Facilitation of Sustainable Urban Structure through Adequate Transport System Planning – Example of Riga Northern Transport Corridor

Introduction

The idea of "Low carbon cities" may be viewed from different angles as it is a broad concept, but linking it to transport planning issues is one of the most common approaches. Current long-term Development Strategy of the City of Riga declares that "Riga should be a convenient and comfortable place to live in both developing into a safe, healthy and attractive seaport city as well as designing Riga's transport system to be safe and convenient for everyone".

This article aims to describe the challenges posed by the current road/street transport situation in Riga and to compare it with the solutions developed in similar cities with recognised urban planning policies. Future initiatives regarding the development of the arterial road and street network in Riga metropolitan region are reviewed with a focus on the largest single project – the Riga Northern Transport Corridor. These initiatives are expected to provide much sought relief in the environmental situation in the city centre, as well as significant transport and accessibility improvements in general.

Figure 1 - Congestion in historical centre of Riga.
Source: Pavils, 2007

In order to compare the development of arterial road and street system structure of Riga with that of urban centres with recognised urban planning policies there were selected two other cities, which in many respects are comparable to Riga.

Authors selected Amsterdam and Copenhagen – two cities of comparable size to Riga, both having important ports (Copenhagen – in past) and airports, similar structure of historical centres and urban areas surrounding them, similar climate and other geographical features. Moreover, both cities have internationally recognised policies in environmental protection and transport planning.

Using the possibilities of the open-source satellite imagery available on Internet ("Google Earth" program), there were identified and mapped all the stretches of dual carriageways in all three cities – Riga, Amsterdam and Copenhagen. In a case of Riga there was separately analysed the situation after the implementation of the actual arterial street development plans according to the Comprehensive Plan of Riga City 2006 - 2018. The example of dual carriageways was selected due to easy visual identification of such roads in satellite images and their critical role in provision of efficient citywide accessibility. Adequate coverage of dual carriageway serves as a good indicator of overall mobility in respective metropolitan region.

Using the obtained information, there was reviewed the adequacy of the future plans of Riga city regarding the development of new high capacity roads/streets and gained confidence that filling the gaps in the network of arterials in Riga will lead to more sustainable development of Riga city both in economical and environmental terms.

Actual Spatial Structure and Transport System of Riga

Riga is the capital city of Latvia and largest urban centre in the Baltic states. Its metropolitan region extends far across the administrative borders of city and includes most of Riga region, Jurmala City, parts of Ogre and Jelgava regions. The population number in Riga metropolitan region is approximately 1,14 million people. However, number of inhabitants inside Riga city is decreasing since the beginning of 90-ties. According to the data of the Central Statistical Bureau of Latvia the population number in Riga in the beginning of 2009 was 715 978 but in 2000 – 766 381. At the same time population number in Riga district is increasing (e.g. in the year 2000 there were 144 876 people living in Riga district but in the beginning of the year 2009 – already 173 770) (Central Statistical Bureau of Latvia, 2009). In practice we can see this process as the urban sprawl extending across the administrative borders of Riga city coupled with the overall decrease of population in Latvia.

The spatial structure of Riga is based on its natural features - the river Daugava (and water systems linked to it), dunes, forests and meadows – and human created or built-up areas (neighbourhoods) and roads - a complex system that has been developing for 800 years. In every period the cityscape has been forming at different social, economical and technological possibility conditions. Every period has brought its specific changes both creating new parts of the city and reshaping the existing ones. (Kublacovs, 2008)

According to the Comprehensive Plan of Riga City 2006-2018 the administrative area of the city of Riga is 304.05 km^2. More than 45% of the city area is covered by the natural areas (including waterways) but 10% is taken by the roads and streets. Residential area covers 26% of the land in Riga, and it is mostly concentrated in the central part of the city on either side of the railway ring that is located on both sides on the Daugava. Taking into account the entire area of Riga, population density is 2407 (inhab./km^2); taking into account just the land area – 2855 (inhab./km^2), but the average floor-space per 1 inhabitant in Riga is 23,4 m^2 (2005). (Kublacovs, 2008)

Geographically Riga city is located on low land and generally lies between 1 and 10 metres above the sea level. The city has developed around the Daugava river close to its mouth. The historical centre of the city is located on the right bank of the 400 – 800 metres wide Daugava river, but the contemporary city and its metropolitan region is split in approximately even halves divided by this river.

