TOD of Vilnius

Development of Vilnius public transport system and local centres to create walkable, transit oriented neighbourhoods

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Colophon

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Graduation thesis report
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Abbreviations

TOD - Transit Oriented Development
PT - Public Transport
NPTS - New public Transit System
SUMP - Sustainable Urban Mobility Plan
FSI - Floor Space Index
NIA - Net Internal Area
GFA - Gross Floor Area

Abstract

Urban mobility and car dependency represent major challenges for contemporary cities. In response, European policy frameworks advocate compact urban development, sustainable mobility, and the strengthening of public transport and walkable environments.

This thesis research the case of Vilnius city and examines two key components of the Vilnius City Master Plan: the planned New Public Transport System (NPTS) and the network of district centre zones designated around major public transport corridors. Although these initiatives do not explicitly refer to Transit-Oriented Development (TOD), the research argues that they are fundamentally transit-oriented ambitions that currently lack a sufficiently integrated implementation framework.

Drawing upon TOD theory, node-place theory, and walkability principles, the research adopts the premise that public transport and walkability are inherently interdependent, as every public transport trip begins and ends on foot. The analysis evaluates the hierarchy of planned transit investments, the planned intensity of district centre development, and the spatial conditions surrounding future transit corridors and nodes.

The findings suggest that future accessibility within Vilnius will be highly differentiated, while planned district centre development remains relatively uniform. In addition, in cities where development opportunities exceed market demand, urban growth is not a spatial threat, but a limited strategic resource for creating walkable environments around transit.

The thesis therefore proposes a strategic TOD framework that links urban development intensity and objectives to the hierarchy of future transit investments. It argues that TOD should not be applied as a universal densification-around-transit model. Instead, different transit nodes require different urban responses, ranging from intensive metropolitan centres to lower-intensity neighbourhood centres focused on local services and residential liveability. These principles are further explored through research-by-design proposals for two contrasting sites in Vilnius.

Although grounded in the context of Vilnius, the findings contribute to broader discussions on TOD implementation by demonstrating the importance of integrating transit hierarchy, node-place balance, walkability, and realistic development capacity when planning future transit-oriented urban environments.

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1

Introduction

Welcome! This chapter introduce you to the main topic of this thesis, location of the project, its relevance to the field of urbanism as well as the importance for the project location. At the end of the chapter I share my own personal motivation and aspirations for this project.

1.1 Research Focus
1.2 Relevance
1.3 Personal Motivation



Introduction

Contemporary cities face complex and interconnected mobility challenges. Historically, urbanisation was gradual and limited, but the widespread adoption of private cars in the 20th century coincided with an unprecedented acceleration of city growth. Over the past century, cities in Europe and beyond expanded rapidly, often in a low-density, car-oriented pattern, and at a certain point, for the first time in human history, more people began living in urban areas than in rural ones. These trends have fundamentally reshaped urban form, producing longer commuting distances, car-dependent neighbourhoods, and sprawling metropolitan regions, and creating persistent congestion, air pollution, and traffic-related health impacts. In response, cities are increasingly seeking to improve public transport accessibility and reliability, as well as to promote slow mobility modes, including walking and cycling, to reduce car dependency and improve quality of life.

At the EU level, strategic frameworks such as the European Urban Mobility Framework, the Sustainable and Smart Mobility Strategy, the Urban Agenda for the EU, the Covenant of Mayors for Climate and Energy, and the Green City Accord provide guidance and support for these efforts. Complementing these policy frameworks, the New European Bauhaus (NEB) initiative promotes a holistic, human-centred approach to urban design, emphasising liveability, spatial quality, and even beauty, and highlighting the importance of creating functional, comfortable, and attractive urban spaces that respond to contemporary mobility and urban form challenges.

Thesis topic

This thesis investigates the development of public transport infrastructure in Vilnius, Lithuania and its interaction with city development and spatial quality. The study focuses specifically on the New Public Transport System (NPTS) and development of local centres around it, proposed in the Vilnius City Master Plan *(Vilniaus Planas, 2021).* The goal of this thesis is to investigate the opportunities of these plans, the threats and issues these visions face and to create a coherent strategy for implementation.

As these planning proposals inherently rely on principles commonly associated with transit-oriented development (TOD), the research will implicitly engage with the TOD framework as an analytical lens. TOD can be described as land-use and transportation planning that focuses urban development around public transit stations, stops, and exchanges. By doing so, it maximizes the efficiency of existing public transit services, makes walking, cycling, and transit use convenient and desirable*(Thomas & Bertolini, 2017)*. A more detailed discussion of TOD as a concept and planning approach is therefore addressed in later chapters of the thesis.

-Thomas & Bertolini, 2017. p.140

Location

Vilnius is the capital of Lithuania and the largest city in the Baltic States, serving as the country's main political and economic centre. Together with its metropolitan region, it generates nearly half of Lithuania's GDP. Vilnius is relatively sparsely populated and spatially extensive compared to cities of similar size, a characteristic that strongly influences mobility demands and travel distances. Despite national trend of decreasing population in Lithuania, Vilnius region has experienced slow but steady population growth over recent decades. (Figure 1)

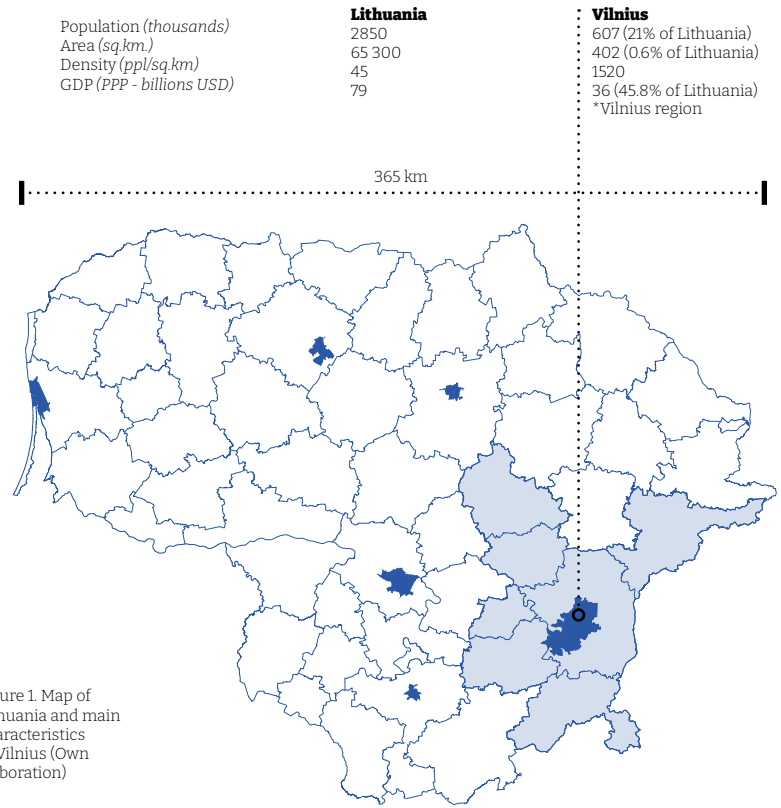


Figure 1. Map of Lithuania and main characteristics of Vilnius (Own elaboration)



Local relevance

Increasing traffic volumes over the last 30 years have significantly reduced the quality of urban environments in Vilnius - from noise and air pollution, to increased travel times, from overparked neighbourhoods, to car oriented new developments. Mobility related issues are one of the most popular public debates, heavily influencing the development trends, even political agendas.

This project aims to examine the real planning solutions set out in the currently valid and several-years-old Vilnius City Master Plan. Since these solutions are legally in force and directly influence how the city is developing today, this project is highly relevant. It seeks to explore in more detail the transport-oriented development strategies included in the plan, their feasibility, the challenges involved, and how these challenges could be avoided.

The new public transport system and the development planned around it are located in the most densely populated areas of Vilnius. Therefore, the quality of their implementation is crucial for a large number of residents.

On top of that, suburbanisation of Vilnius continues and car dependency remains structurally embedded, the city faces a critical question: what kind of urban living can it realistically offer as an alternative to suburban development? In this context, the New Public Transport System cannot be evaluated solely through passenger demand or modal split metrics. Instead, it must be understood as a strategic tool to structure development, consolidate market-driven growth along transit corridors, and improve everyday urban environments. Without integrating public transport with walkability, slow mobility, and spatial quality, the transformative potential of NPTS is likely to remain limited.

1.3 Personal Motivation

Personal aspirations

I chose to explore this topic because I am fascinated by how urban environments shape the way people move, particularly in relation to public transport. In my everyday life and during my travels, I enjoy observing how even ordinary streets become lively and engaging when they are animated by cyclists or trams passing through, how places are transformed by people walking to and from the stations.

These experiences inspire my personal aspiration: to understand and contribute to the creation of urban environments where mobility shapes how people experience and feel in the city, while at the same time recognising that the design of streets, public spaces, and transit nodes strongly influences how people move, interact, and inhabit these places.

Profesional focus

In the early stages of my professional career, I had the opportunity to contribute to Sustainable Urban Mobility Plans for several Lithuanian cities, followed by projects focused on street humanisation and public-space transformation. These experiences exposed the difficulty of reconciling mobility demands with the ambition to create high-quality urban environments. While they greatly expanded my understanding as an architect and urbanist, they also left me with a lingering sense of professional frustration: too often, mobility and urban development seemed to constrain one another rather than work together. This academic project offers an opportunity to step back and explore how these forces might instead become mutually reinforcing.

Take aways

- This thesis investigates the development of public transport infrastructure in Vilnius and its interaction with urban form and spatial quality.
- The study is grounded in the current Vilnius City Comprehensive Plan, examining its proposed measures for public transport and the development of district centres around public transit.
- The study is based on the TOD concept and aims to complement it with a holistic approach to creating walkable and attractive urban environments.

2

Problem description

This section introduces the problem area addressed by the project. To provide a comprehensive understanding of the issue, the first half of the chapter overviews the existing urban structure of Vilnius, the city's development and mobility trends that have emerged over recent decades, and the challenges these trends have posed for the public transport system and the urban environment along the main public transport corridors.

The second part of the chapter offers a detailed overview of existing city plans and the proposals outlined in the Vilnius City Master Plan concerning the development of district centres around the main public transport corridors, as well as the implementation of the new public transport system (NPTS). Key challenges and issues related to the feasibility and practical implementation of these solutions are also discussed.

The section concludes with a problem statement summarizing the main issues identified.

2.1 Development tendencies
2.2 Mobility tendencies
2.3 Planning agendas
2.4 Problem statement

2.1 Development tendencies

Vilnius urban environment

Despite numerous exceptions, the urban environment of the city of Vilnius can be divided into just three types: the city centre, modernist districts, and areas of single-family housing. These three types reflect the historical development of the city.

1. City centre - this consists of the Historic Old Town of Vilnius, a UNESCO World Heritage site, and the historic surroundings. These surroundings are now part of the present-day city centre and include residential housing, business districts, and major attraction sites. Together with the Old Town, they form an environment that, although diverse and varied in character, is relatively coherent as a central urban zone (Figure 2).

2. Modernist multi-apartment residential districts - these are mass-housing neighbourhoods built between 1960 and 1990, which, together with the city's natural framework, encircle the city centre and accommodate the majority of Vilnius residents. These districts were developed according to modernist free-planning principles: they are mono-functional, primarily residential in use, with evenly distributed social functions, an underdeveloped network of public spaces, an unclear structure of public and private spaces, and a tree-like street/cul-de-sac network (Figure 3). Unlike in Western European cities, in Vilnius the expansion of this type of district coincided both with the period of the city's most rapid growth and with the era of the Soviet planned economy, which resulted in the large scale of such environments.

3. Single-family housing areas. These are low-density areas of individual residential houses, located mainly on the outskirts of the city and beyond the city limits (Figure 4). They have largely developed over the past 30 years. These areas are characterized by very low population density, a lack of planning, uncoordinated individual construction practices, and insufficient or poor-quality public infrastructure - such as unpaved streets, a lack of public spaces and services, and inadequate street lighting, etc.



Figure 2. Google 3D view of Vilnius Oldtown. *Source: Google Earth.*

City centre

Built intensity (0.8-1.6)
Population density (50-150 ppl/ha)

Historic centre, block-based development, a dense street network, mixed uses, and a wide variety of services.



Figure 3. Google 3D view of Vilnius modernist districts. *Source: Google Earth.*

Modernist neighbourhoods

Built intensity (0.8-1.6)
Population density (100-300 ppl/ha)

Unformed public spaces, mono-functionality, and an unclear street network.
Advantage - a considerable amount of green spaces and a fairly good distribution of social functions.



Figure 4. Google 3D view of Vilnius suburbia. *Source: Google Earth.*

Low density suburbs

Built intensity (<0,4)
Population density (1-25 ppl/ha)

Extremely low population density, underdeveloped infrastructure, a large number of undeveloped and partially developed areas, and a lack of public spaces and services.

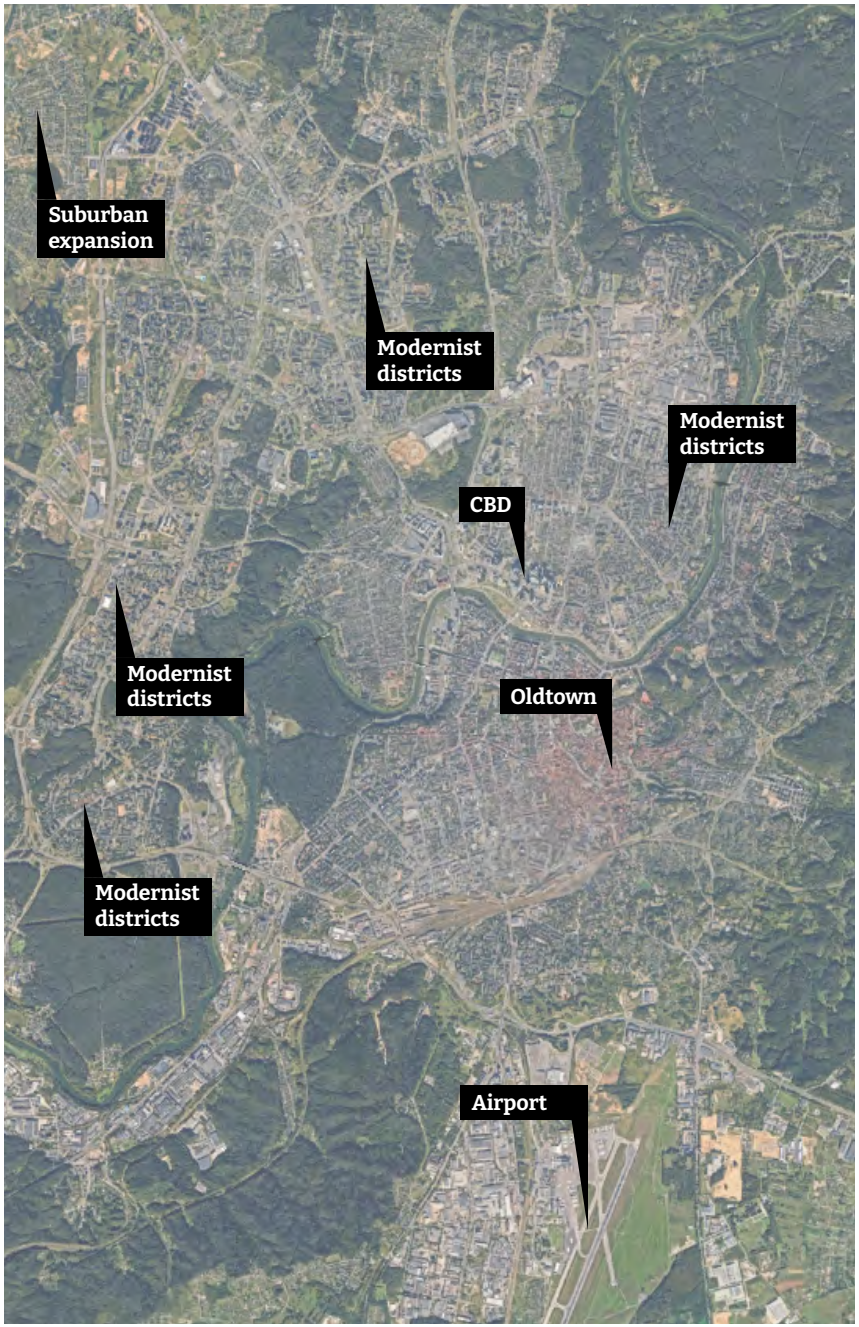


Fig 5. Vilnius setalite view. *Source: Google Earth*

Population density

These previously described characteristics of the city's urban morphological types naturally determine the distribution of residents within the city. Although Vilnius is approximately twice as large in area as capitals such as Amsterdam, Stockholm, and Copenhagen, it does not match these cities in terms of population size. The average population density of Vilnius is only about 15 people per hectare.

However, this does not mean that all residents of Vilnius live in very spacious conditions. A large part of the population lives in relatively densely urbanized areas, with densities ranging from 80 to 250 residents per hectare. These dense areas of Vilnius (the city centre and modernist residential districts) are located within a circle with a radius of only 6 km *(Figure 6)*. In addition, several other relatively dense districts are located further away from this radius. Within this 6-kilometer radius alone, 445,000 residents live, accounting for 73% of the total population of Vilnius. This zone also contains the main employment areas and other major centres of attraction.

Thus, the overall characteristic of low population density in the city is caused by the expansion of the city's administrative territory, which includes low-density built-up areas, large tracts of fields, and undeveloped land that do not end at the city boundary but continue into the suburban areas *(Figure 6)*. In these territories, population density does not exceed 15 residents per hectare. This is problematic, as such low density is not sufficient to support local services such as schools, shops, and reliable public transportation *(Curtis, Renne & Bertolini, 2009)*. Naturally, this also contributes to the dynamics of daily commuting flows to and from the city centre.

- Curtis, Renne, Bertolini. *Transit Oriented Development. Making It Happen*, 2009. p.245

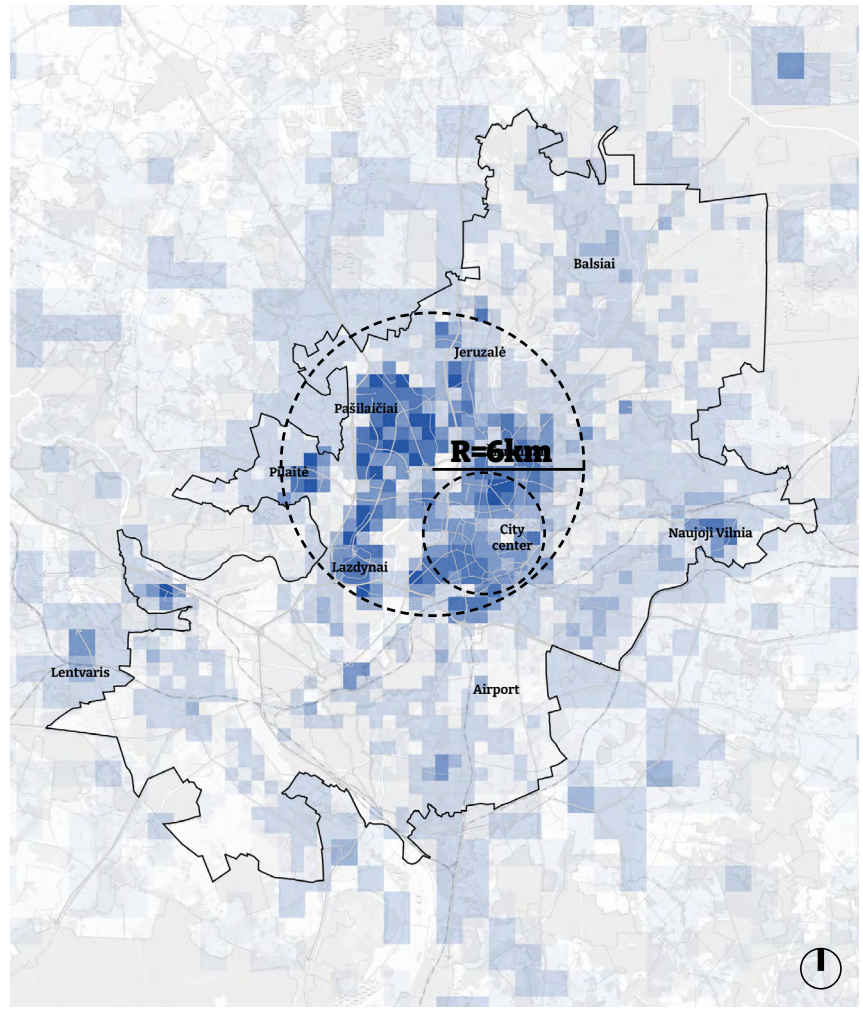


Figure 6. Distribution of residents in 2021. Own elaboration
Data source: www.osp.stat.gov.lt

Population tendencies

As mentioned earlier, these sparsely populated single-family residential areas, which extend beyond the city's administrative boundaries, have developed over the past 30 years, and this trend continues.

Unfortunately, the excessive urban growth potential defined in older planning documents - especially at the city's periphery -has predetermined the expansion of these extremely low-density districts for decades to come. New urban planning documents cannot easily halt this process due to the requirement to respect legitimate expectations *(MMAP, 2018)*.

Even under the most optimistic scenario, over the coming decades, one quarter of all newly constructed housing each year will consist of single-family and semi-detached houses in these sparsely populated areas *(Vilniaus Planas, 2021)*. This does not even account for additional growth in the suburban areas outside the city. Given that workplaces and services are concentrated in the central part of the city, the demand for mobility will continue to increase, while serving such low-density areas with public transport is difficult and inefficient.

At the same time, multi-apartment housing development has also taken place - both in the city centre and on the city's outskirts adjacent to modernist districts (Figure 7). However, the significant decline in population in the modernist districts (largely due to natural demographic change related to the age structure of these neighbourhoods) has prevented the central part of the city from increasing its population density. It can be estimated that over the past 20-30 years, the central part of the city has lost tens of thousands of potential residents who have relocated to more remote peripheral areas *(Figure 7)*. Thus, although the total population of the city has grown, and overall population density has increased, it can be argued that the city has sprawled.

- MMAP. *Recommendations for the detailed elaboration of the Vilnius City Master Plan solutions,* 2018. p.21

- Vilniaus Planas. *Vilnius City Master Plan: Planning Solutions and Explanatory Material.* 2021. p.10

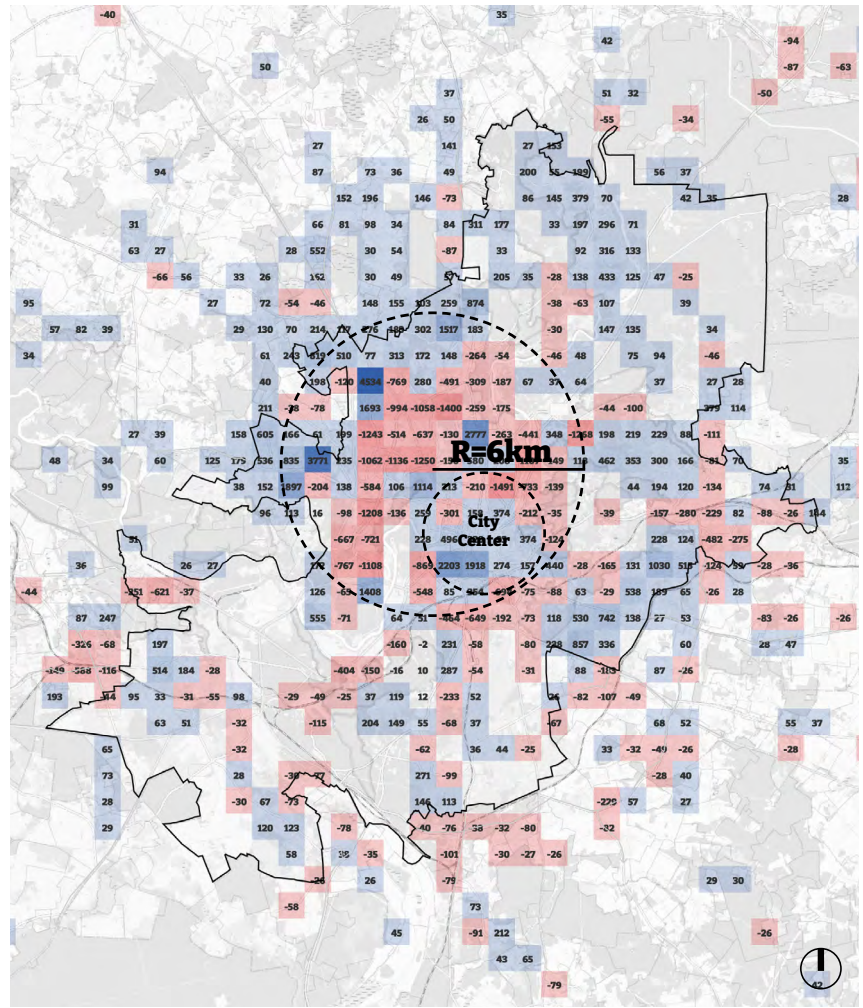


Figure 7. Population change 2011-2021 within 1x1 km grid. Own elaboration
Data source: www.osp.stat.gov.lt

Urban development

The development trends discussed above depict a typical picture of American-style suburbanization, where city centres become emptied and lifeless. Although this suburbanization narrative often dominates the discourse on Vilnius's urban development, it is not entirely accurate in Vilnius's case - the central part of the city (within a 6 km radius) has also been developing rapidly and continues to do so.

This happened because over the past 20-30 years, and still today, the driving force behind Vilnius's development has not been rapid demographic growth (which averages only about 1,500 residents per year), but rapid economic growth *(ID Vilnius, 2024).* Over the past 20 years, more than 1 million square meters of modern office space has been built in Vilnius, and this area has grown sixfold *(Figure 8)*. Warehouse space *(Figure 10)* and retail space *(Figure 11)* have also increased several times.

Slow population growth or even decline in densely populated areas did not mean stagnation - apartment buildings have been constructed in the city centre and around modernist districts, as well as in conversion zones near the centre. About 4,000 new apartments are built each year *(Figure 9)*. This is due to the fact that for many years, the living space per resident in Vilnius was relatively small compared to other European cities. Despite the relatively slow overall population growth, the rapidly growing economy and the demand for a better quality of life made the expansion of the housing stock necessary. Continued stable demand for residential development is also expected *(MMAP, 2018).*

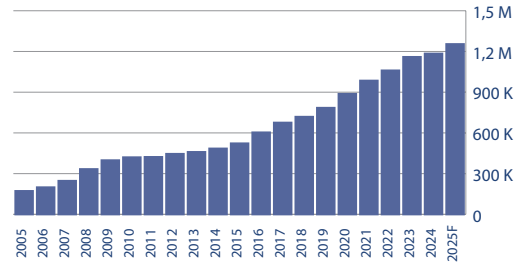


Figure 8. Total modern office stock in in Vilnius (sq.m) *Source: Ober-Haus (2025).*

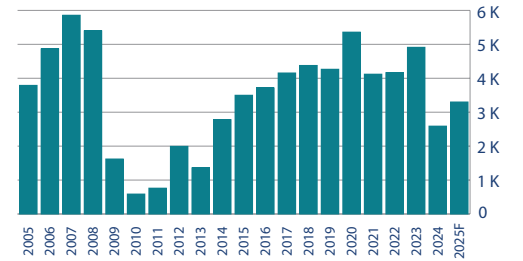


Figure 9. Completed apartment unites per year in Vilnius. *Source: Ober-Haus (2025).*

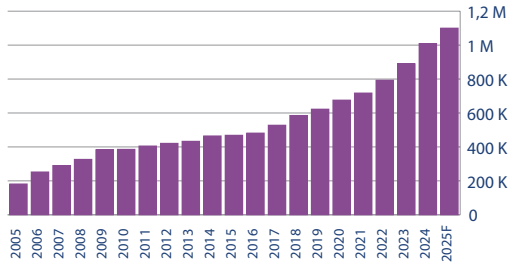


Figure 10. Total warehouse space in Vilnius (sq.m). *Source: Ober-Haus (2025).*

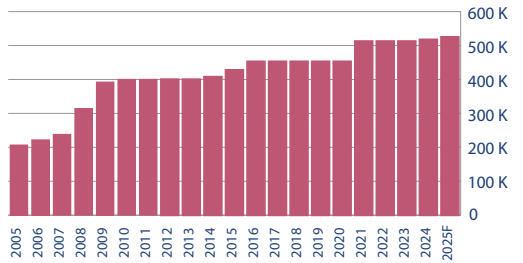


Figure 11. Shopping malls commercial space in Vilnius (sq.m). *Source: Ober-Haus (2025).*

Urban development examples in Vilnius

Below are satellite images showing how, despite the slow overall population growth and the ongoing suburbanization/ sprawl, the city still developed within the 6-kilometer radius urban core.



Figure 12. Setalite view of Paupys district in 2002.
Source: Google Earth.



Figure 13. Setalite view of Paupys district in 2023.
Source: Google Earth.



Figure 16. Setalite view of Vilnius CBD in 2002.
Source: Google Earth.

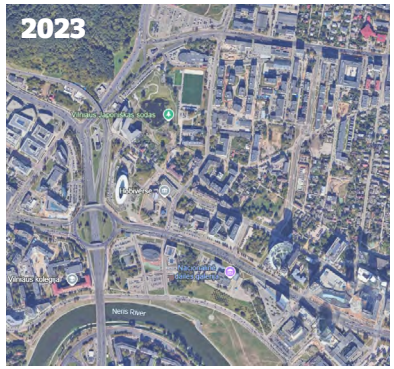


Figure 17. Setalite view of Vilnius CBD in 2023.
Source: Google Earth.



Figure 14. Bird-view of Paupys distirict.
Author: Didžgalvis A. (n.d).



Figure 15. Eye-level view of Paupys district.
Author: Tukaj N. (2023).



Figure 18. Bird-view picture of CBD distirict.
Author: Didžgalvis A. (n.d).



Figure 19. Bird-view of CBD distirict.
Source: Pilotas (2024)



Figure 20. Setallite view of Ozas district in 2002.
Source: Google Earth.



Figure 21. Setallite view of Ozas district in 2023.
Source: Google Earth.



Figure 22. Bird-view of Ozas distirict.
Source: Newhouse (2017).



Figure 23. Eye-level view of Ozas district.
Source: Google streetview (2024).



Figure 24. Setallite view of Pilaite district in 2002.
Source: Google Earth.



Figure 25. Setallite view of Pilaite district in 2023.
Source: Google Earth.



Figure 26. Bird-view picture of Pilaite distirict.
Source: Newhouse (2017).



Figure 27. Eye-level view of Pilaite district.
Source: Vilmesta (2025).



Figure 28. Setallite view of Perkunkiemis in 2002.
Source: Google Earth.



Figure 29. Setallite view of Pekunkiemis in 2023.
Source: Google Earth.



Figure 30. Bird-view picture of Perkunkiemis distirict. *Author: Gelūnas I. (2025). 15min.*



Figure 31. Eye-level picture of Perkunkiemis district.
Author: Pansevič K. (2018). Delfi.

Take aways

- The average population density in Vilnius is low, yet three-quarters of the population live within a relatively compact area.
- Vilnius is becoming more dispersed because the areas with fewer than 15 residents per hectare are expanding, while the densely inhabited areas are also developing more towards the outskirts. All of this leads to an increasing need for mobility.
- Although Vilnius's population is growing slowly and the growth potential is limited due to the country's overall demographics, the city continues to develop due to a growing economy and the demand for housing, offices, and other buildings.

2.2 Mobility tendencies

Increased motorization

Over the past several decades, motorisation in Vilnius has grown radically. In the last 3 decades, trips made by private vehicle grown form 10 percent to more than 50 percent of all trips made in a city. Meanwhile the use of public transport and walking decreased by half *(Figure 32)*. This was caused, first of all, by the growth of economy and the increased affordability of private vehicles.

