

Strategic Land Use Planning for Low Carbon Cities in Ljubljana Urban Region

1 Introduction

Cities and other settlements are still the principal originators of development, for they represent the basis for economic and social interrelations. At the same time, they are great consumers of space, natural resources, and polluters of the environment. They are therefore the key factors in the strategy of sustainable development. In addition to environmental protection including the preservation of historical, cultural, and natural heritage, the term "sustainable development" comprises substantial values, whose aim is to ensure the quality of life for our and next generations. Unfortunately, present urban and mobility patterns do not correspond with these objectives. Due to the rapid growth of urbanised areas, many pollution problems have arisen with negative feedback on the quality of life in cities and their gravitational areas.

Linking settlements to public transport at the regional and local level is the core of this article. Modernisation of transport infrastructure (roads and railroads), as well as development of energy supply, communication and other infrastructure, significantly affect settlement development. Sustainable and comprehensive development will therefore be effective only if settlement development is planned parallel to the infrastructure, especially to transport system, where the public transport should be emphasized.

All across the World, the car as a transport vehicle, which offers comfort, pleasant travelling and flexibility, has spread widely. But at the same time cars have negative environmental impact (pollution, noise). Road transport is after power generation, the second biggest source of greenhouse gas emission in EU. It contributes about one-fifth of the EU's total emissions of carbon dioxide (CO₂), the main greenhouse gas. Passenger cars alone are responsible for around 12% of EU CO₂ emissions. Although there have been significant improvements in vehicle technology, which translates into lower CO₂ emissions – these have not been enough to neutralise the effect of increases in traffic and car size. Besides that, transport modes, where car traffic prevails, often lead to traffic congestion and increased investments into road infrastructure. A direct response to congestion and road investment is an urban sprawl of employment and housing which extend to the suburbs and the periphery of the city where road congestion does not yet exist. With enlarged personal mobility, settlements become dispersed, which again demands more roads and diminishes the efficiency of public transport. Land utilization and the need for a very branched services infrastructure are unreasonable, costs grow, and communities become incapable of dealing with problems, social segregation begins. This is a vicious circle with effects on social and environmental degradation. Such conditions lead to urban development that is not sustainable. Obviously investments in roads are, in the long run, neither economical nor environment-friendly solutions. For development of sustainable and low carbon city reinstatement of public transport is much more efficient and reasonable.

2 Problems at the regional level

As is typical for Western Europe, even in Slovenia the hinterlands of larger cities have experienced massive pressure for development. The extensive development of housing construction in Slovenia from sixties to nineties resulted in two directions. On the one hand there was the mass construction of large apartment block complexes in the suburbs and at the edges of cities. As an opposite to collective construction, scattered single family housing has appeared in the wider city areas. That is why the great expansiveness of suburban sprawl is one of the main problems of the suburbanisation of numerous Slovene cities. In areas of regional centres, where strong road-traffic flows are often hindered by congestion, public transport should be the main traffic system. It should however be well organised, with a high level of service and thus competitive to use of private cars.

In the early nineties almost a third of Slovene population lived in suburban areas. More than half of them commute daily to larger employment centres for work, generally by car. The rapid urbanisation with dispersed and relatively low settlement densities, which is tied to private car traffic, is causing negative effects on the environment as well as economy:

- Large built-up areas and wasteful use of land, insufficient communal infrastructure;
- Monofunctional, monotonous districts, which generate a large volume of transport, especially by car;
- Uneconomical construction of roads and other infrastructure;
- Increased environmental pollution because of daily traffic;
- Problems with sewage and waste-water treatment;
- Issues in cultural landscape preservation, protection of agricultural land;
- Decreasing economic investments in these areas etc.

Parallel to increased use of private cars in Slovenia, use of public transport means has decreased: today only 10% of all the population are public transport users. The present condition demands improvements to the public transport system: efficiency, rationality, practicality, creation of exchange nodes. In the wider sense, there should be denser inhabitation connected with development of public transport nodes. In the view of all negative effects caused by use of private cars (traffic congestion, pollution, accidents etc.), the trends should be redirected to use of public transport, bicycle, and pedestrian traffic.

