

CHILD FRIENDLY CITIES

THE CASE OF WROCLAW IN POLAND



STEF PIETERSE

Graduation Studio Complex Cities

P4 report

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Main mentor: Dr. Roberto Rocco de Campos Pereira

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TABLE OF CONTENT

i.	<u>Introduction</u>	8
I.	<u>The livability of children in Wrocław</u>	II
I.1	<u>Wrocław's urban development</u>	12
I.1.1	A brief history.....	12
I.1.2	Wrocław in the (near) future.....	15
I.2	<u>Urban change and the livability of children</u>	16
I.2.1	The reliance on car use.....	16
I.2.2	Reflections on the livability of children	18
I.2.3	Conclusion.....	19
I.3	<u>Improving the livability of children</u>	20
I.3.1	Sustainable urban mobility measures.....	20
I.3.2	The attractiveness of public space.....	21
I.4	<u>The ineffectiveness of measures</u>	22
I.4.1	The ability of play and move.....	22
I.4.2	Conclusion.....	23
I.5	<u>The development of a vicious circle</u>	24
I.5.1	The outflow of families.....	24
I.5.2	Wrocław's peripheral development.....	24
I.5.3	Children's need to travel by car.....	25
I.5.4	The ongoing outflow of families.....	27
I.5.5	Conclusion.....	29
I.5	<u>Project definition</u>	30
I.5.1	Problem aim.....	30
I.5.2	Research questions.....	30
I.5.3	Methodology.....	31
I.5.4	Social relevance.....	32
I.5.5	Academic relevance.....	33
I.5.6	Intended outcome.....	33
2.	<u>The spatial requirements of children</u>	35
2.1	<u>Children's development need</u>	36
2.1.1	Preschoolers.....	36
2.1.2	Young school-aged children.....	36
2.1.3	Older school-aged children.....	37
2.1.4	Teenagers.....	37
2.2	<u>Preschoolers</u>	38
2.2.1	Safety constraints.....	38
2.2.2	The street profile.....	38

2.2.3	Distance constraints.....	39
2.2.4	Analysis input.....	39
2.3	<u>Young school-aged children</u>	40
2.3.1	Safety constraints.....	40
2.3.2	The street profile.....	40
2.3.3	Distance constraints.....	41
2.3.4	Analysis input.....	41
2.4	<u>Older school aged children</u>	42
2.4.1	Safety constraints.....	42
2.4.2	The street profile.....	42
2.4.3	Distance constraints.....	43
2.4.4	Analysis input.....	43
2.5	<u>Teenagers</u>	44
2.5.1	Safety and distance constraints.....	44
2.5.2	Analysis input.....	44
2.6	<u>The spatial requirements of parents</u>	45
2.6.1	Time-travel budgets.....	45
2.6.2	The linkage between destinations.....	45
2.7	<u>Conclusion</u>	46
2.7.1	The accessibility of activity places.....	46
2.7.2	Analysis input.....	46
3.	<u>The urbanization of Wrocław's region</u>	49
3.1	<u>Case study: "Living in the forest"</u>	50
3.1.1	The Oder river delta.....	50
3.1.1	Housing project: "Living in the forest".....	52
3.2	<u>The livability of children</u>	54
3.2.1	The family Mroszewska.....	54
3.2.2	Urban functions.....	55
3.2.3	Distance constraints.....	56
3.2.4	Safety constraints.....	57
3.3	<u>Conclusion</u>	58
3.3.1	The livability of children in the region.....	58
3.3.2	Reliance on car use.....	58
3.3.3	Effects on the livability children in Wrocław.....	58
3.4	<u>Recommendations</u>	59
3.4.1	The role of the government.....	59
3.4.2	The size and design of 'urban extensions'.....	59

4.	<u>Children’s need to travel by car</u>	61
4.1	<u>Inventory</u>	62
4.1.1	Children’s activity places - schools.....	62
4.1.2	Children’s homes.....	64
4.1.2	The walking network.....	65
4.1.2	The cycling network.....	68
4.1.2	The public transport network.....	70
4.2	<u>Methodology</u>	72
4.2.1	Catchment areas.....	72
4.2.2	Network accessibility.....	72
4.2.3	Adjusted network accessibility.....	73
4.2.4	The accessibility to public transport.....	73
4.3	<u>Preschoolers</u>	74
4.3.1	Network accessibility.....	74
4.2.3	Adjusted network accessibility.....	76
4.2.3	The ability to use public transport.....	78
4.2.4	Reducing the need to travel by car.....	79
4.4	<u>Young school-aged children</u>	80
4.4.1	Network accessibility.....	80
4.4.3	Adjusted network accessibility.....	82
4.4.3	The ability to use public transport.....	84
4.4.4	Reducing the need to travel by car.....	85
4.5	<u>Older school-aged children</u>	86
4.5.1	Network accessibility.....	86
4.5.3	Adjusted network accessibility.....	88
4.5.3	The ability to use public transport.....	90
4.5.4	Reducing the need to travel by car.....	91
4.6	<u>Teenagers</u>	92
4.6.1	Network accessibility.....	92
4.6.3	Adjusted network accessibility.....	94
4.6.3	The ability to use public transport.....	96
4.6.4	Reducing the need to travel by car.....	97
4.7	<u>Conclusion</u>	98
4.7.1	Children’s need to travel by car.....	98
4.7.2	The usability of public transport.....	98
4.7.3	The demand on space for cars.....	99
5.	<u>Reducing the need to travel by car</u>	100
5.1	<u>Methodology</u>	101

5.1.1	Potential accessibility.....	101
5.1.2	The possible interventions.....	101
5.1.3	The decision-making process.....	102
5.1.4	Closest facility analysis.....	102
5.2	<u>Preschoolers</u>	103
5.2.1	Potential accessibility.....	104
5.2.2	Network accessibility.....	116
5.2.3	Adjusted network accessibility.....	128
5.2.4	Conclusion.....	136
5.3	<u>Young school-aged children</u>	138
5.3.1	Potential accessibility.....	138
5.3.2	Network accessibility.....	148
5.3.3	Adjusted network accessibility.....	
5.3.4	Conclusion.....	
5.4	<u>Older school-aged children</u>	162
5.4.1	Potential accessibility.....	162
5.3.2	Network accessibility.....	
5.3.3	Adjusted network accessibility.....	
5.3.4	Conclusion.....	
5.5	<u>Teenagers</u>	168
5.5.1	Potential accessibility.....	168
5.3.2	Network accessibility.....	
5.3.3	Adjusted network accessibility.....	
5.3.4	Conclusion.....	
	<u>Planning towards the P5</u>	174
	References.....	176

i. INTRODUCTION

In many Western European cities, the livability of children is being threatened by a vicious circle of an ongoing increase in car use. For children, it is important to be able to play and move outside, which stimulates the development of their skills. (KpVV, 2008) Because the arrival of the car in the 1970s made it more dangerous for children to live in the city, many families decided to leave the city for a child friendly living environment outside of the city. However, due to this outflow, the distances between children's homes and destinations enlarged, which resulted in many children that were not able to overcome their distance constraints. Because this increased children's need to travel by car and thus car use, it became even more dangerous for children to live in the city, which resulted in even more families that decided to leave the city. And thus, a vicious circle of an ongoing increase in car use occurred, which has not only caused an ongoing outflow of families from the city over the past 40 years, but has also increasingly constrained children's development. (Spape, 2005)

For cities to improve the livability of children, there is a need to develop urban strategies that meet the requirements of children, with measures that enable children to overcome their safety *and* distance constraints. KpVV (2008) shows that the use of sustainable urban mobility measures alone, that aim to discourage car use and encourage the use of alternative modes of transport, is not enough. Since the 1980's, Dutch cities have created new paths for slow modes of transport, introduced traffic calming areas and redesigned streets for mixed uses. Nevertheless, the average age at which children are allowed to travel individually to school has gone up from 6 years to 7 to 8 years old. Bakker & de Vries (2009) add that 75% of all kilometers travelled by Dutch children is on the backseat of the car, which they link to the tripling in the amount of overweight children in the past 25 years. Therefore, cities need to include land use development in their strategies to improve the livability of children, which is based on the requirements of children. Cities that do not, are fighting a losing battle...

I. In 2010, Wrocław was enlisted as the third worst congested city in Europe by TomTom, the tracking and GPS company. Figure 1 illustrates the high demand on space for cars in the city, which has limited the space for slow modes of transport.



Source: Own material

Such a losing battle is being fought in Wrocław in Poland, as well. This city is suffering from a high intensity of car use, which threatens the livability of children. That is why measures are being implemented that aim to reduce car use and improve the ability to travel by slow modes of transport. However, the effects of those measures on the livability of children fail to appear, which is explained by the outflow of families from the city over the past decade. Due to the threatened livability of children, many families

have decided to leave Wrocław for the periphery, which has increased the need for children to travel by car and therewith the demand on space for cars in the city. Because this has made it even more dangerous for children to live in the city, an ongoing outflow of families is occurring that increasingly threatens the livability of children. Therefore, there is an urgent need for Wrocław to increase the effectiveness of its measures by reducing children's need to travel by car, which is the aim of this project.



Source: Archicom (2008)

To define the need to reduce children's need to travel by car, knowledge on children's homes *and* destinations, as well as their safety *and* distance constraints needs to be obtained, which will be used to determine where in Wrocław children have accessibility to their activity places without travelling by car and where not, which is in fact the main research question. The answer on this question will be used to propose recommendations and strategic interventions that will reduce this need for children to travel by car. These can be compared to Wrocław's planned housing development and measures to improve the livability of children to determine the likeliness of Wrocław's planned measures to become ineffective as well. This specific information is of strategic importance for the Wrocław planning authority, for whom there is an urgent need to improve the effectiveness of its measures and by means of this project will be shown how to accomplish this. This will not only benefit the urban planners, but moreover children, their parents, other adults and Wrocław's society as a whole.

This report comprises seven chapters for which the goals will be outlined. In the *first* chapter, Wrocław's losing battle will be explained more thoroughly to define this project. In the *second* chapter, children's spatial requirements will be determined to define how to measure children's need to travel by car. In the *third* chapter, the reasons for the outflow of families to have increased the need (for children) to travel by car will be determined to define recommendations for future development. In the *fourth* chapter, children's need to travel by car in Wrocław will be measured to define the urgency to reduce this need. In the *fifth* chapter, interventions will be proposed that will reduce children's need to travel by car to increase the effectiveness of Wrocław's measures. In the *sixth* chapter, the interventions will be compared to Wrocław's planned measures and housing development to define the likeliness of these measures to become ineffective as well. In the *seventh* and last chapter, a measure will be implemented to illustrate the effects of the interventions on the livability of children.

2. Over the past decade, families have left the child unfriendly city for a more child friendly living environment in the periphery. Figure 2 shows housing development in Wrocław's periphery that has recently been realized.

CHAPTER I

THE LIVABILITY OF CHILDREN IN WROCŁAW



Source: Own material

In this chapter, the reason for Wrocław's measures to improve the livability of children to be ineffective will be explained to define this project. In the *first* paragraph, Wrocław's past and future urban development will be researched to introduce the city. In the *second* paragraph, the use of the car in Wrocław will be researched and reflected on the livability of children to define the ability for children to live in the city. In the *third* paragraph, Wrocław's measures to improve the livability of children will be researched to define the relevance of these measures to be implemented. In the *fourth* paragraph, the ineffectiveness of Wrocław's measures to improve the livability of children will be defined, which will be followed by a research on the reason for the ineffectiveness of measures to occur in the *fifth* paragraph. In the *sixth* paragraph, the project will be defined by the project aim, research questions, methodology, the relevance and the intended outcome. At the end of this chapter, it will be clear how the reason for the ineffectiveness of Wrocław's measures defines this project.

3. Wrocław is implementing measures to improve the livability of children, but the effects fail to appear. Figure 3 shows a new lamppost in a courtyard where a mother guards over her child that is playing in a new playground.

I.I WROCLAW'S URBAN DEVELOPMENT

I.I.I A BRIEF HISTORY

Wrocław's history dates back to the beginning of the 9th century. That was when Wrocław was founded as a Bohemian settlement alongside the Oder river and at the intersection of two important trade routes from East to West. Between the 10th and 13th centuries, the settlement became a religious fortress where communities with differing beliefs from East and West settled. From the moment that traders and craftsmen from the German empire were allowed to settle in Wrocław, the city started to grow and develop. Development in which the Germans were asked to take the lead after Wrocław had been destroyed by an attack of the Mongols in 1241. The Germans gave Wrocław, then called Breslau, city rights in 1262 and structure was given to the economic system by governance that was meant to regulate trade. As an effect, Breslau's population multiplied by ten within less than a century time. (Davies & Moorhouse, 2002)



Source: Wratislaviae Amici (2011)

4. After Breslau's fortifications were levelled, the city found space to expand in a time that improved technological insight were improving living conditions and made it attractive to live in the city. Figure 4 shows Breslau's historic centre in 1870.

Until the 17th century, Breslau experienced moderate growth. The 16th and 17th century were dominated by religious battles as a direct result of Bohemia's decreasing power and made Breslau become under Austrian command. Lutheranism spread over Roman-Catholic Silesia and Breslau was the first city where Lutheranism became the main religion. However, Bohemia regained its power and reclaimed its churches in Breslau and in many other parts of the Silesian region. In 1633, Breslau applied for the status of free city

within the German Empire. Unfortunately this status was never granted. This was the same year in which Breslau lost much of its power through demolitions and destruction during the Thirty Years' War. In this period almost 50% of the 40.000 inhabitants died from the plague and two centuries of stagnation and decline began. (Davies, 1984)

During the 18th century, Breslau was involved in multiple wars. In the year 1741, Silesia was conquered by Prussia and Breslau became the capital of the Prussian province. At the end of the 18th century, Breslau was Napoleon's strategic home base in his battle against Prussia and Russia. During the Napoleonic wars, the city changed drastically. Breslau's fortifications were levelled and many monasteries and cloisters were secularised. And the relocation of the University of Frankfurt on the Oder to Breslau in 1811, made the city become the main centre of the German Liberation Movement against Napoleon. With the levelled fortifications, Breslau

found space to expand in a time that improved technological and scientific insight were improving living conditions and made it attractive to live in the city. Breslau became an important railway hub and industrial centre and with the new university and secularized life a centre of science and art. In 1871, the city had become the 6th largest city in the German empire. Between 1860 and 1910 the population tripled to over more than half a million inhabitants and several new landmarks were build that underlined Breslau's new meaning. Examples are the Kaisers Bridge, the Technisch Hochschule (1910) and Max Berg's Centennial Hall (1913), that was build to house an exhibition held to celebrate the 100th anniversary of Germany's liberation from Napoleon. (Davies & Moorhouse, 2002)



Source: Wratislaviae Amici (2008)

5. In the 2nd half of the 20th century Wrocław became the 6h largest city in the German empire and a center of science and art. Figure 5 shows the Kaiser Wilhelm street in the period 1900-1930.

Between the 1st and 2nd World War, Breslau's population increased mainly by the annexation of surrounding municipalities. The city had reached a population of 600.000 in 1930. In 1933, it was Hitler's NSDAP that took over German command. A development which initiated a national socialistic time and would end up tragically for Breslau. Despite that the city was not affected in the first years of the 2nd World War, it was bombed in 1944 and burned down by the Soviet army at the end of the war. As a result, more than 70% of all the buildings in the city were heavily damaged or destroyed. Many of the former German inhabitants were able to leave Breslau before the Soviet invasion occured. Others that did not leave voluntary were deported back to the West during the occupation. As a result, there was a big decrease in Breslau's population from 630.000 in 1939 to 171.000 at the end of the war in 1946. However, from the moment it became clear that Breslau would become Polish, and the city's name would become Wrocław again, the city found new inhabitants in the areas that were annexed by the Soviet Union. These are located in the former Eastern part of Poland and are now part of the Ukrainian territory. (Eysymontt & Urban, 2008)

6. In the 2nd World War, Wrocław was bombed and burned down by the Soviet army, wherewith 70% of all building in the city were damaged or destroyed. Figure 6 shows the Kaiser Wilhelm street in 1946.



Source: Wratislaviae Amici (2005)



Source: Wratislaviae Amici (2004)

7. After the 2nd World War, the damaged buildings were levelled and replaced by slab buildings, which changed the image of the city in a socialist one. Figure 7 shows the Kaiser Wilhelm street in 2001.

8. The settlement of international companies has given Wrocław a Western-European image. Figure 8 shows the Globis building in Wrocław's city centre where Hewlett Packard is established



Source: Tarsilvex (2012)

After the war, the main priority for the new Polish authorities was to house its new inhabitants as soon as possible, but also to create a real Polish city. All that reminded about Germany had to be removed. The first step was the deportation of the former German inhabitants to the West. But also the image of the city and public life had to be changed. That is why the city decided to level most of the damaged and destroyed buildings and house its new inhabitants in newly build slab buildings, that could be build quickly and house a large

amount of people, which changed Wrocław's image into a real socialist one. (Tyszkiewicz, 2009) In 1956, Wrocław's population reached 400.000 and during the communist time until 1989, this number increased linearly to 640.000, which was comparable to Wrocław's population before the 2nd World war. The end of communism meant freedom and hope for a better life, but also showed that development had stayed behind. Poland had been left in poverty and life and markets needed to be structured from the very beginning. Wrocław was an underdeveloped city that reminded of a failed communist regime. (Davies & Moorhouse, 2002)

Since Poland was admitted to the European Union in 2004, Wrocław's (urban) development has accelarated. The city council has run an active campaign to attract foreign investors and companies, which has not only resulted in many multinational corporations that have settled down in Wrocław, but has also given the city a new Western European image.

Examples of these corporations are LG Electronics, Siemens and IBM in the high-tech sector and Hewlett Packard, Google and Ernst & Young that have recently opened their service centres. The presence of these companies does not only stimulate the labour market, but also provides young Polish students and graduates with the hope for a decent job and a feeling that change is coming. The current percentage of unemployed graduates is estimated to be 20%, which is extremely high. (Marshall Office Lower-Silesia, 2011)

1.1.2 WROCLAW IN THE (NEAR) FUTURE

Since Poland has opened its borders, there has been an increase in the amount of tourists who have visited Wrocław. The varied European heritage, with architecture that is influenced by Bohemian, Austrian and Prussian traditions and a communist time that has left its marks, Wrocław has become a real cultural and touristic hotspot. The latest statistics show that yearly more than 5 million tourists from all over the world decide to visit Wrocław. (Wrocław Statistical Office, 2010) And with upcoming events, the city is likely to strengthen its position on the international touristic map. Wrocław has been chosen as one of the four Polish cities to host the UEFA European Championship in 2012 and will be the European Capital of Culture in 2016, which will give the city much exposure and is likely to attract many new visitors and investors. The organisation of these events works catalytic and will stimulate Wrocław's development.

Towards the European Championship 2012, the year 2011 has been a real peak moment in Wrocław's urban development. A new multifunctional City Stadium has been built and many other strategic urban projects are under construction. Examples are Wrocław's new airport, the new Hilton Hotel and the Skytower project. Wrocław's current airport is outdated and only capable of handling a limited amount of passengers. Therefore, a new airport terminal is being built that is capable of handling a larger amount

of visitors who are about to visit the city. The Hilton Hotel is a strategic project in the city centre that is being built in line with the expected larger demand for hotel beds in the city. The hotel will not only strengthen Wrocław's position on the touristic map, but will also stimulate the labour market and add new urban quality to the city centre. The same can be said for the Skytower project. The Skytower is a multifunctional building with shops, offices and apartments just outside Wrocław's city centre, which influences the development of the area as a whole. With 212 meters, the Skytower will become Poland's tallest building, which will function as a new landmark that represents modern Wrocław. Thus, the opportunities to develop are being taken to strengthen Wrocław's position on the (international) touristic and investment map by developing new urban functions, improving accessibility and adding urban quality, which stimulates the (local) labour market and economy and therewith positively influences the quality of life of Wrocław's inhabitants.



Source: Pascal (2008)

9. Wrocław aims to strengthen its position on the international map, but also to develop as a city that offers a high quality of life. Figure 9 shows Wrocław's main market square, where life is good and tourists and locals meet.

I.2 URBAN CHANGE AND THE LIVABILITY OF CHILDREN

I.2.1 THE RELIANCE ON CAR USE

From the beginning of the 19th century, Breslau started to develop as an industrial city. Like in many other cities in Europe, the conditions of living in Breslau improved drastically by the construction of sewage systems, which made it more attractive for people to live in the city. With the arrival of transport by railway and tram for mass transportation in the second half of the 19th century, people were able to travel over larger distances. This enabled Breslau to expand beyond the borders of the old historic town and house new inhabitants. Although these new modes of transport provided mass transportation over larger distances, there was still a high demand for individual trips over small distances by foot or bicycle. That is why Breslau and other cities in Europe expanded with a high density of housing and functions and with streets that mainly provided space for slow modes of transport, that therewith remained full of

life. This also accounts for urban development in the first half of the 20th century. Although it became possible to travel by car, car use was not yet common good. Breslau expanded by the annexation of bordering municipalities and villages, like Karłowice and Biskupin that were transformed into Garden Cities. These were based on Howard's vision of small communities embedded in a decentralized society, with a high density and a scale appropriate to walking, cycling and public transport. (Davies & Moorhouse, 2002)



Source: Eysymont & Urban (2008)

10. Due to the demand on individual trips over small distances by bicycle or foot, cities expanded with a high density of living and urban functions. Figure 10 shows the high density urban structure of Wrocław in 1935.

After the 2nd World War, Wrocław's development followed a different path of development than cities in Western Europe did. Not only because the destruction of the city in the war *and* the social opinion after made the new Polish authorities decide to level most of the destroyed and damaged buildings, but also due to the change in command. With the arrival of the car as a common mode of transportation, Wrocław was rebuilt according to modern ideals, with a high density of high-rise slab buildings, freeways and wide streets, which provided in the high demand for housing and seems to be influenced by Le Corbusier's vision of the Contemporary City. Le Corbusier predicted the future reliance on car use and preached for a 'total clearance' of the city map to optimize car use. (Hall, 1988) However, Taniguchi and Ikeda (2005) show in an empirical research of Japanese cities, that the reliance on car use was not unavoidable, but has been caused by urban planners that have given in to the demand for car use. Cities that were damaged in the 2nd World War and rebuilt afterwards have higher



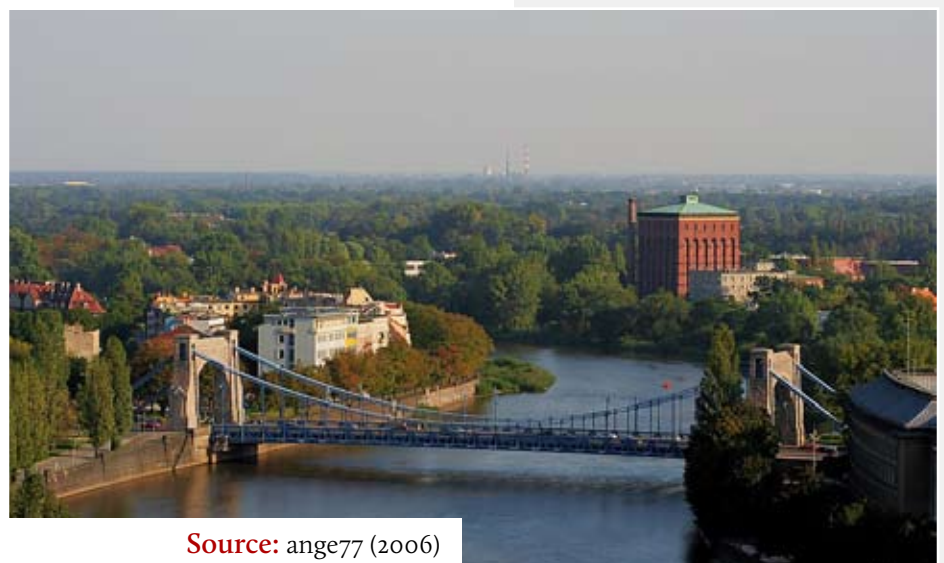
Source: Eysymont & Urban (2008)

petrol consumption levels than cities that were not affected in the war. Beside, the aim to optimize car use in Poland and other Central and Eastern European countries was part of a political process. During the communist time, owning a car was believed to increase the chance of success in life and became a status symbol. (Simons, 1981) That is why until the fall of the communist regime in 1989, the Wrocław planning authority gave in to the demand for car use, where in Western European cities the space for slow modes of transport has been reclaimed since the early 1980s.

Although in many cities in Central and Eastern Europe the car is still seen as a status symbol, this cannot be the only reason for Wrocław to suffer from a high intensity of car use. Statistics show that in Wrocław in 2005, there were 376 cars per 1000 inhabitants, which was much higher than the Polish average of 323 cars per 1000 inhabitants and points out that there is also a spatial need to use the car in the city. (Polish Central Statistical Office, 2007) But also the city's geographical location is likely to be a reason for the high intensity of car use. Historically, Wrocław functioned as an important intersection of trade routes between East and West, where the Oder river could be crossed. This function seems to valid as of today. There are two national roads that run through the city and connect the cities in the South of Poland and the Czech Republic with Poznan and Warsaw, which strongly contributes to the congestion of cars from which the city is suffering.

11. After the 2nd World War, most of the damaged buildings in Wrocław were levelled and the city was rebuilt according to modern ideals. Figure 11 shows a sketch of the urban plan for the Kaiser Wilhelm street in 1951.

12. Wrocław's geographical location is an important reason for the congestion and high intensity of car use in the city. Figure 12 shows the national road towards Warsaw with the Kaisers bridge that bridges the Oder river.



Source: ange77 (2006)

13. Due to the perception of street safety, children might have a more enclosed life, with little experience of the street and perhaps being confined to more car trips. Figure 13 shows the high intensity of traffic on the national road towards Poznan.

14. The demand on space for cars in the city has resulted in residential streets that children are not able to use for playing or travelling purposes. Figure 14 shows a street in Wrocław's city centre.

1.2.2 REFLECTIONS ON THE LIVABILITY OF CHILDREN

The livability of children is not only determined by the street safety, but also by many other factors, like the presence of friendly squares and other public spaces, green, educational facilities, the absence of violence and so on. However, due to the high intensity of car use, there is a high demand on space for cars, which does not only threaten street safety, but also the other factors that determine the livability of children in the city. This can best be explained by looking at the livability of children in Wrocław's city centre, which is surrounded by the two national roads (the freeways) that connect the A4 highway between Berlin and Cracow with Poznan and Warsaw. **Figure 13** shows national road number 5 towards Poznan. The first thing that strikes is the building block beside the road, which shows that people are actually living beside the four lanes of car traffic. With a high intensity of traffic that is located so closely to a living area, it is

likely that inhabitants suffer from the emission of harmful gasses, but also from noise pollution that is being caused by the bad quality of pavement. The latter makes it also dangerous for people to drive and reduces (the perception of) safety, which might result in children having a more enclosed life, with little experience of the street and perhaps being confined to more car trips. This might also result from the tendency for drivers to speed in the city, which is being encouraged by a lack of speed cameras beside the major roads.



Source: Own material



Source: Own material

Figure 14 shows a neighbourhood street with a wide profile that invokes speeding, which illustrates the demand on space for cars. The consequence is that many children are not able to cross the street or to use the street for playing purposes. In case it would be safe for children to cross the street, another problem appears with the parked cars on the sidewalk of the street. These do not only limit the space to play or move, but also the visibility of children by other road users and thus the street usability.

Because there is a high car ownership in Wrocław, there is a high demand for car parking. In the city centre, which is the most dense living area in the city, this space for parking is not available. Therefore, many cars are being parked on the sidewalk of the streets. Due to a lack of effective parking regulations (e.g. car drivers do not have to pay for parking, nor can they be fined for parking incorrectly), the space for walking and cycling is unprotected, which threatens children's ability to walk or cycle.



Source: Own material

The high demand for car parking also threatens the usability and the attractiveness of public space. Figure 16 shows a courtyard in the city centre for which the use, due to the need to park cars, has been undefined. With a lack of playing attributes, public green and pavement it has become impossible for children to use this space for (informal) playing. But also social safety issues are likely to appear. The unorganized building of sheds have created blind spots that are likely to attract unsavoury people.



Source: Own material

1.2.3 CONCLUSION

The livability of children in Wrocław is threatened by the high intensity of car use, which is caused by years of urban development that has given in to the demand on space for cars and has limited the ability for children to use the city. Children's ability to move outside, without the use of the car, is being constrained by (the perception of) street safety, which is threatened by a high intensity and speed of traffic, the width of neighbourhood streets and a lack of parking regulations. Children's ability to play outside is being constrained by (the perception of) street and social safety, which is threatened by the width of neighbourhood streets as well, but also by undefined public space and the lack of places that stimulate children to be outside. Therefore, there is a need to improve the livability of children by sustainable urban mobility measures and the provision of attractive public space, which should enable children to play and move outside.

15. Due to a high car ownership in Wrocław, there is a high demand on car parking that is not available. Figure 15 the national road towards Poznan where sidewalks are being used to park the cars.

16. The need to park cars has resulted in courtyards with undefined space that do not provide any kind of quality of public space for children and other inhabitants. Figure 16 shows a specific courtyard in Wrocław's city centre.

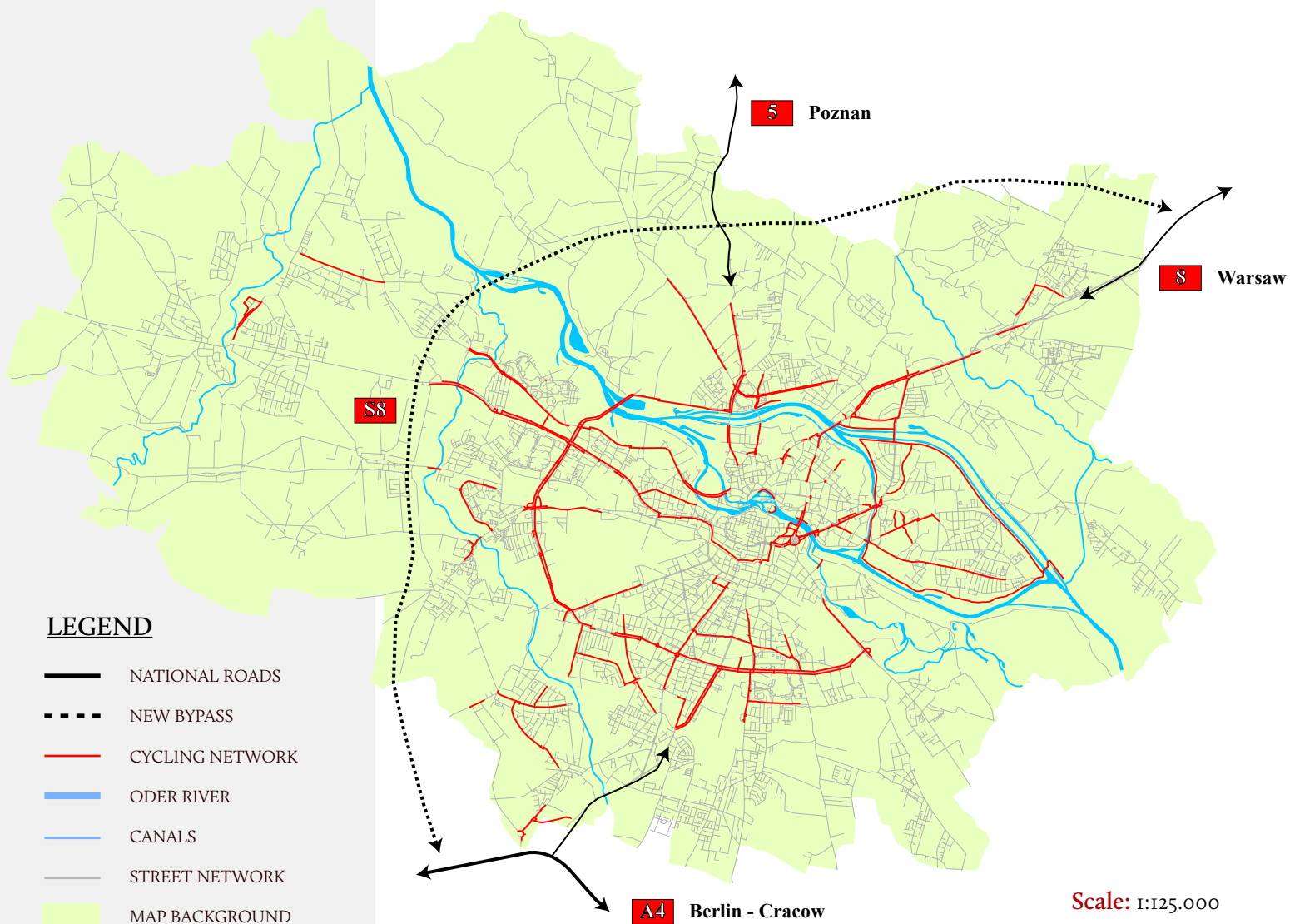
1.3 IMPROVING THE LIVABILITY OF CHILDREN

17. Wrocław aims to improve the livability by reducing car use and improving the ability to travel by alternative modes of transport. Figure 17 shows the bypass around Wrocław that has been built to reduce the amount of car in the city by 20%, but also the 160,8 km. on bicycle paths that aim to enable children to cycle.

Source: Based on SIP (2012)

1.3.1 SUSTAINABLE URBAN MOBILITY MEASURES

Wrocław's aim is to reduce car use and improve the ability to travel by alternative modes of transport, which should improve the livability of children. Car use is being reduced by a new bypass around the city that is aimed to reduce the amount of cars in the city by 20%. The bypass is co-funded by the European Union and is also part of Poland's strategy to improve the accessibility by car towards the European Championship in 2012. Poland aims to disclose the country from North to South and East to West by national highways. The bypass is a strategic project within this strategy that will disclose the A4 highway, that runs from Berlin to Cracow and in planned to connect Germany with the Ukraine, with the national roads towards Poznan and Warsaw. Therefore, the bypass will not only reduce car use in the city, but also improve the accessibility by car on the national and regional scale. (Polish Ministry of Infrastructure, 2011)



The measures that aim to improve the ability to use other modes of transport mainly focus on cycling. From 2000 until 2009, new paths for cycling have been constructed, which has resulted in a doubling (from 74,9 to 160,8 kilometers) in the length of bicycle paths. (Wrocław Statistical Office, 2010) However, because there has been no tradition of cycling in Poland, many people do not own a bicycle yet, which has been the main motivation for the city to invest in a bicycle sharing system. On every street corner, bicycle racks have been placed. In return of a small fee people can borrow a bicycle, cycle for a certain period of time and return the bicycle at one of the bicycle racks that have been placed throughout the city. The main idea is to improve the accessibility to cycling, which will increase the amount of cyclists on the streets and make people aware that cycling is competitive to and a real alternative for car use in the city, in order to create a critical mass.



Source: Shahan (2011)

18. Because there is no tradition in cycling, many inhabitants do not own a bicycle yet. Figure 18 shows the bicycle sharing system that the city has recently implemented to improve the accessibility to cycling for the inhabitants.

1.3.2 THE ATTRACTIVENESS OF PUBLIC SPACE

Wrocław's aim is also to improve the attractiveness of public space for children, which is in compliance with the defined need to improve the livability of children. The city has recently initiated a campaign called "miasto w formie", which means "city in shape" that aims to stimulate Wrocław's inhabitants to live an active life. Thus, the use of slow modes of transport is also being encouraged by soft measures. The attractiveness of public space for children is being improved by the building of playgrounds that should enable children to play and thus live an active life. Figure 19 shows a particular playground that has recently been built in Wrocław's city centre. With the measures that Wrocław is implementing to improve the livability of children, the city shows to understand the reason for the livability of children to be threatened and the need for these measures to be implemented, which makes it likely for the livability of children to improve.



Source: Own material

19. Wrocław is stimulating its inhabitants to live an active life by a campaign called "city in shape". Figure 19 shows a playground that has recently been built in the city centre, which should stimulate children to play outside.

I.4 THE INEFFECTIVENESS OF MEASURES

20. Due to the undiminished high demand on space for cars in the city, half-measures have been implemented that have not improved the livability of children at all. Figure 20 shows the renovation of a sidewalk in the city centre.

21. Despite the city's aim to improve the livability of children, social safety issues have appeared that threaten the livability of children. Figure 21 shows a new playground in the city centre that due these issues is not likely to be used.

I.4.1 THE ABILITY TO MOVE AND PLAY

Due to the bypass around the city, that has been open since September 2011, and the increase in bicycle paths, the ability for children to move outside should have improved. However, nothing is less true. The demand for space on cars seems to be undiminished high, which is illustrated by the newly build bicycle path and renovated sidewalk in figure 20. The aim of sustainable mobility measures is to discourage car use and encourage the need of alternative modes of transport simultaneously. In this specific intervention, a bicycle path has been built in favour of the space for walking, therewith leaving the space for cars untouched and resulting in a reduced ability to walk. The parked car on the renovated sidewalk illustrates that car use has not been discouraged, wherewith the ability to use alternative modes of transport has not been improved. The high demand on space for cars also leads to measures that are wrongly

being implemented. The bicycle path in the figure is not part of a continuous network of bicycle paths, which makes it difficult to define where it is safe to cycle and where not. Therefore, parents are likely to decide that it is not safe enough for their child to move outside. And because the building of new bicycle paths over the past 10 years has only led to a modal split of 3% for cycling, it is highly questionable whether or not these new paths meet the requirements of children and other cyclists.



Source: Own material



Source: Own material

With the building of playgrounds the city aims to enable children to play outside and thus live an active life. However, the empty beer bottles in figure 21 illustrate that this aim is not being achieved as well. Social safety issues have appeared that are likely to prohibit children from being allowed to use the new playground and thus play outside. These social safety issues are also illustrated by figure 22, which shows another courtyard in the city centre where garbage has been dumped beside the con-

tainer by someone that clearly did not care about the life and wellbeing of others. The apparent lack of social control and cohesion in the area is likely to result in many parents deciding it is not safe enough for their children to be outside, let alone to play. The appearance of social safety issues suggests that the social structure in the area has changed, which is likely the result of many parents that have decided to leave the city for a more child friendly living environment outside of the child unfriendly city.



Source: Own material

This suspicion is confirmed by the economic structures in the area that seem to have changed as well. **Figure 23** shows that investors are not attracted to develop in the city centre anymore, for which the most logical explanation seems to be a change in demand. In case an investor renovates these buildings, the costs for this renovation will be calculated in the housing prices. So when there is a lack of investment, the target group that is willing to pay this price is missing, which indicates the apparent change.



Source: Own material

1.4.2 CONCLUSION

The examples in this paragraph show that Wrocław's measures to improve the livability of children have been ineffective so far. Despite the relevance of these measures to be implemented, which has been explained in the previous paragraphs, the ability for children to play and move outside has not been improved. With the demand on space for cars, which seems to be undiminished high, the city has implemented half-measures that have not improved children's ability to move outside at all. And due an apparent change in social and economic structures in the area, there is lack of social control and cohesion, which has resulted in social safety issues to appear. These constrain children's ability to be outside, let alone to play and result in new playgrounds that are not being used at all. Therefore, there is a need to find the reason for the ineffectiveness of measures to happen, whereby Wrocław's migration patterns seems to be the main lead.

22. Due to a changed social structure in Wrocław's city centre, there is a lack of social control and cohesion, which causes the social safety issues to appear. Figure 22 shows a courtyard in the city centre.

23. Beside the social structure, also the economic structure in the city centre has changed. Figure 23 shows that developers are not attracted to invest in the city centre, which is explained by the change in housing demand.

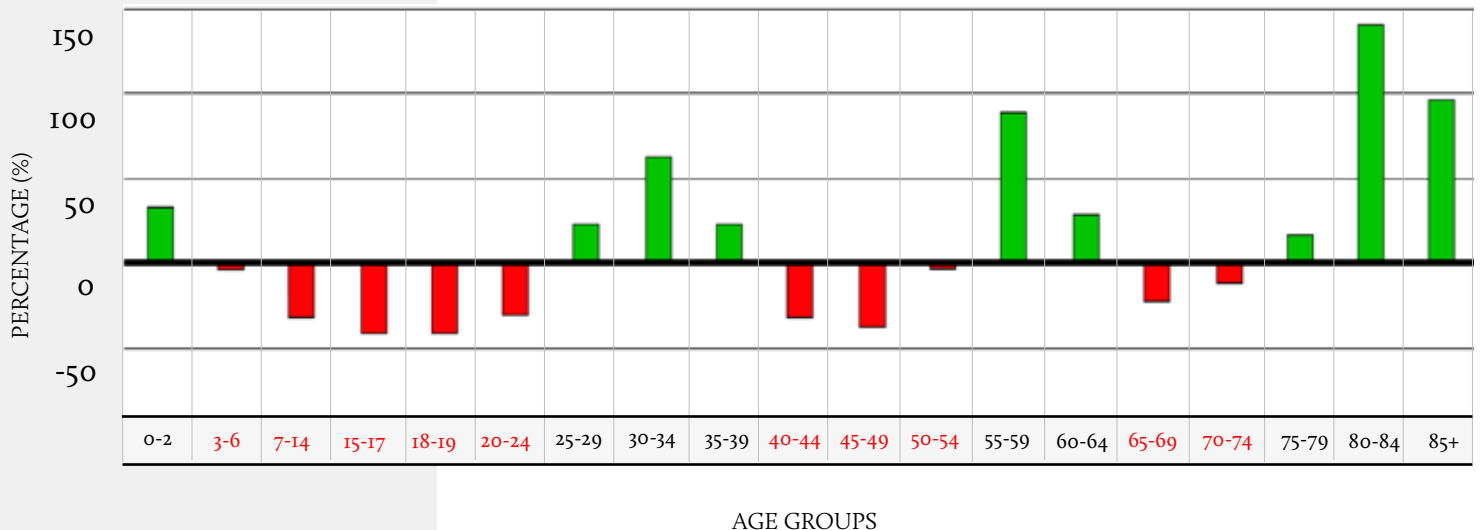
1.5 THE DEVELOPMENT OF A VICIOUS CIRCLE

24. Over the past decade, there has been an outflow of families and seniors from the city. Figure 24 shows the in- and outflow of inhabitants by age groups in Wrocław between 2000 and 2009.

Source: Wrocław SO (2011)

1.5.1 THE OUTFLOW OF FAMILIES

Over the past decade, there has been an outflow of families from Wrocław's city (centre), which is shown in figure 24. In the Netherlands, where a similar outflow of families from the city has occurred over the past decades, the main reason for families to leave the city was to live in a bigger house *and* to live in a more child friendly living environment. Most families migrated over a distance less than 10 kilometers, because the parents still worked in the city where they moved from. (ABF Research, 2002) In Wrocław, the situation seems to be similar. Figure 24 points out that families move from the moment that children start to develop a spatial demand (3-6 years old). The threatened livability of children in the city makes it likely for parents to have the wish for their child to grow up in a more child friendly living environment. Therefore, with the development of Wrocław's periphery, parents seem to be provided in their demand.



1.5.2 PERIPHERAL HOUSING DEVELOPMENT

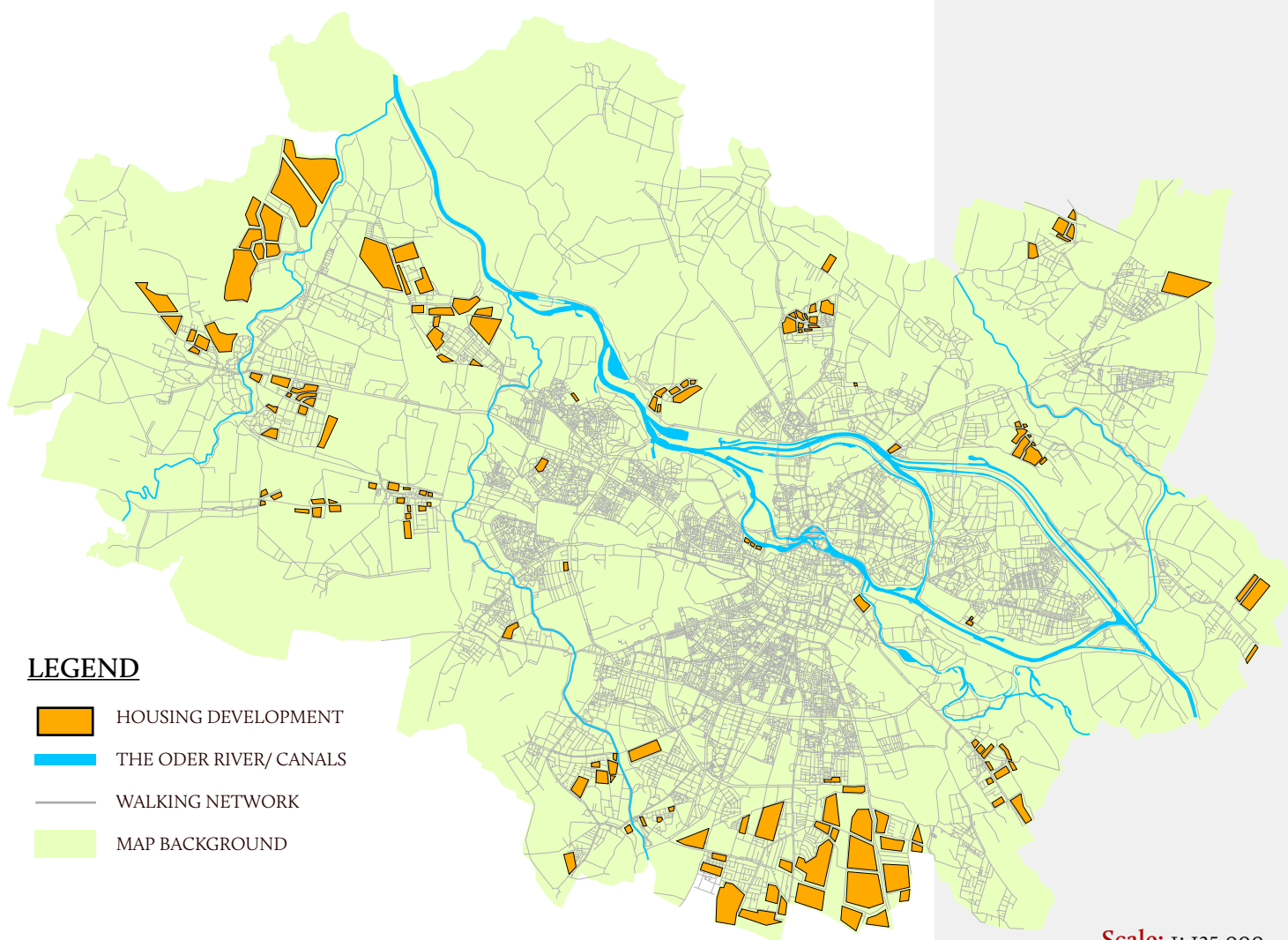
Since Poland was admitted to the European Union in 2004, Wrocław has been given many opportunities to develop. An important example is the financial aid from the EU Regional Development Program, which runs from 2007 to 2013, that the city is using to rapidly and cost-efficiently develop its periphery. In recent years, Wrocław has sold many plots in the periphery of the city to private (foreign) investors and developers. These are allowed to build housing estates without being obliged to provide for the essential infrastructure. Financial aid from the EU is used together with the revenues gained by selling the plots to provide the accessibility and the needed urban functions. Therewith, Wrocław is able to rapidly and cost-efficiently develop its periphery, which provides in the growing demand for new housing in the close vicinity of the city, while an attractive investment climate for developers is assured. (ARMA, 2010)

1.5.3 CHILDREN'S NEED TO TRAVEL BY CAR

The undiminished high demand on space for cars in the city centre is explained by the outflow of families from the city to the periphery. Because this has increased the distances of travelling, the need for children to travel by car has increased as well, which has resulted in an increased demand on space for cars in the city. Figure 27 shows a part of the empirical analysis that has been done in this project on the accessibility of young school-aged children (6-8 years old) to primary school. The dots on the map represent the entrances of houses and buildings where young school-aged children were living in 2005, whereby the green color indicates that a primary school is located within walking or cycling distance. The red color indicates the homes of young school-aged children where children can only travel by car or public transport to school. From the 13436 young school-aged children that were living in Wrocław in 2005,

25. In recent years, Wrocław has sold many plots in the periphery of the city to private (investors. Figure 25 shows the plots where housing is or will be developed until 2020.

Source: Based on SIP (2012)

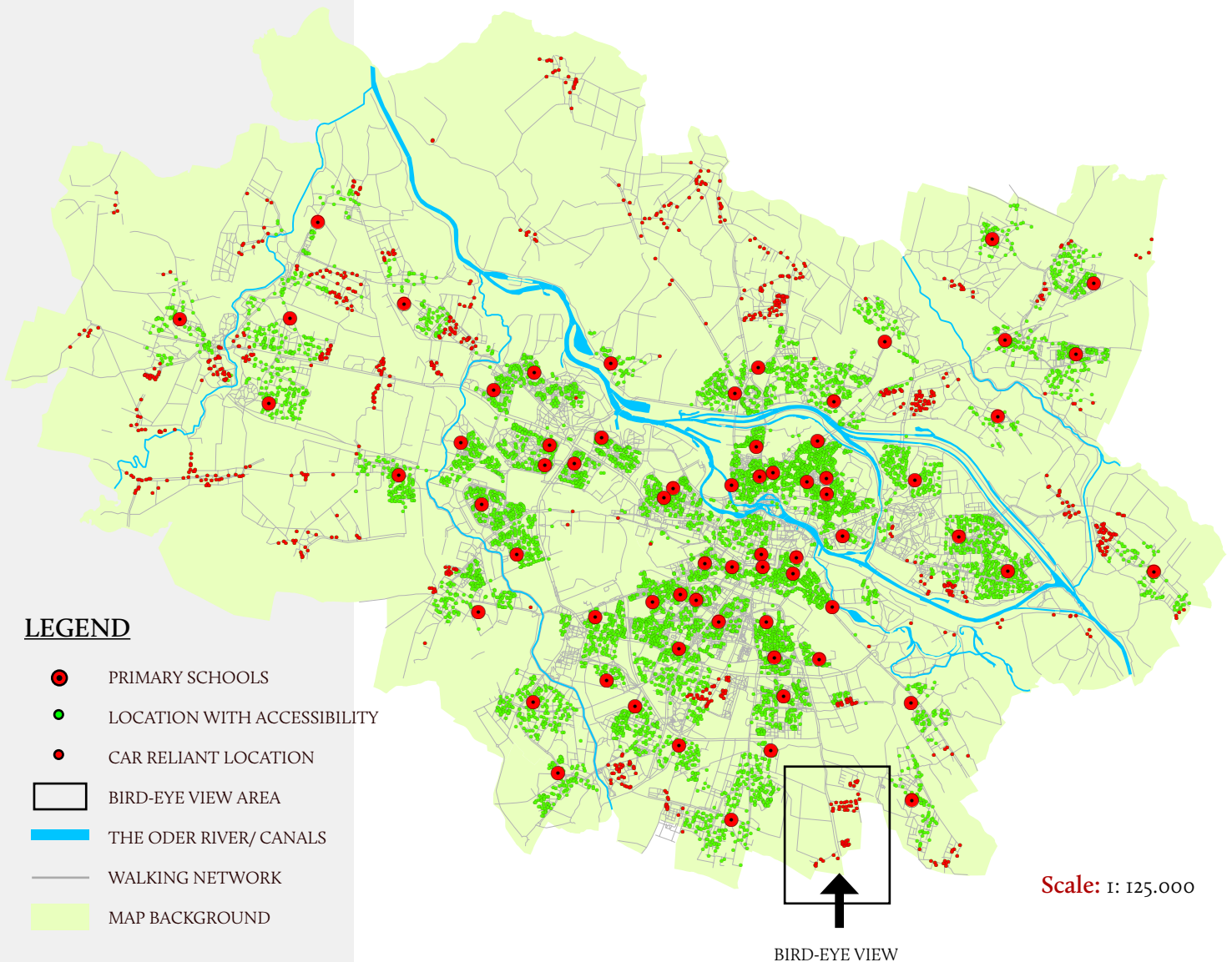


Scale: 1: 125,000



Source: Archicom (2008)

2963 were not able to walk or cycle to primary school, whereby most of the red dots on the map are located in the peripheral areas of the city. In addition, figure 26 shows the “four seasons” housing project in the South of the city, which has also been drawn on the map. For the young school-aged children that have moved from the city centre to this housing project, their status has changed from ‘green’ to ‘red’, meaning an increase in the need to travel by car and car use and the demand on space for cars.



1.5.4 THE ONGOING OUTFLOW OF FAMILIES

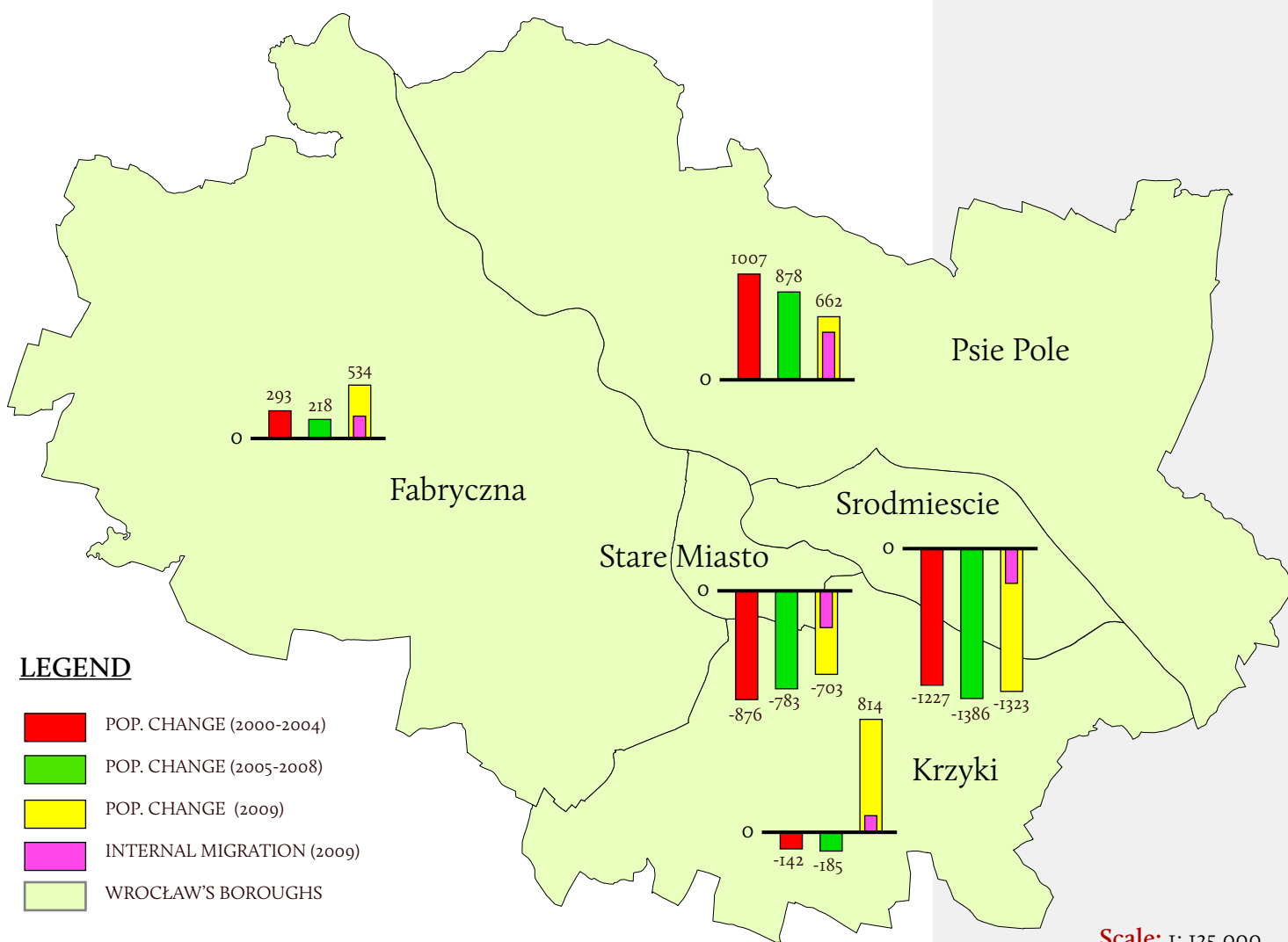
Due to the increase in the need for children to travel by car and therewith the demand on space for cars in the city, the city's measures to reduce car use and improve the ability to travel by slow modes of transport have been ineffective. Therewith, leaving the threatened livability of children unchanged, which has resulted in an ongoing outflow of families from the city (centre). Figure 28 shows statistics on the population change in Wrocław's boroughs between 2000 and 2009 and the in- and external migration in 2009. There has been an ongoing outflow of families from the old historic town (Stare Miasto) and the city centre (Srodmiescie). In 2009, a minority of them moved within the city to the peripheral boroughs. However, a majority (respectively 55% of the inhabitants of the old historic town and 68% of the inhabitants of the city centre) chose to move outside of the city border. Over the past decade, the outflow from the

26. Figure 26 shows a bird-eye view of the 'four seasons' housing project in Wrocław.

27. The need for children to travel by car increases when they move from the city to the periphery. Figure 27 shows the accessibility of young school-aged children to primary school in the city.

28. Figure 28 shows the in- and outflow per city borough between 2000 and 2009.

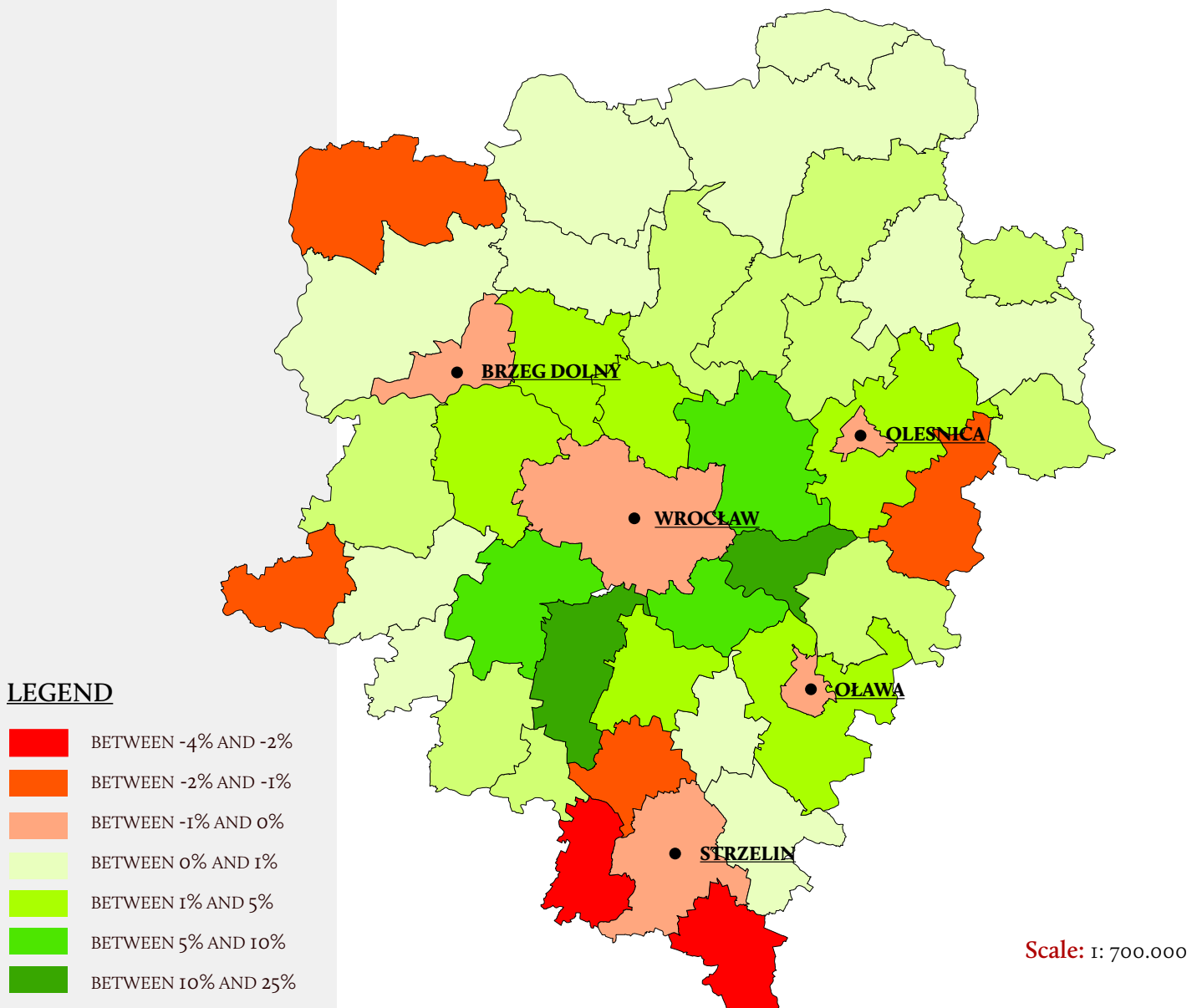
Source: Wrocław SO (2011)



29. The outflow of families over the past decade has been so high, that Wrocław's total population has shrunk. Figure 29 shows the regional population change, whereby it strikes that Wrocław's bordering municipalities show an increase in population.

Source: Wrocław SO (2011)

city has been so high that Wrocław's total population has shrunk with more than 1,5% from 642.614 to 632.996 inhabitants, which explains the changed social and economic structures in the city centre and therewith the social safety issues that have appeared. Figure 29 illustrates Wrocław's shrinking population and points out that most of the families have moved to bordering municipalities, where the population has increased. This is likely to be explained by the wish of parents to not live too far away from work in the city. In addition, figure 30 shows the locations in Wrocław's region where housing has been developed over the past decade. Around the city, a belt of development has occurred, whereby the locations seem to have been determined by the regional disclosing roads that connect the cities in the region to the city. Therefore, it is likely that the amount of car trips from the region to city has increased, which has increased the demand on space for cars in the city as well and thus also contributes in the ongoing outflow of families, which threatens the livability of children.

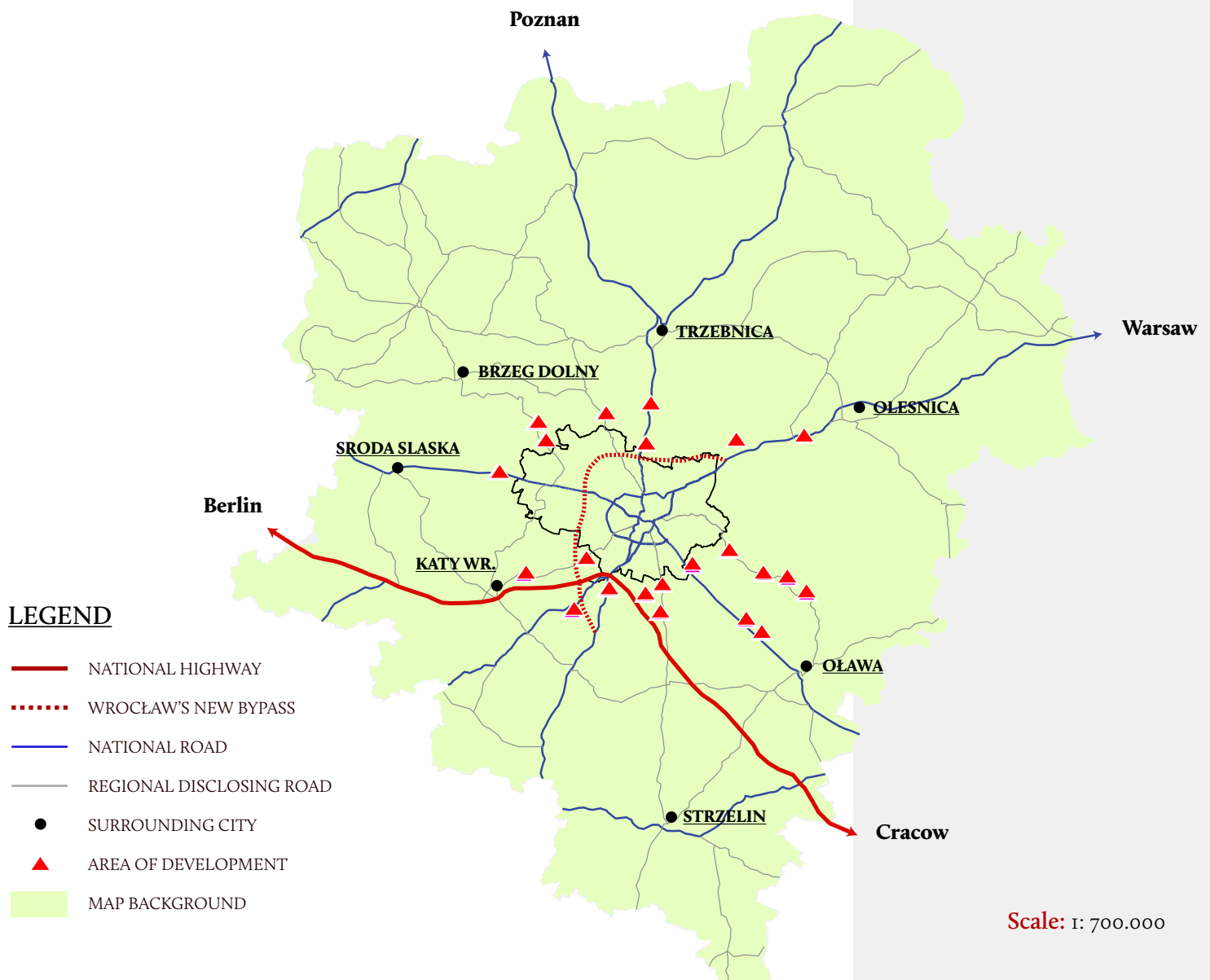


1.5.5 CONCLUSION

The reason for Wrocław's measures to improve the livability of children to be ineffective is the ongoing outflow of families from the city centre. Over the past decade, many families have decided to leave the child unfriendly city centre for the periphery of the city. Because this has increased the need (for children) to travel by car and the demand on space for cars in the city, the measures to improve the livability of children have been ineffective. The consequence is that families keep leaving the city, which has resulted in social safety issues, but also in a vicious circle of an ongoing increase in car use, which increasingly threatens the effectiveness of measures to improve the livability of children. Therefore, Wrocław should aim to restore the balance between the in- and outflow of families from the city centre, which acquires effective measures to improve the livability of children and thus a reduced need (for children) to travel by car.

30. The outflow of families from the city to the region has increased the demand on space for cars as well, which stimulates the ongoing outflow of families from the city. Figure 30 shows a belt of development around the city, where the locations seem to have been determined by the regional disclosing roads.

Source: Own material



Scale: 1: 700.000

I.6 PROJECT DEFINITION

I.6.1 PROJECT AIM

The aim of this project is to reduce the need for children to travel by car in Wrocław, which will increase the effectiveness of Wrocław's measures that aim to improve the livability of children. The research in this chapter has illustrated that there is an urgent need for Wrocław to increase the effectiveness of its measures. Due to a vicious circle of an ongoing increase in car use and the outflow of families from the city, the city's measures to improve the livability of children have been ineffective. To increase the effectiveness of its measures, the vicious circle must be broken, which acquires effective measures and thus a reduced need for children to travel by car. Therewith, sustainable urban measures can be implemented that really discourage car use and encourage the use of slow modes of transport, which will improve the livability of children and thus restore the balance between the in- and outflow of families from the city.

I.6.2 RESEARCH QUESTIONS

The **main** research question is:

“Where in Wrocław do children have accessibility to the activity places they use and where not?”

To reduce the need for children to travel by car by strategic interventions, the most important research step is to determine where in Wrocław children are reliant on car use. Therefore, knowledge on children's homes *and* destinations, as well as their safety *and* distance constraints needs to be obtained, which will be used to determine where in Wrocław children have accessibility to the activity places they use without travelling by car and where not. By defining the spatial need to reduce the reliance of children on car use, it will be possible to determine the likeliness for planned measures to improve the livability of children to be ineffective as well.

The **first** sub-research question is:

“Which specific development needs and constraints define the spatial requirements of children?”

Because the needs and abilities of children change while growing up, also the activity places children use and the constraints that might force them to travel by car to these activity places change. Therefore, it is necessary to define children's spatial requirements by their specific development needs and constraints that are different per phase of development. By obtaining the knowledge on the activity places children use and the safety and distance constraints that might force them to travel to their activity places by car, it will be possible to measure the extent to which these constraints in Wrocław appear and thus to define where there is a need for children to travel by car. This knowledge can be used to define the influence of the urbanization of Wrocław's region on the livability of children as well.

The **second** sub-research question is:

“What are the effects of the urbanization of Wrocław’s region on the livability of children?”

Because the outflow of families from the city to the region is likely to have increased the need (for children) to travel by car as well, there is a need to also reduce the increased demand on space for cars in the city that is being caused by the outflow of families from the city to region. Therefore, the livability of parents and children that have moved from the city to the region will be researched, whereby the aim is to define the need (for children) to travel by car and the reasons for this need to be there. This will be reflected on the demand on space for cars and the livability of children in the city. Based on the reasons for the need (for children) to travel by car to be there, recommendations for future development will be proposed that will improve the livability of children in the city and the region as well.

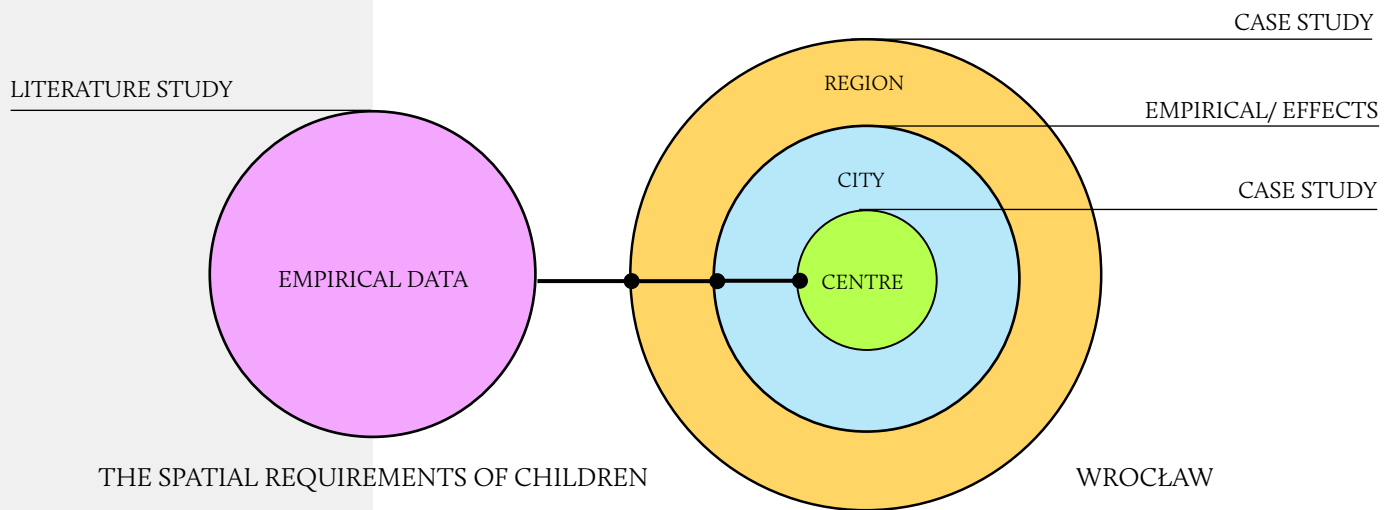
The **third** sub-research question is:

“Which street profile enables children in Wrocław to overcome their safety constraints?”

Because in this research children’s need to travel by car is determined by the distance constraints that children are not able to overcome, the question remains how the profile of the street should be improved to enable children to overcome their safety constraints, in case distance constraints can be overcome. In this chapter has been shown that the demand on space for cars strongly influences the city’s ability to provide a street profile that enables children to play and move outside. Therefore, it is necessary to show which street profile will enable children to overcome their safety constraints in case children’s need to travel and thus the demand on space for cars in the city has been reduced. This will illustrate the increase in the effectiveness of measures to improve the livability of children.

1.6.3 METHODOLOGY

The first step in this research is a *literature study* (chapter 2) on the specific development needs and constraints of children to define their spatial requirements, which will be used to measure and define the need for children to travel by car. The second step is a *case study* (chapter 3) on the effects of the urbanization of Wrocław’s region on the livability of children. Considering the size of the region, the question will be answered by an example that is representative for the urbanization in the region as a whole. The third step is an *empirical research* (chapter 4) on children’s need to travel by car, which is followed by an *effects analysis* (chapter 5 and 6) on the effect of interventions on the need for children to travel by car and the likeliness of Wrocław’s planned measures to be ineffective as well. The fifth step and last step is a *case study* (chapter 7) on the need for Wrocław to change its street profiles to illustrate the increase in effectiveness.



31. In this project, the main methodologies that will be used are a literature study, a case study, an empirical research and an effects analysis. Figure 31 shows the methodological framework of this project in a scheme.

32. By enabling children to walk individually to school, friends and clubs, parents will be discharged from many pick-up and drop-off obligations. Figure 32 shows these obligations for a school in The Netherlands.

1.6.4 SOCIAL RELEVANCE

The insight in the interventions that are needed to reduce the need for children to travel by car is of strategic importance for the Wrocław planning authority, for whom there is an urgent need to improve the effectiveness of its measures and by means of this project will be shown how to accomplish this. A reduced need for children to travel by car will not only benefit urban planners, but moreover children, their parents, other adults and Wrocław's society as a whole. (Ruimte voor de Jeugd, 2005) In the current situation, children in Wrocław experience a lack of physical activity, which negatively influences their health condition, makes them become overweight and increases their stress level. And due to a lack of traffic experience, children are not being taught about the dos and don'ts in traffic anymore, which negatively influences their ability to be independent, to make decisions and to solve problems. (Kips *et al*, 2009)



Source: To be defined (Flickr)

By reducing the need for children to travel by car, the effectiveness of Wrocław's measures to improve the livability of children will increase, which will enable children to travel individually to school, friends and clubs and stimulate the development of their skills. And because this discharges parents from many pick-up and drop-off obligations, parents will benefit as well (Kips *et al*, 2009) But also other vulnerable road users, like elderly people and non-motorized users like pedestrians and cyclists

benefit. They are stimulated to be outside, to meet with each other and to walk and cycle more, which stimulates physical activity and social cohesion and reduces health costs. Because this reduces the intensity of car use in the city even more, the emission of harmful gasses and noise pollution reduce, which benefits Wrocław's society as a whole. (KpVV, 2008)

1.6.5 ACADEMIC RELEVANCE

The ineffectiveness of measures to improve the livability in Western European cities has resulted in many methods that have been developed, whereby the ability for children to use the street can be measured and improved. However, the specific insight that the ineffectiveness of measures is being caused by the outflow of families from the city, which has increased the need for children to travel by car and therewith the demand on space for car in the city is rather new. That is why in several cities, like Delft in The Netherlands and Gent in Belgium, pioneer projects are performed to improve the livability of children by integrated strategies of sustainable urban mobility measures and land use development. However, a methodology whereby the need for children to travel by car can be measured and reduced on the city scale has not been developed yet. Therefore, the methodology that is used to measure and reduce the need for children to travel by car in Wrocław is of academic value that can be developed further.



Source: Kips & Schepel (2009)

1.6.6 INTENDED OUTCOME

The intended outcome of this project is strongly related to the social and academic relevance, whereby the common denominator is insight. On the one hand, the aim of this project is to provide the Wrocław planning authority with insight in why there is a need to reduce the need for children to travel, where to reduce this need and how to do it. This will benefit urban planners, children and Wrocław's society as a whole. However, on the other hand, the aim is to develop a method whereby the need for children to travel by car can be measured and reduced. Thereby, the emphasis will lie on developing a methodological framework which can be used by other cities or academics to develop a knowledge base on children's need to travel by car in cities or to find even more accurate results. Thus, the intended outcome is multiple, whereby the common aim is to develop insight in the need to reduce children's reliance on car use.

