

CiViTAS
Cleaner and better transport in cities

ARCHIMEDES

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Ústí nad Labem

R25.1 – Parking Strategy Research in Usti nad Labem

Ústí nad Labem

March 2010



THE CIVITAS INITIATIVE
IS CO-FINANCED BY THE
EUROPEAN UNION

Project no.	TREN/FP7TR/218940 ARCHIMEDES
Project Name	ARCHIMEDES (Achieving Real Change with Innovative Transport Measures Demonstrating Energy Savings)
Start date of the Project	15/09/2008
Duration:	48 months
Measure:	No. 25: Short term parking scheme in Ústí nad Labem
Task:	11.3.3: Parking Strategy Research
Deliverable:	R25.1: Parking Strategy Study in Usti nad Labem
Due date of Deliverable:	15 th December 2009
Actual submission date:	15 th March 2010
Dissemination Level	Public
Organisation Responsible	Ústí nad Labem Municipality
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Version	1
Date last updated	11 th March 2010

Contents

1. INTRODUCTION.....	4
1.1 BACKGROUND CIVITAS.....	4
1.2 BACKGROUND ARCHIMEDES.....	5
1.3 PARTICIPANT CITIES.....	5
1.3.1 <i>Leading City Innovation Areas</i>	5
2. ÚSTÍ NAD LABEM.....	6
3. BACKGROUND TO THE DELIVERABLE.....	6
3.1 SUMMARY DESCRIPTION OF THE TASK.....	6
4. PARKING STRATEGY RESEARCH.....	7
4.1 GENERAL BACKGROUND.....	7
4.2 PARKING POLICY IN USTI NAD LABEM.....	10
4.3 GENERAL SOLUTION.....	11
4.4 THE BASELINE SURVEY.....	14
4.5 PROPOSAL FOR APPROPRIATE MEASURES.....	17
4.6 MEASURES GENERALISED TO ALLOW APPLICATION ON OTHER AREAS.....	20
4.7 CONCLUSION.....	21
ANNEX 1 – DATA FROM THE BASELINE SURVEY.....	22
ANNEX 2 - THE SCHEME OF AREAS SUITABLE FOR IMPLEMENTATION OF NEW PARKING PLACES IN DOBETICE.....	27

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. Ústí nad Labem

Ústí nad Labem is situated in the north of the Czech Republic, about 20 km from the German border. Thanks to its location in the beautiful valley of the largest Czech river Labe (Elbe) and the surrounding Central Bohemian Massive, it is sometimes called 'the Gateway to Bohemia'. Ústí is an industrial, business and cultural centre of the Ústí region.

Ústí nad Labem is an important industrial centre of north-west Bohemia. The city's population is 93,859, living in an area of 93.95km². The city is also home to the Jan Evangelista Purkyně University with eight faculties and large student population. The city used to be a base for a large range of heavy industry, causing damage to the natural environment. This is now a major focus for improvement and care.

The Transport Master Plan, initiated in 2007, will be the basic transport document for the development of a new urban plan in 2011. This document will characterise the development of transport in the city for the next 15 years. Therefore, the opportunity to integrate Sustainable Urban Transport Planning best practices into the Master Plan of Usti nad Labem within the project represents an ideal match between city policy framework and the ARCHIMEDES project.

The project's main objective is to propose transport organisation of the city, depending on the urban form, transport intensity, development of public transport, and access needs. The process, running until 2011, will include improving the digital model of city transport that Ústí currently has at its disposal. The plan will have to deal with the fact (and mitigate against unwanted effects that could otherwise arise), that from 2010, the city will be fully connected to the D8 motorway, running from Prague to Dresden.

3. Background to the Deliverable

A short term parking scheme is being implemented in Usti nad Labem as part of measure 25 of the CIVITAS ARCHIMEDES project.

Measure 25 consists of two tasks:

Task 11.3.3: Parking Strategy Research – developing a feasibility study for a short term parking scheme;

followed by:

Task 3.7: Implementation of a Short Term Parking Scheme.

3.1 Summary Description of the Task

This deliverable is the result of Task 11.3.3 and is focused on improving conditions for parking in residential areas and in the city centre with regard to the future development. The study benefits from the experience of leading cities, such as Aalborg and other European cities. The proposal for implementing differentiated parking charges aims at reducing environmental impact and individual transport in the area. A survey of existing current traffic situation was finished in the

central part of the city and in the typical representative of a residential housing estate - Dobětice. As a result, traffic problems and lack of space were revealed. Appropriate solutions were proposed. The problems were generalised to serve other localities as well.

4. Parking Strategy Research

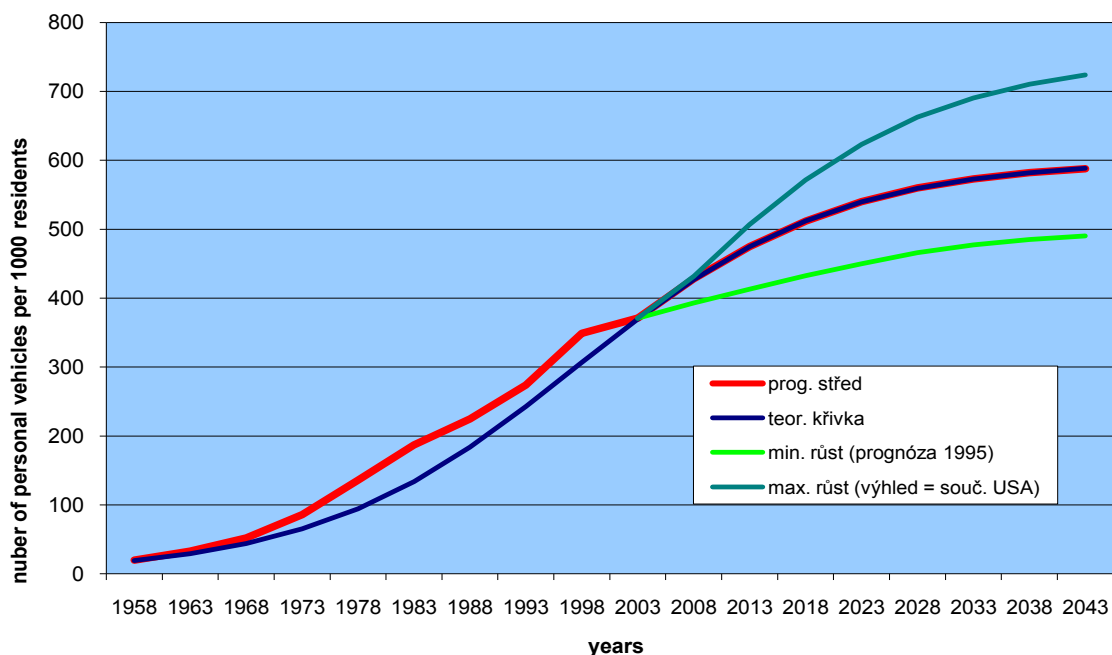
4.1 General Background

Transport policy was previously aimed only at providing a transport route. It did not deal with lack of parking spaces. This transport policy was continuously leading to increasing traffic levels and caused concentration of negative impacts to the environment and to the functioning of residential localities. New problems arose, such as high space occupancy and poor aesthetic level of parking areas, particularly in the historical parts of the city.