There are important effects on low-density urban development, which enlarge automobile dependence and extensive land use. Such problems are typical for many Slovenians towns, especially for Ljubljana urban region.

3 Ljubljana urban region

As our capital city, Ljubljana is a political, cultural and economic centre. One of the main problems of development in the Ljubljana region is also the great extent of suburban sprawl. There are more than 270 000 inhabitants within the municipal boundary, but inclusion of the outlying districts (in the functional urban region) increases the total to more than 500.000 inhabitants. The level of motorization is high (1 car per 2,2 inhabitants) and the mobility (per day) is already 2,4 travels per inhabitant. The increase of private car traffic and the decrease of public transport represent one of the main problems in transportation system and a threat for the environment. Today buses are the only means of inner city public transport in Ljubljana, which is at the upper limits of its capacities. Ljubljana had tramway already in 1901, but it was eliminated 40 years ago. Comparisons with solutions in similar cities have led to the conclusion, that the most favourable long-term answer is a dual public transport system: modernized rail transport (light rail transport and later also tramway through the city)

and buses (suburban and urban system). Therefore we worked on the different research projects, prepared for the City of Ljubljana, where we have focused on the connection between the urban development and the (planned) light rail system (Sasek Divjak, 2001; Sasek Divjak, 2002; Sasek Divjak, 2004). The results were also considered in the new *Strategic Spatial Plan for The Municipality of Ljubljana, Proposal* (Sasek Divjak et al. 2009).

According to the forecast estimate of the future number of inhabitants in the Municipality of Ljubljana, which presupposes 1000 immigrants per year, an assessment was made of approximately 250 000 inhabitants in the year 2027. The assessment has served as the basis of planning for the strategic spatial plan (Jakos in Sasek Divjak et al. 2009).

3.1 The settlements development in the region

The main feature of the Slovenian settlement structure is the large number of relatively small settlements (6000). Only three towns have more than 50.000 inhabitants: Ljubljana with 270.000 inhabitants, followed by Maribor and Celje. Majority of the population in Slovenia is settled in the surroundings of the 1000 larger settlements where approximately 2/5 of all workplaces is located. The lifestyle is typically urban, and the predominant type of housing is a detached single-family house. About 50% of the migrants from both urban and rural areas live there, which is the main reason their socio-economic structure has changed completely. More than half of the suburban working population commutes daily to the main employment centres. Commuters increase the motor vehicle traffic, especially by using cars.

In similar middle-sized European cities the modern tramway was proved as a good solution to solve mobility problems in inner city districts. To avoid the limits of bus (the congestion problem, not enough capacity) or underground solutions (too expensive), the tramway on segregated right of way has proven to be one of the most efficient public transport technologies and has today gained a world success.

Another problem is a shortage of housing in large centres where the demand exceeds supply. As the result, the prices of dwellings and the cost of rents are very high. According to the forecasts we need in Ljubljana about 15.000 new housing units until the year 2015. For this purpose, it will be necessary to prepare a certain number of suitable locations in the central part of the city, suburban areas and other settlements in the region. It is therefore urgent to thoroughly consider where, in what form and to what extent newly built housing communities could be located.

From the point of view of the sustainable development of cities, it is important to establish at the regional level, economic, social and ecological balance of the city and countryside area. Towards the end of the 20th century the way of life and work has changed essentially. The differences between the city and the countryside with regard to lifestyle and access to information have been diminished, not only due to traffic connections but also, because of new information and communication technologies. The operational area of work is not limited only to a compact industrial production. Most workplaces can be found in the service field and remain within the living environment. But at the same time these possibilities have a considerable influence on the extent of town spread and on the demands for the communal infrastructure.