33. Due to the ineffectiveness of measures to improve the livability of children in the city, many methods have been developed whereby the usability of streets can be measured and improved. Figure 33 shows academics that perform Bach's wire frame method to define where safety issues are likely to appear.

CHAPTER 2

THE SPATIAL REQUIREMENTS OF CHILDREN



Source: Own material

In this chapter, the aim is to define the spatial requirements of children by researching their development needs and spatial constraints. The needs and abilities of children change while growing up. An infant learns how to sit and to crawl and only spends time outside in the pram of their parents. And toddlers from the age of one and higher start to become more independent. They learn how to walk, to speak and go to the toilet and slowly but surely start to have an interest in the world around them. However, from the moment a toddler becomes a preschooler, children start to develop needs for which they have a spatial demand. (UIE, 2010) This will be the starting point of the research on children's development needs in the *first* paragraph. In the *second* to the *fifth* paragraph, children's spatial constraints will be defined following their phases of development. In the *sixth* paragraph, the aim is to define the influence of the spatial requirements of parents on children's need to use the car, which is followed by the input for the spatial analysis in the conclusion of this chapter.

34. For many children, the ability to play outside is important for the development of their skills. Figure 34 shows a playground and an improvised soccer pitch in a park in Wrocław's city centre where children are being provided in their need.



Source: To be defined (Flickr)

35. For preschoolers, the neighbourhood playground is an important activity place where they play and meet with other children. Figure 35 shows a sandbox, which is a typical playing attribute that preschoolers use.

36. For young school-aged children, the neighbourhood playing is an important activity place as well. Figure 36 shows a young school-aged child playing in a climbing frame, which is a typical playing attribute that they use.



Source: To be defined (Flickr)

2.1.1 PRESCHOOLERS

Preschoolers (3-4 years old) are in the process of becoming more independent and are eager to learn about other children, adults and the world around them. They ask for public space that enables them to play outside and interact with family and other adults and children around them, which stimulates the development of their personality and their individual way of thinking. (UIE, 2010) There structural, daily returning activity is going to the kindergarten.

(KpVV, 2008) Other activities are mainly non-structural and take place in formal and informal settings. The local playground is an example of a formal setting where children play and meet with each other. Their typical playing attributes are the sandbox, the slide and the swing. Informal settings are mainly located in the close vicinity of their homes. Examples are the front garden, the street in front of their home or the sidewalk or lawn where they can exploit their fantasies by drawing on the pavement, by searching for stones and by playing with the shadow. (OBB, 2008)

2.1.2 YOUNG SCHOOL-AGED CHILDREN

For young school-aged children (5-7 years old) it is important to be able to play with other children, which stimulates their ability to care about the feelings and needs of others. But they are also in an age at which they gain control of their major muscles and enjoy testing them. (UIE, 2010) In line

with this ability, the WHO (2007) states that children from the age of 5 need at least one hour of physical activity per day. A structural, daily returning activity is walking to primary school. Other structural, non-daily returning activities are going to the gymnasium and the swimming pool, where they are introduced to sports and learn how to swim. (Kips & Schepel, 2009) Non-structural activities take place in formal and informal settings. The neighbourhood playground is an example of a formal setting where they use playing

attributes like climbing and tumbling frames that enable them to be physically active. An example of an informal setting is the street, that is not only used to learn how to cycle, but also for informal playing, like ball games and playing hide & seek (OBB, 2008)

2.1.3 OLDER SCHOOL-AGED

Older school-aged children (8-11 years old) are active and eager to try new activities. They long to be part of a group, look up to older children and start to create friendships. Most of them have good fine and large motor skills and long to use them in more specific and diverse physical activities. (UIE, 2010) Their structural, daily returning activity is walking or cycling to primary school. Other structural, non-daily returning activities are going to the sports club or the music school. An example of non-structural formal setting is a pitch that enables them to play soccer or basketball games. The street is an example of an informal setting that is used to play (ball) games and hide & seek, but also to meet with other children and friends (OBB, 2008)

2.1.4 TEENAGERS

Teenagers (12-15 years old) play with other children and teenagers in search for recognition, but also to compare their own abilities to those of others. They have a strong need for informal meetings and settings and use public space as a social meeting place. They are more aware of their specific capabilities and are in the need to fully exploit them. (UIE, 2010) A structural, daily returning activity is walking or cycling to secondary school. Other structural non-daily returning activities are similar to those of older school-aged children, but with the awareness of their own capabilities more specifically chosen. Examples of non-structural activities are playing soccer on a pitch, but also gathering with other teenagers at the local supermarket, where it crowded and interesting to watch people, but also to be seen. (OBB, 2008)



Source: To be defined (Flickr)

37. Older school-aged children have the need to be active, long to play in a group and start to create friendships. Figure 37 shows two older school-aged children that play on a pitch, which provides them in their need.

38. Teenagers are in search for recognition and like to gather with other teenagers, to watch people and to be seen. Figure 38 shows teenagers on bicycles in The Netherlands that have gathered in a busy street with shops.



Source: To be defined (Flickr)

2.2 PRESCHOOLERS



Source: To be defined (Flickr)

39. Preschoolers do not understand the risks of traffic, which makes it likely for them to have unexpected behaviour and creates a need for accompanied trips. Figure 39 shows a mother and preschooler walking together.

40. The street profile needs to provide preschoolers with protection, freedom of movement and the ability to play, so they can discover the outside world. Figure 40 shows a preschooler that is learning how to ride a tricycle.



Source: To be defined (Flickr)

2.2.1 SAFETY CONSTRAINTS

Preschoolers are not able to be outside on their own yet. Research of Heimessen (1972) shows that they do not understand the risks of traffic. In an experiment with electrodes, their heartbeat did not change in dangerous traffic situations, but started to beat faster when they were allowed to buy an ice-cream. Due to the likeliness of unexpected behaviour, parents need to keep an eye on their child and define clear and simple rules, so they know what the boundaries of acceptable behaviour are. (UIE,

2010) This creates a specific demand on the profile of the street, which should allow preschoolers to play outside in front of their homes or on the sidewalk. According to Kips & Schepel (2009), the street needs to provide protection, freedom of movement and the ability to play.

2.2.2 THE STREET PROFILE

Preschoolers can be given protection by putting a limit to the amount and speed of cars and bicycles in the street. OBB (2008) proposes to allow cars and bicycles only with a reduced driving speed (10 to 15 km/h) and for destination purposes only. Another aspect that might endanger the of protection children is their visibility, or the ability of car drivers and children to see each other. The freedom of movement of a preschooler involves the ability to use the street in its whole width, thus not only for

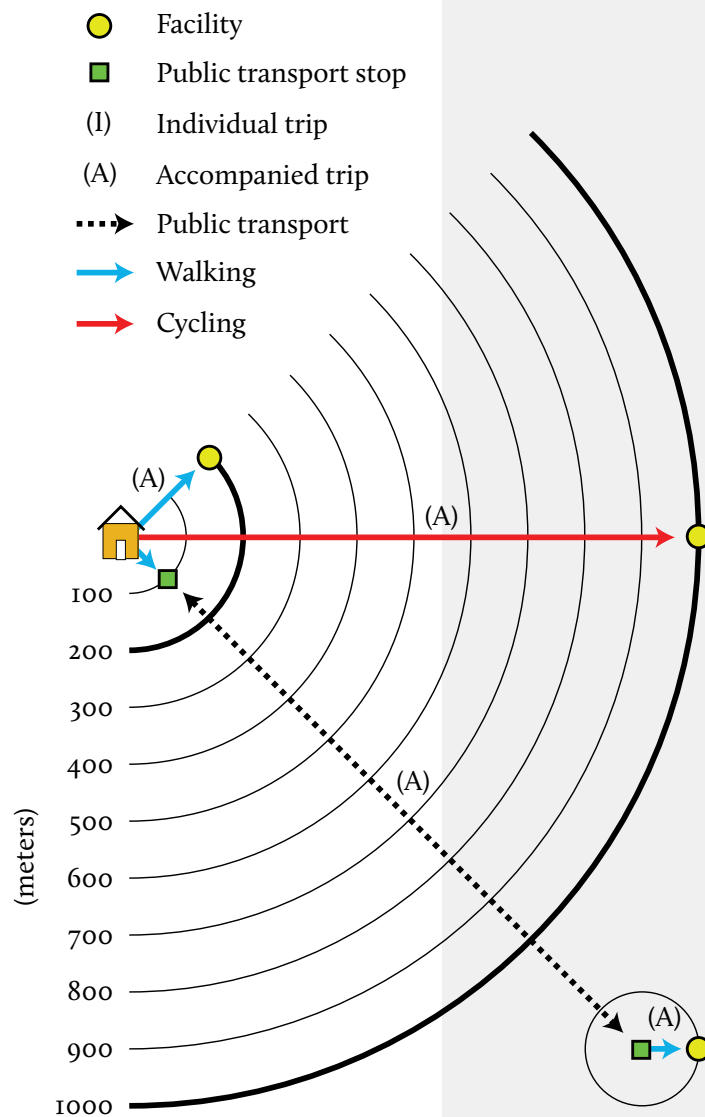
travelling, but also for other purposes, like informal playing. This demands a low intensity of passing cars that drive with a reduced speed, but also involves the way in which car parking is regulated and organised. By reducing the amount of parked cars, but also creating a visible angle in which the cars are parked, freedom of movement can be provided. The ability to play can be provided by a street surface that is well maintained and clean and thus provides preschoolers with space to play without hygienic issues. (Kips & Schepel, 2009)

2.2.3 DISTANCE CONSTRAINTS

Preschoolers are only allowed to travel in company of their parents or other adults. Their physical and motor abilities are not fully developed yet, which means that they can only overcome a short distance by foot or tricycle. (UIE, 2010) So it is important to provide accessibility to their facilities within their distance constraints. OBB (2008) states that preschoolers' playgrounds should be accessible within 3-4 minutes or 200 metres of walking and thus creates a catchment area of about 3 hectares that should enable around 30 preschoolers to access the facility. The average size of a Dutch kindergarten is 250 children. (Sardes, 2009) Therefore, the average distance to kindergarten is larger. Research of CBS (2010) points out that Dutch children in average live 1300 metres away from kindergarten. However, in the city this distance is smaller with 500 to 1000 metres. This means that most accompanied trips to kindergarten cannot be made by foot, which creates a need to develop bicycle paths and public transport connections between homes and kindergartens that allow parents and their child to travel to kindergarten without using the car. However, due to the need to travel between public transport stops and homes and kindergartens and the effort it takes for parents to travel by the bicycle to facilities, it necessary to also define the distance constraints for these trips that preschoolers and parents should be able to overcome.

2.2.4 ANALYSIS INPUT

The distance constraints for walking trips, that will be used as input for the analysis on the accessibility of children's activity places are 200 metres for trips to facilities and 100 metres for trips to public transport stops. For cycling trips, the distance is put on 1000 metres. The physical and mental effort for parents to cycle with a child on the back- or frontseat is reducing the physical distance that parents can overcome in individual trips.



41. Preschoolers have a limited reach and can only make accompanied trips. The distance constraints, that will be used for the analysis are illustrated by figure 41.

Source: Own material

2.3 YOUNG SCHOOL-AGED CHILDREN



Source: To be defined (Flickr)

42. Young school-aged children are at the age that they learn how to cycle. Figure 42 shows a young school-aged child that cycles for the first time, while being taught and supported by his mother.

43. For young school-aged children, the street profile needs to provide them with the ability to play outside. Figure 43 show children in The Netherlands that are playing an informal ball game in a residential street.



Source: To be defined (Flickr)

2.3.1 SAFETY CONSTRAINTS

Young school-aged children are at an age at which they start to play and travel outside alone. In The Netherlands, children are allowed to play outside alone at the age of 5,4 years old (VVN, 2005) Many children older than 6 start to travel alone to school, be it accompanied by their parents to cross the main street. That is how they develop an understanding of the functions of crossings, zebras and traffic lights. (OECD, 1998) Traffic insight grows between the 5th and

10th year of living. Spapé (2005) shows that traffic experienced children perceive dangerous traffic situations between the 7th and 8th year of living. Without traffic experience, this is perceived between the 9th and 10th year of living. Therefore, it is important that children are being encouraged to spend time outside alone from an early age on. Children are likely to be allowed to play and walk outside alone if streets provide protection, freedom of movement and the ability to play, but also provide an experience value and the ability to walk and cycle. (Kips & Schepel, 2009)

2.3.2 THE STREET PROFILE

Young school-aged children can be given protection by putting a limit on the amount and speed of cars. According to KpVV (2008), the average age at which children are allowed to be outside alone is 1 year higher in 30 km/h zones than in residential streets. That is why OBB (2008) proposes a speed of driving that is suitable for residential streets and to allow not more than 12 cars per hour to pass. Protection is also given by street visibility and social control. Passing pedestrians and cyclist, but also windows that are faced towards the streets provide children with social protection that allows them to be outside alone. For children to be able to play in the street, the profile needs to be clean and well maintained, but also offer an experience value. Young school-aged children play hide & seek, ball games and like to

climb and tumble. By providing hedges, benches and trees, but also curb stones, they are able to use the street for their playing purposes. In order for them to walk alone to their facilities, it is necessary to provide sidewalks that are wide enough to walk on safely, but also safe crossings that enable them to cross the street. Therefore, the cross street should have a low traffic intensity, cover small distances to cross, have clear signs and provide visibility between drivers and children. (Kips & Schepel, 2009)

2.3.3 DISTANCE CONSTRAINTS

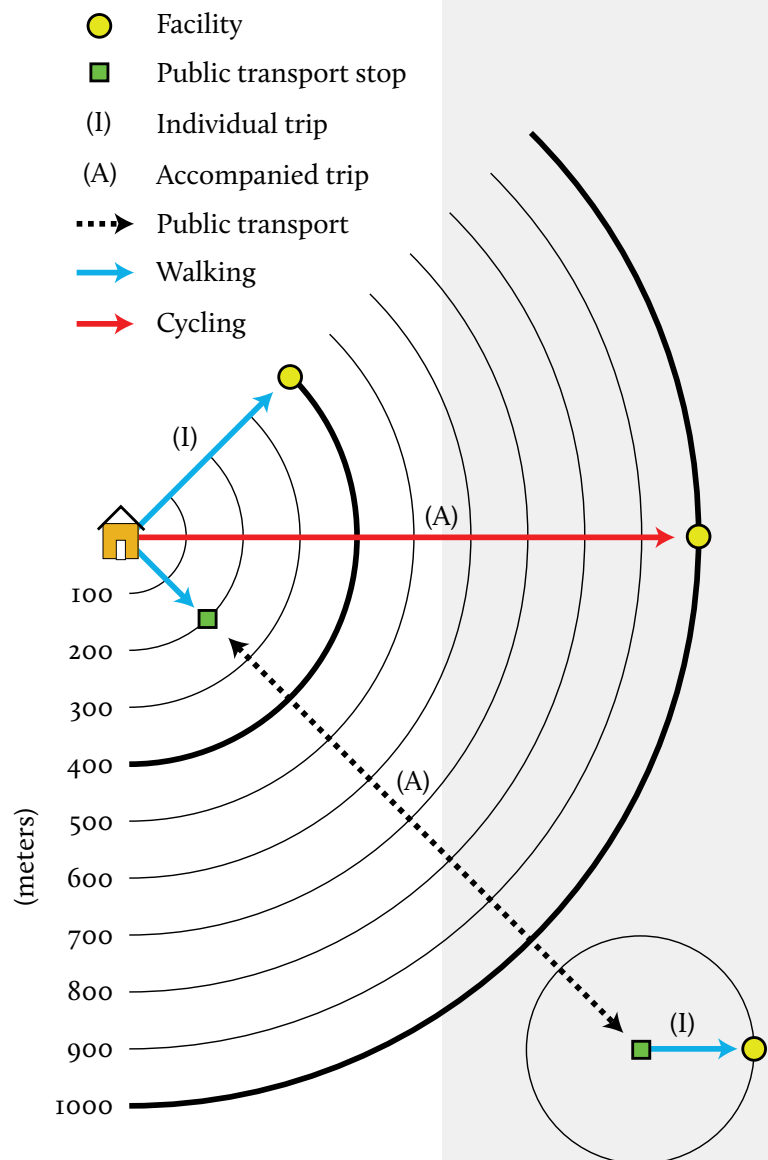
With a limited endurance, young school-aged children can only overcome short distances of walking or cycling. OBB (2008) states that young school-aged children should be able to access a playground within 5 minutes or 300 to 400 metres of walking. Per every 55 to 70 young school-aged children, one playground should be provided. In accordance, research of PBL (2003) and CBS (2010) show that Dutch children live in average 580 metres from their primary school, which serves in average 200 children. In Amsterdam, the average distance between home and the primary schools is 350 metres. (Gemeente Amsterdam, 2006) Young school-aged children that have learned how to cycle might be capable to travel by bicycle to their facilities. However, due to the physical and mental effort this costs, cycling trips are only made in company of their parents or other experienced cyclists.

2.3.4 ANALYSIS INPUT

The distance constraints for walking trips, that will be used as input for the analysis on the accessibility of children’s activity places are 400 metres for trips to facilities and 200 metres for trips to public transport stops. In case a young school-aged child is able to cycle, the distance constraint for cycling trips has been put on 1000 metres. This distance is limited by the physical and mental effort it costs for them to cycle by themselves.

44. Because young school-aged are able to make individual (walking) trips, their reach is limited as well. The distance constraints, that will be used for the analysis are illustrated by figure 44.

Source: Own material



2.4 OLDER SCHOOL-AGED CHILDREN

2.4.1 SAFETY CONSTRAINTS



Source: To be defined (Flickr)

The traffic insight of older school-aged children has improved to a level that they are able to travel by foot, with the bicycle and public transport. Spapé (2005) shows, however, that older school-aged children are not fully traffic experienced yet. They have a longer reaction time than fully experienced road users and they might still show spontaneous behaviour. Cycling is especially dangerous in complex situations and demands full concentration. Research by

45. Older school-aged children are able to walk, cycle or use public transport to travel, although cycling might still be dangerous in complex situations. Figure 45 shows older school-aged children that leave school, which is a dangerous traffic situation

46. For older school-aged children, the presence of benches on the sidewalk of the street is important for their experience value. Figure shows three older school-aged children gathering.

the Municipality of Amsterdam (2006) shows that safety constraints in the city might limit their allowance to travel individually. In Amsterdam, a higher percentage of children is being brought to primary school in comparison to the average in The Netherlands, while the average travelling distance between homes and school in Amsterdam is smaller. Therefore, it is necessary that streets provide older school-aged children with protection, freedom of movement, the ability to play, an experience value and the ability to walk and cycle. (Kips & Schepel, 2009)

2.4.2 THE STREET PROFILE

Protection is given by putting a limit on the amount and speed of cars. OBB (2008) states that the speed of driving should not exceed 30 km/h and that the streets they use should not have a disclosing function. Protection is also given by the visibility on the street and by social control.

The latter can be done by making the streets they use part of other walking and cycling routes, which increases the amount of passing pedestrians and cyclists. Because their activities also take place in the evening, protection should also be provided by the presence of street lighting. A high street experience value is provided by hedges and curb stones, that allows them to play hide & seek and play ball games, but also by benches that are not used to climb and tumble, but rather to gather with friends. (Kips & Schepel, 2009)



Source: To be defined (Flickr)

2.4.3 DISTANCE CONSTRAINTS

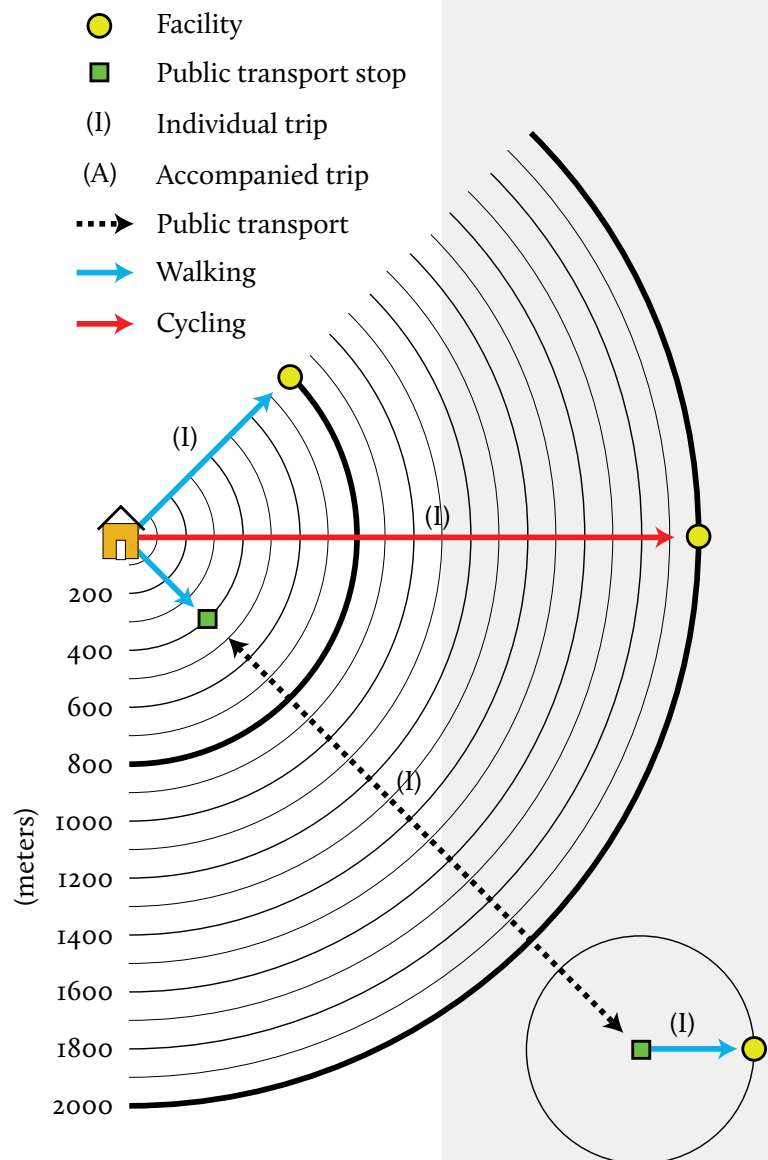
Figure 47 shows the results of a research done by the municipality of Amsterdam (2006) on the relation between travelling distances to school and older school-aged children's choice for mode of transport.

%	< 500	500-1000	1000-1500	1500-2000	> 2000
Bicycle	10	46	57	51	31
Foot	87	39	15	6	-
Car	3	13	19	25	36
Public Transport	-	2	9	19	33

From the children that live closer than 500 metres from school, the majority walks (87%). As soon as the distance becomes larger, children use different modes of transport. Around 50% of the children that live between 500 and 2000 metres from school use the bicycle. As the distance increases, less children walk and more children travel by public transport or car. Above 2000 metres, a minority cycles (31%) and more children go by car (36%) or public transport (33%). Children that use public transport are in average older and live at a larger distance from primary school (2,8 km) than children that travel by car (2 km). (DOS Gemeente Amsterdam, 2006)

2.4.4 ANALYSIS INPUT

The distance constraints for walking trips, that will be used as input for the analysis on the accessibility of children's activity places are 800 metres for trips to facilities and 400 metres for trips to public transport stops. For cycling trips the distance constraint has been set on 2000 metres. Larger distance are likely to be travelled by public transport or the car.



47. Description in the text.

48. The distance constraints of older school-aged children that have been defined and will be used for the analysis are illustrated by figure 48.

Source: Own material

2.5 TEENAGERS

49. Teenagers are able to walk and cycle over large distances individually. The distance constraints that will be used for the analysis are illustrated by figure 49.

Source: Own material

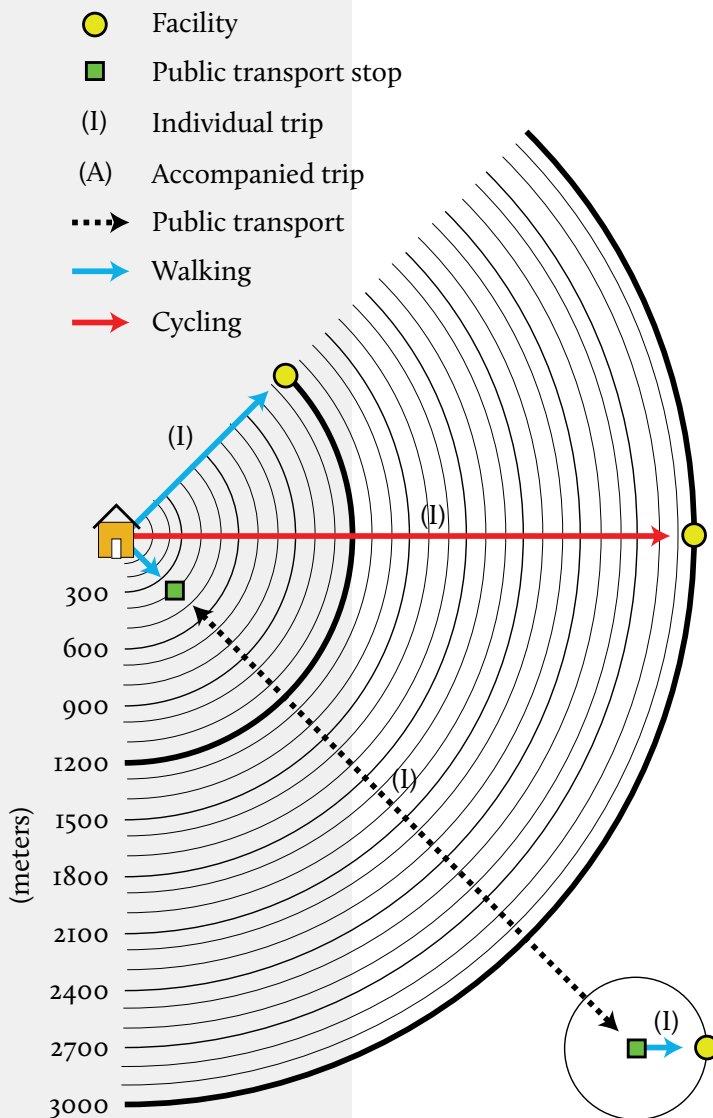
2.5.1 SAFETY AND DISTANCE CONSTRAINTS

Children with an age of 12 years and older are considered to be traffic experienced. Spapé (2005) adds that only complex situations are found to be difficult to oversee and might be experienced to be dangerous. These situations can occur when teenagers cycle to secondary school. Research of CBS (2010) has shown that children in The Netherlands in average live 2,4 kilometres from secondary school with an average size of secondary schools of 1400 children. In cities, the average distance is lower, often within their distance constraints, but outside the familiar neighbourhood or district in which the teenager has grown up. The same can be said for the non-structural formal facilities that they use, like basketball and soccer pitches. According to OBB (2008), these facilities should be accessible within 15 minutes or 1200 metres of walking and with a service area of one facility per 85-100 teenagers. Due to the larger distances of travelling

outside of the familiar district, teenagers are exposed to more intense and faster driving car traffic. (CBS, 2010) Therefore, it is necessary to create routes between districts that are equipped with safe crossings and offer a street profile that has been designed for mixed travelling purposes. A reduced exposure between cars and alternative modes of transport will reduce the danger that is perceived by the teenager during the cycling trip, which might result in more trips that are being made by the bicycle instead of the car. (OBB, 2008)

2.5.2 ANALYSIS INPUT

The distance constraints for walking trips, that will be used as input for the analysis on the accessibility of children's activity places are 1200 metres for trips to facilities and 400 metres for trips to public transport stops. For cycling trips the distance constraint has been put on 3000 metres, which is based on 15 minutes of cycling (12 km/h). Cycling is not only limited by the physical effort it costs, but in case of larger distances also by time.



2.6 THE SPATIAL REQUIREMENTS OF PARENTS

2.6.1 TIME-TRAVEL BUDGETS

Research from the Municipality of Amsterdam (2006) shows that in case older school-aged children are accompanied by parents or other experienced road users on their trip to school, most often these trips are made by car (33%), followed by the bicycle (29%) and by foot (22%). The main reason for trips to be accompanied are distance or safety constraints that cannot be overcome. However, the results also show that most of the car trips are made over a shorter distance than 2000 metres. This suggests that there might also be another reason for children to end-up at the backseat of the car. The Victoria Travel and Activity Survey (VATS, 1999) states that the choice to travel by car, while distance constraints can be overcome is based on parents' travel-time budgets. Parents try to minimise travel time, value the possibility of combining activities and maintain a maximum acceptable travelling time. (Bertolini & Dijst, 2003)

Research under Australian school-aged children in Melbourne shows that 87,5% of the accompanied trips are made by car, with 61% of these trips being linked to other destinations. From all the accompanied trips, 84% of these trips are accompanied by the mother of the child from which more than 70% works in part-time or full-time function. This suggests that the increase in school trips that are made by the car is also related to the increase in women's labour participation. (Jaumotte, 2003)



Source: To be defined (Flickr)

2.6.2 THE LINKAGE OF DESTINATIONS

The linkage between school trips and other destinations suggests that the choice for mode of transport in accompanied trips is not only determined by the journey to school, but more by the array of activities that are performed before or after the school journey. (Morris et al) Travelling by foot, bicycle or public transport can be stimulated by linking the facilities that parents use with the trips between the homes and the facilities of children. This means that accessibility to public transport can be made more efficient by locating stations and stop on walking and cycling routes between children's homes and facilities that parents can use to travel to work, without losing time. Other facilities that need to be spread efficiently are supermarkets and day-care facilities. The latter has become more important by women's increased labour participation, which has resulted in many extra trips that need to be made after school-time.

50. The choice for mode of transport in accompanied trips strongly depends on the ability for parents to make trips in an array of activities. Figure 50 shows a parent that has decided to cycle with her children to an activity place.

2.7 CONCLUSION

51. The distance constraints of children that will be used for the spatial analysis of the need for children to travel by car have been summarized in the tabel in figure 51.

Source: Own material

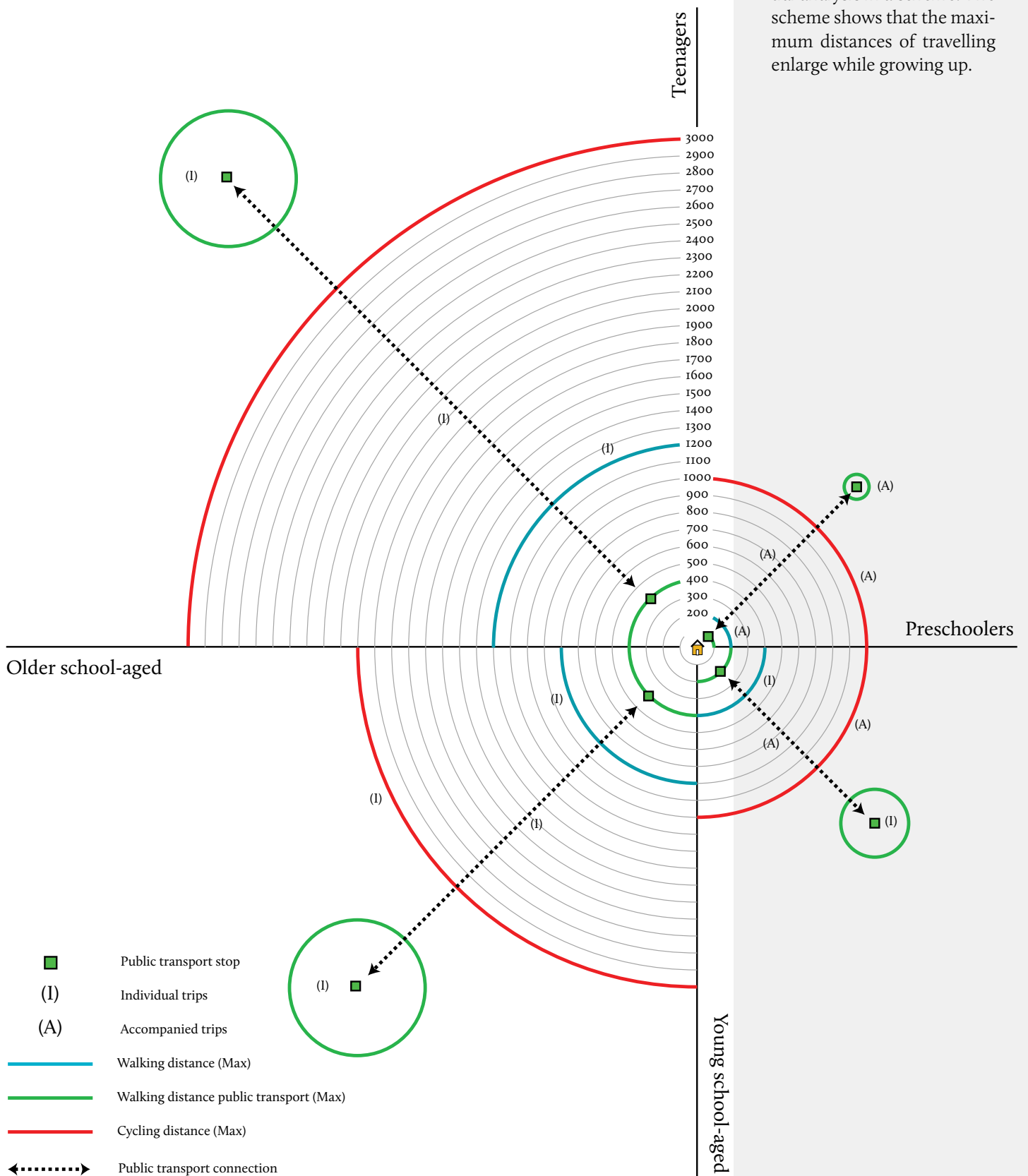
2.7.1 THE ACCESSIBILITY OF ACTIVITY PLACES

Based on the development needs of children, four age groups have been defined of children that have similar spatial requirements. These age groups are: preschoolers, young school-aged children, older school-aged children and teenagers. Because the skills of children develop while growing up, their safety and distance constraints reduce and they start to use more diverse and selective activity places. Nevertheless, all children share the need for education and thus the need to travel to school (kindergarten, primary school and secondary school). Children are able to travel to school without using the car, in case the school is located within the distance constraints of the mode(s) of transport that they are able to use, but only in case routes provide protection, freedom of movement, an experience value and the ability to play, walk and cycle, which seems to be important for all children to overcome their specific safety constraints.

2.7.2 ANALYSIS INPUT

The input for the analysis is illustrated in figure 51 and 52.

Distances (meters)	Individual trip	Accompanied trip
Preschooler		
Foot	-	< 200
Bicycle	-	< 1000
Public transport	-	> 1000 (stop < 100)
Car	-	> 1000 (stop > 100)
Young school-aged		
Foot	< 400	-
Bicycle	< 1000	< 1000
Public transport	-	> 1000 (stop < 200)
Car	-	> 1000 (stop > 200)
Older school-aged		
Foot	< 800	-
Bicycle	< 2000	-
Public transport	> 2000 (stop < 400)	-
Car	-	> 2000 (stop > 400)
Teenager		
Foot	< 1200	-
Bicycle	< 3000	-
Public tr. – Foot	> 3000 (stop < 400)	-
Car	-	> 3000 (stop > 1000)



52. Figure 52 shows the distance constraints of children that will be used for the spatial analysis in a scheme. The scheme shows that the maximum distances of travelling enlarge while growing up.

CHAPTER 3

THE URBANIZATION OF WROCŁAW'S REGION



Source: Own material

In this chapter, the aim is to define the impact of the urbanization of Wrocław's region on the livability of children, for those children that have moved from the city to the region, but also for children that are still living in the city. In the *first* paragraph, the area to research, which is the 'living in the forest' housing project in the Oder river delta, will be researched to explain to what extent and how the region is developing. In the *second* paragraph, the aim is to define the livability of children in this new housing area and the effect of this development on the livability of children in the city, which is done by explaining the situation of the family Mroszewska that has recently moved from Wrocław to this area. In the *third* paragraph, the effects of the urbanization of the region on the livability of children will be defined by conclusions. In the *fourth* paragraph, these conclusion will be used to give recommendations for housing development in Wrocław's region that can be used by municipalities to improve the livability of children in the region and the city as well.

53. This chapter aims to define the impact of the urbanization of Wrocław's region on the livability of children. Figure 53 shows the "Living in the forest" housing project, which is located just outside Wrocław's border and will be researched as a case study.

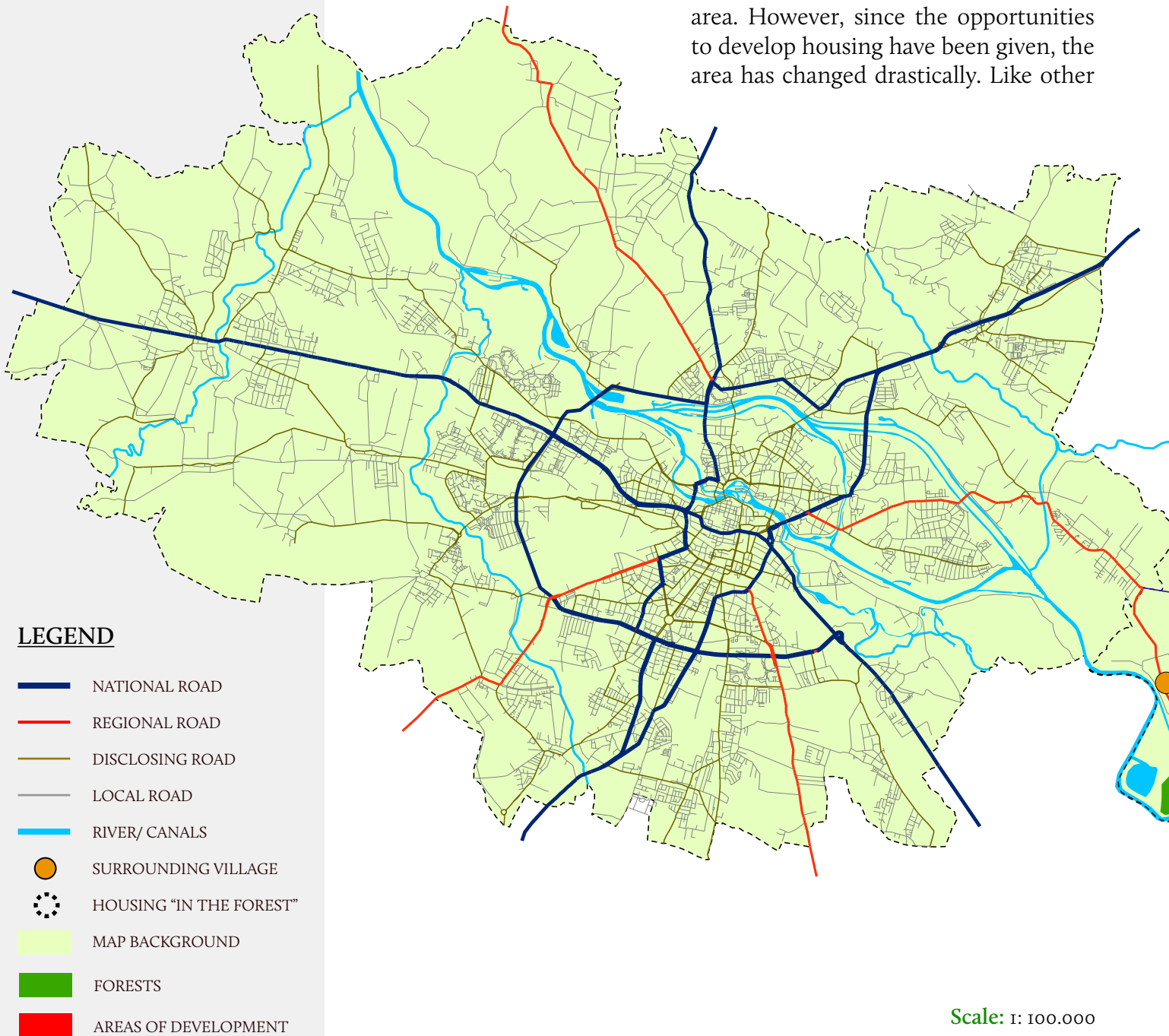
3.1 CASE STUDY: "LIVING IN THE FOREST"

54. The Oder river delta is located in the municipality of Czernica, where many new housing project have been built in recent years. Figure 54 shows Wrocław and Czernica and illustrates the locations where new housing areas have been developed.

Source: Own material

3.1.1 THE ODER RIVER DELTA

Just outside Wrocław's border, between Wrocław and the city of Jelcz-Laskowice (15.000 inhabitants), lies the Oder river delta. Figure 54 shows the map of Wrocław and the Oder river delta with the road that connects Wrocław to Jelcz-Laskowice, which runs through the municipality of Czernica. In the area, several housing projects have been developed over the past 10 years, which has made the population of Czernica grow from 8590 inhabitants in 2004 to 10726 inhabitants in 2009. The Oder river delta used to be known about its small villages, its wetlands and its forests that seem to thrive well in this wet area. However, since the opportunities to develop housing have been given, the area has changed drastically. Like other

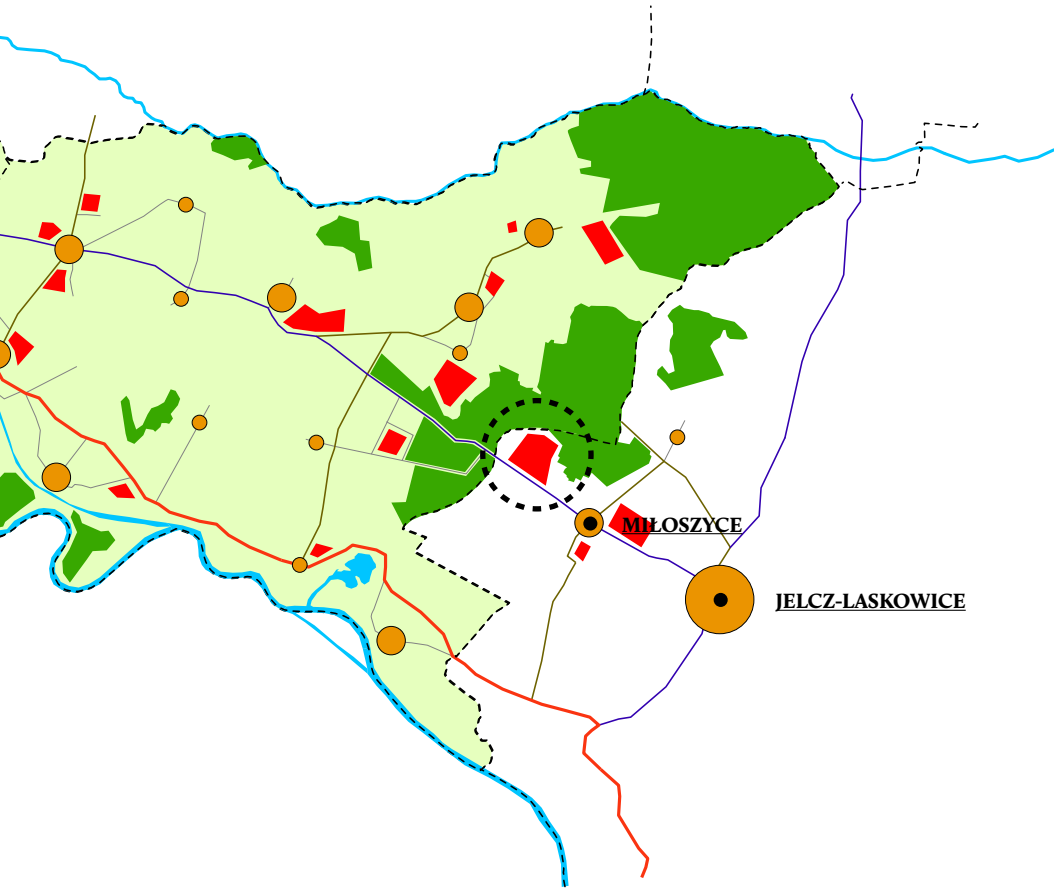


municipalities that are bordering Wrocław, Czernica and the Oder river delta have become popularly known as Wrocław's bedroom. The main reason for this designation is the reliance of its new inhabitants on the city. Most of the plots, that have become available for housing development in the area, have been sold to people that live are used to live in Wrocław. They have built or plan to build their detached family house in the countryside, in the close vicinity of the city where they still rely on. Or in other words, they sleep in the countryside and spend their days in the city. This creates a need to re-search the self-sufficientness of these new housing areas, which might be an indication for the increase in transportation demand from the region to the city. In this chapter, the choice has been made to research the housing project called "living in the forest", near the old village of Miłoszyce (850 inhabitants) on the livability of children in the area and the need and ability for parents or children to travel from the region to the city, as a case study of one of the many housing areas that arise around Wrocław.



Source: Araw (2012)

55. The Oder river Delta used to be known about its small villages, its wetlands and its forests. However, due to the new housing development, the area has become popularly known as Wrocław's bedroom. Figure 55 shows an old village in the delta.

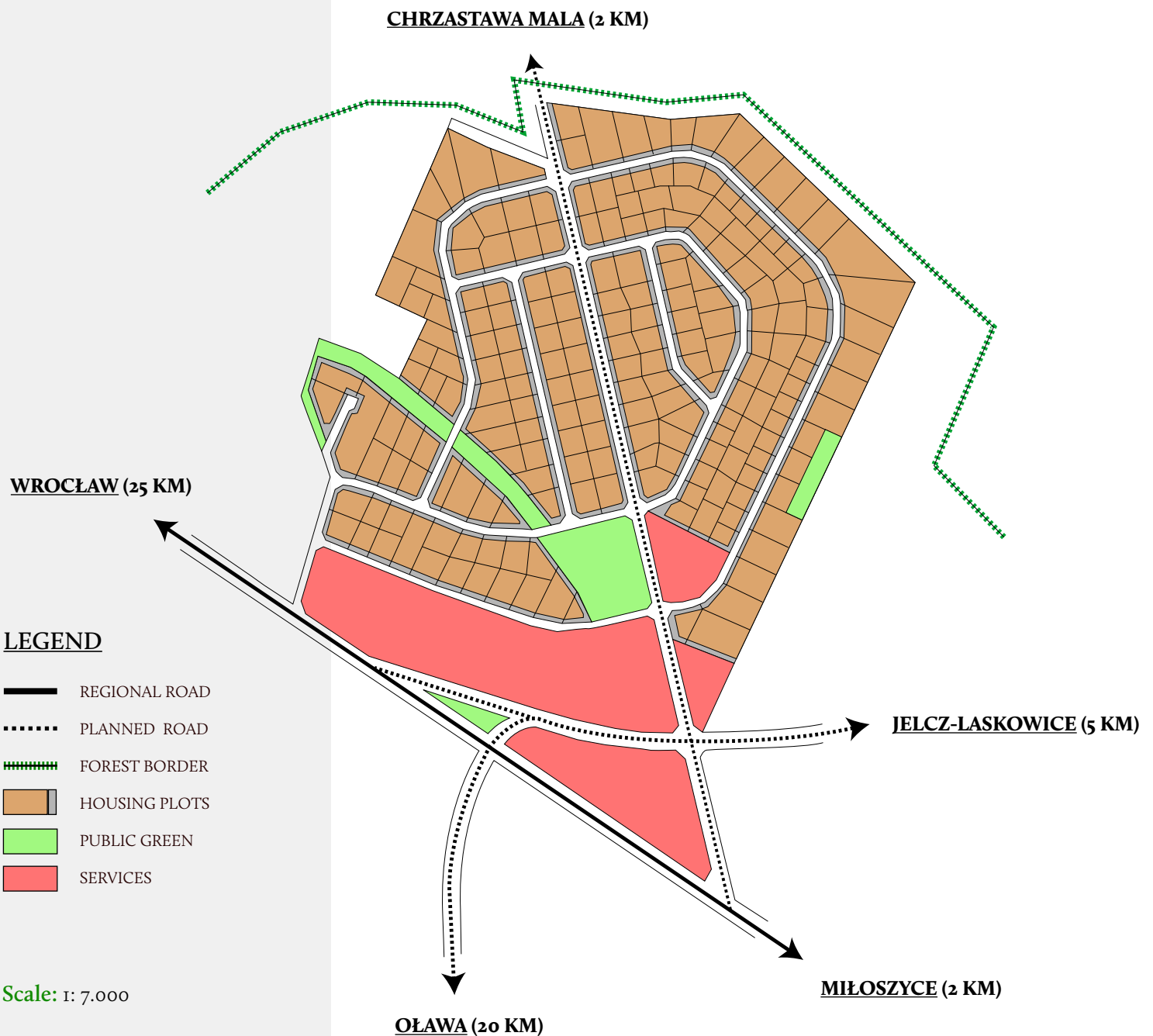


56. The Living in the Forest housing project contains of 200 plots for housing, space for public green and services. Figure 56 shows the division of plots and where housing and services are developed.

Source: Own material

3.1.2 HOUSING PROJECT: "LIVING IN THE FOREST"

The "living in the forest" housing project is named after its location, which is practically in the forest. At a distance of 25 kilometers from Wrocław and 2 kilometers from the villages of Miłoszyce and Chrzastawa Mała, undeveloped land has been divided into 200 plots for the building of detached family housing. Figure 56 shows that beside these plots, space for public green and services, that are still to be defined, has been reserved. Also new (regional) roads will be developed that will connect the new housing area to Jelcz-Laskowice, at a distance of 5 kilometers and to the medium-sized city of Oława (31.000 inhabitants), at a distance of 20 kilometers.



The first plans to develop this area for housing date from 2001. Since then the plots have been sold like hot cakes. According to Kamińska (2010), within a short period of time 150 plots were sold, mainly to people who live(d) in Wrocław and were attracted by the low pricing of the plots, the beautiful location near the forest and the promise of the developer to quickly construct the needed (underground) installations and infrastructure. However, figure 57 illustrates that it takes a long time for the area to actually develop.



Source: Own material

In an article in the local newspaper, the reason for this stagnation in development is explained. In 2001, the municipality of Jelcz-Laskowice sold the undeveloped land to a private developer called “Agropharm”, which since then has been the responsible party for selling the plots and developing the needed infrastructure. However, from the moment that all the plots were sold, the developer disappeared, wherewith the development of the vital installation and infrastructure have stayed out. (Kamińska, 2010) Figure 58 shows the main road through the area that is connected to the regional road that discloses Jelcz-Laskowice to Wrocław. The road has still not been developed, which makes the area badly accessible. According to the article, there are also problems with water supply and the sewage system. The developer is the owner of the water system and pipes and is responsible for the supply of water. Because the developer has disappeared and a permit to connect the whole area to the municipal water supply system has never been granted, many plots cannot be developed. The result has been a legal battle between the municipality and the developer in which the inhabitants of the area and the plot owners seem to be the main victim. In the next paragraph, the consequences of this situation for the livability (of children) in the area and the need for parents and children to travel by car will be researched by explaining the situation and living of the family Mroszewska. This family was one of the first families to buy a plot and build a detached family house in this area, for which they have left Wrocław and in which they have been living over the past two years.

57. Although many plots have already been sold since 2001, it takes a long time for the area to really develop. Figure 57 shows a detached house under construction.

58. Because the developer has disappeared, the construction of the vital infrastructure and installations have stayed out. Figure 58 shows road that discloses the area with the regional road towards Wrocław, which has always not been paved yet.



Source: Own material

3.2 THE LIVABILITY OF CHILDREN

59. The main reason for the family Mroszewska to leave the city for the region was to live in a bigger house and in a more child friendly living environment. Figure 59 shows the detached family house which they have build and where they have been living in for the past two years.

3.2.1 THE FAMILY MROSZEWSKA

Several years ago, Judyta and Bartosz Mroszewska decided to buy a plot and build a detached family house in the this area, with the plan to soon become a family. Now, at the beginning of 2012, Alicja (2 years old) and Sebastian (0,5 years old) complete the family Mroszewska that has moved from Wrocław to their new house two years ago. The main reason for them to move from Wrocław to the region was the wish to live in a bigger house, but also to live in a child friendly living environment. Although living in the house is satisfying, the child friendliness of the area is a different story. Judyta, who is a full time mother, describes that she and her children are living in a social isolement. Because the development of the area is in stagnation, only a few people have actually decided to build a house and live in the area. This means that there are hardly other people to socialize with or children to play with. The stagnation makes also that



Source: Own material

plot owners are not taking the risk to develop at this moment. Others that were developing have stopped their work and try to sell or change their unfinished house, which is illustrated by figure 60. Another factor that explains why plots remain unbuild it that the initiative to develop lies by the owners of the plots themselves. Due to the financial crisis, plots remain undeveloped by a possible lack of finances. Others have bought a plot as an investment, without the plan to build a house and to live on it.



Source: Own material

3.2.2 URBAN FUNCTIONS

The low density of living influences the provision of facilities in the area. Although in the housing plan space has been reserved for services and public green, neither of these have actually been realized. This means that there are no schools for children to attend, nor playgrounds to play in. The only available space for playing is in the yard around the house. However, in case it would be profitable to develop the space for services and public green, it would still be doubtful whether or not it would improve the livability of children. The urban plan does not prescribe the type of services that will be provided and in the design of the plan, there is a clear separation between the space for living and services. Services will be provided outside the living areas and in the close vicinity of the regional roads, which is likely to increase the distances of travelling and constrain or discourage children to travel to school by foot or bicycle.

Figure 61 shows the regional road towards Wrocław. The trees are being used as improvised bus stops where, if lucky, once an hour a bus stops that drives to the city. Due to the low density of living, it is not profitable to provide a high quality public transport connection between the area and the city. The nearest train station is in the village of Miłoszycze at a distance of 2,5 kilometers, which explains why Bartosz is one of many that is daily commuting between the region and work in Wrocław by car.



Source: Own material

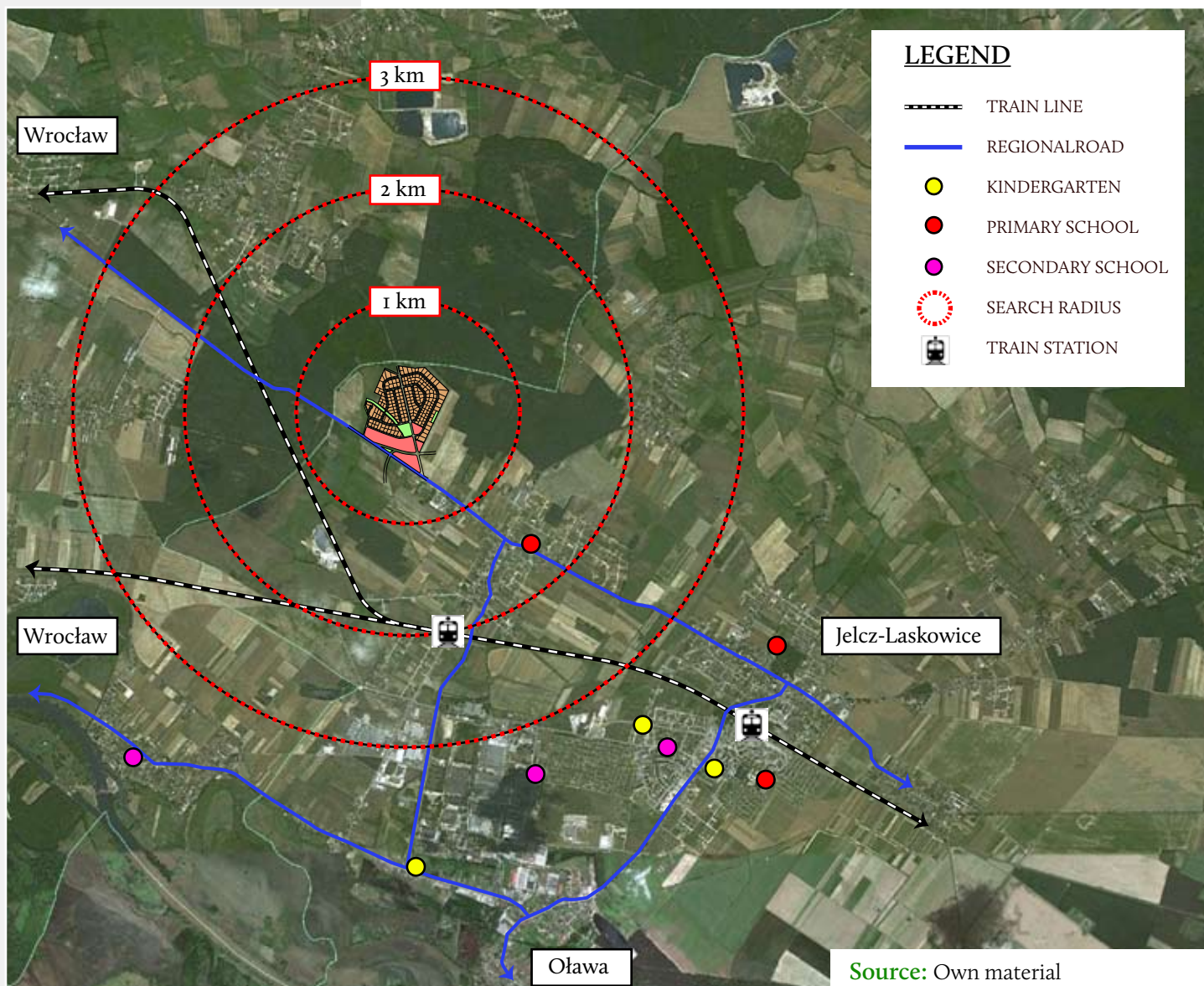
60. Due to the stagnation in development, but also due to the financial crisis and mode of development, many plots have remained undeveloped. Figure 60 shows an unfinished house that the owner wants to change or sell.

61. The stagnation in development makes also that essential urban functions, like public transport are missing. Figure 61 shows trees beside the regional road towards Wrocław that are being used as improvised bus stops.

62. The livability of children in the region is being threatened by distance constraints that cannot be overcome. Figure 62 shows the housing project and the closest schools, whereby only older school-aged children might be able to cycle to school.

3.2.3 DISTANCE CONSTRAINTS

Figure 62 shows the location of the housing project and the nearest kindergartens, primary schools, secondary schools and train stops. Within a radius of 3 kilometers, there is one public primary school, which is located in the village of Miłoszyce. The public kindergartens and secondary school are located in Jelcz-Laskowice, which is located 5 kilometers from the housing area. Considering children's distance constraints, the distance to the primary school in Miłoszyce might be overcome by older school-aged children. Children from other age groups are not able to overcome their distance constraints. This explains why the family Mroszewska has recently decided to buy a second car. Their youngest child will soon be at the age to go to kindergarten. Because Bartosz works in Wrocław and is reliant on car use, a second car needed to be bought to enable Judyta to pick-up and drop-off Alicja at the kindergarten in Jelcz-Laskowice.



3.2.4 SAFETY CONSTRAINTS

Although the older school-aged children are able to overcome their distance constraints and cycle to the primary school in Miłoszyce, the actual chance that they are allowed to is rather small. Like shown in figure 58, the road that discloses the area has not been paved yet, which makes it dangerous for them to cycle. And in case the regional road will be reached, it still needs to be crossed.

Figure 63 shows the regional road between Wrocław and Jelcz-Laskowice and the new crossing that has recently been constructed, which should enable children to cross the road.

The new crossing definitely improves the crossability of the road. There is a zebra and a restpoint, which enables children to cross the road in two stages. However, there is also a problem, which is the lack of measures that slow down the passing cars. In Poland, outside urban areas, cars are allowed to drive 90 km/h. Although a sign has been placed which ask drives to slow down for children that might cross the road, there are no measures that force drivers to do so, for instance in the form of a treshold. With this speed of driving, there is a big chance that drivers will not even notice the sign to be there. Therefore, the measures that aim to enable children to walk or cycle might be ineffective, with driving that has been left untouched.

Safety constraints also appear in the neighbourhood street, that have not been paved yet. Figure 64 shows that it might be difficult and dangerous for children to walk or cycle in the area and that the best way to travel through these streets is actually in a terrain car.

The usability is further limited by a lack of social control, which is caused by the lack of housing beside the street, the lack of cyclists or pedestrians on the street and the lack of street lighting. In the winter, it becomes dark outside around 3.30 pm, which is in fact the main time for primary schools to finish. Therefore, the ability for older school-aged children to cycle to primary school is constrained by safety even more, which makes it unlikely for these children to travel to school by bicycle and without the use of the car.



Source: Own material

63. The ability to cross the regional road for children has not improved by the measures that have been taken to make the road crossable. Figure 63 shows that only a sign has been placed to slow traffic down, where a treshold or a stopping light is preferred.

64. The usability of neighbourhood street is being threatened by a lack of social control. Figure 64 shows that there are no houses and other cyclists or pedestrians that stimulate social control.



Source: Own material

3.3 CONCLUSION

3.3.1 THE LIVABILITY OF CHILDREN IN THE REGION

Compared to the livability of children in the city, the livability of children that have moved to the housing project that has been discussed in this chapter has hardly improved. Although the yard around the new family house enables children to play outside, there are so much more factors that define the livability of children, which in this area are not being provided. Due to the stagnation in development, the facilities and other activity places where children rely on have not been developed, which has made travelling to these facilities become reliant on car use by safety and distance constraints that cannot be overcome. But also in case it would be profitable to develop facilities, the livability of children is not likely to be improved. The urban plan foresees in services that will be developed outside the living areas and near the regional road, which is likely to result in distance and safety constraints that children are not able to overcome.



Source: Own material

65. Due to the need for Bartosz Mroszewski to travel by car to work in Wrocław and the need for Alicja Mroszewski to be transported to kindergarten by car as well, the family Mroszewski has recently bought a second car. Figure 65 shows the two cars in the yard of the house.

3.3.2 RELIANCE ON CAR USE

The stagnation of development is not the only reason for the lack of facilities to occur. The urban plan does not provide space for working facilities, which makes that all the trips to work need to be made over a long distance. Because there are no qualitative public transport connections, that might provide an alternative for car use, there are many daily trips between the region and the city, where work is located, that are reliant on car use.

3.3.3 EFFECTS ON THE LIVABILITY OF CHILDREN IN WROCŁAW

The urbanization of the region is threatening the livability of children in Wrocław by an increase in car trips from the region to the city and therewith a growing demand for space for cars in the city. The example of the housing project in this chapter has shown that the development of these areas is purely focused on housing. Many new inhabitants of the region are reliant on city functions, that with a lack of qualitative public transport connections, can only be reached by car. Considering the actual increase in population in the region, which is caused by the attractiveness of the city, there will be an increase in car use and therewith a growing demand for space for cars in the city. This will negatively influence the effectiveness of measures to improve the livability of children, like the examples in paragraph 1.4 have pointed out, which will encourage the outflow of families from the city and will threaten the livability of children even more.

3.4 RECOMMENDATIONS

3.4.1 THE ROLE OF THE GOVERNMENT

The first recommendation is for the government to take a more active role in urban development. The mode of development, in which the municipality sells undeveloped land to a private developer is a quick win for the municipality, but also creates risks, like the example in this chapter has pointed out. Risks that are also likely to be present in other housing projects, with a mode of development that is typical for the regional development that is taking place. Therefore, it is highly recommendable for municipalities to take the role as developer and develop these areas on the basis of public-private partnerships, in which the municipality keeps the control over the development and the construction of the vital installations and infrastructure is tendered. Before the installations and infrastructure will be constructed, a critical mass of potential inhabitants needs to be created that will not only decide to buy a plot, but also to actually build a house on it. This certainty will not only enable the municipality to develop the installations and infrastructure, but also the needed facilities, which eliminates the risk for the development of the area to fall in stagnation. And the potential inhabitants benefit by the certainty that a social isolation, which has been the case in the “Living in the forest” housing project, will not occur. This makes it more likely for all their reasons to move from the city to their detached family house in the region to be realized.



Source: Berend Quest (2011)

3.4.2 THE SIZE AND DESIGN OF ‘URBAN EXTENSIONS’

The example of the housing project in this chapter has pointed out that in a small-scale ‘urban extension’, with a low density of unvaried housing, it is hard to keep it livable. Therefore, the second recommendation is to develop ‘urban extensions’ on a larger scale, with a higher density and diversity of living, which will not only stimulate the social cohesion in these areas, but also make facilities, like schools, supermarkets and public transport become profitable, more diverse and better accessible. This will benefit the children in the region, but also their parents and therewith indirectly the children in the city. However, whether or not the potential livability will be provided depends on the design of the urban plan, what also has been pointed out by the example in this chapter. The key principle is to develop areas in which public life stands central, with a mix of urban functions and spaces that are accessible by safe streets and routes.

66. There is a need for the government to take a more active role in the development of urban extensions. These extensions also need to be planned with a higher diversity of housing and on a larger scale, which will make it more likely for the area to be livable. Figure 66 shows an urban extension on the larger scale that is under construction in The Netherlands.

CHAPTER 4

CHILDREN'S NEED TO TRAVEL BY CAR



Source: Own material

In this chapter, the need for children to travel by car in Wrocław will be measured to define the urgency for this need to be reduced. In the *first* paragraph, the location of children's homes and activity places, as well as the walking, cycling and public transport network will be defined with which children's need to travel by car will be measured. In the *second* paragraph, the methodology will be explained how this knowledge, as well as the distance constraints that have been defined in the second chapter will be used to measure the accessibility of children's activity places. In the *third* to the *sixth* paragraph, the accessibility of children's activity places and therewith the need for children to travel by car will be defined based on their specific distance constraints. Hereby, a distinction will be made between the age groups that have been defined in the *second* chapter. In the seventh paragraph, the urgency to reduce the need for children to travel by car will be explained by the results of this analysis, which will be used as the input for the fifth chapter in which this need will be reduced.

67. In this chapter, the accessibility of children to the activity places they use will be measured and defined. Figure 67 shows two walking young school-aged children that are dropped off to school by their mother.

4.1 INVENTORY

4.1.1 CHILDREN'S ACTIVITY PLACES - SCHOOLS

68. Description in the text.

69. Description in the text.

70. Description in the text.

71. In this project, the accessibility of children to public schools will be measured and defined. Figure 71 shows the location of public kindergartens (98), primary schools (67) and secondary schools (40) on Wrocław's map.

The choice has been made to analyse the accessibility of children's activity places for schools only. Because there is great diversity of activity places that children use, an analysis on the accessibility of all is rather too time consuming. Considering that children share the need for education on a daily basis, the school (kindergarten, primary and secondary school) is the most important activity place that children attend to. In Poland, schools are divided into public, private and specialized schools. Public schools are free of charge and are attended by the majority of children. Private schools are similar to public schools, with the difference that there has to be paid for education. Specialized schools are for retarded children, but also for children that have a special talent in music or sports. In this project, only the accessibility of public schools will be researched, because these are the standard and should be made accessible for all children.



Source: Pleul (2011)

► Kindergartens

Figure 68 shows a kindergarten in Wrocław, that children are able to attend to between the age of 3 to 5 years old. Although the age group that has been defined in the second chapter of this report is slightly different, the ages are indicative, which makes it possible to use the analysis input for the empirical research in this chapter. Figure 71 shows that there are 98 public kindergartens in Wrocław, wherefore the accessibility will be measured.



Source: Bobowska (2011)

► Primary schools

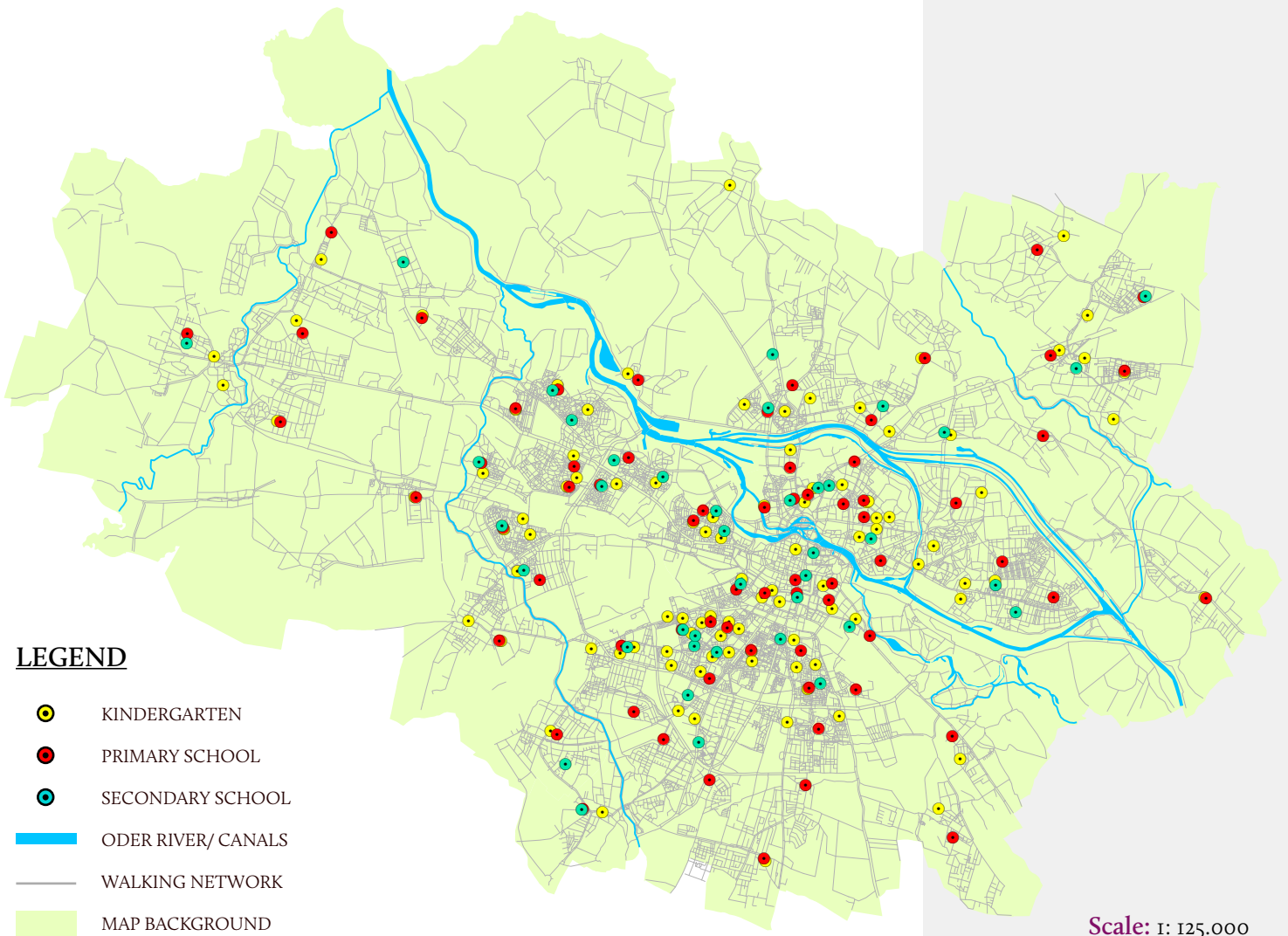
Figure 69 shows a primary school in Wrocław, that children are able to attend to between the age of 6 to 12 years old. This is similar to the age group that has been defined in the second chapter of this report. Therefore, the spatial requirements of young- and older school-aged children can be used for the empirical research. Figure 71 shows that there are 67 public primary schools, wherefore the accessibility will be measured.

► Secondary schools

Figure 70 shows a secondary school in Wrocław, that children are able to attend to between the age of 13 to 15 years old. This is similar to the age group that has been defined in the second chapter. In Poland, from the age of 16, children attend to a liceum, which is often located elsewhere. Figure 71 shows that there are 40 public secondary schools in Wrocław, wherefore the accessibility in this chapter will be measured and defined.



Source: Samoraj (2011)



Scale: 1: 125.000

72. Description in the text.

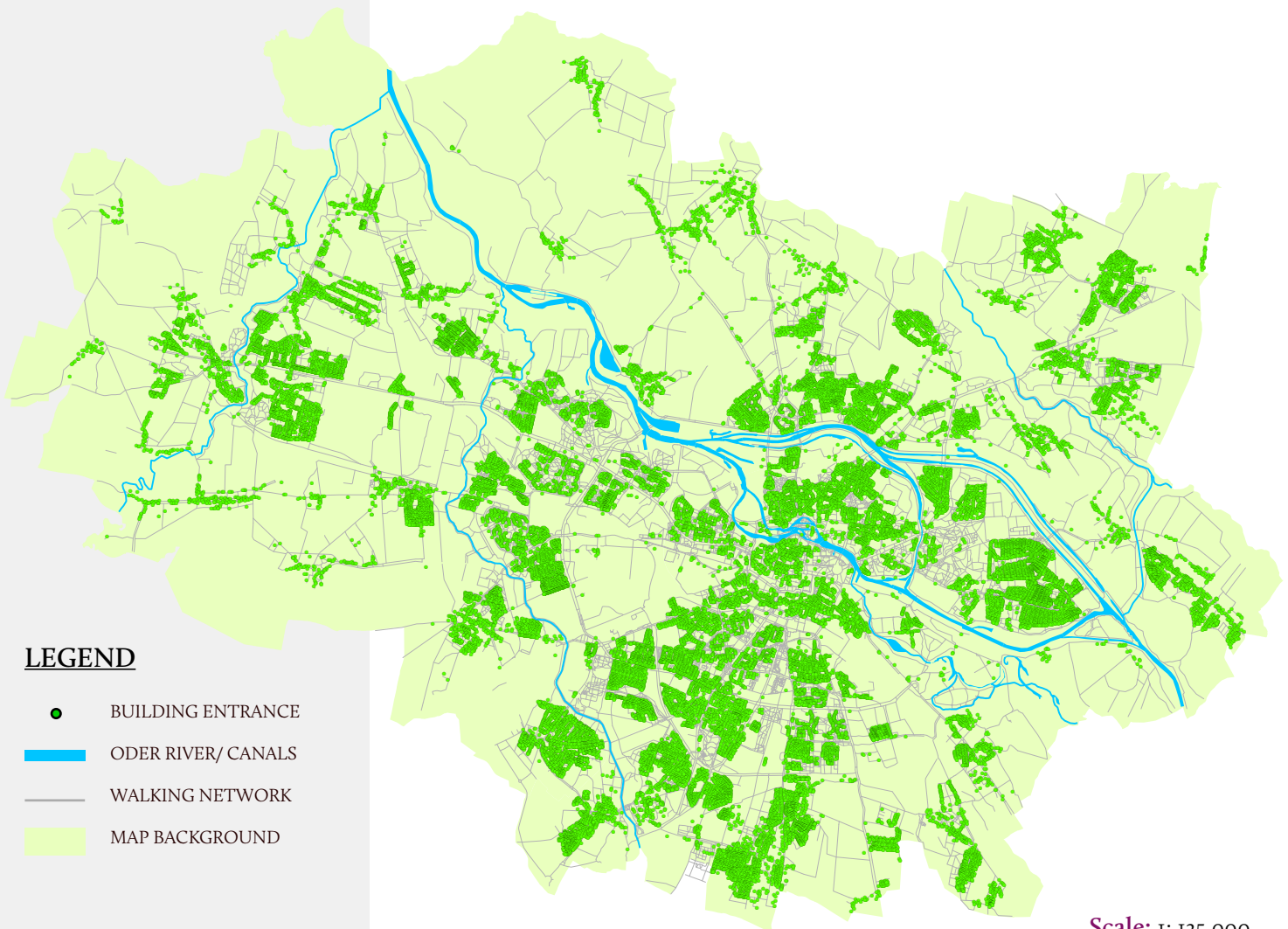
73. Due to the intensity of traffic, the residential street has been defined to be crossable at every moment, without the use of zebras or stopping lights. Figure 73 shows people in Wrocław's city centre that are crossing a residential street without the use of crossing facilities.