However, the mobility behaviour survey, made in 2017 Sustainable Mobility Analysis Report, showed what could be predicted - motorization was also driven by urban development patterns, described previously. In the low density areas, people tend to travel by private vehicle more, than in densely populated districts. (Figure 33). More over, the growth of vehicles per 1000 residents increases faster in the region of Vilnius, than in the municipal area *(Statistics Lithuania, n.d.)*. All of this means that ongoing suburbanisation and suburban expansion will continue to influence travel behaviour.

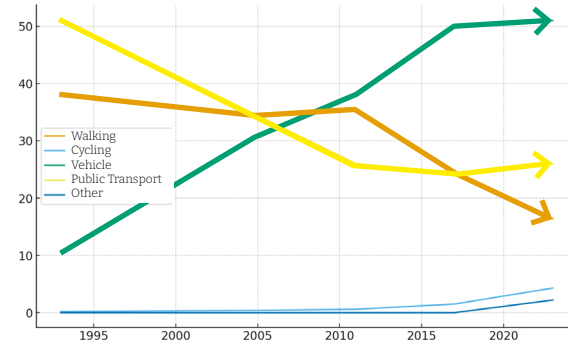


Fig 32. *Change in travel modal split in Vilnius. Source: JUDU, 2023.*

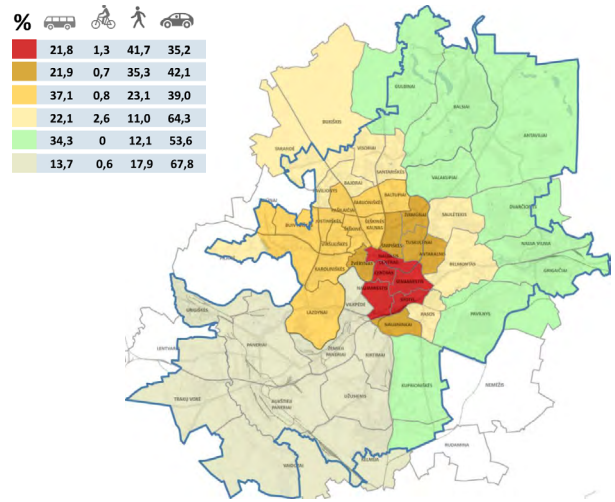


Fig 33. *Modal split share across different neighbourhoods of Vilnius in 2017. Source: Vilniaus Planas, 2018.*

Vilnius public transport system

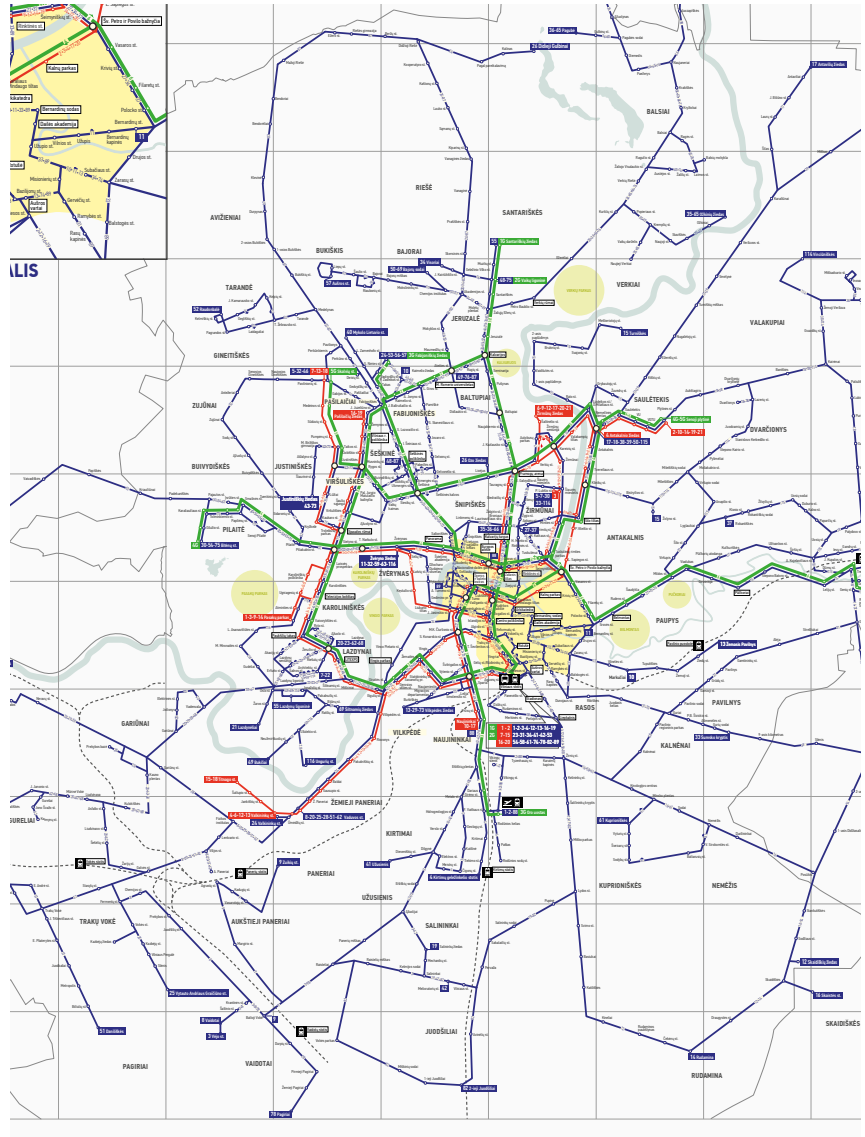
Vilnius is perhaps the only EU capital without a high-capacity public transport system (excluding the much smaller systems in Reykjavik and Ljubljana).

Vilnius's public transport system consists of trolleybus and bus routes. There are express bus routes along the most important, highest-demand corridors - bus routes that connects districts. On these routes, buses do not stop at every stop. There are six such routes in total *(Figure 34)*.

Over the past 30 years, while the city has grown economically and expanded outward, the public transport system has not changed significantly. Of course, the vehicles and stops have been drastically modernized, but these are perhaps the biggest changes.

Although the percentage share of trips made by public transport has decreased dramatically, the number of passengers transported has only decreased slightly. This indicates that the overall demand for mobility in the city has increased, strongly influenced by urban sprawl. This is also confirmed by the rapid growth in the number of kilometres travelled by public transport. *(Vilniaus Planas, 2017)*.

Figure 34 - Vilnius Public transport scheme (Source: JUDU,2021)



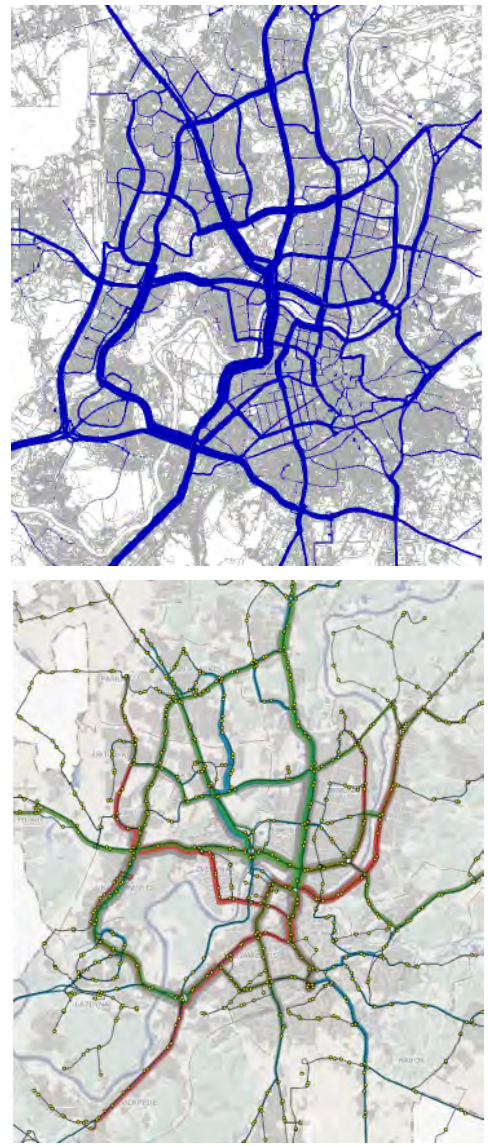
Public transport and walkability

However, a much more important change is not the quantitative change in public transport trips, but the qualitative one. The key aspect here is that in terms of infrastructure development, Vilnius's public transport system resembles not a system (for example, a BRT), but rather a transport service operating on the road network - because most routes run in mixed traffic with private cars on the streets, and the main routes are located on the busiest car roads *(Figure 35)*.

It is precisely this characteristic that makes the previously mentioned dramatic increase in car use have a huge impact on the quality of public transport. Motorization and economically driven, loosely regulated development have gradually created a car-oriented environment, especially along the main car transport arteries - wide, noisy, and polluted streets, large parking lots next to services, shopping centres, and gas stations. This environment is not only unattractive for public transport users but is also extremely unattractive for pedestrians - in other words, it is unwalkable (Speck, 2012).

Why is this important for public transport? Let's begin with the fact that almost all public transport trips start and end with walking. Therefore, to ensure the possibility of traveling in the city without a car, it is important to combine walking and public transport, because neither public transport nor walking alone is sufficient to meet the city's mobility needs in terms of speed, capacity, and flexibility *(Curtis, Renne & Bertolini, 2009)*. For this reason, the attractiveness and quality of public transport depend greatly on the pedestrian environment between the stop and the trip destination, and vice versa.

Figure 35 - Comparison of VIlnius traffic flows (upper) and public transport passengers flow (below) (Source: Vilniaus Planas, 2018)



Main public transport corridors environment

Below are satellite images illustrating the statements made earlier, showing what the environment and streets look like along the main bus routes in Vilnius - specifically the express bus lines.



Figure36. Ukmerges str.
Source: Google streetview (2024).



Majority of these environments around main public transport corridors were developed in the last 30 years, during the period of urban sprawl, motorization growth and economic development (urgency for commercial mall buildings).



Figure37. Ukmerges str.
Source: Google streetview (2024).

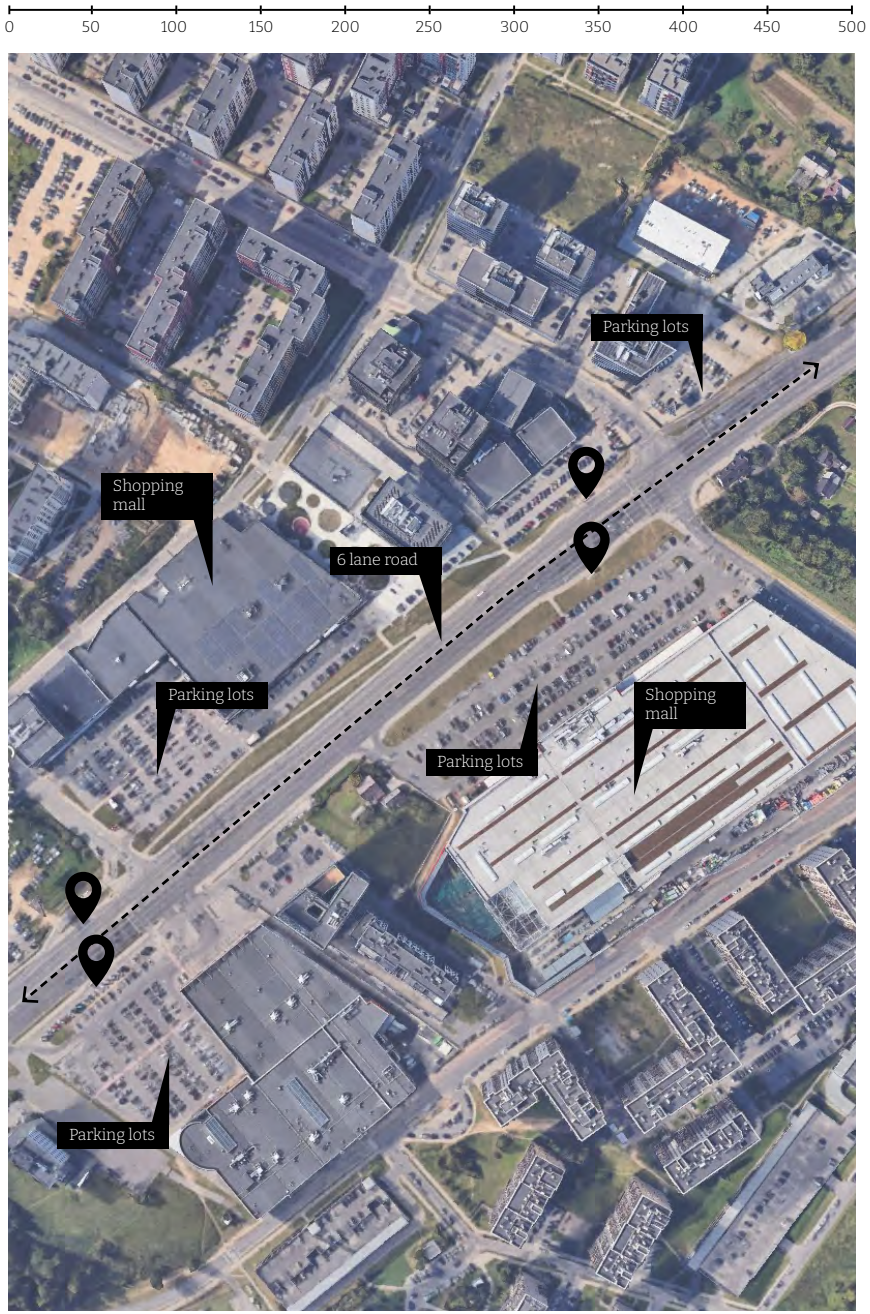




Figure38. Kareivių str.
Source: Google streetview (2024).





Figure39. Ukmerges str.
Source: Google streetview (2024).





Figure 40. Konstitucijos str.
Source: Google streetview (2024).





Figure 41. Pilaites str.
Source: Google streetview (2024).



Take aways

- Vilnius's public transport system is based on buses and trolleybuses. It is one of the few capitals without a high-capacity public transport system.
- The share of trips made by public transport and on foot in the total number of trips in the city has decreased significantly.
- Vilnius has experienced a huge mobility change - car use has increased several times.
- Vilnius's public transport system overlaps with the busiest car traffic streets. This has led to a decline in the quality of public transport, especially in terms of the attractiveness of the surrounding environment for pedestrians.

2.3 Planning agendas

Vilnius City Master Plan

The main planning document for the city of Vilnius - the Vilnius City Master Plan, openly acknowledges the problems of urban sprawl, uncoordinated development, and changing mobility patterns in the city *(Vilniaus Planas, 2021).*

As a response to these challenges, it proposes two essential conceptual solutions:

1. Compact city development - local centres. The city is planned to be divided into priority and non-priority zones. Priority zones include the urban core and areas closer to the centre where development potential should be utilized, within already built-up territories. The focus is on development around major public transport corridors (Figure 42).

2. Development of public transport - the development of a new type of public transport (NPTS).

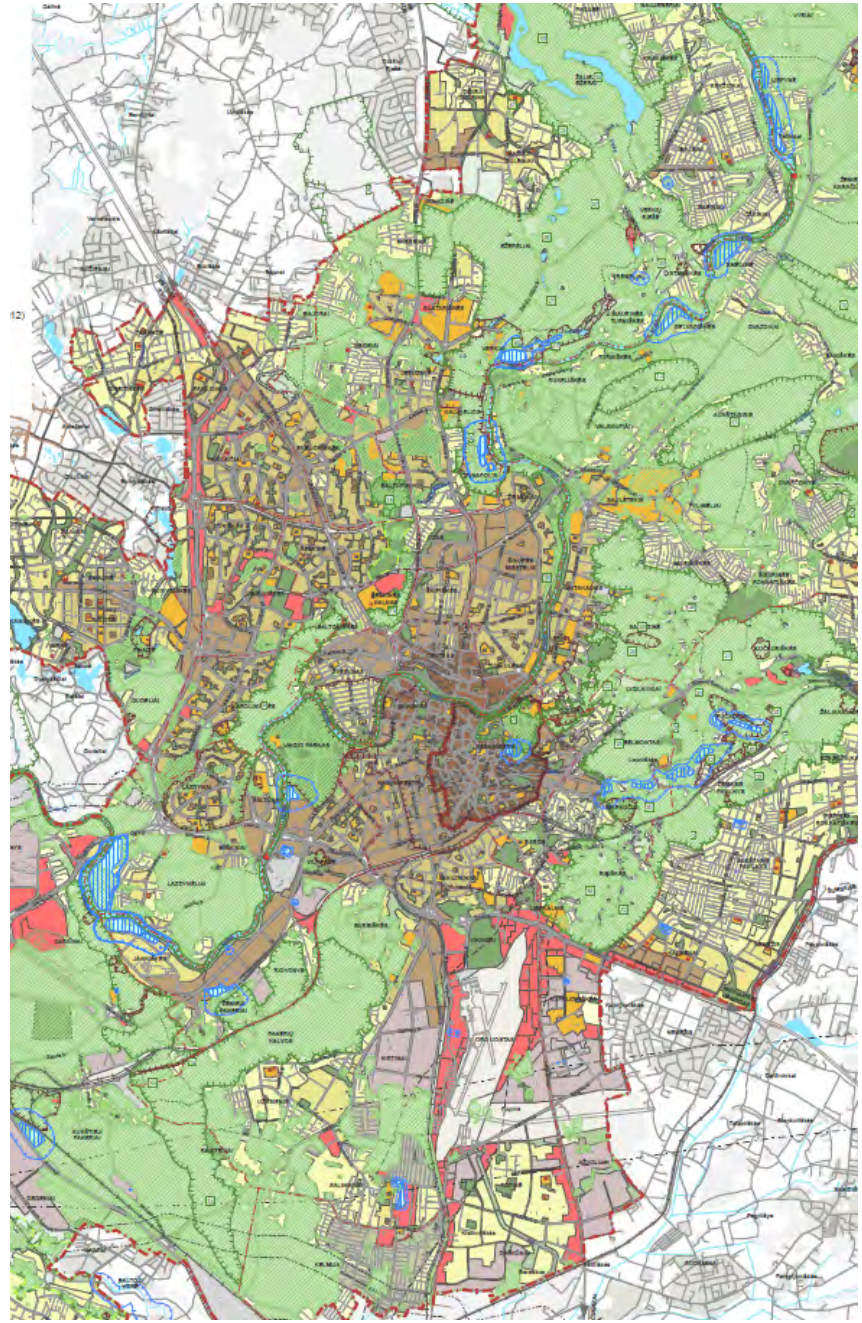


Figure 42 - Excerpt from main drawing of Vilnius City Master Plan. (Source: Vilniaus Planas, 2021)

Local Centres

The Vilnius City Master Plan aims for more compact development by dividing the city into priority and non-priority zones. However, this approach alone has not produced results, as it did not provide any enforcement mechanisms; therefore, development continues to occur in non-priority zones *(ID Vilnius, 2024)*.

The Master Plan also designates local centre zones within the city, mostly around the main public transport corridors *(Figure 42)*. The following development principles are proposed for these zones *(Vilniaus Planas, 2021)*:

-Mixed-use development (residential, commercial, administrative, and public functions)
-Higher building density and intensity (more compact and taller buildings than in residential zones)
-Active street life (ground floors encouraged for shops, services, and public facilities)
-Well-developed infrastructure (transport, utilities, and public spaces)
-Urban centre character (dynamic, attractive, and vibrant area)

This approach fundamentally aligns with the principles of Transit-Oriented Development (TOD) and is, in principle, welcome.

However, these proposals appear convincing only until the current status of these areas are not considered. As mentioned in previous chapters, a significant share of the existing public transport corridors coincides with some of the city's most heavily motorized arterial roads. Not coincidentally, the surrounding areas have developed into pedestrian-unfriendly, car-oriented environments characterized by suburban-type large shopping centres, extensive parking lots, noisy intersections, fuel stations, and car washes.

A reasonable question arises: is it possible to create high-quality, walkable neighborhood centres around one of the city's busiest streets, given the forecasted continued sprawl and the likely non-decreasing volume of car traffic?

NPTS

Essentially, similar feasibility questions arise regarding the plan to develop a new public transport system. The Vilnius City Master Plan proposes the introduction of a new public transport system along the routes of the existing main bus lines. The document does not specify the exact type of transport system, and the routes are indicated as preliminary, however as of 2026, it is likely considered to be a tram, lightrail or similar system.

Additionally, the Master Plan mentions the idea of converting sections of existing intercity train routes into city trains. These trains are proposed to be integrated with the city's public transport system *(Figure 43)*.

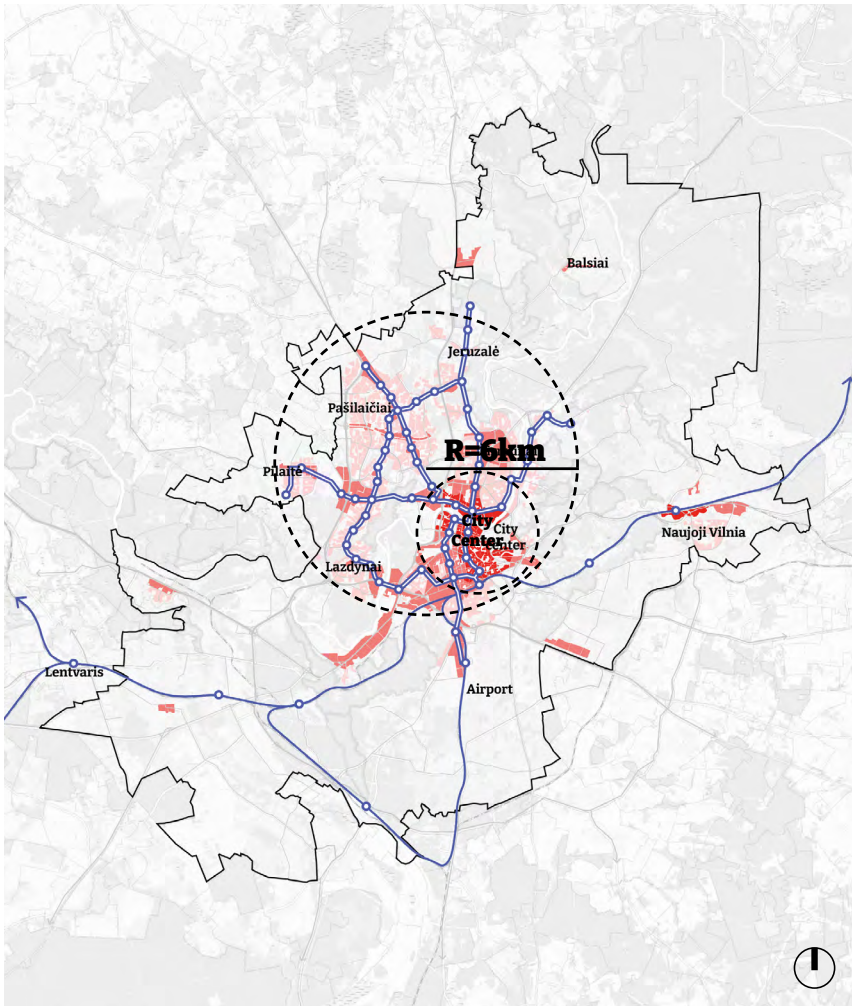


Figure 43 - Plan of NPTS and Local centers. Own elaboration. (Based on: Vilniaus Planas, 2021)

Missing gap

In summary, while the plans are not inherently flawed and, at a strategic level, align with TOD principles, they lack a more detailed, context-sensitive vision that would address implementation challenges and potential risks. A more thorough analysis of different zones is required, along with an assessment of feasibility, in order to develop a vision that ensures the public transport system and district centre development truly deliver high-quality, walkable, transit-oriented neighbourhoods and their centres.

The proposed high-capacity public transport system and district centre strategy affects neighbourhoods that differ greatly in spatial and functional terms. There is a lack of finer-grained analysis regarding how these measures can be implemented and what impacts they will have on different areas.

It remains unclear what development potential this plan actually has - specifically, what share of market-driven urban growth can realistically be absorbed by these transit-oriented areas. As previous lessons of Vilnius shows - inadequate development potential and unclear priorities can lead to unconsolidated, sparse development.

Take aways

- The Vilnius City Master Plan aims for more compact urban development.
- It envisions concentrated, mixed-use development of neighborhood centers around the main public transport corridors.
- A new public transport system (NPTS) is planned to be introduced along the existing main bus routes.
- A reasonable question arises: is it possible to create high-quality neighborhood centers around one of the city's busiest streets, given the forecasted continued sprawl and the likely non-decreasing volume of car traffic on the main city arteries?



Problem Statement

Let's summarize the problems and challenges discussed in this section in relation to the transit-oriented development of district centers envisaged in the Vilnius City Master Plan.

1. Non walkable environments. At present, a large share of the areas surrounding the main public transport corridors are not attractive for public transport use. Many of these areas lack the spatial, functional, and other qualities necessary to ensure walkability. In short, these areas can be described as non-walkable and therefore poorly suited to public transport use.

2. Traffic VS local centres. The main public transport corridors coincide with streets carrying heavy, high-volume through traffic. This creates unfavourable conditions for the development of district centres and poses major challenges in reconciling the need for a high-quality urban environment with the demands of transit automobile traffic. A significant natural reduction in car traffic is unlikely in the coming decades due to ongoing suburbanization trends.

3. Traffic VS NPTS. The planned NPTS routes overlap with existing public transport corridors. For the reasons outlined above, this may create challenges for the delivery of high-quality NPTS infrastructure. As public transport ridership increases, so will the risk that a growing number of people will be exposed daily to the negative impacts of motorization, traffic flows, and non-walkable environments.

4. Lack of vision. Although the goal of developing mixed-use district centres around public transport is fundamentally sound, there is a lack of a clear and targeted vision for how these solutions should be implemented. The planned NPTS and district-centre development framework covers very different types of urban areas - from a fully developed historic centre to post-industrial brownfield sites, from public-transport-served but monotonous housing estates to areas along railway corridors. To implement transit-oriented development in a high-quality manner, it is necessary to assess the specific character, strengths, and weaknesses of each area, its capacity to respond to market-driven development demand, the potential challenges involved, and the development aspects that should be prioritized according to local conditions.

3

Methodology

3.1 Research Question
3.2 Methodological Framework
3.3 Project Time-line

This section presents what this research project will consist of and the **methodology** by which the raised problem area will be examined.

In the first part of this section, the main **research question**, the related **sub-questions**, and the purpose of this study are introduced. The second part presents the **methodological framework** - the way how these research questions will be answered in later chapters. At the end of the section, the time-line for the completion of this project is presented.

3.1 Research Question

How should TOD principles be applied to development of Vilnius new public transport system (NPTS) and local centres in order to make neighbourhoods of Vilnius more vital and walkable?

Sub questions

In order to answer this research question, it is important to split it to several sub questions:

1. What are the key principles of Transit-Oriented Development and walkability ?
TOD principles
Walkability princiles?
How TOD and walkability concepts interact?
Purpose - practical framework for evaluating and designing walkable, transit oriented city, that will be used in this project.

2. How does the current city's development plans reflect TOD principles, and what implementation challenges does it face?

Purpose - Evaluation of existing development plans and their correlation with TOD principles

3. What strategic changes are needed in Vilnius' public transport and urban development planning to implement a Transit-Oriented Development?

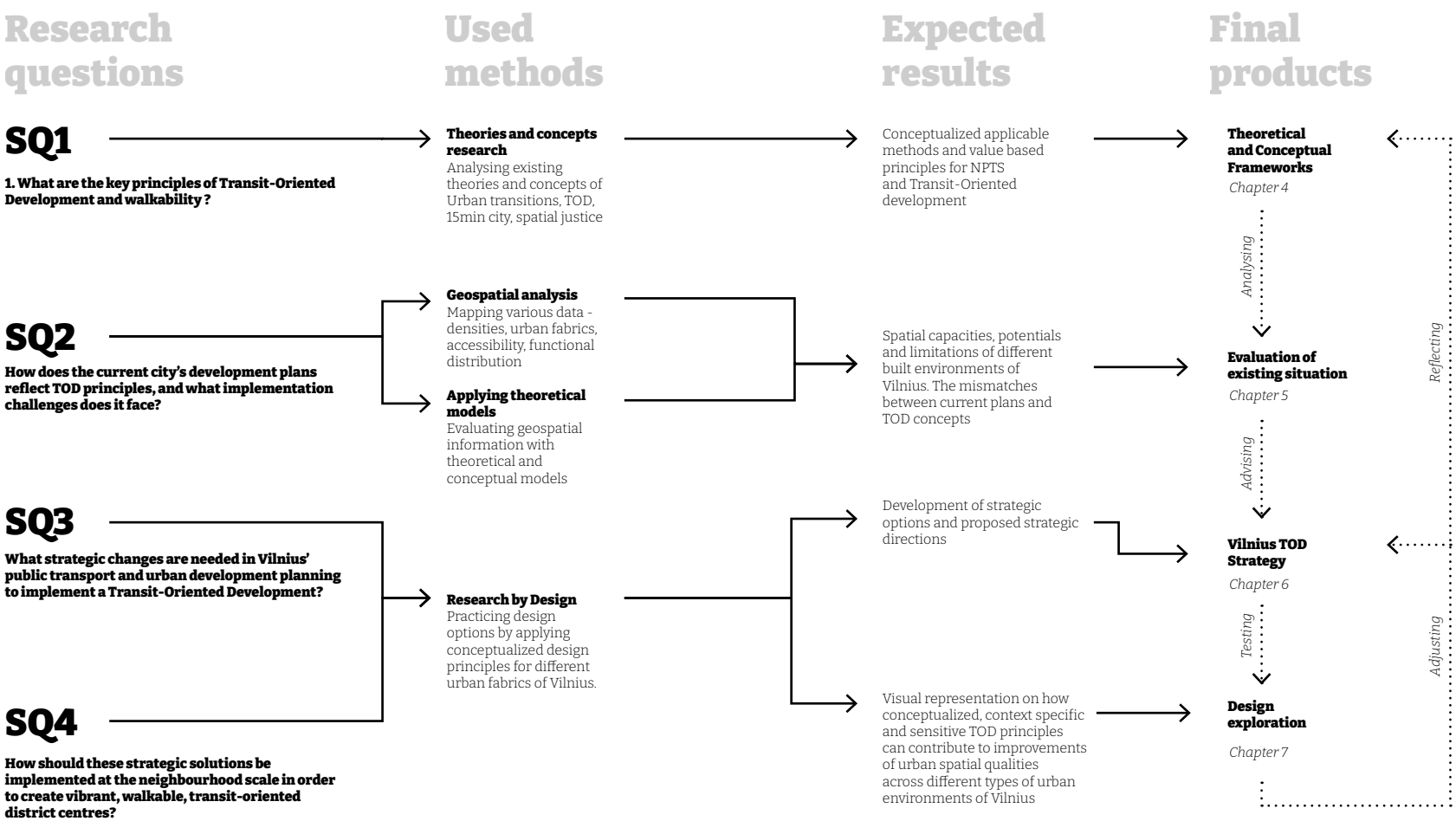
Purpose - Propose strategic, conceptual adjustments for existing development plans.

4. How should these strategic solutions be implemented at the neighbourhood scale in order to create vibrant, walkable, transit-oriented district centres?
Implementation proposals for 2 selected areas.
Purpose - Design test in neighbourhood scale, to evaluate TOD + walkability framework applicability/feasibility in different contexts. Inspiring vision, showing the transformative possibilities of the TOD + walkability framework and how implementation would influence the existing spaces.

