Public transport in the Ljubljana Urban Region

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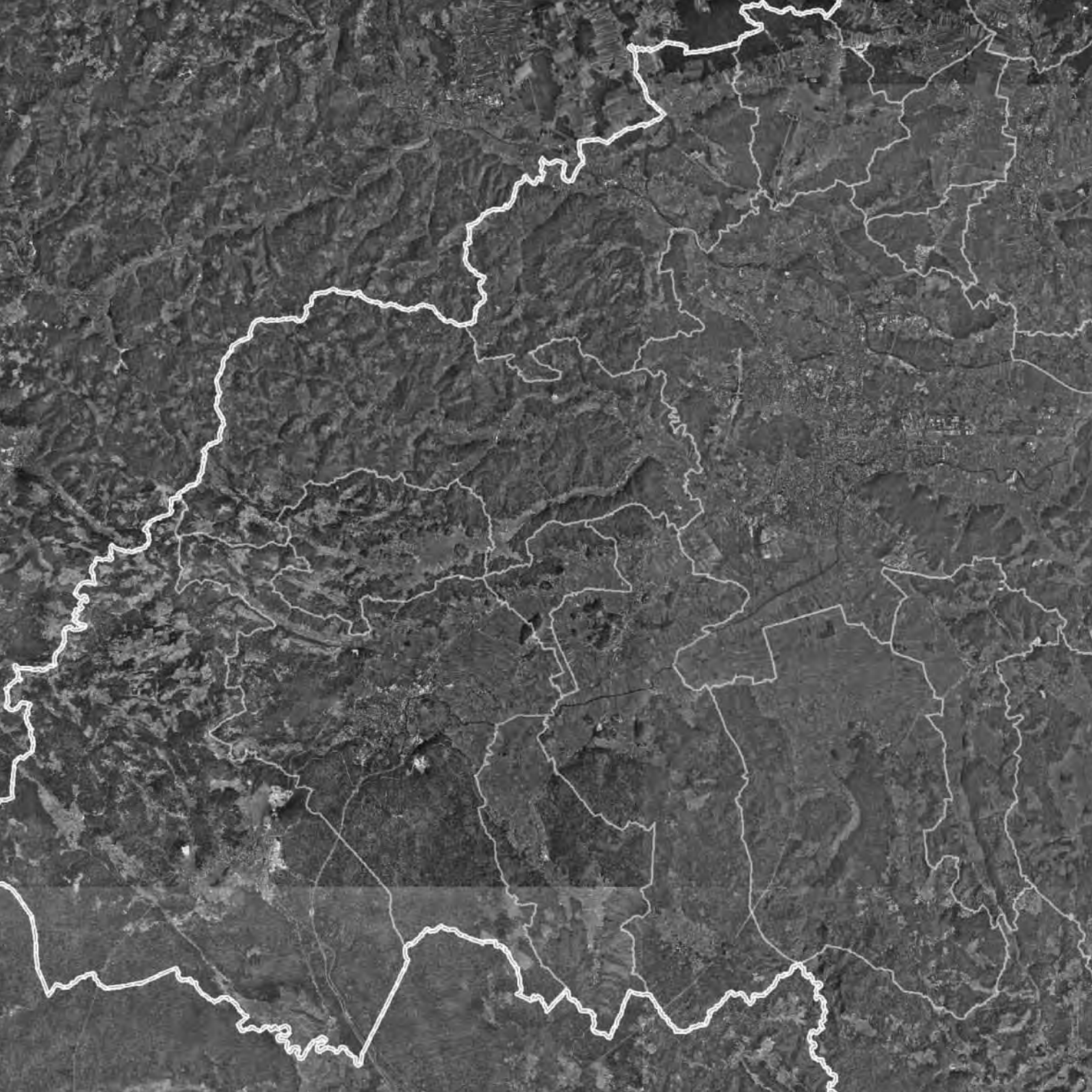

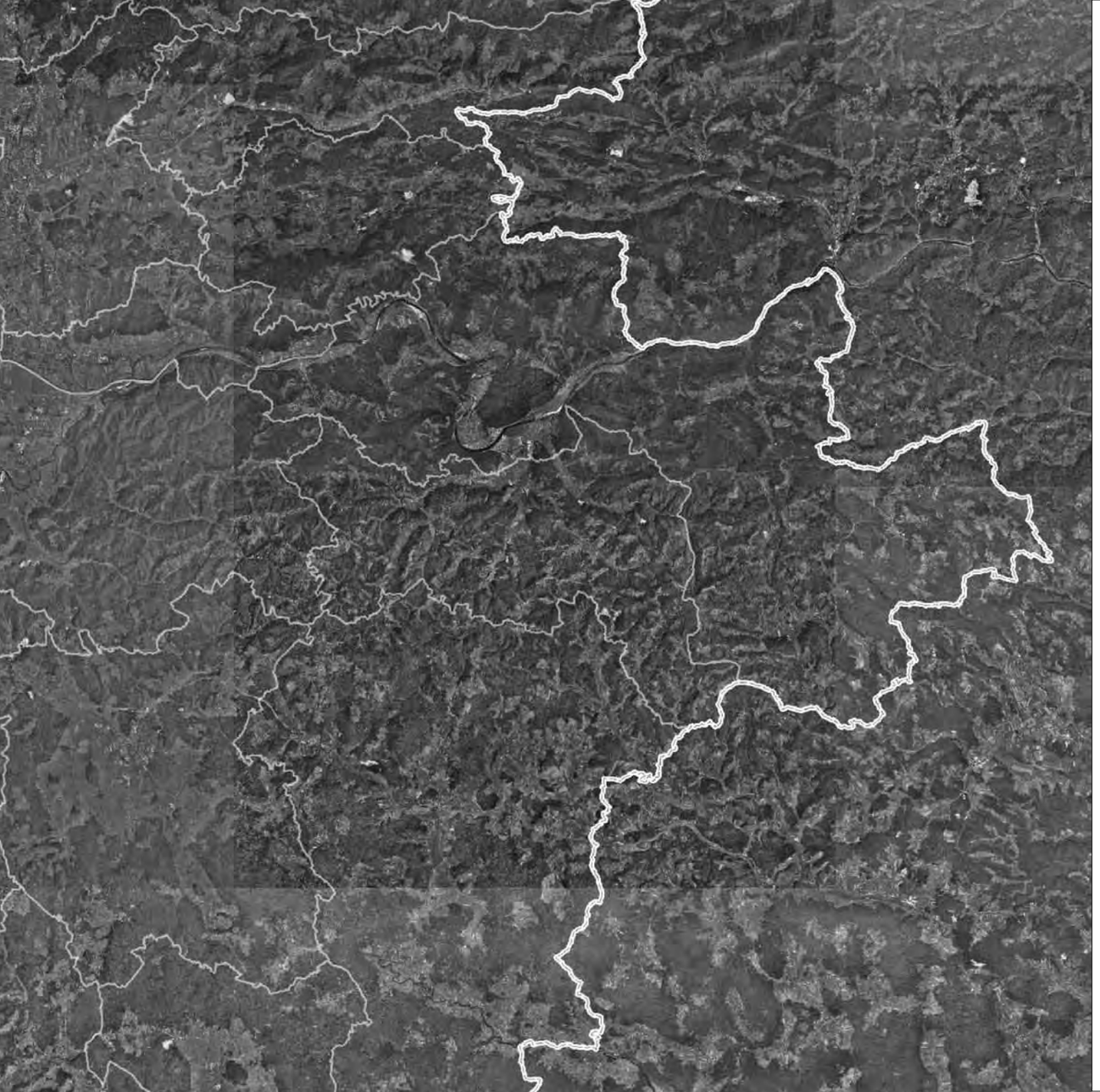

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Zoran Janković

Address of the president of the Council of the Ljubljana Urban Region and Mayor of the Municipality of Ljubljana

Transport significantly contributes to contemporary development, as it overcomes distances and connects people. Apart from its indispensable role in everyday life, its long-term impact on society and the environment increasingly calls for attention. Functional, quality and professional transport management determines the development path both of the region and the State. Hence the project 'Expert guidelines for the regulation of regional public transport' is an excellent foundation for the regulation and establishment of quality public passenger transport on the principles of sustainable mobility by 2027.

At the Municipality of Ljubljana we have set out a long-term programme for public transport and designed activities needed for its implementation. What are the most important projects through which we wish to achieve greater efficiency and safety in public transport, and the use of alternative fuels, as well as encourage cycling and walking?

- By closing the city centre to traffic, newly re-designed public spaces such as Prešeren Square (Prešernov trg) and the Three Bridges (Tromostovje), Ciril-Metod Square (Ciril Metodov trg), Breg, Krakovo Embankment (Krakovski nasip), Špica and Trnovo Quay (Trnovski pristan) are intended for pedestrians and cyclists. The closure also aims to attract new visitors and residents to the city centre. Congress Square (Kongresni trg), when re-opened to the public, will become a pedestrian space, as vehicles are about to be moved from the surface into an underground car park.
- Urbana, the unitary city card, is an electronic smartcard. It was introduced as an urban transport card, and later used on the funicular and for parking in certain areas; it will soon be possible to use it to pay for services in public libraries, and admission to museums, sports and cultural events organised by the Municipality of Ljubljana.
- High-quality public transport route - on Barjanska, Slovenska and Dunajska Roads, a yellow lane for public passenger and collective transport respectively is envisaged. Interventions in the aforementioned area will enable improved connections and the provision of bus stops to change buses, give priority at crossroads to buses on their routes, and improve accessibility at bus stops for people with reduced mobility.
- Additional park and ride schemes (P & R) are also envisaged. A third one will be in operation alongside Stožice Stadium, enabling travel to the city centre by public transport, the bus fare being included in the parking price.
- Launching new bus services providing connections to the neighbouring municipalities - so far direct services are in operation between Ljubljana and the municipalities of Medvode, Brezovica and Škofljica.

- Introduction of bus arrivals displays: displays will be mounted at thirty-three bus stops and two park and ride sites at either end of the route. Thus passengers will receive clear and precise information on bus arrivals.
- Technologically advanced urban buses will modernise and enhance the public transport bus fleet.
- A comprehensive cycling strategy introduces new cycle lanes and enables safe cycle parking (cycle parking facilities).
- The city bike scheme will enable flexible and convenient cycle hire at approximately twenty sites.

Alongside these projects, a long-term plan for a depressed railway is under way; a high-speed train service between Ljubljana, Kranj and Jesenice is being considered, with a branch line to Brnik linking Ljubljana with the airport; and a city congestion charge is also under discussion.

We advocate harmonising the State, regional and municipal levels in order to meet the development challenges of public transport, and launch a fresh investment cycle through project implementation. Residents deserve only the best, and therefore it is our mission that also through the sustainable traffic management we will contribute to improving the quality of life. By achieving the set targets, Ljubljana and the entire region will progress even further on the European and global quality of life scale.

How can each of us do as much as possible for the common good? Politicians - by adopting timely and well considered decisions; professionals - by suggesting solutions to enhance public transport quality; service providers - through their conscientious and expert work; and, finally, users - ready to change their travel habits and adopt new, sustainably oriented modes of transport.

We realise that the financial management of public transport is a huge commitment. According to current estimates, it comprises as much as two thirds of the motorway development programme of the Republic of Slovenia. We have to be interested in pricing and environmental efficiency, and especially in the quality of services and user friendliness. Understandably, some townspeople are annoyed by construction work under way in Ljubljana, which disturb established daily life. The region, and particularly Ljubljana, as well as some other towns, will be affected by construction work for some years to come. Yet every move forward and stage completed bring us closer to a safe and quality journey to our destination.

I am confident that, together, we will know how to be patient and wait for all that we have needed and expected for such a long time. Already now, I thank you all heartily for your understanding and patience. But believe me – it is worthwhile being patient, because all public transport users will rightly take pride in the results of this demanding project. As president of the Council of the Ljubljana Urban Region, as Mayor of Ljubljana and as an everyday user of road transport, I am looking forward to the harmonisations and preparations for the execution of the biggest project of its kind in the history of the region. Every step brings us closer to the impatiently awaited contemporary public transport, which an area as beautiful as the Ljubljana Urban Region undoubtedly deserves.

Dr Marjan Rihar,
Deputy President of the Council of the Ljubljana Urban Region and Mayor of the Municipality of Vrhnika

Given that Ljubljana is a powerful hub in our region, the establishment of an efficient public transport is essential to achieving the mobility of residents and the objectives of sustainable environmental protection. With a view to harmonising the development of the region, it should be considered that daily commutes should not be directed only towards the hub, but also in the opposite direction, as well as between municipal centres in the region. This should be enabled by means of the transport infrastructure and through the operation of the public transport system.
'Expert guidelines for the regulation of regional public transport' is a good starting point for further steps, and is especially relevant to legal regulation, integration in national projects and the planning of financial resources.

Metod Ropret
Mayor of the Municipality of Brezovica

The Municipality of Brezovica welcomes the project 'Expert guidelines for the regulation of regional public transport', because in recent years, we ourselves, along with the Municipality of Ljubljana, successfully extended urban passenger transport routes 6 and 19. Commuting in the area of the Ljubljana Urban Region is the greatest in the country, so we gladly welcome initiatives that offer long-term public transport solutions to the population of this area. We are happy to see that public transport issues in the region are beginning to be dealt with in a complex manner, and not partially/locally, as such solutions have yielded results merely for narrow local areas, and were also short-term.

Primož Župančič
Mayor of the Municipality of Dol pri Ljubljani

The regulation of public transport in the region will enable people to choose a form of transport and convenient passenger transport in terms of fare. Alongside harmonised timetables which meet the actual transport needs of the population and visitors, we may hope for a decline in individual traffic and, consequently, a reduction in CO_2 emissions. The introduction of a unitary payment system will also be an important step.

Toni Dragar
Mayor of the Municipality of Domžale

The Municipality of Domžale is among the most heavily burdened by traffic in the Ljubljana Urban Region, as it accommodates both international and domestic transit traffic, as well as daily migration in the region. The central position of the municipality in relation to the region provides strategic advantages, but it also causes traffic jams, which is why 'Expert guidelines for the regulation of regional public transport' is a good foundation for their resolution. One of the possibilities we have advocated is the development of the Kamnik railway line, which with its link to Brnik and extension to Kranj could become the backbone of development in the north of the region. The project 'Expert guidelines

for the regulation of regional public transport' indicates a fresh paradigm for solving common problems in the region. By connecting the region, primarily in the field of public transport, we will contribute to improving the quality of life in the region, and the numerous accompanying investments involved in this huge project will also contribute to the economic growth of the whole region. In my opinion, the key advantage of associating fragmented local communities in the region is in negotiations with the State. Together, we will have more influence on decisions of common importance which in the past were made by the State, which sometimes did not fully understand the region or individual municipalities.

Jernej Lampret
Mayor of the Municipality of Ivančna Gorica

Our southern area surely belongs in the Ljubljana region, which justifies the need to seek transport solutions not only on the level of the municipality, but regionally. The economic situation and high flow capacity due to the commuting of our residents means that we are keen to adopt the most appropriate means of transport for the future.
The motorway was a huge gain, but it is not enough, so we need to seek a solution in a railway link, taking into account that ecology and safety will provide an adequate connection between the capital and the countryside.
Migration, too, indicates that we may be interesting only on account of reciprocity between the city and its surroundings, at least within a twenty kilometer distance. There is a lot of migration into our municipality; therefore, it is necessary for us to seek a long-term urban-planning solution which has to be considered not only in the light of local, but also regional and national aspects. No part of our area can remain untouched during the preparation of the spatial plan, and particularly not in the case of public transport regulation.

Anton Tone Smolnikar
Mayor of the Municipality of Kamnik

In our municipality we support and are expanding public passenger traffic, and we prioritise cyclists and pedestrians. Public transport is an important alternative to increasing road traffic and the problems associated with it. A quality and efficient public transport system, competitive with motorised road traffic, can be established only together with neighbouring municipalities and especially in cooperation with the Municipality of Ljubljana. While planning public transport, particular care should be given to harmonisation with the development of urban areas, the provision of quality links between towns and other settlements in the region, and to creating public awareness. Our objective is to achieve increased use of public transport and thereby improve the quality of life, as well as ensure greater mobility of the population.

Tomaž Drolec
Mayor of the Municipality of Komenda

At present, the Municipality of Komenda is already well covered by regional bus routes. Daily journeys are provided for by the operators Alpetour of Kranj and Kam Bus of Kamnik, which enable links with central Gorenjska and the wider surroundings, and with the capital, Ljubljana.
In line with various European projects, we should encourage:
- public passenger transport and quality services for users,
- new forms of vehicle uses and/or ownership, and lifestyle with decreased car use,
- new concepts in goods distribution,
- measures for mobility demand management,
- integration of mobility management systems with associated information services.

Franci Rokavec
Mayor of the Municipality of Litija

The Municipality of Litija supported the project to produce 'Expert guidelines for the regulation of regional public transport' because we are aware of the urgent need to find a comprehensive solution to this problem, which is one of the greatest communication barriers in the central Slovenia region. We expect that the aforementioned document will not end up on the shelf, but will give rise to the comprehensive regulation of public transport in the region. Firstly, we would like the aforementioned project to provide travellers, by means of a unitary transport card, with public transport in Ljubljana, links between the bus network and rail network, the use of public transport between the towns near Ljubljana, as well as within the areas of individual municipalities. By providing such a transport card and by constructing the requisite infrastructure, we would actually take a necessary step towards the urgently needed modernisation of public transport.

Mladen Sumina
Mayor of the Municipality of Log-Dragomer

Given the lack of national solutions for regulating public transport, the crafting of 'Expert guidelines for the regulation of regional public transport' was logical and necessary. The data indicate that our municipality has the worst accessibility to public transport within five minutes reach. We also have poor access to other public services. By introducing two new bus stops, we hope to improve the situation substantially. We would like to have the railway passenger service between Ljubljana and Vrhnika reopened.

Janez Nagode
Mayor of the Municipality of Logatec

'Expert guidelines for the regulation of regional public transport' is a first, but important step in the region towards creating a comprehensive, unitary public transport. Over the period of time during the follow-up to the project, it is possible to achieve regulation of public transport in the region (buses, trains), primarily to reduce individual traffic on the roads and, consequently, reduce CO_2 emissions. I hope for the successful and rapid continuation of the project.

Stanislav Žagar
Mayor of the
Municipality of Medvode

In the Municipality of Medvode, the big issue is the regional Ljubljana-Kranj road which runs through the centre of Medvode, which is overburdened principally by numerous daily commuters. The problem could be solved by constructing a link road between Jeprca and Stanežiče, which is being included in the national spatial plan. Inadequate public transport at municipal and regional levels is also a huge issue. Therefore, we are planning to introduce a Park & Ride scheme at the southern entrance to the Municipality of Medvode, where a car park is to be constructed, along with an urban bus stop and a new railway station. This would relieve traffic in the area alongside the present railway station in the centre of Medvode and provide daily commuters and other users with both a managed car park and public urban transport service.

Boštjan Rigler
Mayor of the
Municipality of Škofljica

In the Municipality of Škofljica, as a typical peri-urban municipality, we are fully aware of the importance of the association of municipalities in shaping joint spatial planning on a wider, "regional" level. More than anybody else, in our local community, we can perceive all the shortcomings of ill-considered and unharmonised "regional" spatial planning in the past. Therefore, we wholly support 'Expert guidelines for the regulation of regional public transport' and we actively take part in its preparation. One of the essential problems of a peri-urban area, which is at the same time one of the key components of the regional spatial plan, is the regulation of public transport. We believe that with our joint activities in the preparation of the 'Expert guidelines for the regulation of regional public transport', we will lay the right foundations for a comprehensive solution to traffic issues in our area and, above all, encourage our residents to use public transport.

Milan Izlakar
Mayor of the Municipality
of Šmartno pri Litiji

It is beyond doubt that an association of municipalities is a necessary element in resolving common issues within the region. Traffic management is a shared task, especially stimulating public transport to be customised, comfortable and enjoyable for users. Accessible and rapid public transport makes for more contented commuters and consequently improves everyday life.

Tone Peršak
Mayor of the
Municipality of Trzin

It is believed that a peculiar paradox is characteristic of the Slovenes. On the one hand, social anthropologists have established that we are inclined to collective action, especially to collective responsibility and all kinds of "levelling", which means that individuals who stand out bother us quite a lot; on the other hand, we know that we have problems regarding cooperation and association, which often obstructs our coming together for joint projects. It also causes municipalities to close themselves off behind their fences, and to construct facilities which it would be reasonable for two or three municipalities to build together. From this point of view, spatial planning at the regional level is wholly positive, simply because it allows us to meet and find out what the neighbours are planning. Perhaps it may initiate reflections on building an industrial zone together, for example, where the territories of three municipalities meet. Such an attitude is even more important when it comes to regulating and improving of public transport. If we begin discussions on how huge investments in one municipality greatly increase transit traffic in another, and that this is why it is important to improve the performance of public traffic in the region, we have done a lot, and over time we might truly achieve something.

Lilijana Madjar, MA
Director of the Regional Development Agency of the Ljubljana Urban Region (RDA LUR)

Yes, it is time for sustainable mobility in the Ljubljana region

If Slovenia is situated at the intersection of two significant transport corridors, then Ljubljana is located at the very point of intersection of these two corridors. The Ljubljana Urban Region, and Ljubljana itself, lie at an intersection which is a challenge and an opportunity. This area has never been a truly peaceful one, with a stable balance between economic development, settlement and transport. These relationships were doubtlessly entirely overturned after World War II. During the first decades, Ljubljana presented an inverted picture of the countryside becoming empty, and, honestly, a picture of barely controlled urban development. Rapid population growth in the city during the nineteen-eighties and nineties was followed by an inverted process of migration to the city fringes. But employment did not follow the people, staying behind, concentrated in the city.
The population's needs for mobility were growing, but public transport could not keep pace with these needs. Consequently, the public transport use was declining, and public transport gave the inhabitants of the region no alternative. It became a social service, rather than a backbone of mobility. The winner of this stage of development was the car, with its increasing needs for car parks, for which the roads were always too narrow, and which reduced safety in the city, as well as the quality of the environment.
The region and city of Ljubljana cannot actualise their development vision predicated on mobility based on individual vehicles. It is the task of all of us who have been struggling for a future with better air, less traffic congestion and less noise in this important area of the country, to open the door wide to sustainable mobility with public transport as its backbone.
It is to this goal that the project 'Expert guidelines for the regulation of regional public transport' is dedicated.
It was conducted by RDA LUR in cooperation with the municipalities of the Ljubljana Urban Region, which also financially supported the project and enabled its implementation. The project provides professional and clear answers to the challenges of development and mobility in Ljubljana and the region. We realised that the capital city, Ljubljana, and the Ljubljana Urban Region have been entering the conclusive i.e. post-industrial, or metropolitan, phase in which the substantive challenge is to find alternatives to private vehicles. Among these alternatives, contemporary public transport is the most significant.
Today, when the expert guidelines have been produced, we can say with pride and relief that we know the issues, that we are capable of stating what we want, and that we also know how to reach those goals. Perhaps the most important is the realisation that there

is no sustainable mobility without contemporary public transport. If we are successful in putting into effect the tasks contained in these expert guidelines, I am confident that we will significantly improve the competitiveness of the region, and ensure residents a higher quality of life. Putting into effect sustainable mobility is a responsible and difficult task. Because of constant changes in technology, economic development and capability, and because of the actual traffic situation, this is a significant long-term development issue not only of the region, but also of the country as a whole. As we do not want to wait for someone else's decisions, we want to become through this project a partner in a dialogue. A partner who knows what he/she wants, who does not lament the lack of resources, but knows how to find them through projects.

We are proposing six priority projects concerning public transport regulation in the region: Park & Ride scheme foresees 38 sites for intermodal transfer points divided into three basic types: a transport centre (Potniški center/Passenger Centre in Ljubljana), intermodal hubs outside the region's centre, and P & R schemes alongside the arterial roads of urban centres. Contemporary high-speed routes will run along the principal transport routes and converge on Ljubljana, linking all parts of the region as well as Slovenia. The purpose of the HSRs system is to connect public transport terminals capable of generating sufficient demand and thus ensuring the competitiveness of public transport vis a vis private transport. In this way, car traffic would be shifted to the public transport ahead of urban agglomeration. In the HSRs system the travel speed has to increase from the current average of 5km/h to 24km/h, and along with this increase, the public transport peak period frequency to 5 minutes.

The project 'Modernisation of the railway infrastructure' is an important national project helping to establish public transport in the region within the framework of ensuring normal long-term development and the achievement of objectives. Rail links to important regional centres are essential for effective public passenger traffic.

The project 'Design and implementation of major cycling and walking paths in urban centres and between centres in the region' is set to enable daily commuting for people who choose non-motorised forms of transport instead of motorised. A system of paths will connect settlements and towns in the region, and also connect the Park & Ride schemes.

In the fifth set, we offer 'Policies and soft measures to support the public transport'.

In order to introduce the project of modernising the public transport system, it will be necessary to have harmonised cooperation and commitment to the common goal of the municipalities within LUR.

The priorities of the regions concerning public transport and sustainable mobility also have to be harmonised, because they are the key to the increase of supply and demand for public transport. To this purpose, successful and long-term measures have to be carried out to promote public transport and restrict private vehicle traffic in towns.

Following the example of European good practices, the envisaged independent Regional Coordination Body for steering the development of public transport will be responsible for the effective provision of public transport at the regional level. The intention is to establish a Regional Public Transport Agency with executive powers in analogy with the national concept of integrated passenger traffic.

The firm **OMEGA Consult d.o.o.** from Ljubljana produced the 'Expert guidelines for the regulation of regional public transport'. The project team which conducted and monitored the project work was led by **Miran Gajšek MArch**, head of the Urban Planning Department of the Municipality of Ljubljana and chairman of the Committee for infrastructure, environment and space of the Regional Development Council of the Ljubljana Urban Region. The other members of the group were:

Dr Mitja Pavliha, director of the Directorate of spatial planning at the Ministry of the Environment and Spatial Planning; **Dr Marjan Krasnič**, Ministry of Transport; **Tone Peršak**, Mayor of the Municipality of Trzin, **Ivan Stanič**, Municipality of Ljubljana, Department of Urbanism; and **Lilijana Madjar, MA**, director of RDA LUR. The project was coordinated by the firm Oikos d.o.o., and **Korpus d.o.o.** handled promotion. As RDA LUR simultaneously conducted the project 'Expert guidelines for the preparation of the regional spatial plan', members of the project board of the said project also closely participated in the making of the project task. They were: **Marko Peterlin**, director of the Institute for Spatial Policy, **Zoran Vitorovič**, head of the Department of Spatial Management of the Municipality of Domžale; and **Peter Lovšin**, director of the firm Urbania d.o.o.

In the process of creating the project 'Expert guidelines for the regulation of regional public transport', we organised as many as nine very well attended consultations and workshops in which over three hundred experts and other stakeholders took part and contributed to the quality of our study.

The implementation of the project 'Expert guidelines for the regulation of regional public transport' was made possible by the municipalities of the Ljubljana Urban Region, which ranked this among the priority regional projects. Most of the municipalities also provided funding assistance for the project. The balance of funding, amounting to 440,000 EUR, was provided through co-funding from the European Regional Development Fund within

the framework of the Operational Programme 'Strengthening Regional Development Potentials' for the period 2007-2013 – the development 'Development of Regions' development priorities, and the 'Regional Development Programmes' priority orientations. The project was conducted by RDA LUR in collaboration with the municipalities of the Ljubljana Urban Region.