After 1989, there was a sharp increase in the number of passenger cars in Usti nad Labem. The space available for traffic in the city was not sufficient for the growing number of cars, particularly in the residential areas.

The current European trend is quite the opposite of this. The construction of new parking places in the inner city zones is restricted, parking in areas around the centre is limited, and the parking strategy is aimed at use of public transport. However, this trend demands financing from the city budgets.

Future motorization prognosis for the Czech Republic based on current development in the CR and EU



(Source: Cityplan)

The problem of a lack of parking places emerged with the intense development of residential constructions followed by the new trend of living on the periphery of the city poorly served by public transport. It increased use of personal cars and caused traffic burden on roads.

Stationary traffic includes all stationary vehicles stopped because of the driver's decision for a specific purpose. It can be divided as follows:

- parking
- short-term parking (up to 2 hours)
- long-term parking (over 2 hours)
- permanent parking places (over 24 hours)

Parking (including permanent places) needs to be established for all potential types of transport. These are various solutions:

- Parking lanes - along the side of roads with longitudinal places for parking (i.e. parallel to the direction of traffic flow)
- Parking strips - along the roads with diagonal or perpendicular places for parking (i.e. requiring a wider area for parking than parking lanes)
- Parking bays - parking lane/strip, which are not continuous along the full length between intersections
- Parking spaces - designated areas for parking of several vehicles away from but connected to the road network
- Collective public garages - buildings with the sole purpose of vehicle parking, often multi-storied, under or above ground (parking houses)
- Automatic parking systems - public garages where vehicles are stored mechanically by crane platforms, thus sparing additional access road space and maximising the parking usage
- Garage parking - mostly in the basements of apartment houses, office buildings or shopping centres
- Other types of parking - in buildings, in yards, gardens, industrial sites, etc.

Users are divided as follows:

- Resident - a person living in the covered area
- Enterpriser - natural or legal person having its registered office or business premises in the covered area
- Employee
- Visitor - random visitors of the covered area

In terms of accessibility, parking places can be private or public. The provider can be the city, a private operator or a private operator under a mandate contract.

Stationary traffic can be solved in two ways, which differ in costs, scope and efficiency: short-term and long-term solutions.

Short-term solutions offer immediate solutions through cheap modifications, generally with low efficiency. This is a temporary solution aimed at solving current problems without the ability to address the underlying causes within the transport system. It is aimed at maximizing effective usage of existing infrastructure in terms of available parking places. It is used mainly to solve a very acute lack of parking capacity.

Possible ways of increasing the number of parking spaces:

- Improving information systems to help the driver navigate to a free parking place

- Narrowing the traffic lanes and adding a parking lane / strip
- Shifting from longitudinal parking to sidelong or perpendicular parking by narrowing traffic lanes
- Changing a street to one way traffic flow, so enabling parking on both sides
- Reducing pedestrian and green spaces

Long-term solutions are more expensive, but effective for a much longer period. They are based on the prognosis for future traffic levels and future trends of urbanization. It includes arrangements for stationary traffic and also traffic calming/demand management by organising distribution of urban activities to reduce the transport demand. It is appropriate to implement traffic models simulating the future intensities.

Consequently, transport solutions must avoid aggravation of parking conditions in the outer parts of the city. It is necessary to aim at both city centre and surrounding areas, especially within long-term solutions.

The parking policy must involve public opinion. Inhabitants must clearly be explained the reasons for changes, particularly the introduction of the unpopular parking payment system. At the same time, an information campaign should be held to ensure people have enough time to adapt to new conditions.

Traffic is classified according to whether it is essential i.e. it has an origin / destination or any benefit to the area. Any unnecessary transport causing burden on communication system can be subdivided into three categories:

- 1st level: Does not have a source or destination in the area, transit passing through causing heavy burden to communications.
- 2nd level: Does have local source or destination but it is inappropriately located (such as an industrial building in the city centre). It produces undesirable transport relations usually with high demands on freight transport and negative impact on the environment.
- 3rd level: Source or destination point is properly located in the area, but it is served by inappropriate means of transport causing communication overload.

The unnecessary traffic can have a high demand on the available transport facilities. It decreases the road capacity, causes high density of vehicles and contributes to traffic congestion. The continuity of traffic is affecting the continuity and accuracy of public transport. Tools for reducing the unwanted traffic can be divided into the following groups:

1) Regulation of transport: It is the most demanding instrument in terms of time, finances and human resources. Traffic patterns are changed by construction measures, for example:

- construction of road bypasses
- charged access to the city centre, tolling system
- restricting number of parking places, charging, establishing residential zones

2) Organization of services: Adapting the road network according to the current traffic demand and maximising the effective use of the existing infrastructure, for example by:

- system of one-way roads and no-through-routes forming a non-passable zone with more parking places
- limited access to certain areas
- banned turn on crossroads in the direction of most conflict points (preferably left turns)
- residential zones, zones with speed limited to 30 km/hour and other traffic-calming measures

The disadvantage of these solutions is extension of transport time resulting in greater impact on the environment.

3) Traffic management: Direct influence of transport optimized for specific conditions of the area, such as:

- traffic signals
- traffic signs and horizontal road markings

The best solution is to bypass cities so that through traffic stays outside the built-up areas. This solution is highly time-consuming and expensive, but the most effective one.

After resolving the unnecessary transit traffic, the parking and permanent standing capacity is adjusted on the basis of current levels and future traffic forecasts. Usually, it is necessary to increase the number of parking spaces, first by using the existing space effectively and then by building new collective parking place. The prognosis of future levels of car ownership and use is necessary to obtain sustainable transport in the city.

4.2 Parking Policy in Usti nad Labem

The major problem is a discrepancy between the need for parking spaces and their actual numbers caused by out of date inappropriate construction solutions of socialism with no regard to the development of motorization.

The City Centre and the Surroundings

This area provides work opportunities, services and other activities for the wider region. Meeting the transport needs is even more difficult for regional cities, including Usti nad Labem. Any solution must concern not only the whole city but the Usti region as a complex.