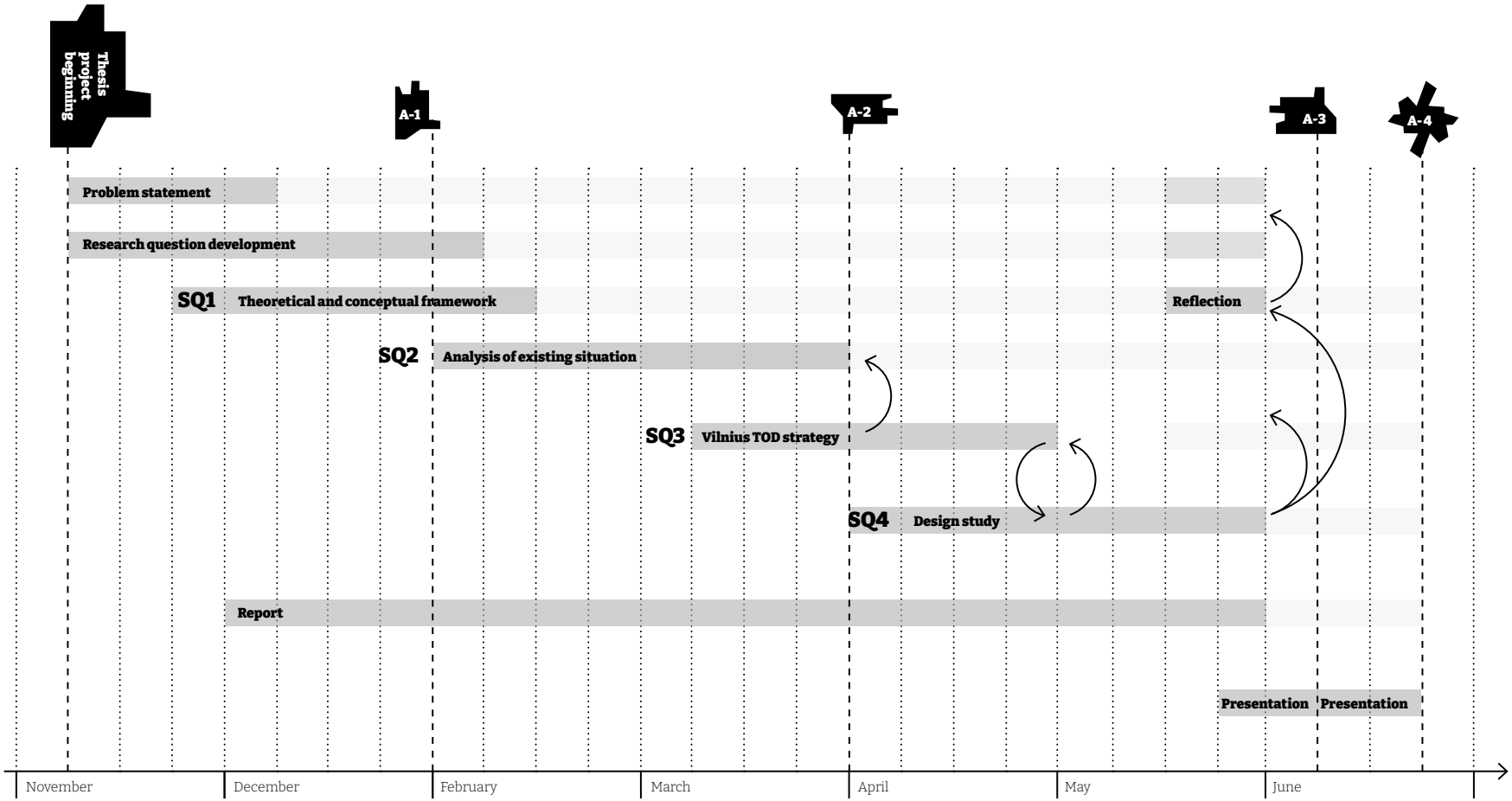
Purpose of the project

By answering these questions, the study aims to examine the feasibility of developing district centres in Vilnius around main public transport corridors. By analysing TOD and walkability concepts, evaluating the current situation in Vilnius based on the principles of these concepts, to propose strategic, city scale TOD implementation steps tested through a research-by-design approach at neighbourhood scale. The research seeks to addresses both Vilnius-specific challenges, but also reflect the broader, global interest for not only changing mobility patterns in cities by TOD, but by doing so - to create walkable, attractive everyday environments.

3.2 Methodological Framework



3.3 Project Timeline



4

4.1 Transit Oriented Development
4.2 Walkability
4.3 Conclusion - Conceptual framework

Conceptual framework

This chapter aims to answer the first part of research question: **What are the key principles of Transit-Oriented Development and Walkability ?** In order to do so, these two concepts will be overviewed in literature, the main ideas of these concepts highlighted and reflected upon the context of Vilnius case. At the end of the chapter - a concluding ideas on how these two concepts intertwine is described and a **conceptual framework**, that will guide the rest of the project is presented.

4.1 Transit Oriented Development

The definition of TOD

TOD is mostly known as a concept for American cities and towns, ar in most European cities planning documents is usually not mentioned. So is the case in Vilnius, however, the essential principles of TOD are not new and many cities were developing around train stations, trams, formed linear centers by development around transit for years before term TOD was conceptualized.

There are multiple definitions of what is TOD. The shortest and the most common would be that TOD is a land-use and transportation planning that focuses urban development around public transit stations, stops, and exchanges. While primarily it aims to increase the efficiency of public transport and the land, it also aims to make walking and cycling more desired *(Thomas & Bertolini, 2017).*

Why walking and cycling is important and how is it linked with public transport? The link between walking and public transport is rooted in the basic criteria of urban mobility and tension between spatial coverage (speed) and flexibility *(Curtis, Renne & Bertolini, 2009). While vehicle is fast and flexible, it lacks capacity, so it can not serve in densely populated areas , where space is short. However, neither public transport nor walking can alone replace a car. Walking is slow, and does not work in places, bigger than a village, however public transport is fixed - not flexible to go everywhere. But combining these two modes manage to substitute the vehicle (Figure 44).*

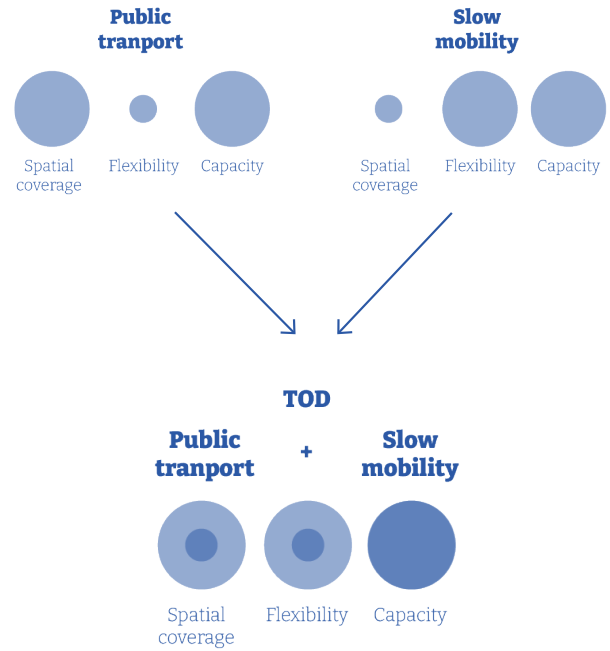


Figure 44 - Public transport and walking interaction. Own elaboration. (*Based on: Curtis, Renne & Bertolini, 2009.)*

Primary and secondary benefits of TOD

	Public Sector	Private Sector
Primart benefits	**1.** Increase ridership and farebox revenues **2.** Provide joint development opportunites **3.** Revitalize neighbourhoods **4.** Economic development	**5.** Increase land values, rents, and real-estate performance **6.**Increase affordable housing opportunities
Secondary/ collateral	**A.** Less traffic congestion and VMT related costs, like pollution and fuel consumption (1) **B.** Increase property- and sales-tax revenues (5) **C.** Reduce Sprawl/ conserve open space (1,3,6) **D.** Reduce road expenditures and other infrastructure outlays (1) **E.** Reduce crime (3,4) **F.** Increase social capital and public involvement (3,4)	**G.** Increase retail sales (1,2) **H.** Increase access to labour pools (A,6) **I.** Reduce parking costrs (C,2) **J.** Increase physical activity (C,E,F)

Transit Oriented Development. Making It Happen. p.242

Smart growth

Developing transit usually means unlocking new development potential, or a new area. While it works in cities that has a lack of space, in less dense cities, like Vilnius, it is important to prioritize inner growth first by revitalizing and filling empty gaps inside core urban area within existing neighbourhoods.

Smart growth prioritization from smartest to dumbest:
1. Urban revitalization
2. Urban infill
3. Urban extension
4. Suburban retrofit
5. Suburban extension
6. New neighbourhoods on existing infrastructure
7. New neighbourhood requiring new infrastructure
8. New neighbourhoods in environmentally sensitive areas

Duany, A., Speck, J. & Lydon, M. (2010)

Urban areas consists of only four elements:
1. Regional centres
2. Neighbourhoods
3. Districts
4. Corridors

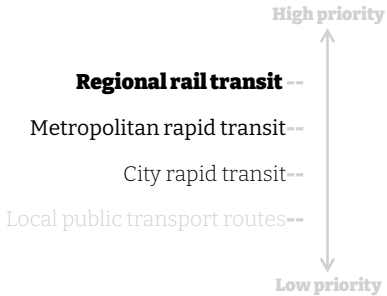
Duany, A., Speck, J. & Lydon, M. (2010)

The identification of these place types is essential to the understanding of an effective regional vision. Identifying this underlying structure enables effective land-use and transportation decisions. For example, roadways within neighbourhoods should rarely be widened, while those between neighbourhoods may be able to support additional traffic without damaging the quality of life of the proximate residents.

TOD principles

1 Transit system hierarchy

TOD is practical when taken into consideration at regional scale. Understanding the hierarchy in transport system at large scale, helps to set the development priorities accordingly.



2 Transit node hierarchy

However, the importance of node is not only determined by the mode of transit, but also by the amount of options you have in a particular node. This means that not all stations and stops are equally strong nodes even if they are on the same train or tram line. Transit nodes, that combines high intermodality - regional, national rails, various metropolitan rapid transit lines, or even park and ride locations are considered as the highest in the hierarchy of transit. While not all of the nodes on the regional transit network are strong nodes, if they are not intermodal with other modes of transit, or consists of low ride frequency. Thus, it is important to evaluate the hierarchy and strenght of the node individually in each case.

3 Node - place balance

However, a weak node, does not mean that it is a bad node. What is actually important for transit oriented development, is the balance between strength of node and a place. This is called The node - place model. A place in this case means the densities of functions, residents, activities, or in other words - the attractiveness of the area. Imbalance between node and place is either a strong node but no densities around, or a strong place, but weakly served by the transit - Unsustained node or unsustained place. The purpose to find a balance is a key guide in deciding where the urban development or transit development should happen in order to create transit oriented cities.

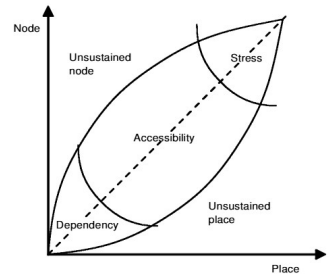


Figure 45. Node–Place model (Source: Bertolini, 1999).

FIGURE 1. The node–place model.

4 TOD framework

More recent practical TOD concepts advises many qualitative measures for transit oriented development. For example TOD framework made by Institute of Transportation and Development Policy suggests urban design scale approaches, that are more associated with other urban design concepts, such as walkable city concept. In the TOD framework these are the main TOD evaluation criteria for development: 1. Create pedestrian-friendly environments 2. Support cycling as a key transport mode 3. Create a well-connected street network 4. Prioritize high-quality public transport 5. Promote mixed land use 6. Increase urban density near transit 7. Limit urban sprawl 8. Reduce car dependency

In this thesis, the guiding concept at neighbourhood scale will be Walkable city concept, as it overlaps with TOD framework, but also includes more holistic approach in creating urban environments.

4.2 Walkability

What is walkability?

Walkability is commonly understood not merely as the presence of sidewalks, but as a comprehensive urban condition that enables walking to become a natural, comfortable, and attractive mode of everyday mobility. Conceptually, the environment can be perceived as walkable if it meets four fundamental requirements: walking must be useful, safe, comfortable, and interesting *(Speck, 2012)*. If any of these conditions is missing, walking is unlikely to be chosen over other modes of transport.

While walkability pillars, suggested by Jeff Speck, represents the clarity of the concept, the more practical aspects of what makes places useful, safe, interesting and comfortable seems harder to define. Jeff Speck in his book "Walkable City" suggests ten steps of Walkability *(Speck, 2012)*:
1. Put the car in its place
2. MIx the uses
3. Get the parking right
4. Let transit work
5. Protect the pedestrian
6. Welcome bikes
7. Shape the space
8. Plant trees
9. Make friendly and unique places
10. Pick winners

However, the attempt to define walkability through ten steps may be better understood as an effort to develop a measurable tool. Rather than constituting a finite set of criteria, the framework highlights the complexity of the concept itself.

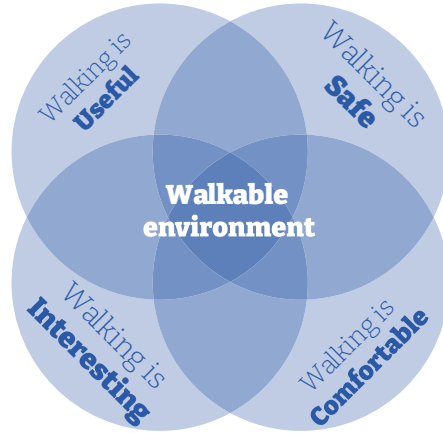


Figure 46. Walkability pillars (Own elaboration, based on Speck,2012).

A similar perspective can be found in David Sim's Soft City concept. While Sim does not explicitly frame his work through the lens of walkability, many of the design principles he advocates address themes commonly associated with walkable environments, including mixed land uses, building typologies, active ground floors, spatial diversity, human-scale urban form, and the overall quality and attractiveness of public space *(Sim, 2019)*. Unlike walkability frameworks that seek to define measurable indicators and performance criteria, Soft City focuses on practical urban design interventions and spatial qualities that can be applied by urban planners, architects, and designers - blocks, street, dimensions, entrance, square, facade, typology, etc. These elements should not be understood as direct tools for measuring walkability, but rather as design mechanisms through which walkability-related objectives can be achieved. In this sense, the arguments underpinning Soft City are largely aligned with those of walkability theory: both emphasise proximity, diversity, comfort, and the creation of environments that support everyday pedestrian life. Soft City therefore complements walkability theory by translating broader conceptual principles into tangible urban design strategies.

Measuring walkability

While walkability pillars conceptualizes the principle requirements for walkable environments, neither 10 walkability steps nor soft city concept - fully provide a measurable tools, that can be applied in different contexts.

This suggests that not all aspects of walkability can be acchieved by measurable actions. Different reseach argues, that walkability consists of both quantifiable and less tangible dimensions *(Saelens, 2008)*. Built environment characteristics such as density, land-use mix, destination accessibility and street connectivity demonstrate the strongest and most consistent associations with utilitarian walking and can therefore be relatively easily translated into planning indicators. However, the literature also highlights the importance of factors such as perceived safety, environmental quality, aesthetics, spatial character and pedestrian experience, which are more difficult to quantify but nevertheless influence walking behaviour, particularly recreational walking *(Saelens, 2008)*.

Walkability concept in this thesis

This distinction suggests that walkability should not be understood solely as a measurable performance metric. Rather, it should be approached as a broader urban design concept that combines objectively measurable spatial conditions with more qualitative experiential attributes.

Consequently, this thesis adopts walkability primarily as a conceptual framework, informed by Speck's four pillars. This approach allows for a broader exploration of the specific contexts of Vilnius while remaining guided by the fundamental principles of walkability.

Recognising that the practical application of walkability must remain sensitive to the unique context and character of individual places, this research does not seek to establish a definitive set of walkability design measures, but to compliment transit oriented development with a design exploration on how to create walkability within places that are unequally served by transit system, have different functional diversity and density.

4.3 Conceptual Framework

Interaction between walkability and TOD

This research is based on the premise that walkability and Transit-Oriented Development are mutually dependent. Walkability cannot function effectively without a transit-oriented urban structure, while TOD fails without walkable environments that enable people to comfortably access and use public transport. Therefore, TOD and walkability are understood not as parallel concepts, but as interconnected components of a single urban system.

In this thesis, Transit-Oriented Development defines where urban intensity concentrates at the city scale, while walkability determines whether people can comfortably move within transit areas at the neighbourhood scale; both are assessed in terms of present conditions and future potential.

Conceptual Framework

To conclude, both concepts - TOD and walkability are interrelated. This interrelation is rooted in the essence of public transport and pedestrian dependency in urban mobility *(1 and 2 in figure 47)*

There are two existing subjects that the **concept of TOD** guides: **Public transport development** (3) and **Urban development** (4). However TOD concept guides these forces in larger scale, through **city/region planning**, landuse, and development allocation.

Wlakability concept helps to navigate **transit and urban development** in **neighbourhood scale**. This way, walkability concept helps to inform urban development, in order to create a good **place**, while TOD concept more helps in creating good **nodes.**

TOD
City scale or regional scale. Helps answering where to allocate transit development and urban development.

Walkability
Neighbourhood scale. Helps answering how transit and urban development needs to be designed to make transit nodes as good places, and neighbourhoods - vital and walkable.

Objectives:
Public transport development
Urban development

Guiding concepts:
Transit oriented development (TOD)
Walkability

Scale
Impact

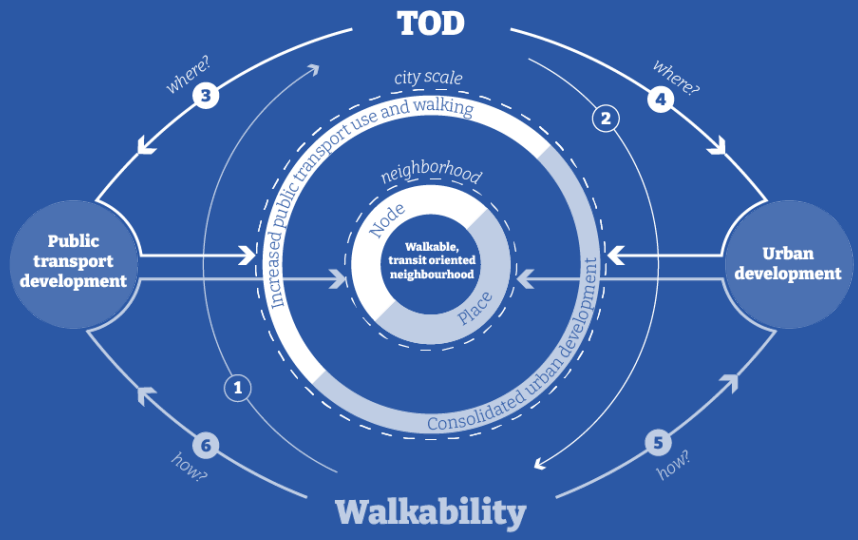


Figure 47. Conceptual framework - TOD and walkability application to the project (Own elaboration)

5

5.1 Transit System analysis
5.2 Urban development analysis
5.3 Node Place Balance
5.4 Walkability challenges
5.5 Conclusions

Analysis

SQ2

This chapter aims to answer the second research question: **How does the current city's development plans reflect TOD principles, and what implementation challenges does it face?**

This chapter will evaluate Vilnius transit development plans, hierarchy of the planned system, the existing and planned densities, the overall development potential and the balance between node and place. At the end of the chapter - main challenges are described, which later strategic and design proposals are based on.

5.1 Transit System Analysis

In order to consolidate urban development around the planned public transport corridors in accordance with the TOD concept, it is important to assess the hierarchy of these lines and transport nodes within the planned transport system.

What municipal NPTS plan includes?

The NPTS plan includes essentially two prospective higher-capacity public transport development solutions:

1. An urban rail line utilising the existing regional railway corridor that runs through the city and connects several more peripheral districts, including Lentvaris, Naujoji Vilnia, Paneriai, and Vokė.

2. Four tram (or similar) lines, largely following the alignments of the current express bus routes.

Both of these solutions are presented in the comprehensive plan at a conceptual level. They remain preliminary, without specifying the exact transport mode, and without defining a hierarchy among these lines. However, in order to develop a transit-oriented city, it is important to assess how the introduction of new transport modes would affect the accessibility of different urban zones at both the city and regional scale.

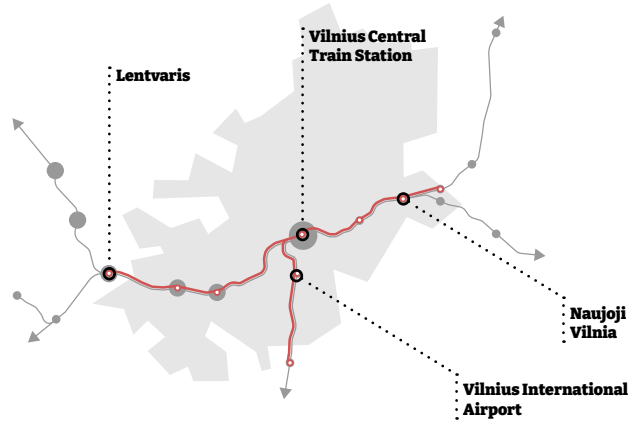


Figure 48. Scheme of planned city train route (Own elaboration, based on Vilnius masterplan)

Planned City trains

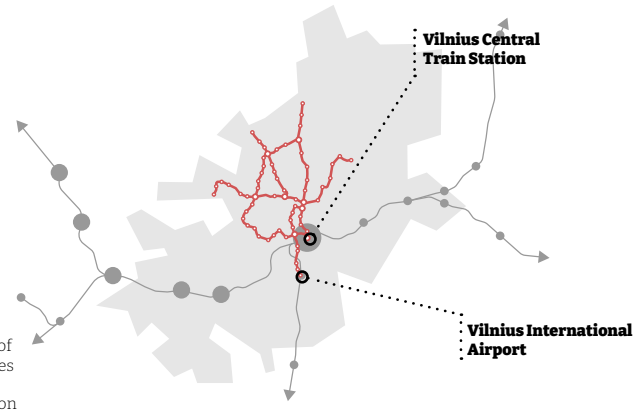


Figure 49. Scheme of planned NPTS routes - tram routes (Own elaboration, based on Vilnius masterplan)

Planned NPTS routes

Regional rail network

Unlike the planned tram lines, the urban rail line is proposed to utilise the existing regional railway corridor, which represents a transit corridor of national importance.

Key aspects:
The western railway section functions as an intercity corridor connecting the capital with the country's largest cities, such as Kaunas, Klaipėda, and Šiauliai.
The eastern section primarily connects smaller towns in a shrinking region, with a combined population of approximately 40,000 residents, which is comparable to the population of a single Vilnius microdistrict.

Therefore, when planning the integration of railway infrastructure into the urban public transport system, it is important to recognise that different railway sections do not have equal strategic importance. The western section represents a corridor of very high importance, connecting the country's main cities and supporting relatively frequent train services, while the eastern section has more limited significance, mainly serving smaller settlements in the eastern regions with a total population comparable to that of one Vilnius neighbourhood.

(In the long term, if geopolitical relations with Belarus were to improve, the importance of the eastern corridor could increase, as it would provide a connection between Vilnius and Minsk. However, even in such a long-term scenario, the western connection would likely remain more significant due to Lithuania's stronger economic, cultural, and geopolitical ties with Western countries.)

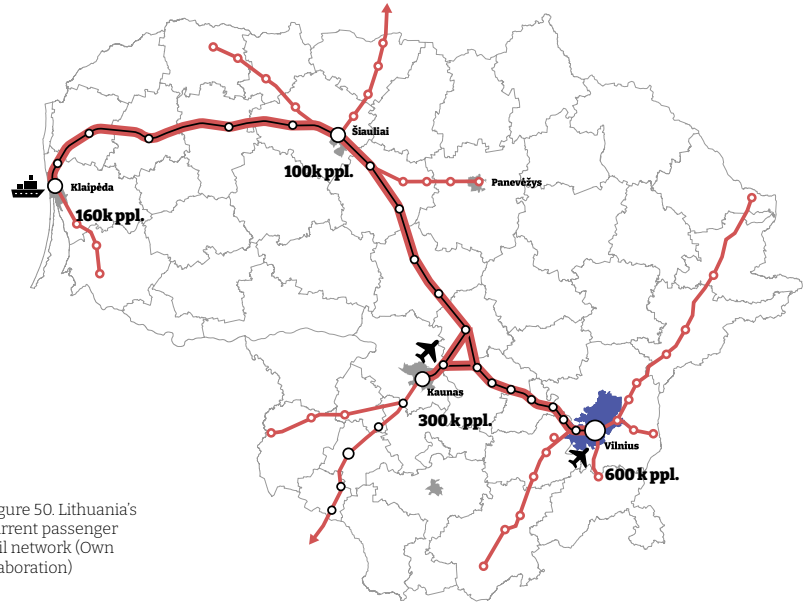


Figure 50. Lithuania's current passenger rail network (Own elaboration)

National railway system

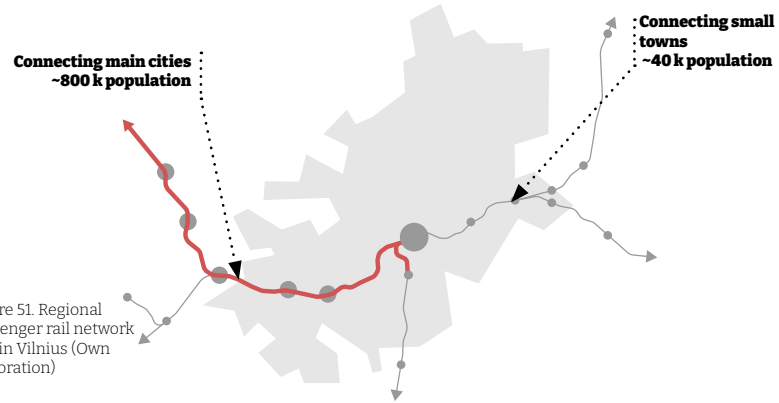


Figure 51. Regional passenger rail network within Vilnius (Own elaboration)

Rail infrastructure hierarchy in Vilnius

Rail Baltica project

The Rail Baltica project is currently under development as a European high-speed rail line, connecting Estonia, Latvia, and Lithuania with continental Europe through Poland.

The planned extension to Vilnius will further increase the strategic importance of the city's western railway corridor, enhancing international connectivity and reinforcing Vilnius as a key transport hub.

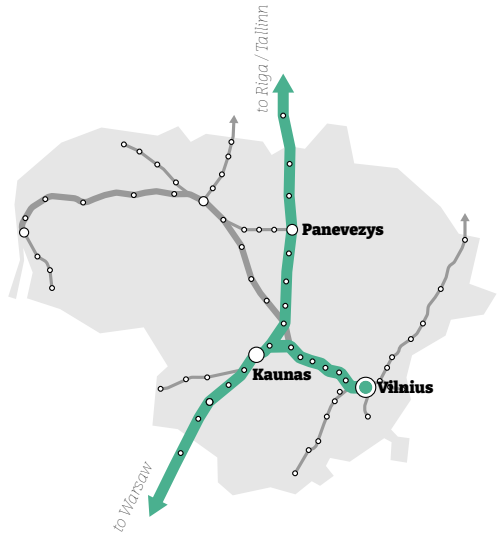


Figure 52. Scheme of planned Rail Baltica route (Own elaboration, based on RB Rail (n.d.))

Rail Baltica plan

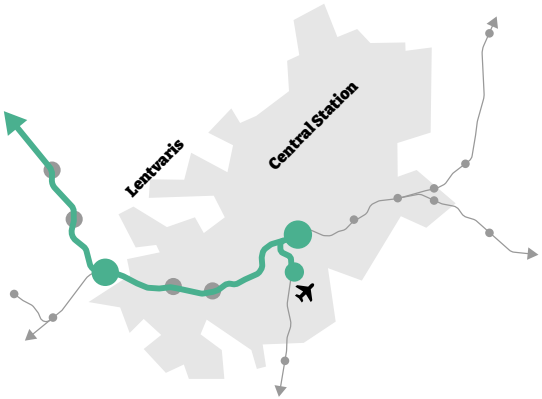


Figure 53. Scheme of Rail Baltica route within Vilnius (Own elaboration)

Rail Baltica Vilnius section

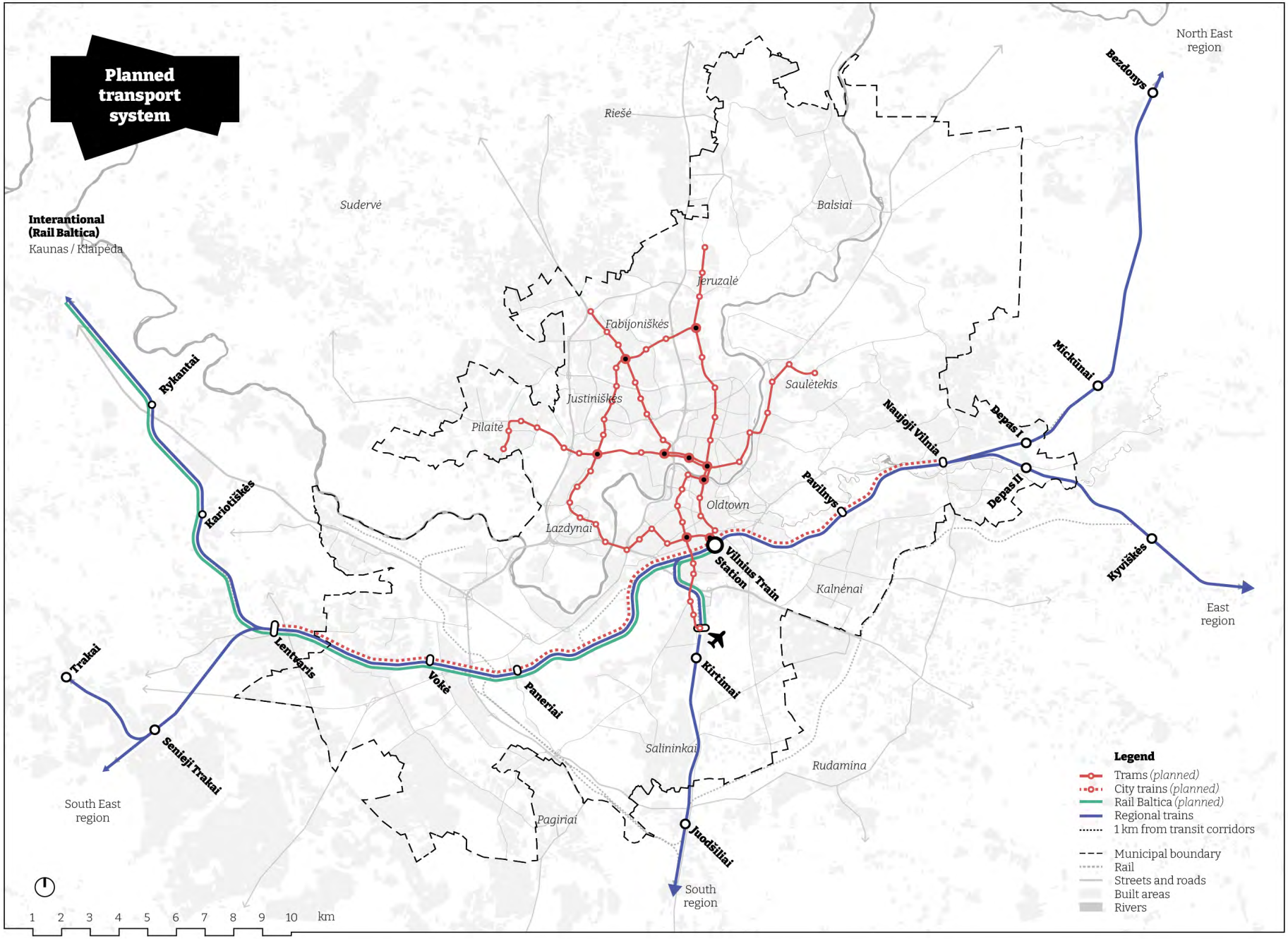


Figure 54. Map of Vilnius transit development plans (Own elaboration)

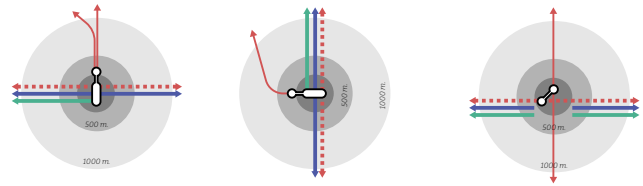
Types and hierarchy of planned transit system nodes

Thus, when evaluating the Vilnius Master Plan's public transport NPTS and urban rail proposals, the planned transport lines and nodes can be organized into a hierarchy based on their relative importance.