In the last decades, directives concerning the planning of urban development in European cities emphasise the comprehensive approach that demands dealing with cities in the wider, regional sense. Especially important is the sustainable approach (respect for the principle of the Agenda 21 and Habitat Agenda), since activities tied to urban processes impose the greatest changes and burdens on the environment. Thus environmental protection strategies have to be tied to social, economic and other strategies (connecting economic development,

environmental protection, transports, housing and planning policies etc.). Model of regional cities oriented towards sustainability includes two strategies:

- A.** Development of the central built-up urban area and its historical core
Central urban places demand renewal, revitalisation and transformation of urban surfaces, especially to improve the urban tissue.
- B.** In suburbanised and rural areas decentralised densening, with smaller concentration centres and good network connection between them. An important principle of the decentralised concentration model is to connect regional structures of urban growth to public transport routes and their stations. The principle enables regeneration of these areas, which need new economic investments, with restructuring and new urban functions.

The basic principle is obvious: to put into force a decentralised scheme at the regional level. The construction is concentrated in the subcentres where mixed use of land prevails (housing and the corresponding public use of surfaces, shops, and services) on strategic points, along the routes of the regional public transport system. The key aspect of the concept is to create a lively urban community within walking distances.

As Ljubljana, the capital city, has spread outwards from its historical core along the radial road system, it has a characteristic star-like shape (Figure 1). Greater Ljubljana agglomeration develops into a conurbation so we plan a harmonious development of the hole. In order to reduce the traffic congestion in the central part of Ljubljana, we foresee the development according to the principle of the decentralised concentration model of settlement. Three main principles of development prevail: regional structures of urban growth are linked to the development of public transport; zone planning is replaced by mixed land use, while urban design policy is directed towards human dimensions, pedestrian distances, and common open spaces.

