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Cleaner and better transport in cities

ARCHIMEDES

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Ústí nad Labem

R27.1 - Feasibility Study of Access Control in Ústí nad Labem



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Contents

1. INTRODUCTION	3
1.1 BACKGROUND CIVITAS	3
1.2 BACKGROUND ARCHIMEDES	3
1.3 PARTICIPANT CITIES	3
1.3.1 <i>Leading City Innovation Areas</i>	3
2. ÚSTÍ NAD LABEM	3
3. BACKGROUND TO THE DELIVERABLE	3
3.1 SUMMARY DESCRIPTION OF THE TASK	3
4. CITY CENTRE ACCESS CONTROL IN ÚSTÍ NAD LABEM	3
4.1 REASONS FOR TRAFFIC REGULATIONS IN THE CITY CENTRE	3
4.1.1 <i>Transport Links</i>	3
4.1.2 <i>Development of Motorization</i>	3
4.2 GENERAL ORGANISATION OF TRAFFIC IN THE CITY	3
4.2.1 <i>Transport Policy</i>	3
4.2.2 <i>Specifications for the City Centre</i>	3
4.3 DEFINITION OF THE AREA	3
4.4 PRESENT STATE	3
4.4.1 <i>Parking</i>	3
4.4.2 <i>Public Transport</i>	3
4.4.3 <i>Cycling</i>	3
4.5 REGULATORY MEASURES	3
4.5.1 <i>Access to the City Centre Allowed for Transport Services Only</i>	3
4.5.2 <i>Access for Freight Vehicles/Vehicles over 3.5 Tonnes Prohibited</i>	3
4.5.3 <i>Zones Restricted According to Emission Values</i>	3
4.5.4 <i>A System of Roads with Regulated Traffic</i>	3
4.5.5 <i>Traffic Signal Lights</i>	3
4.5.6 <i>Paid Entrance (Toll)</i>	3
4.5.7 <i>Calm Zones</i>	3
4.6 PARKING SOLUTION	3
4.6.1 <i>Parking Zones</i>	3
4.6.2 <i>Park & Ride</i>	3
4.6.3 <i>Park & Go</i>	3
4.7 SUPPORTING MEASURES	3
4.7.1 <i>PT Improvements</i>	3
4.7.2 <i>Improving Conditions for Cycling and Walking</i>	3
4.7.3 <i>Solution for Parking Outside the City Centre</i>	3
4.7.4 <i>Promotion</i>	3
4.8 CONCLUSION	3
4.8.1 <i>Comparison of Tools Regulating the Access to the City Centre</i>	3
4.9 RECOMMENDATIONS	3

Annexes:

1 – Current traffic intensity in Ústí nad Labem [personal vehicles, light freight vehicles up to 3.5 tonnes, and heavy freight vehicles per 24 hours]

2 – Current traffic intensity in the city centre [personal vehicles, light freight vehicles up to 3.5 tonnes, and heavy freight vehicles per 24 hours]

3 - Traffic intensity in Ústí nad Labem after restrictions implemented in 2010 [personal vehicles, light freight vehicles up to 3.5 tonnes, heavy freight vehicles per 24 hours]

4 - Traffic intensity in the city centre after restrictions [values for personal vehicles, light freight vehicles up to 3.5 tonnes, heavy freight vehicles per 24 hours]

5 - Difference in traffic intensities [personal vehicles, light freight vehicles up to 3.5 tonnes, and heavy freight vehicles per 24 hours] after regulations implemented in 2010 (red - traffic growth, green - traffic calming)

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 Ústecký 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 Ústí 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

Ústí nad Labem is becoming gradually more and more congested with vehicles as the demand for travel grows. The city centre is overloaded by individual transport and the coordination and non-regulated supplying of business activities creates problems. The city has a target to improve the urban environment and ensure a better life for its inhabitants.

3.1 Summary Description of the Task

A feasibility study was developed to determine feasibility of implementing a city centre access control and develop a plan of measures that could be implemented as part of the Sustainable Urban Transport Plan in Ústí nad Labem with the aim to reduce the volume of traffic in the centre and to improve the environment in the city. The study was aimed at following issues:

- how to reduce the proportion of transit traffic
- how to reduce the number of vehicles entering the city centre
- how to improve conditions for safe walking and cycling
- how to reduce traffic congestion
- how to improve traffic safety and traffic flow
- how to improve conditions for public transport services in the area
- how to solve the parking problem in the city centre

The goal of the study is to propose possible options for regulating traffic in the centre of Ústí nad Labem, with the emphasis on describing the expected positive impacts, considering the

risks and negative consequences of individual actions and inter-comparison of these results with appropriate conclusions.

4. City Centre Access Control in Ústí nad Labem

4.1 Reasons for Traffic Regulations in the City Centre

The city centre is a densely built up area with high proportion of public facilities and services and therefore it is an area with great amount of transport links. The most common reasons for travelling are trips to and from work, school, for shopping and to and from free-time activities.

The city centre is divided into following areas:

- Residential areas (apartment buildings, housing complexes, districts and boroughs)
- Public buildings (cultural, administrative, health facilities, schools, shops and services)
- Industrial areas (industrial buildings and premises)
- Recreational areas (greenery, waters, natural areas)

Residential areas are concentrated mainly on the outskirts, whereas business opportunities have accumulated in the central parts - in the industrial districts away from residential areas, and in administrative buildings located mainly in the city centre. The function of the inner city is primarily to offer concentrated supply of services, shops, offices and schools. For historical reasons, the main traffic flows lead through the city centre, and also the main bus station and train station are located here. The need for transport links to and from the centre is obvious.

4.1.1 Transport Links

Transport links can be divided into internal transport and external transport (including regional transport). Transport links are realised by individual or public transport means (road, rail, water or air transport).

Three basic types of transport links are distinguished:

- 1) link between the place of residence and work or school
- 2) link to amenities and shopping opportunities
- 3) link to recreation, sports and other leisure activities

The essential transport link is from the place of residence to work or school. This relationship is realized basically by every employed resident of the city, usually on an everyday basis. Therefore, the strongest demand for transportation is in the morning before working hours (morning rush hour) and in the afternoon after working hours (afternoon peak). The city centre functions as the major intersection for both individual and public transport with heavy traffic especially during these periods.

Another important relationship is the link to shops, services, medical centres, cultural and leisure destinations. These facilities are mainly concentrated in the city centre; thus the direction of transport is in radial directions from the outskirts to the centre and back. Time of trips realised within these transport links depend on more factors, such as weather, time of

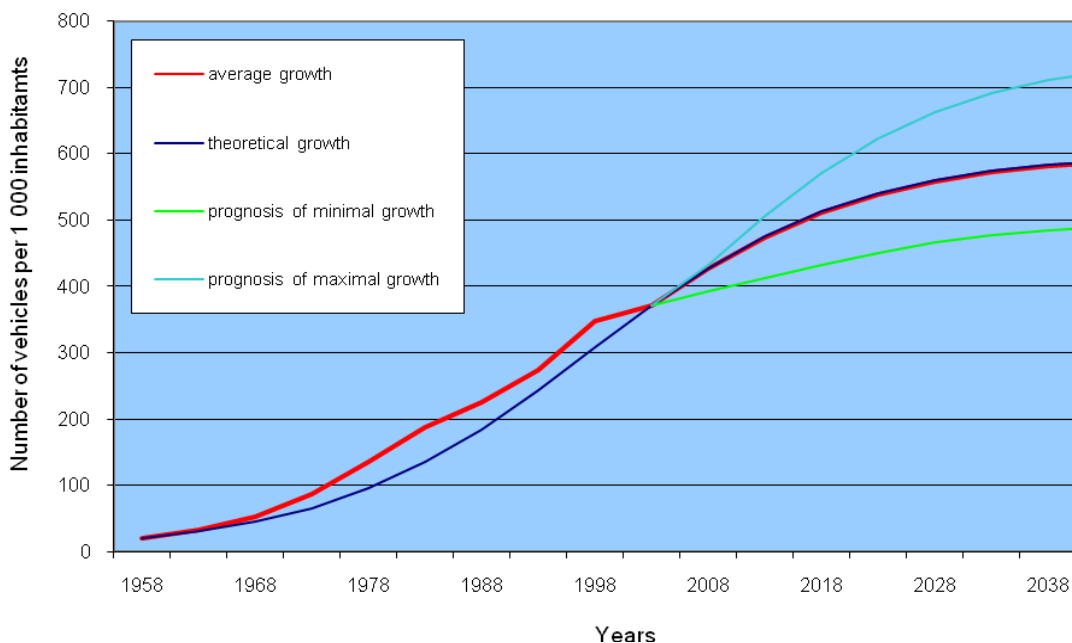
the year (e.g. Christmas), special occasions (e.g. concerts, sport events) and operating hours of commercial facilities, offices and services.

The transport link to recreational destinations is realised by public transportation, individual transport, on bicycle or on foot. Participants of such transport links may also be tourists passing through the city or visiting the city. Trips realised within this transport link vary widely in both time and direction.

4.1.2 Development of Motorization

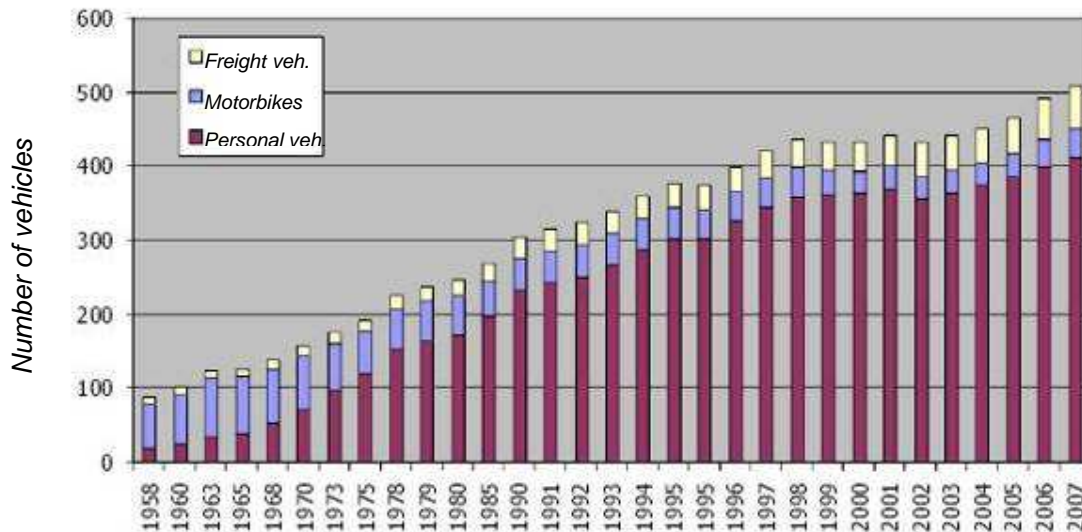
In the past, the only objective of the transport policy was to provide a route as convenient as possible for a driver. Position of the major infrastructure leading through the city centre and fast development of transport services for motor vehicles constitutes major problems. Planning of parking was insufficient and underestimated. After 1989, there was a sharp increase in the number of personal vehicles, causing major negative impact on residential functions of the city and on the environment. At the present time, space occupied by roads and parking places is extremely large with low aesthetic level.

Figure 1 - The level of motorization development in the past and foreseen in the future.
Prognosis for the development of motorisation in the Czech Republic



The next chart shows the trend in the number of motor vehicles (freight vehicles, personal vehicles and motorbikes) calculated per 1 000 inhabitants. These statistics cover the years 1958 - 2007. Data were taken from the database of the Road and Motorway Directorate, Prague Technical Administration of Communications and the Statistical Office of the Czech Republic.