In conclusion, I wish to emphasise that the present project is not the only one working to open the door to sustainable mobility based on public transport. Similar efforts are being made at the national level, as well as in other development regions and municipalities. If we wish to succeed, we have to combine our knowledge, and do as much as possible with the resources available.

Slovenia is big enough and has enough knowledge to become an example for enabling mobility based on the principles of sustainability. Why should we always be studying examples of good practice abroad? Now, we know the way, it is up to us to follow it.

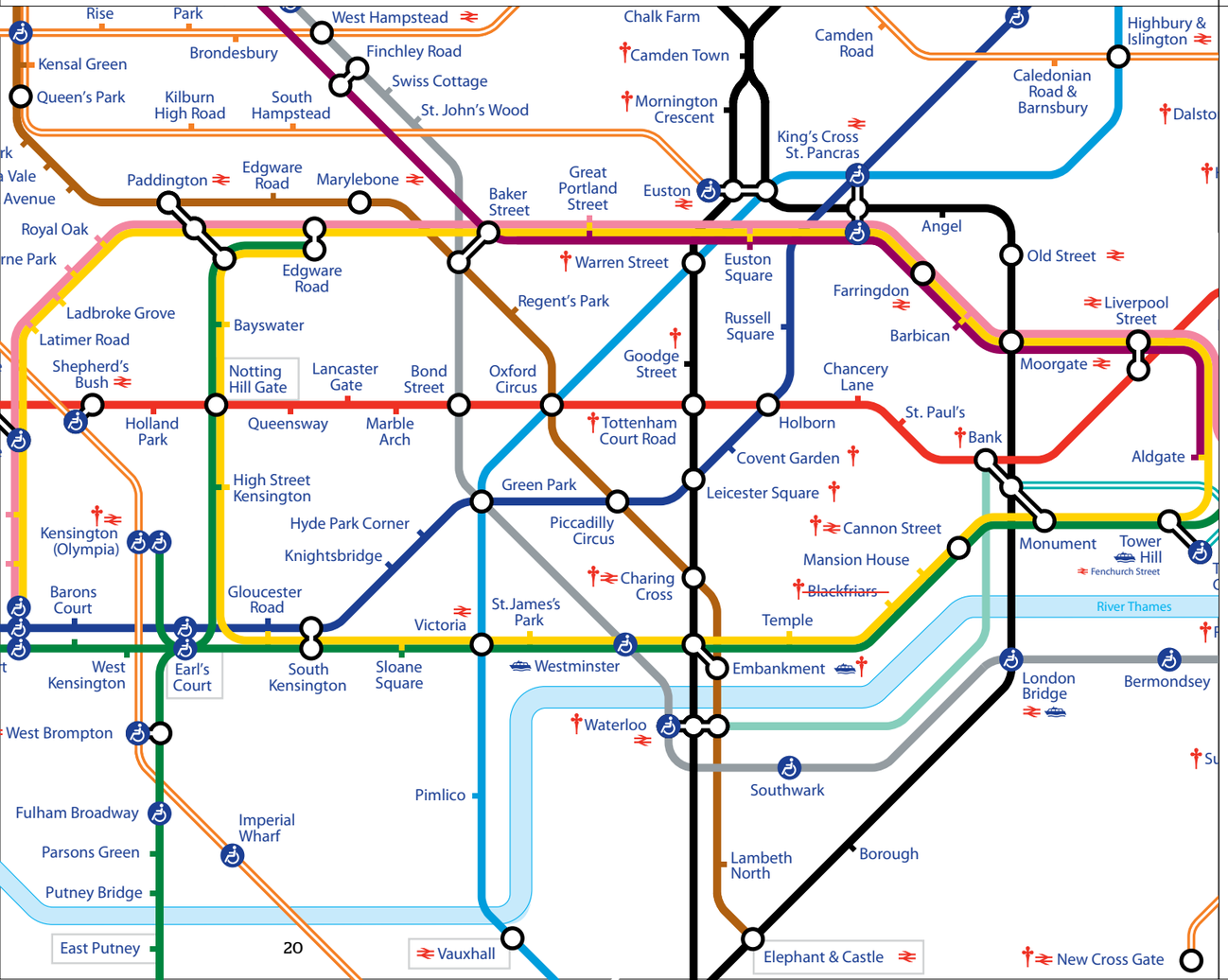


Figure: London Underground Map

Jurij Kobal

Interview with Dr Stephen Atkins

Public transport is a key element in the self-esteem of every European capital city

Dr Stephen Atkins has over thirty years of experience in transport planning, combining research skills with practical experience of implementing transport strategies. He served in the Strategic Rail Authority as an Assistant Director in the Planning Department; previously, he worked as a Chief Officer at Southampton City Council, managing an integrated City development policy group; at London Transport as Policy Studies Manager, and as an academic at Southampton University. Dr Atkins, who was previously Chairman of the Greater London Branch of IHT and a visiting Professor at Southampton University, has helped Ljubljana Urban Region develop capabilities for transport planning and policy for all types of transport. Dr Atkins works with MVA Consultancy, which provides advice on transport and other policy areas to central, regional and local governments, agencies, developers, operators and financiers. MVA works with clients to think through complex issues concerning the location and movement of people, goods and services – as well as helping them to maximise the potential of their own businesses.

There are several cities from smaller to bigger that you have helped develop public transport of different modes of transport. Ljubljana Urban Region is taking its first steps towards becoming a developed region with efficient public transport. Is there any similarity to other cities or regions you have been working with?
I have worked in many different towns and cities in the UK, Europe and the USA. For example when I worked for London Transport, we collaborated in several joint European research and development projects, and I have been on professional exchange visits to several European cities and towns including Madrid, Rome, Copenhagen, Dublin, Lyon, Amsterdam, Orvieto and Mytilini (Greece). Ljubljana is similar in size to many British provincial cities where I have worked, such as Portsmouth, Southampton and Nottingham. But although there are some similarities, all cities have their own unique characteristics of geography, history and culture, and all need their own tailored transport solutions.

Is there a list of priority activities we need to do? Patience, yes - but is there something more?
The most urgent task is to develop institutions to direct and manage the development of public transport across the region. There is a need for a political authority to provide direction, policy and funding for the public transport system across all the separate municipalities. And there is the need for a public body with the technical skills to specify and then procure the system – actual service delivery could then be undertaken either by a public body or by private companies. There needs to be a long-term commitment to the project, as it will take many years to see the full benefits.

What, or maybe even better who, are the drivers of change in means of transport? We, people, will need to change their habits, but helping them to change is probably more important than we can think.
A city of the size of Ljubljana, and with its ambitions to match the best qualities of European capital cities, needs an efficient public transport system. Otherwise, traffic will clog its arteries, pollute its atmosphere and restrict its economic progress. The key figures to make this change are the leading local politicians, who must take hard decisions that may not be popular in the short-term, and officials who devise and deliver the plans.
I have also spoken of the role that public figures can play as 'champions' of the new public transport system. These might be well-known local people from business, sport and the media who can see the vision of an improved Ljubljana and who speak out in favour of public transport and help to win over public support.

Your understanding of transport is like a doctor understanding the circulation of blood. What are the common errors or false opinion we have about traffic?
One error is that traffic always increases – that need not be the case if we plan our transport systems better, plan to accommodate people's desire to travel and not simply for traffic movement. A second error is that if you take away traffic capacity - for example to give more space to pedestrians or public transport - then traffic congestion will inevitably increase. What we find is that people's travel choices are continually changing - for example, when people change house or job - and hence it's much easier for people to adapt to new conditions than some transport models might predict. Generally, congestion stays about the same, as people balance their travel and lifestyle choices. People capacity is more important than traffic capacity.

In London, where you have recently been working, what are the most important milestones in changing transport habits and means of transport?
Well, the introduction of congestion charging was a big event for London and, indeed, for international practice in transport management. But looking back, the opening of new tube lines like the Victoria Line in the 1960s and the Jubilee Line in the 1990s were also very important. Policy changes on cheaper fares and easier fare collection, including concessionary fares for the elderly and disabled, are perhaps less obvious as events, but are important factors in achieving greater use of public transport. And, of course, the introduction of strong parking management measures is always an important incentive in changing travel behaviour.

And you have done it. Londoners have done it. Can people in London be satisfied with transport choices and efficiency of traffic?
Traffic in London has reduced, not just in the central congestion charging zone, but elsewhere, too. This is due to a combination of both push and pull factors, or sticks and carrots, as they are sometimes called. London restricts traffic through congestion charging; through limited parking space and high parking charges, including a rigorous enforcement regime using fines and towing away; and by giving buses priority in key locations. But London also has an extraordinarily good public transport system, with a large network of intersecting tube lines and a bus network of high frequency services to reduce waiting times at bus stops. And flat-rate fares paid through electronic payment (Oyster) cards and good information about travel opportunities make it very easy to use the network. It is the

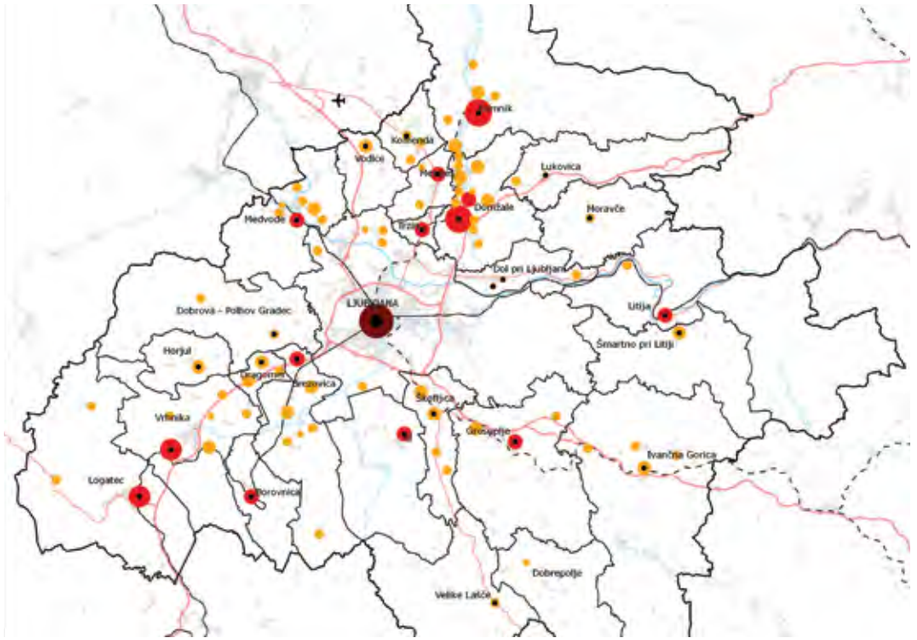
quality and coverage of the public transport network that determines the level of traffic congestion. Of course, some people moan about transport issues in London, but most people are very positive about their ability to move around the City.

In one of your reports, you write of connecting regional center and airport. The competitiveness of the region and the state as a whole depends on it.
A recent report for the UK Government looked at the economic success factors for cities and regions across Europe. Although London is very successful, some of the UK's other cities have not done well in comparison to their continental European regional competitors. A diverse economy, not dependent on any one sector was identified as important, as were higher education, training and skills, political leadership, quality of the environment and innovation. But for transport, a key factor was the presence of a regional airport with good services to a variety of European destinations; these encourage the presence of so-called footloose businesses which could locate anywhere. And obviously, access to the airport from the regional city centre is important. For Ljubljana, there are good connections from Jose Pučnik airport to several European cities, but a high quality link by public transport to the City centre should help to secure economic progress.

Is there something you would like to tell people living in Ljubljana Urban Region in terms of public transport?
You already have a very attractive small capital city, which I love. But if you are to retain its delightful qualities while growing its economy and prosperity, then a good quality public transport system is essential. It's a key feature of any self-respecting European capital city. There may be some short-term pain, but overall, the gain to the City and its people is greater.

Miran Gajšek, MArch, Dr Mitja Pavliha, Marjan Krasnič, Tone Peršak, Ivan Stanič, Lilijana Madjar, MA, and Marko Peterlin.

In order to preserve the positive qualities of past development, promote the advantages of the inherited settlement network and enable responses to the challenges of the future, it is imperative to improve connections and connectivity between the individual parts comprising the regional settlement network of the Ljubljana Urban Region. In the course of the last decades, these parts have become so mutually intertwined that the development of individual settlements can no longer be treated separately from the development of the wider area. A consequence of modified relationships is the emergence of new kinds of functional areas marked by commutes to work, shopping, and a high frequency of economic interactions within the region such as in regional goods and services trade. The Ljubljana Urban Region is a good approximation to such a functional area, with its centre in the city of Ljubljana.



Members of the Ljubljana Urban Region (source: Urban Planning Institute of the Republic of Slovenia, 2009).

Administrative centres
National centre
Municipal centre

Hierarchy of settlements
Centre of national significance
Centre of inter-municipal significance
Municipal administrative centre
Municipal area centre
Significant local centre
Local centre
Subsidiary local centre

Today, all key orientations of traffic and other policies from European to municipal levels find that such a state is unacceptable and requires change. At the level of the European Union, sustainable mobility and urban transport have received particular attention over the last few years. This began with the 'Thematic Strategy on the Urban Environment' (EC, 2006) which, among other things, proposed that agglomerations of over 100,000 inhabitants – which includes the Ljubljana Urban Region – prepare sustainable urban transport plans. At the end of September 2007, the European Commission published the green paper 'Towards a New Culture for Urban Mobility', which initiated a discussion on the content of European policy on this question (EC, 2007).

The green paper's starting point was the finding that more than 70% of the European population lives in cities, and these are the key to growth and employment, given that around 85% of GDP in the European Union is generated in cities. On the other hand, urban traffic accounts for 40% of all CO_2 emissions and 70% of other pollutants from road transport. Urban mobility is, therefore, also an essential element in tackling climate change. The challenge of sustainable development in urban areas consists of harmonising urban economic development and accessibility on the one hand, and improving the quality of life and environment protection on the other hand. Confronting the challenge is a multi-layered process. The European Commission finds that an important part of this is the preparation of the general public for changes in the culture of urban mobility.

In September 2009, the Action Plan followed, setting out measures for a different urban mobility culture at the European Union level. The measures include a follow-up to the CIVITAS ELAN initiative; projects to encourage the use of lower or zero emission vehicles; the establishment of practical connections between urban mobility and existing EU policies relating to health, cohesion and disability; the improvement of travel information, and further support from the Commission for awareness raising campaigns such as European Mobility Week.

National documents represent a similar framework in terms of content. In May 2006, the National Assembly adopted a 'Resolution on Transport Policy' (Official Gazette of the Republic of Slovenia, 2006) stating that with regard to population mobility, a law should be passed to regulate integrated public transport and the determination of solutions concerning the modality of integration of public transport services, bus stops and intermodal terminals. The law should determine the obligation to create a harmonised timetable, a unitary pricing system and a unitary information system for all public transport operators. The resolution states that particular emphasis should be placed on external accessibility to public transport by walking and non-motorised transport modes such as bicycles, as well as private vehicles, which should be parked at inter-modal terminals provided with sufficient parking spaces. The Resolution further states that it is necessary to determine the content of public transport services, as well as national, regional and local bodies competent for the provision of public transport. The introduction of a unitary pricing system and joint ticketing should simplify the use of public transport in terms of ticket purchasing. Appropriate funding would also make public transport services accessible to all inhabitants of Slovenia in terms of cost. The resolution also optimistically anticipates that the implementation of the stated measures would reduce budgetary expenditure on public transport.

Sustainable mobility is also the title and theme of one of the 35 key national development projects within the framework of the 'Resolution on National Development Projects for the Period 2007-2023' (Government of the Republic of Slovenia, 2006). The project deals with the introduction of a joint ticket system and travel information for passengers using public transport, inter-modal terminals, and the architecture of an intelligent transportation system. The objective is to create conditions for the development of a competitive economy and the long-term provision of a higher quality living space through ensuring sustainable mobility.

In terms of infrastructure and physical planning, the essential condition for the development of a healthy regional settlement network comprising the Ljubljana Urban Region is a comfortable and competitive sustainable transport system, including inter-modal freight and public passenger transport. This implies that all spatial development intentions are linked to a different model of mobility and arrangement of housing, social and economic activities, so that the use of private motor vehicles is reduced. In a healthy region, open urban spaces should be intended primarily for pedestrians, cyclists and for enabling activities that connect people, and no longer for driving and parking cars, which pollute the city. Moreover, mobility by means of private car is a privilege of merely half the residents of the city and region, as the other half, primarily due to age or illness, is unable to operate a car, which is neither socially nor culturally acceptable.

Between the city and the region

In 2007, the central Slovenia statistical region of 26 municipalities set out a significant outline of its development vision in 'The Regional Development Programme', which is a fundamental programmatic document at the regional level of the Ljubljana Urban Region. It was adopted by the Council of the Ljubljana Urban Region – i.e. by the mayors of the municipalities in LUR. A positive opinion was also issued by the Government Office for Local Self-Government and Regional Policy. The programme highlights the advantages of all the municipalities in LUR, sets targets and development priorities for the region and the regional development partnership, and suggests measures and actions for their implementation. The principle idea is that the Ljubljana Urban Region is a conurbation with large areas of natural landscape. Through fostering creativity and cooperation, its stakeholders will achieve high competitiveness globally and a high quality of life. The situation of Ljubljana, the largest urban centre in the functional region, the capital of the Republic of Slovenia and a European capital city, will reflect on the entire region.
The following goals are to translate this vision into reality:

- a functioning conurbation where, by 2013, over 80% of people will on average be less than 300m in a straight line from a public space and public transport;
- creative people and successful business organisations whose added value per employee should be increased by 10% by the end of 2013;
- become a region with a European capital city having the highest quality of life in Europe.

Sustainable development is the guideline for regional development. The rich water potential of the Sava River, Ljubljanica River, Kamniška Bistrica River, Krka River and their tributaries should be better exploited, as well as the extensive wooded hinterlands, wetlands and other areas of preserved nature which are precious ecological compensation areas. With a detailed knowledge of the carrying capacity of land resources, and through careful use of advanced technology, the city will put quality sites to better use and reduce energy consumption. It is imperative to create an appropriate organisational environment for encouraging the use of solar energy, and harnessing energy from thermal waste treatment, heat pumps and other environmental friendly modes of energy generation from renewable sources. All future spatial arrangements should be directed towards preserving and upgrading the natural qualities of the city and the region, and reducing emissions, notably those of greenhouse gases. With a view to ensuring a good quality and healthy living environment, spatial arrangements must provide good ventilation for settlements, irreproachable drinking water and access to natural landscape in the landscape parks in the hinterland. The treatment of all waste water in waste water treatment plants will also be an important task.
Among the main measures to achieve these goals are the following: accessible quality of life, preserved natural and cultural heritage, planning for a quality living environment, efficient utility services, equal opportunities, culture, e-administration and a supportive environment for entrepreneurship.

Levels of activity

In order to achieve the objectives of sustainable mobility and urban transport, it is necessary to determine levels of activity in terms of territory, cohesion and function. Only in this way can we have a clear picture of the scope of the planned development, of the range of possible operators, the necessary organisational adjustments and the content of implementation documents.
There are four levels:

- local, where improvements to the quality of life and development occur;
- regional, because the success of development at the regional level is directly proportional to the maintenance of self-sufficiency of individual members and indispensable connectedness within a stronger and more competitive physical and working entity;
- national, because the capital of the Republic of Slovenia is also the largest urban centre in the region;
- international, due to the geostrategic position of the region.

Local level

What is most important is the preservation and strengthening of the network of interdependent, yet autonomous local centres. Settlements must be oriented towards the preservation of inherited spatial qualities (the renovation, regeneration, rehabilitation of derelict areas; densification of development in compact areas in all urban settlements) where it is at the same time possible to set up an effective system of public transport (park and ride schemes in larger regional centres and alongside arterial roads, improved regional rail services, the introduction of high-speed railway lines, organisational changes); variously designated development areas must as a rule be planned within a maximum of 5 minutes walking distance from present and future bus stops serving urban and regional public transport. Such a guideline for urbanisation should be in force not only

for the Municipality of Ljubljana, but for all settlements in the region. Given current trends, such orientation may be extended to neighbouring regions. This means that at the local level, the network of social activities is strengthening, that proportional functional self-sufficiency is being preserved, particularly in the largest settlements, and that the accessibility of settlements in line with their relative importance is being improved. It is necessary to enable employment in all municipal centres, which entails the creation of the appropriate physical conditions for sustainable employment arrangements in economic zones in compliance with contemporary siting principles. The aim is also to preserve the vitality of individual members of the urban network and reduce the need for commuting.

Regional level

The operation of the functional urban region must be accelerated. In terms of space and function, it has been developing as a regional city and an all-Slovene metropolis. It already functions as a linked system of settlements in an urban region with 500,000 to 700,000 inhabitants. But in the course of the last two decades the scope and length of journeys in the Ljubljana Urban Region have increased overall on account of trips with private cars. Despite a substantive rise in mobility in Slovenia from 1990 to 2008, the annual number of passengers using public transport declined from 168 million to 90 million. The census data for the Municipality of Ljubljana show that in 2002 as many as 63% of residents travelled to work as car drivers, whereas only 21% used public transport for journeys to work. Even more drastic was the decline in the number of passengers in the inter-urban transport, which better indicates the overall state in the Ljubljana Urban Region – it fell from 294 million passengers in 1990 to barely 68 million in 2003. By contrast, the number of passenger cars per thousand inhabitants in the Ljubljana Urban Region increased in 2001-2008 from 475 to 529. Such a situation derives from a vicious circle whereby the increase in traffic generates congestion and exacerbates the need for new investments in road infrastructure. Better roads enable better mobility, thus generating more private car traffic, which eventually again produces deadlocks, and the vicious circle is closed. Today, constant and rapid growth in private car traffic is a matter of course, and both traffic experts and politicians reckon with it without much consideration.

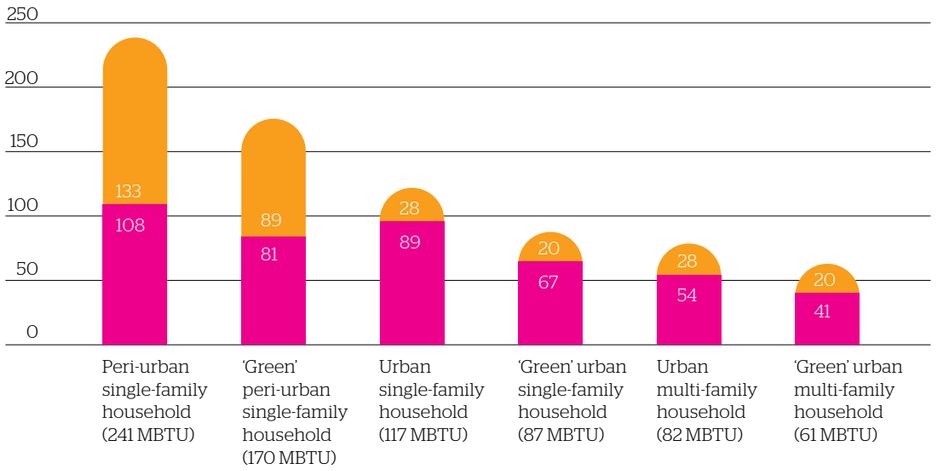
The fundamental driving forces of this development in the past two decades have been a higher degree of motorisation driven by values linked to personal freedom and material welfare, as well as cheap fossil fuel. These fundamental driving forces were involved in investments to improve the road network, in the accelerated suburbanisation of the countryside in the past decade, as well as dispersed spatial development, which contributed a loophole for this type of development.

In the long term, such organisation of transport and spatial development incurs immense social costs and reduces the quality of life of all residents in the urban region. Due to the individualisation of traffic, its costs have risen. There has also been a surge in energy consumption and environmental burdening, and the quality of life has deteriorated both in towns and the country. According to the estimates of American experts, energy consumption in homes and traffic in suburbanised settlements is four times that in cities (Fried, 2009).

Energy consumption by type of housing unit

Energy consumption in transport
Energy consumption at home

Million BTU* per year

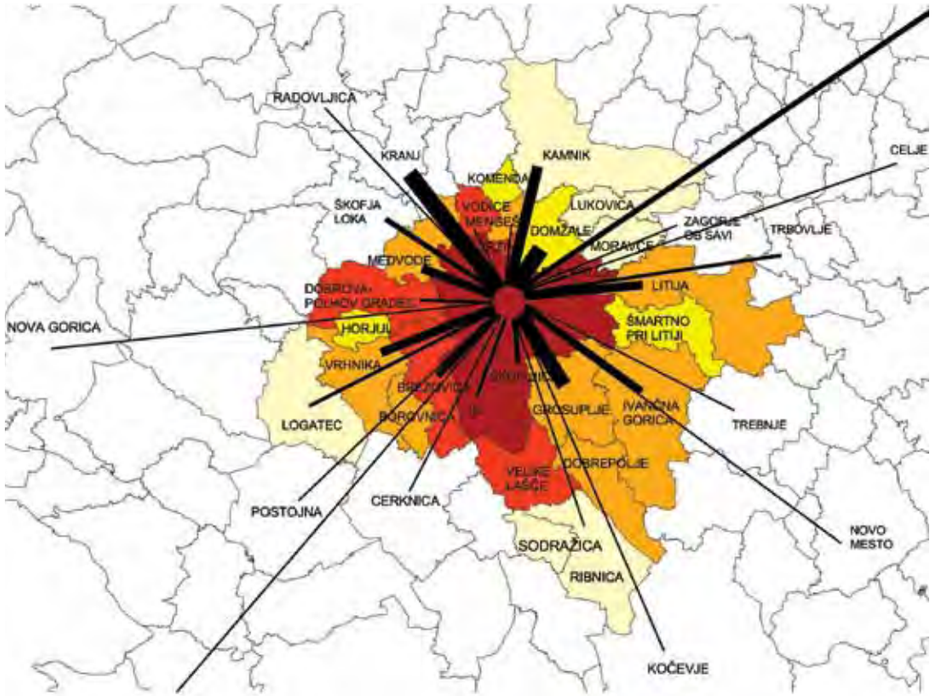


* BTU = British thermal Unit, 1BTU = 1.055 J

Proportion and number of residents in employment by municipalities who travel to work to the Municipality of Ljubljana. (Source: Institute for Spatial Policies, 2008.)

