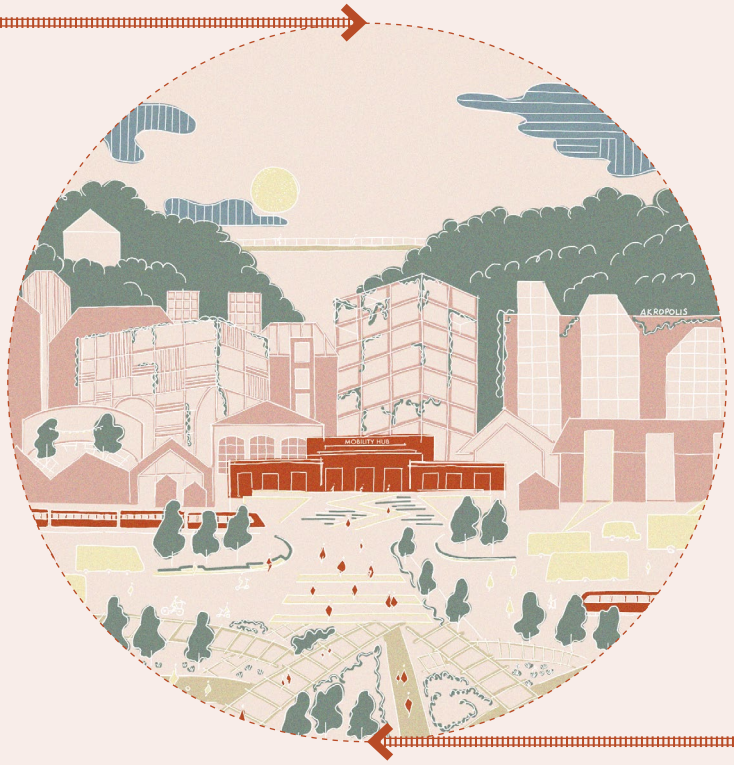
Urban Impact on Major Lithuanian Cities of Rail Baltica Line

Kaunas Case



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P5 Report | MSc Urbanism | TU Delft

COLOPHON

Urban Impact on Major Lithuanian Cities of Rail Baltica Line: Kaunas Case

P5 Report
June 2023
Delft, The Netherlands
All content is made by the author unless stated otherwise

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ABBREVIATIONS AND DEFINITIONS

Abbreviations

EU - European Union
FSI - Floor Space Index
GSI - Ground Space Index
NSB - North Sea-Baltic
OSR - Open Space Ratio
PT - Public Transport
TEN-T - Trans-European Transport Network
TOD - Transit-Oriented Development
UN - United Nations
SDGs - Sustainable Development Goals

Country codes according to ISO 3166

BE - Belgium
DE - Germany
EE - Estonia
FI - Finland
NL - The Netherlands
LT - Lithuania
LV - Latvia
PL - Poland
SE - Sweden

Definitions of the key terms

Active mean of transport - walking, cycling (Berghauser Pont & Haupt, 2021).

Sustainable mobility - forms of mobility which acknowledge the need and desirability of mobility, and, at the same time, can reduce its negative effects (Banister, 2005).

Density - the relationship between a given area and the number of certain entities in that area (Berghauser Pont & Haupt, 2021).

TOD - a land-use and transportation planning that makes walking, cycling, and transit use convenient and desirable, and that maximizes the efficiency of existing public transit services by focusing development around public transit stations, stops, and exchanges (Thomas & Bertolini, 2017).

Rail Baltica - the project that aims to connect Poland to Finland through the Baltic states by a new high-speed railway line.

Language

As the project is carried out in Lithuania, there are names and other words that include Lithuanian letters (ą, č, ę, ė, į, š, ų, ū). Names of places are written in the original Lithuanian form, when there is a common translation to English, this form is used and an original Lithuanian name is provided in brackets.

ABSTRACT

In recent decades, the relevance of the railway as a more sustainable alternative for (inter)national commuting has increased significantly. Moreover, contemporary railway stations are becoming not only important mobility hubs where national and local transportation systems are interlinked but also new city centres offering a variety of functions and attractive places to live and work. However, there are still missing links in the European railway network. One of them, the connection between Poland to Finland through the Baltic states will be implemented by 2030. After completion, Kaunas, the second largest city in Lithuania, will become an important railway node. The thesis investigates how to exploit the potential of the Rail Baltica project and use it as a catalyst for the development of the city. To achieve this, personal experiential knowledge is combined with the data-driven approach to propose a visionary plan for Kaunas railway station and its surroundings that would accelerate the transition towards sustainable, safe and accessible mobility for all and would integrate the area into the existing urban fabric. The proposal suggests that large blocks, similar to Kaunas New Town, could ensure the continuity of the urban fabric, integrate existing heritage into the new structure and allow phasing. The densification framework defines the parameters of each block, aiming for a higher density towards the mobility hub. In addition, changes in street network and profiles are suggested to prioritise public transport and active modes of mobility. The key elements of the masterplan are detailed including the mobility hub where both railway and bus stations are combined and the hub is expanded towards the opposite side of the railway tracks. Moreover, standards for new blocks and streets are defined to ensure high-quality development which promotes high-density neighbourhoods while preserving local identity and heritage. Lastly, the regional impact study is used as an evaluation tool. It concludes that due to the limits of population growth in Lithuania, there is a need for collaboration between Rail Baltica cities to develop their railway station areas in a way that would complement each other rather than compete.

Keywords:

Transit-oriented development (TOD), Rail Baltica, Railway station, Kaunas, Densification

ACKNOWLEDGEMENTS

I am incredibly grateful to all the wonderful people who made it possible.

To my mentors, Rients Dijkstra and Verena Balz for sharing your knowledge and experience, guiding me through the process and helping me to see my hometown, Kaunas, from a different perspective.

To my family and friends, for supporting and believing in me.
Ypatingai ačiū Jums, tėveliai, kad suteikėte galimybę mokytis.

To fellow students and tutors at TU Delft. These two years were an incredible experience and I learned a lot from everybody I met.

TABLE OF CONTENTS

The first chapter gives an overview of the **country, where the project is located**. Moreover, the general **context about Lithuania** is provided as well as a primary comparison to the Netherlands. The comparison aims to highlight that further design decisions are based on the particularity of the country and due to a rapid difference in density, not always can be judged according to Dutch standards. Lastly, **personal motivation** and reasoning for choosing the location and the topic are presented.

1. INTRODUCTION

1.1 PROJECT LOCATION

My graduation project is located in Lithuania, my home country (Figure 1.1). It is the largest Baltic state, situated on the eastern shore of the Baltic Sea. Lithuania shares the border with Latvia in the north, Belarus in the southeast, Poland in the south and the Kaliningrad area (Russia) in the southwest. From the beginning of my studies, I had a goal to work on the location in my motherland, to apply the knowledge and experience was gaining at TU Delft to tackle the problems I was familiar with very well.

Figure 1.1: Globe projection showing the location of Lithuania (Author, 2022)

1.2 NATIONAL CONTEXT

To understand the national context, it is important to emphasise the size and density of Lithuania. For comparison, Figure 1.2 shows Lithuania and the Netherlands on the same scale. Lithuania is large than the Netherlands, however, there are approximately 6.5 times more residents in the Netherlands and Lithuania is almost 12 times less densely inhabited (based on Worldometer elaboration of the latest United Nations data).

2 626 767
population size

43 people/ km²
density

62,674 km²
land area

17 230 373
population size

508 people/ km²
density

33 720 km²
land area

Figure 1.2: Comparison of Lithuania and the Netherlands (Author, data source: www.worldometers.info, 2023)

Nature

Lithuania's history and identity are highly connected to nature. Forests cover 39% and water bodies cover 4% of the total area. Built-up areas are spread across only 2% of the land (Lietuvos Respublikos Aplinkos Ministerija, 2017).

Low density

The density of Lithuania is 43 people/ km² which is one of the lowest rates in Europe. Some of the main European urban centres have the highest density of 170 people/ km² (Lietuvos Respublikos Aplinkos Ministerija, 2017).

Suburbanization

Most cities still have space to grow towards the outskirts. The suburban lifestyle is attractive to many people, who prefer to live in a quieter environment, own a larger house or are not able to afford real estate in the central part of the cities.

Car dependency

Low density together with urban sprawl, low-quality public transportation networks and certain mobility habits result in high car dependency.

Figure 1.3: Qualities that describe the national context of Lithuania (Author, 2023)

1.3 PERSONAL MOTIVATION

In 2015, I started my Bachelor's studies in Architecture in Vilnius, the capital of Lithuania. Due to some circumstances, for the whole month of September, I was living in my hometown, Kaunas, and commuted daily to Vilnius by train. The two largest cities of Lithuania are approximately 90 km distance one from another, therefore, the train ride took from 1 hour 10 minutes (intercity) to 1 hour 38 minutes (regional train). Daily commute at first seemed to be exciting and fun, however, with time it started appearing long and exhausting. As a user, I became very familiar with the stations' surroundings and got a good understanding of current issues. During that time, the promise of a 36-minute ride by train between Kaunas and Vilnius seemed almost impossible but a very desirable future. It was the first time when I heard about the Rail Baltica project.

In 2019, as a recent graduate, I was working for an urban planning and design studio that was invited to participate in the workshop Vilnius Connect. It was organized by the Vilnius Municipality together with Lithuanian Railways (AB "Lietuvos geležinkeliai") as a part of activities to re-develop the railway station area in Vilnius. The main driver of the transformation was the Rail Baltica project - a fast railway line to connect Poland to Finland through the Baltic states. Originally, the railway line was planned to go through Kaunas and Panevėžys, leaving Vilnius aside. However, Vilnius seized the opportunity to become part of the European railway network and an additional branch was added from Vilnius to Kaunas. The workshop allowed me to get familiar with the project, and the challenges of designing the station and surrounding area both as a mobility hub and a vibrant neighbourhood. Later, the international competition for the station area was organized and Zaha Hadid Architects were chosen to implement their vision. What surprised me at the time (and still surprises), was that while Vilnius was actively aiming for changes, Kaunas and Panevezys (two main cities of Lithuania that will have the main line of the railway to go through) seemed to do almost nothing.

In 2021, I moved to the Netherlands to continue my studies at TU Delft. Due to the housing crisis, I managed to get an apartment only in the Hague (Figure 1.4), close to the Holland Spoor station, therefore, my daily commute happened again by train. However, this time the train ride took from 6 to 10 minutes depending on the train. It was surprising to experience how well is the railway system integrated into a general mobility network and how dependent the country is on a well-functioning railway. The railway strikes in September of 2022 were a great illustration of this phenomenon. When you commute daily, little details of the station environment become more significant - how many stairs you have to take, how many barriers there are, how easy is to navigate and find the right train, how far away is the bus stop from the station. Not everything was perfect, however, I believe that this experience allowed me to get a better understanding of what is important while designing the station area. The Dutch practice is something that I wished to test and apply in my design.

Figure 1.4: The view of the Holland Spoor station from my apartment in the Hague (Author, 2021)

During the summer of 2022, when the increasing traveller flows after the pandemic and other issues led to overcrowded airports and rising ticket prices, I decided to choose an alternative way to come back home from the Netherlands to Lithuania. Then, the necessity of the railway connection from Lithuania to the rest of Europe becomes clear. My best option was to take a train to Berlin and then a bus to Lithuania. However, this gave me a chance to get to know the German railway system better and try how the 9-euro-ticket model worked for them. Compared to the Netherlands, one significant difference was having no barriers (gates) to access the station and from the user's perspective, it was very convenient.

On September 2022, when it was time to make a final decision on the thesis topic, all my previous experiences got me a clear understanding, of what I wished to explore during my thesis. I believe, that the Rail Baltica project can be highly beneficial for Lithuania and especially for the cities the line goes through, therefore, I aim to investigate its potential further.

The chapter focuses on the contextualization of the problems and challenges that were the starting point of my project. To begin with, European and global **planning documents and policies** are reviewed to gain an in-depth understanding of the desired future of European mobility. What is more, the **European railway network** and current bottlenecks are demonstrated to position the Lithuanian railway in the overall network and to highlight its importance to the **TEN-T North Sea-Baltic corridor**. Further, the **Rail Baltica project** is presented as well as the progress and **main stations** along the high-speed railway line. **Kaunas** railway station is highlighted as one of the main railway hubs that currently lacks a strategy for the **station and the surrounding area**, therefore, a broader context of the city is presented. Lastly, the chapter is concluded with the **problem statement**.

2. PROBLEMATIZATION

2.1 EUROPEAN POLICY: MOBILITY

The most relevant planning documents of the XXI century are reviewed with a focus on mobility and how its challenges and opportunities are addressed.

The Leipzig Charter on Sustainable European Cities

The Leipzig Charter defines the "common principles and strategies" for European urban development. The charter states that Europe "needs cities and regions which are strong and good to live in". In this case, the need for sustainable, accessible and affordable urban transportation is highlighted, especially together with the well-functioning regional transportation network. The charter emphasizes the importance of traffic management and multimodal transportation hubs that include infrastructure for cycling and walking. What is more, it is stated that "urban transport must be reconciled with the different requirements of housing, work areas, the environment and public spaces". The Leipzig Charter also promotes efficient and affordable transportation as one of the means to cope with unemployment and social exclusion in deprived neighbourhoods (European Union, 2007).

Transforming Our World: The 2030 Agenda for Sustainable Development

The document introduces the 17 Sustainable Development Goals to eradicate poverty and set the course for global sustainable development for the next 15 years. They focus on "three dimensions of sustainable development: the economic, social and environmental". The topic of mobility is mostly related to goal number 11: "Make cities and human settlements inclusive, safe, resilient and sustainable". In sub-section 11.2 it is mentioned that by 2030, a safe, affordable, accessible and sustainable mobility system should be provided to everybody. Moreover, there should be an additional focus on road safety and an improved public transport system, especially for more vulnerable social groups (United Nations, 2015b).

Paris Agreement

Paris Agreement does not directly address the topic of mobility. However, it is a legally binding international agreement that aims to "strengthen the global response to the threat of climate change". Among other things, it aims for adaptability, climate resilience and low greenhouse gas emissions development (United Nations, 2015a).

New Urban Agenda

New Urban Agenda was adopted at the Habitat III conference in Quito, Ecuador. It focuses on sustainable urban development. The document states that equal (also, equitable and affordable) access for all to public goods and services should be ensured. Urban mobility should be age- and gender-responsive, sustainable, safe, and accessible (especially for more vulnerable social groups) and public spaces, including streets sidewalks and bicycle lanes, should be safe, inclusive, accessible and high quality. Road safety and the need to raise awareness are also highlighted. A wide range of different mobility options should be promoted, especially public transport and non-motorized options (walking, cycling). Sustainable mobility and transport are mentioned as a way to improve urban-rural interactions and connectivity. Moreover, sustainable and efficient infrastructure and services could be a way to reduce congestion, and air and noise pollution. Integrated urban and territorial planning could prevent urban sprawl and reduce mobility challenges and the need to commute. Moreover, different systems (such as air, rail, etc.) should be better integrated. Smart-city approach and innovative transport technologies could be used as a way to promote move environment-friendly decisions as well as to improve the quality of services (United Nations, 2017).

The European Green Deal

The European Green Deal calls for action to achieve zero net emissions of greenhouse gases by 2050 while ensuring a just and inclusive transition. One of the main pillars to reach this goal is "the shift to sustainable and smart mobility". It highlights the need for transport to become "drastically less polluting, especially in the cities" to cope with emissions, urban congestion and to improve public transportation. According to the European Green Deal, transport currently is responsible for a quarter of the EU's greenhouse gas emissions and this number is still increasing. To achieve climate neutrality by 2050, a 90% reduction of emissions is needed (European Commission, 2019).

The New Leipzig Charter

The New Leipzig Charter provides the policy framework for European Union to implement European and global agreements reviewed above (with the main focus on the New Urban Agenda, Paris Agreement and the European Green Deal). It sets a goal of maintaining the quality of life in European towns and cities, ensuring that it is available to everybody. It states that "urban transport and mobility system should be efficient, carbon-neutral, safe and multi-modal". The charter recognises that a modal shift should happen towards public transport, biking and walking and low-carbon forms of mobility and logistics should be promoted. As a way to reduce the need for using transportation, a polycentric settlement structure is suggested. It should be compact, dense and mix-use. Digitalization trend is also acknowledged as well as smart urban mobility solutions. What is more, the common distribution of services is highlighted, therefore, public transport (among other services) should be "inclusive, affordable, safe and accessible for all", especially taking into consideration the most vulnerable social groups and those living shrinking or remote areas (European Union, 2020).

Territorial Agenda of European Union 2030

The territorial Agenda of European Union 2030 is an "action-oriented framework" that focuses on the territorial cohesion of the European Union. Territorial cohesion is defined as development that is well-balanced in different countries as well as in various areas within each country. Mobility topic is covered in the sub-section "Sustainable connections: Sustainable digital and physical connectivity of places". It states that "smart, sustainable and safe forms of transport and connectivity are needed" to support the idea of territorial cohesion. To achieve climate-related objectives (reduce the impact of climate change, noise and air pollution) and to improve connectivity and accessibility across the continent, the importance of intermodal freight and passenger transport is emphasised. It is important to connect all places with main transport nodes and focus on regional planning and development of core network corridors. Moreover, it is stated to be important to connect transnational mobility networks to secondary and local ones and to "cooperate on multimodal and environmentally friendly accessibility of and within urban centres " (European Union, 2020a).

Conclusion

Multiple planning documents reviewed above highlight that changes in mobility habits and infrastructure are highly important to achieve global and European goals of sustainability and climate neutrality. Similar aspirational qualities (Figure 2.1) of the mobility system are mentioned in multiple sources. The most common keywords are sustainable, safe, affordable and accessible mobility. Special attention is paid to public transportation, biking and walking. Moreover, polycentric development is encouraged as a way to prevent urban sprawl and reduce mobility needs. Also, the importance of well-connected (trans)national and local mobility networks and multimodality is highlighted.

Figure 2.1: Keywords representing the main qualities of mobility mentioned in the planning documents (Author, 2023)

2.2 EUROPEAN RAILWAY NETWORK

In 2020, the European rail network reached nearly 200 000 km, of which 12 000 km was high-speed rail (above 200km/h speed) (Luman & Gouveia, 2022). Figure 2.2 demonstrates the distribution of the railway network, showing clear concentration in Central and Western Europe. Lithuania (highlighted in white) together with other Baltic-Nordic region countries is significantly less connected by railway.

Figure 2.2: European rails network (Author, 2022)

2.2 EUROPEAN RAILWAY NETWORK

Currently, the transport sector is one of the largest pollutants, responsible for ¼ of the EU's greenhouse gas emissions (European Commission, 2019). To reach climate neutrality goals set by European and global policies for 2050, the EU aims for the transition towards more sustainable means of transportation. Figure 2.4 shows that road, water and air transportation pollute the most while railways are responsible only for the insignificant part of emissions. Therefore, actions are taken to encourage people to choose to travel by train instead of a plane, which could highly contribute to the EU's sustainability goals ((Luman & Gouveia, 2022). For example, European Commission recently approved plans by the government of France to abolish flights when the same journey could happen by train in less than 2,5 hours (Reid, 2022).

However, the proximity of the cities, in many cases, is not necessarily proportional to the commute time by rail, a lot of inequalities and missing links are still present in the European railway network. It can be seen in Figure 2.3. The map demonstrates the time of direct journeys by train to reach major European cities. For example, until December 2022 it was not possible to reach Lithuania by train travelling from the Netherlands or any other Western or Central European country. Only recently, a train from Warsaw to Kaunas was introduced, however, the journey lasts almost 8 hours and a change of train is needed. Fortunately, as the new high-speed railway lines will be continued to develop across Europe as part of the EU's TEN-T project to link European roads and rails, the need for short-distance flights could be reduced even more (Reid, 2022). It would be especially beneficial for the countries such as Lithuania which is currently highly dependent on reachability by plane or by road transport.

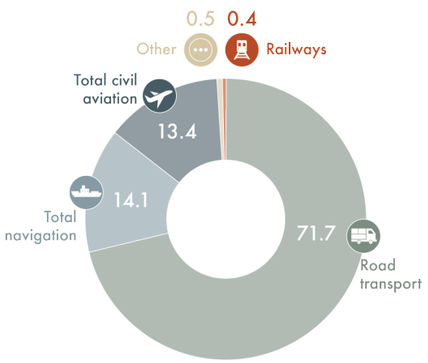


Figure 2.4: Greenhouse gas emissions from transport in the EU, percentages (Author, adapted from EEA Transport and environment report 2021, 2023)

Figure 2.3: Travel times across Europe (Author, adapted from www.eurail.com, 2023)

2.3 TEN-T NORTH SEA - BALTIC CORRIDOR

Trans-European Transport Network (TEN-T) North Sea-Baltic (NSB) multimodal corridor connects countries from the North Sea and Baltic regions (Figure 2.6). The North Sea-Baltic corridor passes through Belgium, The Netherlands, Germany, Lithuania, Latvia, Estonia and, recently added, Finland and Sweden. The NSB Corridor aims for well-connected Member States to ensure they would make better use of their economic potential (European Commission, 2022). It is important to see Baltic countries and Lithuania as a part of the larger European system, to understand that the quality of the mobility network of the country will have an impact on a larger scale as well. The corridor includes a network of railways, roads, inland waterways and air transport. The recent report on the NSB corridor claims, that "the main goals for Lithuania's transport sector are to improve transport sector quality and technical parameters, to strengthen intramodality of different transport modes, to increase the cooperation with the transport systems of neighbouring countries, and to be an integral link for the NSB Corridor" (European Commission, 2022). Moreover, the importance of the Rail Baltica project is highlighted.

"Development of the Rail Baltica project is a priority for the Baltic States and Lithuania. The project will help to improve connectivity at national and regional level and will contribute to the achievement of Lithuania's transport sector goals" (European Commission, 2022).

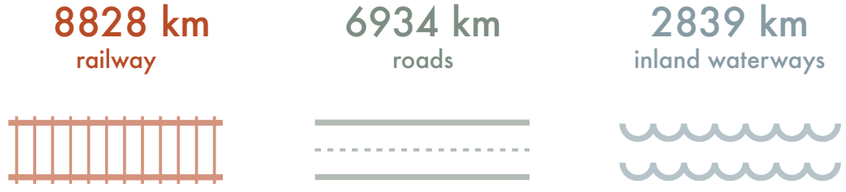


Figure 2.5: Statistics about the TEN-T North Sea-Baltic corridor (Author, 2023)

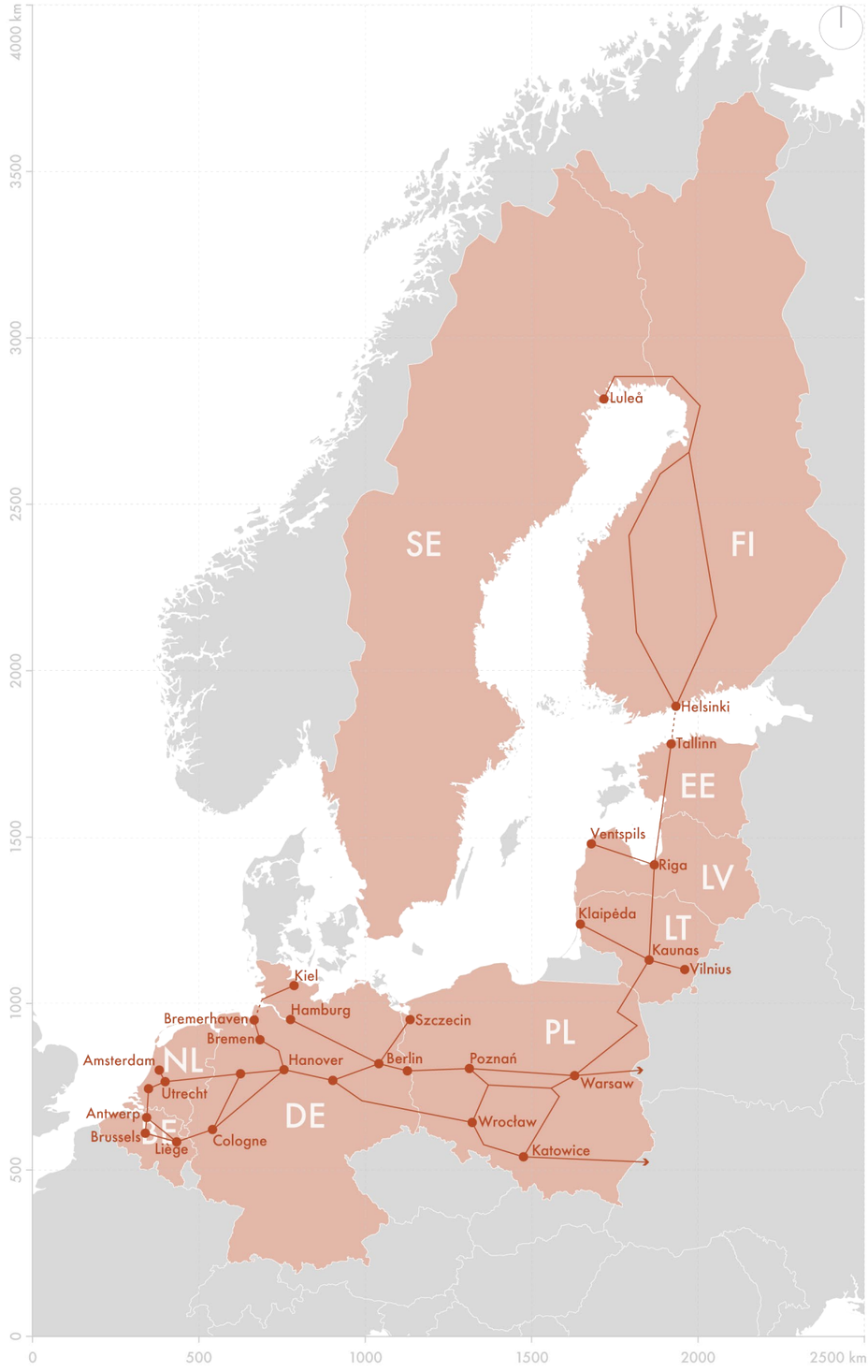


Figure 2.6: TEN-T North Sea-Baltic corridor (Author, adapted from www.railwaypro.com, 2023)

2.4 RAIL BALTICA OVERVIEW

The planning process of the Rail Baltica high-speed railway officially started in 2010 (Figure 2.7). The need for a railway connection within the Baltic countries and from Lithuania to Poland is clear from the previous analysis of the European railway network. Moreover, as stated previously, it will become an important part of the NSB Corridor. Rail Baltica will consist of 7 main passenger stations and three freight terminals, one in each Baltic state. Officially, the ferry link between Tallinn and Helsinki is considered to be part of the line. In the beginning, Vilnius, the capital of Lithuania was not included in the Rail Baltica project, however, the agreement was reached to have an additional branch that intersects the main branch in Kaunas. This decision puts Kaunas in a strategic location where it has the potential to become a highly important mobility hub. Even more, the main freight terminal of Lithuania will be located on the outskirts of Kaunas. Figure 12 demonstrates, how commute time between Kaunas and other Rail Baltica cities nearby will change. In most cases, the journey time should be reduced in half, making Vilnius and Panevėžys accessible in less than 40 minutes.

As the planning process of the railway line is already being finished (Figure 2.7), I chose to not question decisions made on a regional scale, however, to use the implementation of the Rail Baltica as a catalyst for change in Kaunas and explore how its potential could be fulfilled. The project originally was planned to be finished in 2026, however, delays might happen due to the pandemic and materials shortage. However, the time for the cities to prepare for the changes in the mobility system is now.

The project requires the construction of a new station in some cities, such as Tallinn or Panevėžys or redesigning of the current station in others. As this process depends on the municipal government as well, the planning of the station areas happens very differently depending on the city (Figure 2.10).

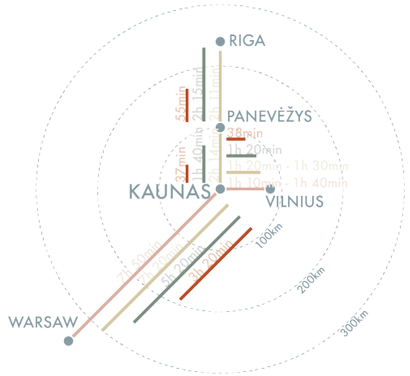


Figure 2.8: Commute time (current and after the Rail Baltica project is implemented) (Author, 2023)

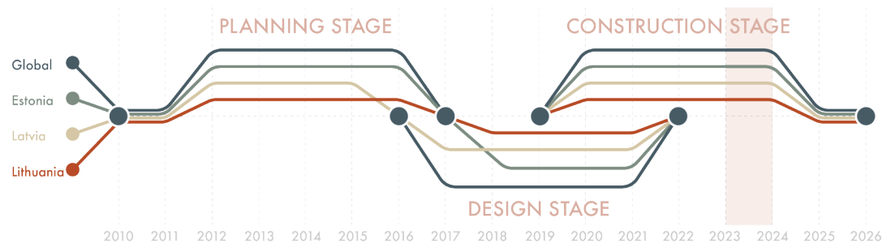


Figure 2.7: Timeline of the Rail Baltica project (Author, adapted from www.railbaltica.org, 2023)

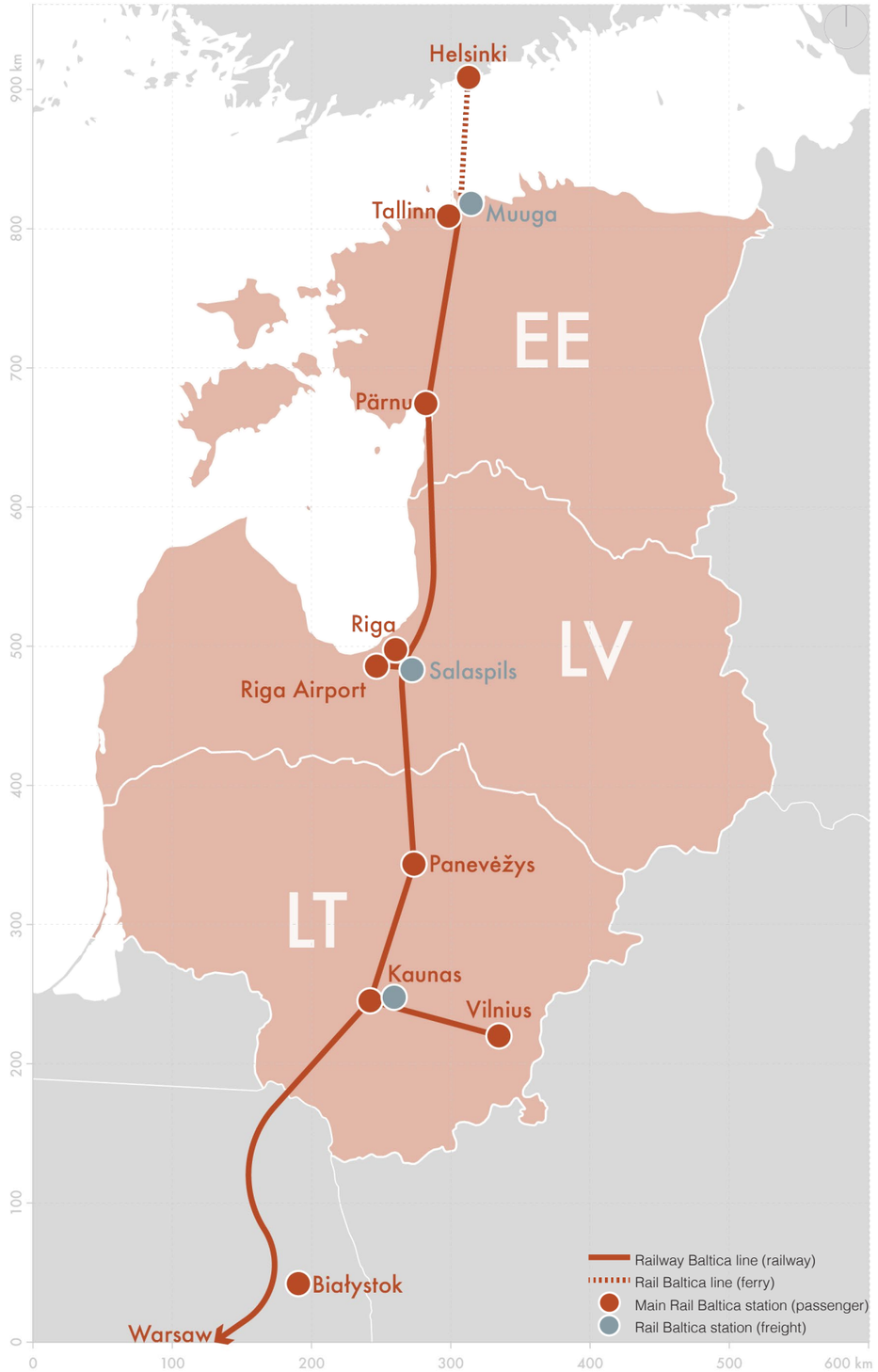


Figure 2.9: Locations of the Rail Baltica stations (Author, adapted from www.railbaltica.org, 2023)

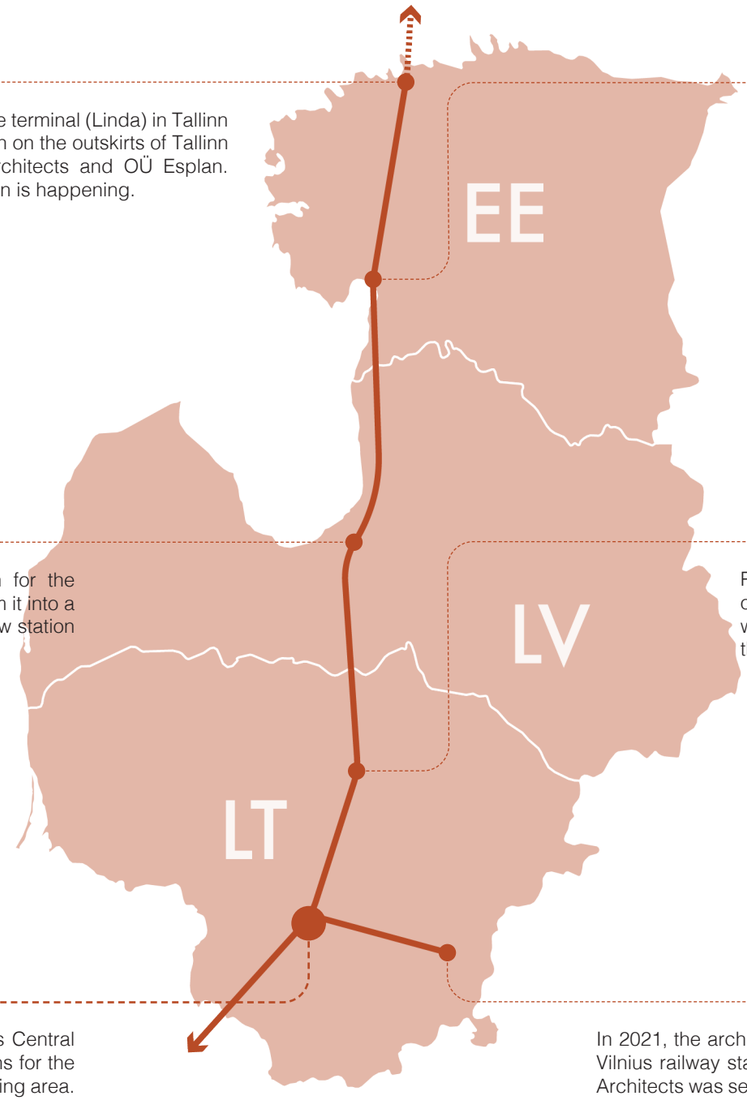
2.5 RAIL BALTICA PASSENGER STATIONS

Tallinn

In 2019, the winners of a multimodal Ülemiste terminal (Linda) in Tallinn were announced. The new passenger station on the outskirts of Tallinn (Ülemiste) is designed by Zaha Hadid Architects and OÜ Esplan. Currently, the preparation for the construction is happening.

Riga

In 2019, PLH Arkitekter proposed a plan for the current Riga Central station area to transform it into a modern intermodal transportation hub. A new station building and infrastructure is planned.



Kaunas

Rail Baltica line will use the current Kaunas Central station, however, there are still no clear plans for the redevelopment of the station or the surrounding area. The possibilities study is carried out at the moment.

Pärnu

Recently, a contract was signed with the Spanish engineering company “Ardanuy Ingenaria” to develop the design for the Pärnu regional station.

Panevėžys

Panevėžys Rail Baltica station will be located on the outskirts of the city. Recently, an opportunity study was carried out to decide on the exact location of the station. The plans are not confirmed yet.

Vilnius

In 2021, the architectural competition for the redevelopment of the Vilnius railway station happened and the proposal by Zaha Hadid Architects was selected. Moreover, there are plans to redevelop the bus station nearby and transform the adjacent railway depot area.

Figure 2.10: The diagram shows what are the plans for the Rail Baltica stations (Author, 2023)

2.6 MAIN FOCUS: KAUNAS

Why Kaunas?

Kaunas has the most potential to benefit from the Rail Baltica line that has not been explored yet. To understand the benefits of the new high-speed railway line, it is important to take into consideration several aspects. First of all, due to its central location, it has the potential to become the main mobility hub of Lithuania. In the future, a high-speed railway link could also connect Kaunas to Klaipėda (together with the Port of Klaipėda) to strengthen the network even more.

Figure 2.11: The location of Kaunas County and Kaunas City in Lithuania (Author, 2023)

Population trends

Secondly, taking into consideration population trends, Kaunas, the 2nd largest city in Lithuania, faced degrowth for the last two decades, recently the curve started to grow slowly, therefore, it is important to embrace this process. The city still faces the challenges of an ageing population and emigration. By creating a lively and pleasant environment in the city to live in, attracting more foreign investments and creating job opportunities, population trends could be influenced positively.

305 120

population size (2023)

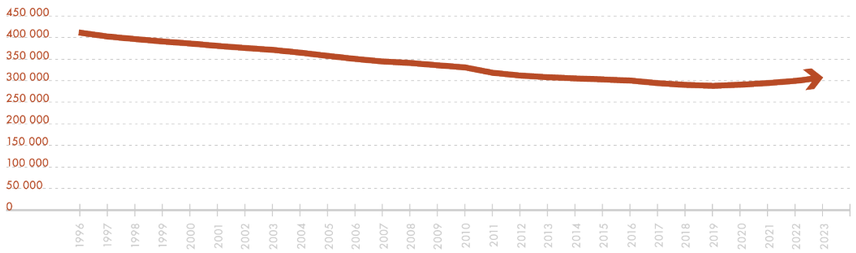


Figure 2.12: Population trends of Kaunas (Author, adapted from www.geodata.lt, 2023)

Suburbanization and car dependency

Moreover, Kaunas faced rapid suburbanization in recent decades that resulted in high car dependency and traffic congestion. However, there is still plenty of space and potential to densify the central part of the city.

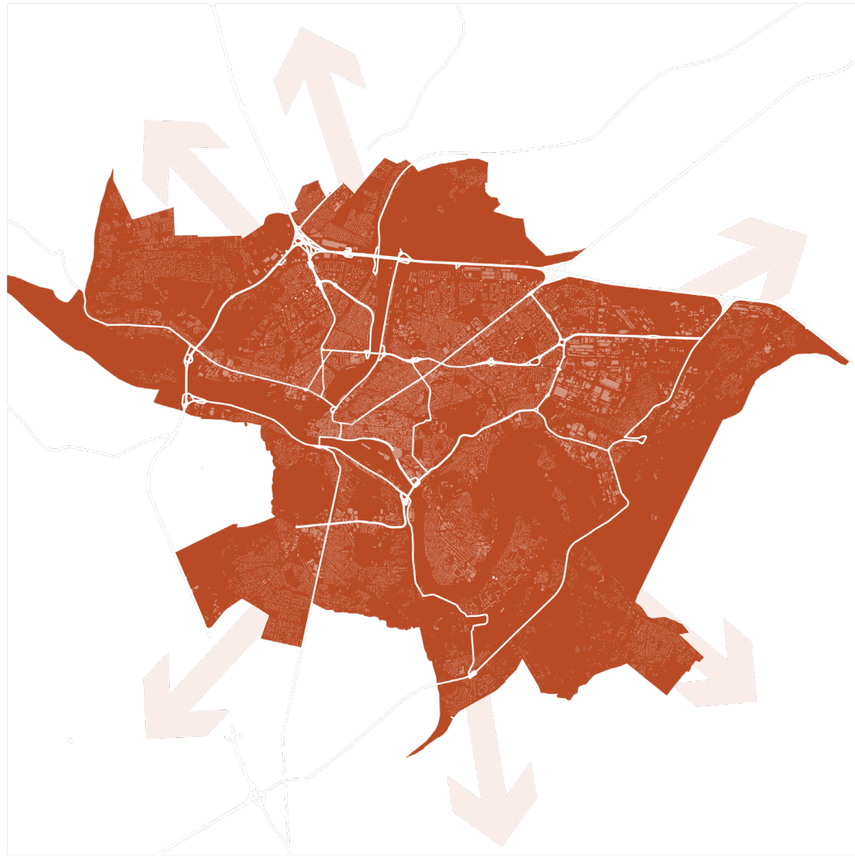


Figure 2.13: Suburbanization directions (Author, 2023)

2.7 KAUNAS RAILWAY STATION AREA

Kaunas Central Railway station is located in the central part of Kaunas, however, the station itself does not fulfil the needs of an international importance mobility hub. The further analysis of the station environment is provided in Chapters 5 and 6. Moreover, on one side, the railway station is surrounded by large-scale industrial blocks that are partially abandoned or adapted to other temporary functions as the industry tends to move out of the city. On the other side, the large area of land is dedicated to the railway infrastructure and maintenance. Following the example of Vilnius, where the Lithuanian Railway (AB “Lietuvos geležinkeliai”) authorities already announced plans to move the train maintenance facilities outside the city and to free up the space for the development of the city, it is possible to anticipate a similar scenario in Kaunas and explore potentials for the area redevelopment.

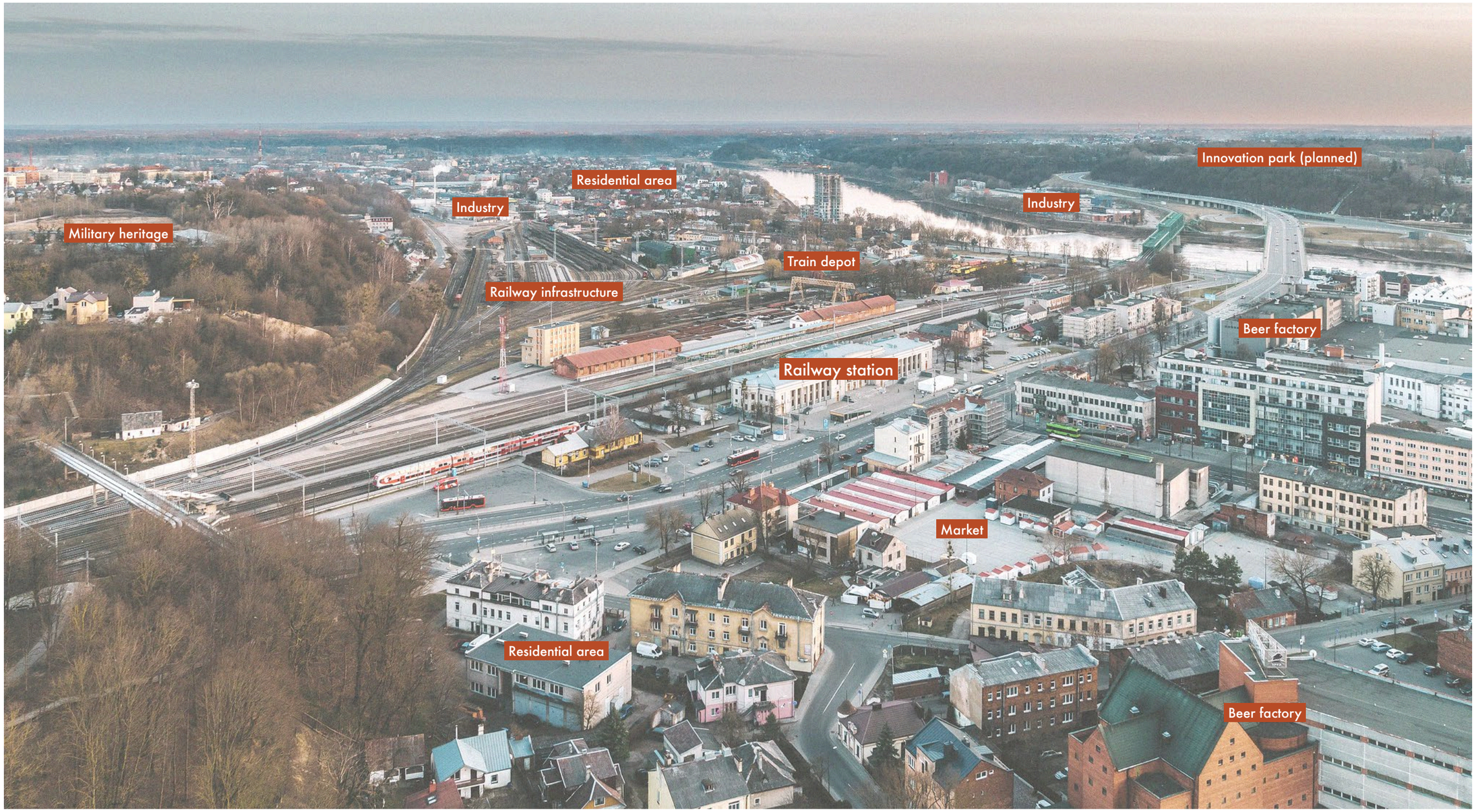


Figure 2.14: Kaunas railway station area (Image by A. Aleksandravičius)

2.8 PROBLEM STATEMENT

According to the European Green Deal (European Commission, 2019), transport currently is responsible for a quarter of the EU's greenhouse gas emissions and this number is still increasing. Urgent actions have to be taken to create a paradigm shift towards more sustainable mobility to reach climate neutrality goals by 2050.

On the European level, more travelling should happen by train rather than by plane. However, part of Europe is still not well integrated into the European railway network. One of the key projects, especially important for the TEN-T North Sea-Baltic corridor, is Rail Baltica. Soon, it will connect Poland to Finland through the Baltic States with a new, fast railway line. The project has the potential to significantly improve connectivity within the region, attract new flows of passengers, and foreign investments and contribute to changing mobility habits. It could be highly beneficial to the major cities that will have Rail Baltica stations.

However, the development of each station and adjacent area is a matter of the local government, therefore, it is happening very unevenly. While the capitals of the Baltic countries are taking advantage of the opportunities, Kaunas, the second-largest city of Lithuania, which will become an important railway node, has not yet acted.

Kaunas railway station is currently surrounded by a large infrastructural area, train maintenance depots, and former industrial areas with a mix of some residential and public functions. There is a lot of potential for the redevelopment of the area. It could be developed as a well-functioning mobility hub that promotes a shift towards sustainable means of mobility on both local and regional levels. Moreover, creating new or extending existing city centres towards the railway station could contribute to preventing urban sprawl and suburbanization. The graduation thesis aims to investigate spatial and functional conditions needed for these transitions to happen.

Figure 2.15: Summary of the problem statement (Author, 2023)

The chapter focuses on how the project was conducted. The **research aim** together with two objectives is specified followed by two main **research questions** and a few sub-questions for each. To answer the specific research sub-question and to achieve the research aim, a variety of qualitative and quantitative **methods** were used. The second part of the chapter provides descriptions of the methods and specifies which ones **contribute to answering** the certain research sub-question. Lastly, the **research and design process** diagram summarizes the workflow of this project.

3. METHODOLOGY

3.1 RESEARCH AIM

RESEARCH AIM

This project aims to propose a **visionary plan** for the Kaunas railway station and its surroundings that would accelerate the transition towards **sustainable, safe and accessible mobility for all** and would **integrate the area into the existing urban fabric**.

OBJECTIVE

Sustainable, safe and accessible mobility for all

Developing a multimodal mobility hub together with the railway station.

Contributing to change of mobility towards a less car-oriented network in Kaunas.

Creating a well-functioning mobility hub as a transition point from the regional to local transportation networks.

OBJECTIVE

Integrating the area into the existing urban fabric

Designing the railway station and adjacent public spaces.

Redeveloping the area as a new urban centre while preserving industrial identity and heritage.

Redeveloping and densifying the area in such a way that new living and working quality could contribute to minimizing the need for urban sprawl and suburbanization.

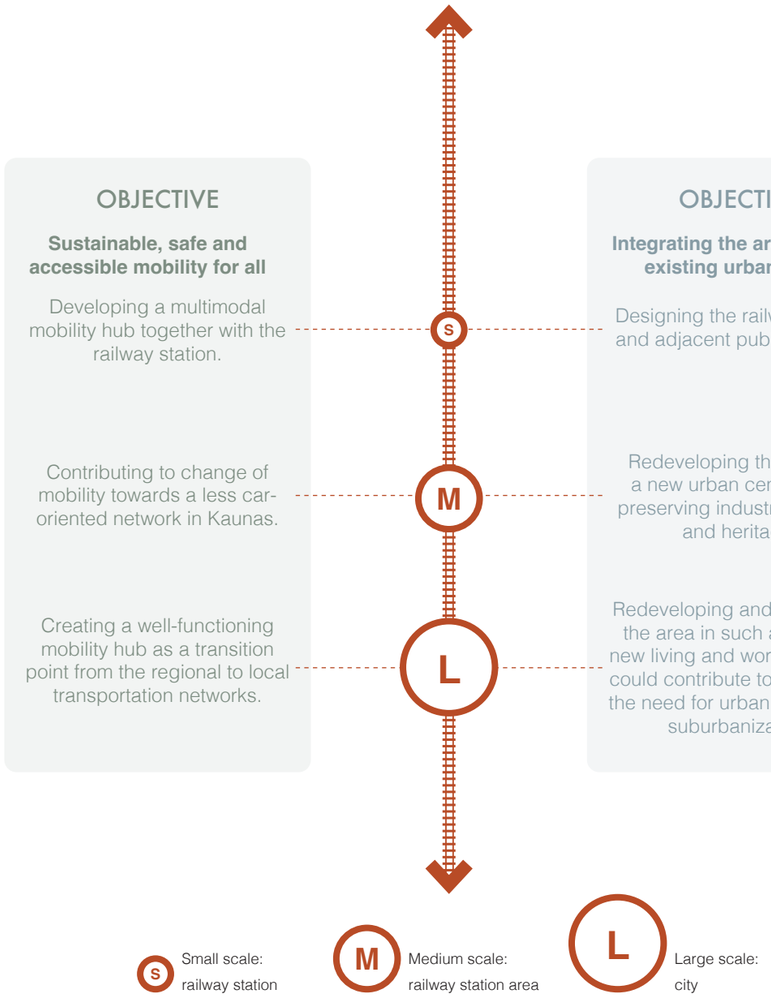


Figure 3.1: Diagram of the research aim and objectives (Author, 2023)

3.2 RESEARCH QUESTIONS

RQ1

How **redeveloping the railway station area** could contribute to **promoting sustainable, safe and accessible mobility** in Kaunas?

