after signing the ARCHIMEDES contract, an uncertainty on the construction of the Music Hall arose. The prices from the tender did not match the expected budget figures. This uncertainty led to an order to suspend working on a new P-information system, until a solution on the Music Hall problem was found.
- This new situation, concerning needs and economy, resulted in a request to re-evaluate if a new parking system was needed, or if the task should be redefined to a renovation of the existing system.
  After a period of stand still, the Music Hall's financial problems were solved, and the process of planning and designing a new parking guidance system, could start.
- One of the key elements in designing the new information system was deciding on the zoning of the city. Dividing the city into logical zones and deciding which car parks should be referenced on which signs. The second part of this problematic topic was to find a political compromise between reducing traffic by only giving targeted information to drivers on nearest car parks, and satisfying the anticipated politically supported interest from the City Centre's commercial association in giving broad information on all free spaces. This originates from the association's competition with the big shopping centre in the city's outskirts. There was also politically supported interest from the owners of individual car parks in being presented on signs in all parts of the city to draw customers to the shopping centre associated with their particular car park.

  In the end this zoning process was done in three phases. First the employee in the municipality responsible for parking made up a model for new zones based on the city's official parking strategy. Secondly an associate professor in Traffic Planning at the university made a new suggestion based on the former, modified after some more theoretical reflections. This proposal was modified in the city to make it politically acceptable and based on this a consultancy transformed the model into an operational description in the tender material.

This process – where the same work was more or less done three or four times – was time consuming, but as described in *Stage 3: Plan the new Parking Information System,* worth the effort.

- The supply of the system was tendered out. Compiling the tender material was a complicated and time consuming process. As already described, offers were received from 3 different companies and the company offering the most economically advantageous bid was selected.
- During the implementation process the selected supplier had some general problems complying with the agreed time schedule and at one point in time, he had to inform the city that his subcontractor for signs in Italy was two months delayed, which resulted in a similar delay in the implementation process. As described previously, the prospect of not having a parking guidance system during the Christmas sales led to the postponement of the start of the physical installation until after Christmas 2011.
- Small slips in keeping the schedule in this last part of the implementation process led to a final opening of the system at the end of April 2012.

4.2. Communication

4.2.1. Involvement of the Companies Behind the Private Car Parks

One of the important premises for a well functioning Parking Information System is that it includes all relevant car parks. If only a subset is included – for example only publicly owned car parks – the drivers will not act according to the information provided, but will start circulating in the city centre searching for a possible free space in one of the private car parks. The inclusion of all car parks, regardless ownership etc. is therefore critical.

In Aalborg there is an old tradition for Public – Private partnership, or cooperation. In the old Parking Information System, which dated from 1995, information for 4 out of 9 car parks was for privately owned car parks. But in the meantime more private car parks had been established, and it had not been possible to include them the information system, for various technical reasons as the physical design and placement of the signs and the design of the system itself. Such integration has been demanded from both road users and from the companies behind the car parks.

Thus it was an important task to include all relevant private car parks in the new system. On the one hand this required that the technological solution was designed to handle these private car parks in terms of open interfaces to the different systems in the car parks delivering dynamical data on the parking, and the integration of these car parks into the different signs in the city. On the other hand it required an ongoing communication and cooperation process with the owners of these car parks to agree:

1. that it was advantageous to include information on the private car parks in the public system,
2. the technical solution for exchanging data between the private data collection system and the public information system (and how a private data collection system should be established, if it did not exist previously)
3. the possible financial issue between the parties for the private business being exposed on the public information system.

This communication mostly took place as a continuation of the existing channels between the city and the private companies.

At project start-up a meeting was held with all relevant interested parties among the companies running the private car parks, to present the plans, to create understanding for the importance of integrating the private car parks in the common information system, and to initiate the debate on technical and economical solutions.

Later, bilateral meetings were held between the Project Managers from the City and from the supplier, and each car park.

In a good dialogue decisions were made on financial and technical matters.

It was agreed, that each car park had the technical and financial responsibility for sensors and systems inside its own car park, and for delivering the data into an agreed interface. Besides the initial costs for setting up this part of the system – and possible maintenance costs it – the participation in the information system is free of charge.

Most companies were very positive to this model. At the time of finalizing the implementation, the status is that one small car park has chosen not to participate based on a balancing of implementation cost compared to expected benefit given that it is situated in the periphery of the city centre, and a second car park is not yet delivering dynamic data due to lack of focus from the company behind the car park.