- 1001 - 1500
- 1501 - 2000
- 2001 - 2500
- 2501 - 3000
- 3001 - 3500
- 3501 - 4000
- 4001 - 4500
- more than 4501

- less than 25,0 %
- 25,1 to 35,0 %
- 35,1 to 45,0 %
- 45,1 to 55,0 %
- 55,1 to 65,1 %
- more than 65,1 %



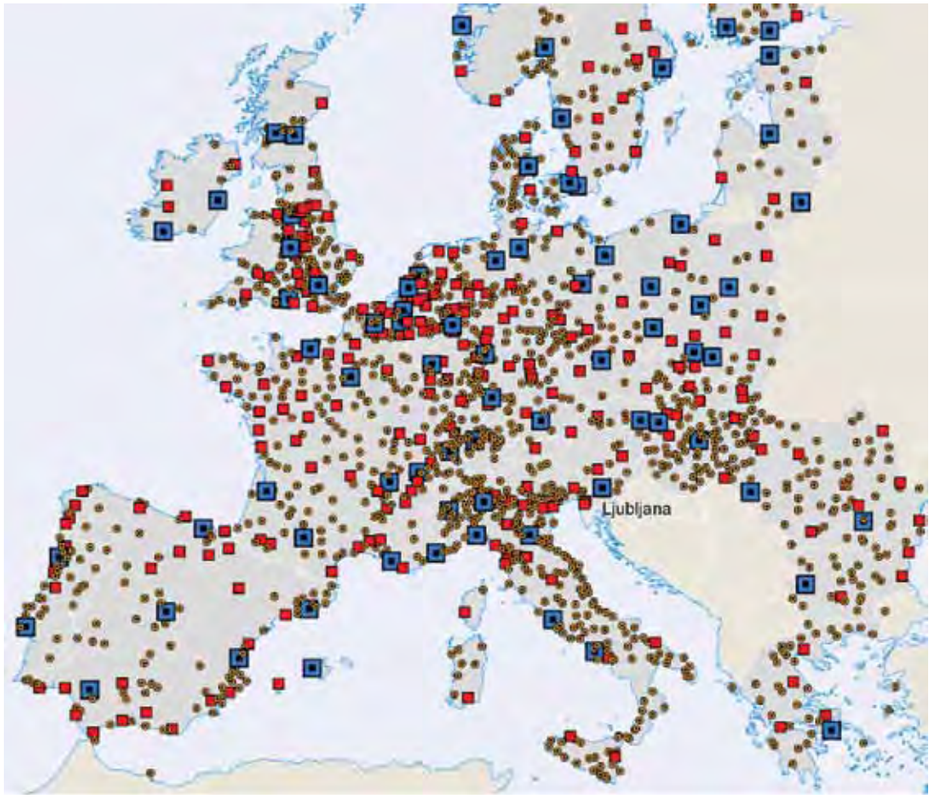
The regional network of settlements, or "the regional city", is being actualised through great mobility between towns and settlements in the region, between residential and employment areas, retailing, recreation and education facilities. Yet the principle city-making functions at the national level are situated within the urban structure of Ljubljana. Space cannot be developed in a universal, comprehensive and coordinated manner through partial spatial plans for individual municipalities of the central Slovenia region. In terms of space, the region must become a 'Regional City' developing on the basis of the new 'Regional Spatial Plan', together and in consonance with all the municipalities in the region. The region must have those elements which go beyond the municipal level and are valid for the entire functional (gravitation) region or its major parts, e.g. public transport, waste treatment, natural environment protection, regional recreational programmes and the like. Its essential characteristic must remain polycentrism, with a defined hierarchy of development poles. Alongside Ljubljana - which must to a certain extent incontestably continue to develop centripetally, as it is a regional and national centre - in a polycentric urban system, regional urban centres must also be strengthened. Most of the traffic and other flows in the region continue to emanate radially to and from the central urban conglomeration, similarly to other regional centres in Slovenia. This is why the main transport links from all parts of the area must be radially and concentrically connected. In view of the sustainable mobility of commuters in the region it will be necessary – particularly with regard to these radial links with Ljubljana – to give priority to the radical modernisation of the infrastructure and the public transport fleet. Any further settlement should be connected with the public transport services network. Slovenia has a variegated regional identity and a rich cultural heritage, but for all its geographical variety, it gives the impression of being one big garden city, identifiable on the map of Europe only as a whole. Through optimised functional division and improved inter-connectedness, the settlement network in the Ljubljana Urban Region, made up of some larger and some smaller urban agglomerations, may also be outwardly competitive.

Comparison of methods of travel to work in the Ljubljana Urban Region with some other urban regions in Europe. (Source: Institute for Spatial Policies, 2008.)

	Number of inhabitants	Share of travel to work by car	Share of travel to work on foot/by bicycle	Share of travel to work by public transport (metro, bus, tram)	Other
Ljubljana (SI)	4 88.364	71	12	16	1
Graz (AT)	3 57.548	60	20	18	2
Kobenhavn (DK)	1.806.667	52	24	20	4
Tartu (EE)	1 49.488	34	28	35	3
Barcelona (ES)	4.804.606	49	17	29	5
Oviedo (ES)	1.075.329	55	27	17	2
Logrono (ES)	2 70.400	58	31	9	3
Oulu (FI)	1 92.974	49	23	28	0
Luxembourg (LU)	1 36.625	66	14	17	3
s' Gravenhage (NL)	9 55.243	51	27	19	3
Amsterdam (NL)	1.320.137	51	22	24	3
Rotterdam (NL)	1.345.339	58	21	18	3
Utrecht (NL)	1.117.997	57	26	14	3
Groningen (NL)	3 59.957	55	35	7	3
Enschede (NL)	6 08.827	62	32	3	3
Oporto (PT)	1.089.118	46	21	27	6
Braga (PT)	1 64.192	47	25	21	7
Banska Bystrica (SK)	1 11.984	26	26	47	0
Nitra (SK)	1 63.540	22	21	53	4

The national and international level

The Municipality of Ljubljana receives around 140,000 commuters to work or school daily from other municipalities in the wider area, in addition to a substantial share of peri-urban journeys for other reasons such as business trips, shopping and leisure. On an international scale, Ljubljana is no longer treated as the city of Ljubljana, but as an urban area comprising an area of daily commutes concentrating on Ljubljana. The ESPON (European Spatial Planning Observation Network) programme offered a European view of Ljubljana's significance within the international network of cities. Within the framework of the project dealing with the European urban network, the Ljubljana Urban Region was defined as a MEGA or metropolitan growth area of European significance (Nordregio, 2004). In the enlarged European Union (including Switzerland and Norway), 76 MEGAs were identified. In Slovenia's immediate vicinity, they include Milan, Bologna, Munich, Vienna, Bratislava and Budapest, which puts Ljubljana – although it has just over half a million inhabitants – alongside larger neighbouring cities. At all events, Ljubljana is a capital city and a significant link of the four cohesion areas of the European Union. Its position at the intersection of the 5th and 10th European transport corridors, its railway node, the vicinity of the port of Koper and the 'Jože Pučnik' (Brnik) international airport provide the Ljubljana Urban Region with the territorial conditions to become a hub of a metropolitan European growth area. It will then be able to assume a significant role in functional connections between the states within its cohesion area and augment its influence at the global, European, inter-regional and national levels. Moreover, the regional city of Ljubljana is an entity with sufficient financial, logistic, cultural and research capacity to contribute more decisively to the development of the macro-region connecting Central Europe with the Balkans (Southeastern Europe) and the Alps with the Adriatic.



The Ljubljana urban area within the European urban network (Source: ESPON/Nordregio, 2004)

Metropolitan European Growth Areas (MEGA)

Transnational/national functional urban area

Regional/local functional urban area

Project study's content

The 'Expert guidelines for the regulation of regional public transport' project study is primarily intended to contribute to the implementation of the 'Regional Development Programme of the Ljubljana Urban Region'. The first of the three goals set out in the programme has been to establish a functional peri-urban area where, by 2013, over 80% of people will on average be less than 300m in a straight from a public space and public transport (RDA LUR, 2007). In order to achieve this goal, the project is set to establish public transport links allowing residents and visitors to select a convenient mode of transport, attractive in terms of timetable and fare. The openness and practicality of the public transport system assumes a particular importance in view of the reduction of the traffic generated by daily commuting (to work, school) and the large number of visitors who visit the region owing to the economic and political role of Ljubljana as a capital city. Renovation of the public transport in the region would boost its attractiveness and quality as a place for living, studying, working and visiting. This entails a potential for synergy development effects in numerous fields, which improves the region's international competitiveness.

The project study encompassed the following content:

- agreement on the objectives of sustainable transport in the region in connection with neighbouring regions,
- public programmes accessibility analysis,
- preparation of the public transport plan,
- proposal to introduce a unitary timetable and unitary ticket,
- establishment of a regional regulatory body for public passenger transport (PPT).

The project study presents expert guidelines for the regulation and establishment of high quality public transport in the Ljubljana Urban Region by 2027. It is based on the principles of sustainable mobility defined as meeting the travel needs of individuals in a way that allows them free movement, accessibility, communication, transfer and the use of links without sacrificing other essential human or ecological values today or in the future. The principles of sustainable mobility also provided concrete guidelines in the preparation of the study to establish a public transport system in LUR that will offer its residents and visitors convenient possibilities of choice of transport mode by supplying an attractive PPT in terms of timetable and price, thereby enhancing the quality of life in the region.

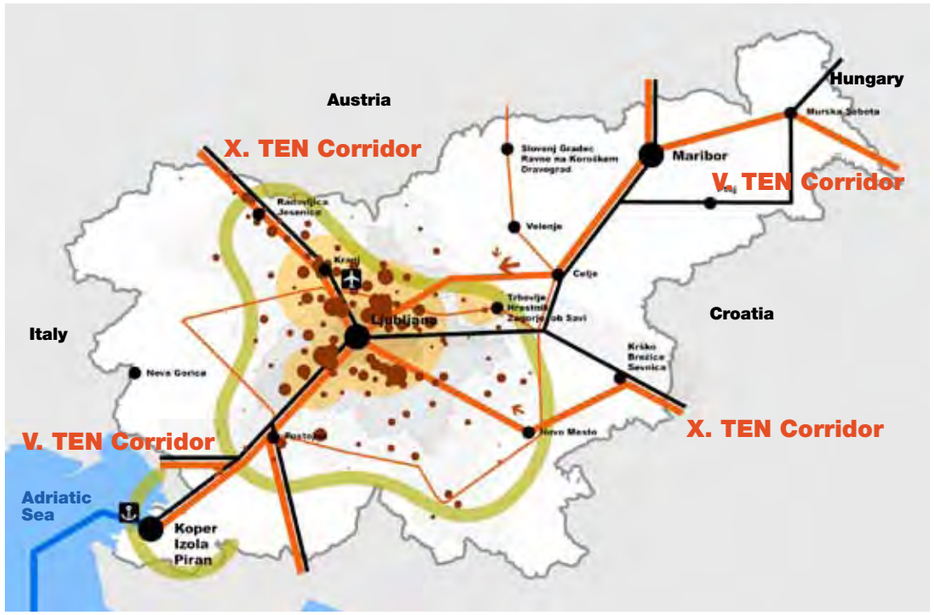
MEGA – CABA
(Source: MOL OUP)

- Republic of Slovenia
- Traffic study area
- Ljubljana Urban Region
- Municipality of Ljubljana
- Long distance international road link
- Cross-border road link
- Long distance international rail link
- High speed rail link
- Navigable maritime route
- Port of Koper
- 'Jože Pučnik' Airport, Ljubljana
- National/international transport hub
- National transport hub

Daily vehicle traffic volume to/from MOL: from nearby settlements
- 100
- 1000
- 10,000

From direction
- 100
- 1000
- 10,000

- Area of integrated public transport and settlement
- MEGA area - suggestion



Contemporary public transport is comfortable, fast, effective and affordable

The general rise in welfare brought about a decline in public transport patronage and the increased use of private motor vehicles. The consequences of described non-sustainable development are heavily congested traffic in larger settlements and between regional centres and the capital, increasing deterioration of air quality, increasing external transport costs and their share in household expenses.

Considering these facts, the design of contemporary transport regulation needs to take into account the existing physical conditions, recognise and accept negative trends, and then make a selection of priority development actions, as well as define the roles and responsibilities of monitoring bodies. This applies to all decision makers at different levels of activity, so that we could achieve synergy effects in a collective effort to improve current traffic conditions and eliminate as quickly as possible the biggest shortcomings of the system, and create within a foreseeable period of time an effective, an economical and sustainable system for the future.

The development of traffic in the Ljubljana Urban Region must be oriented towards changing the proportions in the use of various means of transport. A priority assumption for the design of regulations, and an outline of the measures required, is the promotion of different forms of public transport and the restriction of car traffic. The purpose is to reduce the need for the use of the private car, optimise transport costs, and at the same time strengthen the mobility of all population groups and, consequently, reduce the negative impact of traffic on the environment. The introduction of a modern public transport system, of course, means that it will be comfortable, rapid, effective and affordable for all users.

Thus far, the development of the traffic system in Slovenia has primarily been oriented towards improving the road infrastructure and, consequently, improvements in the mobility of individual vehicle users, whilst PPT remained stagnant. This development resulted in the low mobility of non-motorised users, traffic deadlocks, the environment burdened by emissions and noise, and poor traffic safety. The renovation of PPT in the region would boost the region's attractiveness and quality as a location for living, studying, working and visiting. This entails a potential for synergy development effects in numerous fields, which augments the region's international competitiveness.

The study entitled 'Expert guidelines for the regulation of regional public transport' was conceived to this end. The study presents expert guidelines for the regulation and establishment of quality PPT in the Ljubljana Urban Region (LUR) by 2027; it comprises six interim reports and a joint final report, which was submitted to the contracting body in October 2009. The task's result has been a proposal for a plan of a PPT system designed on the basis of the vision of allowing all users the convenient opportunity to choose a transport service which is attractive in terms of time and cost. The common goal of the new PPT regulation has been to raise the quality of life in the region in compliance with the paradigm of sustainable mobility.

A positive response to the growing problems originating in the traffic system in LUR can be achieved only by reducing the use of private vehicles. In order to improve mobility, a share of passengers must be shifted from private cars to non-motorised modes of travel, notably to public transport. The shift to public transport can be accomplished by traffic restrictions and toll schemes for entry to urban centres, respectively, followed by measures favouring PPT development. The most effective solution is a system of high-speed bus routes running in dedicated yellow lanes, which would link inter-modal interchange points with adjacent car parks in the gravitational centre of the region. At these points alongside arterial roads, daily commuters would be offered the most convenient transport solution within the urban agglomeration.

The proposed PPT plan envisages upgrading the existing PPT concept based on the establishment of contemporary high-speed routes (HSR) with yellow lanes and PPT hubs with P & R sites in the region. It is essential to enable the building of inter-modal transport chains allowing transfers between individual traffic, public transport and non-motorised traffic (cycling, walking), including additional transport modes with the possibility of switching between them.

High quality PPT requires a new organisational structure to be introduced gradually in stages. The speed of implementation of the stages depends on the duration of legal and

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administrative procedures, the commitment and coordination of the relevant bodies, and financial support. In the first stage, already in 2010, the introduction of unitary regional entity is envisaged – a Regional Coordinating Body for PPT. The second stage encompasses the execution of projects and coordination of the introduction of the system in individual municipalities. Municipalities are assigned sets of priority tasks to be implemented, and at the same time, regional interests in the process of harmonisation of activities relative to PPT must be represented at the national level.

In the third stage, the system operates until the need for enlargement. The enlargement of the scope of PPT in the final stage involves relevant statutory and organisational adjustments of PPT at the municipal, regional and national levels. Consequently, the Regional Coordinating Body is transformed into a Regional Agency for PPT to effectively perform the functions pertaining to the operation of public transport, and into a separate independent Regional Regulatory Body to oversee the performance of these functions. The final stage signifies the imminent realisation of the goal of introducing a high quality integrated PPT in LUR by 2027.

In the course of the planning period, the outlined plan may achieve a rise in trips made by PPT in LUR by more than 50%. Additional passengers switch from private cars to PPT at journey's origin or at P & R interchange points. Thanks to

P & R schemes 25,000 car users daily would park on the outskirts. Such a rise in the use of PPT services (reduction in the number of private cars used) result in a better quality of living in the region due to the reduction of noise, gas emissions (CO_2, NO_x,) particulate matter (PM_{10}), and the relief of traffic congestion in urban centres. It also contributes to reorienting surfaces formerly used by motorised traffic to give priority to non-motorised traffic, green areas and areas for recreation or public use. The proposed PPT plan in LUR with HSRs on yellow lanes is an upgrading of the existing plan, which allows for its rapid implementation. The proposed HSRs system is sustainable over the entire planning period, which leaves sufficient time to reflect on the next step: tram or underground railway (metro).

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Contents

Introduction

Thus far, the development of the traffic system in Slovenia has primarily been oriented towards improving the road infrastructure and, consequently, improving the mobility of individual vehicle users, whilst PPT remained stagnant. This development resulted in the low mobility of non-motorised users, traffic deadlocks, urban spaces occupied by parked vehicles, the environment burdened by emissions and noise, as well as the deterioration in traffic safety. The renovation of PPT in the region would boost the region's attractiveness and quality as a location for living, studying, working and visiting. This entails a potential for synergy development effects in numerous fields, which augments the region's international competitiveness.

The study entitled 'Expert guidelines for the regulation of regional public transport' was conceived to this end. The task's outcomes are expert guidelines for the regulation and establishment of quality PPT in the Ljubljana Urban Region (LUR) by 2027. The production of the study was delayed by six months due to complaints made during the public procurement procedure, although this had no impact on the completion term.

The study comprises six interim reports and a joint final report, which was submitted to the contracting entity in October 2009. The report submissions were accompanied by coordination meetings, task presentations and workshops involving the wider interested public. The conclusions reached in the workshops served as guidelines in the crafting of the Plan for PPT in LUR.

The fundamental principles of sustainable mobility are defined from the social point of view as meeting the travel needs of individuals, allowing them free movement, accessibility, communication, transfer and the use of links without sacrificing other essential human or ecological values today or in the future. The principles of sustainable mobility also provided concrete guidelines in the preparation of the study to establish a public transport system in LUR that will offer its residents and visitors convenient possibilities of choice of transport mode by supplying an attractive PPT in terms of timetable and price, thereby enhancing the quality of life in the region. The openness and practicality of the public transport system assumes a particular importance in view of the reduction of traffic generated by daily commuting (to work, school) and the large number of people who visit the region owing to the economic and political role of Ljubljana as a capital city. Ljubljana has a huge background of daily commutes based on private car traffic, which is why as large a share of daily commuters as possible needs to be shifted to public transport.

The project encompassed the delivery of the following key activities (KA):

- agreement on the objectives of sustainable transport in LUR in connection with neighbouring regions;
- public programmes accessibility analysis;
- preparation of the plan for PPT;
- proposal to introduce a unitary timetable and unitary ticket;
- establishment of a Regional Regulatory Body for PPT.

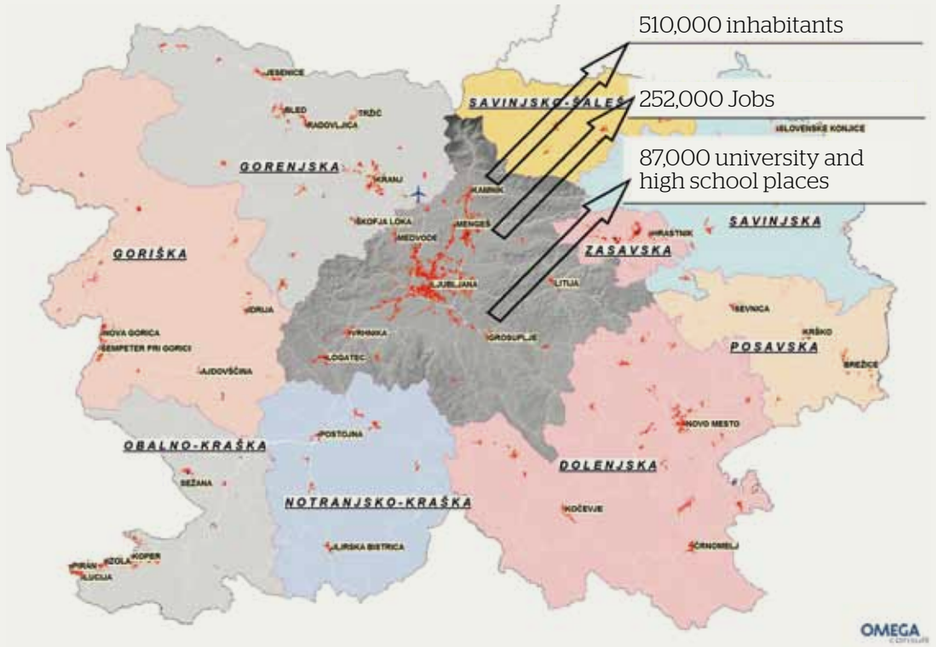
Review of the existing condition

The Ljubljana Urban Region covers the area of the central Slovenia statistical region. LUR, with Ljubljana as the capital city, is the main target of commuting flows in Slovenia. It also attracts daily commuters to work and school from the neighbouring regions. The Municipality of Ljubljana (MOL) is the regional gravitation centre within LUR, and is where all main regional and inter-regional flows converge. Ljubljana's ‚Jože Pučnik' Airport also contributes to international migration flows. Ljubljana is also located at the intersection of the 5th and 10th TEN corridors, so there is a concentration of flows in the region's gravitation centre which results in traffic deadlocks during peak periods. These traffic conditions - created mainly by daily commuters in cars - result in delays in travel, an environment overburdened by emissions from traffic, noise, and poor traffic safety. These negative effects of traffic affect the quality of life of MOL residents and commuters, as well as visitors. Public transport is most effective and performs best when moving passengers to and from intensive activity areas that are destinations and densely populated areas that are journey origins.

The Ljubljana Urban Region is the most densely populated Slovene region. Both LUR's population density and population growth are approximately double the average in Slovenia. In comparison with other regions, LUR has the highest population growth. Some 510,000 people live in this region; with 252,000 people in employment and 87,000 high school and university students; the region is also the largest commuting centre in Slovenia. The Municipality of Ljubljana, with 290,000 inhabitants and over 200,000 jobs, stands out in LUR.

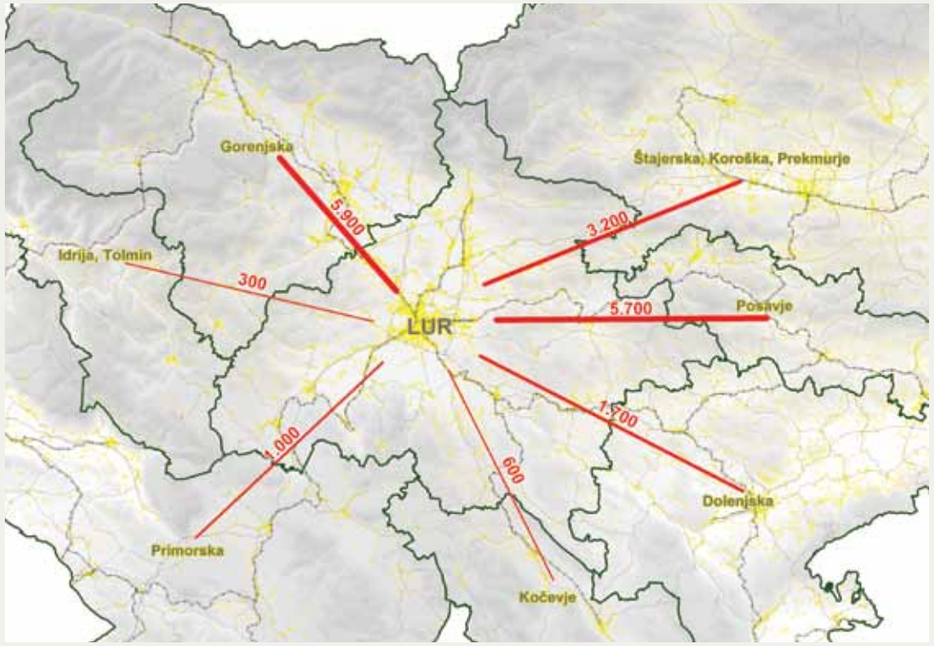
The number of journeys by PPT in Slovenia is in decline. Between 2004 and 2008, the number of kilometres travelled by buses both in urban and inter-urban public services fell (by 13% on inter-urban routes and 16% on urban routes). The number of passengers also declined (by 34% for inter-urban services and 13% for urban ones). Despite funding assistance and the maintenance of the scope of public bus services, their use is in decline. In the course of the monitored period, there was a perceptible 16% surge in the number of passenger journeys by rail.

Figure 2.1: Settlement and the structure of LUR



Daily journeys on an average working day in LUR in 2008 totalled over 100,000, of which approximately 90% were made by private cars.
Figure 2.2 shows estimates of passengers carried by public bus and rail transport on a day in 2008 serving routes within and outside LUR. Within LUR, around 900,000 trips are made on an average working day.

Figure 2.2: Estimate of the number of passengers using public transport in 2008 on routes within LUR – outside LUR



Transport network accessibility enables the recognition of the interdependency between transport organisation and land use, understanding motion as a basic necessity.
An analysis of current accessibility by PPT was made for variously distributed activities in space (Table 2.1). The accessibility criterion was 'the 15 minutes walking distance concept', which means 300m in urban areas and 500m in rural areas.

Table 2.1: Activities within/ outside the range of accessibility

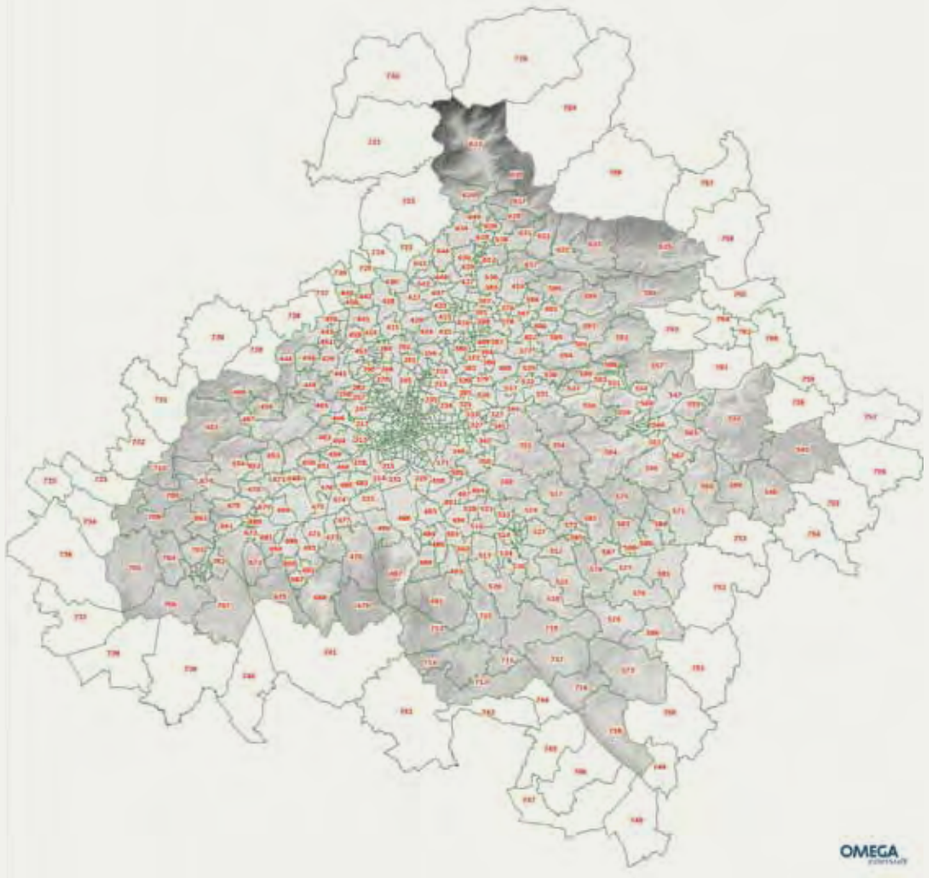
employment	84
residents	72
cadastre - public services	82
cadastre – commercial and leisure services	87
cadastre - tourism	77
public surfaces	63
elementary school (number of pupils)	79
middle school (number of students)	90
faculty (number of students)	94
nurseries (number of vacancies)	81
hostel for high school students (number of vacancies)	94
hostel for students (number of vacancies)	93

The desired accessibility rates are between 70% and 85% (70% – cadastre – tourism; 80% – employment, residents, public surfaces, elementary schools, high schools, faculties, nurseries, hostels for high school students, hostels for students; 85% – cadastre – public services, cadastre – commercial and leisure services). According to our results (Table 2.1), the accessibility rate should rise for residents, cadastre – public services, public surfaces and elementary schools. It should be emphasised that the results for elementary schools represent an indirect criterion due to organised school bus transport.