Development of Riga's built-up areas has been forming mainly in a way of circles or rings starting with the oldest – the small medieval core. Thus Riga city has been developing as a highly mono-centric metropolis. Patterns of a poly-centric city structure in Riga started to develop only in the beginning of the 20th century when the building areas began to grow outside the city's railway ring on the both sides of the Daugava. In such a way the former historical suburbs (e.g. Ciekurkalns, Sarkandaugava etc.) one by one were incorporated in the growing city structure. This tendency was especially intensive after the World War II, when all around the contemporary city centre – the Old Town, boulevards and the former suburbs – another one layer of cityscape was formed – the huge residential districts built during the Soviet era. Grava (1993) argues that Riga's "socialist city" is an almost continuous ring of thick band within the concentric pattern. More than a half of the total city population lives in these projects today. In terms of quantity of housing, this has been a tremendous

accomplishment. In terms of the quality of urban life, there is room for vast improvement. (Kublacovs, 2008)

Seawards from the historical centre on the both banks of the Daugava river there is located Riga port. In recent years the port is undergoing rapid development, and there have been set ambitious plans for further development of it. In 2008 there were served roughly 30 million tons of cargo. Port occupies large area in the northern part of the city, which has not been used intensively enough so far.

Riga airport is located 13 kilometres west from the centre. Over the last years airport has seen dramatic increase in its activities and in 2009 has gained dominating position in the Baltic market serving 60% of the total number of airline passengers in the Baltic states (LETA, 2009). In 2008 there were served 3,7 million passengers.

Throughout the turbulent history of the 20th century Riga has suffered heavily and nowadays it can be easily seen that regarding the development of transport infrastructure in Riga there is large room for improvement. The city has got fairly well developed system of public transport infrastructure, which includes wide network of tram, bus, trolleybus and railway lines. Investment programs for development of bicycle roads and modernisation of tram system are ongoing, there is planned modernisation of suburban railway system, development of park&ride system, and improvement of the entire public transport system and its efficiency is set as one of the main priorities. Driving with car in the medieval centre of the city is being discouraged since the middle of 1980ies.

Since the late 1960ies there was started development of a system of radially located dual carriageways leading towards the city. These roads turn into the city streets before reaching the centre of the city. A bypass around the city was built – a single lane road each direction 12 – 20 kilometres from the centre of the city. Major bottleneck in the street network of the city is Daugava river crossings. Until recent time there were only three bridges for motor vehicles across the Daugava in Riga, all located within the historical centre of the city and without proper network of access roads leading towards these bridges. Next available river crossing was located 15 kilometres outside the city centre. Some improvement in this dire situation is coming with the development of the Southern arterial – the Southern bridge was completed in the late 2008 and feeders to this bridge are under construction now.

Figure 2 - Congestion in the historical centre of Riga
Source: G.Pavils, 2007

As a result the daily life of Riga is characterised with constant congestion on the streets of the historical city centre.

Environmental drawbacks of the street network of Riga city are represented in map (Figure 3), which shows the unwanted consequences of motor vehicle traffic generated air pollution. This map shows that the highest levels of motor vehicle generated NO_2 air pollution are exactly in the centre of Riga city. Similar spatial dispersion of pollution in Riga is characteristic also for other nitrogen oxides, CO, benzene and particle pollution as well as noise pollution.

In the areas where medium annual concentration of NO_2 exceeds 40 µg/m^3 (the darkest colour on the map) there is needed action to avert adverse impact of pollution on human health. Measurements show that this threshold is exceeded daily in Riga centre from 10 AM to 20 PM and also in other areas of city. Similar thresholds are exceeded also for benzene, particles and low level ozone of photochemical origin.