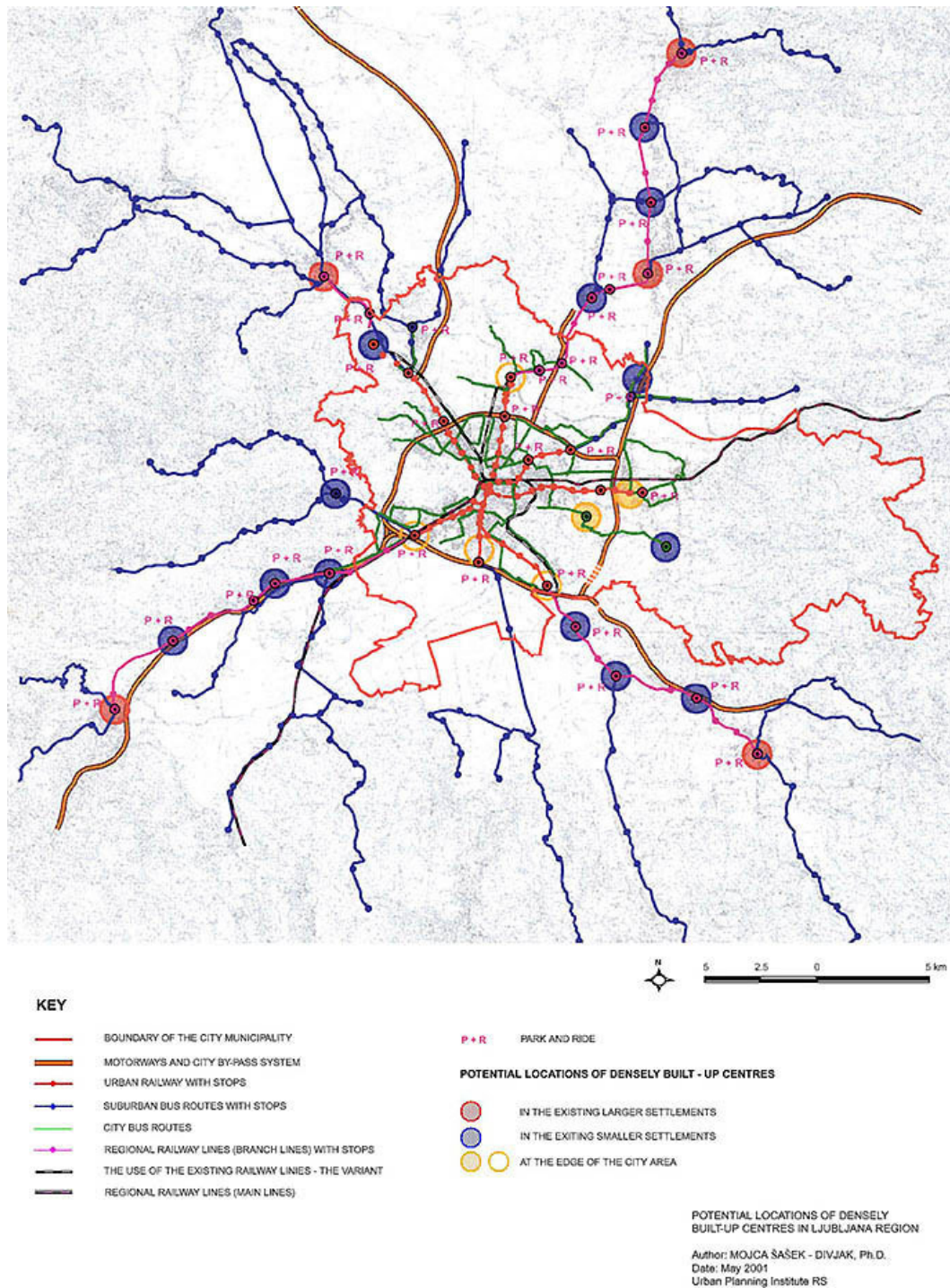


Figure 1: The model of decentralised concentration in Ljubljana functional region.

Author: Mojca Sasek Divjak, UIRS. Source: Sasek Divjak 2001

3.2 Densely built-up centres in the suburban space

A star-like shape is typical of the regional development of Ljubljana: almost densely built-up city area stretches up to the round (circumferential) by-pass. From the by-pass outwards, the

city has been expanding in the shape of five branches. Along those directions, dispersed housing of one-family houses prevails, frequently as dormitories that need the concentration of functions and upgrading in the sense of creating new job opportunities.

Densely built-up city within the circle created by the by-pass has possibilities of development by rehabilitating degraded areas («grey zones»), by renovating older urban areas and by improving the location pattern. Taking into consideration the sustainable aspects of the city development and the problems caused by the motor traffic in the inner city, the solution to this issue is to discharge the pressure on the centre by applying the decentralised settlement model. This model gives priority to the development of several urban subcentres or densely built-up settlements (providing housing, services, employment opportunities, recreation) that would function almost independently along public transport lines. In such a way, the dispersed suburban housing pattern of mainly detached one-family houses would become more densely built-up and improved by a better supply. The city would grow along densely built-up axes with centres linked with a rapid public transportation system. The green intermediary spaces would enable transversal communication between landscape elements and would preserve the integrity of urban units.

In designing new or upgraded communities, the existing construction should be taken into consideration as well as the existing central surfaces in the smaller suburban agglomerations. At the same time the dispersed built-up area in the suburbs should become more densely built-up. New or improved central surfaces would represent the central part of the development areas and settling around them should be designed as an autonomous unit within walking distances where functions are intermixed (shops, services, public use of space, housing, etc.) Within such a framework, new job programs would be feasible, as well as new residential areas.

The central backbone of such model is the public transport system. For its satisfactory functioning, an integral solution for the regional traffic system is urgently needed.

We have established three types of potential local centres “near the railway stations”:

- The A Type:
We have taken into consideration the existing larger settlements with central functions. Redevelopable and infill sites should develop underutilized parcels with new uses that allow them to function as walkable, mixed-use districts. New possible activities (community-serving retail, offices and business premises) will take place in the core area. They should be developed with higher commercial intensities, job clusters, and moderate to higher residential densities. The traffic infrastructure envisages a bus station and possibly a railway station, and a “park and ride site” that accommodates a larger parking place.
- The B Type:
The existing smaller settlements, local traffic interchanges. They should place more emphasis on moderate density residential, service, retail, entertainment, civic, and recreational uses. In the vicinity of a public transport station, there should be a “park and ride site”, accommodating a larger parking place.
- The C Type:
Centres at the edges of the city area. Mainly mixed-use districts with redevelopable and infill sites, that should transform underutilized parcels with new uses.