74. Description in the text.

4.1.2 CHILDREN'S HOMES

The Wrocław planning authority has provided information about the homes of its inhabitants, in the form of an ArcGIS shapefile that has been shown in figure 72. The dots on the map represent the entrances of all the houses and buildings in the city on the 31st of December 2005, which is linked to a database that contains information on the amount of inhabitants that lived in these objects and the years in which they were born. This has been filtered and cut and has resulted in four shapefiles of building entrances for every age group that are linked to the amount of children living in these objects. At the end of 2005, there were:

- 13081 preschoolers, living in 9348 houses/ buildings;
- 13436 young school-aged children, living in 9563 houses/ buildings;
- 20042 older school-aged children, living in 12593 houses/ buildings;
- 18208 teenagers, living in 11832 houses/ buildings.



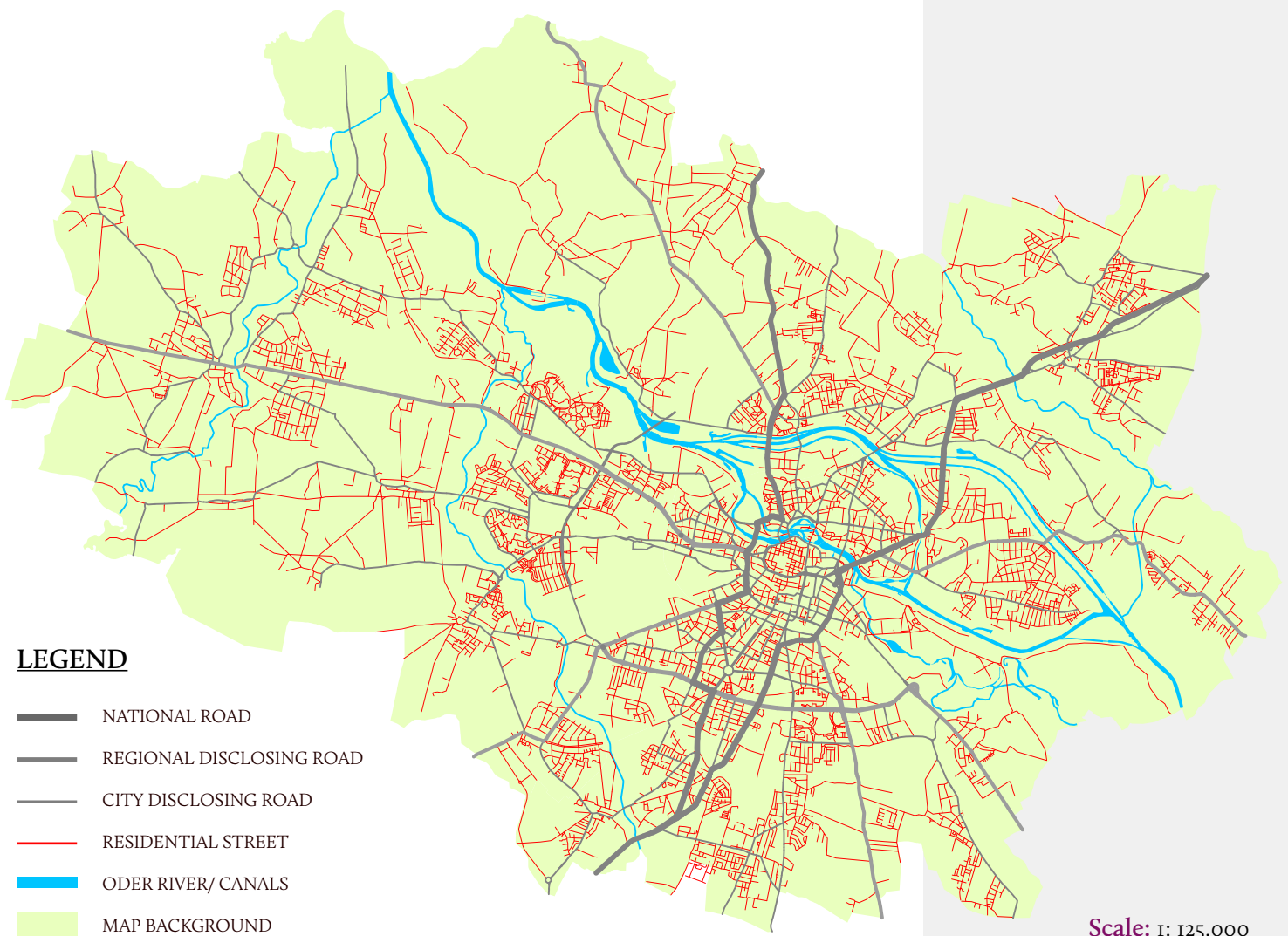
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4.1.3 THE WALKING NETWORK

As an alternative for car use, children might walk, cycle or use public transport to travel to school. To measure the distance between homes and schools, the walking and cycling network, as well as the locations where access to public transport is provided need to be defined. When it comes to defining the space where children are able to walk and where not, the most accurate method would be to analyze the walkability of roads,



Source: Own material



75. Description in the text.

76. Description in the text.

77. Description in the text.

78. Children are able to walk in residential streets, on sidewalks beside traffic intense roads and on (informal) walking paths. Figure 78 shows that walking network that has been defined and will be used to measure the walkability to public schools.

streets and walking paths. However, considering the size of the city this is not realistic. Therefore, a simplified approach has been chosen by only taking the crossability of roads and streets into account. Figure 74 on the previous page shows the network of roads and streets for cars that has been divided into four categories. These are based on the information that the Wrocław planning authority has provided on the intensity of traffic in the city. The national roads, that have frequently been addressed in the first chapter of this report, have the highest intensity of traffic. (category 4) This is followed by regional disclosing roads (category 3) and city disclosing roads (category 2). The lowest intensity of traffic is found in residential streets. Because children's ability to cross the road is influenced by the intensity of traffic, the categorisation is an indication whether or not children will be able to cross without the use of crossing facilities, like zebras and stopping lights that make it safe to cross busy roads. Therefore, the residential streets have been defined to be crossable at every moment.



Source: Own material

► Sidewalks

On the roads with a high intensity of traffic (category 2 and higher), children are only able to walk on the sidewalks and cross the road in case a facility is provided that makes it safe to cross the street. Figure 75 shows a particular sidewalk beside the national road towards Poznan. The separation between car traffic and slow traffic, in the form of hedges, also indicates that children are not able to cross these roads at every moment.



Source: Own material

► Walking paths

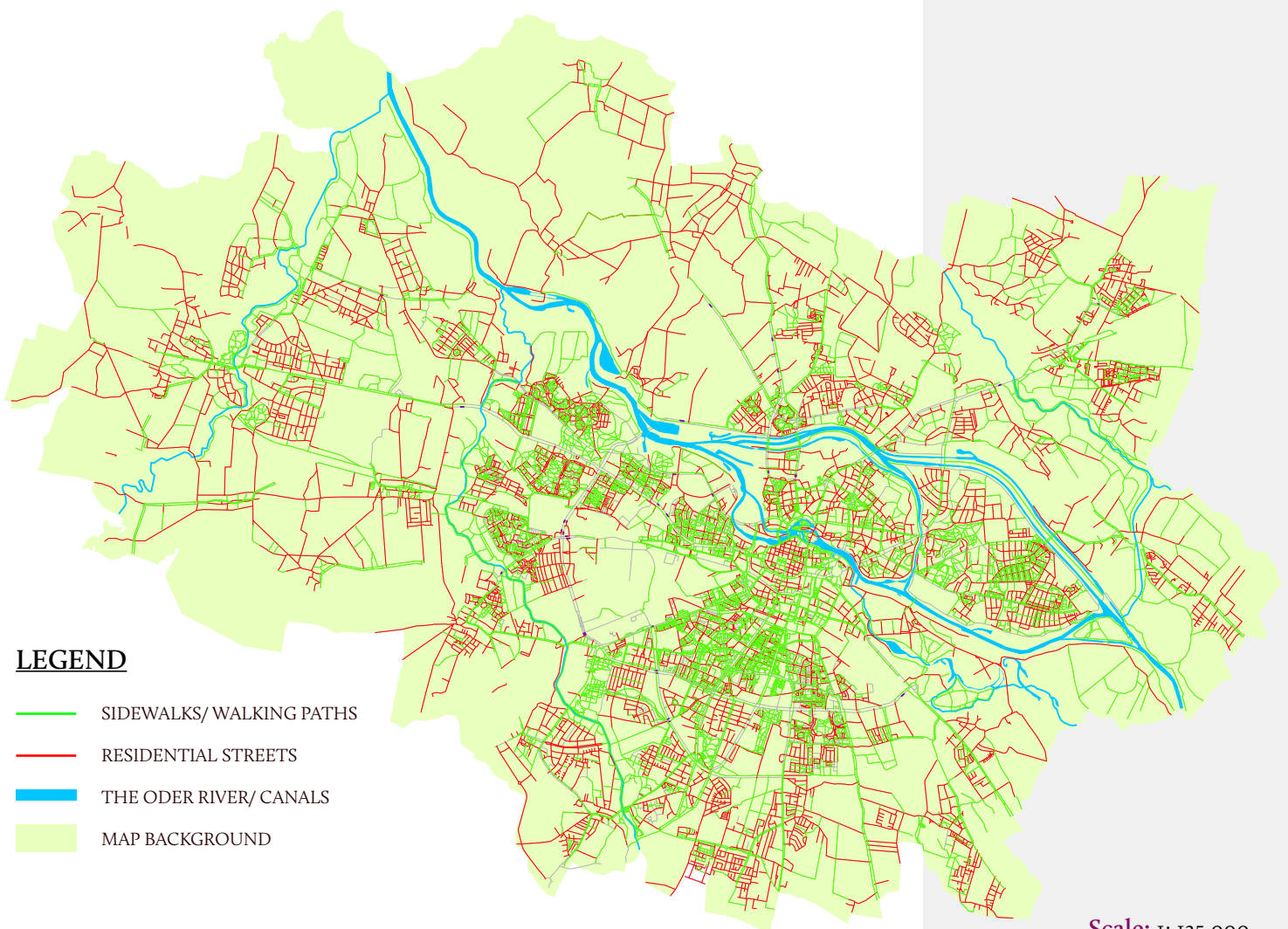
Beside the residential streets and the sidewalks that can be used for walking, there is also dedicated infrastructure that is meant for walking purposes only. Figure 76 shows a walking path around a park in Wrocław's city centre, where it is safe to walk. The walking paths and sidewalks are drawn in figure 78, that together with the residential streets define the walking network. This will be used to measure accessibility of schools by foot.

► Informal walking paths

Figure 77 illustrates that there are many walking paths in Wrocław that have not been planned by the city, nor been constructed. These informal walking paths have been caused by a lack of network directness, which illustrates that people aim to walk the smallest distance possible. Because there is an apparent need to use these paths, they are also included in this research and have been drawn in figure 78 as dedicated walking paths.



Source: Own material



Scale: 1: 125.000

79. Description in the text.

80. Description in the text.

81. Description in the text.

82. Children are able to cycle in residential streets and on (informal) bicycle paths beside traffic intense roads. Figure 82 shows the cycling network that will be used to measure the ability for children to cycle to school.

4.1.4 THE CYCLING NETWORK

When it comes to defining the space where children are able to cycle and where not, the most accurate method would be to analyze the cyclability of roads, streets and cyclings paths. However, like it has also been shown in the previous sub-paragraph, this is considering the size of the city not realistic. Therefore, a similar approach is used in which children's ability to cycle on roads and streets has been taken into account. Based on the categorization of the intensity of traffic, the roads with a high intensity of traffic (category 2 and higher) have been defined to be not safe enough for children to cycle on them. Only dedicated paths beside these roads can be used for cycling purposes, which also means that they can only be crossed by making use of zebras or stopping lights. This is also shown in figure 79, where the separation between a busy road and a cycling path in Wrocław's city centre indicates that the road cannot be crossed at every moment.



Source: Own material

► Cycling paths

Like already mentioned in the second chapter of this report, the network of cycling paths in Wrocław is limited. There is approximately 160 kilometers of dedicated cycling infrastructure, which is for a big city like Wrocław small, but still twice as much as 10 years ago. Figure 82 shows the cycling paths that are mainly constructed beside the roads with a highest intensity of traffic, which should enable children to cycle beside these roads.



Source: Own material

► Residential streets

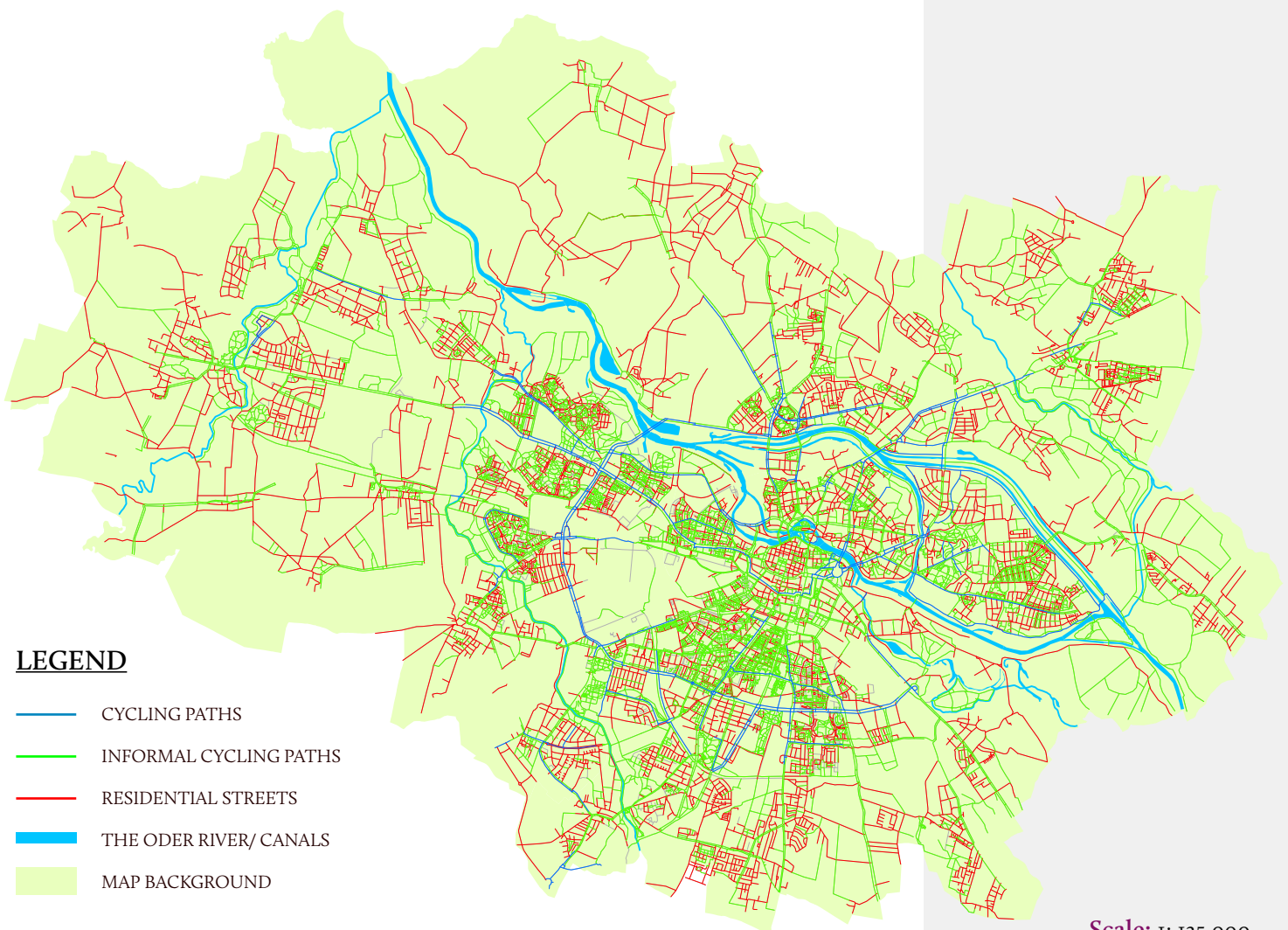
The streets that have been defined to be safe enough for children to cycle on them are the residential streets. Figure 80 shows a particular street in Wrocław's city centre that is being used by a cyclist. Due to the lack of dedicated cycling infrastructure, there is a high reliance on residential streets for cycling purposes. This is also illustrated by figure 82, where the amount of residential streets clearly outweighs the amount of cycling paths.

► Informal cycling paths

Beside many roads that have a high intensity of traffic, there is a lack of dedicated cycling infrastructure. Therefore, there is a high reliance on sidewalks and walking paths that are being used as informal cycling paths. Figure 81 shows a sidewalk beside a road with a high intensity of traffic in Wrocław's city centre that is being used by a cyclist. The informal cycling paths are included in the cycling network, which is shown in figure 82.



Source: Own material



Scale: 1: 125.000

83. Description in the text.

84. Description in the text.

85. Description in the text.

86. Children are able to use trains, trams and buses in Wrocław to travel by public transport to school. Figure 86 shows the public transport network that will be used to measure the ability for children to use public transport to travel to public schools.

4.1.5 THE PUBLIC TRANSPORT NETWORK

When it comes to defining children's ability to travel by public transport, it is necessary to research the modes of public transport that are available in Wrocław and the locations of public transport access points through the city. However, whether or not children are able to use public transport also depends on the usability or service level of Wrocław's public transport system, which imposes factors like safety or travelling time. Because it is rather time consuming to also analyze this, in this project the focus lies on measuring the distances between children's homes and public transport access points and therewith defining whether or not children are able to overcome their specific distance constraints to travel by public transport. In Wrocław, there is an extensive public transportation network, whereby there are 3 different ways in which there can be travelled. The provision of transportation by railway, tram and bus will here be further explained.



Source: Own material

► Railway stations

Traditionally, Wrocław used to be an important railway hub, which makes that railways are running in every direction. Figure 83 shows the railway station of Wrocław Nadodrze, which is located in the city centre and is the second most important station in the city. Figure 86 shows that beside this station and Wrocław's main railway station, there are 14 other railway stations that might provide children with the ability to travel to school.



Source: Own material

► Tram stops

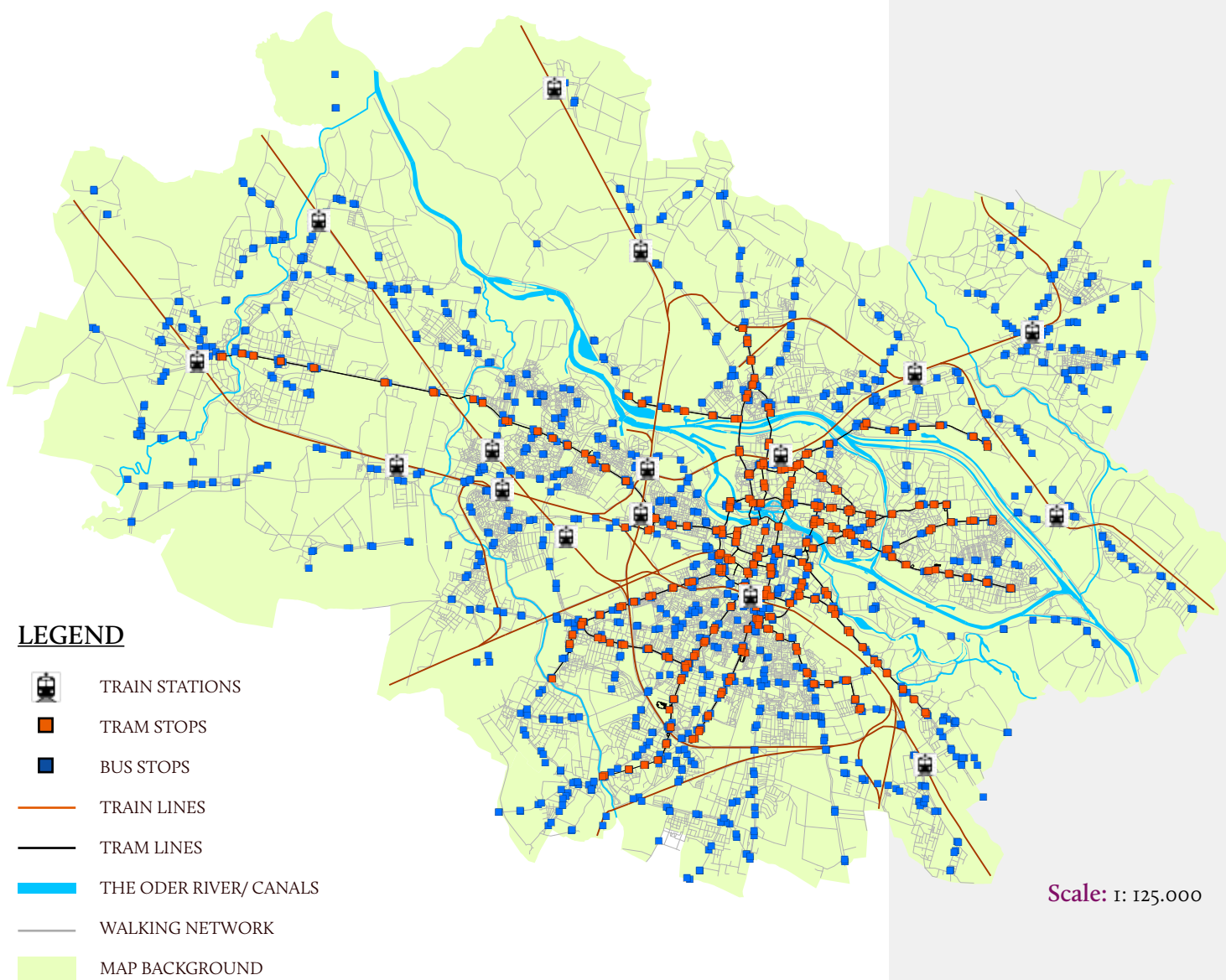
In Wrocław, there is an extensive tram network of 19 tram lines and 387 stops that might provide children with the ability to travel to school. Figure 84 shows an example of a tram stop in Wrocław's city centre. The tram lines mainly run beside the national roads and the roads that disclose the region and the city and serve the city core. Figure 86 shows the tram system and makes clear that one tram line to the West serves a long distance.

► Bus stops

Children that do not live in the core city might be able to travel by bus to school. In Wrocław, there are 71 bus lines and 2148 bus stops, which indicates the reliance on transportation by bus. Figure 85 shows the surrounding of the Wrocław Nadodrze railway station, where transport by railway, tram and bus come together. Figure 86 shows all the bus stops that are located in the city and illustrates the reliance on public transport by bus.



Source: Own material



Scale: 1: 125.000

4.2 METHODOLOGY

4.2.1 CATCHMENT AREAS

Now the locations of children's homes and public schools *and* the walking, cycling and public transport network have been defined, the accessibility of the public schools that children attend to in Wrocław can be measured and defined per age group and mode of transport. The main approach is to measure the accessibility from children's homes to schools by 'travelling' a distance X over network Y away from activity place Z, wherewith a catchment area is created which makes it possible to define those children that live within this catchment area and thus are able to travel to activity place Z by transport mode Y. This can be explained by an example. For preschoolers, a distance of 200 meters will be travelled over the walking network away from kindergartens, which will create catchment areas wherewith the ability for preschoolers to walk to kindergarten in Wrocław can be defined. So for a preschooler, two catchment areas are created wherewith their ability to walk and cycle to kindergarten can be defined and one catchment area is created wherewith their ability to walk to public transport access points can be defined. Because these catchment areas are likely to overlap, it is also possible to overlay them and therewith determine children's ability to travel by multiple modes of transport.

To determine children's freedom of choice to travel by multiple modes of transport, the walking, cycling and public transport catchment areas will be overlaid and clipped, which will result in 5 abilities:

- The ability to travel by foot, bicycle and public transport;
- The ability to travel by foot and bicycle;
- The ability to travel by bicycle and public transport;
- The ability to travel by bicycle;
- The ability to travel by public transport.

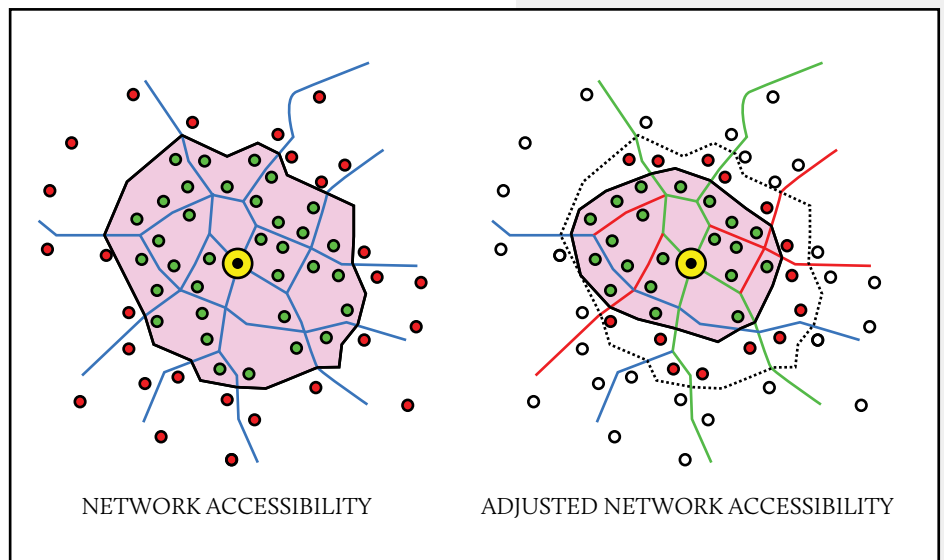
In case non of these abilities are provided, children are reliant on car use and thus the need for children to travel by car will be defined.

4.2.2 NETWORK ACCESSIBILITY

Three research step will be carried out to define children's accessibility to public schools in Wrocław. The first step it to define the accessibility by measuring the travelling distances over the walking and cycling network that have been defined in the inventory of this chapter. Thus, for all age groups, three catchment areas will be created, respectively for the walkability and cyclability to schools and the ability to walk to public transport access points. These catchment areas will be overlaid and clipped, wherewith 5 different catchment areas for the 5 abilities will be created. To define how many children have a certain ability to travel, the catchment areas will be projected on the entrances of the buildings where children were living in 2005, which is connected to a database with information on the amount of children that were living in these buildings. Therewith, it will be possible to calculate those children that need to travel by car.

4.2.3 ADJUSTED NETWORK ACCESSIBILITY

The second research step is to define an adjusted network accessibility, in which the usability of the cycling network will be taken into account. Because the need to travel is strongly influenced by the ability to cycle (which produces the largest catchment area), and the defined cycling network consists only of a small percentage of bicycle paths, there is a need to give a more realistic image of the ability to cycle and therewith the need for children to travel by car. Like indicated before, the most accurate method would be to measure the cyclability of the network, which is considering the size of the city and the time it would take to define this not realistic. Therefore, a different method will be used. The catchment areas will not be created by travelling a *distance* over the walking and cycling network, but a *time*. Because the main goal is to define the lack of cycling infrastructure in the cycling network, the influence of this lack on the need to travel by car can be made visible by maintaining a different speed of cycling over cycling paths (12 km/h), residential streets (8 km/h) and walking paths (5 km/h). Thereby, a distance of 1000 meters will be translated in 5 minutes of travelling (based on 12 km/h), which will result in an adjusted cycling distance between children's homes and schools. This adjusted distance will show an increase in the amount of children that need to travel by car, which therewith produces a more realistic image of the accessibility of schools.



4.2.4 THE ABILITY TO USE PUBLIC TRANSPORT

The third research step is to define the ability for children to use public transport more thoroughly. In the first and second research step, the ability to use public transport will be defined based on the distance between children's homes and public transport access points. Because public transport is part of a network, children are able to travel through the whole city in search for a school where the distance between the public transport stop and the school can also be overcome. However, it is important to define the ability for children to walk from a public transport stop to school, because a long travelling time or a need to transfer to other public transport might be a reason for children to need to travel by car as well. The distance between schools and public transport stops might also result in a reliance on car use in case parents are not able to combine accompanied trips to school with a next trip by public transport. This ability will also be researched.

87. The network accessibility and the adjusted network accessibility analyses are illustrated in figure 87. The red dots represent the homes of children where there is a need to travel by car. The adjusted network accessibility analysis gives a more realistic image of the actual accessibility to schools in the city.

4.3 PRESCHOOLERS

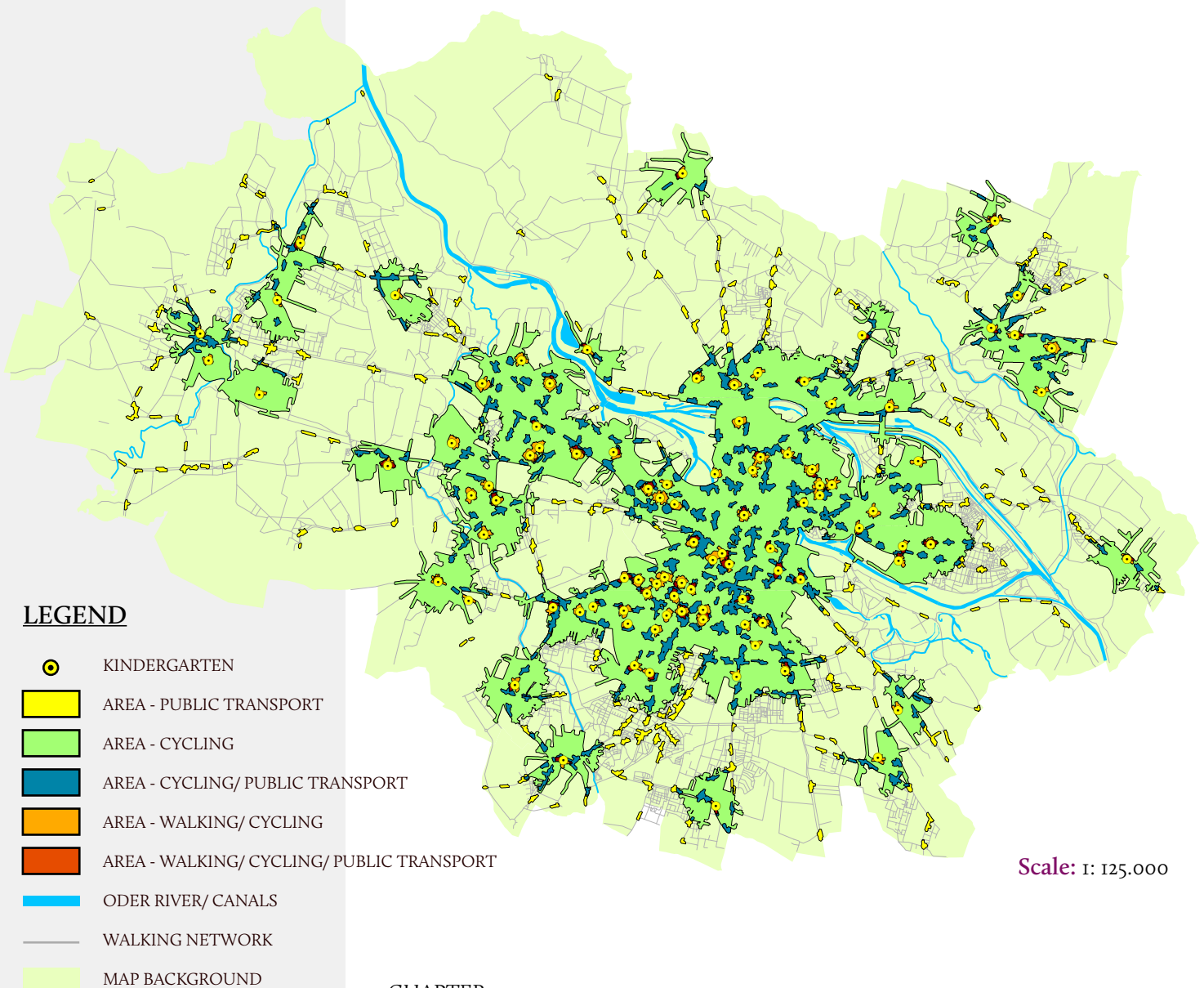
88. Description in the text

89. Description in the text.

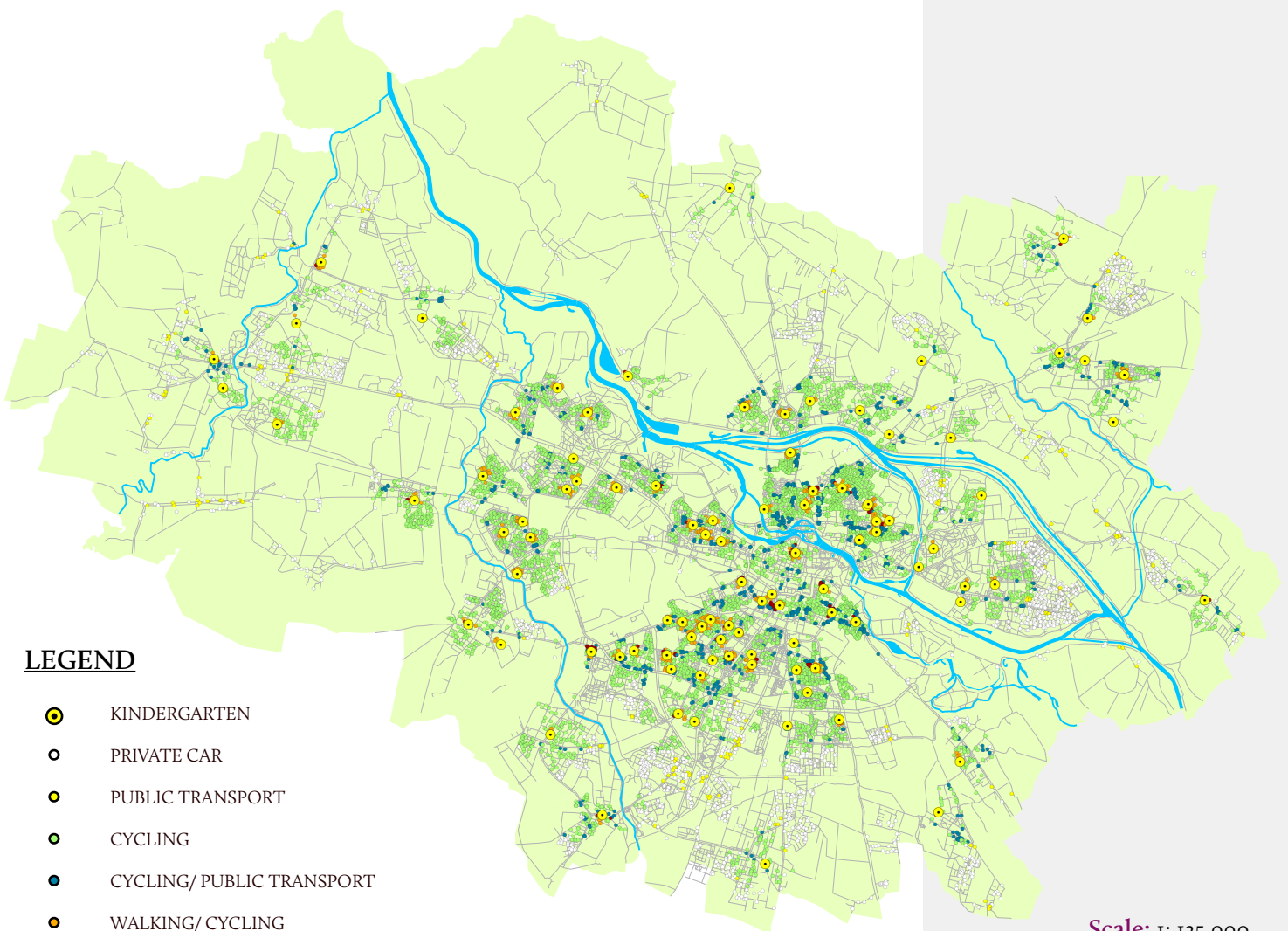
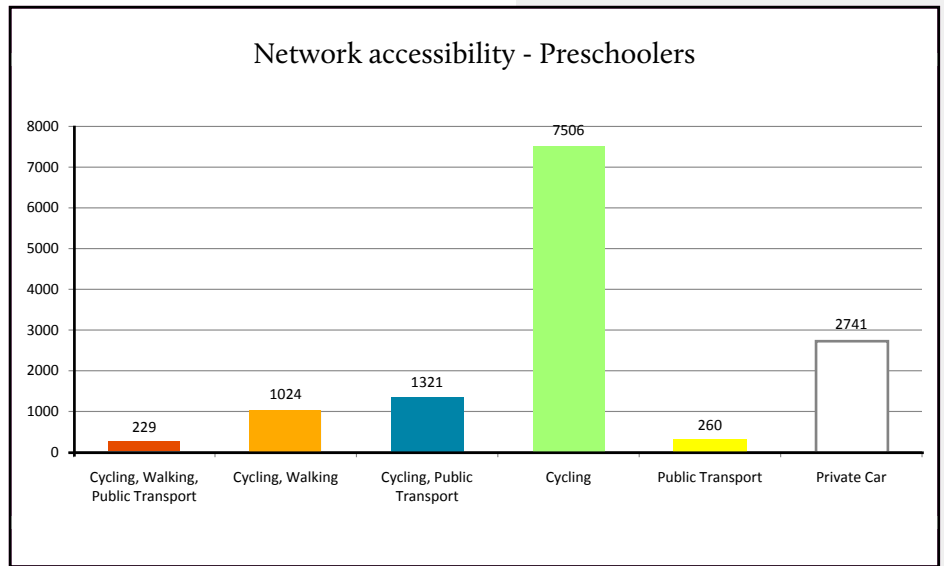
90. Description in the text.

4.3.1 NETWORK ACCESSIBILITY

Figure 88 shows the network accessibility catchment areas that have been created for preschoolers. These are based on 200 meters walking over the walking network and 1000 meters cycling over the cycling network away from kindergartens and 100 meters walking over the walking network away from public transport access points. The catchment areas have been overlaid, which has resulted in 5 catchment areas that represent the abilities for preschoolers to travel to kindergarten. Figure 90 shows the projection of the catchment areas on the entrances of houses and building where preschoolers were living at the end of 2005, which has resulted in preschoolers' ability to travel to kindergarten. The results are shown in figure 89. From the 13081 preschoolers that lived in Wrocław, 1253 (9,6%) were able to travel by foot and by bicycle to kindergarten within their distance constraints, from who 229 were also able to walk to pub-



lic transport access points within these constraints. 8827 (67,5%) preschoolers were able to travel by bicycle to kindergarten, but not by foot, from who 1321 were also able to walk to public transport access points. And 3001 (22,9%) preschoolers were not able to travel by bicycle, nor by foot to kindergarten from who 260 preschoolers were able to walk to public transport access points. Therefore, the conclusion is that 2741 (20,1%) preschoolers were reliant on the car to travel to kindergarten.



LEGEND

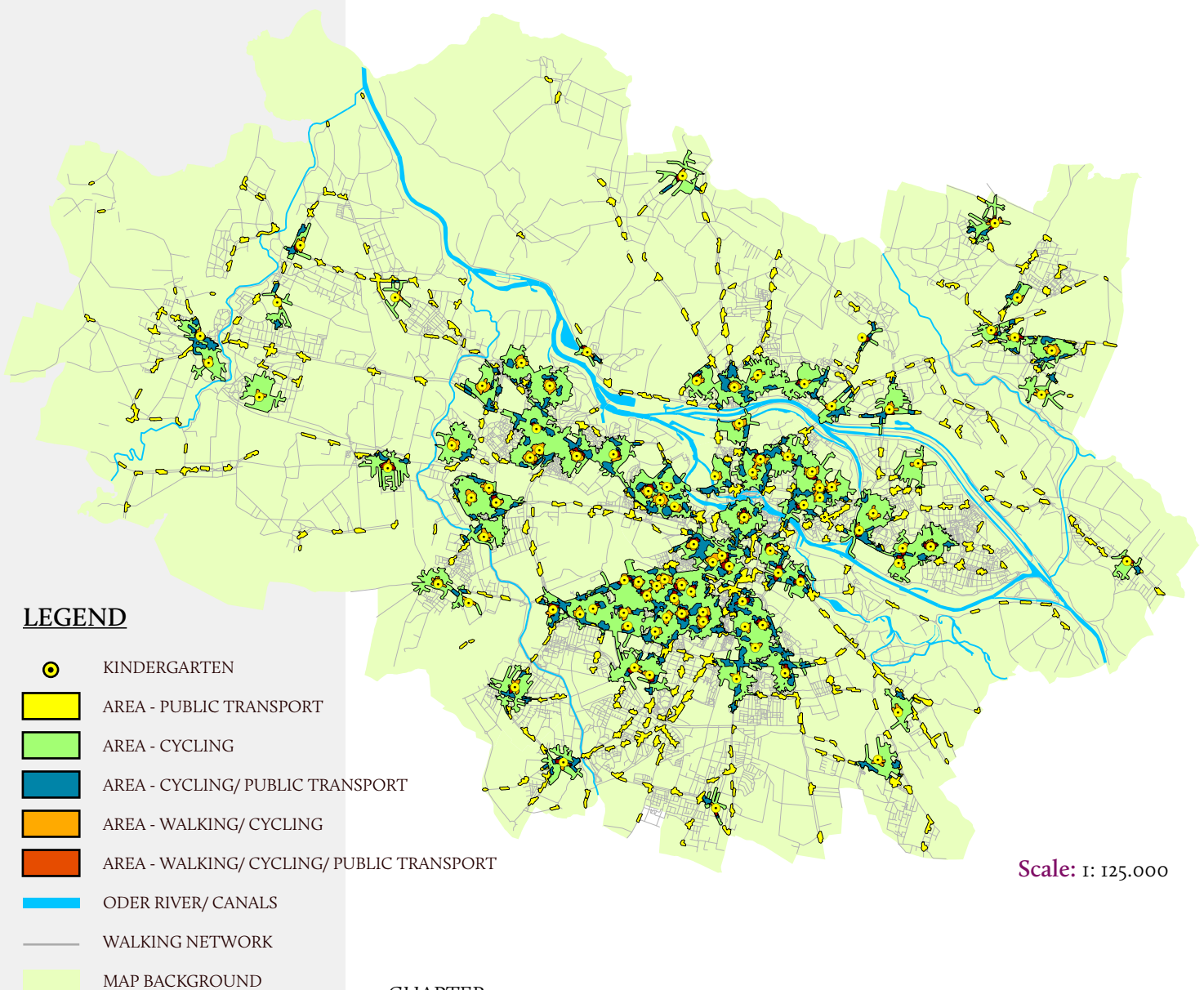
- KINDERGARTEN
- PRIVATE CAR
- PUBLIC TRANSPORT
- CYCLING
- CYCLING/ PUBLIC TRANSPORT
- WALKING/ CYCLING
- WALKING/ CYCLING/ PUBLIC TRANSPORT
- ODER RIVER/ CANALS
- WALKING NETWORK
- MAP BACKGROUND

Scale: 1: 125.000

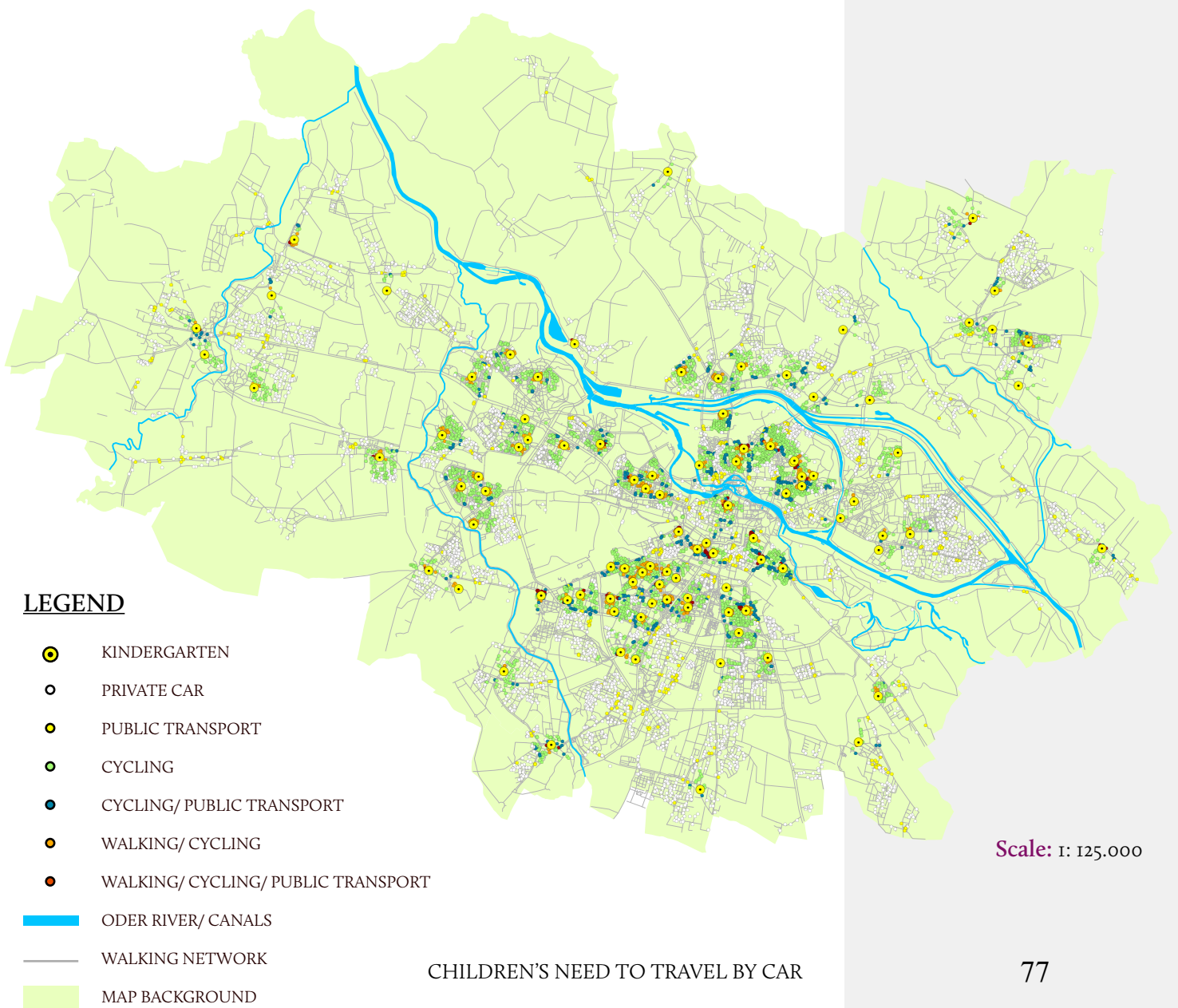
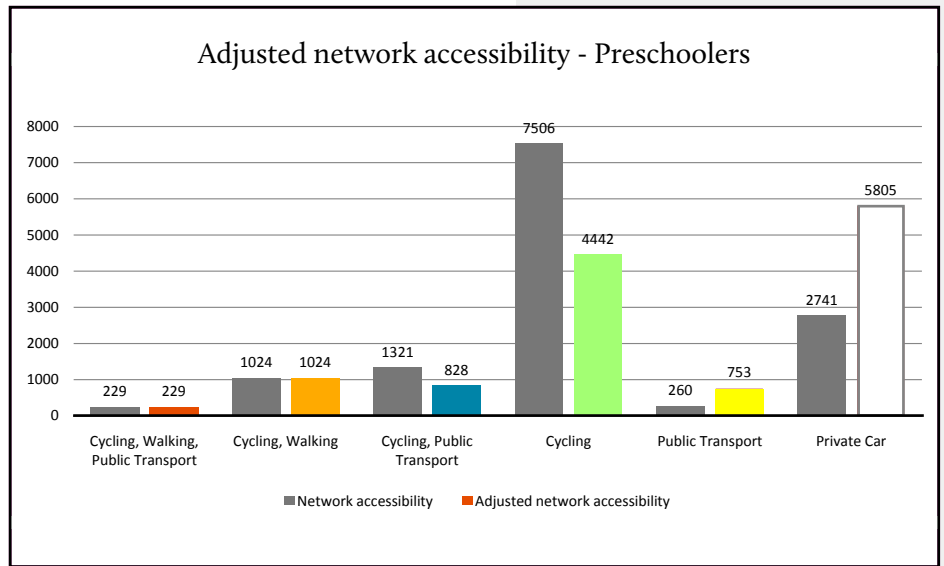
- 91. Description in the text
- 92. Description in the text.
- 93. Description in the text.

4.3.2 ADJUSTED NETWORK ACCESSIBILITY

Figure 91 shows the adjusted network accessibility catchment areas that have been created for preschoolers. These are based on 200 meters walking over the walking network and 5 minutes of cycling over the cycling network away from kindergartens and 100 meters walking over the walking network away from public transport access points. The catchment areas have been overlaid and projected on the entrances of houses and buildings where preschoolers were living at the end of 2005, which has resulted in preschoolers' adjusted ability to travel to kindergarten. The results are shown in figure 92. From the 13081 preschoolers that lived in Wrocław, 1253 (9,6%) preschoolers were actually able to travel by foot and by bicycle to kindergarten within their distance constraints, from who 229 were also able to walk to public transport access points within these constraints. 5270 (40,3%) preschoolers were actually able to travel

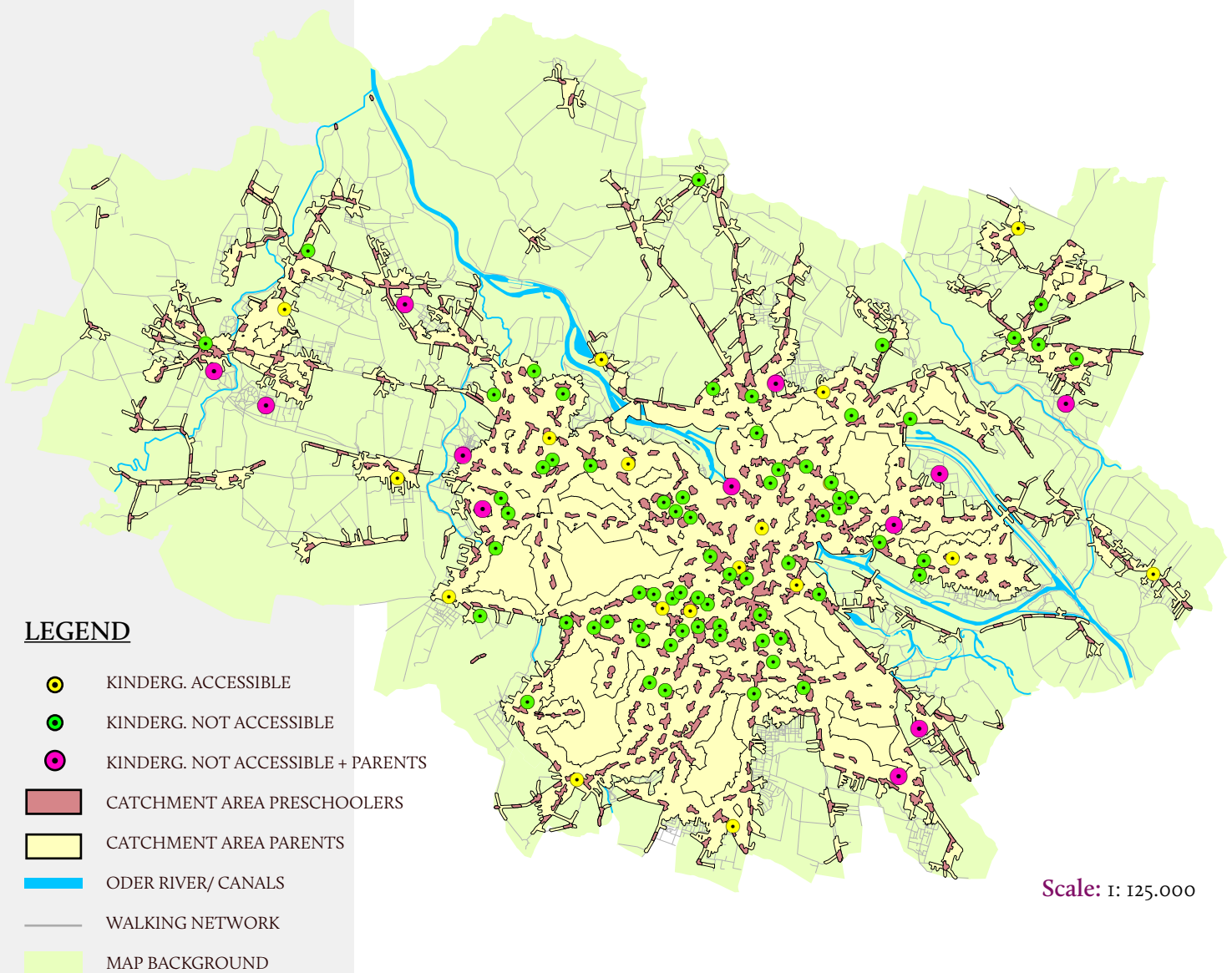


by bicycle to kindergarten, but not by foot, from who 828 preschoolers were also able to walk to public transport access points. And 6558 (50,1%) preschoolers were actually not able to travel by bicycle, nor by foot to kindergarten from who 753 preschoolers were able to walk to public transport access points. Therefore, 5805 (44,4%) preschoolers were actually reliant on the car to travel to kindergarten, which is an increase of 3064 preschoolers compared to the results of the network accessibility analysis.



4.3.3 THE ABILITY TO USE PUBLIC TRANSPORT

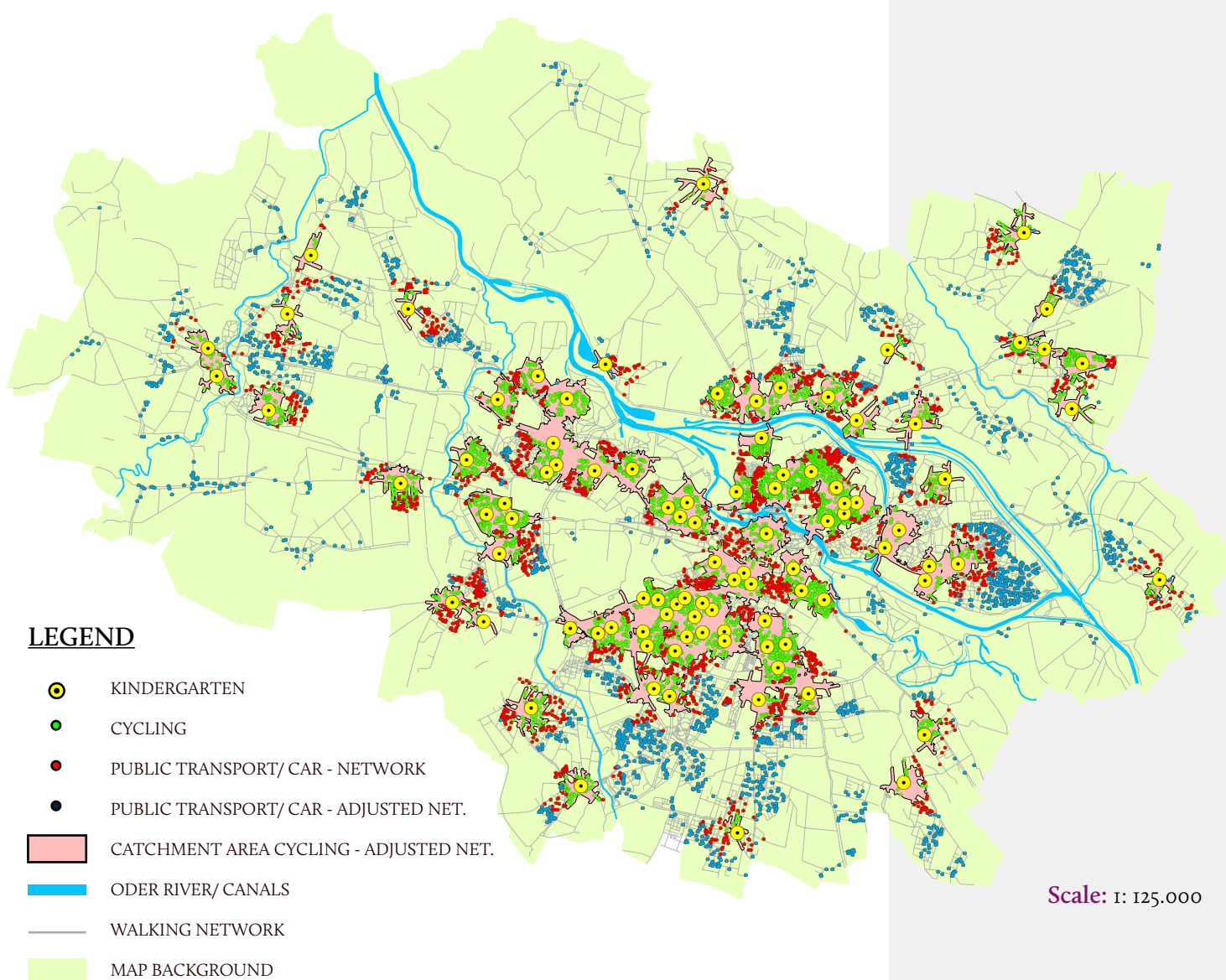
The results in the adjusted network accessibility analysis show that 1810 preschoolers are able to walk to a public transport access point within their distance constraints, from who 753 are reliant on public transport. However, the ability to use public transport is also influenced by the ability to walk from public transport access points to kindergarten. **Figure 94** shows that from the 98 kindergartens in Wrocław, only 17 are located within the distance constraints of preschoolers. And from the 81 kindergartens that are not accessible, 12 are located at a larger distance than 400 meters from public transport access points. This distance has been determined as the maximum distance that parents are willing to walk between kindergarten and public transport stops to 'continue' their accompanied trip to a next destination. Therefore, it is likely for many possible walking or cycling trips to become trips that are being made by the car as well.



4.3.4 REDUCING THE NEED TO USE THE CAR

95. Description in the text

There is a big need to reduce the reliance on car use for preschoolers. Following the most realistic accessibility analysis, 6558 preschoolers are not able to walk or cycle to kindergarten, from who 3557 are not able to cycle to kindergarten due to a lack of cycling infrastructure, which is shown in figure 95. Therefore, there is a big need to improve the usability of the cycling network by the creation of new cycling paths. From the 1810 preschoolers that are able to walk to public transport access points, 753 are reliant on public transport. Whether or not these preschoolers will travel by public transport is questionable. This because only 17 kindergartens are located within preschoolers' distance constraints from public transport access points. But the need for children to travel by car is also likely to be higher than measured due to the many parents that are not able to perform the accompanied trips to kindergarten in an array of activities.



Scale: 1: 125.000

4.4 YOUNG SCHOOL-AGED CHILDREN

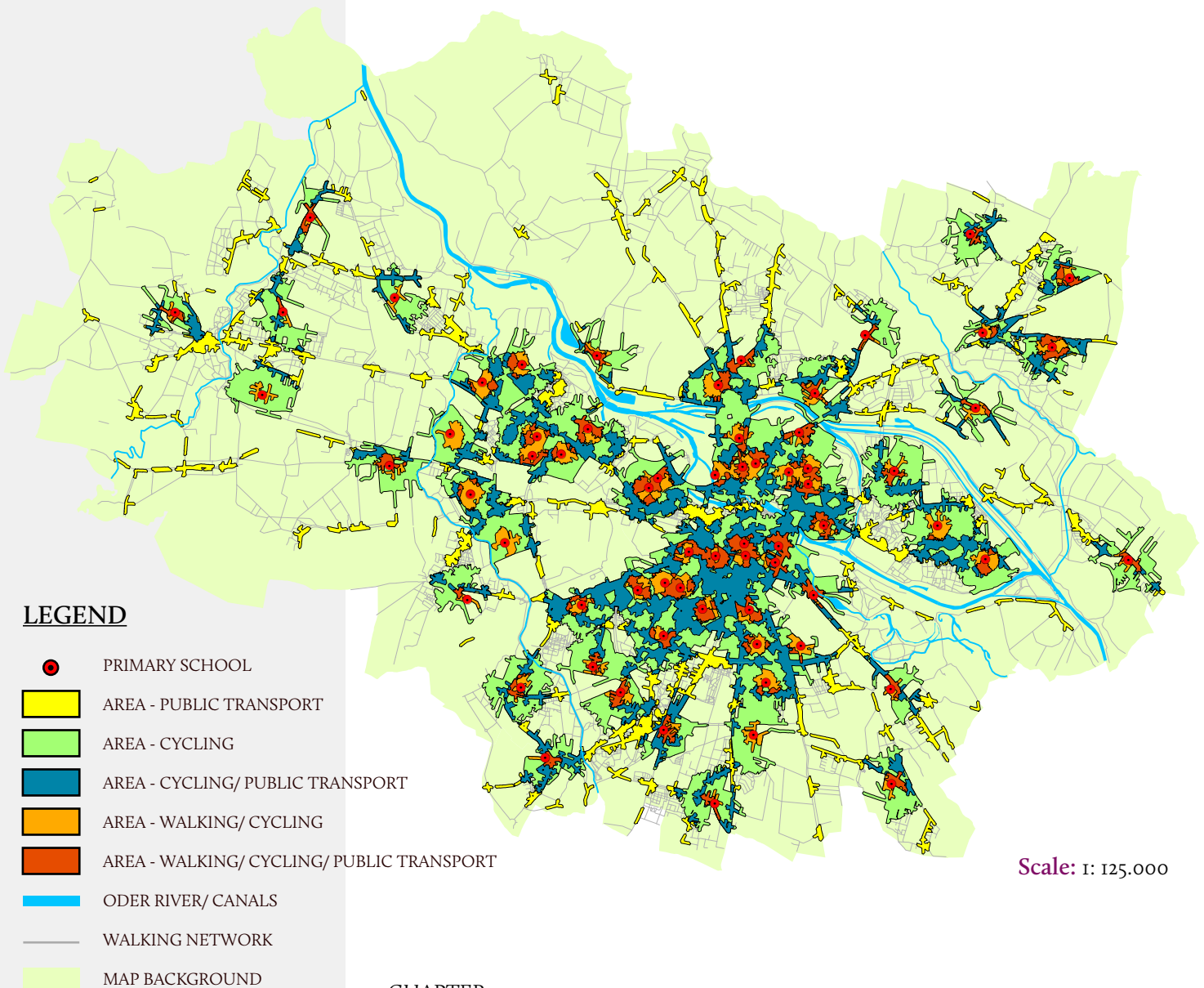
96. Description in the text

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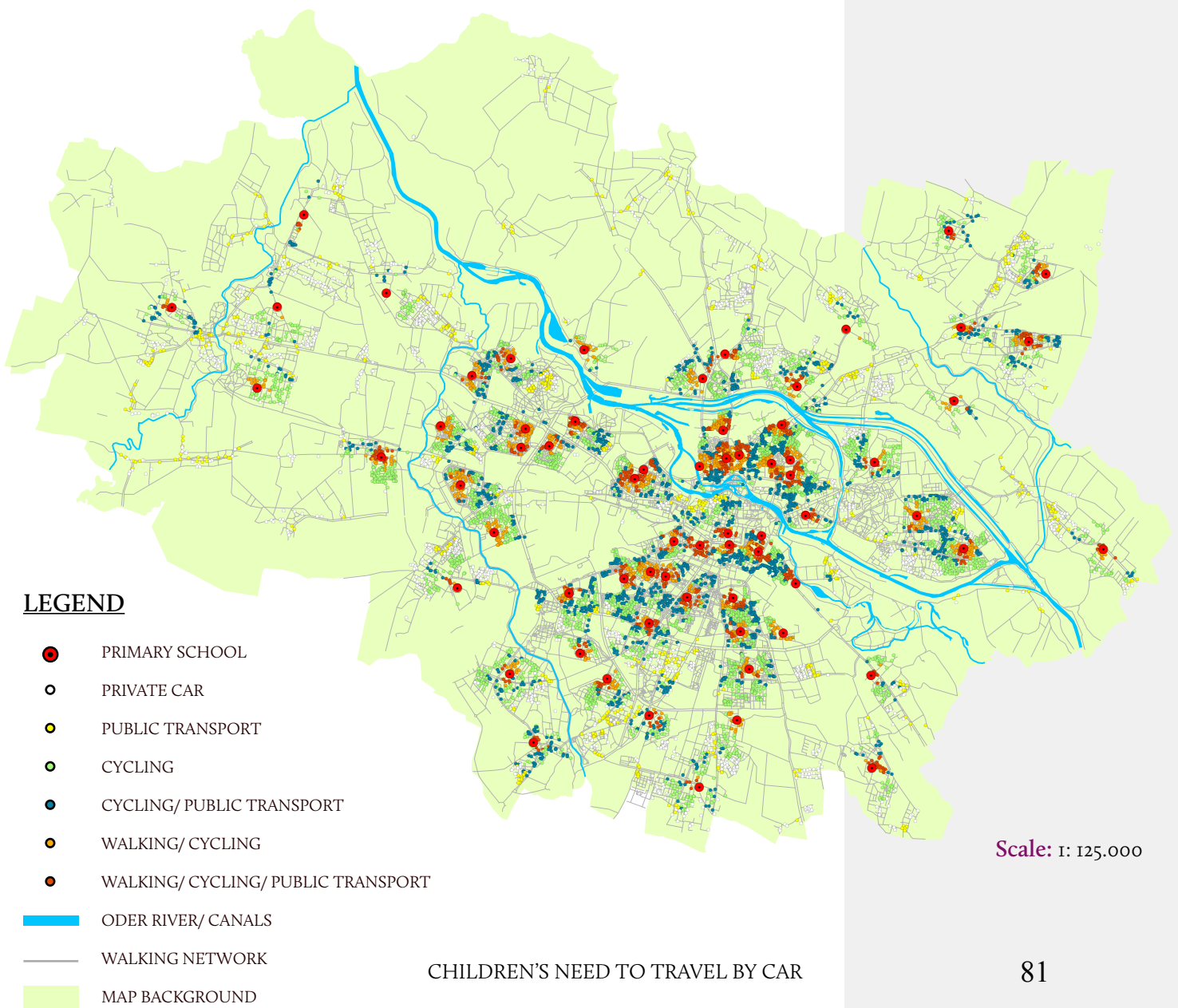
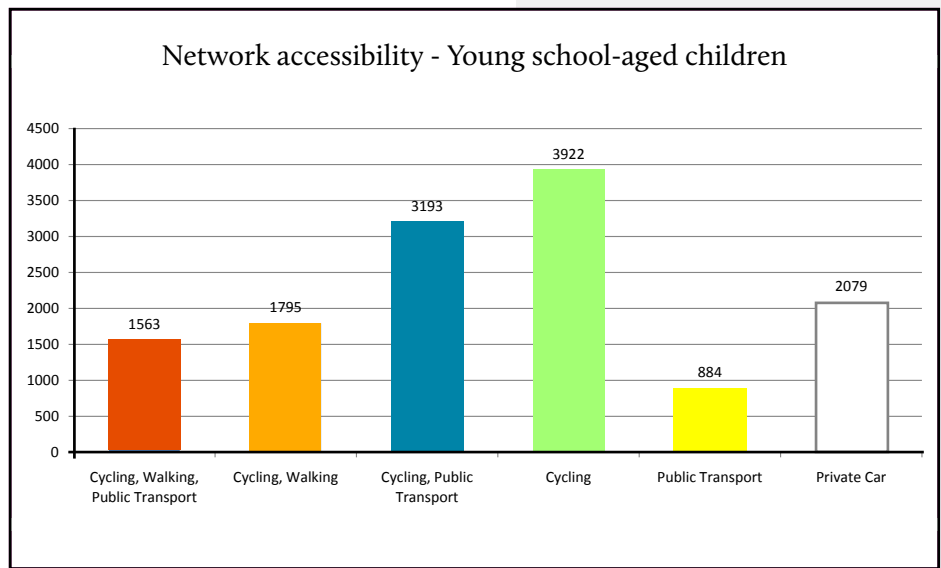
98. Description in the text.

4.4.1 NETWORK ACCESSIBILITY

Figure 96 shows the network accessibility catchment areas that have been created for young school-aged children. These are based on 400 meters walking over the walking network and 1000 meters cycling over the cycling network away from primary schools and 200 meters walking over the walking network away from public transport access points. The catchment areas have been overlaid, which has resulted in the abilities to travel to primary school. Figure 98 shows the projection of the catchment areas on the entrances of houses and building where young school-aged children were living at the end of 2005. The ability for young school-aged children to travel to primary schools is shown in figure 97. From the 13436 young school-aged children that lived in Wrocław, 3358 (25,7%) were able to travel by foot and by bicycle to primary school within their distance constraints, from who 1563 were also able to walk to public transport



access points within these constraints. 7115 (54,4%) young school-aged children were able to travel by bicycle to primary school, but not by foot, from who 3193 were also able to walk to public transport access points. And 2963 (22,7%) young school-aged children were not able to travel by bicycle, nor by foot to primary school from who 884 were able to walk to public transport access points. Therefore, the conclusion is that 2079 (15,9%) young school-aged children could only travel by car to school.



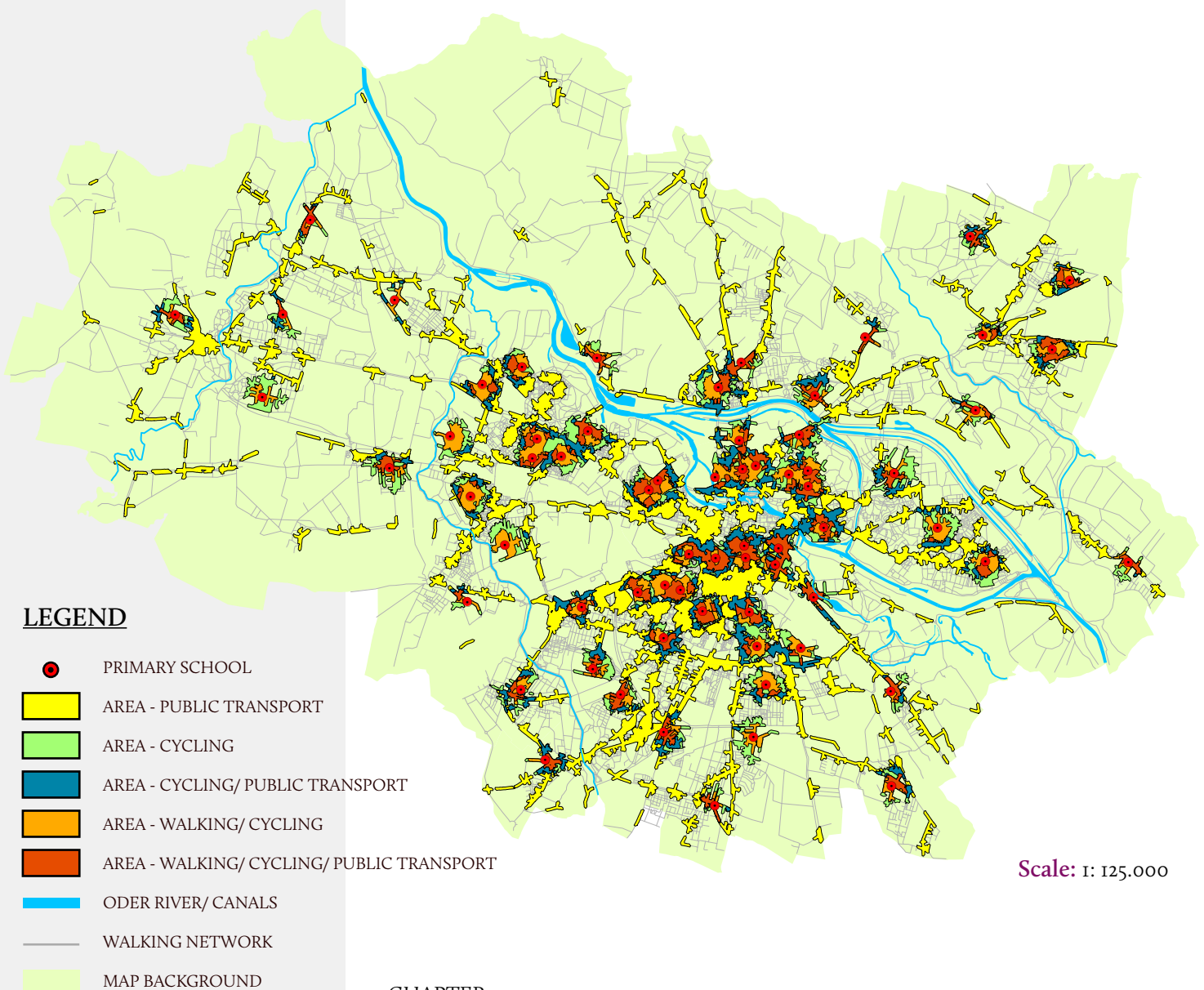
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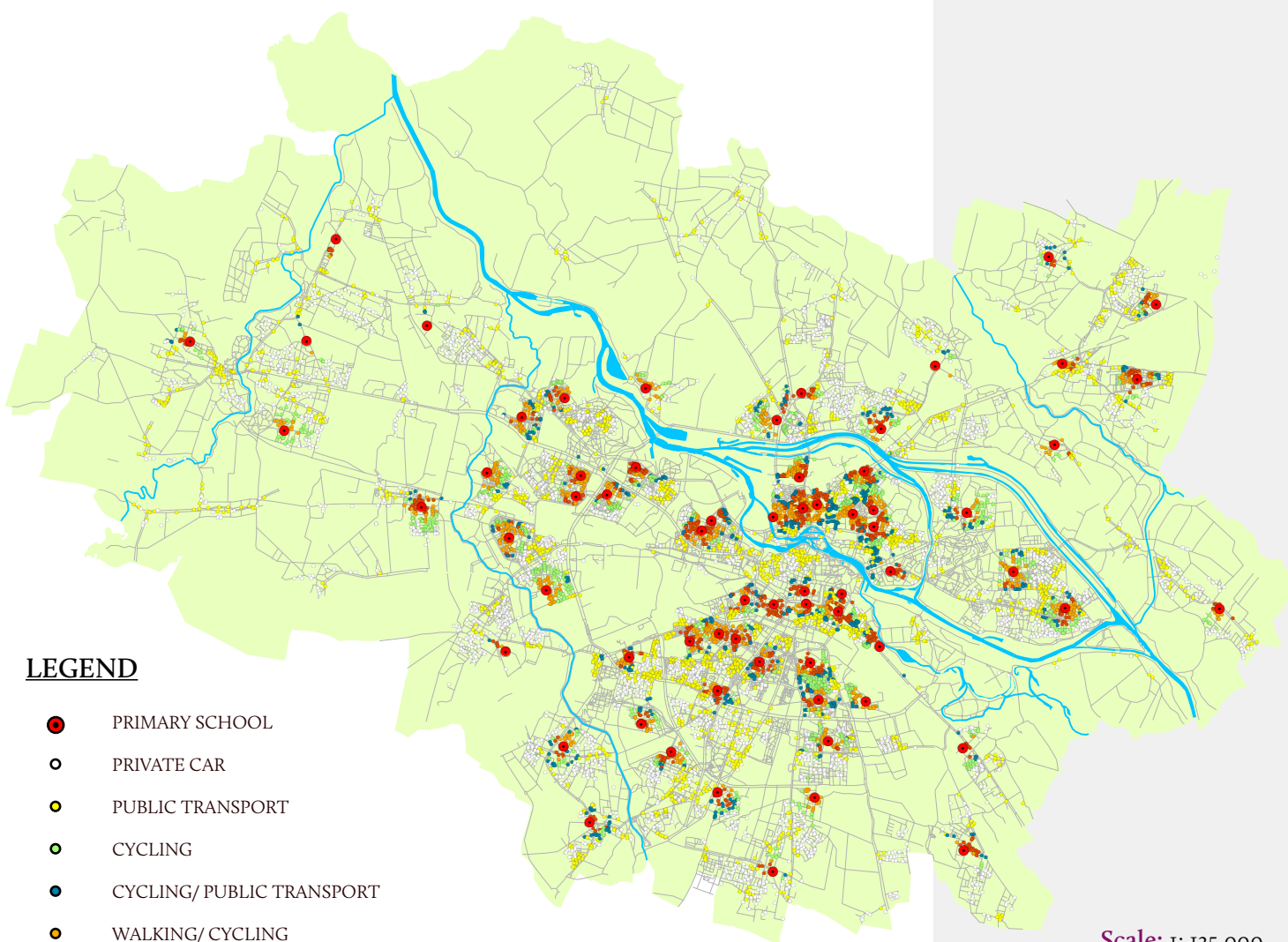
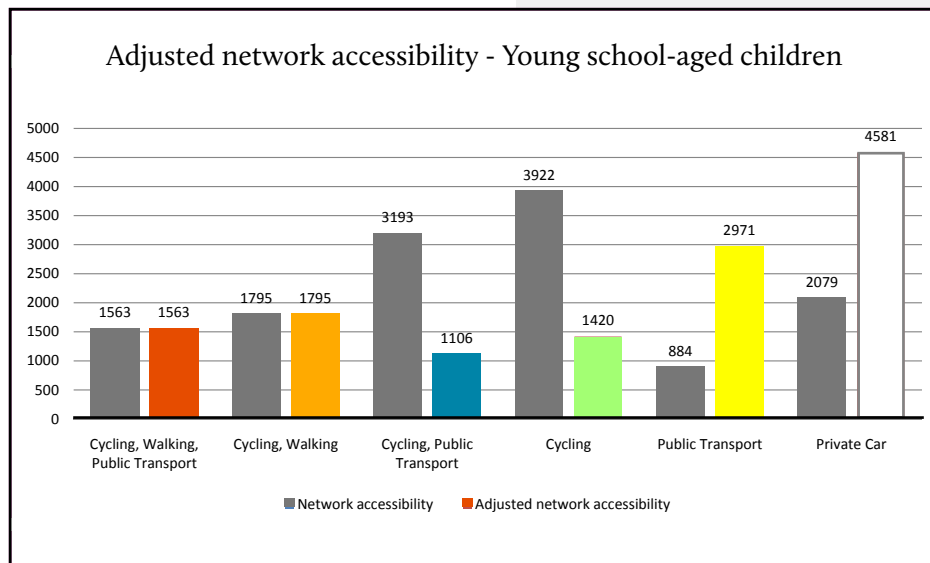
101. Description in the text.