The division of space into traffic zones and expected development

We divided the area of LUR including its fringe area into 770 internal traffic zones, of which 719 are within LUR and 51 along the LUR area boundary. The size of a zone depends on the gravitational influx of traffic with respect to existing and anticipated transport links, the number of residents and the future distribution of residents, as well as existing employment and activities, and their future spatial distribution. Outside the LUR area, in the neighbouring regions and wider international space, our zoning took into account all gravitational traffic influxes into the LUR area, running on the current and anticipated traffic infrastructure. We also considered the most important strategic destinations and origins of journeys such as the 'Jože Pučnik' Airport, international border crossings and all the surrounding urban centres whose gravitational areas overlap with LUR (Kranj, Škofja Loka, Postojna, Idrija, Ribnica, Kočevje, Celje).

Figure 2.3: Traffic zoning in the area of LUR



Forecasts of the socio-economic structure of space are expressed through the socio-economic characteristics of the traffic zones in the target year 2027. The implemented traffic zones are representative of the spatial structure; their content is the input data for modeling the future state and volume of traffic flows. Forecasting travel generations hinges primarily on the anticipated demographic structure, whilst forecasting travel attractions depends on the foreseen economic structure of the space. In the chapter there is a forecast of the demographic and economic development in the area for the target year 2027 together with the foundations and starting points taken into consideration for the forecast.

Forecasts on the demographic development are based on the internationally acknowledged Eurostat projection of demographic development produced for the national level and relevantly applied to the LUR level, the most recent forecasts for the LUR area and the latest strategic spatial plans of the municipalities in LUR and their expert guidelines. Alongside these starting points, the final forecast of demographic development took into account scenario 0, appropriately applied to the traffic zones level, which assumes that the total number of residents in the LUR area in 2027 will not be substantially different with respect to the starting year 2008. Forecasts for economic development are based on relevant, internationally acknowledged macro-economic forecasts produced for the national level and appropriately applied to the LUR level, on other latest forecasts, municipal economic plans, the latest strategic spatial plans of the municipalities in LUR and their expert guidelines appropriately applied to the traffic zones level, and on considerations of the forecasts on the demographic development according to scenario 0.

Table 2.2: Aggregate socio-economic data for the zoning area for 2008 and anticipated values for the target year 2027

Year	2008	2027	difference in %
Number of residents	601,975	601,992	0.0%
Number of households	223,654	253,216	13.2%
Workforce jobs (number)	278,126	280,472	0.8%
Economically active population	280,432	253,522	-9.6%
Workforce jobs - secondary sector (number)	86,770	77,417	-10.8%
Workforce jobs - tertiary sector (number)	122,860	130,082	5.9%
Workforce jobs - quaternary sector (number)	67,160	72,475	7.9%
Workforce jobs - retail (number)	31,204	39,969	28.1%
Retail areas (ha)	238	302	26.8%

In accordance with the mentioned forecasts of demographic development and development spatial plans of municipalities in LUR, the final forecast of the demographic development took into account scenario 0, which assumes that the total number of residents in the wider LUR area in 2027 will not be substantially different with respect to the starting year 2008. Consequently, we incorporated the spatial development plans of the municipalities in LUR into the forecast of the internationally acknowledged Euro stat projection of national demographic development. The fundamental laws underlying the demographic development of LUR and MOL are the same as those for the whole of Slovenia; therefore, demographic projections made at the national level could be relevantly applied to the existing spatial units (traffic zones) in LUR on the basis of the known number and structure of residents by territorial district.

The economic development forecast, incorporating international macro-economic forecasts adjusted by the regional and municipal development plans - and considering the convergence effect of growth rates and demographic development following scenario 0 - assumes that the total number of jobs in the LUR area will not change substantially. Yet, the employment structure will change and the number of jobs offered to economically active people will rise. In compliance with the development plans of the municipalities of LUR, there will be a partial redistribution of jobs in the area. The economic development forecast for LUR for the target year 2027 is relevantly applied to the level of the traffic zones which represent the economic structure of the area.

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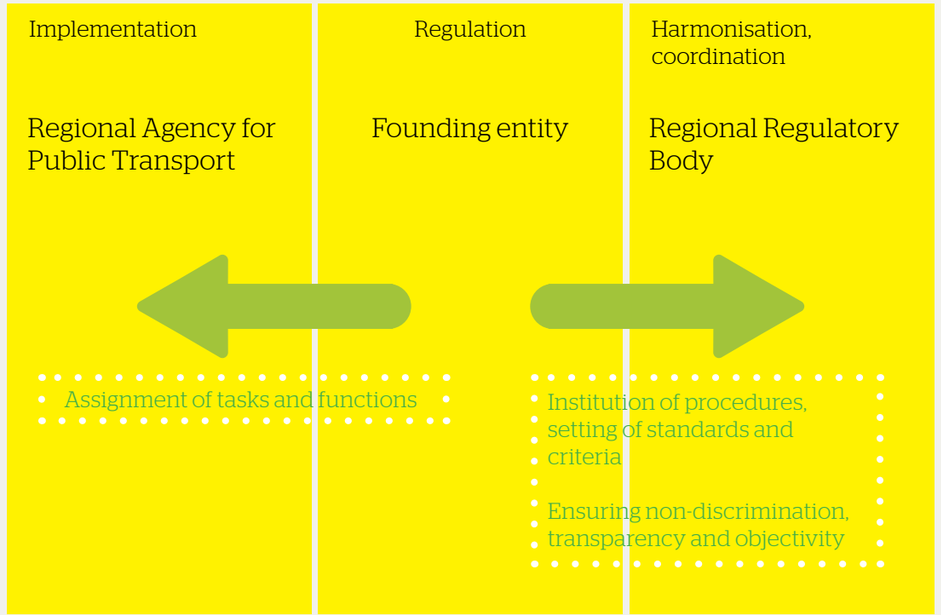
Organisational regulation of the new PPT in LUR

Within the structure of the new PPT system its organisation must be regulated to enable the successful management of the entire integrated PPT. Technical, technological, organisational, economic and legal elements have to be taken into consideration and interconnected. The interaction between elements refers to horizontal links between individual subsystems and vertical links between elements within an individual subsystem. A proposal for new institutional regulation of the public transport system must comply with transport policy guidelines and take into account foreign good practices.
In the final regulation of the PPT system, the executive and supervising/coordinating functions are separated at the regional level, and performed by the relevant Regional Agency for PPT and the Regional Regulatory Body. The scheme of the final regulation of PPT as foreseen for 2027 is shown in Figure 3.1.

Figure 3.1: Institutional regulation of the new PPT system



Proposal for new institutional regulation of PPT in LUR

It is essential to the realisation of a new vision of transport to ensure high-quality transport. The existing PPT system in LUR must be modernised through contemporary and innovative services focused on the satisfaction of customers and in compliance with the development needs of LUR. The new proposal for the regulation of PPT in LUR has to be acceptable to the general public, and needs to have public and private financial assistance assured. A sufficiently high quality level of services tailored to the needs of all users can only be ensured by integrated public transport.

The legislation in force governing public passenger transport does not include the possibility of regionally organised PPT. For the successful regulation of PPT at the regional level, cooperation between the municipalities in LUR would be needed, directed toward the common goal.
In order for the measures to be successfully implemented at the municipal level, some support as to the manner of their implementation should be ensured. Therefore, the establishment of a new entity has been proposed which would perform overall coordination and supervision of the PPT system and prepare projects for the renovation of the PPT system.

On the basis of Art. 4 of the Decree on the Creation of the Regional Council, and as in the adopted Regional Development Programme of the Ljubljana Urban Region 2007–2013, the Council of LUR may adopt at one of its sessions a decree to establish a Regional Coordinating Body for PPT as an expert advisory body for the regulation of PPT. The Regional Coordinating Body for PPT would, as an independent entity carrying out tasks in the public interest, be responsible for preparing and organising projects designed to launch a new PPT system.

The purpose of constituting a Regional Coordinating Body is to steer, promote and harmonise the development and operation of the regional PPT system, as well as ensure support for the region in attaining the set sustainable mobility targets. This initial concept of the regulation of the integrated PPT system will ensure the realisation of the set sustainable transport targets in the region.

The main tasks of the Regional Coordinating Body for PPT are as follows:

- coordinating and formulating the common interests of the region (PPT operators, individual local communities, users and the general public);
- representing the region's common interests in harmonisation processes at the national level;
- ensuring funds for financing PPT projects (public, private and EU funds);
- preparing relevant legal frameworks for the implementation of activities;
- setting up communication and information channels;
- determining priority activities and projects, their tendering and implementation.

The organisational transformation of the Regional Coordinating Body for PPT into 'Agency' and 'Regulatory Body' would happen by 2027, after the launch of the integrated regional PPT. Prior to this transformation, new legislation to permit it will have to be passed.

Minimum quality standards for the PPT services and TQM system

Public transport is a service of key importance for residents. The quality and organisational form of public transport depend on the definition of integrated public transport, whereby measurable systems for ensuring quality are in the forefront. Such an approach ensures the development of integrated systems, and also enables the measurement of improvements in the services offered.
Therefore, transport authorities set minimum standards and levels of service. By so doing, they ensure the constant minimum public transport service quality required, enable the measurability of improvements and define the public interest.

The TQM (Total Quality Management) system is to be introduced as a minimum requirement for achieving a certain PPT quality level harmonised for all operators. The Regional Coordinating Body determines minimum standards or modules for individual key areas (with regard to national PPT standards) that must be met by operators. These modules direct the modalities of work of operators and refer to:

- operators' staff qualifications and training with regard to individual technologies, purpose and difficulty of transport (time, route, passenger structure – children, people with special needs) and with regard to professional profile (fire safety, first aid certificate, professional-technical training) etc.;

- additional training: additional technical training, driving in hazardous weather conditions, energy efficient driving, additional technical training for new transport technologies, qualifying for additional transport services (transport of children, skiers, tourists and similar);
- informed staff: staff are appropriately informed about PPT services (routes, timetables, ticket prices; they are able to advise passengers);
- fleet maintenance: standards for cleanliness and technical maintenance of vehicles;
- overall internal organisation of the operators: staff behaviour, dress code etc.

In cases of breaches or failing to meet minimum standards in an area, operators shall be charged a contractual penalty. Initially, the verification of meeting minimum standards would be done by the Regional Coordinating Body through its supervising function. Later, this role would be assumed by the Regional Regulatory Body.

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Methodology of PPT systems simulations

Crafting 'Expert guidelines for the regulation of regional public transport' required the use of various methodological approaches. During the first stage, an analytical traffic model was produced to analyse the current situation. This model was the basis for the first two iterations: assignment of routes in the gravitational centre of the region and the feasibility of links with the railway infrastructure. This model, however, had its limitations, as it was too narrow with respect to the gravitational area of LUR, which also reaches into neighbouring regions. The zoning we used for the analytical traffic model was articulated in more detail during the ensuing stages, particularly for the area between MOL and the LUR boundary. The analytic traffic model served to check the effectiveness of the basic or starting scenarios of public transport regulation in LUR.

The traffic model was devised on the basis of the latest updates of data for the following areas:

- demographic data,
- socio-economic data,
- transport data,
- other.

The traffic model used is a four-step model and allows precise traffic analyses, including the re-distribution of journeys, induced traffic and choice of means of transport. The passenger traffic model comprises 770 zones internally and in the outer area. The internal part comprises the area within LUR and the fringe zones. Traffic flows in the outer area are assigned by a synthetic 4-step traffic model developed within the framework of the task 'Project for the comprehensive development of the third development axis area'.
The model was calibrated on the existing situation with the use of the data collected.

The traffic model of internal passenger traffic is a synthetic, simultaneous and four-step model. It was devised with the VISEVA software tool. The generation, distribution and choice of means of transport were calculated for 13 travel destinations, of which 6 are round trips:

- home-work and work-home,
- home-education and education-home,
- home-shopping and shopping-home,
- home-leisure and leisure-home,
- home-other and other-home,
- work-other and other-work and
- other-other.

Travel generation and attraction

Travel generation/attraction analyses by traffic zone were calculated on the basis of the latest socio-economic data. Travel generation factors by destinations are taken from the 'Multi-modal transport model for the Ljubljana region' (2003) and incremented with respect to the reported increase in travel resulting from the traffic count analysis. The total number of all generated trips relative to the internal traffic model on an average working day in 2008 is shown in Table 4.1.

Table 4.1: Total number of trips generated on an average working day in 2008

Area	Number of trips generated
Municipality of Ljubljana	1.300.482
LUR	1.794.811
Internal traffic model	1.971.720

Table 4.2 shows the number of journeys by destination generated on an average working day in the area of the internal traffic model.

Table 4.2: Number of journeys by destination generated on an average working day in the area of the internal traffic model in 2008

Destination	Generation
home-work	217.072
home-education	103.682
home-retail	142,634
home-leisure	181.548
home-other	139,550
work-home	152,387
education-home	87.573
shopping-home	199.637
leisure-home	222.299
other-home	153.404
work-other	72.711
other-work	39.800
other-other	259.423
Total	1.971.720

Distribution of journeys and choice of means of transport

The second step of the four-step traffic model deals with the distribution of journeys. The distribution of journeys was produced with the gravitation model on the basis of existing and calibrated traffic models, on the basis of data from analyses and studies, and on the basis of a user survey. The distribution of journeys and the choice of the means of transport were produced on the basis of travel cost resistances related to the use of the traffic network, which included:

- road network,
- non-motorised traffic network,
- public transport network,
- link points between public, non-motorised and road networks.

The generalised costs of private vehicle users on the existing road network were assigned through the burdening of the network by the starting travel matrix calibrated on the traffic count data. The method employed was the capacity restrained method. By using the road network burdening method, delays due to congestion both in public and road networks could be analysed and taken into account.

The method of choosing the means of transport assigns the transport mode on the basis of generalised cost matrices for both groups of transport modes: individual (motorised (cars) and non-motorised (cycling and walking)) and public for each origin-destination pair.

The choice of the means of transport was produced separately for each destination. The distribution and the choice of means of transport are assigned by the simultaneous model EVA, which simultaneously assigns travel matrices for each means of transport. Average travel time is taken into account as resistance. Resistance matrices for all inter-zone trips are derived from burdening performed in the VISUM tool. The parameters taken into account were the following:

- for walking trips: walking time;
- for cycling trips: cycling time + 30 sec. preparation time;
- for public transport trips: overall journey time including:
  - walking to the bus stop,
  - waiting time,
  - bus ride time,
  - changing time,
  - walking time in between and
  - walking from the bus stop to the destination;

- for private car trips: driving time on the burdened network + time for seeking a park space with respect to the zone type + walking to the car park.

Internal travel matrices are converted into driving matrices by employing the same private car occupancy factors as in the 'Multi-modal transport model of the Ljubljana region'. Every travel purpose has a different occupancy rate. Driving matrices relating to an average working day were made for three typical hours: morning and afternoon peak hours and the off-peak hour. The same distribution of hours for journeys was used as was used in the 'Multi-modal transport model of the Ljubljana region'. Specific distributions of hours for every destination and every means of transport were taken into account.

Burdening the traffic network

The burdening of the traffic network was carried out at the daily traffic levels in peak hours (morning, afternoon) and off-peak hours. For the motorised road traffic we used the method of burdening by multi-modal model in accordance with the stochastic learning process method which included the computation of intersection capacities by the HCM 2000 (module ICA) method.

Capacities of individual network sections and intersections were assigned on the basis of technical elements and other characteristics. On the basis of a section's capacity, design speeds and speed limits, speed-flow curves were assigned for every section type (function BPR2 is taken into account). All signalised intersections in LUR were modeled in detail. Flow capacities at these intersections were calculated iteratively by directions during the burdening process. Speed-flow curves and intersection capacities are taken as a basis to assign the travel cost resistance of every section travelled and the choice of route on the road network involving the origin-destination pair.
Walking and cycling are burdened by the fastest route method, and public transport by the timetable method. As to the public transport network, the following elements were included in the calculation of journey resistance:

- accessibility;
- average waiting time;
- travel time;
- number of changes;
- time needed for change between modes;
- fare as resistance.

Convergent iteration function was employed to optimise choice of route.

Model calibration and validation

Every step of the traffic model was calibrated and validated. A check of the internal traffic model of generation-attraction can be found in Table 4.3.

Table 4.3: Travel generation check: travel purposes, all-day traffic

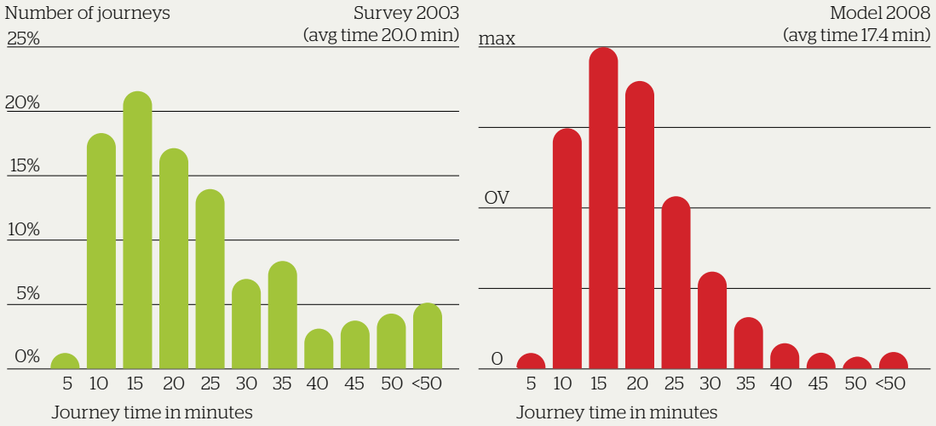
MOL
LUR

	Survey 2003		Model 2008		Difference (pp*)	
Work	22.8%	26.1%	22.8%	23.7%	0.0 pp	-2.4 pp
Education	10.5%	12.7%	11.3%	14.3%	0.8 pp	1.6 pp
Shopping	17.3%	16.3%	24.4%	13.3%	7.1 pp	-3.0 pp
Leisure	25.6%	20.5%	24.2%	27.0%	-1.4 pp	6.5 pp
Other	23.8%	24.4%	17.4%	21.7%	-6.4 pp	-2.7 pp

*percentage points

The checking of the distribution of journeys for all journeys of the internal traffic model at the level of an average work day in 2008 was performed by the software tool VISEVA.
An example of a comparison between average journey duration and the distribution of journeys by travel time for private motor traffic is shown in Figure 4.1.

Figure 4.1: Distribution of journeys by private car



A comparison between modes of transport based on traffic count and model data was performed for all four modes in two areas, journeys within MOL and journeys in LUR. Comparison shown in Table 4.4.

Table 4.4: Mode shares for different means of transport

Means of transport	Survey 2003		Model 2008		Difference (pp*)	
	MOL	LUR	MOL	LUR	MOL	LUR
Private motor vehicles	56%	68%	62%	71 %	6 pp	3 pp
PPT	15%	10%	10%	8%	-5 pp	-2 opp
Bicycle	10%	7%	8%	6%	-2 ot/pp	-1 ot /pp
Walking	19%	15%	20%	15%	1 pp	0 pp

*percentage points

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An example of the validation of burdening in the morning peak hour is shown in Tables from 4.5 to 4.9.

Table 4.5: Matching analysis of model and traffic count values, morning peak hour in 2008

Morning peak hour	Criterion	Traffic count points - value	
		all	automatic
deviation of vehicle distance travelled (%)	< 3	-0.45	-0.48
correlation coefficient	> 0.90	0.975	0.987
RMSE (%)	< 30	19.24	17.77
NCHRP 255 (%)		97.06	99.12
share of sections with GEH < 5 (%)	> 85	81.44	88.99
share of sections meeting the third DMRB criterion (%)	> 85	83.47	92.51
standard deviation (vehicles/h)		100	91
MRE (%)		12.46	9.43
average GEH		3	2.12

Table 4.6: Matching analysis of model and traffic count values at selected cross-sections of urban passenger transport

Method	Morning peak hour	Criterion
MRE (%)	9%	< 30.0
correlation coefficient	0.99	> 0.9
share of cross-sections with GEH value < 5	96%	> 85%
average GEH value	1.81	< 5

Table 4.7: Comparison between model and traffic count passenger-kilometres of the urban passenger transport

Period	Passenger-kilometres		Absolute difference	Difference in %
	Model	Traffic count		
UPT - morning peak hour	68,878	68,064	814	1.2

Table 4.8: Matching analysis of model and traffic count values at selected cross-sections for operators Kambus and LPT

Operator	Statistical method	Morning peak hour	Criterion
Kambus	MRE (%)	16	< 30.0
	correlation coefficient	0.98	> 0.9
	% of cross-sections with GEH value < 5	93	> 85.0
	GEH mean value	2.40	
LPP	MRE (%)	16	< 30.0
	correlation coefficient	0.99	> 0.9
	% of cross-sections with GEH value < 5	86	> 85.0
	GEH mean value	2.45	

Table 4.9: Comparison between model and traffic count data on passenger kilometres for operators Kambus and LPT

Operator - day period	Passenger kilometres		Absolute difference	Difference in %
	Model	Traffic count		
Kambus - morning peak hour	11557	11621	-64	-0.5
LPT - morning peak hour	19766	18675	1091	5.8

Forecasts for the burden on the traffic network in 2027

In addition to the inter-modal four-step passenger traffic model for the base year 2008, a projection of traffic flow volume for 2027 was made. The forecast is based on demographic and socio-economic development forecasts, and on the analysis of spatial impacts of scenarios for regulating public transport in order to attain the standards. The forecast takes into consideration the existing situation, development data on jobs distribution, earlier development trends in the discussed area and spatial plans for the future. The forecast also took into account previous growth in the number of passengers carried by public transport and the growth of traffic flows as recorded by traffic count points. The forecast also includes the envisaged construction of the traffic infrastructure, together with elements of scenarios for regulating public transport in the region such as:

- new road links and reconstructions;
- new P & R schemes, new car park buildings and extension of existing ones;
- new bus routes and new timetables;
- overground and underground urban light rail services;
- upgrading inter-urban railway services along with timetables;
- waterways;
- introduction of a unitary ticket and unification of timetables.

The total number of all journeys generated on an average working day in 2027; this rise is shown in Table 4.10.

Table 4.10: Total number of journeys generated

Area	Number of journeys generated	Increment factor 2027/2008
Municipality of Ljubljana	1,628,024	1.25
LUR	2,176,070	1.21
Internal traffic model	2,356,291	1.20

Accessibility standards can be ensured through combinations of measures for regulating public transport such as timetables, the fare charging system and measures stated within the framework of activities for the 'Preparation of the PPT Plan'. These combinations of measures may be called scenarios for the regulation of public transport. They were checked against the multi-modal passenger traffic model for the time horizons of 0 and +20 years.

The best effects to improve traffic conditions and the quality of life in the region would be achieved by the plan for the new PPT. The plan begins with solutions for the heavily congested area (MOL) and at the same time ensures links with the regional PPT. The regulation of PPT within the region's gravitational centre is the most effective measure in the common transport chain. It is beneficial to all residents in the region and particularly daily commuters. Links via a network of interchange points ensure synergic effects between urban, regional and inter-regional PPT. Improvements to PPT in the region's gravitational centre - which comprises almost four fifths of origins and destinations respectively of daily commutes in LUR - signifies an important overall improvement for the commuters in LUR.

All existing PPT services have been preserved. They match existing demand and thus ensure basic accessibility for residents. So the role of the existing PPT system is primarily a social one. It ensures mobility for non-motorised residents, yet it does not contribute to the quality of life in the region. The principles of a unitary ticket and unitary timetable are incorporated into the foundation of all systems. Passengers are free to switch between the vehicles of PPT. The transport chain is composed of the most effective travel links in terms of time. The choice of travel links is assigned by journey time and the waiting (change) time.

Designing scenarios

The starting points for designing the PPT plan for LUR were shaped iteratively on the basis of scenarios for PPT systems. Various elements of the PPT systems - such as accommodation in space, technologies and prerequisites for attaining their performance, and options for integrating urban and regional PPTs - form individual scenarios for the assignment of the starting elements of a PPT system. PPT systems are made up of different elements on whose foundation simulations involving different assumptions were later performed. The elements of PPT systems represent various combinations of technologies, their performances, and their accommodation in space. Therefore, a single combination is called a system. Simulations of the passenger load in the LUR area and neighbouring regions areas were performed. We determined the magnitude of demand and the performance of the systems. This was the basis for the financial evaluation of the

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system. In performing passenger load simulations in the LUR area and the areas of the neighbouring regions, we applied the following assumptions:

- for those people already compelled to use PPT, we assumed the existing system of inter-urban and urban routes;
- average increase in journeys at a rate of 2.5% per year;
- 13 P & R sites in the area of the Municipality of Ljubljana as stated in the Implementation Spatial Plan (ISP) of MOL;
- high-speed public transport lines operate at 5 minute frequency rates during peak periods; capacity of vehicles running on high-speed routes is not restricted.

The first iteration dealt with the starting element of the system designed to set up a high-quality PPT in LUR, which comprises contemporary high-speed routes (HSRs) in the region's gravitational centre, with links to a network of inter-modal interchange points next to P & R sites. HSRs operate every 5 minutes and run at an average speed of 35 km/h.
We produced six scenarios whose performances were checked by traffic models:

- System 1. This system served to verify the performance of a system where high-speed routes run along existing traffic routes. System 1 connects 9 P & R sites. Within System 1, Bavarski dvor is the exclusive interchange point between all three high-speed routes.
- System 2. This system served to verify the performance of the system if the high-speed route, instead of running along the existing route on the Dunajska Road, runs along the future Styrian arterial road. At the same time, we verified the performance of traffic flows outside compact urban agglomerations. System 2 links 8 P & R sites. Within this system, we divided the common high-speed routes interchange point to obtain two interchange points: Bavarski dvor and OF Square/Trg OF. The latter location allows the erection of an inter-modal passenger terminal.
- System 3. This system served to verify the performance of the system if HSRs, running along new routes, connect the following P & R sites: Rudnik, Vižmarje and Ljubljana south. With System 3, we also checked flows through sections characterised by less dense development, where setting up bus services would cause less harsh impacts on space. System 3 connects 11 P & R sites. Unlike System 1, System 3 does not link with the P & R scheme at Ježica. Within System 3, there are two interchange points: Bavarski dvor and OF Square/Trg OF. The latter location allows the erection of an inter-modal passenger terminal.