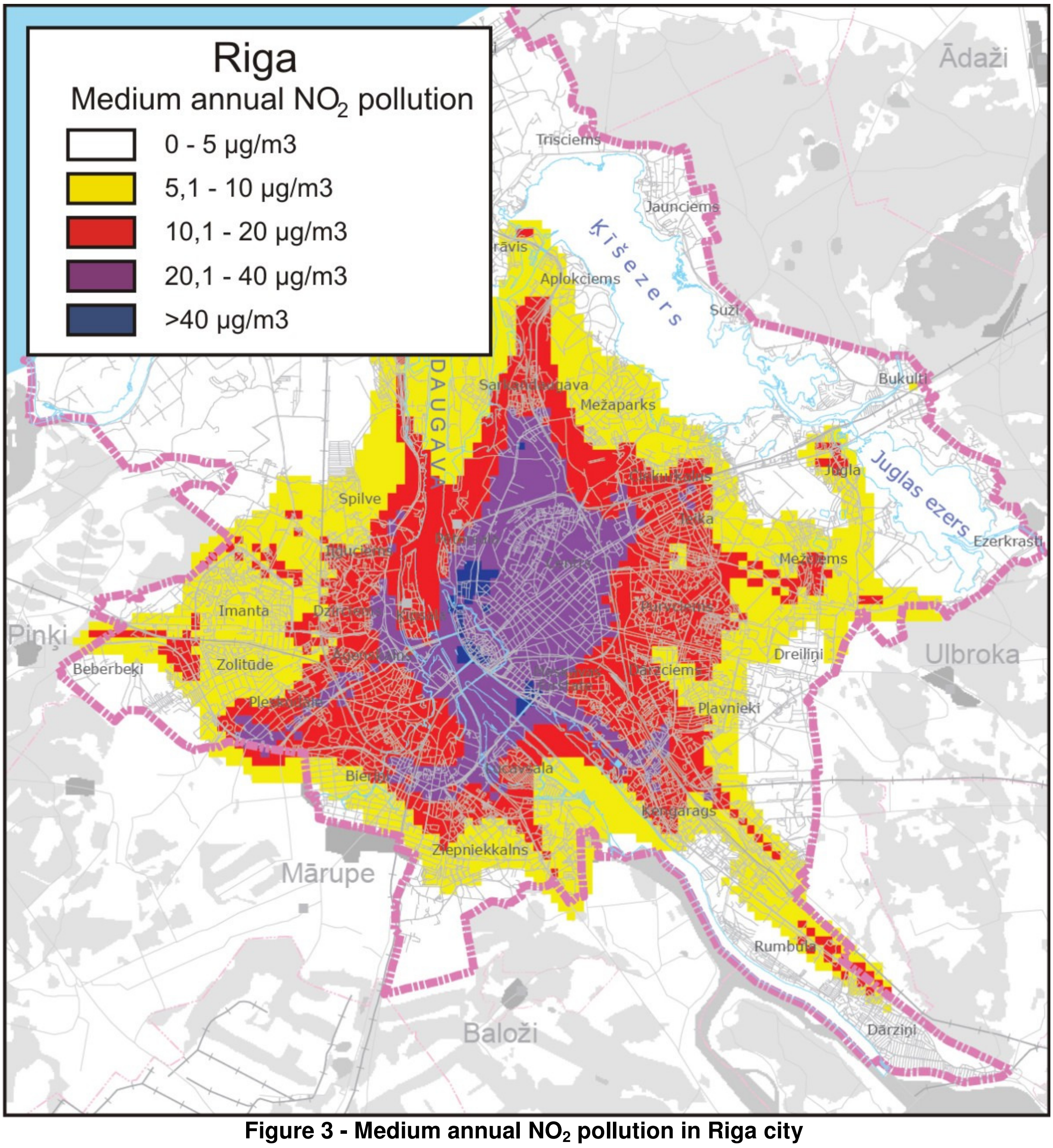

Figure 3 - Medium annual NO_2 pollution in Riga city
Source: Rīgas teritorijas ..., 2005

Contrary to the previous ones, current National Environmental Policy Plan (Nacionālais vides politikas plāns, 2003) does not list the most important environmental problems in Latvia. But as there are no other environmental hotspots in country with daily impact on human health and Riga centre is the area with the highest density of working places in country and high density of inhabitants, motor vehicle generated air pollution problem in Riga city centre can be considered to be one of the most important environmental problems in Latvia, leaving adverse impact on lives of hundreds of thousands of people.

Figure 3 serves also as a testimony of inefficient motor vehicle traffic with thousands of cars standing in congestions, constantly starting up and slowing down, waiting at red lights and circling around the city blocks in a search of parking places – all of this resulting in direct economical losses to citizens and city in general.

There could be named numerous shortcomings of transport system in Riga, which lead to these consequences. One of the main ones is lack of efficient system of arterial roads and streets both leading to the city centre (radial) and bypassing it (tangential), and the fragmented character of the entire street system.

Spatial Structure and Transport System of Amsterdam

Similar to Riga metropolitan population of Amsterdam is 1 million people, although this city is part of the larger Randstad conurbation having 6,7 million inhabitants. Geographically Amsterdam is located on low land (medium 2 metres above the sea level) and its development in many respects is centred around the large North Sea Canal (275 m wide) what also makes it similar to Riga. Another similarity to Riga is the large port district (Westpoort) located seawards from the city centre. The turnover in the Port of Amsterdam though is more than two times larger than in Riga (Port of Amsterdam, 2009). The airport of Amsterdam is located 9 km from the centre and is the fifth largest in Europe (47,4 million passengers in 2008) (Airports Council International, 2009).

Amsterdam in many respects can be considered to be a model city regarding transport policies. Interesting peculiarity of the city is the unique system of canals in the historical centre of the city, which is intensely used up to this day. The city is considered to be one of the most bicycle friendly cities in the world with well established, specific bicycle culture. Driving with car in the city centre is being discouraged and there is a very well developed system of public transport system, which includes wide network of tram, metro, bus, ferries, water taxis and railway.