4.2.2.Communication with the Public

Before installing the dynamic signs in the streets an advertisement in the newspaper informed the potential users on the new Parking Information System, the installation process, and that the old system would be closed during removal with the consequence that for a short period there would be no dynamic parking information.

Aalborg info

Nyt P-vejvisningssystem

Efter mere end 15 år med skilte, der viser antallet af ledige pladser på parkeringsanlæggene i Aalborg Midtby, er det nu tid til at udskifte systemet. Samtidig udvides systemet, så der henvises til alle større offentlige og private p-anlæg i midtbyen med offentlig adgang.

Arbejdet er i gang, og næste skridt er at fjerne de eksisterende skilte og opstille nye. For at kunne udføre projektet hurtigst muligt, vil der blive slukket for alle tavler fra mandag den 30. januar. Dog vil enkelte skilte, der viser direkte ind til P-anlæggene, blive opretholdt længst muligt.

Det nye system forventes at være i drift igen i starten af april. De nye skilte vil være afblændet af røde kryds indtil ibrugtagning.

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AALBORG KOMMUNE.DK

- åben døgnet rundt på nettet

Figure 10 Add informing on new Parking Information System.

The adverts were followed up with two news articles in the newspaper. The one with focus on the presentation of the new information system, and the other taking the private car parks' point of view – 'At last, we are included in the Parking Information System' says one of the newly added car parks owners.

When the system was physically installed in the streets, but before switching on the functionalities, a follow-up article was in the newspaper.

Sådan kommer den ny tavle til at se ud. Med den blå bundfarve, som bruges i alt andet byudstyr.

P-skiltene bliver opdateret

Af Lars Termansen
lars.termansen@nordjyske.dk

AALBORG: Vejen til Aalborgs parkeringspladser bliver lettere og mere oplysende.

De elektroniske skilte, der viser trafikanterne til de større parkeringsanlæg i Aalborgs midtby skal udskiftes.

Det gamle system er blevet 15 år, og den ny skiltning vil også vise af mod større parkeringsanlæg, som ikke var anlagt for 15 år siden.

Endelig er systemet forberedt for udvidelse med kommende større parkeringsanlæg, og der vil i alt blive opstillet skilte 33 steder.

Næste skridt er at fjerne de eksisterende skilte og opstille nye. Skiltene bliver slukket fra mandag 30. januar.

- Det er selvfølgelig trafikanter, som ikke så stedkendte, der har størst nytte af tavlerne, men lokalkendte kan også bruge dem. Især når der i perioder med spidsbelastning er rift om p-pladserne, isger civilingeniør Peter Sønderlund, Aalborg Kommune.

Systemet med tavler, tællestationer og styresystem koster knap 4 mio. kr. en investering.

- Udover at vise, hvor der ledige p-pladser, undgår vi også, at trafikanterne kører rundt unødvendigt for at lede efter en p-plads, bemærker Peter Sønderlund.

Aalborg Kommune forventer, at det nye system er klar til brug i starten af april. De nye skilte er i starten dækket af røde kryds. Når de fjernes, er det et tegn til trafikanterne om, at skiltene er i brug.

Trafikanterne kan tjekke de ledige pladser på www.trafikken.dk. De samme oplysninger kan fås ved at sende en sms med teksten PARK til 1231.

FAKTA

HER VISES DER TIL

- Tavlesystemet udvides til at omfatte 11 anlæg.
- De fem offentlige er Budolfi Plads, Gåsepigen, Aalborg Kongres- og Kultur Center, Sauers Plads og Sømandshjemmet.
- De seks private anlæg er Salling, Føtex (Slotsgade), Friis, C.W. Obel (Badehusvej), Palads Parkering og Kennedy Arkaden.

Figure 11 Article presenting the new information system

Michael W. Henriksen håber, at det ny tavlesystem gør hans p-hus mere synligt.
Arkivfoto: Thomas Gaardsmand

- Endelig kommer vi også med

Af Lars Termansen
lars.termansen@nordjyske.dk

VESTBYEN: Et af byens parkeringshuse kan næsten ikke vente på, at Aalborg Kommune udskifter det gamle tavlesystem med et nyt.

Hos C.W. Obel på Badehusvej har man længe følt sig forbigået i kommunens skiltning, fordi der ikke vises af mod p-huset.

Det kan teknisk set ikke lade sig gøre, fordi der ikke er plads til flere, er svaret.

Men nu kommer C.W. Obels p-hus med på de nye tavler.