Following the logic of TOD theory, the most important connections are those of regional significance, while city-level transport infrastructure has comparatively lower strategic importance. Based on this principle, transport lines and nodes in Vilnius can be categorized into four levels of importance within the transport system:

1. Metropolitan transit hubs - nodes integrating essentially all types of public transport, including regional trains, the future Rail Baltica corridor, as well as planned urban rail and NPTS lines.
2. Regional rail hubs - railway nodes where regional trains and the planned urban rail line intersect, but which are not connected to the NPTS network.
3. City transit nodes - points or corridors well-accessible at the city scale where two or more NPTS lines meet; however, these locations do not provide direct regional connections.
4. City transit stops - city-level public transport (NPTS) corridors and stops, serving local mobility needs.

Metropolitan Transit nodes

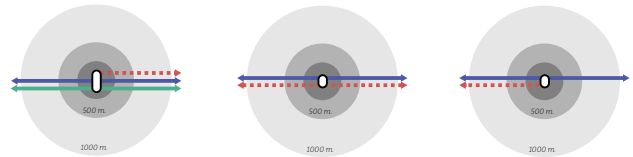


RB+RT+CT+TRx2

RB+RT+CT+TR +Airport

CT+TR

Rail transit nodes

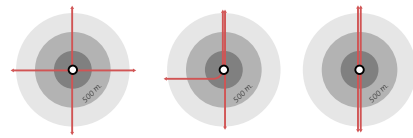


RB+RT+CT

CT+RT

CT+RT

City transit nodes



Tram Intersections

Tram Conections

Tram corridors with more than two tram lines

City transit stops (corridors)



Figure 55. Types and hierarchy of future transit nodes in Vilnius (Own elaboration)

Metropolitan Transit nodes

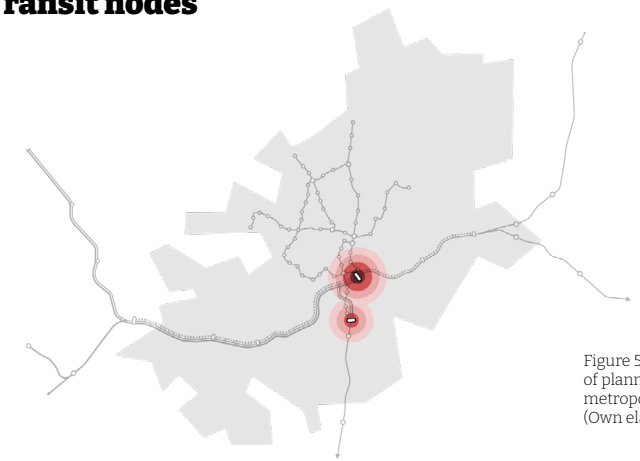


Figure 56. Locations of planned metropolitan nodes (Own elaboration)

Rail transit nodes

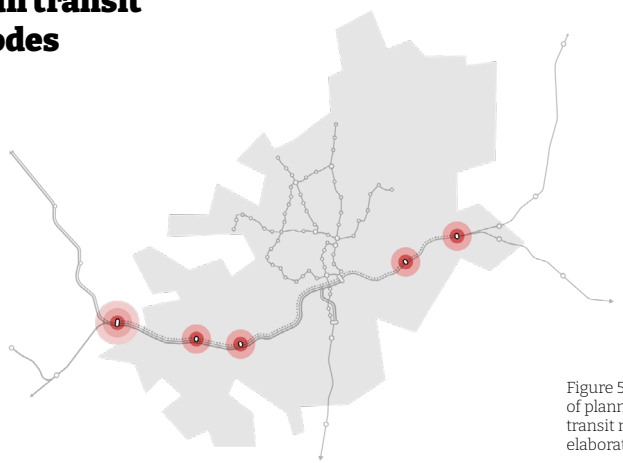


Figure 57. Locations of planned rail transit nodes(Own elaboration)

City transit nodes

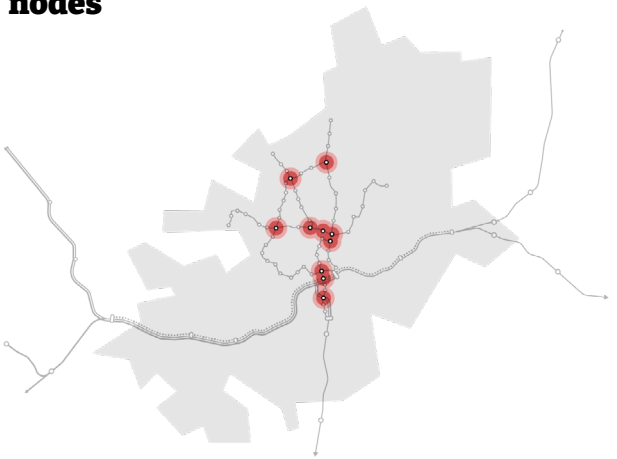


Figure 58. Locations of planned urban transit nodes (tram) (Own elaboration)

City transit stops

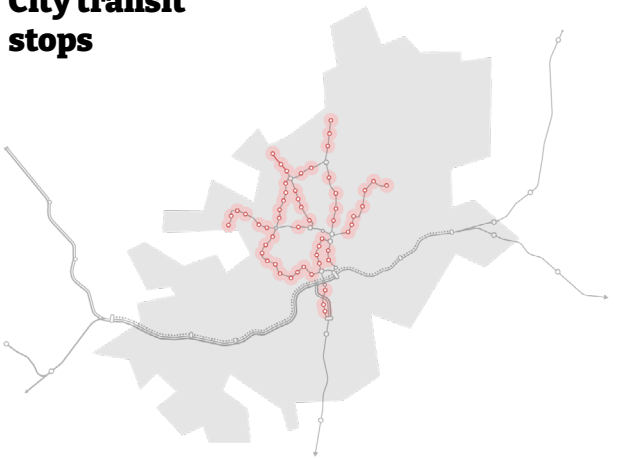


Figure 59. Locations of planned city transit corridors (tram) (Own elaboration)

Take aways

- When assessing the hierarchy of the planned public transport system, the existing regional transport system and its development play an important role.
- The most important future public transport nodes are those where the planned tram lines, the urban rail route, regional rail services, and the currently developing Rail Baltica international railway line intersect.
- The planned transit nodes can be classified into four categories according to their level of importance.

5.2
Vilnius Development Analysis

Once the planned public transport system - including regional rail development - and the expected strength of future transit corridors and nodes are understood, it is important to evaluate the urban development conditions related to the "place" dimension:

1. The current population distribution around the planned transit infrastructure
2. Development limitations around transit corridors and nodes
3. The development capacity and its spatial distribution as defined in the city's Master Plan

Existing densities

Most residents live along lower-importance NPTS corridors. The development of tram lines should not primarily serve as a tool to unlock development potential, but rather as an instrument to improve connectivity and the quality of life in existing neighbourhoods. In these areas, densification is generally not required for NPTS implementation, as the current population density is sufficient to support city-level public transport infrastructure.

Along the railway, there is virtually no residential population. Therefore, the construction of urban rail lines and stations will have limited immediate impact on local mobility. In these areas, it is particularly important to focus on developing housing and other urban functions, while viewing transport infrastructure development as a tool to consolidate and support overall urban growth.

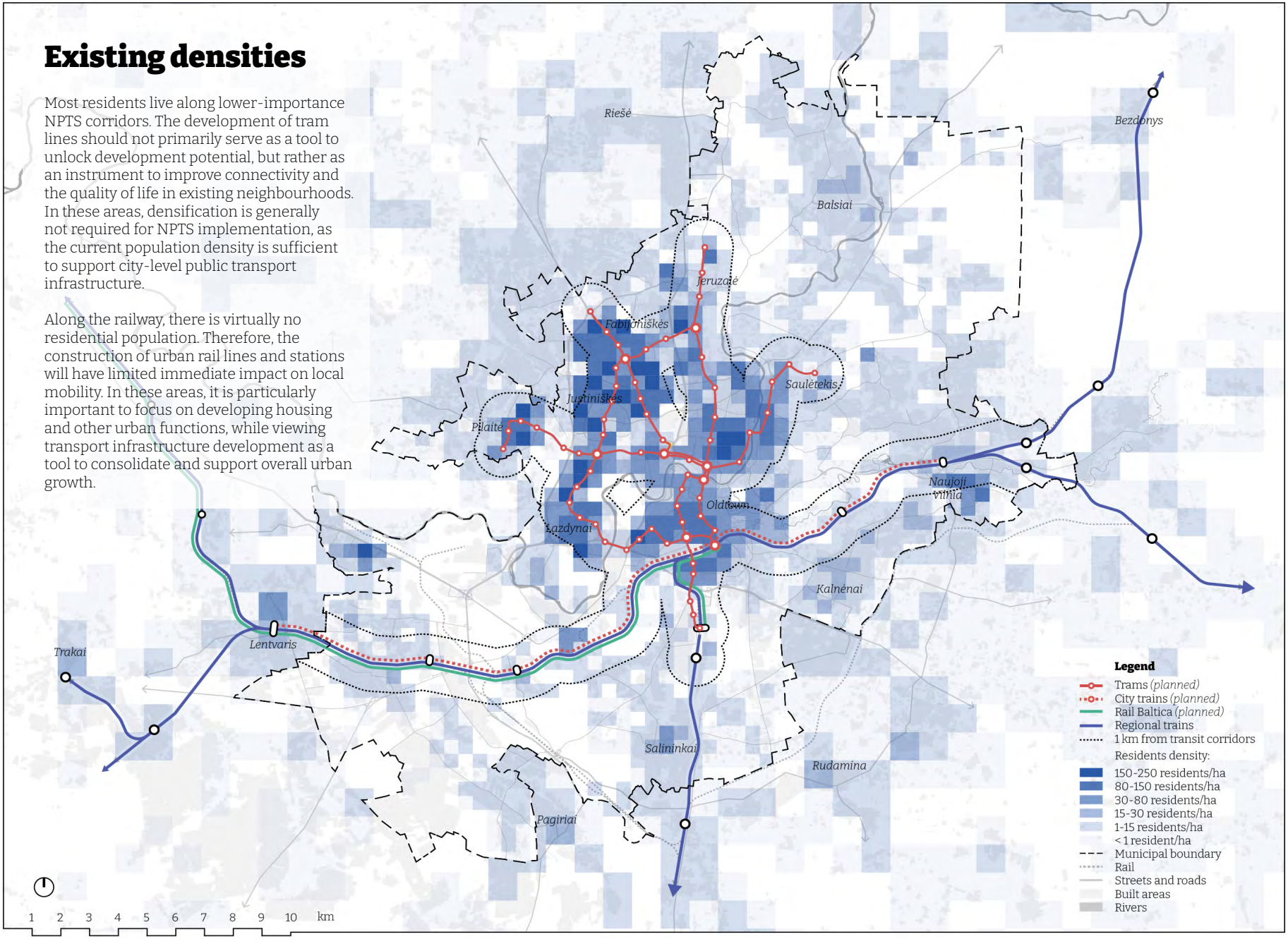


Figure 60. Residents density around planned transit development projects (Own elaboration)

Landscape structure

In Vilnius, the railway line extends to the city centre and the historic Old Town, with the Central Station located in the heart of the city. However, a significant proportion of the land surrounding the railway corridor forms part of the city's green network.

More broadly, a large share of Vilnius is composed of green infrastructure and natural areas. This represents one of the city's key assets, contributing to quality of life, strengthening the city's image and identity, and supporting its ecological systems. At the same time, these areas limit development opportunities along regional transport corridors. As a result, it is particularly important to make efficient use of redevelopment and conversion sites located near the railway. Given the limited availability of land in these highly accessible locations, development should be concentrated and intensive, accommodating a diverse mix of functions in order to maximise the benefits of proximity to the rail network.

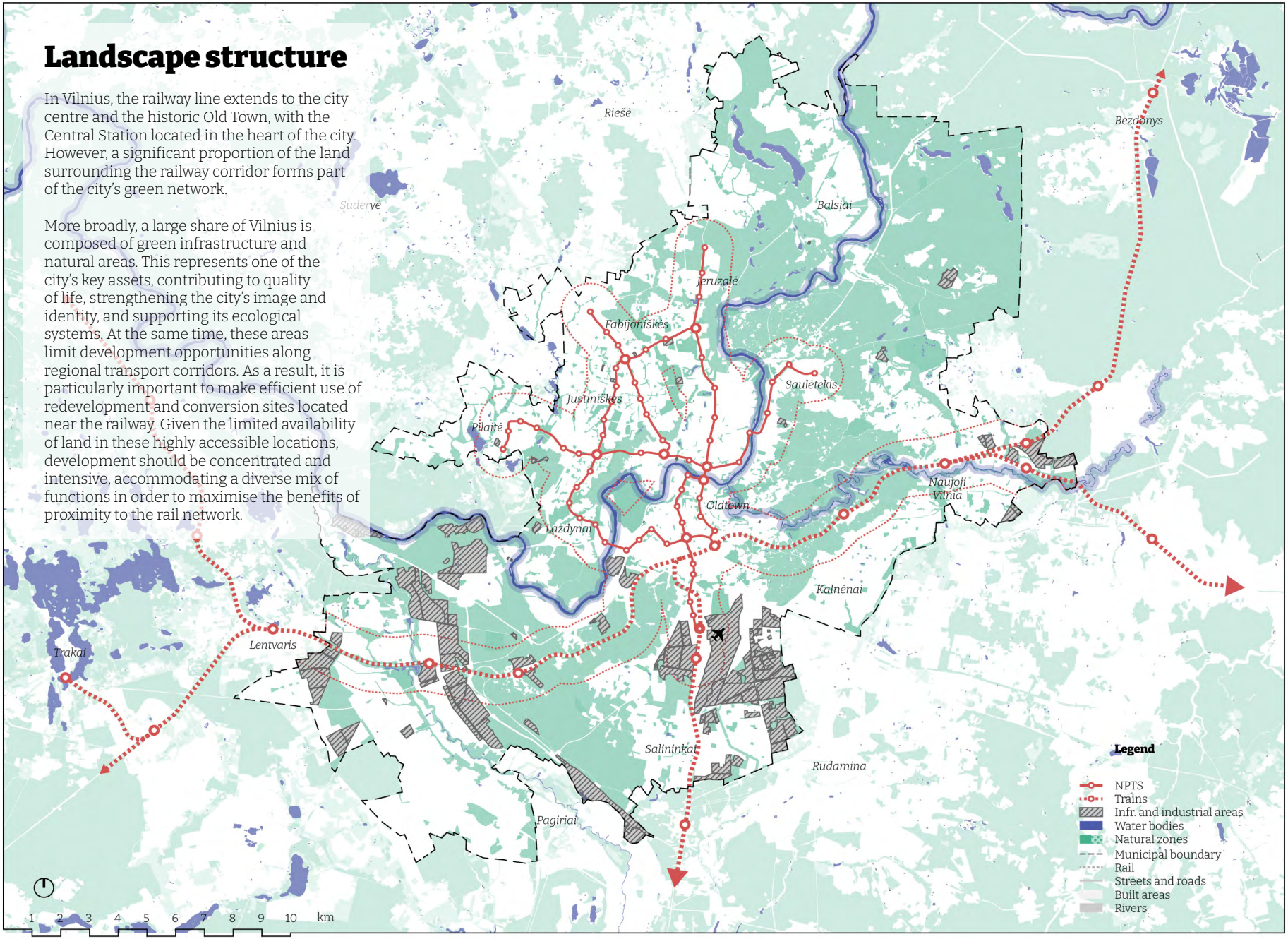


Figure 61. Landscape structure of Vilnius and its relation to planned transit development projects (Own elaboration)

Natural limitations around NPTS

These circumstances highlight the need to maximise the potential of existing redevelopment sites located along the railway corridor. In some cases, redevelopment areas situated near the railway but lacking direct access should be better integrated into the rail network through the introduction of intermediate stations and improved connections. Redevelopment opportunities around the city's Central Station should also be utilised more effectively. In contrast, in areas located further from the railway corridor, priority should be given to strengthening and reconnecting the city's green network, which is currently fragmented in several locations.

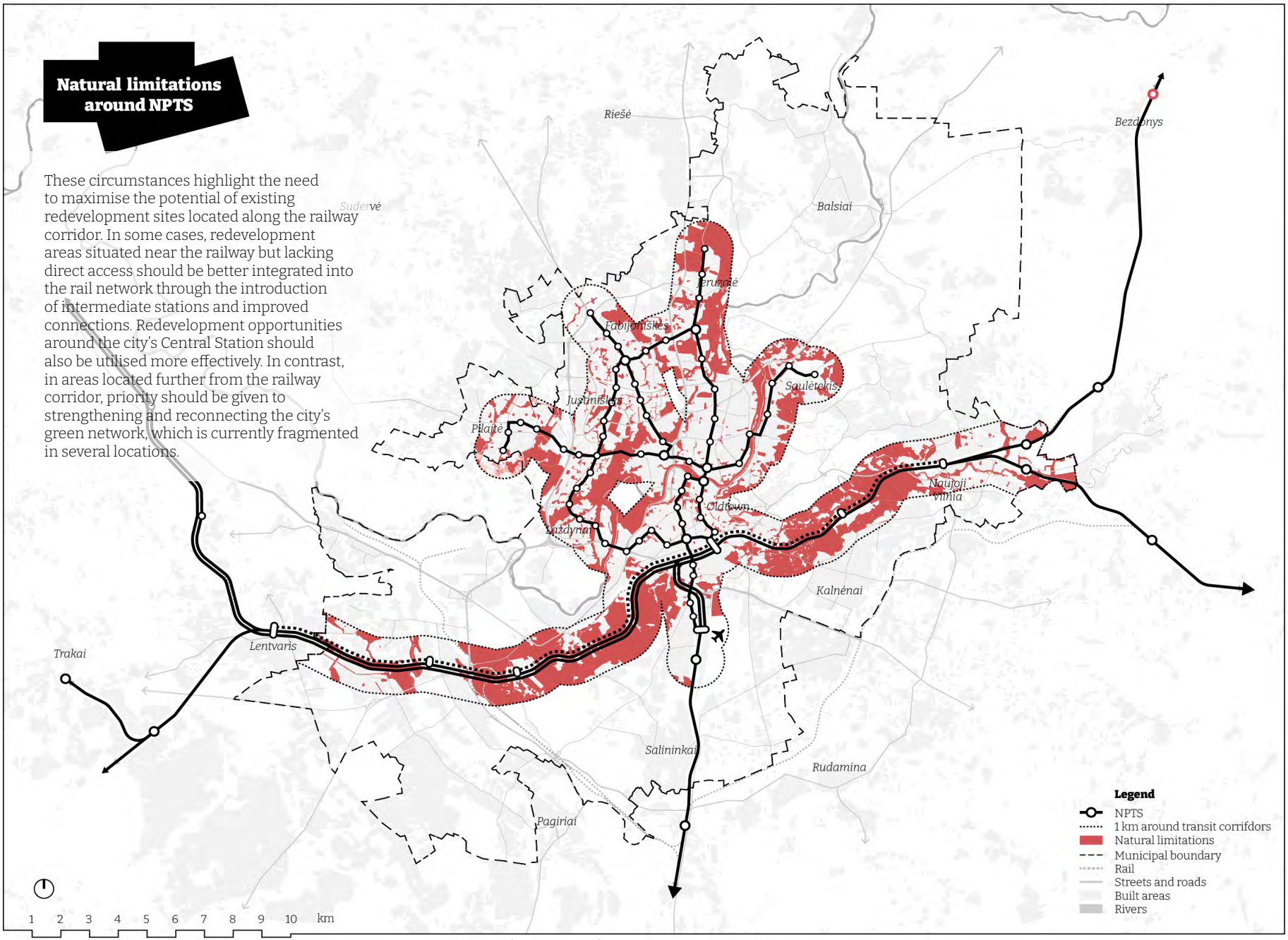


Figure 62. Spatial/development limitations within 1km from planned transit development projects (Own elaboration)

Planned development densities

The permitted development density in different areas around planned transport corridors and nodes is very similar, regardless of the importance of the transport node within the overall transport system (Fig.64). For example, we can observe an intention to develop high-density urban centres along future tram corridors in modernist neighbourhoods. While this appears to reflect the overal idea of densification around transport corridors, when viewed at the scale of the region or the entire city, these areas represent relatively low accessibility, especially from the regional transit.

By comparison, conversion areas such as the territory near the airport or Vilkpėdė are planned with essentially similar densities, even though these areas are incomparably more important within the transport hierarchy. They are not only close to the city centre and are planned to be accessible via multiple public transport lines from different districts, but will also be well sonnected within other cities and the region, after the Rail baltica project is finished.

It is also important to note that significant residential densification is not strictly necessary to justify the implementation of a single tram line and ensure sufficient passenger flows, as in many existing residential districts along future tram corridors population densities already reach 80–150 residents per hectare, and in some cases even 200–250 residents per hectare (Fig.60).

Market demand

Assessing the relationship between planned development intensity and transit development requires an understanding of actual development demand in Vilnius. Only then can it be determined whether the market will be capable of transforming areas around future transit corridors and nodes into walkable, functional, and transit-supportive environments. Based on development trends observed over recent decades (Fig.63) and having in mind both -the economic growth and the average residential floor area per capita remaining significantly lower than in many Western European cities, it can be assumed that demand for new housing and office development will persist. Assumed demand:

- Residential apartment market per year 3000 apartments (average 50 sq. meters) **~150 000 m²**
- New office market per year **~100 000 m²**

Total ~250 000 m² per year.

This does not include the warehouse development market, retail and other, however, teritories for warehouses, industries are not envisioned in residential zones, but along ringroads, highway and near the airport.

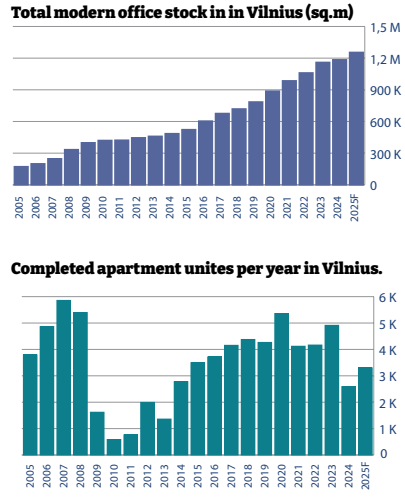


Figure 63. Vilnius development market. *Source: Ober-Haus (2025).*

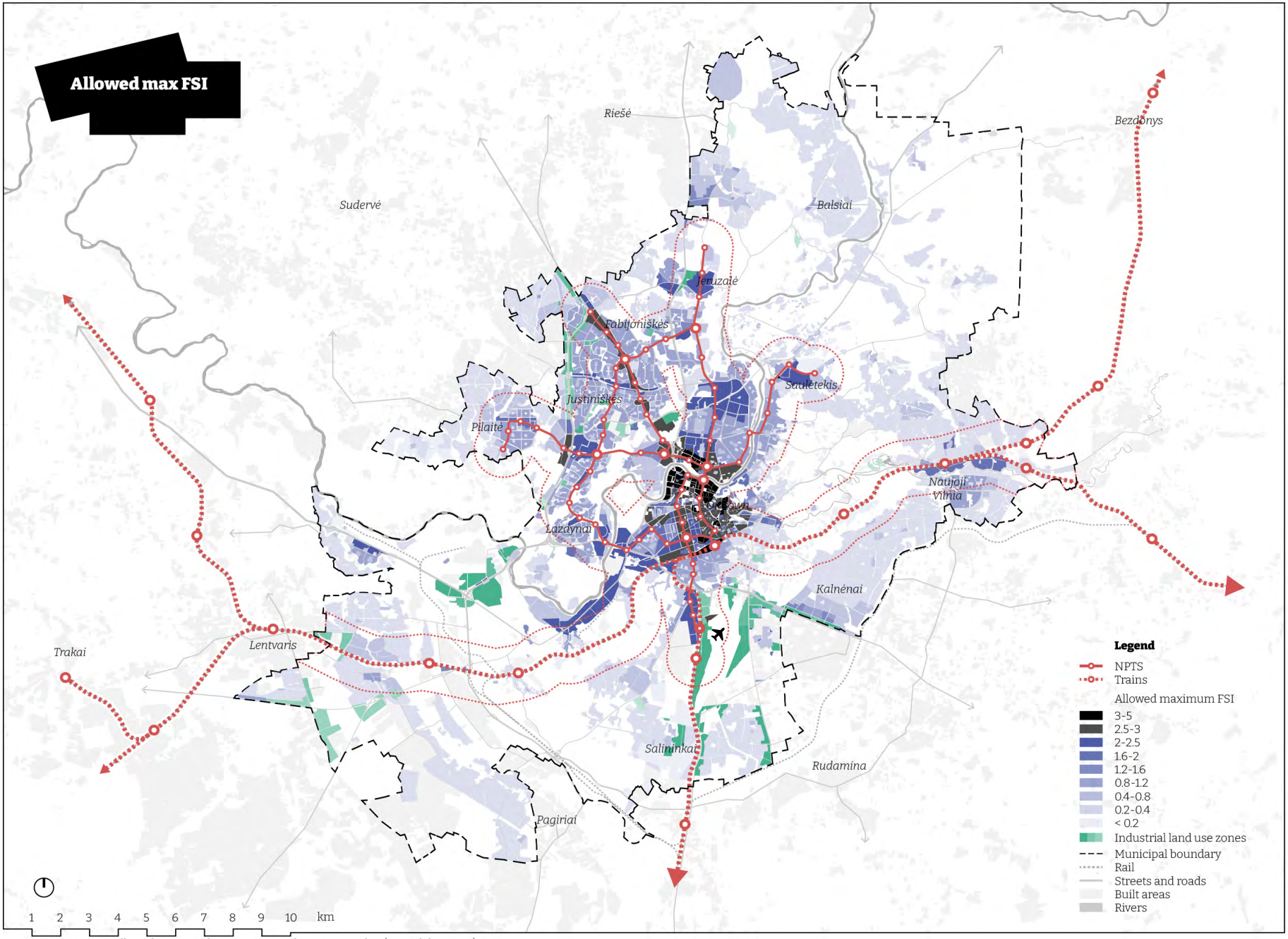


Figure 64. Maximum allowed FSI according to current Vilnius Masterplan (Own elaboration)

Conversion areas along transit

A significant share of the high-density development areas identified in the Master Plan and designated as district centre zones in the zoning plan remain either undeveloped or do not currently function as urban centres. In this research, these areas are referred to as conversion areas, as they are intended to be transformed from brownfields, former industrial sites, large-format retail developments, and other underutilised land into new district centres. These areas represent some of the city's largest concentrated development opportunities.

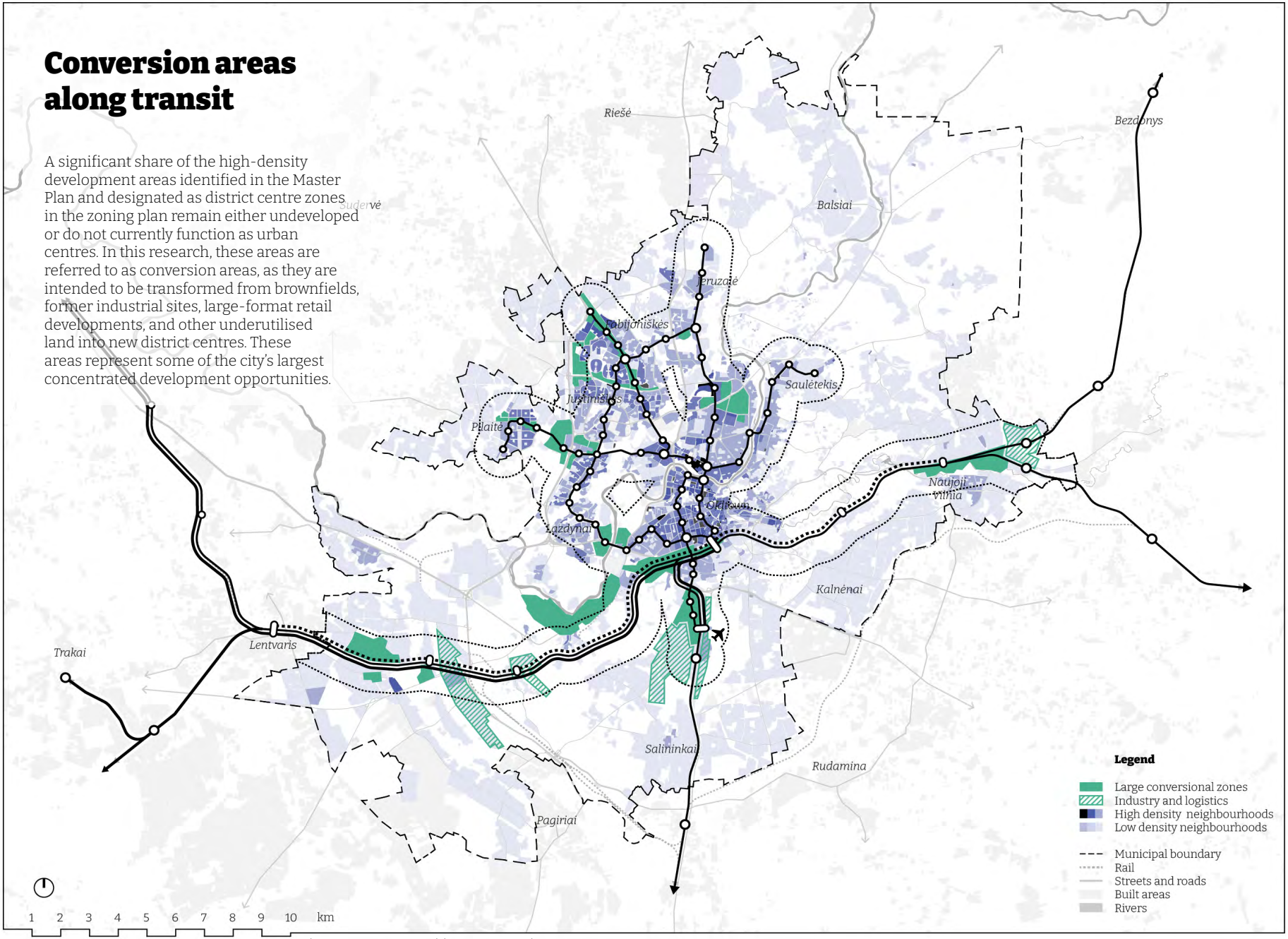


Figure 65. Large conversion areas of possible development (planned as local centers) (Own elaboration)

Developed parts of city



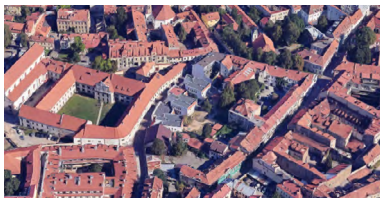


Single-family housing areas. Densification of these areas is possible, however, their overall development potential is limited.





Densely populated residential districts (microrayons) - the potential for new development is limited. Only fragmented development is feasible, primarily aimed at improving the quality of the existing living environment, enhancing functional diversity, and activating ground floors. Even if further development were pursued, it would require comprehensive, district-wide planning solutions. In practice, development opportunities are very limited. Overall development potential: minimal.





Old Town. Development potential is minimal due to heritage protection requirements. Development is limited to restoration, reconstruction, and infill on a small number of vacant plots. Overall development potential: minimal.