City has been developing as a hub of national highway system since 1930ies (Autosnelwegen, 2009). The Netherlands and Amsterdam especially have experienced in full the complexities in developing a highway system, including rioting against the development of highway near the centre in Niewmarkt in 1975 and cancelling construction of highway to Rotterdam in order to conserve green space.

Roads and streets cover 8% of the area of Amsterdam, and generally the entire transport system may be considered as very developed. Just the fact that there are 254 bridges for traffic, from which 217 are the ordinary ones but 37 turning or lifting ones, supports such a statement. The city has both the inner and the outer ringroad thus ensuring good accessibility for every place in Amsterdam. (Projektu centrs, 2004)

Engineers in the Netherlands have mastered the art of construction of immersed tunnels under the numerous canals without substantial interruption in shipping activities and grounding the structures in watery, unstable sediments. As a result Amsterdam metropolitan

area nowadays has one of the densest networks of highways and this system is undergoing constant development.

Spatial Structure and Transport System of Copenhagen

Copenhagen is the dominating urban centre in Denmark. Metropolitan population of the Greater Copenhagen Area is 1,7 million people (VisitCopenhagen, 2009). Geographically Copenhagen is located on low land. Major part of the city is located on the large Zealand island but large part of the city is located also on Amager island where currently are ongoing the largest urban developments including development of Ørestad city. This can be compared with Riga, where the development of new centre is planned on the other side of Daugava, away from the historical centre.

Contrary to Riga and Amsterdam the port in Copenhagen is loosing its economical importance and it is developed mainly as a cruise ship destination. Historically port has been located close to the city centre and has left big influence on the urban structure of the city. Copengahen airport is the largest in Scandinavia (16th – 17th largest in Europe) (Airports Council International, 2009) and is located 8 kilometres south from the centre, on Amager island.

Copengahen has been recognised as one of the environmentally most friendly and most liveable cities in the world with strong environmental policies in many areas, including transport planning. It is one of the most bicycle friendly cities in the world, where 36% of citizens use bicycle in their daily trips (VisitCopenhagen, 2009). The well developed system of public transportation includes extensive systems of railway, buses and recently built metro. Should be stressed the major importance of railway system in Copenhagen metropolitan area, which to a large extent plays the role what metro and tram systems play in other cities.

Copenhagen city itself is only 88 km^2 large but its metropolitan area is much larger. This urban space is well known for its united and planned spatial structure - the finger plan. Respectively, the development of Copehagen city and its metropolitan area is happening mainly along the major transport corridors in 5 directions. Railway forms the backbone of these transport corridors. Thus the urban centres are ensured with very good accessibility conditions meanwhile preserving large natural areas between the developed urban corridors. (Projektu centrs, 2004)

Copenhagen has also a well developed network of arterial roads and streets, which includes both radial roads and bypasses around the city. Especially impressive is Oresund bridge&tunnel – a great achievement of engineering and construction, crossing the Oresund strait to Sweden. In spite of these achievements congestions are common on the roads of Copenhagen due to vast, spread-out urban area and bottlenecks at the ends of the sections of arterial roads.

Comparison of Dual Carriageway Systems

In order to compare the network of arterial roads and streets of three cities there were used opportunities offered by the program „Google Earth”. There were selected Areas of similar size were selected and all the road sections with clearly visible division between the opposite directions of road – e.g. dual carriageways – were measured. Although not all of these roads are highways and motorways, each such road can be considered to be a large capacity road. Total length of road sections in 10 km distance from the centre was measured for numeric comparison.

In a case of Riga there was measured the total length of the existing dual carriageways as well as the length of the future roads after the completion of the Riga Northern Transport Corridor project, the Eastern and the Southern arterials and some smaller schemes (in the Table 1 named – „Riga after investments").

Table 1 - Comparison of dual carriageway systems within 10 kilometres from the city centre, Riga, Amsterdam and Copenhagen

City	Length of dual carriageways, km	No of segments	Medium length of segment
Amsterdam	142	42	3,4
Copenhagen	120	58	2,1
Riga	77	28	2,8
Riga after investments	118	27	4,4

Source: Pavils, 2009 using Google Earth and Rīgas teritoriijas ..., 2005

Although the Table 1 shows serious difference in the total length of dual carriageways between Riga on one side and Copenhagen and Amsterdam on the other side, one can argue that city can have an efficient street system without dense network of dual carriageways. The key here is the difference in the planning (the spatial structure) of dual carriageways, what becomes obvious on maps (see Figures 3, 4 and 5).

Figure 4 - Dual carriageways in Amsterdam
Source: Pavils, 2009

The map of dual carriageways of Amsterdam metropolitan area shows that Amsterdam belongs to larger conurbation. There are visible independent arterial road and street systems of Haarlem (to the west from Amsterdam) and Almere (to the east from Amsterdam).