- Det ser vi meget frem til, og jeg tror på, at det kan give os et ekstra skub, siger afdelingsleder Michael W. Henriksen, C.W. Obel Ejendomme.

- Der er i hvert fald mange fra oplandet, som siger, at de ikke kan finde en parkeringsplads i Aalborg, selv om der er masser af tomme pladser. Men de kan jo ikke finde frem til dem, hvis de ikke ved, hvor de skal finde dem. Så jeg har absolut store forventninger til det ny system, siger Michael W. Henriksen.

Parkeringshuset på Badehusvej har siden starten kæmpet med at få kunderne til at køre den vej, og selv om gps og mobiltelefoner kan lede bilisterne på vej, så er der stadig brug for skilte.

- Jeg kører selv efter parkeringsskilte, når jeg er i udlandet, og bare det, at vi har fået "døde" p-skilte op, har hjulpet på belægningstallet, bemærker bestyreren af p-huset på Badehusvej.

De gamle skilte kommer ned, og der henvises til flere anlæg.
Arkivfoto: Martin Damgård

Figure 12 The information system from a privat carparks view - 'At last wee are included'

4.3. Problems Identified

On the time schedule there have been slightly more problems than expected in this kind of a project. See *4.1.3 Hurdles in the Planning and Implementation Schedule*. As described, the problems have been partly due to unresolved expectations to the project and the framework around the project, and partly due to project management mainly at the supplier.

4.4. Future Plans

In the ARCHIMEDES project only the final evaluating is still lacking. Both before and after data has been gathered, and the evaluation process will be finalised as described in the evaluation plan. The extension of the project period gives the possibilities for a better and more comprehensive evaluation, even though satisfactory evaluation would have been possible under the original time schedule.

After the ARCHIMEDES project the Parking Information System will continue to be an important ITS solution in Aalborg. The system will continue to run, and will be extended with new areas and functions during the coming years.

Appendix A: Parking Occupation Rate and Parking Charge – a Literature Review

1. Introduction

1.1 Background

The general increasing trend of car-ownership requires more parking areas. It is particularly the case in middle-sized and big cities where the parking areas are insufficient. Hence to decrease the traffic flow and regulate the need for parking areas, parking charges have been introduced in most cities and major towns. The aim with parking charge is first and foremost to regulate the parking demand and secondary to charge to the owners of the parking areas.

If the parking areas are privately owned gaining the revenue is often the aim with the parking charge, while in other cases the parking areas are aimed as a service, which underpin other activities in the neighbourhood.

The size of the parking charge should preferably be closely connected with the demand for parking areas. Too low a price has no influence on driving and parking behaviour, whereas too high a charge results in drivers selecting other parking areas. In practice a city centre might lose activities if the parking charge is too high and instead use free parking areas nearby as e.g. a shopping mall.

This report describes knowledge regarding price elasticity between parking charge size and parking occupancy rate. Experiences are gathered from cities in the industrialized part of the world. Results are mostly found for medium-sized and big cities. However, only a very limited number of results are found, which basically document the connection between parking occupation rate and parking payment. In many cases the results that were found were qualitative or taken from underlying reports without necessary explanation available. The effect of increased parking charge differs significantly depending on, among other things, the size of the urban area and how high the parking charge was in the beginning.

2. General Approach

2.1 Parking Demand Management

The demand for parking areas can be managed by the size of the charge and/or by time-based restrictions. The price for parking can differ – in some locations the same level of parking charge is valid all time while in other locations it differs. For example, the price could be low for the first 1-2 hours and subsequently higher, hence any short-term parking for shopping is cheap while an attempt is made to avoid long-term parking. Another approach is to have an expensive parking fee in the daytime while it is cheap or free at night. This approach implements a charge for users of the parking area for business, shopping, or leisure purposes, while the residents can park with low/no costs. The time-based restrictions have the same intentions; short-time parking restrictions allow e.g. shopping while full day parking is minimized.

2.2 Payment Approaches

The parking charge can be established in different ways. It can be charged according to use, often per hour parked in a parking area. Also, it can be paid as season tickets, e.g. per month or year regardless of the actual use of the parking area in question. The most

widespread payment method is by a parking meter, where the user pays the parking fee in advance. It means that the user has to estimate how long the parking time will be. It results in many cases in too low payment and hence the risk of get a parking fine or too high payment with associated dissatisfaction for the user. Payment with credit card allows the user to be charges for the used parking time only. In Aalborg a Danish middle-sized city, users of the publicly owned parking areas can register their credit card to a charge station and get a parking ticket, and the parking charge is initiated. When users leave the parking area the same credit card is used again, and the system calculates the time used and it only charges the appropriate fee. Also payment at a barrier based on the entry and exit time to/from a parking area is widespread – it is however only useful for large parking areas or areas where public use of the parking areas is undesired. Within the last years mobile payment has been a new alternative approach to pay parking charges. This area for parking charge payment is developing rapidly and new methods and systems are reasonable available today.