A shortage of space is a typical attribute of the city centre along with high concentration of services and buildings causing high demands on the number of parking places. Furthermore, the demand is increased by transit traffic. Therefore, it is clear that the demand for parking in the centre dominates over the demand for permanent standing. Still, the possibility for residents to leave the vehicles near their homes must be preserved.

The effective parking policy requires an appropriate way of regulating parking and permanent standing, a traffic model to forecast the future transport links and demand for parking and the correct implementation of the proposed measures in the streets of the city. An important element is public awareness, not just local but widely spread involving visitors of the area. Information should be clear, simple, understandable and coherent. Helpful tools are official web site of the city, bulletin boards and distributed leaflets. The actual implementation of the information system includes realization of vertical and horizontal marking signs and telematics. The sufficient number of payment machines in the streets is a must. The additional useful information provided to drivers should contain alternative modes of transport to the centre, such as public transport connections and timetables, the tariff information, distances to the centre, orientation points, graphical visualisation, etc. Important role for sustainable stationary traffic is designated to the police. Checks must be frequent and consistent ensuring compliance with traffic rules and parking rules. Supervision of the police would also guarantee the passage of vehicles of the integrated rescue system.

Residential Areas

Residential areas are located mainly on the outskirts, outside main traffic flows. There are a few business and cultural destinations in these areas, so transit traffic is not generally causing parking problems. The major problem here is a significant deficit of permanent places, especially near the large housing estates that contain many housing units. The number of permanent places was designed to serve conditions in the past with no regard to future increases in traffic levels.

The majority of traffic is realised by local residents, therefore the demand for parking / permanent standing is relatively constant during the year. Long-term parking is predominant. Some people use their vehicles to travel to / from work, but mostly cars are used irregularly for shopping, special events and other rather rare occasions, otherwise the vehicles are left on parking lots. In practice, at least one parking spot is needed for one household according to the number of current housing units and the prognosis for residential development. The number of parking spaces must meet the current requirements with a certain reserve for parking capacity to serve the future demand.

Number of parking places is dependent on:

- The development of the area
- The degree of motorization and its development
- Type of buildings
- Number of housing units
- Number of inhabitants of the area
- Facilities in the area and transport links
- Social proportions of the population
- The quality of public transport

Housing Estates

Too many residents require more parking spaces and the number of vehicles is still growing. From a parking perspective, the only solution is to increase the number of parking lots. What can be prevented is the number of parked commercial vehicles. It is also possible to ban parking of business cars and cars of drivers without an address in the area.

Family houses and areas with lower density of residents

The number of inhabitants is lower, and in these areas, it is often possible to park on the property attached to the house. There is enough space on the streets. Longitudinal parking is achievable within a walking distance. These areas do not have serious parking problems.

4.3 General Solution

The efficient organization of parking can be solved as follows:

1) Restrictions on transit traffic and individual transport

The best way to reduce unwanted traffic is a bypass of the city (a bypassing section of highway D8 is being built round Usti nad Labem). Depending on the size of the city and both current and prospective traffic volumes, a large capacity highway bypass or a less expensive road bypass is preferred. Bypass improves the connection to the existing road network and the serviceability of the area. At the same time, the traffic through the city centre must be adjusted accordingly by traffic calming measures, such as preventing access to the centre, or making the passage through the centre time-consuming, complicated and inconvenient for drivers.

In the centre, it is desirable to create a restricted area – e.g. a pedestrian zone, with banned passage for vehicles or permitted passage only to certain vehicles (typically catering, public transport, emergency vehicles etc.) at certain times.

Tools to reduce individual transport:

- Support public transport
- Implement areas available for permanent parking places
- Charge the access to the city centre

2) Stationary traffic in the city centre

Parking charges reduce demand for parking and often result in reduction of traffic in the area. Drivers rather leave their vehicles in charge-free areas and continue their journey by another mode of transport (ideally by public transport). Charging increases revenue budgets covering the operation costs of parking places, reduces exhaust emissions and negative impact of motor transport (noise, vibration, accidents, etc.) and contributes to safety and development of non-motorized transport means (walking, cycling).

Means of stationary traffic solutions for the city centres:

- Paid parking
- Zones with charged standing
- Underground parking
- Collective parking places outside the centre on the outskirts of the city

3) Stationary traffic in residential areas

In residential areas, parking problems are concentrated mainly in areas with housing estates, rather than in areas with family houses. It is appropriate to apply engineering solutions.

Calming the traffic in areas of family houses:

- Residential zones – Solution is demanding in terms of construction measures. Physical and psychological calming features should be applied. Traffic space and residential space should be at one level.
- Zones "TEMPO 30" – Solution applicable to the existing communications with service functions and various levels of elevation of road and pavements. It requires psychological and physical calming elements.

The most common parking problem is the lack of places suitable for permanent parking. It occurs typically in highly populated housing estate areas. The only solution is to increase the number of available places in following ways:

Change of parking policy

To use the current available parking place and existing road space more effectively, a change in parking policy is needed. For example, a change from longitudinal parking to the angled one would create new parking lots. Additional parking places can be realised by unidirecting the existing two-way-traffic roads and by establishing additional parking lanes or strips. Usually, such modifications lead to narrowing of lanes, thus causing calming effect to traffic and enhance road safety. Specific solutions are dependent on space available for communications, and on the possibility to extend the roads.

Parking areas

In areas with lower density of buildings, it is usually possible to find suitable premises to set up new parking lots, even if the walking distance is longer; whereas in heavy-populated residential areas it is problematic to find open areas suitable for the implementation of parking spaces. It is necessary to use the available space efficiently. Parking in such areas is usually free of charge, except for more secure fenced parking places.

Parking houses

With a big deficit in parking capacity, commonly around busy house estates, it is appropriate to establish large capacity multiple-storied public garages. Most convenient way is to build above ground premises because they are significantly less expensive and the aesthetic aspect is not such a serious issue as in the city centre. However, it is appropriate to integrate the parking houses into the surroundings as much as possible, utilizing the terrain inclination, etc. Charges for parking in parking houses can include other services, such as guarding of the vehicles.

Charging the long-term and permanent parking vehicles

Despite many disadvantages, to charge parking and permanent standing is one of the possible solutions. Insufficient supply of parking space can be solved by establishing collective public garages. However, it requires considerable investments and the costs of operation and maintenance are also high. But in practice, financing from the city is probably not realistic.

Furthermore, the question is raised, why some vehicle owners should pay for collective parking in garages while others park for free on local roads and parking lots. Vehicles left in a garage are protected from weather (rain, snow, frost) and criminal activities (theft, vehicle damage, stolen vehicle). It is therefore an alternative with extra services offered to the driver. Then, the driver should be allowed to choose whether to pay and take advantage of comfort and safety along with the benefit of guaranteed available parking space, or to park for free with all the risks involved. The practice shows, that a paid garage / secure parking space finds its customers, even though it is not the majority of drivers.