There is evident a full ringroad scheme rather close to the centre of Amsterdam and radial roads mostly terminating at this ringroad or close inside of it. One can suppose that inside of this ringroad the dominant role of transportation is taken by public transportation and bicycles (centre from the ringroad can be reached with bicycle in 15 – 20 minutes).

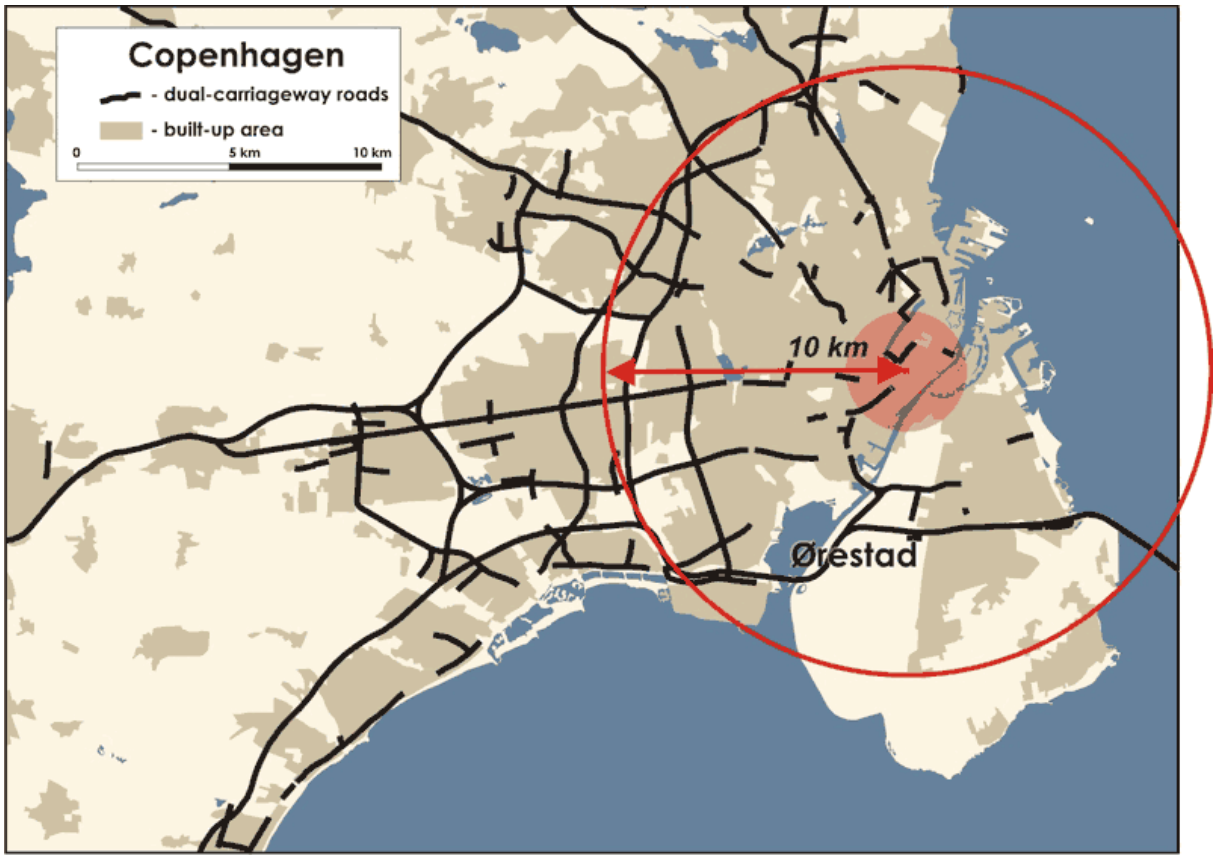

Figure 5 - Dual carriageways in Copenhagen
Source: Pavils, 2009

Copenhagen metropolitan area is monocentric, with expressed „fingers" of suburbs (developing according the so-called „five-finger" plan (Denmark – The Finger Plan, 2009)). Built-up area of Copenhagen covers larger area than in Riga or Amsterdam – here is more expressed the phenomenon of continuous urban sprawl consisting of detached houses. However, in practice much of larger and green corridors have been preserved.

Contrary to Amsterdam the highway rings – bypasses here are further away from the centre – approximately 8 – 12 kilometres from it. Radially located dual carriageways though lead closer to the centre, basically terminating in 4 – 6 kilometre distance from it. Easily visible is the remarkable location of the new centre – Ørestad city, located to the south from historical centre, on the western side of Amager island – it will be easily accessible from the arterial roads.