4.4.2 ADJUSTED NETWORK ACCESSIBILITY

Figure 99 shows the adjusted network accessibility catchment areas that have been created for young school-aged children. These are based on 400 meters walking over the walking network and 5 minutes cycling over the cycling network away from primary schools and 200 meters walking over the walking network away from public transport access points. The catchment areas have been overlaid and projected on the entrances of houses and buildings where young school-aged children were living at the end of 2005. Their ability to travel to primary schools is shown in figure 100. From the 13436 young school-aged children that lived in Wrocław, 3358 (25,7%) were actually able to travel by foot and by bicycle to primary school within their distance constraints, from who 1563 were also able to walk to public transport access points within their constraints. 2526 (19,3%) young school-aged children were actually able to travel by bi-



cycle to primary school, but not by foot, from who 1106 were also able to walk to public transport access points. And 7552 (57,7%) young school-aged children were actually not able to travel by bicycle, nor by foot to primary school from who 2971 were able to walk to public transport access points. Therefore, 4581 (44,4%) young school-aged children were actually reliant on the car to travel to primary school, which is an increase of 2502 children compared to the results of the network accessibility analysis.



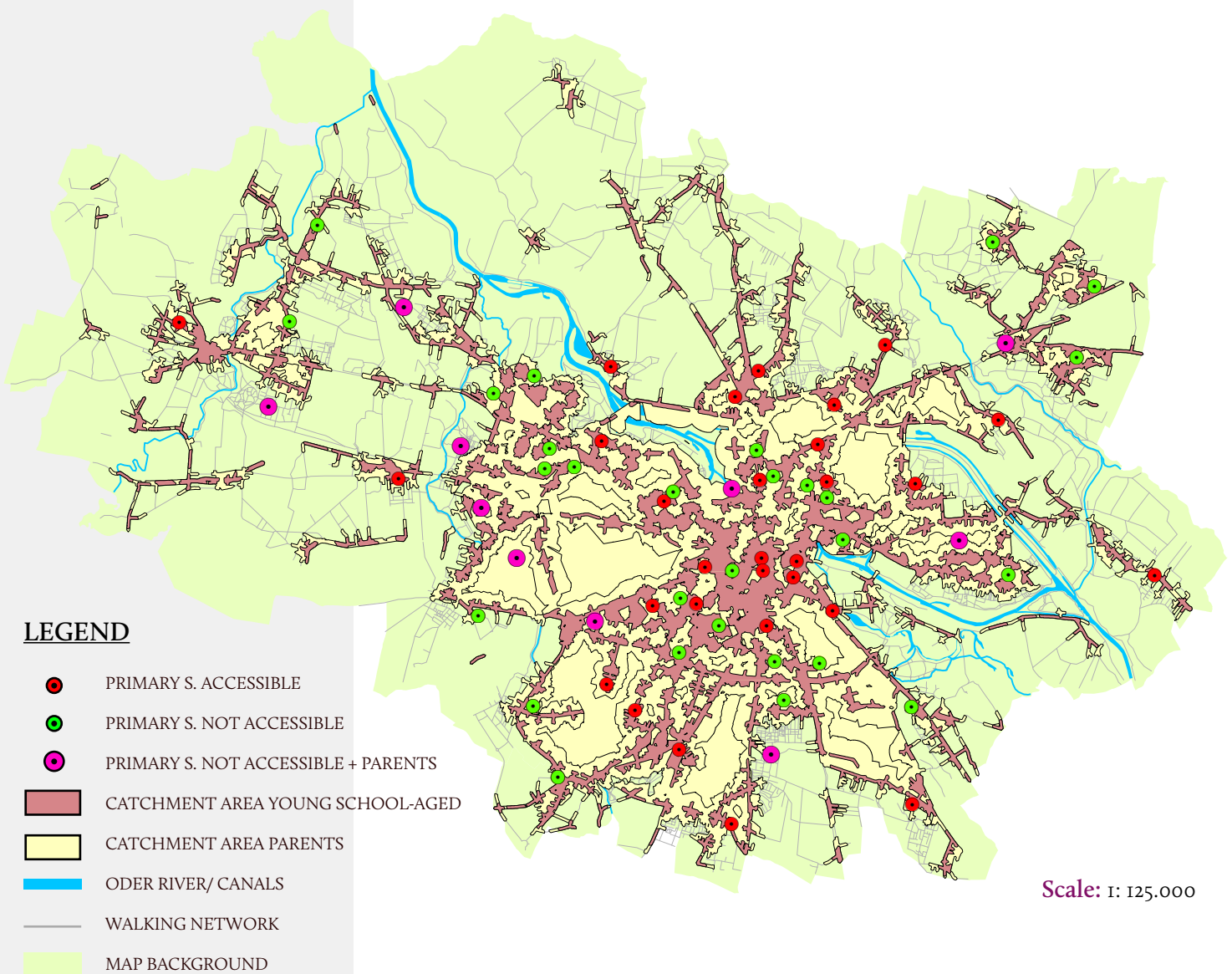
LEGEND

- PRIMARY SCHOOL
- PRIVATE CAR
- PUBLIC TRANSPORT
- CYCLING
- CYCLING/ PUBLIC TRANSPORT
- WALKING/ CYCLING
- WALKING/ CYCLING/ PUBLIC TRANSPORT
- ODER RIVER/ CANALS
- WALKING NETWORK
- MAP BACKGROUND

Scale: 1: 125.000

4.4.3 THE ABILITY TO USE PUBLIC TRANSPORT

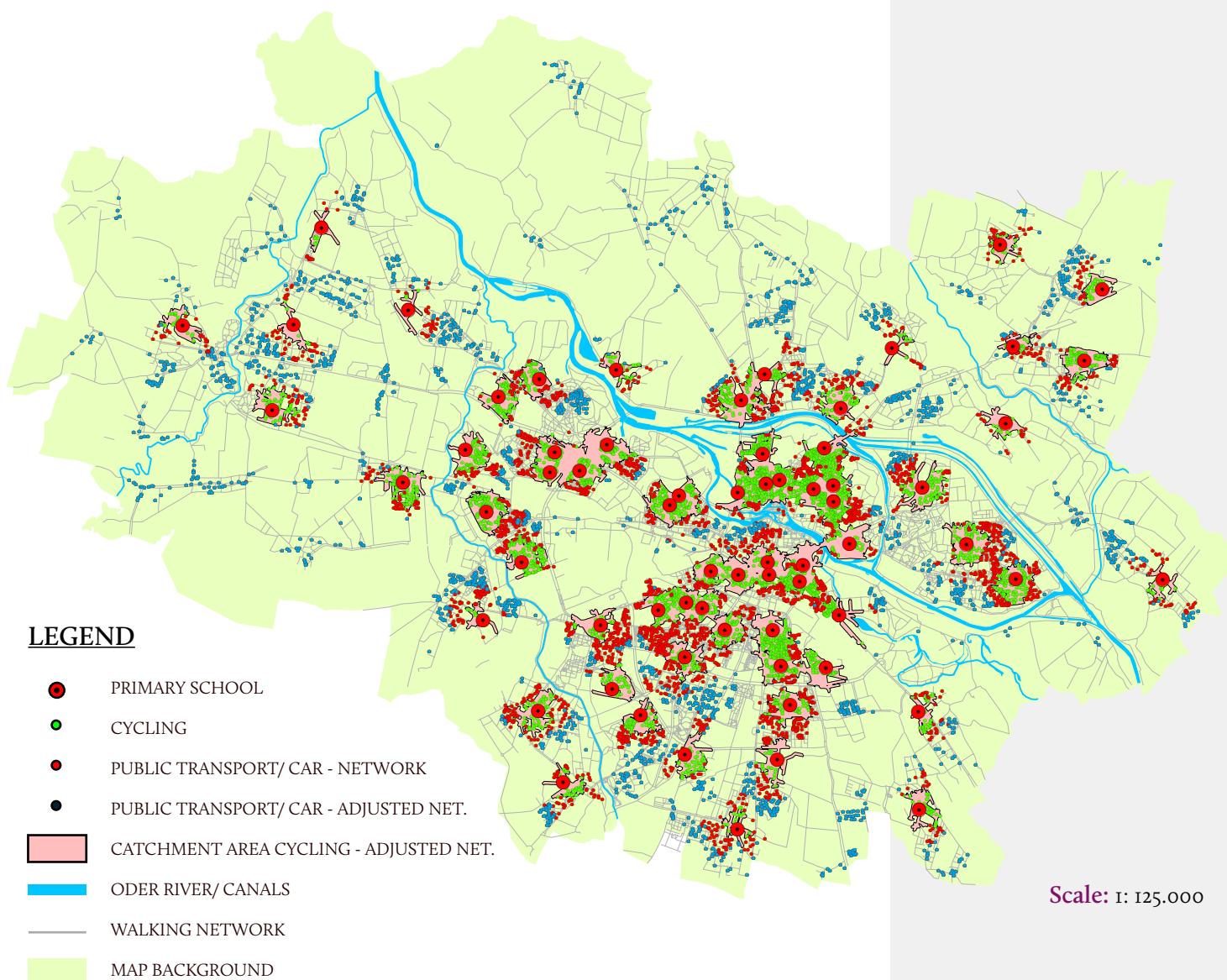
The results in the adjusted network accessibility analysis show that 5640 young school-aged children are able to walk to a public transport access point within their distance constraints, from who 2971 are reliant on public transport. However, the ability to use public transport is also influenced by the ability to walk from public transport access points to primary schools. Figure 102 shows that from the 67 primary schools in Wrocław, only 29 are located within the distance constraints of young school-aged children. And from the 38 primary schools that are not accessible, 10 are located at a larger distance than 400 meters from public transport access points. This distance has been determined as the maximum distance that parents are willing to walk between primary school and public transport access points. Therefore, it is likely for many potential walking or cycling trips to become trips that are being made by the car as well.



4.4.4 REDUCING THE NEED TO USE THE CAR

103. Description in the text

There is a big need to reduce the reliance on car use for young school-aged children. Following the most realistic accessibility analysis, 7552 young school-aged children are not able to walk or cycle to primary school, from who 4589 are not able to cycle to primary school due to a lack of cycling infrastructure, which is shown in figure 95. Therefore, there is a big need to improve the usability of the cycling network by the creation of new cycling paths. From the 5640 young school-aged children that are able to walk to public transport access points, 2971 are reliant on public transport. Whether or not these trips by public transport will be made is questionable. This because only 29 primary schools are accessible for young school-aged children. But the need for children to travel by car is also likely to be higher than measured due to the many parents that are not able to perform the accompanied trips to kindergarten in an array of activities.



4.5 OLDER SCHOOL-AGED CHILDREN

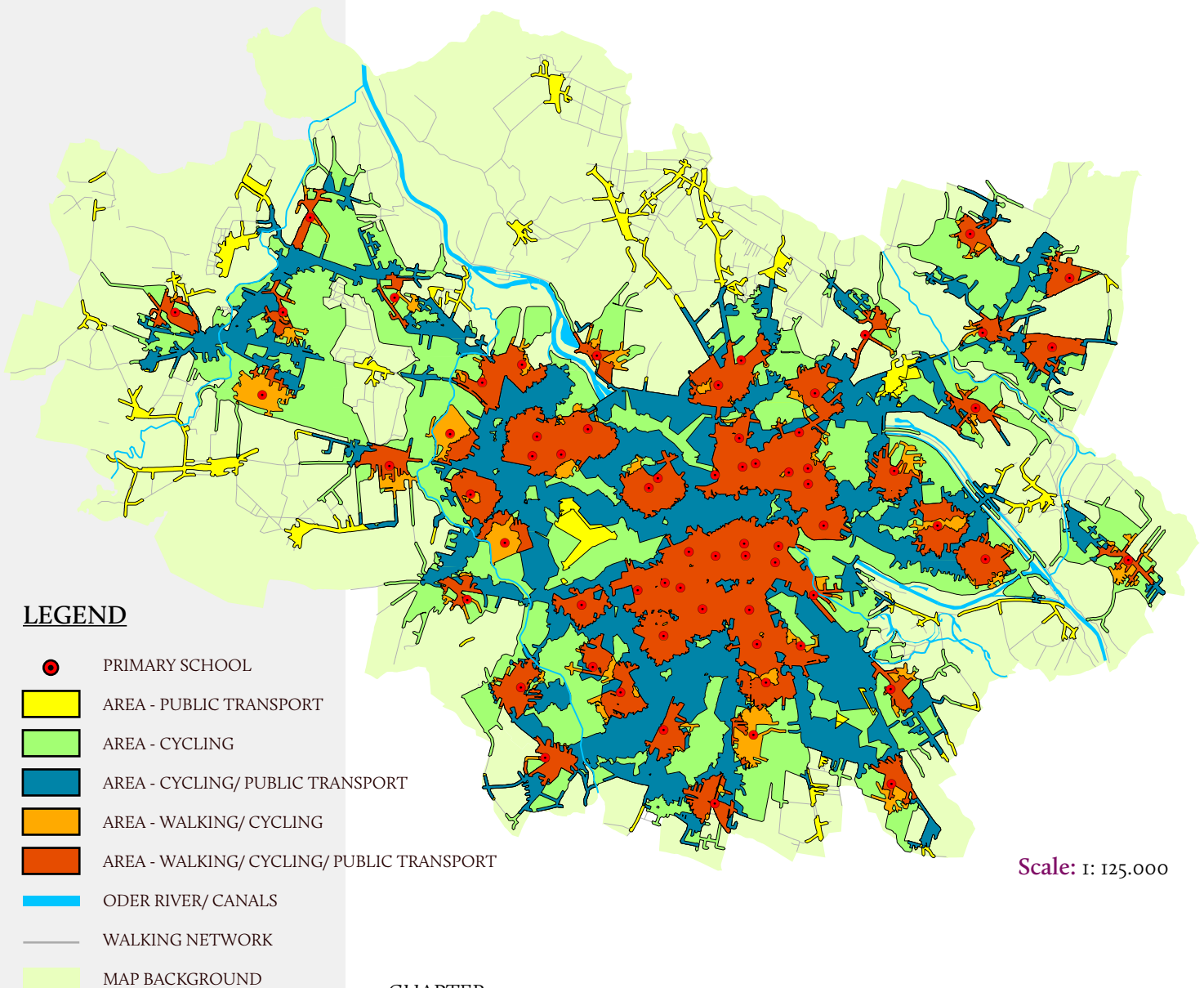
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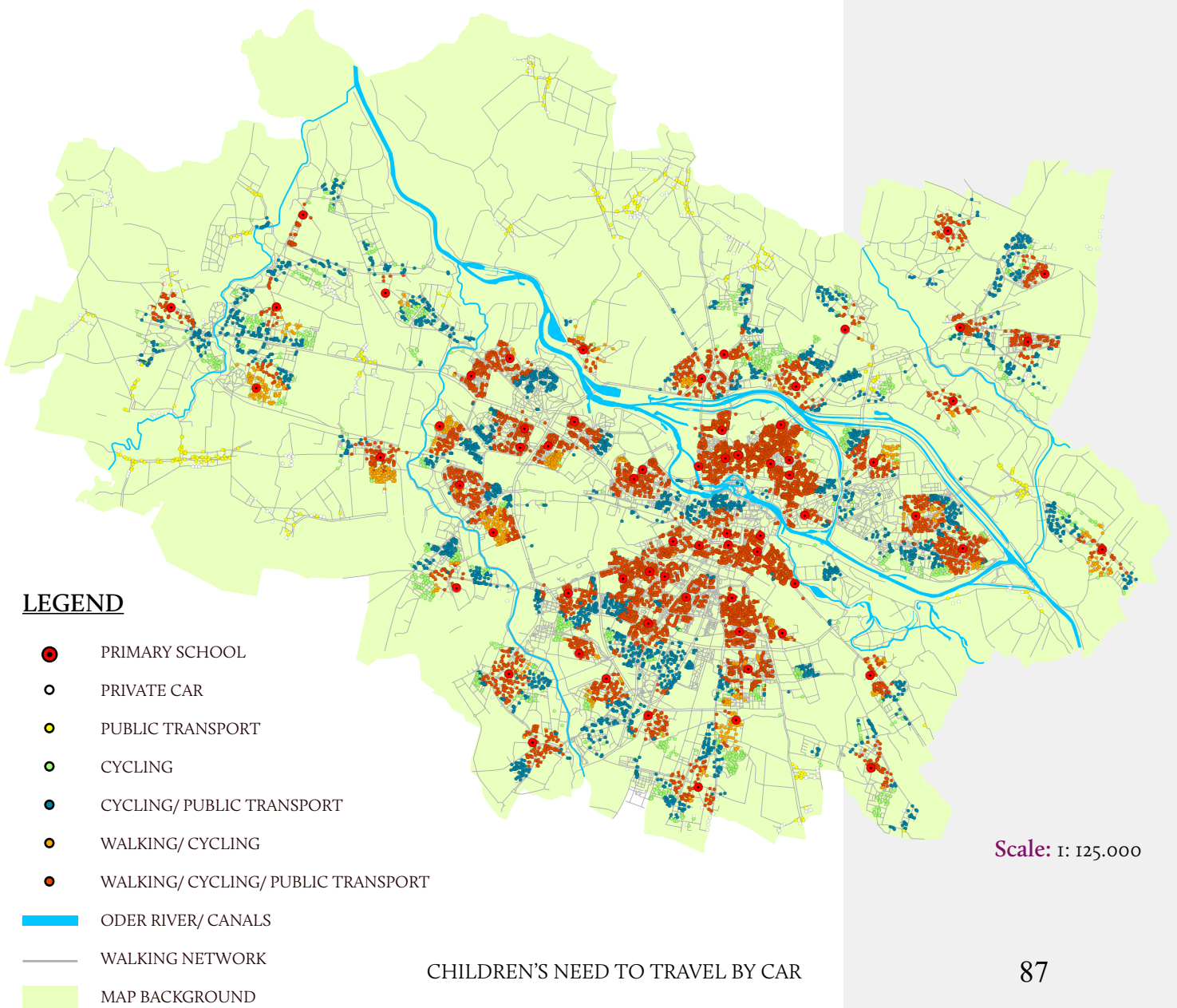
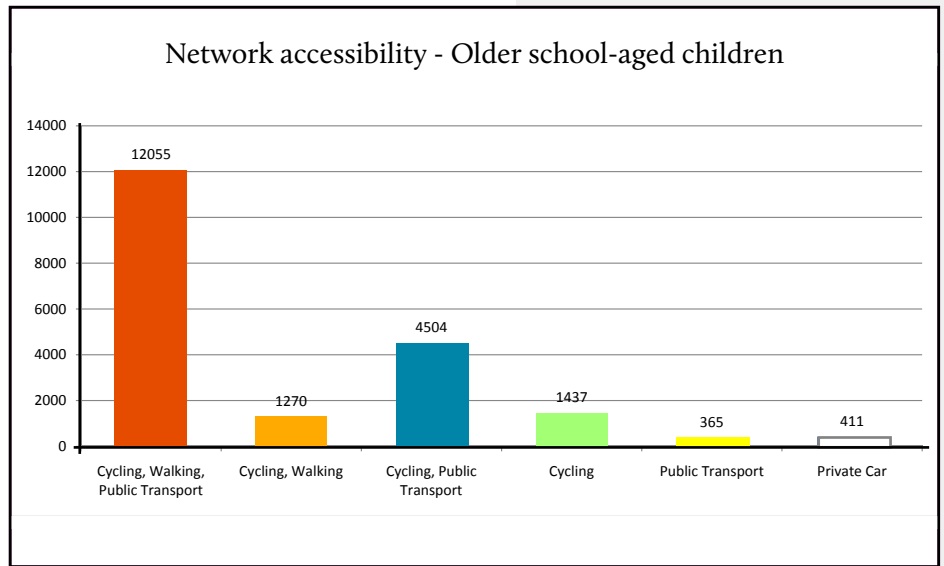
106. Description in the text.

4.5.1 NETWORK ACCESSIBILITY

Figure 104 shows the network accessibility catchment areas that have been created for older school-aged children. These are based on 800 meters walking over the walking network and 2000 meters cycling over the cycling network away from primary schools and 400 meters walking over the walking network away from public transport access points. The catchment areas have been overlaid, which has resulted in the abilities to travel to primary school. Figure 106 shows the projection of the catchment areas on the entrances of houses and building where older school-aged children were living at the end of 2005. Their ability to travel to primary schools is shown in figure 105. From the 20042 older school-aged children that lived in Wrocław, 13325 (66,5%) were able to travel by foot and by bicycle to primary school within their distance constraints, from who 12055 were also able to walk to public transport access points within these con-



straints. 5941 (29,6%) older school-aged children were able to travel by bicycle to primary school, but not by foot, from who 4504 were also able to walk to public transport access points. And 776 (3,9%) older school-aged children were not able to travel by bicycle, nor by foot to primary school from who 365 were able to walk to public transport access points. Therefore, the conclusion is that 411 (2,1%) older school-aged children were reliant on car use to travel to primary school.



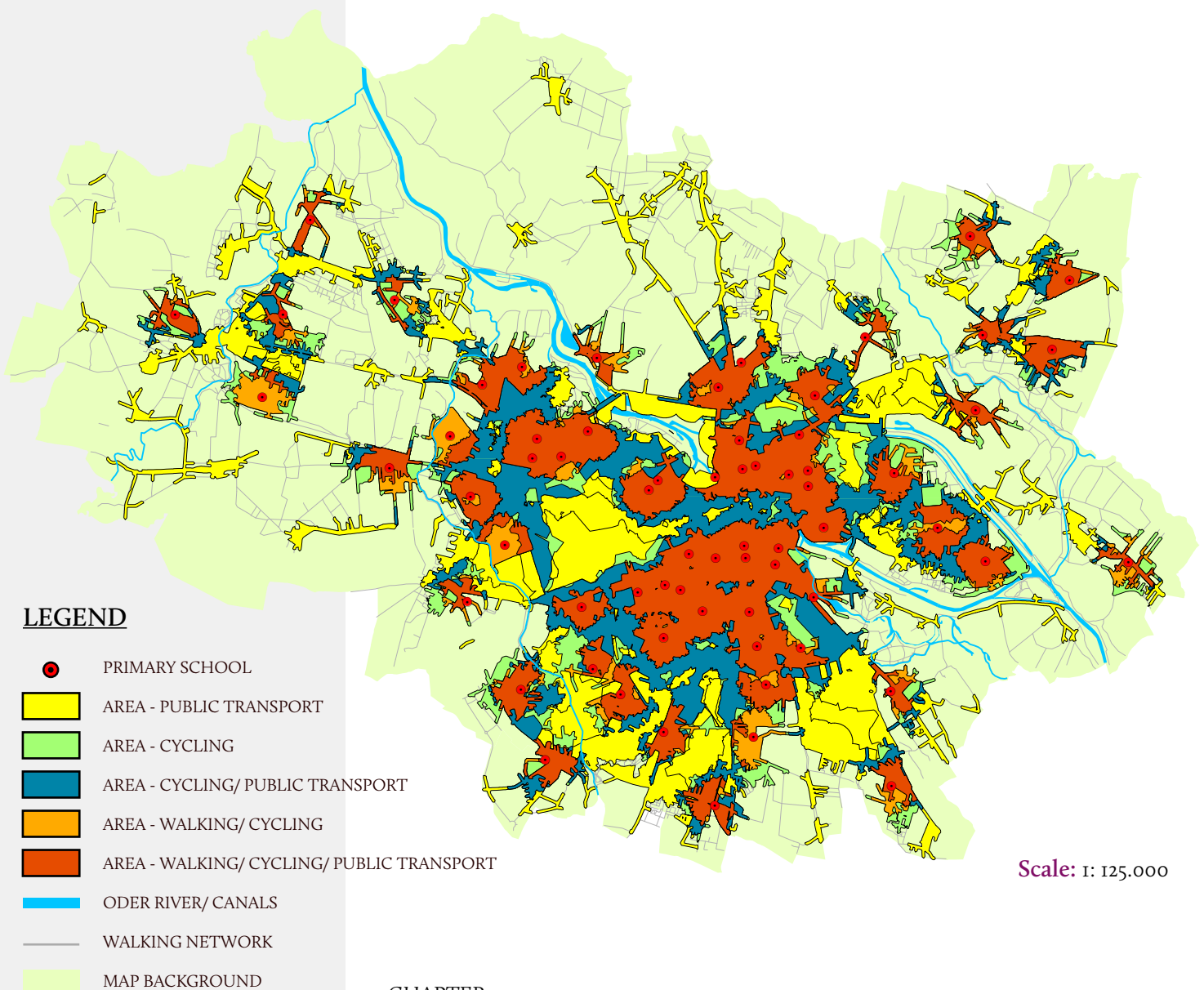
107. Description in the text

108. Description in the text.

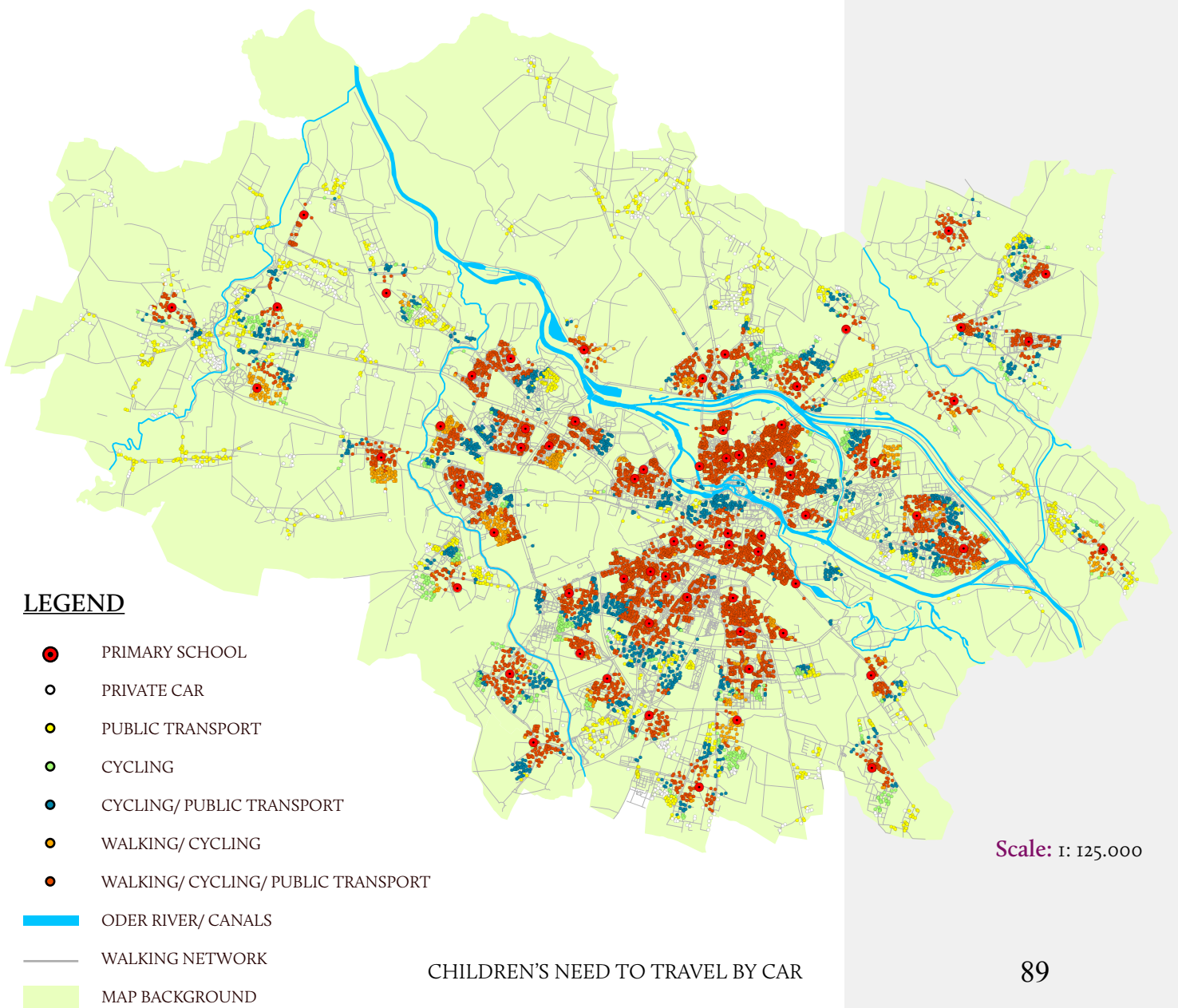
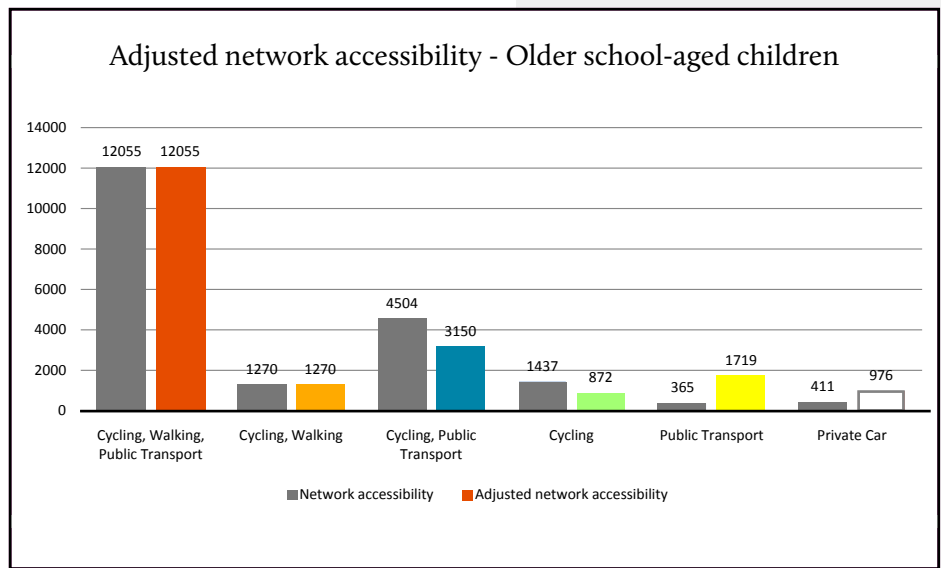
109. Description in the text.

4.5.2 ADJUSTED NETWORK ACCESSIBILITY

Figure 107 shows the adjusted network accessibility catchment areas that have been created for older school-aged children. These are based on 800 meters walking over the walking network and 10 minutes cycling over the cycling network away from primary schools and 400 meters walking over the walking network away from public transport access points. The catchment areas have been overlaid and projected on the entrances of houses and buildings where older school-aged children were living at the end of 2005. Their ability to travel to primary schools is shown in figure 108. From the 20042 older school-aged children that lived in Wrocław, 13325 (66,5%) were actually able to travel by foot and by bicycle to primary school within their distance constraints, from who 12055 were also able to walk to public transport access points within their constraints. 4022 (30,8%) older school-aged children were actually able to travel by bi-

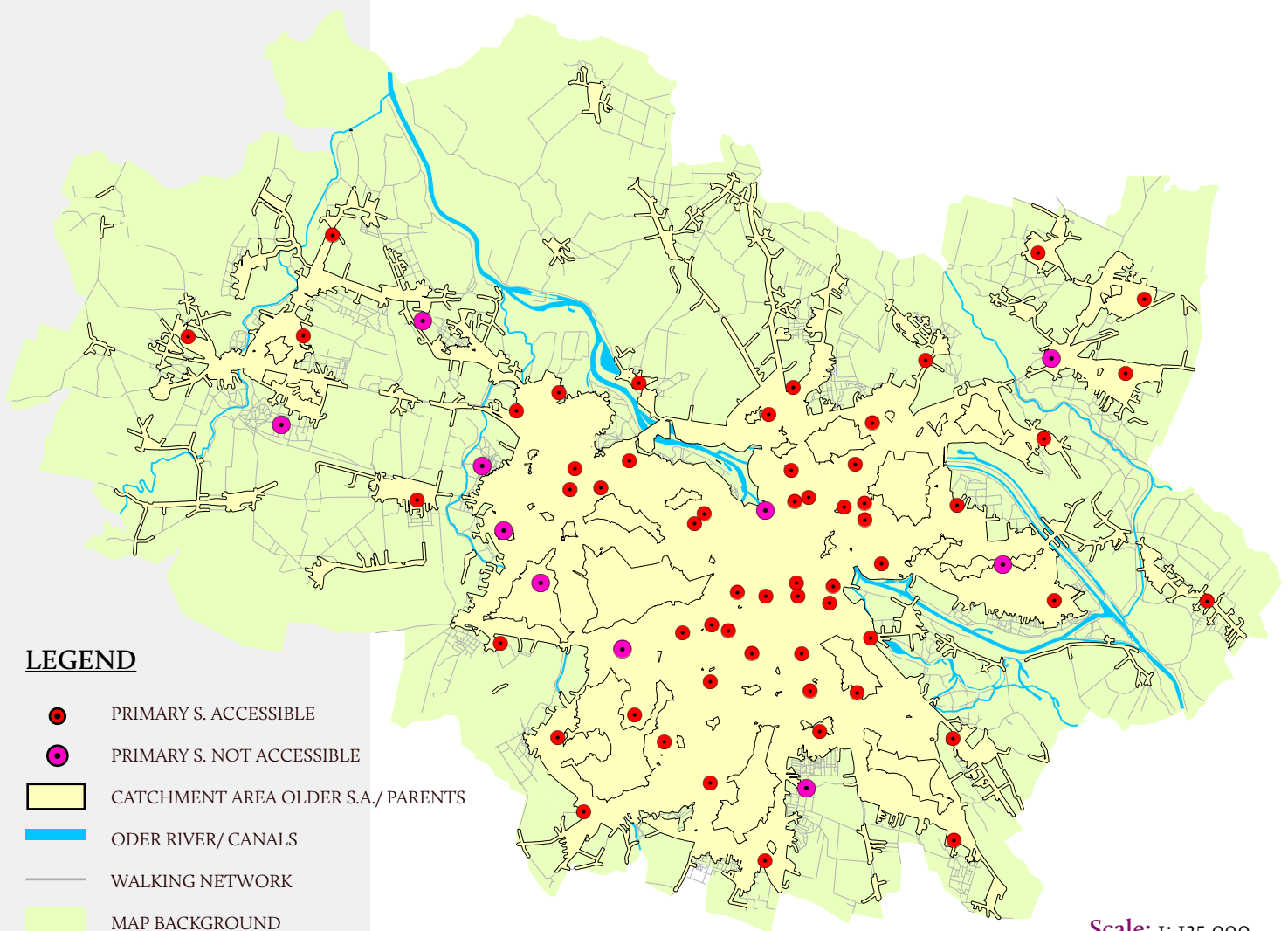


cycle to primary school, but not by foot, from who 3150 were also able to walk to public transport access points. And 2695 (20,6%) older-school-aged children were actually not able to travel by bicycle, nor by foot to primary school from who 1719 were able to walk to public transport access points. Therefore, 976 (7,5%) older school-aged children were actually reliant on the car to travel to school, which is an increase of 565 children compared to the results of the network accessibility analysis.



4.5.3 THE ABILITY TO USE PUBLIC TRANSPORT

The results of the adjusted network accessibility analysis show that 17024 older school-aged children are able to walk to a public transport access point within their distance constraints, from who 1719 are reliant on public transport. However, the ability to use public transport is also influenced by the ability to walk from public transport access points to primary schools. Figure 110 shows that from the 67 primary schools in Wrocław, 57 are located within the distance constraints of older school-aged children. Because older school-aged children have the same distance constraints to walk to public transport access points like parents have for their combined accompanied trips, for parents as well there are 10 primary schools where they are not able to combine their accompanied trips. Therefore, it is more than likely that certain trips that are reliant on public transport will end up as trips that are being made by the car as well.

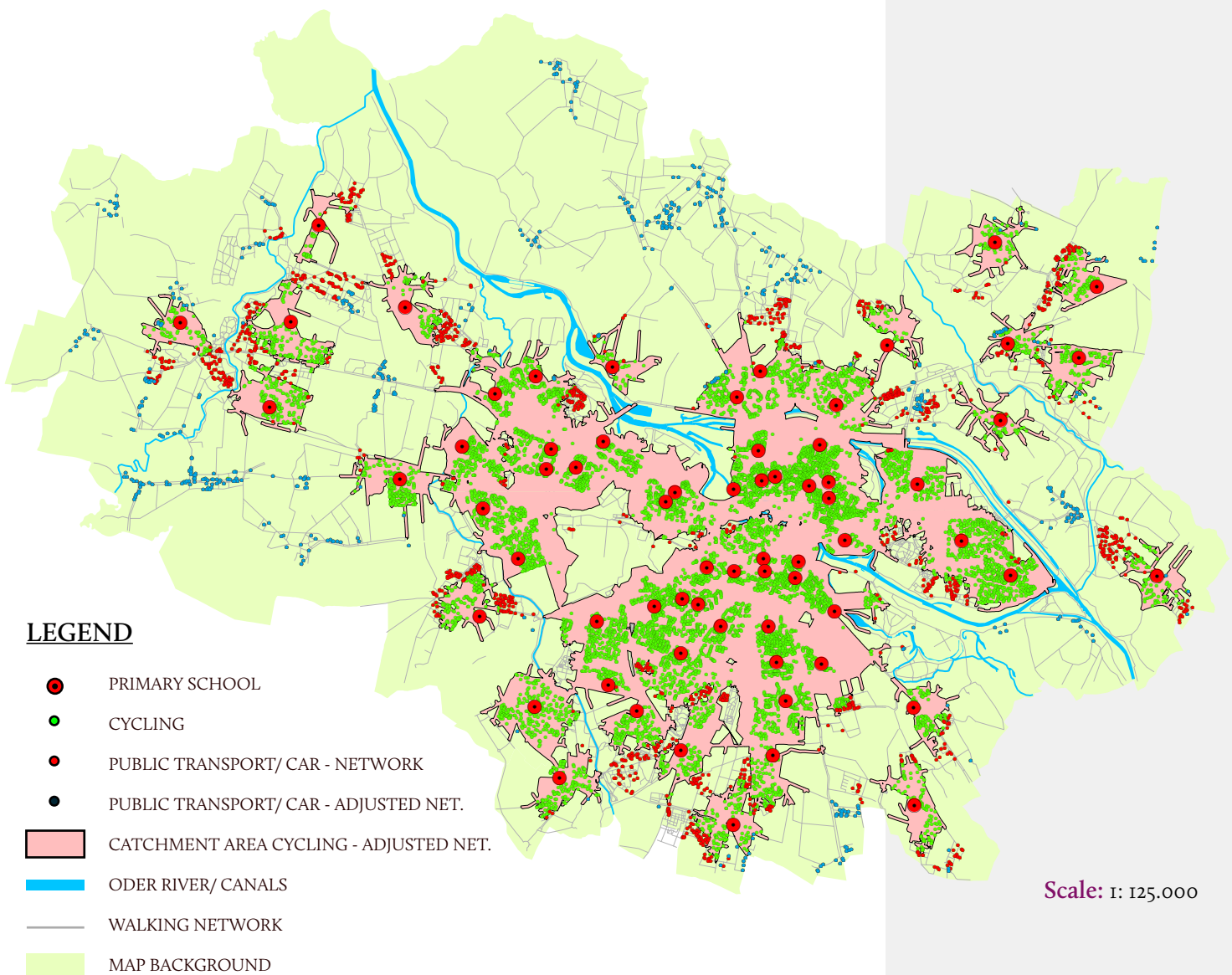


Scale: 1: 125,000

4.5.4 REDUCING THE NEED TO USE THE CAR

III. Description in the text

There is a need to reduce the reliance on car use for older school-aged children. Following the most realistic accessibility analysis, 2695 older school-aged children are not able to walk or cycle to primary school, from who 1919 are not able to cycle to primary school due to a lack of cycling infrastructure, which is shown in figure III. Therefore, there is a big need to improve the usability of the cycling network by the creation of new cycling paths. From the 17024 older school-aged children that are able to walk to public transport access points, 1719 are reliant on public transport. Whether or not these trips by public transport will be made is questionable. This because only 57 primary schools are accessible for older school-aged children. But the need for children to travel by car is also likely to be higher than measured due to the many parents that are not able to perform the accompanied trips to primary school in an array of activities.



4.6 TEENAGERS

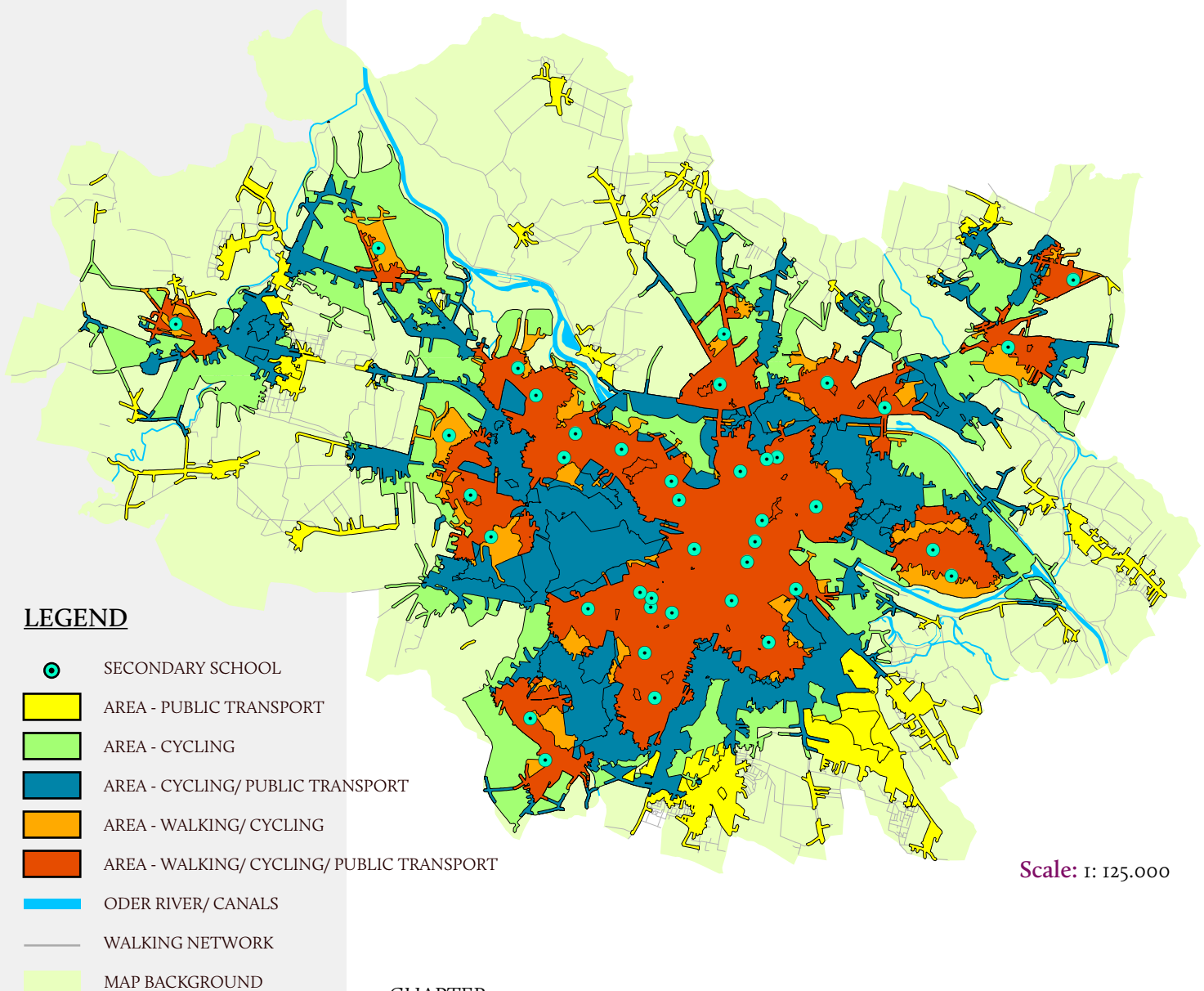
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II3. Description in the text.

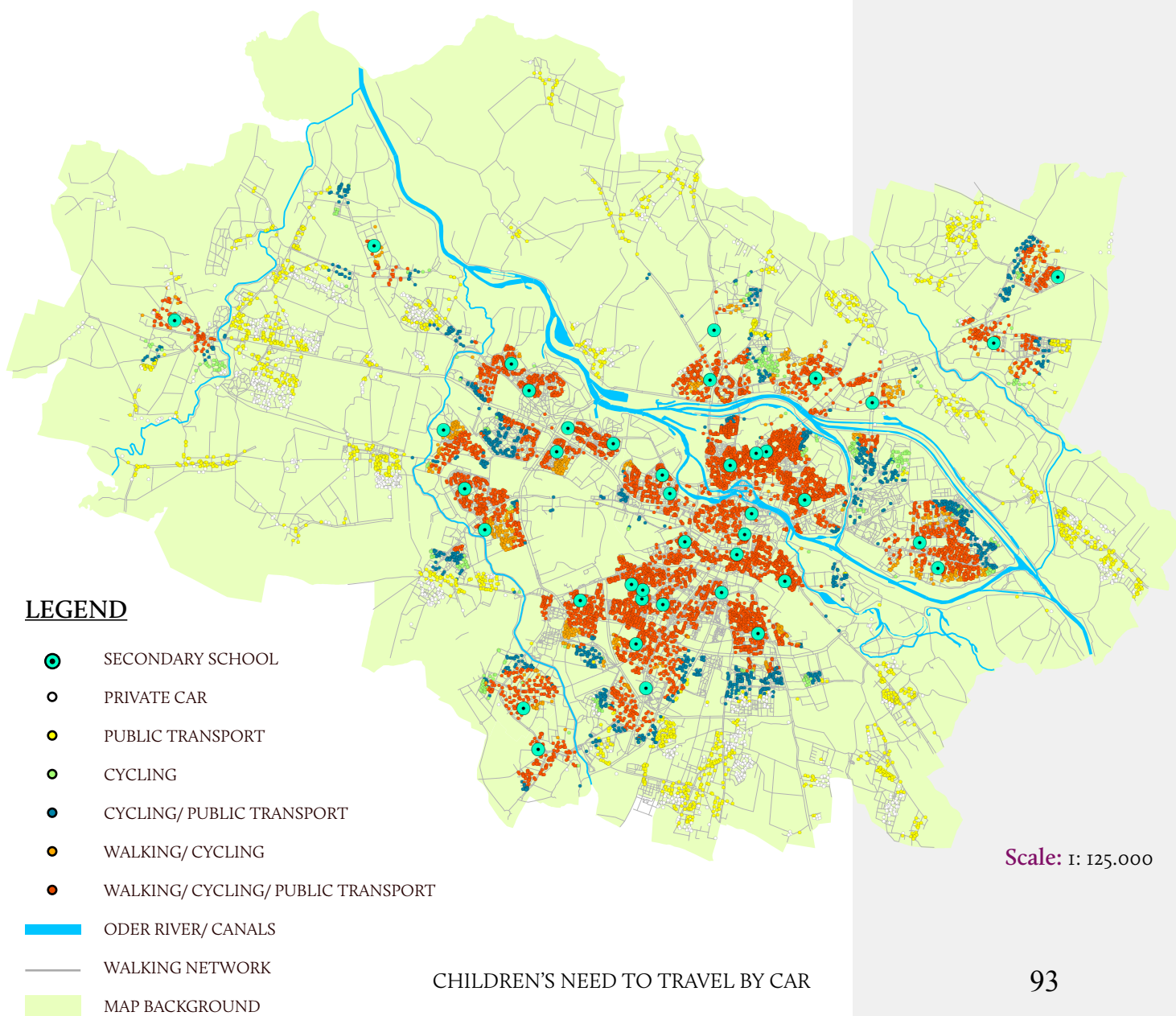
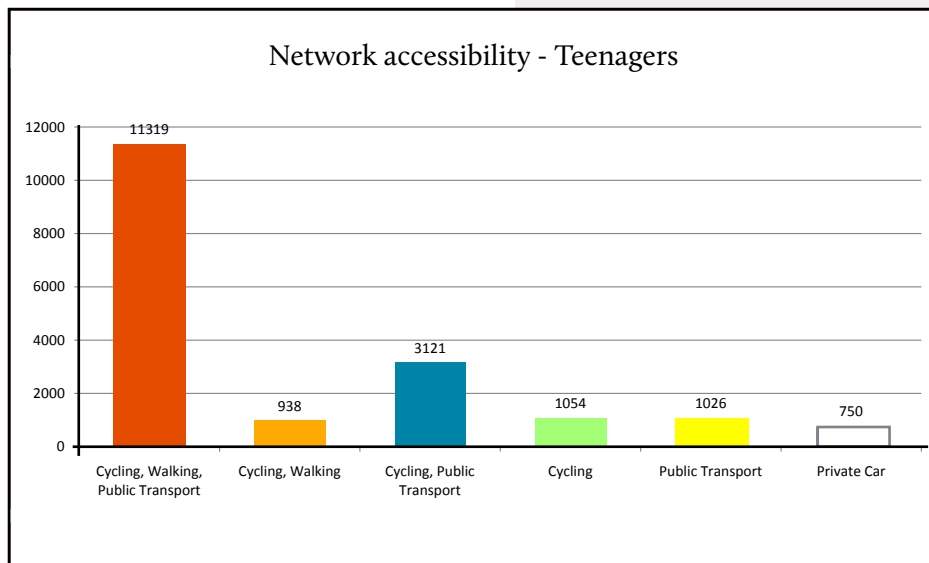
II4. Description in the text.

4.6.1 NETWORK ACCESSIBILITY

Figure II2 shows the network accessibility catchment areas that have been created for teenagers. These are based on 1200 meters walking over the walking network and 3000 meters cycling over the cycling network away from secondary schools and 400 meters walking over the walking network away from public transport access points. The catchment areas have been overlaid, which has resulted in 5 catchment areas that represent the abilities for teenagers to travel to primary school. Figure II4 shows the projection of the catchment areas on the entrances of houses and building where teenagers were living at the end of 2005, which has resulted in their ability to travel to secondary school. The results are shown in figure II3. From the 18208 teenagers that lived in Wrocław, 12257 (67,3%) were able to travel by foot and by bicycle to secondary school within their distance constraints, from who 11319 were also able to walk to public trans-



port access points within these constraints. 4175 (22,9%) teenagers were able to travel by bicycle to secondary school, but not by foot, from who 3121 were also able to walk to public transport access points. And 1776 (9,8%) teenagers were not able to travel by bicycle, nor by foot to secondary school from who 1026 teenagers were able to walk to public transport access points. Therefore, the conclusion is that 750 (4,1%) teenagers were reliant on the car to travel to secondary school.



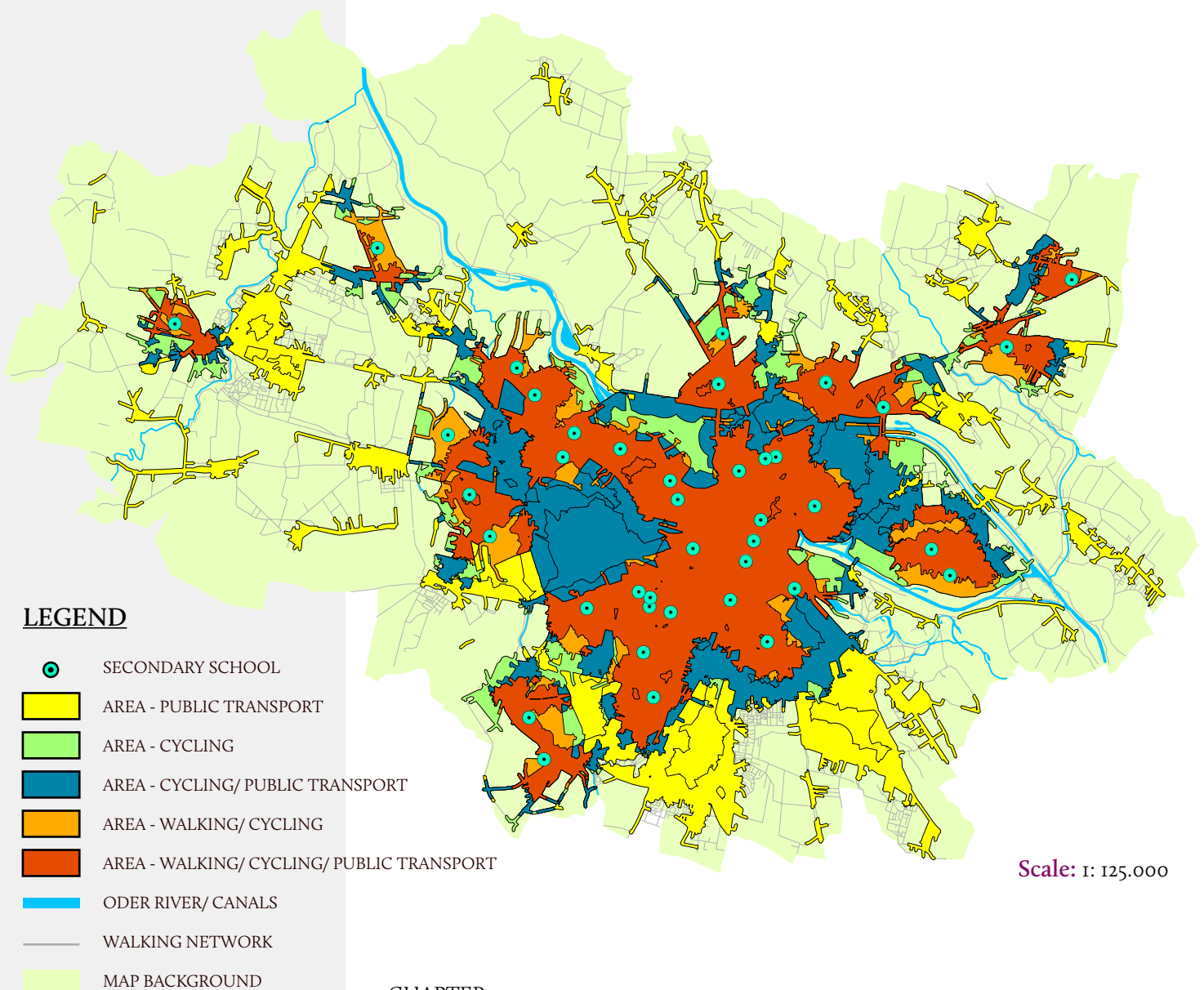
II5. Description in the text

II6. Description in the text.

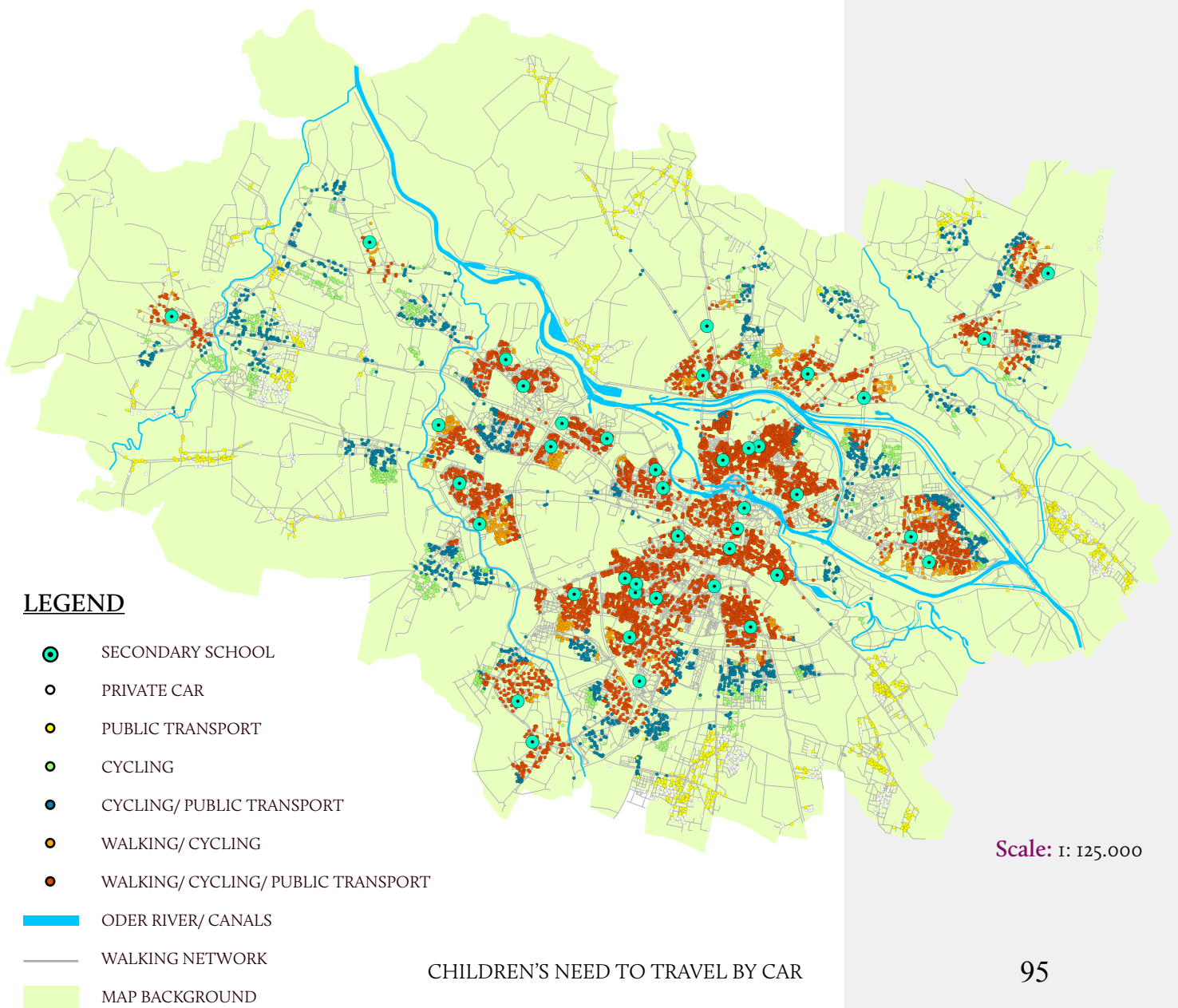
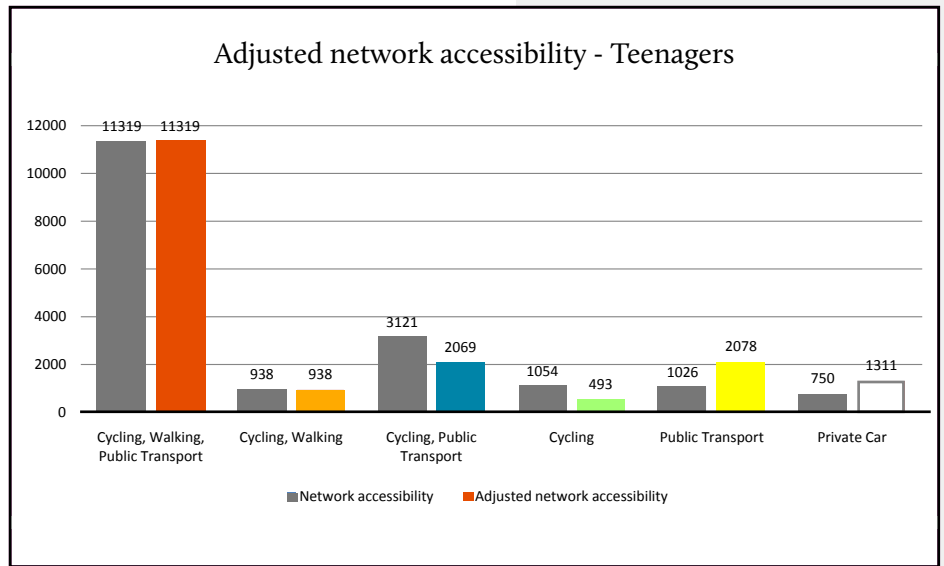
II7. Description in the text.

4.6.2 ADJUSTED NETWORK ACCESSIBILITY

Figure II5 shows the adjusted network accessibility catchment areas that have been created for teenagers. These are based on 1200 meters walking over the walking network and 15 minutes of cycling over the cycling network away from secondary schools and 400 meters walking over the walking network away from public transport access points. The catchment areas have been overlaid and projected on the entrances of houses and buildings where teenagers were living at the end of 2005, which has resulted in teenagers' adjusted ability to travel to secondary school. The results are shown in figure II6. From the 18208 teenagers that lived in Wrocław, 12257 (67,3%) teenagers were actually able to travel by foot and by bicycle to secondary school within their distance constraints, from who 11319 were also able to walk to public transport access points within these constraints. 2562 (14,1%) teenagers were actually able to travel by bi-

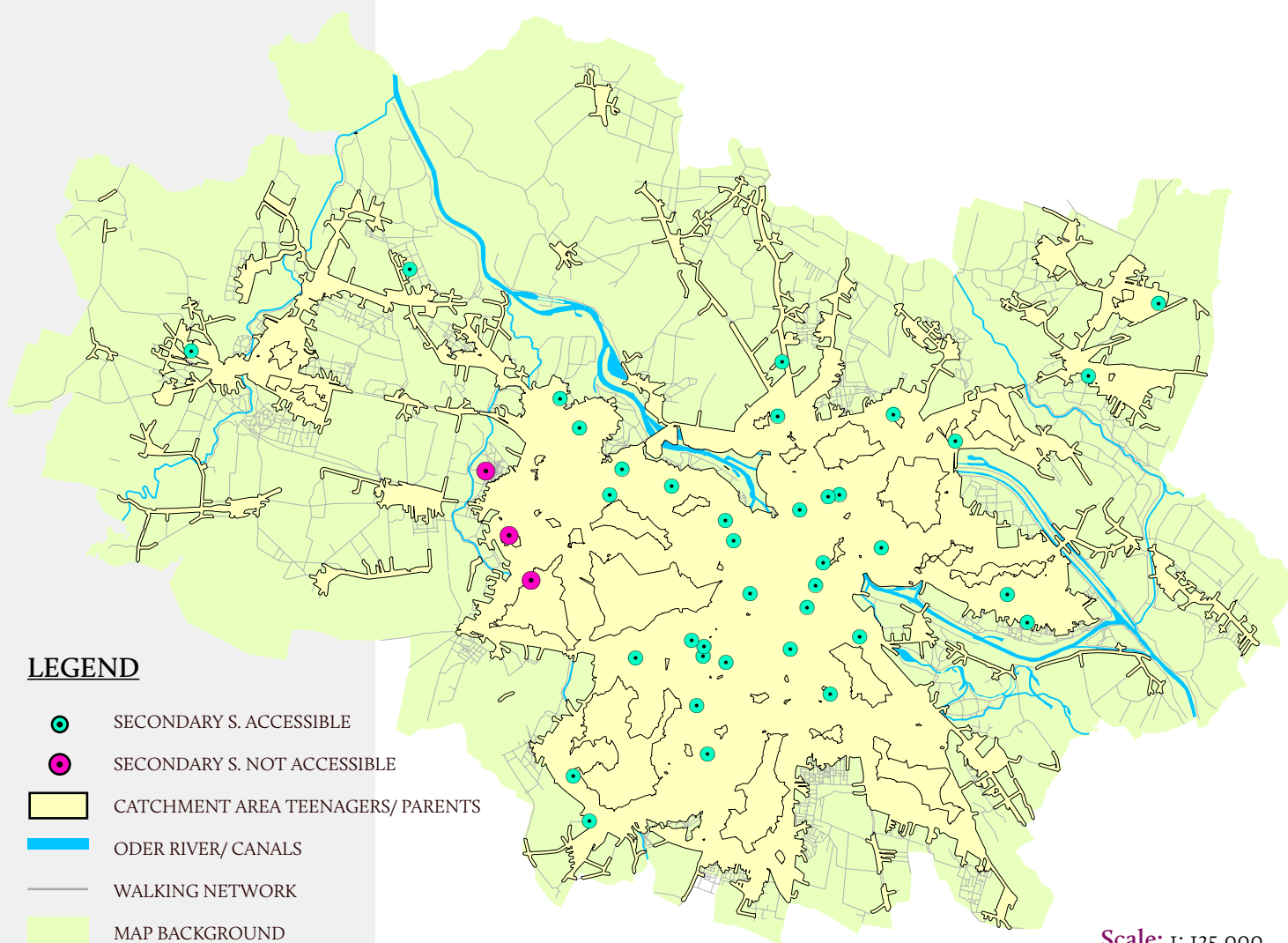


cycle to secondary school, but not by foot, from who 2069 teenagers were also able to walk to public transport access points. And 3389 (18,6%) preschoolers were actually not able to travel by bicycle, nor by foot to secondary school from who 2078 teengagers were able to walk to public transport access points. Therefore, 1311 (7,2%) teenagers were actually reliant on the car to travel to secondary school, which is an increase of 561 teenagers compared to the results of the network accessibility analysis.



4.6.3 THE ABILITY TO USE PUBLIC TRANSPORT

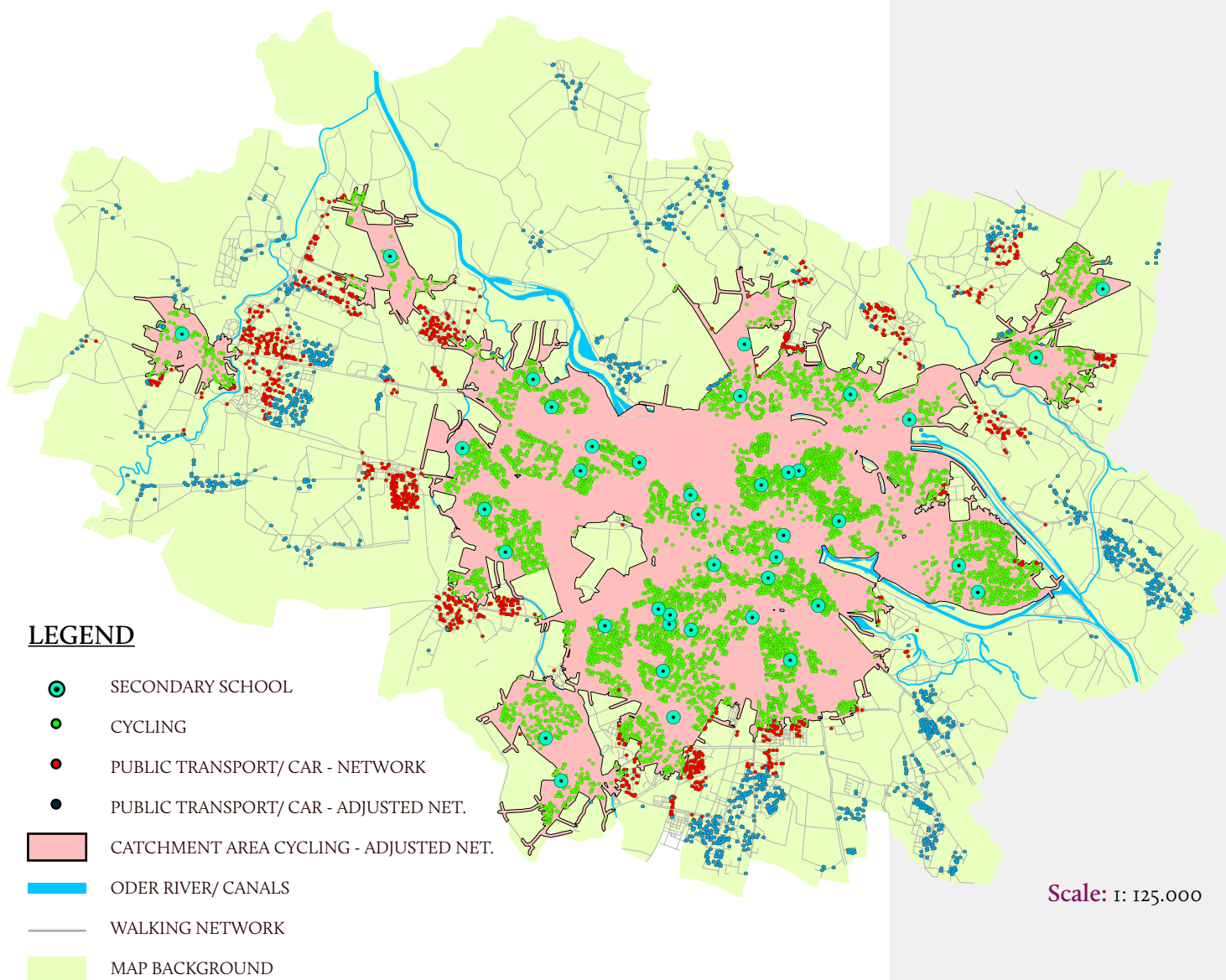
The results of the adjusted network accessibility analysis show that 16466 teenagers are able to walk to a public transport access point within their distance constraints, from who 2078 are reliant on public transport. However, the ability to use public transport is also influenced by the ability to walk from public transport access points to secondary schools. Figure 118 shows that from the 40 secondary schools in Wrocław, 37 are located within the distance constraints of teenagers. Because teenagers have the same distance constraints to walk to public transport access points like parents have for their combined accompanied trips, for parents as well there are 3 secondary schools where they are not able to combine their accompanied trips. Therefore, it is likely that certain trips that are reliant on public transport will end up as trips that are being made by the car as well, although the amount of these trips will be rather small.



4.6.4 REDUCING THE NEED TO USE THE CAR

There is a need to reduce the reliance on car use for teenagers. Following the most realistic accessibility analysis, 3389 teenagers are not able to walk or cycle to secondary school, from who 1613 are not able to cycle to secondary school due to a lack of cycling infrastructure, which is shown in figure 119. Therefore, there is a big need to improve the usability of the cycling network by the creation of new cycling paths. From the 16466 teenagers that are able to walk to public transport access points, 2078 are reliant on public transport. Whether or not these trips by public transport will be made is questionable. This because only 37 out of 40 secondary schools are accessible for older school-aged children. But the need for children to travel by car is also likely to be higher than measured due to the many parents that are not able to perform the accompanied trips to secondary school in an array of activities.

119. Description in the text



5.7 CONCLUSION

120. Description in the text

5.7.1 CHILDREN'S NEED TO TRAVEL BY CAR

In Wrocław, there is an urgent need to reduce the need for children to travel by car. In this chapter, children's reliance on car use has been measured and defined, which has resulted in statistics that are shown in figure 120. From the 75767 children in the age between 3 and 15 years old that were living in Wrocław at the end of 2005, 20194 (26,7%) are not able to walk or cycle to school. This number is explained by 8516 children that are not able to overcome their distance constraints, because the spreading of schools or the directness of the walking or cycling network has resulted in too large distances to travel. The other 11678 children are not able to cycle to school because there is a lack of cycling infrastructure, which threatens the usability of the cycling network. Therefore, the conclusion is that there is a need to re-search how the spreading of schools, the directness of the networks and the provision of cycling infrastructure can reduce children's reliance on car use.