SQ1.1
How to create a mobility hub that would serve the needs of the increased flows of passengers after the Rail Baltica project is implemented?

SQ1.2
How redeveloping the station area could contribute to a change in mobility towards a less car-oriented network in Kaunas?

SQ1.3
How to create a well-functioning interconnection between local and regional mobility networks and how it impacts on a regional scale?

RQ2

What are the **spatial and functional conditions** needed for the Kaunas railway station area to become **well integrated into the existing urban fabric** of the city?

SQ2.1
How the Kaunas railway station and the adjacent public spaces should be transformed to fit the changing needs and role of the railway station?

SQ2.2
How the area should be redeveloped taking into consideration proximity to the Kaunas centre and industrial heritage present on site?

SQ2.3
How much the area should be densified and what kind of quality of living and working could contribute to minimizing urban sprawl and suburbanization?

Figure 3.2: Table of the research questions and sub-questions (Author, 2023)

3.3 METHODS

QUALITATIVE RESEARCH

Case study analysis

To achieve a better understanding of possible outcomes and effects of similar scale and range projects, learn from good practices in the Netherlands and abroad.

- Various examples of block typology
- Various examples of streets and public spaces

Literature analysis

To use theoretical knowledge as a base for planning and design decisions. As a starting point, I chose literature related to the topics of density and TOD. Further, the theory was used to elicit specific knowledge or validate certain decisions.

- Transit-oriented development (TOD)
- Density

Observations

To collect data from the Kaunas railway station area, two site visits were conducted in December and in March.

Due to the weather conditions (cold, snow storms), it was not possible to spend a lot of time in the area, however, during the site visits I was able to:
- Take pictures
- Take video footage
- Sketch
- Take notes
- Experience the place by different means of transport (on foot, by car, by bus, by train)

Moreover, a lot of inspiration came from observations of daily life and the environment. Living in the Netherlands, frequently commuting by train and by bike as well as international trips by train to Paris and Zurich this year were a great source of inspiration and learning experience.

Figure 3.3: Table of the methods used during the research (Author, 2023)

Planning documents analysis

To understand what kind of future relevant parties (global initiatives, EU, national and local governments) are planning for, especially in terms of mobility and urbanization.

- Global level (UN)
- European level (EU, European Commission)
- Regional level (TEN-T North Sea-Baltic corridor)
- National level (Lithuanian government)
- City level (Kaunas municipality)
- Local level (masterplans and detailed plans for specific areas)

QUANTITATIVE RESEARCH

Data analysis

Open data sets are used for analysis or to get quantifiable data while testing hypotheses or validating certain design decisions (for example, densification).

- Data from Open Street Maps
- Data from Natural Earth
- Data from Lithuanian State Data Agency

Mapping

To map different elements of the urban fabric, mobility and natural networks.

- Mobility network (roads, railway, public transport, bike paths)
- Built environment (districts, blocks, buildings, functions, heritage, public spaces, recreational areas)
- Natural network (green spaces, water, topography)

3.4 APPLICATION OF THE METHODS

Various methods were used to answer the research questions. The size of the red dot indicates the importance of the method to elicit specific knowledge needed for the research sub-question to be answered (Figures 3.4, 3.5).

RQ1

How **redeveloping the railway station area** could contribute to **promoting sustainable, safe and accessible mobility** in Kaunas?

SQ1.1

How to create a mobility hub that would serve the needs of the increased flows of passengers after the Rail Baltica project is implemented?

SQ1.2

How redeveloping the station area could contribute to a change in mobility towards a less car-oriented network in Kaunas?

SQ1.3

How to create a well-functioning interconnection between local and regional mobility networks and how it impacts on a regional scale?

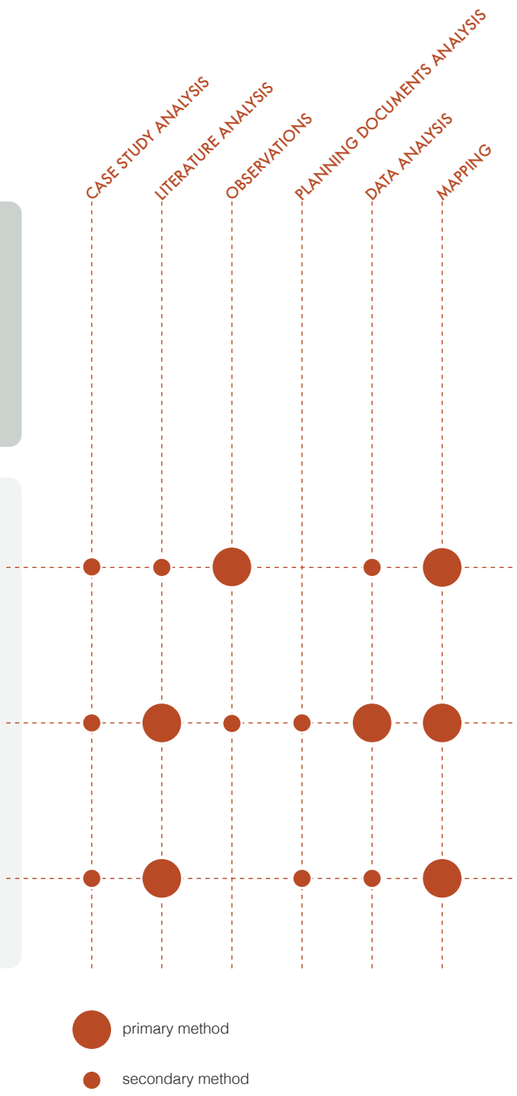


Figure 3.4: Methods used to answer research question 1 and related sub-research questions (Author, 2023)

RQ2

What are the **spatial and functional conditions** needed for the Kaunas railway station area to become **well integrated into the existing urban fabric** of the city?

SQ2.1

How the Kaunas railway station and the adjacent public spaces should be transformed to fit the changing needs and role of the railway station?

SQ2.2

How the area should be redeveloped taking into consideration proximity to the Kaunas centre and industrial heritage present on site?

SQ2.3

How much the area should be densified and what kind of quality of living and working could contribute to minimizing urban sprawl and suburbanization?

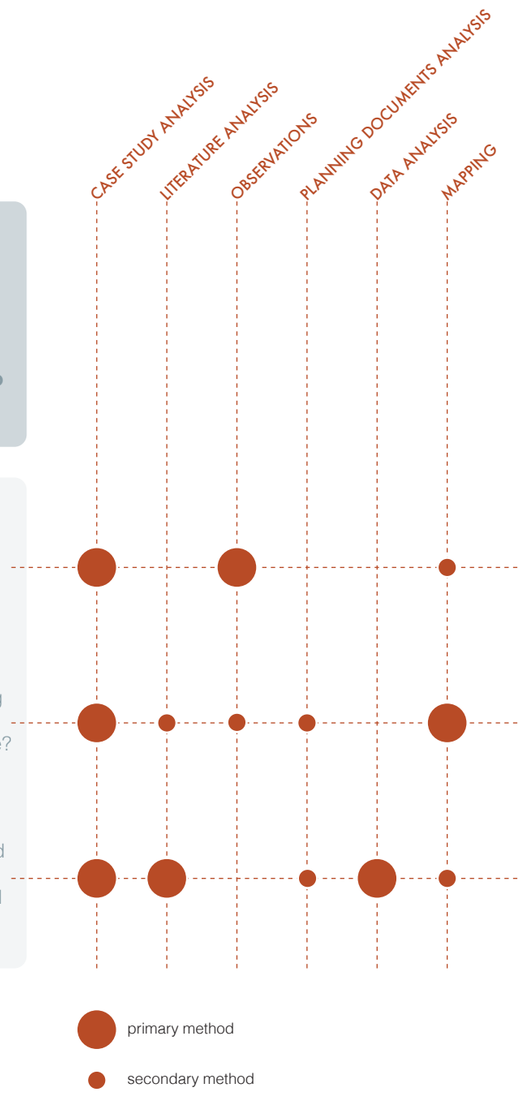
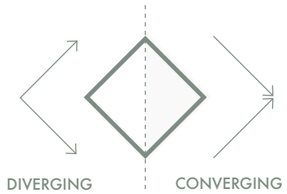


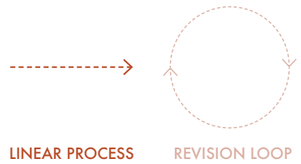
Figure 3.5: Methods used to answer research question 2 and related sub-research questions (Author, 2023)

3.5 RESEARCH AND DESIGN PROCESS

The process can be divided into divergence and convergence stages. While defining the problem, exploring possible solutions and reflecting on my work, the aim was to broaden my knowledge. However, when choosing the topic at the beginning of the year, using analysis to justify certain decisions and proposing the vision for the area, decisions had to be made. During those stages of the process, the aim was to focus the knowledge.



The workflow of this project was both linear and non-linear. This is also reflected in the structure of the booklet. On one hand, every step had the main focus followed by the graduation presentations. However, it was also a constant process of combining research and design. The main revision cycles are shown in the diagram.



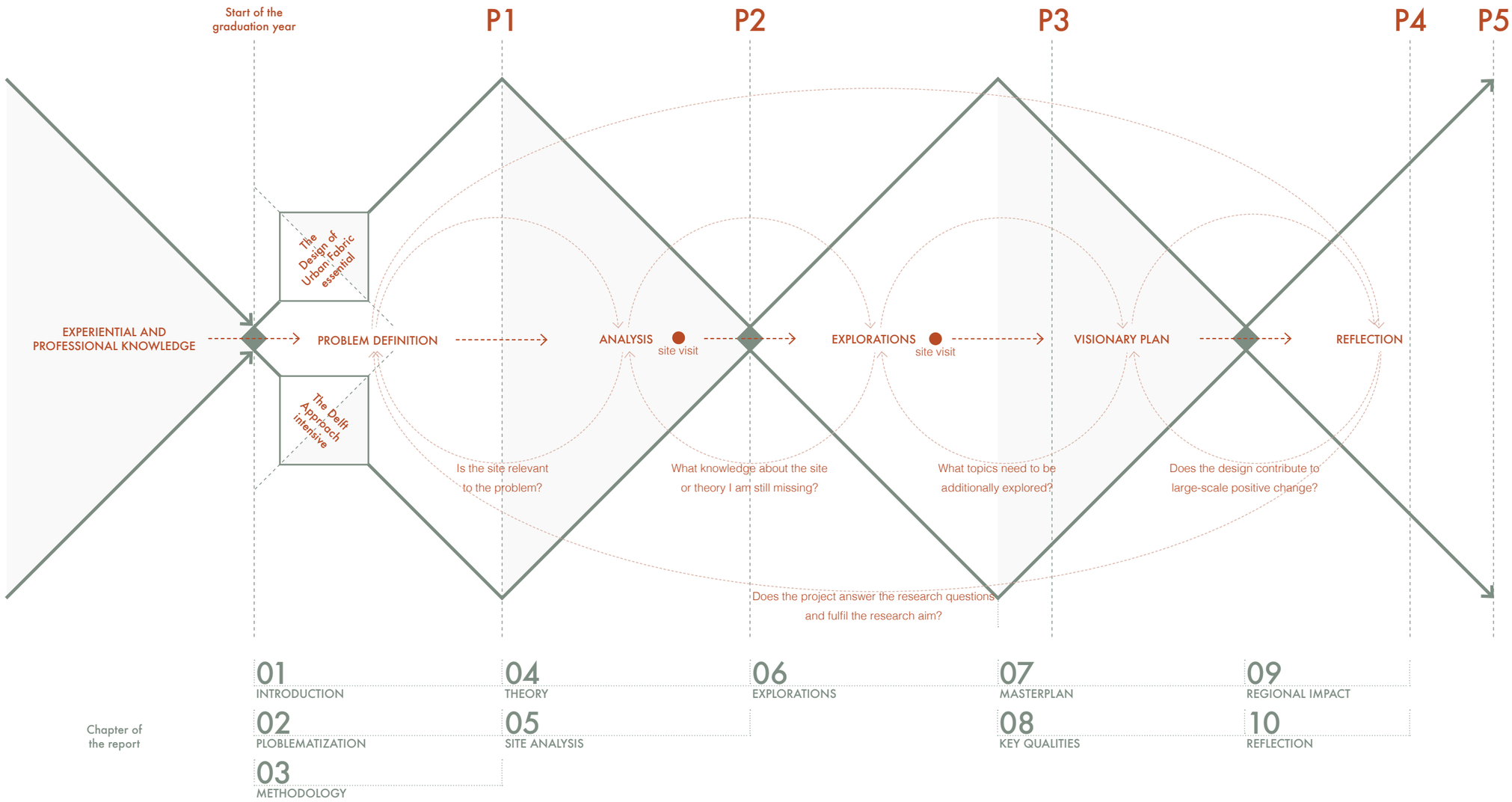


Figure 3.6: Table summarizing the research process, project timeline and chapters of the report (Author, 2023, inspired by the diagram "Dynamic view of the strategy-making stages of planning" (Franken-Champlin, 2019))

The chapter provides theoretical background that is used as a base for further research and design. As the project evolved, new topics emerged, therefore, the literature is reviewed also further in the report. This chapter consists of **conceptual framework** and **literature review** mostly focused on the concepts of TOD and density.

4. THEORY

4.1 CONCEPTUAL FRAMEWORK

The conceptual framework (Figure 4.1) represents the effect on the Kaunas railway station by Rail Baltica high-speed railway line implementation. The project will have a direct impact on the railway station and adjacent areas. Furthermore, by taking the right actions, the changes made on a local level could positively impact the region. Moreover, as the changes will affect other cities in the region, successful collaboration is important for the implementation of TOD on a regional level.

The project aims to propose a vision, that takes into consideration four main pillars of “planning mobility in the contemporary city” that emerged from the literature: urban mobility, spatial development, socio-economic and cultural processes (Bertolini, 2012).

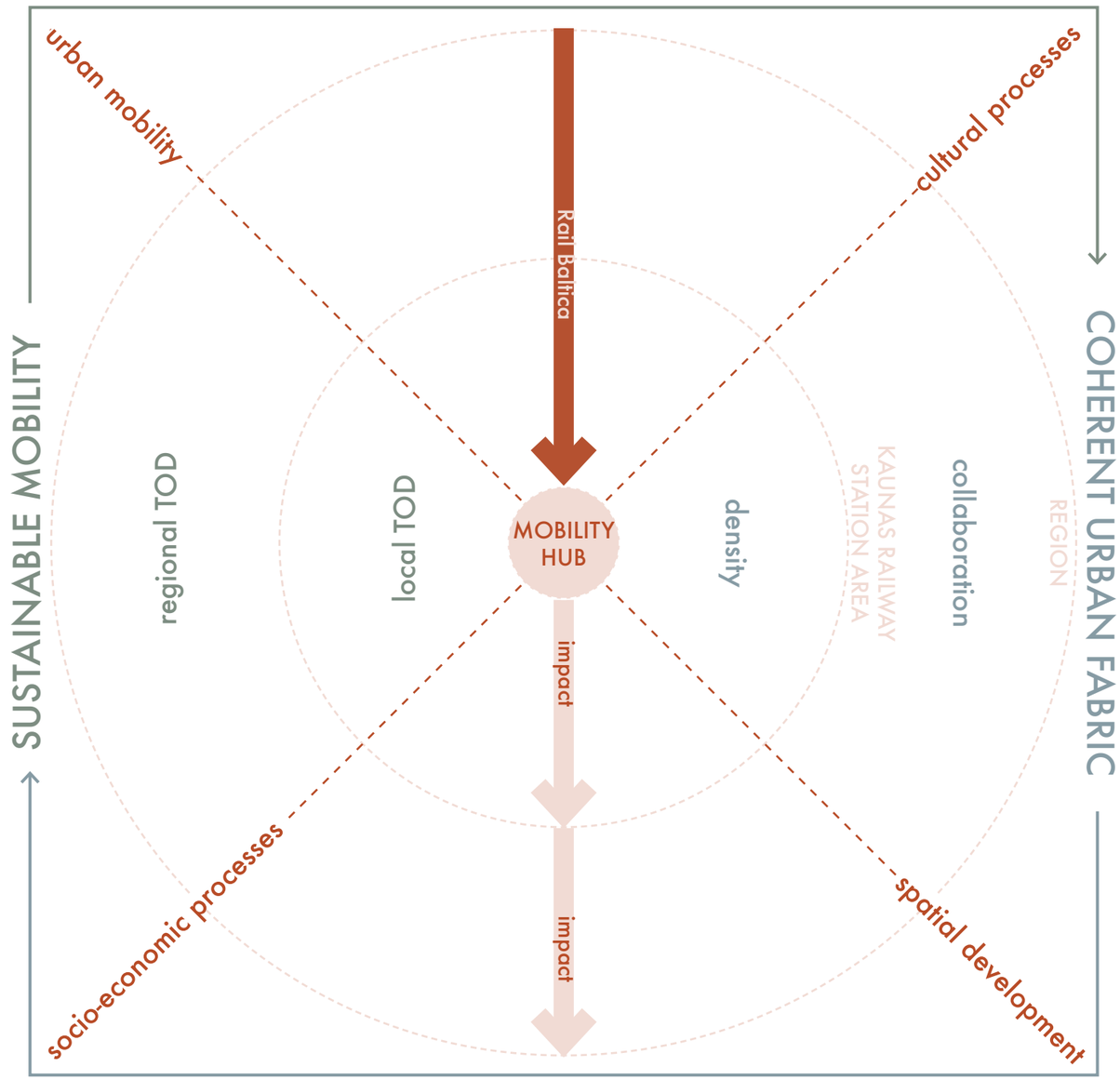


Figure 4.1: Conceptual framework (Author, 2023)

4.2 LITERATURE REVIEW

Process of the literature review

The literature review was a semi-systematic process. The concept of Transit Oriented Development (TOD) emerged at the beginning of the year when I chose a graduation topic related to mobility and railway station surroundings. As a base for the theory review, I chose literature by Luca Bertolini and other commonly acknowledged authors focusing on this field. As new topics and concepts appeared during the process (for example, density), I used those keywords to search for additional literature in various academic databases.

Moreover, it is important to note, that while the TOD concept is well-known in the Netherlands and multiple other countries around the world, from my experience studying and working in Lithuania, it is not commonly applied in the country. Therefore, while acknowledging the knowledge gap, I aim to explore the literature related to TOD while reflecting on its transferability to the local context.

Challenges of mobility planning

Luca Bertolini (2012) states that nowadays mobility planning requires understanding and managing complex relations between urban mobility, spatial development, socio-economic and cultural conditions. It is a result of the "growing diversity of activities and locations" in our daily life. However, the current lifestyle causes a paradox due to increasing dependency on mobility. On one hand, it brings freedom, however, it often becomes a necessity when without mobility the basic services are not accessible (Bertolini, 2012).

What is more, the dilemma emerges as mobility is deeply rooted as an essence of socio-economic processes, however, the negative effects of mobility (energy consumption, emissions, noise and air pollution, accidents, etc) are as stronger as ever (Bertolini, 2012).

Understanding this as one of the challenges of contemporary mobility planning, there is a need to look for ways to implement more sustainable mobility. The term "sustainable mobility" is commonly used, however, it is also often criticized as being vague and unclear. However, it is used for the conceptual framework as it was adapted from the planning document analysis (Chapter 2.1).

While acknowledging the further specify what it means, for the general understanding the definition of the term by David Banister (2005) is that it is "forms of mobility which acknowledge the need and desirability of mobility, and, at the same time, can reduce its negative effects".

From the literature emerges the need not only to minimize the negative effect of unsustainable transport but to reduce the reasons to commute. To achieve this, TOD introduces the idea of combined planning of transport and land usage.

Transit-oriented development (TOD)

The definition of TOD

The definition of TOD is extracted from the article by Thomas and Bertolini (2017): "TOD can be described as land-use and transportation planning that makes walking, cycling, and transit use convenient and desirable, and that maximizes the efficiency of existing public transit services by focusing development around public transit stations, stops, and exchanges. Successful TOD can be defined as the implementation of this type of development at a regional scale". The definition summarises how most authors define the concept of TOD, only some of them provide a more context-specific definition (Hrelja et al., 2020).

From the definition, the two main aspects emerge, land use and transportation. For the first one, the most important elements are increasing density and a mix of functions. For transportation planning, "it is a matter of improving the competitiveness of alternatives to the car" and it could be achieved by increasing flexibility, effectiveness and door-to-door transit of other means of transportation, especially non-motorized ones (Curtis et al., 2016).

Adjacent terminology

From the literature review, similar concepts appear occasionally. The most relevant for my topic could be Bus Rapid Transit (BRT) which is used to define TOD based on bus transport instead of, most frequently, railway (Hrelja et al., 2020). Currently, the Kaunas bus station could be considered to be of higher importance than the Railway station. In Lithuania, the destinations to travel by train are quite limited and, especially, the smaller towns are accessible only by bus. To improve commuting by bus, the new bus station was built recently in Kaunas centre. However, together with Rail Baltica, the railway coverage and infrastructure will be improved as well as commute time will significantly decrease, therefore, there is potential to shift towards the railway. For this reason, the focus of the literature review, as well as the project, is TOD development around the railway station.

TOD parameters

Various literature sources suggest slightly different parameters regarding the radius of the TOD influence zone around the station. The most often used parameter is walking distance from the station, however, in literature this varies from 400 m (5-minute walk) to 800 m (10-minute walk) (Hrelja et al., 2020) or even 1,2 km (15-minute walk) (Atelier Zuidvleugel, 2006). If the research also includes biking, the geographical catchment zone could be from 1,6 km to 10 km, or from 7 to 25 minutes of biking (Hrelja et al., 2020).

Due to different sources that analyse various contexts that are different from Lithuania and due to lack of literature and research looking into the local context. The maximal recognised value, 1,2 km is used. Moreover, this radius covers the whole focus area around Kaunas railway station (Chapter 5.10.1). The same radius is further used as a basis for the regional analysis (Chapter 9).

Local and Regional TOD

From the literature, TOD emerges in two different scales, local and regional. As reviewed in the article (Hrelja et al., 2020), multiple authors proposed TOD as a way to "ramp up the three Ds (density, diversity and design) at the local level". While other literature sources focus on strategic and policy frameworks for TOD and its implementation, often by using case studies (Curtis et al., 2016; Papa & Bertolini, 2015; Straatemeier & Bertolini, 2020). As the primary focus of the thesis is design, the local TOD approach is more relevant for further research. From the mentioned "3s", density appeared to be needed to research further.

Density

When studying the literature about density, the most important goals were understanding what density is, which parameters define density and whether are there any correlations between density and sustainability.

Definition and parameters of density

In the book "Spacematrix: Space, Density and Urban Form" (Berghauser Pont & Haupt, 2021), density is defined as "the relationship between a given area and the number of certain entities in that area. These entities might be people, dwellings, services, or floor space". The two different types of density are highlighted further, urban density which describes the built environment and is used for descriptive purposes and urban density which is used for normative, legal use. The concept of density was brought to my attention after the recent discussions on Lithuanian social media about the densification of Vilnius, the capital of Lithuania, centre. For that case, as in many others, different calculations of density were used to support opposite arguments. Moreover, even the same density does not mean the same quality. Critics argue that using density "for anything but statistical purposes is questionable" as the parameter itself does not able to reflect the actual qualities of the space. A similar amount of dwelling can express various urban forms and provide completely different characters. Therefore, for the further analysis of density, multiple variables are taken into consideration to ensure that numbers can, at least partially, define the actual quality of urban form. The parameters are reviewed in Chapter 7.3.3.

Density and sustainability

"Denser urban environments certainly do not automatically mean less transport and energy consumption". However, if reversed, to reduce road transportation, dense settlements are the necessary prerequisite. The reasoning behind this statement usually is based on financial and other feasibility to offer "energy-efficient and environmentally responsible" alternatives (Berghauser Pont & Haupt, 2021).

Conclusions

To conclude, the literature review allowed me to gain a general understanding of the concepts. In the chapter, the most relevant aspects were mentioned. Some topics, such as density are researched further. However, while the main principle of TOD, integrated transport and land use planning, is a key aspect of the project, the exact specifics and numbers were tested to find the best configuration for the local context rather than adopted from the literature.

The chapter reviews the **key topics relevant to research and design**. It provides information about Kaunas and the approximate project location. The goal of this analysis is to **determine the boundaries** of the exact **area of intervention**. Moreover, to find out topics that need to be explored further.

5. SITE ANALYSIS

5.1 OVERVIEW OF THE SITE ANALYSIS

The overview of the analysis (Figure 5.1) demonstrates which topics are explored further. Moreover, depending on the topic, the suitable scale is selected (Figure 5.2). Certain information is provided about the whole city of Kaunas, while some analysis focuses on the broader area (central part of Kaunas) or the focus area around the main railway station of Kaunas. The analysis results in the definition of the area of intervention and its main parameters.

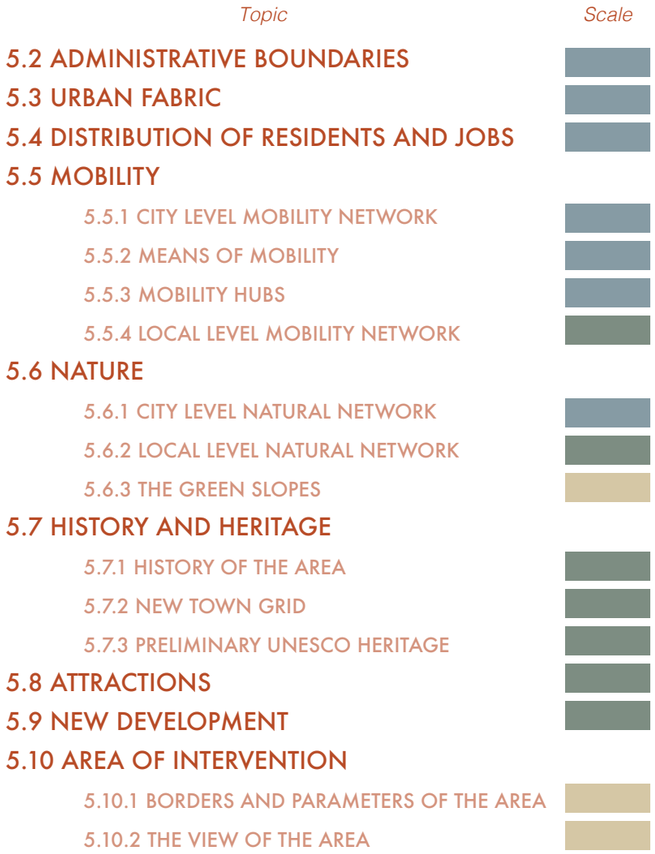


Figure 5.1: Diagram of the site analysis content (Author, 2023)

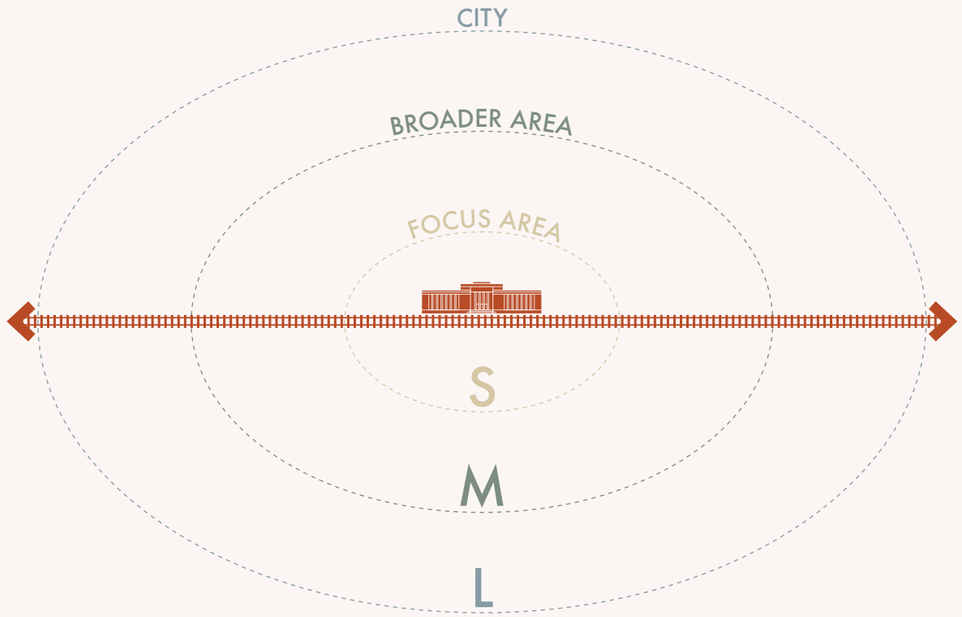


Figure 5.2: Different scales of analysis (Author, 2023)

5.2 ADMINISTRATIVE BOUNDARIES

Kaunas is divided into 11 administrative units (elderships) (Figure 5.3). Kaunas central railway station is located on the border between Centras and Šančiai elderships. The largest elderships are located in the south (Petrašiūnai, Panemunė, Aleksotas) and in the north (Šilainiai), however, the ones in the south are less dense in terms of population as large natural areas are included (Figure 5.4). More detailed information about the distribution of residents and jobs is provided in Chapter 5.4.

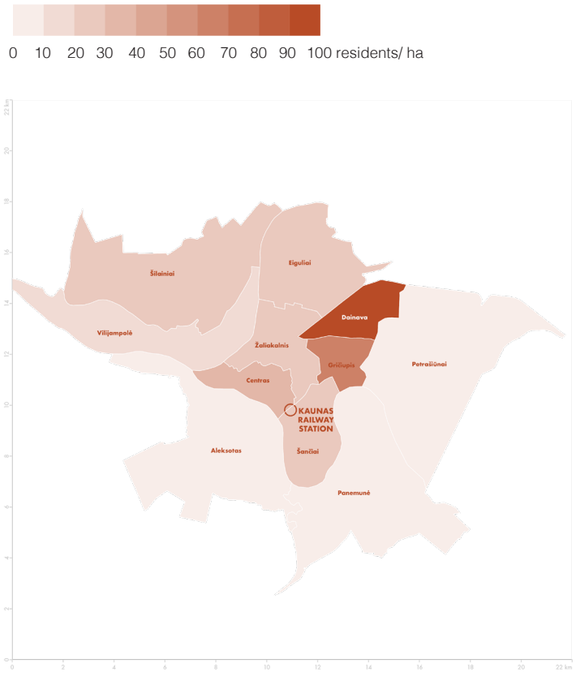


Figure 5.4: Population density per ha in 2021 (Author, data source: www.osp.stat.gov.lt, 2023)

Figure 5.3: Administrative boundaries and number of residents in 2021 (Author, data source: www.osp.stat.gov.lt, 2023)

5.3 URBAN FABRIC

Kaunas had formed around the core area between two rivers, Nemunas and Neris. The city is quite low-density, there are some industrial areas in the central parts of the city, however, the industry is being pushed to the outskirts. Moreover, suburbanization and urban sprawl happened quite intensively in the last decades. The map (Figure 5.5) provides general information about various parts of the city. The three illustrations below (Figures 5.6-5.8) demonstrate what they look like.

Figure 5.6: An example of the Soviet mass housing area (Google Satellite, 2023)

Figure 5.7: An example of the mix-use area (Google Satellite, 2023)

Figure 5.8: An example of the mix-use area (Google Satellite, 2023)

Figure 5.5: Different areas of Kaunas (Author, 2023)

5.4 DISTRIBUTION OF RESIDENTS AND JOBS

The most densely populated neighbourhoods (Figure 5.10) are the Soviet mass housing areas in the north of Kaunas; however, those areas are unattractive to younger residents, and therefore, the areas face issues of an ageing population. Young families tend to move to the suburbs of the city. Companies (Figure 5.11) are mostly concentrated in a few industrial zones, along the main roads and in the city centre.

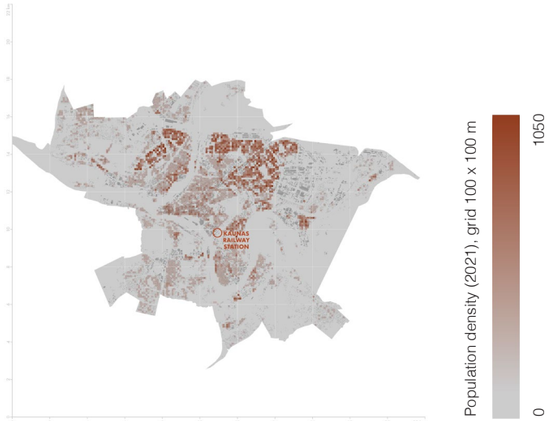


Figure 5.10: Distribution of residents
(Author, data source: www.osp.stat.gov.lt, 2023)

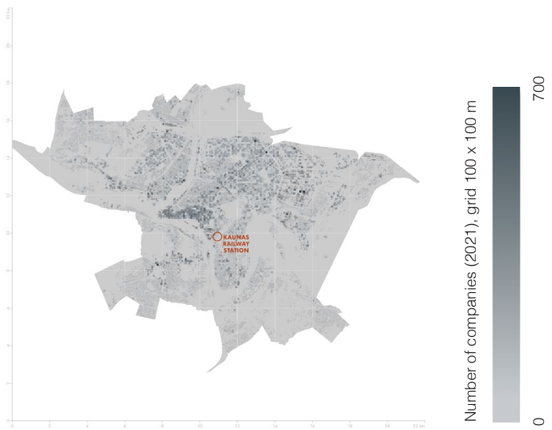


Figure 5.11: Distribution of companies
(Author, data source: www.osp.stat.gov.lt, 2023)

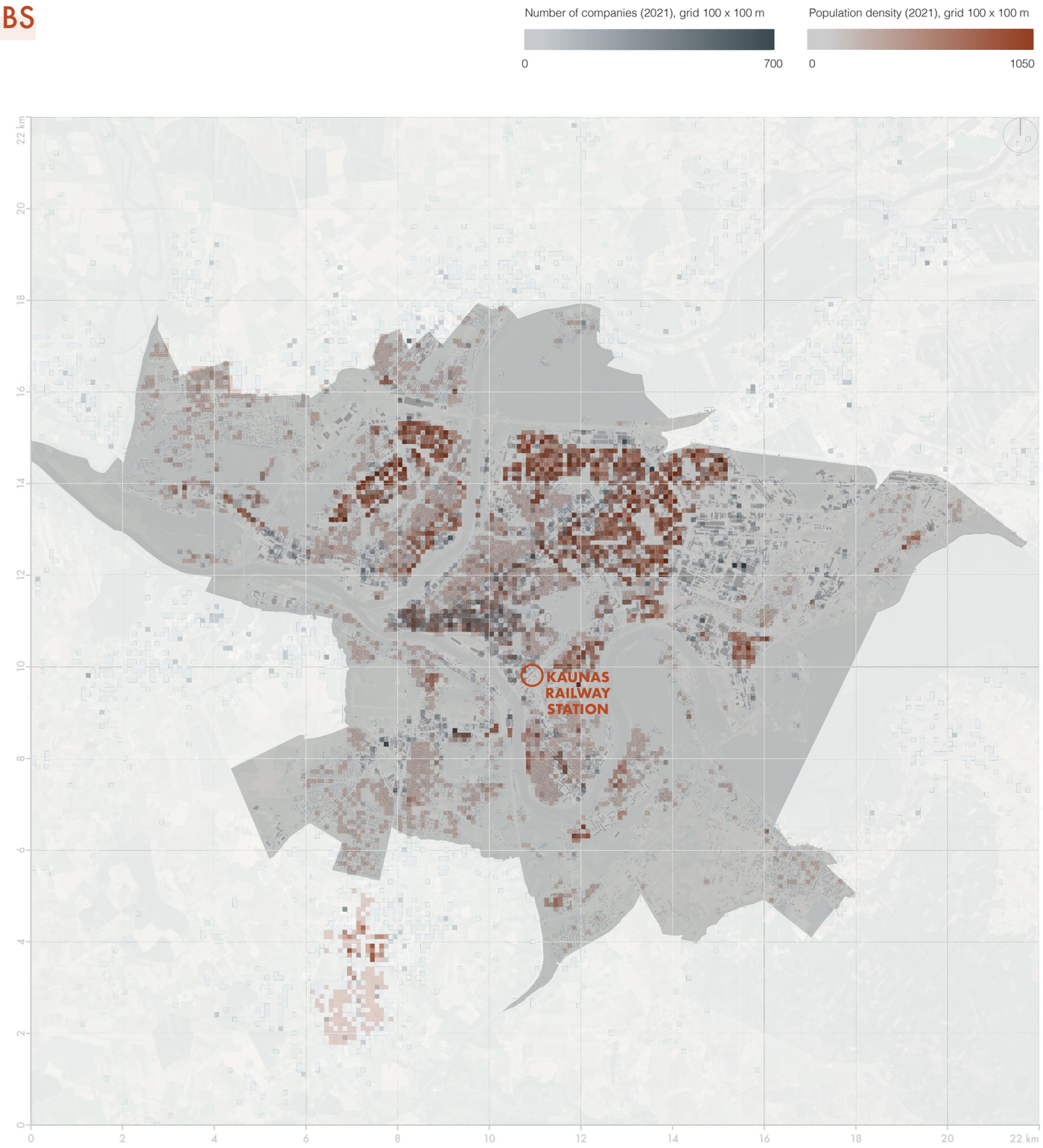


Figure 5.9: Distribution of population and companies
(Author, data source: www.osp.stat.gov.lt, 2023)

5.5 MOBILITY

5.5.1 CITY LEVEL MOBILITY NETWORK

Mobility in Kaunas is based on the road network (Figure 5.12). Highways partially surround Kaunas except for the southeastern part where Kaunas hydroelectric power plant sluice becomes a bottleneck limiting the flow of traffic. There is a plan to complete the missing part of the ring road around the city and the new bridge is a key project for this to succeed. The second main change is the planned Kėdainiai bridge next to the confluence of the Nemunas and Neris rivers. When implemented, there might be a shift towards increased importance of the streets on the opposite side of the Nemunas River (the dashed green line in the map, Figure 5.12).

Railway tracks are located in the southeastern part of Kaunas, the main railway station is situated next to the city centre and the second, region Palemonas station in the northeast is mostly used as a freight station, however, some regional passenger trains stop there as well. Public transport coverage within the city (Figure 5.13) is quite extensive, however, usually the quality of it is the issue.

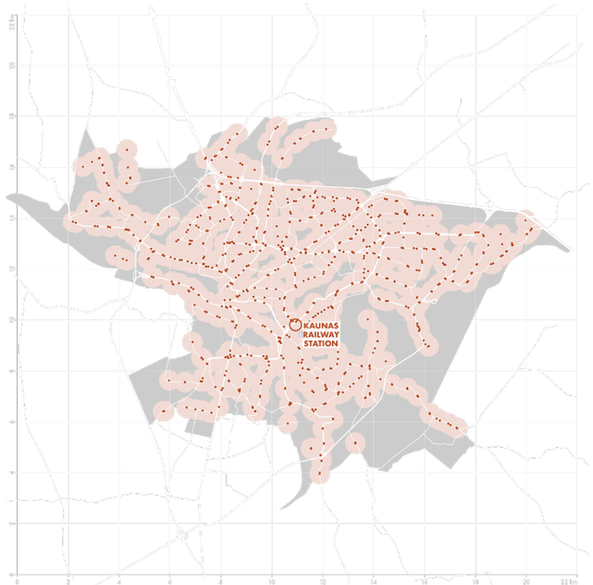


Figure 5.13: Public transport stops and 5-minute (400 m) accessibility radiuses (Author, data source: Open Street Maps, 2023)

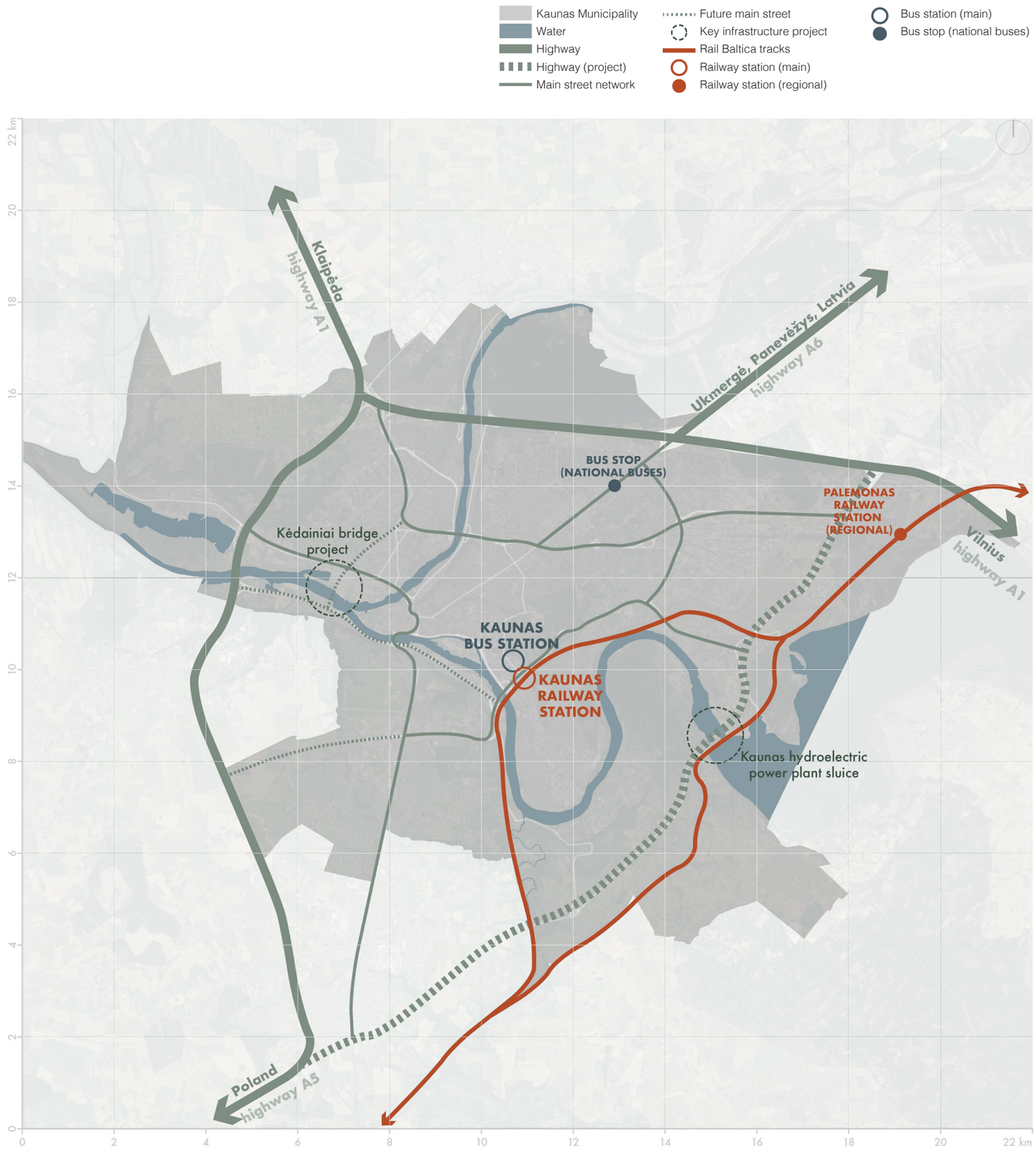
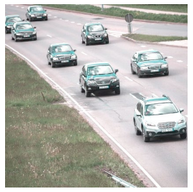


Figure 5.12: Mobility network of Kaunas (Author, 2023)

Main means of mobility in Kaunas

Car



Private car

Car sharing

Taxi services

Public transport

Bus

Trolleybus

Other

Bike

Scooter

Walking

Means of national/ international mobility

Train

Bus

Plane

Figure 5.14: Means of mobility in Kaunas (Author, 2023)

Kaunas railway station

The current Kaunas Central Railway station was built between 1949 - 1953 by Russian engineer Petr Ashastin (Петр Андреевич Ашастин). The last time it was renovated was in 2008. Currently, there is one more regional station in the North-Eastern part of Kaunas, Palemonas. It is also used as the main freight terminal.

Figure 5.15: Kaunas railway station (image by R. Ščerbauskis)

Kaunas bus station

The new bus station was built in 2017 by the architecture studio “Dviejų grupė“. Both national and international buses use the station. Some buses make an additional stop in the western part of the city, however, there is no second station.

Figure 5.16: Kaunas bus station (image by www.contestus.lt)

Kaunas airport

Kaunas airport is located outside the northeast border of Kaunas municipality, in Karmėlava. There is a bus connection from Kaunas railway station to Kaunas airport, however, it is not very frequent and takes approximately 30 minutes.

Figure 5.17: Kaunas airport (image by A. Aleksandravičius)

5.5 MOBILITY

5.5.4 LOCAL LEVEL MOBILITY NETWORK

On the local level (Figure 5.18), there is a clear network of streets that are important for the overall road system of the city. One of the most important (B1 category) streets (street categories are regulated by Lithuanian law (Lietuvos Respublikos aplinkos ministerija, 2011)) is located in front of the railway station creating a clear barrier between the centre and the station. The road network is further analysed to determine possible changes in the street profiles and number of the lanes in Chapter 7. As previously mentioned, the public transport (buses, trolleybuses) network is quite extensive, however, on a smaller scale it is not very convenient to access the railway station. What is more, the bike path network is currently being improved, however, due to climate, terrain and lack of coherent infrastructure, it is currently more used for leisure rather than as a mean of mobility. The Strava heatmap (Figure 5.19) is used to highlight that industrial and infrastructure areas attract almost no people to move through them compared to other central areas of the city.

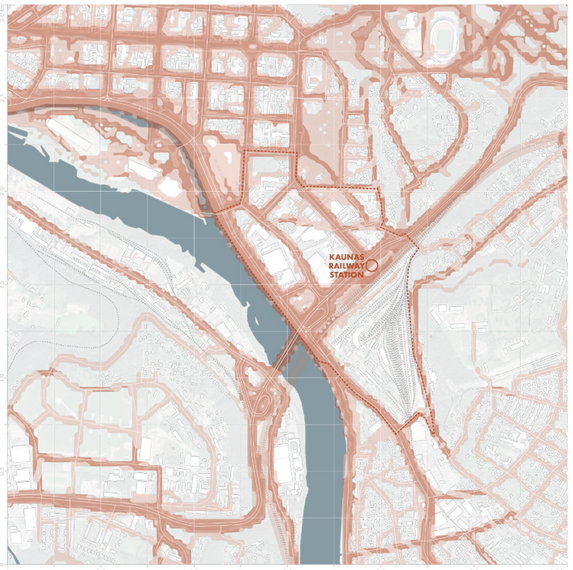


Figure 5.19: Heatmap demonstrating the frequency of activities (walking, running and biking) in the area (Author, source: www.strava.com, 2023)

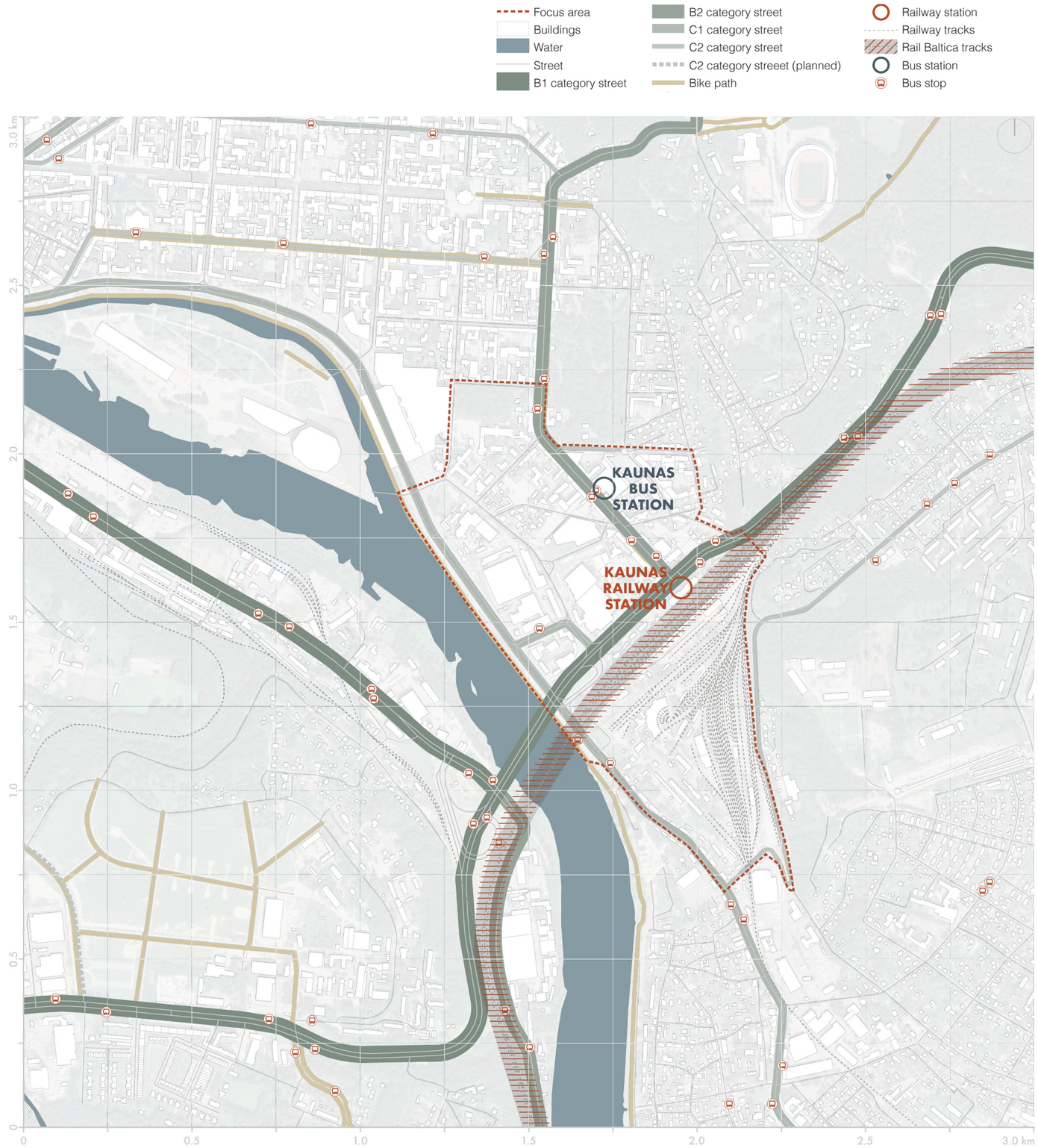


Figure 5.18: Mobility network of the area (Author, 2023)

5.6 NATURE

5.6.1 CITY LEVEL NATURAL NETWORK

The green-blue structure of Kaunas (Figure 5.20) is based on the location of the two largest rivers, Nemunas and Neris and the green slopes along them. The main green patches, Kleboniškis forest in the north and Panemunė pinewood in the south are connected through smaller green patches.

Kaunas is surrounded by agricultural landscapes, smaller green patches, forests and grass fields (Figure 5.21).