Figure 2 - Number of vehicles per 1 000 inhabitants



The sharp increase in the number of vehicles in the last several years is obvious and the growth continues. Consequently, the traffic volumes and the demand for parking are expected to grow.

The current trend in the world, however, is that the city streets tend to keep clean of vehicles and motor traffic, calming the environment, and serve primarily to the residents of the city. The transit traffic is directed via bypasses outside built-up areas, lowering the negative impact on the city and its inhabitants. Priority is shifted to public transport, which is more efficient, environmental friendly and often faster than transport by cars.

Despite the growing traffic volumes and essentially unchanging capacity of road network, it is still necessary to maintain transport services reasonably covering the transport demand of inhabitants and visitors, to allow them to reach desired destinations. At the same time, alternative travel possibilities should be offered outside the city, with sufficient capacity reserve, allowing fast transit for those, who only need to pass.

4.2 General Organisation of Traffic in the City

4.2.1 Transport Policy

Transport policy must be consistent with the Master Plan of Ústí nad Labem, which is in the concept stage at the moment. The policy should deal with both motor and non-motor traffic conditions (cycling and walking) and should be aimed at improving public transportation (mainly local and regional PT).

Based on transport policy, a transport concept is developed according to the present and foreseen state of transport volumes and transport links, traffic flows, location and size of traffic sources and destinations. Then, the current transport infrastructure network is revised in terms of sufficiency and the adequate network is proposed to meet the transport needs. Reasonable segregation of individual modes of transport, public transport priority, traffic calming and appropriate parking solutions are applied within the transport policy.

According to the function, individual local roads are divided into following groups:

- A - Speed roads with transport function
- B - Collective roads with transport and serving function
- C - Utility roads with serving function
- D – divided into:
 - D1 – Local roads with mixed operation
 - D2 – Local roads inaccessible by motor vehicles

Local roads, type A, serve mainly the purpose of transit traffic. Pedestrian crossings should be separated by elevations or underpasses.

On local roads, type B, traffic calming should be applied adequately not to affect the fluency of the traffic flow. Most pedestrian crossings are located on this type of road.

On local roads, type C, traffic calming is desirable with pedestrian crossings directly on the same level.

Local roads, type D, include calming elements within their character. Movement of pedestrians is expected on the whole street profile.

The traffic is organised by directing the unnecessary transport onto roads of higher function type, thus reducing traffic on other local roads in the city. This goal must be achieved through effective tools that ensure good transport links and easy navigation with minimal maintenance. It should be suitable for all modes of transport (private or public transport, cycling, walking), satisfying the urban requirements and protecting the environment. The solution must be able to meet also the future traffic needs (predicted mainly from computer traffic models). It is necessary to divide traffic into such, which is necessary for the proper functioning of the city (public transportation, supply vehicles, taxi cars, emergency vehicles, cars of residents) and transit passing through the area, which brings no benefit and causes burden to the local road network.

The unnecessary traffic can be divided into three categories:

- 1st level: Does not have its source or target in the area, it is transit traffic with heavy burden on roads, undesirable in residential areas and in the city centre.
- 2nd level: Has its source or destination in the area, but it is poorly positioned (e.g. an industrial building in the city centre, a shopping complex with no connection to a sufficient capacity road network). This causes undesirable transport links and burden on local roads with high demand for both freight and personal transport.
- 3rd level: A transport source or destination is well placed in the area, but the transport links are realised by undesirable modes of transport (mainly personal vehicles, whereas public transportation is underutilised). This causes major problem mainly in the city centre.

The unnecessary traffic has high transport demands, lowering considerably road capacity, causing high density of vehicles in the streets and creating traffic congestions (mainly in peak hours on working days between approximately 8 – 10 am and 4 – 7 pm, depending on local conditions). Furthermore, the risk of traffic accidents is increased, together with the negative environmental impacts (noise, vibrations, dust, and exhaust emissions).

Tools for reducing the unnecessary traffic can be divided into the following groups:

- **Demand management:** The most demanding instrument in terms of time, financial and human resources. It changes traffic patterns in the area by adequate construction, organizational and regulatory measures, such as:
 - Pricing entry to the city centre, tolls

- Lowering the number of parking places, implementing parking fees and residential zones
- Reducing the attractiveness of passing the city centre by narrow lanes, complex intersections, long delays on traffic signals
- **Traffic organisation:** Organising the transport network to adapt the current traffic demand in the most effective way by using tools such as:
 - Implementing a complex system of one-way roads, dead-end roads, and non-passable roads with more space for parking
 - Prohibiting or limiting passage through certain roads
 - Prohibiting turning on intersections (preferably in the direction of most conflict points – mainly left)
 - Establishing residential zones, "Speed 30" zones
 - Implementing calming elementsThe disadvantage of this instrument is the fact that the route of the trip is becoming longer, causing more negative impacts to the surroundings.
- **Traffic management:** It is based on direct influence of traffic in the particular location by optimising the conditions in the following way:
 - Building bypasses
 - Implementing traffic lights
 - Implementing vertical and horizontal traffic signals

The best effect in reducing traffic on roads in central and residential areas can be achieved by building bypass and leading the traffic away from the city. However, this solution is time consuming and expensive.

The number of parking places should suit the character of the area, according to such factors as number of housing units in the area, size of shopping premises, cultural places, medical facilities, offices etc. The traffic intensity is one of the major factors influencing the parking conditions; therefore the solution should be aimed at reducing use of personal vehicles and promoting use of public transport. Furthermore, the prognosis of the future transport development determines the required parking and regulatory policy.

Parking capacity usually has to be increased by establishing the most effective use of the existing parking premises, then by constructing new parking areas and collective garages.

The number of required parking places is dependent on:

- character of buildings, number of housing units and number of residents
- attractiveness of services and business, type of offered services and goods, size of shopping areas
- the size of the area and the acceptable walking distance
- public transport services (intervals, routes, distance to stations, quality of services, low-floor vehicles, cleanliness, acceptable price, on time operation etc.)
- character of parking demand - short-term, full-time or permanent standing

For cycling policy, the strategy is based on revealing interesting cycling targets and determining potential future points of interest, locating cycling paths and trails. When constructing or reconstructing local roads, it is necessary to verify if the direction corresponds with a cycle route, if it is connecting different cycle routes, if the direction is desirable for cycle transport or if the cycling traffic is already ongoing through the road. In this case, implementation of designated areas for cyclists in a segregated lane or outside the route is

desirable. It is appropriate to establish a secure storage space for bicycles in nearby areas. In addition to the established cycle routes, access for cyclists to all residential areas and the city centre should be considered in relation with other measures, such as closing roads for other modes of transport, allowing cycling in both directions on one-way roads, implementing proper traffic markings, allowing entrance to pedestrian zones, etc.

4.2.2 Specifications for the City Centre

The reasons, why the problem with transit traffic is serious mainly in the city centre, are various. The historical trend caused all the major routes to pass through the centre or in its close proximity, where the old buildings are dense and streets are narrow. Such areas do not allow construction of high capacity roads or multiple parallel roads. Also, the number of parking places is strictly limited. Therefore, it is necessary to regulate primarily the traffic load on local roads (particularly the transit traffic) and subsequently, to deal with parking.

Parking in the city centre is not as homogenous as in residential areas, with great number of company vehicles. Turnover of vehicles is quite high, mainly on squares and attractive destinations, depending on location, time and season (tourism, holidays, special occasions).

The majority of cultural and historical monuments and cultural activities are located in the city centre, thus tourists and visitors concentrate in these parts. It is desirable to implement traffic calming measures on parts attractive for tourism by appropriate regulation, organization and traffic management. During the tourist season (depending also on the weather), transport demand rises, number of personal vehicles is increased and the parking problem becomes critical.

Other restrictive conditions in the centre include the historic style of buildings with narrow streets and limited space available for constructions, and a high demand on the aesthetic level of the surroundings. The city centre should serve primarily the residents, providing wide sidewalks, greenery and resting areas, with the aim on pedestrians (including tourists).

4.3 Definition of the Area

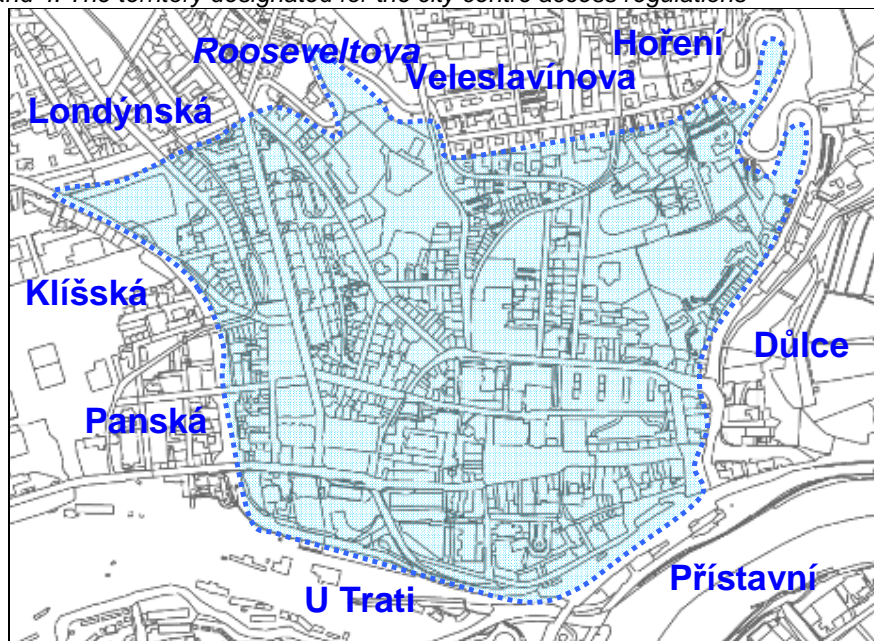
The very centre of Ústí nad Labem covers relatively small area. Development is dense and non-homogeneous, with large number of shops and services, and many housing units. There is a main train and bus station located in the city centre.

The access to the centre was based on the character of buildings and the limitations of the road network. It was necessary to ensure continuous transport link with the least negative impact on traffic flow and road capacity, directing the traffic to the outer parts of the zone.

The city centre was defined within the following streets:

Klíšská – Panská – U Trati – Přístavní – Důlce – Hoření – Veleoslavínova – Rooseveltova – Londýnská.