Age groups	network	adjusted net	increase
Preschoolers			
Car reliant	2741	5805	3064
Public transport	260	753	493
<i>Subtotal</i>	<i>3001</i>	<i>6558</i>	<i>3557</i>
Young school-aged			
Car reliant	2079	4581	2502
Public transport	884	2971	2087
<i>Subtotal</i>	<i>2963</i>	<i>7552</i>	<i>4589</i>
Older school-aged			
Car reliant	411	976	565
Public transport	365	1719	1354
<i>Subtotal</i>	<i>776</i>	<i>2695</i>	<i>1719</i>
Teenagers			
Car reliant	750	1311	561
Public transport	1026	2078	1052
<i>Subtotal</i>	<i>1776</i>	<i>3389</i>	<i>1613</i>
TOTAL	8516	20194	11678

5.7.2 THE USABILITY OF PUBLIC TRANSPORT

From the 20194 children that are not able to walk or cycle to school, 7521 (37,2%) are able to walk withing their distance constraint to public transport access points. Thus, for these children public transport might be an alternative for travelling by car. However, in this chapter has been shown that the ability to travel by public transport also depends on the distance between public transport access points and schools and the ability of par-

Age groups	max. distance	# schools	# not accessible
Preschoolers	100	98	81
Parents	400	~	12
Young school-aged	200	67	38
Parents	400	~	10
Older school-aged	400	67	10
Parents	~	~	~
Teenagers	400	40	3
Parents	~	~	~
TOTAL	-	205	132
Children	-	~	~
Parents	-	~	35

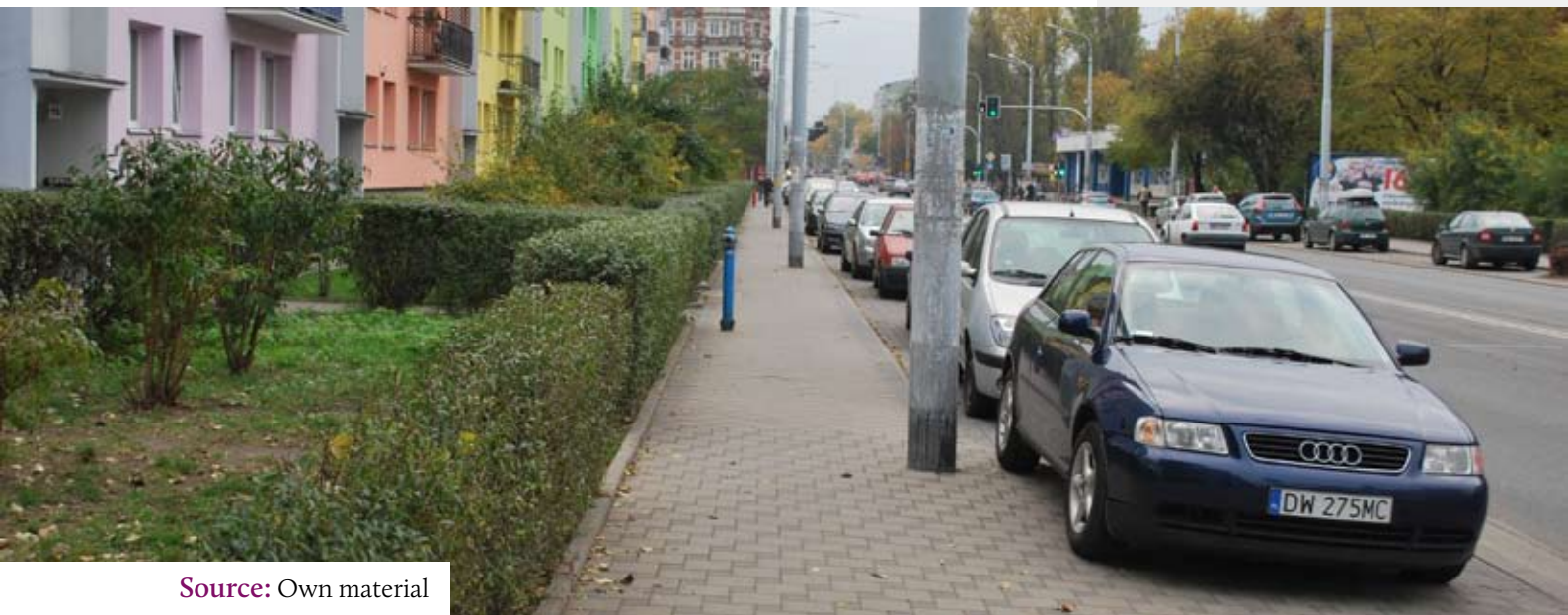
ents to combine their accompanied trips to school with other destinations. Therefore, the distance between schools and public transport access points cannot be too large. (400 meters in this analysis) Figure 121 shows an overview of the ability to travel between schools and public transport access points. From the 205 public schools in Wrocław, children are not able to access 132 of them, from which 35 are not accessible by parents as well. The consequence is that it might take too much effort for children to travel by public transport, which will result in more car trips and parents that decide to make their accompanied trip by car as well. Therefore, the amount of children that is reliant on car use, which is 12673, is likely to be even higher due to the reduced ability to travel between public transport access points and schools. The conclusion is that there is need to improve the accessibility between public transport access points and schools, wherefore the spreading of public transport access point and the directness of the walking network need to be researched.

5.7.3 THE DEMAND ON SPACE FOR CARS

The 12673 children that are reliant on car use to travel to school put a high demand on the space for cars in the city. Because many of these children share the same living location, it is likely for car trips to carry more than one child at a time. So in case every car trips carries 1,5 child, this means that every morning and afternoon more than 8.000 car trips need to be made between children's homes and schools. Thus, on a daily basis 16.000 car trips are made by the fact that children are not able to overcome their distance constraints. This does not only result in a high intensity of car use around schools, but also a high demand on space for car parking in the close vicinity of schools, which threatens the effectiveness of Wrocław's measures to improve the livability of children. The result is an ongoing outflow of families from the city and thus a growing demand on space for cars, which increasingly threatens the livability of children in Wrocław.

CHAPTER 5

REDUCING THE RELIANCE ON CAR USE



Source: Own material

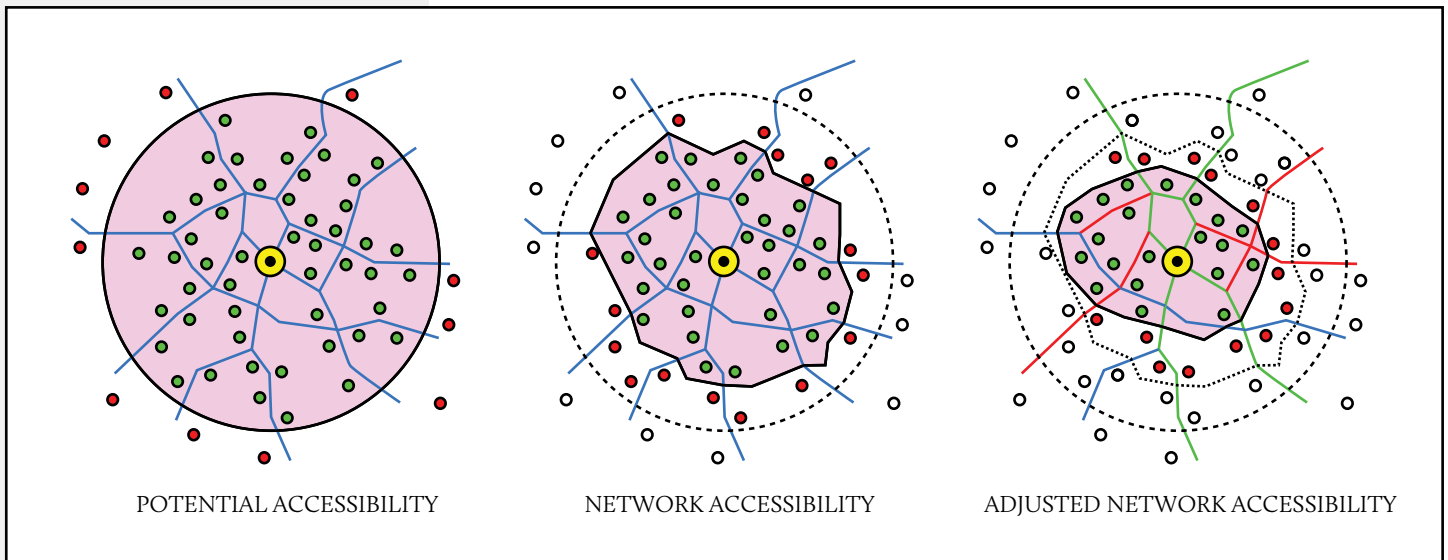
In this chapter, the aim is to propose the strategic interventions that are needed to reduce children's need to travel by car, which will increase the effectiveness of Wrocław's measures. These interventions will be used in chapter 7 as well in comparison to Wrocław's planned measures and housing development to define the likeliness of the measures to be ineffective. In the *first* paragraph, the methodology will be explained that will be used to define the interventions that are needed to reduce children's need to travel by car. In the *second* to the *fifth* paragraph, interventions will be proposed following the methodology for the specific age groups to reduce the need to travel by car, whereby the effects of these interventions on the reliance on car use will be defined as well. In the *sixth* paragraph, the strategic interventions between the age groups will be compared to define the similarities, which be used to create a strategic map that indicates how Wrocław should reduce the need for children to travel by car. This map will be used in the seventh chapter of this report.

I22. The need for children to travel by car is strongly influenced by the usability of the cycling network. Figure 122 shows an informal cycling path, with lampposts that prohibit children to cycle with a normal speed. In this chapter, the need for this path to become a cycling path will be defined.

5.1 METHODOLOGY

5.1.1 POTENTIAL ACCESSIBILITY

In the previous chapter, children's need to travel by car has been defined based on their network and adjusted network accessibility to schools. However, to define the interventions that are needed to reduce this defined need, children's potential accessibility needs to be measured and defined as well. The potential accessibility is measured and defined by the distance of travelling as the crow flies. This means, in case children do not have potential accessibility, it is possible to exclude the need for infrastructural interventions to provide these children with accessibility to school. In this research, a layer approach will be used to reduce the need for children to travel by car. First, interventions will be proposed to provide children with potential accessibility, which will be followed by interventions that will provide children with network and adjusted network accessibility, whereby the reliance on car use will reduce layer by layer.



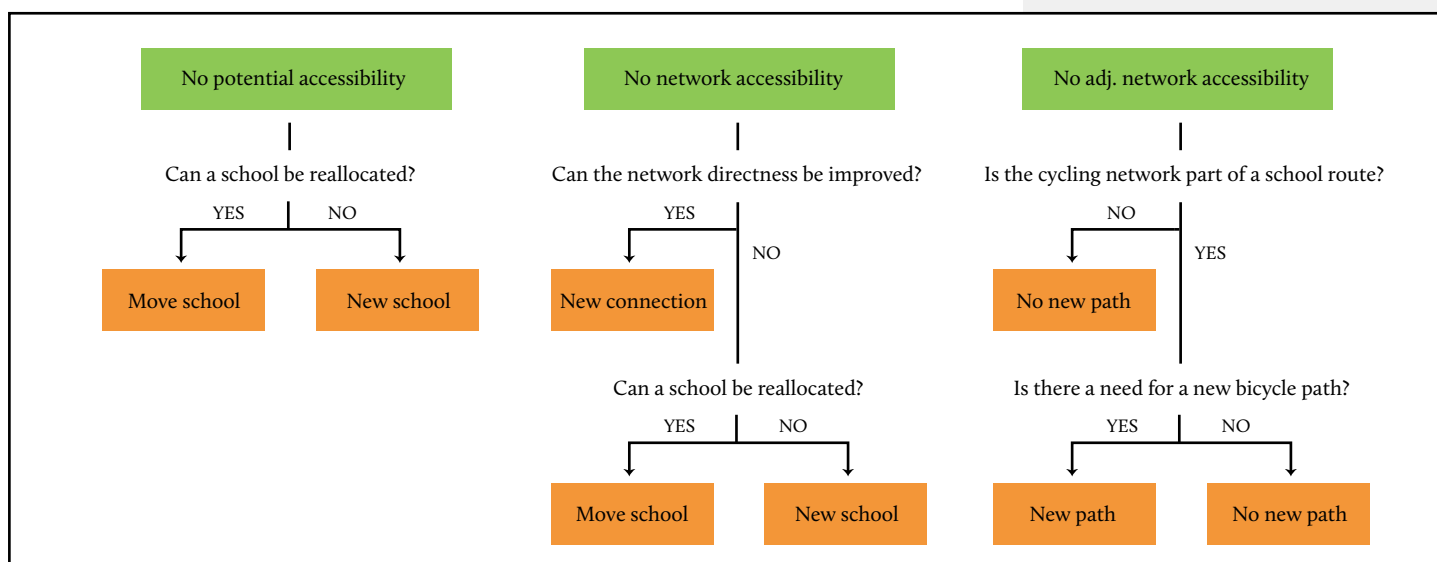
123. In this research, layer by layer the need for children to travel by car will be reduced by interventions. Figure 123 shows the three layers that will be used to reduce children's need to travel by car.

5.1.2 THE POSSIBLE INTERVENTIONS

There are four possible interventions that can be implemented to reduce the need for children to travel by car. These interventions are different for the defined research layers. To improve children's potential accessibility to schools, there is a need to research the accuracy of the location and the provision of schools. Thereby, the possible interventions are to reallocate schools or to provide new schools. To improve children's network accessibility to schools, there is a need to research the directness of the walking and cycling network. Thereby, the possible interventions are to construct new infrastructural connections or crossings. In case the network accessibility cannot be improved by the network directness, there is a need to intervene by the reallocation or provision of schools as well. To improve the adjusted network accessibility, there is a need to research the need for new bicycle paths on the routes between children's homes and schools.

5.1.3 THE DECISION-MAKING PROCESS

To define the specific intervention(s) that are needed, there is decision-making process that is different for the defined reserach layers. For the potential accessibility, the main question is whether or not a school can be moved or not. This decision depends on several factors, like the presence and distance to other schools, but also the size of the school. In case there is no school that can be moved, a new school needs to be build. For the network accessibility, the main question is whether or not an infrastructural change will reduce the need for children to travel by car. In case the network directness will not make a difference, the question is whether or not a school can be moved or that a new school needs to be provided. For the adjusted network accessibility, the question is whether or not a new bicycle path on a route between the homes of children that do not have adjusted network accessibility and schools will improve this accessibility.



5.1.4 CLOSEST FACILITY ANALYSIS

Because children’s need to travel by car has been defined on the city scale, there is a need to determine the areas that need to be researched where interventions need to be implemented. To define these areas, a closest facility analysis will be carried out, wherewith the shortest routes between the homes of children and schools will be defined. This will make it possible to define the amount of children that need to travel by car per closest school, wherewith the schools that might be relocated will be defined as well. Because the question whether or not a school can be relocated is relevant for the potential and network accessibility, the closest facility analysis will be carried out for these analyses to define the research areas. In the adjusted network accessibility analysis, the closest facility analysis will also be carried out, but only to define the routes between the homes of children that do not have adjusted network accessibility and schools.

124. The interventions that are needed to reduce the need for children to travel by car will be defined following a decision-making process. Figure 124 shows the questions that will be considered to define the interventions.

5.2 PRESCHOOLERS

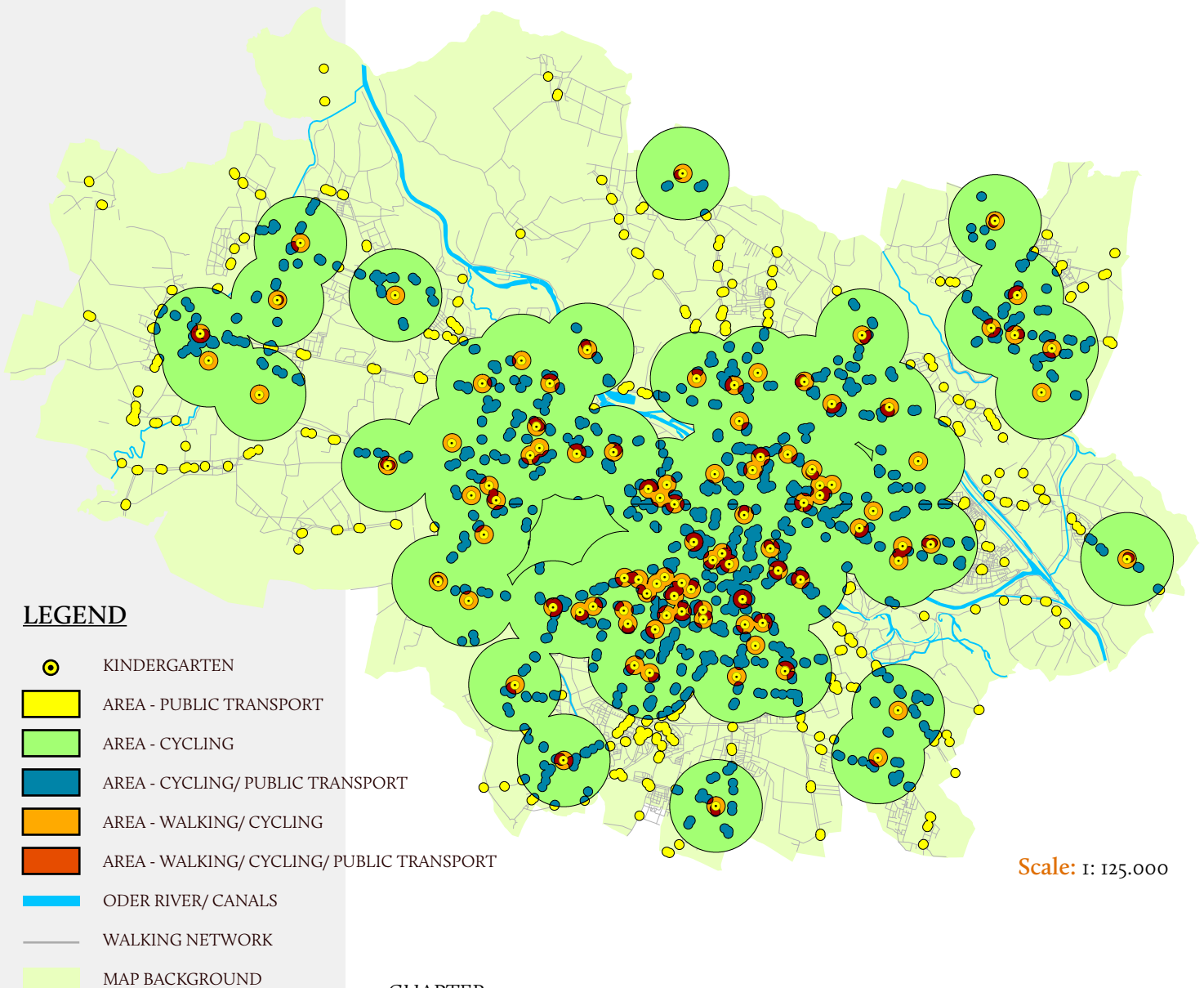
125. Description in the text

126. Description in the text.

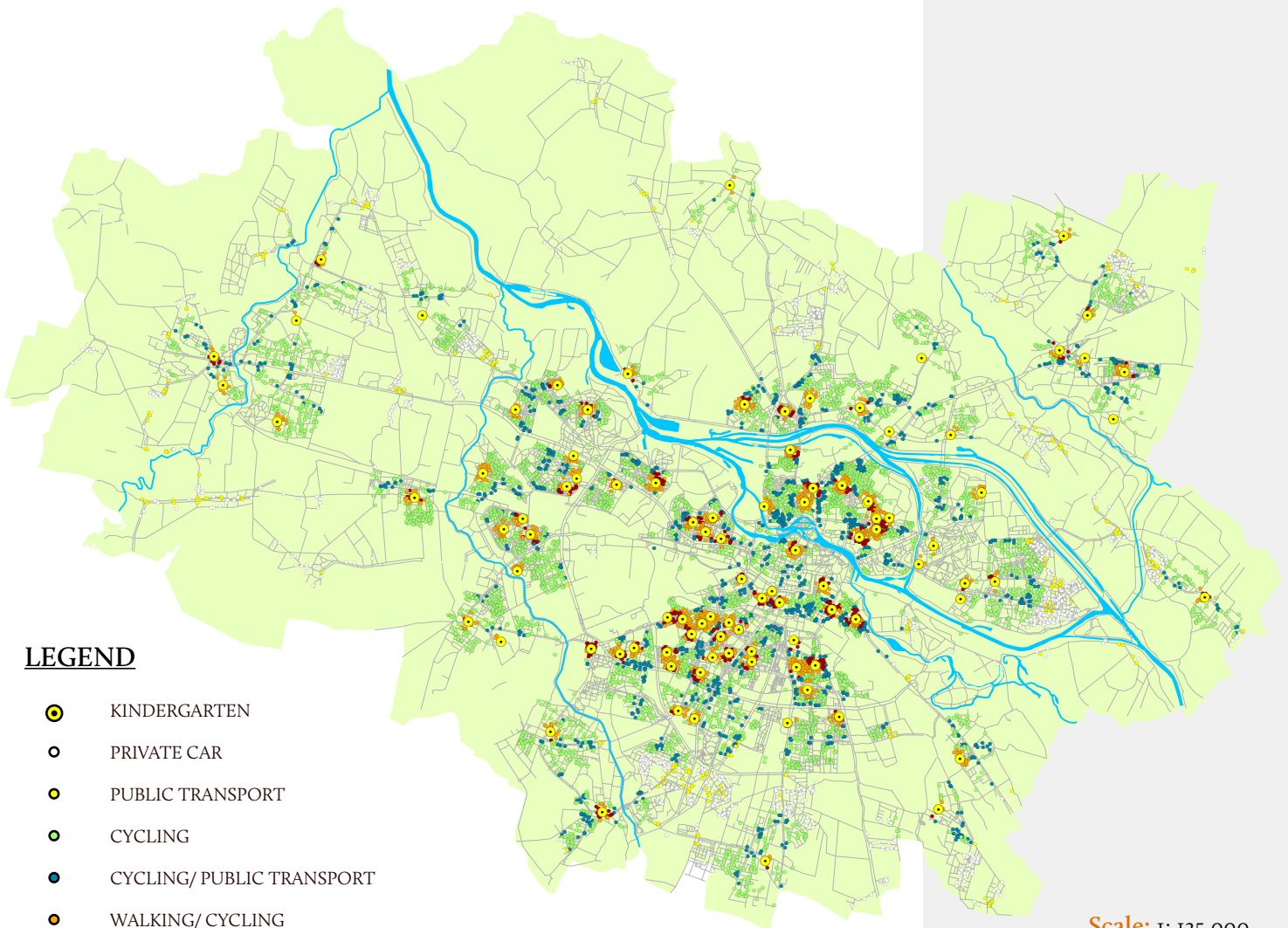
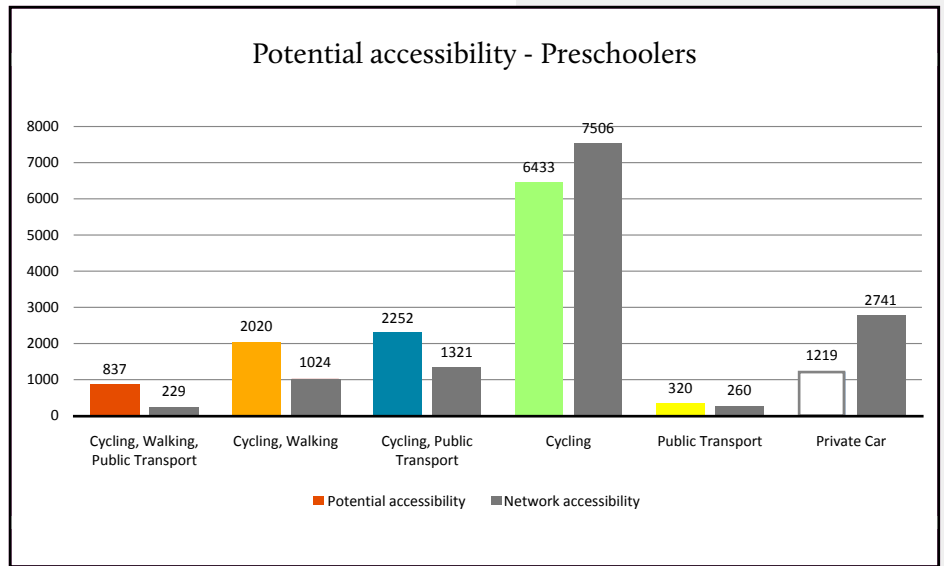
127. Description in the text.

5.2.1 POTENTIAL ACCESSIBILITY

Figure 125 shows the potential accessibility catchment areas that have been created for preschoolers. These are buffers of 200 meters for walking and 1000 meters for cycling around kindergartens and buffers of 100 meters for walking around public transport access points. The catchment areas have been overlaid, which has resulted in 5 catchment areas that represent the potential abilities for preschoolers to travel to kindergarten. Figure 127 shows the projection of the catchment areas on the entrances of houses and building where preschoolers were living at the end of 2005. The results are shown in figure 126. From the 13081 preschoolers that lived in Wrocław, 2857 (21,8%) were in potential able to travel by foot and by bicycle to kindergarten within their distance constraints, from who 837 were also able to walk to public transport access points within these constraints. 8685 (66,4%) preschoolers were in potential able to travel by



bicycle to kindergarten, but not by foot, from who 2252 were also able to walk to public transport access points. And 1539 (11,8%) preschoolers were in potential not able to travel by bicycle, nor by foot to kindergarten from who 320 were able to walk to public transport access points. The conclusion is that 1219 (20,1%) preschoolers were in potential reliant on the car to travel to kindergarten, which leaves 1522 preschoolers that were reliant on the car to travel to kindergarten by the lack of network accessibility.



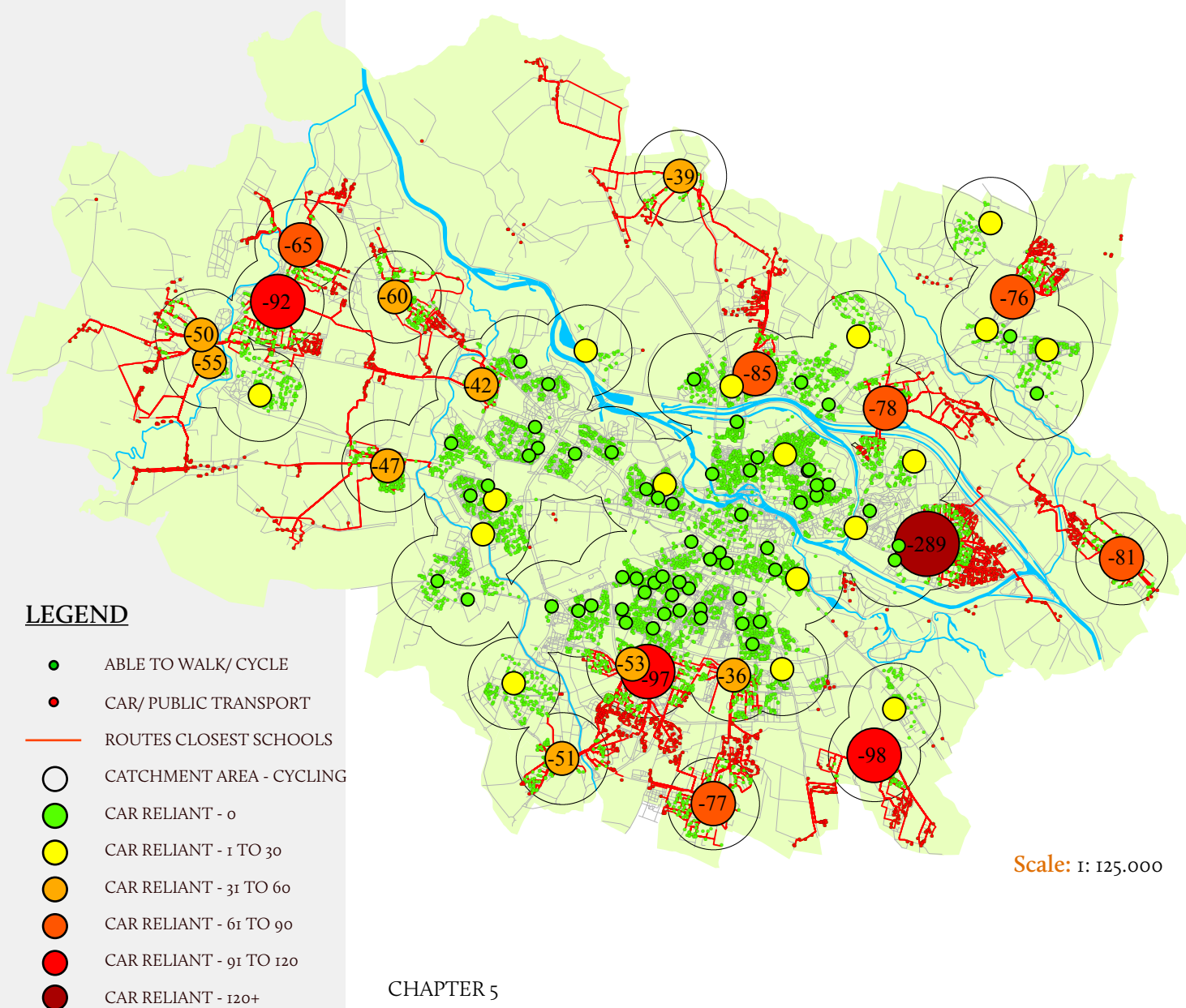
LEGEND

- KINDERGARTEN
- PRIVATE CAR
- PUBLIC TRANSPORT
- CYCLING
- CYCLING/ PUBLIC TRANSPORT
- WALKING/ CYCLING
- WALKING/ CYCLING/ PUBLIC TRANSPORT
- ODER RIVER/ CANALS
- WALKING NETWORK
- MAP BACKGROUND

Scale: 1: 125.000

► Closest facility analysis

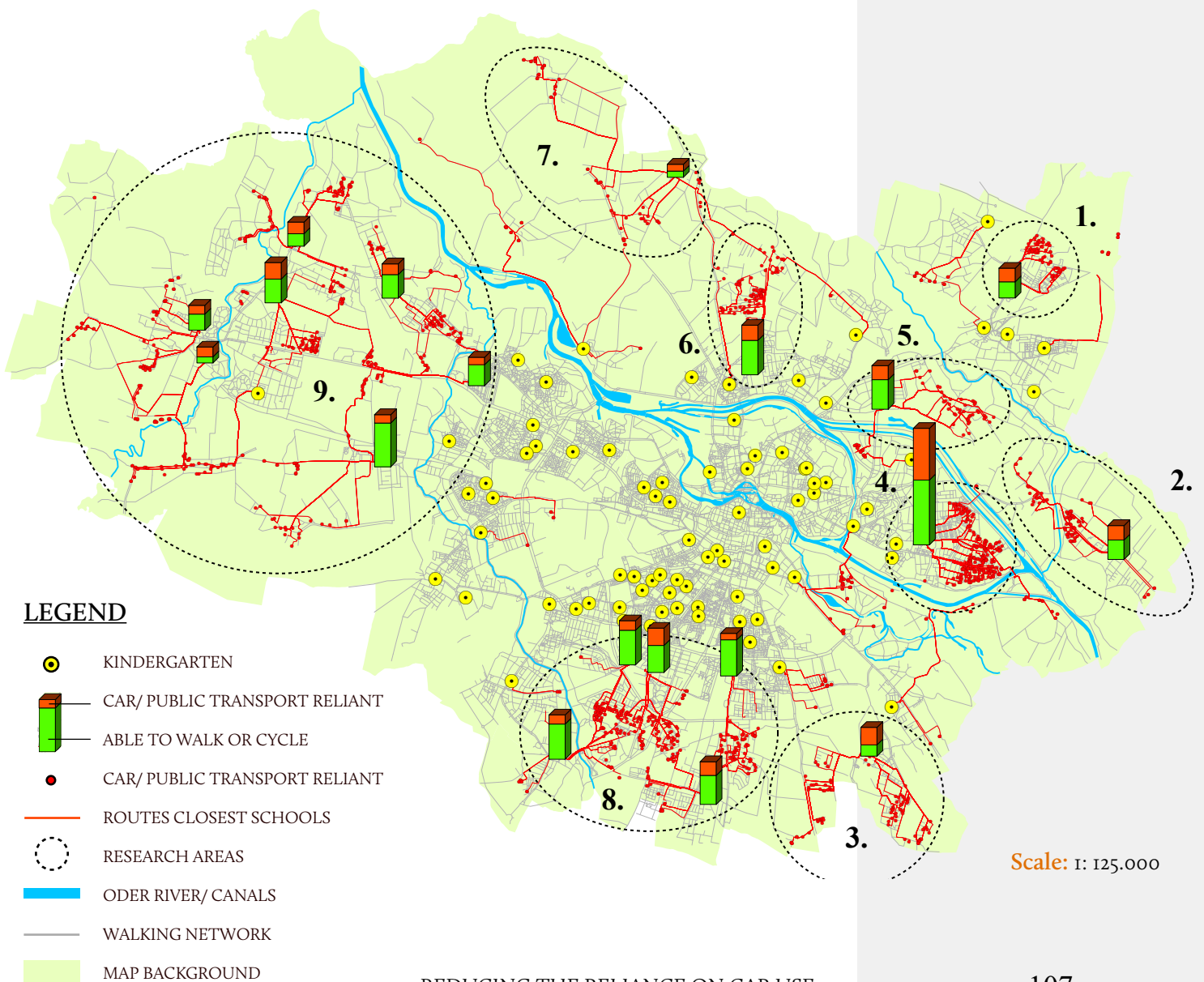
Figure 128 shows the closest facility analysis that has been carried out for preschooler’s potential accessibility to kindergarten. The shortest routes between the homes of preschoolers and kindergartens have been measured and defined. Only those routes where preschoolers did not have potential accessibility by bicycle or foot have been drawn in figure 128. The preschoolers that did not have potential accessibility have been projected on the closest kindergartens, wherewith 19 kindergartens have been selected to research. Figure 129 shows that with this selection, the aim is to reduce the 1539 preschoolers that were reliant on car use or public transport at the end of 2005 with 1471. Figure 130 shows that the kindergartens to research have been divided over 9 research areas where interventions in the spreading of schools are needed. These interventions have been proposed and implemented, like it will be shown in the next pages.



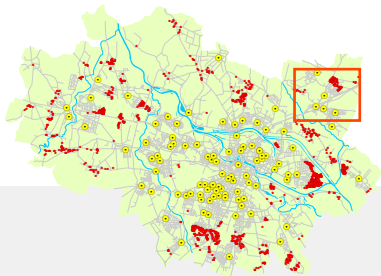
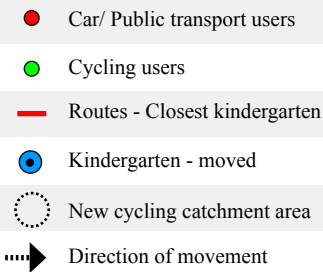
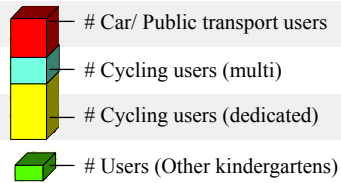
District name	# kindergartens	# preschoolers	# car reliant
1 Psie Pole	1	167	76
2 Swojszyce	1	190	81
3 Brochow	1	161	98
4 Biskupin	1	653	289
5 Kowale	1	243	78
6 Rozanka	1	177	85
7 Swiniary	1	73	39
8 Krzyki	5	1219	314
9 Lesnica	7	1216	411
TOTAL	19	4099	1471

129. Description in the text.

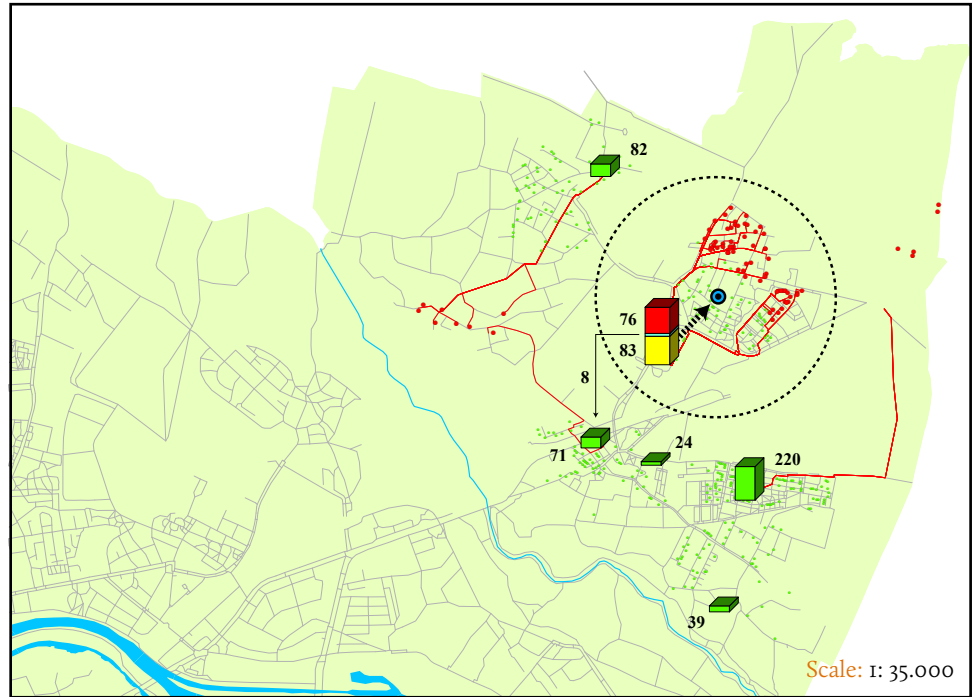
130. Description in the text.



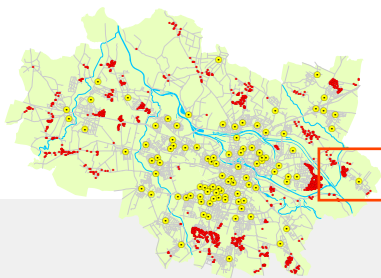
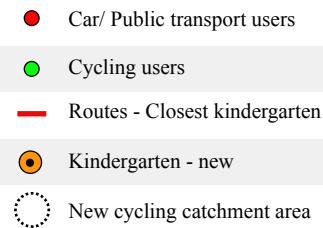
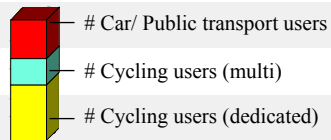
► The proposed interventions



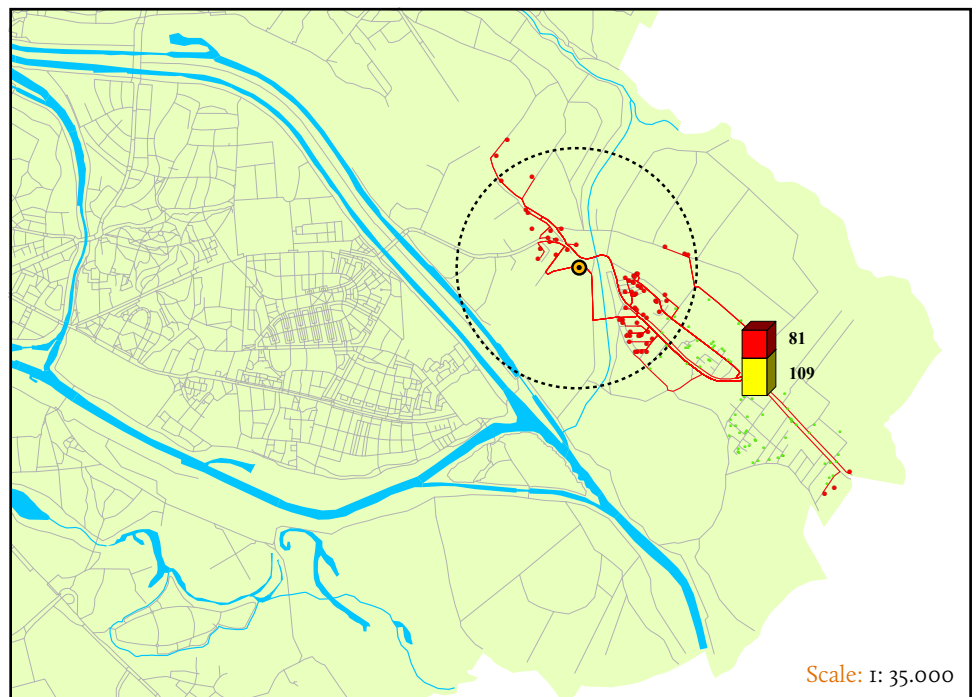
Area 1. Wrocław Psie Pole



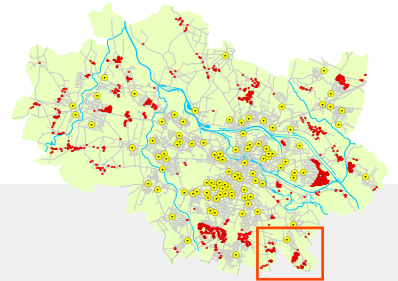
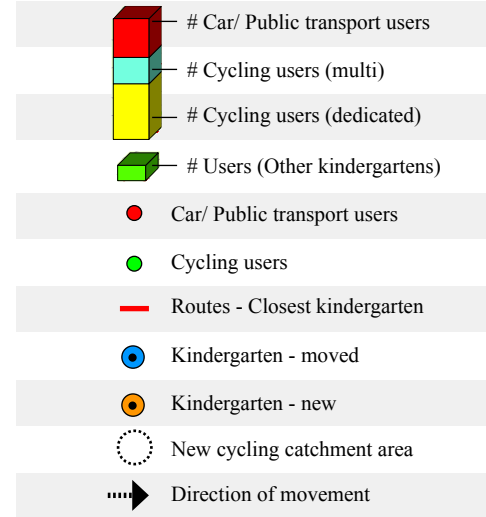
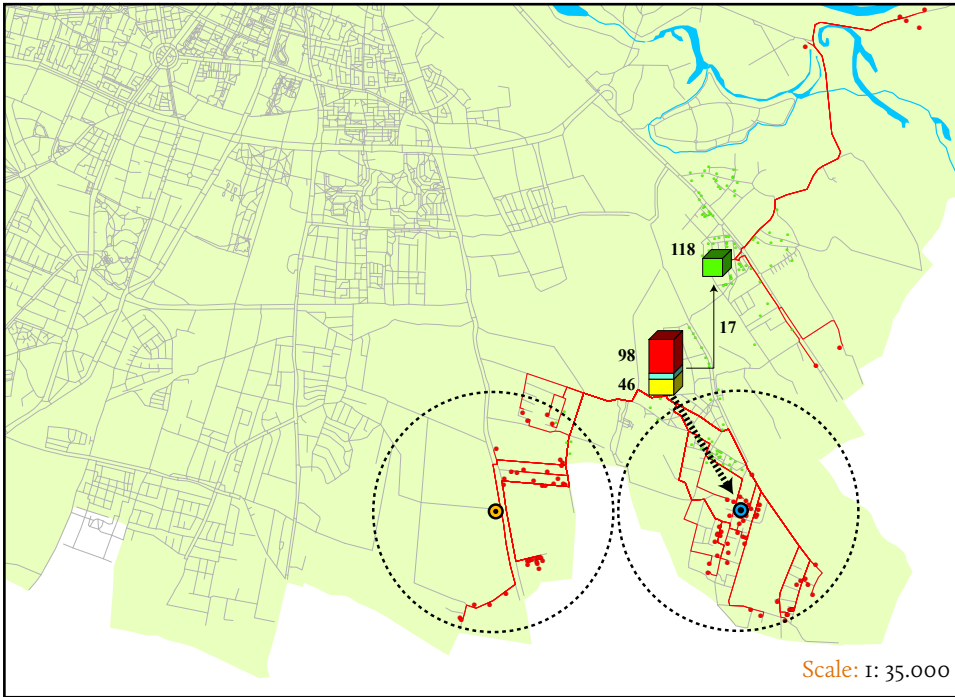
131. In the Psie Pole district, 76 preschoolers do not have potential accessibility to kindergarten by bicycle or foot. The nearest kindergarten can be moved to the North, which will provide these preschoolers with accessibility to kindergarten as well. Thereby, the potential accessibility of the 83 preschoolers that are reliant on this kindergarten will remain in tact.



Area 2. Wrocław Swojszyce

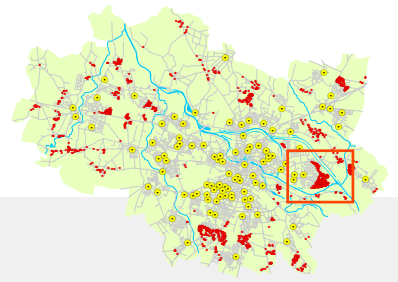
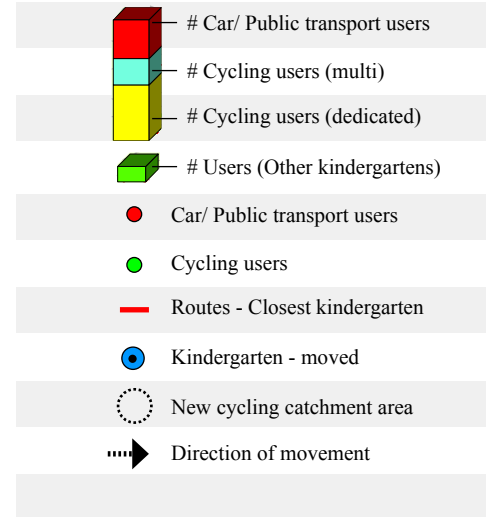
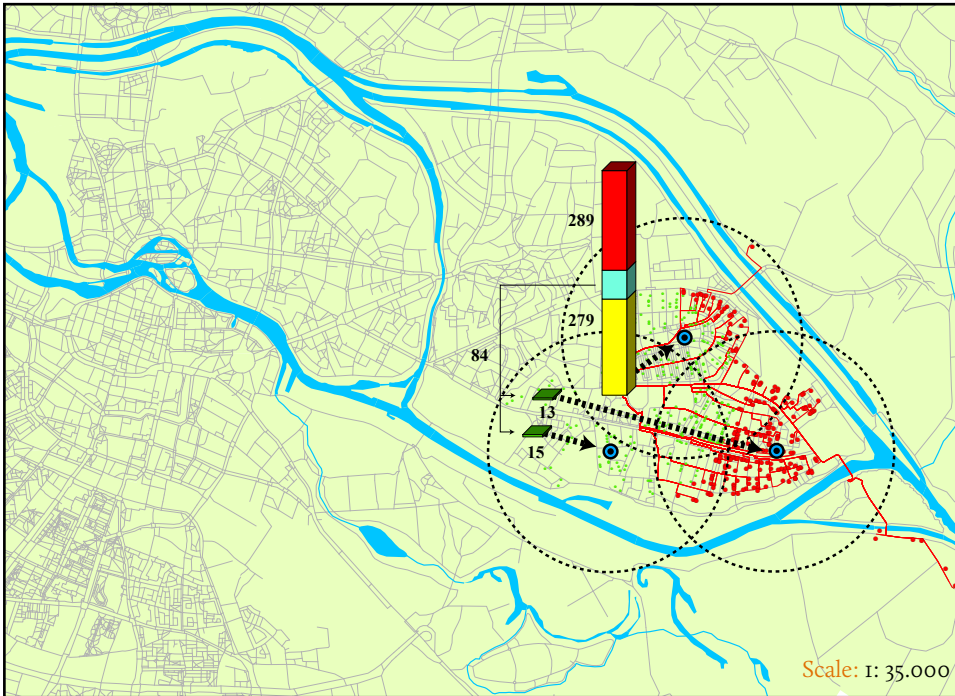


132. In the Swojszyce district, there are 81 preschoolers that are not able to travel by bicycle or foot to kindergarten. To provide them with accessibility, a new kindergarten needs to be provided, because the nearest kindergarten cannot be moved. By moving the kindergarten, the potential accessibility of 109 preschoolers that do not have an alternative will be lost.



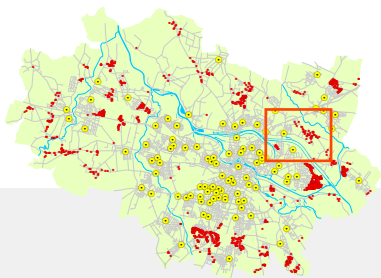
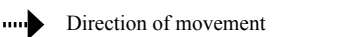
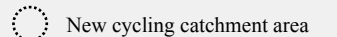
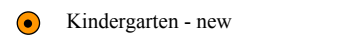
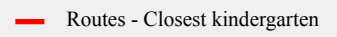
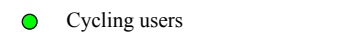
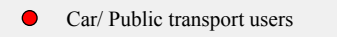
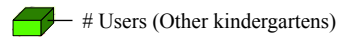
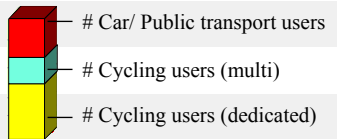
Area 3. Wrocław Brochów

133. In the Brochów district, 98 preschoolers do not have potential accessibility by bicycle or foot to kindergarten. This accessibility can be provided by moving the nearest kindergarten and providing a new kindergarten as well. Therewith, the potential accessibility of the 46 preschoolers without an alternative remains in tact, while 17 others do have an alternative.

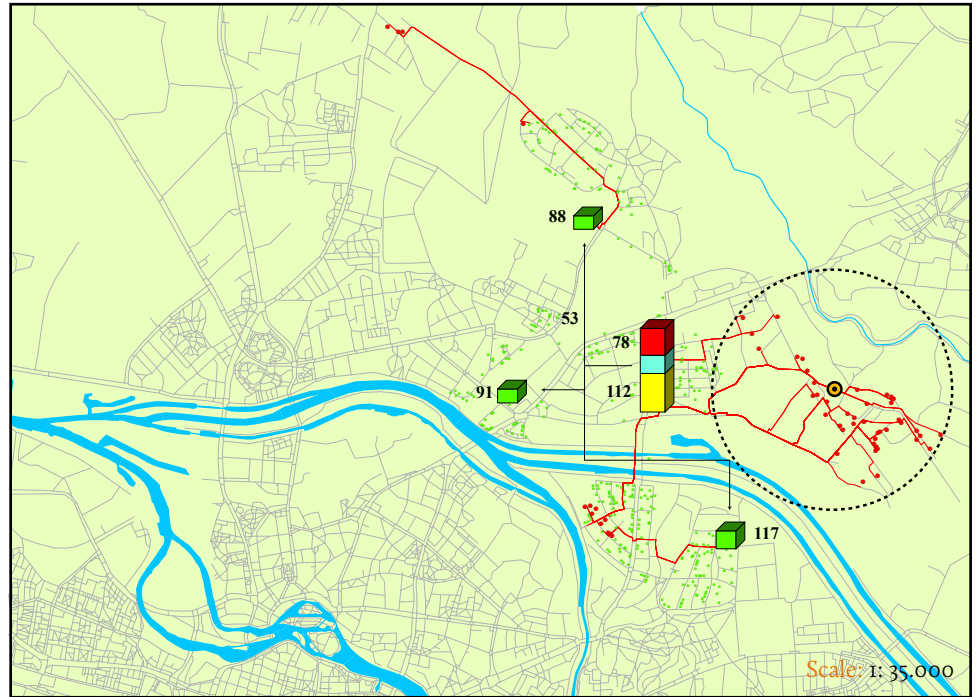


Area 4. Wrocław Biskupin

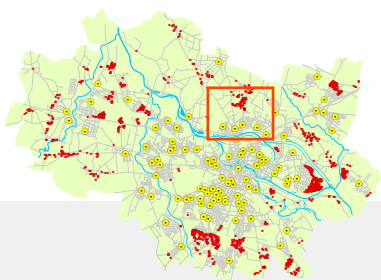
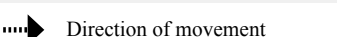
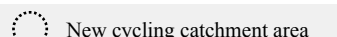
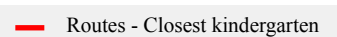
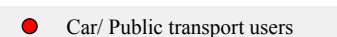
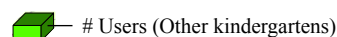
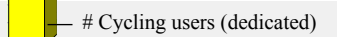
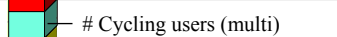
134. In the Biskupin district, 289 preschoolers do not have potential accessibility to kindergarten by bicycle or foot. The nearest kindergarten, as well as two other kindergartens need to be moved. Therewith, not only the potential accessibility of 279 preschoolers without an alternative remains in tact, but the amount of preschoolers is also more evenly distributed.



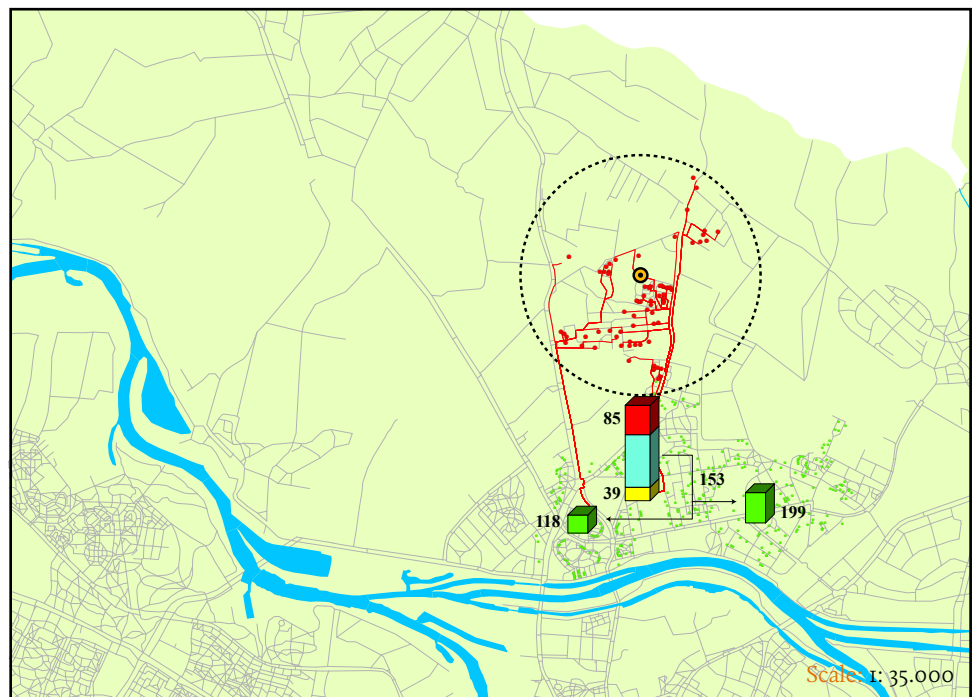
Area 5. Wrocław Kowale



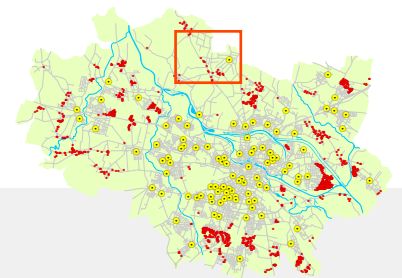
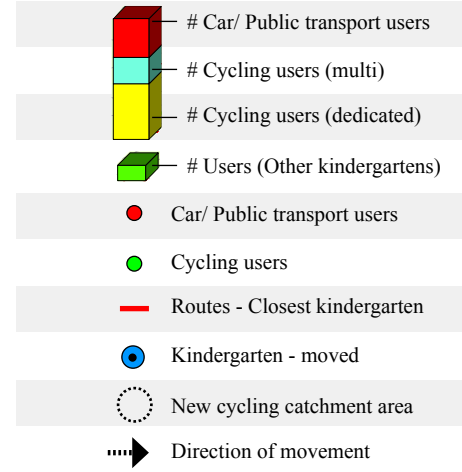
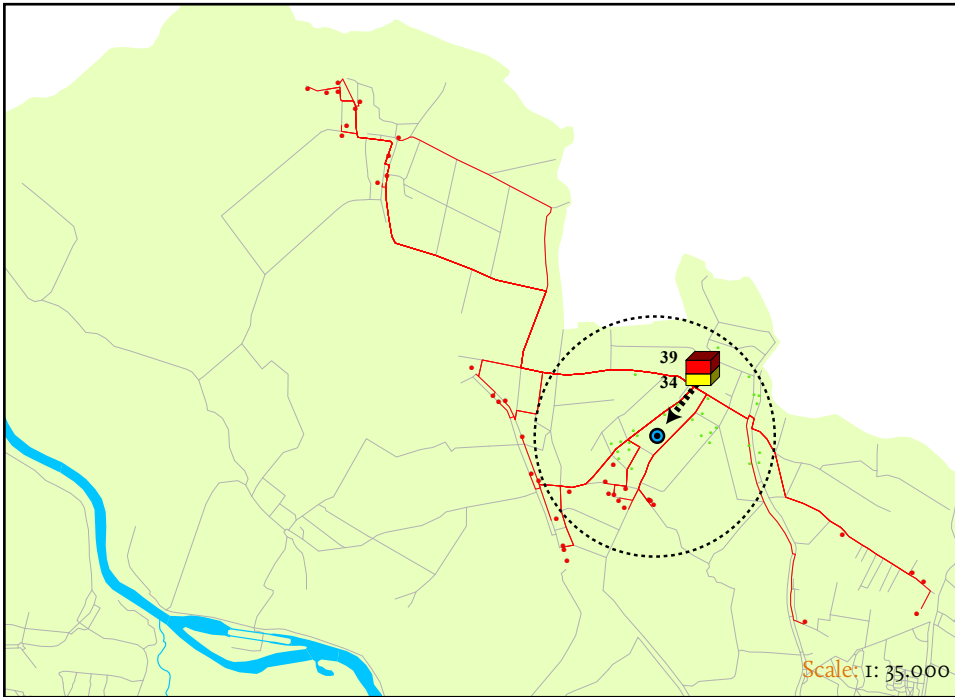
135. In the Kowale district, 78 preschoolers do not have potential accessibility by foot or bicycle to kindergarten. To provide them with this accessibility, a new kindergarten needs to be provided, because the nearest kindergarten cannot be moved. Although 53 preschoolers have potential accessibility to other kindergartens, 112 preschoolers do not have this possibility.



Area 6. Wrocław Rozanka

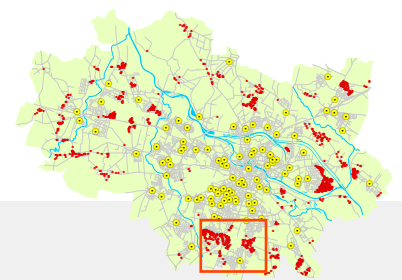
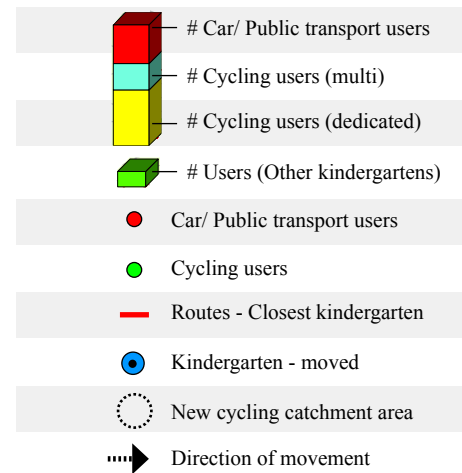
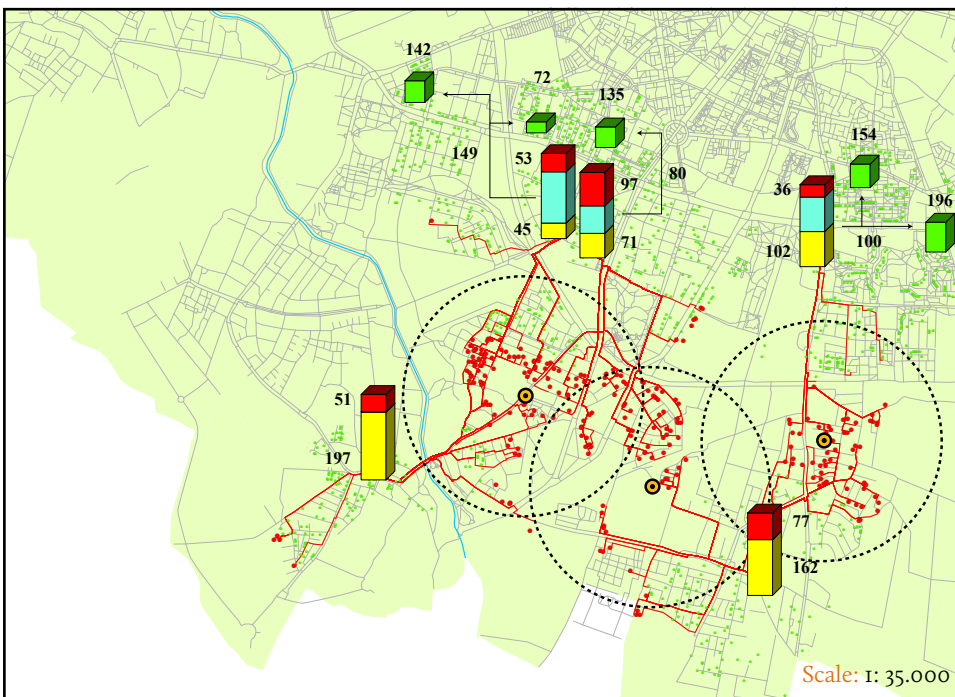


136. In the Rozanka district, 85 preschoolers are not able to travel by bicycle or foot to kindergarten. To provide them with potential accessibility, a new kindergarten needs to be provided. The nearest kindergarten cannot be moved. Although there are 153 preschoolers with an alternative, the size of these alternative kindergartens make a move not preferable.



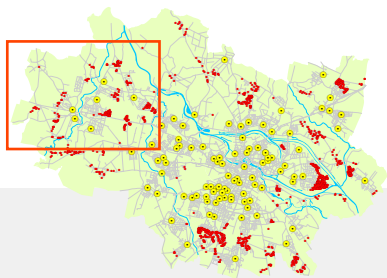
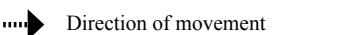
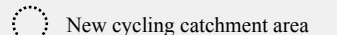
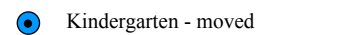
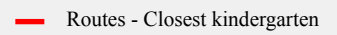
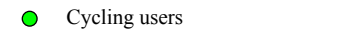
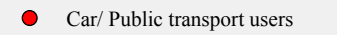
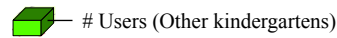
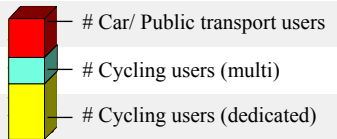
Area 7. Wrocław Swiniary

137. In the Swiniary district, there are 39 preschoolers that do not have potential accessibility to kindergarten. This accessibility can (partly) be provided by moving the nearest kindergarten. Because the preschoolers that remain without potential accessibility by bicycle or foot are widespread and low in number, for them public transport should be an alternative.

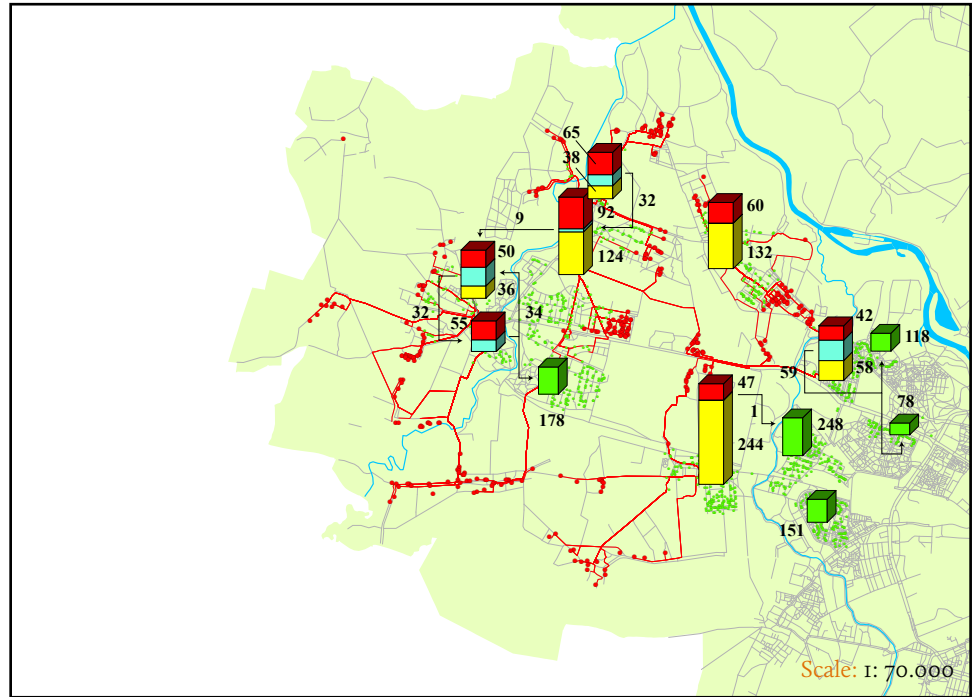


Area 8. Wrocław Krzyki

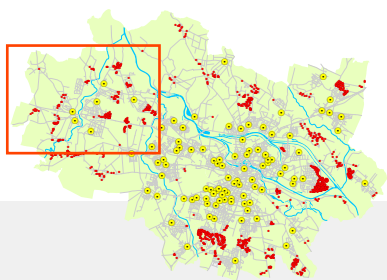
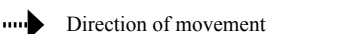
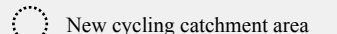
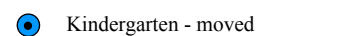
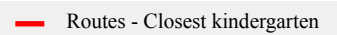
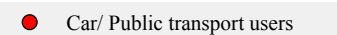
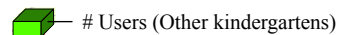
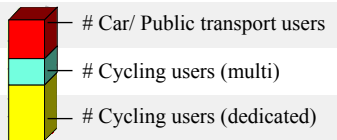
138. In the Krzyki district, 314 preschoolers are not able to travel to kindergarten by bicycle or foot. Potential accessibility can be provided by three new kindergartens. From the five nearest kindergartens, none should be moved. These kindergartens are all large in size and because neighbouring kindergartens are missing or large in size as well, a move is not preferable.



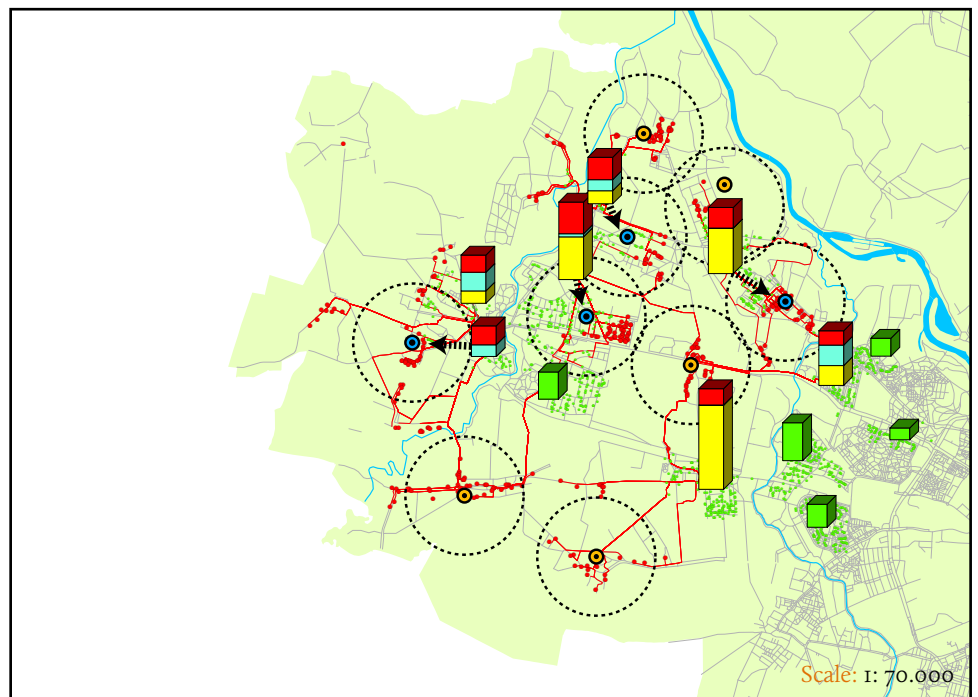
Area 9 (a). Wrocław Lesnica



139. In the Lesnica district, 411 preschoolers do not have potential accessibility to kindergarten by bicycle or foot. This potential accessibility can (partly) be provided by moving four of the seven nearest kindergartens. Three kindergartens should not be moved, because neighbouring kindergartens are missing, are too large or will be moved to improve accessibility.



Area 9 (b). Wrocław Lesnica

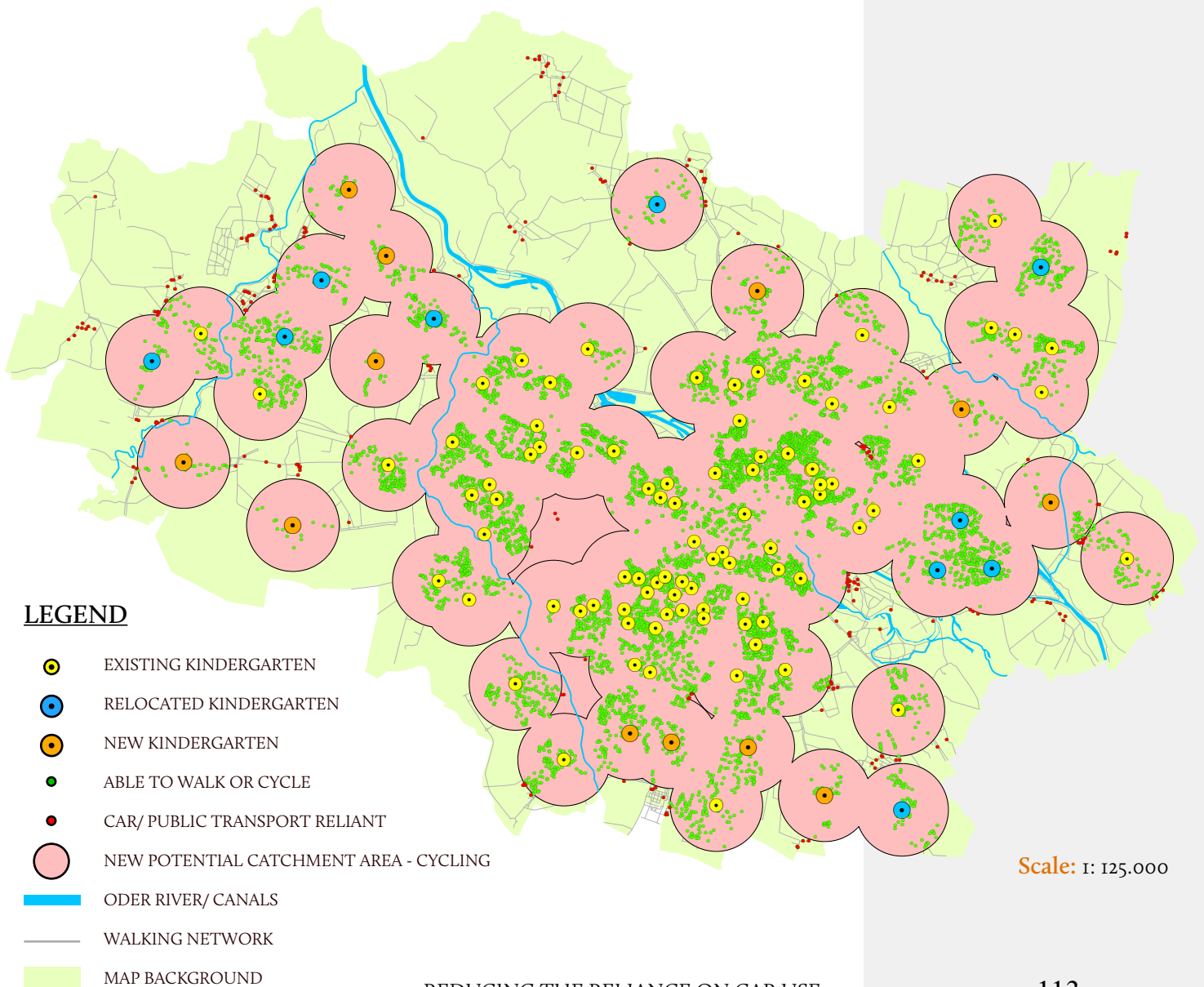


140. The movement of the four kindergartens is partly possible by the provision of new kindergartens. There is a need to provide five new kindergartens that are mainly located in areas with a relative low population and density. These are often villages that have been annexed in the past decades and shelter a potential for urban development and growth.

► The interventions implemented

The interventions that have been proposed in the 9 different analyses are shown in figure 14I. In total, 10 kindergartens have been relocated and 12 new kindergartens have been provided. The new potential catchment area for cycling has been drawn around the 110 kindergartens (98 existing and 12 new), which has been projected on the entrances of buildings where preschoolers were living. The amount of preschoolers that were reliant on car use or public transport in 2005 has been reduced from 1539 to 294, which is a reduction of 1245 preschoolers that are now able to walk or cycle to kindergarten. The aim was to reduce this amount with 1471 preschoolers, but it has become clear that due to the spreading of preschoolers, it is spatially impossible to provide all of them with potential accessibility by bicycle or foot to kindergarten. For these preschoolers, public transport needs to be provided and become a real alternative to car use.

14I. Description in the text.



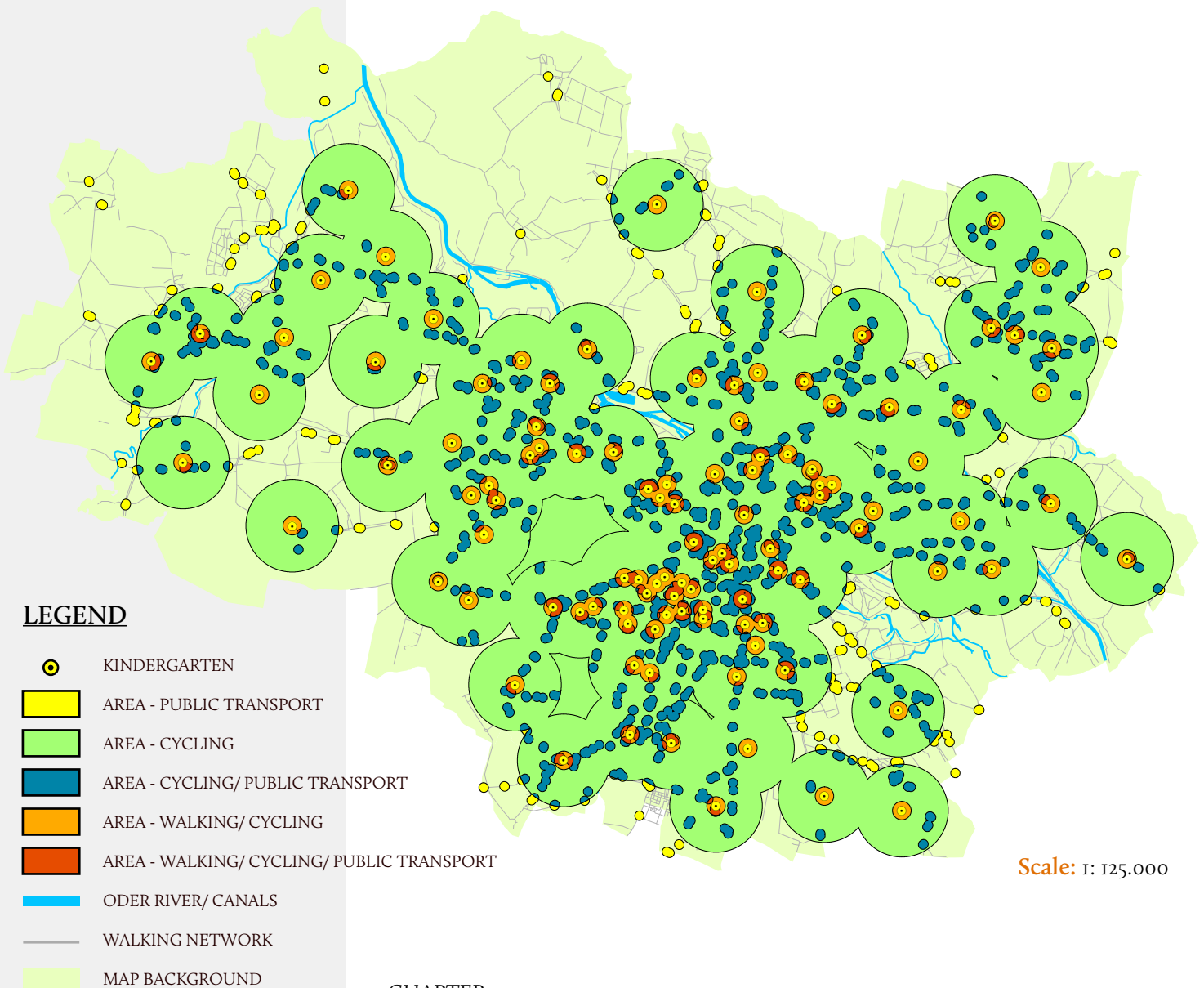
I42. Description in the text.

I43. Description in the text.

I44. Description in the text.