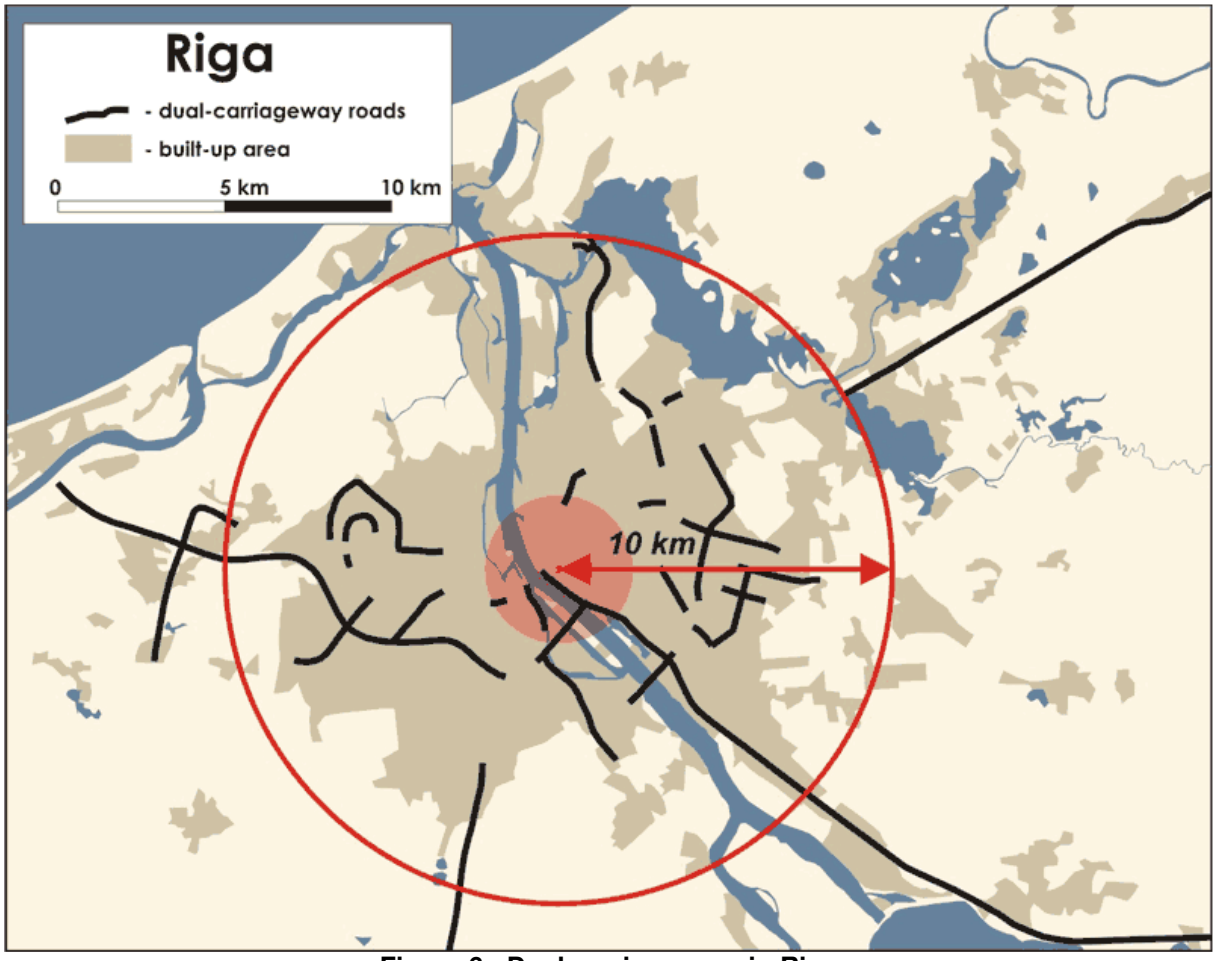

Figure 6 - Dual carriageways in Riga
Source: Pavils, 2009

As written earlier Riga metropolitan area is highly monocentric, with smaller satellite towns and dormitory areas around it.

It is clearly visible that contrary to Amsterdam and Copenhagen dual carriageways in Riga are represented with disconnected segments. Lack of comprehensive network of such roads is obvious in Riga. Thus dual carriageways here do not provide rapid, undisturbed access from one location of metropolitan area to another and motor vehicles here have to use roads and streets of lower category.

Riga Northern Transport Corridor Project and Other Road Development Initiatives in Riga City

Although the development of new highways in the eyes of general public may not be considered as an environmentally friendly act, the above-mentioned examples of Amsterdam and Copenhagen are illustrative – besides the highly developed public transport system that works jointly with park&ride system, bicycle roads and ever increasing limitations for motorised traffic, an economically viable and environmentally friendly (thus also liveable) city needs a well developed (it does not necessarily mean extensive) and versatile system of arterial road transport network.