2.3 The Effects of Parking Charges

Basically an increased parking charge can affect the parking demand in two ways. More expensive parking does in general result in less parking in an area and that the average parking period will be reduced. The effect from these two tendencies is the effect on the occupancy rate of the parking area due to a changed in the size of the parking charge. The effect on the parking occupancy rate diminishes in many cases within a few years.

Price elasticity quantifies the relative change in parking behaviour due to the relative change in the parking charge size. If a price is increased and an activity is reduced it is negative elasticity and vice versa. This report is focused on negative price elasticity only, because focus is on the reducing parking occupancy rate due to increased parking charges. Hence if price elasticity is denoted as bigger than another (i.e. if it is numerically bigger) then it has a bigger effect. This means that a price elasticity of -0.30 is bigger than one with the value of -0.10.

3. Parking Charges and Effects – an Overview

3.1 Older Studies

First follow some results from older studies regarding the introduction of parking charges. The reference is from the Danish Environmental Protection Agency (1994).

In part of the Irish city of Cork a parking card was introduced in 1975, where the drivers should register their arrival time by themselves. It resulted in less illegal parking inside the area but more outside. In the Danish city, Århus a parking charge was introduced on the central square, Bispetorvet in 1980. It resulted instantly in a 35%reduction in the number of the parked cars. Also the average parking time was reduced and the total occupancy rate was reduced from 97% to 53%. There is no information about any long-term effects. In 1987 in Gothenburg a significant increased parking charge was introduced. However, despite a significant initial effect the occupancy rate was the same after two years as it was before. In 1989 parking charges were introduced in the centre of Aalborg. On the parking areas affected the occupancy rate was reduced from 68% to 35%. Equally in 1989 a parking charge of 3 DKK per hour was introduced in the minor Danish cities Kolding and Næstved. In Kolding it resulted in a reduction in occupancy rate from approximately 100% to 80%, while it went down from 97% to 60% in Næstved. The year after the area with parking restrictions in Copenhagen was expanded significantly, and still one year later the parking occupancy rate hadreduced by 25%.

The experiences from the results presented above are that introduction of parking charge results in an immediate, significant effect, but where documented the occupancy rates increased again after a period. It was not documented how much the charges were increased and in other cases the parking charges were introduced after free parking. Hence parking price elasticity cannot be established on this basis.

Moreover the parking charge price elasticity was studied in a number of big cities in an older study (1971-1982). The overall parking charge elasticity was -0.3 but with variation between -0.1 and -0.43. Regarding long-term parking the effects were significantly higher; between -0.74 and -1.20.

3.2 Dublin

A study regarding parking in Dublin is found in Kelly & Clinch (2005). Dublin city has 500,000 inhabitants and approximately 1 million in the whole urban area. The parking charge was increased by 45% from IR£ 1.00 to IR£1.50 in 2001 (inflation included). Data were collected from all parking metres in the city for 6 weeks before the increased price was introduced and again for 6 weeks one year after.

The outcome was a reduced parking occupancy rate, which partly was caused by the fact that fewer cars were parked in the parking areas, but also because the average parking period decreased some 17%. Parking price elasticities of -0.28 and -0.29 were found respectively for working days and for working days including Saturdays. The parking price elasticity was most significant in the morning and at night with -0.61 and -0.31 respectively. At noon and at 3 o clock the figures were lower at -0.15 and -0.24 respectively. The results were rather consistent except regarding Thursday nights, which included evening opening hours. At this time the parking price elasticity significant was lower at -0.20. As might be expected that in a period with a high parking demand, the effect of increased parking charges was low. In the studied areas long-term parking (>3 hours) was not allowed. Hence, the found effects cannot be used regarding commuters who in general need full day parking.

3.3 Horsens, Denmark

In the minor Danish city of Horsens a parking charge was introduced in 2000 with DKK 6 per hour. Some 50% of the short-term parking areas were included. In January 2003 the price increased to DKK 7.50 per hour and it resulted in a reduction of 4% in the parking occupancy rate. It is equivalent to a parking price elasticity of -0.16. In the beginning of 2007 was the price increased to DKK 10 per hour, but the effect on the occupancy rate was not published (Helbo 2004).