- System 4. System 4 is an upgrade of System 1, whereby we checked the possibility of a direct linkage of the urban PPT with the region, namely through the P & R site in Trzin. Some passengers - from the areas of Mengeš, Trzin, Kamnik and Domžale, - could use the P & R scheme along with the high-speed route already in the region and ahead of traffic congestion. We verified the efficiency of the P & R schemes at a greater distance from the centre of LUR. System 4 links 9 P & R schemes. Within System 4, Bavarski dvor is the exclusive interchange point.
- System 5. System 5 is an upgrade of System 2, with a high-speed extension to the P & R scheme in Trzin. System 5 connects 9 P & R sites. Within System 5, there are two interchange points: Bavarski dvor and OF Square/Trg OF. The latter location allows the erection of an inter-modal passenger terminal.
- System 6. System 6 is a combination of the P & R schemes linked by existing urban bus routes and additional HSRs running on existing railway lines. HSRs run on the existing upgraded railway infrastructure with 10 supplementary stations: P & R Črnuče, P & R Ježica, P & R Stanežiče and stations in between. The Kamnik and the Gorenjska railway lines are used to this end: the Kamnik line to Kamnik with a P & R scheme in Trzin, and the Gorenjska line to Medvode with a P & R scheme there. Both additional rail services perform like the system of high-speed routes: five-minute service frequency and an average speed of 35 km/h. We took into account the possible future development of the railway infrastructure, which would involve the construction of a new double-track railway relieving the existing line to Kranj. System 6 connects 11 P & R schemes. Within System 6, there are two interchange points: Bavarski dvor and OF Square/Trg OF. The latter location allows the erection of an inter-modal passenger terminal.

When assessing or evaluating the development scenario, which will probably have long-term effects, it is necessary to check the efficiency of the use of resources (hereinafter referred to as cash flow analysis for a selected system) for achieving certain physical effects, and the success of the scenario in terms of meeting programme targets (comparison between planned and actually produced effects). Multi-criteria analysis is a method of assessing the attainment of objectives. Objectives attainment is measured against selected and weighted criteria, whereby we can obtain a unitary assessment of objectives attainment for individual projects and also a benchmark for comparisons within a group of projects. Using DEX, a qualitative multi-criteria modeling methodology, supported by the DEXi software tool, we united a range of selected criteria and assigned their significance in the

assessment process concerning the choice among different scenarios. The DEXi tool allows assessments at every stage of the decision making process.

Table 5.1 shows the normalised criteria values calculated for each individual scenario within the value interval from1 to 5. The basis for calculating the criteria parameters are the results of evaluations of system simulations. Every chosen criterion expresses the preferences of the decision-maker. Weights were the same for all criteria, since all criteria are equally significant. Table 5.1 shows scenarios by weighted criteria parameters. The classification of scenarios based on multi-criteria decision making models is shown in Table 5.2.

Figure 5.1: Criteria values assigned for each individual scenario

	Scenario (i)					
Indicator (j)	1	2	3	4	5	6
Passenger kilometers - PPT	4.00	3.00	4.00	5.00	3.00	1.00
Reduction of CO_2 emissions from private vehicles	4.00	2.00	3.00	5.00	3.00	1.00
Total length of HSR	3.00	5.00	4.00	3.00	3.00	1.00
Number of passengers in the morning peak hour	5.00	3.00	2.00	4.00	3.00	1.00
Number of parked cars at P & R	4.00	2.00	3.00	5.00	2.00	1.00

Figure 5.1: Display of scenarios from 1 to 6 by individual weighted criteria parameters

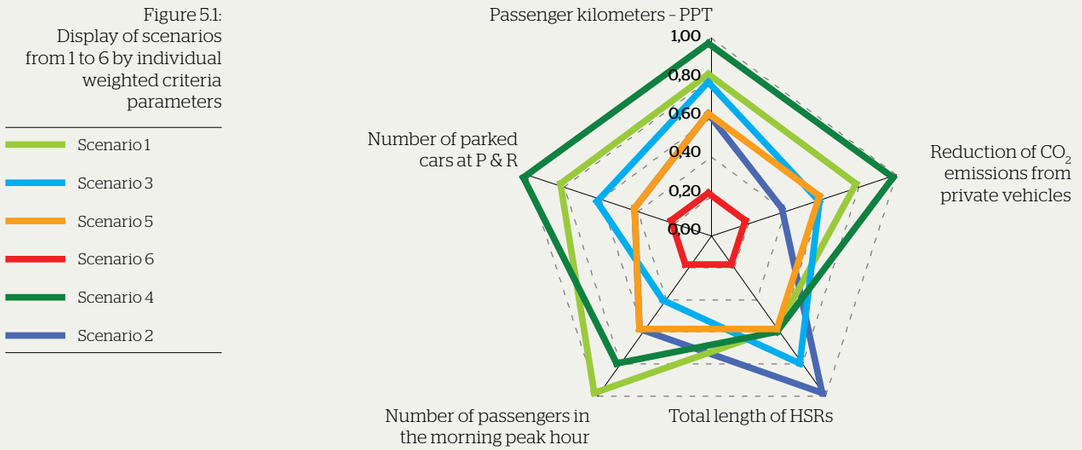
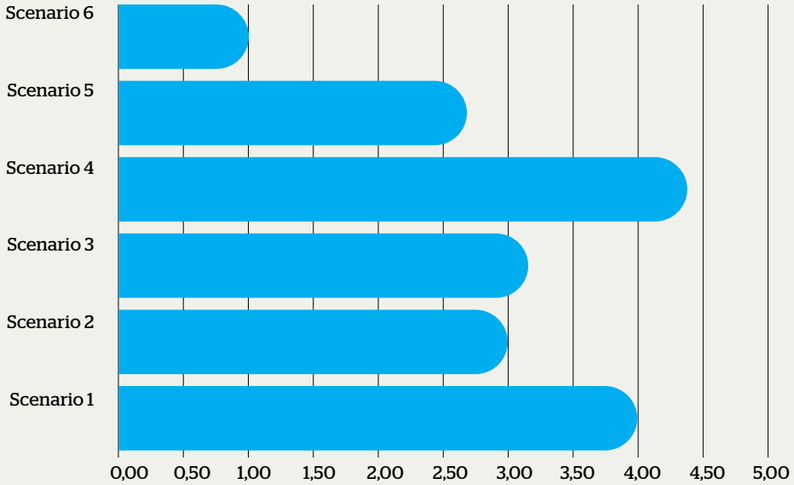


Table 5.2: Multi-criteria classification of scenarios

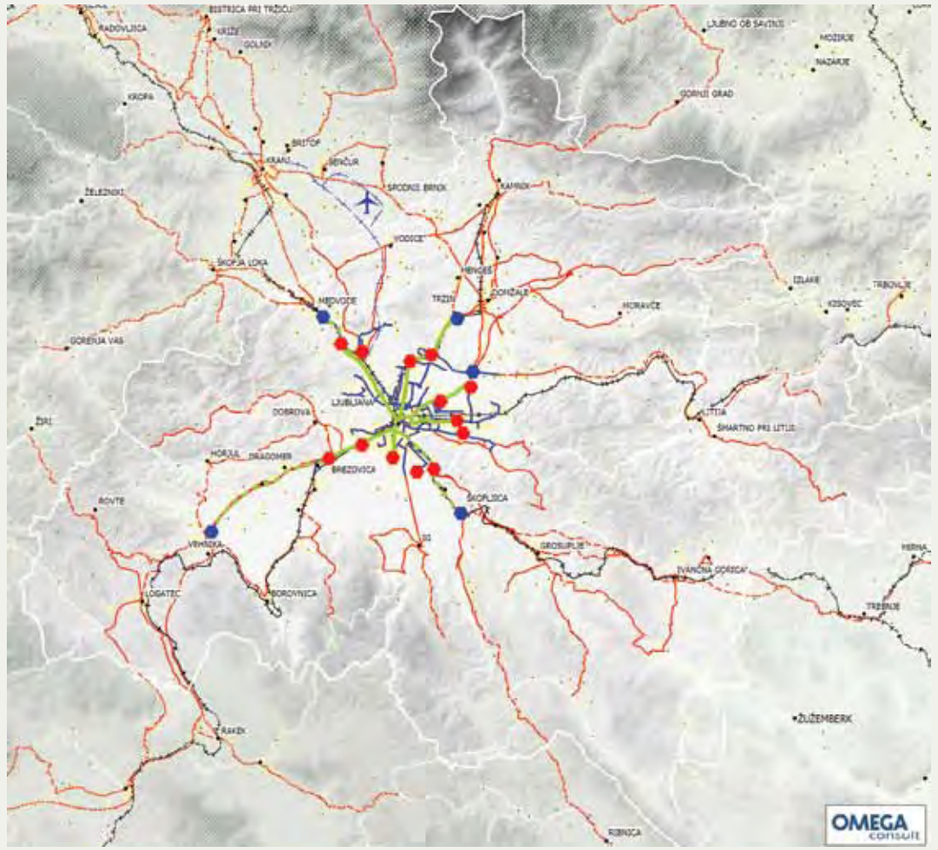


On the basis of multi-criteria analysis we may find that Scenario 4 is the best. This scenario is an upgrade of Scenario 1, which is the second best, and involves extending HSRs into the region to the inter-modal terminal including a P & R scheme in Trzin. We find that the establishment of inter-modal interchange facilities including P & R schemes, linked with the region's gravitational centre by high capacity PPT services, is effective and may be an element of the PPT plan for the region. Scenario 6, using rail for HSRs on existing railway routes, proved the least effective.

At the coordination meeting between MOL and RDA of LUR on the Strategic Spatial Plan and the Implementation Spatial Plan of MOL, a conclusion was reached that System 1 running on the main routes in the gravitational centre of the region corroborates the design of public transport as outlined in both aforementioned Plans, and that in the follow-up iterations it should be treated as the original system for the design of the new regional PPT. System 1 is shown in Figure 5.3. Inter-modal hubs in the municipal centres are also important elements of a high quality regional PPT. These hubs concentrate PPT services, thereby generating sufficient demand from passengers.

Figure 5.3: System 1 comprising intermodal transfer facilities and P & R schemes, high-speed lines in Ljubljana, railway and inter-urban bus services

- Contemporary high-speed routes
- UPP services
- Inter-urban bus services
- State roads
- Railway
- Anticipated link between 'Jože Pučnik' Airport and the railway
- P & R (park and ride)
- New technology potential
- P & R (potential)



An investment simulation was made for the launch of the new PPT system, including the anticipated effects assessment. The simulation was performed on the basis of the cash flow analysis and the financial evaluation of Systems 1a and 1c. System 1d was not financially evaluated as it represents an upgrade of the existing infrastructure without dedicated use and hence is not attributable to the investment costs of the system. This is why we may claim that in terms of costs System 1d is more economical than or equal to System 1c. Cash flow analysis estimates the value of a project's anticipated costs and benefits in the form of cash inflows and outflows over a certain period. Financial evaluation includes only the income and costs of an investment. The 'investor pays all' approach was used here; revenue comes from fares charged.

The model assumptions are as follows:

- 8 km of underground route in the centre of Ljubljana according to System 1a,
- construction period from 2009 to 2012,
- first year of operation is 2013,
- concession period duration is 30 years,
- capital co-participation in the investment is 5%,
- investment loan interest rate is 7% per year,
- loan repayment period is 30 years,
- growth rate of the number of journeys per year is 5.2%,
- journey distribution during the day equals the distribution of rides according to the AVRIS timetables,
- ticket price is 1€, annual price growth rate 2%,
- inflation rate 2%.

The cash flow analysis results are shown in Figures 5.4 and 5.5. Cash flow and cumulative cash flow from the 30-year operation of the system are displayed.

Figure 5.4: Cash flow from System 1a combining underground and overground technologies

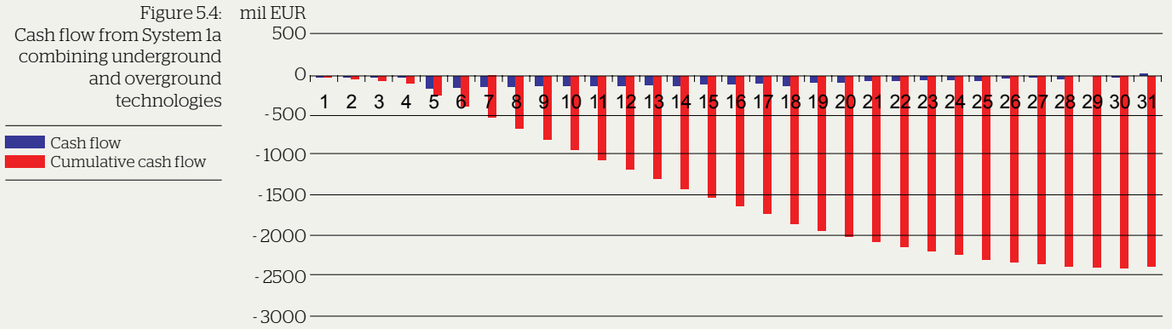
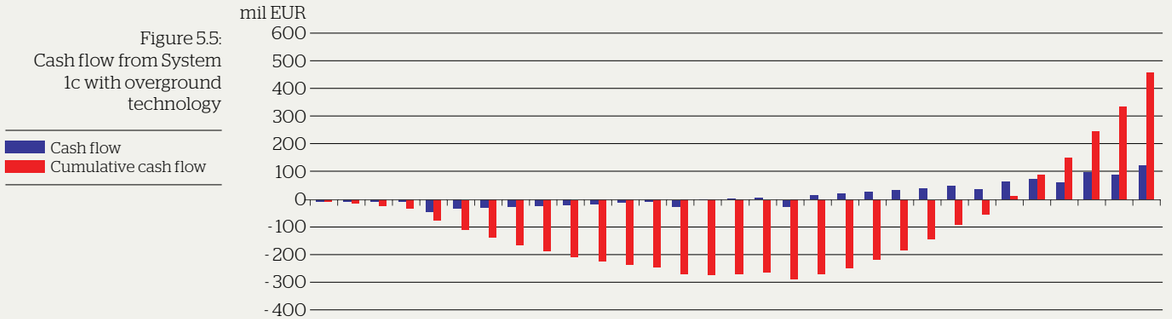


Figure 5.5: Cash flow from System 1c with overground technology



System 1c using overground technology achieves positive cash flow in 2024, and positive cumulative cash flow in 2034. The achieved financial internal yield rate over 30 years is positive. In the case of System 1a combining overground and underground technologies, a positive cash flow is achieved by 2039, but during the 30-year concession period a positive cumulative cash flow is not achieved.

We assessed the feasibility of individual technological solutions of the HSRs system implementation. HSRs system involving an underground railway (System 1 a) has the largest passenger carrying capacity, as it runs completely separate from other traffic, reaches the highest average speeds, and each train composition may carry the largest passenger load. Consequently, it has the least direct impact on the environment, as it produces no emissions locally, and ensures the biggest shift of passengers from private vehicle use. However, setting up HSRs based on underground lines is very demanding financially and therefore exceeds the planned time frame. It remains a development option for the system. The other two systems are comparable from the point of view of competitive performance. But building a system involving trams requires the construction of an additional dedicated transport network. The system of yellow lanes on which high capacity buses run means upgrading the existing traffic infrastructure and is available to other components of PPT such as inter-urban buses. We may conclude that upgrading the existing PPT with yellow lanes and high capacity buses is the most workable approach to building HSRs in the region's gravitational centre.

In the second iteration, the linkage of the regional PPT with the railway system, the setting up of a transport hub and the region's direct connection with the HSRs were verified. We discussed solutions suggesting the incorporation of railway development plans outlined in the 'Resolution on National Development Projects for the period 2007-2023' and in strategic documents of MOL. The railway infrastructure development plan envisages the construction of a railway bypassing Ljubljana and the depression of the railway through the city, respectively, as well as the construction of a high-speed double-track railway to Jesenice with a link to Ljubljana's 'Jože Pučnik' Airport. On the basis of the original concept, with HSRs running along the traffic routes of the region's gravitation centre, four variants were created associated with the solutions of the Ljubljana's railway node. The variants of the traffic system in the LUR area differ among themselves as to the length and alignment of contemporary high-speed routes emanating from the gravitational centre, and with respect to the alignment of the railways for regional and high-speed passenger trains and freight trains.

The variants of the traffic system are 1A, 2A, 1B and 2B. The variants 1A and 1B envisage, in addition to a freight railway bypass, a depressed railway and a tunnel through Rožnik Hill for passenger trains. In the case of systems 2A and 2B, only a bypass railway for mixed

freight and passenger traffic is envisaged. Table 5.2 shows the differences between system variants 1A, 2A, 1B and 2B which were checked against a traffic model.

Table 5.2: Main differences between traffic systems (1A, 1B, 2A and 2B) with respect to their basic characteristics

\+ characteristic true
– characteristic false

Basic characteristics of the systems	System 1A	System 1B	System 2A	System 2B
Alignment of HSRs* along the main arterials + Trzin and Medvode	+	-	-	-
Alignment of HSRs along the main arterials + Trzin and Medvode + Vrhnika	-	+	+	+
Construction of a new railway Ljubljana-Vrhnika	+	-	-	-
Use of existing rail routes through the city	+	-	+	-
Elimination of existing rail tracks through Ljubljana	-	+	-	+
Depressed rail tracks in the centre of Ljubljana with a tunnel through Rožnik Hill and a bifurcation towards Gorenjska and Primorska	+	+	-	-
Freight railway bypass	-	-	+	-
Bypass railway (freight and passenger traffic)	-	-	-	+
Number of inter-modal terminals	6	7	6	7
Construction of a new regional railway Črnuče-Ljubljana Centre past Stožice (re-alignment)	-	-	-	+
Construction of a terminus railway stations envisaged	-	-	-	+

HSR* - high-speed routes

The bypass railway eliminates freight traffic from the city centre. The elimination of freight traffic from the centre is desirable both in terms of noise emissions and safety (for example, accidents may occur in the transport of hazardous substances). These accidents represent a big threat to the population both in the case of overground and underground freight traffic.

The bypass railway, alongside the transformation of the railway station into a terminus station, creates conditions for the elimination of existing sections of railway track in the directions of Primorska and Gorenjska. The existing railway infrastructure runs overground and has priority in the traffic system over all other components of the system

(public and private road transport). The elimination of existing railway tracks allows the building of direct traffic connections in the city and, moreover, renders vacant the space previously occupied by the railway infrastructure in the very city centre. It enables the change of use of these traffic areas in favour of residents and green modes of traffic, which is one of the important orientations of sustainable development. From this point of view, the elimination of the overground railway alignments means a development opportunity for the city of Ljubljana. At Stožice, commercial and leisure programmes will come into being. A new rail link has been suggested to connect the Passenger Centre, the centre at Stožice and the bypass railway. This connection also enables a direct rail link between the Passenger Centre, Ljubljana's 'Jože Pučnik' Airport and the existing railway line to Kamnik. This connection has the character of an interurban, regional, inter-regional and international rail line and does not compete with the northern PPT high-speed line which, as part of the high capacity regional PPT, ensures substantially higher service frequency in peak periods.

In the second iteration we checked the variants of integration between the regional PPT and the railway network development, as well as the linkage between the HSRs in the region's gravitational centre with the regional PPT. The railway network development, as dealt with in the systems, differs primarily as to the solution of Ljubljana's railway node. This aspect is important primarily for inter-regional journeys (daily commuters from neighbouring regions). We found that the realisation of the railway node (depressed railway or a bypass railway and elimination of the existing railway routes in the city) has no impact on the modal split of passengers travelling from neighbouring regions to LUR.

The impact on the modal split within LUR caused by the different ways of developing the railway network dealt with in scenarios 1A, 1B, 2A and 2B remains within 1 percentage point. It has to be emphasised that all scenarios take into account the new service frequencies of the railways, the additional high-speed railway service with a branch line to 'Jože Pučnik' Airport, the double-track high-speed rail link between Ljubljana and Kamnik, as well as supplementary railway stations. In addition to the network of inter-modal interchange facilities with P & R schemes and HSLs in the region's gravitational centre, these elements of scenarios ensure the rise of the modal split by 35%. We found that the manner of arrangement of the Ljubljana's railway node in itself does not modify the scope of the PPT services and that it also does imply a change in the velocity of journeys. This

component of the scenarios has no particular influence on the rise in competitiveness of PPT over private vehicles. But this does not mean that it does not have an important influence on other factors such as the quality and comfort of PPT.

The scope and effects of the arrangement of Ljubljana's railway node which involves the 5th and 10th TEN-corridors exceed the framework of the PPT regulation in the region and assume national significance. The scenarios of integrating the regional PPT with the railway network were among the starting points for preparing the decision 'Preparation of the National Spatial Plan for Ljubljana's Railway Node'. The decision is being prepared by the Ministry of the Environment and Spatial Planning on the initiative of the Ministry of Transport. In preparing solutions for Ljubljana's railway node, links with PPT in LUR, and particularly with PPT lines in the city must be taken into account. The option to upgrade HSLs to another technology should also be considered - primarily light rail underground services in the city centre.

Later in the production of the PPT plan for LUR, the rail component of the public transport was integrated with the regional PPT. On the basis of the railway infrastructure development plan, the following elements were included in the production of the PPT scenarios: a high-speed rail link with Ljubljana's 'Jože Pučnik' Airport, service frequencies of passenger trains on other lines including the double-track line to Kamnik, and all supplementary railway stations.

Designing the plan for PPT in the region

The starting points of the proposed plan are based on the anticipated settlement and employment structure; on the draft MOL Implementation Spatial Plan; the MOL strategic implementation plan and designated land use in the municipal plans of LUR; strategic development documents and projects of the State which concern the area of influence of LUR; the joint agreement with neighbouring regions on the visions and goals of PPT in LUR and on the anticipated road infrastructure in the discussed area. The plan is equally a result of the exchange of expert opinions and coordinating activities at work meetings between the contracting entity and the project planning group in the course of the implementation of tasks.

The public transport plan is based on the establishment of high-speed routes (HSR) converging on the region's gravitational centre, Ljubljana, and on the parallel establishment of a supporting inter-modal chain of sub-systems at all levels of the passenger traffic system in LUR. The plan envisages both technological and operational compatibility and the harmonised operation of the PPT subsystems, including a unitary timetable and ticket within the PPT subsystems. In such a way passengers can be offered a 'door-to-door' service and a seamless journey, which is an essential quality of today's effective multi-modal transport systems.

The basic components of the plan for a high-quality PPT in the Ljubljana Urban Region are as follows:

- establishment of HSRs on yellow lanes;
- HSRs service frequency is 5 minutes in peak periods, running at commercially competitive speeds;
- HSRs capacity matches the demand for HSRs;
- erection of inter-modal interchange points with P & R schemes in municipal centres on the fringe of Ljubljana to serve as collection points for the regional PPT;
- establishment of a transport hub in Ljubljana for horizontal and vertical connections between the transport system components;
- other PPT lines feeding the inter-modal interchange points;
- railway network development, including a link to 'Jože Pučnik' Airport in compliance with 'The Strategy of the Development of Slovene Railways';
- establishment of new railway stations in LUR as planned by Slovene Railways;
- harmonised railway timetables with suburban train services every 30 min., and every 15 min. in peak periods, as envisaged by ' Strategy of the Development of Slovene Railways', including an additional link to Kamnik;
- introduction of a regional unitary PPT ticket;
- other PPT services remain at the existing levels;
- making the Ljubljanica River a navigable waterway, as foreseen in the draft Spatial Implementation Plan of MOL.

The basic characteristics of the PPT system in LUR are shown in Table 5.3.

Table 5.3: Basic characteristics of the PPT system in LUR

Basic characteristic of the system	Yellow lanes with high capacity buses
Number of main arterials with anticipated HSRs	7
Number of inter-modal interchange points	5
Number of all anticipated P & R schemes in LUR	38
Number of anticipated P & R schemes in MOL	13
Anticipated number of HSRs	All existing bus routes + 4 additional routes
Anticipated length of HSRs	36.1 km

The design of the plan for PPT in LUR by 2027 is presented in Figure 5.6. The plan to establish a high-quality PPT in LUR which anticipates the use of HSRs is based on the introduction of yellow priority lanes for contemporary high-capacity buses. Yellow lanes run alongside the existing road surfaces of urban arterial roads and are reserved for high-capacity buses and all other urban, suburban and inter-urban buses, as well as taxis and ambulances. From the view point of PPT issues, they offer a relatively efficient, rapidly built and economical short-term solution.

The plan envisages inter-modal interchange facilities at locations where changing between different modes occurs (high-speed bus routes, railways, bus services, P & R schemes), as well as an inter-modal terminal in the city centre acting as a transport hub. Inter-modal interchange points and P & R schemes constitute a collection network to feed public transport in LUR. At these points the HSRs system is integrated with the inter-urban, suburban and inter-regional PPT. Thus the travel distances of existing regional PPT routes become shorter, which allows for a higher frequency of service.

The plan outlines three basic types of central point for public transport. These points are inter-modal interchange facilities with P & R schemes. They are: a transport hub (Passenger Centre in Ljubljana), inter-modal interchange points in the municipal centres, and P & R schemes alongside the main arterial roads in urban centres.

- The Passenger Centre in Ljubljana is a central PPT station in the region and nationally. As a central inter-modal terminal it connects the components of the transport system both horizontally, between modes, and vertically. Vertically, it connects international links,

including Ljubljana's 'Jože Pučnik' Airport, with inter-regional and regional links as well as urban public transport. The central inter-modal terminal also links horizontally: railway, bus and urban PPT with contemporary high-speed routes in LUR, the taxi terminal and non-motorised traffic.

- Inter-modal interchange points connecting PPT with private motorised (P & R) and non-motorised traffic are to be set up in the municipal centres of LUR.
  These interchange points are linked with the central PPT services (bus and/or railway station) and only as such do they form a network of PPT interchange points in the region.
- Inter-modal interchange points are also set up at P & R sites, as outlined in ISP of MOL, and changes occur between different modes (high-speed routes, railway and bus services, P & R schemes). If these interchange points also act as links at intersections between traffic corridors and PPT, they become secondary inter-modal terminals.