Figure 5.21: Satellite view of Kaunas and its surroundings (Google Satellite, 2023)

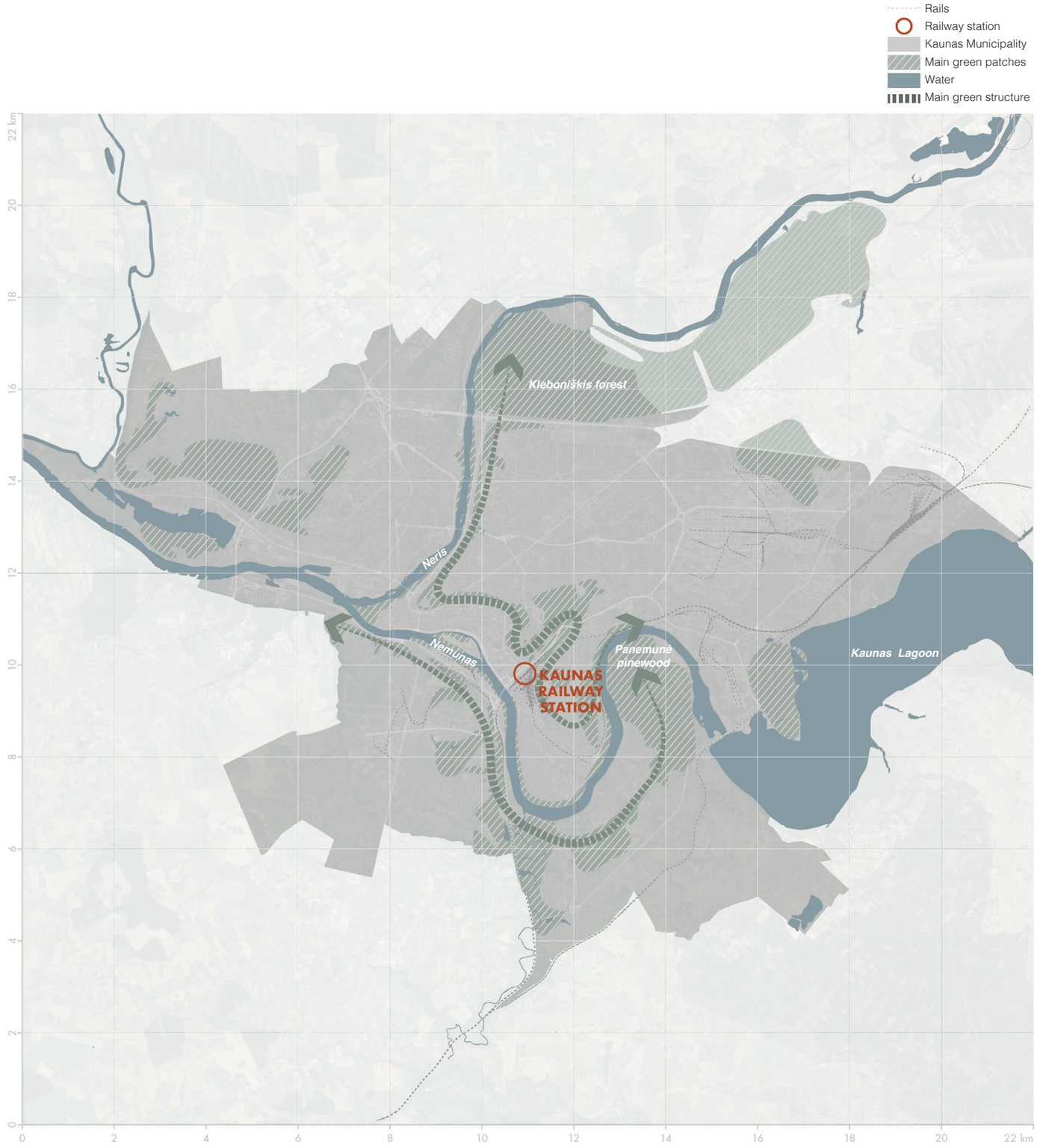


Figure 5.20: The main green-blue structure of Kaunas (Author, 2023)

5.6 NATURE

5.6.2 LOCAL LEVEL NATURAL NETWORK

The area of interest (Figure 5.22) is located on a lower terrace of the city. From one side, the Nemunas River forms a border. As there is a 10 metres height difference, the area has a low risk to be flooded. From the east side, the area is limited by green, quite steep slopes (Figure 5.23). The green slopes are an important part of Kaunas green network. However, they are lacking good quality connections for pedestrians and cyclists to reach the higher terrace.

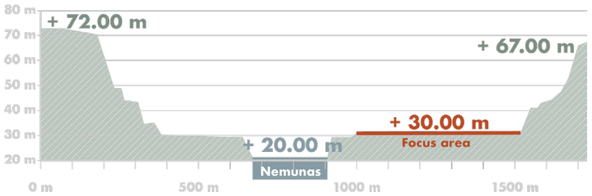


Figure 5.23: Section of the topography of Kaunas centre (Author, 2023)

Figure 5.24: Satellite view of the area (Google Satellite, 2023)

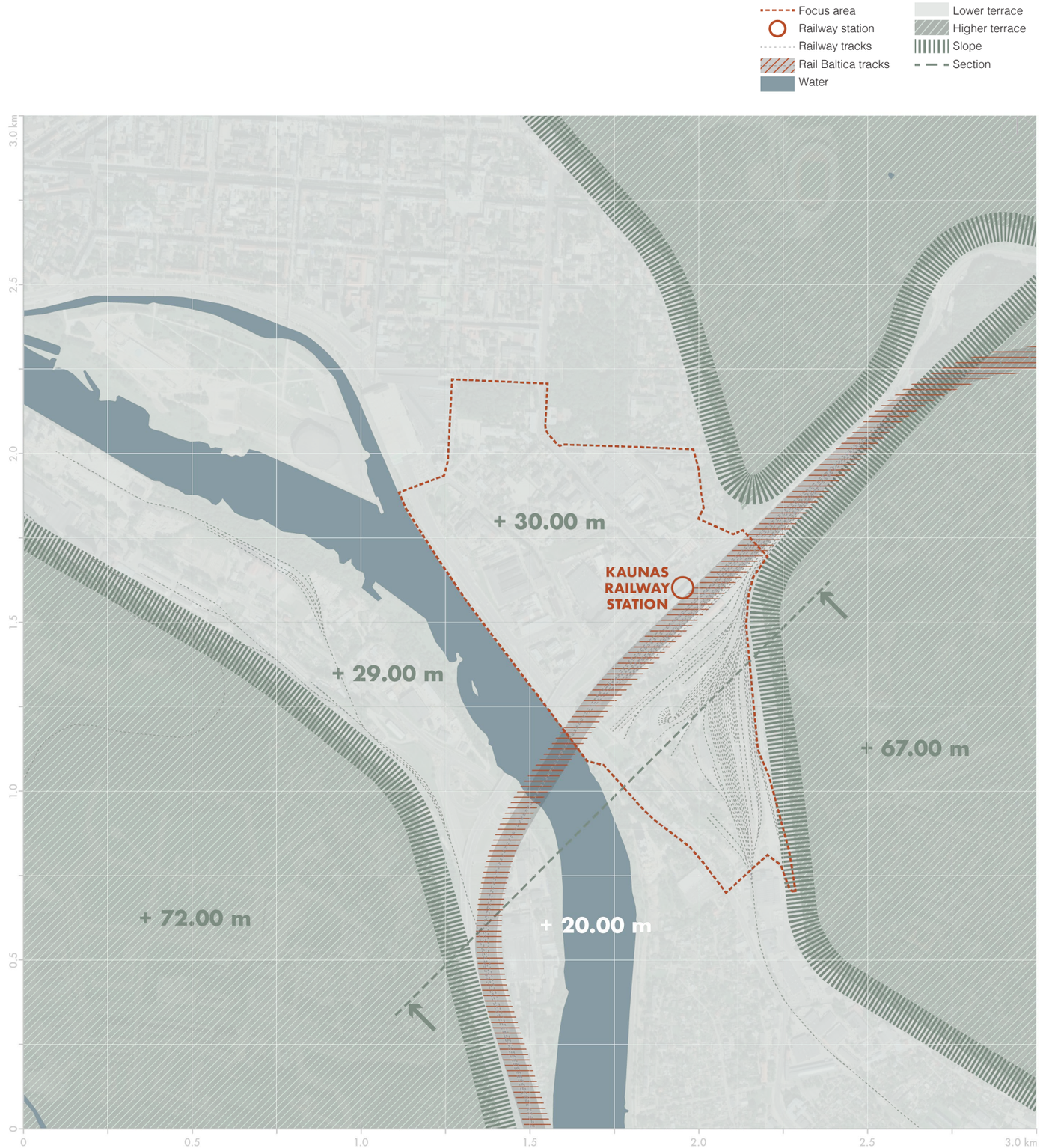


Figure 5.22: Topography of the area (Author, 2023)

Figure 5.25: Green slopes (Author, image by A. Aleksandravičius, 2023)

5.7 HISTORY AND HERITAGE

5.7.1 HISTORY OF THE AREA

The history of the area (Figure 5.26-5.29) is highly related to the history of the railway in Kaunas. The first railway station (Figure 5.30) was constructed in 1859 - 1862 together with the railway line between Warsaw and St. Petersburg. Simultaneously, large industrial buildings began to appear along the Nemunas River due to the proximity of the railway, river transport and port. The first industrial companies focused mainly on the metal processing and spirits industry (Kaunas City Municipal Administration, 2021). The station was destroyed during WWII and later rebuilt at the same place in 1949 - 1953.

While the New Town part of the focus area changed over time, the triangle-shaped site behind the station has been used as a railway infrastructure and maintenance zone for more than 150 years. Further towards the southeast, the Šančiai district grew from a military base. However, the functions in the area changed significantly since then and Kaunas continued to expand further. The shift requires to think the future of former industrial and infrastructure zones while preserving their valuable qualities.

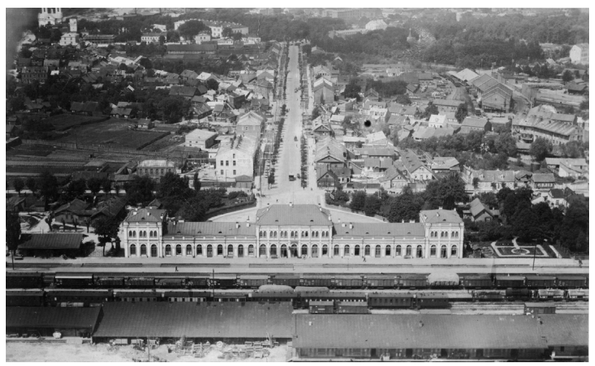
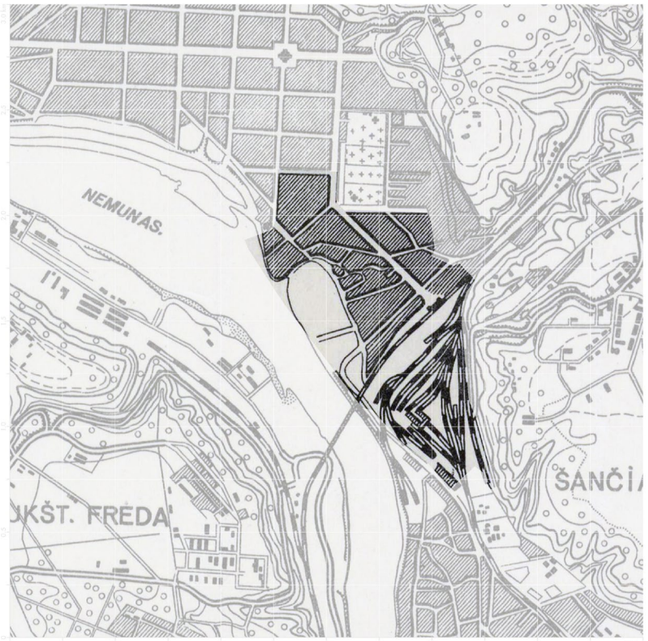


Figure 5.30: Kaunas railway station and the surrounding area (From the collection of Lithuanian Aviation Museum, 1928)

1889



1926

1931

1969

Figures 5.26 - 5.29: Historic maps of the area (Author, source: storymaps.arcgis.com, 2023)

5.7 HISTORY AND HERITAGE

5.7.2 NEW TOWN GRID

Part of the area is located in the heritage zone “historic part of Kaunas, called New Town (Naujamiestis)” (Figure 5.31). The upper part of the New Town can be distinguished by the clear grid structure that gets disrupted towards the station. The clear rectangular grid of the New Town was introduced in the middle of the XIXth century, during the occupation by the Russian Empire. It created the system of the main axis (currently the main pedestrian alley, Liberty Boulevard (liet. Laisvės alėja) leading towards the Old Town with three adjacent public squares (Figure 5.32).

Furthermore, during the Interwar period (1918-1939), after Lithuania regained its independence, Kaunas became a provisional capital of Lithuania. While Vilnius was under occupation, Kaunas grew as a centre of political and cultural life. The change of status required new buildings to meet the needs of the capital. Most of those buildings (a few of them are shown in Figures 5.33-5.35) are located in the New Town and on a higher terrace, towards the northeast, in the area called “Žaliakalnis”. Due to its unique whole, the buildings built between 1918-1939 and the urban structure of Kaunas Centre entered the UNESCO preliminary list of World Heritage Sites. Part of the focus area, called “Industrial New Town” is part of the site, which is considered to become a UNESCO heritage (Kaunas City Municipal Administration, 2021). However, while the decision is not there yet, the graduation project focuses on the heritage already included in the national heritage list while acknowledging the need for further discussion on how the needs of the contemporary mobility hub could align with the preservation of the Interwar Period heritage. The national heritage of the area is reviewed in Chapter 7.3.1.

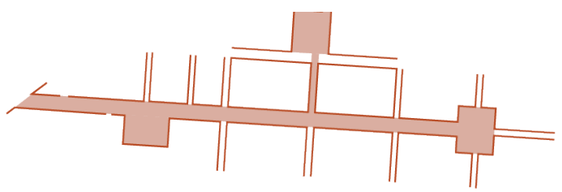


Figure 5.32: The main public space system of Kaunas New Town (Author, 2023)

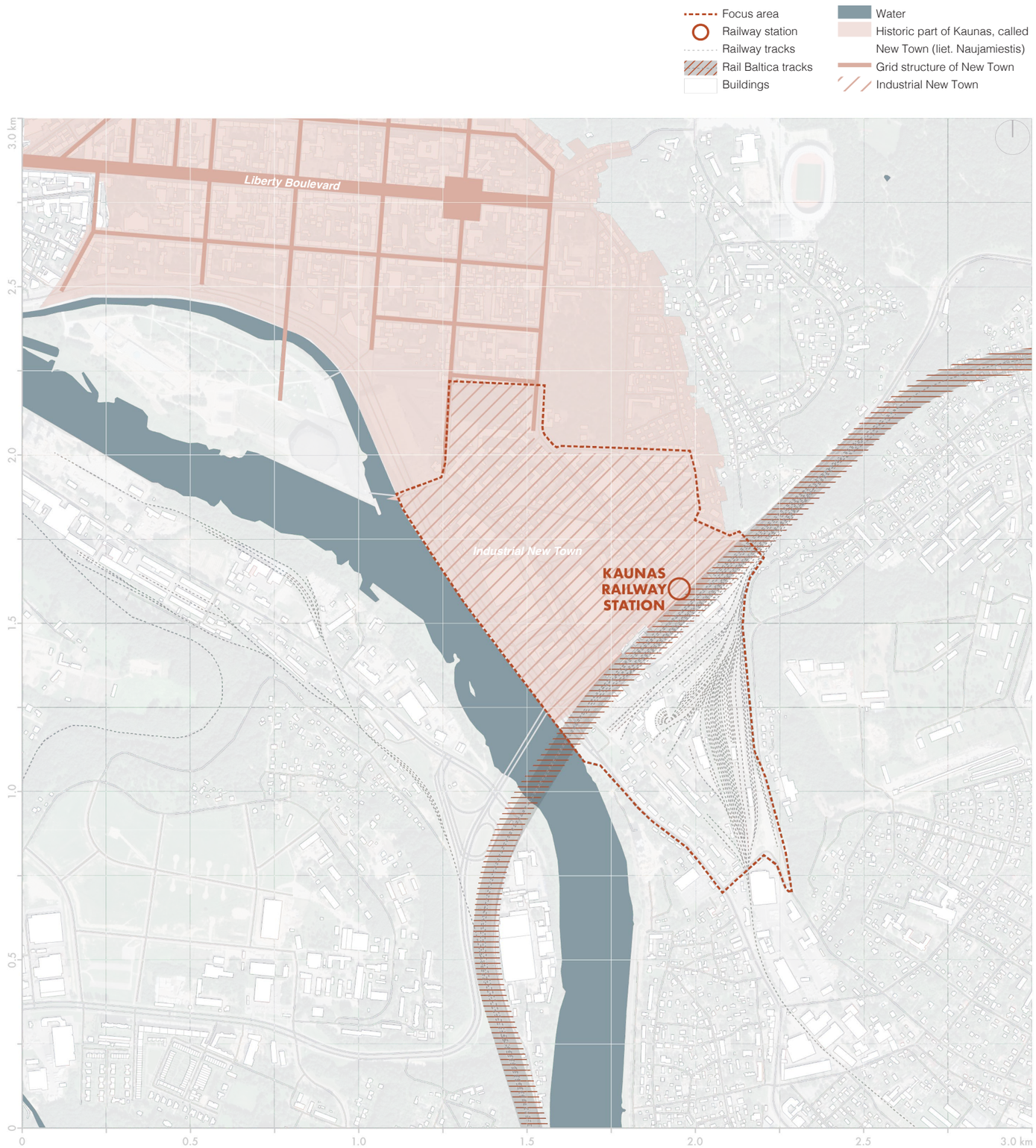


Figure 5.31: Map of the New Town grid structure (Author, 2023)

Figures 5.33 - 5.35: Kaunas Interwar period architecture (Author, images by A. Aleksandravičius (left, bottom right) and R. Tenis (upper right), 2023)

5.8 ATTRACTIONS

Kaunas is a monocentric city where the main attraction are located in the central part of the city (Figure 5.36). A few decades ago, the main public functions were concentrated in the New Town, along the main axis (Liberty Boulevard (liet. Laisvės alėja) and in the Old Town. However, when the “Akropolis” shopping centre was opened next to the waterfront in 2007 the attention started shifting towards the Nemunas River. In 2008, construction of the new basketball arena started on Nemunas Island. The “Žalgiris” arena accommodates approximately 15 500 basketball fans and usually is completely sold out when “Žalgiris”, the local basketball team is playing. In recent years, the development of Nemunas Island continues with the recently completed swimming pool and a science museum which is still under construction. Moreover, last year the football stadium was opened after the reconstruction which accommodates also around 15 000 people. Due to the quality of the event spaces, more important events such as concerts or games are recently happening in Kaunas, for example, Euroleague Final For this spring (Figure 5.37).

Figure 5.37: Basketball fans in Kaunas centre before the Euroleague final in May 2023 (Image by R. Tenis, 2023)

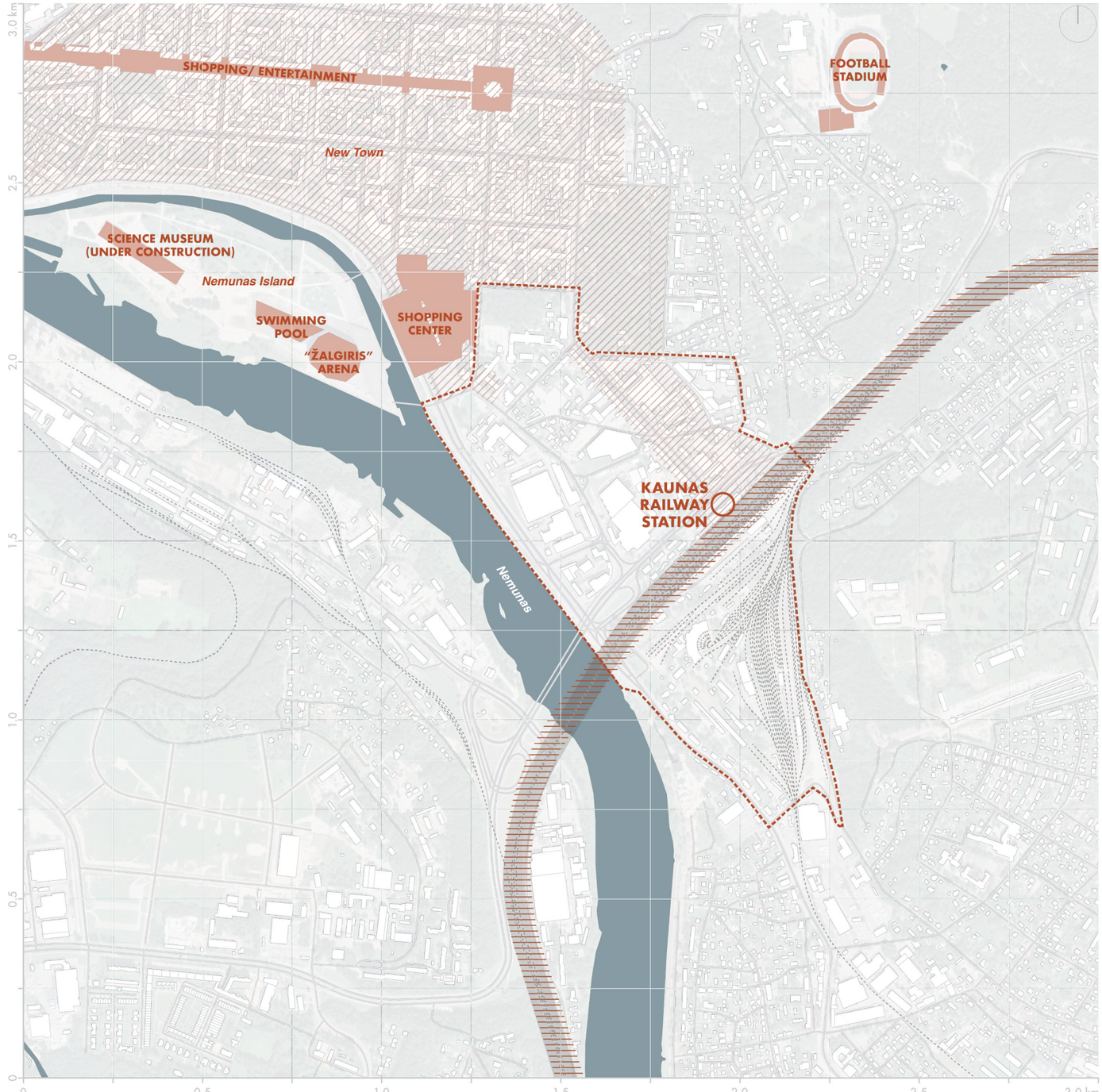


Figure 5.36: Map of the main attractions in the area (Author, 2023)

5.9 NEW DEVELOPMENT

There are a few large development projects planned in the area (Figure 5.38) including the Kaunas railway station and railway tracks (1), a science museum on Nemunas Island (2), residential developments (3, 4) and an innovation park (5). The information about the projects is extracted from www.citify.eu.

1. Kaunas Railway node

Currently, the strategic plan for the Kaunas railway node is being prepared. The exact details of the project regarding the central station are still to be determined. Therefore, the thesis explores the potential of the railway station while the actual decisions are not made yet.

2. Science Island and Nemunas Island Park

A science museum on Nemunas Island (Figure 5.39) is currently under construction and should be open in 2023. Simultaneously, the park surrounding the museum is being renewed.

3. “Nemunaičiai” development

It is a large residential and mixed-use development happening in the former industrial area next to the Nemunas River. The first stage which is almost completed, offers 162 apartments from 31 to 120 m². The Floor Space Index (FSI) of the first stage is 1.9. The next stages should offer both apartments and office space, however, the exact plans are not yet public.

4. “Matau Kauną” development

A residential complex will accommodate 40 apartments from 51 to 75 m². The total area is 10 ha, however, FSI is not specified.

5. Aleksotas Innovation Park

20 ha area in Aleksotas will be developed as an innovation park focused on research and design (R&D). At least 1100 new jobs should be created in the area. Currently, the project is still under development.

Figure 5.39: Construction on Nemunas Island (Image by kaunas.lt, 2021)

Figure 5.38: Map of the new developments in the area (Author, 2023)

5.10 AREA OF INTERVENTION

5.10.1 BORDERS AND PARAMETERS OF THE AREA

The previous analysis allowed me to determine the main features of the area and to identify the boundaries of the intervention (Figure 5.40). There is potential to develop further, however, for the project, natural limits were selected such as the Nemunas River waterfront in the southwest and green slopes in the northeast of the station. What is more, Griunvaldas Street marks the edge between a clear new town grid and a more undefined grid of the industrial part of New Town. It became a northern barrier together with the “Akropolis” shopping centre. Also, the park in the north is a memorial place and it does not require urgent interventions. On the opposite side of the station, towards the southeast, the whole railway infrastructure area is included assuming that there is a possibility to relocate railway maintenance and develop the area to fit the needs of the city. Further towards the southeast, some still functioning industrial areas could be transformed in the future, however, for this project, it is considered as a boundary. Also, there is new development next to the waterfront, therefore, that area is not included as well. The defined area is 89,1 ha in size and is approximately 1700 m long and 750 m wide. Kaunas railway station is the central point of the area (Figure 5.41). Therefore, it takes approximately 15 minutes to walk from the furthest point of the railway station.

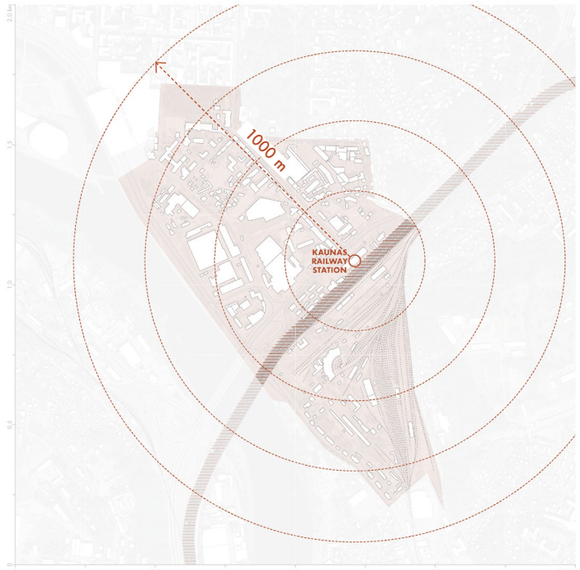


Figure 5.41: Distances from the railway station (Author, 2023)

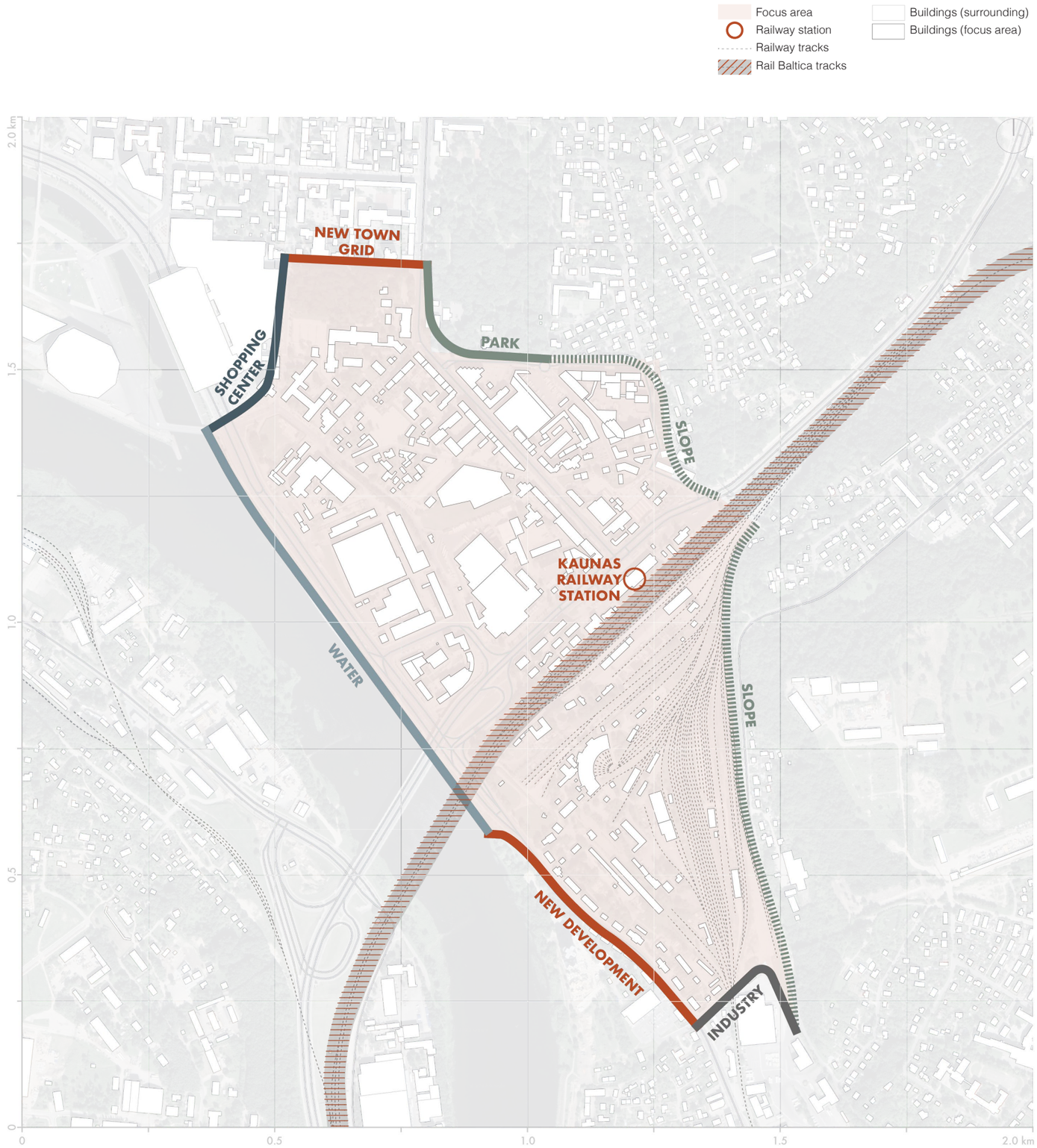


Figure 5.40: Conclusion map showing the boundaries of the project site (Author, 2023)

5.10 AREA OF INTERVENTION

5.10.2 THE VIEW OF THE AREA

Figure 5.42: Area of intervention (Author, image by A. Aleksandravičius, 2023)

6. EXPLORATIONS

6.1 EXPLORING THE IDENTITY
6.2 EXPLORING THE “PERFECT” BLOCK

The chapter aims to answer the question: ***what to do?*** in the area that was defined in the previous chapter. The chapter demonstrates my chosen workflow combining both structured research and intuitive, personal experience-based explorations. The chapter is divided into two parts:

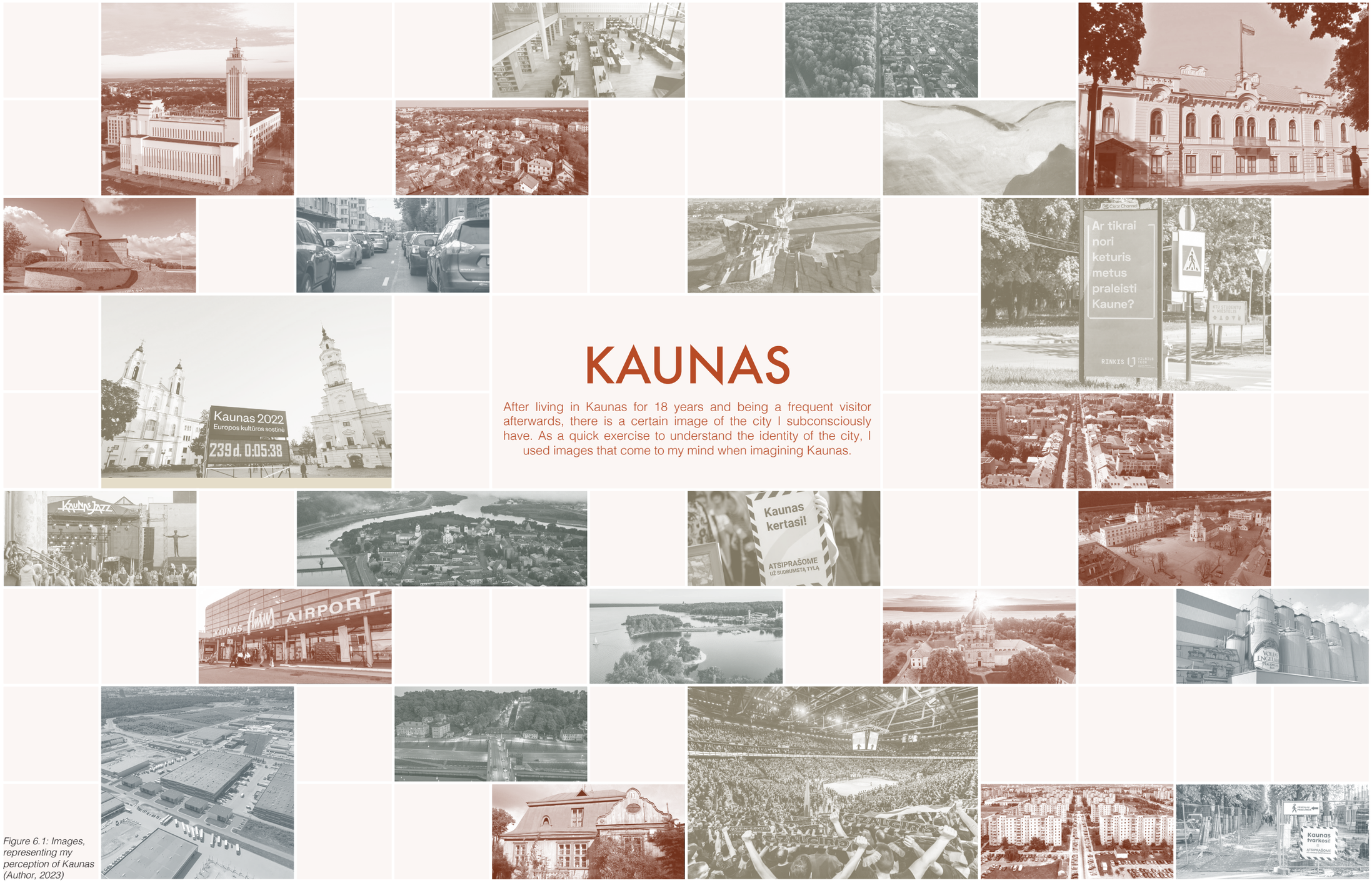
Exploring the identity part focuses on the perception and character of Kaunas. This part is subjective and reflects on my personal experience as a resident or a frequent visitor of Kaunas, my home town, for the last 27 years.

Exploring the “perfect” block part investigates different urban blocks aiming to understand what kind of density, character and urban life could be created using certain blocks. The aim is to choose the most suitable block configuration for the project area. Then the selected block is analysed further.

6.1 EXPLORING THE IDENTITY

6.1.1 KAUNAS: PERSONAL IMPRESSIONS

- Built environment
- Nature
- Infrastructure and economy
- Culture and events



KAUNAS

After living in Kaunas for 18 years and being a frequent visitor afterwards, there is a certain image of the city I subconsciously have. As a quick exercise to understand the identity of the city, I used images that come to my mind when imagining Kaunas.

Figure 6.1: Images, representing my perception of Kaunas (Author, 2023)

6.1 EXPLORING THE IDENTITY

6.1.1 KAUNAS: PERSONAL IMPRESSIONS

Built environment
Nature
Infrastructure and economy
Culture and events

KAUNAS INTERWAR PERIOD ARCHITECTURE

Kaunas Interwar Period (Modernist) architecture which was built in the central part of Kaunas between 1918 and 1939 is currently undergoing the process to be nominated for UNESCO World Heritage.

STUDENT CITY

There are 8 higher education institutions and 7 vocational schools located in Kaunas. In 2019 - 2020, approximately 34 500 students were studying in institutions of higher education (EKT & Civitta, 2020).

TREES

17% of the Kaunas area is covered by forests (EKT & Civitta, 2020), moreover, the green slopes create a visual sense of greenery, especially when looking from the perspective of the centre.

TEMPORARY CAPITAL (1919-1940)

Kaunas rapidly grew between 1918 and 1939 when it became the temporary capital of Lithuania. While Vilnius was under occupation, Kaunas became a centre of political and cultural life.

LOW-DENSITY

Kaunas occupies 157 km² area of which 48% is urbanized area and 17% is forest. In 2020, the population density was 1843,1 residents/ km² (EKT & Civitta, 2020).

M.K.ČIURLIONIS

The street in front of the railway station is named after one of the most famous artists in Lithuania, M.K.Čiurlionis (1875-1911). He was a painter, composer and writer.

KAUNAS CASTLE

It is located in the Old Town. For the first time, the name Kaunas was mentioned in written sources in 1361 in the letter by the Crusaders, mentioning the planned attack on the Kaunas Castle.

TRAFFIC

The modal split shows that in 2018 (the latest results before the pandemic), 57% of travelling happened by car, 29% by public transport, 4% by bike and 10% by walking (EKT & Civitta, 2020).

IX FORT MEMORIAL

The fort is part of the Kaunas fortification system that was built at the end of the XIXth century. It is currently a memorial to the victims of Nazism.

THE 2ND CITY: COMPETITION WITH VILNIUS

There is a sense of competition rather than collaboration between Kaunas and Vilnius that comes from historic and cultural circumstances. The image represents the competition between the largest universities to attract new students.

EUROPEAN CAPITAL OF CULTURE 2022

Nomination of the European Capital of Culture 2022 was a strong catalyst of the cultural life in Kaunas that involved various projects of public participation, festivals, and concerts spread over the year 2022.

KAUNAS

After living in Kaunas for 18 years and being a frequent visitor afterwards, there is a certain image of the city I subconsciously have. As a quick exercise to understand the identity of the city, I used images that come to my mind when imagining Kaunas.

LIBERTY BOULEVARD

The main pedestrian alley, Liberty Boulevard (liet. Laisvės alėja) is located in the New Town and leads towards the Old Town. The length of the boulevard is 1,6 km.

KAUNAS JAZZ FESTIVAL

Kaunas Jazz Festival has more than 30-year history and happens every spring in the "Žalgiris" arena and various public spaces in the city, especially in the Kaunas New Town.

RIVER CONFLUENCE

Kaunas as a settlement started growing between two rivers, Nemunas and Neris. Kaunas Old Town is located close to their confluence followed by a large park at the point where the two rivers meet.

GREEN ACTIVISM

Citizens highly value trees, which results in occasional protests when the project proposes cutting the existing trees. Often, those situations lack clear input by arborists whether it is needed.

TOWN HALL SQUARE

Kaunas Old Town is relatively small and has a clear main street that leads to the Town Hall Square. It is situated close to the river confluence and it is a strong attraction point for tourists and locals.

KAUNAS FLUXUS AIRPORT

The 2nd largest airport in Lithuania (the 4th largest one in the Baltics) is located slightly outside Kaunas, towards the northwest. There are also plans for the further expansion (EKT & Civitta, 2020).

KAUNAS LAGOON

Kaunas Lagoon was created in 1959 by damming the Nemunas River. Kaunas Lagoon prevents flooding that used to happen quite frequently and provides water to the hydroelectric power plant.

PAŽAISLIS MONASTERY

The complex of the monastery and the church is famous for its Baroque architecture. It is situated close to the Kaunas Lagoon, in the eastern part of the city.

KAUNAS BEER

One of the largest beer production companies in Kaunas, "Volfas Engelman" is located in the New Town, close to the railway station.

KAUNAS FEZ (FREE ECONOMIC ZONE)

Kaunas Free Economic Zone is a business park in the outskirts of Kaunas, close to the Kaunas airport and the highway A6 towards the north-western part of Lithuania.

TERRACED LANDSCAPE

The centre of Kaunas is located close to the river confluence on the lower terrace and is 30-35 m above sea level. It is surrounded by higher terraces (approximately 70-80 m above sea level).

BASKETBALL AND ŽALGIRIS

Basketball is considered to be a "second religion" in Lithuania and the Žalgiris basketball team is an important part of Kaunas identity. It results in Žalgiris Arena attracting around 15 000 visitors each time they play.

WOODEN ARCHITECTURE

Certain parts of Kaunas (especially the Žaliakalnis neighbourhood) are known for the unique wooden architecture built mostly at the beginning of the XXth century.

SOVIET PERIOD HOUSING

The most densely populated neighbourhoods are the Soviet housing areas (built around 1975-1985) in the north of Kaunas; however, those areas are unattractive to younger residents.

CHANGES

Over the years I see the constant change in the image of the city. In my opinion, the city is in transition from the post-soviet to the contemporary, "western" city.

Figure 6.2: Keywords, representing my perception of Kaunas (Author, 2023)

6.1 EXPLORING THE IDENTITY

6.1.2 IDENTITY OF THE PROJECT AREA

The identity image (Figure 6.3) demonstrates different layers of the previously defined focus area.

SPACE AND OPENNESS	The area maintains the open space character that is common for the whole city.
GREEN SLOPES	The central part of Kaunas is surrounded by green hills, therefore, even though there is not much greenery in this particular area, the green city character is still visible.
LARGE-SCALE INDUSTRY	Large-scale industry and former industrial buildings are dominant in the area. Moreover, the two newly built 16-floor high residential towers also became clearly visible from the surroundings.
STATIONS AND HERITAGE	The railway station is the key destination of the area (based on the location and spatial composition of the area), surrounded by heritage and low-rise residential buildings. The bus station is located 400 metres further.
CAR-ORIENTED MOBILITY	Current mobility is based on cars, local public transportation (buses and trolleybuses) and the railway system (which is currently less used for the national commute than buses).
RAILWAY TRACKS	The railway infrastructure corridor covers a large part of the area; therefore, the railway tracks are the main element.

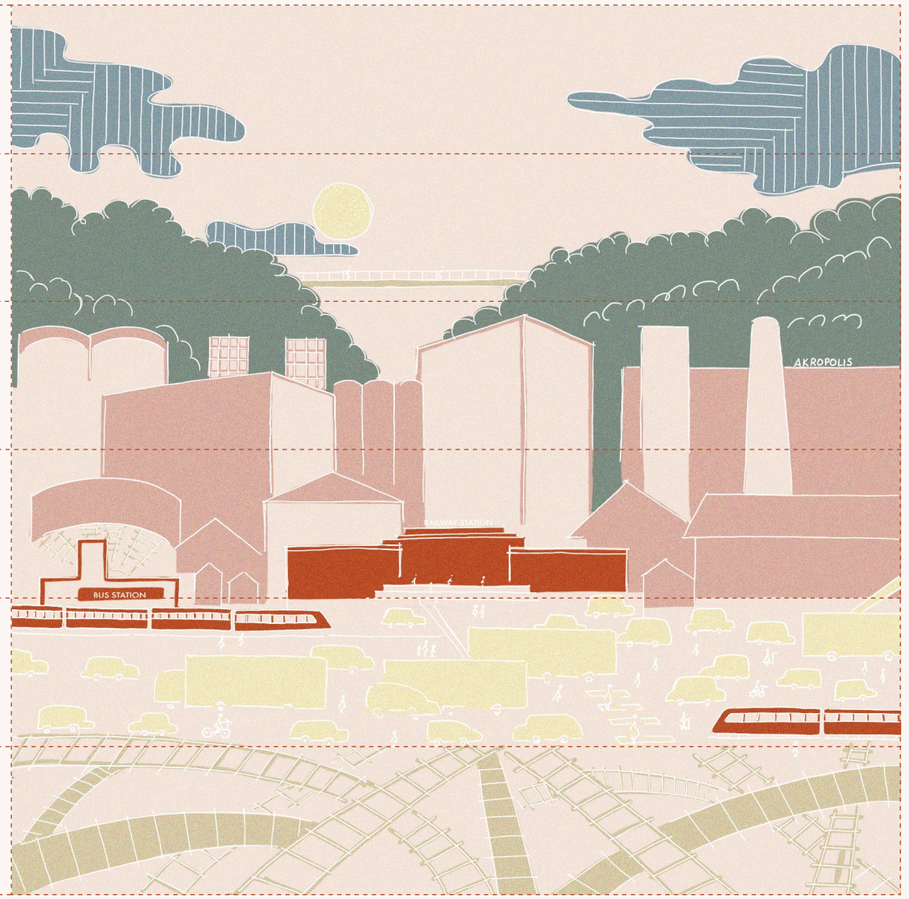


Figure 6.3: Image, representing the identity of the project area (Author, 2023)

6.1 EXPLORING THE IDENTITY

6.1.2 IDENTITY OF THE PROJECT AREA

As previously mentioned in my motivation, the Kaunas railway station area is very familiar to me. However, when I started working on the graduation project, I did realise that there are certain streets and locations within the larger project area that I have never visited. The main reason for that is that there are not many points of destination within the area except for railway and bus stations and several other services and entertainment. My commute within or through the area would always happen by the same main streets. To learn more and experience the area, two site visits were conducted in December and in March. Both times it was still winter weather in Lithuania, therefore, due to cold and snow storms, I was not able to spend a lot of time in the area or to capture how it functions in warmer weather.

The whole project area can be divided into several areas with different characters; however, an industrial character is what most of them have in common.

Railway infrastructure area

The area behind the railway station (Figure 6.4) has been used for railway needs for over 150 years. Most of the area is not fenced, however, there is no clear passage towards the station through the excess rails. Part of the area, which includes the heritage buildings is fenced and it is not possible to access it. During the visit (Monday morning), there were almost no people in the area. Recently, the bar opened next to the railway depots which is likely to attract some flows of visitors during the summertime.

Railway station area

Currently, the railway station (Figure 6.5) lacks other functions and activities that would generate larger flows of people. There is a small car parking nearby, and a few bus and trolleybus stops that require some walking from the station. Next to the station, there is also a taxi parking area. Due to the underground passage and lack of attractiveness, the square in front of the station is usually pretty empty.

The bus station and Vytautas Street

Vytautas Street, the street that leads towards the railway station when coming from New Town, is quite active and facilitates a lot of mixed-use activities. The main ones are a bus station (Figure 6.6) and a market. The whole area is considered to be not very attractive or prestigious, however, after the bus station was renovated in 2017, it positively impacted the area.

Beer industry

The beer industry is not only visible when coming to the area, one can immediately smell it. The beer industry has been part of the area since the end of the XIXth century. “Volfas Engelman” brewery (Figure 6.7) is located on the opposite side of the street from the railway station and occasionally hosts some events open to the public. However, the factory complex consists of large-scale industrial buildings with inactive facades and large trucks parked behind them.

Figure 6.4: Railway infrastructure area (Author, 2023)

Figure 6.5: Railway station (Author, 2023)

Figure 6.6: Bus station (Author, 2023)

Figure 6.7: “Volfas Engelman” brewery (Author, 2023)

6.1 EXPLORING THE IDENTITY

6.1.2 IDENTITY OF THE PROJECT AREA

Former industry

A clear grid structure of Kaunas New Town gets disrupted closer towards the railway station. Especially along the waterfront and Karalius Mindaugas Street, there are large-scale industrial buildings that lost their original function and are either abandoned or repurposed at least for a short time (for example, indoor sports arena, go-kart track). Some of them are a key part of the local identity and history, for example, the metal factory complex in the photograph.

Figure 6.8: Former metal factory "Victory" (liet. "Pergalė") (Author, 2023)

6.1 EXPLORING THE IDENTITY

6.1.2 IDENTITY OF THE PROJECT AREA

Waterfront

River Nemunas is a key element that impacted the formation of Kaunas centre; however, the city is not using the potential of the rivers, especially in the project location. The image was taken during the upcoming snowstorm; therefore, no people are visible, however, due to the lack of activities along the waterfront and difficult access (there were approximately 500 meters between pedestrian crossings to access the waterfront) it is likely that the similar situation is all year round.

Figure 6.9: Nemunas River waterfront (Author, 2023)

6.1 EXPLORING THE IDENTITY

6.1.3 MAIN FINDINGS

Figure 6.10: Current state of the Nemunas embankment (Author, 2023)

Lack of human scale

Most parts of the project area are lacking human scale which could encourage walking and staying in the area. It is a result of wide and intensive streets (for example, Karalius Mindaugas St. in Figure 6.10), large industrial buildings and large spaces dedicated to railway infrastructure.

Figure 6.11: Kaunakiemis Street; one of the streets in the former industrial area (Author, 2023)

Lack of functions

Except for Vytautas Street, other parts of the area (Figure 6.11), do not offer a variety of functions, in other words, not many reasons to go to certain places. One of the good examples is a new bar that opened next to the railway depots and attract people to a usually quite monofunctional industrial area.

Figure 6.12: Lack of greenery at the Railway station square (Author, 2023)

Lack of nature

The project site is surrounded by green hills and water, however, the focus area itself does not have any larger green spaces. What is more, hard paving is dominating the area. One of the important examples is the station square (Figure 6.12). It results in fewer people using the space.

Figure 6.13: Rotterdam Central Station (Author, 2023)

Potential new centrality

There are multiple examples of how the station functions as one of the centres of the city as it already generates a large flow of people, for example, the Rotterdam Central Station. However, it needs to facilitate other functions that would encourage people to come to the area for different purposes.

Figure 6.14: LocHal library in Tilburg (Author, 2023)

Potential reuse of industry

Existing industrial buildings in the area has the potential to be transformed and repurposed to fit the changing needs of the city. There are multiple good examples of how it could be done, however, it is also important to be critical about which buildings (when it is not heritage) should be preserved.

Figure 6.15: Public promenade along the Seine (Author, 2022)

Potential of the waterfront

For a long time now, there were discussions in Kaunas about the need to “bring the city closer towards the rivers”. However, as the main barriers are intense-traffic streets, bold action needs to be taken in terms of mobility. Figure 6.15 demonstrates the activities in the former street along the Seine.

The approach

Explorations of the block aimed to get a better understanding of various types, densities and capacities. As the project area facilitates quite a lot of freedom to create new blocks (as shown in the analysis, part of the area contains chaotic large industrial blocks and another part of the area is an open space, a former infrastructure corridor).

The main questions were: what size, how dense and what qualities should the newly proposed blocks contain? As a starting point, I chose 10 blocks from my personal experience I was interested in. A few of the selected blocks are in Lithuania, build in different periods to understand the local context. Some of them were the projects I visited in the Netherlands and Paris. The Barcelona block is a famous example and I was interested in comparing it with others.

It is important to note, that in my opinion, there is no one “perfect block” (no “one-size-fits-all”). On one hand, there is research defining the optimal size of the block in regards to walkability, the number of residents that is more suitable to form the community, however, I believe, that the blocks I selected (except the Soviet block, that I chose only for the context) despite their different parameters, are good examples of the block. The goal is to find the typology that fits best regarding the local context and vision for the future.

The parameters

To compare the blocks, literature was studied to explore the terms used to define density. In the book “Spacematrix: Space, Density and Urban Form”, the three main qualities of urban types are highlighted: intensity (Floor Space Index), compactness (Ground Space Index) and network density (N) (Berghauser Pont & Haupt, 2021). For analysis, only the first two are taken into account.