Figures 3 and 4: The territory designated for the city centre access regulations



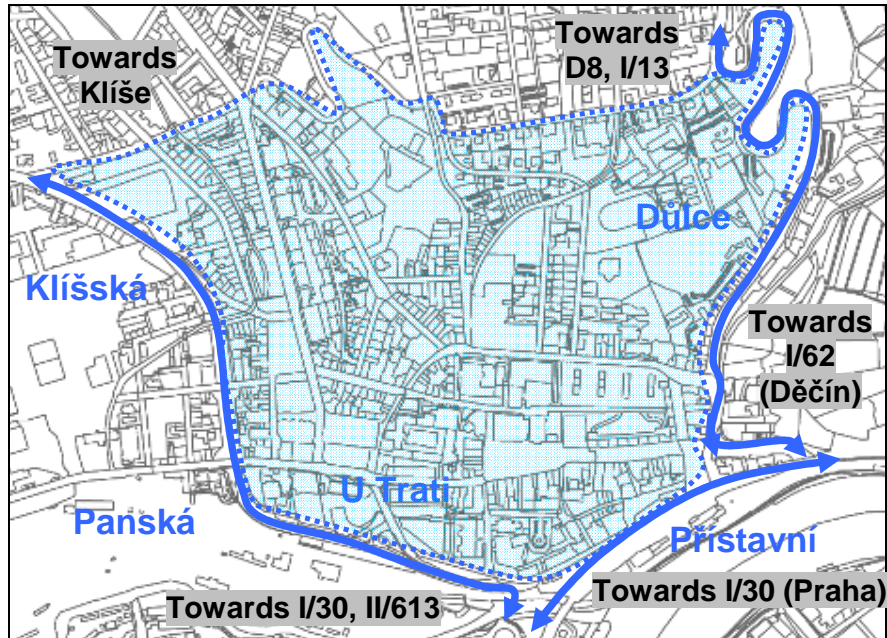
The length of the road network in the city centre is 10,53 km. Six crossroads are controlled by traffic lights. Regulatory measures applied in the area are:

- access for motor vehicles prohibited
- access for freight vehicles prohibited
- one-way traffic
- access for transport services only – which contains supply vehicles, medical and emergency vehicles, communal and maintenance vehicles, handicapped drivers, residents, taxi drivers and public transport

Several roads were selected from the current road network as suitable for transit traffic according to their technical state, which allows dense traffic flow of high intensity. Roads appropriate for redirecting the traffic from the city centre are:

- **Přístavní** – double flow road in both-directions, connecting roads I/30 and I/62 with regional importance, protected by flood-barriers
- **Důlce** – part of I/30, traffic in both directions, connection to D8 highway (Exit 74) and I/13
- **U Trati** – traffic in both directions
- **Panská - Klíšská** – local road with traffic in both directions, which are segregated on certain parts of the road, connects the city parts Klíše and Předlice with roads I/30 and II/613

Figure 5: Local roads suitable for transit traffic



4.4 Present State

Centre of the city is relatively small with dense build-up areas. The busy road network is influenced by buildings of historical character. Currently, the intensive traffic in the city centre is not comprehensively regulated. Solutions to calm the traffic in the central zone while meeting the transport demand are needed, with the aim of making environmental improvements - for both residents and visitors - and on cycle transport improvements.

Roads with the most intensive traffic are following:

- Přístavní – more than 35 000 vehicles/day
- Předmostí – between Důlce and Přístavní around 30 000 vehicles/day
- Velká Hradební and Pařížská – around 21 000 vehicles/day
- U Trati, Panská and Klíšská – around 20 000 vehicles/day
- Masarykova – around 20 000 vehicles/day
- Brněnská – almost 15 000 vehicles/day
- Malá Hradební – around 10 000 vehicles/day
- Bratislavská - Winstona Churchilla – around 10 000 vehicles/day

For more details about the intensity of traffic on individual streets in the city centre, please see the schemes in the Annexes.

The high intensity of motor vehicles on roads in the centre causes a major safety hazard to the large number of pedestrians passing through. To improve the situation, Ústí nad Labem implemented several measures to protect pedestrians, such as high quality marked crossings, signals for blind people, speed bumps and pedestrian refuges.

Public transport vehicles operate on the same infrastructure as individual transport with no priority measures in place.

The following major roads in the city centre have regulated access (a map of these roads is presented in figure 7):

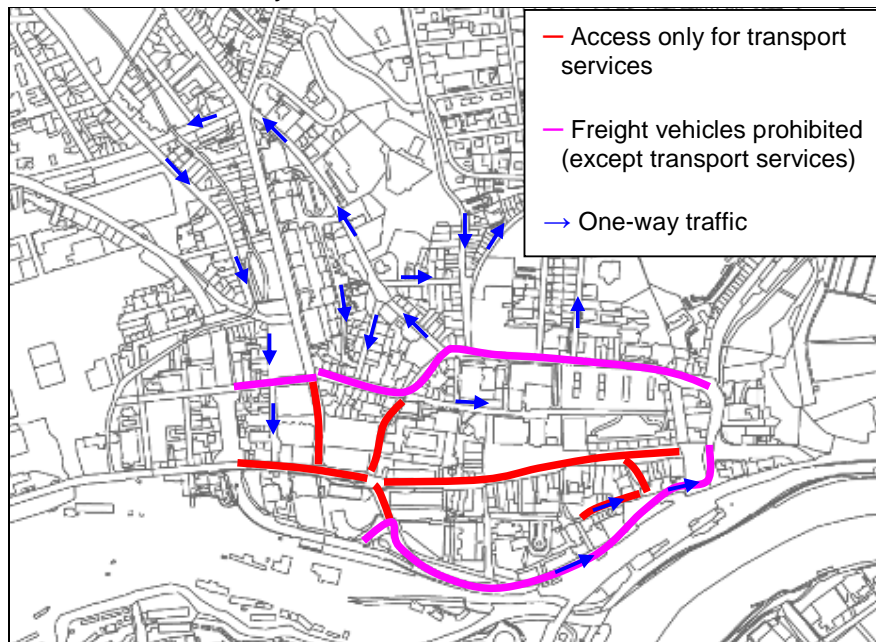
- **Revoluční** – the road is newly reconstructed, traffic operates in both directions, access is allowed on certain parts only for transport services
- **Mírové square** – links the roads Revoluční and Hrnčířská, two-way traffic, the road with the adjacent square were recently reconstructed to serve as a calm point, access restricted to transport service vehicles only
- **Hrnčířská** – the road continues from the Mírové square, two-way traffic in 2 lanes, newly reconstructed
- **Hradiště** – narrow one-way road, traffic allowed only towards train station
- **Velká Hradební** – two-way traffic, part of the road is marked as a residential zone, access prohibited for freight vehicles except for transport services
- **V Jirchářích** – reconstructed road, which connects roads U Nádraží and Hrnčířská, restrictions of residential zone applied on the whole length
- **Pařížská** – two-way traffic in 2 lanes, access prohibited for freight vehicles
- **Malá Hradební** – road reconstructed in 2009, two-way traffic in 2 lanes on the most of the road (from the shopping centre to the train station), on part of the road 1 lane is designated to public transport only, access for freight vehicles prohibited except for transport services
- Other important roads with one-way traffic are **Bratislavská and Winstona Churchilla**

Figure 6 - Major roads in the city centre (current state):



Taken together, the traffic regulations in the city centre forms an area closed for motor vehicles except public transport services. This area, which is roughly defined by roads Malá Hradební – Revoluční – Hrnčířská, consists of both historical buildings and modern development with narrow streets and is served only by public transport.

Figure 7: Scheme of roads in the city centre with restricted access



4.4.1 Parking

Parking in the centre of Ústí nad Labem is problematic. All parking, whether in collective garages (mainly located underground), on all the roads in the city centre and on parking areas in this area is paid. Traffic signs indicate the charging information for all the streets. On roads with newly reconstructed surfaces or with road markings, places designated for parking are marked with blue lines. Charging is realised through payment machines in the streets or through GSM network by SMS payments.

The survey conducted as part of ARCHIMEDES task 11.3.3 (Parking Strategy Research in Ústí nad Labem) and described in ARCHIMEDES deliverable R25.1 (Parking Strategy Study in Ústí nad Labem) revealed that the number of parked vehicles significantly exceeds the number of offered parking places in the area. In 2006, a parking scheme was developed for the city within the Master Plan, where the parking deficits are described in detail.

In general, the city centre lacks sufficient capacity for parking. The existing reserve within a walking distance from public facilities will soon be exhausted. The dense built up area causes difficulties in finding space available for implementation of new parking areas or collective garages. About 3,300 places are currently available for parking in the centre, including private property.

Number of parking places available in the city centre is presented in the following table:

Type of parking	Number of parking places
Parking marked on the surface	1 792
Personal garage	201
Collective garage	678
Parking in the streets (unmarked)	343
Parking in yards and other	261
Total	3 275

For the Master plan, the city centre was divided into 19 sections, according to the character of development (buildings, facilities, greenery, etc.). Section 1 and 2 involve mainly amenities and the parking demand is huge. Although these sections contain the largest parking capacities, the number of places is not sufficient. All the available parking areas are completely utilised, especially on working days. Another high capacity parking area is located in the section 19. In some sections, such as 15 and 18, parking is concentrated directly on roads. In other parts, vehicles are parked in yards or garages.

Figure 8: Scheme of the city centre divided into 19 sections according to their various characters

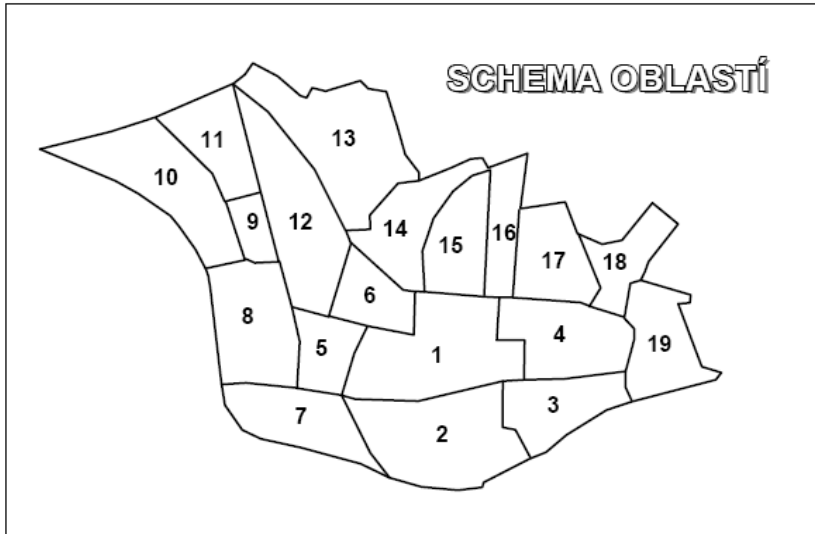


Figure 9: Location of major parking areas in the city centre (including the ones under construction)

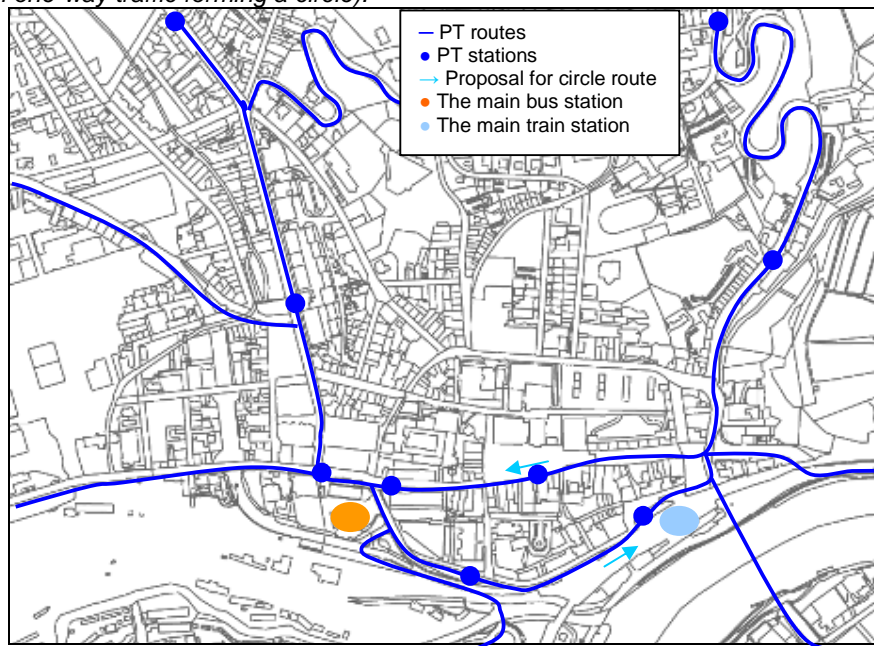


4.4.2 Public Transport

The city centre is well served by a dense network of public transport lines - buses and trolleybuses. The number of PT stations (7 in the central part) is sufficient and allows passengers to reach any point in the central area within a reasonable walking distance. Public transport routes pass through the regular road network with no priority. However, on roads Hrnčířská and Revoluční, access is denied for motor vehicles with the exception of public transport.