Figure 5.6:
Plan of PPT in LUR in 2027 with HSRs and inter-modal interchange points

- High-speed routes (HSR)
- Railway
- Inter-urban bus routes
- UPT routes
- Dual carriageway roads
- 4 Interchange points with P & R schemes - number of possible PPT modes
- 3
- 2
- 1
- Transport hub

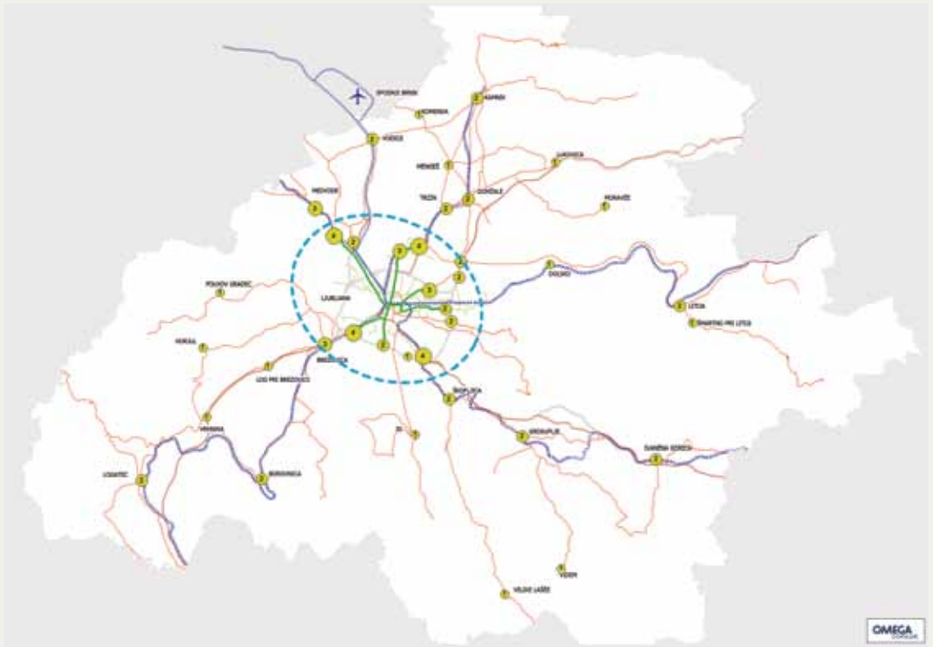
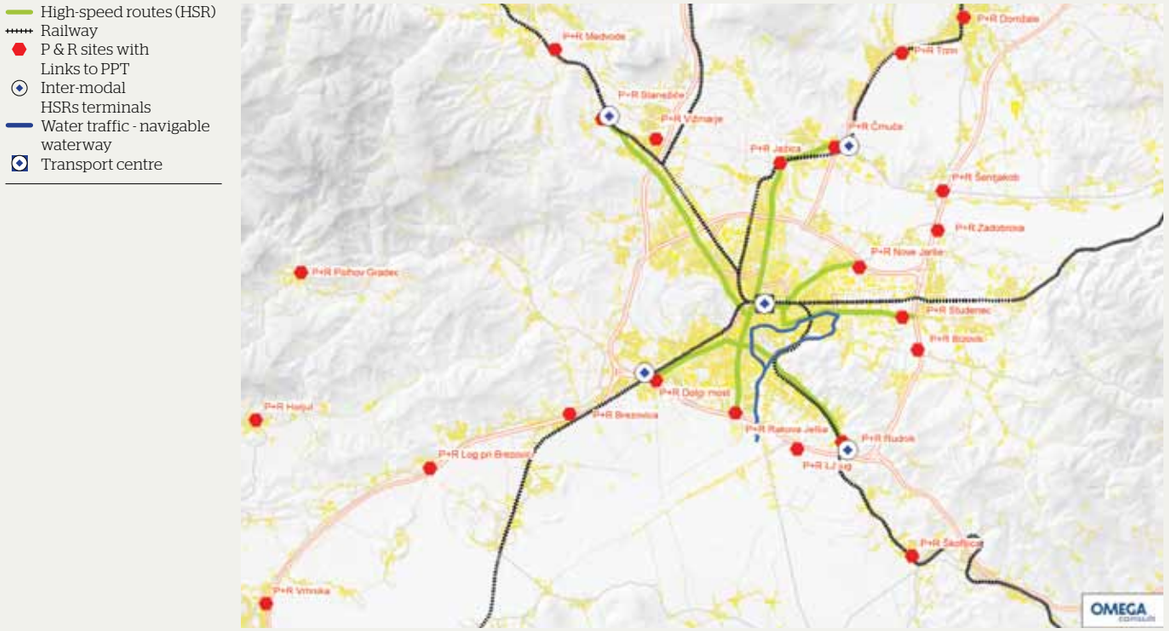


Figure 5.7: Plan of PPT in 2027, a detail - yellow lanes for high-capacity buses represent HSRs

Figure 5.7 shows a component element of the PPT plan: HSRs system - yellow lanes. It shows the alignments of HSRs - yellow lanes, anticipated locations of inter-modal interchange points, anticipated locations of P & R schemes, anticipated alignments of railway tracks and navigable waterways.



The plan anticipates five inter-modal terminals at locations which will allow switching between all PPT modes. These include the transport centre in the centre of Ljubljana, where urban, suburban, regional, inter-regional and international PPT routes will intertwine. In this scenario, the remaining HSRs inter-modal terminals are anticipated to be in Črnuče, Stanežiče, at Dolgi most and in Rudnik.

The greatest effect of a high-quality PPT is achieved with regard to the daily commuters who shift to PPT. The shift of daily commuters from individual vehicles to other transport modes is also seen in the relief of traffic space previously intended for motorised traffic. It facilitates the use of private vehicles for other destinations and enables the re-orientation of this space to give priority to non-motorised traffic, recreation, green surfaces etc.
As well, improved PPT services create conditions in the areas surrounding inter-modal terminals and interchange points with P & R schemes for an upgrading of the latter with new activities in the immediate vicinity. Such developments bring about potential for the synergy effects of the presented PPT plan within the framework of business opportunities and spatial plans in the region.

The development of PPT (introduction of new technology and infrastructure) means an improvement in the quality of public transport. The consequences will affect not only the relationship between public and private transport, but all kinds of individual traffic.

Evaluation of the traffic aspect of the PPT plan

The evaluation of the traffic aspect of the PPT plan is based on simulations performed by a multi-modal passenger traffic model. We compared the proposed plan for PPT in 2027 with the scenario 0. Scenario 0 represents the PPT system in 2027, with no upgrading and only the basic maintenance of the current system being implemented.

The number of passengers on sections of the traffic network in the morning peak hour in 2027 is shown in synoptic Figure 5.8. Private car traffic burden by hours is shown in synoptic Figure 5.9.

Figure 5.8: Passenger traffic burden on public transport, morning peak hour in 2027

Figure 5.9: Figure 5.9: Private vehicle traffic burden, peak hour in 2027

We evaluated the PPT plan by passenger-kilometres travelled, change in modal split, and private vehicles stopped at P & R schemes. Passenger kilometres travelled by PPT and private vehicle respectively in 2027 are shown first (Figure 5.10). In 2027 the number of passenger kilometres travelled by PPT would rise by 35%.

Figure 5.10: Passenger kilometres travelled by PPT and private cars, respectively, according to scenario 0 and the PPT plan, on an average day in 2027

PPT
P & R
Private cars
Private cars and P & R

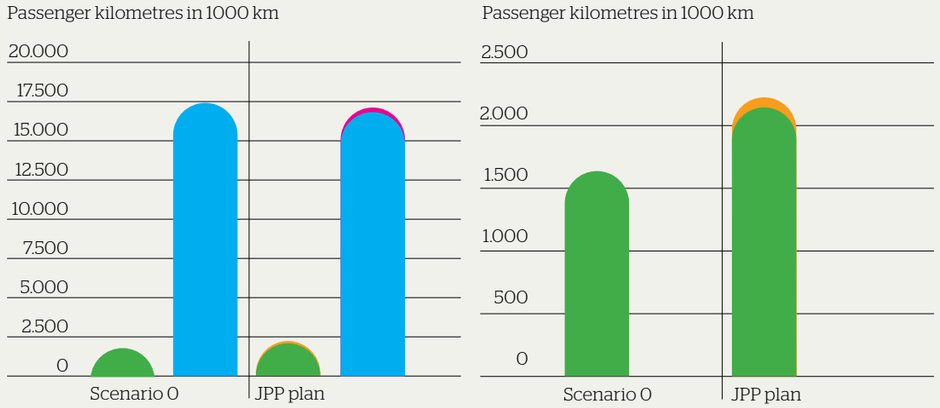


Figure 5.11: Number of journeys by means of transport within LUR according to scenario 0 and the PPT plan, journeys per year in millions

Individual motorised traffic
PPT without P & R
P & R passengers

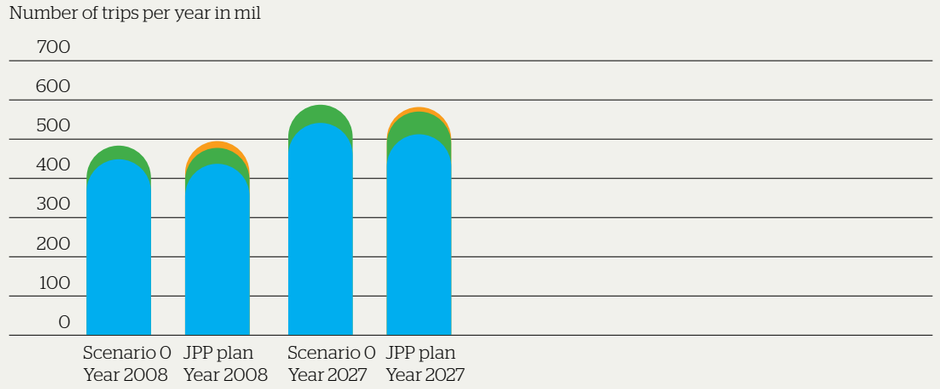
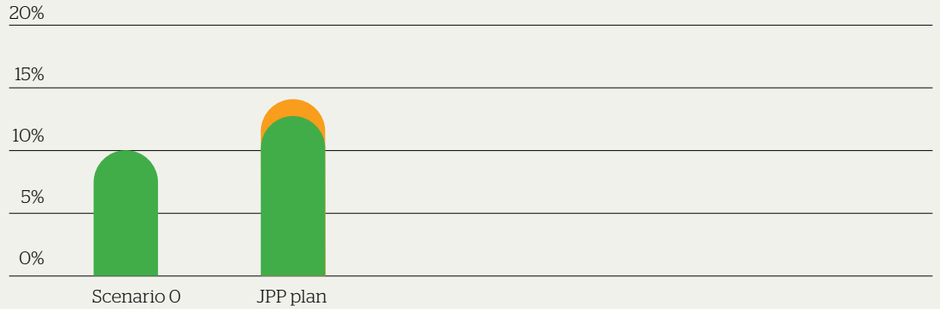


Figure 5.12: Modal split between private cars and PPT on an average working day in 2027

JPP/PPT
P & R



The plan's effect was gauged by the change in choice of means of transport. The annual change in modal split for 2008 and 2027 is shown in Figure 5.11. A change in modal split was also measured for an average working day. The effect of the PPT plan on the modal split of an average working day is shown in Figure 3.12.

Environmental impact

A new standard of linkages between settlements mirrors the new quality of transport services between them. This quality results from new and improved services delivered by PPT (e.g. HSRs system, new service frequencies on the railway), from new time intervals of PPT services, and modified travel times that PPT passengers can benefit from. The difference is thus expressed by an overall change in the PPT system performance in the LUR area. The prediction of connections between different groups of settlements is based on the proposed plan for the launch of a high-quality PPT in LUR by 2027, with HSRs as its fundamental support.

The synthetic indicator which best and comprehensively illustrates changes in the performance of the entire PPT system in LUR is the accessibility indicator. The new future standard of linkages between settlements may be best exemplified by the change in accessibility for residents of important programmes in an area by the use of PPT. The accessibility indicators in connection with the potential of the space represent that group of accessibility indicators which best describe the linkage between the traffic system and regional economic development. Following the implementation of the PPT plan,

the accessibility standards for all residents in LUR and the respective accessibility between the urban settlements will improve. This is a motivation for increased demand for PPT services, which become more competitive than private car traffic.

We measured the changes in the standard of linkages expressed by the synthetic accessibility indicator on the basis of changes in the performance of the proposed PPT plan with regard to scenario 0, which represents existing services projected for the target year 2027. The performance of the PPT plan in terms of accessibility was checked by means of a traffic model on an average working day in 2027.

The accessibility indicator signifies the amount of accessible programmes in the space of LUR with regard to the overall performance of PPT in the region within a chosen time interval of journey made by PPT inside 1 hour. As to the travel time by PPT, we followed the 'door-to-door' concept, adding 10 minutes to every trip, and the time needed to board a PPT vehicle.

We took into account changes in PPT services from the viewpoint of the time needed to access the following important programmes:

- accessibility of residents;
- accessibility of public services;
- accessibility of commercial and leisure services;
- accessibility of tourist areas;
- accessibility of public surfaces;
- accessibility of available vacancies in nurseries;
- accessibility of available vacancies in elementary schools;
- accessibility of available vacancies in middle schools.

The results of changes in accessibility by PPT are shown for Ljubljana and Domžale in Figures 5.14 to 5.17.

Figures with grid graphs present changes in accessibility with regard to the proportion of programmes accessible by PPT in selected time intervals. For every centre discussed there is a graphic display of those time intervals which best reflect the change in accessibility, with the exception of Ljubljana, where a 50-minute time interval is also shown for the sake of comparison. Changes in accessibility by systems are best seen already at the outset - in the case of Ljubljana, with a 10-minute ride by PPT which primarily reflects the fact that the majority of programmes in LUR are concentrated in Ljubljana. Consequently, the change in the PPT system performance is the greatest here due to HSRs.

In the case of Domžale the change in accessibility is best reflected by a time period up to 30 min.; in the case of Logatec by a time period up to 50 min..

Figure 5.13: Accessibility in terms of time from Ljubljana by PPT according to the plan of high-quality PPT, 2027

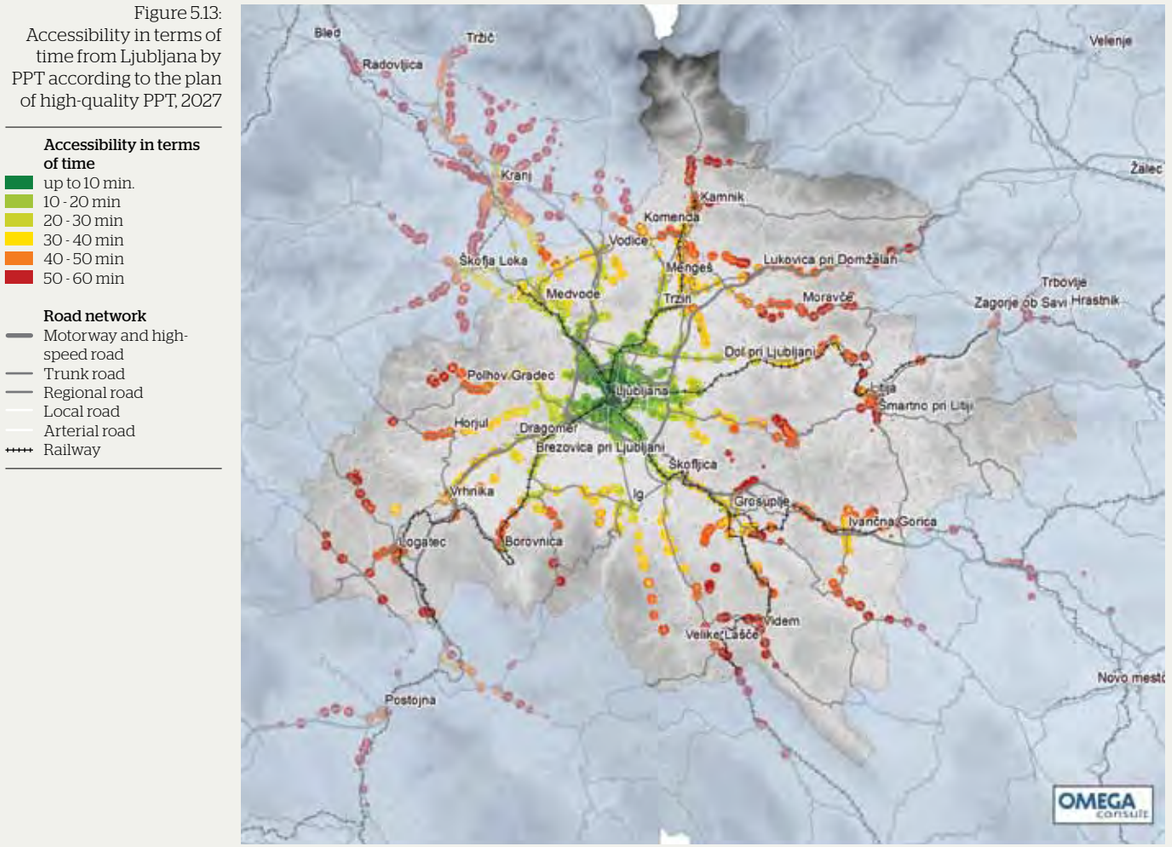


Figure 5.14: Proportion of programmes in LUR accessible from Ljubljana (isochrone 50 min.)

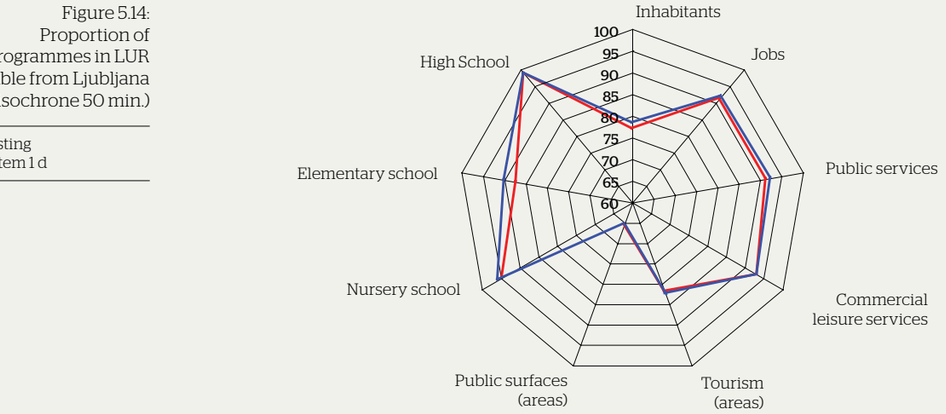


Figure 5.15: Proportion of programmes in LUR accessible from Ljubljana (isochrone 10 min.)

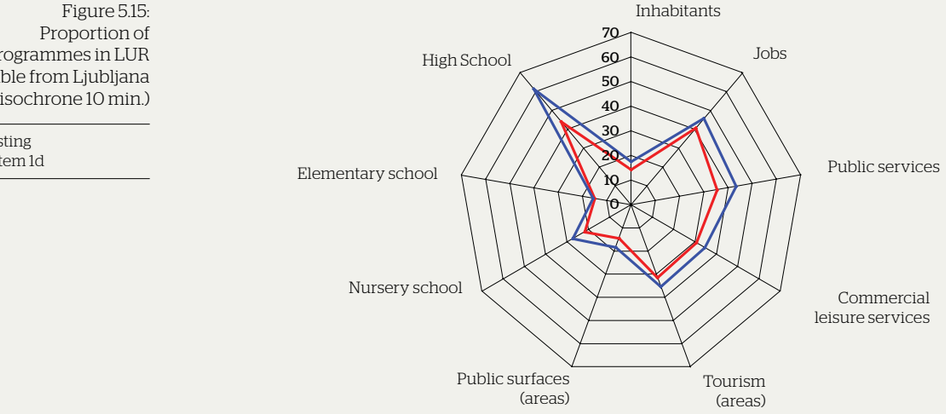


Figure 5.16: Accessibility in terms of time from Domžale by PPT according to the plan of high-quality PPT, 2027

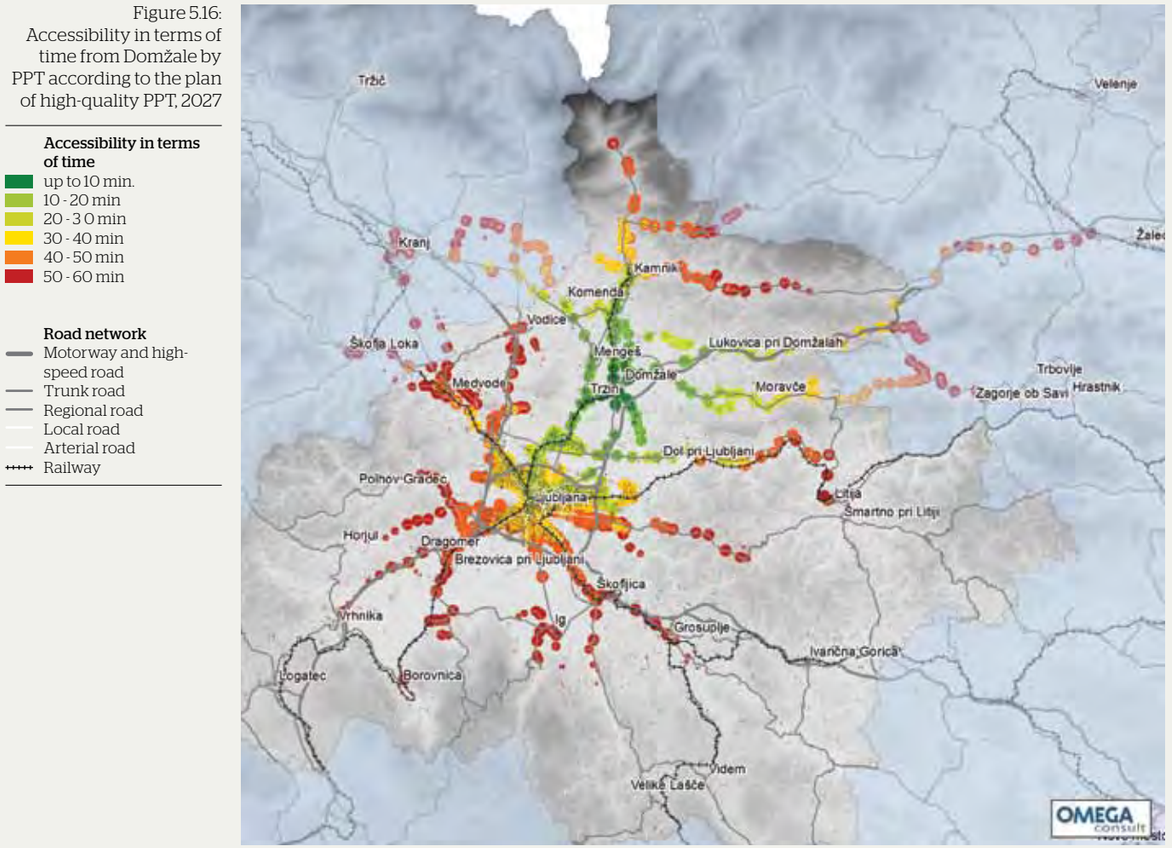
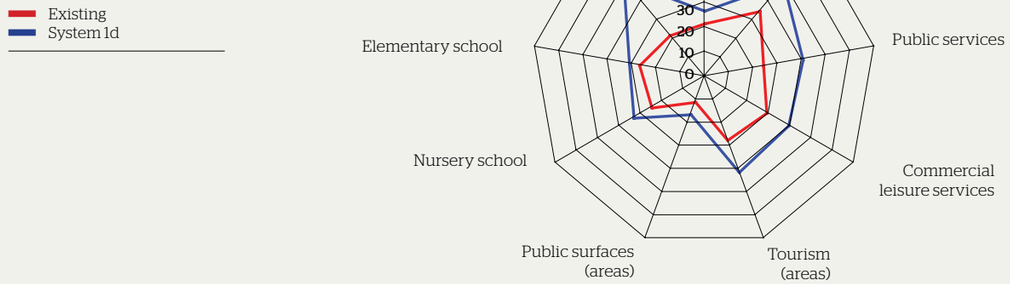


Figure 5.17: Proportion of programmes in LUR accessible from Domžale (isochrone 30 min.)



The accessibility analysis showed that the proposed plan for a high-quality PTT in the area of LUR improves the existing accessibility by PPT to all programmes and from all directions. The improvement of accessibility to the programmes in the area by PTT reflects the competitiveness of PTT with private vehicles.

Social benefits from establishing the PPT system

In the process of establishing the concept of sustainable mobility in towns and urban settlements, the goals of a wider social environment and the long-term effects of traffic on the environment and conditions of life have been placed in the forefront. Public transport is a 'public good', and therefore it is not only individuals who benefit from it, but the whole of society, because it provides mobility to the region, diminishes the negative effects of traffic etc. Social benefits are presented as net external costs.
External costs are those costs incurred by a certain activity of a business, although they express themselves in areas not directly related to the business activity. The external effects of traffic (positive or negative) are not expressed in the market through PPT fares, but they influence social welfare. The establishment of an effective PPT reduces the external costs of traffic. The reduction comes from the reduction in the use of individual vehicles and an increase in the use of PPT (net ext c = ext c PPT+ (- ext c of car traffic).
This is a result of the change in the modal split - passengers shift from individual means of transport to public transport which is a benefit to society as a whole. The result is an estimate of external costs related to passenger kilometres.
The competitiveness of public transport in comparison with individual transport has been analysed in the case of urban public transport. Judging from the results yielded by the OPCOST tool for calculating the costs of users - in compliance with 'The Ordinance on the methodology for the preparation and treatment of investment documentation in the field of state roads' -, we estimate that the average cost of operation of an individual vehicle, excluding time, amounts to 0.20 EUR/km. Taking into consideration the average occupancy rate of vehicles driven to work, their average speed of 24 km/h, mean transit distance of 5.7km, the cost of time with regard to average gross salary in the Republic of Slovenia, and an estimate of daily parking costs, the cost per individual vehicle passenger is estimated at 0.75 EUR/km

In urban traffic, the travel cost is 0.80 EUR. Given the results from the models, the estimated travel speed of buses in the morning peak hour is 13 km/h. Taking into account an average transit distance of 6km in the city and the average gross salary in the Republic of Slovenia, the estimated cost of a trip by urban public transport is 0.76 EUR/km.

Social benefits were estimated by comparing the existing system in 2008 and the new PPT system in 2008. The evaluation includes the operational costs of the PPT system,

the operational costs of personal vehicles, the external costs of the PPT system and the external costs of personal vehicles which are compared between them. The economic evaluation of the new in relation to the existing PPT system is shown in Table 5.4.

Table 5.4: Economic evaluation of PPT systems in 2008

System cost in 2008	Existing PPT system	New PPT system	Difference
Operational PPT system costs	57,264,000	67,626,000	-10,362,000
Individual vehicle operational costs	817,592,000	801,240,000	16,352,000
PPT system external costs	15,355,000	17,346,000	-1,991,000
Individual vehicle external costs	483,687,000	474,013,000	9,674,000
TOTAL	1,373,898,000	1,360,225,000	13,673,000

Due to the improved performance of the new system, there is a growth in service and passenger kilometres in the new PPT system which results in the rise of relevant costs. On the other hand, there is a decline in private vehicle traffic, which generates savings. The final outcome of the comparison between the systems is 13.7 mil EUR of social benefits in the first year of evaluation. We estimate that these savings may rise to 20.5 mil EUR in the final year.