4 The planning concept in the corridors of the railway

In our research project about the planning concept in the corridors of the railway in Ljubljana region (Sasek Divjak, 2002), the problems emerging in the functional urban region of Ljubljana are analysed, in the first place, those that are concerned with suburbanisation in the corridors of the railway transportation. The corridors correspond to a shank-like way of settling in the shape of larger or smaller settlements with dispersed single-family housing in between.

Several studies were made to find a “best suited network for public transport” for the long term and to identify a first priority investment. The analyses were combined with the results of workshops with traffic planners, urban planners and politicians of the Ljubljana region. Better prospects of the implementation of railway improvement exist in the branch lines leading to the north (to Kamnik) and to the south (to Grosuplje). After analysing the costs of the investments into the railway and taking into account the technical and organisational aspects, the first priority line is towards Kamnik. That is the reason why this branch and the possibilities of concentrating settling in the nearer areas of the railway stations (10 min. walk) have been studied in detail. We have shown possibilities of the settlements growth taking into account two strategies: upgrading (reuse) of the existing urban areas (preferably in a short-term period) and adding new areas (according to long term needs). We have taken into consideration the present land-use and limitations about preservation and cultivation of agricultural land, forests, water sources and areas of overflows etc. The entire area is rich in natural and cultural heritage, which is under a special protection regime. Green areas will continue to play a significant role in planning which will aim at preserving both, the existing green as well as building new ones (also for recreational purposes).

4.1 Northern part of Ljubljana urban region - historical development and natural resources

In the railway corridor of the northern branch of Ljubljana region there are three important centres: Trzin, Domžale, and Kamnik. The line of settling runs from the city by-pass across the Sava River to Crnuce and Trzin where it splits into two parts: North towards Menges and East towards Domzale. Along the Kamniska Bistrica River, it continues to Kamnik, which is a historic town and has remained the local centre up to this day.

The southern part of the branch, the area is divided in two parts by railway and motorway. On the west side, the area is undulated, covered mainly by forests and partly urbanised. Flat land, markedly transformed by agricultural use (reclaimed forest land and regulated beds of brooks), extends to the east.

In the central part, near Domzale, natural and urban elements appear in the direction north – south. The fertile Menges Field extends along the railway to the west. To the east stretches a belt of urban areas on both riverbanks.

Kamnik lies in the northern part at the foothills of a mountainous region between the railway and the Kamniska Bistrica River. West of it is cultivated farmland, to the east extends hilly and mainly forested land. The basic feature of settling and traffic structure is a distinctive longitudinal organisation in the direction north - south following the flow of the river.

The area stretching to Domzale used to be an agrarian hinterland of Ljubljana in the past when it was settled by smaller villages. Besides farming, the area developed horse cart transport and straw-plaiting. At the end of the 19th century, the construction of the railroad had its impact on the industrialisation of the area, which flourished after the Second World War. It caused the re-

structuring of the population, de-agrarisation of the area and a rapid growth of the town of Domzale where flats for workers in larger industrial plants were built in the first place.

Later, in the sixties, manufacture and small industry witnessed great development, which also caused the re-structuring of existing farms. That period saw a great expansion of the central Domzale as well as southern part, which became interesting due to the capital's vicinity, the construction of the rapid motorway and its pleasant natural ambience. Favourable housing loans, cheaper building sites and lower construction costs in comparison with the central part of Ljubljana, had its influence as well. Sub-urbanisation movements became strong and caused the emergence of new urban units, such as the new settlement of Trzin.

Still today when the private incentive and the construction of smaller plants prevail, we witness marked sub-urbanisation movements. New suburban housing neighbourhoods emerge that are frequently combined with small business.