3.4 Aalborg, Denmark

An increased parking charge was introduced in Aalborg in January 2003. In the city centre the price went up from DKK 8 to 10, while it went up from DKK 5 to 7 outside the city centre (Fischer 2004). An estimate on the parking price elasticity has been made on the basis of three selected parking areas. See table 1.

A price elasticity of -0.14 and -0.21 can be found for Gåsepigetorvet and Budolfi Plads, respectively. These values are more or less consistent with most other parking price elasticities. Regarding Havnen with much higher price elasticity, this seems reasonable due to the fact that this parking area is less attractive and was hence deselected after the price was increased. These results should be handled with care, because they were based on only a few parking areas covering a few hundred parking spaces in total.

	Occupancy rate		Effect	Price per hour DKK		Changed price	Elasticity
Parking area	Before	After		Before	After		
Gåsepigetorvet	0.58	0.56	-3,4%	DKK 8	DKK 10	25%	-0,14
Budolfi Plads	0.95	0.90	-5,3%	DKK 8	DKK 10	25%	-0,21
Havnen	0.36	0.24	-33,3%	DKK 5	DKK 7	40%	-0,83

Table 1. Changed prices, parking occupancy rates, and price elasticity for selected parking areas in the centre of Aalborg. It should be noted that the results found are based on readings from graphs, which can cause minor inaccuracies.

3.5 Copenhagen

In the Danish capital Copenhagen there have been a number of studies on the connection between average parking time and the price per hour. See figure 1.

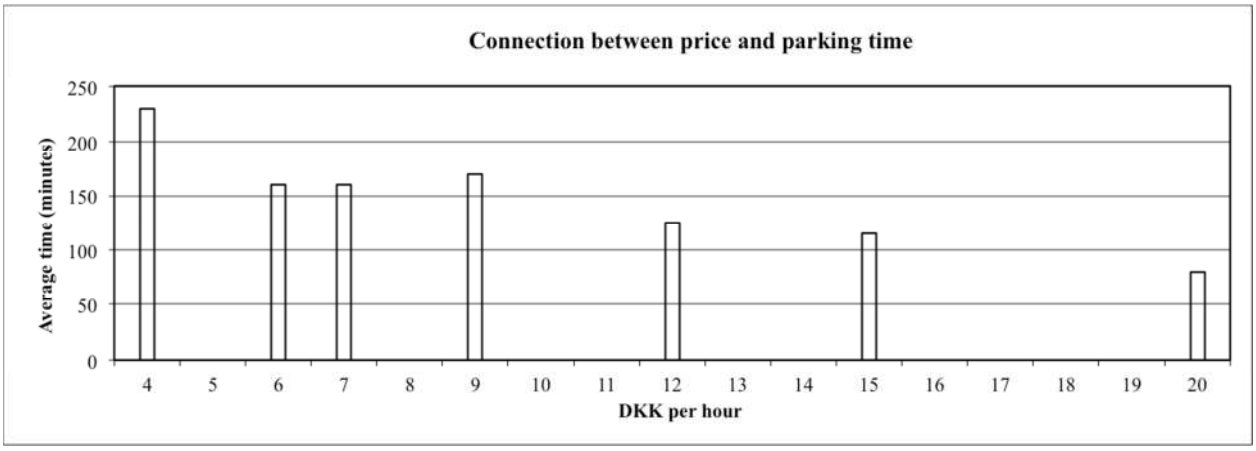

Figure 1. Connection between the average time per parking and the price per hour for parking.

All numbers in the figure are based on data from 1999 and 2000 (Andersen 2004). Direct price elasticity cannot be found on this basis. However, if it is assumed that the price variation affects the time of each parking only, and not the number of parking activities, an adapted parking price elasticity appear in table 2.

Price per hour (DKK)	4	6	7	9	12	15	20
Price difference (compared to DKK 4 per hour)	0	50	75	125	200	275	400
Change in parking demand	0	-0.30	-0.30	-0.26	-0.46	-0.50	-0.65
Adapted price elasticity	**0**	**-0.61**	**-0.41**	**-0.21**	**-0.23**	**-0.18**	**-0.16**

Table 2. The price per hour for parking, the occupancy rate, and the adapted price elasticity.