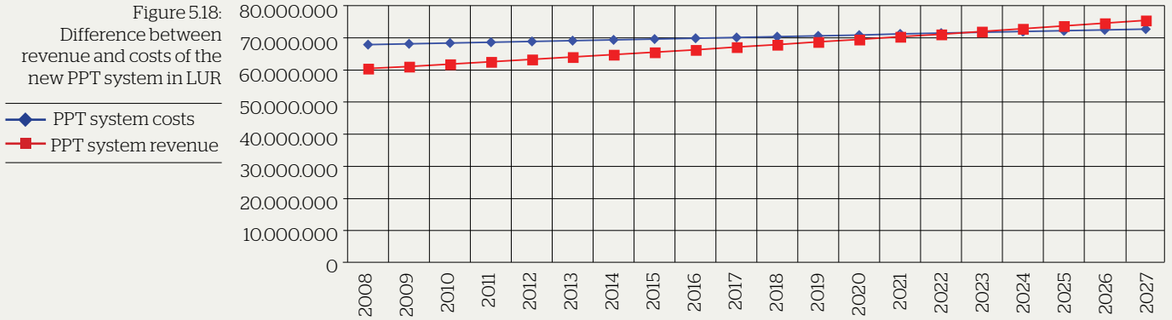
Financial evaluation of the new system

An estimate of the revenue from the new system for the starting year 2008 and the final year 2027 is presented. Appurtenant costs for respective years were estimated. A cash flow analysis was made and the current net value of the system was calculated.

The system's revenue is based on estimated revenue from the existing system in 2008 translated to the proposed new system. The financial estimate for 2027 was based on the travel matrix for 2027. The estimated revenue from the new system in 2008 totals 60.1 million EUR, and in 2027, 75.2 million EUR. Total revenue over a 20-year period amounts to 1,347.7 million EUR. Total discount revenue at 7% discount rate amounts to 744.4 million EUR.

The system costs are based on an estimate of service kilometres for both years measured at unitary prices by modes. The estimated value of costs of the new system amounts to 67.6 million EUR in 2008, and in 2027, to 72.5 million EUR. Total costs over a 20-year period amount to 1,400.4 million EUR. Total discount revenue at 7% discount rate amounts to 787.4 million EUR.

Figure 5.18: Difference between revenue and costs of the new PPT system in LUR



The net current value of the system is -43 million EUR. The difference between revenue and costs in the first year is -7.5 million EUR, which is less than the estimated deficit of the existing system for 2008. In the last year, this difference amounts up to 27 million EUR. The graph (Figure 5.18) displays flows of benefits and costs for the monitored period.

Although it performs better, the new system still does not cover its costs. But the first year already presents an absolute reduction in the estimated deficit, and in the following years, the difference between costs and revenue continues to diminish, which means that the need for additional funding also diminishes. An economic evaluation shows that the social benefits from setting up a new PPT system exceed the financial deficit and justify additional public funding for the system.

In comparison with the other two systems, the yellow lanes are an effective, quickly built and a convenient solution in terms of cost for setting up PPT. The establishment of special lanes for high-quality bus services along the suggested routes ensures:

- high-speed passenger rides, as yellow lanes are designated exclusively for PPT, taxis, delivery, intervention and maintenance vehicles;
- priority status in traffic (priority given at signalised intersections) for PPT vehicles using the yellow lane;
- the enhanced passenger carrying capacity of the new buses, with the fleet remaining unchanged ;
- rapid all-door boarding/alighting when electronic ticketing is used.

PPT system sustainability means achieving a standard of service performance which permits competition with the use of private vehicles. An increase in the number of rides on HSR buses running on yellow lanes leads to an increase in the number of buses on the roads. But the current size of bus stops (especially in the region's centre) and the infrastructure shared with other traffic limit the system, preventing it from competing with private vehicles beyond a certain point.

An advantage of the yellow lanes system lies in its multi-phased nature. The phased nature of the HSRs system enables the passage from the yellow lanes system for high-capacity buses to a light rail system, either overground, a tram, or partially overground and partially underground. The latter enables the most efficient passage from the yellow lanes, although this solution – because of the excavation of underground routes in the centre of Ljubljana – is more expensive than a tramway. An underground railway ensures the best results in terms of travel speed and passenger comfort, because the lines are faster and completely separate from other traffic. Another advantage lies in freeing space in the city centre and locally reducing noise and gas emissions from traffic.

If the aforementioned scheme for the region's gravitational centre were implemented, the HSRs contained in the PPT plan could be sustainable until the end of the planning period (year 2027, Figure 6.1). If the yellow lanes HSRs system requires upgrading to a light rail technology to be launched by 2027, we should begin a skeleton project already in 2015, because the introduction of such technology is estimated to take 12 years (approximately 4 years for planning and 8 years to build the system).

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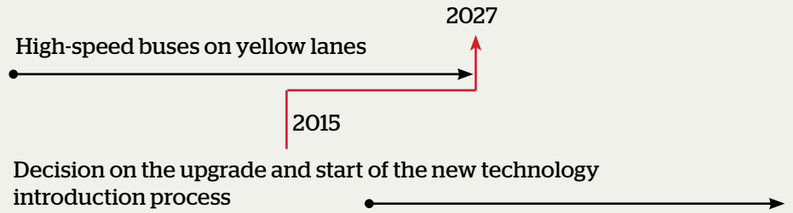
Figure 6.1: Phased introduction of new technologies to upgrade the PPT system in the region



The introduction of the new PPT system will unfold in separate phases. It will depend on the speed of legal and administrative procedures, the commitment of relevant bodies and financial assistance for the implementation of the project. It was assumed that the PPT renovation project should begin in 2009/2010 and would continue until 2027. The introduction of the new PPT system in the region comprises the following phases: preparatory period, projects implementation, harmonisation and monitoring of the system launch, and operation of the system.

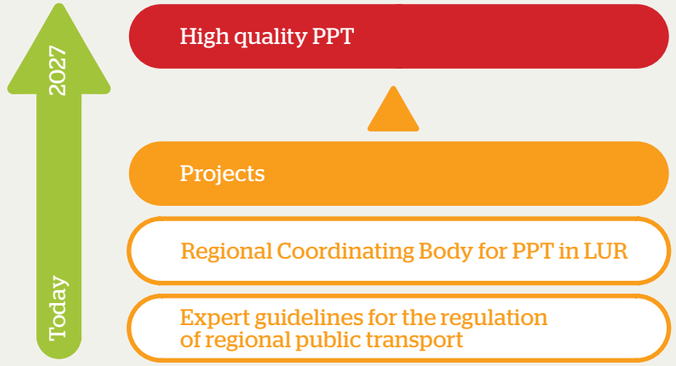
Preparations for introducing the new system

In the preparatory phase, the tasks are ordered as follows:

- crafting expert guidelines outlining the requirements of the new system;
- setting up a suitable organisational and legal framework;
- establishing a Regional Coordination Body responsible for the launch of the new system in the region.

A primary and basic activity suggested as the outcome of the study 'Expert guidelines for the regulation of regional public transport' is the establishment of the so-called Regional Coordinating Body for PPT in LUR (Figure 6.2), which we foresee as a regional body which will commence carrying out projects to shape the new regulation of PPT in the Ljubljana Urban Region.

Figure 6.2: Basis for planning further steps in the process of establishing of high quality PPT system



The Regional Coordinating Body represents the basis for the launch of activities to renovate the PPT system in the region by means of the following basic measures:

- bringing together and shaping the shared interests of the region (PPT operators, individual local communities, users and the general public);
- representing the region's shared interests in harmonisation processes at the national level; ensuring financial resources for funding PPT projects (State, private and EU resources);
- providing relevant legal frameworks for carrying out activities;
- establishing efficient communications and information channels;
- determining the region's priority activities and projects, their tendering and realisation;
- taking corrective measures in case of unexpected shifts from the planned course of the project's implementation.

When the Regional Coordinating Body for PPT has been set up, it can begin implementing the PPT system renovation projects, which include simpler projects which serve as the basis for the continuation of activities. The Regional Coordinating Body determines priority activities and projects for establishing the high-quality PPT by, for example, setting up regional PPT bus stops and P & R schemes, introducing high-speed routes system, promoting PPT services, non-motorised forms of traffic etc. Projects are to be implemented only when regional and municipal priorities are determined and mutually harmonised. Initially, the project of PPT informatisation is to be implemented, which involves setting up relevant communications channels, an efficient and clear information system for PPT customers and the promotion of PPT services.

Implementation of projects and harmonising the system launch

The implementation of projects and harmonising launch activities are carried out simultaneously. All functions are performed or determined by the Regional Coordinating Body for PPT, which:

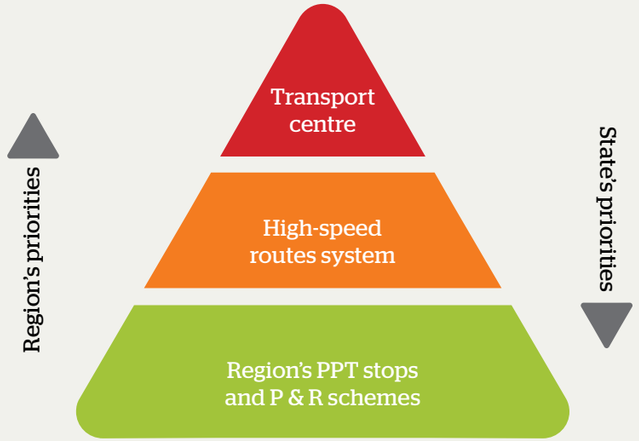
- tenders and implements selected priority projects;
- coordinates and shapes the shared interests of the region regarding PPT (the interests of PPT operators, individual local communities, users and the general public);
- represents the region's shared interests regarding PPT in the harmonisation at the national level;
- obtains financial resources to fund PPT projects (State, private, EU resources);
- sets up efficient communications and information channels;
- takes corrective measures in the case of unexpected shifts from the planned course of the project's implementation.

When the Regional Coordinating Body has been established, it may begin to implement PPT projects according to the following suggested order:

- System renovation begins with simpler projects which serve as the basis for further activities. The projects are implemented only when the regional and municipal priorities have been determined and mutually harmonised. Initially, the project of PPT informatisation is implemented. It involves setting up relevant communications channels, an efficient and clear information system for PPT customers and the promotion of PPT services.

- The projects which follow are classified by significance according to the regional and municipal priorities as shown in Figure 6.3. The region gains in connectedness and coordination by setting up a network of bus stops and P & R schemes, while the most important gain for the State is the creation of a transport centre – a central inter-modal interchange point in the region's gravitational centre. Apart from establishing the rail link with the 'Jože Pučnik' Airport, it would also be the national central inter-modal transfer point, allowing connections with inter-regional and international transport.
- New, additional technical and technological solutions, as well as more demanding PPT projects are introduced by the Regional Coordinating Body when the existing system incorporating the measures taken is no longer sustainable – meaning that it does not meet the required performance and awaited transportation standards in comparison with individual vehicles. When the high-quality PPT has been set up, the transformation and division respectively of the Regional Coordinating Body is performed, resulting in a Regional Agency for PPT and a separate independent Regional Regulatory Body.

Figure 6.3: Priority projects in establishing the PPT system



Supervision of services operation

During the step-by-step launch of the system, the Regional Coordinating Body supervises the operation of the services of individual operators:

- supervises operations by controlling services, technical, safety and environmental standards, as well as financial statements;
- collects information on operations as to the compliance of transport services with contractual provisions, customer and general public satisfaction, complaints etc.

System operations and PPT integration enhancement

In accordance with the PPT system development, the Regional Coordinating Body would assign new activities in the context of enhancing PPT. Enhancing the scope and complexity of tasks leads to a situation in which the existing system is no longer sustainable, which means that it does not achieve the required performance or meet the awaited passenger transport standards. Therefore, the statutory framework must also be adapted in order to ensure the most efficient performance of functions and their supervision. Optimal regulation of the system is based on the separation of implementation and supervision functions. The Regional Coordinating Body combining both functions is to be transformed so that these functions are performed separately and more precisely.

The transformation takes place in the following manner:

- the Regional Coordinating Body for PPT assigns new priority projects;
- the State creates the relevant legal framework, permitting the design of a new PPT organisation;
- the Regional Agency for PPT and a separate independent Regional Regulatory body are established.

After an appropriately adapted legal and organisational framework has been set up, a relevant body, by adopting the constituent act, establishes the Regional Agency for Public Transport, determining its functions and tasks. In addition, the body establishes the Regional Regulatory Body, which works independently from the Agency and the founding body. Its constituent act is also drawn up, providing for procedures, criteria and conditions of operation to ensure the enforcement of the principles of non-discrimination, transparency and objectivity in supervising the Agency's operations.

Differentiated support of the forms of the integrated PPT

Apart from suitable technological infrastructure based on high-speed routes, the effective operation of an integrated PPT system requires an appropriately regulated system of parking and switching from private vehicles to public transport, as well as appropriate accessibility and regulation for non-motorised traffic. By combining the outlined traffic sub-systems, we achieve various traffic regimes.

Interactive geographic map of PPT in LUR with the region's unitary timetable

An interactive web map was produced which clearly displays future bus and rail lines together with all stops and stations and the integrated operational PPT system. The portal can be found at http://www.omegaconsult.si/portallur/obrazci/prikaz.aspx. The portal shows all the forms of public transport in LUR which encompass bus and railway lines and waterways. It also contains an interactive web map. The portal displays the basic functionalities which are to inform a potential passenger on all modes of public transport.

The purpose of the portal is to bring information on all forms of PPT into one place. A passenger, as a PPT customer, is interested in how to get from point A to point B using PPT, whereby the form of PPT and the operator are of secondary, or no importance. What matters most are: the links between the intermodal interchange points, where passengers can change; timetables, and journey times. This is integrated information, which presents PPT as a unitary system with all its important travel information (timetables, stops, stations, lines) in one place, presenting the customer with the optimal travel options available by using various PPT systems.

Figure 7.1 shows the PPT entry points. The portal employs the cartographic resources of Google Maps.

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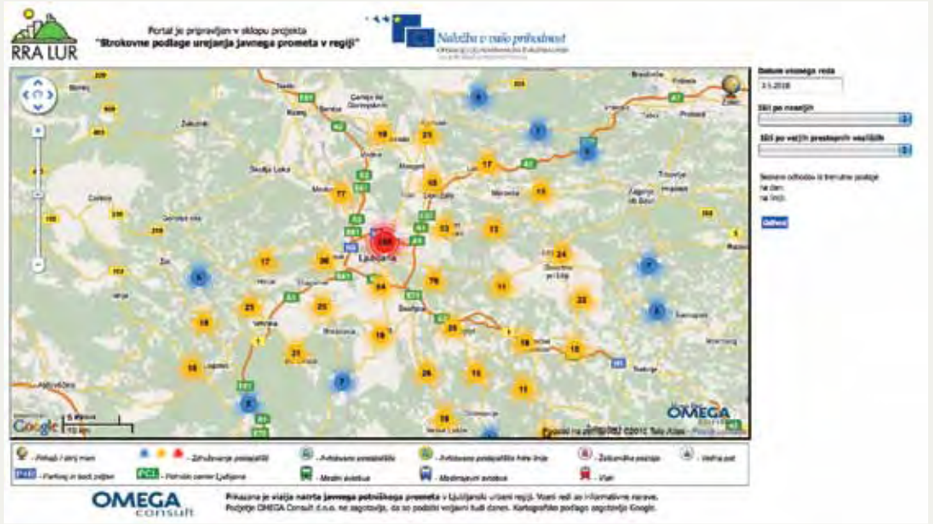
Figure 7.1: Display of the PPT in the LUR web portal content



The portal PPT in LUR shows an interactive web map of public transport in LUR containing harmonised timetables for inter-urban buses, railway, urban buses in Ljubljana and high-speed routes. The timetables of individual PPT operators are combined into the harmonised unitary timetable and presented by stops and by intermodal interchange facilities.

The interactive map displays the following information on PPT:

- bus stops and routes of Ljubljana UPT,
- bus stops and high-speed route,
- bus stops and routes of inter-urban bus transport (all operators),
- rail lines and stations,
- waterways,
- P & R schemes and intermodal interchange points,
- location of the Passenger Centre Ljubljana (PCL).

The basic idea of the web portal is the integration of information on PPT services in LUR. The interactive map collects and presents in a user-friendly way data on all forms of PPT in LUR. There is the regional unitary timetable of PPT stops and stations for every day in the year. The portal will serve for the actual planning of routes and enable passengers to use different PPT modes and thereby achieve minimum journey times by using PPT. The portal contributes to the idea of setting up a PPT system which will compete with the other forms of transportation (primarily private cars) in terms of journey times and costs as well as effects on the environment.

Intermodal interchange points

Interchange facilities offer numerous types of journey and flexibility by providing choices between different operators and services. Bearing in mind the concept of 'door-to-door' connections, it is necessary to establish such a system which will minimise the feeling that a journey is being disrupted. Therefore, passengers need to be able to transfer as quickly and safely as possible, all passengers having equal access to all forms of transportation. Passengers transfer from private vehicles or P & R schemes to buses, high-speed routes, railway, taxis or non-motorised forms of traffic. In accordance with this policy, the renting of bicycles needs to be provided for, as well as bicycle storage facilities, cycle lanes and the carriage of bicycles on buses. It is necessary to provide relevant information and additional commercial services, and adapt the offer to all target groups of customers.

When establishing intermodal transfer facilities it is necessary to:

- correctly locate the site for the interchange point and its connection with other modes and P & R scheme;
- identify potential user groups and their accessibility needs (the elderly, disabled people, pupils, commuters, low income people, parents with a pram, passengers with heavy luggage, foreigners) and include them in the planning process;
- determine technical requirements and elements, and integrate them with the spatial requirements;
- design a suitable architectural solution for the facility;
- provide visible and clear signage to simplify the choice of route for passenger inside the facility;
- provide a comprehensive information system – information on PPT services, departures,

delays, ticket purchases, traffic; accessibility of pre-trip information on the internet or via mobile telephony; availability of current travel information via monitors, maps and information points;

- include the possibility of supplementary information – for example, provision of information about destinations (cultural events, tourism, services etc.);
- ensure security and control, tailor solutions for passengers' protection against physical assault, theft of car/bicycle, vandalism etc. (patrols, video surveillance...);
- ensure the possibility of additional services through public-private partnerships.

Table 7.1 displays a matrix based on the above requirements which shows the requirements and the list of necessary components of interchange points respectively associating individual modes of transport.

Table 7.1: Matrix-based presentation of components that an interchange points system requires to perform and provide 'door-to-door' service

Walk	low-floor vehicles, ramps;
	comprehensive information system;
	safe footways (wide pavements), signalisation giving priority to pedestrians
	smart cards system (RFID technology), vending machines;
	arrangement of bus stops (shelter, seating, quietness, cleanliness etc.)
	offer of additional services (shop, bakery etc.)
Bicycle	low-floor vehicles, platform to facilitate change;
	comprehensive information system
	bicycle storage facilities
	bicycle rental service and network of bicycle rental shops;
	smart cards system, vending machines;
	arrangement of bus stops and offer of additional services;
Car	P & R scheme (car parks, arrangement of bus stops, comprehensive information system);
	concentration of services;
	smart card system, vending machines
Bus	comprehensive information system;
	safe crossing of traffic areas (signalisation giving priority to passengers);
	concentration of a variety of services;
	smart cards, vending machines.

Note: The comprehensive information system refers to pre-journey information (internet, cell phones) and to audio-visual information at bus stops and along routes (monitor, information point map) on arrivals, eventual delays, possible changes or continuations of the journey and all services offered (for example, possibility of bicycle storage and bicycle rental). Information must also be adapted for blind people.

In planning interchange points, consideration must be given to the fact that it is not a merely technical issue, but also a sociological and psychological one (for example, interchange facility interior design). An interchange facility design that considers all the aforementioned factors must be integrated into the urban environment so as to correspond to current and future demand and activities.

It is essential that an interchange point is easily surveyable, enabling rapid passenger transfers thanks to easily available and intelligible information. It also involves the design of transport routes which make changes as fast and safe as possible.

Regulation of non-motorised traffic

In compliance with private vehicle traffic restriction measures, a sufficient choice of alternative transport modes needs to be provided ensuring 'door-to-door' access throughout the town. For example, developing and promoting non-motorised traffic would serve this purpose. Cycle lanes and footways would encourage sustainable mobility modes and achieve more efficient land use. Measures to improve accessibility by non-motorised modes inside and outside towns involve a series of activities and measures which separately and in conjunction with other forms of PPT contribute to the greater mobility of residents and at the same time foster healthier and higher quality way of life. Investments in non-motorised traffic infrastructure networks (cycle lanes, pedestrian zones, footways) are relatively cheap compared to investments in other traffic infrastructure. Moreover, they create conditions for ecological and health friendly mobility, as well as synergy opportunities in tourism and urban traffic.

The establishment of a comprehensive and elaborate network of cycle paths and footways in towns has gained importance only in the past few years, since the sustainable aspect of mobility is now in the forefront of the European traffic policies. Establishing a network of links for non-motorised residents and its connection to areas of recreational, cultural and tourist activities is of key importance for the quality of life in towns, and creating an additional opportunity for tourism development. The entire PPT network in the region must be connected with non-motorised traffic, with local authorities being the principle promoters of developing the cycle network.

The arrangement of cycle lanes and paths with requisite infrastructure comprises:

- arrangement of special lanes and paths with surface markings separating them from other carriageways or pedestrian areas;
- arrangement of appropriate infrastructure: illumination of pathways, provision of safe bicycle storage in the city and surroundings, overpasses and underpasses;
- ensuring safe routes for cyclists and pedestrians, primarily in the city centre (more friendly urban traffic regulation for cyclists and pedestrians with cycle and pedestrian zones, areas closed to motor traffic, and low speed motor traffic in other parts of the city core);
- bicycle rental possibilities;
- carriage of bicycles on buses etc.

Safe footways will primarily require the design of safe pedestrian crossings, overpasses and underpasses, suitable traffic signalisation, illuminated routes inside and outside towns, and clearly marked slow motor traffic zones with a high presence of pedestrians, especially children.

Restricting private vehicle traffic in towns

Measures to restrict or ban traffic from town centres have many positive and some negative consequences. Among the positive consequences, proven in numerous European cities, we may rank: the positive impact on the air quality in the town, the regeneration of the urban core and service activities, the encouragement of non-motorised traffic, greater safety for strollers, calmer and more peaceful life in the town etc. A negative consequence of the closure of the city core may be a fall in trade and number of visitors if adequate accessibility by PPT is not ensured. Access to the closed part of the town must be ensured for delivery vehicles with permits to supply shops and restaurants, as well as for residents' private vehicles in cases of emergency.

Before the application of changes in the traffic regulation in town, several scenarios and ways of implementing the project should be examined, so that the best may be chosen. After the decision to change the traffic regime has been made, a package of additional support measures must be carefully tailored. The following are some measures which result in restricting private vehicle use and whose effects largely overlap.

Table 7.2: Measure to restrict private vehicle traffic

Measures to reduce the use of private vehicles
- yellow lanes to ensure priority to PPT over other types of traffic
- city-entry charges for private vehicles
- differentiated parking charges relative to the period of use and location
- special city-entry charges for private cars during peak hours
- reimbursement for travel to work (company schemes)
Measures to restrict access for private vehicles
- form partnerships between municipalities and various interest groups
- collaborate with urban planners in planning
- hold permanent consultations with the public (meetings, workshops, collaboration over the internet...) and keep the public informed of the situation
- establish a municipal advisory office to keep residents informed
- regulate delivery
- ensure by-passes and parking spaces on the town fringe
- provide relevant signage when the regime changes (sign boards)
- cooperate closely with the police when preparing new traffic regimes
- arrange urban green spaces, walking paths and parks
- provide access by PPT
- provide access by non-motorised traffic
Measures to promote PPT use
- collaborate closely with the media - inform on all stages of traffic regulation
- allocate municipal resources to promote PPT usage
- collaborate with educational and public institutions
- carry out various media campaigns adapted to target user groups

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Conclusions

The plan proposed in 'Expert guidelines for the regulation of regional public transport' is realised through the establishment of the Regional Coordinating Body for PPT, which is later transformed into the Regional Regulatory Body and the Regional Agency for PPT. The Regional Coordinating Body is concerned with directing, regulating and introducing adaptable forms of public transport in urban and suburban parts of the region. The forming of the Regional Coordinating Body leads to a unified review and supervision of integrated public transport flows. It also provides for the legal framework needed for the effective operation of the regional PPT.

The relevant legal basis must enable the management of the integrated PPT system at the regional level in compliance with the national level. In order to harmonise services with the needs of the regions and municipalities, it is has been suggested that the legal framework, with respect to regulation at national level, be adapted at the regional and municipal levels respectively. The legislation should, in accordance with the gradual modernisation of public transport, initially create a framework for establishing the Regional Coordinating Body, and later, a separate statutory framework at the regional level which would allow for the establishment and operation of the Regional Agency for PPT and the Regional Regulatory body.

The legislation should regulate the allocation of tasks and competences between entities at the regional and municipal levels in coordination with the national legislation. The emphasis of the new regional legislative regulation is primarily

on separating supervisory and implementation functions, whereby the law must ensure that the supervisory function is completely autonomous and independent from the implementation function.

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Expert guidelines for the regulation of regional public transport
Summary

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The source of all pictorial and graphic material and tables in the summary of Expert guidelines for the regulation of regional public transport': Omega consult, d. o. o., with the exception of Table 2.1: Activities within/outside the range of accessibility in page 45 which is from AVRIS, LPP, SURS, GURS, IPIS, IPN MOL, MOP and Integrated transport chains from EU Portal, 2003, in page 99.

Park and ride

The P & R scheme (park and ride) is a combination of private and collective transport enabling the user to drive to key locations on the fringes of the city in their own car or in some other vehicle, leave the car at the P & R car park, and head towards the inner region on high-quality public transport. The scheme has some variants: the 'park and bike' scheme found at certain locations involves parking a private car and renting a bicycle to continue the trip. And there is a 'park and pool' scheme involving car-pooling i.e. one or more drivers arrive in their own cars and continue the travel sharing one of their cars. All of these forms are complementary and inter-connected, and therefore they need long-term planning and direction.

The whole system of P & R sites in the region will act as intermodal interchange points situated in local centres and on the fringes of Ljubljana where, apart from various forms of transportation, users will also have at their disposal other services from public (libraries, pharmacies, some administrative offices) to commercial (shops, banks and so on). Thus the function of the intermodal interchange point is two-fold: to enable passengers fast and safe transits between forms of transport, and to attract passengers to public forms of transport, thereby making them competitive.

The current estimate – with regard to the implementation forecasts for other projects and selected systems – of the number of intermodal interchange facilities required in the region is 38.

Three basic types of intermodal interchange point have been specified: a transport centre (Passenger Centre in Ljubljana), intermodal hubs outside the regional centre and P & R schemes along arterial roads to urban centres. The standards for public transport services and other service activities have been specified for each type of point.