However in highly populated residential areas with low capacity of free parking places drivers are forced to pay for parking. This case can be considered as discriminating, because some drivers have to pay for parking and others park for free.

In some residential areas with high parking demand and low capacity of space, the situation is solved by developing zones of charged parking in the streets. Zones would be designed for residents, who would receive a parking card (issued by magistrate or by designated administrator). Visitors would use payment machines. Company vehicles would be eliminated from these areas. The garage and permanent parking would be optional and extra charged as an extraordinary service, therefore would be more expensive than parking in streets. This solution would:

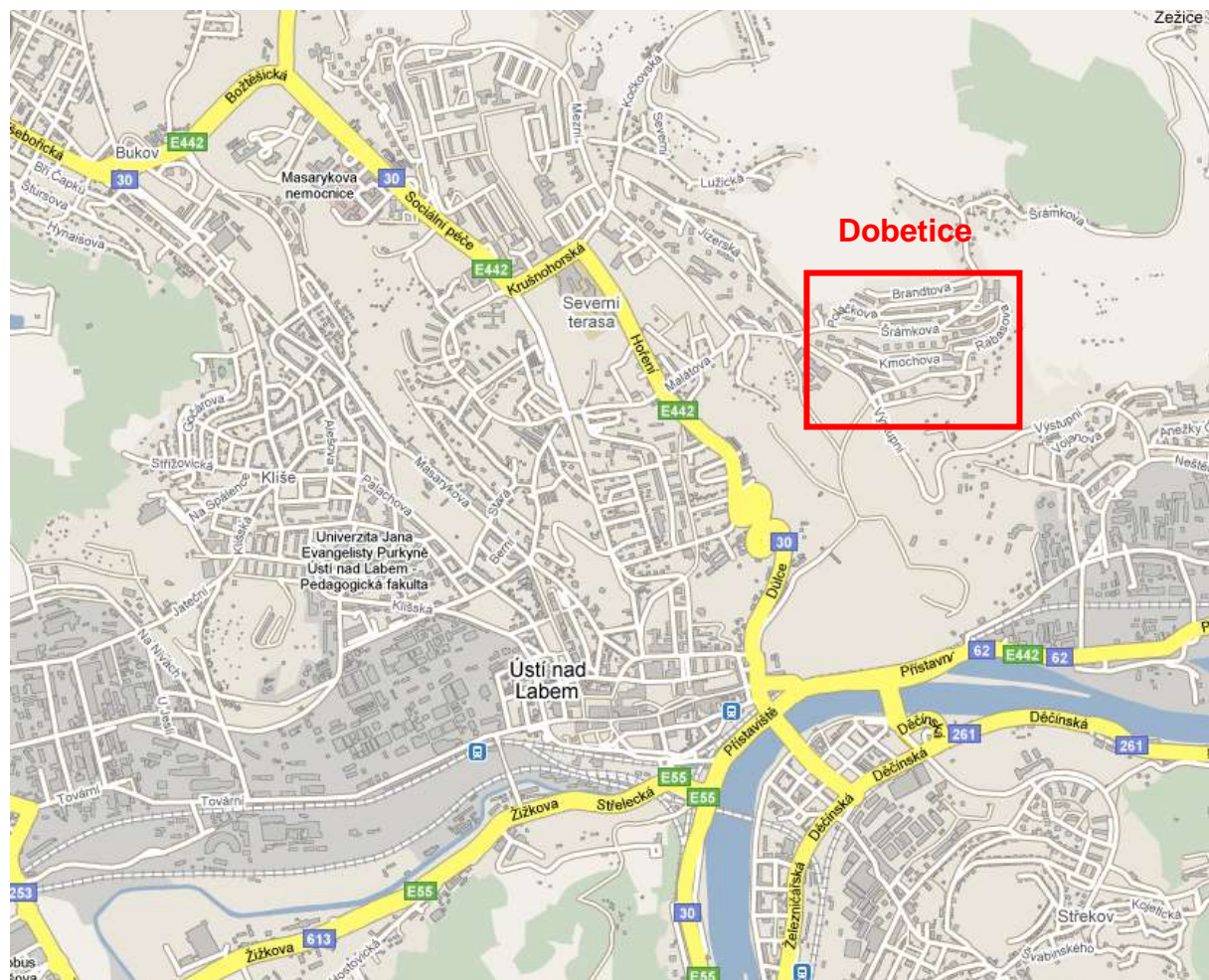
- eliminate the number of permanently parked vehicles of non-residents, thereby releasing space for residents
- avoid discrimination of vehicle owners forced to pay garage parking
- offer garage parking to non-residents charged by higher rate, thus reduce the price for residents and help to finance the operation costs and maintenance

The price for parking must respect the financial situation of the population in the region and not be burden to the family budget. At the same time it must also be less than the fee for parking in the city centre. It is possible to provide the first card for residential parking free for each household, with a progressive increase in price for additional cards.

When establishing charged zones, it is necessary to ensure sufficient number of parking places for residents, enabling them to benefit from the services they are paying for. Also, initial investments are needed for installing traffic signs, parking meters, for operation and maintenance and for issuing parking cards. The process would be accompanied by promotion and information campaign explaining the reasons for such steps. It is important to ensure police control and consistent persecution of drivers illegally using the resident parking sites.

4.4 The Baseline Survey

A field survey of selected areas was carried out to obtain data on the number of parked vehicles and the number of parking places. The chosen locality was a typical example, showing most of the parking problems common in the city, allowing generalisation of the possible solutions and eventually to enable their application to all parts of Usti nad Labem. The sample residential area was the housing estate Dobetice, which has a high concentration of population, high levels of built-up space and therefore major parking problems. Dobetice housing estate is located to the north of Usti nad Labem. It has varied terrain. The locality contains services, such as schools, shops, restaurants, retirement home etc. The area is served by 2 bus links and 2 trolleybus links.