Over 20 bus and trolleybus lines operate in the city centre. The average transport performance on a regular working day is 42.7 thousand km, from which 2 890 km are in the city centre. Currently, it is considered to lead the PT route in a single direction to form a circle in the centre (as marked on the figure 10 below).

Figure 10: Scheme of public transport routes and station in the city centre (arrows represent proposal to establish one-way traffic forming a circle):



4.4.3 Cycling

Ústecký region is attractive area for cycling. The centre of the city has a potential to develop into a crossroad of cycle routes leading to many cycle points of interest. However, cycle routes are not interlinked at the present state and cycle transport is not well developed in Ústí nad Labem. Cycle routes in the closest proximity to the city are 1st class route number 2 and 4th class routes number 3074, 3084, 3090 (national classification of cycle routes class I to IV).

4.5 Regulatory Measures

The city centre covers a rather small area. Its function is various, from providing residents with housing, offering cultural realisation, business opportunities, shops, services, offices, medical facilities, etc. Therefore, accessibility of the centre has to be on a high level.

When proposing regulations for the city centre access, following should be taken into consideration:

- **City public transport:** The area is intensively served by public transport. Buses and trolleybuses connect the centre with other parts of the city, transporting mainly residents between their home – work/school – free time activities – services.
- **Charter buses:** The main station for charter buses is located in the city centre, therefore it is necessary to allow passage of these buses through the central areas.
- **Supply vehicles:** Currently, most shops and services are provided by their own supplier individually creating large traffic volumes. This logistic system must be respected.
- **Residents:** Large number of housing units is located in the city centre. Many inhabitants are owners of vehicles and should be allowed to reach their home by car. Number of parking places in the centre is not currently sufficient for both residents and visitors. Residents' vehicles mostly perform trips to and from the centre, not moving between points of interest in the area. Such vehicles require parking premises near the place of owner's residence.
- **Shops and services:** It is necessary to ensure entrance to variety of shops and services located in the centre and possibly allow customers to bring purchased items home by car. It should be decided whether all the current trips by individual means of transport should be preserved. Short term parking schemes on individual premises are designed by the operator.
- **Medical facilities:** Access by personal vehicles must be ensured mainly to the hospital, where a large number of people with mobile restrictions are expected. Public transport is often not an acceptable alternative.
- **Main stations:** The main bus station and the main train station serve as important points for different means of transport. Parking premises are important to interlink individual and public transport in the centre and to allow comfortable access to public transportation.
- **Regular trips:** Typically citizens require commuting to work by own vehicle, increasing the parking deficit in the city centre, where work opportunities are concentrated. Intensity of such traffic is unevenly distributed during a day and during a week.
- **Irregular trips:** Some occasions require access to the centre by a vehicle, for example moving to a different place, transportation of heavy items, transportation of mobile disabled people, of children and animals, etc.
- **Tourists:** Ústí nad Labem is not a typical tourist destination. However, tourism is still expected. Main points of interest in the city centre are Větruše castle, Střekov castle, the river Elbe and the Zoo. Tourism increases the demand for parking.
- **Transit traffic:** Transit traffic without the source or destination in the city centre is realised by personal and freight vehicles, causing burden by noise, emissions, and safety hazard.
- **Taxi:** Taxi vehicles should have access to all important localities in the centre, such as medical, cultural and business facilities, hotels, offices and PT stations.

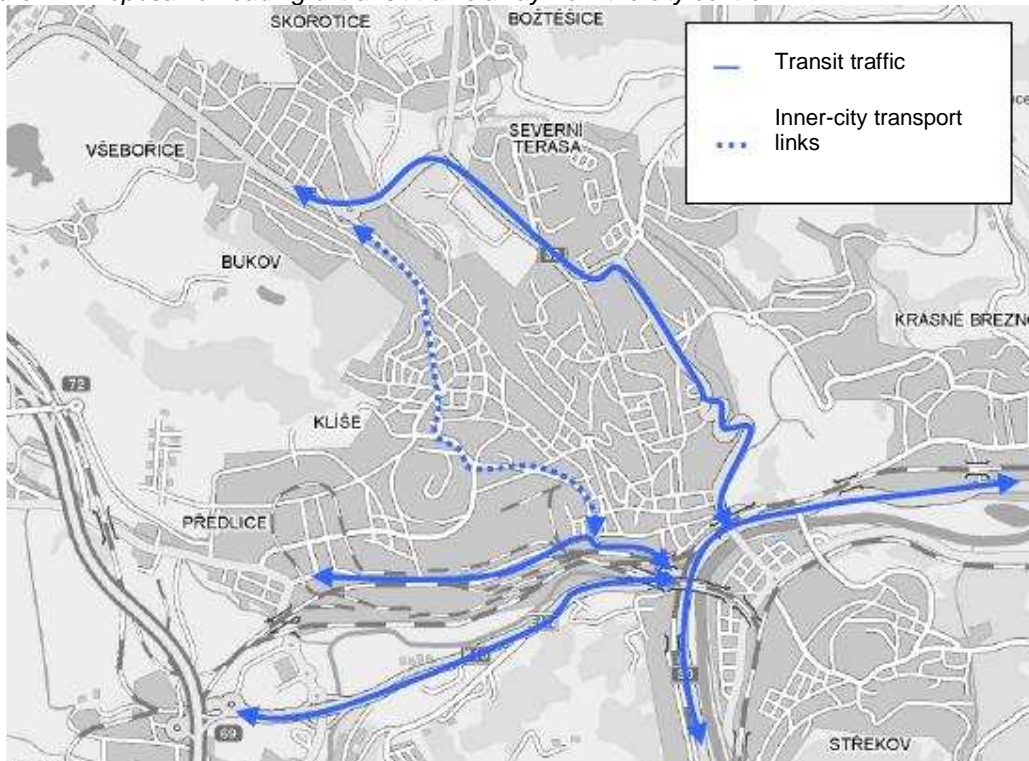
- **Emergency vehicles:** The whole area must be served by vehicles of Integrated Rescue System – police, ambulance and fire brigade – along with other service vehicles.
- **Other transport links realised in the area:** It is appropriate to consider, which transport links are necessary in the area and should be preserved and for which should be found a proper alternative.
- **Cycle transport:** Good conditions for cycle transport should be developed in the city centre, including construction of cycle paths and elements improving safety, allowing cycle transport on areas with restricted traffic or with no traffic, implementation of safe storage areas for bicycles, promotion of cycle transport.
- **Pedestrians:** The aim is to adapt the city centre primarily to pedestrians, thus calming the traffic in the area and reducing noise and emissions influencing the surroundings. The central zone must be equipped by adequate width of pavements, offer suitable resting places, provide greenery, develop barrier free routes, etc.

The main task is to eliminate the transit traffic (which brings no benefit to the area) from the city centre and to transfer it on suitable routes outside the central part. Such restriction would have impact on the whole road network in the city and if applied correctly, it would improve the traffic flow and traffic safety significantly.

Calming of the traffic intensity should be applied primarily to following busy streets: Velká Hradební, Pařížská, Bratislavská, and Winstona Churchilla, Masarykova (Please see the scheme in figure 6).

The alternative routes for transit traffic were proposed on the current road network of the city and are marked on the following figure.

Figure 11: Proposal for leading of transit traffic away from the city centre

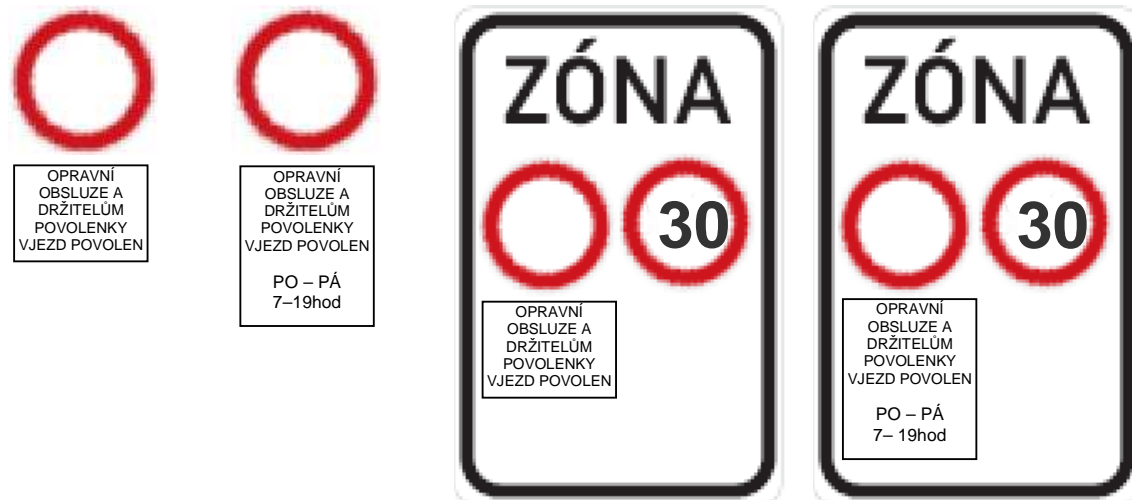


4.5.1 Access to the City Centre Allowed for Transport Services Only

This solution is very radical. The access is denied for all motor vehicles except for supply vehicles, medical and emergency vehicles, communal and maintenance vehicles, vehicles of handicapped drivers, residents, taxi drivers and public transport.

Such solution would be signified by traffic signs and road markings, on all the entrances to the city centre. It is proposed to mark the area as "Zone 30", which would further calm the traffic by reducing the speed and thus improving traffic safety. Regulations would be enforced by city police; any unauthorized access would be fined. Alternatively, the regulation can be limited only on working day peaks.

Figure 12: Horizontal traffic signs for regulated access to the city centre (4 options dependent on time-limits and speed-limits)



Permits for entry would be issued by Ústí nad Labem Municipality or by the City Police for one-time access or for various periods. Permits would be assigned to a resident or to a particular vehicle of the resident. Portable permits would be issued for the whole housing unit/family.

Advantage:

- This solution greatly reduces traffic volumes in the city centre.
- Serviceability is maintained by public transport vehicles, which would operate more efficiently in improved traffic conditions. More inhabitants start to use public transport in the city centre.
- The noise burden from traffic is lowered.
- Safety on roads is improved.
- As a result, city centre is more attractive for both pedestrians and cyclists.