It is important to highlight that these calculations are highly dependent on the definition of the boundary of the block also referred to as the base land area (A). It is defined as “the unit of the analysis” which can be determined in various ways (Berghauser Pont & Haupt, 2021). To simplify the analysis, the base land area was calculated according to the building outline or other clear physical boundary of the block, for example, a fence.

To calculate the ***ground space index (GSI)***, the built-up area (B) is divided by A.

Open space ratio (OSR) is the opposite parameter to the GSI that is either calculated by subtracting GSI from 1 or by calculating the open space of the block and that number was divided by A.

To calculate the ***floor space index (FSI)***, gross floor area (F) is divided by A. The parameter F is equal to B multiplied by the number of floors (L).

The equivalent terms for intensity and compactness are included in the Territorial Planning Law of the Republic of Lithuania (liet. “Lietuvos Respublikos Teritorijų Planavimo Įstatymas”). FSI is referred to as building intensity (liet. užstatymo intensyvumas) and GSI is called building density (liet. užstatymo tankis) (Lietuvos Respublikos Seimas, 2023). The following document also provides a detailed description of how both indexes should be calculated. However, to simplify the analysis process, approximate parameters were used to get an overall understanding of the blocks. For this reason, in different sources, different results might occur.

The process

For the first round of experimentation, a typical block layout was applied to the project area without too much detailing. To achieve the maximal capacity, heritage, minor streets and other constraints were not taken into consideration. The only limitations are the approximate boundary of the project area, the Rail Baltica rails, location on the passenger station, M.K.Čiurlionis Street (the street that goes in from of the station and has high importance for the overall mobility network), Vytautas and Karalius Mindaugas streets are mainly kept where the configuration of the block allows it.

Afterwards, the potential number of residents, employees and space for amenities was calculated for each scenario. Numbers, used for these calculations are explained in the following pages. It is important to note that this was not applied to the Soviet block in Kaunas as it was used just as a comparison, not considered to be a good example. The reasoning is provided in Chapter 6.2.7.

This step is important to understand the capacity of the area. The heritage, other values and constraints are taken into consideration further in the process.

To make a quick assessment of the potential capacity of each tested block, the main parameters for calculations were established. They were either based on current standards and laws in Lithuania or good practice abroad.

Net area

To calculate the net area when the total (gross) area is known, an index of 0.7 is used. It is an approximate number common in Lithuanian practice to determine how much space walls and other construction features occupy.

Programme mix

For this exercise, the ratio defining the mix of functions was 50/40/10. This means 50% space for housing, 40% for office space and 10% for amenities. It is a common ratio resulting in an equal distribution of space for living and working and works as a base that can be adjusted later.

Space for living

To make an assumption of how much space one resident requires, a quick assessment of the current situation was conducted. To begin with, the minimum required net space per person is 14 m^2 (Lietuvos Respublikos aplinkos ministerija, 2003). However, according to the data provided by State Data Agency, in 2021, in urban areas of Kaunas County, the average net space per capita was 34.2 m^2. It was similar to the average for the whole country (in urban areas) which was 33.8 m^2. For comparison, the average net space per capita for rural areas in 2021 was 47.7 m^2. For the calculations, 35 m^2 net space per capita was used.

Space for working

Office space per capita is less regulated than dwelling space, therefore, approximate numbers were used, in this case, 20 m^2 net space per employee.

Amenities

Lithuania is still lacking a clear regulation on facilities needed to be in close proximity to residential areas. This results in areas, especially suburbs, where there are no amenities needed within a walkable or cyclable distance and multiple daily commutes happen by car. For this chapter, net space for amenities is calculated without further detailing and later in the process, types and numbers for amenities will be specified.

Figure 6.16: Illustration of parameters used for the calculations (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.3 THE AVERAGE BLOCK OF KAUNAS

To measure what is the average block size in the central part of Kaunas (Figure 6.17), the analysis was carried out. For the research, the base land area (block size) was defined by the edge of the surrounding streets. In the central part of Kaunas, multiple buildings are located on the hills and have access either from the higher or lower terrace of the city. Those areas do not form a clear block boundary; therefore, they were not taken into account for this analysis.

0.5 - 1.5 ha blocks are common either in the Old Town of Kaunas or for some of the single-family housing areas.

Figure 6.18: Example of an area with 0,5 - 1,5 ha size blocks (Author, 2023)

3 - 4 ha size blocks are located mostly in the Kaunas New Town or larger single-family housing areas.

Figure 6.19: Example of an area with 3 - 4 ha size blocks (Author, 2023)

Blocks that are **larger than 5 ha** are mostly industrial, former industrial or Soviet-time residential housing areas.

Figure 6.20: Example of an area with blocks larger than 5 ha (Author, 2023)

Figure 6.17: Block size map of Kaunas (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.4 OVERVIEW OF THE ANALYSED URBAN BLOCKS

As previously mentioned, 10 blocks (Figure 6.21) were selected for further explorations. Each block was chosen as an average or typical example of a block in a certain area. The first three examples are from Lithuania to understand different local typologies. The selected blocks were built at different times: Kaunas New Town block was built in the middle of XIXth century, the second block was part of the development of Kaunas during the Soviet time and the last block is from one of the largest contemporary development by a single developer in Vilnius. Quartier Massena was one of the locations we visited during the field trip in Paris with the unique concept by Christian de Portzamparc where the rules for the blocks were proposed instead of the exact masterplan. Two blocks with different parameters were chosen from this area. Moreover, two analysed projects are located in the Netherlands. First, Borneo Island interested me because of the smaller blocks consisting of semi-detached houses and large residential buildings functioning as separate blocks. Secondly, Little C in Rotterdam is known as a high-density development that maintained high living quality. Lastly, the Eixample area in Barcelona is a famous example of a masterplan of the area that contains repetitive, high-density blocks.

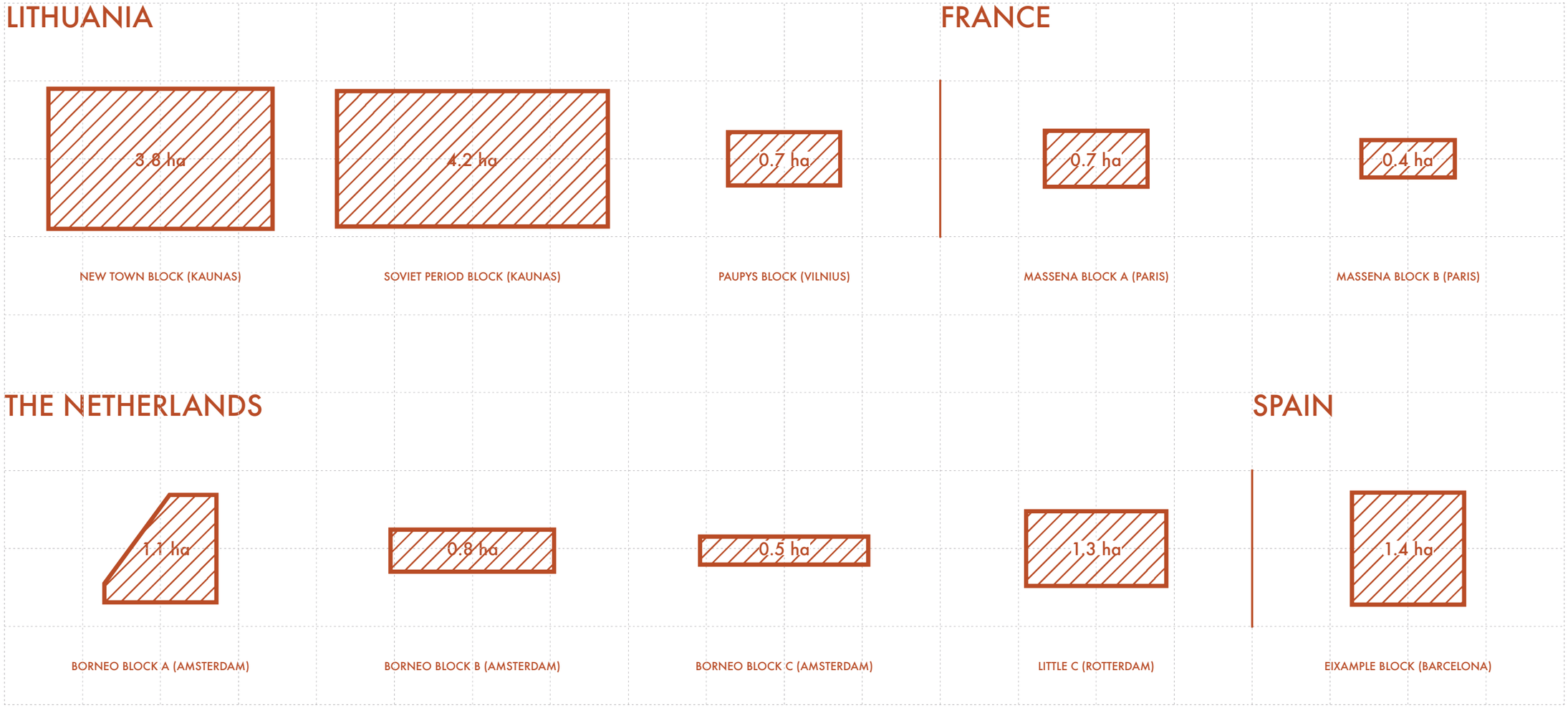


Figure 6.21: The 10 analysed blocks (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.4 OVERVIEW OF THE ANALYSED URBAN BLOCKS

The table (Figure 6.22) shows how the block looks like, moreover, their coordinates are provided to allow finding the exact block easier.

LITHUANIA

NEW TOWN BLOCK (KAUNAS)

54.896426, 23.916090

SOVIET PERIOD BLOCK (KAUNAS)

54.925982, 23.945553

PAUPYS BLOCK (VILNIUS)

54.679869, 25.301754

FRANCE

MASSENA BLOCK A (PARIS)

48.830214, 2.379706

MASSENA BLOCK B (PARIS)

48.828131, 2.381534

THE NETHERLANDS

BORNEO BLOCK A (AMSTERDAM)

52.371691, 4.946427

BORNEO BLOCK B (AMSTERDAM)

52.370788, 4.941233

BORNEO BLOCK C (AMSTERDAM)

52.371587, 4.948419

LITTLE C (ROTTERDAM)

51.909004, 4.464367

SPAIN

EIXAMPLE BLOCK (BARCELONA)

41.395006, 2.171990

Figure 6.22: Appearance and location of the blocks (Author, images source: Google Satellite, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.5 PARAMETERS OF THE ANALYSED URBAN BLOCKS

Using the parameters described in Chapter 6.2.1, the density of each block was calculated (Figure 6.23). The blocks are further compared according to their GSI and FSI parameters in Chapter 6.2.6.

LITHUANIA

	NEW TOWN BLOCK (KAUNAS)	SOVIET PERIOD BLOCK (KAUNAS)	PAUPYS BLOCK (VILNIUS)
A (base land area) (ha)	**3.8**	**4.2**	**0.7**
L (number of floors)	**1 - 6**	**5-12**	**3-6**
GSI (ground space index)	**0.53**	**0.11**	**0.57**
OSR (open space ratio)	**0.47**	**0.89**	**0.43**
FSI (floor space index)	**1.77**	**0.69**	**2.15**

FRANCE

	MASSENA BLOCK A (PARIS)	MASSENA BLOCK B (PARIS)
A (base land area) (ha)	**0.7**	**0.4**
L (number of floors)	**2-12**	**1-7**
GSI (ground space index)	**0.38**	**0.84**
OSR (open space ratio)	**0.62**	**0.16**
FSI (floor space index)	**2.60**	**5.47**

THE NETHERLANDS

	BORNEO BLOCK A (AMSTERDAM)	BORNEO BLOCK B (AMSTERDAM)	BORNEO BLOCK C (AMSTERDAM)
A (base land area) (ha)	**0.4**	**0.8**	**0.5**
L (number of floors)	**8-10**	**3**	**3**
GSI (ground space index)	**0.42**	**0.81**	**0.88**
OSR (open space ratio)	**0.58**	**0.19**	**0.12**
FSI (floor space index)	**3.45**	**2.44**	**2.66**

SPAIN

	LITTLE C (ROTTERDAM)	EIXAMPLE BLOCK (BARCELONA)
A (base land area) (ha)	**1.3**	**1.4**
L (number of floors)	**5-17**	**1-6**
GSI (ground space index)	**0.44**	**0.99**
OSR (open space ratio)	**0.56**	**0.01**
FSI (floor space index)	**4.23**	**5.09**

Figure 6.23: The main parameter of the analysed blocks (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.6 MATRIX OF THE ANALYSED URBAN BLOCKS

The matrix (Figure 6.24) compares the blocks according to GSI and FSI. A few main groups could be identified. Soviet period block demonstrates significantly lower parameters. Little C, Borneo block A, and Massena block A have similar GSI, however, the FSI varies from 2.60 to 4.24. The two blocks in Lithuania, Kaunas New Town block and Vilnius Paupys block have quite similar GSI and FSI, however, those blocks differ in size. Borneo blocks B and C are quite similar; therefore, they are close to each other in the matrix. They both are examples of high-density, low-rise development. Lastly, Massena block B and Eixample block in Barcelona demonstrates significantly higher GSI and FSI. However, it is important to note, that originally Barcelona block was designed with an open space in the middle of the block, however, over time, most of the inner spaces were filled in with 1-2 floor buildings. This also happened to the analysed block.

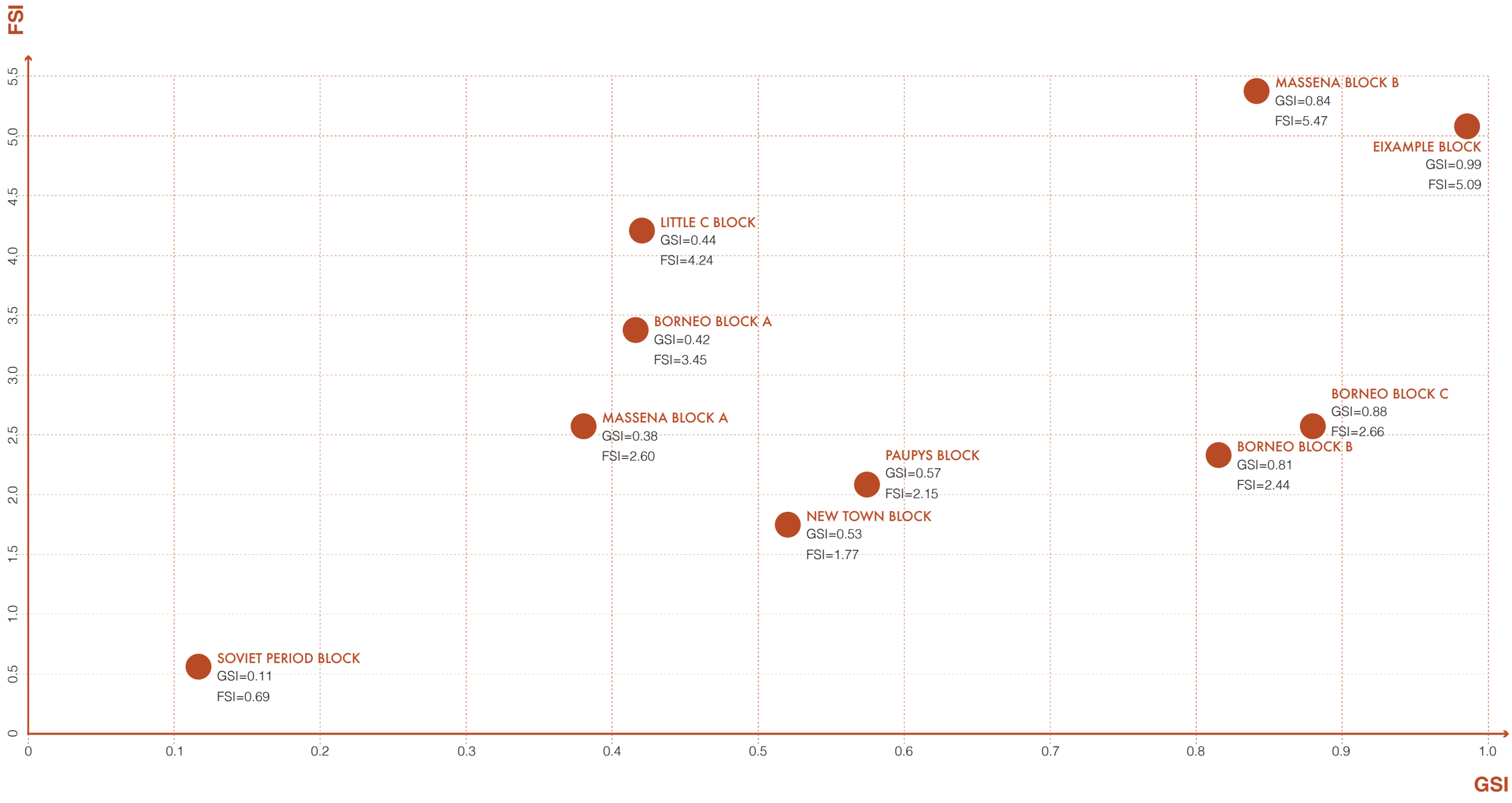


Figure 6.24: Matrix of the analysed urban blocks (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.6 NEW TOWN BLOCK (KAUNAS, LITHUANIA)

Number of blocks	**19**
Residents	**12 700**
Employees	**17 750**
Space for amenities (m^2)	**88 800**

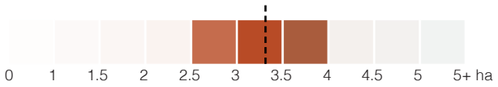


Figure 6.26: 3 - 4.5 ha size blocks (Author, 2023)

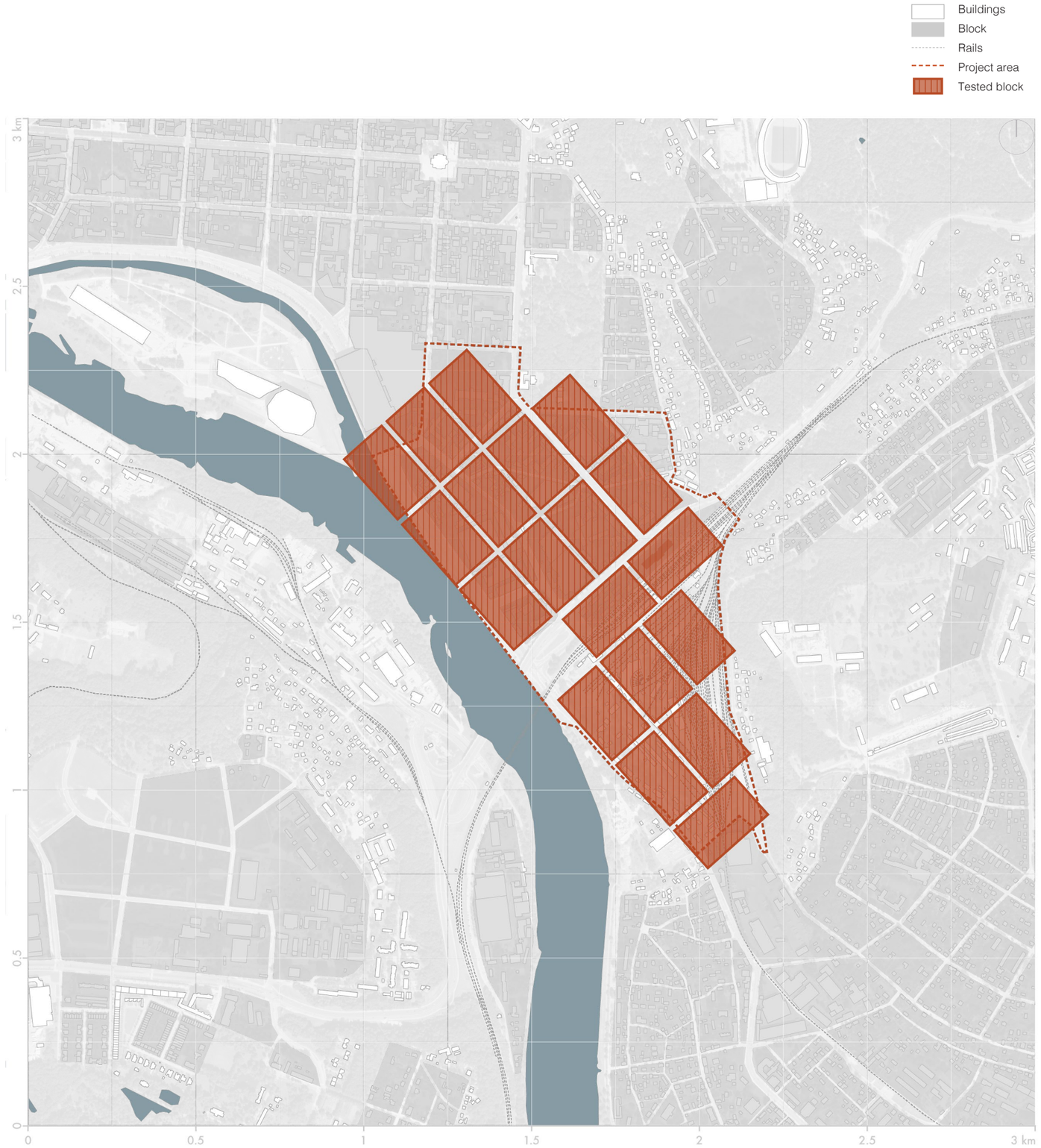


Figure 6.25: Application of the block in the project area (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.7 SOVIET PERIOD BLOCK (KAUNAS, LITHUANIA)

During the occupation by the Soviet Union (the 2nd half of the XX century), Kaunas continued to expand towards the north and large residential districts were built. Nowadays, these neighbourhoods remain the most populated areas in the city, however, due to monofunctional blocks, poor quality, undefined public spaces, and unresolved parking issues these areas became problematic and ageing neighbourhoods. For this reason, this type of block is not tested as a valid option for the project area, it is analysed only to provide the context.

Figure 6.27: Urban fabric 1000 x 1000 m (Author, image source: Google Satellite, 2023)

Figure 6.28: Urban fabric 500 x 500 m (Author, images source: Google Satellite, 2023)

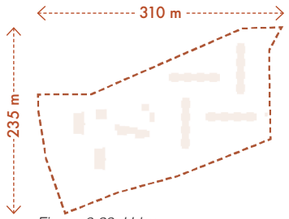


Figure 6.29: Urban block (Author, 2023)

Figure 6.30: Buildings (Author, 2023)

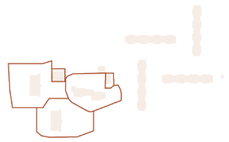


Figure 6.31: Parcels (Author, 2023)

PARAMETERS

A (base land area) (ha)	**4.2**
L (number of floors)	**5-12**
GSI (ground space index)	**0.11**
OSR (open space ratio)	**0.89**
FSI (floor space index)	**0.69**

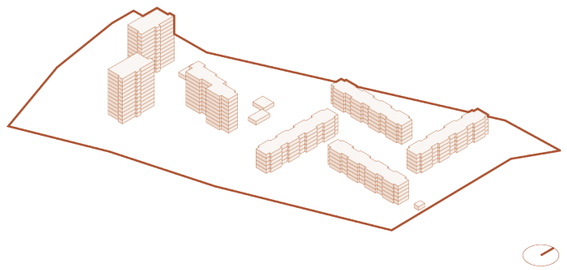


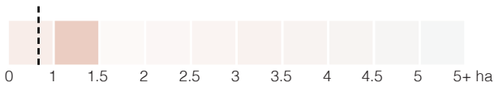
Figure 6.32: Axonometric view (Author, 2023)

Figure 6.33: Soviet period mass housing in Kalniečiai neighbourhood (Image by M. Patašius, 2020)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.8 PAUPYS BLOCK (VILNIUS, LITHUANIA)

Number of blocks	**17**
Residents	**10 000**
Employees	**14 000**
Space for amenities (m^2)	**70 000**



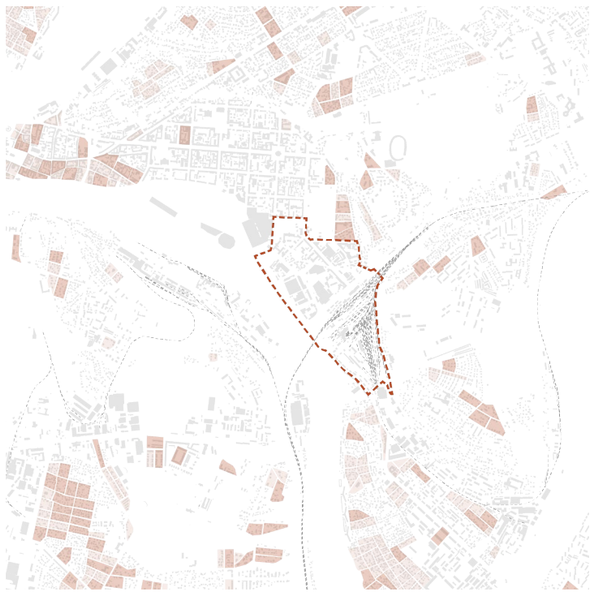


Figure 6.35: Blocks smaller than 1.5 ha (Author, 2023)

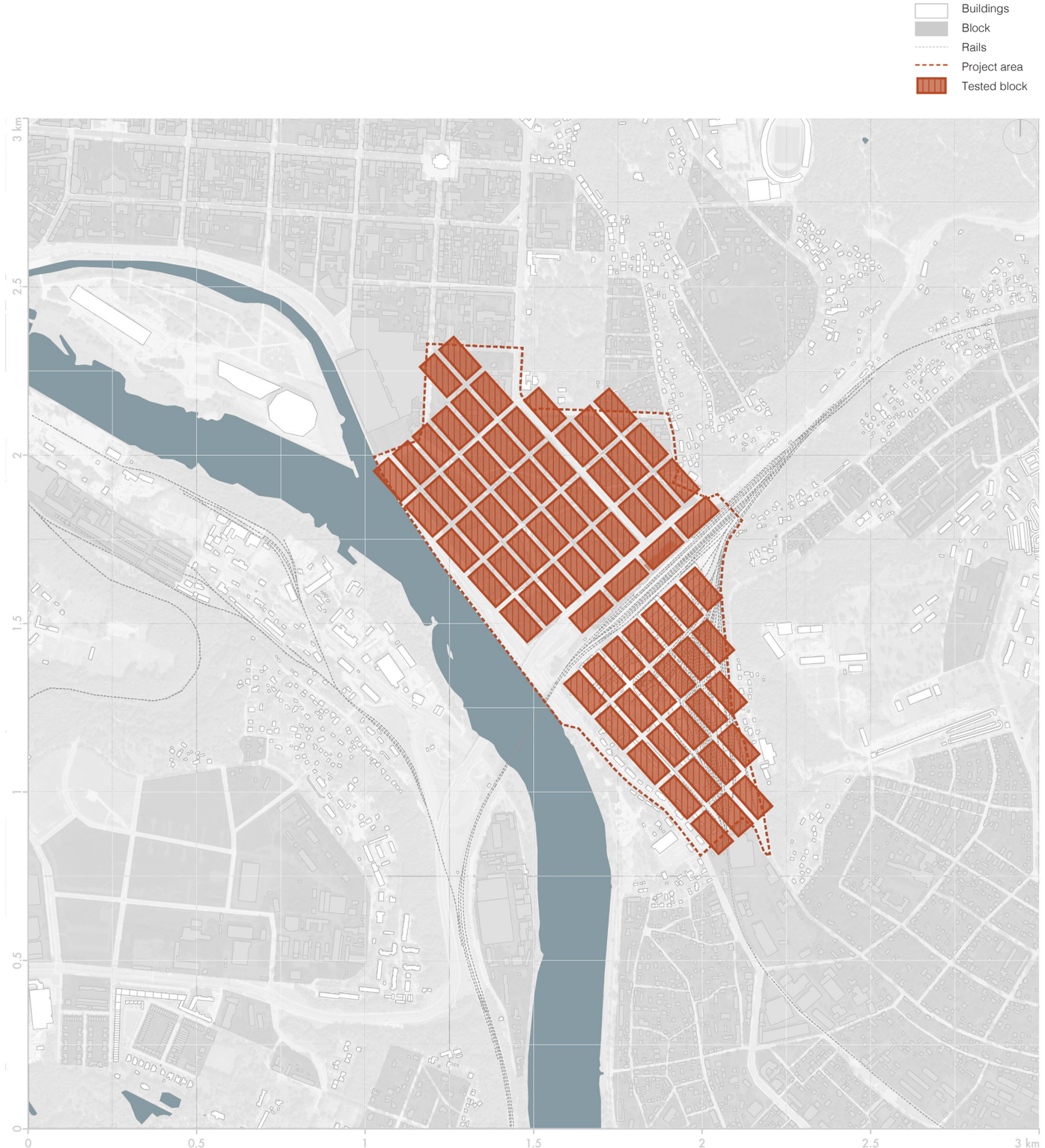
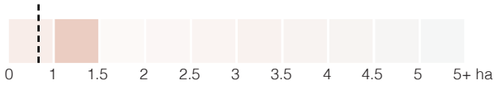


Figure 6.34: Application of the block in the project area (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.9 MASSENA BLOCK A (PARIS, FRANCE)

Number of blocks	**72**
Residents	**12 350**
Employees	**17 250**
Space for amenities (m^2)	**86 330**



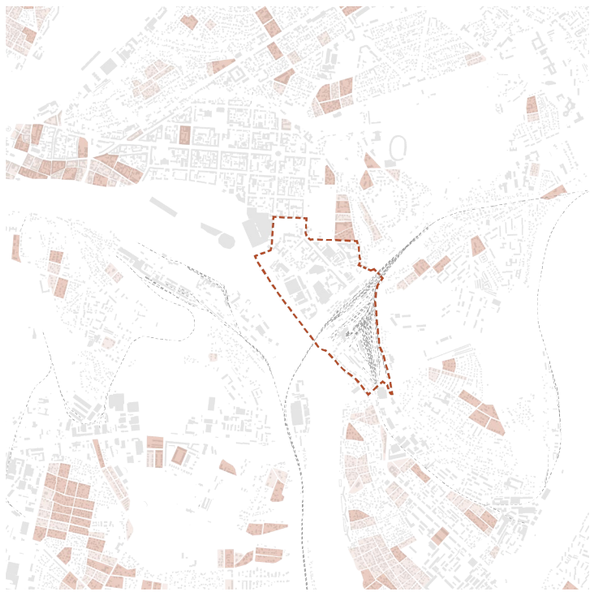


Figure 6.37: Blocks smaller than 1.5 ha (Author, 2023)

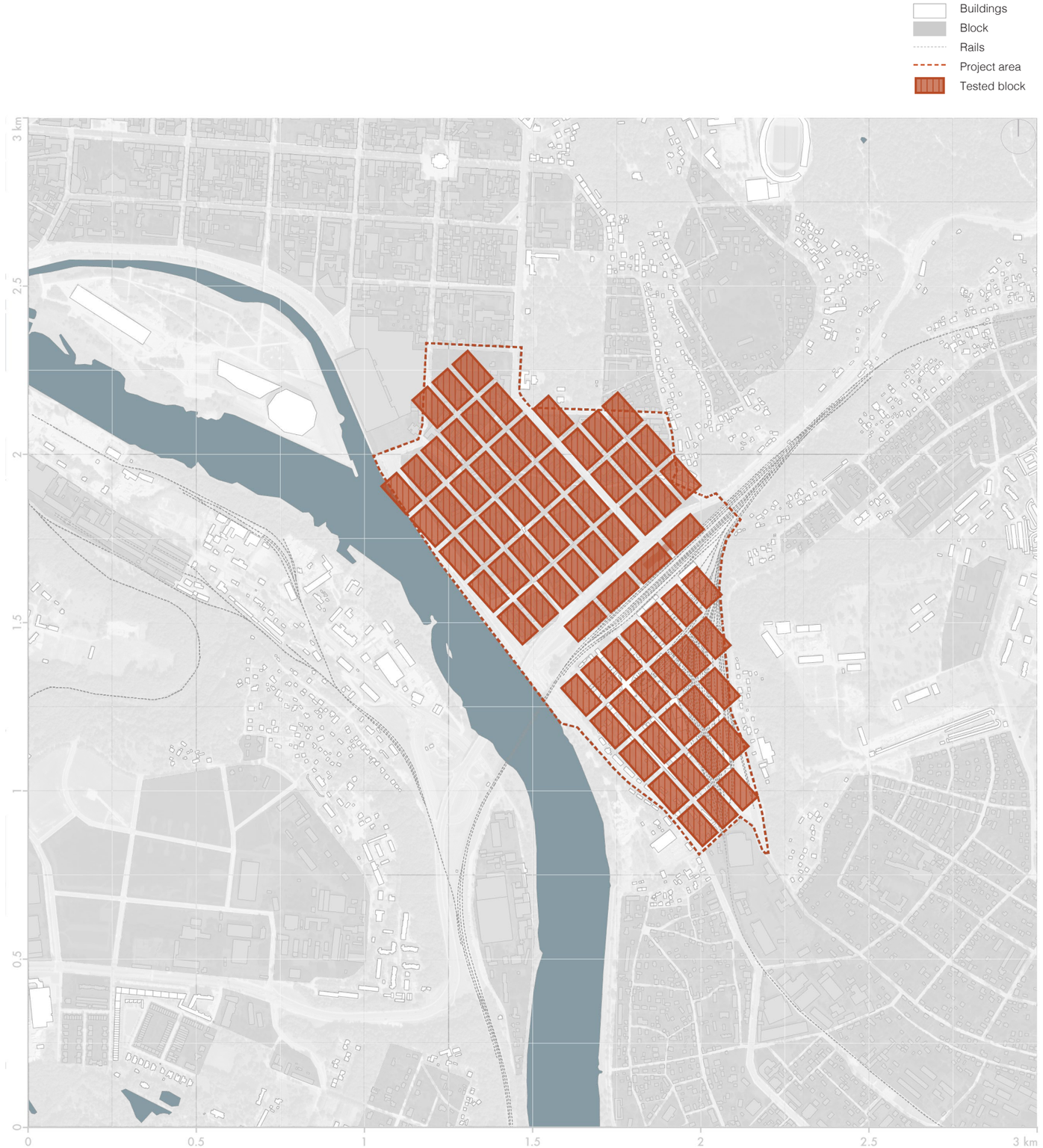
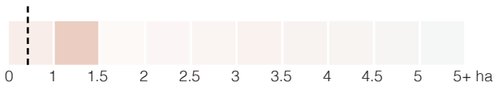


Figure 6.36: Application of the block in the project area (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.10 MASSENA BLOCK B (PARIS, FRANCE)

Number of blocks	**103**
Residents	**22 550**
Employees	**31 550**
Space for amenities (m^2)	**157 850**



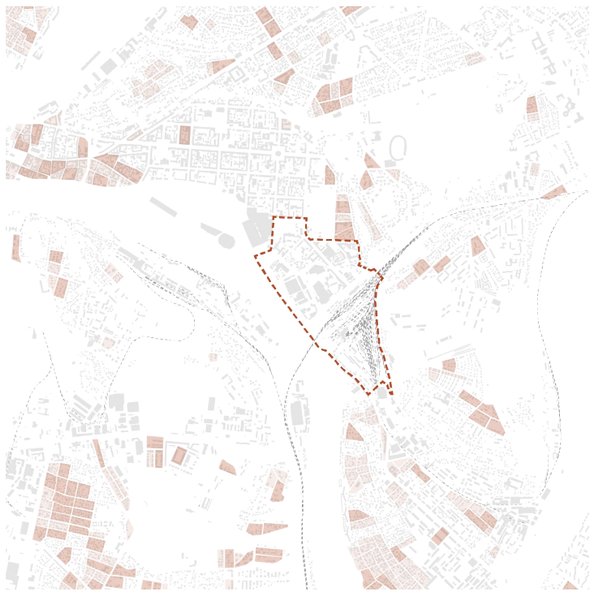


Figure 6.39: Blocks smaller than 1.5 ha (Author, 2023)

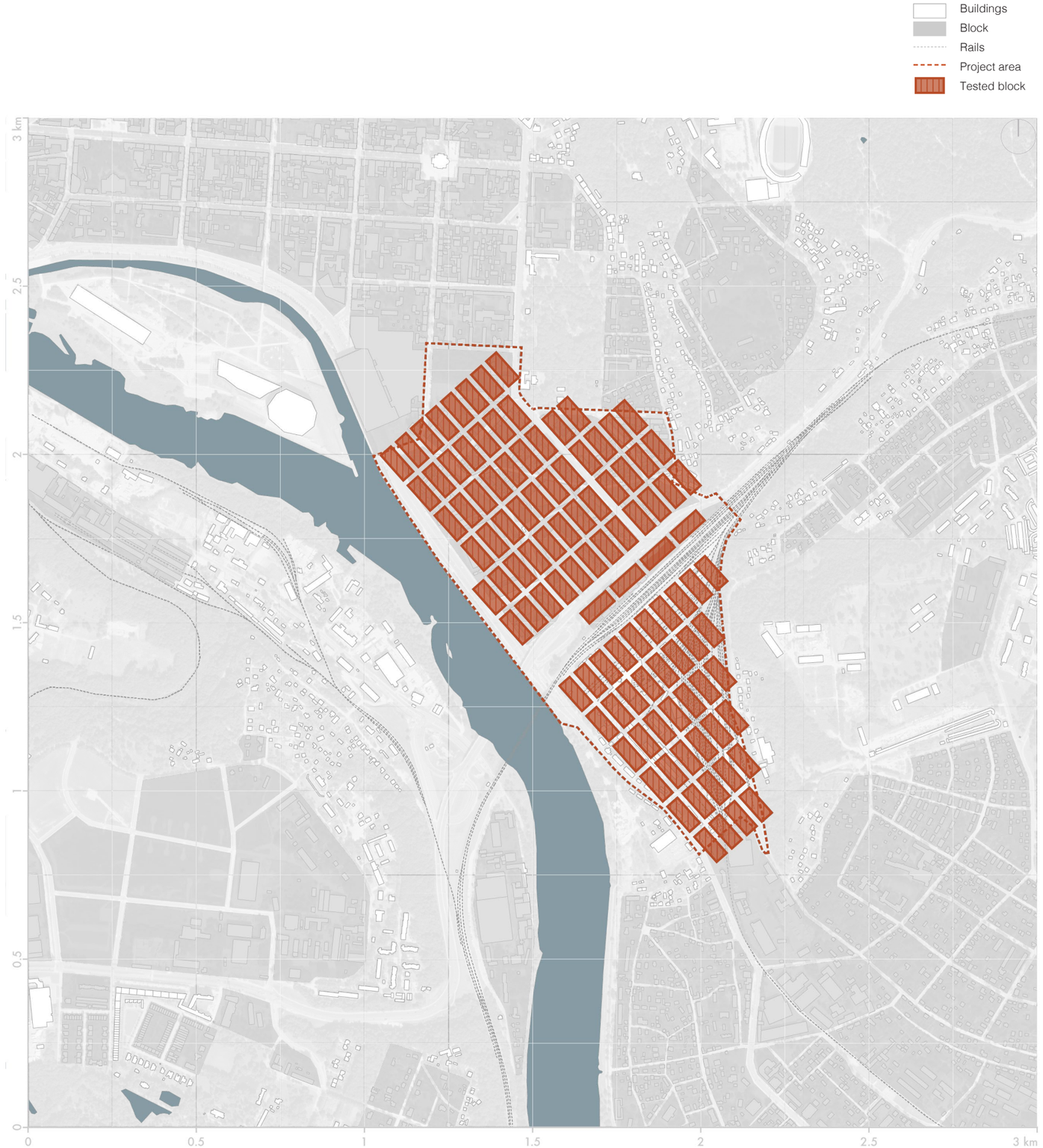
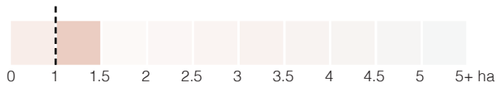


Figure 6.38: Application of the block in the project area (Author, 2023)

6.2 EXPLORING THE "PERFECT" BLOCK

6.2.11 BORNEO BLOCK A (AMSTERDAM, THE NETHERLANDS)

Number of blocks	**56**
Residents	**20 200**
Employees	**28 300**
Space for amenities (m^2)	**141 500**



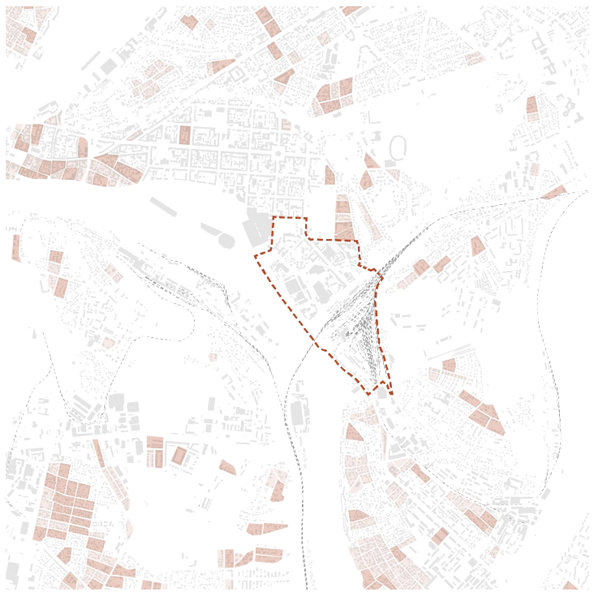


Figure 6.41 Blocks smaller than 1.5 ha (Author, 2023)

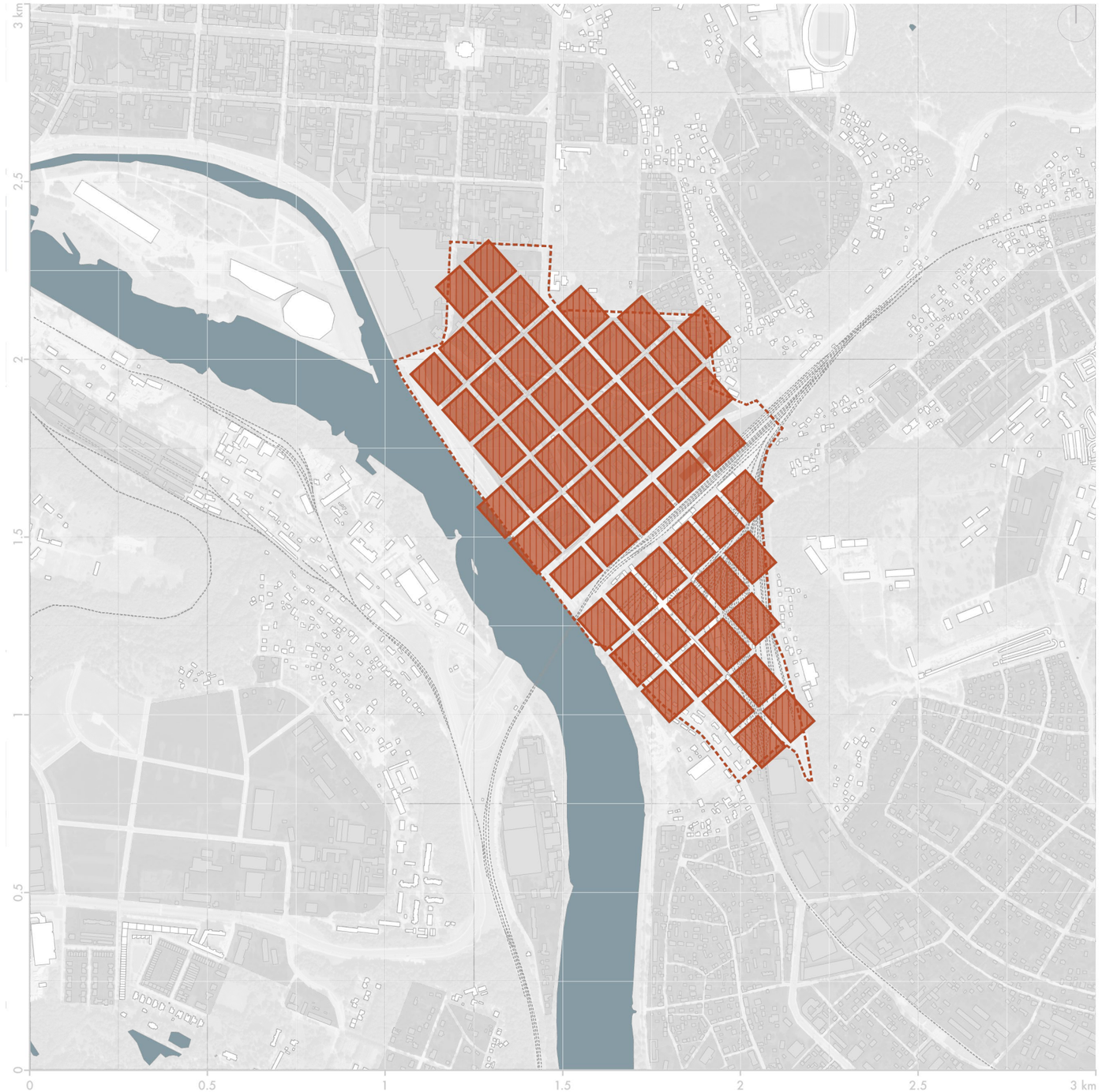
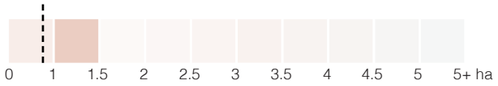


Figure 6.40: Application of the block in the project area (Author, 2023)

6.2 EXPLORING THE "PERFECT" BLOCK

6.2.12 BORNEO BLOCK B (AMSTERDAM, THE NETHERLANDS)

Number of blocks	**59**
Residents	**11 000**
Employees	**15 450**
Space for amenities (m^2)	**77 200**



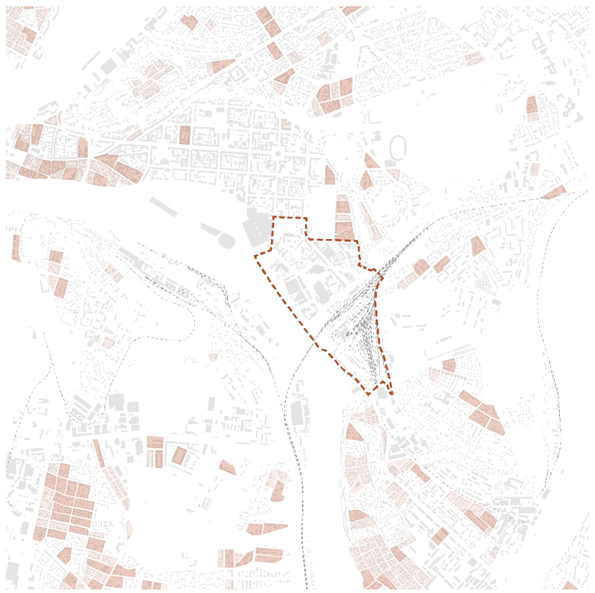


Figure 6.43: Blocks smaller than 1.5 ha (Author, 2023)

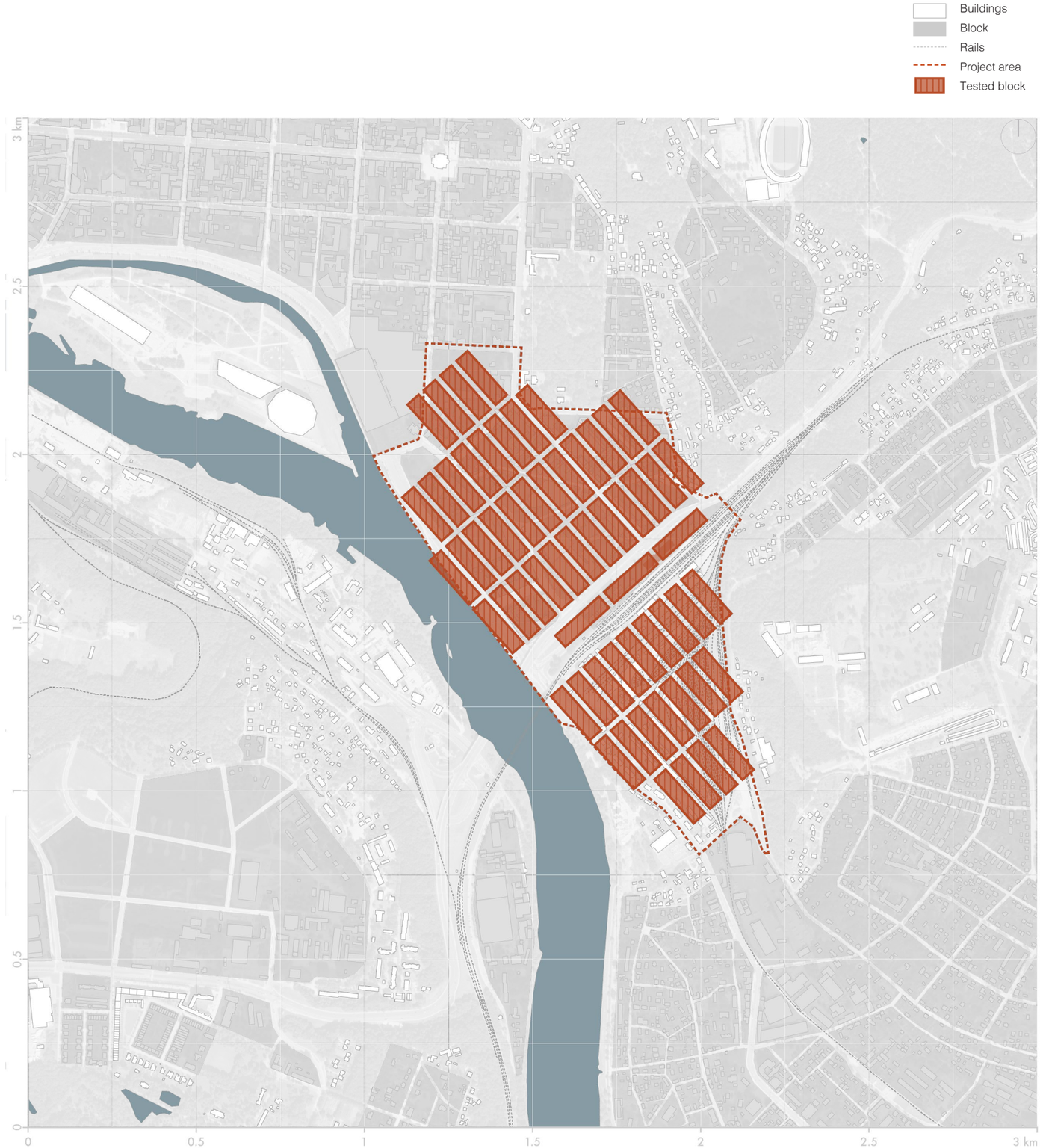
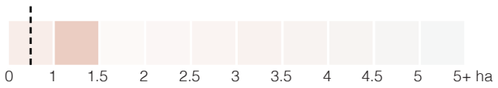


Figure 6.42: Application of the block in the project area (Author, 2023)

6.2 EXPLORING THE "PERFECT" BLOCK

6.2.13 BORNEO BLOCK C (AMSTERDAM, THE NETHERLANDS)

Number of blocks	**76**
Residents	**10 900**
Employees	**15 250**
Space for amenities (m^2)	**76 250**