Development of new highways in Riga metropolitan region is not aimed at increased motorisation. City planners in Riga have gained confidence that there is pronounced need to divert car traffic away from the city centre. In order to achieve this goal there is need to

develop a new network of arterials (see Figure 7) that would also decrease pollution level citywide and especially in densely populated areas, decrease delays and travel times, and will also decrease number of traffic accidents. Among other benefits this development finally will open a possibility for development of attractive and accessible open spaces along the Daugava waterfronts.

The largest project in the pipeline of road development projects in Riga is the **Riga Northern Transport Corridor** project. This project should result in convenient expressway crossing Riga from East to West and bypassing the historic centre of the city. The overall planned length of the road is 27 – 30 km and the road shall be integrated into the network of Riga's streets with 9 – 12 interchanges. Northern Corridor will include also a new Daugava Crossing. Due to planned tunnels and considerations of high bridge (53 metres above the Daugava river) this complex project is unique for Latvia and Baltic region.

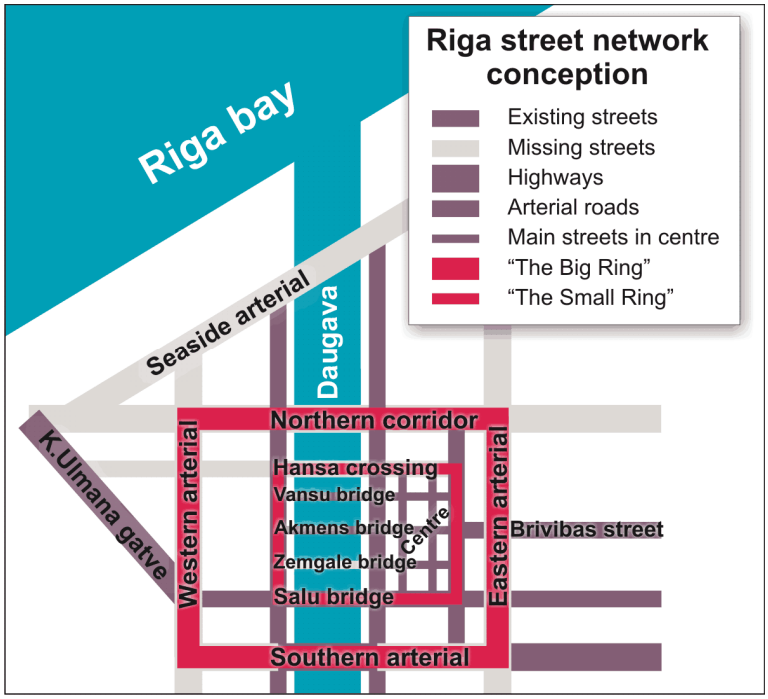

Figure 7. Riga street network conception
Source: Rīgas teritorijas…, 2005

Project was launched in December 2005 and there are ongoing draft design and environment impact assessment procedures as well as other activities to prepare it for further investments. According to current plans it is planned to start the construction in 2012 and to complete it in 2018 (Ziemeļu koridors, 2009).

Besides this project there are ongoing also other activities aiming at improvement of arterial roads in Riga metropolitan region.

An important project is the **Eastern arterial** which aims to develop a feeder for heavy traffic going from the eastern direction to Riga port. Currently lorries have to use the existing street network, impairing the development possibilities of Riga port and creating additional load on congested streets of Riga (even along the riverbank near the Old Town). This project is in active development stage and is developed gradually, by designing and building smaller sections of the future road.

Very important development is the **Southern arterial**, which connects to the Eastern arterial in the east. It aims at development of convenient arterial road south from the centre of the city. In November 2008 there was opened key element of this road – the Southern bridge, currently there is on-going construction of access roads on both banks of the Daugava river. Among other benefits this road will provide also an easier access for heavy traffic to the left bank of Riga port until the Northern Corridor gets built.

Outside Riga City borders there is planned ambitious development of **Riga ringroad**, turning it into dual carriageway expressroad in its entire length. There is planned also upgrading of **Via Baltica** (north-south axis) and the **state Eastern arterial** to double carriageway roads.