Disadvantage:

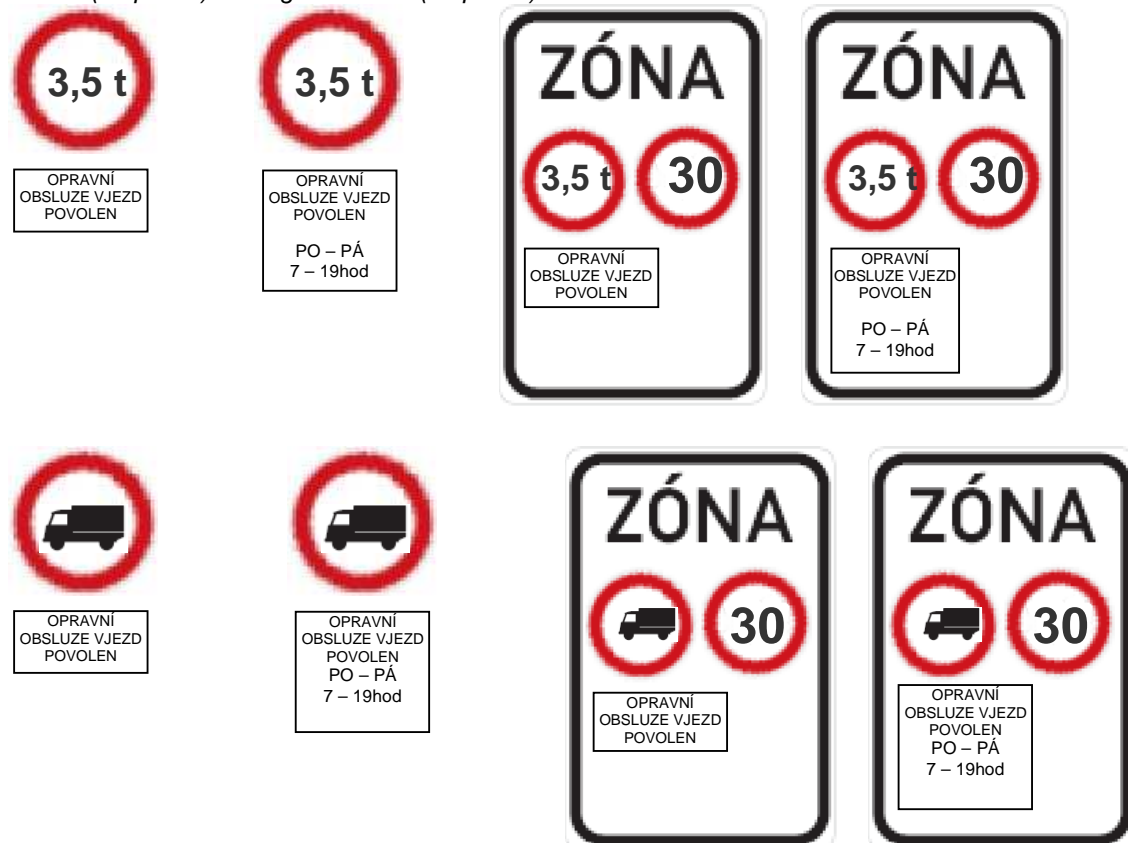
- The solution is significantly limiting the use of personal vehicles, preventing their use for such purposes as shopping, use of services, visiting, transport of heavy loads, etc. It would cause resistance from owners of stores, businesses and services operating in the city centre.
- All traffic is converted to roads Žižkova, Přístavní and Důlce.

- Demand for parking around the city centre would be greatly increased. The most critical parking problem would be by the hospital and by the University, where the current reserve is not sufficient.
- Necessity to control issuance of access permits to prevent exploitation.
- Necessity of continual control and enforcement by the City Police.

4.5.2 Access for Freight Vehicles/Vehicles over 3.5 Tonnes Prohibited

Access to the city centre is allowed to vehicles under 3,5 tonnes (which are not freight vehicles) and to transport services - supply vehicles, medical and emergency vehicles, communal and maintenance vehicles, vehicles of handicapped drivers, residents, taxi drivers and public transport. Entrance for freight vehicles/vehicle over 3,5 tonnes could be prohibited permanently or it can be time-limited (during the busy hours of working days). Access permits for restricted vehicles could be issued on request with reasoning (such as moving furniture, large deliveries, etc.) The zone would be indicated by traffic signs, as presented on the figure.

Figure 13: Horizontal traffic signs marking the area with access prohibited for vehicles above 3,5 tonnes (4 options) or freight vehicles (4 options)



Advantage:

- In overall, traffic conditions slightly improved.

Disadvantage:

- Freight vehicles form only 10% of total traffic load in the centre. Access for personal vehicles is not regulated; therefore, this solution is not very effective traffic calming measure.
- Demand for parking stays the same with unchanged deficit of parking places.
- Difficulty for town centre residents and businesses in getting certain deliveries.

4.5.3 Zones Restricted According to Emission Values

Access to the city centre can be regulated by prohibiting entry to vehicles not meeting certain emission standards, as introduced in other cities in the world (in Germany, Sweden, Great Britain, Japan etc.). Ústí nad Labem is currently considering a change in legislation, which would enable establishment of limited emission zones in the city in 2011 compatible with German ones (*Umweltzonen*). It is necessary to provide alternative routes for vehicles not authorised to enter the zone. Vehicles of transport services would be issued permits entitling them to enter but it would be desirable for them to meet the standards as well.

Figure 14: Traffic signs marking low-emission zones in German cities



The advantage of this measure is to improve the environment in the area due to lower emissions.

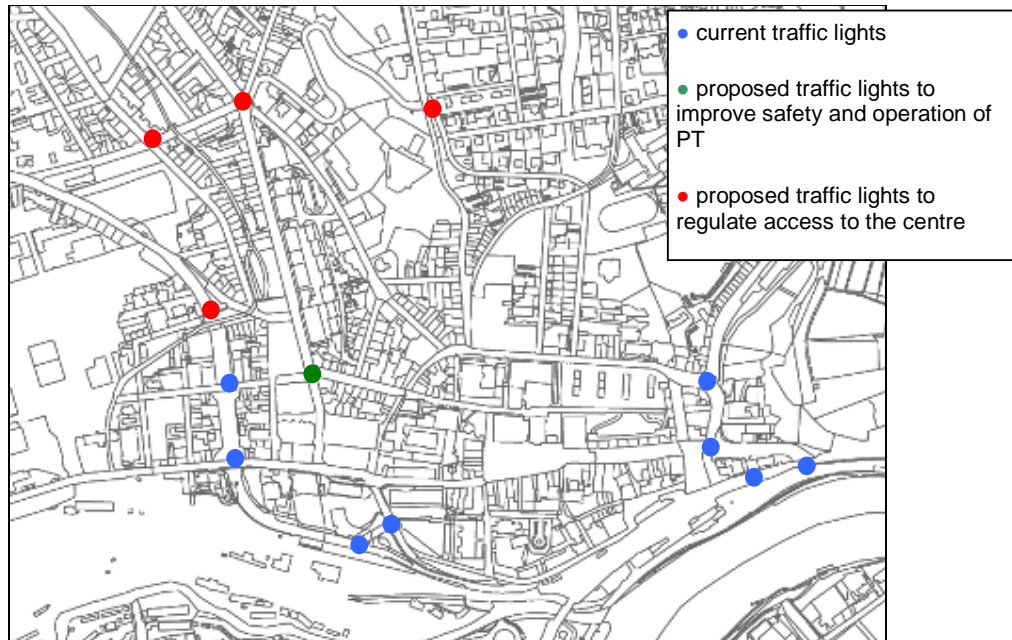
Advantage:

- Environment is improved in the area due to lower emissions.
- Traffic intensity slightly lowered.

Disadvantage:

- Parking problem not solved.
- Problem becomes with the public transport in the city centre. Many PT vehicles currently do not meet the emission standards, their average age is 10 years.

Figure 16: Location of current and proposed traffic lights in the city centre



Advantage:

- Safety for pedestrians improved.
- Fewer accidents occur especially when turning left.
- Better fluency of traffic on subordinate roads.
- PT vehicles operate more smoothly.
- Operation of signal lights is based on actual real-time traffic situation.
- Calming the traffic at night by preventing speeding vehicles.

Disadvantage:

- Separate lanes for PT are required to allow proper priority of way (the width of roads in the city centre is not sufficient).
- Expensive implementation of the measure.

4.5.6 Paid Entrance (Toll)

Technical solutions are based on identifying vehicles entering the area in following ways:

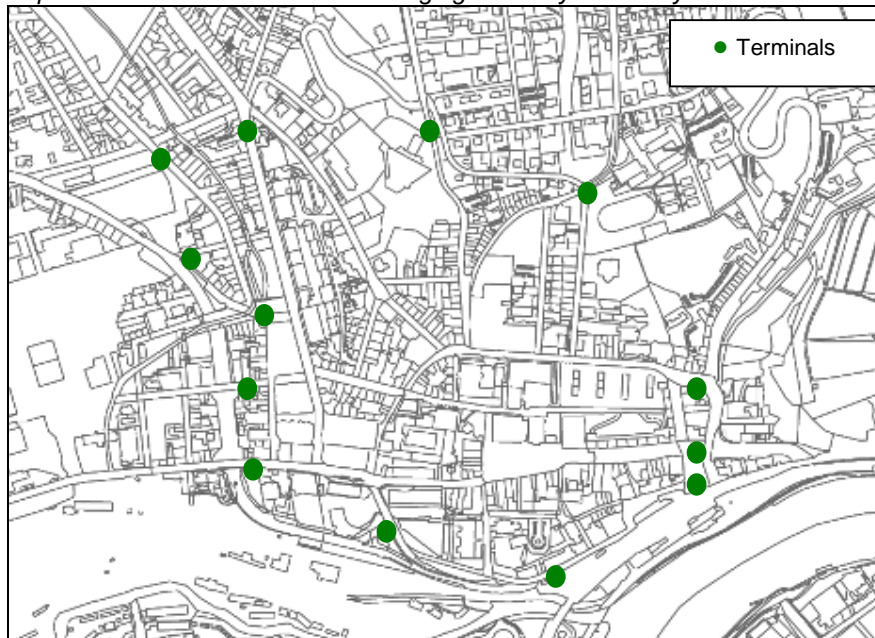
- On Board Unit - a small device placed in every vehicle, detected by short-range toll gates (already implemented for freight vehicles on highways) or by GPS (inputs transferred to the control station by mobile phone). The advantage of such solution is that the entrance is not interrupting the traffic flow.
- Automatic Number Plate Recognition - Automatic recognition of license plates of all vehicles passing the cameras by the entrance to the central zone. This solution is the most convenient one as it does not require active participation of drivers.
- Direct payment at terminals located at all entrances to the area. This solution is space-consuming because it requires a larger number of parallel lanes with payment

terminals to avoid excessive disrupting of traffic and traffic jams in the surrounding areas.

Data are usually stored until the fee is paid (which does not apply for direct payments). The payment method should be flexible and user friendly: electronically, by GSM (sending SMS by a mobile phone), by a bank transfer, at ATMs, at terminals in cash or by credit card, at ticket machines in the streets, in shops, at gas stations in the area, etc.

Paid entrance can be limited only to working days or to specific time of days (for example between 7 am – 7 pm). The rate of the toll can be regulated according to traffic intensities or category of vehicles. Transport services should have free access; residents should have significant discounts (e.g. 75% - 100%).

Figure 17: Proposal for location of terminals charging the entry to the city centre



Advantage:

- The traffic volume in the centre is reduced (by around 20% according to the experience of other cities), emissions are decreased accordingly.
- Demand for parking is expected to be reduced, increasing the capacity for parking of residents.
- Another positive aspect is certain income to the city budget.

Disadvantage:

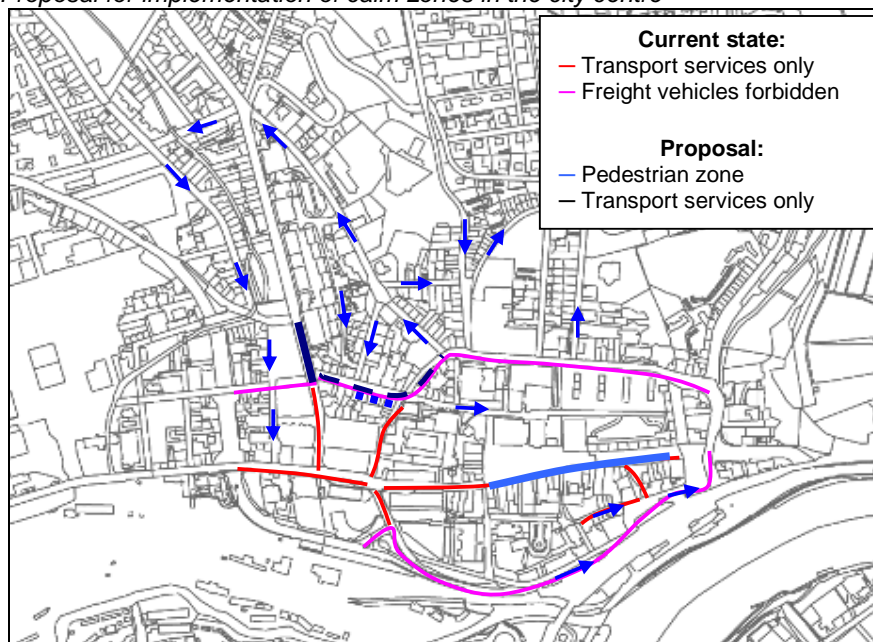
- High investment costs to build the necessary technology.
- Difficulties in servicing the area
- Transport services in the area will be difficult - either vehicles will pay tolls (results in expensive services), or get an exemption from the city, or it will be served outside the paid period.
- Inconvenient for costumers of shops and services.
- Parking problem can be shifted to the surrounding adjacent areas.
- Construction of toll gates will distort the urban appearance of the area.