The survey in Dobetice was carried out as follows:

- 1) Various criteria were monitored:
 - a. number of parked vehicles

- b. type of parking place (parking lanes, strips, bays, other parking spaces and garages)
 - c. capacity of parking space (field detected or calculated from the official data of the city road network according to dimensional dispositions)
 - d. photo documentation to reveal characteristic way of parking in the area, typical errors of drivers, etc.
- 2) Dobetice housing estate was divided into 72 sections according to the characteristic road profile – i.e., one section with perpendicular parking on both sides, another one with narrow bottleneck road, next one with longitudinal parking, etc. The survey was carried out on all the sections.
- 3) The survey was conducted on different days of the week and at different times:
- | | | | | |
|----------|-----------|-------|----|-------|
| Tuesday | 12/5/2009 | 9:50 | to | 11:30 |
| Thursday | 14/5/2009 | 11:00 | to | 11:45 |
| Thursday | 14/5/2009 | 13:30 | to | 14:50 |
| Friday | 15/5/2009 | 9:05 | to | 11:15 |
| Tuesday | 19/5/2009 | 8:10 | to | 9:50 |
| Sunday | 14/6/2009 | 19:00 | to | 21:00 |
| Monday | 15/6/2009 | 22:45 | to | 23:45 |
- 4) Collected data were processed:
The capacity for each locality was marked. The actual number of parked / permanent standing vehicles was enumerated. The numbers are considered against the space available for parking in the locality with regard to the legal limitations. The capacity is compared with the parking demand determined throughout the field survey. Finally, possible solutions are proposed to reach the two main goals:
- to reduce the parking deficits - ideally to match supply with demand and keep certain reserve in the number of parking places or in the spare areas for future development of parking places.
 - to propose modifications of current situation to prevent illegal parking in the area and prevent road safety hazards.

The proposed solutions involve analysis of appropriateness and possible risks, technical descriptions and schematic graphics. It deals also with political issues, future development of the area and compatibility with drivers in terms of intuitiveness and ease of use. The solutions are generalised for all the locations with their typical parking problems.

The study contains data from the past surveys realised within the SUTP development concerning information about parking problems in different parts of Usti nad Labem in 2001 – 2006 (see Annex 1). These data confirm the fact that all the localities suffer from parking problems.

Identified problems of stationary traffic in Dobetice

Several recurring parking / permanent standing problems were revealed during the field survey.

Major problems:

- serious deficit in the number of available parking places
- cars parked everywhere, on places inappropriate for parking

Frequently occurring issues:

- parked vehicles creating road bottlenecks

- parking in the driving lane of the street
- disregard of road signs
- longitudinal parking disregarding insufficient width of the road
- parking within crossroads causing traffic risks
- commercial vehicles parked in the residential area
- insufficient space disables transit of larger vehicles, such as fire trucks, garbage trucks and ambulance

Calculation of required number of parking spaces

The number of parking places (P) and permanent parking places (O) needed was calculated from the number of buildings (flats, shops, cultural, health, refreshment facilities, organizations, etc.) in the area. These values are multiplied by the influencing motorisation index (k_a) and index of parking spaces determined by the character of the commune (k_p). The required number of parking spaces (N) is then calculated by the formula:

$$N = O \cdot k_a + P \cdot k_a \cdot k_p$$

$k_a = 1,1$... index of the level of motorization approximately 440 vehicles / 1000 inhabitants
 $k_p = 0.6$... municipalities over 50 000 inhabitants with a good quality of public transport

As a result, the current number of required parking places in Dobetice is 3 227 and the deficit in parking is $3227 - 1649 = 1578$, which is 48.9%. Therefore the serious lack of suitable parking places was confirmed.

The prognosis for the future development of parking needs is using presumed inputs, such as demographic development, development of purchasing power, development of number of personal vehicles, etc. The horizon for the parking policy was set to 2025, marking the end of the new Master plan.

Input data:

- Number of housing units: 2 773
- Population: 6 752
- Demographic data of the Czech Republic

Gender	Total	Single	Married	Divorced	Widowed
Males	5082934	2218146	2303015	442271	119502
including number of children under 18		1020491			
Females	5298196	1812202	2289692	560967	635335
including number of children under 18		967613			
Total	10381130	4030348	4592707	1003238	754837
including number of children under 18		1988104			

The prognosis for the development of the number of personal vehicles from the year 2006, source CityPlan:

Years	No. of cars
2000	3 438 870
2005	3 958 708
2010	4 468 000
2015	4 898 000
2020	5 232 000
2025	5 480 000
2030	5 652 000
2035	5 766 000
2040	5 844 000

The nationwide prognosis of the growth of the number of personal vehicles is used to determine the required number of parking spaces in 2025 in Dobetice. The current number of cars is 4 423 370 (data from 2008) corresponding with the level of motorization 425 personal vehicles / 1 000 inhabitants. The growth is estimated up to 134% by The Central Management of Roads and Highways. Due to the ongoing financial crisis the value of 124% is rather more realistic. The prospective level of motorization in 2025 is 527 personal vehicles / 1 000 inhabitants. The required number of places for long-term parking in Dobetice in 2025 using this formula is **3 558 parking places**.

4.5 Proposal for Appropriate Measures

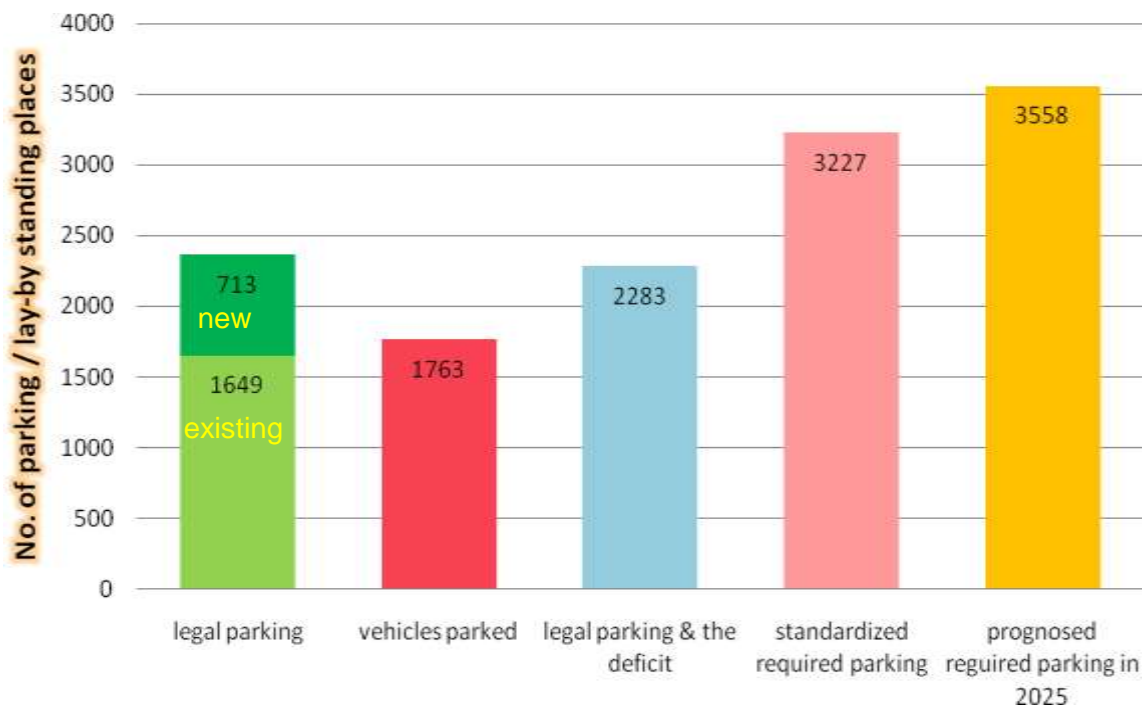
New parking places acceptable for the inhabitants should be designed within walking distance, which can be considered as up to 500 metres. Buildings in Dobetice are fairly evenly distributed throughout the area, therefore the parking demand is quite equal in all the parts and corrective measures should be applied evenly. The problem is lack of free space between the houses.