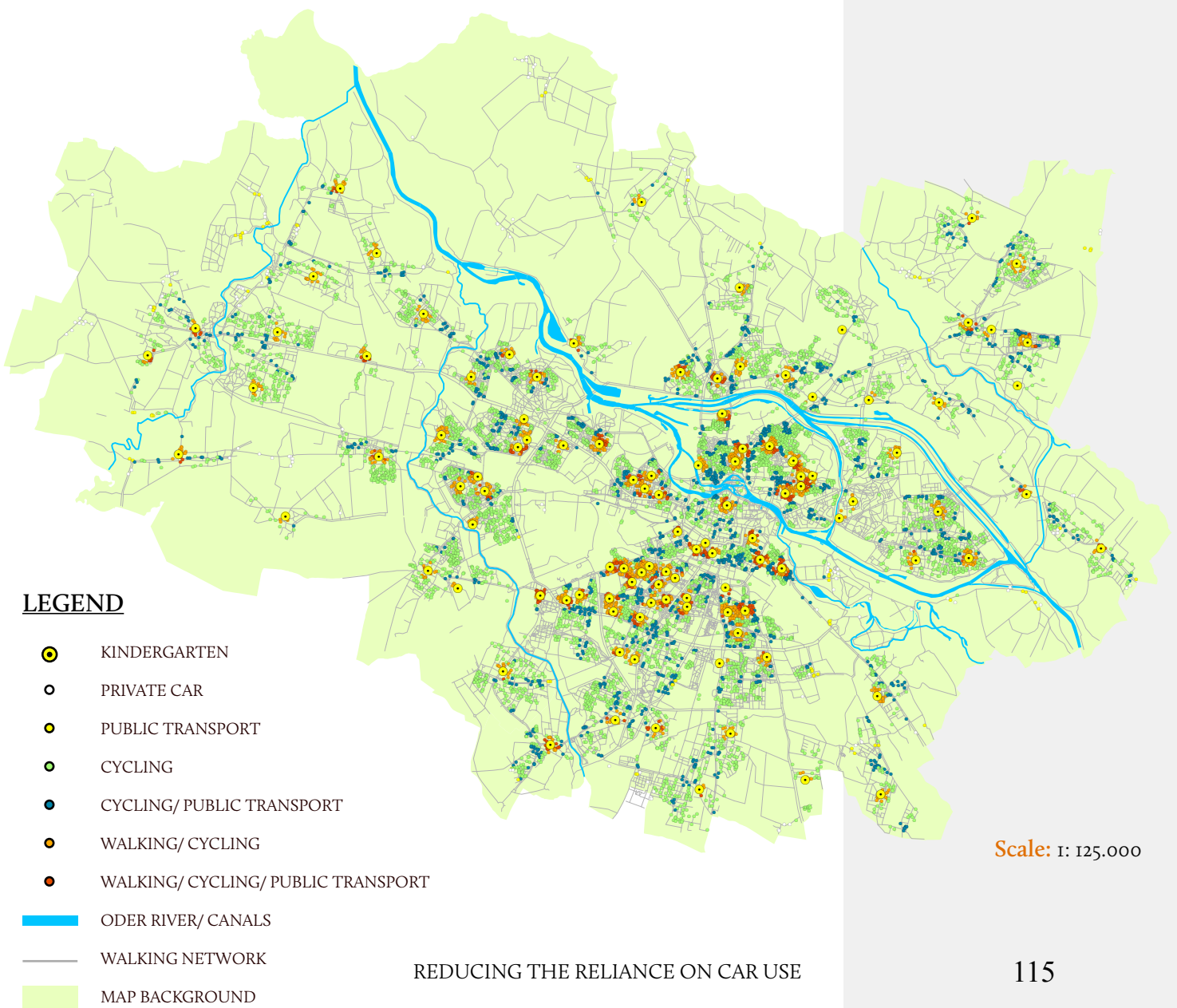
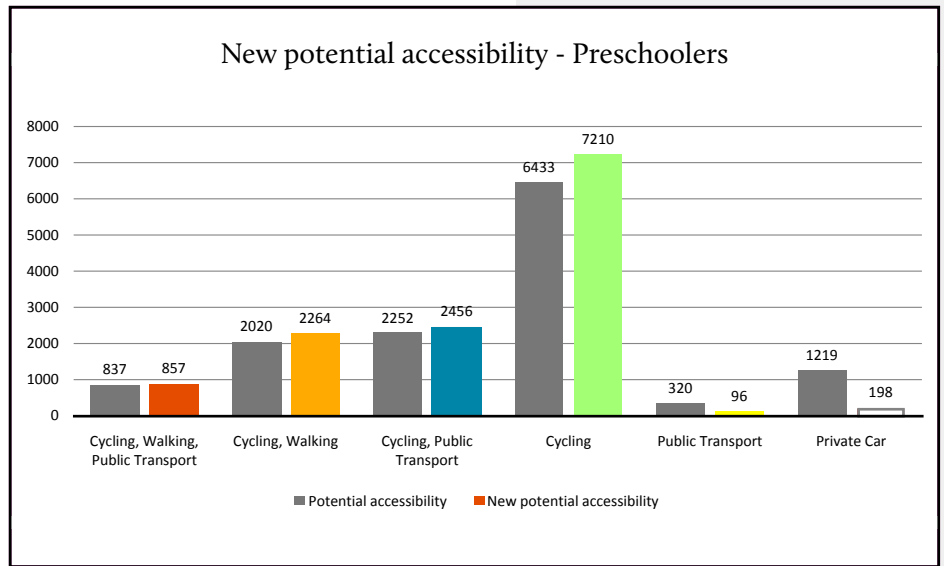
► New potential accessibility

Due to the implemented interventions, the potential accessibility to kindergarten has not only changed the need for preschoolers to travel by car, but therewith also their ability to travel by foot, bicycle or public transport. Figure 142 shows the new catchment areas that have been drawn around the existing and new kindergartens and the public transport access points. These have once again been projected on the building entrances where preschoolers were living, like shown in figure 144. The results of this analysis are shown in figure 143. The potential ability to walk to kindergarten has increased from 2957 to 3121 preschoolers, which is an increase of 184 preschoolers, from who 20 now also gain potential accessibility to kindergarten by public transport. The potential ability to cycle to kindergarten, without the ability to walk, has increased from 8685 to 9666 preschoolers, which is an increase of 981 preschoolers, from who



Scale: 1: 125.000

204 now also gain potential accessibility to kindergarten by public transport. From the 1539 preschoolers that were reliant on the car to travel to kindergarten, only 294 preschoolers still are, from who 96 also have potential accessibility to kindergarten by public transport. This means a reduction of 1245 preschoolers that are now able to walk or cycle to kindergarten. There are still 198 preschoolers that are reliant on the car, for whom the ability to travel by public transport should be provided.



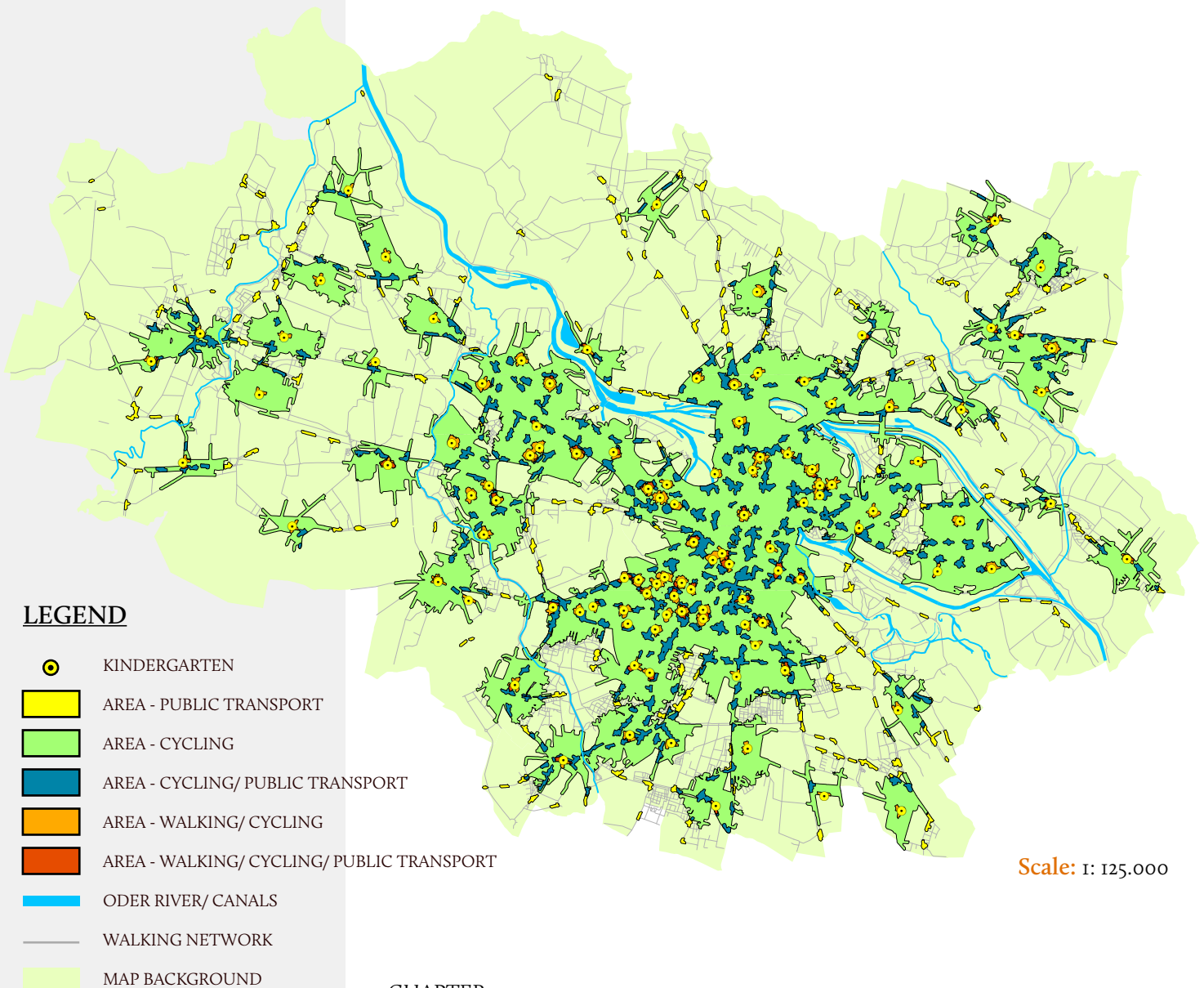
I45. Description in the text.

I46. Description in the text.

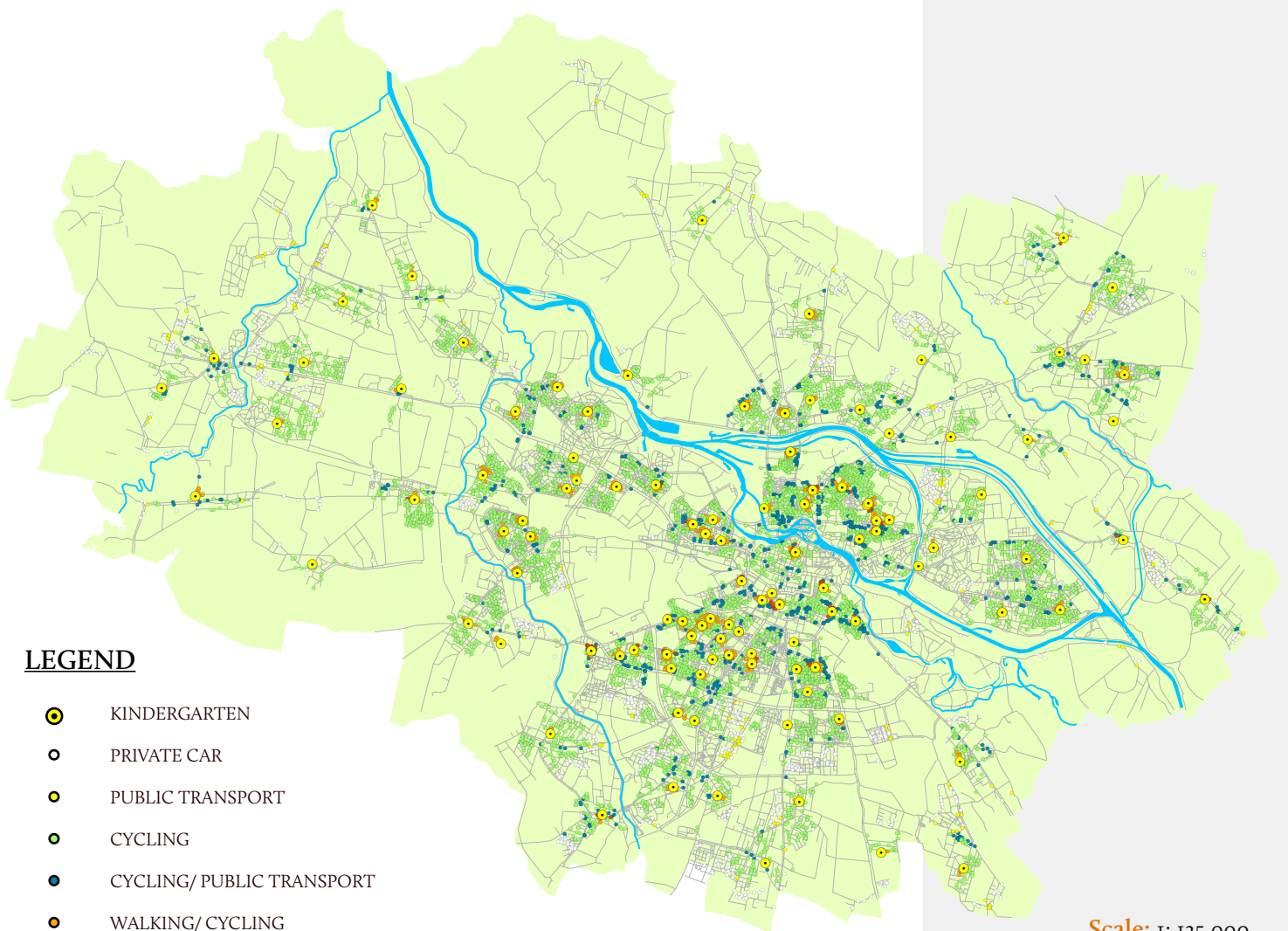
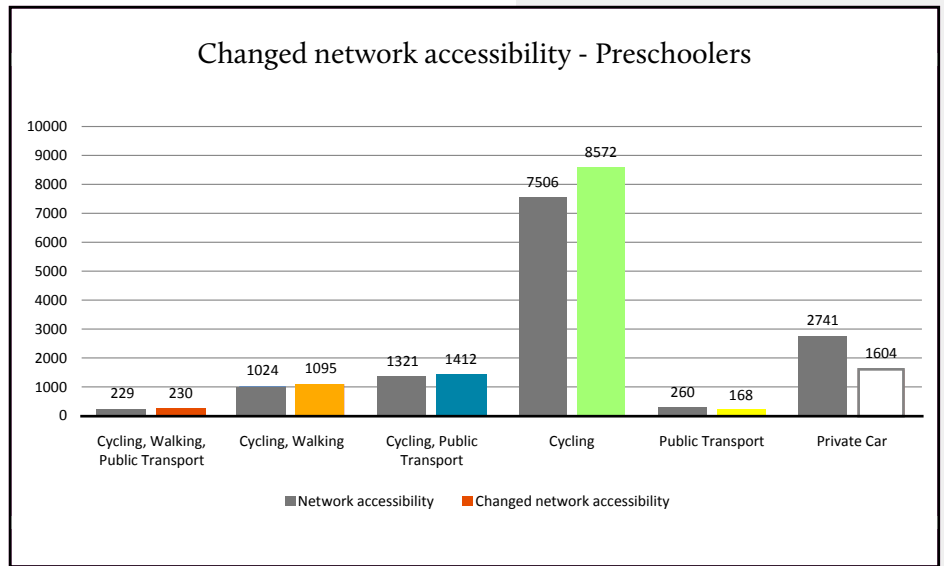
I47. Description in the text.

5.2.2 NETWORK ACCESSIBILITY

Due to the new potential accessibility, preschoolers' network accessibility has changed as well. Many preschoolers have been provided with the potential ability to walk or cycle to kindergarten, from who many have also gained network accessibility to kindergarten. Figure 145 shows the new network accessibility catchment areas that have been created. These have been projected on the building entrances where preschoolers were living, which is shown in figure 147. The results of this analysis are shown in figure 146. The ability to walk to kindergarten has increased from 1253 to 1325 preschoolers, which is an increase of 72 preschoolers, from who 1 extra preschooler now also gains potential accessibility to kindergarten by public transport. The ability for preschoolers to cycle to kindergarten, without being able to walk, has increased from 8827 to 9984 preschoolers, which is an increase of 1167 preschoolers, from who 91 now also gain



accessibility to public transport access points. From the 3001 preschoolers that were reliant on the car to travel to kindergarten, only 1772 preschoolers still are, from who 168 also gain potential accessibility to kindergarten by public transport. This means a reduction of 1229 preschoolers that are now able to walk or cycle to kindergarten. There are still 1604 preschoolers that are reliant on the car, for whom the ability to walk or cycle to kindergarten will be improved by interventions in this paragraph.



LEGEND

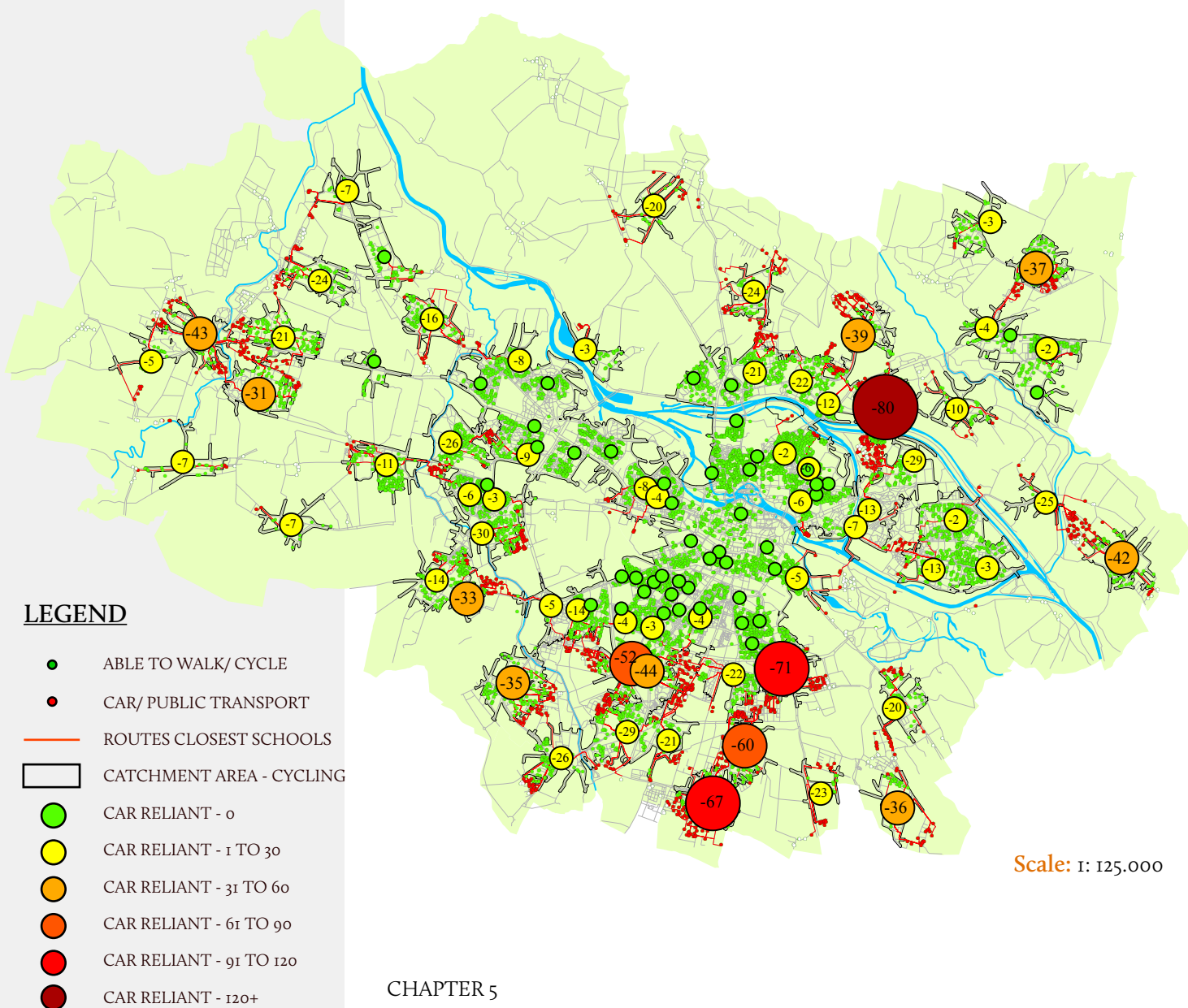
- KINDERGARTEN
- PRIVATE CAR
- PUBLIC TRANSPORT
- CYCLING
- CYCLING/ PUBLIC TRANSPORT
- WALKING/ CYCLING
- WALKING/ CYCLING/ PUBLIC TRANSPORT
- ODER RIVER/ CANALS
- WALKING NETWORK
- MAP BACKGROUND

Scale: 1: 125,000

148. Description in the text.

► Closest facility analysis

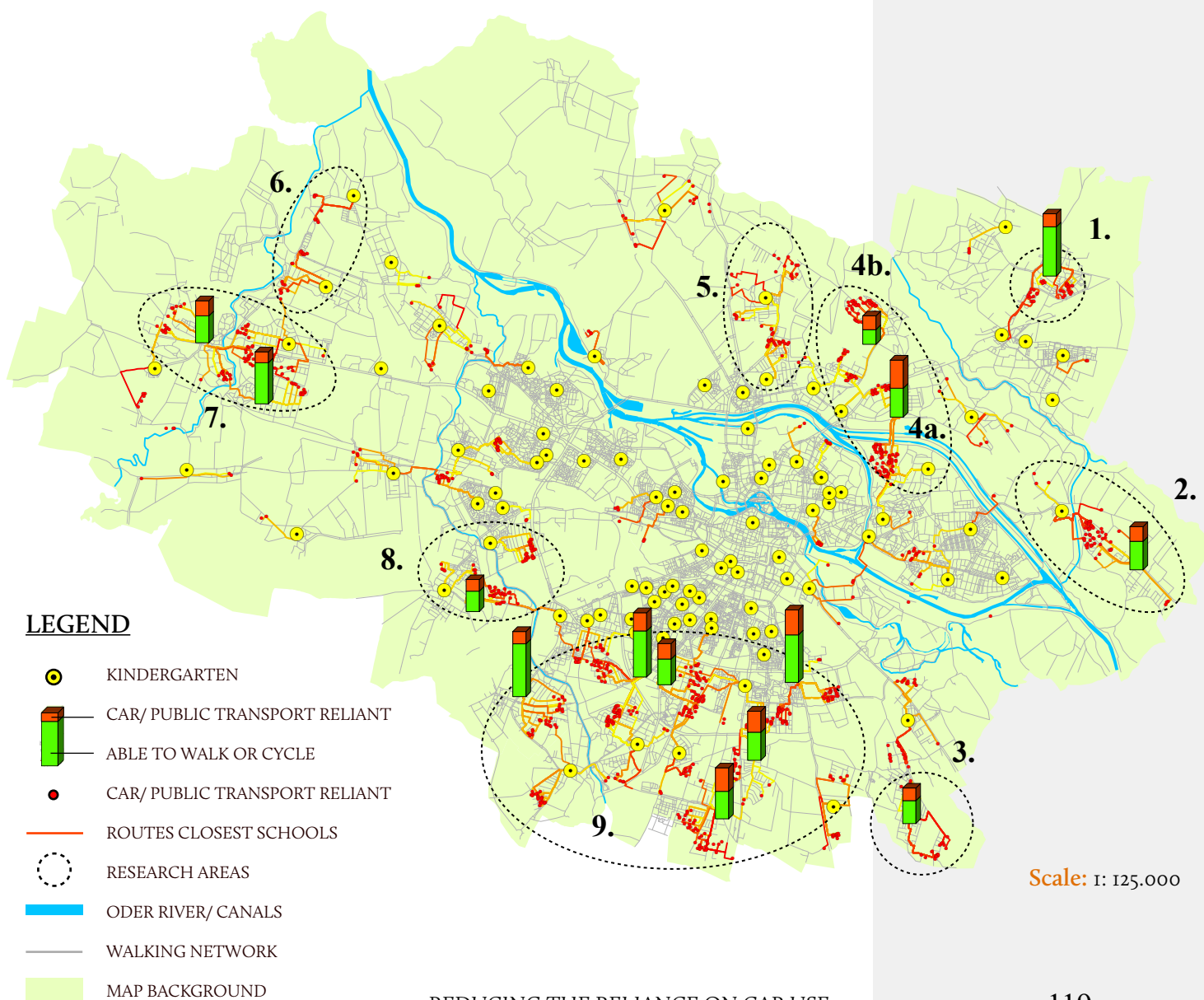
Figure 148 shows the closest facility analysis that has been carried out for preschooler's network accessibility to kindergarten. The shortest routes between the homes of preschoolers and kindergartens have been measured and defined. Only those routes where preschoolers did not have network accessibility by bicycle or foot have been drawn in figure 148. The preschoolers that did not have network accessibility have been projected on the closest kindergartens, wherewith 18 kindergartens have been selected to research. Figure 149 shows that with this selection, the aim is to reduce the 1478 preschoolers (1772 total - 294 potential) that were reliant on car use or public transport at the end of 2005 with 746. Figure 150 shows that the kindergartens to research have been divided over 9 research areas where interventions in the network directness or spreading of schools are needed. The research results are shown in the next pages.



District name	# kindergartens	# preschoolers	# car reliant
1 Psie Pole	1	167	37
2 Swojszyce	1	123	42
3 Brochow	1	91	36
4a Szczytnika	1	162	80
4b Karłowice	1	81	39
5 Rozanka	2	274	45
6 Lesnica (1)	2	139	31
7 Lesnica (2)	2	200	74
8 Muchobor	1	91	33
9 Krzyki	6	976	329
TOTAL	18	2322	746

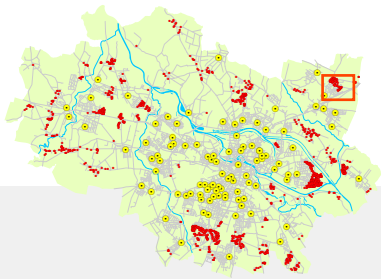
I49. Description in the text.

I50. Description in the text.

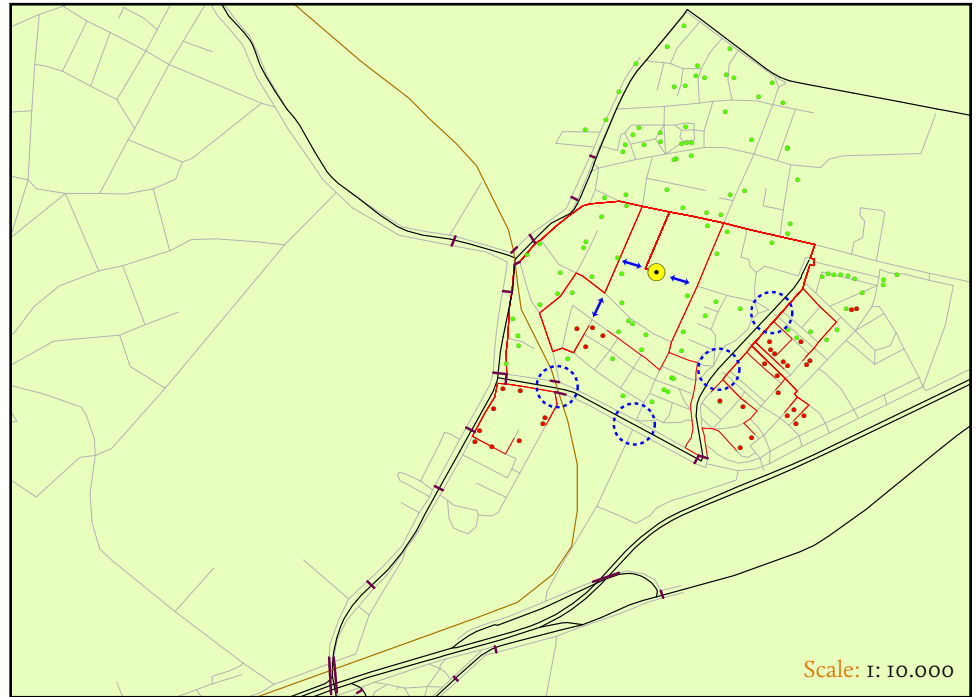


► The proposed interventions

- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest kindergarten
- Kindergarten
- Traffic intense road
- Crossing of a barrier
- Train line
- Kindergarten - new
- Kindergarten - moved
- Crossing - new
- ↔ Connection - new



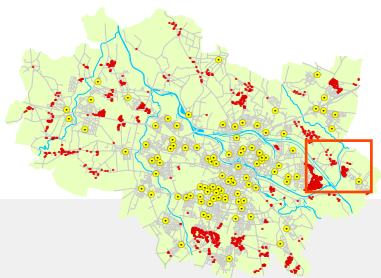
Area 1. Wrocław Psie Pole



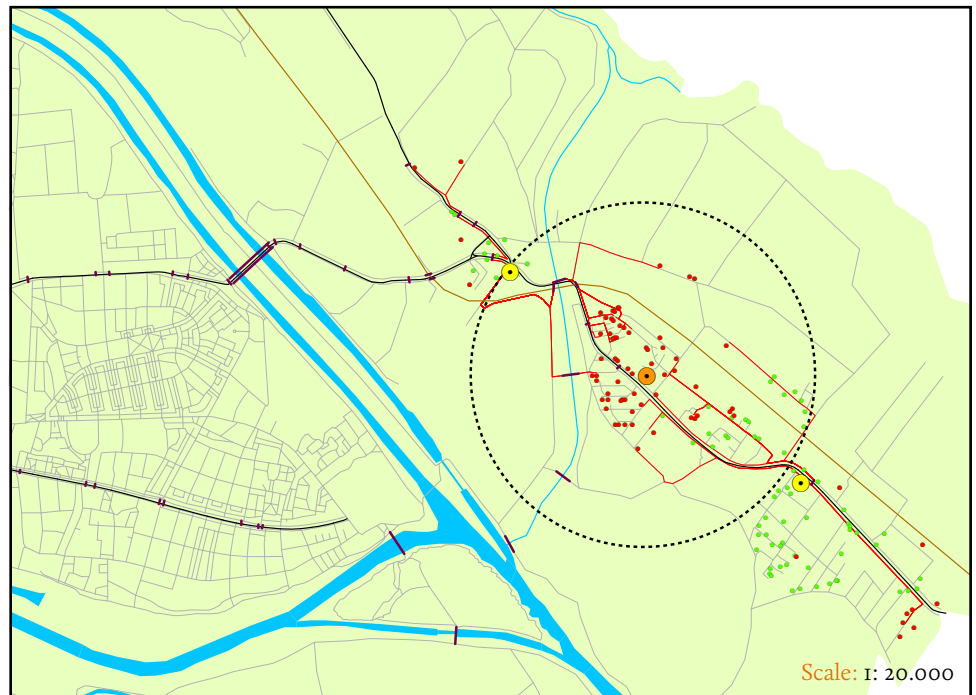
Scale: 1: 10.000

151. In the Psie Pole district, 37 preschoolers do not have network accessibility to kindergarten by bicycle or foot. Network accessibility can be provided by increasing the directness of the walking and cycling network. This imposes the construction of 3 new bicycle paths and 4 new crossing facilities that will enable preschoolers to cross the car intensive road.

- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest kindergarten
- Kindergarten
- Traffic intense road
- Crossing of a barrier
- Train line
- Kindergarten - new
- Kindergarten - moved
- Crossing - new
- ↔ Connection - new

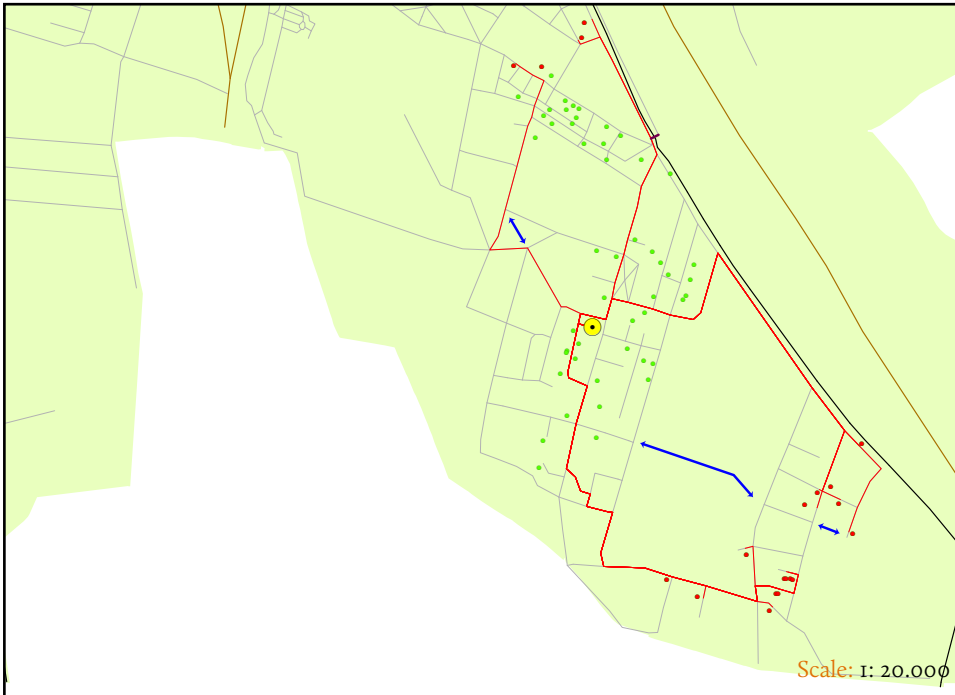


Area 2. Wrocław Swojszyce



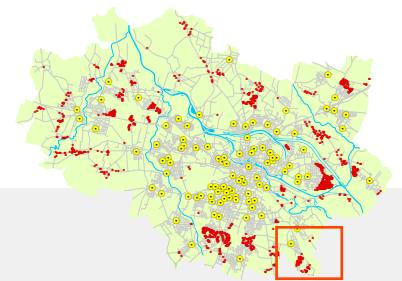
Scale: 1: 20.000

152. In the Swojszyce district, 42 preschoolers do not have network accessibility to kindergarten by bicycle or foot. Network accessibility can be provided by the provision of a new kindergarten. Interventions in the network directness will have no effect and due to the elongated urban structure, the other kindergartens in the district cannot be relocated.

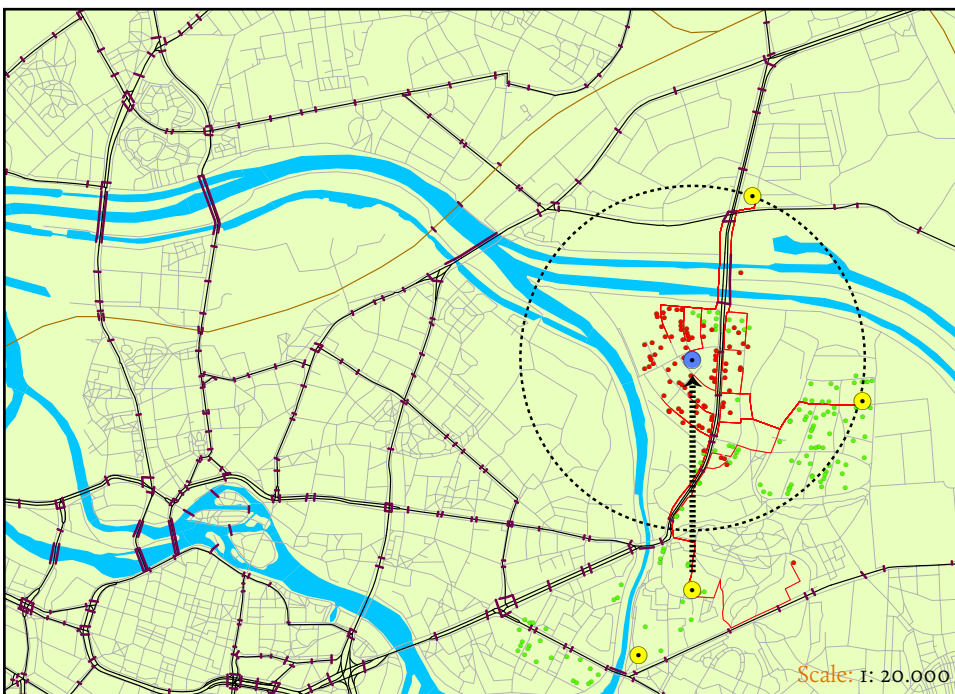


153. In the Brochow district, 36 preschoolers do not have network accessibility to kindergarten by bicycle or foot. Network accessibility can be provided by increasing the directness of the cycling network. This imposes the construction of 3 new bicycle connections that will reduce the travelling distances for these preschoolers to kindergarten.

- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest kindergarten
- Kindergarten
- Traffic intense road
- Crossing of a barrier
- Train line
- Kindergarten - new
- Kindergarten - moved
- ⊙ Crossing - new
- ↔ Connection - new

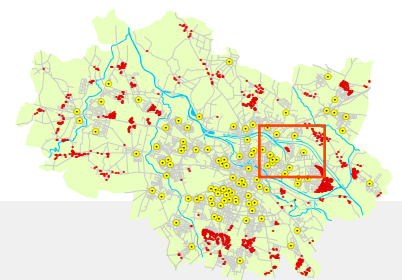


Area 3. Wrocław Brochow



154. In the Szczytnika district, 80 preschoolers do not have network accessibility to kindergarten by bicycle or foot. Network accessibility can be provided by the reallocation of a kindergarten. Interventions in the network directness will have no effect. The relocated kindergarten is small in size and the preschoolers are able to attend an alternative kindergarten.

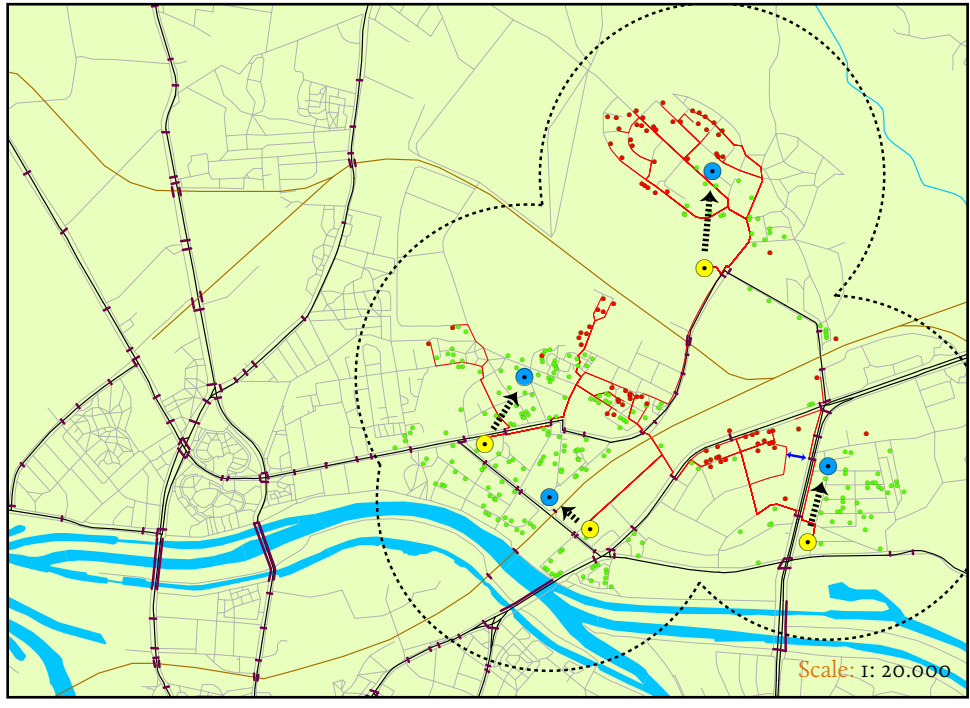
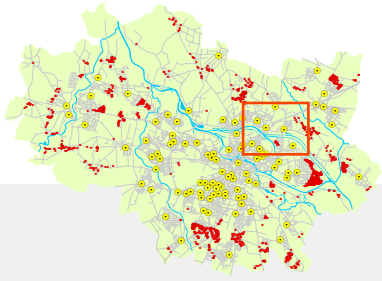
- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest kindergarten
- Kindergarten
- Traffic intense road
- Crossing of a barrier
- Train line
- Kindergarten - new
- Kindergarten - moved
- ⊙ Crossing - new
- ↔ Connection - new



Area 4. Wrocław Szczytnika



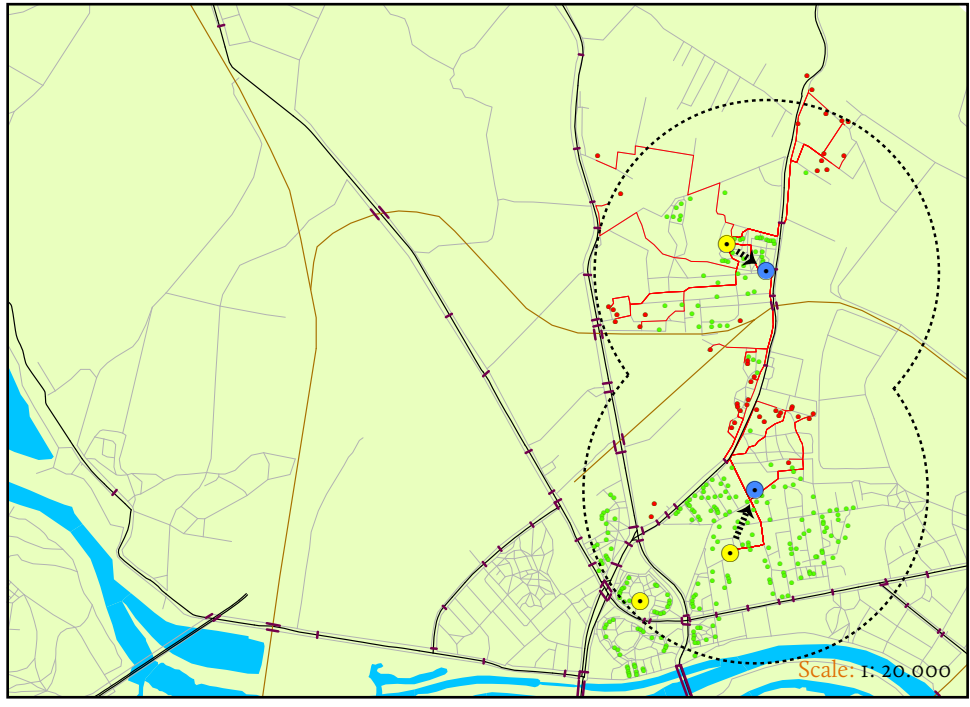
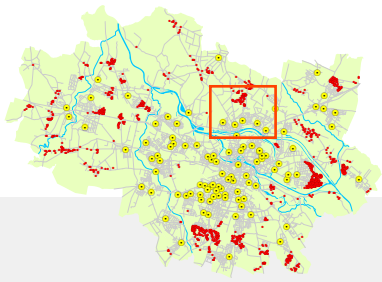
- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest kindergarten
- Kindergarten
- Traffic intense road
- Crossing of a barrier
- Train line
- Kindergarten - new
- Kindergarten - moved
- Crossing - new
- ↔ Connection - new



155. In the Karlówice district, 83 preschoolers do not have network accessibility to kindergarten by bicycle or foot. Network accessibility can be provided the reallocation of 4 kindergartens. These can be moved without the loss of potential or network accessibility for the preschoolers that attend these kindergartens. This will be completed with 1 new walking path.

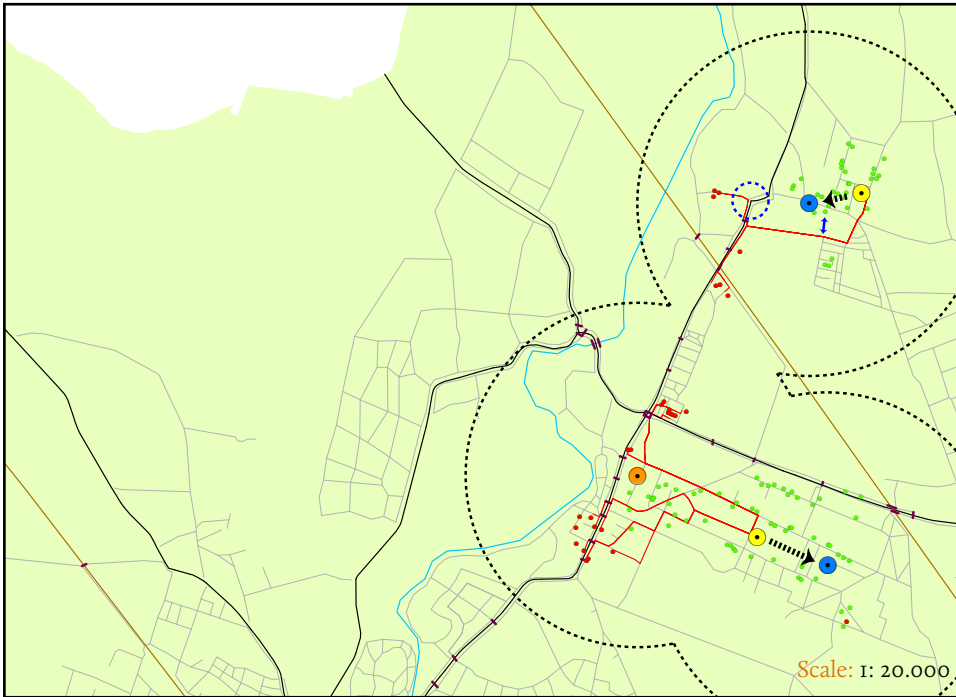
Area 5. Wrocław Karlówice

- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest kindergarten
- Kindergarten
- Traffic intense road
- Crossing of a barrier
- Train line
- Kindergarten - new
- Kindergarten - moved
- Crossing - new
- ↔ Connection - new



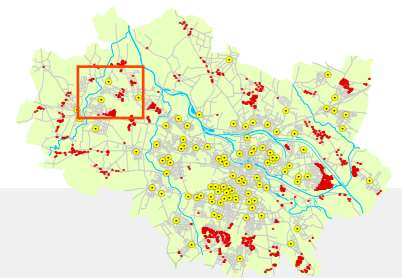
156. In the Rozanka district, 45 preschoolers do not have network accessibility to kindergarten by bicycle or foot. Network accessibility can be provided the reallocation of 2 kindergartens. Due to the presence of an alternative kindergarten, these can be moved without the loss of potential or network accessibility for the preschoolers that attend these kindergartens.

Area 6. Wrocław Rozanka

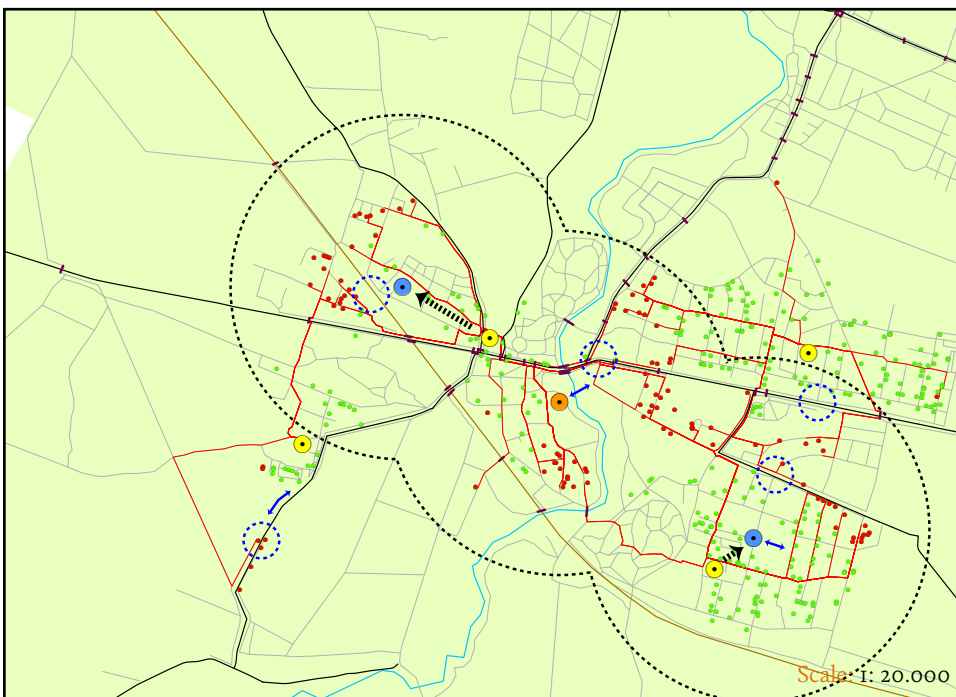


157. In the Lesnica (1) district, 31 preschoolers do not have network accessibility to kindergarten by bicycle or foot. Network accessibility can be provided by the reallocation of 2 kindergartens without the loss of network accessibility, whereby a new walking path and crossing facility need to be constructed and a new kindergarten needs to be provided as well.

- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest kindergarten
- Kindergarten
- Traffic intense road
- Crossing of a barrier
- Train line
- Kindergarten - new
- Kindergarten - moved
- Crossing - new
- ↔ Connection - new

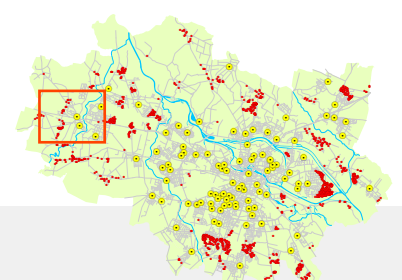


Area 7. Wrocław Lesnica (1)



158. In the Lesnica (2) district, 100 preschoolers do not have network accessibility to kindergarten by bicycle or foot. Network accessibility can be provided by 2 new bicycle paths and 5 new crossing facilities. However, 2 kindergartens need to be relocated and 1 new kindergarten need to be provided as well. The reallocation is without the loss of network accessibility.

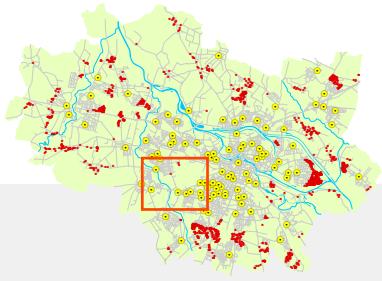
- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest kindergarten
- Kindergarten
- Traffic intense road
- Crossing of a barrier
- Train line
- Kindergarten - new
- Kindergarten - moved
- Crossing - new
- ↔ Connection - new



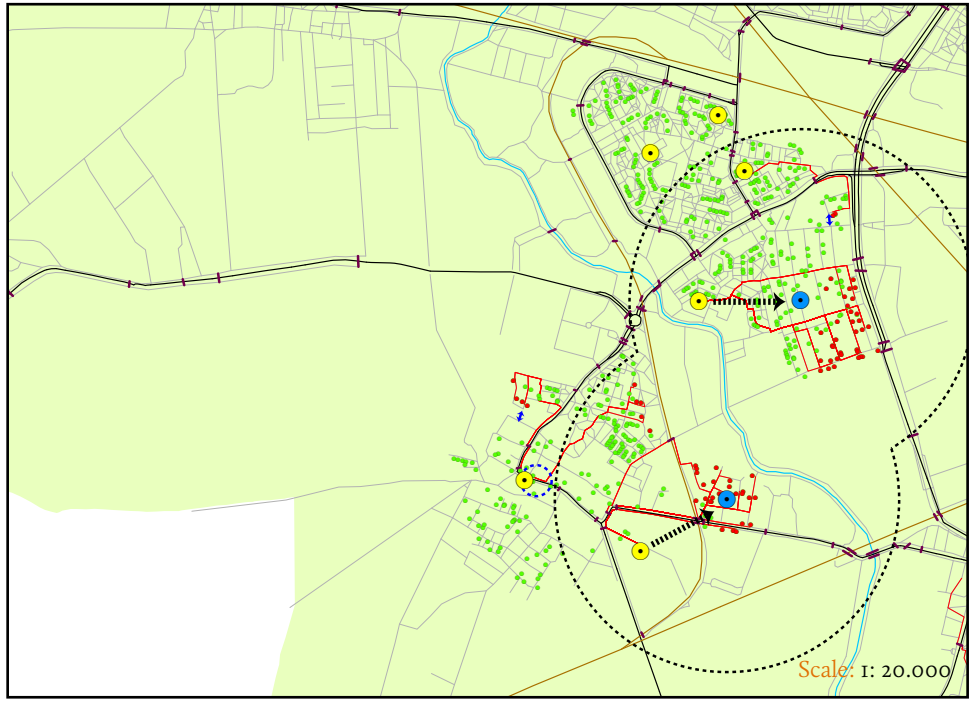
Area 8. Wrocław Lesnica (2)



- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest kindergarten
- Kindergarten
- Traffic intense road
- Crossing of a barrier
- Train line
- Kindergarten - new
- Kindergarten - moved
- Crossing - new
- ↔ Connection - new

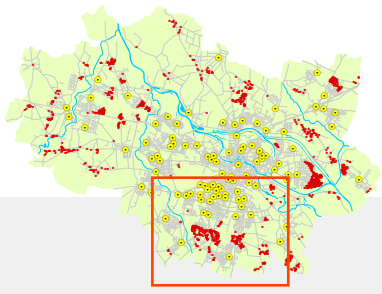


Area 9. Wrocław Muchobor Mały

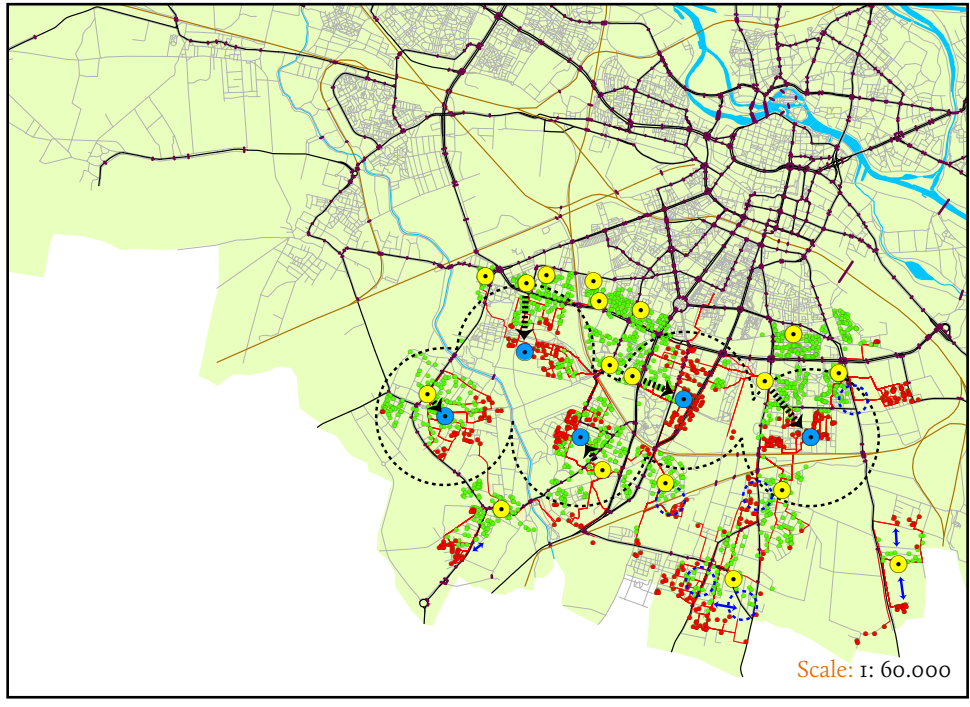


i59. In the Muchobor Mały district, 33 preschoolers do not have network accessibility to kindergarten by bicycle or foot. Network accessibility can be improved by 2 new walking paths and 1 new crossing facility. Further, 2 existing kindergartens can be relocated without the loss of potential or network accessibility, wherewith all preschoolers gain accessibility.

- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest kindergarten
- Kindergarten
- Traffic intense road
- Crossing of a barrier
- Train line
- Kindergarten - new
- Kindergarten - moved
- Crossing - new
- ↔ Connection - new



Area 10. Wrocław Krzyki

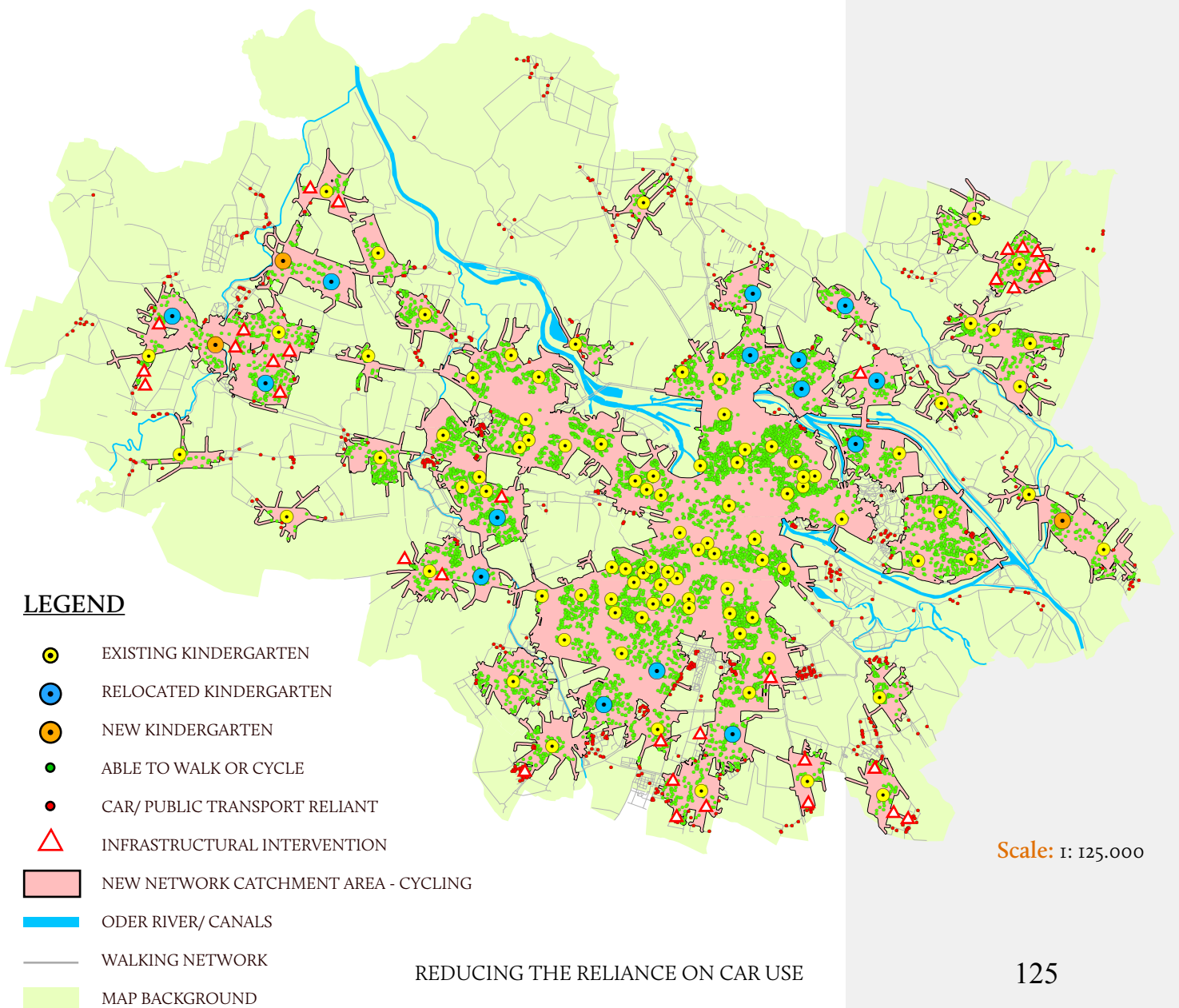


i60. In the Krzyki district, 329 preschoolers do not have network accessibility to kindergarten by bicycle or foot. Network accessibility can be improved by 4 new walking paths and 5 new crossing facility. Further, 5 existing kindergartens can be relocated without the loss of potential or network accessibility, wherewith most preschoolers should gain accessibility.

► **The interventions implemented**

The interventions that have been proposed in the 9 different analyses are shown in **figure 161**. In total, 15 kindergartens have been relocated and 2 new kindergartens have been provided. The new network catchment area for cycling has been drawn around the 112 kindergartens (98 existing and 12+2 new), which has been projected on the entrances of buildings where preschoolers were living. The amount of preschoolers that were reliant on car use or public transport in 2005 has been reduced from 1772 to 852, which is a reduction of 920 preschoolers that are now able to walk or cycle to kindergarten. The aim was to reduce this amount with 746 preschoolers, but in the analyses several kindergartens that were not counted within this aim have been analyzed as well. From the 852 preschoolers that are not able to walk or cycle to kindergarten, there are still around 300 preschoolers that do not have potential accessibility to kindergarten.

161. Description in the text.



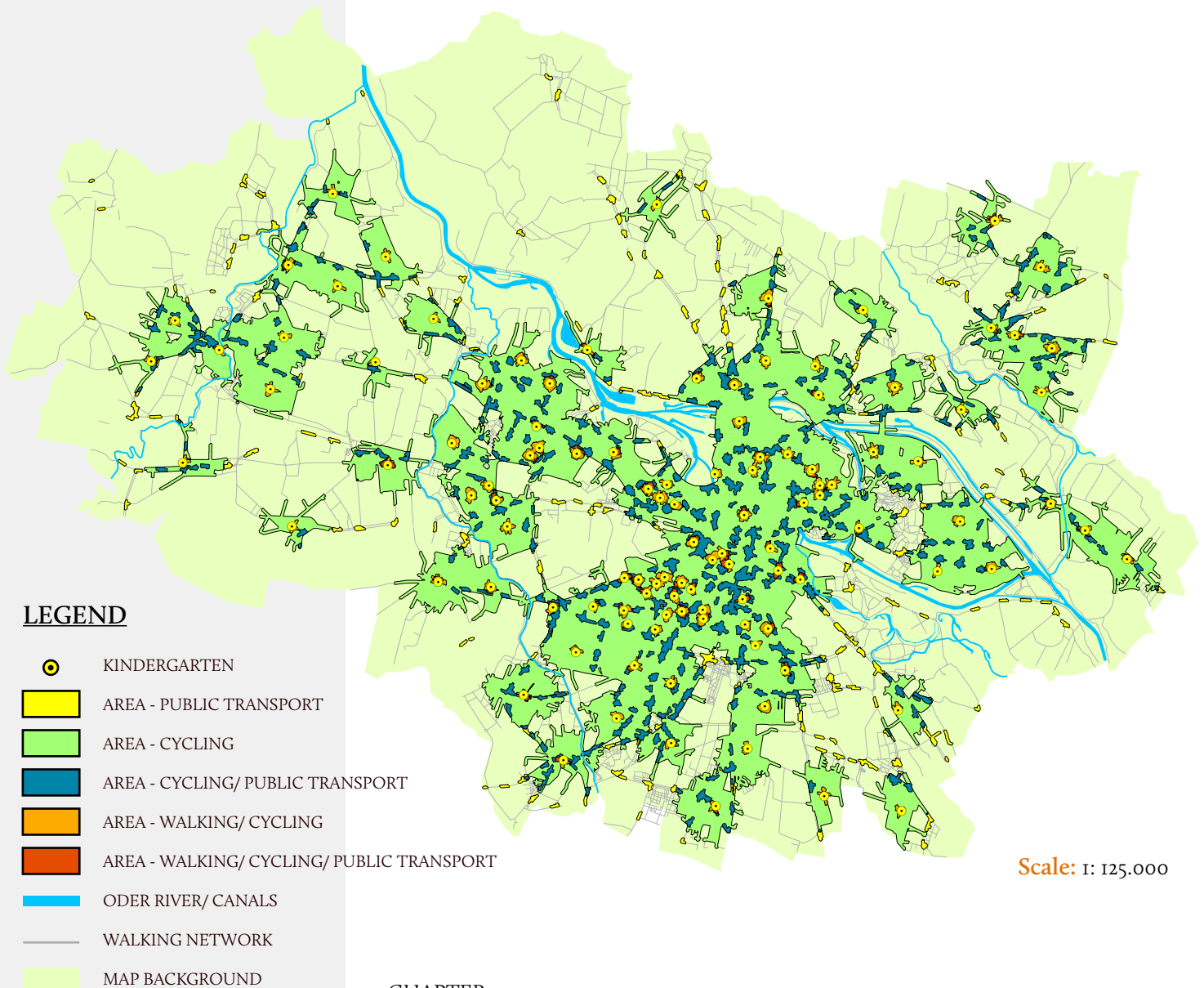
162. Description in the text.

163. Description in the text.

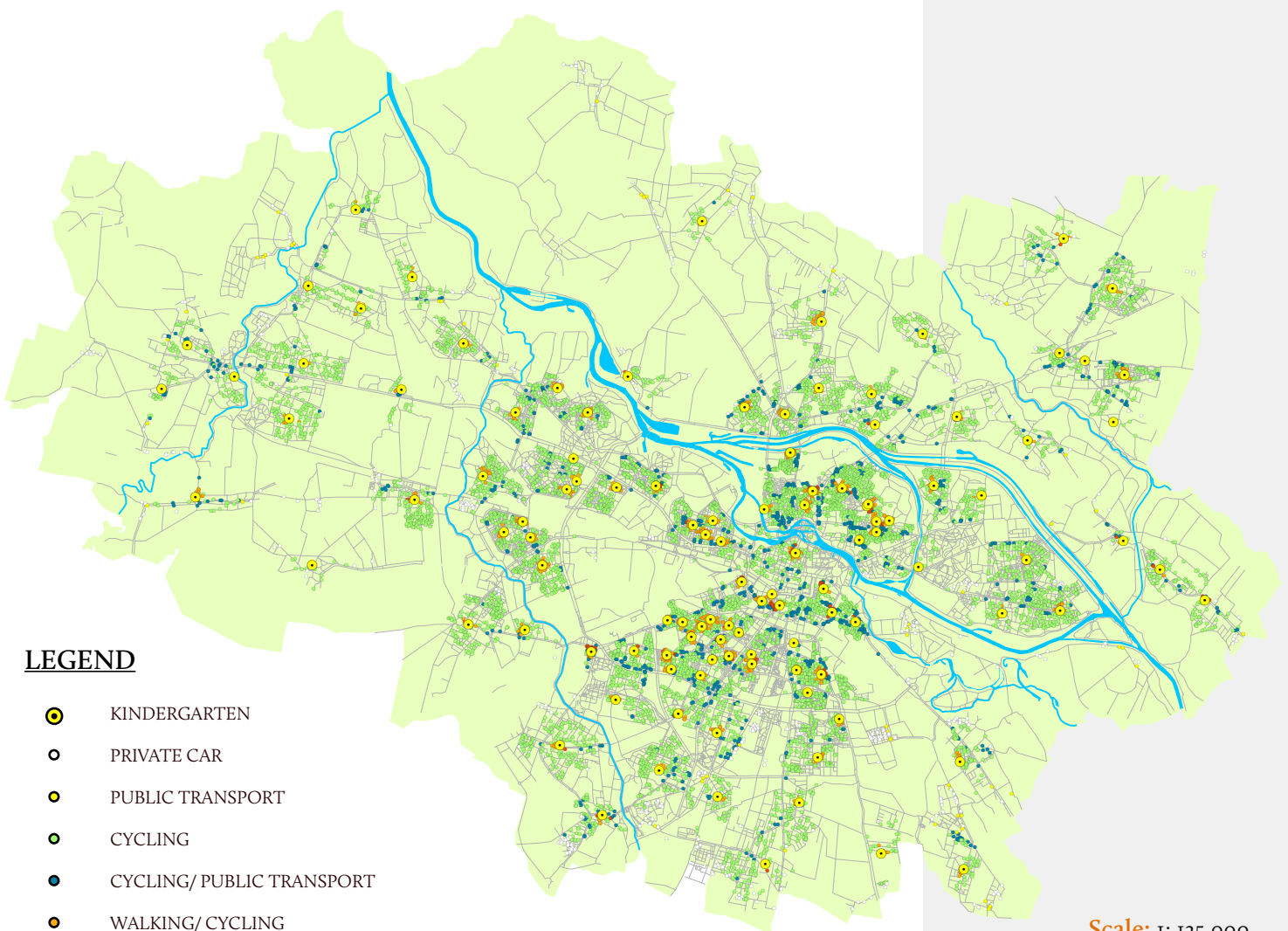
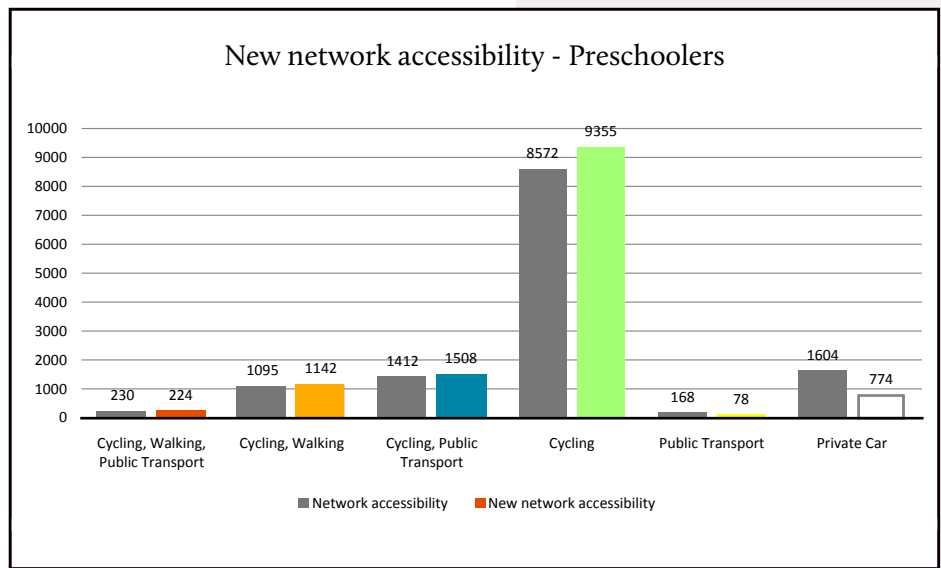
164. Description in the text.

► New network accessibility

Due to the implemented interventions, the new network accessibility to kindergarten has not only changed the need for preschoolers to travel by car, but also preschoolers' ability to travel by foot, bicycle or public transport. Figure 162 shows the new catchment areas that have been created around the existing and new kindergartens and the public transport access points. These have once again been projected on the building entrances where preschoolers were living, like shown in figure 164. The results of this analysis are shown in figure 163. The ability to walk to kindergarten has increased from 1366 to 1325 preschoolers, which is an increase of 41 preschoolers, from who 6 have lost network accessibility to kindergarten by public transport. The ability to cycle to kindergarten, without the ability to walk, has increased from 9984 to 10863 preschoolers, which is an increase of 879 preschoolers, from who 96 now also gain network ac-



cessibility to kindergarten by public transport. From the 1772 preschoolers that were reliant on the car to travel to kindergarten, only 852 preschoolers still are, from who 78 also have network accessibility to kindergarten by public transport. This means a reduction of 920 preschoolers that are now able to walk or cycle to kindergarten. There are still 774 preschoolers that are reliant on the car, for whom the ability to walk or cycle can be improved by researching the other kindergartens as well.



LEGEND

- KINDERGARTEN
- PRIVATE CAR
- PUBLIC TRANSPORT
- CYCLING
- CYCLING/ PUBLIC TRANSPORT
- WALKING/ CYCLING
- WALKING/ CYCLING/ PUBLIC TRANSPORT
- ODER RIVER/ CANALS
- WALKING NETWORK
- MAP BACKGROUND

Scale: 1: 125.000

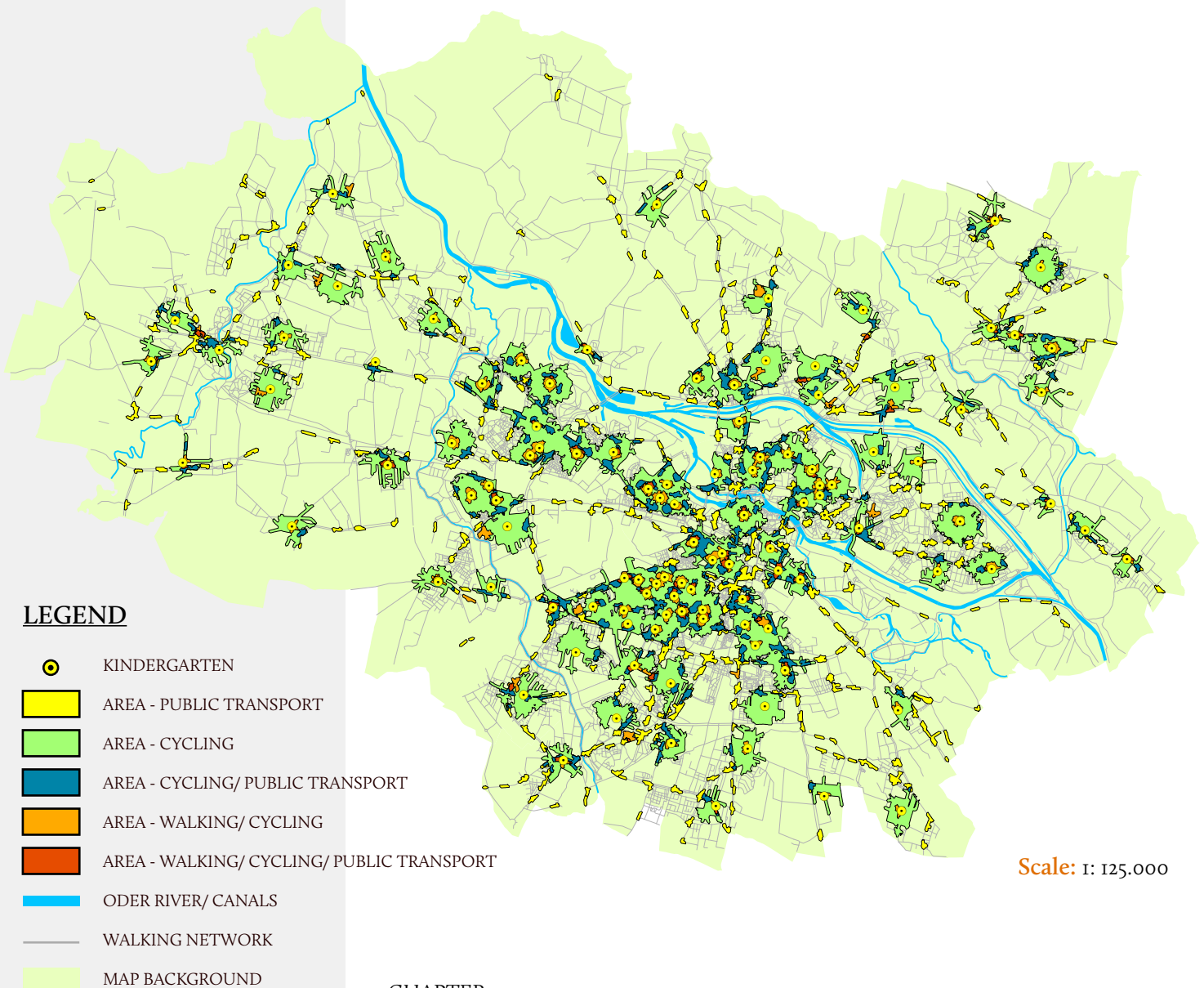
165. Description in the text.