4.5.7 Traffic Calmed Zones

The city centre can be regulated by construction work only in certain areas. Calming elements suitable for regulations are mainly speed bumps and slow-down stripes, elevated surface (on intersections), roundabouts, reflective traffic signs, speed measuring radars with information boards, diagonal lines marked on a surface, or greenery by roads visually narrowing the space. Traffic restrictions applied on a certain area result in calm zones:

- Pedestrian zones – Streets are intended only for pedestrians. Individual elements are on one level, allowing obstacle-free access. Operation of public transport in the zone is possible if the road is sufficiently broad and lanes for PT are well visibly marked (preferably also with tactile warning marks). Only few streets in the city centre are suitable for establishment of pedestrian zones while preserving the current serviceability. The maximum speed is set to 20 km/hour.
- Residential zone - It is intended for both pedestrians and vehicles necessary in the area. These zones shall be located at quiet streets without street curbs, with all the construction elements on one level. The maximum speed limit is 20 km/hour.
- Zone “speed 30” – Construction elements are on various levels. Many deceleration and calming tools have preventive effect and should discourage unnecessary traffic from entering the area. Suitable for residential areas and the city centre. The speed limit is 30 km/hour.

Figure 18: Proposal for implementation of calm zones in the city centre



Advantage:

- Calming effect on traffic.
- Reduction of motor vehicles in the area.
- Higher level of attractiveness for pedestrians and cyclists.
- Improved safety, lower emissions and noise level.

Disadvantage:

- Need for investment costs necessary to implement this measure.
- Shift of motor vehicles on other roads in the adjacent areas.
- Possible problems with services in the area (such as supply of shops in the area, where a pedestrian zone is proposed – Pařížská Street).
- Construction works would reduce number of available parking places.

4.6 Parking Solution

The parking policy in the city centre is based on charged parking.

Paid parking reduces demand for parking and often results in reduction of traffic in the area because drivers in an effort to save money leave their cars in areas with free parking and continue the journey by another mode of transport (preferably by public transport). Therefore, such a solution helps reduce negative impact from traffic as emissions, noise, vibrations, accidents, etc in the central area. Safe and cleaner streets contribute to development of non-motorized transport (walking and cycling). Charged parking increases public budget and can cover operation of parking places.

In peak periods, it is appropriate to establish a higher fee. As a motivation element, it is proposed to offer discounts on parking for fully occupied vehicles, although control is difficult and demands manual handling. In practice, there are two solutions of charged parking: paid parking zones and paid parking lots.

4.6.1 Parking Zones

In the current situation, some places for parking in the city centre are charged already, but without a clear system. It can be confusing which parking places in the city centre are paid and which are not, especially for visitors. Despite the charges, the demand for parking significantly exceeds the available capacity. It is necessary to establish an effective measure reducing the deficit. The main options are:

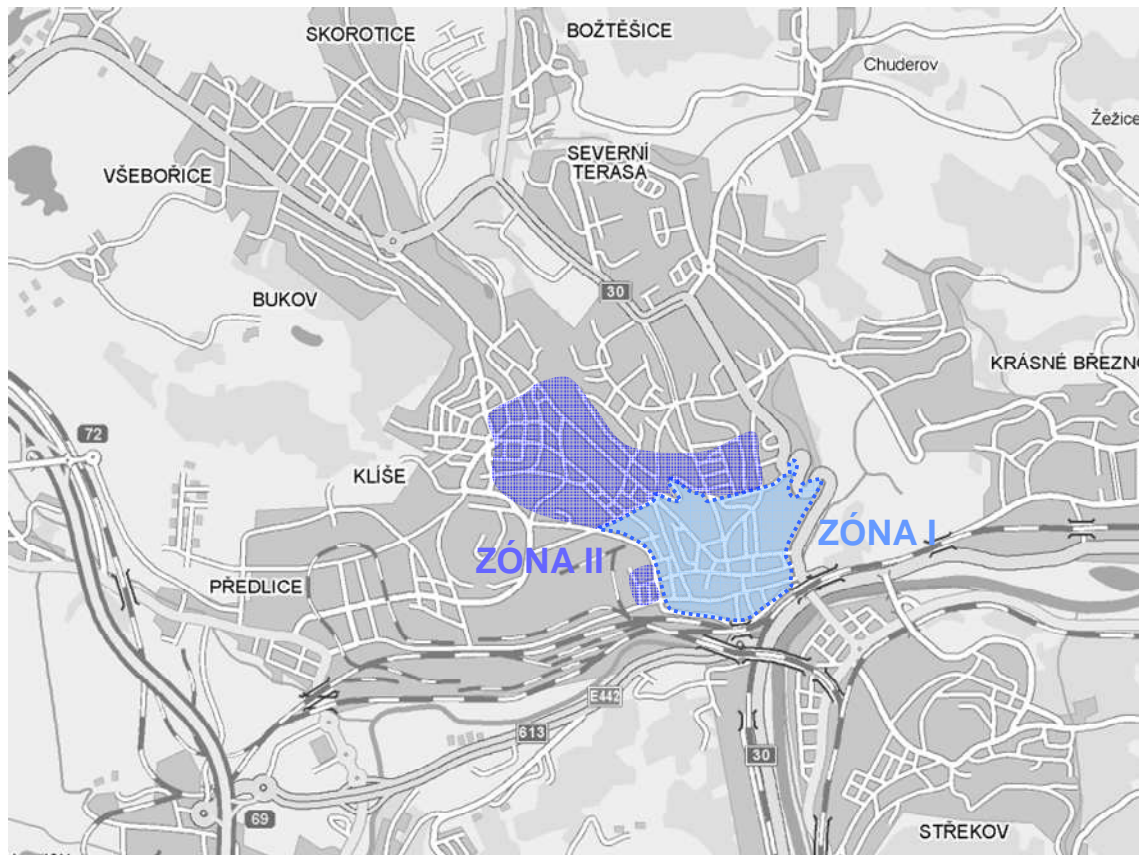
- To increase the number by building new garages, which in the city centre can only be implemented underground, with high investment costs. No other method of increase is possible in the area due to space limitations.
- To adjust parking in the centre for short-term parking, avoiding vehicles parked for long periods (with the exception for residents), by introducing paid parking zones. This would be implemented by establishing progressive parking tariff: the first two hours with acceptable fee, each next hour significantly higher, such as:
 - 1st hour 20 CZK
 - 2nd hour 25 CZK
 - Each additional hour 50 CZK

It can be assumed that, given the high price for parking in the centre, many drivers would park in surrounding areas, merely shifting the parking problem. This increased demand for

parking would be solved by establishing a second zone with lower rate, such as 10 CZK for each hour.

The charging zones must be clearly and visibly marked by traffic signs and designated areas (parking lanes and parking bays) defined by blue horizontal markings. Payments can be realised via ticket machines or mobile phones (SMS). Residents and transport services would be issued parking cards. Charging can be time-limited to work days. Competence for control would be given to the city police. The vehicles of non-payers would be towed away or 'clamped' to prevent their departure.

Figure 19: Proposal for parking zones in the city centre



Residential parking

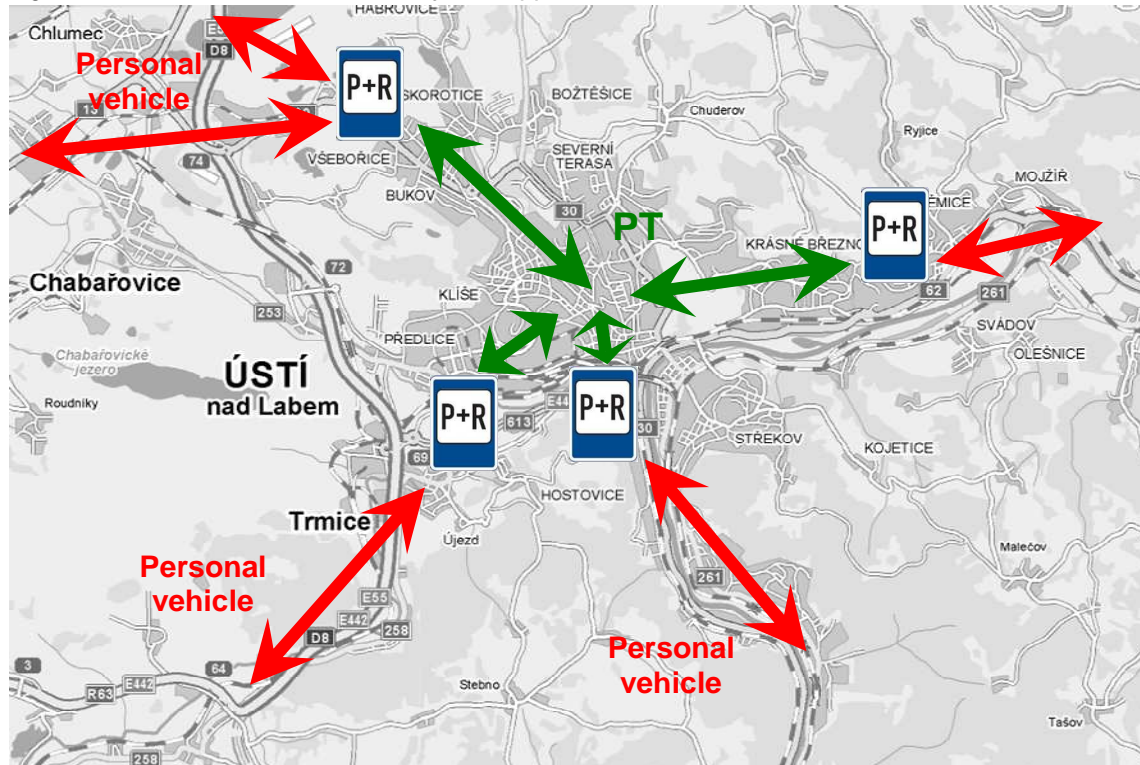
This solution is realised by issuing cards for residential parking. It is suitable for densely built-up areas in Zone 1 and Zone 2, such as in streets Winstona Churchilla and Dlouhá.

4.6.2 Park & Ride

Many people from the areas surrounding the city commute to the centre, increasing the demand for parking. It is desirable that they park their car on collective parking areas on the outskirts located by major access roads. These parking areas should be excellently connected to the centre by public transport. Park and Ride must be financially convenient (affordable prices, discount for PT), encouraging drivers to use the system. Currently, the fundamental problem is that the public transport does not serve the surrounding areas

sufficiently, which makes this type of commuting far more time-consuming. Therefore, the city is not suitable for such solution in the present state.

Figure 20: Scheme of Park and Ride system applied for Ústí nad Labem



4.6.3 Park & Go

The alternative option substituting park and ride system is implementation of collective parking premises in the area just outside the city centre to allow drivers to walk the rest of the distance on foot. This solution is workable for Ústí nad Labem due to the fact, that the area of the city centre is small and hence the walking distances are short and therefore acceptable. Furthermore, public transport services in the centre are well developed (dense network of lines, short intervals, fast connections) and convenient for users.