Proposed measures:

- 1) Regulation of existing legal parking spaces:
 - a) Indication of parking lanes and parking bays on all urban roads
 - b) Indication of areas with forbidden parking by both road marking and signing, especially near crossroads
 - c) on roads with insufficient width for two-way driving lanes (minimum lane width of 2.25 metres) and parking strip (min 2.0 metres) where the traffic is safe, the longitudinal parking is tolerated as follows:
 - parking lane is not marked
 - "stopping prohibited" is marked on the other side of the road and indicated by traffic signs
 This measure is appropriate for areas, where strictly forbidden parking would seriously increase the deficit of parking spaces.
 - d) Modification of selected streets to one-way roads to allow longitudinal parking on one side or on both sides.
- 2) Implementation of new parking/permanent standing places on the existing road or on other available space, connecting the parking place with the existing route network by new section of road.
- 3) Development of public garages in areas with the most critical parking facilities
- 4) Police enforcement of traffic laws and permanent monitoring of the areas

A summary of the results can be seen clearly in the following chart. The first column represents the number of current existing legal parking places and new places available for legal parking proposed in the study (marked on the map in the Annex 2). The second column shows the maximum number of parked cars counted during the field survey. The middle column is the sum of legal standing slots and the number of vehicles parked in violation of the law. This value appears to be the most important indicator of the current parking demand in the area. It is assumed that incorrectly parked vehicles would be parked legally, if there were available suitable parking premises. Compared to the first column, it is clear that legal parking together with the proposed new parking places could cover the current parking demand in Dobetice. The next two columns represent the calculated number of parking spaces according to Czech technical norms CSN 73 6110 and according to the future prognosis of parking demand in 2025. However, these requirements cannot be met due to limited available space and dense development in the area. The deficit can potentially be balanced by establishing additional collective garages on the outskirts of the housing estate Dobetice.

The number of parking places in Dobetice is demonstrated in the following graph:



Number of newly proposed parking places in Dobetice

section	Approx. no. of new parking places	solution
3	10	Shift to one-way roads
5	2	
7	10	
9	1	
1	12	New parking places
31	12	
44	17	
51	40	
18	17	Longitudinal parking in new

section	Approx. no. of new parking places	solution
19	12	parking bays along the road
32	12	
40	62	
42	34	
43	16	
59	30	
60	30	
72	10	
19	180	Collective garages two-storied
60	206	Collective garages three-storied
total	713	

The total number of newly designed parking places is 713, which together with the current number of legal standing is $1649 + 713 = 2362$ parking places in Dobetice. This sum would cover the parking demand in the area, which is the number of legal standing and the deficit together: $1649 + 634 = 2283$ ($2362 > 2283$). The sum of existing and proposed parking places is higher than the largest number of parked vehicles in the streets of Dobetice found during the survey ($2362 > 1763$).

Paid Parking Zones

A zone of paid parking in the whole Dobetice area would reduce the number of non-resident vehicles parked in the streets releasing some space for residents' vehicles. This solution would enable realisation of collective garages for drivers willing to pay extra charges for better services.

As part of this, commercial establishments would be provided with adequate number of parking spaces for customers. Marked spaces for visitors would be available.

Rates:

- Residential parking cards for on-street parking
 - The price for parking the first vehicle should be very low or even free.
 - Residential parking card in the city centre costs 400 CZK / year in the place of residence, the second card per household is five-times more and all the next ones ten-times more. It is desirable to introduce lower charges in Dobetice.
- Resident parking cards for collective garages
 - The price is designed to be significantly more expensive but better services would be offered.
 - The annual price for parking in collective garages in the city centre is 6426 CZK, it should be cheaper in Dobetice.
- Enterprise parking cards for collective garages
 - The price would be very high helping to finance the operation costs of garages and decreasing the price for residents.

- Visitor fee
 - short-term parking for approximately 10 CZK
 - long-term parking distinctively more expensive
 - Visitors would pay for parking at parking ticket machines placed at visitor parking premises.

The solution is rather problematic to implement due to the fact, that - according to the survey - most of local residents are not willing to pay for parking / permanent standing at their place of residence – in contrast to the attitude in the city centre. Also, high prices of parking in collective garages may cause insufficient use of the capacity and the shortage of parking places on the streets would then prevail.

4.6 Measures Generalised to Allow Application on Other Areas

The serious parking deficit is critical in many localities. This common problem can be found in highly populated areas with dense build-up spaces. The length of roads is not sufficient for parking of so many inhabitants. The only solution is to find additional space for new parking places without threatening the road safety, pedestrians, cyclists and especially children.

The procedure is the following:

- 1) to identify the current number of parking places
- 2) to identify the number of required parking places

In the case of deficit, then:

- 3) to regulate the existing legal parking space by:
 - implementing road marking for parking lanes and parking bays
 - indicating places where parking is forbidden by road markings and traffic signs
 - on roads with sufficient available width for both-way traffic, tolerate the longitudinal parking as follows: parking lane is not marked
"stopping forbidden" is marked on the other side of the road and is indicated by traffic signs

This measure can be applied on road sections with clear visibility, constant width, low traffic intensity and high safety level. It is necessary to ensure safe passage of integrated rescue system vehicles.

- 4) to transfer to one-way road to gain extra space for longitudinal parking lane

- 5) to implement new parking places and connect these areas to existing roads

- 6) to implement collective public garages where the parking deficit is the highest. This solution is financially demanding, so charges would be levied for parking in garages to partially retrieve the costs. It needs to be born in mind that although most residents in the city centre consider it to be acceptable to pay for parking, residents in the suburbs may not be willing to pay for local parking / permanent standing, even with improved additional services.