4.2 Potential possibilities for more dense built-up areas

Planned development is based upon the long-term plan, land use plan and its limitations, suitability of space, urbanisation needs and infrastructural networks, particularly regional rail line. However, land policy and suitable economic measures should enable a greater availability of land for building purposes on defined locations.

The results of the concept of public transportation study for the city and region of Ljubljana (TTK, 1999) show that the northern stretch is a priority for improvement. This is the reason why we have analysed the possibilities for urbanisation in this railway corridor (Figure 2).

We have been concerned with the width of the corridor along the railway that would be interesting in regard to urbanisation:

- 600 m on both sides as a possibility of shorter accessibility in 10-minute walking
- 800 m on both sides as a possibility of a longer accessibility in walking distance (serried orange line)
- 1000 m on both sides, easily accessible by bicycle.

The majority of the existing settling is already integrated into these limits.

The feasibility of a huge investment in such a railway infrastructure as is envisaged for the northern branch demands a parallel availability of new residential and other uses that represent a great deficit in the central region of Slovenia.

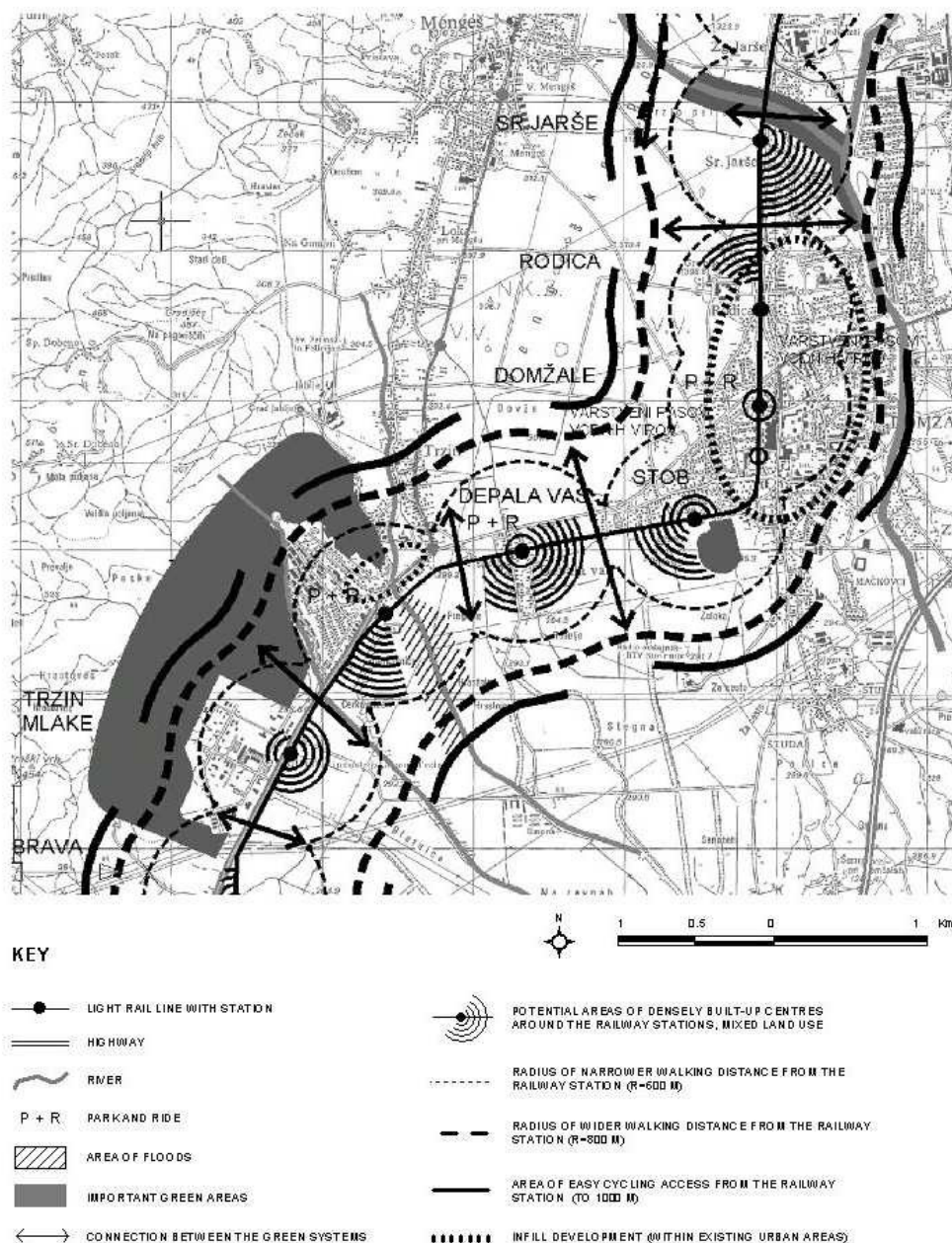


Figure 2: Potential possibilities for more dense built-up areas in northern part of Ljubljana region. Author: Mojca Sasek Divjak, UIRS. Source: Sasek Divjak 2004

For better accessibility we have added a few train stations and some of them were partly moved. In addition to construction of the second track and electrification of the line, it will be necessary to modernise and equip the stations (stops), especially those designed for P + R (park and ride). Possibilities for the addition of densely built-up settling are shown in concentric belts (by 50 m) around the railway stops. Each settlement certainly demands a detailed treatment. Usually a central part around the light rail stop comprises mixed land use: commercial and office space, service facilities, public programmes, common open space and various types of housing as low-rise residential (multi-apartment) units. It is followed by compact single-family housing (row,

atrium houses and closely packed single-family detached homes), recreational area and other programmes.

Concentration and restructuring of the urban fabric within the existing built up areas is envisaged for Domzale. It would be possible to reconstruct and reuse underutilised, degraded or abandoned industrial zones and transfer them into residential, business and commercial areas. The terrain along the Kamniska Bistrica River should become a green recreational area running continuously through the settlement. Domzale railway station should be moved slightly to the north (together with the bus station) to the area that offers possibilities for modernisation and accompanying programmes.