Parking areas required for the Park & Go system, in areas where space is less constrained than the core city centre:

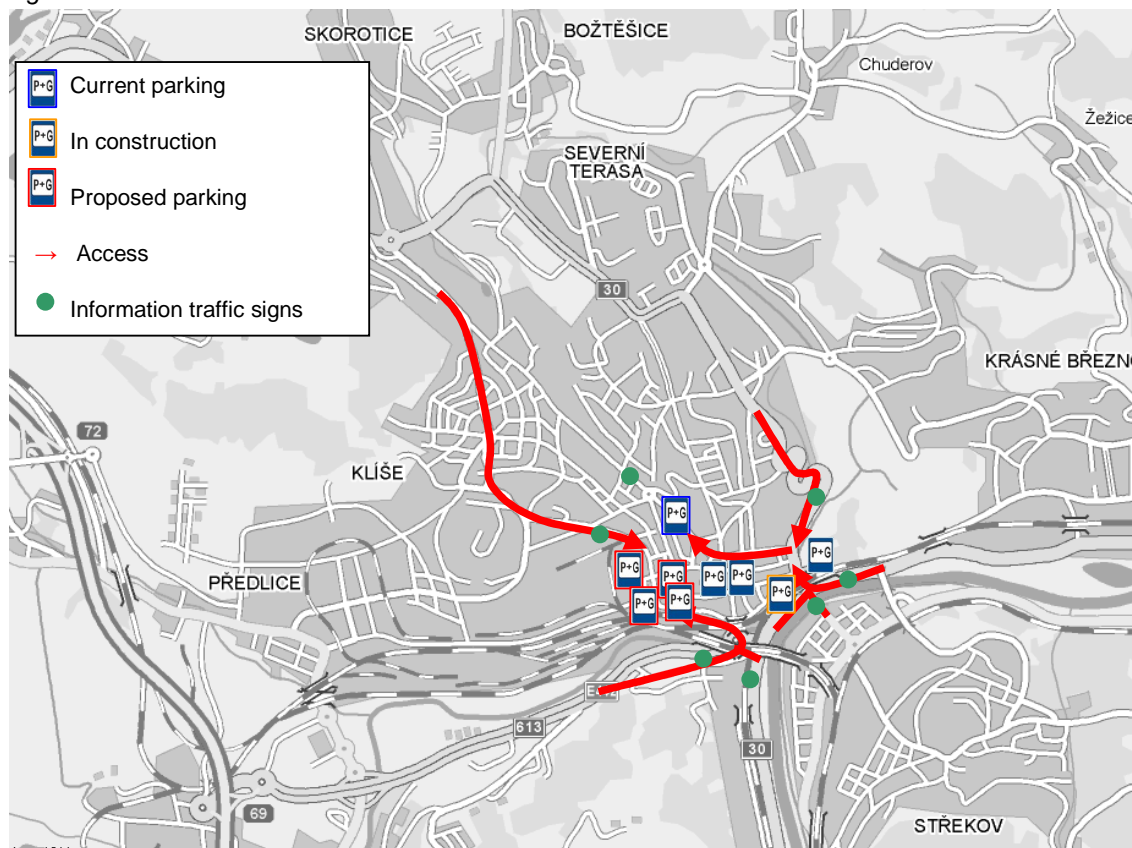
- Current parking areas: underground parking by the City Hall (175 places) and under Mírové square (145 places), parking house by the bridge E. Beneše (360 places), parking area by the hotel Vladimír (74 places with certain reserve)
- Parking area in construction: Collective garages by the train station (200 places planned)
- Proposed parking areas: Under Lidické square (270 places planned), parking houses in streets U Chemičky by Tovární (600 places planned), U Chemičky by Spitálské square (870 places planned), Revoluční and U Trati (290 places planned)

The proposed parking premises are located in developing areas and are therefore meant for other purposes outside the Park & Go system, such as for local shops and services, train

station, long term parking etc. The access to the premises is ensured by roads away from the centre. Park & Go is suitable solution for the city centre in combination with paid parking zones and residential parking zones.

Implementation of the parking premises and their operation is financially demanding and thus such parking needs to be charged. The fee must be low enough to appear attractive for drivers and significantly lower than parking in the centre. It includes possibility to prepay permits for long-term parking (quarter year card, annual card). Promotion of the measure is important. It further requires clear and visible traffic signs marking the area. It would be suitable to implement interactive information boards showing number of parking lots available at each P&G premises and navigating drivers to the nearest empty one.

Figure 21: Park & Go scheme in Ústí nad Labem



4.7 Supporting Measures

It is necessary to propose alternatives attractive and advantageous for users to ensure proper functioning of transport system not only in the central area, but by consequence in the entire city. A shift from personal vehicles to PT, cycling and walking is desirable.

Supportive measures are laid out in the following sections.

4.7.1 PT Improvements

The major factor influencing traffic in the city centre is public transport services. The city must provide quality PT in following fields:

- Fleet: improve quality of buses and trolleybuses (operate low-floor vehicles, ensure cleanliness, reduce old vehicles)
- Proper information and dispatch system
- Services: Cover most of the area, suitable intervals, on time with time tables
- Tariff rate: acceptable and adequate prices, consumer-friendly payments (SMS tickets, prepaid permits and ticket machines widely available)
- Establish integrated transport system for buses, trolleybuses, trains and regional charter buses
- Infrastructure: well maintenance of bus stations (clean, sheltered, providing updated information), non-obstacle accessibility, equipped by pedestrian crossings
- Promotion of PT in the city

PT is in the city operated by Ústí nad Labem Public Transport Company. Currently, the major problem is unsatisfactory condition of most of the vehicles (their average age is 16 years for trolleybus and 10 years for buses). According to surveys, serviceability of the city is for passengers convenient, although the intervals between connections are expressed to be too long mainly at nights and on weekends. Furthermore, most of the bus stations are in poor state.

Another issue is to ensure accurate operation of all the lines. This can be achieved by:

- establishing dedicated lanes for PT
- implementing preference of PT on all crossroads by interactive traffic signal lights
- segregating road network by leading PT on roads, where motor vehicles are prohibited

4.7.2 Improving Conditions for Cycling and Walking

Improvements can be realised by restricting motor transport in the city, which results in reducing harmful emissions and noise, and improving traffic safety. Also PT improvements can help change habits towards sustainable transport modes in the city. Walking and cycling needs to be supported as a clean, healthy and desirable means of transport.

Following is necessary:

- To improve public transportation
- To calm the city traffic
- To implement safe pedestrian crossings
- To implement greenery and quiet areas
- To develop the cycle routes (existing and new ones in direction of attractive destinations, interlinks)
- To enable cycling on most areas of the city (even zones, where traffic is excluded)

4.7.3 Solution for Parking Outside the City Centre

The impact of access restrictions applied on the city centre takes effect on the surrounding areas, which needs to be taken into account. Parking problem of the whole region outside the centre must be considered. As stated in section 4.6, Park & Ride system is not suitable

for the city. Instead, Park & Go system was proposed. Traffic calming measures are appropriate also for these areas.

4.7.4 Promotion

It is necessary to thoroughly and repeatedly inform the public about the city centre access control measures, its reasons, effects and benefits to spread the awareness and help the shift towards more sustainable transport. Any significant change in passenger habits is a long-term process, as well as the promotion should be accordingly.

Appropriate information forms are brochures and leaflets, posters, promotion in the Information centre (presentations, information boards, literature, etc) public events, regional newspapers and radio, the official city website. The promotion and information style should be uniform within the Municipality, City Police, PT Company, operators of public garages, etc.

4.8 Conclusion

4.8.1 Comparison of Tools Regulating the Access to the City Centre

The comparison of expected effects of individual restricting measures on a current state is presented in Figure 22. The qualifying scale consists of 5 degrees.

Figure 22: Comparison of measures regulating access to the city centre in Ústí nad Labem

The scale:	Fields:														
	Traffic					Parking		Economy			Desired fields				
	Reduction of unnecessary traffic	Transport services	Occasional random traffic	Access to shops and services	Public transport	Traffic safety	Residents	Visitors	Investment costs	Operating costs	Profits	Environment	Attractiveness	Cycling	Walking
The effect on current state in the city centre:															
1	Positive														
2	Rather positive														
3	No effect														
4	Rather negative														
5	Negative														
Measures:															
Zone with access for transport services only	1	3	5	5	1	1	1	5	4	3	5	1	1	1	1
Zone with access for freight vehicles denied	2	3	3	3	3	2	3	3	4	3	3	3	3	3	3
Zone restricted according to emission levels	2	3	4	3	3	3	3	3	4	4	3	1	2	2	2
System of impassable roads	1	4	4	3	3	2	3	3	4	3	3	3	2	2	2

Interactive traffic light signalisation	2	4	4	3	2	2	3	3	5	4	3	2	2	2	2
Paid entrance to the city centre (toll)	1	3	3	4	1	2	2	3	5	4	2	2	2	2	2
Pedestrian zones	1	4	5	5	2	1	2	5	5	3	3	1	1	2	1
Residential zones	1	4	4	4	2	1	2	5	5	3	3	1	2	1	1
Zones "speed 30"	2	3	3	3	2	1	3	3	4	3	3	3	2	2	2
Calming elements themselves	3	3	3	3	3	1	3	3	4	3	3	3	2	2	2
Parking zones	3	3	3	3	3	3	2	4	4	4	2	3	3	3	3
System Park & Ride	2	3	3	3	3	3	2	4	5	5	2	2	3	3	3
System Park & Go	1	3	3	3	2	3	3	2	5	5	2	1	1	2	2

It is not possible to exclude all the traffic from the city centre, which would prevent serviceability of the area. Also, prohibition of freight vehicles is not an effective measure for the designated area, where the majority of transport is realised by personal vehicles. System of impassable roads is broadly applied in the centre already, and would not bring many improvements if its implementation was increased. Park & Ride solution is not applicable for Ústí nad Labem as noted in section 4.6. Finally due to the fact, that Ústecký region is one of the poorest ones in the Czech Republic, with lowest social conditions and wages, and the highest rate of unemployment, paid entrance to the city is also less suitable solution.

As seen in figure 22, all the regulatory measures have their advantages and disadvantages. The optimal solution would be a combination of restrictions, which satisfy following conditions:

- Number of vehicles in the centre is effectively reduced – provide residents and visitors with suitable equivalent, motivate towards desired habit change
- Traffic performance in the area is reduced – necessary traffic operates on the shortest routes
- Safer traffic in streets is ensured – reduction of accidents, injuries and deaths, lower financial losses
- Better conditions for PT, cycling and walking are provided – motivation for users, increase of use, improve present state of facilities and services
- Negative impact on environment is lowered – limiting motorised transport and its effects
- Urban functions are not significantly limited – satisfy needs of inhabitants

The suitable solutions are rather complex, expensive, and unpopular long-term processes, which bring the greatest positive effect to the city.

4.9 Recommendations

Ústí nad Labem is provided by large capacity roads bypassing the city centre (Důlce – Přístavní – U Trati, Panská, and Klíšská). Condition for directing the traffic successfully around the centre is completion of flood barriers by the river Elbe (planned on 2011). Part of the traffic is expected to be shifted to roads Veleslavínova and Rooseveltova. Scheme of routes suitable for transit traffic is presented in figure 24.