System of intermodal interchange points and P & R schemes

No.	Name of P&R scheme	Parking capacity
0	Črnuče	300 - 500
1	Zadobrova	do 20
2	BTC	1000 - 2000
3	Studenec	500 - 100
4	Bizovik	300 - 500
5	Rudnik	500 - 1000
6	Barje	100 - 300
7	Rakova Jelša	1000 - 2000
8	Dolgi most	1000 - 2000
9	Brezovica	100 - 300
10	Brod	100 - 300
11	Stanežiče	300 - 500
12	Ježica	1000 - 2000
13	Trzin	50 - 100
14	Škofljica	100 - 300
15	Vrhnika	20 - 50
16	Medvode	300 - 500
17	Litija	20 - 50
18	Domžale	20 - 50
19	Grosuplje	20 - 50
20	Mengeš	up to 20
21	Vodice	100 - 300
22	Log pri Brezovici	up to 20
23	Šmartno pri Litiji	do 20
24	Šentjakob	100 - 300
25	Polhov Gradec	do 20
26	Moravče	up to 20
27	Lukovica	up to 20
28	Logatec	up to 20
29	Velike Lašče	up to 20
30	Komenda	up to 20
31	Kamnik	up to 20
32	Ivančna Gorica	up to 20
33	Ig	20 - 50
34	Horjul	up to 20
35	Dolsko	20 - 50
36	Dobrepolje	up to 20
37	Borovnica	20 - 50
38	Passenger centre Ljubljana	

Suggested plan timeline

2010 — 2017

- Building of structures and arrangements
- Preparation for construction (acquisition of land and permits)
- Inclusion of intermodal interchange points in municipal spatial planning documents

Contemporary high-speed routes (HSR)

Contemporary high-speed routes (HSR) will run along the main transport routes in Ljubljana and, given the traffic burden, they will connect all parts of the region and also of Slovenia. The objective of HSRs is a quality connection with public transport starting bus stops capable of generating sufficient demand and thus boosting the competitiveness of public against the private transport and shift passengers from private cars to public transport before they reach the urban agglomeration. Within the HSRs system, travel speed has to be raised from today's average of 5km/h to 24 km/h and, along with it, the frequency rate in peak periods to 5 minutes. The awaited results are also forecast by surveys which find that the introduction of high-speed routes running 30% faster would attract 60% of all respondents to public transport despite a 10% higher cost.

The high-speed route technology itself has not been selected, as a series of analyses is still needed. With regard to current knowledge of the situation in the region and in Ljubljana, the most suitable variant in terms of cost and time appears to be high-capacity buses on separate lanes with priority at intersections (BRT – Bus Rapid Transit). With growing demand, this technology can be upgraded to light railway, tram or metro, which can be partially or entirely underground. The routes of the high-speed lines in accordance with the proposed variant run along Dunajska Road to Črnuče, and along Celovška Road to the planned residential neighbourhood of Stanežiče. As to the other arterial roads, it runs from the anticipated P & R schemes at the ring road access points towards the city centre; along Tržaška Road to Dolgi most; Barjanska Road to Rakova Jelša; Dolenjska Road to Rudnik; Zaloška Road to Studenec, and along Šmartinska Road to Nove Jarše. Besides existing services, four more additional high capacity bus services are anticipated: from Črnuče to Dolgi most, Nove Jarše to Rakova Jelša, Stanežiče to Studenec, and Stanežiče to Rudnik.

High-speed routes system
(Source: RDA LUR)

- Urban public transport lines
- Suburban public transport lines
- HSR 1 - Črnuče - Dolgi most
- HSR 2 - Stanežiče - Rudnik
- HSR 3 - Nove Jarše - Rakova Jelša
- HSR 4 - Stanežiče - Studenec
- Railway
- Railway development (depending on the National Spatial Plan!)

The plan envisages the erection of four intermodal hubs at locations that allow changes between all PPT modes. One of these would be the transport centre in the centre of Ljubljana where urban, suburban, regional, inter-regional and international PPT flows will intertwine. According to this scenario, the other HSRs intermodal hubs would be in Črnuče, Stanežiče, Dolgi most and Rudnik.

The advantage of the yellow lanes system lies in its phased nature, as the system permits the introduction of a new overground or underground light railway to replace yellow lanes by the time their capacity has become exhausted.

The characteristics of the PPT plan involving HSRs yellow lanes system are summarised as follows:

- establishment of HSRs in the form of separate lanes for high capacity buses;
- ensuring priority for PPT vehicles using yellow lanes (priority at signalised intersections);
- HSRs routes in total are 36.1 km in length;
- enhanced carrying capacity of the new buses with the fleet remaining unchanged;
- speedy boarding and alighting through all bus doors when the electronic fare collection system has been introduced;
- five intermodal interchange points representing feeder points for PPT, which allow fast and reliable changes for passengers;
- besides the existing bus services, four additional routes for high capacity buses are envisaged: Črnuče–Dolgi most, Nove Jarše–Rakova Jelša, Stanežiče–Studenec and Stanežiče–Rudnik;
- optional yellow lane infrastructure upgrade to metro, tram or light railway.

Suggested plan timeline

2010 — 2020

Purchase of modern means of transport with requisite equipment
Building some structures and accommodating the system into the regional traffic regime

Preparation for construction (acquisition of land and permits)
Scheme of accommodation of high-speed routes into the traffic regime

Modernisation of the railway infrastructure

The region is at the junction of the 5th and 10th pan-European corridors and at the junction of the most important e-Rail lines. On average, 361 passenger and freight trains arrive in and depart Ljubljana Railway Station every day; more than three million passengers and over 15 million tons of goods depart from it annually. At present, both passenger and goods trains are running on all and the same rails, and all this traffic is managed from the main station. The drawback is that the lines to Jesenice, Kamnik and Novo mesto are single track; these branch lines also have level break-offs. The functional shortcomings limit the performance of the railway system within the entire system. The system is also outdated technologically.

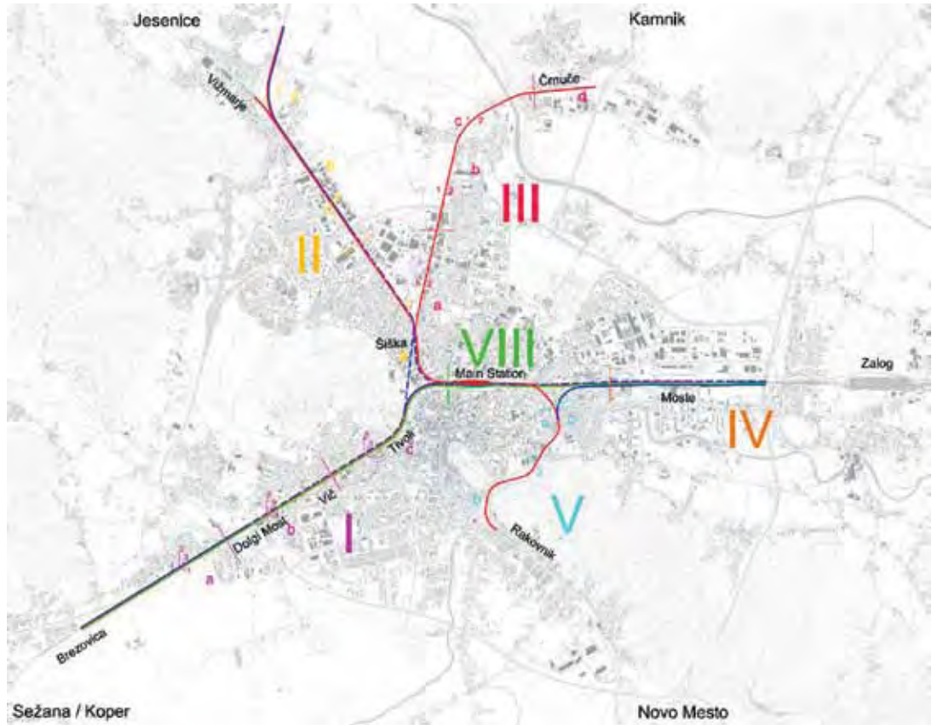
The modernisation of the railway infrastructure is an important national project which will assist the region creating a public transport system within the framework of enabling normal long-term development and the achievement of the objectives. The operators made a selection from four different solutions to the regional railway network problem, the most suitable of which is show shown in the figure.

Important connections in need of renovation and modernisation are as follows:

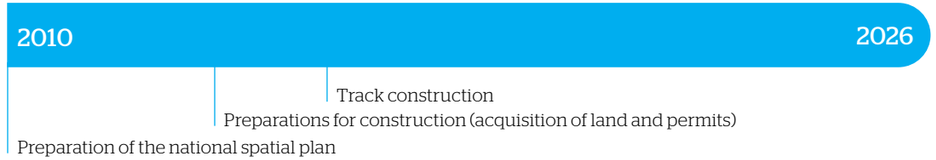
- establishment of a high-speed link between Ljubljana and 'Jože Pučnik' Airport;
- a new track or sidings on the railway link between Ljubljana and Kamnik, and 15-minute service frequency;
- upgrading the track or the siding is needed on the railway link between Ljubljana and Grosuplje, and a 15-minute service frequency;
- upgrading the track or the siding is needed on the railway link between Ljubljana and Vrhnika, and a 15-minute service frequency;
- the arrangement of Ljubljana's railway node bringing about convergence of rail links from all directions for both passenger and goods traffic.

The accommodation of the central national intermodal hub and Ljubljana's railway node respectively is the key to all further decisions on the implementation of public transport systems in the region. It represents a turning point as to accommodations of structures in space. By regulating regional railway traffic, we aim to exclude goods traffic from the city centre and the railway station, and free the in-bound/out-bound railway lines for public passenger transport. We also wish to secure sufficient rail capacity for the national railway node, and improve its safety and flow capacity. Rail links with important regional centres (Kamnik, Vrhnika, Grosuplje) are significant parts of the public transport project implementation, as they complement other forms of public transport and reduce traffic originating in other regions.

Possible arrangement variant of Ljubljana's railway node (Source: A Study on the Variants of Ljubljana's Railway Node, 2009)



Suggested plan timeline



Design and implementation of key cycling and walking connections in town centres and between regional centres

A system of cycling and walking routes will be set up in order to enable commuting for people who opt for non-motorised rather than motorised forms of transport. The system of routes will connect settlements and towns in the region, as well as the P & R schemes. Thus people will be able to choose forms of transport, cycle or walk the entire length of the journey, park and bike and other options. Alongside the routes, the system will provide other transport connections and services as well as the infrastructure needed for the safe and normal operation of the system. The system will provide bicycle storage facilities, road assistance and direction systems on the route, from route planning to steering on the ground.

Joint web portal for cycling and running routes, footways and waterways. Source: www.gremonapot.si

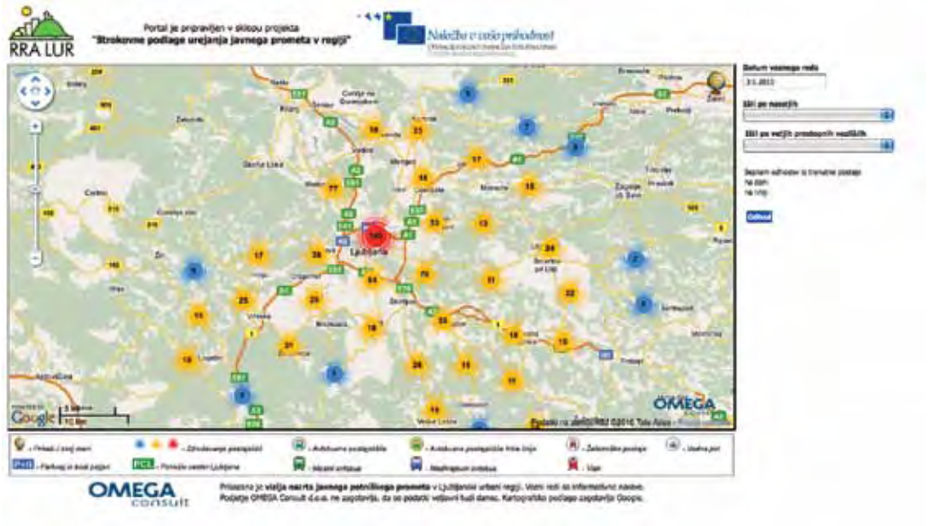
The project will encompass connections between various types of routes (including tourist routes), the establishment of, and information support for the regional network, links with natural and cultural sights, and services enabling the operation of the whole system. Part of the system is already being set up by the Municipality of Ljubljana by means of the web portal Gremo na pot, but in future much more attention will be given to the construction of cycling and walking routes together with the accompanying infrastructure which will comprise:

- arrangement of special lanes and paths separated from carriageways and pedestrian spaces by road markings;
- arrangement of suitable infrastructure: illumination along the routes, secure bicycle storage facilities in the city and surroundings, overpasses and underpasses;
- ensuring safe cycling and pedestrian routes primarily in the city centre (more friendly urban traffic regulation for cyclists and pedestrians involving cycle and pedestrians zones, areas closed to motorised traffic, and low speed motorised traffic in other parts of the city centre);
- bicycle rental possibilities;
- carriage of bicycles on buses etc.

Suggested plan timeline

Policies and soft measures in support of public transport

In order to successfully introduce public transport system modernisation, harmonised collaboration and commitment to the common goals of the municipalities within LUR will be needed. Larger municipalities, representing the driving force of the projects development, are more exposed, because the traffic regulations of the smaller municipalities are largely dependent on the bigger municipalities, due to daily flows of commuters (workers and students). Therefore, it is important that neighbouring municipalities are both informed about project implementation and included in project planning. Successfully performed local measures to improve traffic serve as good practices for other municipalities.



Display of the content of the PPT in LUR web portal (Figure: OMEGA consult d.o.o., 2009)

To this end, long-term and successful measures have to be put in place to promote public transport and restrict private vehicle traffic in the towns of all regions. These measures must be performed simultaneously and efficiently in order not to cause the public discontent and the impression that the system involving restrained private vehicles use is ineffective, as traffic bottlenecks may occur each time daily or weekly actions to reduce traffic are carried out.

The regions must also harmonise their priorities concerning public transport and sustainable mobility, as they are essential for boosting the supply and demand for public transport. The effective performance of the public transport system within the region is attractive for residents from neighbouring regions, while its smooth operation is an example of good practice and a promoter of the development of traffic regulations in municipalities of other regions.

Setting up and performing the following activities will necessitate coordination:

Measures to reduce the use of private vehicles:

- introduction of yellow lanes to ensure priority to PPT over other types of traffic,
- city-entry charges for private vehicles,
- differentiated parking charges relative to the day period and location,
- special city-entry charges for private cars during peak hours,
- reimbursement for travelling to work (company schemes);

Measures to restrict access for private vehicles:

- form partnerships between municipalities and various interest groups,
- collaborate with urban planners in planning,
- hold permanent consultations with the public (meetings, workshops, collaboration over the internet...) and keep the public informed on the situation and progress of works,
- establish a municipal advisory office to inform residents,
- regulate delivery,
- ensure by-passes and parking spaces on the fringes of the city,
- provide relevant signage when the regime changes (sign boards) ,
- cooperate closely with the police when preparing new traffic regimes,
- arrange urban green spaces, walking paths and parks,
- provide access by PPT,
- provide access by non-motorised traffic;

Measures to promote PPT use:

- collaborate closely with the media – inform about all stages of traffic regulation,
- allocate municipal resources to promote PPT usage,
- collaborate with educational and public institutions,
- carry out various media campaigns adapted to target user groups.

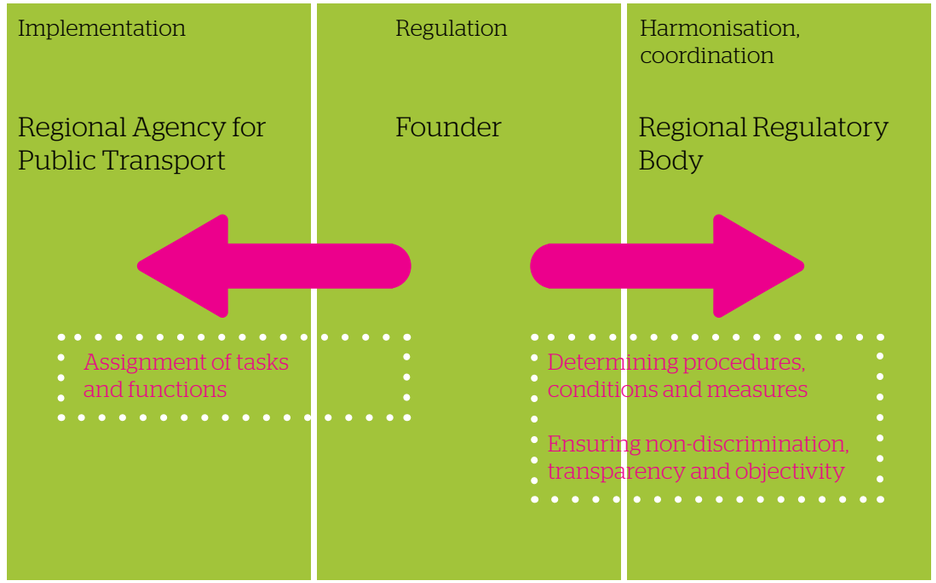
Suggested plan timeline

The Regional Coordinating Body for steering the development of public transport

An effective performance of the public transport services requires, following European good practices both at the national and regional level, two independent bodies: an executive body and a supervisory body.

Analogously to the national concept of integrated passenger transport, executive functions may be assumed by the newly formed Regional Agency for Public Transport. Comprehensive regulation of the public transport necessitates the establishment of

Institutional arrangement of the new PPT system (Figure: OMEGA consult d. o. o., 2009)



a parallel body to supervise and harmonise the activities of the stakeholders i.e. the Regional Regulatory Body.

The final objective of regulating the public transport system is the separation of the supervisory and the executive functions performed by two different bodies. We suggest a gradual constitution for these two bodies, in accordance with the sector's development needs and the development of the supporting legal frameworks. At the outset of the launch of the integrated public transport, we suggest founding a unitary body – a Regional Coordinating Body (hereinafter referred to as KRT) to deal with the development and steering of public transport in the region.

KRT would represent a basis for the introduction of the new public transport regulation and later on would – with regard to the needs, magnitude and complexity of the public transport system – adapt its organisational form in accordance with the accompanying legislative changes. The Regional Regulatory Body should be formed and organised in such a way to enable efficient supervision, harmonisation and coordination of the entire integrated public transport system. The starting points for shaping and organising the most suitable statutory form of the Regional Regulatory Body result from the analysis of the existing legislation and the set of anticipated tasks the Regional Regulatory Body should perform. Special consideration should be given to the fact that this body's work would cover the central Slovenia region and, furthermore, connect the neighbouring regions (Notranjska, Zasavje, Gorenjska and Dolenjska). In formulating the management policy of the Regional Regulatory Body, numerous interests have to be heeded. Therefore, the constituent act has to be prepared accordingly, together with proposals for legislative changes relative to the regulation and operation of public transport at the national, regional and local levels. The organisational forms of public transport differ from country to country, even from town to town, as to management organisation, forms of regulatory body, funding models and structure and methods of collaboration of transport companies. In Europe, there are two types of organisational forms of public transport which differ in terms of where the initiative comes from (market driven or proposed by the authorities). A system driven by the market provides exclusively commercially viable services. There is a wide range of commercial organisational forms, completely free access to the market on the one hand, and on the other hand the authorities awarding long-term exclusive contracts conceding more or fewer rights to operate these services.

Following the division of tasks between the Regional Regulatory Body and the Regional Agency for Public Transport, the regulatory body would assume the following tasks:

- supervision of all implementation functions of the new PPT system;
- harmonisation of interests and resolving disputes between the PPT stakeholders, which are: the State, the region, the local communities, the Regional Agency for PPT, partner organisations, operators and customers;
- supervision of the ensured balanced volume of services to maximise social benefits;
- preparation of the working materials required by the Ministry of Transport, after prior consent;
- issuing general legal acts needed to implement its powers conferred by public law; measures for fostering the development and usage of PPT in LUR;
- participation in preparing expert guidelines for traffic policy concerning the organisation and implementation of PPT services within an integrated system;
- introduction of a total quality management (TQM) system through setting standards by key areas;
- verification of the implementation of staff training plan by the operators;
- collaboration with the relevant body for traffic in preparing the starting points and programmes needed for drawing on EU funds;
- surveys (measuring satisfaction with PPT services and forecasting demand);
- responsibility for the development of an integrated PPT in LUR.

The Regional Regulatory Body obtains the resources needed for the performance of its tasks from the state budget, and on the basis of the legislation in force governing the revenues acquired by implementing services on the market, from donations and other sources.

Suggested plan timeline:

2010

Establishment of KRT
Operation of KRT

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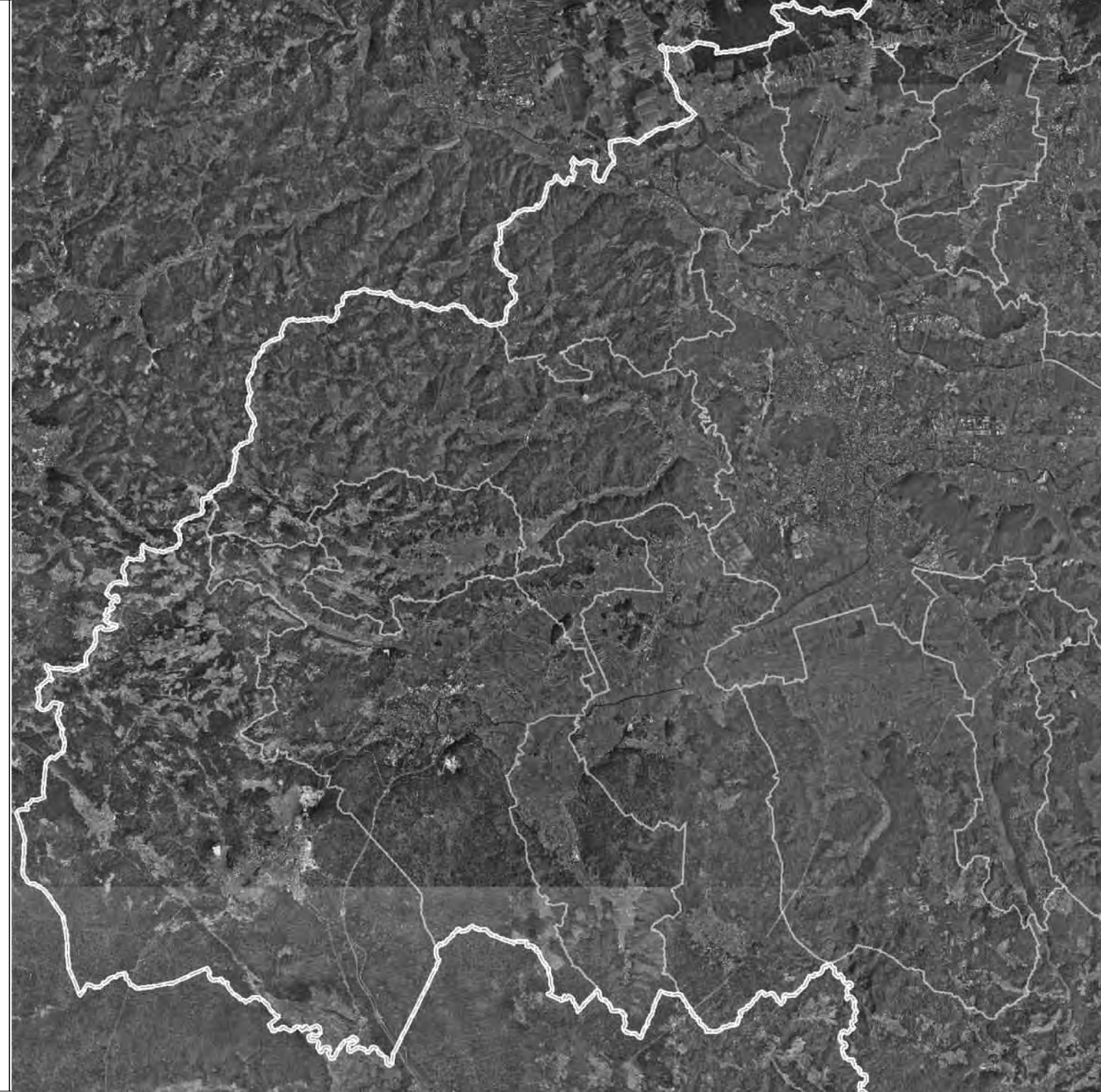

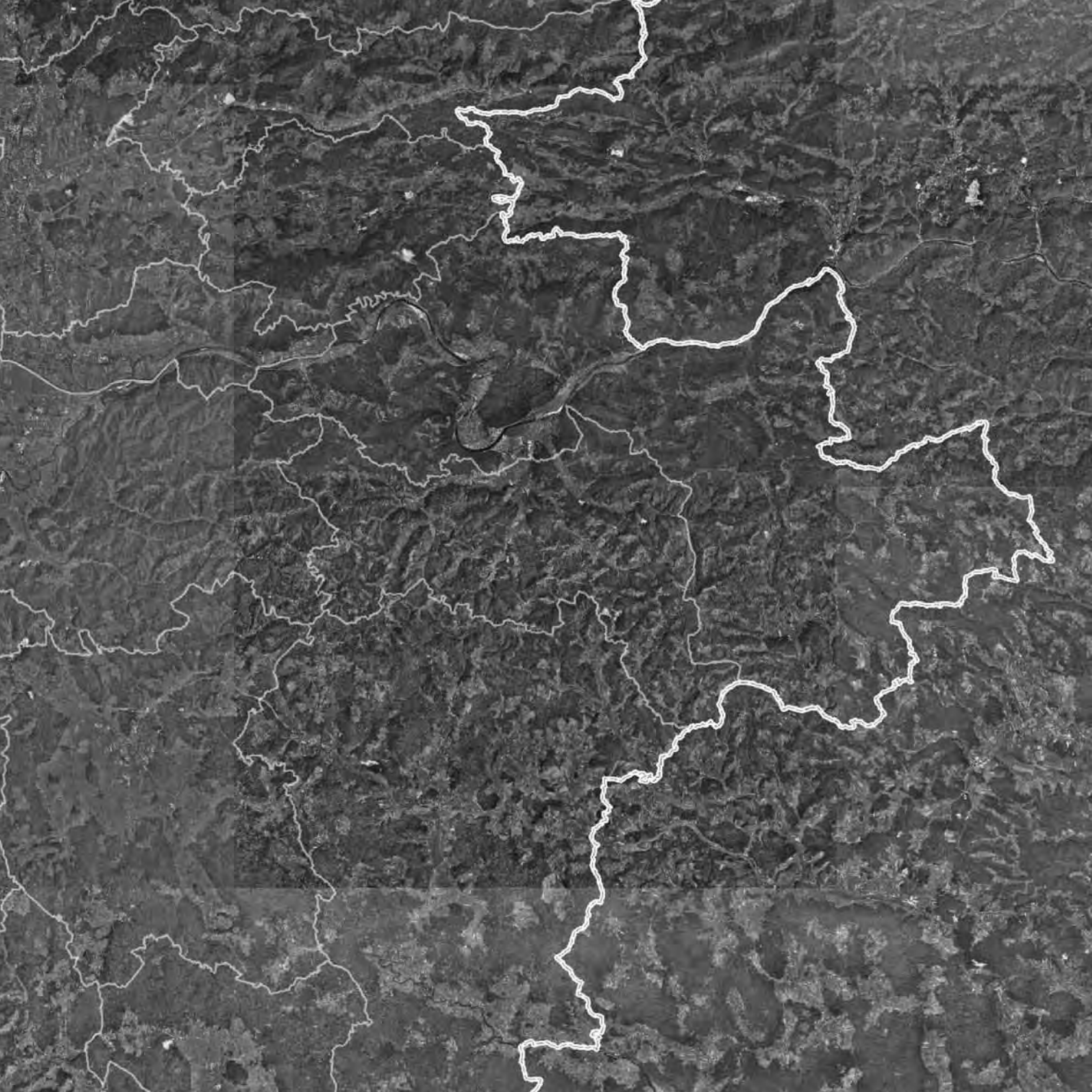

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