Industrial, logistics, and warehouse areas. Development is possible; however, these areas currently accommodate active economic uses, and the Master Plan designates them for industrial and storage functions. Unlocking their development potential would require amendments to the Master Plan. Overall development potential: moderate.

Conversion areas





Conversion areas These include areas occupied by existing retail and warehouse buildings, and partially underutilised industrial sites where the Master Plan designates future residential or mixed-use district centre development. Overall development potential: high.





Brownfields. These include former garage complexes, areas occupied by abandoned warehouse buildings, and partially underutilised industrial sites where the Master Plan designates future residential or mixed-use district centre development. Overall development potential: high.

Development potential within conversion areas

On one hand, their current conditions create an environment that is unattractive for pedestrians and, consequently, for public transport users, surrounding the future tram lines and urban rail stations. On the other hand, these areas present significant potential for developing high-quality, walkable district centres and to improve the quality of neighbourhoods. The Master Plan designates these territories for district centres or high-density residential zones, although at present they are either brownfields, partially functioning industrial sites, or suburban-style areas dominated by car-oriented shopping centres, parking lots, and similar uses.

Figures 66–68 estimate the development capacity of the identified conversion areas based on the maximum FSI permitted by the Vilnius Master Plan. The calculations assume that 40% of the site area is allocated to streets, public spaces, and infrastructure. Representative block typologies are then modelled, assuming that 80% of total building floor area contributes to the FSI calculation (Fig.68)

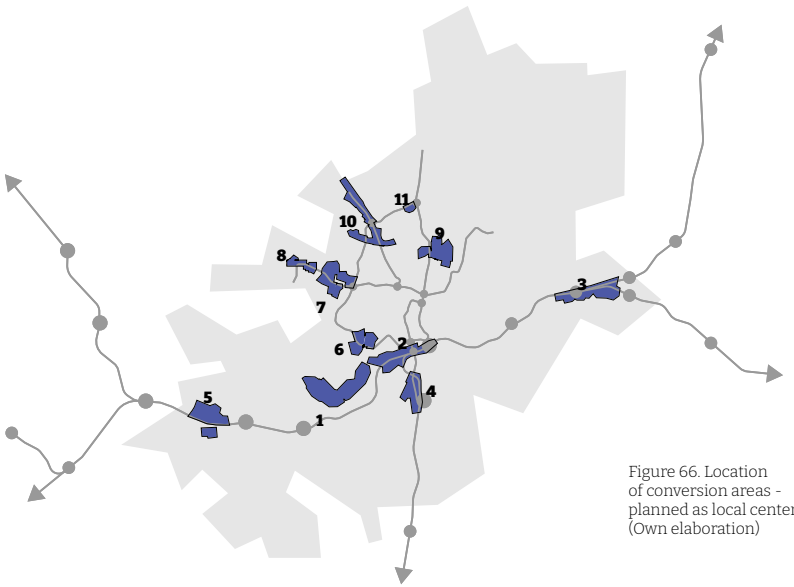
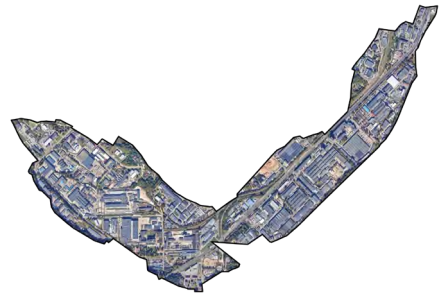


Figure 66. Location of conversion areas - planned as local centers (Own elaboration)

Total Area - includes all land within the study area.
Conversion area - includes land designated for district centre or dense residential development zones within total area.
Developable Area - assumes that 40% of the conversion area is required for streets, public spaces, and infrastructure, leaving 60% available for development.
Development potential - developable area X maximum allowed FSI



1.

Total area size	1 954 553 m²
Con. area (FSI 2.5-3.0)	1 207 965 m²
Con. area (FSI 0.5-0.8)	746 588 m²
Developable area (FSI 2.5-**3.0**)	724 779 m²
Developable area (FSI 0.5-**0.8**)	447 952 m²
Development potential (NIA)	**2 532 698 m²**



2.

Total area size	1 160 747 m²
Con. area (FSI 2.5-3.0)	681 434 m²
Con. area (FSI 0.5-0.8) *1/2 developed	479 313 m²
Developable area (FSI 2.5-**3.0**)	408 860 m²
Developable area *1/2 developed	143 793 m²
Development potential (NIA)	**1 442 269 m²**



3.

Total area size	739 157 m²
Con. area (FSI 1.7-2.4)	739 157 m²
Developable area (FSI 1.7-**2.4**)	443 494 m²
Development potential (NIA)	**1 064 385 m²**



4.

Total area size	1 059 954 m²
Con. area (FSI 2.5-3.0)	797 769 m²
Con. area (FSI 0.9-1.2)	74 871 m²
Con. area (FSI 0.5-0.8)	187 314 m²
Developable area (FSI 2.5-**3.0**)	478 661 m²
Developable area (FSI 0.9-**1.2**)	44 922 m²
Developable area (FSI 0.5-**0.8**)	112 388 m²
Development potential (NIA)	**1 579 799 m²**

5.

Total area size
Con. area (FSI 2.5-3.0)
Con. area (FSI 0.5-0.8)
Developable area (FSI 2.5-**3.0**)
Developable area (FSI 0.5-**0.8**)
Development potential (NIA)



6.

Total area size	- m²
Con. area (FSI 2.5-3.0)	485 961m²
Developable area (FSI 2.5-**3.0**)	291 576 m²
Development potential (NIA)	**874 729 m²**



7.

Total area size	- m²
Con. area (FSI 2.5-3.0)	531 135m²
Con. area (FSI 0.5-0.8)	320 353 m²
Developable area (FSI 2.5-**3.0**)	318 681m²
Developable area (FSI 0.5-**0.8**)	192 212 m²
Development potential (NIA)	**1 109 812 m²**



8.

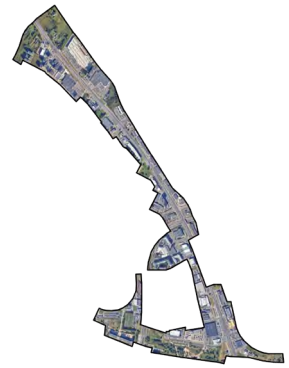
Total area size	- m²
Con. area (FSI 1.7-2.4)	175 206m²
Developable area (FSI 1.7-**2.4**)	105 124 m²
Development potential (NIA)	**252 297 m²**





9.

Total area size	- m²
Con. area(FSI 2.5-3.0)	1 089 312 m²
Developable area (FSI 2.5-**3.0**)	653 587 m²
Development potential (NIA)	**1 960 761 m²**



10.

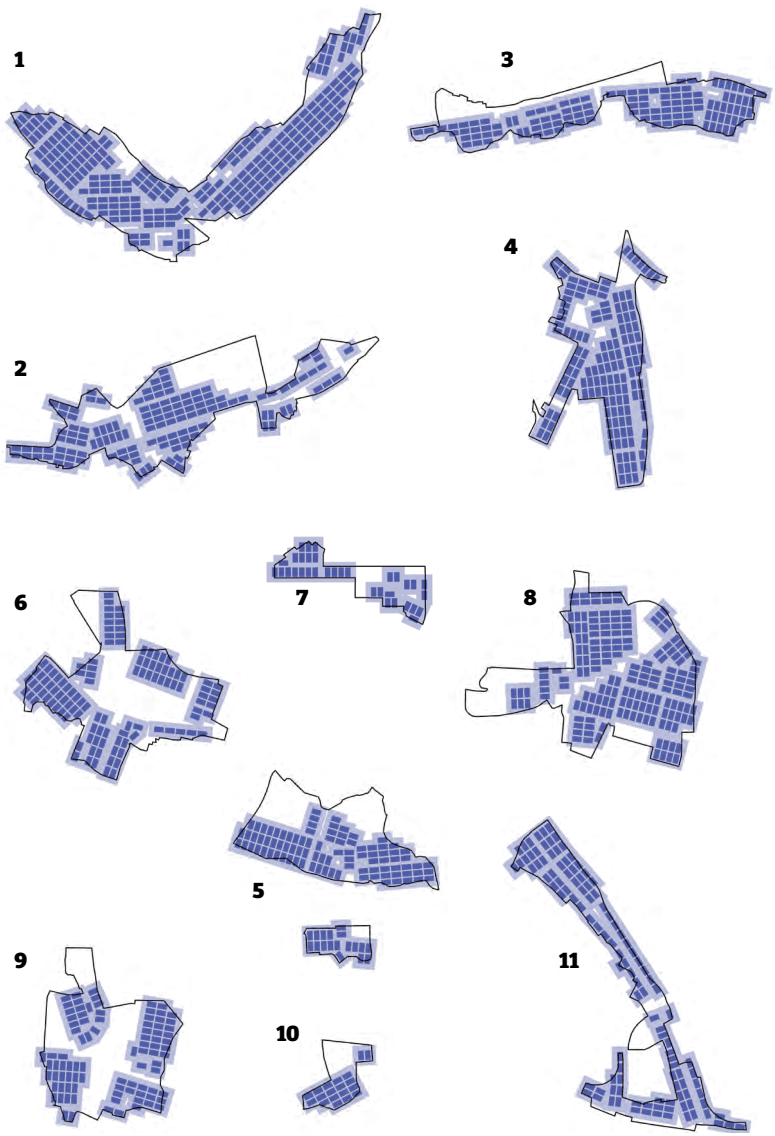
Total area size	- m²
Con. area (FSI 2.5-3.0)	600 648 m²
Developable area (FSI 2.5-**3.0**)	360 389 m²
Development potential (NIA)	**1 081 167 m²**



11.

Total area size	- m²
Con. area (FSI 2.5-3.0)	117325 m²
Developable area (FSI 2.5-**3.0**)	70 395 m²
Development potential (NIA)	**211 185 m²**

Figure 67. Conversion areas development capacity as currently planned (Own elaboration, based on Vilnius Masterplan)



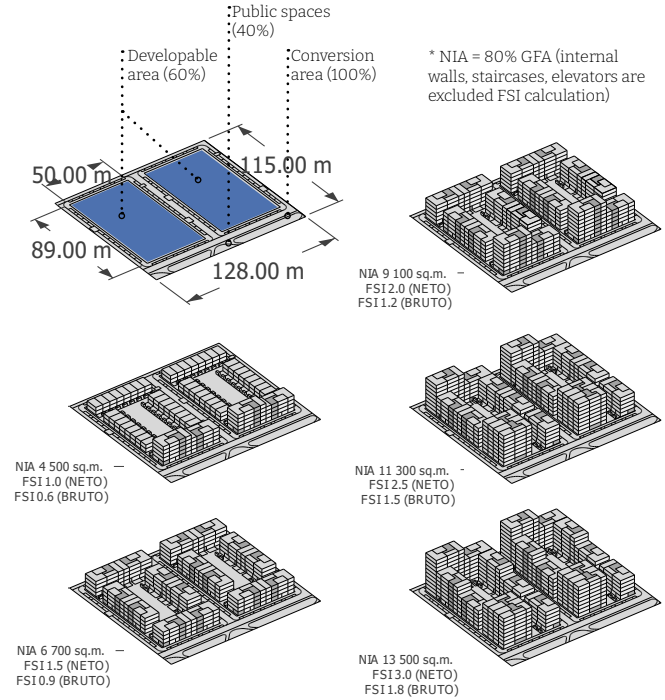


Figure 68. Visual representation of densities (Own elaboration)

Total development potential

Total development potetntial **~13 000 000 m²**
Residential apartment market per year 3000 apartments (average 50 sq. meters) **~150 000 m²** (Fig.63)
New office market per year **~100 000 m²** (Fig.63)

Even if the entire residential and office development market were to focus solely on developing these large-scale conversion areas, they would be sufficient for more than 50 years. Naturally, given that the city also has many additional individual vacant plots, infil parcels and more distant territories set to be developed, the overall development potential is extremely high. Therefore, the current urban sprawl represents a highly inefficient way of developing the city. At the same time, all these zones are envisioned as dense development areas, regardless the difference of these places in the transit node hierarchy.

Take aways

- The current distribution of population density in Vilnius is effectively the reverse of the transport hierarchy: the highest residential densities, as well as a significant share of major urban attractors, are located in districts distant from the railway corridor.

- Development along areas adjacent to the railway is significantly constrained by Vilnius' natural ecological framework. This makes it particularly important to make effective use of the available brownfield and conversion sites located near the rail infrastructure.

- Overall, the planned development capacity in Vilnius is very high. Even if the entire residential and office development market were concentrated solely within convertible district centre zones, this supply would be sufficient for at least 50 years of development. Despite the absence of a clear shortage of developable land within the city, relatively high-density development is still planned across all district centre zones, without sufficient differentiation based on their spatial position within the city and the planned public transport system.

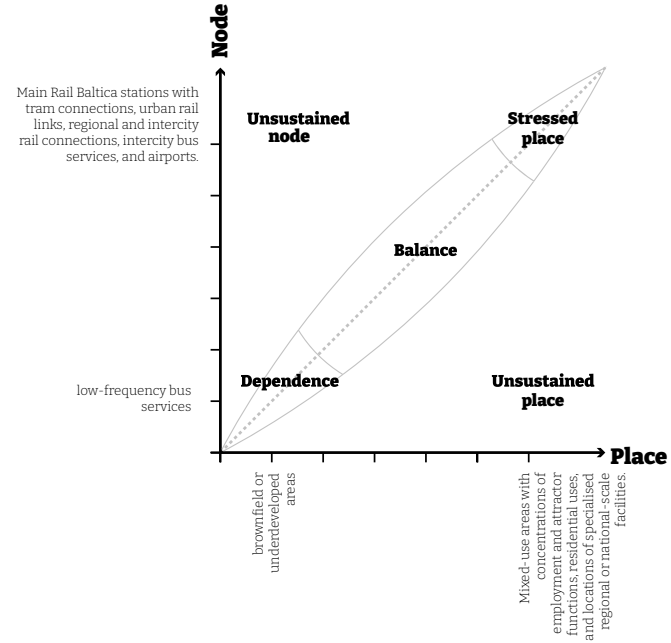
5.3
Node - Place balance

In order to address the question of how existing urban plans for district centre development and transport infrastructure respond to TOD principles, it is essential to compare these two dimensions of urban development and evaluate them through a node–place balance perspective.

The following aspects are assessed: the existing balance between place strength and node (transit) strength, and the projected balance based on planned development. This approach allows for an evaluation of weaknesses, potential risks, and challenges across different urban areas, as well as the identification of opportunities.

Based on this node–place balance assessment, different parts of the city are conceptually classified into zones that tend either towards unsustained nodes or towards unsustained places.

At the same time, additional insights are provided for each zone, relating to existing and potential future challenges, such as the emergence of stressed places or the presence of underutilised development opportunities.



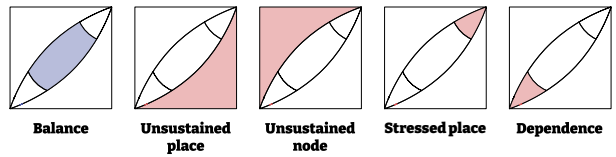


Figure 69. Node–Place balance model (Own drawn, adapted from Bertolini, 1999).

Method

Existing conditions are assessed, followed by a development vector, which allows for a projection of the future balance. This is a conceptual evaluation that defines an underlying principle and also enables reflection on how planned urban development aligns with both ongoing and proposed transport infrastructure projects. The aim is to identify how transport and urban development plans should be adjusted in order to achieve a balanced place–node relationship and to appropriately distribute and structure market-driven urban development demand as a tool for creating high-quality, transit-oriented urban centres.

Dense residential neighbourhoods with a tram

These are large modernist residential districts housing a significant share of Vilnius' population. Currently, they are served mainly by buses and trolleybuses, which do not match their density and daily mobility needs.

Planned tram lines would significantly improve city-level accessibility, better connecting these areas with the centre and key employment zones. District centre zones are also designated along these corridors, introducing expectations of higher-density mixed-use development.

At a metropolitan scale, however, this remains primarily an internal city transport upgrade, while the areas stay relatively distant from regional rail nodes. In this context, highly intensive development of district centres and national-scale functions may be disproportionate to their position in the transport hierarchy.

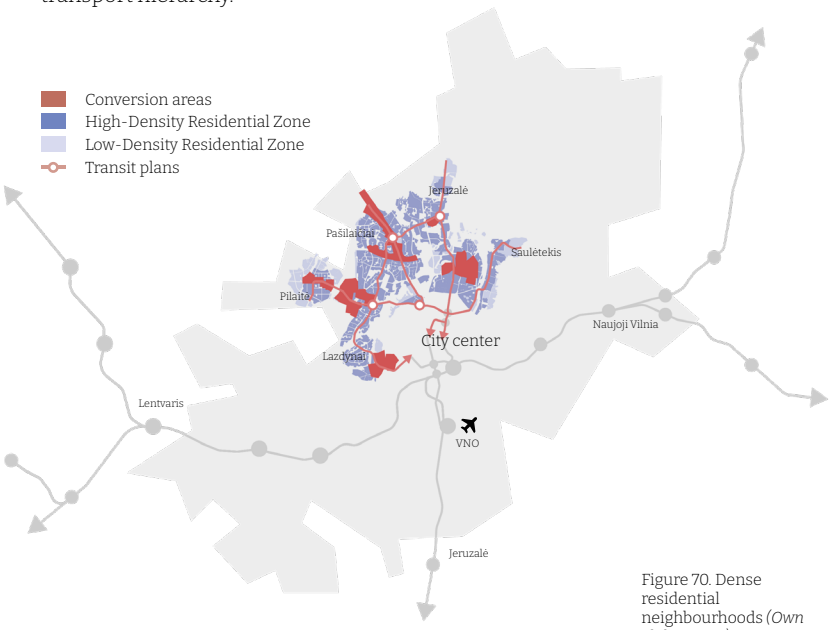


Figure 70. Dense residential neighbourhoods *(Own elaboration)*

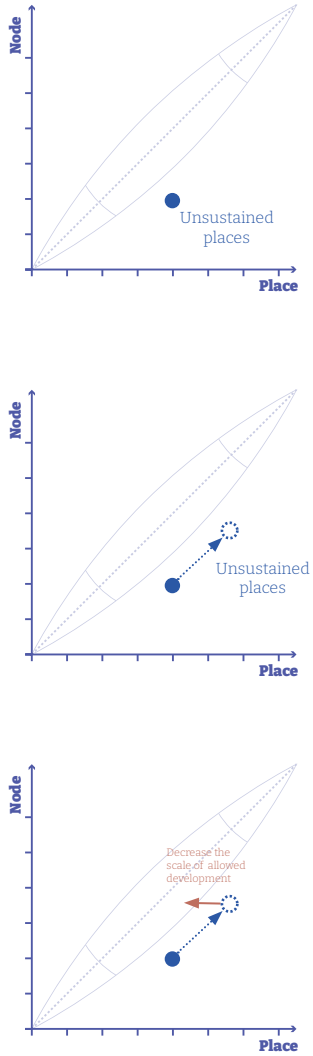


Figure 71. Current and futurenode-place balance evaluation *(Own elaboration)*

Existing balance

The existing situation is characterised by densely populated residential districts served only by buses and trolleybuses. Despite high population densities, the level of public transport service is relatively low. This results in decreased usage of public transportation.

Planned balance

Tram development would improve accessibility and help balance the current under-served condition of residential districts. However, district centre zones already show emerging large-scale developments, including stadiums, office complexes, and major retail centres. The planned high-density mixed-use designation along these corridors may therefore maintain or even reinforce a node–place imbalance, regardless of the introduction of tram infrastructure.

Conclusions

Tram development is assessed as a positive improvement in transport accessibility and overall node strength. Place development along these corridors should be limited, focusing mainly on walkability and small-scale local centres rather than higher-order functions. This helps maintain a more balanced node–place relationship at the neighbourhood scale.

Main metropolitan station areas

The metropolitan station areas consist of the central city railway station (1) and the airport transit zone (2). The central station already functions as the main metropolitan node, combining strong regional and intercity rail connections, bus services and direct access to the city centre and major activity concentrations. While its node–place condition is currently well balanced, continued intensification may lead towards a stressed place situation due to increasing spatial and functional pressure.

The airport area (2), in contrast, is currently weakly developed, with limited urban structure and only partial public transport accessibility despite the presence of an international airport. Major investments are planned, including Rail Baltica, urban rail, tram connections, and new station infrastructure, which will significantly increase its node strength. However, given the lack of surrounding urban development, there is a risk of developing an unsustained node condition if place functions are not sufficiently established, having in mynd, that this area is not surrounded by any residential districts.

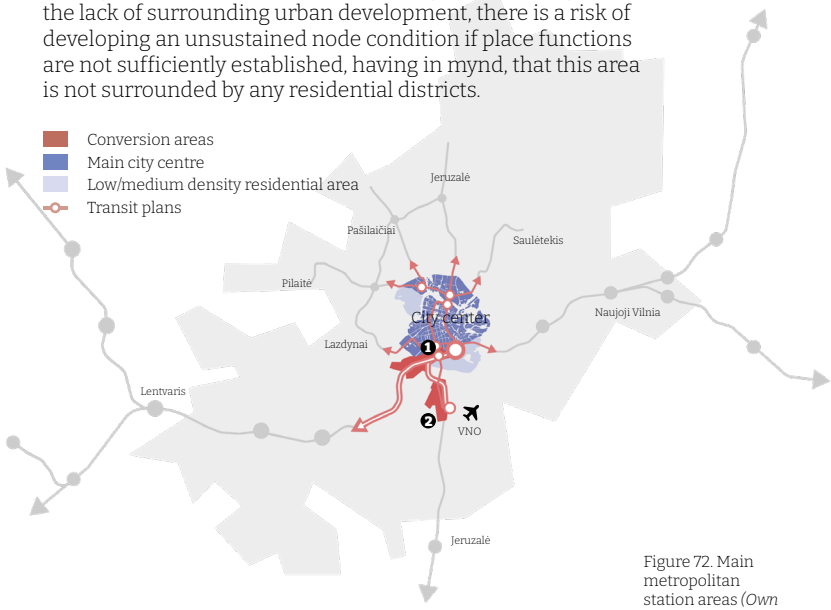


Figure 72. Main metropolitan station areas *(Own elaboration)*

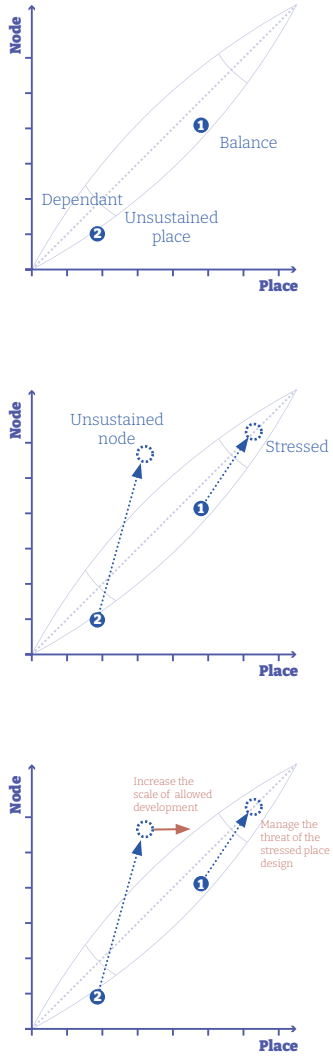


Figure 73. Current and futurenode-place balance evaluation *(Own elaboration)*

Existing balance

The central station area (1) is a strong node–place condition, combining high accessibility with major urban functions, including the historic centre and employment areas.
The airport area (2) is currently weak, close to a dependent/unsustained place, with low accessibility and limited urban structure despite the airport.

Planned balance

The central station area (1) strengthens further through Rail Baltica, urban rail, tram integration, and continued intensification, increasing pressure and risk of a stressed place condition.
The airport area (2) becomes a strong node due to major transit investments, but risks becoming an unsustained node without sufficient surrounding development.

Conclusions

The central station area (1) has strong development potential, supported by remaining conversion land and improved rail connectivity. Overall, a balanced node–place condition is achievable, although design-level attention is needed to avoid typical central-station pressure and potential stressed place effects.
The airport area (2), in contrast, requires a strong increase in place intensity to match its planned node development and ensure a functional node–place balance.

Areas around regional railway

These are regional railway corridors within Vilnius, where urban development is generally underdeveloped, which also explains weak city public transport. The western corridor has limited urban structure, except one planned conversion zone (1) not integrated with major transit projects, while Rail Baltica and city rail are planned along the axis.

The eastern corridor already has a denser populated residential district (2) and planned city rail, but remains a weaker regional rail branch and will not reach the accessibility level of the western corridor.

Overall, the western corridor has strong potential to align conversion areas with major transit investments. The eastern corridor has a lower accessibility ceiling, limiting possible development intensity within the transport hierarchy. The current plans however, risks of having unsustained places in both of the local centers, but for different reasons - unalignemnt with transit in the western corridor(1) and the risk of overdevelopment in the east corridor (2)

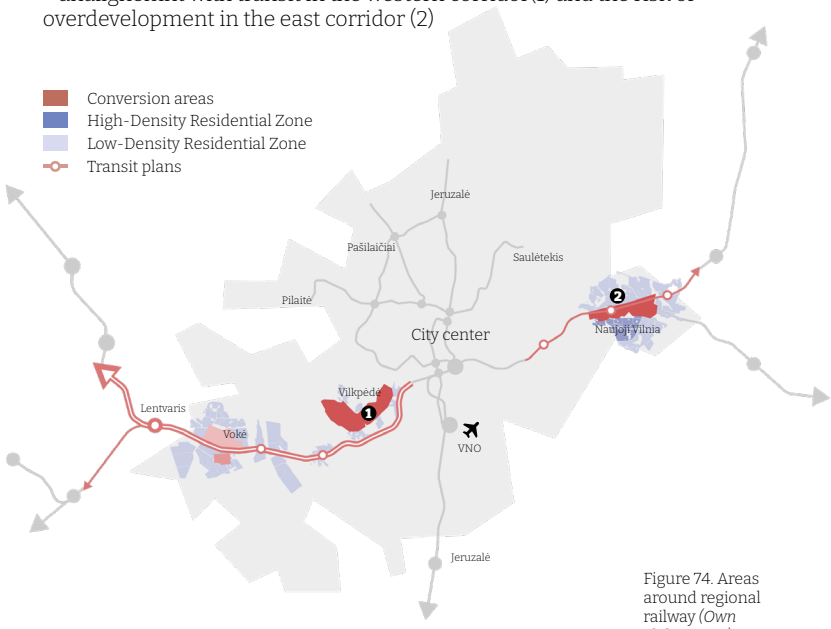


Figure 74. Areas around regional railway *(Own elaboration)*

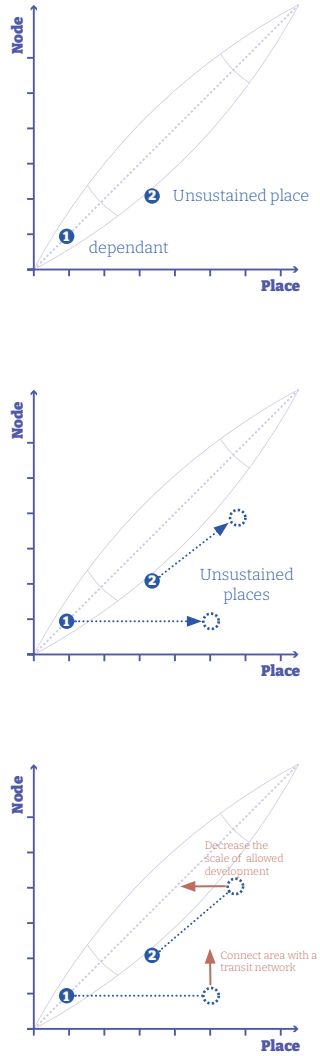


Figure 75. Current and futurenode-place balance evaluation *(Own elaboration)*

Existing situation

The western corridor has a strong regional rail function, with frequent connections to major cities (Kaunas, Klaipėda, etc.), but within Vilnius it passes through largely undeveloped areas with no real urban structure, resulting in dependent places (1). The eastern corridor mainly serves a single dense residential district (2), similar to modernist housing estates, connected mainly by buses and low-frequency regional rail, resulting in an unsustained place condition.

Planned development

The western corridor is planned to be strengthened by urban rail and Rail Baltica, but a large conversion area remains poorly integrated, creating a risk of an unsustained place despite strong regional rail.

The eastern corridor gains city rail, but weak regional rail limits its hierarchy position; if district centre development introduces too many high-order functions, city rail alone may not be sufficient, risking a node–place imbalance similar to modernist tram-served districts.

Conclusions

In the western corridor, transit projects should be integrated with conversion areas (1) to strengthen city–regional connectivity and improve system use.

In the eastern corridor, development should remain limited to walkability and local centre, supporting a balanced node–place condition.

2 types of disbalance

The analysis shows that district centres development is currently planned in a largely uniform way, despite significant differences in existing and planned node–place conditions. While there are various local exceptions, the overall pattern suggests a need for better differentiation between areas based on their transport context.

This indicates two main types of imbalance: areas where planned transit investment is not fully supported by sufficient urban development, and areas where higher place intensity is combined with relatively weaker transit conditions.

Overall, a more differentiated approach to development intensity and objectives could help better align district centre planning with the evolving public transport system, including regional connectivity.

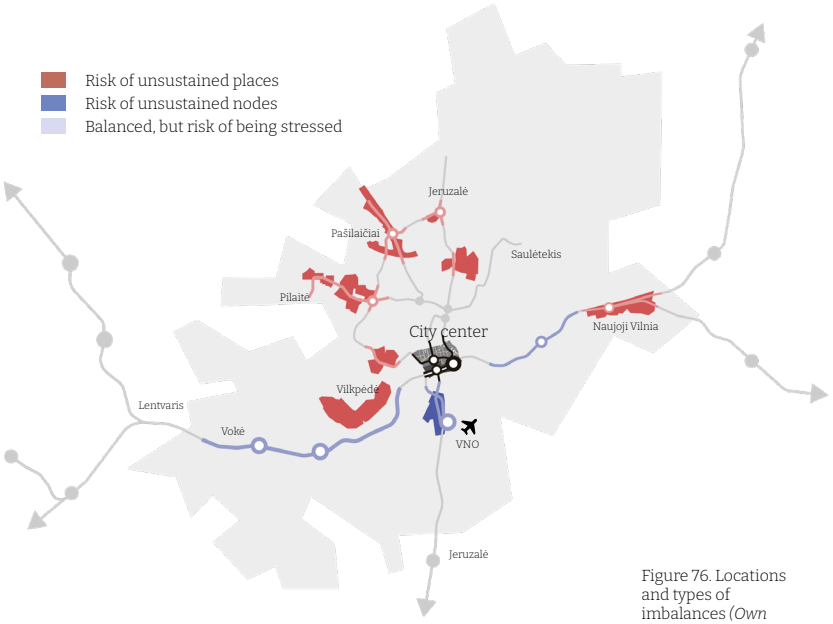


Figure 76. Locations and types of imbalances *(Own elaboration)*

Take aways

- According to the Node–Place model assessment of the planned development of district centres and public transport infrastructure in Vilnius, most district centres can be grouped into two categories: locations at risk of becoming either unsustained nodes or unsustained places.
- Most modernist residential districts, where district centres and tram connections are planned, risk remaining unsustained places.
- In contrast, areas adjacent to the railway, following the implementation of major transit projects, risk developing into unsustained nodes.

5.4 Walkability Challanges

Car oriented environments along main transit corridors

Although walkability challenges are often associated with design and planning decisions at the neighbourhood or district scale, in the case of Vilnius they are also partially shaped by city-scale planning decisions.

As discussed in the Problem Description chapter, a significant share of the existing rapid bus corridors overlap with high-capacity roads and car-oriented environments, even when serving established urban areas and large residential districts.