The adapted price elasticity is significantly higher with slightly increased prices than with markedly increased prices. However, two central reservations should be made towards these results. First of all there is no information available regarding any deselection of parking activities due to the high prices for parking. It seems reasonable that this is the case, both intuitively but also because a reduced parking activity due to higher prices found in other studies. It favours an even higher price elasticity than that found. The other thing is that it is not documented if factors other than the price affect the results. There is, however, no doubt about that other factors affect the parking demand, because an increased attractiveness on

expensive parking areas results in a lower price elasticity than elsewhere – a tendency which also was found regarding the Aalborg Results presented above. Hence, these results from Copenhagen should be seen more as general information on the connection between parking prices and parking occupancy rates than as estimates on the parking price elasticity.

3.6 Eugene

In the American city Eugene in Oregon with some 155,000 inhabitants the monthly parking charge was increased markedly in 1995. It was carried out in two municipally owned parking houses and a large number of parking areas. In the parking houses the price was increased by 88% from 16$ to 30$. On the parking areas it increased from 6$ to 16$ for the cheap areas (167%) and from 16$ to 34$ for the expensive ones (113%). It is not found how many parking spaces each type of parking areas contained, but the number of sold monthly parking permissions decreased from 560 to 360. It is equivalent to a price elasticity of -0.60. One half of the reduction was because the car drivers parked in other areas, increased car-pooling, or used a free shuttle bus (Economic & Planning Systems, Inc. 2002). The markedly high price elasticity is reasonable due to the fact that the free shuttle bus made it easy to deselect the parking in the area.

3.7 Additional Results

The price elasticity is also studied as the summation of the long-term effects in a number of central business districts. The lowest effect was found for commercial drivers (-0.02), a bit more for commuters and education purposes with -0.08 and -0.10 respectively. Regarding other car owners the elasticity was -0.30. The total price elasticity was found to be -0.16. It should be noted that these results are based on the effect on the number of trips, which may differ from the effect on the parking demand – a problem similar to the one regarding the results from Copenhagen. Also it is not documented how those price elasticities have been estimated (Litman 2009). The low price elasticity seems reasonable because the results are long-term ones, as also found in other studies.

4. Summary

Generally the most reliable estimate of price elasticity assessed on the effect on parking demand from changing the parking charge level is in the range -0.15 to -0.30. Two central conditions should be noted:

1. the more attractive a parking area is, the higher is the parking charge in most cases, and
2. the more attractive a parking area is, the less elasticity can be found between parking price and parking occupancy rate.

This means that for the parking demand in a central part of a city to decrease, a significant increase in the parking charge is required. An overview of the results found is available in Appendix 1. Regarding the centre of Aalborg a price elasticity of -0.20 is the best estimate. Regarding parking areas at the fringe of the city centre is the elasticity bigger although uncertain. The best estimate here is assessed to be around -0.50. These estimates are meant for short-term parking, where the parking charge depends on the time used in the parking area. Hence, in the centre of Aalborg a change in price from DKK 14 to DKK 20 per hour would result in a reduced occupation rate of some 9%.

Two conditions should be noted; an increased price for monthly and annual parking permissions should be expected to result in bigger reductions than the ones presented above. Also, the most significant effects can be expected within a short time after a change

in parking charge prices has been carried out. The effect often decreases over time, because the car drivers get used to it and also because the car ownership has been continuing increasing the last decades. Hence, if a proactive parking demand management is desired, it is important that the parking charge prices can be modified when required to match any changes in parking demand.

5. References

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6. Appendix

Locality	Country	Inhabitants	Price before	Price after	Elasticity	Time
Big cities	?	> 1 million	?	?	From -0,1 to -0,43. Long-term: from -0,74 to -1,20	1971-1982
Dublin	Ireland	506,000 + suburban	IR£1 (€1.27)	IR£1.50 (€1.90)	-0,28 for workdays. -0,29 for workdays and Saturdays	2000-2001
Horsens	Denmark	Some 45,000	6 DKK	7.5 DKK	-0.16	2000-2003
Aalborg	Denmark	Some 125,000	8 DKK	10 DKK	-0,14 to -0,21 in city centre. Significant higher in the fringes of the city centre	2003
Copenhagen	Denmark	Some 1.2 Million	No before and after prices. A comparison between various parking areas.		Between -0,61 for the cheapest areas to -0,16 for most expensive areas	1999-2000
Eugene	Oregon, USA	150,000	16-30 $, 6-16 $ or 16-34 $ per month		-0,60 (affected by other measures)	1995
Big cities	?	?	?	?	-0,16 regarding long-term effects	?

Table 3. An overview of the found parking price elasticity.