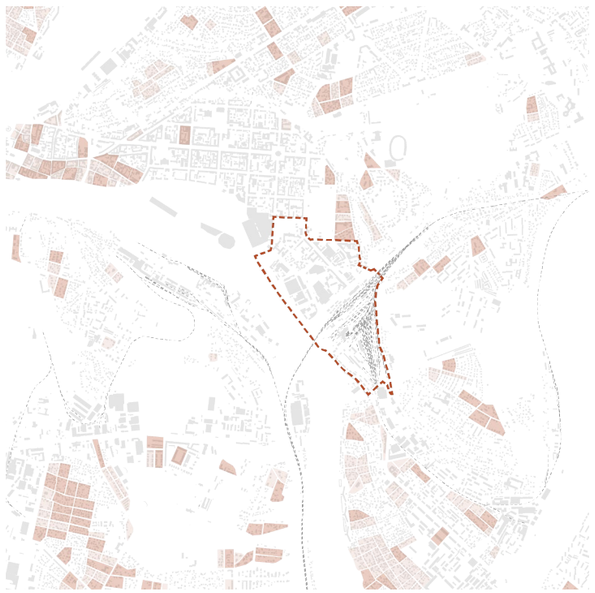


Figure 6.45: Blocks smaller than 1.5 ha (Author, 2023)

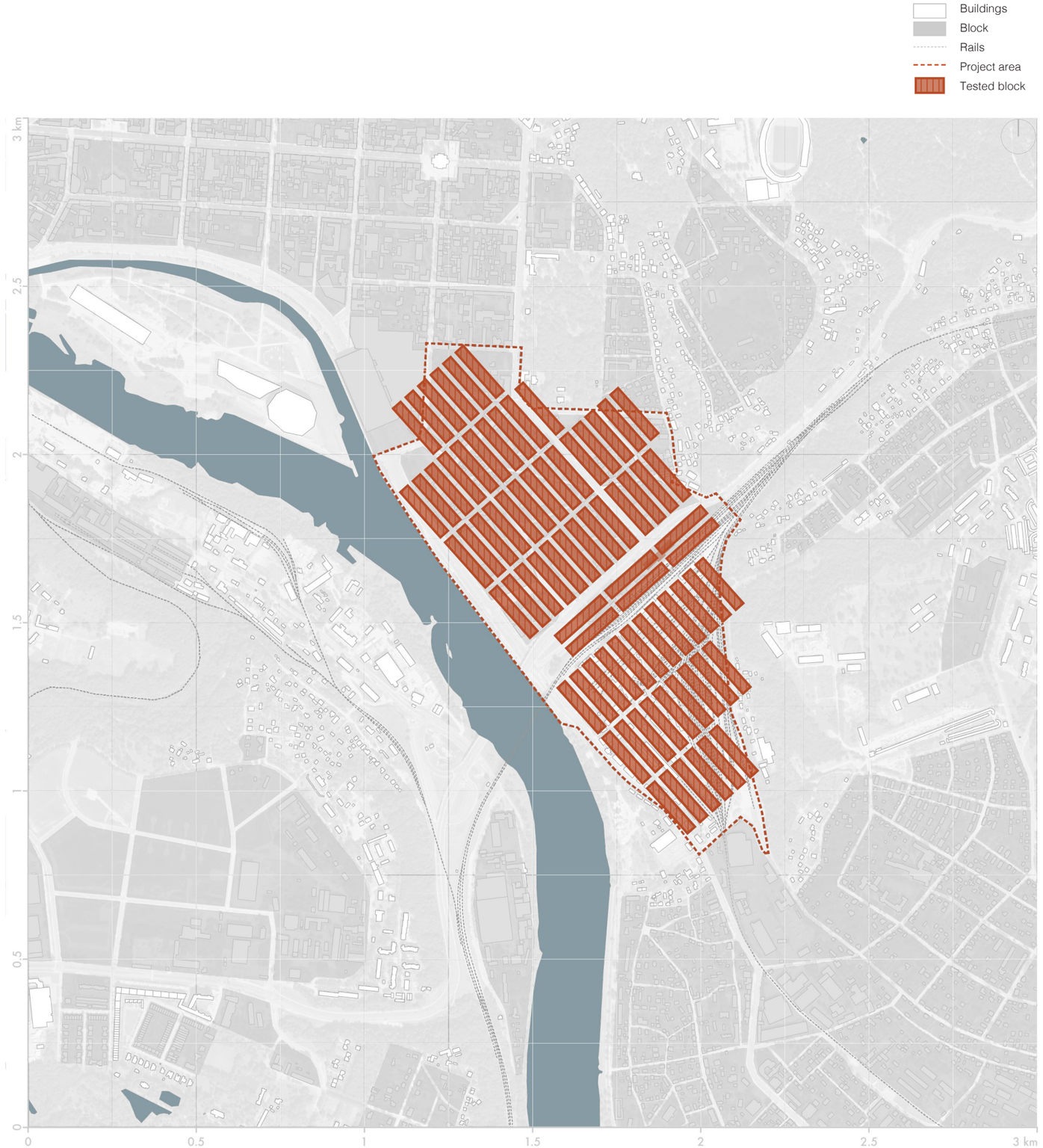
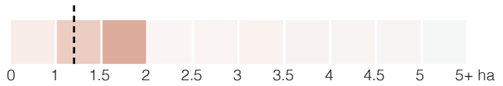


Figure 6.44: Application of the block in the project area (Author, 2023)

6.2 EXPLORING THE "PERFECT" BLOCK

6.2.14 LITTLE C BLOCK (ROTTERDAM, THE NETHERLANDS)

Number of blocks	**43**
Residents	**23 200**
Employees	**23 450**
Space for amenities (m^2)	**162 250**



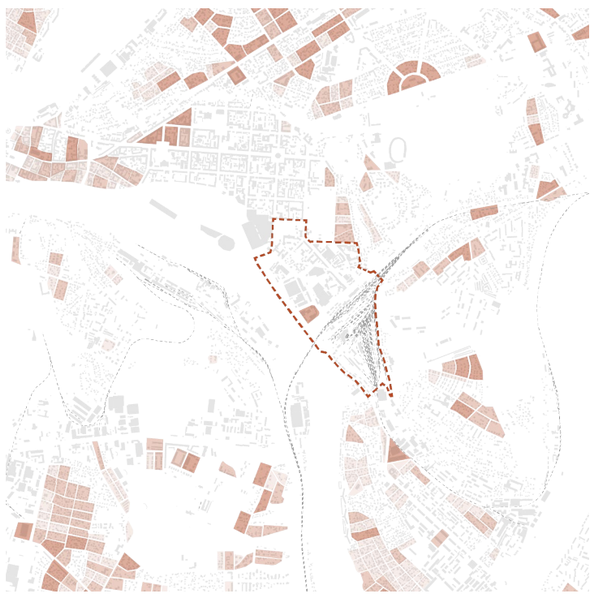


Figure 6.47: Blocks smaller than 2 ha (Author, 2023)

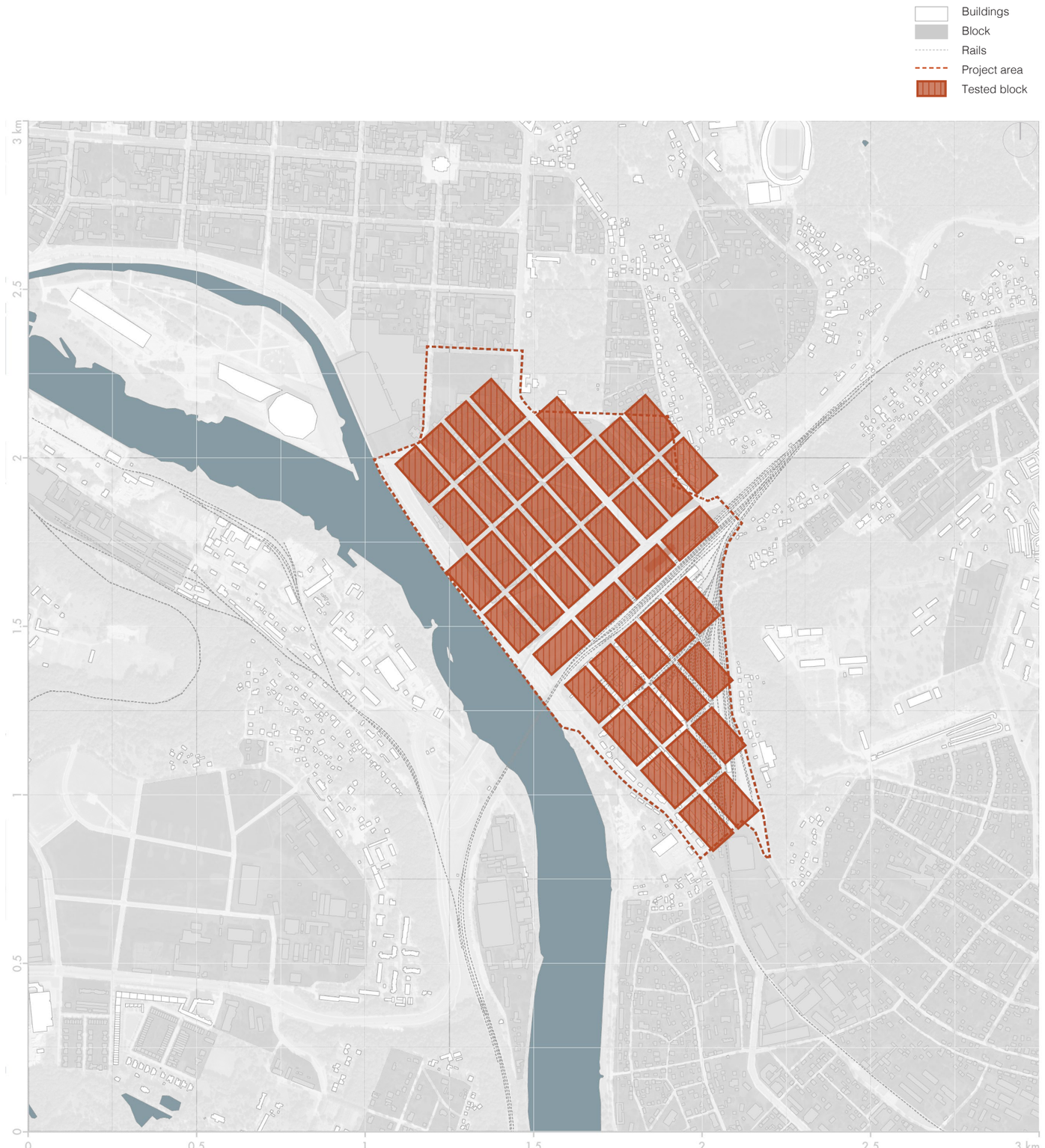
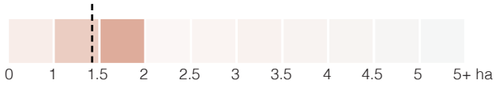


Figure 6.46: Application of the block in the project area (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.15 EIXAMPLE BLOCK (BARCELONA, SPAIN)

Number of blocks	**38**
Residents	**27 850**
Employees	**39 000**
Space for amenities (m^2)	**195 000**



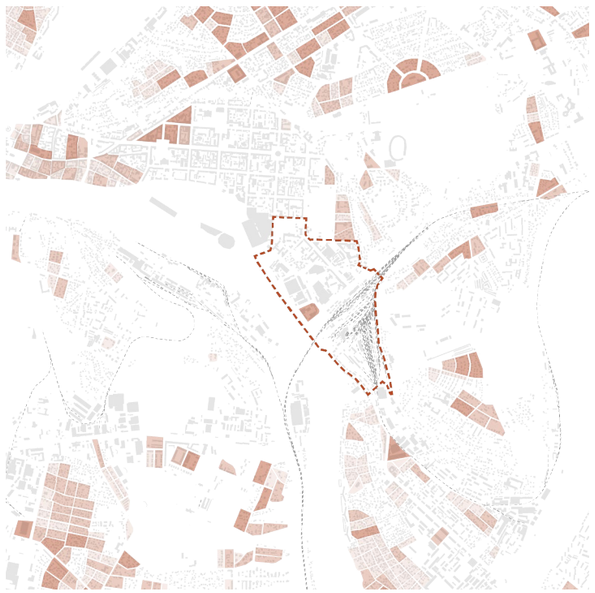


Figure 6.49: Blocks smaller than 2 ha (Author, 2023)

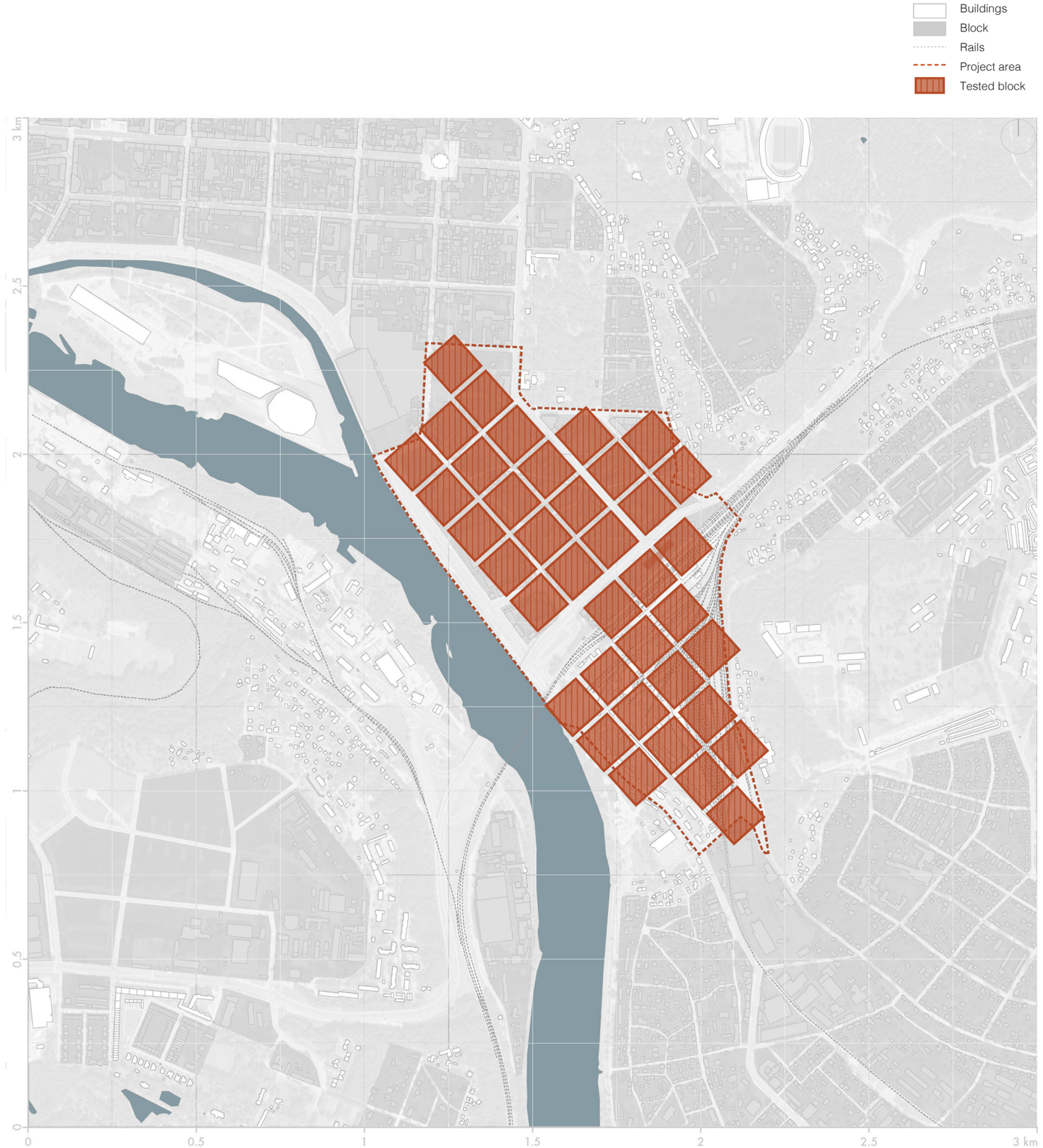


Figure 6.48: Application of the block in the project area (Author, 2023)

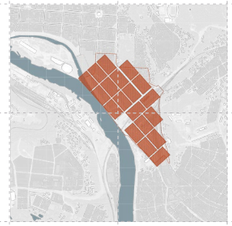
6.2 EXPLORING THE “PERFECT” BLOCK

6.2.17 MAXIMAL CAPACITY

The maximal capacity of the block varies from 10 000 residents and 14 000 employees to almost 28 000 residents and 40 000 employees (Figure 6.50). However, to achieve the maximal density it would be needed to completely redevelop the whole area and that would likely negatively affect the quality. Moreover, the city does not need such large new development. This topic is reviewed further in Chapters 6.2.24 and 9.3.

LITHUANIA

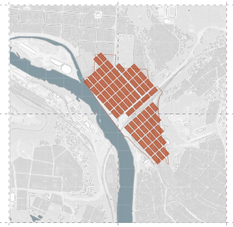
NEW TOWN BLOCK (KAUNAS)



Residents	12 700
Employees	17 750
Amenities (m²)	88 800

SOVIET PERIOD BLOCK (KAUNAS)

PAUPYS BLOCK (VILNIUS)



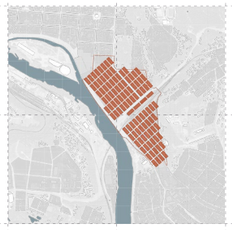
Residents	10 000
Employees	14 000
Amenities (m²)	70 000

FRANCE

MASSENA BLOCK A (PARIS)

Residents	12 350
Employees	17 250
Amenities (m²)	86 330

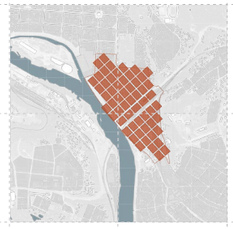
MASSENA BLOCK B (PARIS)



Residents	22 550
Employees	31 550
Amenities (m²)	157 850

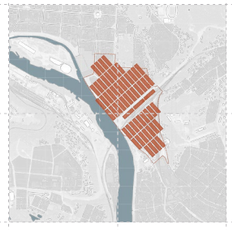
THE NETHERLANDS

BORNEO BLOCK A (AMSTERDAM)



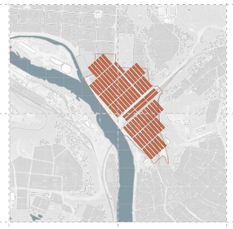
Residents	20 200
Employees	28 300
Amenities (m²)	141 500

BORNEO BLOCK B (AMSTERDAM)



Residents	11 000
Employees	15 450
Amenities (m²)	77 200

BORNEO BLOCK C (AMSTERDAM)



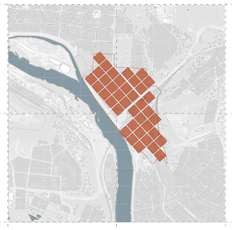
Residents	10 900
Employees	15 250
Amenities (m²)	76 250

LITTLE C (ROTTERDAM)

Residents	23 200
Employees	23 450
Amenities (m²)	162 250

SPAIN

EIXAMPLE BLOCK (BARCELONA)



Residents	27 850
Employees	39 000
Amenities (m²)	195 000

Figure 6.50: Capacity of the analysed blocks (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.18 MAIN FINDINGS

After applying and testing various blocks in the area, it was clear that certain typologies are too unnatural for the area, especially the smaller ones that would create a dense street network while the priority is to propose high-quality, green public and private spaces. In comparison, Kaunas New Town block appeared to look more alike as it already covers the neighbouring central area, Moreover, due to its perimeter build-up, opportunities to create high-quality green spaces within the block and to preserve the heritage buildings as it is easier to integrate them in a larger block, the Kaunas block was chosen as a base for further design. Of course, it is not an aim to apply the exact block to the area, however, to take the main principles and qualities and to adjust according to the site. What is more, as the FSI of the block is quite low in comparison to other blocks and also does not satisfy the principles of TOD to densify around the station, there will be further testing on how much the block could be densified to maintain its character.

Figure 6.51: Proposal: Kaunas block 2.0 (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.19 KAUNAS NEW TOWN BLOCK

The central part of Kaunas rapidly grew in the middle of the XIXth century. Kaunas New Town has a clear perpendicular street grid that shapes large urban blocks. The block selected for the analysis is a typical New Town, located next to the main pedestrian artery, Liberty Avenue (liet. Laisvės alėja).

Figure 6.52: Urban fabric 1000 x 1000 m (Author, images source: Google Satellite, 2023)

Figure 6.53: Urban fabric 500 x 500 m (Author, images source: Google Satellite, 2023)

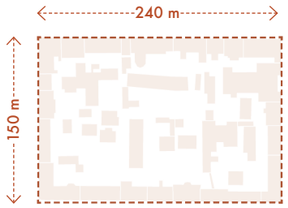


Figure 6.54: Urban block (Author, 2023)

Figure 6.55: Buildings (Author, 2023)

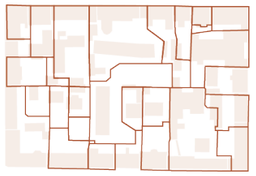


Figure 6.56: Parcels (Author, 2023)

PARAMETERS

A (base land area) (ha)	**3.8**
L (number of floors)	**1 - 6**
GSI (ground space index)	**0.53**
OSR (open space ratio)	**0.47**
FSI (floor space index)	**1.77**

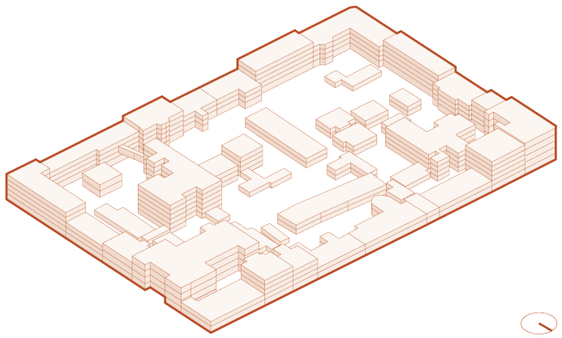


Figure 6.57: Axonometric view (Author, 2023)

Figure 6.58: The edge of the block (Image by A. Aleksandravičius, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.20 QUALITIES OF THE BLOCK

The previous explorations of the urban blocks led to the conclusion that the relatively large (approximately 3,8 ha) block, common for Kaunas New Town is the most suitable typology for the project area. However, it is important to note that this does not mean the direct application of the block. Certain qualities should be preserved and amplified to keep the identifiable character similar to Kaunas New town block while the main issues of the New Town block should be prevented. Moreover, there is quite a wide range of parameters which define density that could be adjusted to find the most suitable block configuration for the project area.

Relatively large block

The specific analysed block was 3,8 ha. I am not aiming to develop all blocks in the same size or maintain the rectangular shape as it was done in the Barcelona Eixample district by Ildefons Cerdà, however, to preserve approximately the similar size where possible.

The perimeter build-up (outline)

The current project area contains an organic street network, which I believe should be preserved to a certain level, therefore, I am using as a base a single block, not the whole urban system of Kaunas New Town. However, the perimeter build-up in Kaunas New Town and Old Town creates a clearly defined network of public spaces that works well in the central part of the city and this principle could be extended towards the project area. Especially, taking into consideration, that the main axis in the area, leading from the centre (Vytautas street (liet. Vytauto prospektas)) towards the railway station, also contains perimeter build-up (Figure 5.69).

Buildings in the inner space of the block

As the blocks of the New Town are quite large and there are often not many reasons to go inside the block, they remain full of surprises even for the citizens of Kaunas. During the site analysis, I visited the analysed block and I realised that I have never known what it is inside, even though I passed by hundreds of times. Buildings inside the block are usually either free-standing or attached to the outline buildings (Figure 6.61).

Higher outline

In most cases, the outline (red colour in Figure 6.60) is higher than the buildings inside (green colour in Figure 6.60). There are some exceptions to this rule: there are some quite tall free-standing buildings inside that block and in some cases, the outline is only two storeys high, however, in general, there is a principle of the higher outline. In the project area, this rule will be applied as well, especially higher outline can benefit to define a wider street space, however, it will be adjusted according to the overall block structure. Moreover, it works as a buffer and creates a quieter environment inside the block.

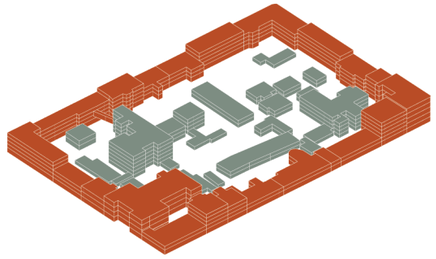


Figure 6.60: Height of the block (Author, 2023)

Figure 6.59: Vytautas Street facades (Author, 2023)

Figure 6.61: Buildings inside the block (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.20 QUALITIES OF THE BLOCK

Varying height of the outline

As mentioned previously, the block outline in the analysed block (in the others as well) varies from 2 to 6 floors (Figure 6.62). In some cases, it gets higher towards the corner. It creates more playful and less repetitive characters, therefore, should be embraced.

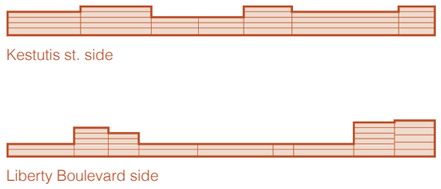


Figure 6.62: Height of the outline of the block (Author, 2023)

Spacious inner yards

OSR of the analysed block is 0.47 meaning quite a spacious inner block. In the New Town, those blocks are mostly filled in with cars (more detailed elaboration on this is provided further) (Figure 6.63), therefore, the current situation is not very pleasant. However, openness provides a lot of potential to have nice private or semi-private outdoor spaces for the residents and other users of the block.

Figure 6.63: Inner space of the block (Author, 2023)

Passages

To keep the perimeter outline, the inner space is usually accessible through the passages (Figure 6.66). Some of them are for pedestrians, while others are for cars including emergency vehicles. However, in current blocks, there are issues of privacy and accessibility as locals aim to lock the gates and limit accessibility to the inner spaces it is often related to a lack of space to park a car.

A mix of functions within the block

Due to the central location, the block is a good example of mixed-use. This particular block contains housing (apartments, student housing), office spaces, administrative functions, kindergarten, cafes, shops and other functions (Figure 6.64). Public functions that do not require visibility, are located inside the block (such as a kindergarten).

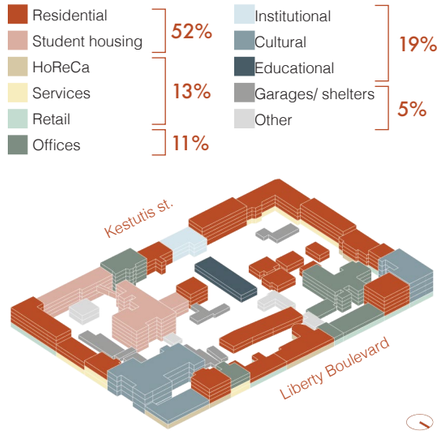


Figure 6.64: Functions of the block (Author, 2023)

Active ground floors of the outline buildings

The blocks that are located next to the main pedestrian axis (Liberty Boulevard) and adjacent streets demonstrate a desirable number of active facades containing restaurants, bars, shops and other public functions (Figure 6.65) that benefit from the flow of people. Due to the size of the central part of the city, it is not possible to have every part of the street as active as the main one, however, the location of the stations and other public functions nearby could generate sufficient flows of people as well in the project area.

Figure 6.65: Active facades of Liberty Boulevard (Author, 2023)

Figure 6.66: The passage accessible from Liberty Boulevard (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

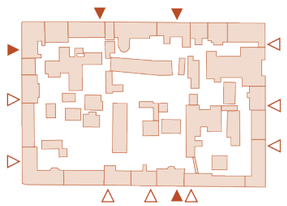
6.2.21 ISSUES OF THE BLOCK

Analysis of the Kaunas New Town block helped to identify two main issues of this type of block: walkability and inner space invaded by cards.

Walkabiltiy

As the proposed block is quite large (it takes around 5 minutes to walk around half of the block), the system of inner passages should be introduced together with a clear definition of public and private space within the block. This issue will be solved further in the process. Currently, the inner yards system reminds a labyrinth where fences and dead ends make it difficult or impossible to get through (Figure 6.69).

Figure 6.67: Walkability of the block (Author, 2023)



△ Access for cars
▲ Access for pederstrians

Figure 6.68: Passages to the inner yards (Author, 2023)

Figure 6.69: The fence (Author, 2023)

Space for cars

Another issue, cars, should be taken into consideration when planning the number of residents, employees and visitors of the block. When the New Town was planned around 1847, parking was not an issue, however, nowadays it is one of the main causes of the conflicts within those blocks. Firstly, there is not enough space for cars owned by residents, and workers of the block and, on top of that, frequent visitors also try to park in those inner yards as they are tax-free compared to the streets. This also results in inner yards covered in hard surfaces, lacking greenery and private or semi-private spaces for the block. The exceptions are functions such as kindergartens or private houses which fenced their private yards (Figure 6.70).

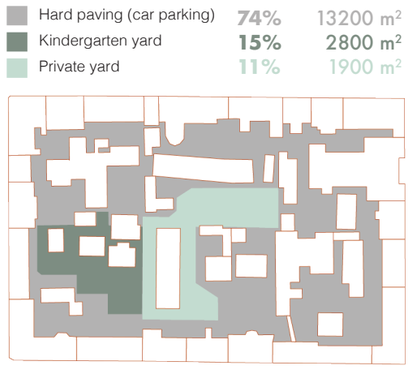


Figure 6.70: Type of pavement inside the block (Author, 2023)

Figure 6.71: Space for cars (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.22 PARAMETERS OF THE BLOCK

This part explores the parameters of the block using Microsoft Excel to make calculations and 3D software to visualise the findings. The aim is to find the most suitable block configuration that allows keeping low-rise Kaunas character, high living and working quality and at the same time to create a high-density neighbourhood, following the principles of TOD. After the options are evaluated, the next step will be transferring the parameters to the location, taking into account the current street network, heritage and other constraints.

The adjusted parameters are FSI, OSR (it is chosen instead of GSI due to the importance of the open space for the character of the block), height (L) average for the block, L maximal for the block and depth of the perimeter buildings (outline). In the report, density is shortened to D. Descriptions of the parameters are provided in Chapter 6.2.1.

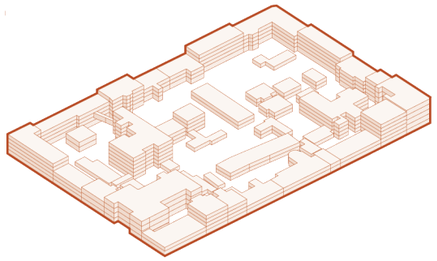


Figure 6.72: The Kaunas New Town Block (Author, 2023)

How much the block can be densified to main the original character of the Kaunas New Town Block?

The process

In this chapter, the summarized version of the testing is provided, taking into consideration that Microsoft Excel allowed testing multiple variations very quickly. That resulted in multiple options that had similar patterns. To simplify the process that could be later adjusted according to the needs of the exact blocks, the certain parameters were chosen.

The original block has **the size of the block (A) 3,8 ha**. That was kept in all tested blocks.

OSR is 0,47, however, to maintain certain freedom, it was decided to vary the block OSR and three options were tested, **0,40/ 0,45/ 0,50**. It followed the logic that the more dense the block (in this case, higher buildings), the higher should be OSR to balance and maintain the feeling of spaciousness inside the block.

For the sake of simplification, the **average building height (L)** is used for calculations. The average height of the block is separated into the average height of the outline buildings and inner buildings. To follow the logic of the Kaunas New Town block, the rule is that the inner buildings should be the same average height or lower, to maintain the character of the block. The Kaunas New Town block has an average height of **4 floors of the building outline** and **2 floors of average buildings inside the block**. For variations, the height of **2/ 4/ 6/ 8/ 10 floors** was used. This takes into account that the proposed maximum for the buildings in the area is 16 floors (only for the part of the area that is not limited by heritage, this is further explained in the Chapter 7.3.5), therefore, the average of 10 would allow having one or a few higher buildings in the block and lower other ones.

The depth of the outline of the block is approximately **15-18 metres**. Firstly, the block variations were tested with a **depth of 12/ 15/ 18/ 20 metres**. Further, the **depth of 18 metres** was chosen as it fits the contemporary typologies of housing and offices (further, it will be adapted within the block to diversify possible typologies).

Lastly, the **FSI of the block is 1,8** which is quite low compared to other explored blocks in Chapter 6, therefore, following TOD theory, and the goal to densify more around the station, this research aims **to determine the highest possible FSI** that still not compromise the quality and character of the Kaunas New Town block.

The testing process using the parameters above is explained in Figure 6.73.

Step1. Determining the size of the block.

Step 2. Determining the depth of the outline.

Step 3. OSR is calculated.

Step 4. Determining the desired OSR. The ground floor area of the inner block is calculated.

Step 5. Determining the desired number of floors for the outline and inner buildings.

Step 6. FSI is calculated. Also, the number of residents, employees and space for amenities.

Step 7. Changes are made to create more realistic visual while maintaining the parameters.

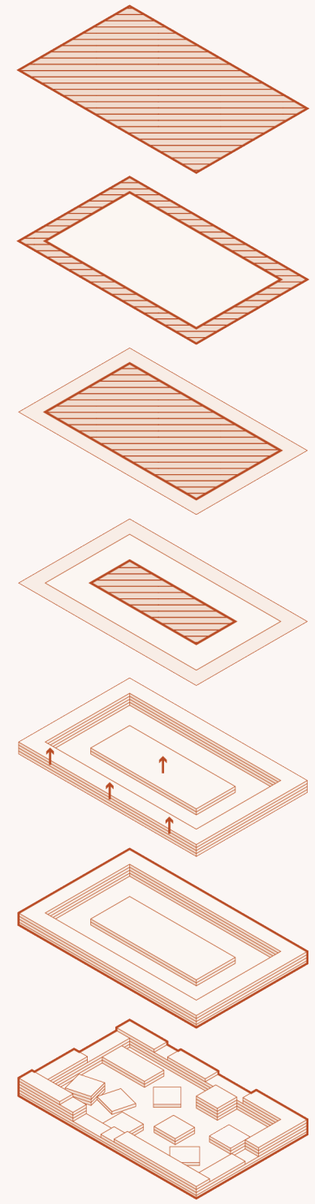


Figure 6.73: Framework for applying various parameters to the block (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.23 TESTING PARAMETERS OF THE BLOCK

		RESIDENTS	EMPLOYEES	AMENITIES	SECTION
1	**FSI = 2.4** Depth 18 m OSR=0.40 4 floors 4 floors	860	1210	6050 m²	
2	**FSI = 2.6** Depth 18 m OSR=0.4 2 floors 6 floors	940	1320	6590 m²	
3	**FSI = 3.1** Depth 18 m OSR=0.40 4 floors 6 floors	1120	1570	7830 m²	
4	**FSI = 3.6** Depth 18 m OSR=0.40 6 floors 6 floors	1300	1810	9070 m²	
5	**FSI = 4.0** Depth 18 m OSR=0.45 6 floors 8 floors	1440	2020	10100 m²	
6	**FSI = 4.7** Depth 18 m OSR=0.50 8 floors 10 floors	1700	2370	11860 m²	

NEW TOWN BLOCK FSI=1.8
PAUPYS BLOCK FSI=2.2

BORNEO BLOCK B
FSI=2.4

MASSENA BLOCK A
BORNEO BLOCK C
FSI=2.6

BORNEO BLOCK A
FSI=3.5

LITTLE C
FSI=4.2

MASSENA BLOCK B FSI=5.5
BARCELONA FSI=5.9

Figure 6.74: Table of the variations of density within the Kaunas New Town block (Author, 2023)

6.2 EXPLORING THE “PERFECT” BLOCK

6.2.24 THE MAXIMAL PARAMETERS

The previous table (Figure 6.74) demonstrates how many people could be accommodated in the block if the density parameters would be changed. From the comparison to other blocks (Figure 6.24), it is clear that the current FSI of 1.77 is relatively low and as the goal is to concentrate living and working around the main station, it needs to be increased.

It is usually difficult to define limits, as the dilemma occurs between economic benefits and often decreased quality of life when the capacity of the block or the whole neighbourhood is exceeded. In Lithuania, there are new developments, especially on the outskirts of the city, that come to my mind when imagining high density (Figure 6.77). The aim is to avoid the poor quality of high-dense development. One of the good examples is the analysed Little C block. However, there is a large open area around the block making it feel less tight.

The first step to answer the question of how much the area should be densified was calculations of capacity. According to calculations, approximately 700 people could live in the original New Town block. However, according to data from Lithuanian State Data Agency, only 300 residents actually lived in that block in 2011. Therefore, densifying twice as much already seems like a rapid shift of the block. After multiple testing sessions, FSI = 4 was selected as a maximum. The further tested options, such as FSI = 4.7 (Figure 6.76) offer similar character as Little C, however, if it would be applied to a larger area, the result might be similar to the example in Figure 6.77.

It is important to note that this part of the explorations was data-based, however, also taking into consideration the subjective experience of various densities and assumptions based on them. Therefore, Chapter 9 proposes an evaluation framework, where the capacity of the total number of residents, office space and space for amenities should be re-evaluated taking into consideration the overall need for new developments in the city and broader region or network (in this case, Rail Baltica station cities).

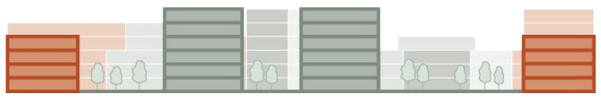


Figure 6.75: Kaunas block when FSI=2.4 (Author, 2023)

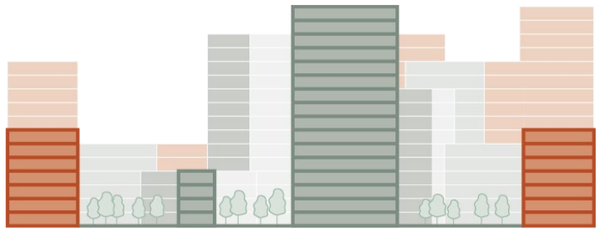


Figure 6.76: Kaunas block when FSI=4.7 (Author, 2023)

Figure 6.77: High-density and considered to be low-quality Perkūnkiemis neighbourhood in Vilnius (Image by Irmants Gelūnas (BNS), 2017)

The main question in this chapter is **what is the vision for Kaunas** and **how the project will contribute to its implementation**. All the previous research and design led to a defined project area, and an understanding of the context, problems, and possibilities in terms of density and capacity. The first design attempts were carried out during the explorations phase as a method to research and test various topics. Conclusions of the block exploration proposed the idea of choosing a typical Kaunas New Town block as a base for the design, however, while preserving its positive qualities and minimising negative ones. This decision catalysed the further design process. As usual for the creative workflow, it was a work with multiple topics simultaneously, jumping from scale to scale. However, to ensure a clear narrative, the design is presented in a more structured way.

This chapter proposes a **block structure**, defines desired **density and other parameters** of each block, and suggests an updated **mobility scheme**, **public space** and **green networks**. To deal with the uncertain future, the last part of the chapter highlights the backbone of the project and potential phasing opportunities.

7. MASTERPLAN

7.1 VISION

7.1.1 THE VISION STATEMENT

Kaunas will **continue to grow** in terms of **population**. It will demonstrate **economic strength and stability**, which will attract local and foreign investments. Lastly, Kaunas will successfully implement a **transition towards sustainable mobility**. **Kaunas central railway station area will become a catalyst of those changes together with the implementation of the Rail Baltica high-speed railway.**

First of all, railway and bus stations will be combined to create a well-functioning (inter)national mobility hub. Moreover, through the new railway branch, Kaunas Airport will become better integrated into the transportation network. To promote a car-free future, the mobility hub will be comfortably accessible by public transportation, walking and cycling. To fulfil the needs of the contemporary railway station, a new building on the opposite side of the rails will be built as an extension of the existing station. It will ensure better accessibility of the station, facilitate commercial activities, parking for bicycles, shared mobility, and during the transition period, private vehicles to encourage combined journeys.

Secondly, the area will be densified towards the mobility hub following the principles of TOD, to create a concentration of residents and jobs in the best-accessible location in the city. The new development will be focused on high quality, however affordable housing; therefore, it will encourage more people to live in the city centre instead of the suburbs. Moreover, it will become more attractive for students and young professionals to study and work in Kaunas. Heritage and former industrial areas will be combined with the new buildings to maintain the unique character of the area.

The new blocks will set an example of a car-free development. The inner yards of the block will be dedicated to people instead of cars. Inside the block, private and semi-private green spaces will be created. Moreover, the blocks will offer a variety of functions including shops, kindergartens, schools and other amenities needed for daily life within walking distance. In combination with well-developed public transport, biking infrastructure, and shared mobility, the need to own a car will be minimized. For some time, parking in certain zones of the project area will be available and other alternatives, such as parking lots on the outskirts of the city, next to the regional railway stops, will be provided.

Lastly, the new block structure will propose a network of public spaces that will ensure the liveability and vibrancy of the area. Together with the mobility hub, it will contribute to the **creation of a new centrality within the central part of Kaunas.**

Figure 7.1: An illustration of the vision (Author, 2023)

7.1 VISION

7.1.2 THE DESIRED CHANGE

Figure 7.2 summarizes the proposed vision for the Kaunas Railway Station area and the main transitions that should happen. The chapter will elaborate further on how to achieve them.

From...		to...
SPACE AND OPENNESS		SPACE AND OPENNESS
GREEN SLOPES		GREEN SLOPES
LARGE-SCALE INDUSTRY		TRANSFORMED INDUSTRY AND DENSIFICATION
STATIONS AND HERITAGE		(INTER)NATIONAL MOBILITY HUB AND REUSED HERITAGE
CAR-ORIENTED MOBILITY		ACTIVE MOBILITY AND PUBLIC TRANSPORT
RAILWAY TRACKS		EXCESS TRAIN TRACKS AS A PART OF PUBWLIC SPACE

Figure 7.2: Proposed changes of the focus area to achieve the vision (Author, 2023)

7.2 POTENTIAL USERS

The proxy actors are used to highlight the needs of future users of the area. The aim is to make an inclusive proposal that takes into consideration the needs of various social and age groups. The chosen potential users were selected aiming for diversity. Due to the time constraints and the scope of the project, six of them were selected, however, it is important to note that are way more groups that should be also considered. The creation of the users was a subjective process based on a combination of various data sources (articles, media, social media, research papers) and personal experiences and my acquaintances in Kaunas. To represent the residents, a young family and an elderly couple were chosen. Younger people tend to be more likely to live in the city centre and more willing to change their mobility habits. However, there is often an issue of affordability and a less attractive environment to raise a family in the centre (lack of private and public green spaces, noise and traffic pollution, lack of schools and kindergartens, lack of playgrounds) that results in young families moving to the suburbs. As one of the goals is to create an alternative to the suburban lifestyle, young professionals and families were selected as one of the key target groups. Moreover, there is potential to attract elderly people who used to live in large suburban houses and do need a smaller place once their children moved out. When considering business, the focus is on the employees of the offices. An attractive environment for the companies to be located in the area would strengthen the economy of the city. Moreover, it is also crucial to promote small businesses as part of the local economy. Lastly, the two selected users commute by train frequently to focus on the passenger needs of the future Rail Baltica line.

In this spread (Figure 7.3), the overall information about the users and their needs is provided. The potential users will be used further to evaluate the quality and usability of the key spaces of the proposal.

	RESIDENTS		BUSINESS		OTHER	
	YOUNG FAMILY	ELDERLY COUPLE	SMALL BUSINESS OWNER	OFFICE WORKER	FREQUENT VISITOR	COMMUTER
						
About	- he works at one of the offices in the area - she works in Vilnius, however, she often works remotely - daughter goes to the kindergarten	- he is retired - he has difficulties walking - she works as a teacher in a school nearby - they moved to the area from the suburbs of Kaunas	- he wants to open a cafe and bakery in the area	- he lives in Šilainiai (a neighbourhood in the north of Kaunas) - works in the office next to the station - often needs to travel abroad	- she lives in Kaišiadorys (a smaller town between Kaunas and Vilnius, connected by the railway) - comes every week for the market	- student - she studies on the KTU campus - has lectures a few times per week - she lives in Panevėžys
Needs	- kindergarten and school nearby - playgrounds - recreational green spaces - occasionally needs accessibility by car - terrace/ large balcony - quietness - co-working space	- accessible and barrier-free area - recreational green spaces - (community) garden - community centre	- access for delivery trucks - visibility - flow of people - space for an outdoor terrace	- good accessibility by public transportation - quick connection to the airport - restaurants and cafes for lunch - places to meet friends after work - gym	- easy access to the market - places to sit and rest - barrier-free area - services (cafe, restaurants, groceries next to the station)	- good public transport connection between the station and KTU campus - bike sharing and bike path towards the campus - services (cafes, restaurants, groceries next to the station) - comfortable place to work while waiting for the train

Figure 7.3: A diagram of the potential users and their needs (Author, 2023)

7.3 SPATIAL CONFIGURATION

7.3.1 DEFINING THE BLOCK STRUCTURE

The vision highlights the need for densification towards the mobility hub as one of the key components. Explorations of the urban blocks in Chapter 6 led to the conclusion that the relatively large (approximately 3,8 ha) block, common for Kaunas New Town is the most suitable type for the project area. However, it is important to note that this does not mean the direct application of the block.

After the qualities, issues of the block and maximal parameters to densify were determined in the previous chapter, this chapter proposes a new structural plan based on the application of the block while taking into consideration the current street network, natural elements, existing functions and heritage areas and buildings. The map (Figure 7.4) demonstrates the combined plan of limitations and opportunities and maps by topic are provided in the following pages.

The proposed structural backbone is based on the aim to respect and preserve existing specifics of the area while creating opportunities for densification and changes needed for the area to function as a new centre and high-importance mobility hub. Moreover, when partially keeping the existing, phasing becomes possible as there are conditions for the area to change over time while having a clear vision of the desirable future.

The main constants of the area are the natural structure of the slopes and water as well as a historic park in the north of the area that is currently part of an enclosed military hospital complex. Moreover, it is a historically important site, an industrial part of the New Town, therefore, there are a few protected complexes and buildings. It should be discussed further about the value and need to preserve other buildings and structures that are not part of the cultural heritage list, especially the ones built in 1918-1939 due to UNESCO application, however, for this project, only buildings and zones included in the national heritage registry are considered. In the further, flexibility of the plan would allow the preservation of other buildings if they would be recognised as important, however, this would reduce the density of the area. In addition, there are certain functions, for example, beer production in the area that has deep historic roots and does not imply any plans to move out any time soon, therefore, it is considered to be a later stage of the implementation. Lastly, as the previous analysis in Chapter 5 explains, city-level importance streets are crossing the area. Even though the desired future focuses on public transportation and active modes of mobility, there is still potential for shared, electric mobility to become an alternative to private vehicles. Moreover, there is a need for logistics, emergency and even military vehicles to access and cross the area. Therefore, the aim is to reduce the importance and need for cars, however, while still maintaining the main street network. In this case, the focus is on improving the quality of the street environment.