On one hand, it could be argued that the provisions of the newly adopted Master Plan, which designate district centres along main streets, and development of trams, simply require time for implementation and for the "humanization" of these streets and surrounding environments. However, this perspective would be misleading, as similar district centre zones were already designated in the 2003 Master Plan. Unfortunately, as we know, these areas did not develop into environments characteristic of district centres, but rather into suburban, car-oriented settings-large shopping centres, auto service facilities, and expanses of asphalt designed for parking.

Why did this happen? In my view, there are two main reasons. First, until the completion of the western bypass and other major road infrastructure projects around 2016, several of these streets functioned as the city's primary regional corridors. Over time, this led to the emergence of car-oriented environments along them, characterised by large parking areas, retail warehouses, and other suburban-style developments. Transforming these environments into more urban and walkable places is therefore a long-term process.

Second, despite the construction of alternative bypass routes, planning documents continue to assign these streets a major traffic function by classifying them as Category A or B roads. This creates a planning contradiction, where the intended role of the street, the development of the surrounding urban environment, and public transport investment often work against one another. As a result, the existing conditions are largely maintained, limiting opportunities to create high-quality district centres and more accessible public transport corridors.

Lithuanian regulations classify streets into four categories according to their function (Ministry of Environment ,2024):

Category A – High-speed roads: Provide long, continuous city connections and links to major highways; primarily for through traffic.
Category B – Main streets: Connect functional zones, districts, and major city centres, including large transport hubs; also link to suburban roads.
Category C – Service streets: Serve as functional and compositional city axes; carry main public transport lines and provide internal city connections.
Category D – Auxiliary streets: Local functional and compositional axes; distribute traffic within smaller areas and provide access to individual buildings and facilities.

The design requirements associated with higher-category roads, including higher design speeds, larger traffic volumes, multiple traffic lanes, and greater distances between pedestrian crossings, create challenges for the development of walkable environments and transit-oriented district centres.

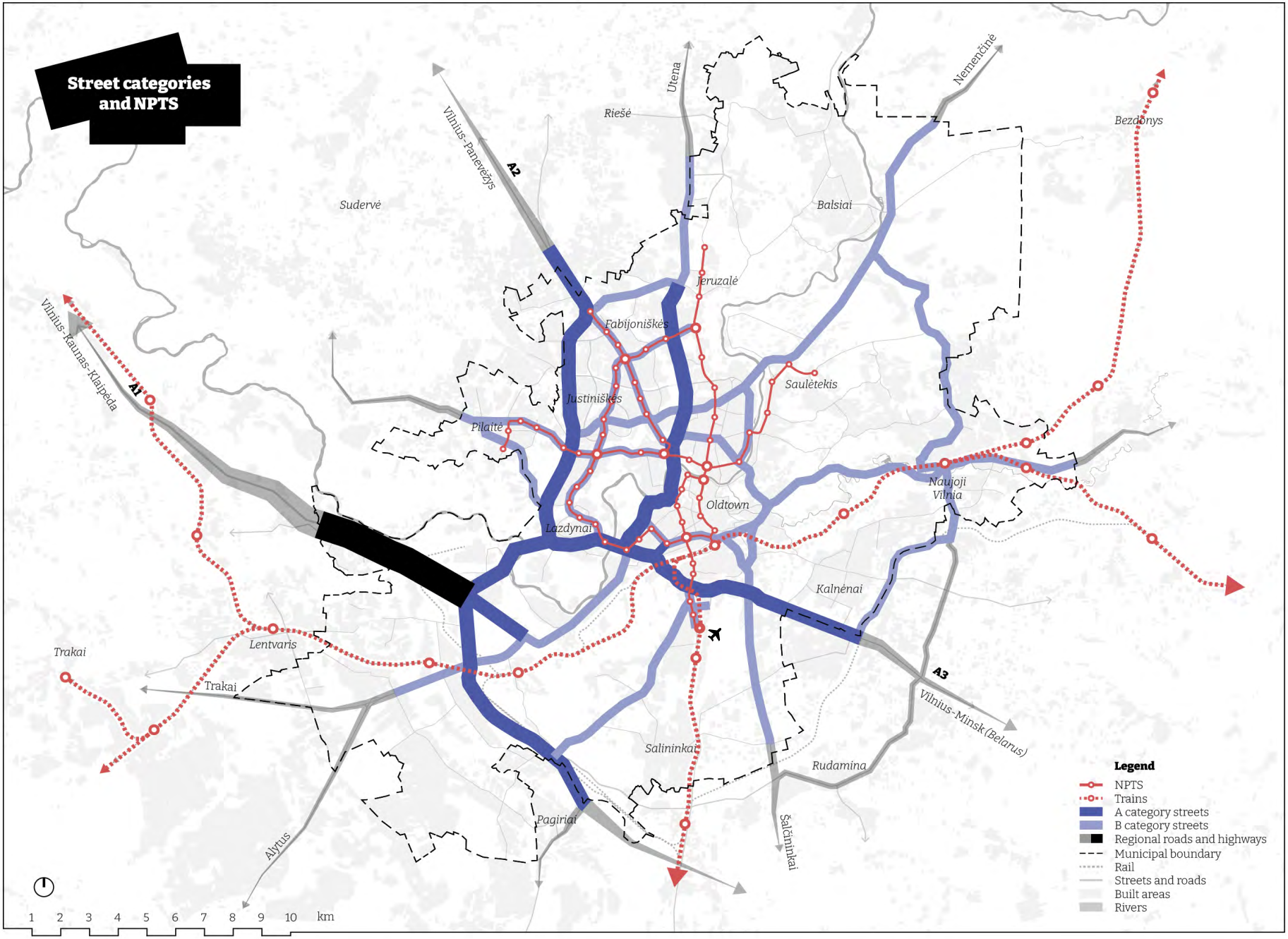


Figure 77. High category traffic streets in relation to planned transit system *(Own elaboration)*

The most affected areas

The most critical locations are not all Category B streets, but rather those where they create a direct conflict between the objectives embedded in planning documents. In particular, locations where Category A or B streets overlap with district centres (City Part Centre Zones) and rapid public transport corridors can be considered inherently conflict-prone. In these areas, competing objectives are concentrated within the same space: prioritising public transport, walkability, and the development of functional and spatially coherent urban centres, while simultaneously accommodating smooth, high-capacity through traffic. A total of five such areas have been identified, considering only redevelopment sites and other areas with significant development potential rather than fully developed urban districts.



Figure 78. Locations traffic and urban development conflict zones *(Own elaboration)*

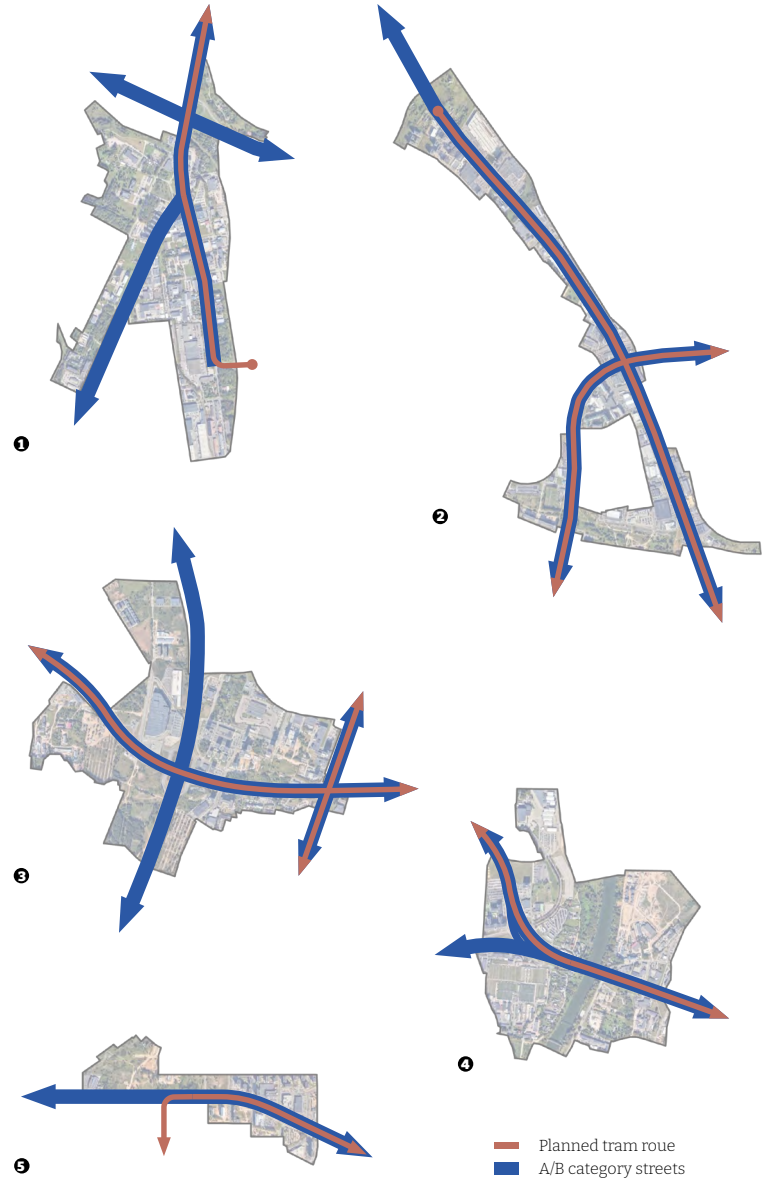


Figure 79. Conversion zones with future transit corridors intersected by A/B category streets *(Own elaboration)*

Planned development of B category streets

There are still several unbuilt B-category streets or important C-category streets, that are planned in Vilnius Masterplan *(Vilniaus Planas, 2021)*. In order to support transit-oriented development in the city, even automobile infrastructure should be reconsidered through a TOD lens. Rather than focusing on improving car mobility by continuously expanding or upgrading arterial roads, planning should instead address which strategic road links are actually necessary to remove traffic pressure from transit corridors neighbourhood centres.

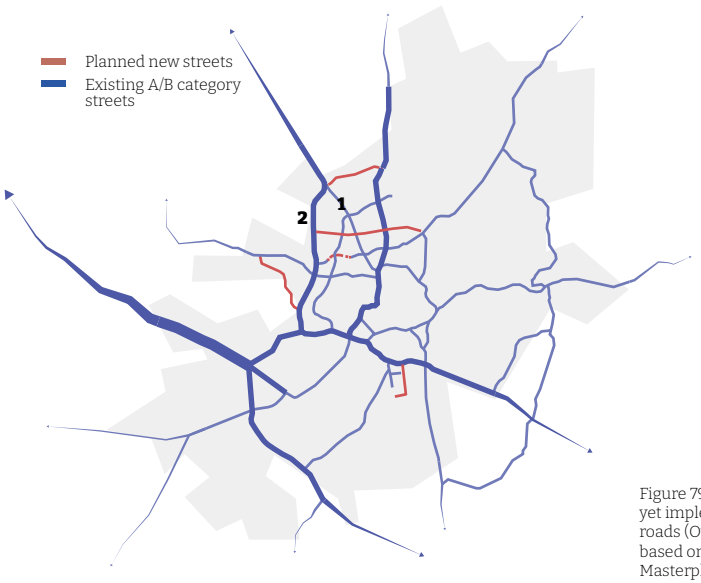


Figure 79. Planned but not yet implemented arterial roads (Own elaboration, based on Vilnius Masterplan)

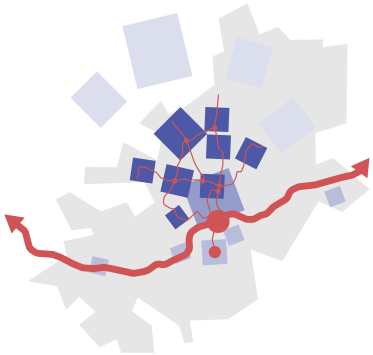
Take aways

- Although walkability around public transport corridors is a more fine-grained, neighbourhood-scale challenge, it is also partly determined by higher-level planning decisions.
- A significant share of public transport corridors, along which district centres are planned, are designated as B-category streets, which are expected to accommodate and facilitate high volumes of car traffic. These design requirements significantly constrain the potential to create high-quality, pedestrian-friendly environments along public transport corridors.
- Some of the planned B-category streets in Vilnius have not yet been constructed. The development of these streets should therefore be reconsidered not primarily as a means of increasing automobile capacity, but as an opportunity to redistribute and divert traffic flows away from public transport corridors, thereby improving conditions for walkability and transit-oriented urban environments.

5.4 Conclusions

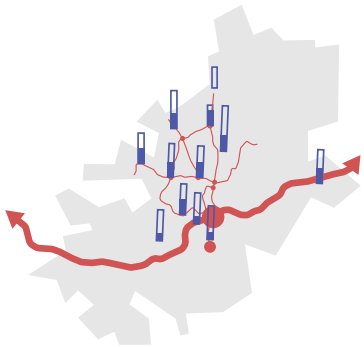
SQ2

How does the current city's development plans reflect TOD principles, and what implementation challenges does it face?



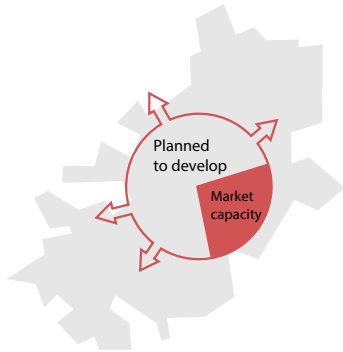
Node-place disbalance

Currently, the highest concentrations of jobs and residential areas are located far from transport nodes of regional significance. As a result, investments in urban rail and Rail Baltica will further increase the imbalance between node and place along the railway line and at its stations. At the same time, this creates a situation in which critical national Rail Baltica infrastructure, urban rail, and the associated massive investments will not directly serve the hundreds of thousands of residents living in more distant districts. Therefore, it is essential over the coming decades to consolidate urban development around railway nodes as much as possible, thereby strengthening the place/node balance of these hubs.



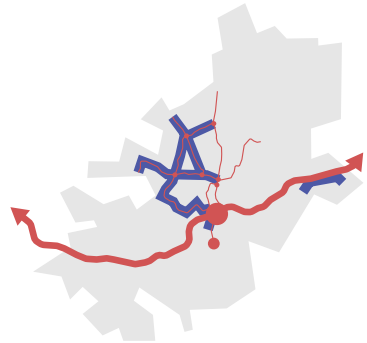
Uniform development potential is planned, regardless of the planned transport hierarchy.

However, the Master Plan currently proposes similar building densities across different developable areas, without taking into account the place-node balance of each location. Most areas along the future tram lines do not require an increase in place value, as these territories already have a significant concentration of residents, and while the future tram will provide excellent public transport, it will primarily serve as a city-level transport corridor. The opposite situation exists around railway stations, where national, regional, and urban transport modes intersect. Although these are highly important transit nodes, the planned development density is set at the same level as around regular tram corridors.



Excessive overall development potential

Vilnius has a large number of convertible, underdeveloped areas along the future public transport corridors. While this represents a potential opportunity, the current Master Plan proposes development densities in these areas that exceed the real capacity of the construction market. This creates a challenge in consolidating and developing territories, particularly in locations where the most important transport nodes will be established. To achieve a balanced node–place relationship, it is crucial to consider the realistic capacity of the market to develop these areas over the coming decades; otherwise, a significant number of underdeveloped zones along public transport corridors will persist.



Conflict between car traffic, public transport ar neighbourhood development planning

Transit-oriented development requires qualitative criteria related to the concept of a walkable city. Although these issues are often addressed at a smaller, district scale, in Vilnius the challenges of car-oriented environments are already embedded at the planning level. A significant portion of the planned tram corridors and the district centres along them coincide with existing or planned high-capacity arterial roads (Categories A and B). This compromises the concept of transit-oriented development, as the TOD framework calls for creating walkable, transit-oriented environments around public transport corridors and nodes.

Figure 80. Analysis conclusion schemes (Own elaboration)

6

Vilnius TOD Strategy

This chapter aims to answer the third part of research question: **What strategic changes are needed in Vilnius public transport and urban development planning to implement a Transit - Oriented Development?** This chapter presents conceptual strategic principles intended to address the missing gaps between TOD principles and the current planning framework of Vilnius, identified in the previous chapter.

Vilnius TOD Strategy

SQ3

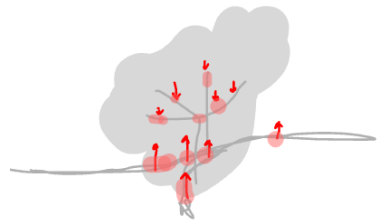
What strategic changes are needed in Vilnius public transport and urban development planning to implement a Transit - Oriented Development?

To achieve transit-oriented urban development in Vilnius, a clearer TOD strategy is needed to better integrate public transport planning and urban development.

Such a strategy could be based on a set of interconnected conceptual principles linking these planning domains. In response to the challenges identified in the previous chapter, three conceptual principles for a Vilnius TOD strategy are proposed. These principles address the key issues that emerged from the analysis: urban development that is insufficiently aligned with the planned hierarchy of the public transport system; development parameters for district centres that do not correspond to actual market capacity and conflicts between district centre development, public transport priorities, and the organisation of through traffic at the city-planning level.



Plan transit system as an urban development framework



Allign urban development with transit hierarchy and market capacity



Rearrange vehicle traffic to prioritize development of transit and walkable neighbourhood centres

Figure 81. Conceptual principles of Vilnius TOD strategy (Own Elaboration)

7

Design exploration

This chapter corresponds to the fourth sub question and explores **how should strategic TOD solutions be implemented at the neighbourhood scale in order to create vibrant, walkable, transit-oriented district centres?** Urban development visions for two different neighbourhood centres (conversion zones) were created, aiming to spatially interpret the objectives defined within the TOD strategy and to test how the proposed principles would operate at the neighbourhood scale.

7.1 Selected Areas
7.2 Site 1 - Metropolitan Center
7.3 Site 2 - Residential Neighbourhood Center
7.4 Conclusions

7.1 Selected Areas

Two design areas

The objective of the design phase is to develop visions for two conversion areas designated as district centre zones in the Vilnius Master Plan. Following the TOD strategy proposed in the previous chapter, two areas with fundamentally different development objectives were selected.

The first area represents a future metropolitan centre (1), where the objective is to concentrate a significant share of future urban development, employment, and city- and national-scale functions. A site adjacent to Vilnius Airport was selected due to its future role as one of the strongest transit nodes in the metropolitan region.

The second area represents a neighbourhood centre located along a future tram corridor (2). Here, the objective is fundamentally different: to create a walkable district centre while minimising development intensity, avoiding major attractors and higher-order functions, and focusing primarily on local services and everyday neighbourhood activities.

To explore potential solutions to the conflict between transit-oriented development and car-oriented street infrastructure, both areas were selected in locations where planned public transport corridors coincide with high-capacity urban roads.

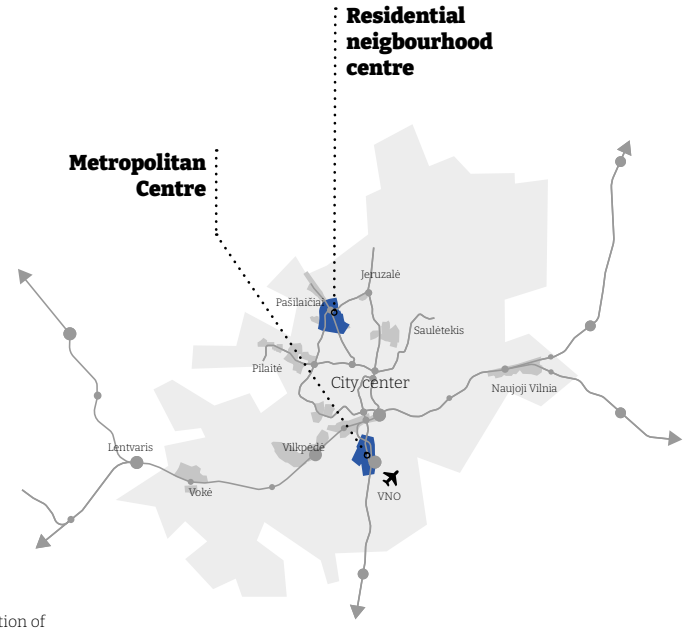


Figure 82. Location of selected design areas (Own Elaboration)



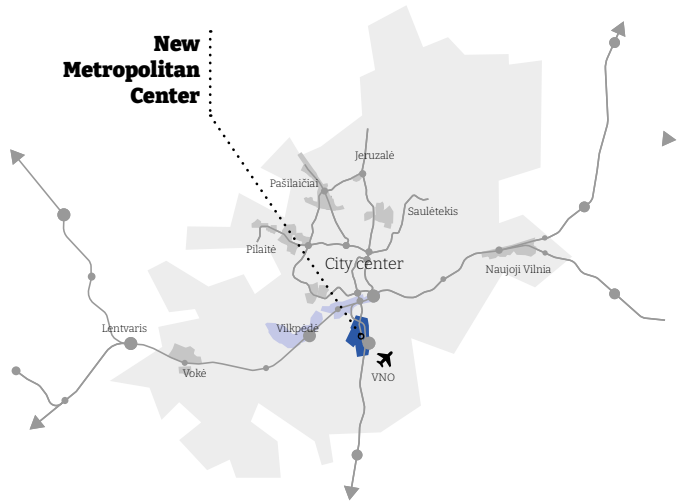
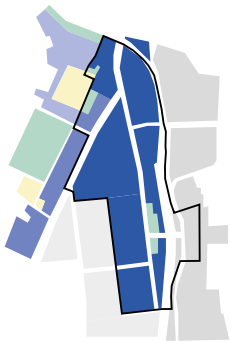


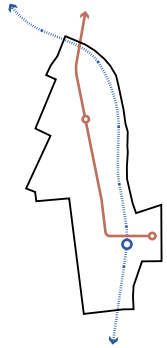
Figure 83 - Site 1 (Metropolitan center) location scheme. (Own elaboration)

Existing situation

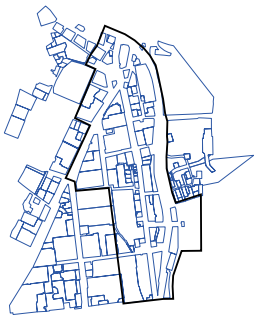


Zoning plan
Local center zone, surrounded by residential, industry/logistics and service zones (based on Vilnius masterplan)

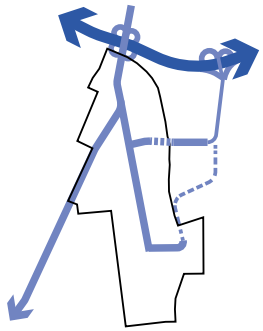
- Urban Centre Zone
- High-Density Residential Zone
- Low-Density Residential Zone
- Green Space Zone
- Specialized Complexes Zone



Transit
Existing railway ditch and express bus route - the location of planned tram line and Rail Baltica Station



Parcels
Majority of the areas are privately owned parcels



Major streets
Existing and planned higher category streets (based on VIlnius Masterplan)

Figure 84. Schemes explaining the existing situation of the design site (Own elaboration)

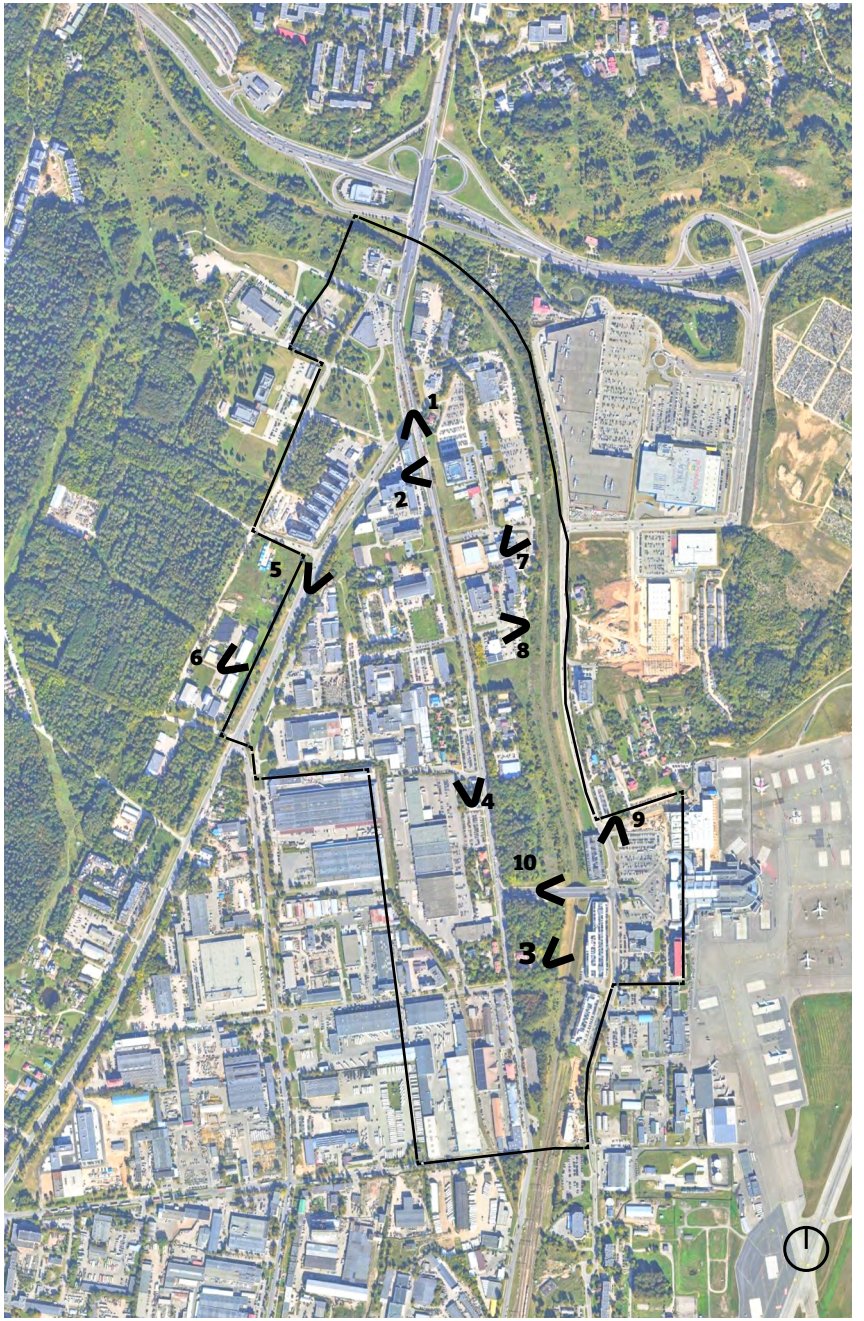


Figure 85. Map of locations of street views. *Source: Google Earth*



Public transport corridor and a bus stop



Bus stop and new office building



Train station near the Airport



Undeveloped parcels



Overview of the northern part of the area, with emerging office buildings, new housing units, and large, suburban style retail stores



B category street



Rail ditch and large shopping mall



Access side streets



Multi srotey parking lots near the airport



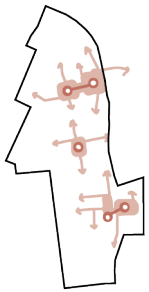
Airport environment, multistorey parking lots, rail ditch and a train stop

Figure 86. Views of the existing situation of the design area. *Source: Google streetview (2024).*

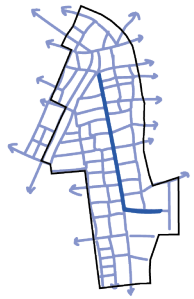
Design concept



Transit corridors - the core of pedestrian oriented public space structure



Main plazas, squares and mixed functions around stations



Dense grid of walkable, slow streets



Green park loop for pleasant residential realms

Figure 87. Design concept schemes (Own elaboration)

Public space structure

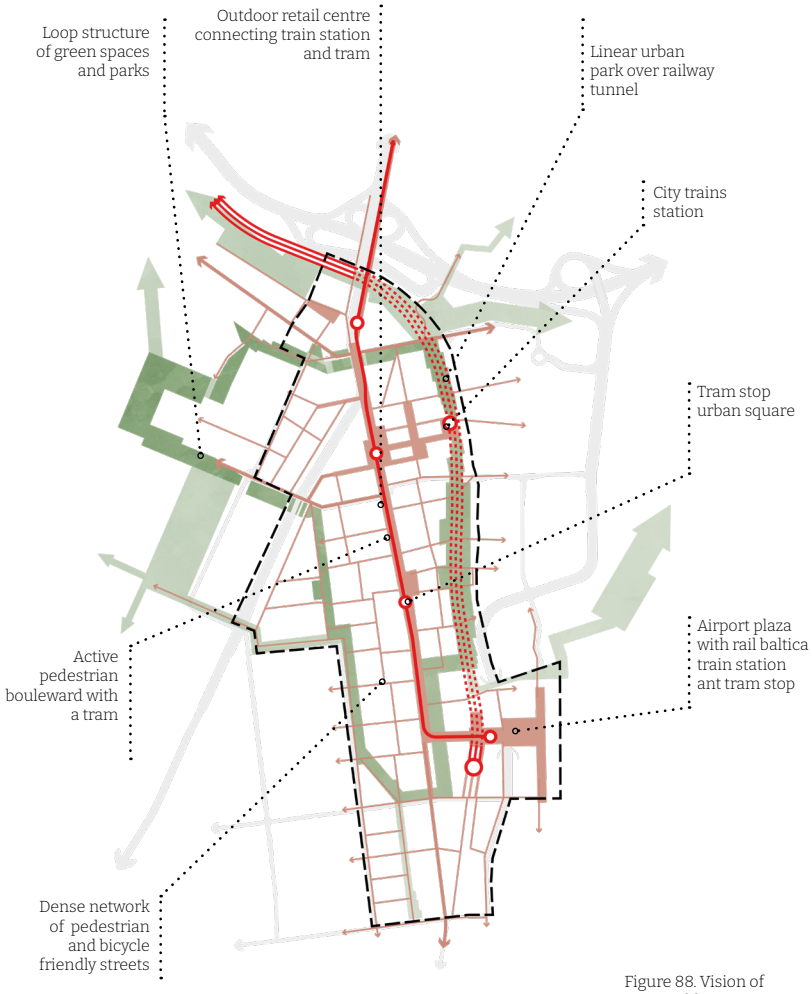


Figure 88. Vision of main public space structure and transit. (Own elaboration)

Transit organisation

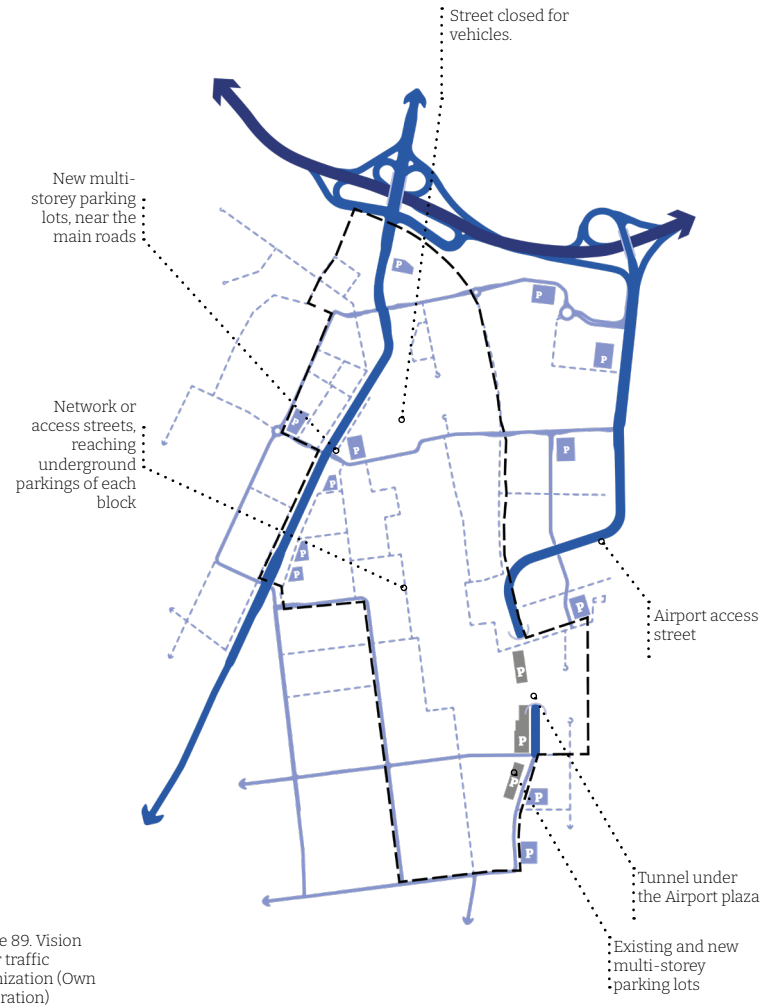


Figure 89. Vision of car traffic organization (Own elaboration)