166. Description in the text.

167. Description in the text.

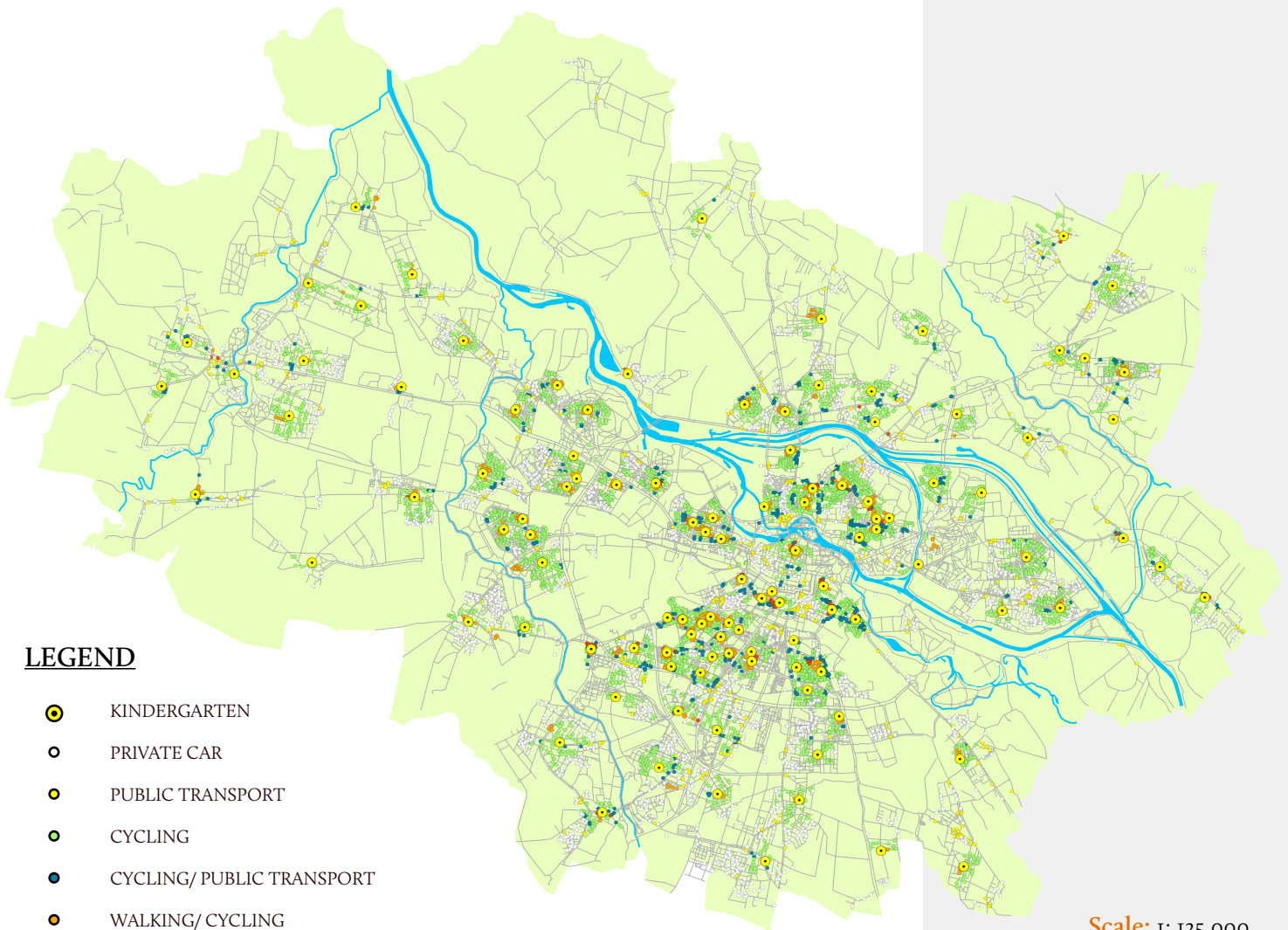
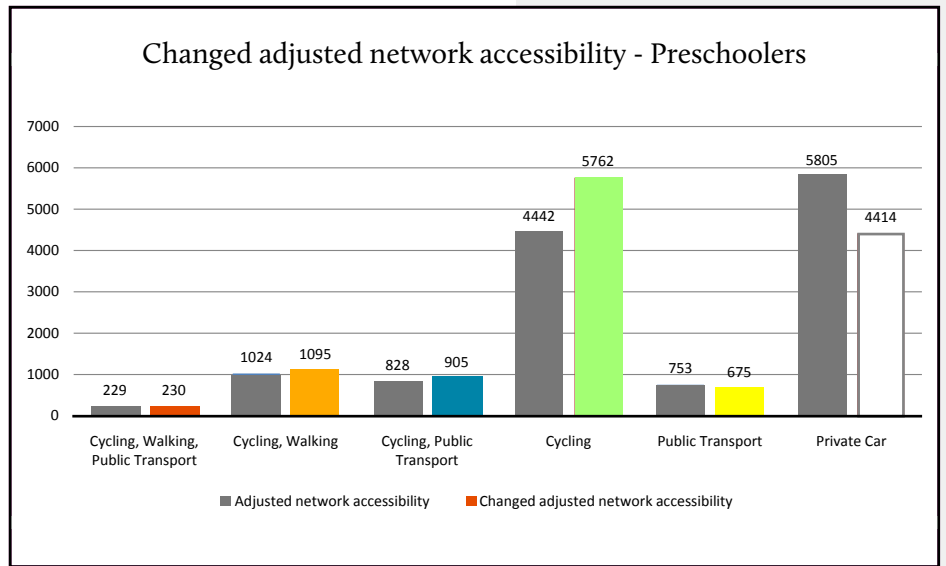
5.2.3 ADJUSTED NETWORK ACCESSIBILITY

Due to the new network accessibility, preschoolers' adjusted network accessibility has changed as well. Many preschoolers have been provided with the ability to walk or cycle to kindergarten, from who many have also gained adjusted network accessibility to kindergarten. Figure 165 shows the new adjusted network accessibility catchment areas that have been created. These have been projected on the building entrances where preschoolers were living, which is shown in figure 167. The results of this analysis are shown in figure 166. The ability to walk to kindergarten has increased from 1253 to 1325 preschoolers, which is an increase of 72 preschoolers, from who 1 extra preschooler now also gains accessibility to kindergarten by public transport. The ability for preschoolers to cycle to kindergarten, without being able to walk, has increased from 5270 to 6667 preschoolers, which is an increase of 1397 preschoolers, from who 91



Scale: 1: 125.000

now also gain accessibility to public transport access points. From the 6558 preschoolers that were reliant on the car to travel to kindergarten, 5089 preschoolers still are, from who 675 also gain accessibility to kindergarten by public transport. This means a reduction of 1459 preschoolers that are now able to walk or cycle to kindergarten. There are still 4414 preschoolers that are reliant on the car, for whom the ability to walk or cycle to kindergarten will be improved by interventions in this paragraph.



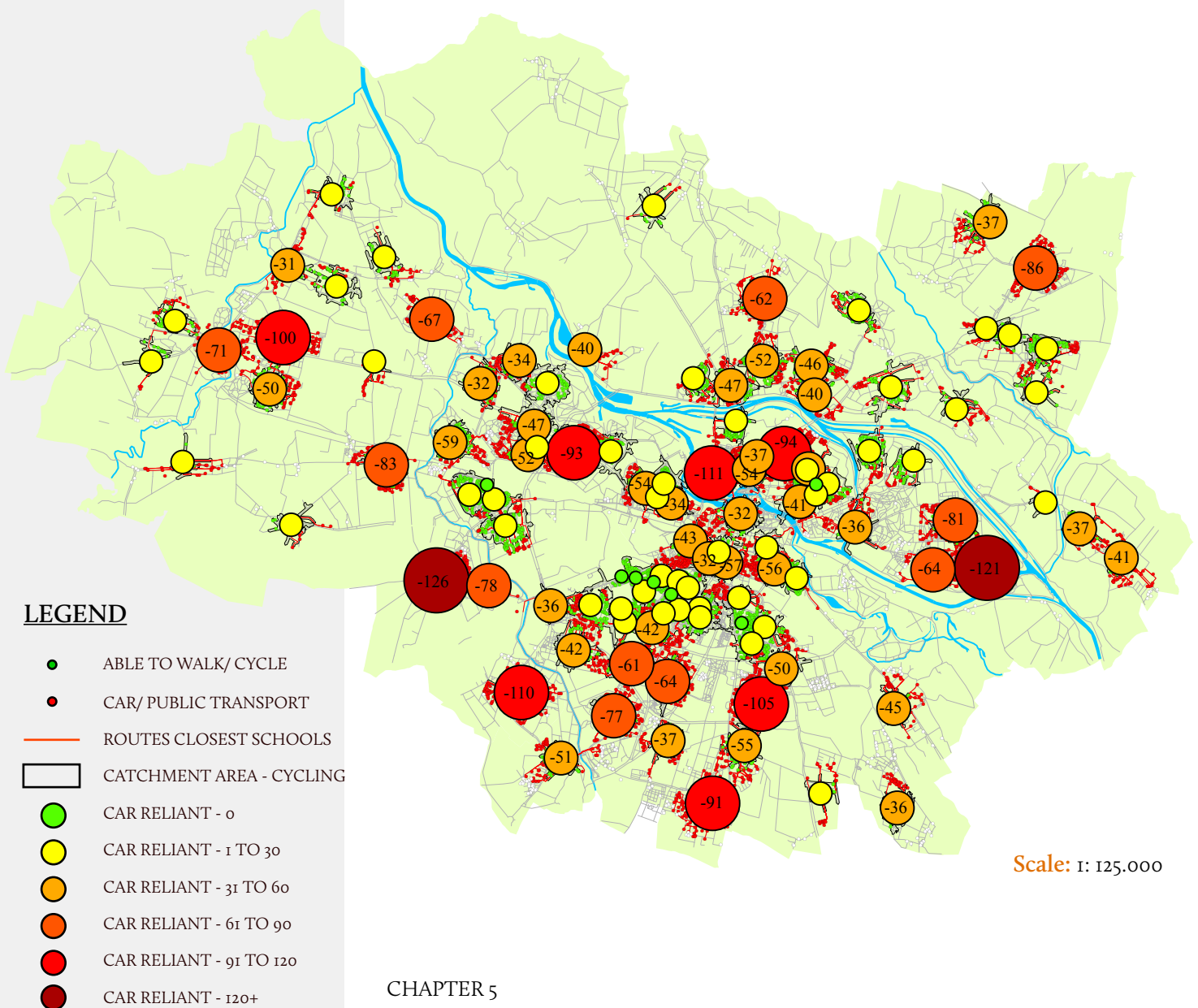
LEGEND

- KINDERGARTEN
- PRIVATE CAR
- PUBLIC TRANSPORT
- CYCLING
- CYCLING/ PUBLIC TRANSPORT
- WALKING/ CYCLING
- WALKING/ CYCLING/ PUBLIC TRANSPORT
- ODER RIVER/ CANALS
- WALKING NETWORK
- MAP BACKGROUND

Scale: 1: 125.000

► Closest facility analysis

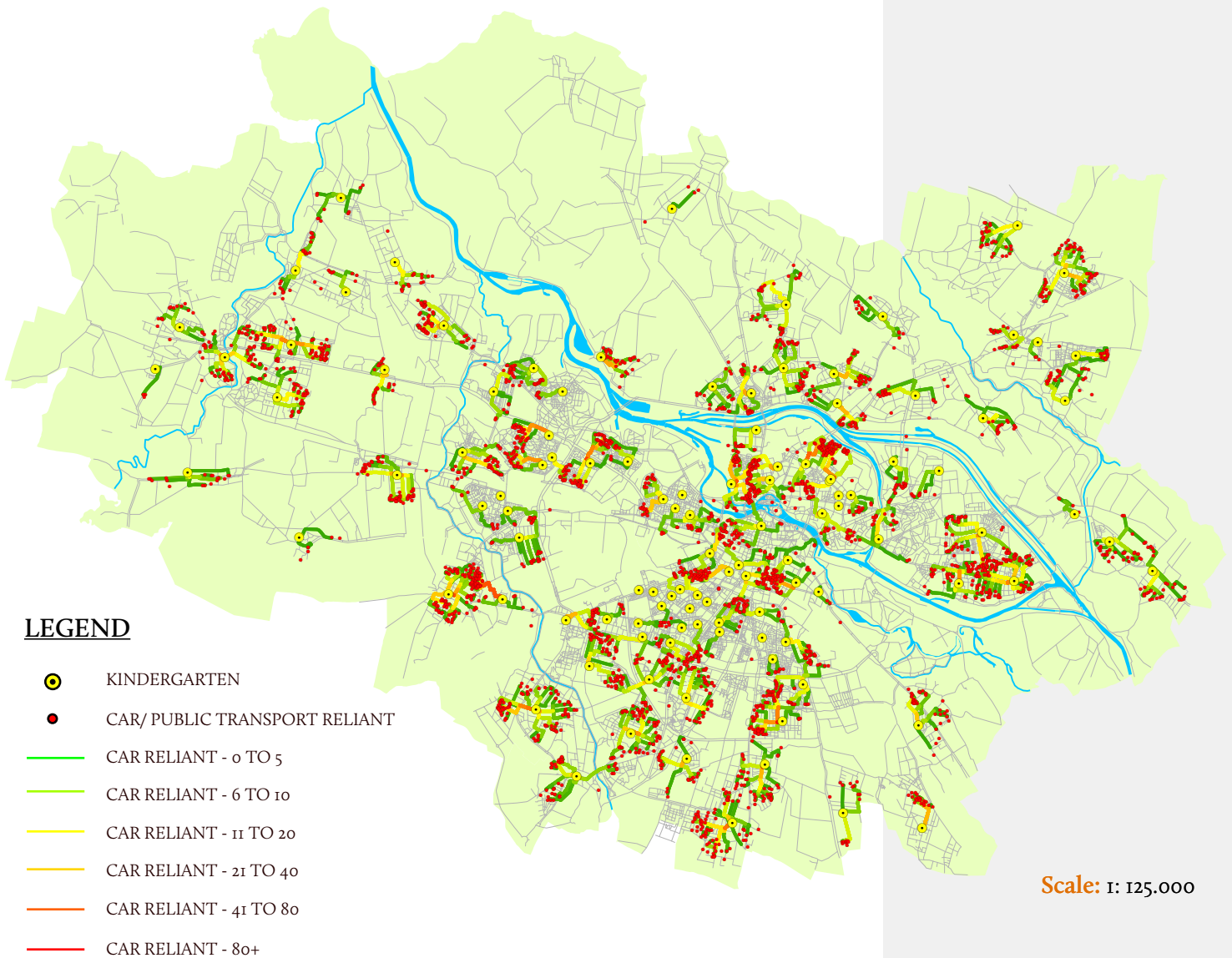
Figure 168 shows the closest facility analysis that has been carried out for preschooler’s adjusted network accessibility to kindergarten. The routes between the homes of preschoolers and kindergartens, that are based on the shortest travelling time, have been measured and defined. Only those routes where preschoolers did not have adjusted network accessibility have been drawn in figure 168. The figure illustrates that throughout the city, there is a loss of adjusted network accessibility. This is caused by the incompleteness of the cycling network, there the lack of cycling paths imposes a reduced adjusted network accessibility. Because the spreading of the problem is so wide and comprehensive, the needed interventions that will improve the adjusted network accessibility to kindergartens will not be proposed by research areas, but on the city scale. Therefore, the first step is to define the potential intensity in which routes might be used.



► Defining the intensity of use

169. Description in the text.

Figure 169 shows the intensity in which the routes between the homes of preschoolers without adjusted network accessibility and kindergartens might be used. The potential intensity of use has been defined to determine where in Wrocław the construction of new bicycle paths will benefit preschoolers the most. The intensity of use could be defined, because in the closest facility analysis, routes have been drawn from every building entrance to the kindergarten that is located within the shortest traveling time. Many of these routes intersect because on the routes between children's homes and kindergartens, other homes of children are located. Therefore, by performing an intersection analysis, it has become possible to define the potential intensity of use on the routes between kindergartens and the homes of those preschoolers that do not have adjusted network accessibility which enables them to walk or cycle to kindergarten.

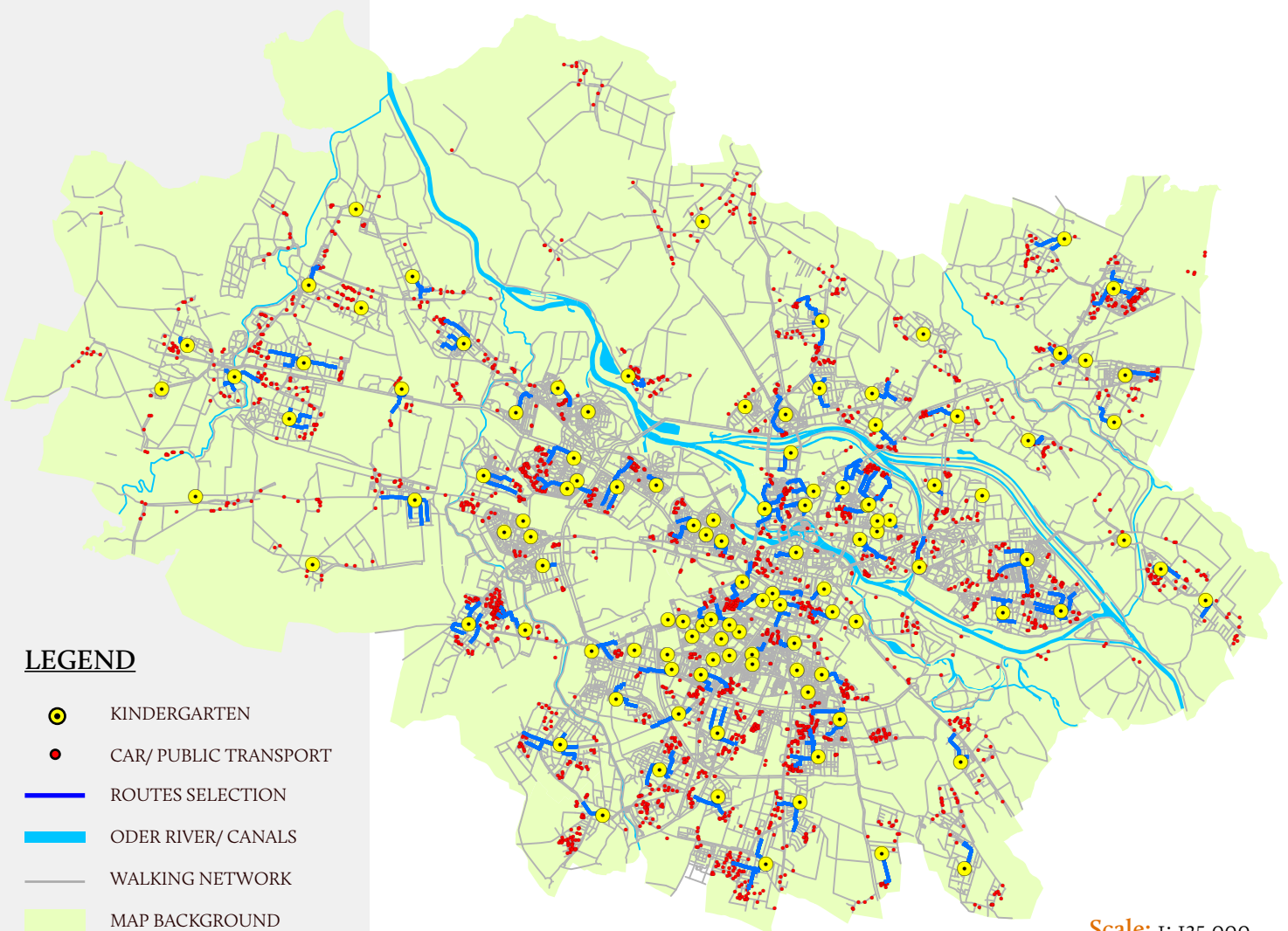


Scale: 1: 125.000

170. Description in the text.

► The need for cycling paths

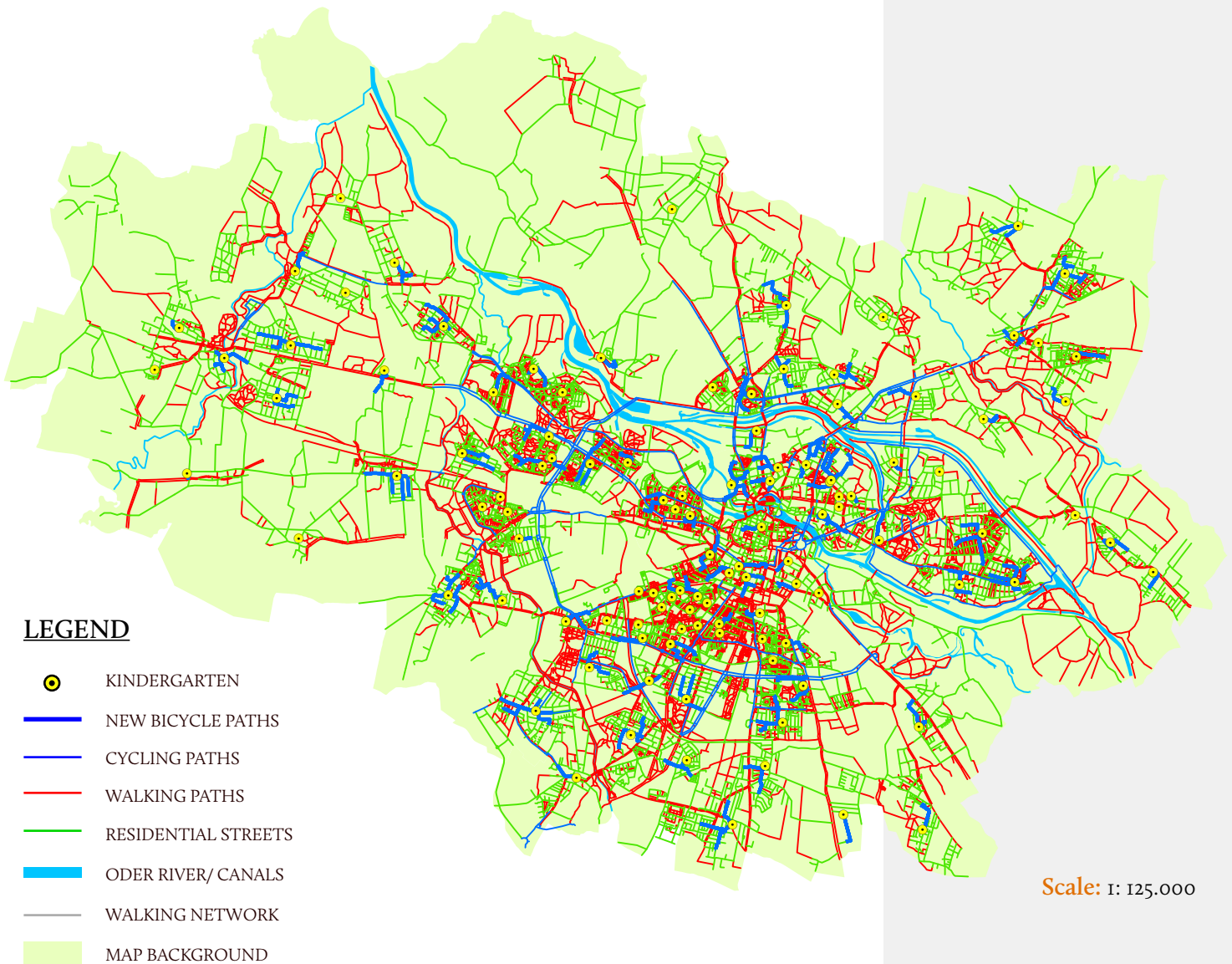
With the knowledge on the potential intensity in which routes might be used, it has become possible to make selections wherewith the effects of interventions on the usability of the cycling network can be measured. In figure 170, a particular selection is shown. All the routes, which are based on the shortest possible travelling time, where in potential more than 10 preschoolers might cycle to kindergarten have been selected. The figure shows that these routes all start at the kindergartens, which is logical since all routes end at kindergartens where thus the highest potential intensity will be found. Based on trial and error, the selection of 10 preschoolers has been determined, because herewith the most important 'long lines' away from kindergartens have been selected. The figure also illustrates that at certain kindergartens no infrastructure has been selected. At these location, the intensity is lower than 10 preschoolers or might be lacking.



► Rebuilding the cycling network

Figure 171 show the cycling network and the different types of infrastructure that define this network. To measure the effect of the provision of bicycle paths on the routes where more than 10 preschoolers might be able to cycle to kindergarten, the network needs to be rebuilt. Because the infrastructure has been selected from the cycling network, which means that different types of infrastructure have been selected, the maximum cycling speed on the selected infrastructure needs to be redefined. This has been performed by projecting the selected infrastructure on the different types of infrastructure, whereby overlapping walking paths (5 km/h) and residential streets (8 km/h) have been adjusted to the speed that can be obtained on cycling paths, which is 12 km/h. With the adjusted cycling speed, the network has been rebuilt and the adjusted network accessibility has again been measured, which is shown on the next page.

171. Description in the text.



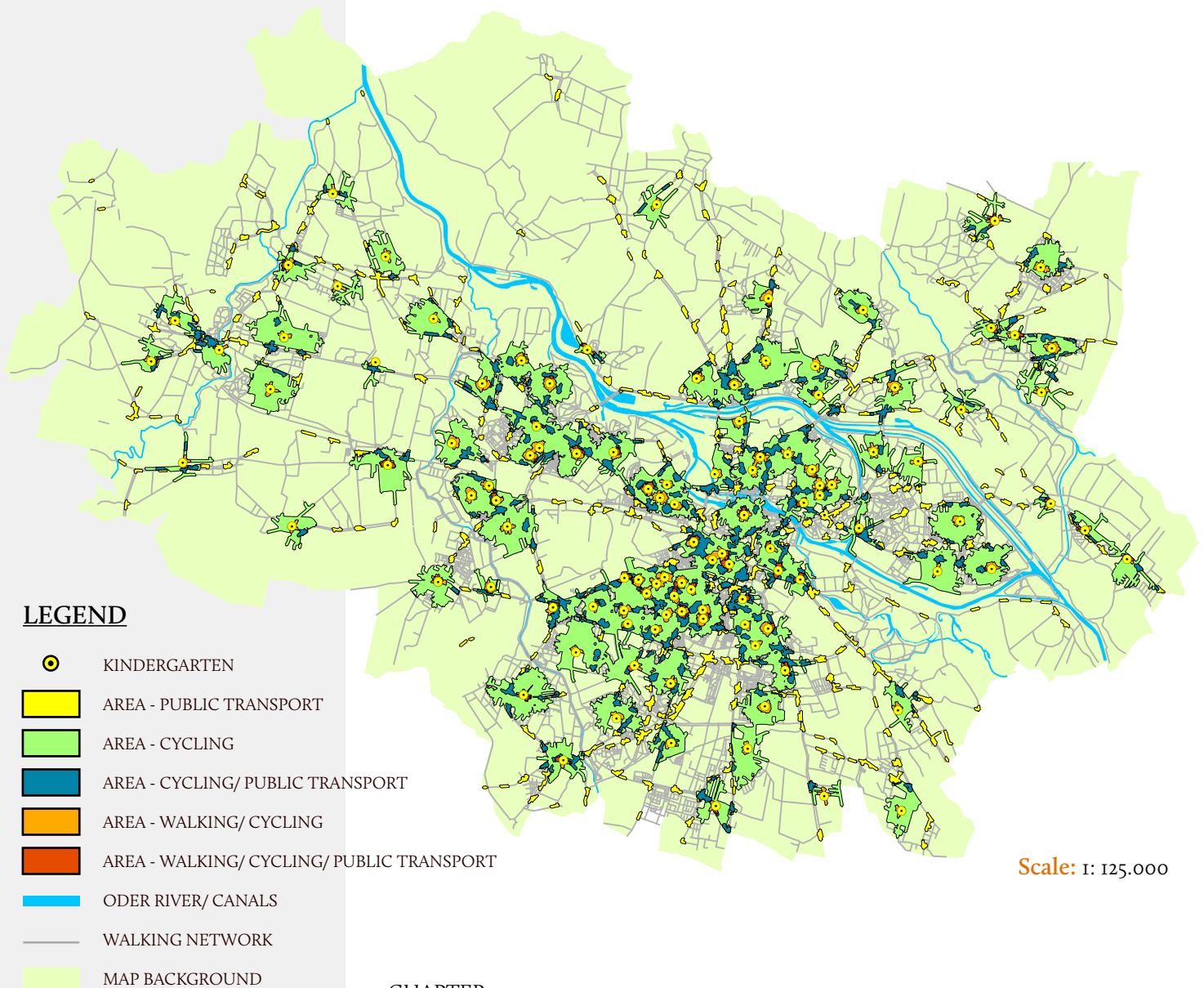
172. Description in the text.

173. Description in the text.

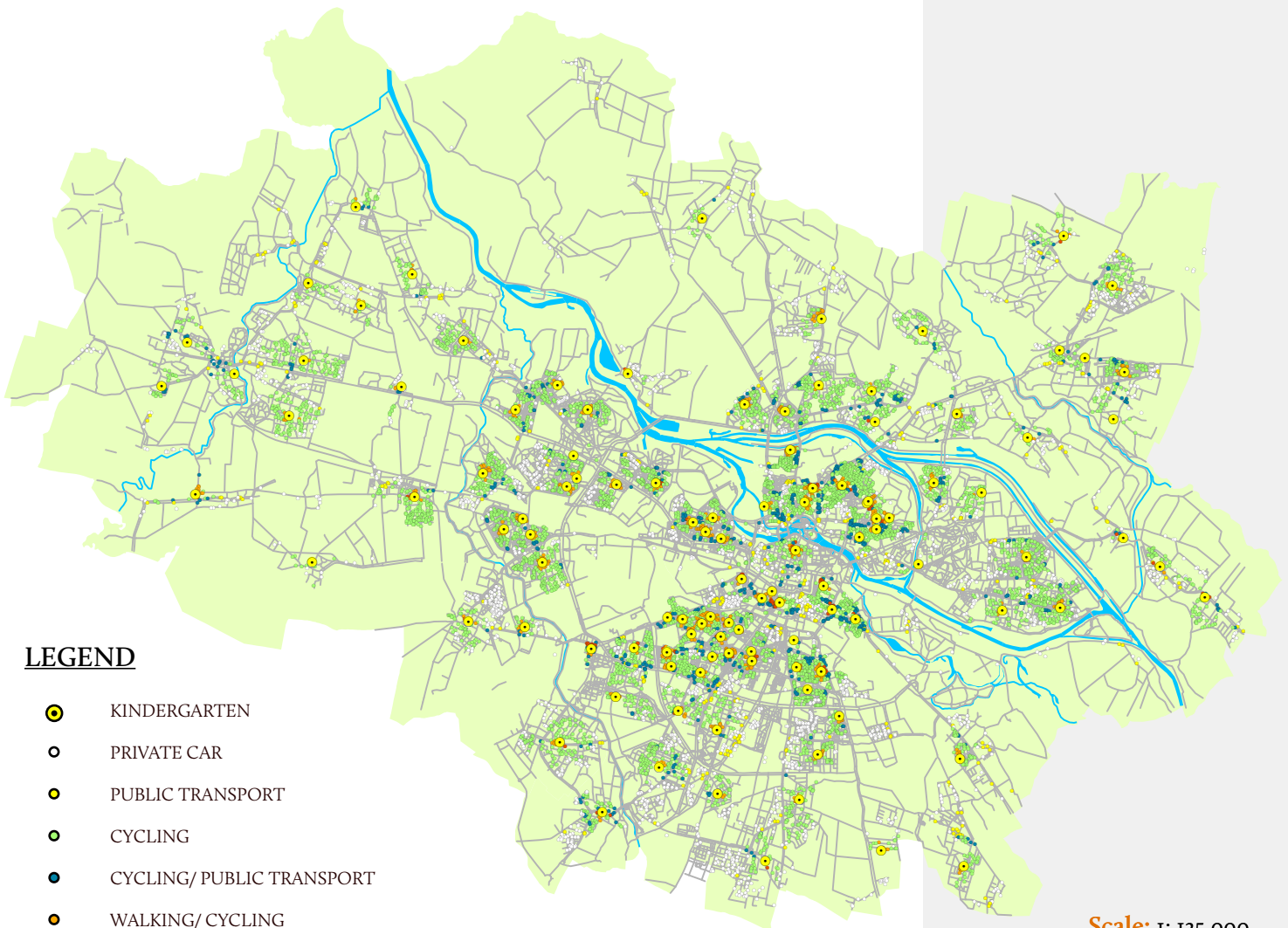
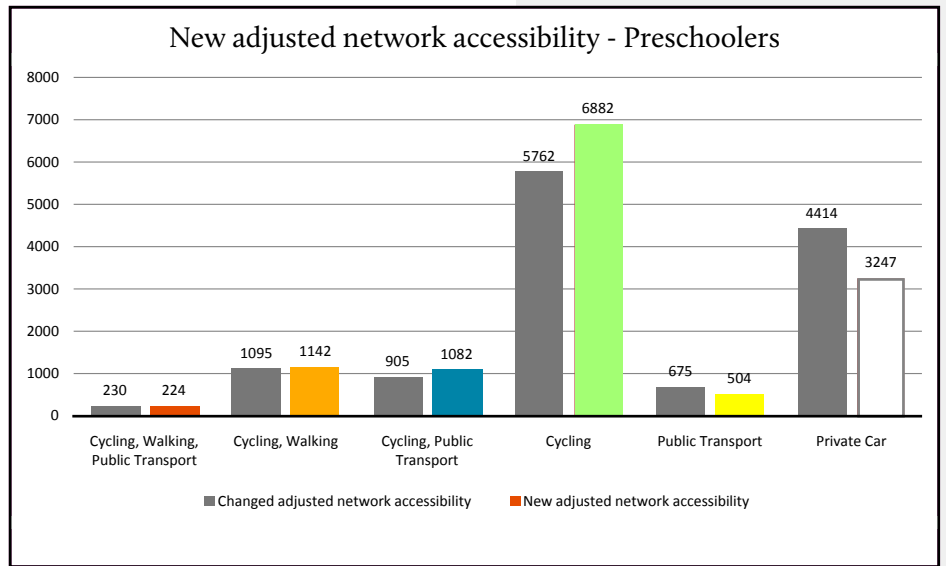
174. Description in the text.

► New adjusted network accessibility

Due to the implemented interventions, the adjusted network accessibility to kindergartens has not only changed the need for preschoolers to travel by car, but therewith also their ability to travel by foot, bicycle or public transport. Figure 172 shows the new catchment areas that have been drawn around the existing and new kindergartens and the public transport access points. These have once again been projected on the building entrances where preschoolers were living, like shown in figure 174. The results of this analysis are shown in figure 173. The actual ability to walk to kindergarten has increased from 1325 to 1366 preschoolers, which is an increase of 41 preschoolers, from who 6 have lost the ability to travel to kindergarten by public transport. The actual ability to cycle to kindergarten, without the ability to walk, has increased from 6667 to 7964 preschoolers, which is an increase of 1297 preschoolers, from who



177 now also gain accessibility to kindergarten by public transport. From the 5089 preschoolers that were reliant on the car to travel to kindergarten, only 3751 preschoolers still are, from who 504 also have actual accessibility to kindergarten by public transport. This means a reduction of 1338 preschoolers that are now able to walk or cycle to kindergarten. There are still 3247 preschoolers that are reliant on the car, for whom the ability to travel by public transport should be provided and improved.



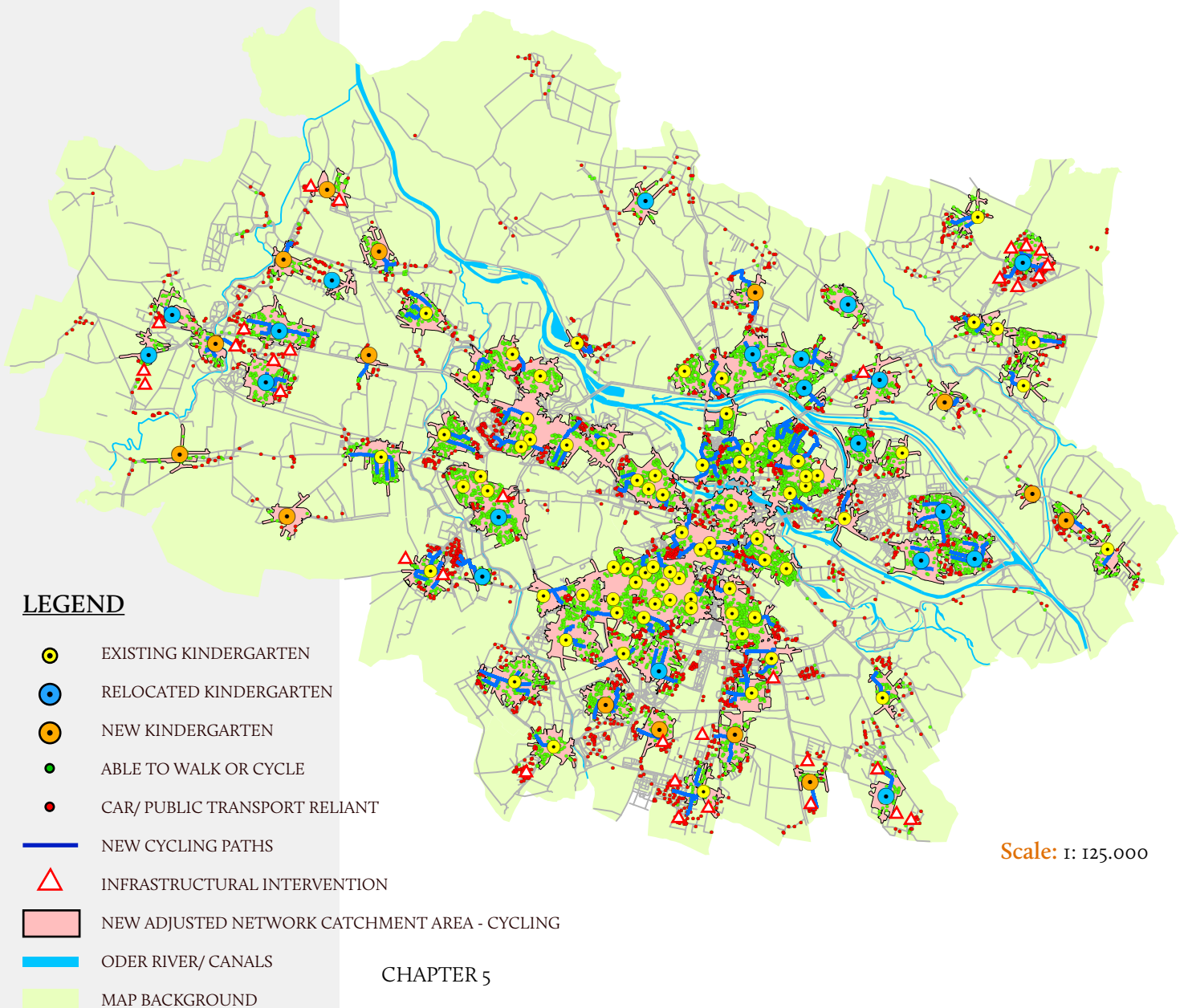
LEGEND

- KINDERGARTEN
- PRIVATE CAR
- PUBLIC TRANSPORT
- CYCLING
- CYCLING/ PUBLIC TRANSPORT
- WALKING/ CYCLING
- WALKING/ CYCLING/ PUBLIC TRANSPORT
- ODER RIVER/ CANALS
- WALKING NETWORK
- MAP BACKGROUND

Scale: 1: 125.000

5.2.4 CONCLUSION

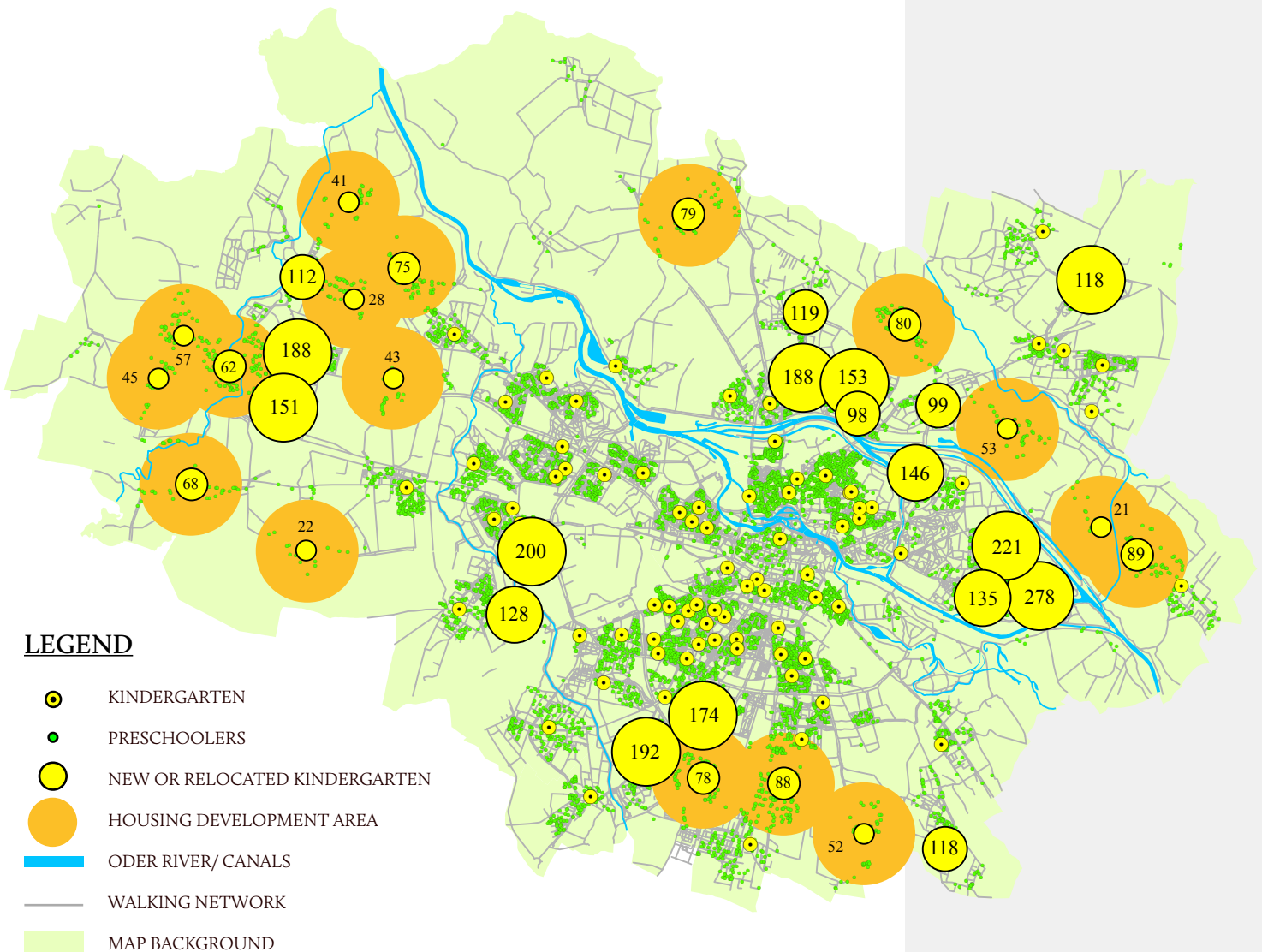
Figure 175 shows the overall map of the interventions that have been proposed and implemented in this research. In total, 15 new kindergarten have been provided and 20 kindergartens have been relocated. Beside 32 infrastructural interventions, new bicycle paths have been implemented that are based on the intensity of use. Before interventions were proposed and implemented, 6558 preschoolers were not able to walk or cycle to school, from who 753 were able to travel by public transport. In the situation after, 3751 preschoolers are not able to walk or cycle to school, from who 504 are able to use public transport. Thus, the amount of preschoolers that is reliant on car use has been reduced with 2827 preschoolers. Assuming that every car trip contains 1,5 children, a reduction of approximately 4000 daily car trips between the homes of preschoolers and kindergarten has been achieved, wherewith the demand on space for cars is reduced.



► **New adjusted network accessibility**

In the current city, 98 kindergartens are provided for 13081 preschoolers, which means that in average 133 preschoolers attend a kindergarten. Due to the interventions, the average kindergarten size has changed from 133 to 116. Therefore, there is space for Wrocław to grow. **Figure 176** shows the sizes of those kindergartens that have been moved or provided in this project. The kindergartens with a catchment area of 1000 meters around it are kindergartens where the kindergarten size should be increased, which thus are strategic locations to develop new housing. Because many of these kindergartens or not really there in real life, these circles are the locations where Wrocław should develop housing in the next years, to enable the building of kindergartens in these locations, wherewith the current need for children to travel by car will be reduced. Later in this project, the areas will be compared to Wrocław’s planned housing development.

176. Description in the text.



5.3 YOUNG SCHOOL-AGED CHILDREN

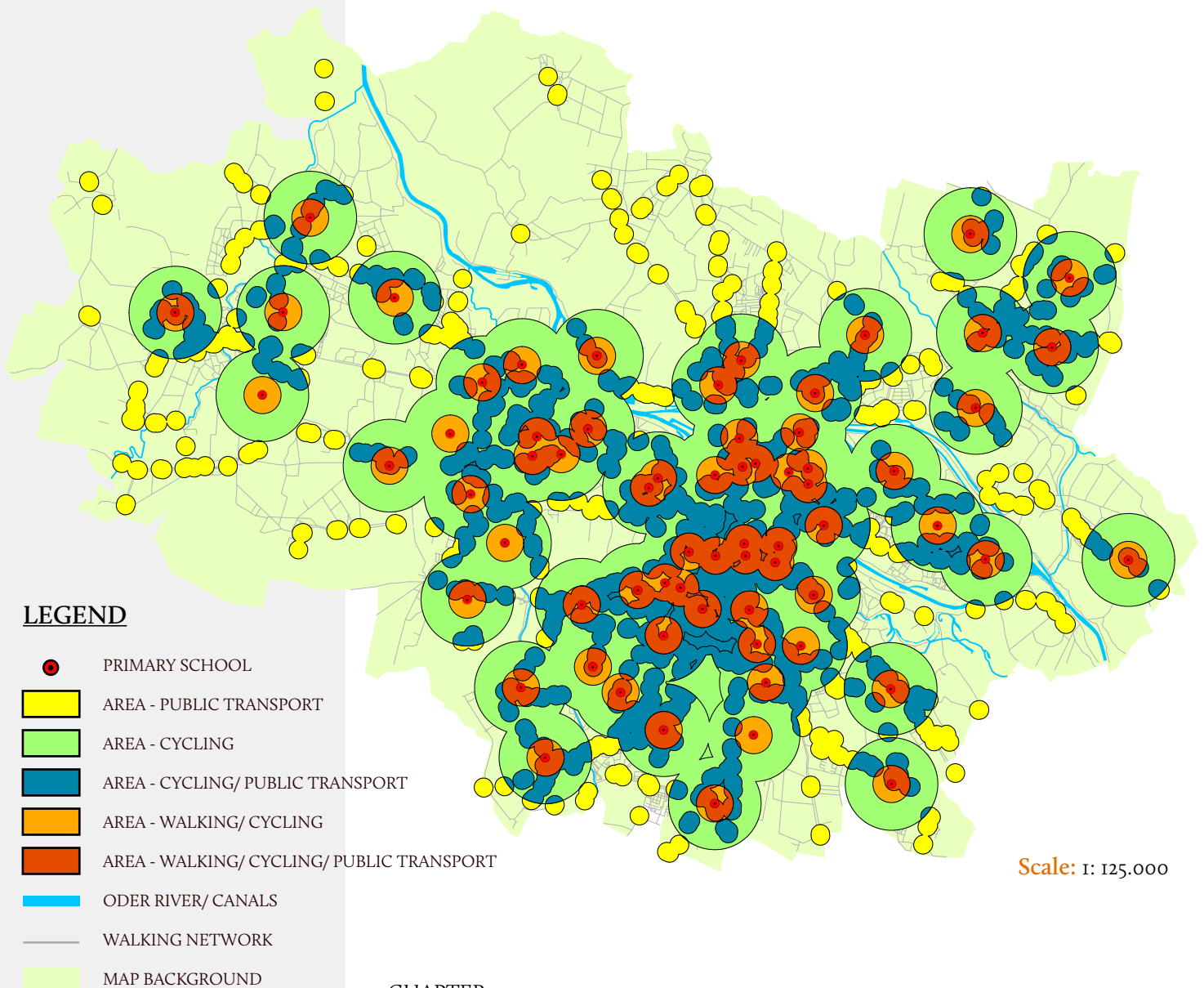
176. Description in the text

177. Description in the text.

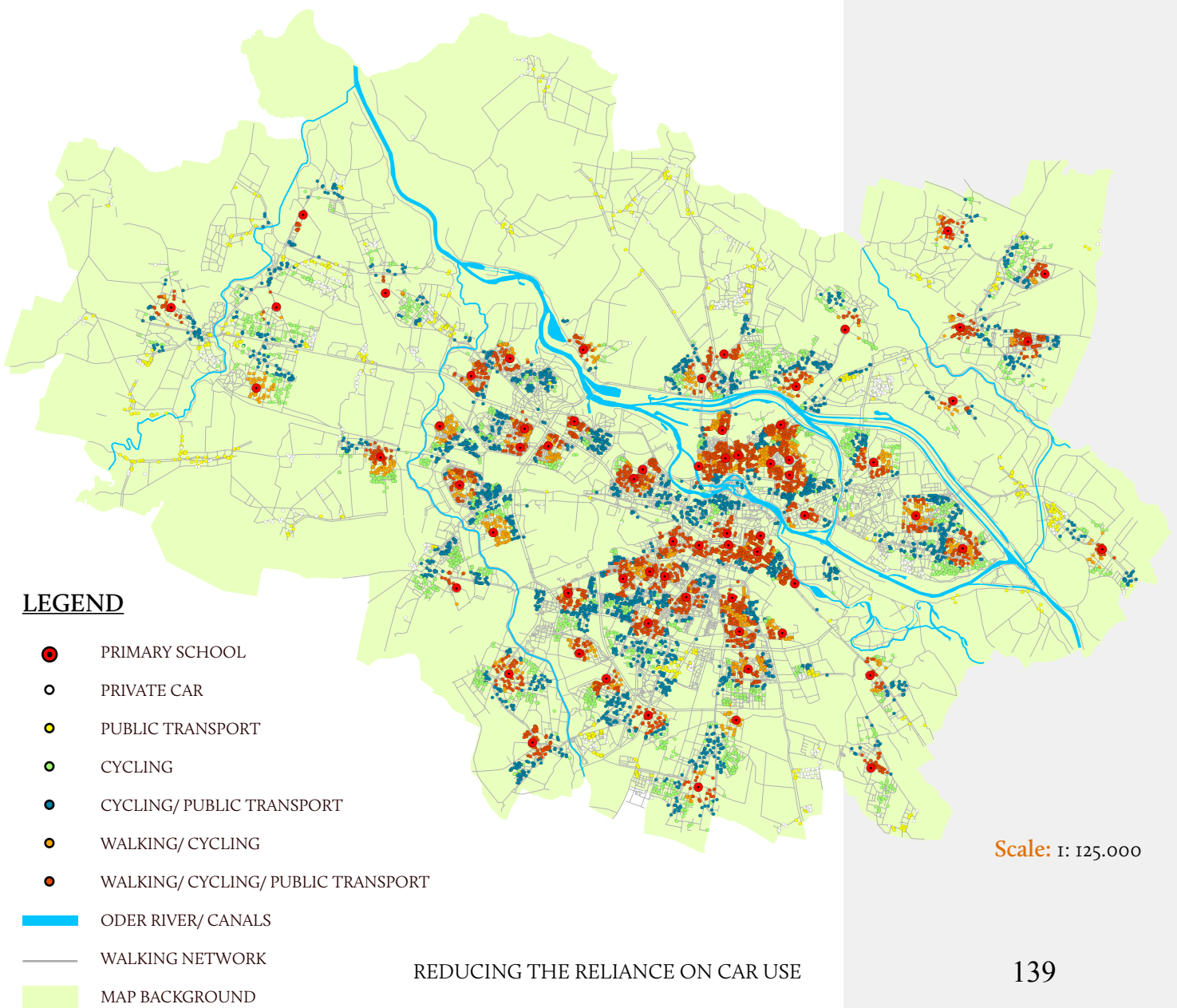
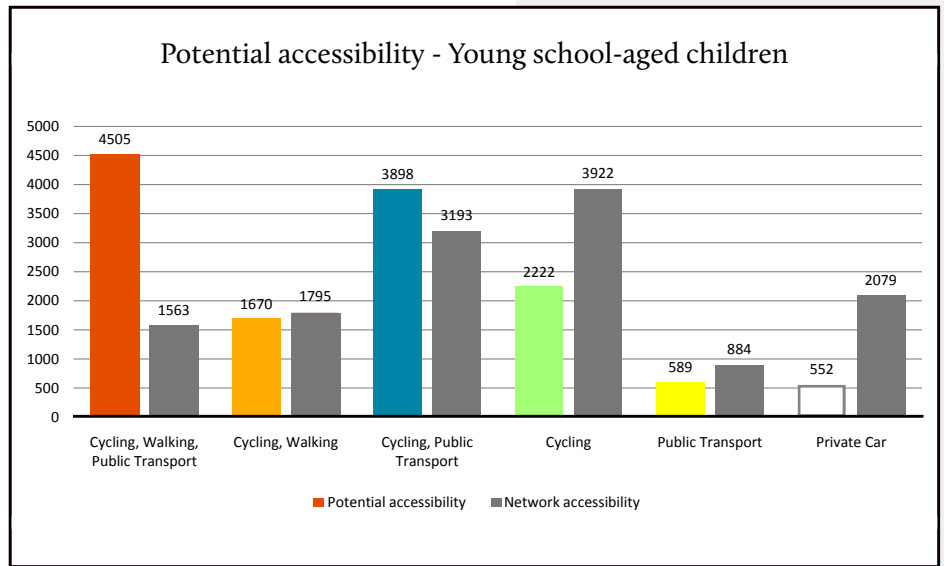
178. Description in the text.

5.3.1 POTENTIAL ACCESSIBILITY

Figure 176 shows the potential accessibility catchment areas that have been created for young school-aged children. These are buffers of 400 meters for walking and 1000 meters for cycling around primary schools and buffers of 200 meters for walking around public transport access points. The catchment areas have been overlaid, which has resulted in the 5 catchment areas. Figure 178 shows the projection of the catchment areas on the entrances of houses and building where young school-aged children were living at the end of 2005. The results are shown in figure 177. From the 13436 young school-aged children that lived in Wrocław, 6175 (46,0%) were in potential able to travel by foot and by bicycle to primary school, from who 4505 were also able to walk to public transport access points within these constraints. 6120 (45,5%) young school-aged children were in potential able to travel by bicycle to primary school, but

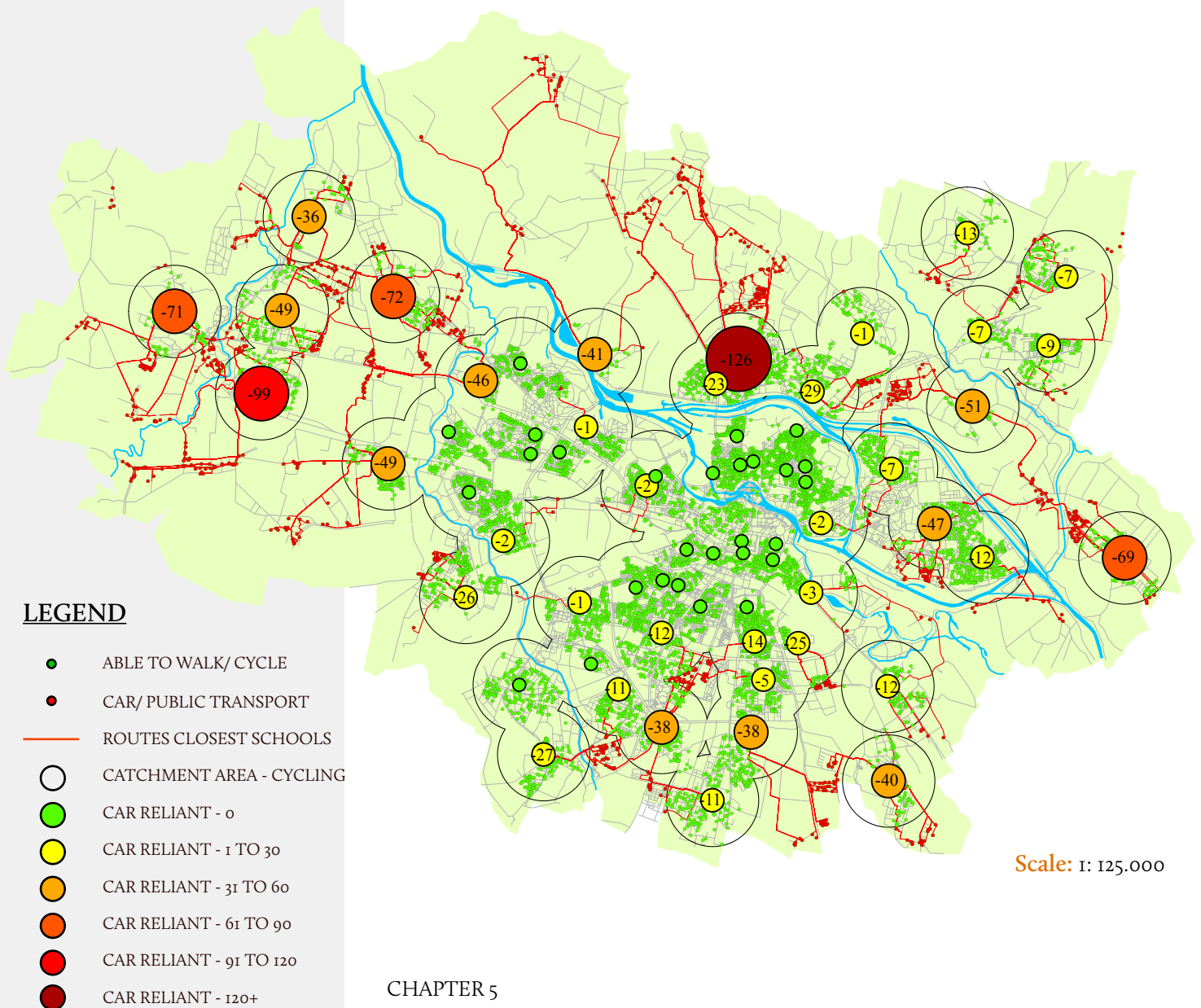


not by foot, from who 3898 were also able to walk to public transport access points. And 1141 (8,5%) children were in potential not able to travel by bicycle, nor by foot to primary school from who 589 were able to walk to public transport access points. The conclusion is that 552 (4,1%) young school-aged children were in potential reliant on the car to travel to school, which leaves 1527 young school-aged children that were reliant on the car to travel to primary school by a lack of network accessibility.



► **Closest facility analysis**

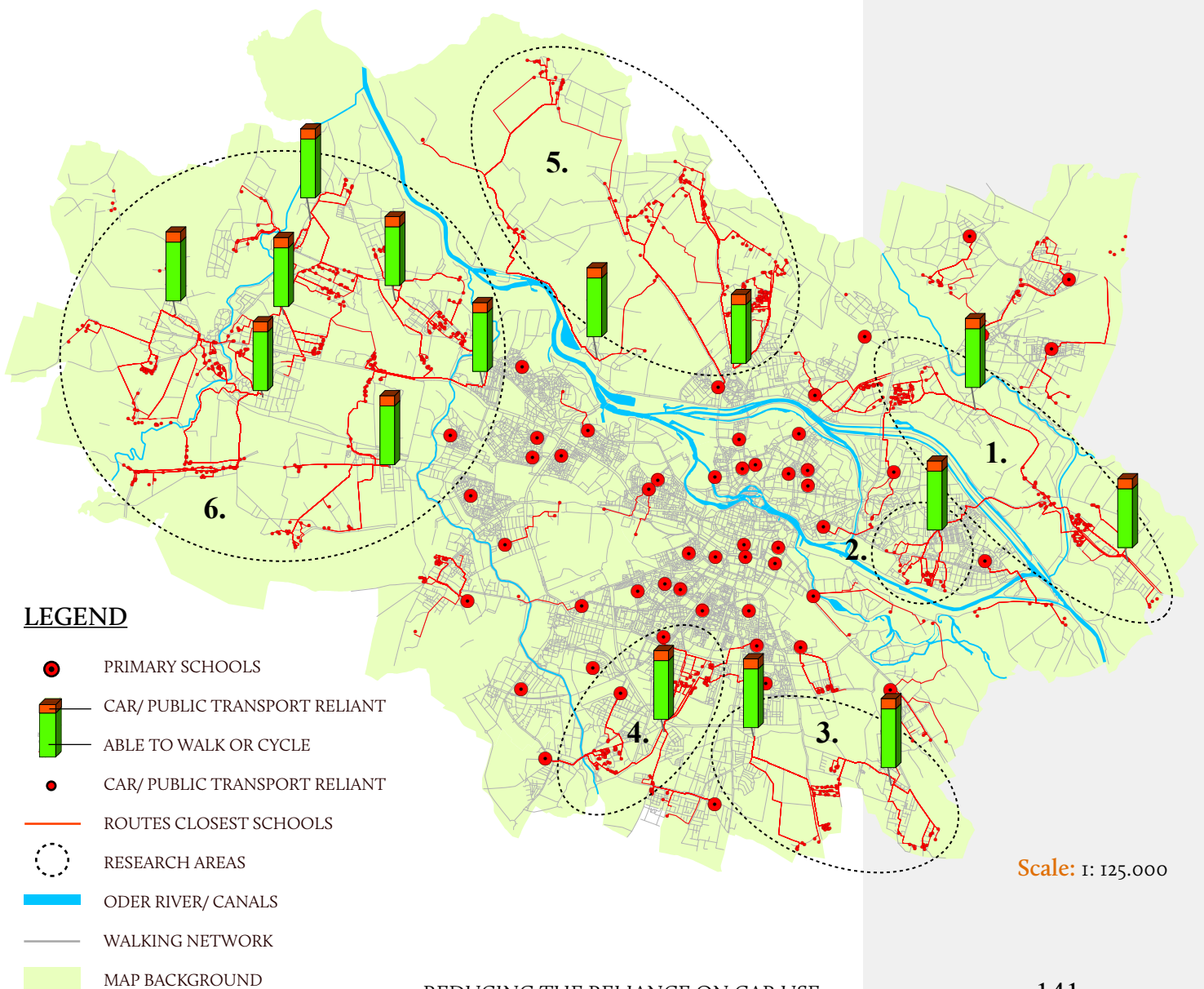
Figure 179 shows the closest facility analysis that has been carried out for young school-aged children’s potential accessibility to primary school. The shortest routes between their homes and primary schools have been measured and defined. Only those routes where they did not have potential accessibility by bicycle or foot have been drawn in figure 181. The young school-aged children that did not have potential accessibility have been projected on the closest primary schools, wherewith 15 primary schools have been selected to research. Figure 181 shows that with this selection, the aim is to reduce the 1141 young school-aged children that were reliant on car use or public transport at the end of 2005 with 882. Figure 180 shows that the primary schools to research have been divided over 6 research areas where interventions in the spreading of schools are needed. The research and proposed interventions are shown in the next pages.



District name	# primary sch.	# young s.a.	# car reliant
1 Swojszyce	2	264	130
2 Biskupin	1	320	47
3 Brochow	2	346	78
4 Krzyki	1	254	118
5 Rozanka	2	418	167
6 Lesnica	7	1128	422
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
TOTAL	15	2740	962

180. Description in the text

181. Description in the text



► The proposed interventions

Car/ Public transport users

Cycling users (multi)

Cycling users (dedicated)

Users (Other kindergartens)

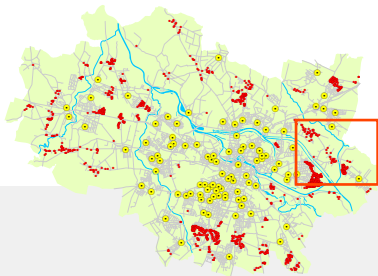
● Car/ Public transport users

● Cycling users

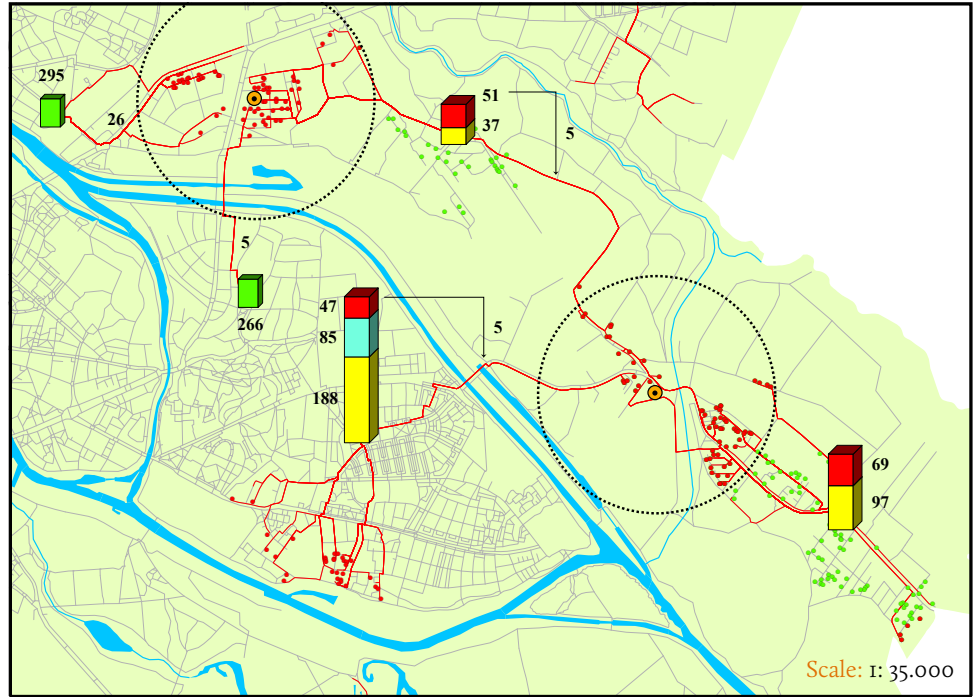
— Routes - Closest kindergarten

● Kindergarten - moved

○ New cycling catchment area



Area 1. Wrocław Swojszyce/ Kowale



i82. In the Swojszyce/ Kowale districts, 130 young school-aged children do not have potential accessibility to primary school by bicycle or foot. The nearest primary schools cannot be relocated, because this would result in a loss of potential accessibility, for the children that now have this accessibility. Therefore, 2 new primary schools need to be provided.

Car/ Public transport users

Cycling users (multi)

Cycling users (dedicated)

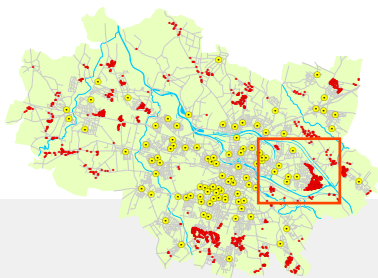
● Car/ Public transport users

● Cycling users

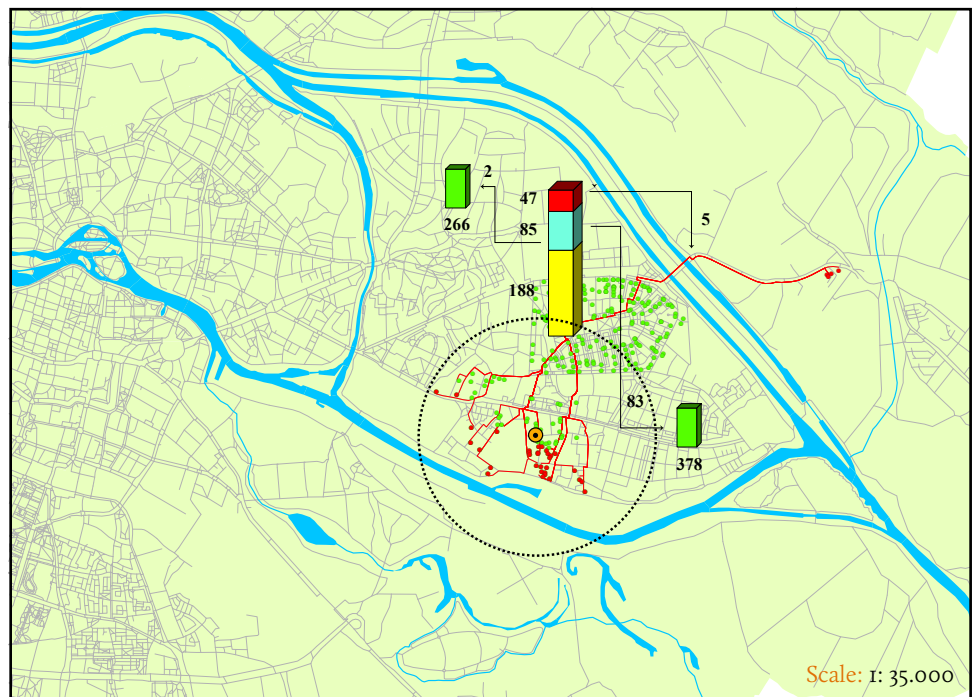
— Routes - Closest kindergarten

● Kindergarten - new

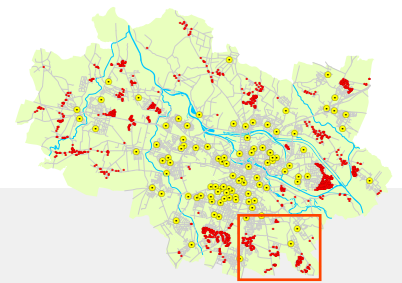
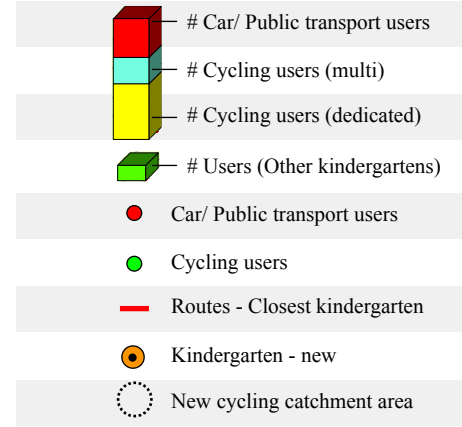
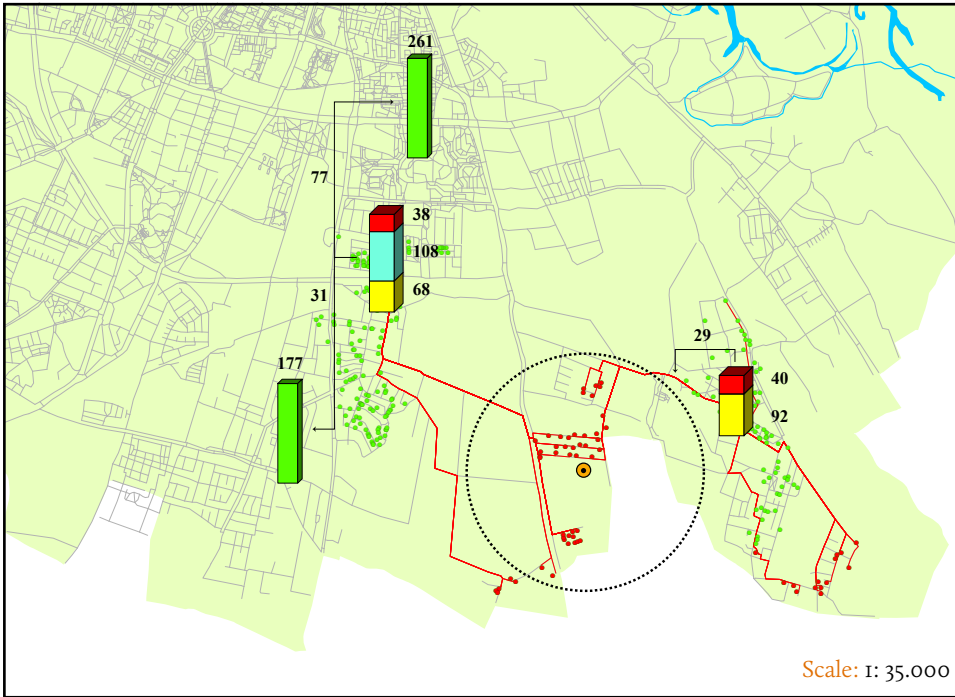
○ New cycling catchment area



Area 2. Wrocław Biskupin/ Sepolno

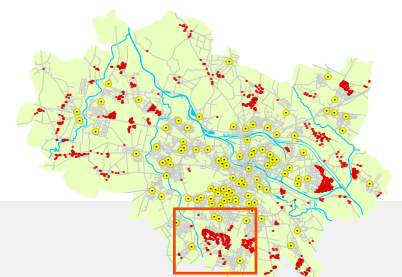
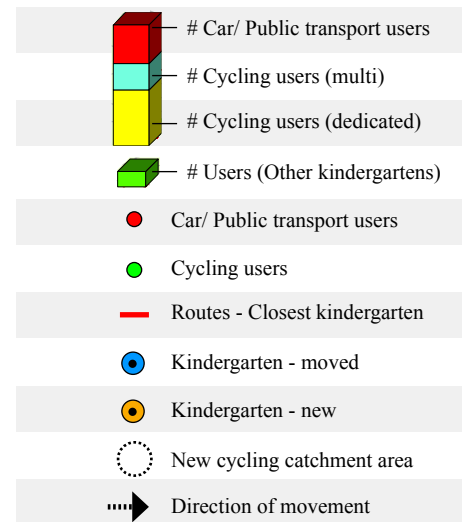
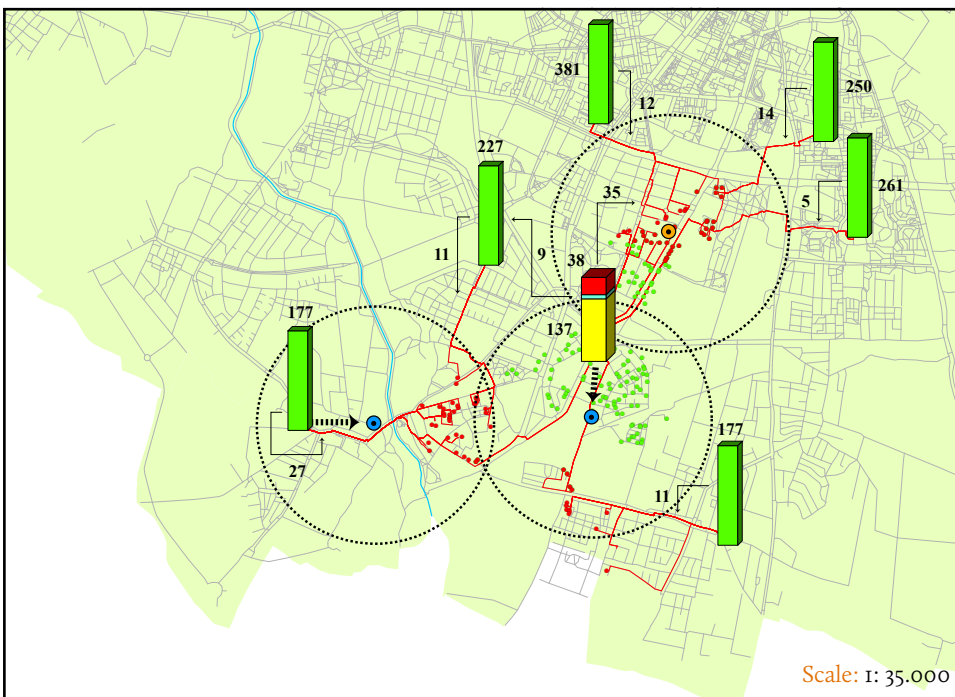


i83. In the Biskupin/ Sepolno districts, 47 young school-aged children do not have potential accessibility to primary school by bicycle or foot. The nearest primary school(s) cannot be relocated, because this would lead in a loss of potential accessibility. There are too many children are reliant on these primary schools. Thus, a new primary school needs to be provided.