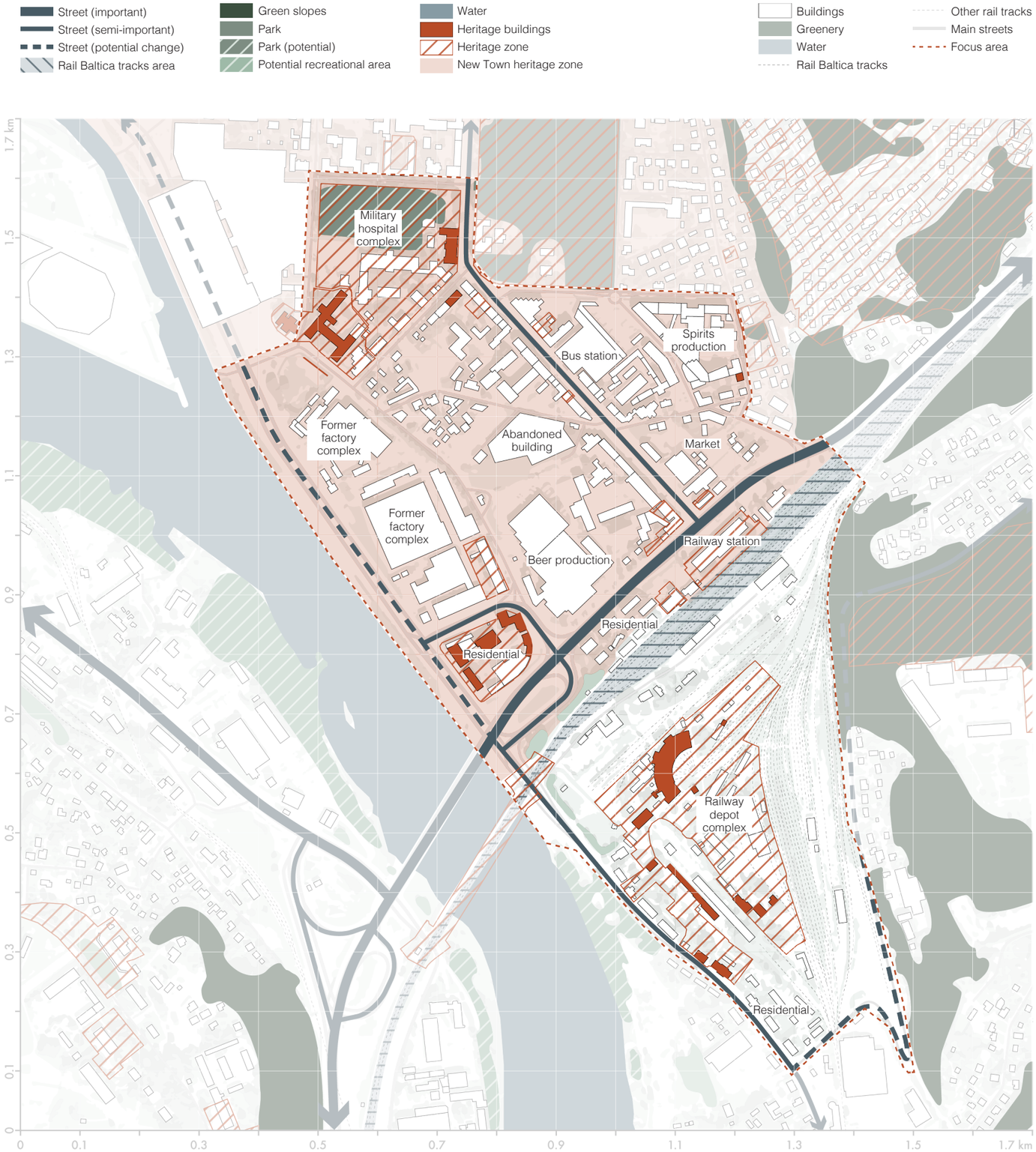


Figure 7.4: The map of the key objects and zones in the area (Author, 2023)

7.3 SPATIAL CONFIGURATION

7.3.2 LIMITATIONS AND OPPORTUNITIES

MOBILITY NETWORK

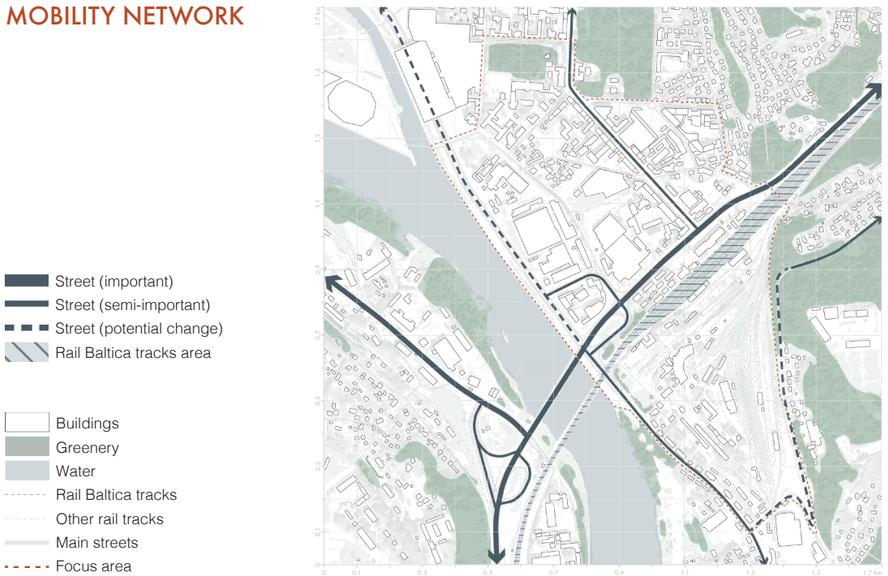


Figure 7.5: The main elements of the mobility network (Author, 2023)

NATURAL NETWORK

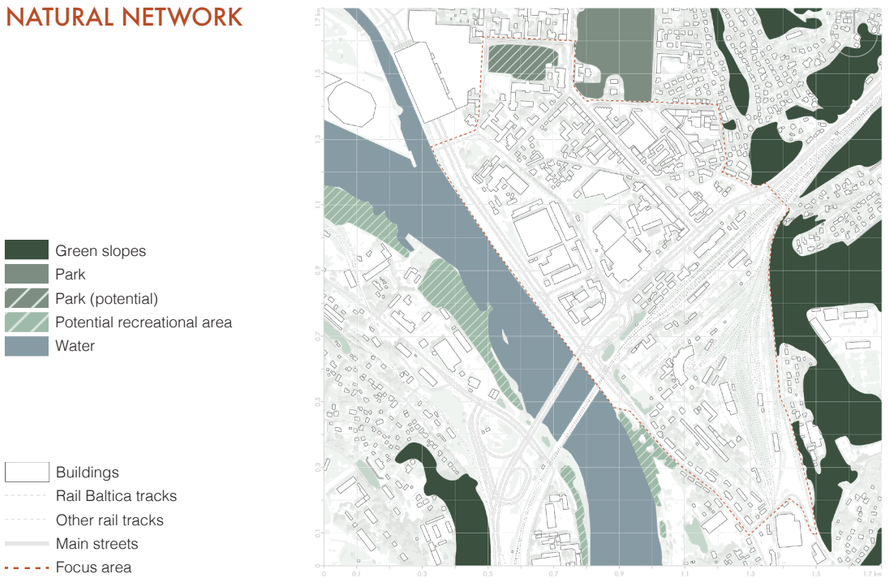


Figure 7.6: The main elements of the natural network (Author, 2023)

FUNCTIONAL ZONES

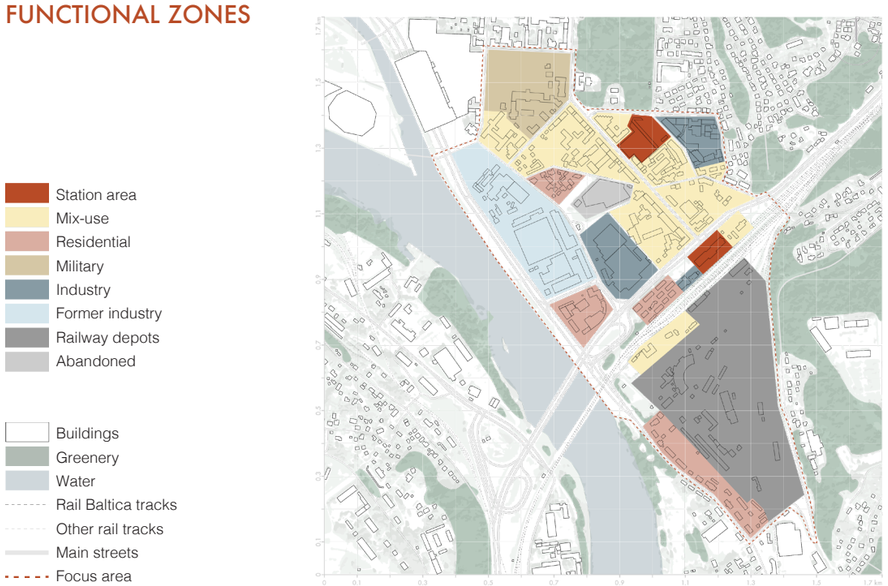


Figure 7.7: Dominant functions of the different areas (Author, 2023)

HERITAGE

Figure 7.8: Heritage buildings and zones (Author, 2023)

7.3 SPATIAL CONFIGURATION

7.3.3 THE PROPOSED BLOCK STRUCTURE

The proposed block structure was created by respecting the previously mentioned elements. The larger block structure allows phasing and preserves heritage inside the block and the main street network. However, the new street is introduced to ensure better accessibility of the former industrial area (between blocks 2, 3, 5, 6, 9, 10). Moreover, the block structure of the former railway infrastructure area is created similarly. First of all, blocks are created to have clear connections to the station. Moreover, the aim is to include, preserve and enable the potential of the railway depot buildings that are protected by the heritage. Lastly, the new blocks along the hill (number 18, 19) and the new street next to them, follow the direction of the current railway tracks.

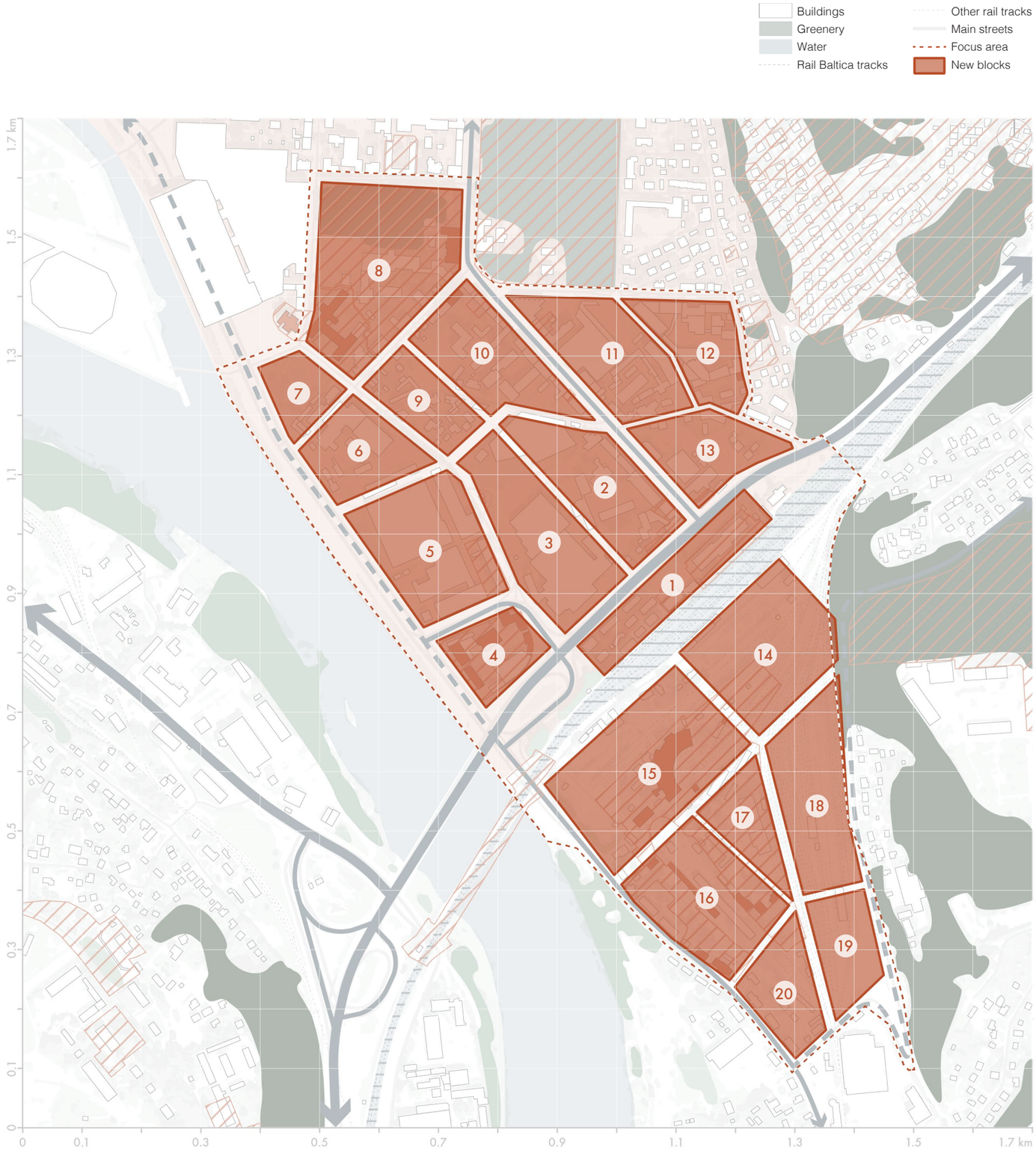


Figure 7.9: The proposed block structure (Author, 2023)

7.3 SPATIAL CONFIGURATION

7.3.4 APPLIED DENSITY: PARAMETERS AND NUMBERS

The diagram shows how the parameters should be applied to the proposed blocks. The application follows the rules of gradually increasing density (FSI) towards the station. Moreover, there are height limitations in the New Town heritage zone, therefore only a few higher buildings are allowed in the station block (only on the edge of the heritage zone, next to the railway). On the opposite side, the height goes up to 16 floors, not higher than the new residential complex that is currently being built next to the site, closer to Nemunas River.

The axonometric scheme (Figure 7.11) demonstrates the average height of the block and added maximum height in the red line pattern. In the table (Figure 7.10), the parameters of each block are detailed. The grey text indicates that either the block belongs to heritage (blocks 4, 8) or the block is developed as a public space, proposing only pavilions in it.

PARAMETERS

Block 1
A = 2.58 ha
FSI = 3.5
$L_{(max)}$ = 12 floors
GSI = 0.50
OSR = 0.50

Block 2
A = 3.36 ha
FSI = 3.0
$L_{(max)}$ = 8 floors
GSI = 0.55
OSR = 0.45

Block 3
A = 3.99 ha
FSI = 3.0
$L_{(max)}$ = 8 floors
GSI = 0.55
OSR = 0.45

Block 4
A = 1.64 ha
FSI < 2.0
$L_{(max)}$ = 3 floors
GSI = 0.50
OSR = 0.50

Block 5
A = 4.00 ha
FSI = 3.0
$L_{(max)}$ = 6 floors
GSI = 0.55
OSR = 0.45

Block 6
A = 2.18 ha
FSI = 2.5
$L_{(max)}$ = 5 floors
GSI = 0.60
OSR = 0.40

Block 7
A = 1.20 ha
FSI = 2.5
$L_{(max)}$ = 5 floors
GSI = 0.60
OSR = 0.40

Block 8
A = 6.00 ha
FSI< 2.0
L(max) = 2 floors
GSI = 0.40
OSR = 0.60

Block 9
A = 1.69 ha
FSI = 2.5
$L_{(max)}$ = 6 floors
GSI = 0.60
OSR = 0.40

Block 10
A = 3.14
FSI = 3.0
$L_{(max)}$ = 7 floors
GSI = 0.55
OSR = 0.45

Block 11
A = 3.38 ha
FSI = 3.0
$L_{(max)}$ = 6 floors
GSI = 0.55
OSR = 0.45

Block 12
A = 2.16
FSI < 2.0
$L_{(max)}$ = 4 floors
GSI = 0.60
OSR = 0.40

Block 13
A = 2.25 ha
FSI = 3.0
$L_{(max)}$ = 7 floors
GSI = 0.55
OSR = 0.45

Block 14
A = 4.29 ha
FSI < 4.0
$L_{(max)}$ = 16 floors
GSI = 0.50
OSR = 0.50

Block 15
A = 5.76 ha
FSI = 3.5
$L_{(max)}$ = 16 floors
GSI = 0.50
OSR = 0.50

Block 16
A = 3.40 ha
FSI = 3.5
$L_{(max)}$ = 10 floors
GSI = 0.50
OSR = 0.50

Block 17
A = 1.51 ha
FSI = 0.0
L(max) = 1 floor
GSI = 0.05
OSR = 0.95

Block 18
A = 1.90 ha
FSI = 3.5
$L_{(max)}$ = 10 floors
GSI = 0.50
OSR = 0.50

Block 19
A = 1.70 ha
FSI = 2.5
$L_{(max)}$ = 6 floors
GSI = 0.60
OSR = 0.40

Block 20
A = 3.49 ha
FSI = 2.5
$L_{(max)}$ = 6 floors
GSI = 0.60
OSR = 0.40

Figure 7.10: Parameters table (Author, 2023)

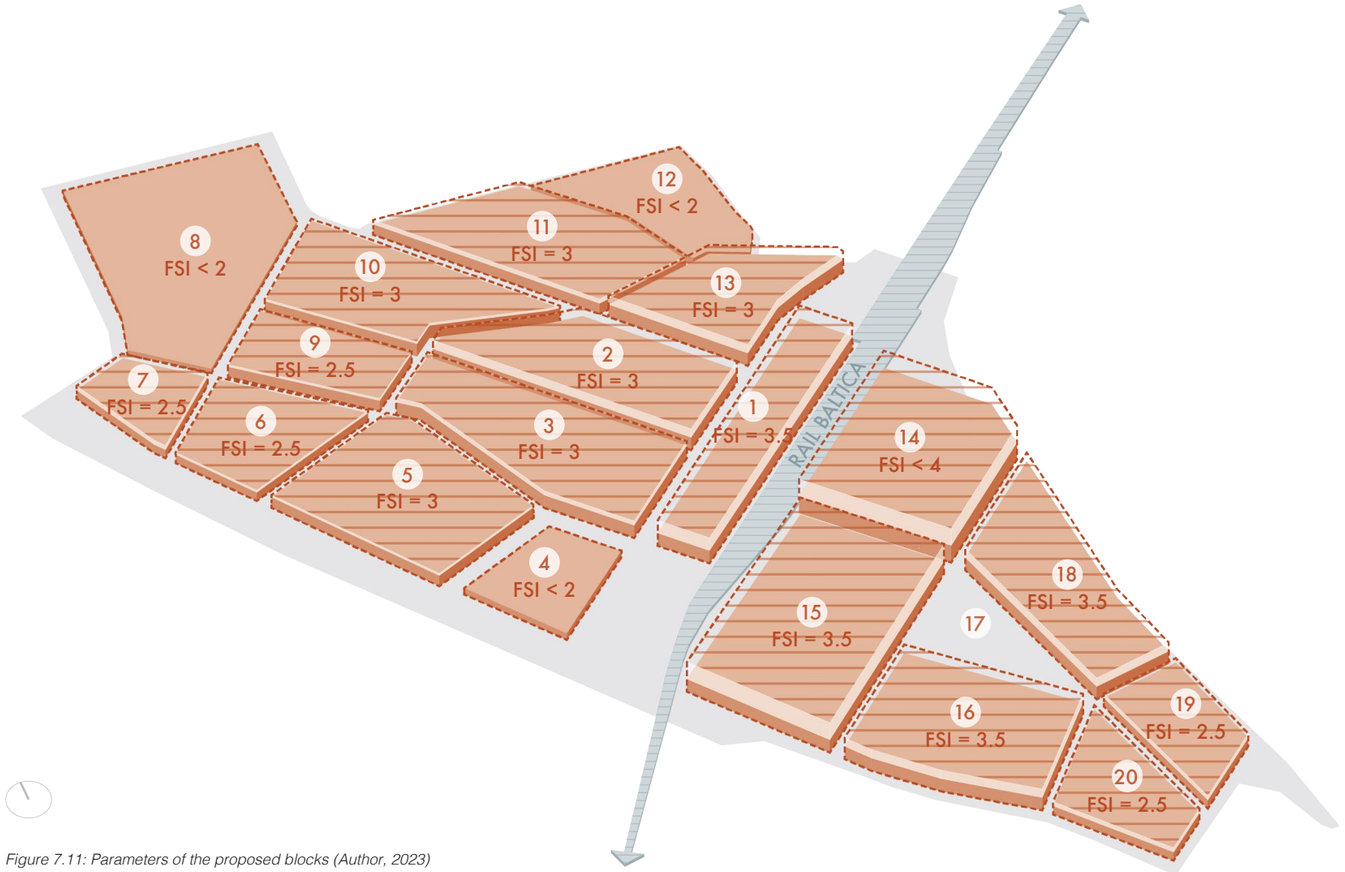


Figure 7.11: Parameters of the proposed blocks (Author, 2023)

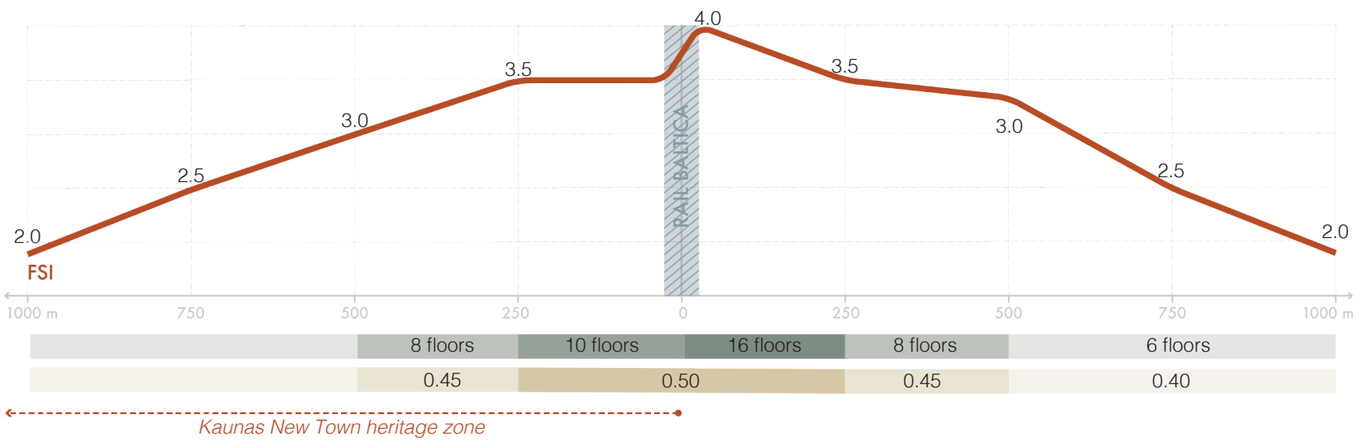


Figure 7.12: Parameters matrix of the proposed blocks (Author, 2023)

7.3 SPATIAL CONFIGURATION

7.3.5 APPLIED DENSITY: HEIGHT

The maximal height was determined not only by FSI experimentations, however, also by taking into consideration the local context. As part of the area belongs to Kaunas New Town historic zone which is included in the heritage list, there are certain limitations. The proposed height should not exceed 8 floors (approximately 24 m), while 10 floors could only be built next to the station if needed. It is desired to preserve the maximum height of 30 m. It is also related to the aim of maintaining visibility of the green slopes around the area that are approximately 37 m higher than the lower terrace (Figure 7.15). Lastly, on the opposite side of the tracks, in Šančiai district, the maximal height is 16 floors (56 m), the same height as already built residential towers next to the focus area (Figure 7.16). However, the higher buildings should be only as accents when the average height needs to preserve the character of the Kaunas block (7.14).

Figure 7.13: Height of the Vytautas Street (Google Satellite, 2023)

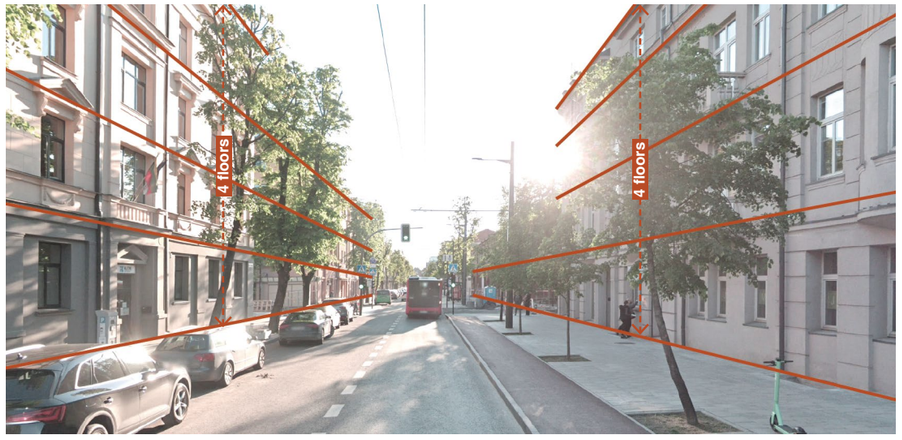


Figure 7.14: Height of the street next to the analysed New Town block (Google Satellite, 2023)

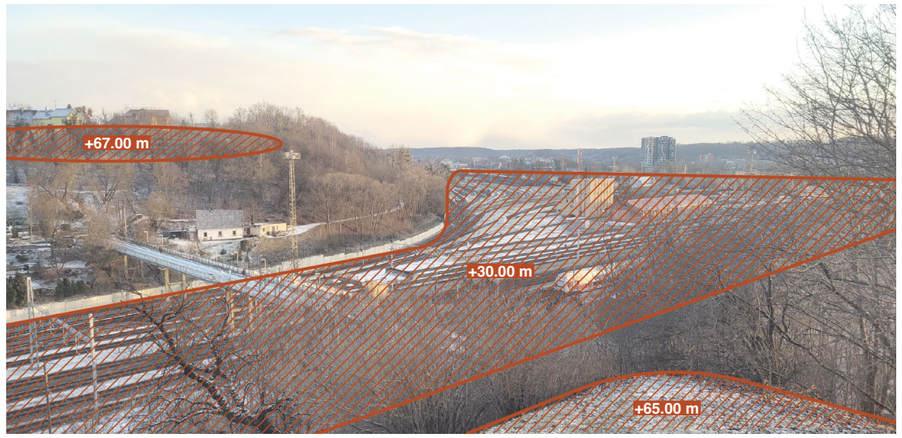


Figure 7.15: Height of the different terraces (Google Satellite, 2023)

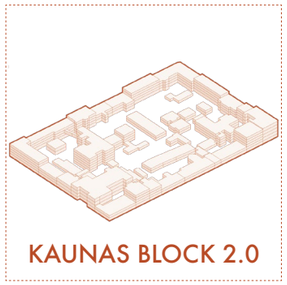
Figure 7.16: Height of the newly built residential towers next to the focus area (Šančiai) (Google Satellite, 2023)

7.3 SPATIAL CONFIGURATION

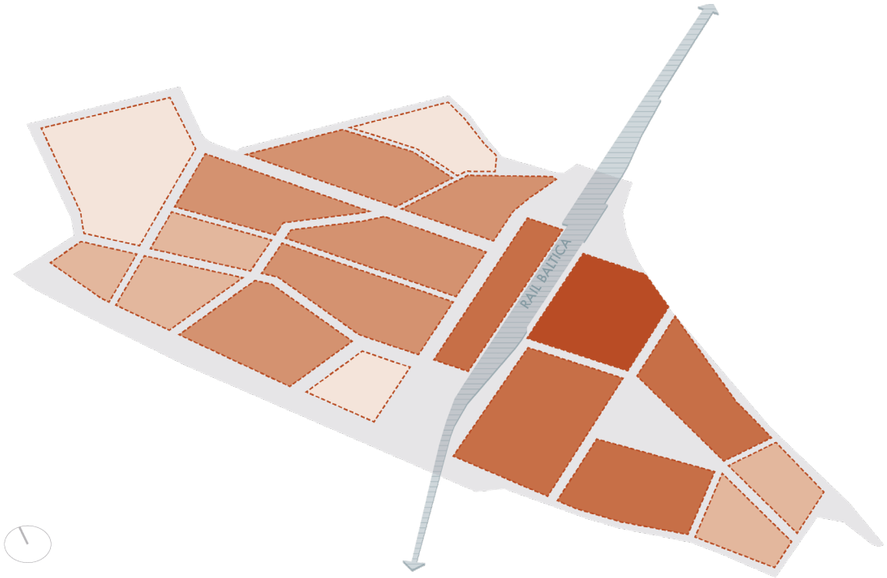
7.3.6 APPLIED DENSITY: EVALUATION

The densification framework is based on structured flexibility, therefore, while it has clear rules for each block to be developed, it could change and react according to the needs of the city and the region. This topic is further elaborated in Chapter 9.3.

A comparison is provided between the proposal (Figure 7.17) and the application of the Kaunas block without adjusting FSI (Figure 7.18). The potential numbers of residents, jobs and amenities differ almost two times. This demonstrates that the proposed framework already exceeds density which is quite high for Kaunas, however, this decision is justified due to its location next to the Rail Baltica station and, if needed, it can react to the needs of the region.



KAUNAS BLOCK 2.0



17 000 RESIDENTS

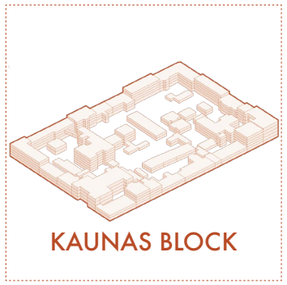
24 000 EMPLOYEES

112 000 m² AMENITIES

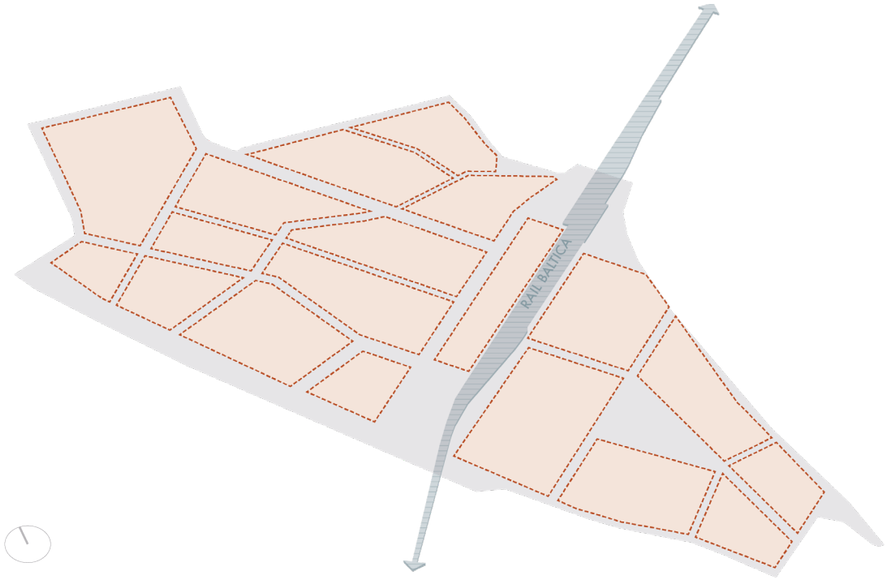
1.5 2.0 **2.5** **3.0** **3.5** **4.0** 4.5

FLOOR SPACE INDEX (FSI)

Figure 7.17: Capacity of the area if the proposed densities are implemented (Author, 2023)



KAUNAS BLOCK



10 000 RESIDENTS

14 000 EMPLOYEES

72 000 m² AMENITIES

1.5 **2.0** 2.5 3.0 3.5 4.0 4.5

FLOOR SPACE INDEX (FSI)

Figure 7.18: Capacity of the area if the density of Kaunas block is applied (Author, 2023)

7.4 MOBILITY

7.4.1 THE CAR-FREE FUTURE?

The term “car-free mobility” is used to refer to the desired future when commute happens by other means of transportation. It is also likely that there will be no total reduction of cars, however, private vehicles will be replaced by car sharing. However, even if electric shared mobility would be more sustainable, there would be still an issue of space. As other means of transportation (public transportation, biking, walking) reduces traffic congestion and active modes of transport also improve health, they are the desired way of commuting and the main focus of the project.

Modal split

However, when planning for the paradigm shift towards less car-dominant mobility in Kaunas, it is important to note that the current modal split (Figure 7.19) which demonstrates high usage of cars that is likely to grow if no measures are taken. Therefore, there is a need to act now, however, while not neglecting the fact that in the upcoming future, certain infrastructure (streets, parking) for cars will be needed and by ignoring the need, the situation might be similar to the analysed Kaunas block where the whole inner space is filled by cars.

Zero-emission zones

There were already proposals to introduce a zero-emission zone (Figures 7.20,7.21) in the centre of Kaunas, however, the reactions of the citizens were very negative and the project is currently not moving forwards. However, if a similar proposal would be implemented, the project area should be included and even could become an experimental ground to introduce the zero-emission zone to the citizens.

Parking

Lastly, as mentioned previously, there is a need to propose complex solutions for parking, at least during the transition towards shared mobility. According to the current parking ratio scheme, part of the project area has a parking ratio of 0,5 meaning that half of the parking spaces required according to law need to be planned. The whole surrounding area has a parking ratio of 1. Even though the reasoning to have fewer parking spots in the central zones of the city is correct, without ensuring alternatives (public transport, active means of transport) it results in people still owning cars and chaotically leaving them.

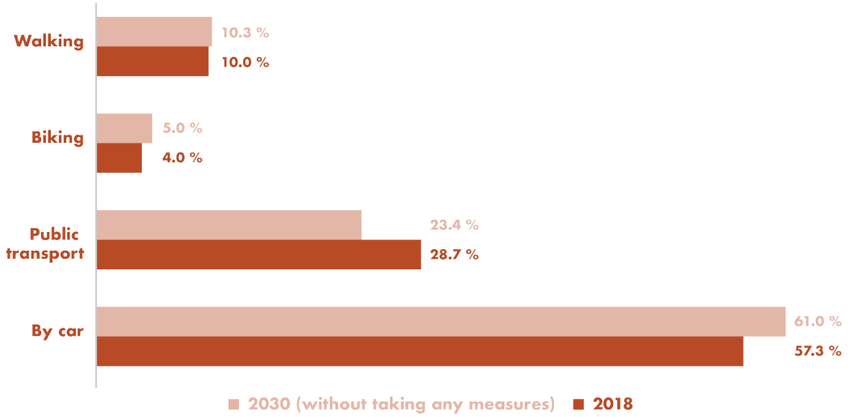


Figure 7.19: Modal split of Kaunas in 2018 and predicted for 2030 (Author, adapted from (Kaunas City Municipal Administration et al., 2019), 2023)

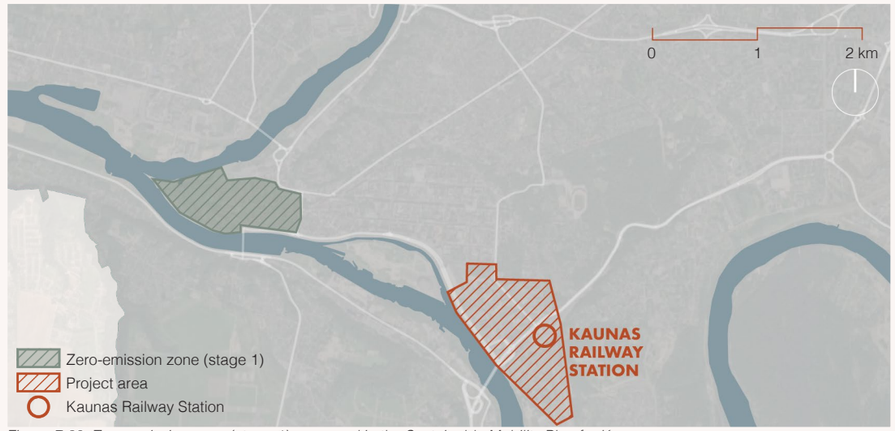


Figure 7.20: Zero-emission zone (stage 1) proposed in the Sustainable Mobility Plan for Kaunas (Author, adapted from (Kaunas City Municipal Administration et al., 2019), 2023)

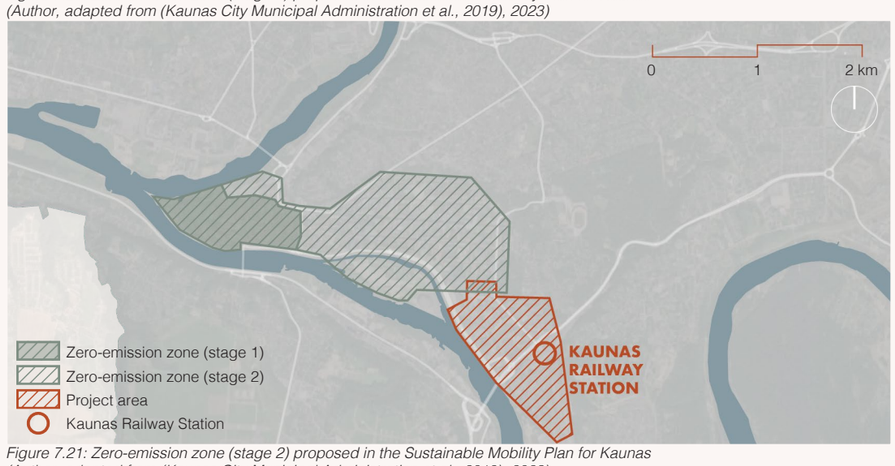


Figure 7.21: Zero-emission zone (stage 2) proposed in the Sustainable Mobility Plan for Kaunas (Author, adapted from (Kaunas City Municipal Administration et al., 2019), 2023)

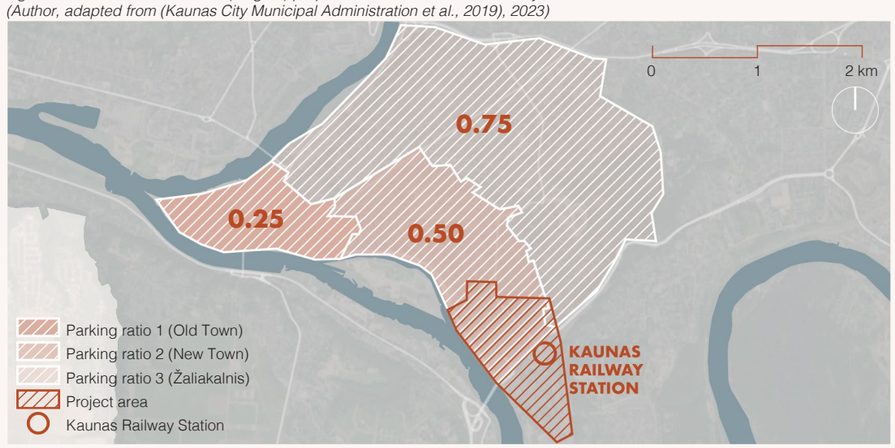


Figure 7.22: Current parking ratios in Kaunas (Author, adapted from (Kaunas City Municipal Administration, 2016), 2023)

7.4 MOBILITY

7.4.2 THE STREET NETWORK

The current street network is quite disrupted by large industrial blocks, moreover, there is quite complicated connections from the east side of the rails (Figure 7.23).

Figure 7.23: Current street network (Author, 2023)

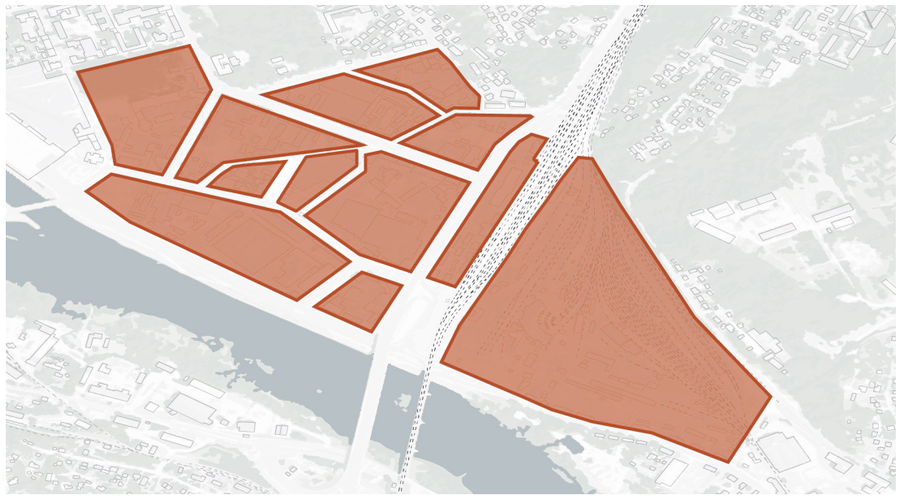


Figure 7.24: Current block structure (Author, 2023)

The proposal (Figure 7.25) suggests preserving the unique angular street characters, however, creating a more coherent network. The block and street structure in the former railway infrastructure zone follows the direction of the rails.

Figure 7.25: Proposed street network (Author, 2023)

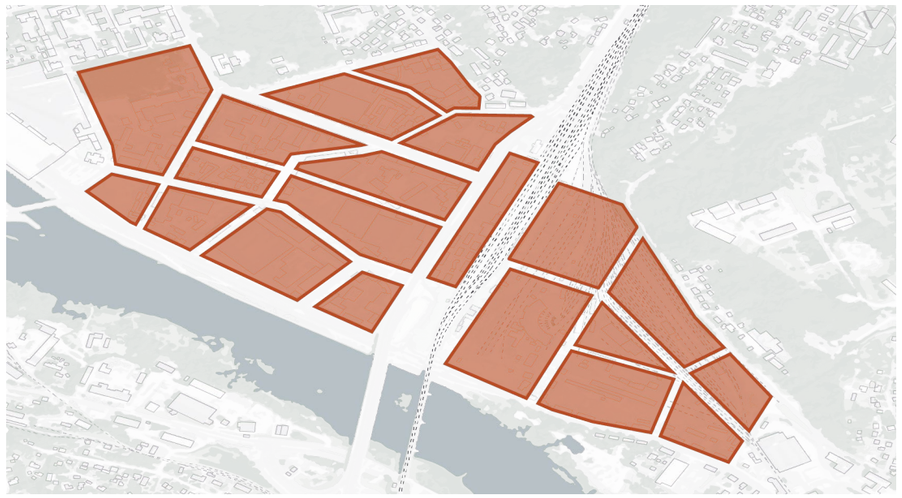


Figure 7.26: Proposed block structure (Author, 2023)

7.4 MOBILITY
7.4.3 CONNECTIVITY

Due to landscape conditions, the structure of the city, and rails being on the ground level, there are only a few different ways to cross the railway. Number 1 is a pedestrian bridge, connecting the hills, however, the quality of it very is poor. The second passage is also only for pedestrians to access the platforms as it goes under the station, however, there is no further passage. Lastly, number 3 goes under the bridges and fits the needs of multiple modes of transport.

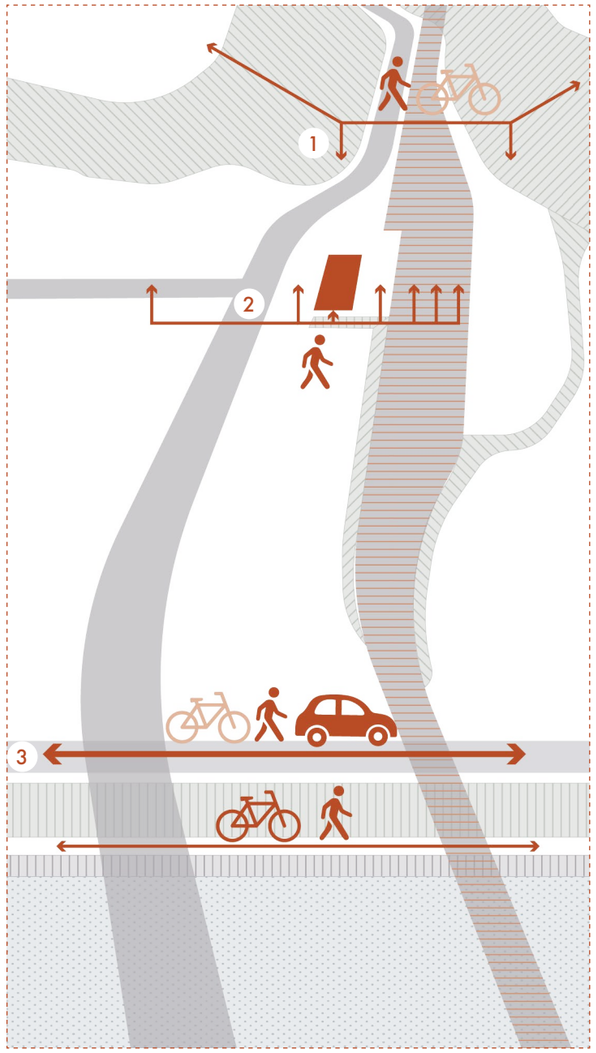


Figure 7.27: Current connections through the rails (Author, 2023)

There are no options (except very expensive and likely not necessary) to introduce more connectivity for motorised vehicles. However, there is a need to improve connectivity that would fit the universal design principles. Moreover, there is a possibility to introduce one more passage for pedestrians and cyclists, however, the need for it is still questionable as other passages are not far away. It could be implemented in the future if needed.

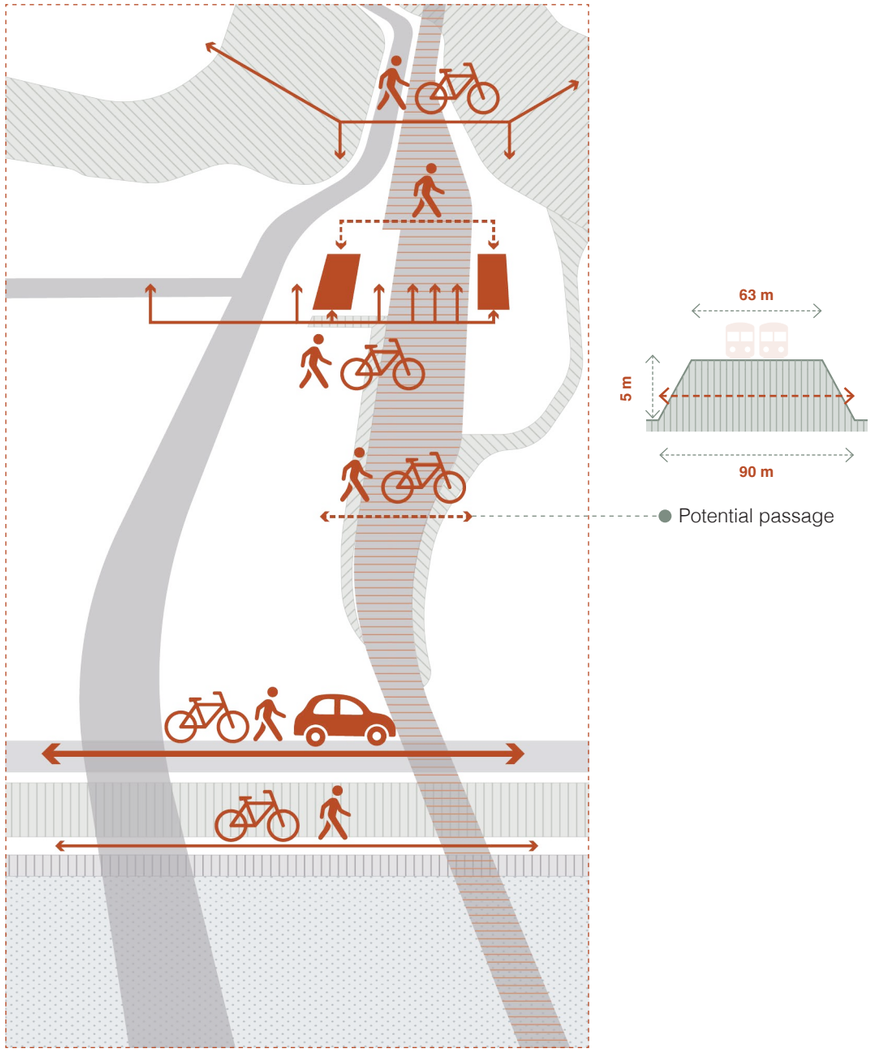


Figure 7.28: Changes in connectivity through the rails (Author, 2023)

7.4 MOBILITY

7.4.4 NEW STREET STANDARDS

Even though the focus is towards a car-free future, the street network is still needed (for public transport, shared mobility, logistics, services, emergency vehicles as well as for private cars, at least during the transition period). Therefore, the proposal focuses on the street network that prioritises public transportation and active modes of transport. The concept of shared streets which is not yet common in Lithuania (there are a few examples in Vilnius) should be introduced to Kaunas.

While proposing new streets in Kaunas (Figures 7.29, 7.30), the Netherlands became the source of inspiration, especially the streets with green character, slow traffic zones and entrances from the street side, where residents create their gardens.

The examples of street sections (Figures 7.32, 7.33) demonstrate how bike paths, sidewalks and spaces for active ground floors should fit along the street or shared space. Moreover, parallel parking is mixed with trees to ensure a green character.

Figure 7.29: Inspiration for the street character (Delft, Netherlands) (Author, 2023)

Figure 7.30: Inspiration for the street character (Amsterdam, Netherlands) (Author, 2023)

Figure 7.31: Proposed street types (Author, 2023)

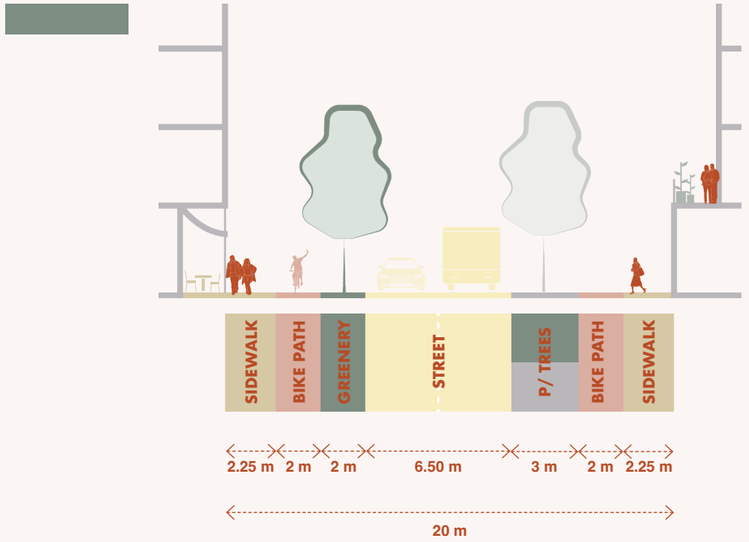


Figure 7.32: Proposed new street section (Author, 2023)

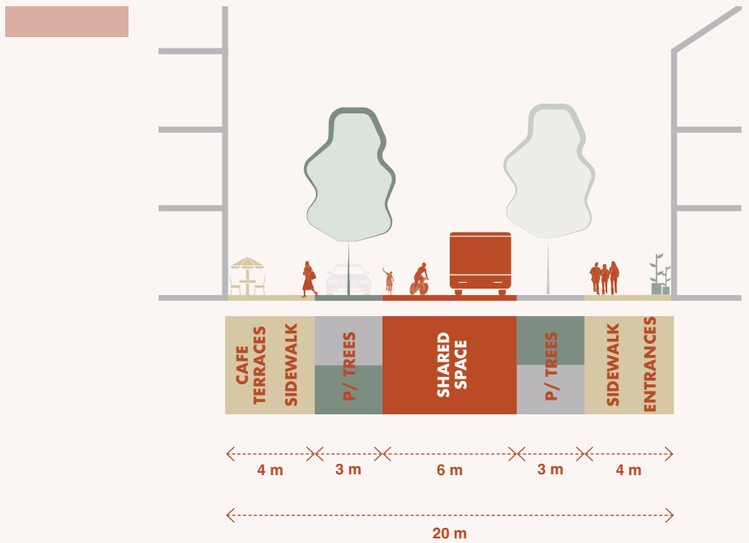


Figure 7.33: Proposed shared street section (Author, 2023)

7.4 MOBILITY

7.4.5 PUBLIC TRANSPORT

The current public transport network is quite well-developed (Figure 7.34), however, as there are not many bus lanes (Figure 7.35), public transport is usually slow. Moreover, it is considered to be poor quality.

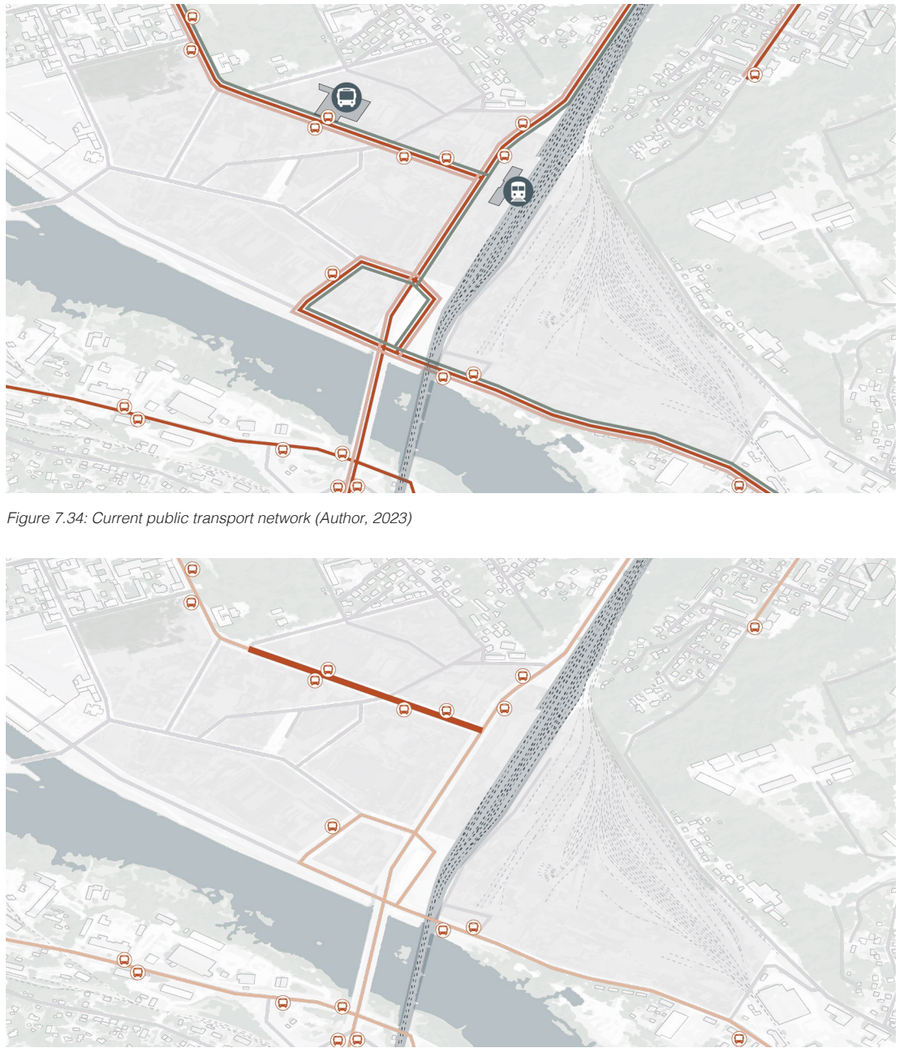


Figure 7.34: Current public transport network (Author, 2023)

Figure 7.35: Current bus lanes (Author, 2023)

The proposal (Figure 7.36) suggests extending the public transportation network and bus lanes along the waterfront (leading to the Old Town) and on the opposite side of rails, going up the hill and connecting higher and lower terraces.