Built environment

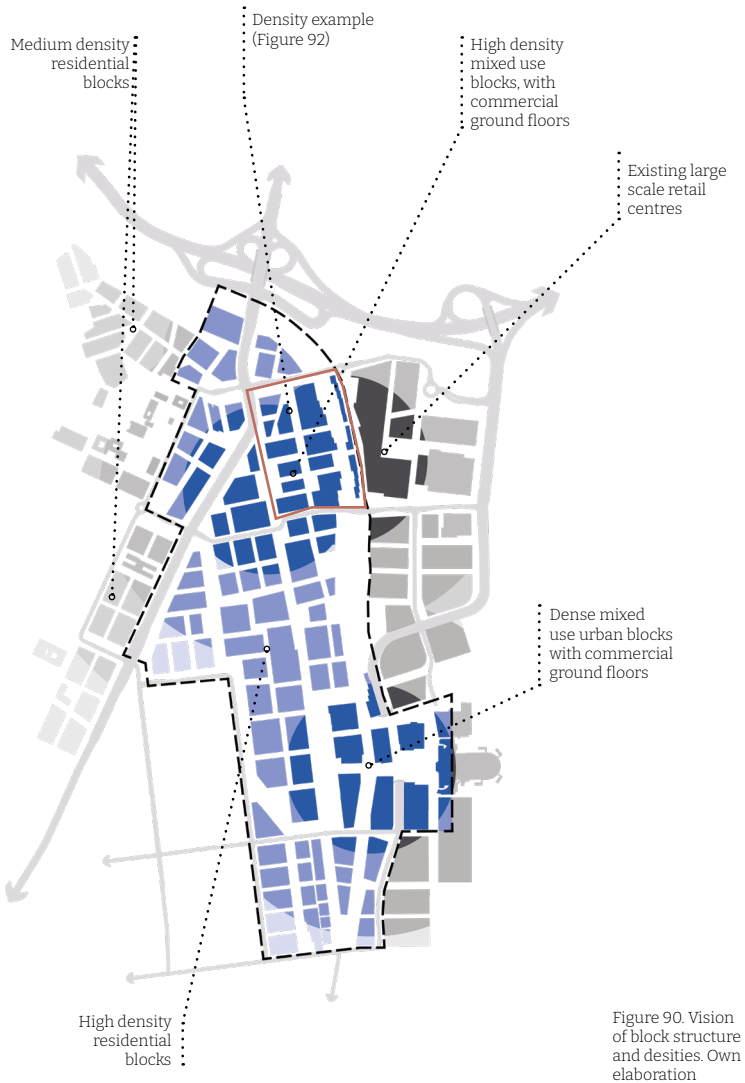


Figure 90. Vision of block structure and desities. Own elaboration

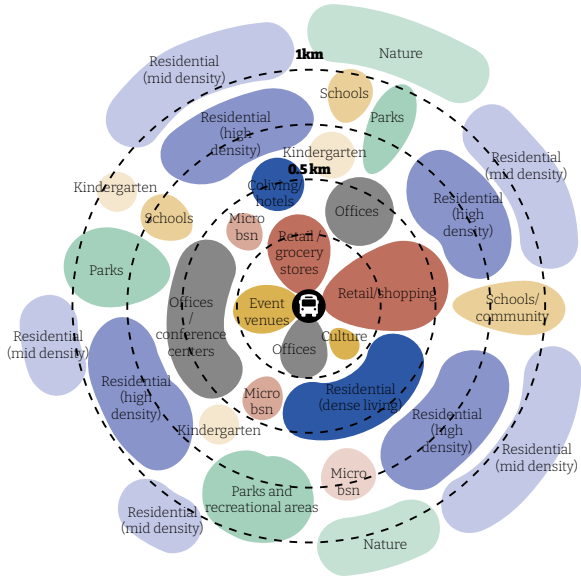


Figure 91. Principles of functional distribution and proximity. (Own elaboration)

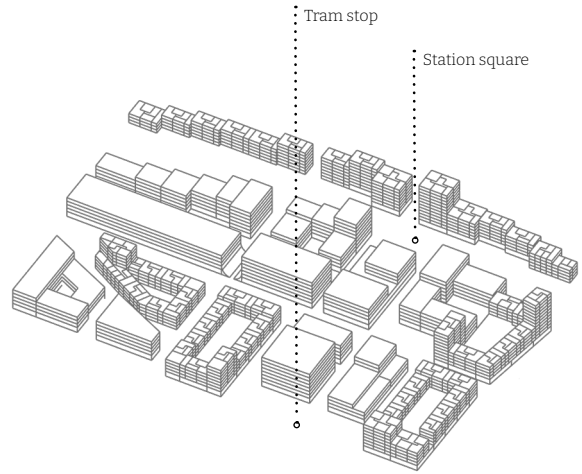


Figure 92. Axonometry view of development densities. (Own elaboration)

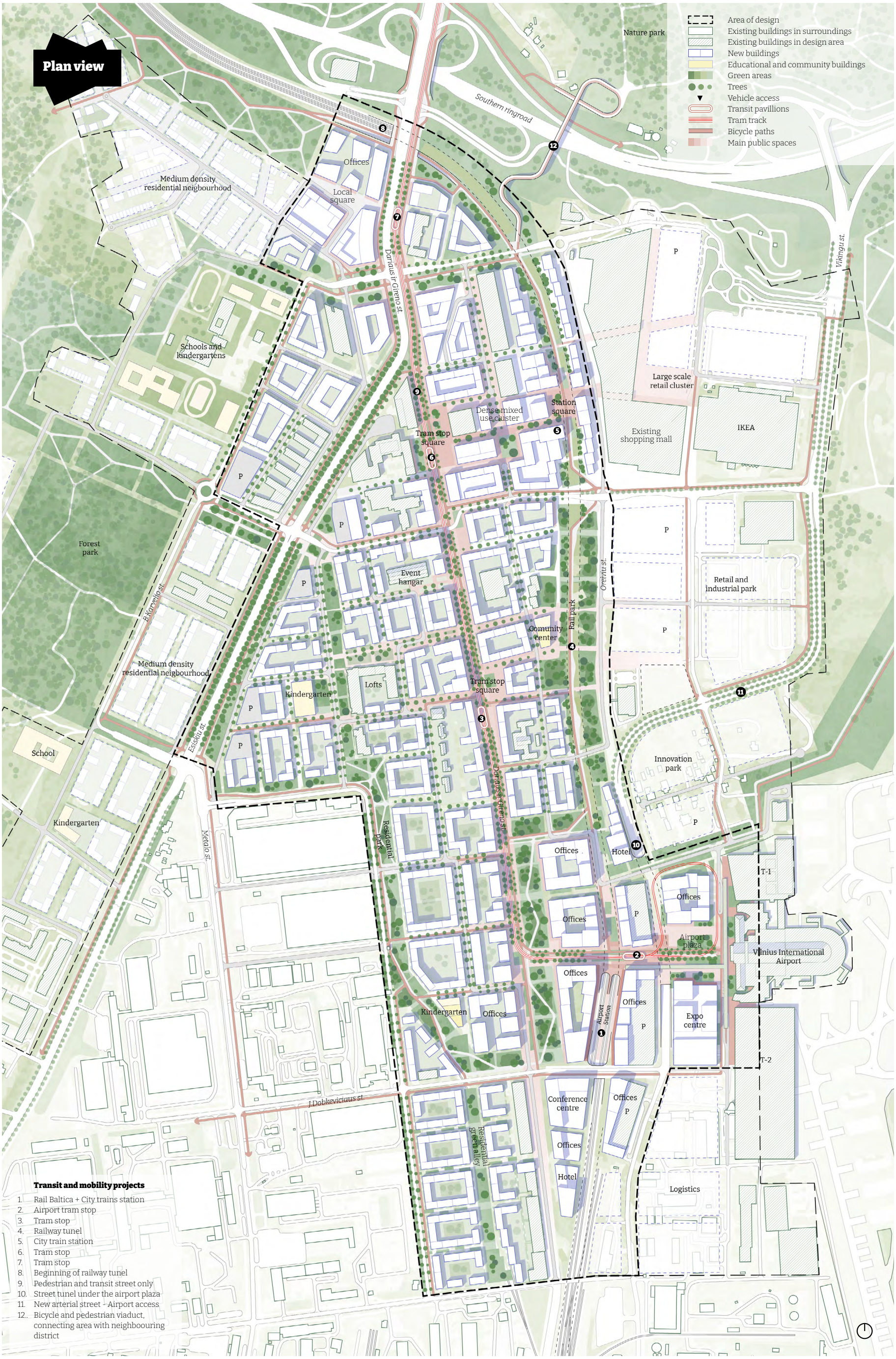
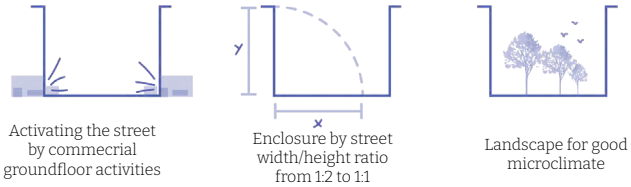


Figure 93. Vision plan of future metropolitan centre (Own elaboration)

Main transit corridor

In a dense, mixed-use, and transit-served urban environment, accommodating large volumes of car traffic becomes increasingly incompatible with walkability and urban quality. For this reason, the proposed main street is designed as a pedestrian-, cycling-, and public transport-oriented boulevard, serving as the primary public space and mobility corridor of the district.

Main principles for a good street:



Activating the street by commecrial groundfloor activities

Enclosure by street width/height ratio from 1:2 to 1:1

Landscape for good microclimate

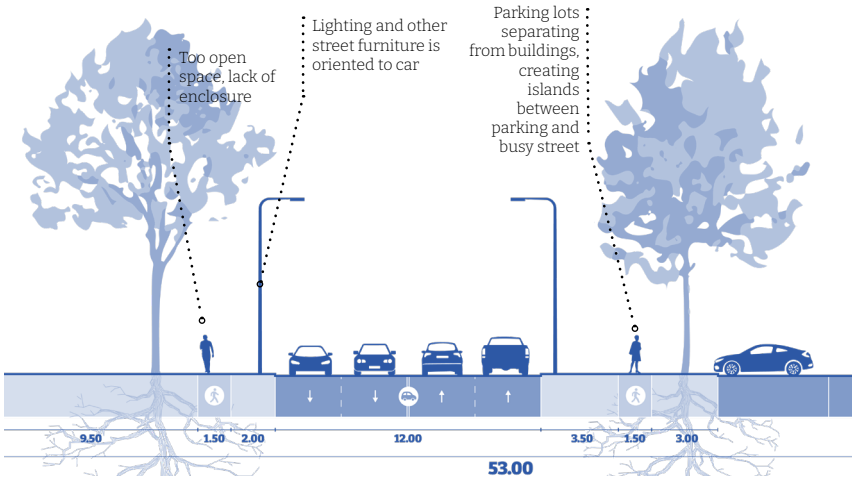


Figure 94. Section view of existing Dariaus ir Girėno street. Own elaboration

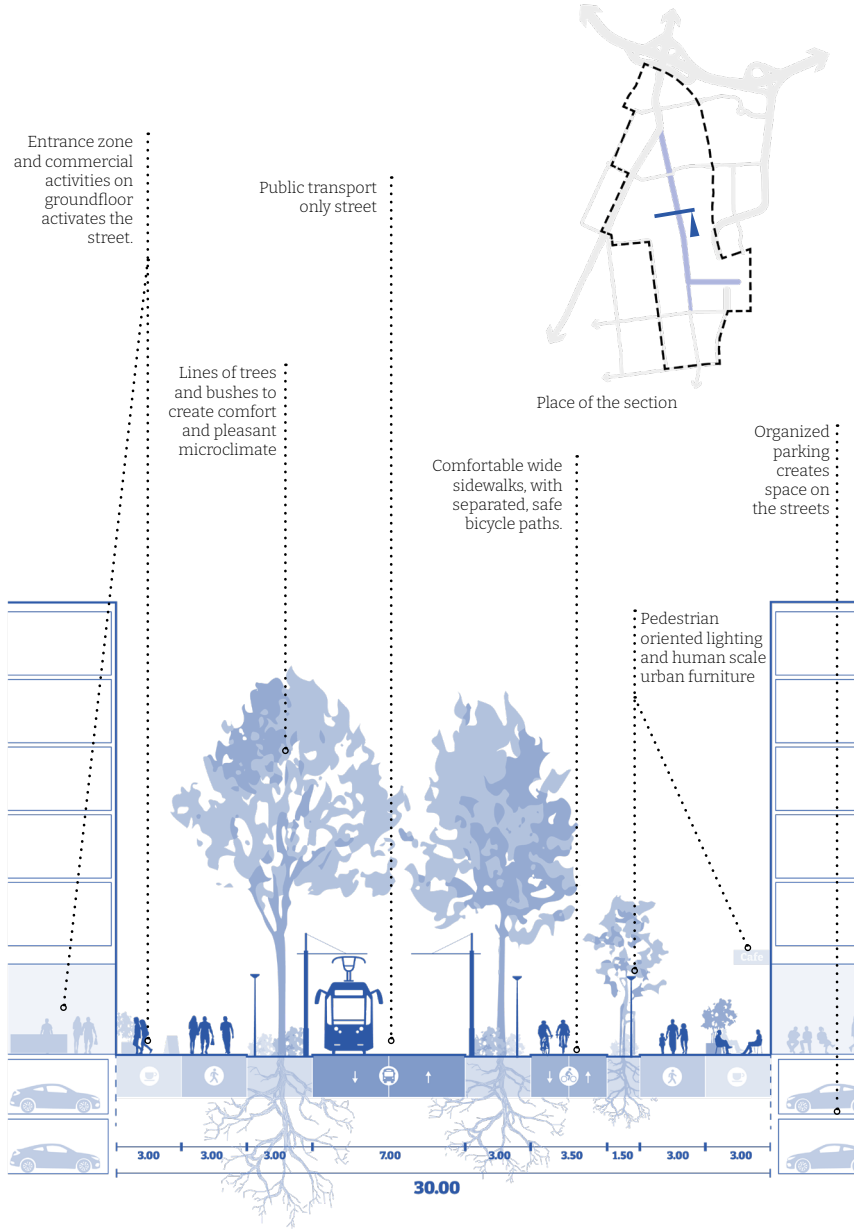


Figure 95. Section view of proposed Dariaus ir Girėno street. Own elaboration

Network of walkable streets

A dense network of low-speed and pedestrian-oriented streets ensures convenient access to public transport while also supporting easy movement between destinations within the district itself. As the proposed metropolitan centre accommodates higher densities and building heights, even car-free streets are designed with generous widths to maintain comfortable street enclosure ratios, sufficient greenery, good solar access, and a high-quality microclimate.

Ground floors are envisioned as active frontages, with commercial uses concentrated along key public spaces and movement corridors. Along quieter streets, residential ground floors with direct street access, terraces, and small front gardens can contribute to a lively and diverse public realm, creating a more engaging pedestrian environment.

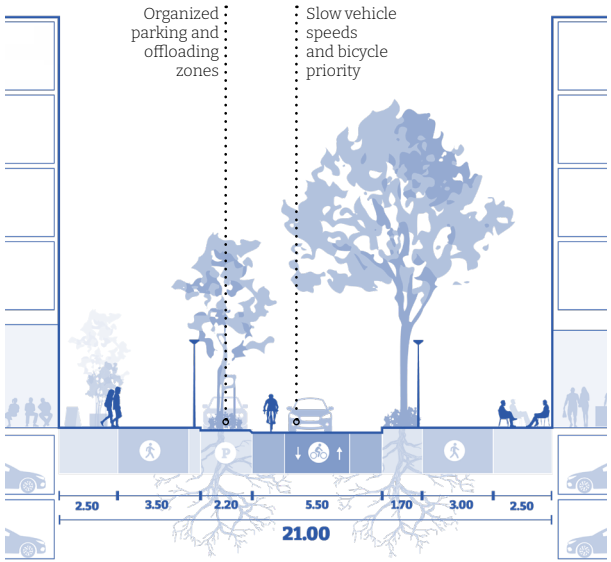
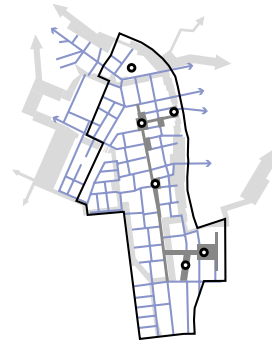


Figure 96. Section of proposed slow streets. (Own elaboration)



Network of slow streets

Figure 97. Section of proposed pedestrian and cycling only streets. (Own elaboration)



Figure 98. Street views of Dariaus ir Girėno street. *Source: Google streetview (2024).*



Figure 99. Illustration of the proposed development vision. Generated using ChatGPT (OpenAI) (Indicative representation)



Figure 100. Street view of Airport access. *Source: Google streetview (2024).*



Figure 101. Illustration of the proposed development vision. Generated using ChatGPT (OpenAI) (Indicative representation)



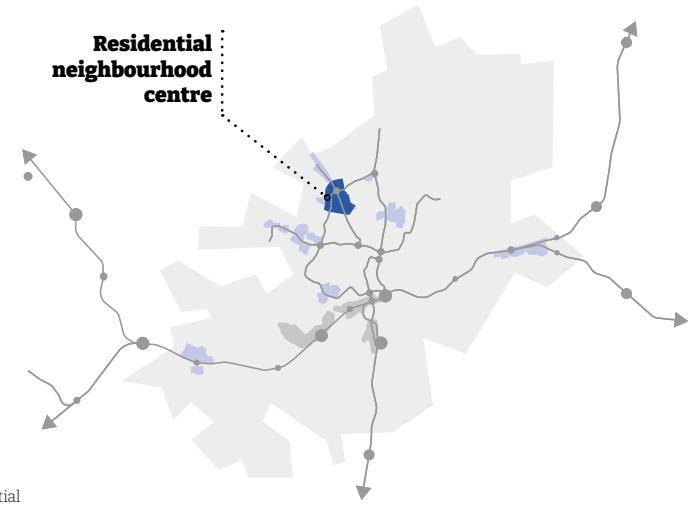


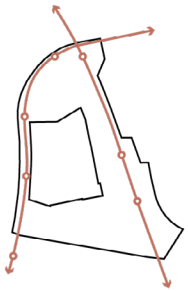
Figure 102.
Site 2 (Residential neighbourhood centre) location scheme. (Own elaboration)

Existing situation

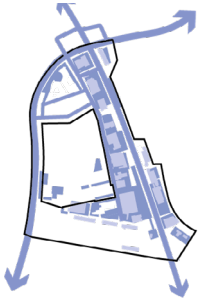


Zoning plan
Local center zone, surrounded by dense, medium dense residential zones

Urban Centre Zone
High-Density Residential Zone
Low-Density Residential Zone
Green Space Zone
Specialized Complexes Zone



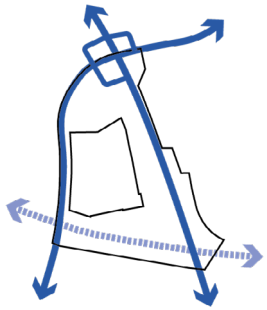
Transit
Existing express bus routes and planned future tram routes.



Car oriented environments
Majority of environments around public transport are coverd by parking lots, asphalt and suburban style shopping hangars



Parcels
Majority of the areas are privately owned parcels



Major streets
Existing and planned higher category streets

Figure 103. Schemes explaining the existing situation of the design site (Own elaboration)

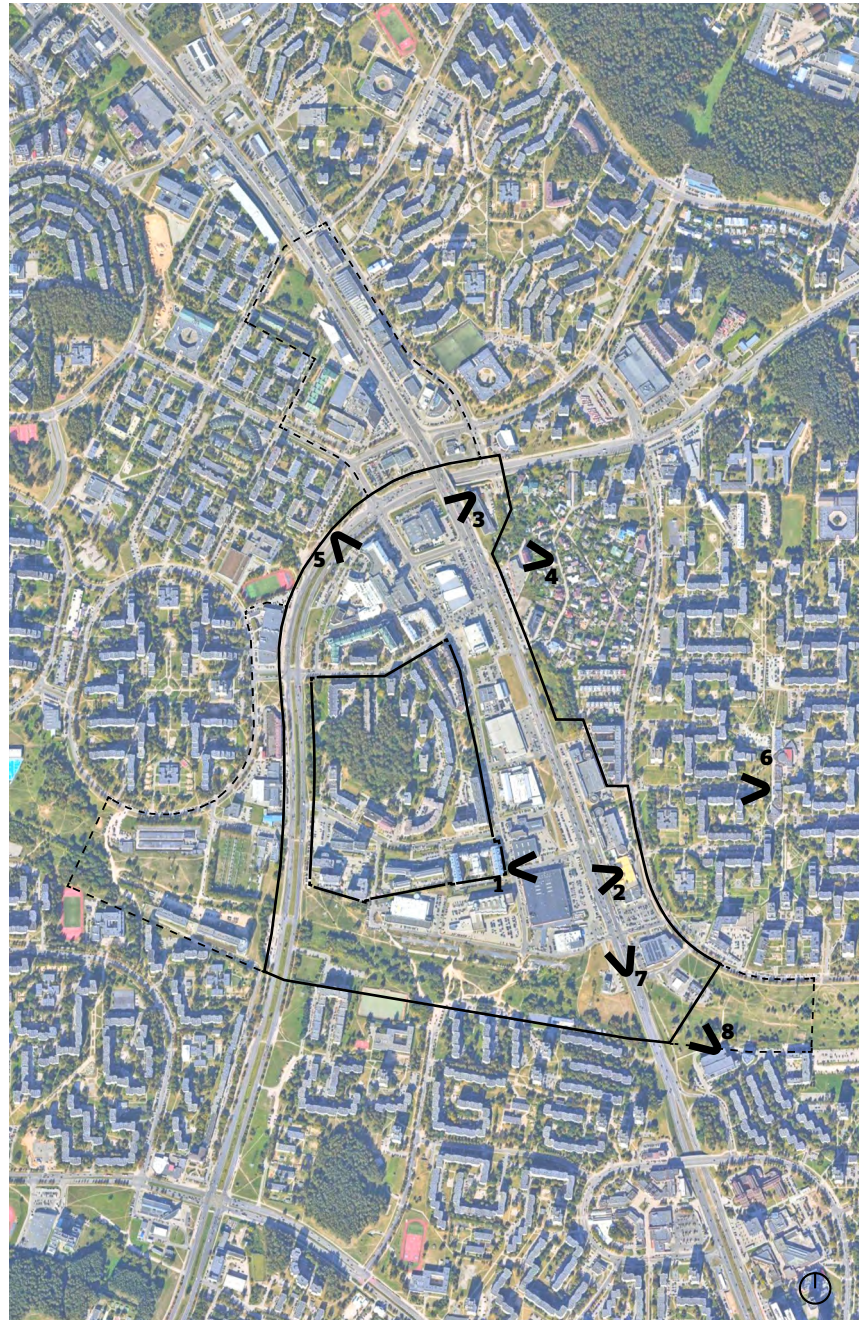


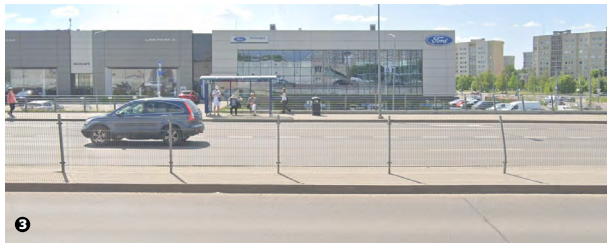
Figure 104. Map of locations of street views. *Source: Google Earth*



Back side of suburban mall



Bus stop between road and parking lot



Public transport stop, surrounded by roads, parking lots, and car dealership warehouse



Overview of the northern part of the area



Access to multifunctional building



Modernist neighbourhoods streets



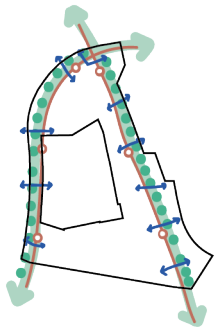
Ukmergės street - the arterial road where the main tram corridor is planned



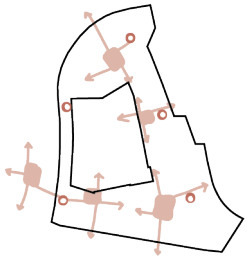
Overview of the southern part of the area

Figure 105. Views of the existing situation of the design area. *Source: Google streetview (2024).*

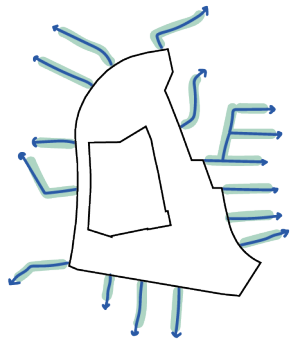
Design concept



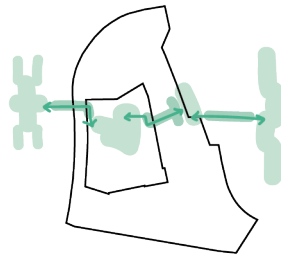
Development of tram = revitalizing the street



Creating small local squares near the tram stops



Improving the connections in surrounding neighbourhoods



Connecting green areas of surrounding neighbourhoods

Figure106. Design concept schemes (Own elaboration)

Public space structure and transit accessibility

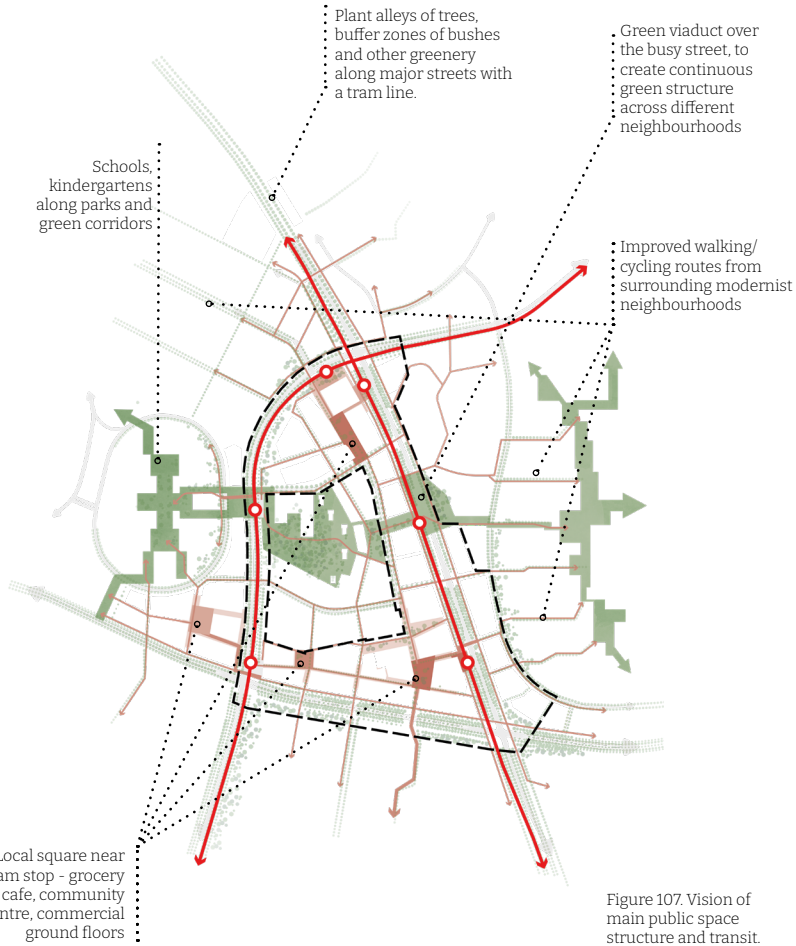


Figure 107. Vision of main public space structure and transit. (Own elaboration)

Transport organization

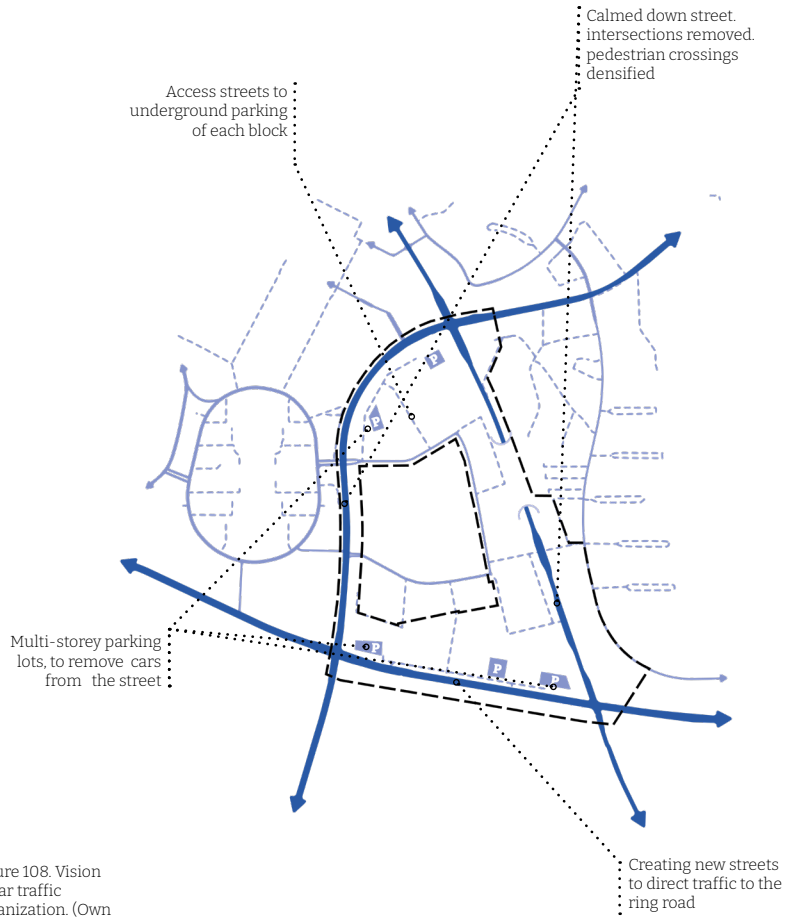


Figure 108. Vision of car traffic organization. (Own elaboration)