- 7) ensure police monitoring over the enforcement of traffic laws

Zones of paid parking

This measure should decrease the number of commercial vehicles parked in the residential areas by implementing the paid zone in the whole problematic section. The paid parking space would be intended for residents only, with several visitor parking spots served by parking ticket machines. Residents would be issued a parking card for a small fee for the first car in the household, for each additional car the cost would be significantly higher. Parking in public garages would be more expensive than parking in the streets to cover the operating costs. Still, the fee would be lower than prices of parking in the city centre.

4.7 Conclusion

Residential areas should not be charged by paid parking / permanent standing zones, unlike the central parts of Usti nad Labem, due to the fact that the number of required parking places is not affected by the presence of employment opportunities, services, health and cultural enjoyment, etc., as it is in the city centre. The parking demand is determined by the number of people living in the area. It is not possible to suppose the residents are able to park elsewhere if they are not willing to pay for parking at the place of residence. Parking in residential areas with housing estates can be solved only by increasing the number of parking places. The problem is insufficient space available for additional parking spots, even if exploiting the green areas. The parking problem does not occur in areas with family houses, where car owners can park on their own properties and the density of population compared to the space available on streets is not too high.

It is necessary to try to predict the future development of levels of car ownership and use dependent on purchasing power of the population to determine the number of required parking spaces. In 60s and 80s, the extreme parking deficit was caused by underestimating the future degree of motorisation, especially in housing estate areas. To eliminate the lack of parking in the future, the prognosis was calculated to the year 2025. It is not possible to cover the present and future parking demand entirely, but the parking deficit can be at least minimized.

A typical example is housing estate Dobetice, where the current parking capacity covers about half of the parking demand. Drivers leave their cars at all locations where it is physically possible, regardless the traffic laws. Vehicles are parked within intersections, on both sides of narrow streets. The passage for other vehicles is difficult and the road safety level is threatened. These conditions are dangerous especially for pedestrians. Despite the efforts, it was not possible to find a completely adequate solution. There is almost zero territorial reserve and the built-up areas are very dense with no available space for additional parking premises. Several localities were identified to be suitable for additional parking places and together with the existing legal parking places, the current parking / permanent standing demand can be covered. The deficit can be balanced only by implementing collective public garages with paid services, although, the residents may not be willing to pay for such secure local parking. For the future, the collective garages, zones of paid parking or additional parking places in long walking distances would have to be implemented.

Measures for improving the critical parking situation have to be accompanied by intensive promotion campaigns, explaining the reasons of these changes. After implementing the changes, it is necessary to monitor their functions and effectiveness and make any adjustments according to the findings. Furthermore, supervision of the police and interaction with the Municipality of Usti nad Labem is required.

ANNEX 1 – Data from the Baseline Survey

Number of vehicles parked in Dobetice housing estate:

Section number	Street	Tue	Thu	Thu	Fri	Tue	Sun	Mon
		12.5.2009 9:50 - 11:30	14.5.2009 11:00 - 11:45	14.5.2009 13:30 - 14:50	15.5.2009 9:05 - 11:15	19.5.2009 8:10 - 9:50	14.6.2009 19:00 - 21:00	15.6.2009 22:45 - 23:45
1	Poláčkova	11	X	5	8	8	7	24
2	Poláčkova x Ježkova	3	X	1	3	4	6	6
3	Poláčkova	15	X	12	12	9	16	16
4	Poláčkova	43	X	44	38	41	67	67
5	Poláčkova	2	X	2	1	2	6	7
6	Poláčkova	33	X	34	34	28	63	66
7	Poláčkova	5	X	3	3	14	21	24
8	Poláčkova	17	X	28	19	29	47	59
9	Poláčkova	0	X	2	0	4	0	1
10	Šrámkova	19	23	2	16	17	7	16
11	Šrámkova (domov důchodců)	3	4	21	3	4	0	0
12	Šrámkova	2	1	1	3	4	2	2
13	Šrámkova	3	5	4	3	3	2	4
14	Brandtova	15	X	12	12	14	22	23
15	Brandtova	25	X	17	20	19	41	40
16	Brandtova	21	X	29	31	28	60	65
17	Brandtova	31	X	21	25	21	54	46
18	Brandtova	37	X	32	32	32	55	58
19	Brandtova	4	X	4	2	6	10	14
20	Poláčkova x Ježkova (SČ sdružení neslyšících)	3	X	0	2	2	3	2
21	Ježkova	0	X	0	2	3	7	9
22	Ježkova	14	X	22	14	15	31	34
23	Ježkova	16	X	19	16	25	43	44
24	Ježkova	10	X	13	9	13	23	24
25	Ježkova	10	X	4	5	4	9	10
26	Ježkova	22	X	18	20	25	27	32
27	Ježkova	6	X	2	2	3	4	5
28	Šrámkova	5	3	6	4	6	5	11
29	Rabasova	6	X	11	10	9	16	16

Section number	Street	Tue	Thu	Thu	Fri	Tue	Sun	Mon
		12.5.2009 9:50 - 11:30	14.5.2009 11:00 - 11:45	14.5.2009 13:30 - 14:50	15.5.2009 9:05 - 11:15	19.5.2009 8:10 - 9:50	14.6.2009 19:00 - 21:00	15.6.2009 22:45 - 23:45
30	Rabasova	39	X	39	41	44	65	65
31	Rabasova	10	X	11	10	10	22	25
32	Rabasova	24	X	20	20	22	42	40
33	Rabasova	31	X	33	31	35	58	60
34	parkoviště Rabasova	0	X	20	18	25	38	42
35	Rabasova	20	X	26	23	25	31	33
36	Rabasova	6	X	12	5	11	17	21
37	Rabasova	10	X	8	10	13	1	4
38	Rabasova	12	X	17	14	13	22	25
39	Rabasova	1	X	0	1	1	0	0
40	parkoviště Rabasova	0	X	14	14	18	45	40
41	kryt CO Rabasova	1	X	2	3	2	1	4
42	Kmochova	1	X	0	2	1	1	5
43	Kmochova	8	X	7	8	12	16	16
44	Kmochova	38	X	38	32	40	70	76
45	Kmochova (placené park.)	0	X	22	28	26	63	73
46	Kmochova	47	X	46	15	44	81	100
47	Kmochova	12	X	11	6	10	18	20
48	Kmochova	31	X	39	34	39	55	58
49	Šrámkova (restaurace MILPA)	34	37	27	35	43	41	32
50	Pod Rozhlednou	7	X	8	9	8	40	18
51	Pod Rozhlednou	22	X	0	15	20	0	36
52	parkoviště domov důchodců	X	6	24	6	4	0	0
53	Šrámkova Top Club Restaurace	X	5	X	3	5	0	0
54	Šrámkova MŠ	X	0	X	2	1	0	0
55	Šrámkova (parkoviště výměník tepla)	X	5	X	5	3	7	8
56	Šrámkova	X	2	X	2	1	0	1
57	Šrámkova (parkoviště)	X	30	X	33	28	51	52
58	Šrámkova (parkoviště)	X	48	X	58	62	85	87
59	Šrámkova	X	6	X	9	5	0	15
60	Šrámkova	X	0	X	0	9	27	29