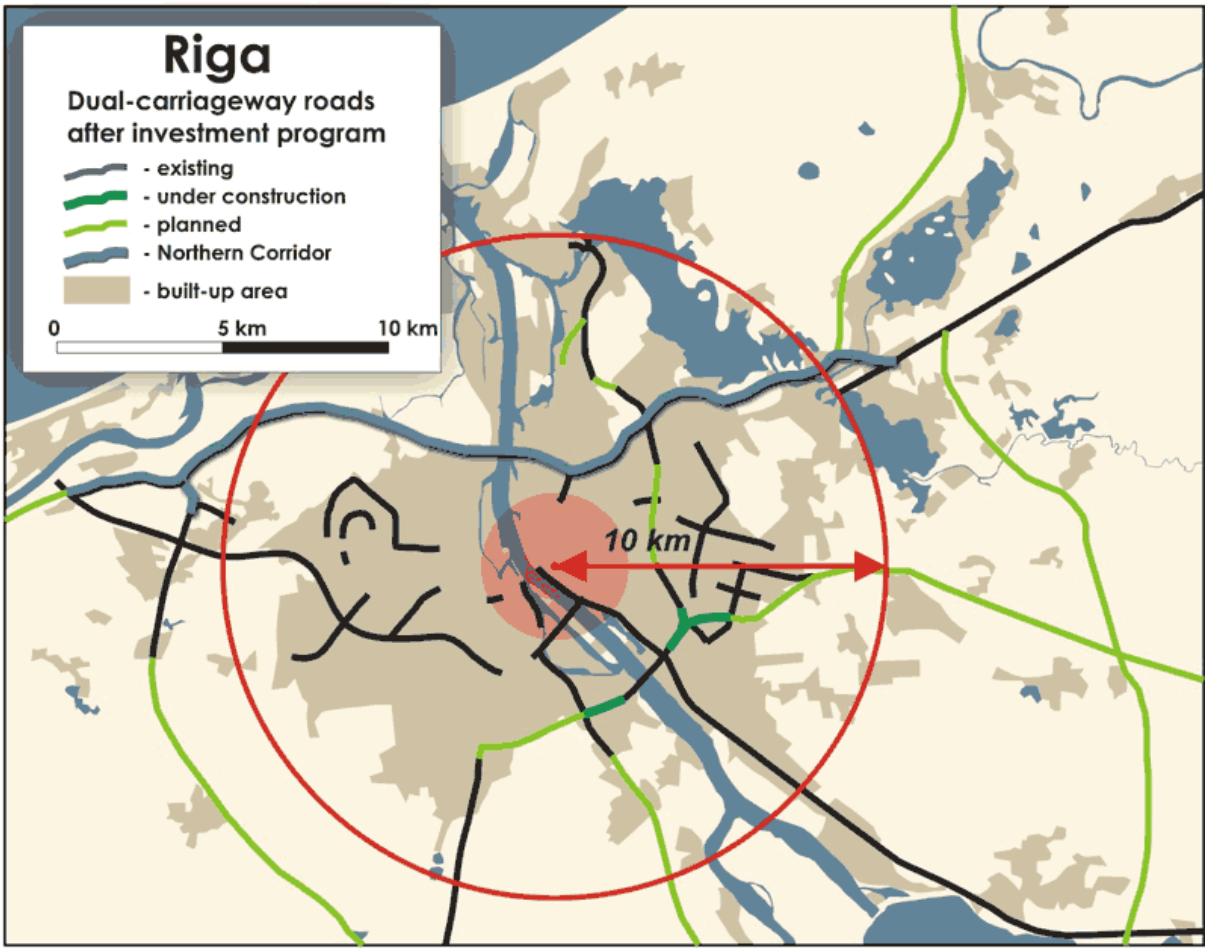

Figure 8 - Dual carriageway system in Riga after realisation of planned projects
Source: Pavils, 2009

It is expected that the development of the above mentioned schemes together with the developments of public transport system, park&ride and bicycle road system will lead to radical decrease of the motor vehicle generated air pollution load on densely inhabited centre of Riga.

Preliminary investigations show that the development of the Riga Northern Transport Corridor alone will lead to dramatic decrease of traffic load in the central area of Riga. There is planned 30 – 50% decrease of traffic flow on three bridges of the historical centre. Project leads to sharp decrease of travel time spent in Riga metropolitan region (in 2019-2041 saved 489 626 000 total vehicle hours) and – even if total number of vehicle kilometres increases due to improved road network, during the appraisal period of 23 years there are saved 325 million litres of fuel, resulting in Present Value of the reduction of emissions slightly more than 15 million EUR (Faber Maunsell, 2008).

Thus we can consider that in the current situation the development of new arterial roads is an adequate measure to improve the environmental situation in Riga metropolitan region and especially in the city centre. This measure will lead both to overall reduction of generated air pollution and increase of the economical viability, thus strengthening the liveability of Riga city and region in general. Planned investments will bring the density of dual carriageways in Riga to similar levels of present-day in Amsterdam and Copenhagen. The medium length of a segment of dual-carriageway within 10 kilometre distance from the city will increase from the current 2,8 kilometres to 4,4 kilometres, resulting in better connectivity and more efficient travel. Development of the ring of arterial roads will create basis (either with or without the congestion charge scheme) for further decrease of motor vehicle traffic in the centre of city.

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