Built environment

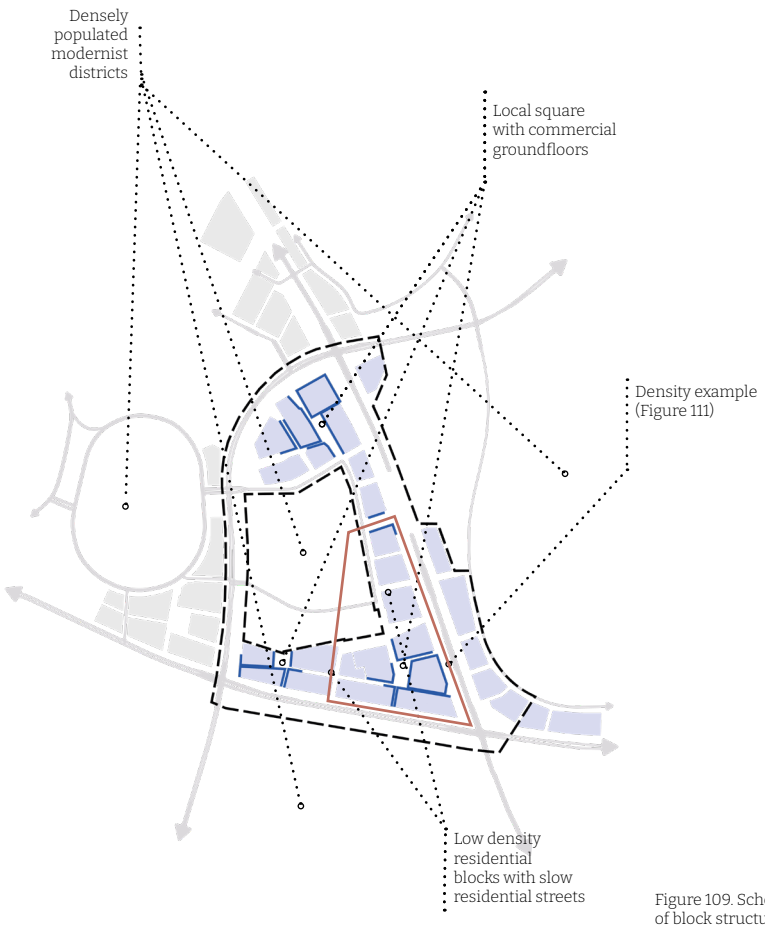


Figure 109. Scheme of block structure and densities. (Own elaboration)

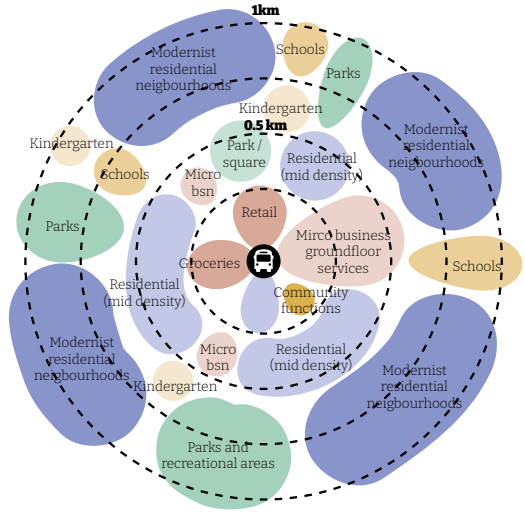


Figure 110. Principles of functional distribution and proximity. (Own elaboration)

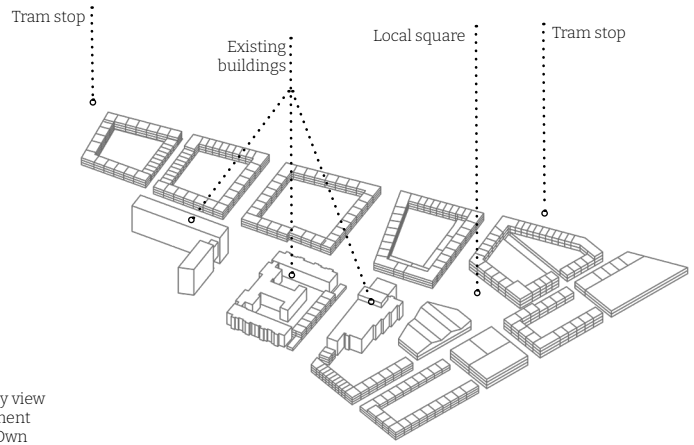


Figure 111. Axonometry view of development densities. (Own elaboration)

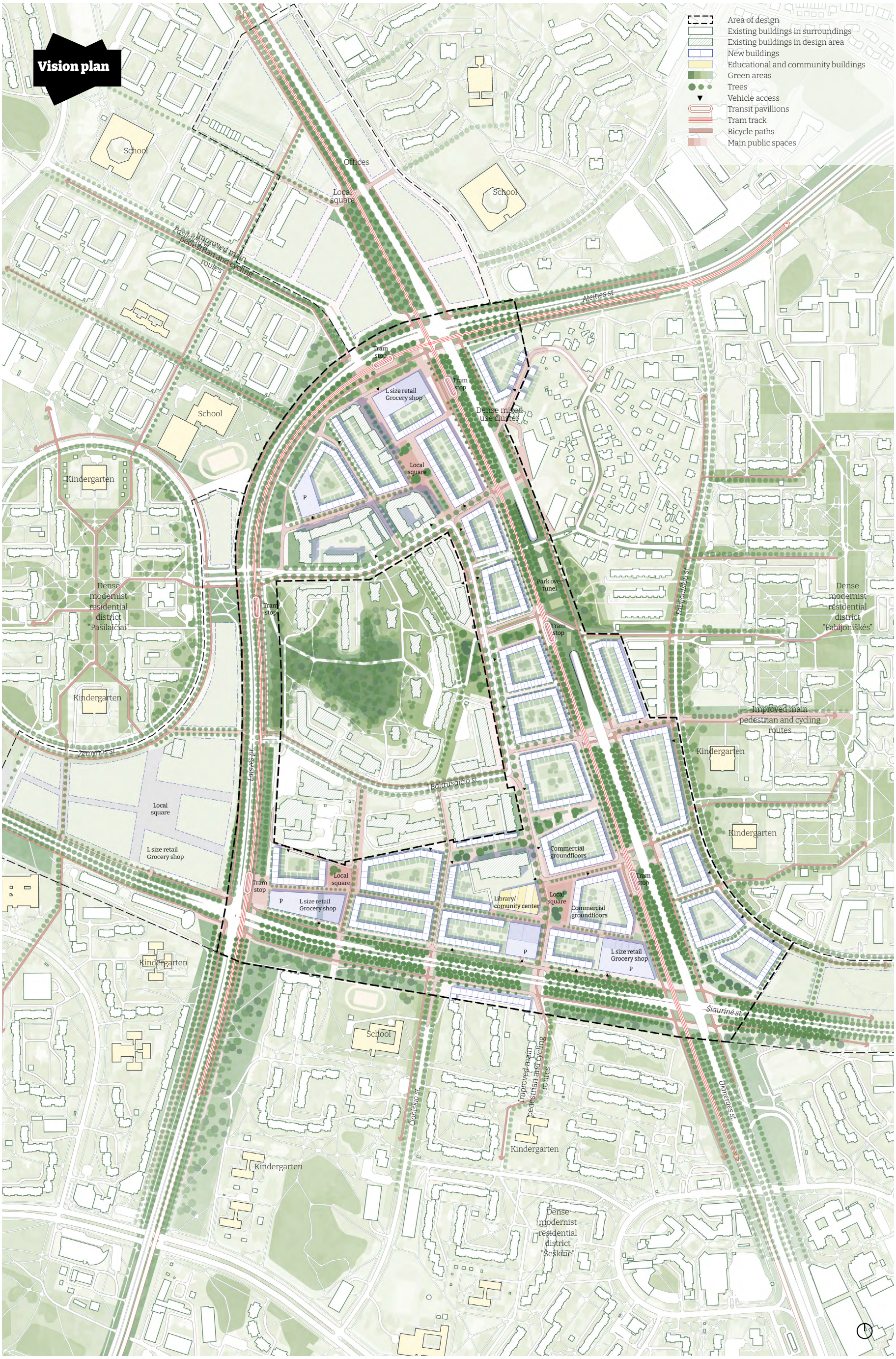


Figure 112. Vision plan of Residential neighbourhood centre in Pašilaičiai district. (Own elaboration)

Main transit corridor

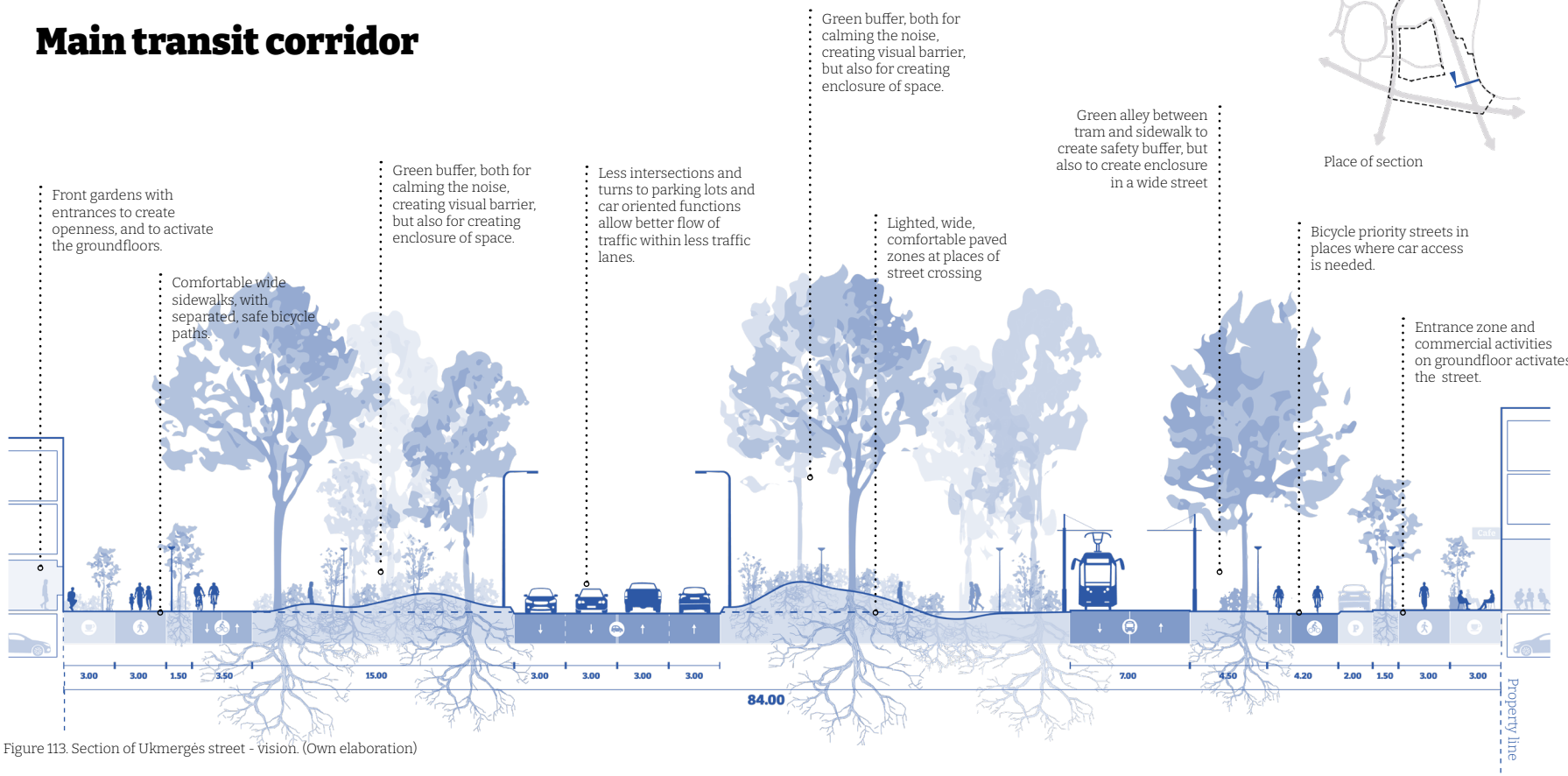


Figure 113. Section of Ukmergės street - vision. (Own elaboration)

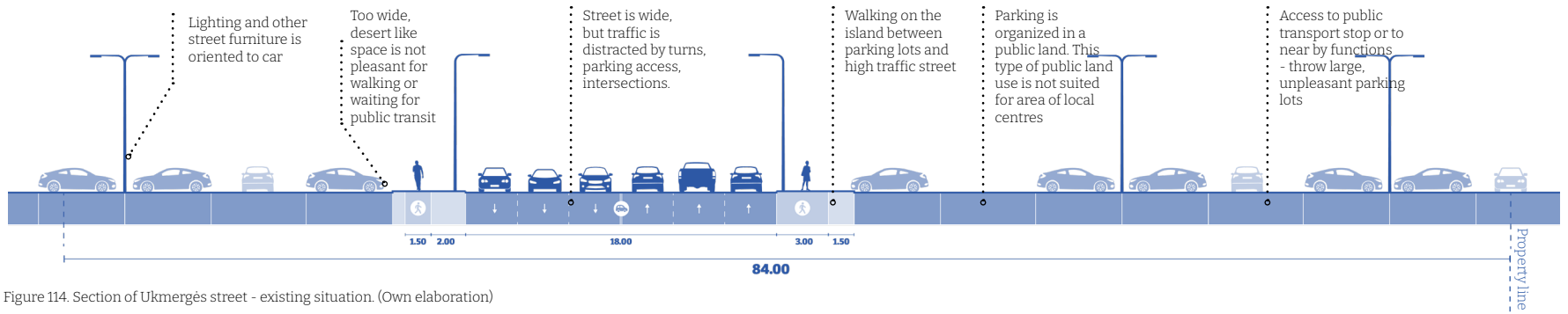


Figure 114. Section of Ukmergės street - existing situation. (Own elaboration)

Network of walkable streets

The proposed street network consists of pedestrian streets and low-traffic shared streets. The relatively low planned building density and height allow for narrower streets, intimate pedestrian passages, and greener transition spaces at building entrances, including the introduction of small front gardens and semi-private courtyard elements.

In streets where car access is required, a greater street width becomes necessary. To maintain a sense of spatial enclosure while preserving the relatively low-density character of the area, the proposal introduces rows of trees and layered vegetation, creating green corridors that soften the presence of vehicular infrastructure and contribute to a more human-scale streetscape.

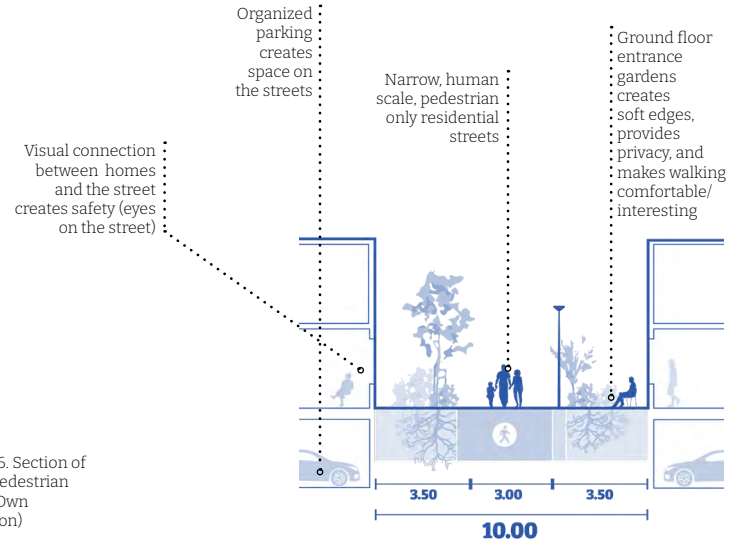


Figure 116. Section of narrow pedestrian streets. (Own elaboration)

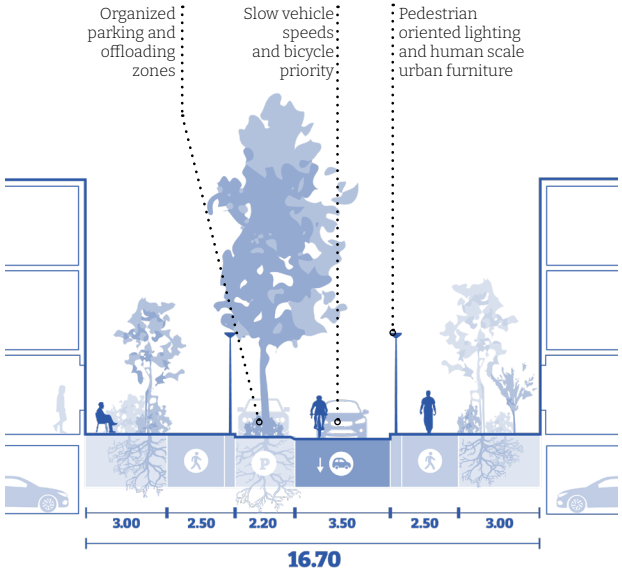


Figure 115. Section of slow traffic residential streets. (Own elaboration)

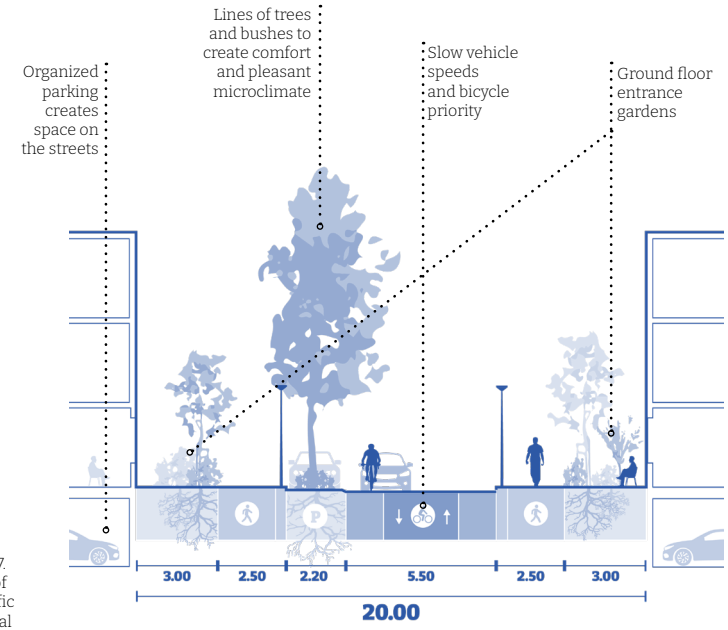


Figure 117. Section of slow traffic residential streets. (Own elaboration)



Figure 118. Street view of Ukmergės street and a suburban style parking lot. *Source: Google streetview (2024).*



Figure 119. Illustration of the proposed development vision. Generated using ChatGPT (OpenAI) (Indicative representation)



Figure 120. Street view of Back sides of Ukmergės street malls. *Source: Google streetview (2024).*



Figure 121. Illustration of the proposed development vision. Generated using ChatGPT (OpenAI) (Indicative representation)



Figure 122. Street view of residential access street in a modernist residential neighbourhood.
Source: Google streetview (2024).



Figure 123. Illustration of the proposed development vision. Generated using ChatGPT (OpenAI) (Indicative representation)

7.4 Comparison

The process of developing walkable, transit-oriented visions for the two sites revealed that the implementation of TOD principles at the neighbourhood scale cannot rely on a universal set of urban design measures. While in both sites it was seeked to create vibrant, walkable, transit-oriented district centres, the proposed interventions differ significantly in response to their position within the urban and transit hierarchy. In the metropolitan centre, walkability is supported through higher densities, a greater mix of uses, intensified development around major public transport infrastructure, and a concentration of regional destinations (more measurable aspects). In contrast, the residential district centre achieves walkability through a more modest urban form, focused on local services, everyday destinations, human-scale public spaces, and a comfortable pedestrian environment (less measurable aspects).

The design exploration further suggests that urban design attributes commonly associated with walkability cannot be evaluated independently from their wider urban context. Paradoxically, characteristics often universally considered to support walkability, such as a diverse functional mix, concentrations of employment, retail, and cultural destinations, may only contribute to walkability when located in places that are appropriately positioned within the wider public transport network. In highly accessible transit nodes, these functions and high densities reinforce proximity, support active street life, and increase opportunities for walking. However, if located in areas with lower levels of transit accessibility, the same functions may generate longer travel distances and greater dependence on private vehicles. From a TOD perspective, therefore, walkability is shaped not only by the characteristics of a place itself, but also by its relationship to the wider urban and transport structure.

These findings suggest that walkability is not determined by a fixed set of spatial parameters or design interventions. Rather, it emerges through the alignment of urban form, land-use intensity, accessibility, and place function within the broader urban system. Consequently, creating walkable environments requires context-sensitive urban design responses that maintain the core, conceptual principles of walkability (e.g. Speck four pillars of walkability) while adapting their spatial expression to the specific role of a place within the city.

8

8.1 Conclusions
8.2 Reflection

Conclusions and reflection

8.1 Conclusions

Answering reseach question

This research sought to answer the question: **How should TOD principles be applied to the development of Vilnius' new public transport system (NPTS) and local centres in order to make neighbourhoods more vital and walkable?**

The findings suggest that Transit-Oriented Development should not be understood simply as urban growth around public transport. Instead, the fundamental objective of TOD is to create a balance between transit accessibility and place intensity. Equally important is the creation of walkable environments around public transport corridors and nodes. In this sense, a transit-oriented city is also a walkable city.

Furthermore, the relationship between public transport and walkability is inherently interconnected. Increasing public transport use inevitably increases pedestrian activity, as every public transport trip begins and ends as a walking trip. For this reason, TOD does not treat public transport infrastructure as an isolated mobility investment, but as part of a broader urban environment that must condition walking to be safe, comfortable, useful and interesting.

The node–place assessment demonstrated that, despite positive intentions to concentrate development around public transport, the current planning framework of Vilnius does not fully support the creation of balanced transit-oriented environments. The analysis revealed a mismatch between the hierarchy of planned transport investments and the relatively uniform development expectations assigned to district centre zones. Similar density and functional parameters are often planned in locations with fundamentally different levels of accessibility and connectivity.

This mismatch became particularly evident when comparing dense residential districts planned around future tram corridors with areas surrounding future metropolitan transit nodes. Many existing residential districts already possess substantial place intensity due to their population density. In these areas, the introduction of tram infrastructure alone may be sufficient to significantly improve node–place balance. Additional large-scale development, employment concentration, or higher-order functions risk creating unsustained place conditions.

Conversely, the strongest future transit nodes, where regional rail, city rail, tram, and Rail Baltica services intersect, remain relatively underdeveloped despite offering the highest accessibility potential in the metropolitan region. The research therefore suggests that within comming decades, a greater share of market driven urban development, including housing, employment, commercial activities, and metropolitan-scale functions, should be directed towards these locations. Such an approach would simultaneously strengthen transit use, support more balanced node–place conditions, and make better use of planned transport investments.

The research therefore concludes that TOD implementation in Vilnius should be based on a differentiated approach rather than a uniform development model. Public transport investments should be planned as a metropolitan framework, development intensity should respond to the hierarchy of transit nodes.

This would allow future growth to be directed towards the most accessible locations while enabling local centres in tram-served districts to evolve as walkable neighbourhood centres rather than secondary metropolitan centres.

The design testing phase further demonstrated that different node types require fundamentally different urban responses. While both metropolitan centres and neighbourhood centres can achieve TOD objectives and create walkable, liveable environments, their roles, intensity, and implementation differ significantly.

A key finding of the design exercise was that lower-intensity neighbourhood centres should not be viewed as a limitation, but as an opportunity to offer qualities often sought in suburban living, including larger homes, greener environments, quieter surroundings, and a stronger sense of neighbourhood identity. By combining these qualities with walkability, local services, and public transport accessibility, TOD can provide an attractive alternative to car-dependent suburban growth.

The design exercise also highlighted differences in implementation. Metropolitan centres are often located within large conversion areas and benefit directly from major transit investments, creating strong transformational potential. Neighbourhood centres, in contrast, are typically embedded within existing residential districts, where creating walkable environments depends not only on new development, but also on improving pedestrian connections and public spaces throughout the surrounding neighbourhood.

Limitations, Transferability and Future Research

Several limitations should be acknowledged. The node-place assessment was conducted as a conceptual planning framework rather than a quantitative model.

Future research could investigate more precise indicators, thresholds, and methodologies for evaluating node–place balance, as well as the relationship between transport accessibility, development intensity, and housing market demand. The research also did not evaluate land values, development economics, or future transport demand, all of which may significantly influence development outcomes.

An important practical limitation concerns implementation. Many of Vilnius' conversion areas consist of fragmented land ownership patterns, making substantial changes to development parameters difficult to achieve in practice. Adjustments to density, height, or land-use regulations would likely require compensation mechanisms, negotiation processes, and long-term institutional commitment. For this reason, the proposed strategy should not be understood as a fixed development blueprint, but rather as a framework for prioritisation and decision-making.

Although the research was developed specifically for Vilnius, the proposed approach may also be relevant to other cities facing similar challenges. The combination of transit hierarchy analysis, node–place balance assessment, and differentiated development strategies could be applied in contexts where significant transport investments are planned alongside large-scale urban development opportunities. Rather than prescribing specific densities or urban forms, the framework offers a method for aligning urban growth with long-term accessibility patterns and public transport investments.

Finally, the research highlights the importance of viewing TOD as a strategic urban development framework rather than solely a transport planning concept. By coordinating transport hierarchy, development intensity, and walkability, TOD can support the creation of more accessible, liveable, and coherent urban environments while making more effective use of public transport investments.

8.2 Reflection

Research approach

At the beginning of the thesis, I approached the topic as a question of how the spatial proposals of the Vilnius Master Plan could be better understood and critically interpreted in relation to public transport and district centre development. From the very beginning, however, I made a conscious methodological decision not to fundamentally redesign the transport system or propose an alternative master plan.

Instead, I deliberately retained the existing NPTS corridors, railway projects alignments, and district centre locations as they are defined in the planning documents. This was not a limitation of the research or lack of critical view, but a conscious and considered choice. I approached the Master Plan as a negotiated outcome - a product of long-term consensus between planners, policymakers, legal frameworks, infrastructure constraints, developers, local communities and the culture of place itself.

In this sense, my work can be described more as a form of critical reading and spatial interpretation rather than a redesign exercise.

The aim was not to change/replace the existing planning framework, but to understand how it operates, where its internal tensions lie, and how it could be conceptually strengthened through an additional layer of analysis.

This position also reflects a certain respect for planning as a collective and complex process. Rather than treating the Master Plan as a purely technical document that can be easily "corrected", I approached it as a spatial agreement shaped by multiple competing logics and long-term compromises.

Development of understanding

Over the course of the thesis, my understanding of the problem gradually evolved. What initially appeared as a question of transport structure and corridor planning became increasingly a question of how urban development logic, accessibility, and spatial intensity interact over time.

Importantly, I did not approach Transit-Oriented Development as a replacement for existing planning logic, but rather as an additional interpretative framework. TOD became a way to read the existing plan differently - to understand where its strengths lie, where tensions emerge, and how different parts of the system relate to each other.

One of the key shifts in my thinking was recognizing that TOD is not a uniform prescription for densification around all transit infrastructure. Instead, it can be understood as a balancing framework that helps to distribute development intensity more meaningfully across different types of locations, depending on their accessibility, role, capacity and demand for change.

This perspective allowed me to move away from a simplified interpretation of TOD as a purely density-driven model, and toward a more relational understanding of urban development.

Methodological reflection

The Node-Place model functioned as an important analytical tool for structuring the research and identifying spatial imbalances between transport accessibility and urban intensity.

However, during the process I also became aware of the limitations of translating complex urban systems into simplified conceptual or quantitative frameworks. In practice, I increasingly used the model not as a precise measurement system, but as a conceptual lens for interpreting spatial relationships.

At the certain stage of the thesis I had to choose, whether to try "improve" the model by specific measures or stay broad and conceptual. I found a conceptual approach - more practical, because of flexibility to interprete. This led me to question the role of precision in urban planning models. While metrics can be useful for comparison and structuring analysis, excessive precision can sometimes create a misleading impression of certainty in processes that are inherently long-term, uncertain, and politically mediated.

As a result, I shifted towards valuing conceptual clarity and relational understanding over numerical exactness.

Ethical and professional reflections

Several ethical and professional considerations emerged during the research process.

One of them relates to the relationship between planning ambition and realistic implementation capacity. The Master Plan proposes significant development potential across multiple areas, but it is not always clear whether this corresponds to actual market dynamics and long-term development feasibility.

Another consideration relates to spatial equity. Large-scale investments in transport infrastructure, such as railway corridors and high-capacity transit systems, do not automatically translate into improved accessibility for all residents, particularly those living outside direct corridor influence zones.

These reflections raised broader questions about the role of planning: whether its purpose is to define ideal spatial futures, or to carefully balance ambition with realistic trajectories of urban change.

Design process

The final design exploration reinforced this perspective. By testing different spatial configurations of transit-oriented district centres, I observed that walkability is not strictly dependent on high density or intense functional mix.

Rather, walkability can emerge through a combination of spatial scale, public realm quality, and careful architectural and urban design decisions. This helped me reconsider the assumption that urban quality is primarily determined by intensity, rather than by the structure and design of space.

At the same time, this exercise highlighted a gap in Vilnius current urban development practice, where high-quality residential neighbourhoods with strong spatial identity, but without heavy commercial or office programming, remain relatively rare.

At the kick of phase of thesis, I named suburbanisation as an outcome of liberalization, and people looking for living qualities Vilnius can not propose. Even though suburbanization was not a central focus of the thesis at later phases of the research, it remained an underlying theme throughout the process. Rather than treating it as a problem to be solved, I tried to maintain a more neutral and exploratory stance, asking what kinds of spatial preferences suburbanization reflects and how these might be addressed within the city itself.

One of the key insights was the recognition that Vilnius contains significant internal development potential capable of accommodating many of these preferences through alternative urban typologies, such as lower-density residential areas, larger housing units, and private outdoor spaces.

This led me to question the binary framing often present in planning discourse, where the choice is implicitly between high-density, transit-oriented apartment living or low-density suburban expansion. Instead, I became more interested in intermediate typologies that could bridge this divide.

Reflection on justice

This thesis was developed within the broader studio cluster Just Urban Transitions. While the work gradually shifted toward spatial structure, transport hierarchy, and node–place relationships, the theme of spatial justice remained an underlying reference point throughout the process, even if it was not always addressed as an explicit analytical framework.

In this sense, I moved somewhat away from a direct engagement with "justice" as a defined theoretical lens, and instead approached it in a more implicit and continuous way through spatial observation and interpretation. I repeatedly reflected on how the proposed district centres, public transport corridors, and urban development patterns distribute benefits and burdens across the city.

In particular, I considered how existing planning decisions may reinforce uneven accessibility outcomes - for example, through the concentration of high-capacity public transport investments in areas that do not necessarily align with current population distribution, or through the persistence of suburbanization patterns that generate increased car dependency, traffic pressure, and related environmental and spatial burdens along major arterial streets. Or how just is the current even densification is in unevenly transit served environments.

From this perspective, questions of justice were continuously present in the background of the analysis, especially in terms of distribution of benefits and burdens across different urban areas. While not always framed explicitly in normative terms, these considerations influenced how I interpreted the relationship between transport infrastructure, urban development potential, and the lived realities of different parts of Vilnius.

Closing thoughts

Overall, I am happy this thesis turned into a modest form of critical reading of an existing planning framework rather than an attempt to replace it. The decision to retain the structure of the Master Plan was a deliberate methodological choice, grounded in the understanding that planning documents represent complex negotiated agreements rather than purely technical designs.

Working in this way required balancing critique with respect - questioning assumptions while still operating within the boundaries of an existing and legitimized planning system. The main contribution of the work therefore lies not in proposing an alternative plan, but in introducing an additional interpretative layer focused on Transit-Oriented Development as a balancing framework between place intensity and accessibility. I believe this approach can be a valueable additional piece in a puzzle of planning and negotiating the future development of Vilnius, but other cities as well.

This process also changed my own position as an urbanist: from seeking to correct or redesign systems , toward attempting to understand, interpret, and refine it from within.

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*Use of artificial intelligence

Generative AI tool (ChatGPT, OpenAI) was used by providing prompts, describing design proposals, to create the illustrative visualisations (Figures 99, 101, 119, 121 and 123) which were included for an abstract, atmospheric visualization of the visions, and do not present a specific design proposals.

The language proofreading/editoring of some sections of the text were carried out with a help of AI tool (ChatGPT, OpenAI).

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