5. Conclusions

To avoid unbalanced, unhealthy and unsustainable growth of human settlements, it is necessary to promote land-use patterns (at the regional and sub-regional level) that minimise transport demands, save energy and protect open and green spaces. We propose two strategies:

- a) Development of the central built-up urban area of the city and its historical core;
- b) Decentralised settling model with densely built-up centres in suburbanised areas.

The improvements (due to new concentration centres) that would represent a more sustainable form of suburban and extra-urban settlements on the basis of rehabilitation and functional upgrading:

- Minimization of daily migrations in the region;
- Condensation of settling and better use of land;
- Better urban standard, upgrading of functions (central, manufacturing, recreational), which contributes to increased vitality and an enhanced quality of life;
- Develop mixed –use urban districts (with housing, workplaces and the necessary services) is one way to reduce the growth in the total volume of suburban areas;
- New job opportunities, more local work and activity;
- Better communal and other infrastructures;
- Promotion of sustainable modes of transportation (higher concentration of population / public transport - good quality mass transit system);
- More choice and diversity in the range of living accommodation.

It is important to integrate in the right way the old parts of settlement, especially villages. If these parts have their own character and identity they must be respected in future planning. Emphasis must be put on trying to preserve units or buildings that merit preservation.

Because of rapidly growing construction in the suburban space of Ljubljana, new circumstances will certainly occur when the public transport network is upgraded (the suburban railway in the first place). That is why local development plans should be adapted and upgraded in this sense. If they are not changed, those areas will be built up and there will be no possibility to create urban subcentres (close to the station).

The experience has shown that a public transport investment alone is not able to solve the mobility and environmental problems. At low carbon strategies we must take in consideration not only the public transport development but also an extended policy of urban planning, land use and environmental covering issues.

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