The city centre should be marked as a zone regulated in following ways:

- Access allowed for transport services (including residents and PT)
- Access allowed for vehicles meeting low emission standards (not applied on transport services)
- Maximum speed 30 km/hour

Park & Go system implemented

Figure 23: The traffic signs marking the Zone I in the city centre and Zone II surrounding the centre



For this combined solution, serviceability of the area is preserved. For other transport, access can be granted by permits issued on well reasoned request.

It is desirable, that vehicles ensuring transport services in the centre also satisfy the emission standards to reach the desired positive effect on the area (lower burden on environment, less noise, emissions, vibrations). This measure requires change of a law.

The speed limitation is expected to prevent traffic accidents and lower health and financial losses. Currently, the traffic in the city centre is very dense, operating on many crossroads located throughout the whole area, resulting in low relative speed of traffic. After the implementation of restrictive measures, the intensity will lower and, although the speed will be limited to 30 km/hour, the traffic flow will be improved.

Park & Go premises placed around the centre must be suitable for long-term parking (over 2 hours) and much more convenient than parking in the streets. Therefore, it is proposed to implement charged parking in the core city centre with progressive rate as described in section 4.6 and 4.6.1. Parking must be clearly and visibly marked. Many consumer-friendly payment possibilities need to be provided. To avoid overflow of vehicles in areas surrounding the centre, Zone II should be established, where parking is designed mainly for residents.

The expected impact is reduction of vehicles parked on streets. Measures will be supported by interactive information boards directing drivers to nearest available parking lot, which will further reduce a route performed by the vehicle.

Figure 24: Parking solution - routes bypassing the centre, paid parking zones, Park & Go areas

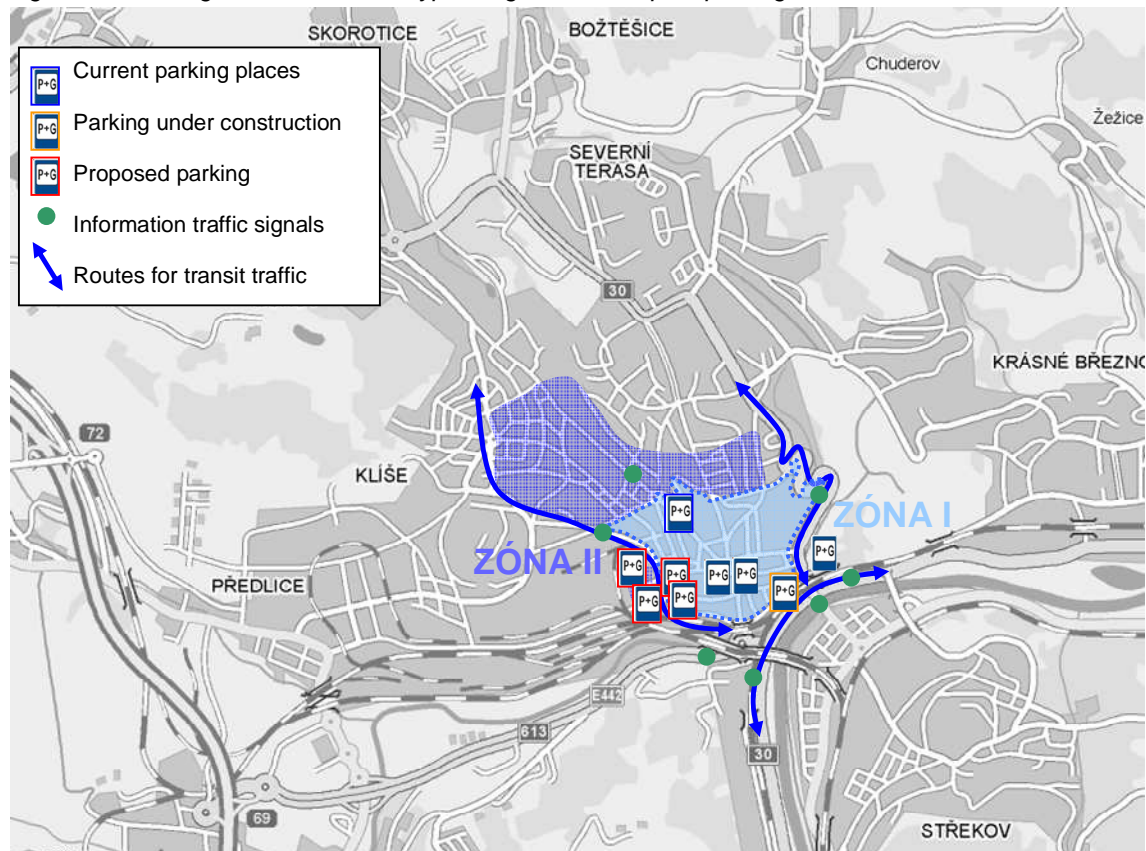
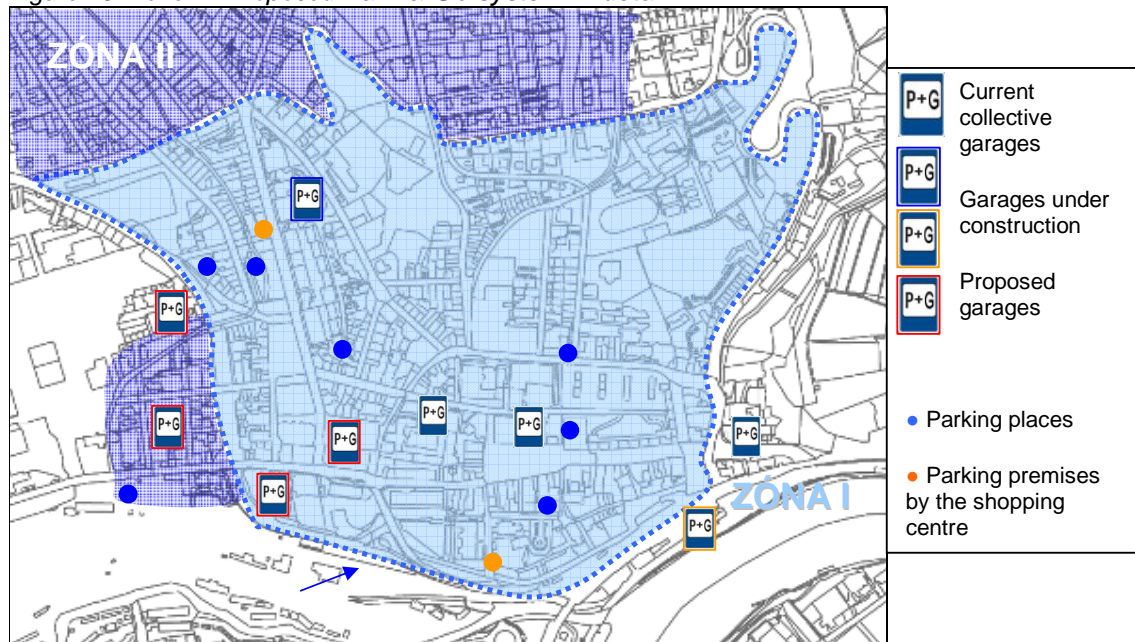


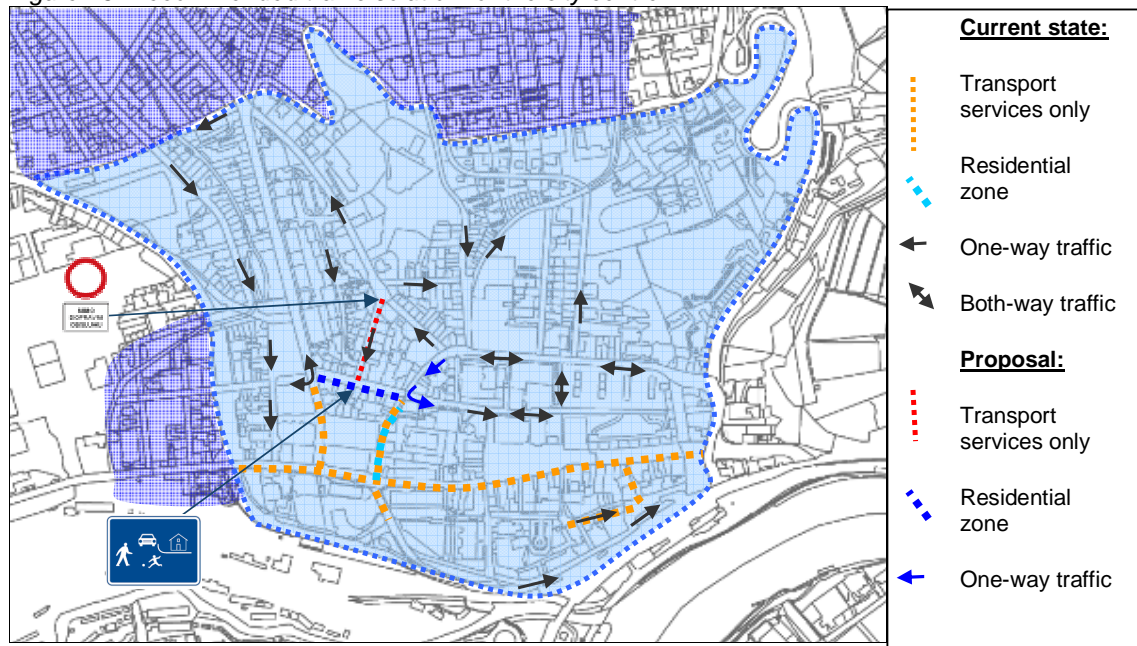
Figure 25: Zone I – Proposed Park & Go system in detail



Furthermore, traffic should be restricted by establishing a residential zone in the street Pařížská. The implementation should follow current trends in design to be effective (eliminate passage of vehicles) safe for users (especially for vulnerable groups: pedestrians, children, cyclists) and the aesthetic. It is based on one level surface (no curbs), distinguished by colour and type of pavement, supported by calming measures mainly at the entrance, such as speed bumps, greenery, or resting premises. Indirect slow route for vehicles would serve as a discouraging tool. It is possible to exclude motor vehicles completely from the zone with the exception for transport services. This residential zone would be interconnected with the existing residential zone by Ústí nad Labem Municipality. The whole area would become calmer, safer and more attractive, encouraging walking and cycling.

A large section of the street Velká Hradební is proposed to be one-way road. The street is narrow with a little space on sidewalks, causing safety hazard mainly for pedestrians. Regulated traffic would increase the size of area designated to walking and it could further provide space available for parking (longitudinal). Traffic would be diverted to the street Dlouhá, from which the two entrances to the underground garage are located. This measure would significantly restrict passability of the centre, thus reduce the number of vehicles entering the area (avoiding transit traffic).

Figure 26: Recommended traffic solution for the city centre



The resulting changes in traffic load are presented in the Annex 5.

Regulations proposed for the city centre are aimed at calming the area, improving conditions for its users. It is supposed to be a quiet zone for residents and visitors, prioritising non-motorised modes of transport – walking and cycling. Current situation in the centre of the city as well as the surrounding areas and access roads needed to be examined to determine the correct regulating solution. The major traffic problems revealed were:

- High intensity of passing vehicles (unnecessary transit traffic)
- Significant deficit of parking places

Some change to the current situation needs to be applied namely on streets Masarykova and Pařížská, because of the large number of pedestrians walking in the area. On the contrary, exemplary calming measures were already applied on Mírové square and Revoluční street, where motor vehicles are denied with the exception of transport services.

In the study of city centre access control, all the regulatory tools applicable on the city centre were listed and analysed, compared and considered for application. As a result, some measures were recommended as suitable for limiting the entrance to the centre of Ústí nad Labem. It was revealed, that the proper solution is a combination of tools forming a comprehensive system of traffic regulations. The solution is not eliminating traffic completely. It rather encourages car users to change their habits and use other means of transport. Due to traffic restrictions, the centre can become a calm zone more attractive for both residents and visitors.