Section number	Street	Tue	Thu	Thu	Fri	Tue	Sun	Mon
		12.5.2009 9:50 - 11:30	14.5.2009 11:00 - 11:45	14.5.2009 13:30 - 14:50	15.5.2009 9:05 - 11:15	19.5.2009 8:10 - 9:50	14.6.2009 19:00 - 21:00	15.6.2009 22:45 - 23:45
61	Šrámkova (garáže)	X	X	X	X	X	X	X
62	Šrámkova (parkoviště výměník tepla)	X	0	X	0	0	0	0
63	Šrámkova	X	0	X	0	0	0	0
64	Kmochova (potravin)	X	20	20	23	25	21	31
65	SOS	X	0	6	27	25	3	0
66	SOS	X	13	5	17	13	2	0
67	SOS	X	9	3	16	19	0	0
68	Lídl	X	53	38	46	43	37	14
69	Poláčkova (v zákazu stání)	X	0	2	0	0	0	0
70	ZŠ Rabasova	X	X	8	6	8	0	0
71	Výstupní (lékarna)	X	X	3	6	6	1	1
72	Šrámkova	X	X	X	1	2	7	7
73	dvůr Poláčková ???	X	X	X	3	0	0	0
74	Garáže	X	X	X	X	X	X	X
75	Kmochova	x	x	x	x	x	x	x
76	Rabasova (parkoviště)	x	x	x	x	x	x	x
total		735	270	878	986	1113	1622	1763

The actual capacity for parking in Dobetice housing estate:

Section	Street	longitudinal	vertical	slantendicular	other	total	ballance
1	Poláčkova	0	0	0	0	0	-24
2	Poláčkova x Ježkova	0	0	0	0	0	-6
3	Poláčkova	14	0	0	0	14	-2
4	Poláčkova	0	70	0	0	70	3
5	Poláčkova	0	0	0	0	0	-7
6	Poláčkova	0	65	0	0	65	-1
7	Poláčkova	0	0	0	0	0	-24
8	Poláčkova	17	43	0	0	60	1
9	Poláčkova	0	0	0	0	0	-4

Section	Street	longitudinal	vertical	slantendicular	other	total	ballance
10	Šrámkova	4	20	0	0	24	1
11	Šrámkova (domov důchodců)					0	-21
12	Šrámkova	2	0	0	0	2	-2
13	Šrámkova	0	0	0	0	0	-5
14	Brandtova	20	0	0	0	20	-3
15	Brandtova	10	25	0	0	35	-6
16	Brandtova	17	38	0	0	55	-10
17	Brandtova	13	26	0	0	39	-15
18	Brandtova	23	0	0	0	23	-35
19	Brandtova	0	0	0	0	0	-14
20	Poláčkova x Ježkova (SČ sdružení neslyšících)					0	-3
21	Ježkova	0	0	0	0	0	-9
22	Ježkova	23	0	0	0	23	-11
23	Ježkova	10	0	22	0	32	-12
24	Ježkova	10	0	15	0	25	1
25	Ježkova	2	6	0	0	8	-2
26	Ježkova	0	32	0	0	32	0
27	Ježkova	0	0	0	0	0	-6
28	Šrámkova	0	0	0	0	0	-11
29	Rabasova	6	0	0	0	6	-10
30	Rabasova	19	41	0	0	60	-5
31	Rabasova	9	12	0	0	21	-4
32	Rabasova	19	20	0	0	39	-3
33	Rabasova	16	43	0	0	59	-1
34	parkoviště Rabasova	0	14	0	0	14	-28
35	Rabasova	12	0	0	0	12	-21
36	Rabasova	0	0	0	0	0	-21
37	Rabasova	0	0	0	0	0	-13
38	Rabasova	0	20	0	0	20	-5
39	Rabasova	0	0	0	0	0	-1
40	parkoviště Rabasova	0	42	0	0	42	-3
41	kryt CO Rabasova	0	0	0	0	0	-4
42	Kmochova	0	0	0	0	0	-5
43	Kmochova	6	0	0	0	6	-10

Section	Street	longitudinal	vertical	slantendicular	other	total	ballance
44	Kmochova	23	55	0	0	78	2
45	Kmochova (placené park.)	0	117	0	0	117	44
46	Kmochova	25	65	0	0	90	-10
47	Kmochova	10	0	0	0	10	-10
48	Kmochova	12	40	0	0	52	-6
49	Šrámkova (restaurace MILPA)	0	53	0	0	53	10
50	Pod Rozhlednou	0	0	0	0	0	-40
51	Pod Rozhlednou	0	27	0	0	27	-9
52	parkoviště domov důchodců	0	22	0	0	0	-24
53	Šrámkova Top Club Restaurace	0	0	0	0	0	-5
54	Šrámkova MŠ	0	0	0	0	0	-2
55	Šrámkova (výměník tepla)	0	0	0	0	0	-8
56	Šrámkova	0	0	0	0	0	-2
57	Šrámkova (parkoviště)	9	40	0	0	49	-3
58	Šrámkova (parkoviště)	0	90	0	0	90	3
59	Šrámkova	0	0	0	0	0	-15
60	Šrámkova	0	0	0	0	0	-29
61	Šrámkova (garáže)	0	0	0	82	82	
62	Šrámkova (výměník tepla)	0	0	0	0	0	0
63	Šrámkova	0	0	0	0	0	0
64	Kmochova (potraviny)	0	20	0	0		-31
65	SOS	0	50	0	0	0	-27
66	SOS	0	0	0	0	0	-17
67	SOS					0	-19
68	Lídl	0	0	0	99	0	-53
69	Poláčkova (v zákazu stání)	0	0	0	0	0	-2
70	ZŠ Rabasova	0	0	0	0	0	-8
71	Výstupní (lékarna)	0	4	0	0	4	-2
72	Šrámkova	0	0	0	0	0	-7
73	dvůr Poláčková	0	0	0	0	0	-3
74	Garáže	0	0	0	108	108	
75	Kmochova	0	0	0	0	0	0
76	Rabasova (parkoviště)	0	0	0	33	33	0
Total sum						1649	-634

ANNEX 2 - The scheme of areas suitable for implementation of new parking places in Dobetice