Figure 7.36: Proposed public transport network (Author, 2023)

Figure 7.37: Proposed bus lanes (Author, 2023)

7.4 MOBILITY

7.4.6 BIKE INFRASTRUCTURE

There is some bike infrastructure according to the maps by Kaunas Municipality, however, the network is not well-developed (Figure 7.40).

Moreover, the quality of current bike paths is not sufficient. In many cases, it is not a separate bike path, however, a narrow line along the street (Figure 7.38) or a combined bike and pedestrian path (Figure 7.39) where there is no space for bikes. Therefore, it is important to develop new streets and redesign the current ones while having defined standards (Figure 7.41).

The new network of streets (7.42) with bike paths (where possible, on both sides), as well as shared spaces where the traffic is less intense, are introduced.

Even though, due to the climate (cold and snowy winters) and terrain (different terraces of the city), it is important to develop bike infrastructure starting with the station area. If a zero-emission zone would be implemented in the centre, shared bikes could be a strong alternative to cars, especially considering that the whole centre is on one level.

Figure 7.38: Quality of the existing bike infrastructure (Kaunakiemis Street) (Google Satellite, 2023)

Figure 7.39: Quality of the existing bike infrastructure (Vytautas Street) (Google Satellite, 2023)

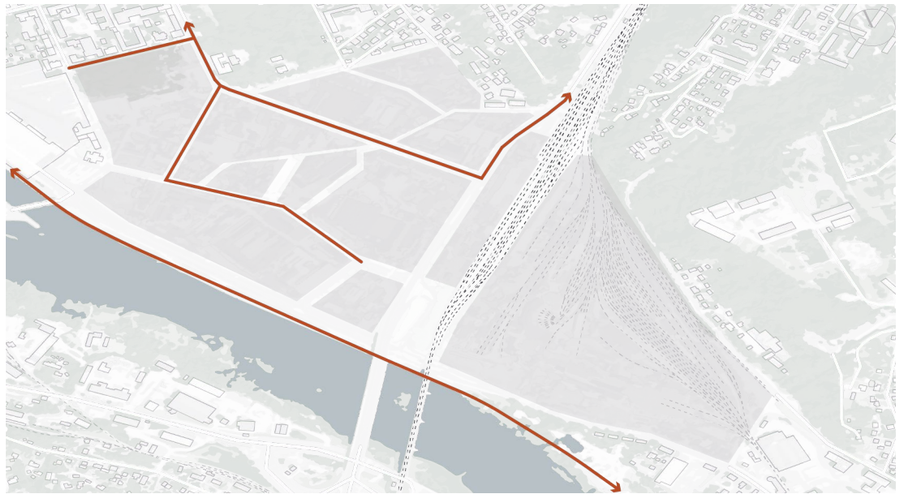


Figure 7.40: Current bike network (Author, 2023)

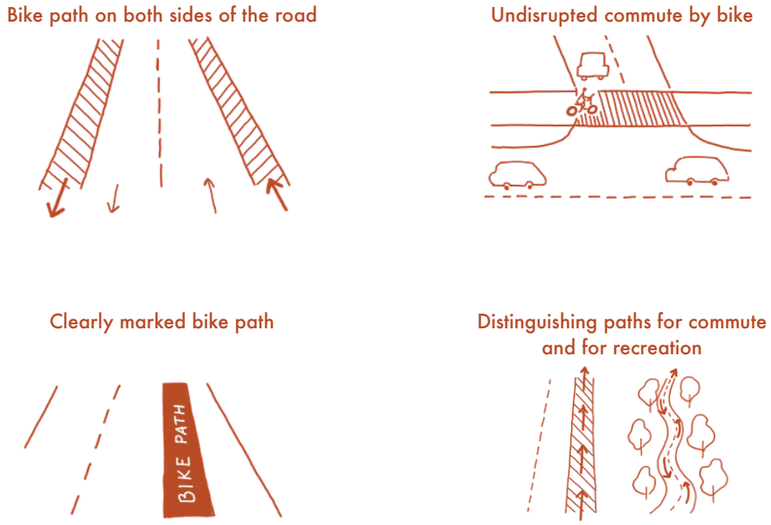


Figure 7.41: Proposed principles for new bike paths (Author, 2023)

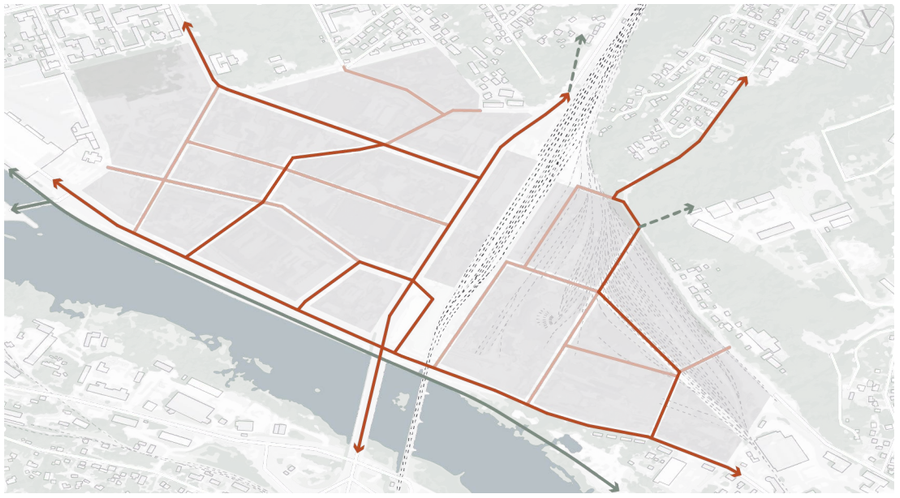
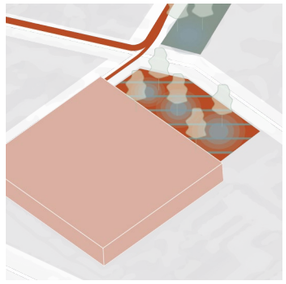


Figure 7.42: Proposed bike network (Author, 2023)

7.5 PROGRAMME MIX

The programme mix defines the dominant function of the part of the block or the whole block (Figure 7.46). The analysis of the original Kaunas block showed that approximately 50% of apartments (student and regular housing), around 11% of offices and 39% of amenities and institutions. However, the analysed block is in a very central part of Kaunas where all the institutions are located. The station area might be an attractive place to introduce more offices and coworking spaces, therefore, the shift is suggested to around 40% offices and 10% amenities.

The main public squares (Figure 7.47) are located next to reused buildings (industrial or industrial heritage) to highlight them as a part of the former identity of the area and to exploit the potential of the unique spaces. The former metal factory (figure 7.43) is already used for various cultural events and this could be embraced. The unique rounded form of the railway maintenance depot (Figure 7.44) could be used as a food hall and the round central element as a rainwater basin. Lastly, to bring attention to the former power plant building (Figure 7.45), the pocket square is positioned in front of the building. It could be used as a more enclosed, cosy space for cafes and bars while the heritage building could include cafes in the front and community space at the back side, connected to the community garden towards the inner yard. The main green spaces are further explained in Chapter 7.6. It is important to facilitate green spaces for both residents and nature, provide playgrounds, outdoor gym equipment, and sports fields as well as zones to sit, relax and enjoy nature.



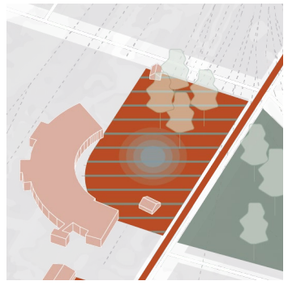


Figure 7.43: Public space and the event hall (former metal factory) (Image by T. Stukas (top), Author, 2023 (bottom))

Figure 7.44: Food hall at the former railway depot and its square (Image by G. Valatka (top), Author, 2023 (bottom))

Figure 7.45: Pocket square to emphasise historic power plant building (proposed cafe and community space) (Image by M. Skerniškis (top), Author, 2023 (bottom))

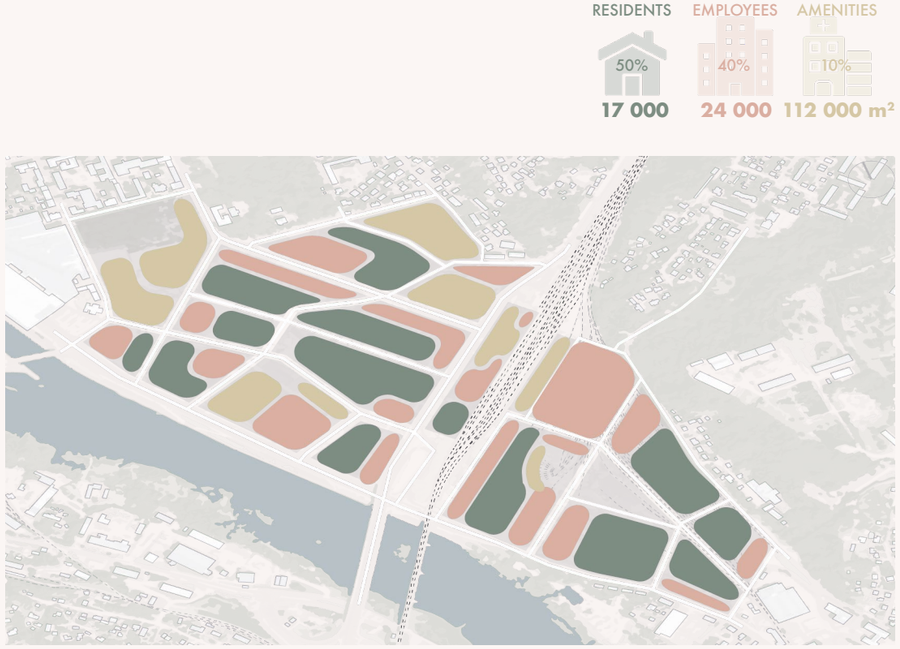


Figure 7.46: Dominant function of the area (Author, 2023)

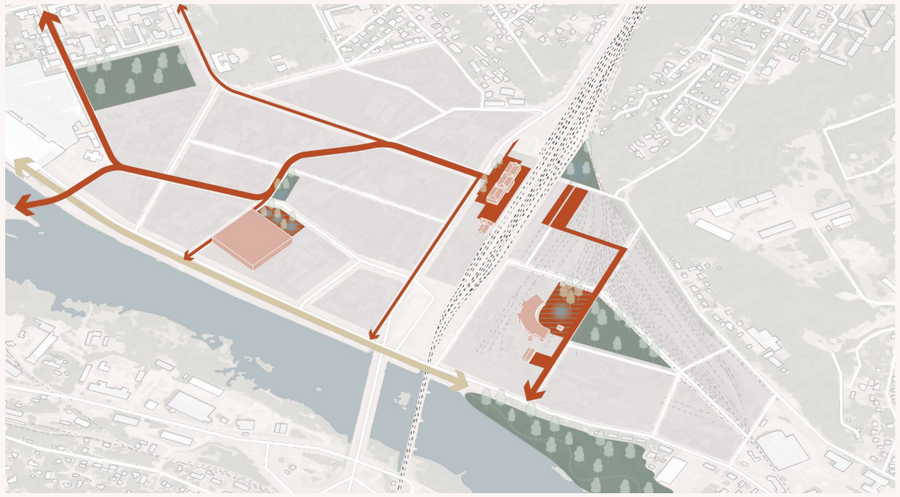


Figure 7.47: Main public spaces (Author, 2023)

7.6 GREEN-BLUE NETWORK

The proposed green-blue network is based on the concept (Figure 7.49) of introducing two central green elements as the connectors between green slopes and the waterfront of Nemunas River. Moreover, green street profiles and yards within the blocks contribute to having continuous greenery as a biodiversity corridor (Figure 7.48). It also would improve the microclimate and well-being of people.

What is more, there is a small river Girstutis which goes down the slope and towards Nemunas and it is currently under the ground. There is potential to open some parts of it and use those areas for rainwater collection within the blocks and main public spaces. Rainwater basins are also introduced in other squares and parks, for example, the railway depot square.

Lastly, the waterfront of Nemunas River should be adjusted for recreation and the military park in the north, which is currently fenced, should be opened to the public.

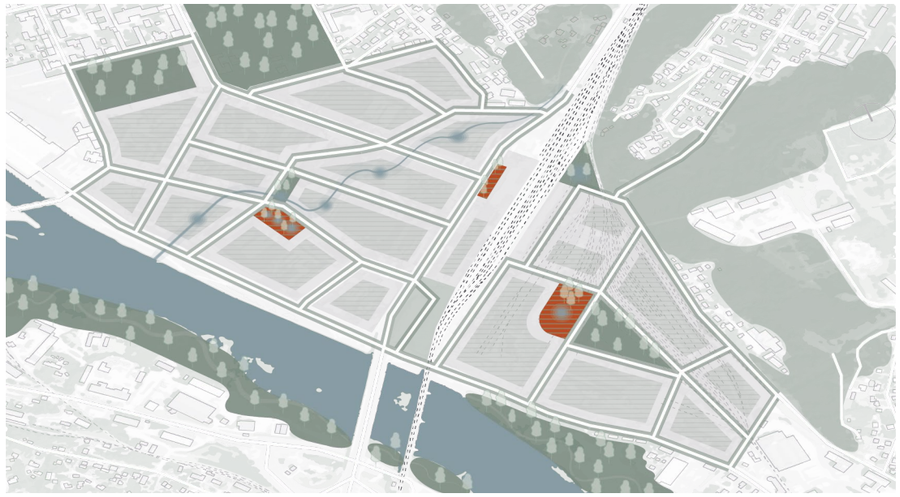


Figure 7.48: Green-blue network (Author, 2023)

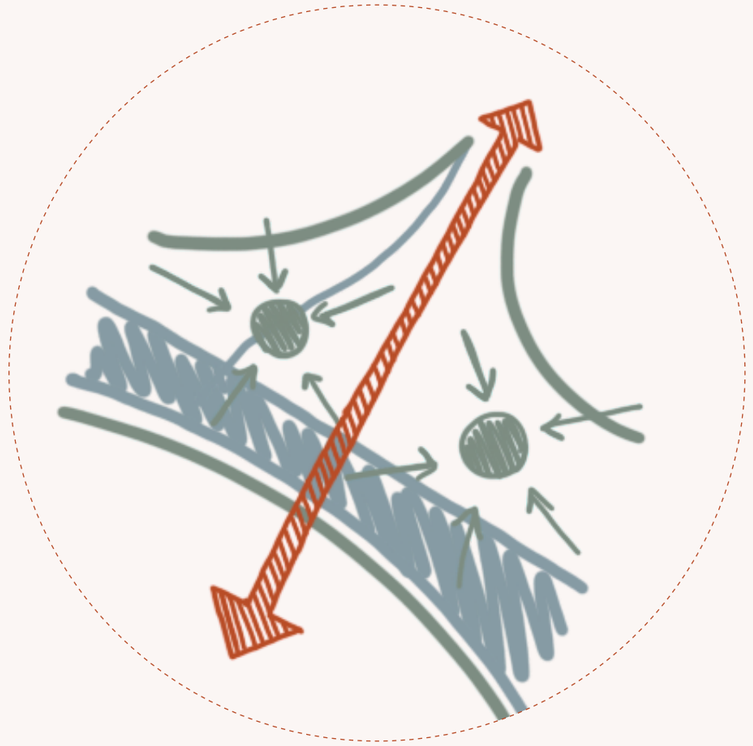
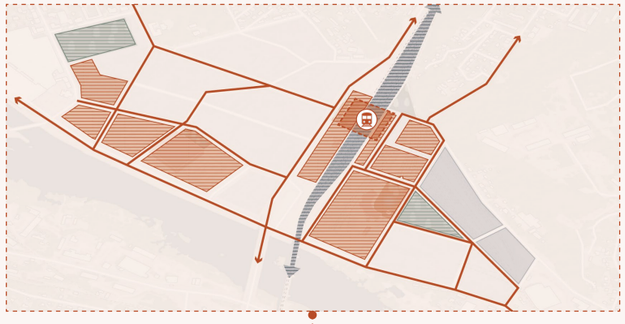


Figure 7.49: Concept scheme of the green-blue network (Author, 2023)

7.7 THE MASTERPLAN

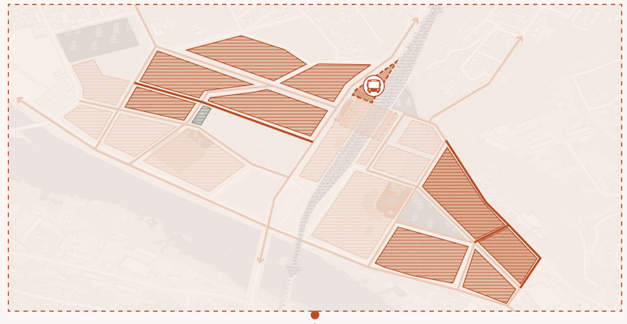
Figure 7.50: Axonometric view of the masterplan (Author, 2023)

7.8 PHASING



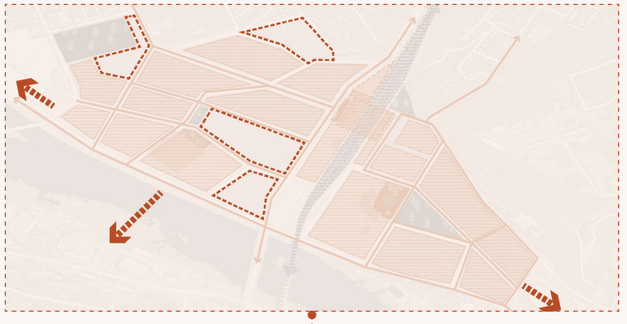
PHASE 1

Phase 1 focuses on the preparation of the station and surrounding area for the Rail Baltica line start, approximately in 2030. Moreover, as the railway maintenance industry is relocated to the outskirts of the city, the first blocks are implemented as well as the central park. For the time being, blocks (in grey colour) are used for parking while the soil is being cleaned. Moreover, the military park in the north is open to the public and redevelopment of the former industrial blocks starts. It is possible to start with these blocks as they are already mostly abandoned and have fewer owners.



PHASE 2

During phase 2, the important change is the relocation of the current bus station. The redevelopment of the current bus station block could happen together with the surrounding ones, along Vytautas Street. Moreover, the blocks on the east side are completed.



PHASE 3

Several areas within the project area are less likely to change: still working (and even expanding) spirits industry, military hospital (in the north, next to the park) and recently redeveloped heritage block next to the water. The project proposes changes in those areas as well, however, the framework allows resilience as the future of those areas is not yet decided.

Figure 7.51: Phasing diagram (Author, 2023)

The chapter demonstrates **the key qualities of the project**. **The Mobility Hub** focuses on the central part of the vision and elaborates on how the hub works. The view of the station square emphasises what is the desired character. **The block** and **the street** are selected as examples. It is important to note that each block and street should take into consideration its unique qualities and embrace them. Therefore, the historic curved street was selected as well as the block from phase 1 that involves railway heritage to demonstrate how those qualities fit into the new design.

8. KEY QUALITIES

8.1 THE KEY QUALITIES

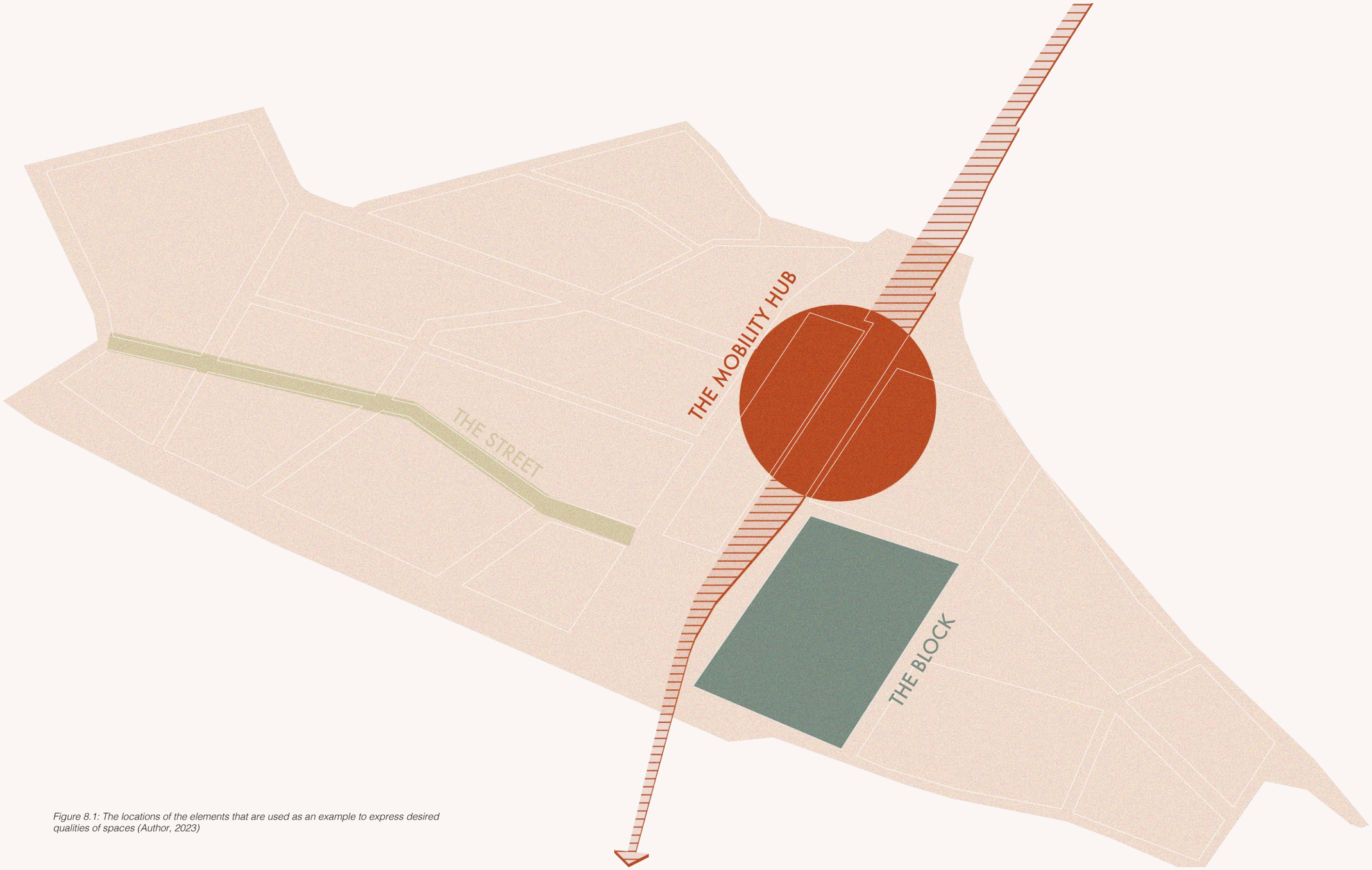


Figure 8.1: The locations of the elements that are used as an example to express desired qualities of spaces (Author, 2023)

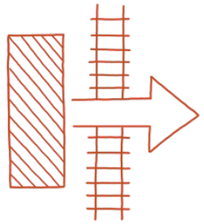
8.2 THE MOBILITY HUB

8.2.1 THE MAIN PRINCLIPLES OF THE MOBILITY HUB

The schemes (Figure 8.2) summarise how the current railway station (Figure 8.3) is transformed.

1 COMBINING THE STATIONS

2 EXTENDING THE HUB



3 IMPROVING ACCESSIBILITY AND LIVELINESS

Figure 8.2: The main principles of the mobility hub (Author, 2023)

Figure 8.3: Kaunas railway station area (Google Satellite, 2023)

8.2 THE MOBILITY HUB

8.2.2 EXPLAINING THE PRINCIPLES

1 COMBINING THE STATIONS

The stations are 400 metres away, however, due to underground passages and other barriers it feels long and unpleasant to walk from one to another. Moreover, as in the future, the need will grow for combined travelling as well as it is likely that the shift will happen and railway station will be used more than the bus station, the proposal suggests combining the stations. There is enough space to fit the bus parking between the street and the rails, northwest of the railway station.

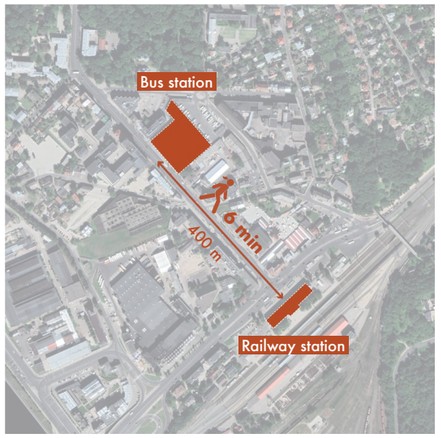


Figure 8.4: Proximity between the stations (Author, 2023)

2 EXTENDING THE HUB

The current railway station clearly faces the centre, however, it is difficult to access the station from the opposite side. Taking into consideration the part of the population living behind the station (including further ones, not visible on the map) and the proposed development, there is potential to expand the station. The new and current buildings could be linked underground (or as the arc form building). Moreover, the extension of the station could fit more needs (shops, cafes, parking, bicycle parking) of the station that are not fitting into the current station.

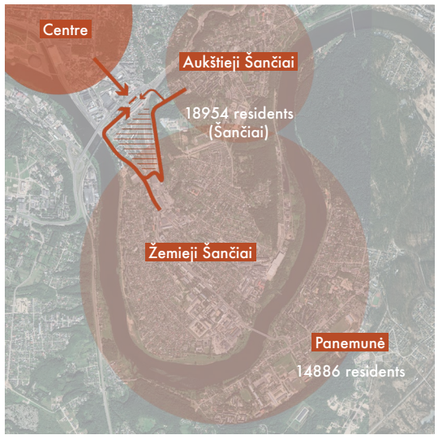


Figure 8.5: Accessibility from the southeastern side of the station (Author, 2023)

3 IMPROVING ACCESSIBILITY AND LIVELINESS

Complicated access to the station (there is no pedestrian crossing, and accessing the station requires going through the underground passage), lack of functions, natural elements, seating and proximity to the busy street results in the unlively and often empty station square.

Figure 8.6: Barriers to access the station (Author, 2023)

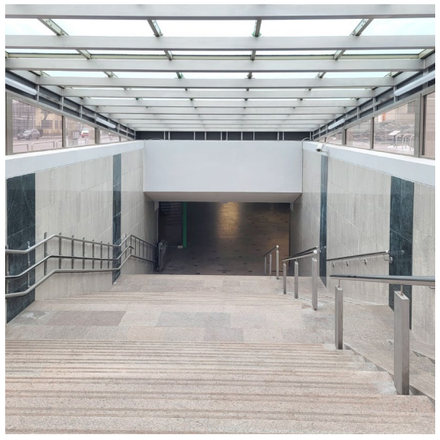
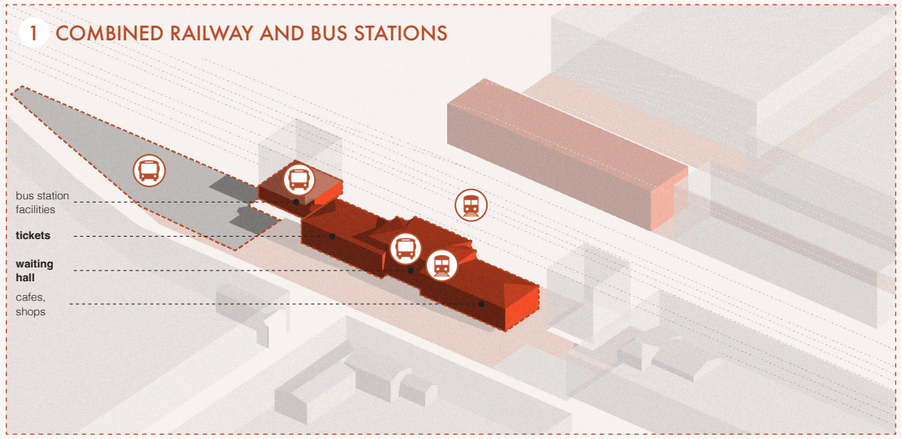


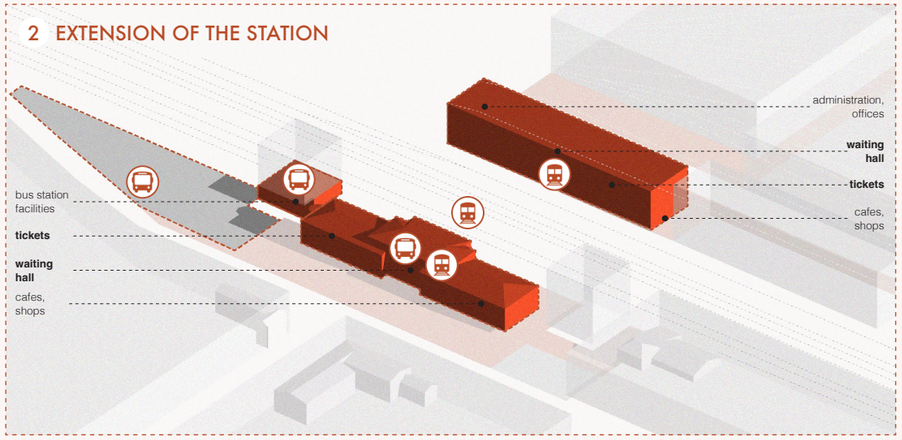
Figure 8.7: Underground crossing to access the station (Author, 2023)

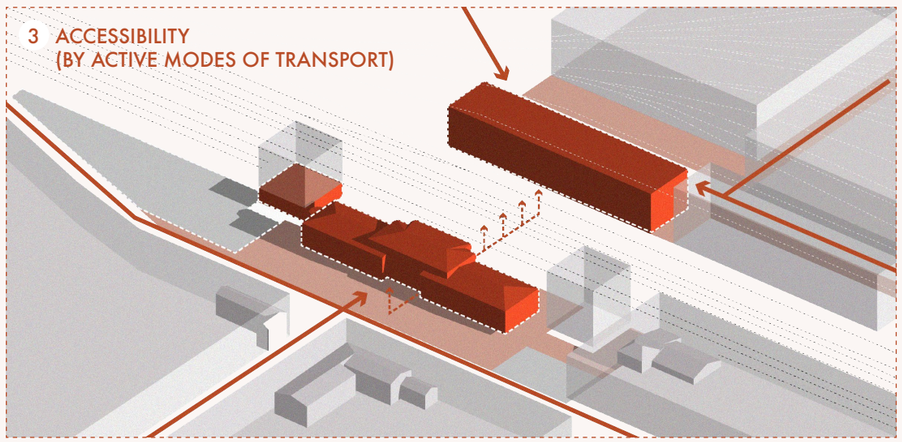
Figure 8.8: Unused station square (Author, 2023)

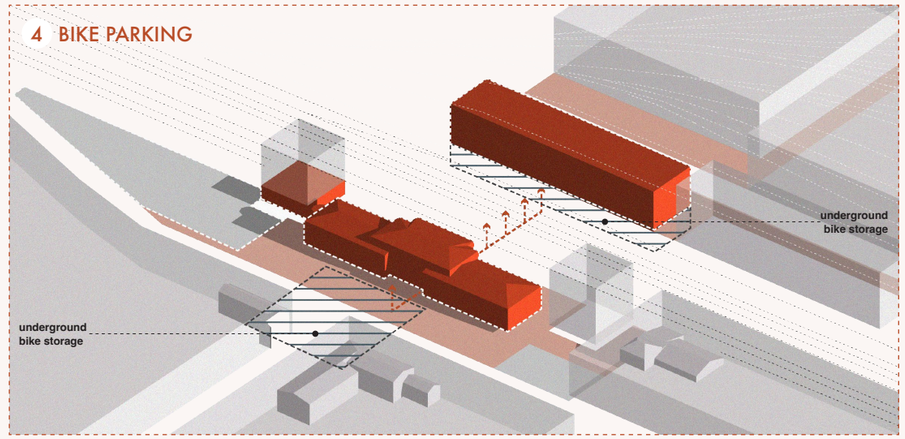
8.2 THE MOBILITY HUB

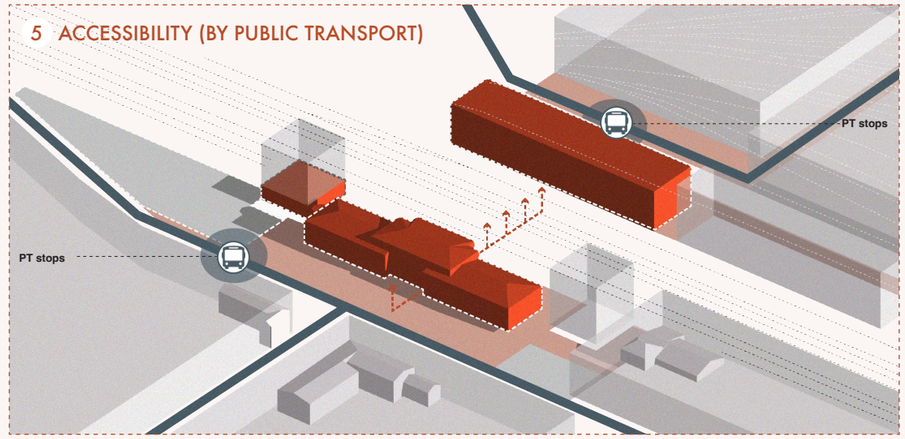
8.2.3 FUNCTIONAL DIAGRAMS

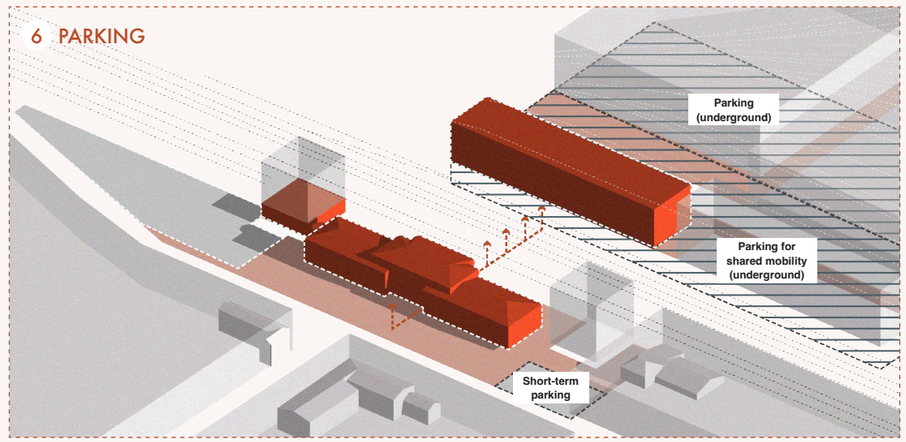












Figures 8.9 - 8.14: Diagrams, explaining how the mobility hub functions (Author, 2023)

Figure 8.15: The view of the mobility hub square (Author, 2023)

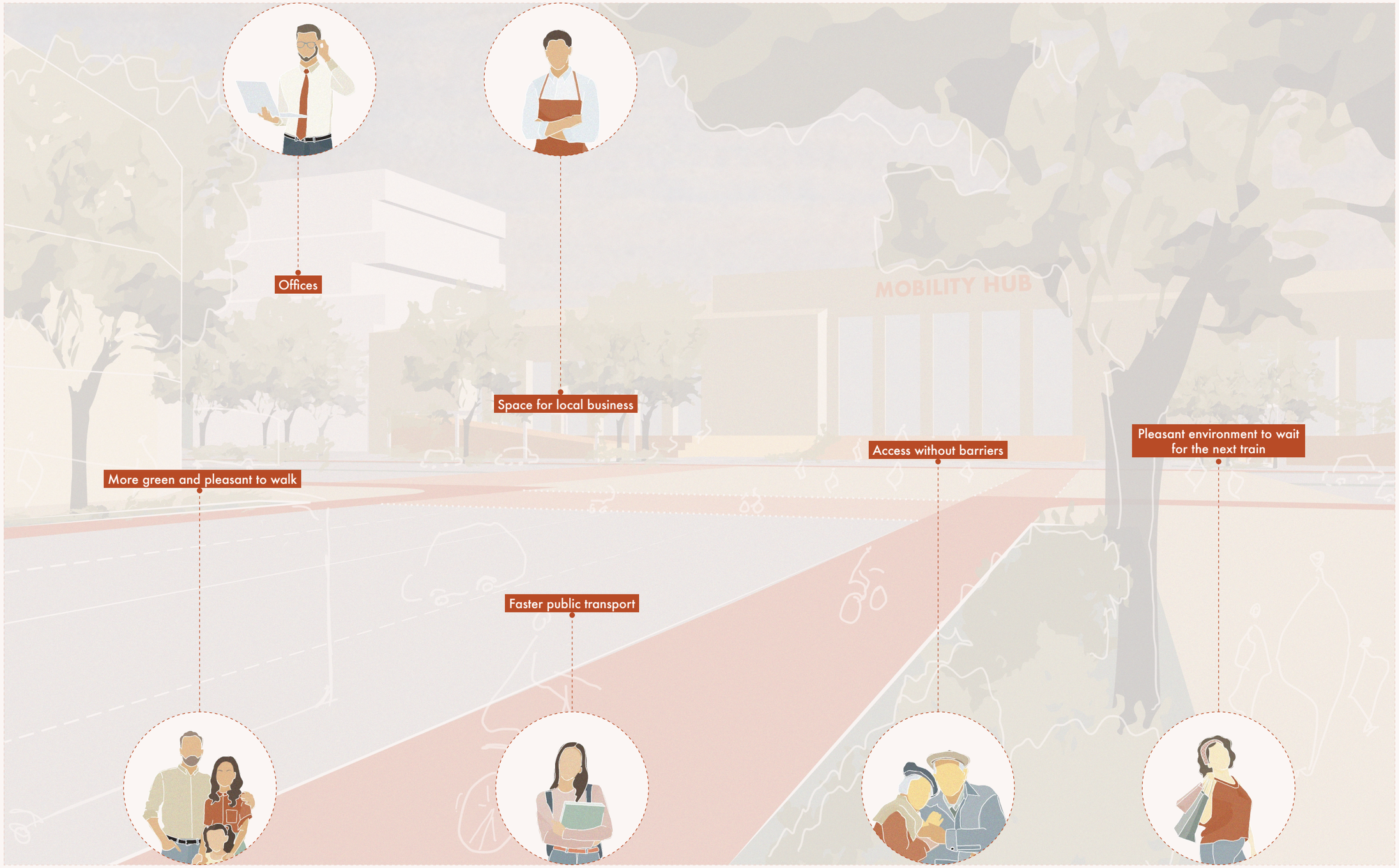
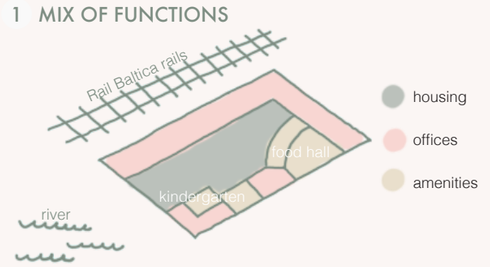


Figure 8.16: Users of the mobility hub square (Author, 2023)

8.3 THE BLOCK

The example block is located (Figure 8.17) next to the rails and close to the waterfront and mobility hub. Moreover, it includes the railway depot building and former power plant buildings that are protected by heritage. The historic buildings are reused for public functions, the rounded depot as a food hall and a smaller power plant building as a cafe, community space and the central element of the pocket square (Chapter 7.5). The mix of functions is proposed within the block, offices are located more on the outline while residential buildings form the inner street. The outline buildings are higher following the principle of Kaunas block. Moreover, there are multiple passages to enter the inner yard, however, the access by car is limited. Parking spaces (during the first stages of the project) are located outside the block, along the streets. Active ground floors are located along the outline, especially on the eastern side of the block and some along the inner main street. A community centre and kindergarten are located inside the block to provide the necessary social infrastructure. This principle should be followed in each block, ensuring enough social functions for the whole development.

Figure 8.17: Location of the example block (Author, 2023)



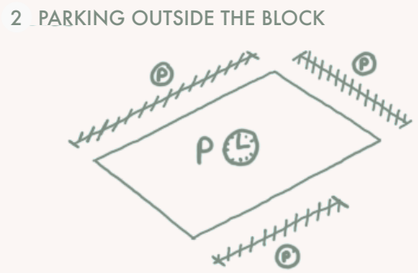


Figure 8.18: Principles of the block (Author, 2023)

8.3 THE BLOCK

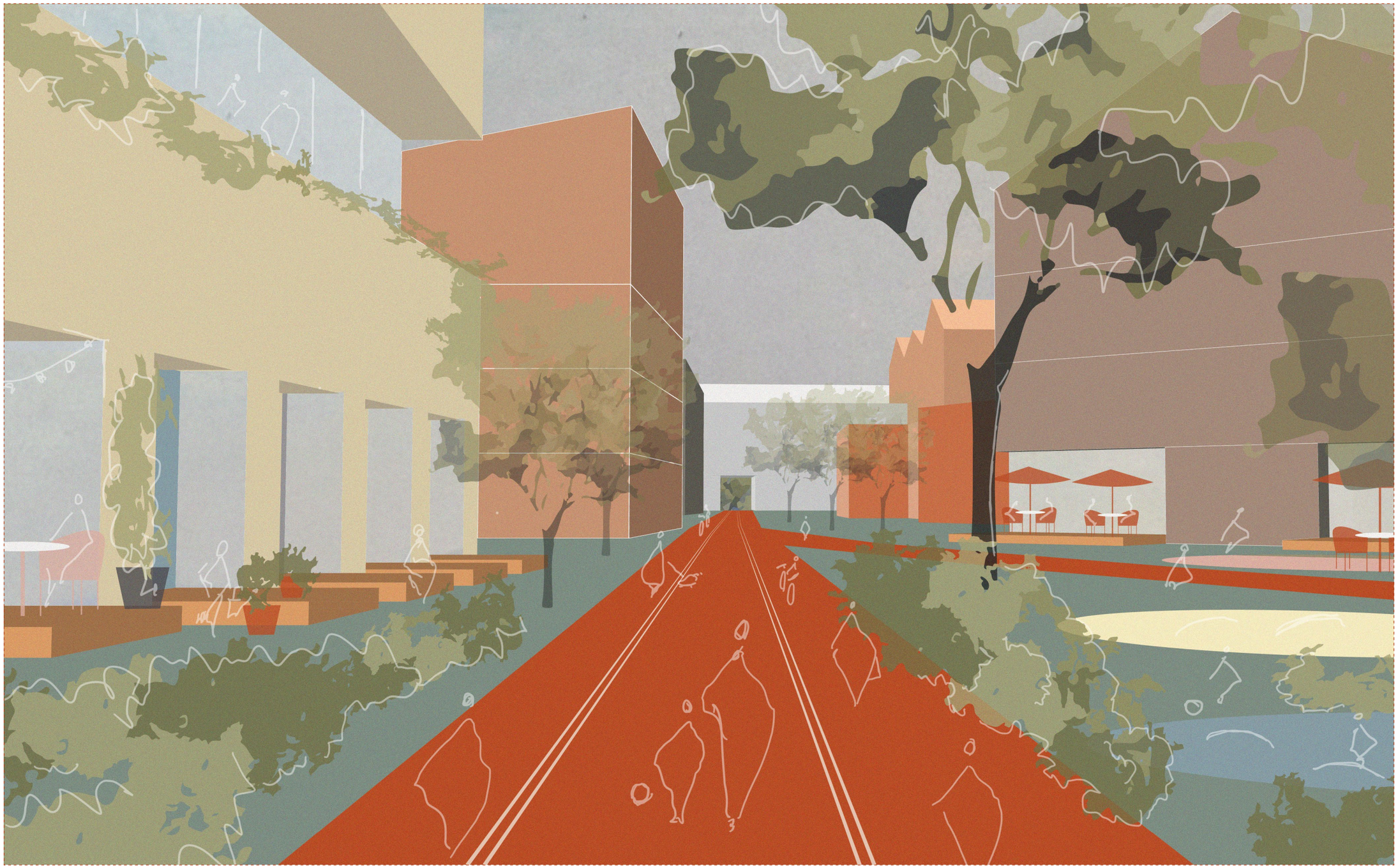


Figure 8.19: The view of the inner yard of the block (Author, 2023)

8.3 THE BLOCK

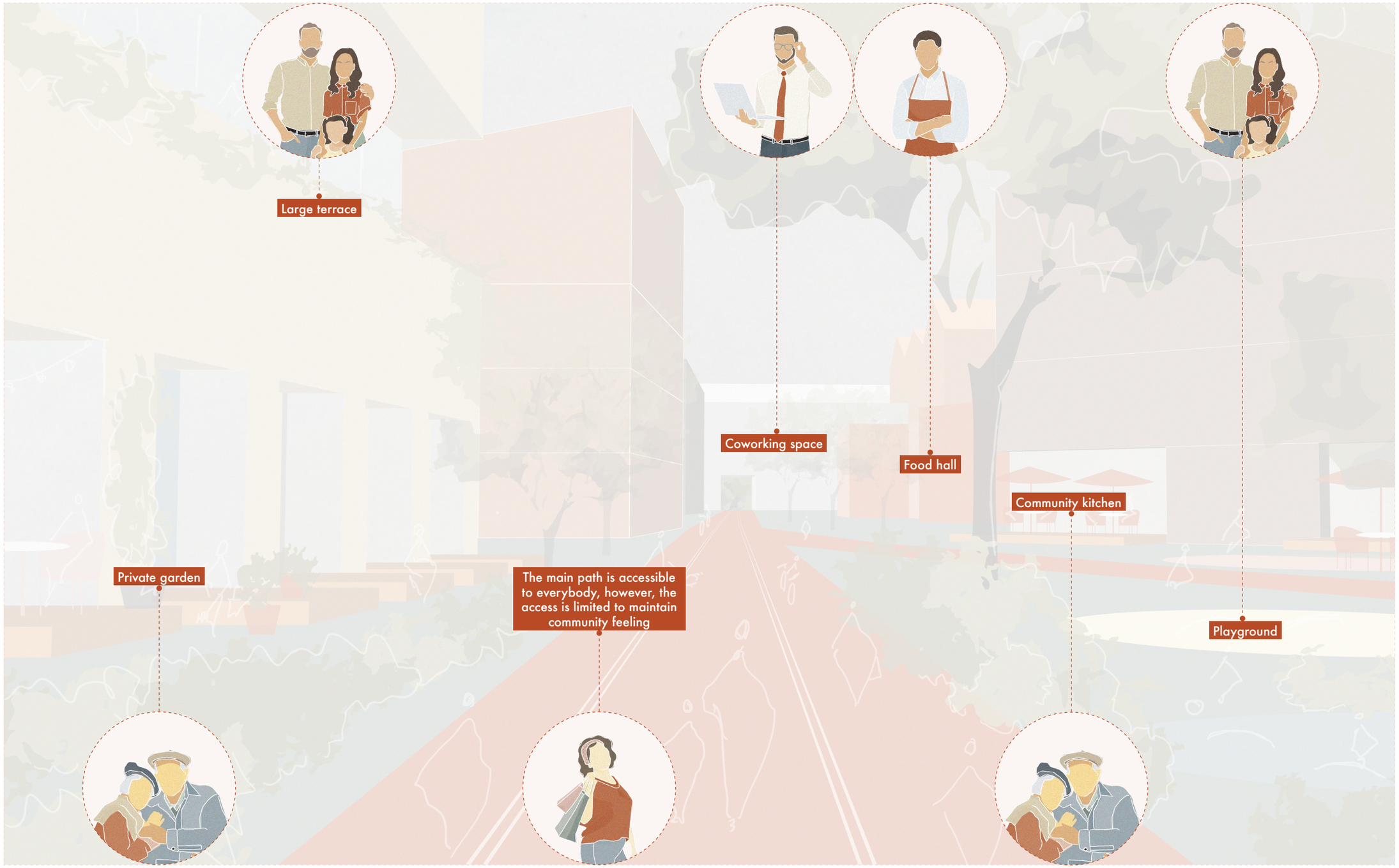


Figure 8.20: The users of the inner yard of the block (Author, 2023)

8.4 THE STREET

Kaunakiemis Street (Figure 8.21) is detailed as an example of the proposed street quality and design standards for the area. The street is unique due to its angular shape which dates back to the XXth century. The shape remains the same in the new proposal, however, there is potential to improve the quality of the street together with the redevelopment of the area. The detailing demonstrates the last phase of the proposal when the densification framework is fully implemented. The proposed mobility scheme (Chapter 7.4.4) suggests transforming the street into a shared space. The proposal for the street combines the preservation of historic industrial identity and the introduction of new, contemporary elements and qualities (Figure 8.22).

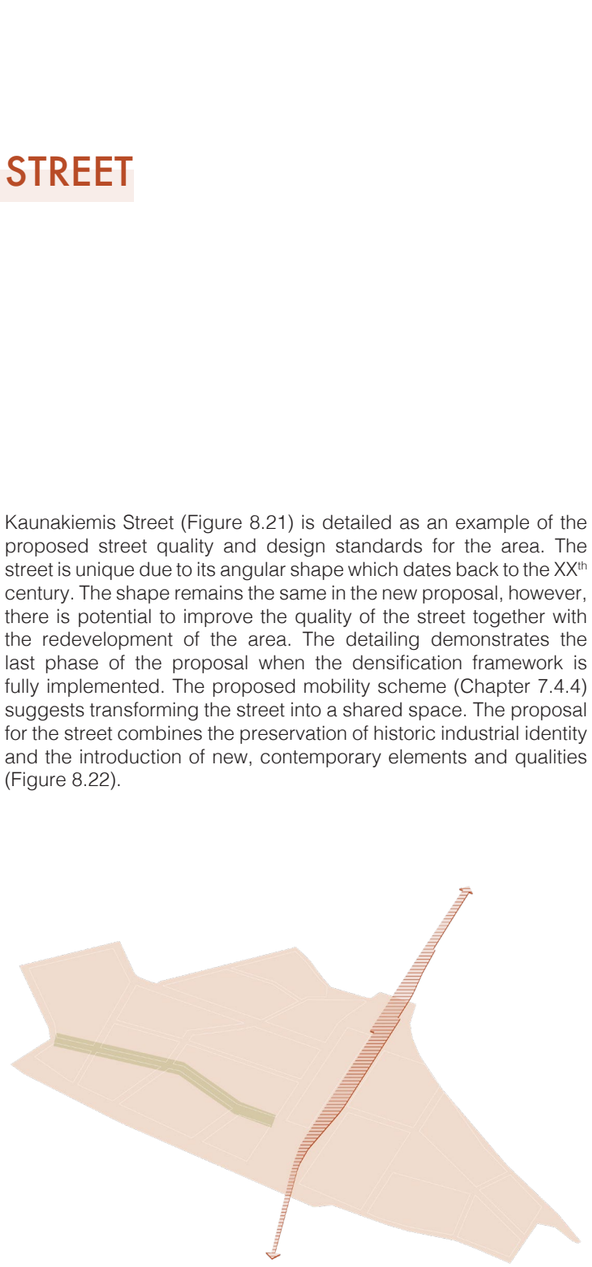


Figure 8.21: Location of the example street (Author, 2023)

Figure 8.22: Principles of the street (Author, 2023)

8.4 THE STREET

Figure 8.23: The view of the street (Author, 2023)

8.4 THE STREET

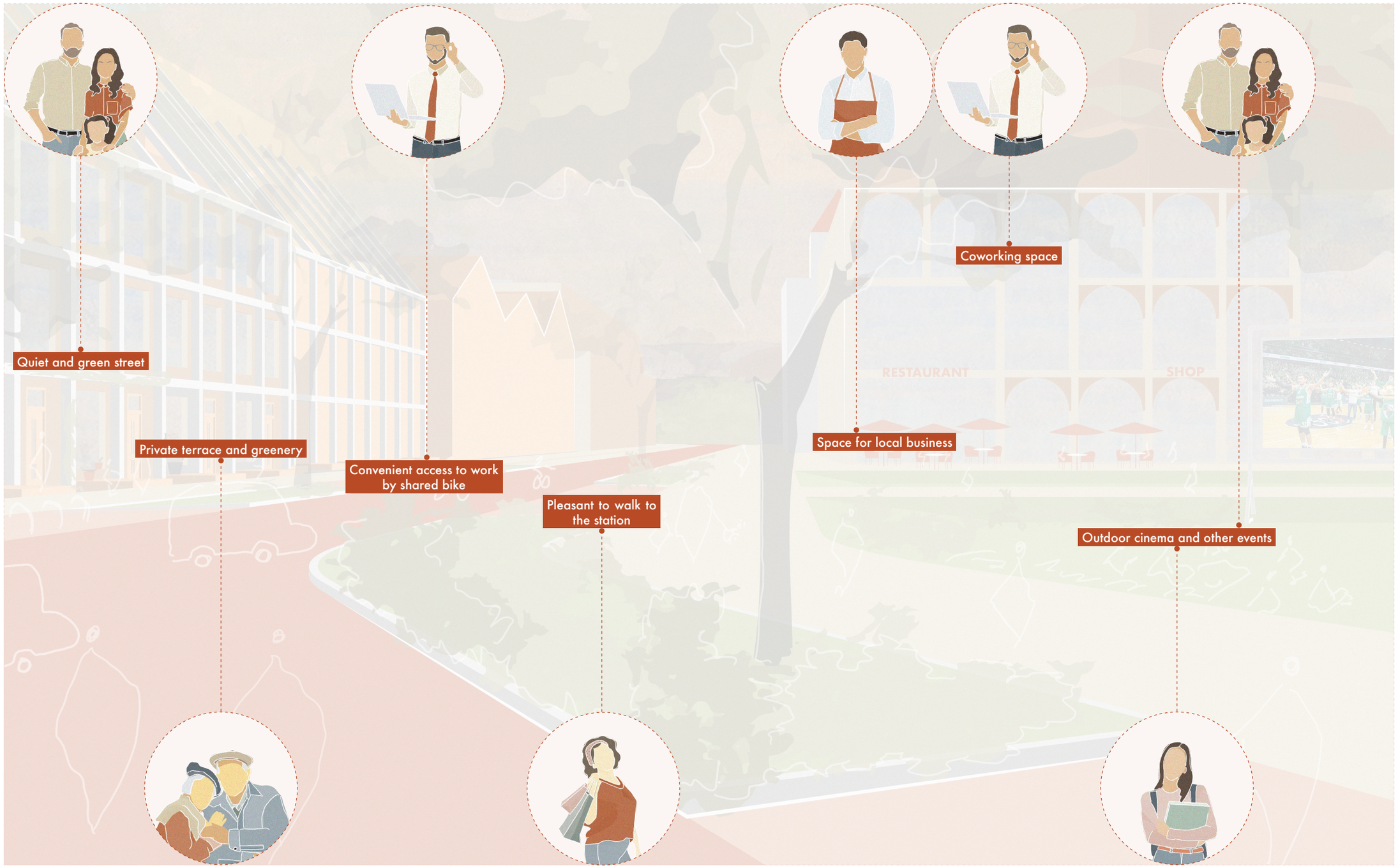


Figure 8.24: The users of the street (Author, 2023)

In Chapter 9, the regional scale is used to **reflect** on the proposal for the Kaunas railway station area. At the beginning of the report, it is reminded that the station area is part of the larger **railway network**. This time, it draws attention only to the Lithuanian part of Rail Baltica to reflect on the station area in comparison to two other international passenger station areas: Panevėžys and Vilnius. Moreover, it compares the current situation of the Kaunas railway station area to the proposal presented in the previous chapters. Further, the chapter provides the **notions for future collaboration** between the cities and the areas in focus.

9. REGIONAL IMPACT

9.1 RAIL BALTICA NETWORK

At the beginning of the report, I stated my motivation for choosing the Kaunas railway node as the key place where the main branch of the Rail Baltica intersects with the one between Kaunas and the capital, Vilnius. However, it is important to look at each station not only as an independent node but rather as a network where changes in one place affect or can complement the whole network. It could be viewed even as a larger system, including the Rail Baltica line in Latvia and Estonia and the link towards Warsaw in Poland. However, for this reflection, I am looking into the Kaunas railway node as a part of the Lithuanian Rail Baltica system. The map (Figure 9.1) shows all the passenger stations and stops that are announced until this day (May 2023). It is important to note, that in some sections, the exact location of the railway tracks and stations are still to be decided, however, I was using the official map by Rail Baltica as a base for the reflection. There are also further plans to include a branch towards the Baltic Sea in the west to connect Klaipėda, the port city, to the network.

As a complex project involving multiple stakeholders, it requires collaboration between the parties. Figure 9.2 demonstrates the cooperation on an international and national level. However, while collaboration is noticeable on a larger scale, the Rail Baltica cities are not yet considered a network that should work together while planning changes in the station areas. Especially considering that in Lithuania, the Rail Baltica crosses 5 counties (Panevėžys, Kaunas, Vilnius, Marijampolė and Alytus counties) and from the 10 main cities (by population size), 5 of them are directly affected by the project (Panevėžys, Jonava, Kaunas, Vilnius and Marijampolė).

When proposing the vision for the Kaunas railway station area, the influence of other cities was not considered, however, it is used to re-evaluate the proposal and propose further notions for collaboration.

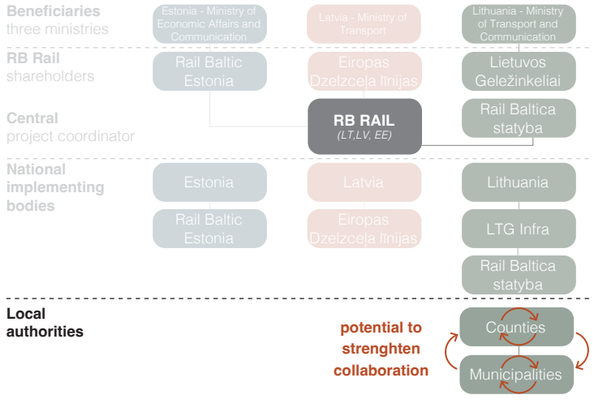


Figure 9.2: Stakeholders involved in the Rail Baltica project (Author, source: www.railbaltica.org, 2023)

1 Vaškai Station
2 Joniškėlis Station
3 Panevėžys International Passenger Station
4 Ramygala Halt
5 Pasraučiai Halt
6 Ručiūnai Halt
7 Jonava Halt
8 Kaunas Airport (KUN) Passenger Station
9 Neveronys Halt
10 Palemonas Station
11 Kaunas International Passenger Station
12 Kazlų Rūda Passenger Station
13 Marijampolė Passenger Station
14 Border Station
15 Kaišiadorys Station
16 Vievis Station
17 Lentvaris Station
18 Vilnius International Passenger Station
19 Vilnius airport (VNO) Passenger Station

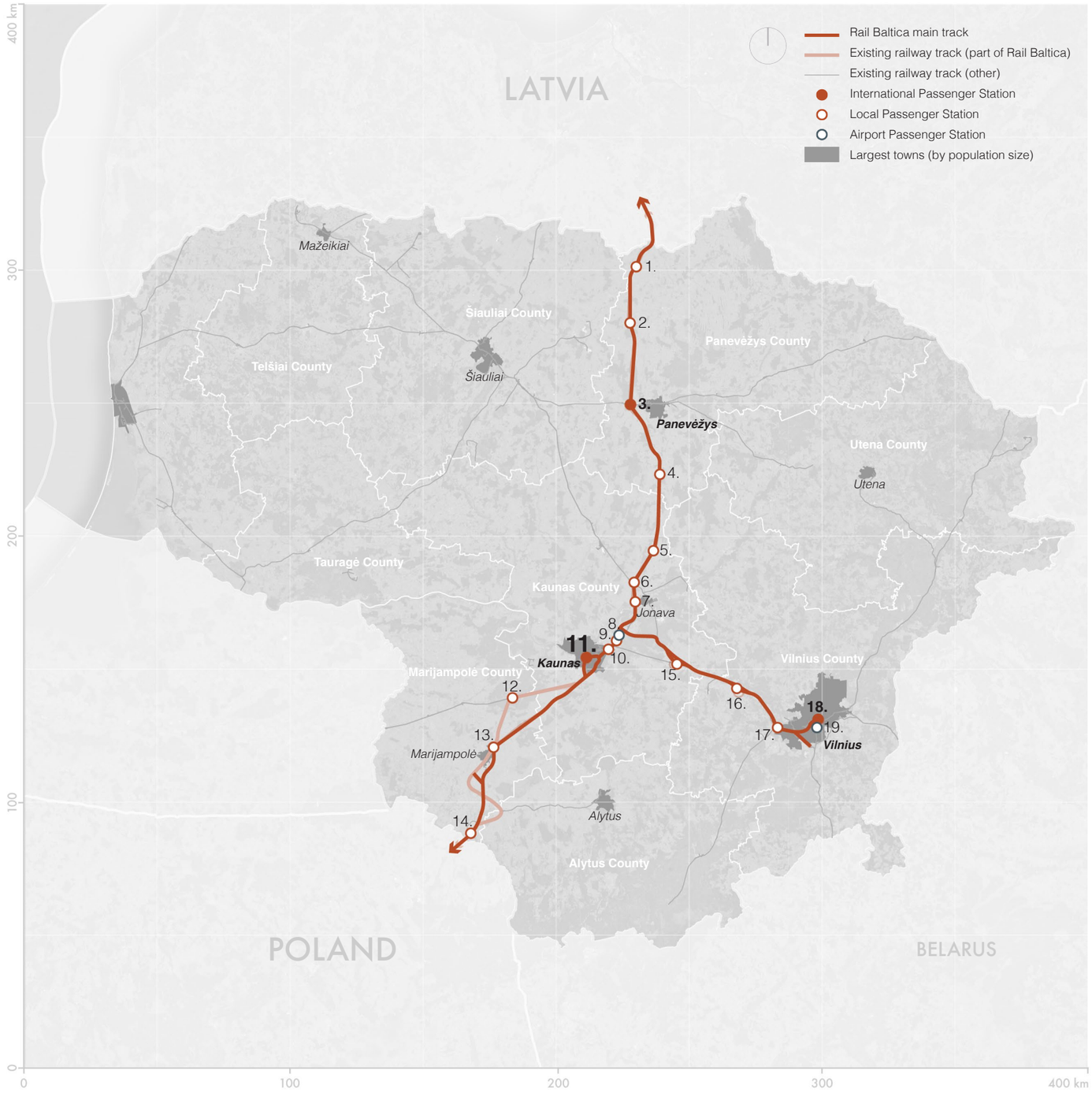


Figure 9.1: International and regional passenger stations and stops of the Rail Baltica line (Author, source: www.railbaltica.org, 2023)

9.2 POTENTIAL FOR COLLABORATION

The proximity between the main stations

After the Rail Baltica will be implemented, commute time by train between Kaunas - Vilnius and Kaunas - Panevėžys will be less than 40 minutes. The Marchetti Principle (Marchetti, 1994) states that people do not want to travel more than an hour a day on average. Moreover, according to Eurostat (Eurostat, 2020), in 2019 average one-way commute time to work in Lithuania was 23 minutes. However, it could be assumed (based on my personal experience commuting from Kaunas to Vilnius while studying and experiences from multiple other sources) that if the commute does not happen daily (for example, hybrid work or study model) and if both starting point and destination are located close to the stations, living, working or studying in another city could be considered. Similarly, there are cases of fellow students at TU Delft, who live, for example, in Amsterdam and commute by train a few times per week. While Kaunas and Vilnius as the two largest cities were always in a certain competition in terms of development and attracting new residents, students and investments, the potential of Panevėžys, the fifth largest city of Lithuania, will increase significantly. Moreover, there is potential to recognise the qualities of each city in the network, adjust the developments around the stations accordingly and aim for collaboration rather than competition.

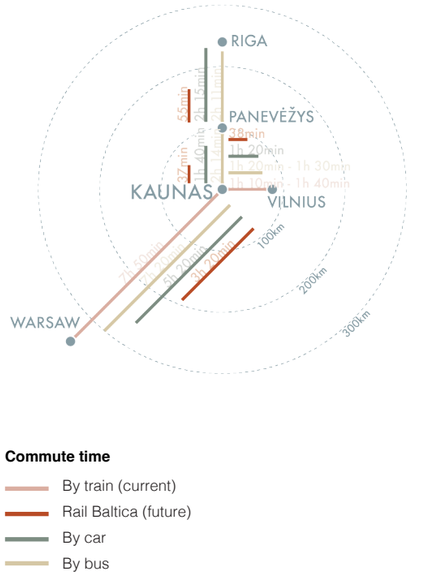


Figure 9.3: Commute time (current and after the Rail Baltica project is implemented) (Author, 2023)

Framework for evaluation

When looking into the development around the station, the radius of 1.2 km is selected as it is approximately 15-minute walking or 5-minute biking distance (Atelier Zuidvleugel, 2006).

Position demonstrates the position within the Rail Baltica network.

Accessibility refers to the location within the city and the ability to reach the station area.

Population and **employees** reflect how densely people live and work in the area. Further, population and jobs could be evaluated more exactly, however, as the analysed areas are changing and in Lithuania there is a lack of public data about predicted numbers of new residents and employees, points are used instead of people/ ha and employees/ ha.

Mix refer to the mix of function in the area. Due to the lack of data, it is done approximately, therefore, the point system is introduced as well.

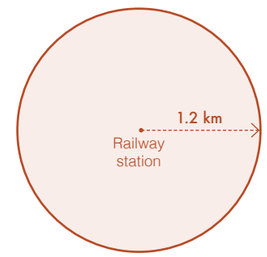


Figure 9.4: Radius used for the analysis (Author, 2023)

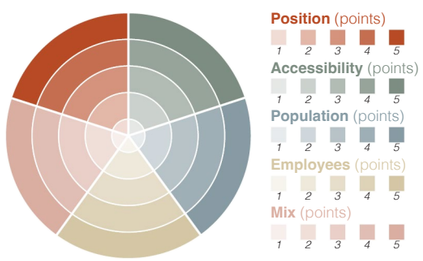


Figure 9.5: Evaluation diagram (Author, based on the methodology by Atelier Zuidvleugel (2006), 2023)

Vilnius Railway Node

Vilnius Rail Baltica station will remain in the same place, however, there is an undergoing project called “Vilnius Connect” that aims to redevelop the station and its surroundings.

Figure 9.6: Vilnius Railway Node (Author, 2023)

Evaluation

The evaluation (Figure 9.7) is carried out while considering the changes which are already planned. As a capital, Vilnius have (and will increase even more) the highest concentration of residents, jobs and a mix of functions. However, it is an additional Rail Baltica branch, therefore, its position score is lower. Moreover, within the city (Figure 9.6), the station is located in the south, while Vilnius rapidly grows towards the north, therefore, the station is more difficult to access for a large part of the population of Vilnius.

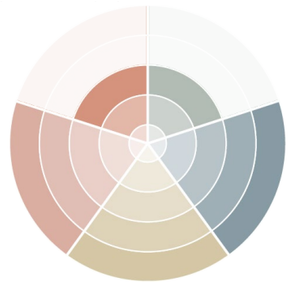


Figure 9.7: Evaluation diagram of Vilnius (Author, 2023)

Panevėžys Railway Node

Currently, the exact location of the new station is not clear yet, however, there are plans to build the station approximately 11 km from the centre of Panevėžys, towards the west.

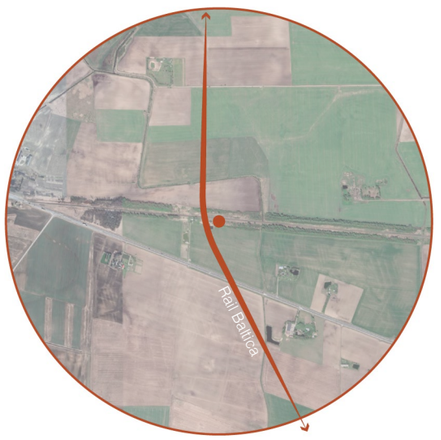


Figure 9.8: Panevėžys Railway Node (Author, 2023)

Evaluation

Due to technical reasons, the new railway station of Panevėžys needs to be located outside the city (Figure 9.8). While it scores very low in almost all the categories (Figure 9.9), the position in the overall network is very high as it is between Kaunas and Riga, the capital of Latvia. The free space around the station suggests high development potential. For example, the distance from the centre and high connectivity could be beneficial if the area would be developed as a production and innovation hub.

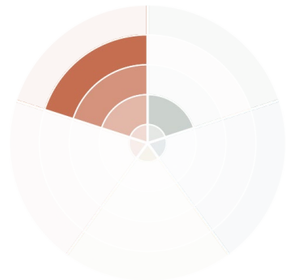


Figure 9.9: Evaluation diagram of Panevėžys (Author, 2023)

9.2 POTENTIAL FOR COLLABORATION

Kaunas Railway Node (current situation)

As previously mentioned, Kaunas railway station will remain at the same place. Firstly, the existing situation of the area is evaluated and then it is compared to the proposal.

Figure 9.10: Kaunas Railway Node (current) (Author, 2023)

Evaluation

The station is quite well-connected, however, before the implementation of Rail Baltica, connectivity by train is quite limited. The station is quite accessible when travelling from other parts of Kaunas. However, the main issue is that it is a monofunctional area that is not used intensively, therefore, it received low scores in the categories of Mix, Population and Employees.

Figure 9.11: Evaluation diagram of Kaunas (Author, 2023)

Kaunas Railway Node (proposal)

The aim is to demonstrate how much the situation will differ from the current situation. For comparison further, the proposal is used.

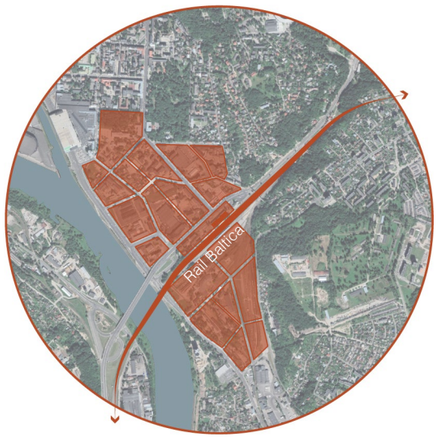


Figure 9.12: Kaunas Railway Node (proposal) (Author, 2023)

Evaluation

After proposed changes in the area, improvements of the mobility network would allow having a very well-accessible station both in terms of local and national accessibility. There would be a rapid increase in the mix of functions, housing and offices, however, the development should be less dense than in Vilnius and more focused on the quality of it.

Figure 9.13: Evaluation diagram of Kaunas (Author, 2023)

9.3 LIMITS TO GROWTH

Population trends

The project proposes to inhabit approximately 17 000 people (around 8000 new apartments). It is a maximal capacity that would be reached when the whole 90 ha area would be redeveloped. It is likely that the project would continue for a few decades until it is implemented fully or that some parts would remain the same (for further elaboration, look into the phasing, Chapter 7.7). Therefore, there is a need for flexibility and constant re-evaluation of the reasoning to build more. There are a few trends that need to be taken into consideration when making the decisions. First of all, the total population of Lithuania is predicted to decrease (Figure 9.17). However, in the future, due to the unstable global situation and climate change, the region might face immigration due to wars or climate crises. The decrease in population in Lithuania mostly affects rural and peri-urban areas, while the largest cities, Vilnius and Kaunas remain to grow (Figure 9.16). That results in the need for more housing and other functions in the cities. Moreover, there are certain migrations within the city and its surroundings. First of all, the tendency of suburbanization (Figure 9.15). Moreover, the most densely populated areas within Kaunas are built during the Soviet period (Chapter 5.4), however, due to poor quality and reputation they are becoming less attractive for young people to live and there is a need for better quality apartments.

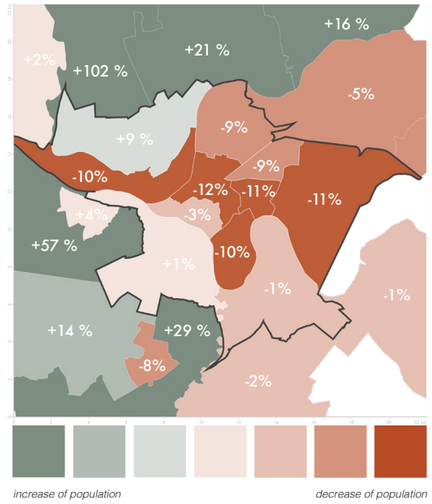


Figure 9.14: Change in the number of residents in Kaunas counties 2011-2021 (%) (Author, adapted from www.geodata.lt, 2023)

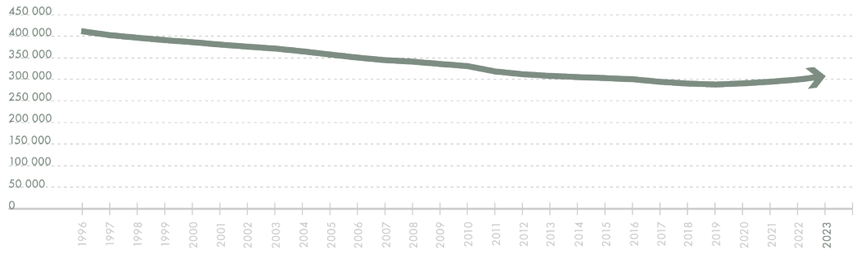


Figure 9.15: Population trends of Kaunas (Author, adapted from www.geodata.lt, 2023)

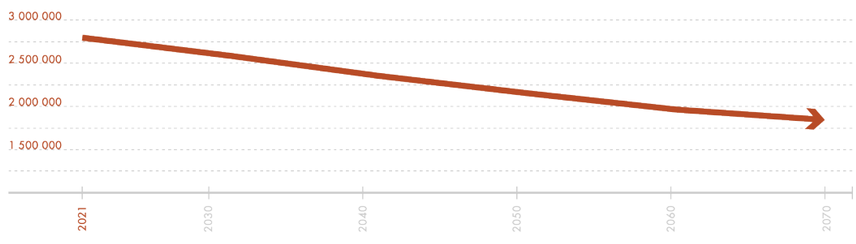


Figure 9.16: Predicted population number of Lithuania (Author, adapted from www.geodata.lt, 2023)

9.4 NOTIONS FOR FUTURE COLLABORATION

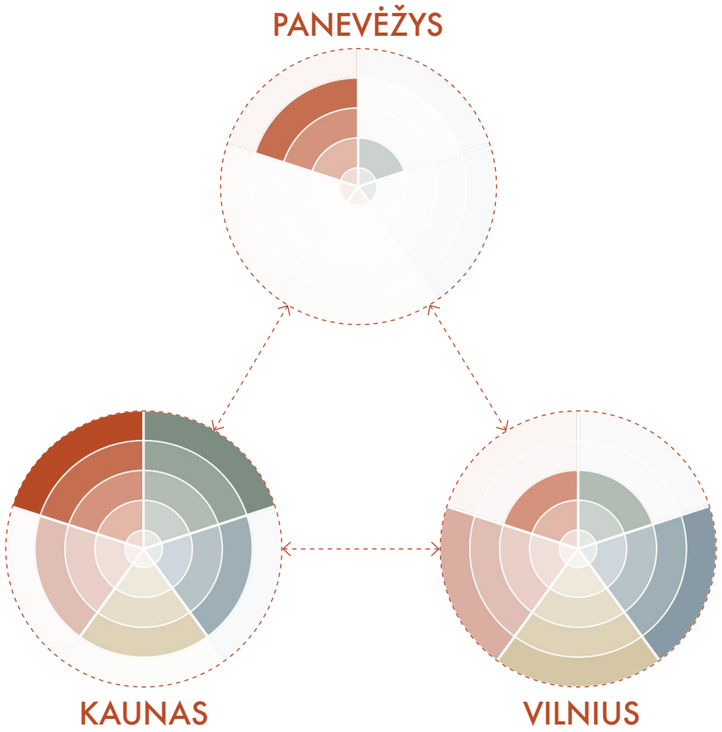


Figure 9.17: Comparison of the Rail Baltica cities (Author, 2023)

To conclude, to fulfil the potential of each city and area of influence around the Rail Baltica station.

Vilnius should continue high-density, mix-use development, however, the meaning of high-density for Vilnius should be determined not only by considering the maximal capacity of the area but also by taking into consideration other cities.

Kaunas has more potential to thrive by exploiting its geographic location and accessibility to attract investments and business to the area. Moreover, to create high-quality, less dense neighbourhoods than Vilnius, which would be a better fit for Kaunas character.

Panevėžys could use the potential of the location of the station to attract industries and innovations to the city. Large-scale businesses, that would be limited to operating in the central parts of the city, could benefit from the Rail Baltica station and proximity to Riga and Kaunas (including Riga and Kaunas airports) and positively affect the economy and attractivity of the city.

Figure 9.18: Mural next to the Kaunas Railway station. The image is mirrored to illustrate people coming back to Kaunas instead of leaving (Author, 2023)

The reflection chapter aims to **evaluate** my work including the process, result and its broader meaning and potential impact. This part includes **mandatory reflection for P5**; however, it also provides my **conclusions** of the project and reflects on the **limitations** and **relevance** of the project.

10. REFLECTION

10.1 CONCLUSIONS

At the beginning of the graduation year, I defined my main research aim, objectives and research questions related to them based on the primary ideas of what I wish to achieve during this project. Before the second review in January (P2), I reviewed and slightly modified those elements as I got a better understanding of the area and the topics. Mostly, it involved being more specific on the scales I am choosing to investigate.

As a last step of the project, I aim to once more re-evaluate the graduation project and reflect on the implementation of the research aim, objectives and ability to answer the research questions. My **research aim** was "to propose a visionary plan for the Kaunas railway station and its surroundings that would accelerate the transition towards sustainable, safe and accessible mobility for all and would integrate the area into the existing urban fabric". The main keywords were visionary plan; sustainable, safe and accessible mobility for all; integrating area into the existing urban fabric.

The term **visionary plan** I adapted quite early in the process when I faced the dilemma of whether the project should propose a bold, statement vision or act more sensitively, realistically acknowledging what could be done. My conclusion was that Kaunas is lacking more visionary approach towards the future of the city; therefore, I chose the first pathway. It was also a personal challenge, as I know Kaunas and the area very well, including existing debates and that it will be a long way to convince the municipality and the citizens to change their approach and habits towards a more sustainable and less car-oriented mobility system. Moreover, it is a current negative opinion and even fears about the ongoing densification of the city, especially from the residents nearby. Due to my knowledge about those topics, I received feedback during P2 and P3 to be more precise about what I call a visionary plan and encouragement to make a statement about what would be an ideal, desirable future. After rethinking the feedback, I elaborated on the term "Visionary plan" and decided that with my project I will aim to spark the debate about future mobility habits, highlight the importance of the Kaunas railway station area, and urgency to act now to make the best use of the opportunities provided by Rail Baltica and, finally, the need rethink how we deal with the heritage in the central parts of the city that would both preserve the heritage and treat it with respect and, in the same time, allow density and mix of a programme to fulfil growing needs to densify the centre of the city.

The research aim highlights two main topics: **mobility** and **urban fabric**. It follows the principle of TOD, stating that mobility and land use planning should happen simultaneously (Thomas & Bertolini, 2017). In terms of mobility, there were three main objectives on three different scales.

On a local scale: **to develop a multimodal mobility hub together with the railway station**. A railway station as a mobility hub is one of the key elements detailed in Chapter 8. My proposal contains combining the railway station with the bus station, extending the station towards the other side of the railway with a proposed second building. Moreover, it ensures accessibility by public transportation, by bike and on foot. It prioritises pedestrians as they are enabled to access the station with fewer barriers. There is bike parking proposed with the possibility to extend it as the need increases. Lastly, it ensures space for short-term parking, space for taxi drivers, shared mobility and some space for private vehicles that could be transformed into larger parking for shared mobility or a bike garage as the mobility habits will shift.

On a larger scale (the project area) the objective was **to contribute to a change in mobility towards a less car-oriented network in Kaunas**. It aligned with my goal to be visionary and propose a more radical shift towards sustainable mobility. First of all, the new blocks are introduced with a minimal amount of parking for the residents and employees (for the transition period, there are alternative spots for parking in the area that would be reduced over time). It is crucial to introduce these new standards together with the functions needed for daily living within walking distance. Moreover, the project proposes to improve the network and quality of public transport and promote bicycles as a form of daily mobility (instead of only recreational usage as it is now). To promote public transport, more bus routes are introduced as well as new bus lanes to prioritise and speed up public transportation in comparison to cars. To make a shift towards the use of a bike not only for recreational purposes, however, as a mean of commuting, a continuous network of bike paths is introduced, however, it should cover the whole city. For this case, I was learning from the good Dutch experience on how to introduce more bike-oriented standards, such as bike paths on both sides of the road where possible, bike lanes or paths uninterrupted where they intersect with the other streets (usually, with streets of less importance). Those rules are introduced as one of the key elements for street design in Chapter 7.

Lastly, the objective on a regional scale was **to create a well-functioning mobility hub as a transition point from the regional to local transportation network**. First of all, to contribute to this objective, both railway and bus stations are combined as one mobility hub and public transport stops are located even closer to the stations to better integrate the networks. As Rail Baltica is planning to include Kaunas airport in the railway network, this will also be better embedded into the system. Moreover, in Chapter 10, it is also shown how Kaunas is positioned within the larger network to emphasise the station area as a part of a larger system connecting various cities and their local systems to the main regional one of the Rail Baltica.

In terms of the second objective, integrating the area into the existing urban fabric, the three smaller objectives were set to achieve it as well. On a small scale, it was **to design the railway station and adjacent public spaces**. First of all, the overall system of the public spaces was created to include the railway station squares (both sides of the station, the existing and the new one) and emphasise their importance in the network. Then, there are more detailed designs provided in Chapter 8. To conclude, the design is focused to create a pleasant and accessible environment for commuters and to ensure the liveliness of the space by introducing a variety of functions. The design is aimed to complement the mobility needs as it is a primary function of the space.

The objective on a larger scale is **to redevelop the area as a new urban centre while preserving industrial identity and heritage**. The key qualities of the area are explored in Chapter 6. In the reflection, I am addressing the need to rethink and re-evaluate the heritage. As there are quite a few buildings or complexes that are protected by heritage it is important to find a way to make use of those areas and buildings while still preserving the valuable qualities. This proposal is mostly visible behind the station, where the former railway depot complex is integrated into newly designed, dense blocks. What is more, heritage and industrial buildings are viewed as potential places to catalyse public life, therefore, a few of the main new public spaces are adjacent to the former industrial buildings where the public programme is proposed. These new attraction points will contribute to the creation of a new centrality together with renewed mobility hub and quite dense mix-use blocks around the station.

The last objective on a large scale was **to redevelop and densify the area in a such way that new living and working quality could contribute to minimizing the need for urban sprawl and suburbanization**. To achieve this goal, there were two main groups of potential tenants identified, young professionals or families who are more likely to choose to live in the centre (a detailed description is provided in Chapter 7), especially, if it is affordable and there are facilities needed for families, such as kindergartens, schools, parks and other recreational spaces. Potentially, it could be people who also work in the area or even work in a different city that is connected to the Rail Baltica network. The second category, elderly people, could be the ones that currently live in large suburban houses, however, they do not need that much space when their kids grew up. To create a valid alternative to the suburban lifestyle, it is important to maintain certain qualities such as greenery, privacy, at least a small private or shared outdoor space (a terrace, balcony, community garden) and larger recreational spaces nearby. If combined with less time commuting to and from home, it could become an attractive alternative.

The research questions and **sub-questions** structure follows the six objectives focusing on the question **"How?"**. The report is organized to demonstrate the process; therefore, it explains the decision-making process and answers the questions on how these objectives are achieved.

To conclude, further in this chapter, it is reflected more in detail on various aspects of the process and results of the graduation year, however, I am positive about the outcome of the project and, in my opinion, I managed to propose a bold yet implementable visionary plan for the Kaunas railway station area. Lastly, these are **the main findings** I would like to highlight. Most of them I had as a primary hypothesis before starting the project, however, during the project I was convinced how important they are for Kaunas.

1. Need to exploit the potential. The Kaunas railway station area due to its location (both in terms of central location within the city and Kaunas central location in Lithuania), accessibility (both well-accessible by the local transportation network and (inter)national one (Rail Baltica high-speed railway line, Kaunas airport, large regional, national and international bus network), interesting and unique identity (rich history of industrial development of the city, more than 150 years of being used for railway needs) and large underdeveloped areas which are quite rare for the centre of the city, has all the conditions needed to

10.1 CONCLUSIONS

become an example of a TOD-principles-based area in Kaunas.

2. Need to act now. As the strategic plan for the Kaunas Railway node is being prepared at the moment, it is time (in my opinion, the time has been for quite a while now, as most of the other international railway nodes for Rail Baltica have started to work on the station areas quite some years ago) to act on a municipal level, to collaborate with the railway authorities, other stakeholders and residents, and to start discussing the future of this area.

3. Need for the vision. There are multiple systematic issues regarding the general, strategic and detailed plans (liet. bendrasis planas, specialusis planas, detalusis planas) in Lithuania. This topic would require a different focus for the graduation thesis; therefore, I am not aiming to elaborate on this. However, it is important to have a vision and a spatial plan that would describe the direction of the development and prevent fragmented, individual projects that would not contribute to the whole. It also requires a well-functioning partnership between municipalities and private developers.

4. Need for the mobility paradigm shift. There is an urgent need for the change of mobility habits towards less car-oriented mobility. The Problematization chapter summarized the planning documents on a European and global level which highlight a large amount of greenhouse gas emissions caused by road transport (compared to other means of transport in the EU), therefore the necessity to act to meet sustainability goals. In Lithuania, in my opinion, there is more potential to shift towards shared (electric) mobility and public transport. Shared mobility is a way to still provide the comfort and privacy of a private vehicle, however, to reduce the overall number of cars. On the other hand, it does not solve the challenges of lack of space, and traffic congestion and it is still more polluting the public transportation (including the recourses needed to produce those vehicles). Bike infrastructure also has the potential to become more popular for commuting, especially shared bikes, electric bikes and scooters. For them, it is crucial to have suitable infrastructure not only for convenience but especially for safety. Recently, shared electric scooters became very popular in Lithuania, however, without dedicated paths, they usually use pedestrian sidewalks and cause danger and injuries. Moreover, due to sessional conditions and hilly landscape, it is more likely that public transport will remain more usable than biking throughout the whole year.

5. Need to rethink heritage. As mentioned previously, heritage became one of the important topics of the project due to the multiple heritage buildings and complexes in the area. Moreover, half of the area is part of the New Town protection zone. I do acknowledge that the preservation of heritage requires special attention and knowledge and the final decisions should be made by the experts in the field, however, from the perspective of an urban planner, I believe that there should be a way to rethink how we preserve heritage to not limit but rather complement new developments. Moreover, following the current geopolitical situation, is it also time to raise questions about the value and need to preserve examples of Socialist realism architecture, such as the Kaunas Railway station building. However, it would require additional explorations, therefore, for this project, as it is currently protected by heritage, I proposed to preserve the building. In my opinion, in the future, the composition (a straight axis towards the railway station, symmetrical character) should remain the same as it holds the historic value of over 150 years, while the station building itself was rebuilt and renovated a few times, therefore, it could be changed further according to the modern needs.

6. Need to build trust. From my work and personal experience working in Lithuania, I am familiar with the popular opinions regarding mobility changes. For a long time, a car was a sign of prestige and comfort and this is a difficult paradigm to shift. Every project that proposes limiting car mobility attracts very negative reactions. One of the examples was the zero-emission zone proposed in Kaunas Centre as a part of the Kaunas Sustainable Mobility Plan in 2020. The critique of limiting car traffic is also related to the negative image of public transportation. It is considered to be slow, poor quality and used mostly by pupils, students and elderly people (it is my observation, based on various experiences working in Lithuania, participating in meetings with citizens, reading online articles and comments under the articles of related topics, etc). Therefore, there is a need to be quite careful while communicating about certain changes, introduce not only limitation-based policies but rather invest in education, changing habits from the early days, discuss the need and importance of a more sustainable transportation system, highlighting the benefits of a car-free lifestyle (such as saving time on commuting, health benefits to walk or bike and so on). It is also time to start pilot projects of car-free neighbourhoods (such as the ones in my project) to demonstrate how this lifestyle can work and contribute to a less polluting future.

Figure 10.1: The project location (Author, 2023)

10.2 LIMITATIONS AND TRANSFERABILITY

To make the project feasible within the time limit of one academic year, certain limitations were applied and several topics could be developed further in the future. First of all, due to the chosen studio (Design of the Urban Fabric), I narrowed down my focus to one railway node, Kaunas central passenger station, and aimed for a more design-oriented thesis. However, as I emphasised in Chapter 10, there is potential to develop the main railway nodes simultaneously, taking into account their impact on the larger railway system. Moreover, due to limited time, certain parts of the design are less detailed. It is also due to the aim to propose a framework that allows certain flexibility.

Secondly, the project is based on the assumption that the number of residents in Kaunas will grow and other behaviour and mobility-related hypothesis. However, I do believe that successful projects can have a positive influence on immigration and emigration trends and shift the habits of the citizens. Moreover, what happened with the COVID-19 pandemic and the shift towards remote work demonstrated how certain aspects of daily life can immediately change. This topic was not much elaborated on in the project, however, it could be developed further to question the need for office space and the transformability of the building typology to react to certain shocks.

What is more, to remain visionary, I did not focus on the current planning regulations in Lithuania, however, they could be explored and even questioned further. There should be a special focus on street standards, as some of the proposed elements are not yet fully recognized in Lithuania, such as shared streets (Vilnius is experimenting with it already). Moreover, the proposal for the transformation of the heritage areas does not fully align with current regulations that would be much more limiting in terms of new development in heritage zones. I do recognize this and the fact that there needs to be a more detailed study of their valuable qualities. However, as previously mentioned, this was done on purpose, to explore and challenge their potential.
Moreover, the project is not focused on a participatory approach, there was no direct involvement of citizens or other interested parties. However, their interests were taken into consideration based on my knowledge, statistical studies, popular opinions from media and social media and my experience working in Lithuania. Moreover, as I am quite familiar with the area, I do consider my personal experience as a user experience. Also, to involve actual citizens and other stakeholders in a way that would contribute to my work would take time and resources that would work only if I made it an important part of the thesis. However, I did choose another direction due to the aim to remain visionary and propose solutions that would not yet be easily accepted by the public (I reflected on this in the Conclusions chapter). I do see my project as a starting point that could spark the discussion about the future of this area.

Lastly, as open data is still a quite new concept in Lithuania, there is a lack of accessible data, for example, plots, public transportation and stops, residents and jobs data are provided only as a grid (the smallest grid is 100x100 metres). Therefore, some exact calculations were impossible. It could have been done if the necessary data would be accessible. Redrawing the data in QGIS would have been too time-consuming and not accurate.

To conclude, several topics of the graduation project could be elaborated further. What is more, it is important to state, the project results should not be directly applied to a different site with a similar case. The final result is embedded into the specific local context. The identity, configurations and limitations of Kaunas were taken into account; therefore, it should not be directly transferred to another location without considering those aspects. However, by using the approach and framework of the analysis and experimentation processes, a place-based TOD proposal could be adapted for the different areas.

Figure 10.2: The project location (Author, 2023)

10.3 RELEVANCE

From the societal point of view, as the Rail Baltica high-speed rail is being constructed at the moment, the project is a highly important and unique opportunity for Lithuania. First of all, completing the missing part of the European railway network for passengers, goods and the military becomes crucial in the time of war in the region. It will bring the Baltic countries closer towards Western Europe. Secondly, there is a chance for a paradigm shift from the car-dependent mobility system towards sustainable mobility. This shift is crucial to target climate change threats. For a long time, car ownership was considered to be not only a necessity but also a sign of status and wealth in Lithuania. It is still common for the family to own more than one car and to use it daily. Moreover, public transport, especially buses and trolleybuses are criticized for being poor quality and uncomfortable and is often used by less wealthy social groups The site of my graduation project has the potential to highly contribute to this paradigm shift. The railway station area is where the local and regional mobility systems intersect making it the most connected node in the city. The project aims to experiment with how to create a well-functioning multi-modal hub to ensure a sustainable, accessible and safe mobility network in Kaunas while ensuring an inclusive and just transition. What is more, better connectivity to Central and Western Europe could attract new foreign investments and create more job opportunities. For a shrinking country like Lithuania, where emigration, social inequality and poverty levels are rising, creating an attractive area for business around the railway station could contribute to long-lasting economic and societal benefits. **To conclude,** I chose to work on this location and topic as I believe that the Rail Baltica project could contribute to positive societal changes for Lithuania, however, to take advantage of those opportunities, we need to act now.

Figure 10.3: The project location (Author, 2023)

From the scientific point of view, my Master's thesis follows the graduation trajectory of design. Therefore, the research by design is an important part of the process. My goal was to experiment with quantitative data (especially, with the numbers and parameters defining density) and use it together with the qualitative approach where identity, observations and qualities of the space are used to judge the options. Therefore, it is a combination of objective and subjective components that are merged into my design proposal. This approach could be further developed and applied in various locations. What is more, the project aims to bridge the knowledge gap between a data-driven approach towards mobility planning and subjective user experience. Lastly, the concept of TOD is not widely used in Lithuania, it lacks even a translation of the term and key literature, therefore, the project contributes to informing about the concept and highlights the potential to explore it further in the Lithuanian context.

Figure 10.4: The project location (Author, 2023)

From an ethical perspective, it is important to highlight, that a large part of the area belong to private individuals or companies, however, the proposed new development considers that. The changes in the area should not negatively affect the owners of the land, however, as there are larger societal benefits of densifying the area, it should be a fair system of compensations and benefits that do not force them out of the area and provide sufficient alternatives. Moreover, the new proposal is created in a way, that allows phasing of the development and certain blocks could be implemented further in the future if there are no other possibilities.

Figure 10.5: The project location (Author, 2023)

10.4 REFLECTION

Reflection on the final product

Previously, I reflected on the implementation of the research aim and objectives. It was my chance to look back into what I was aiming to do before P2 and if I managed to achieve my goals. Even though I was following more experimental research and design processes and allowed myself not to be limited by the objectives, when I looked back, I noticed that my final result is well aligned with them. However, I was more focused on the local scale and the regional one was done with less detailing.

I decided on **the topic** only at the beginning of September, for quite a long time before, I was considering focusing on the Soviet housing estates in Lithuania. However, I am glad about my choice as during the year I was more and more convinced how relevant is the topic at the moment. Especially, considering that the actual proposal for the Kaunas railway node is not yet prepared. Moreover, this topic allowed me to deepen my knowledge about mobility, and, in my opinion, the Netherlands is a perfect place to observe and learn from the good practices, especially regarding the bike infrastructure. I do believe, that my topic was a good fit for the Design of Urban Fabric studio. The topic of the studio this year was “Embracing Plurality – Growing Porosity” and even though I did not specifically focus on this, I am still convinced that the topic fits quite well and as it is stated in my graduation plan, “it is an open, porous area in Kaunas, currently mainly used as an infrastructure corridor. Due to its central location, there is potential to shape the space in such a way that it would better accommodate the needs of the city”. Moreover, the approach of the studio that is location-based, focused on explorations and eye-level experiences, while still including multi-scalar, data-driven-based research and design is well-suitable for me.

Reflecting on **the final result**, I am quite satisfied with the outcome. I am convinced that the visionary approach was the right choice, however, I still feel that my attachment to the location stopped me from being too visionary. It was quite a struggle in the process to combine a bold approach and my knowledge of reality and difficulties, especially to make a shift towards sustainable mobility. However, I believe that personal experience was also a benefit to preventing insensitive and ignorant approaches that would be very visionary, however, completely unimplementable. During the process, I faced multiple dilemmas about whether to preserve certain elements (such as buildings, and historic street structure that was quite unorganized in the part of the area). I also received an observation, that Lithuanians seem to be very attached to the heritage without being critical about its value. However, I do believe that is highly related to the history of Lithuania and historic traumas. During the Soviet time, it was a goal to rebuild historic locations with modernistic buildings, and removing heritage was also an attempt to remove the history of an independent country. Therefore, any plans to drastically change (especially straighten the street network or rebuilt areas completely) the urban fabric, remind me of that. Therefore, in my project, talking about the identity and values of the current area vas highly important. In the end, I believe that I still managed to achieve the combination of visionary and sensitive approaches quite well.

Reflection on the approach and the process

I would describe **the process** of the graduation year as “structured chaos”. It was done quite consciously, as I wanted to avoid repeating the workflow I have done previously in my work as an urbanist and to use the study years for a more experimental approach that usually is not suitable in practice. However, it was also a challenge to deal with the freedom which lead to indecisiveness, was time-consuming and prevented me from making certain decisions quickly. I also had to learn to trust the experimental process and at some points, it was quite difficult, however, it led to results that surprised me and worked well in the end. One of the examples would be using Excel to test the block. It encouraged me to explore Kaunas New Town block which became the key element of my design. At that point (the beginning of March), the design started to fall into place and the pathway was clearer afterwards. Moreover, using Excel as a research and design tool was one of the most surprising elements, as I have never considered it as a tool for design, however, it is something that helped significantly. Instead, I was planning to work more on QGIS to do data-based research and design. At the beginning of the academic year, I noticed that most of the data I needed was not open data yet, therefore, I did only some of the data-driven analysis, for example, block size analysis. Unfortunately, it required manually inputting the data, therefore, it was quite time-consuming. An analysis was also made in QGIS using datasets with population and job data. Moreover, I wished to learn more about network analysis and Space Syntax, however, due to time constraints I had to make priorities and it seemed to be less relevant to the project. What is more, in the beginning, I was planning to do more in-depth on-site analysis involving spending

Figure 10.6: The process (Author, 2023)

10.4 REFLECTION

quite a lot of time at the location, observing, sketching, and using Ethnographic research as a method. However, due to the schedule, the site visits were planned for December and March and I did not take weather conditions into account. Due to cold weather and snowstorms (even at the beginning of March) and unfortunately being sick while I was in Lithuania, I was not able to spend much time outside observing the area, especially sketching outside. I also planned to spend more time travelling by train, exploring how people perceive the station while arriving or leaving Kaunas but that was also not possible as much as I wished. Moreover, originally, I planned to arrange a tour of the still functioning railway depot area and interview Lithuanian Rails authorities, other stakeholders and citizens. Due to the same limitations, it was not done. It was also my fault due to not planning ahead and partially because I decided that the participatory and visionary approaches would be too difficult to combine and I had to make a choice.

What is more, during the process, I gained a better understanding of density and the various parameters that define it. For this, case study analysis worked very well as a base to understand various qualities. Also, I mostly chose the projects that I visited before and was able to observe and experience their qualities in person. During the process, the theory was used to provide ideas or validate hypotheses. The base was the theory of TOD, however, even though the main ideas were very important for the project, the exact numbers and parameters found in the literature seemed to vary and be quite context-specific, therefore, I chose to test and be critical about what is suitable for Kaunas. Moreover, quite a lot of sources focused on regional TOD, including frameworks for collaboration, coordination and stakeholder engagement which are briefly explored in the Regional Impact chapter; however, it is not the main focus of the thesis. **To conclude,** the experimental approach was the right decision. It was quite challenging, especially with the time management, therefore, I am glad that it led to a clear final vision.

I would also like to reflect on **the topic** and how the understanding of it shifted over the year. In the beginning, I had quite an ambitious approach as I aimed to develop multiple station areas, at first Kaunas, Vilnius and Panevėžys railway nodes, further focusing on Kaunas both passenger central station and regional station on the outskirts of the city including the freight terminal in Palemonas (Kaunas). However, during P1, I received feedback that encouraged me to have a clearer focus; therefore, I chose only Kaunas main passenger station as a key element. The wish to integrate the regional scale remained, however, at that point, I was not sure how. Therefore, the guidance from my mentors allowed me to find a way to use it as a reflection tool and I am glad about this decision. Moreover, originally, I was considering only the area behind the railway station, as I would take the industrial area in front of the station as given. However, the feedback from my mentor draw my attention that having industry, especially former industry, within the centre of the city is not aligning with the TOD and I decided to include that area in my project as well. This allowed me to choose the scope of the project that is feasible in a given timeframe.

Personal and professional growth

During my graduation year, my aim as an urbanist was to redefine my value system to set my priorities, especially while working on a site that is familiar to me since childhood. I aimed to learn how to act in a sensitive, site-specific way while combining innovation, experimentation and having a bold approach towards the future. Moreover, my previous knowledge about urbanism was mostly based on work experience, therefore, one of my goals was to strengthen my theoretical knowledge about the field. However, even though I spent quite some time studying theory and gained a better understanding of TOD, density, and public space design, most of my decisions were based on experimentation and intuition rather than literature. I am especially glad to learn more about density and to learn how to quickly calculate various parameters of the space (space needed for cars, bicycles, how many residents would live, etc). What is more, from the Delft Approach intensive, I started drawing and sketching by hand quite a lot and during the year I noticed how my skills significantly improved and it became easier to communicate my ideas through drawings.

Figure 10.7: The process (Author, 2023)

The chapter provides information on the **figures** in the report and their sources and used **references**: literature and planning documents. I would like to note that if the source of an image or text is not stated, it is my work. If the mistake had been made, please contact via email, at ruta.vitkute95@gmail.com. What is more, as the project location is in Lithuania, multiple used sources were in Lithuanian, therefore, names of literature and planning documents are provided in Lithuanian if there is no official translation to English.

11. FIGURES AND REFERENCES

11.1 LIST OF FIGURES

The list of figures specifies the exact source when possible. Moreover, ownership is stated when there were multiple sources included in the figure.

11.1 LIST OF FIGURES

11.1 LIST OF FIGURES

11.2 LIST OF REFERENCES

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