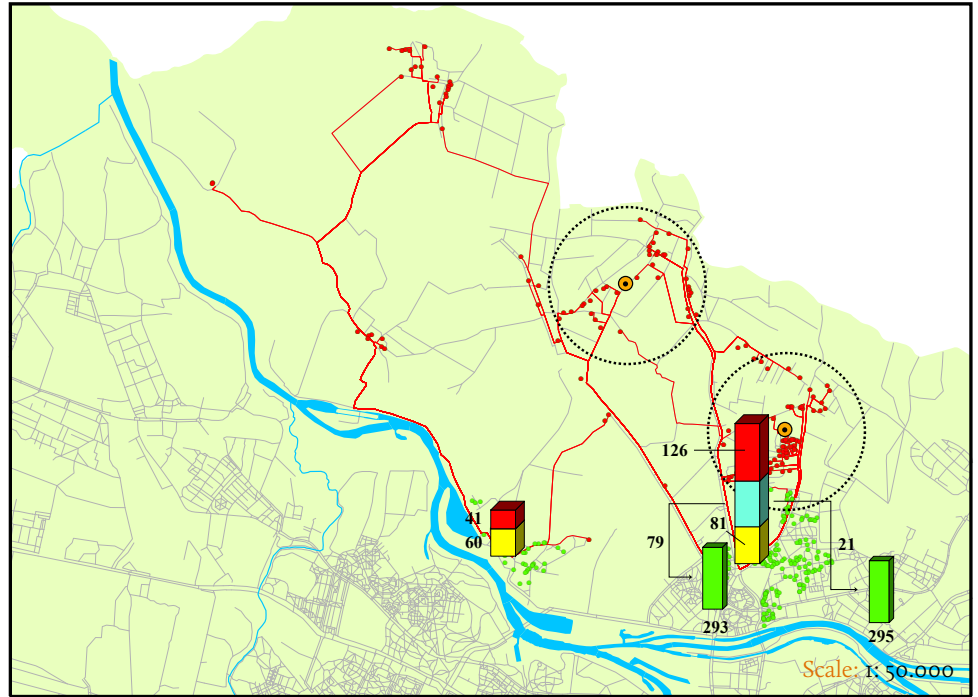
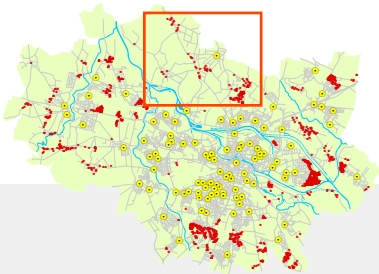
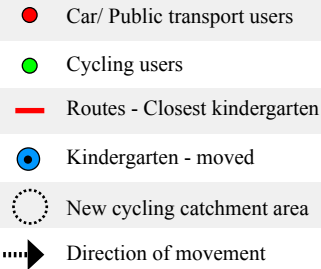
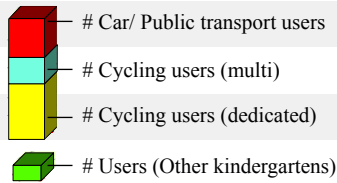
Area 3. Wrocław Brochów/ Krzyki

184. In the Brochów/ Krzyki districts, 78 young school-aged children do not have potential accessibility to primary school by bicycle or foot. Due to the reliance on the nearest primary schools and the size of the alternative primary schools, the nearest primary schools cannot be relocated. Therefore, in this situation a new primary school needs to be provided.



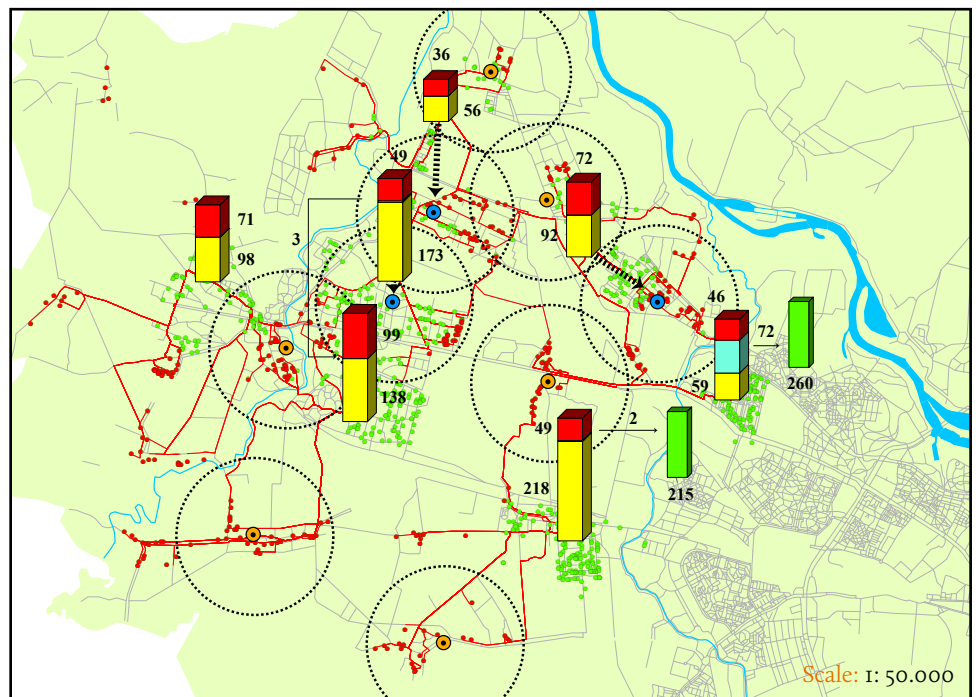
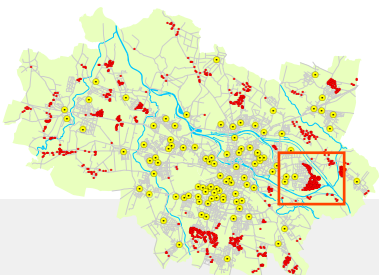
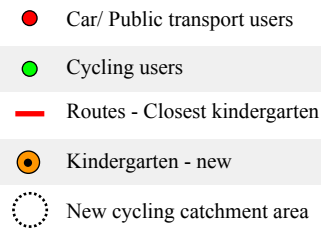
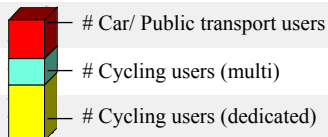
Area 4. Wrocław Krzyki

185. In the Krzyki districts, 118 young school-aged children do not have potential accessibility to primary school by bicycle or foot. To provide these children with potential accessibility, 2 primary schools need to be relocated. This is partly possible because 1 new primary school will be provided. With the relocation of these schools, no potential accessibility will get lost.



r86. In the Rozanka districts, 167 young school-aged children do not have potential accessibility to primary school by bicycle or foot. The nearest primary school(s) cannot be relocated, because this would lead in a loss of potential accessibility, but also because the alternative schools are too large in size. Thus, a new primary school needs to be provided.

Area 5. Wrocław Rozanka

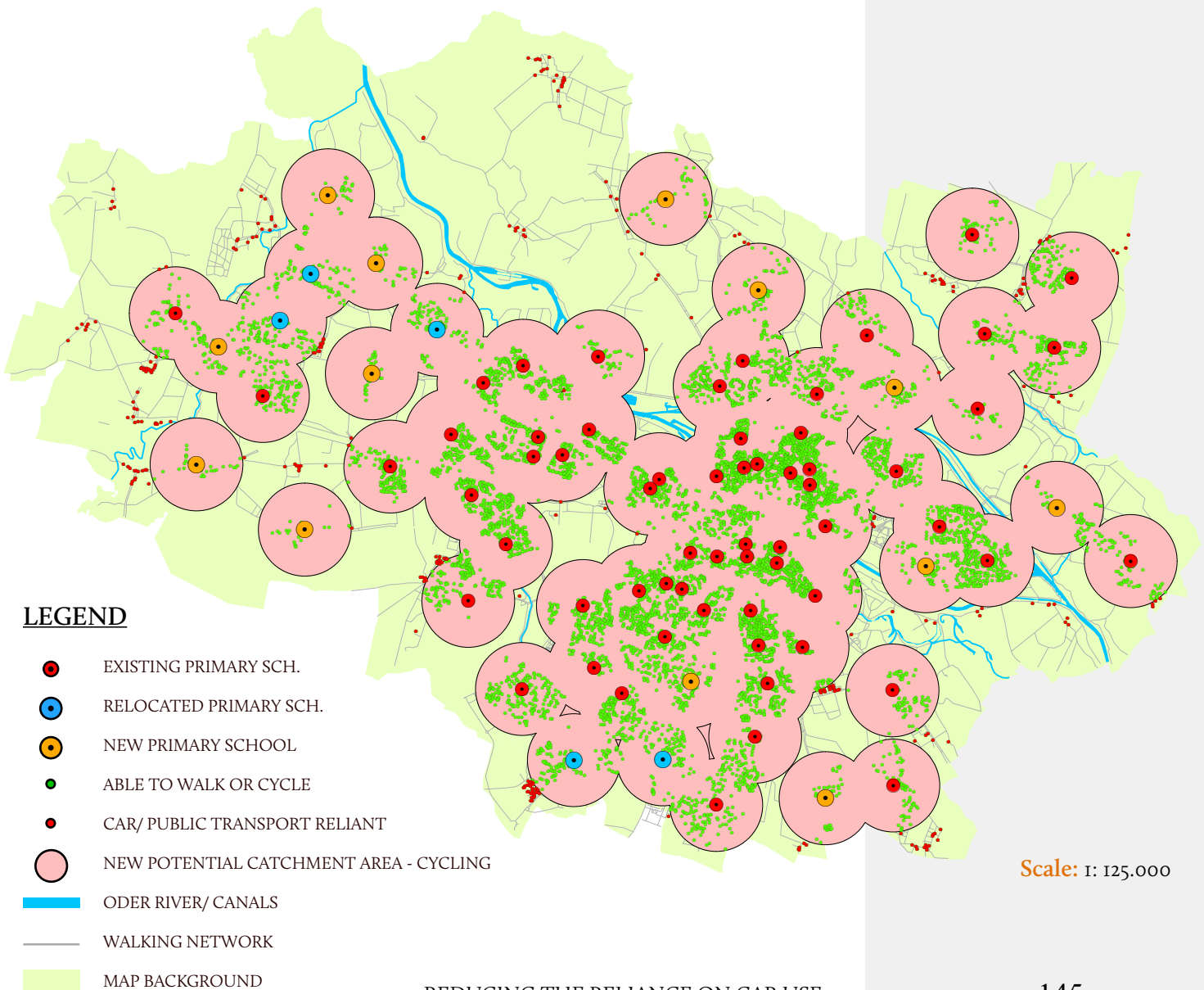


r87. In the Lesnica districts, 422 young school-aged children do not have potential accessibility to primary school by bicycle or foot. To provide these children with accessibility, 3 primary schools can be relocated, due the provision of 6 new primary schools. These are often located in villages that have been annexed in the past decades and can be developed further.

Area 6. Wrocław Lesnica

► **The interventions implemented**

The interventions that have been proposed in the 6 different analyses are shown in figure 190. In total, 5 primary schools have been relocated and 13 new primary schools have been provided. The new potential catchment area for cycling has been drawn around the 80 primary schools (67 existing and 13 new), which has been projected on the entrances of buildings where young school-aged children were living. The amount of young school-aged children that were reliant on car use or public transport in 2005 has been reduced from 1141 to 380, which is a reduction of 761 children that are now able to walk or cycle to primary school. The aim was to reduce this amount with 962 preschoolers, but it has become clear that due to the spreading of young school-aged children, it is spatially impossible to provide all of them with potential accessibility. For these children, public transport needs become a real alternative to car use.



Scale: 1: 125.000

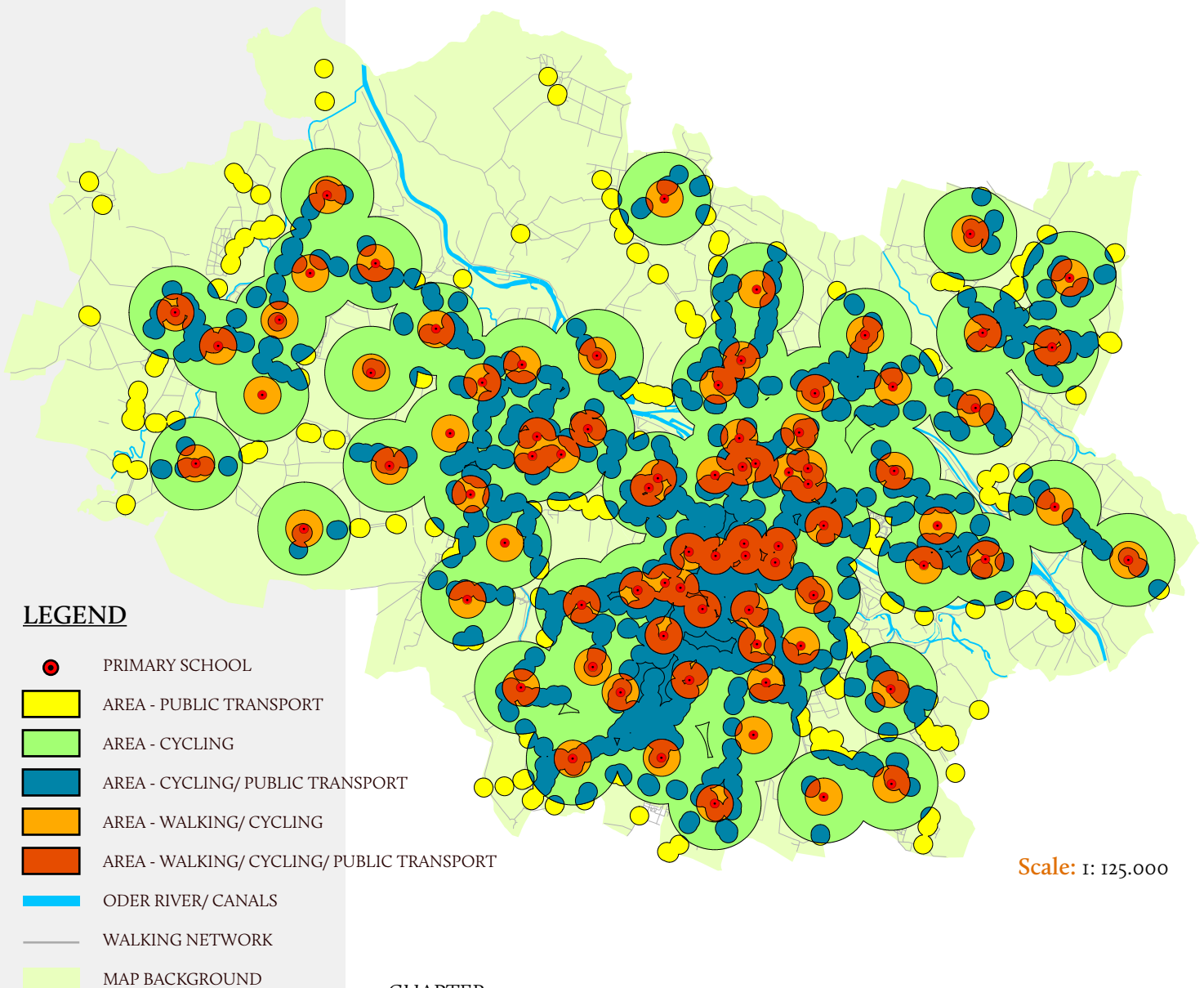
189. Description in the text

190. Description in the text.

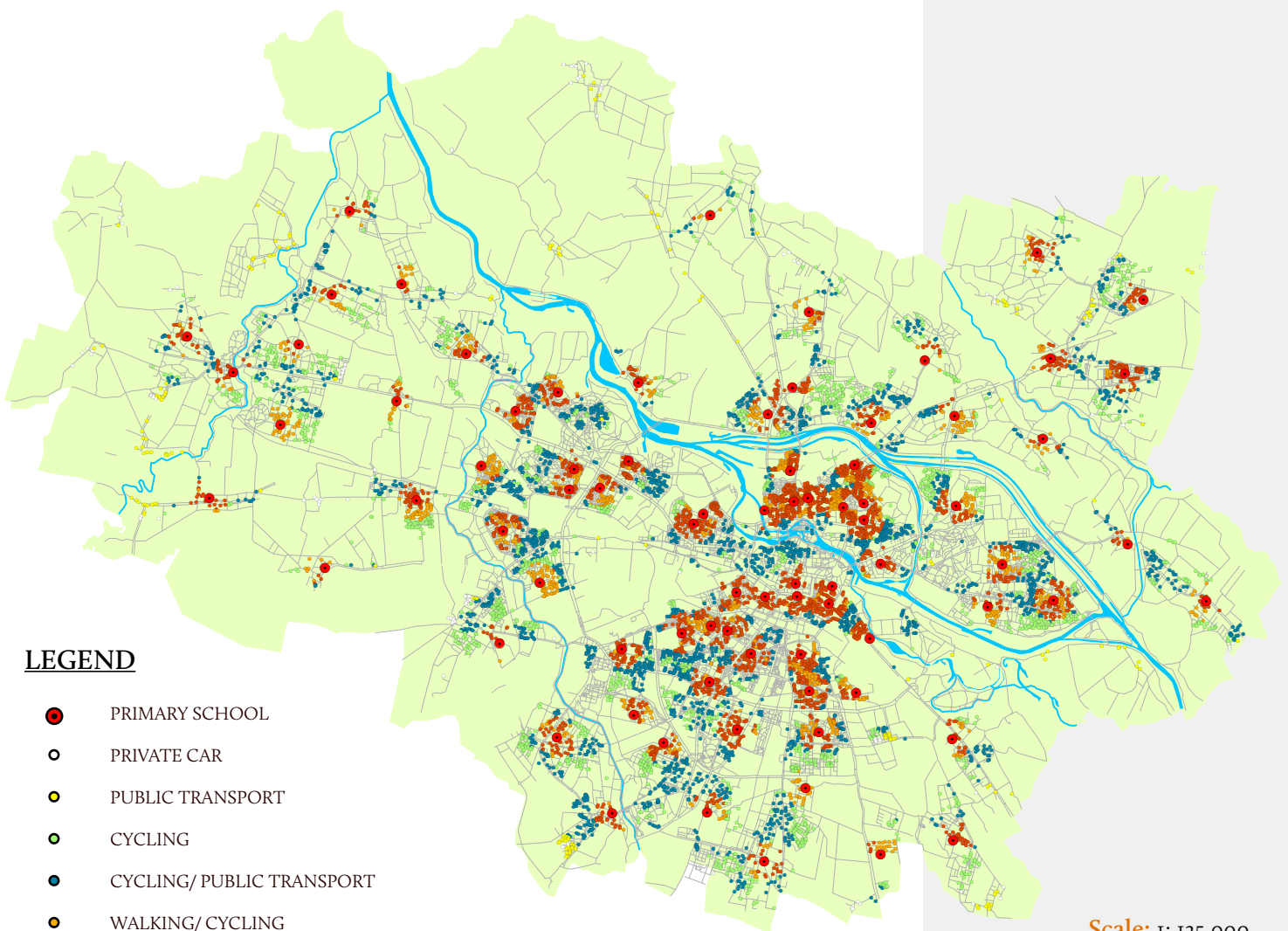
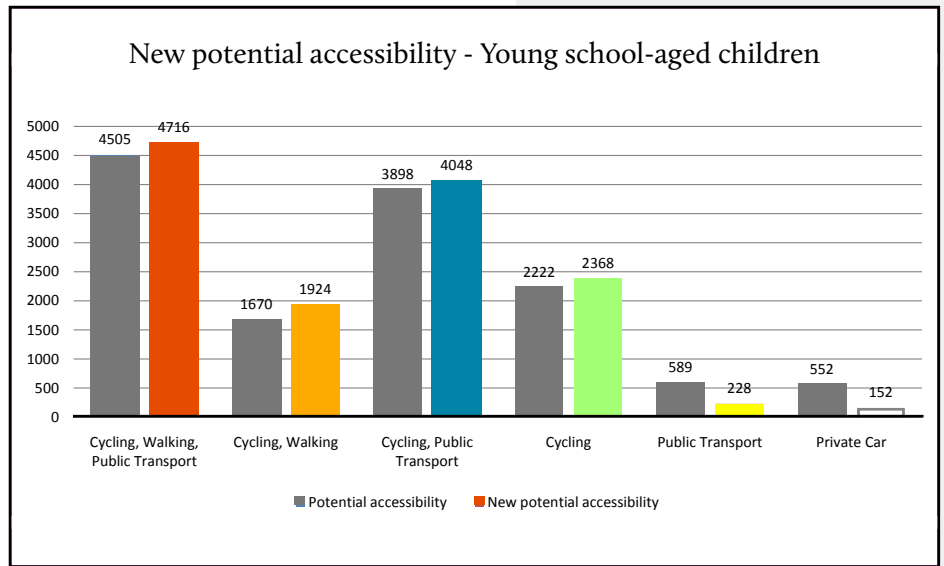
191. Description in the text.

► New potential accessibility

Due to the implemented interventions, the potential accessibility to primary school has not only changed the need for young school-aged children to travel by car, but also their ability to travel by foot, bicycle or public transport. Figure 189 shows the new catchment areas that have been drawn around the existing and new primary schools and the public transport access points. These have once again been projected on the building entrances where young school-aged children were living, like shown in figure 191. The results of this analysis are shown in figure 190. The potential ability to walk to primary school has increased from 6175 to 6640 young school-aged children, which is an increase of 465, from who 211 now also gain potential accessibility to primary school by public transport. The potential ability to cycle to primary school, without the ability to walk, has increased from 6120 to 6416 young school-aged children, which is an



increase of 296, from who 150 now also gain potential accessibility to primary school by public transport. From the 1141 young school-aged children that were reliant on the car to travel to school, only 380 still are, from who 228 also have potential accessibility to primary school by public transport. This means a reduction of 761 young school-aged children that are now able to walk or cycle to primary school. There are still 152 young school-aged children that are reliant on the car to travel to school.



LEGEND

- PRIMARY SCHOOL
- PRIVATE CAR
- PUBLIC TRANSPORT
- CYCLING
- CYCLING/ PUBLIC TRANSPORT
- WALKING/ CYCLING
- WALKING/ CYCLING/ PUBLIC TRANSPORT
- ODER RIVER/ CANALS
- WALKING NETWORK
- MAP BACKGROUND

Scale: 1: 125,000

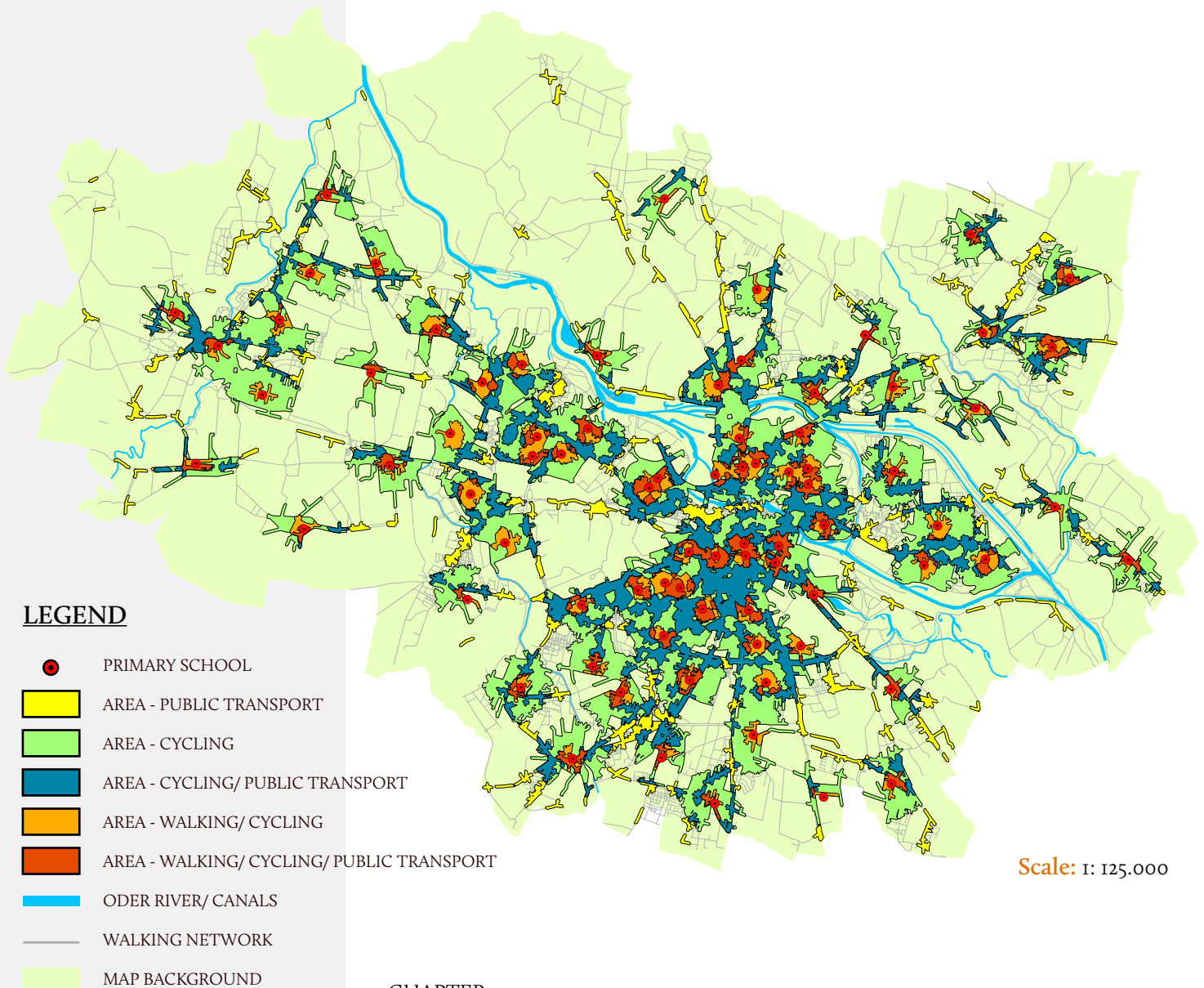
192. Description in the text

193. Description in the text.

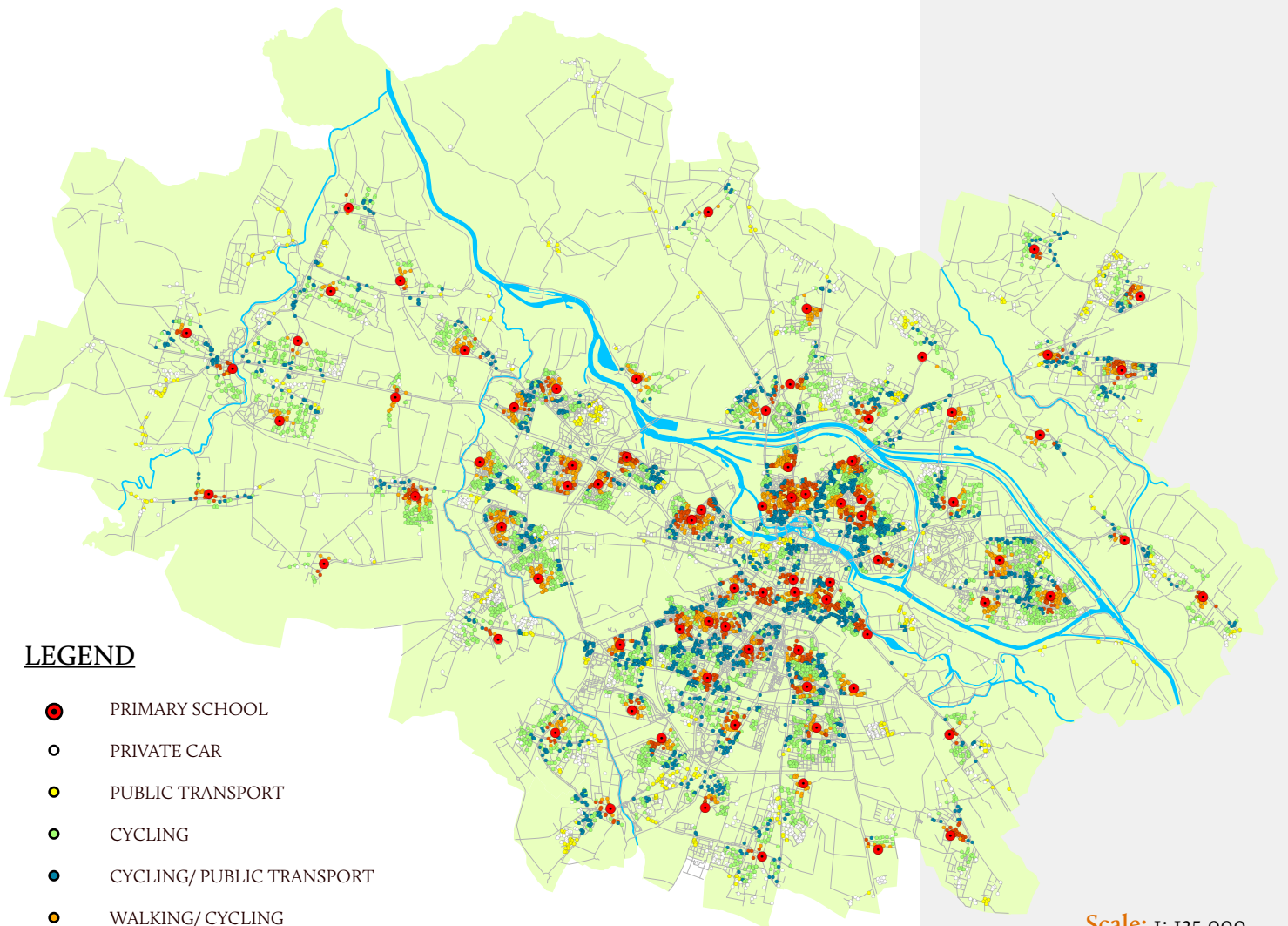
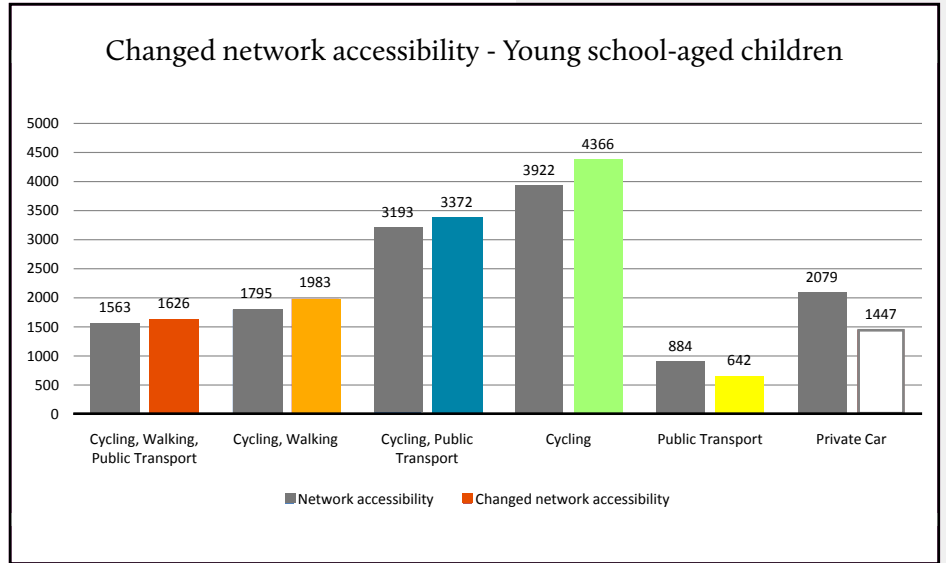
194. Description in the text.

5.3.2 NETWORK ACCESSIBILITY

Due to the new potential accessibility, young school-aged children's network accessibility has changed as well. Many of them have been provided with the potential ability to walk or cycle to primary school, from who many have also gained network accessibility to primary school. Figure 192 shows the new network accessibility catchment areas that have been created. These have been projected on the building entrances where young school-aged children were living, which is shown in figure 194. The results of this analysis are shown in figure 193. The ability to walk to primary school has increased from 2358 to 2609 young school-aged children, which is an increase of 251, from who 63 now also gain potential accessibility to primary school by public transport. The ability for young school-aged children to cycle to primary school, without being able to walk, has increased from 7115 to 7738, which is an increase of 623 children, from



who 179 now also gain accessibility to public transport access points. From the 2963 young school-aged children that were reliant on the car to travel to primary school, only 2089 preschoolers still are, from who 642 also gain potential accessibility to primary school by public transport. This means a reduction of 874. There are still 1447 young school-aged children that are reliant on the car, for whom the ability to walk or cycle to primary school will be improved by the interventions in this paragraph.



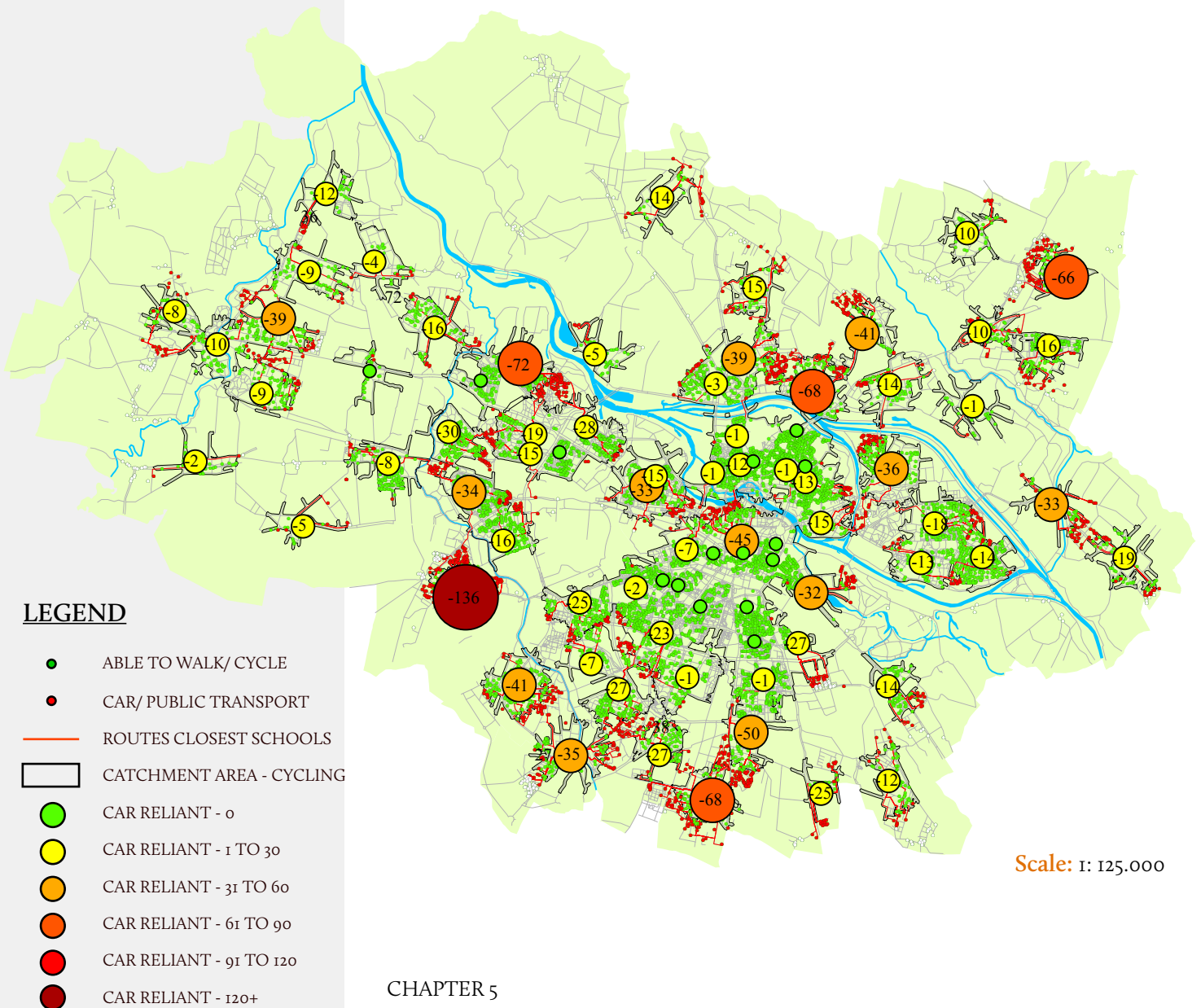
LEGEND

- PRIMARY SCHOOL
- PRIVATE CAR
- PUBLIC TRANSPORT
- CYCLING
- CYCLING/ PUBLIC TRANSPORT
- WALKING/ CYCLING
- WALKING/ CYCLING/ PUBLIC TRANSPORT
- ODER RIVER/ CANALS
- WALKING NETWORK
- MAP BACKGROUND

Scale: 1: 125,000

► Closest facility analysis

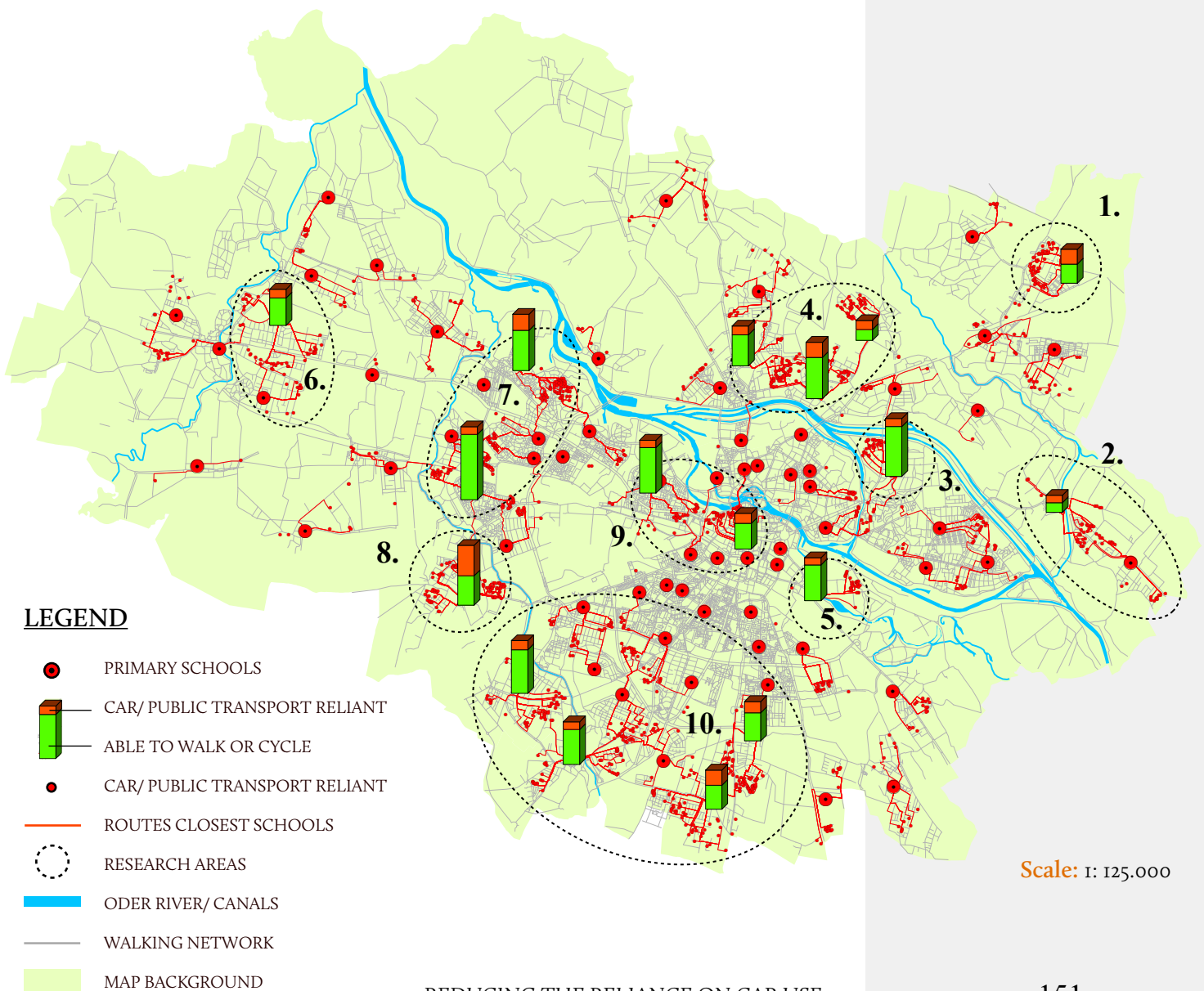
Figure 195 shows the closest facility analysis that has been carried out for young school-aged children's network accessibility to primary school. The shortest routes between the homes of young school-aged children and primary schools have been measured and defined. Only those routes where they did not have network accessibility by bicycle or foot have been drawn in figure 197. The young school-aged children that did not have network accessibility have been projected on the closest primary schools, where-with 17 primary schools have been selected to research. Figure 197 shows that with this selection, the aim is to reduce the 1709 young school-aged children (2089 total - 380 potential) that were reliant on car use or public transport at the end of 2005 with 868. Figure 196 shows that the primary schools to research have been divided over 10 research areas where interventions in the network directness or spreading of schools are needed.



District name	# kindergartens	# preschoolers	# car reliant
1 Psie Pole	1	152	66
2 Swojszyce	1	76	33
3 Szczytnika	1	259	36
4 Karłowice	3	520	148
5 Oławskie	1	192	32
6 Lesnica	1	162	39
7 Nowy Dwor	2	579	106
8 Muchobor	1	268	136
9 Szczepin	2	397	78
10 Krzyki	4	778	194
TOTAL	17	3383	868

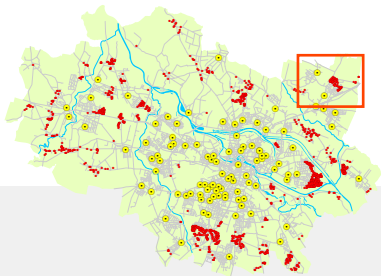
196. Description in the text

197. Description in the text

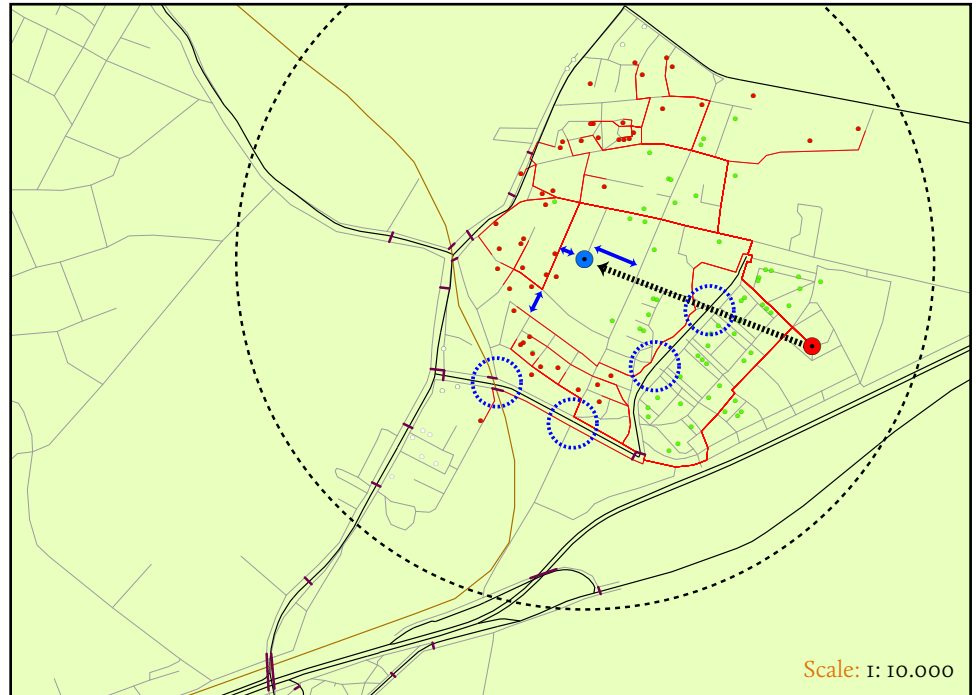


► The proposed interventions

- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest primary school
- Primary school
- Traffic intense road
- Crossing of a barrier
- Train line
- Primary school - moved
- Crossing - new
- ↔ Connection - new

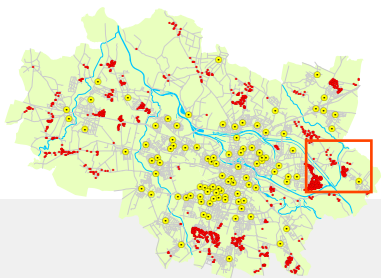


Area 1. Wrocław Psie Pole

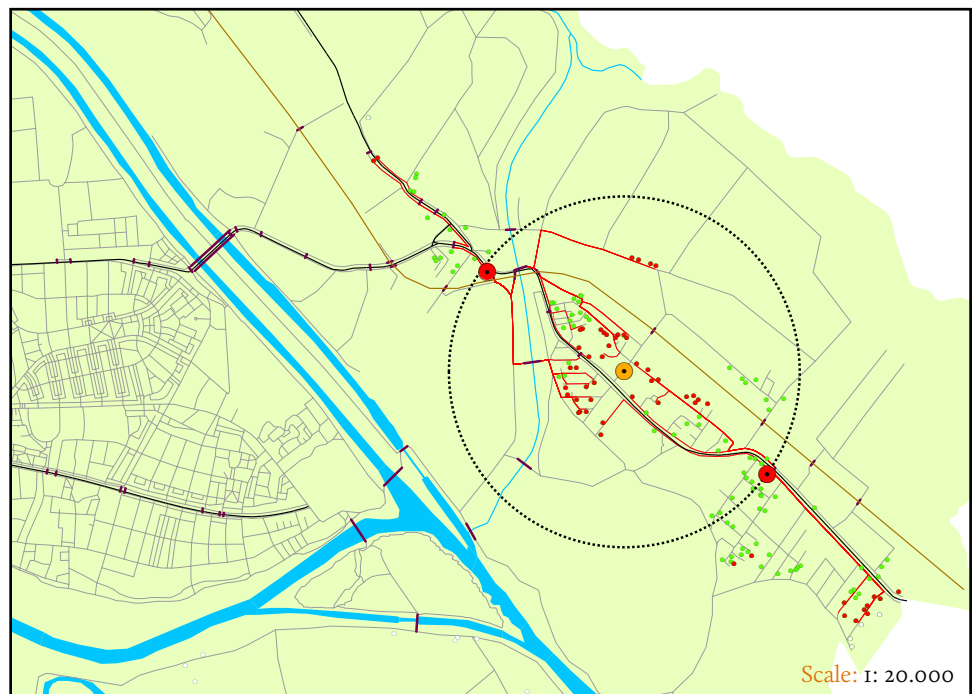


198. In the Psie Pole district, 66 young school-aged children do not have network accessibility to primary school by bicycle or foot. Network accessibility can be provided by relocating the primary school and increasing the directness of the walking and cycling network. This imposes the construction of 3 new bicycle paths and 4 new crossing facilities.

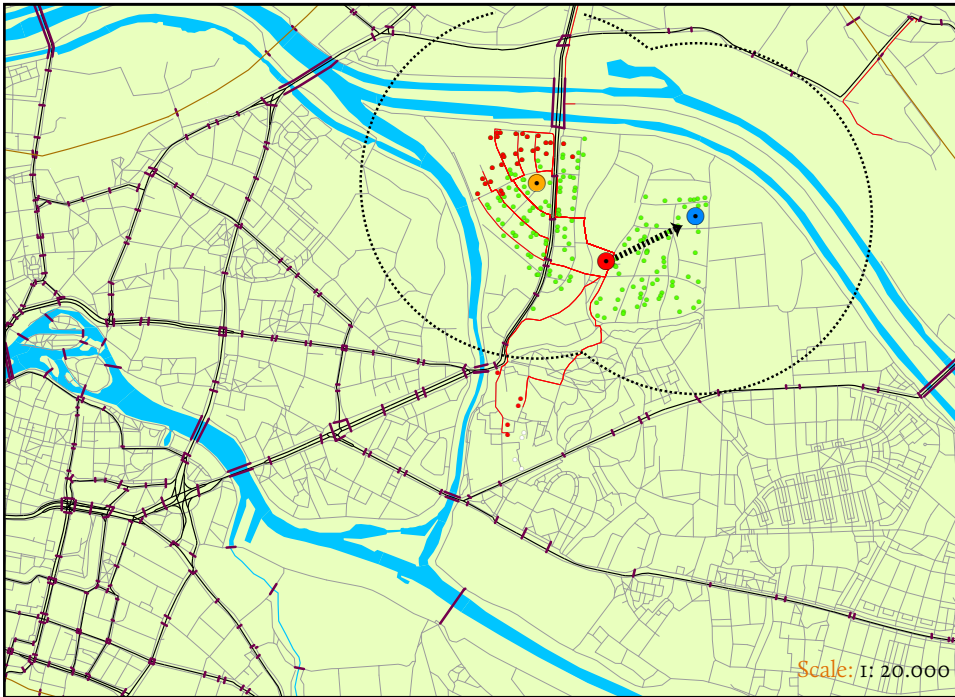
- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest primary school
- Primary school
- Traffic intense road
- Crossing of a barrier
- Train line
- Primary school - new



Area 2. Wrocław Swojszyce

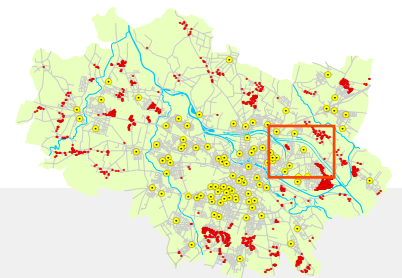


199. In the Swojszyce district, 33 young school-aged children do not have network accessibility to primary school by bicycle or foot. Network accessibility can be provided by the provision of a new primary school. Interventions in the network directness will have no effect. And due to the elongated urban structure, other primary schools in the district cannot be relocated.

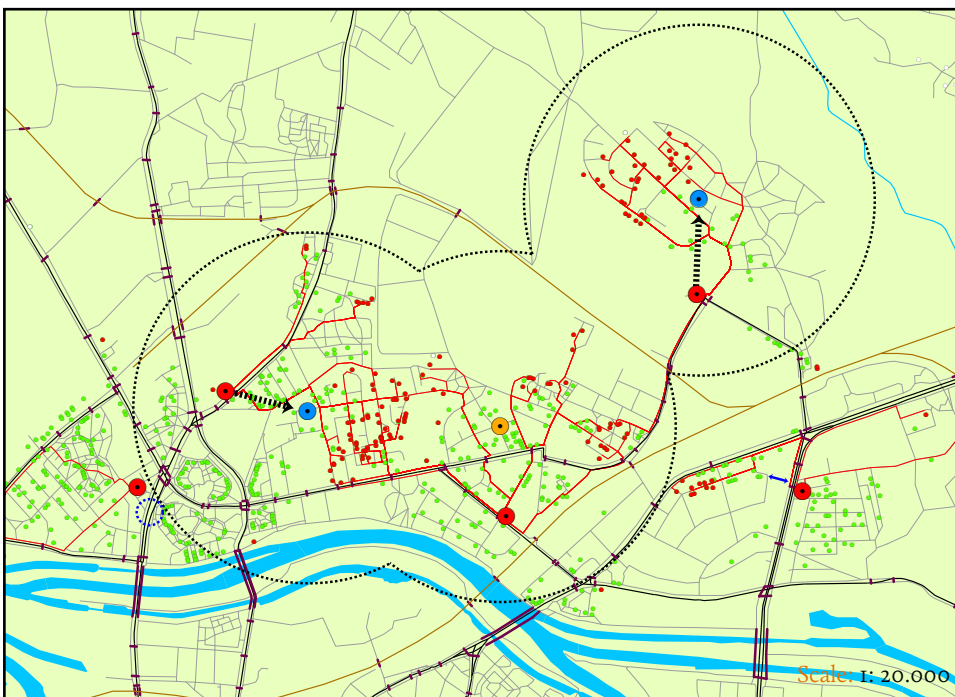


200. In the Szczytznika district, 36 young school-aged children do not have network accessibility to primary school by bicycle or foot. Network accessibility can be provided by relocating the nearest primary school and providing 1 new primary school, which is done without a loss of accessibility. Interventions in the network directness will not be effective.

- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest primary school
- Primary school
- Traffic intense road
- Crossing of a barrier
- Train line
- Primary school - new
- Primary school - moved

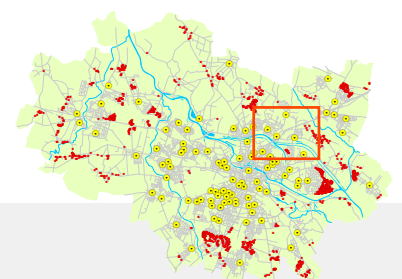


Area 3. Wrocław Szczytznika



201. In the Karłowice district, 148 young school-aged children do not have network accessibility to primary school by bicycle or foot. Network accessibility can be provided by increasing the directness of the walking network, by the construction of a new bicycle paths and crossing facility. But also, 2 primary schools need to be relocated and 1 school needs to be added.

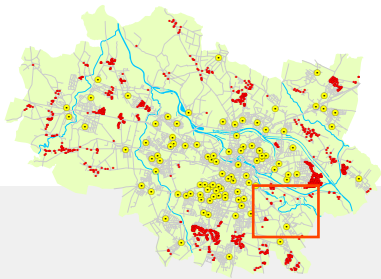
- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest kindergarten
- Primary school
- Traffic intense road
- Crossing of a barrier
- Train line
- Primary school - new
- Primary school - moved
- Crossing - new
- ↔ Connection - new



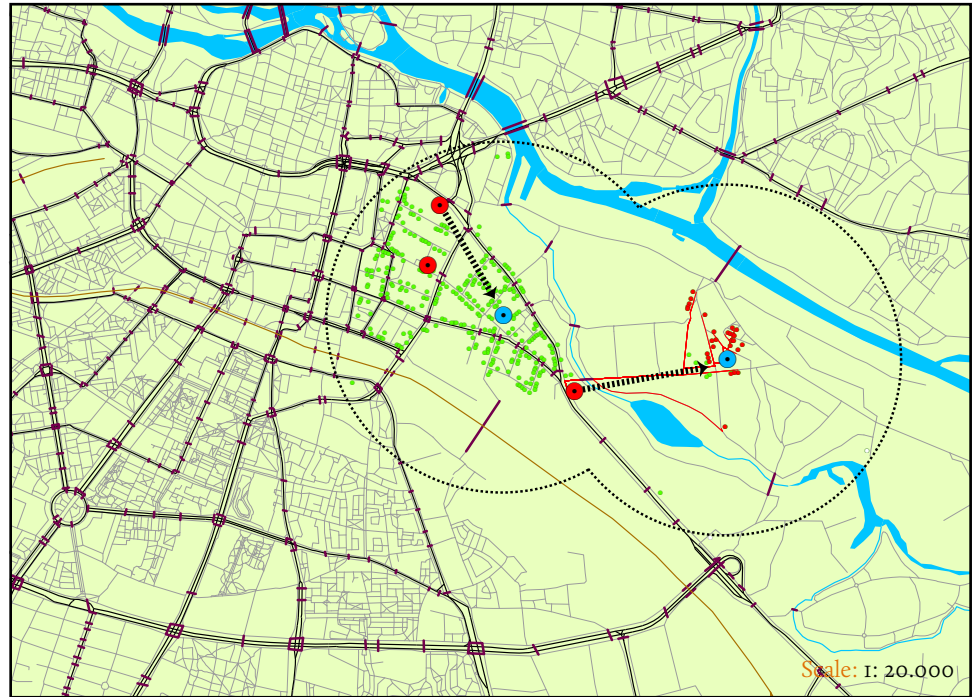
Area 4. Wrocław Karłowice



- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest primary school
- Primary school
- Traffic intense road
- Crossing of a barrier
- Train line
- Primary school - moved

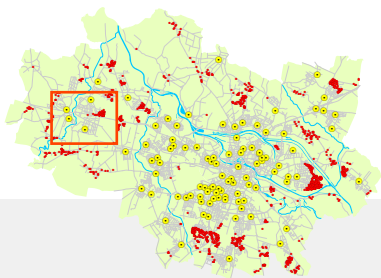


Area 5. Wrocław Oławskie

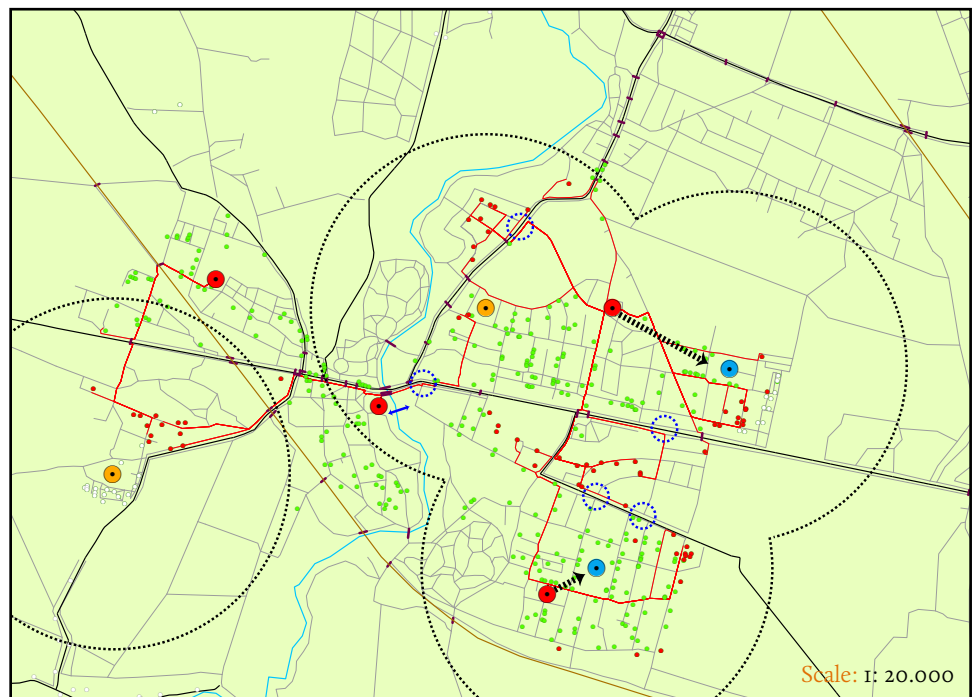


202. In the Oławskie district, 32 young school-aged children do not have network accessibility to primary school by bicycle or foot. Interventions in the network directness will have no effect. Therefore, the nearest primary school will be moved, as well as an alternative school, wherewith there will be no loss of network accessibility for young school-aged children.

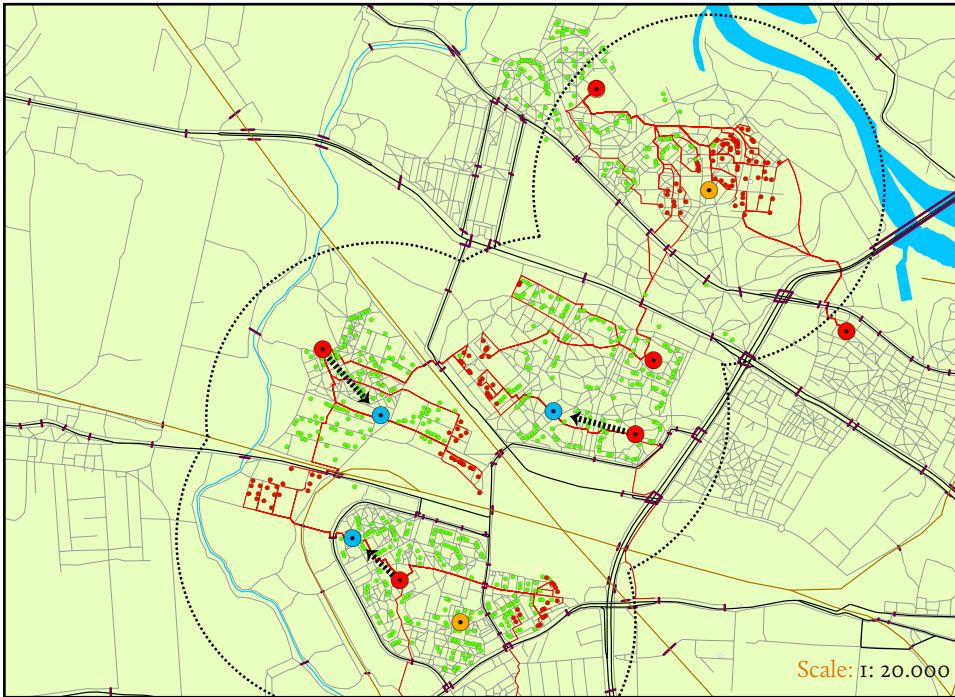
- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest primary school
- Primary school
- Traffic intense road
- Crossing of a barrier
- Train line
- Primary school - new
- Crossing - new
- ↔ Connection - new



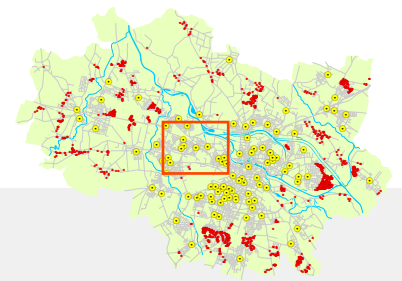
Area 6. Wrocław Lesnica



203. In the Lesnica district, 39 young school-aged children do not have network accessibility to primary school by bicycle or foot. Interventions in the network directness are needed in the form of a new bicycle path and 5 new crossing facilities. But also, 2 primary schools can be relocated without a loss of accessibility and 2 new primary schools need to be provided.

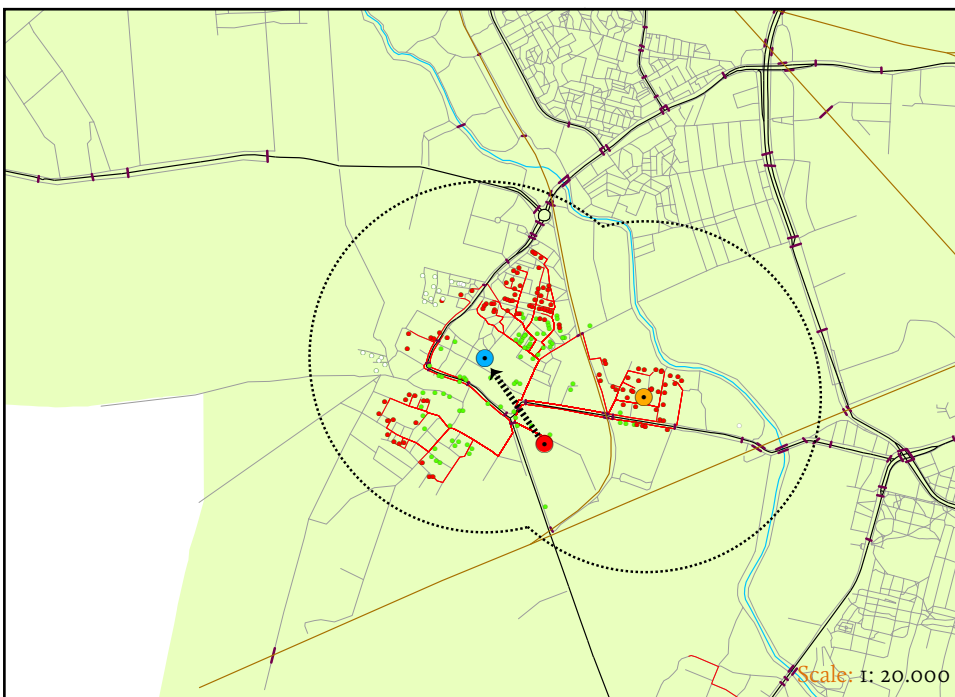


- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest primary school
- Primary school
- Traffic intense road
- Crossing of a barrier
- Train line
- Primary school - new
- Primary school - moved

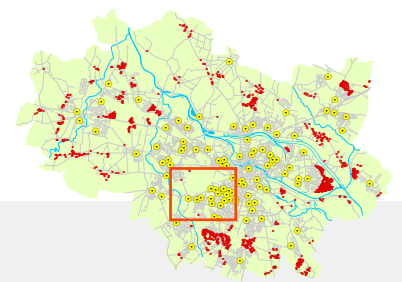


Area 7. Wrocław Nowy Dwor

204. In the Nowy Dwor district, 106 young school-aged children do not have network accessibility to primary school by bicycle or foot. Interventions in the network directness will not be effective. Therefore, the spreading of primary school is improved by the relocation of 3 primary schools, without a loss of accessibility and the provision of 2 new primary schools.



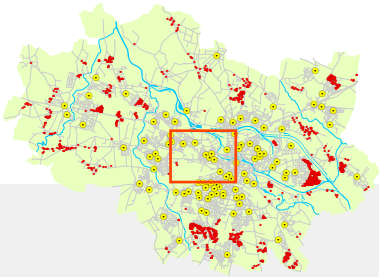
- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest kindergarten
- Primary school
- Traffic intense road
- Crossing of a barrier
- Train line
- Primary school - new
- Primary school - moved



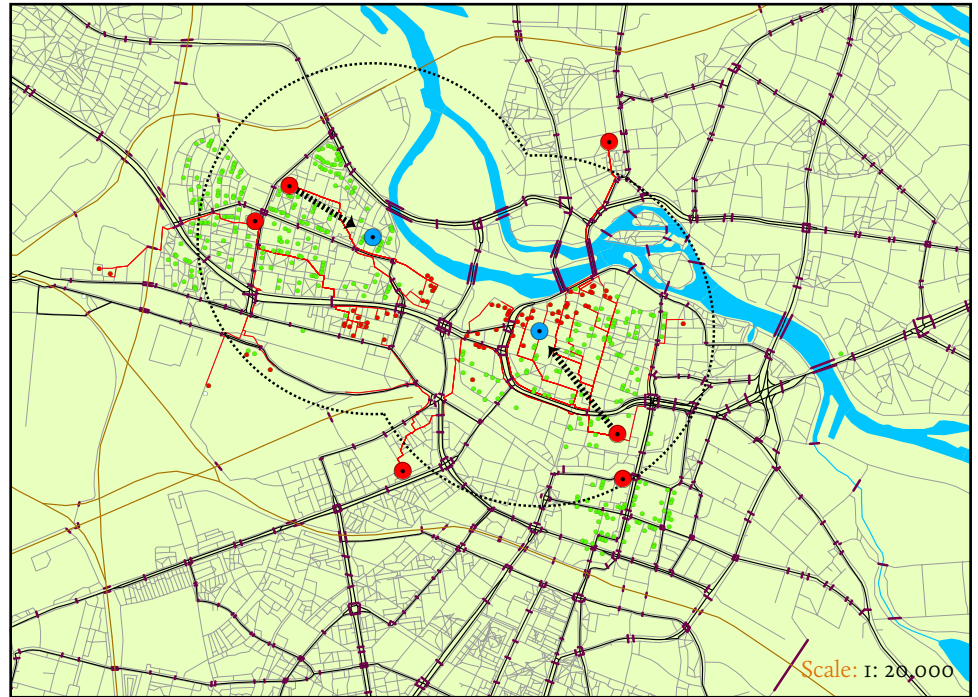
Area 8. Wrocław Muchobor Mały

205. In the Muchobor Mały district, 136 young school-aged children do not have network accessibility to primary school by bicycle or foot. Interventions in the network directness will be not effective. Therefore, the spreading of schools is improved by the relocation of the nearest primary school, without a loss of accessibility and the provision of 1 new school.

- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest primary school
- Primary school
- Traffic intense road
- Crossing of a barrier
- Train line
- Primary school - moved

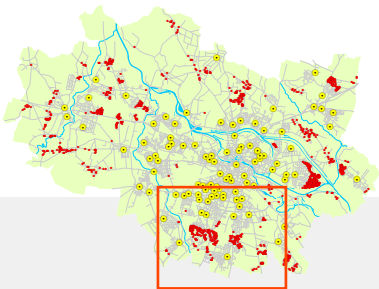


Area 9. Wrocław Szczepin

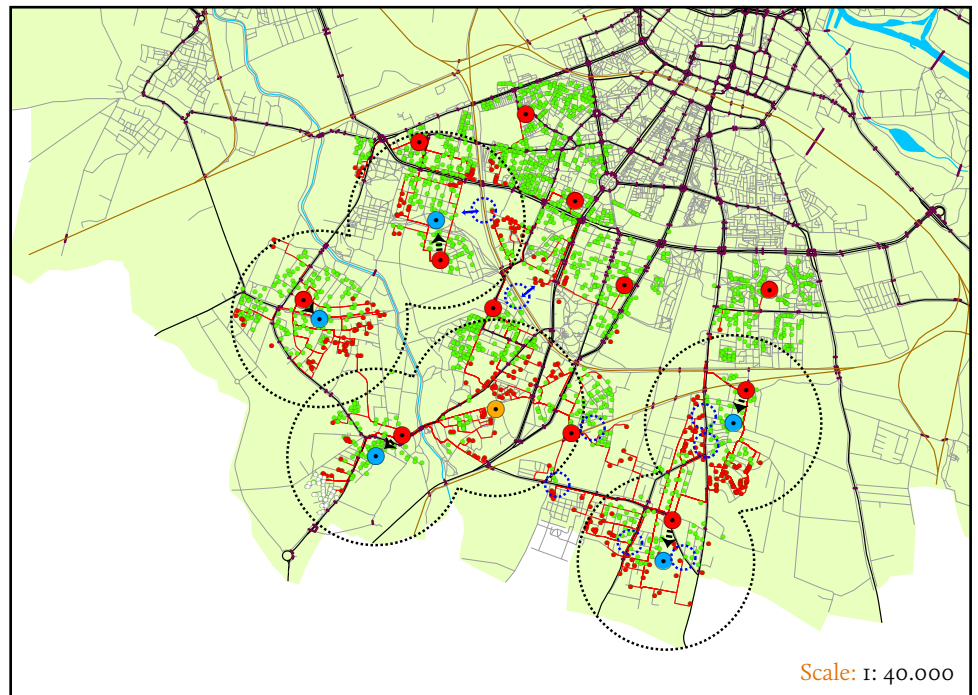


206. In the Szczepin district, 78 young school-aged children do not have network accessibility to primary school by bicycle or foot. Interventions in the directness of the walking or cycling network will have no result. Therefore, the nearest two primary schools will be relocated, which can be done without a loss of network accessibility for young school-aged children.

- Car/ Public transport users
- Walking/ Cycling users
- Routes - Closest primary school
- Primary school
- Traffic intense road
- Crossing of a barrier
- Train line
- Primary school - new
- Primary school - moved
- Crossing - new
- ↔ Connection - new



Area 10. Wrocław Krzyki

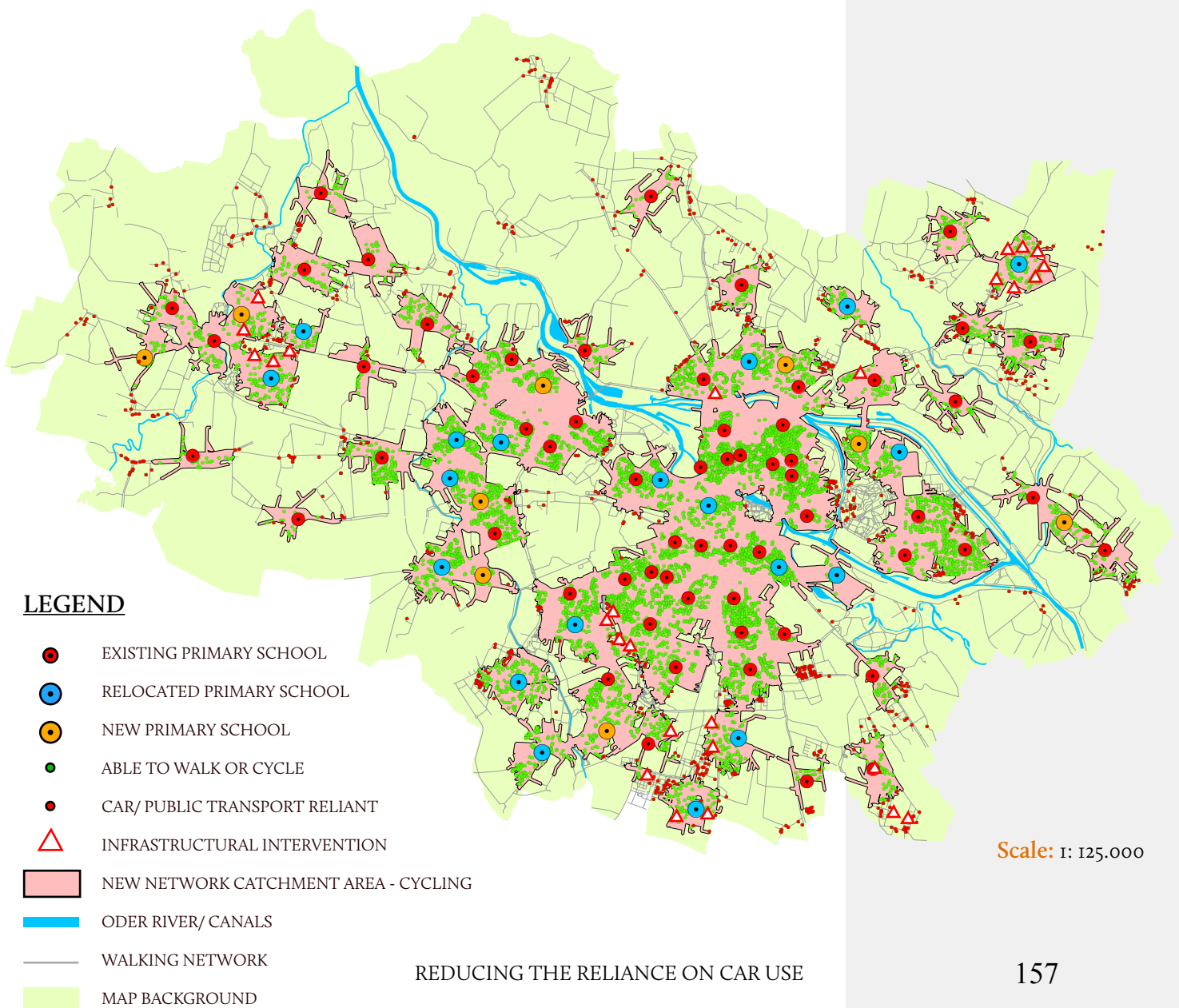


207. In the Krzyki district, 194 young school-aged children do not have network accessibility to primary school by bicycle or foot. Interventions in the network directness are needed in the form of 2 new walking paths and 8 new crossing facilities. But also the spreading of schools changes with the relocation of 5 schools and the provision of 1 new primary school.

► **The interventions implemented**

208. Description in the text

The interventions that have been proposed in the 10 different analyses are shown in figure 208. In total, 18 primary schools have been relocated and 9 new primary schools have been provided. The new network catchment area for cycling has been drawn around the 89 primary schools (67 existing and 13+9 new), which has been projected on the entrances of buildings where young school-aged children were living. The amount of children that were reliant on car use or public transport in 2005 has been reduced from 2089 to 1091, which is a reduction of 998 young school-aged children that are now able to walk or cycle to kindergarten. The aim was to reduce this amount with 868 young school-aged children, but in the analyses several primary school that were not counted within this aim have been analyzed as well. From the 1091 children that are not able to walk or cycle to primary school, around 300 do not have potential accessibility.



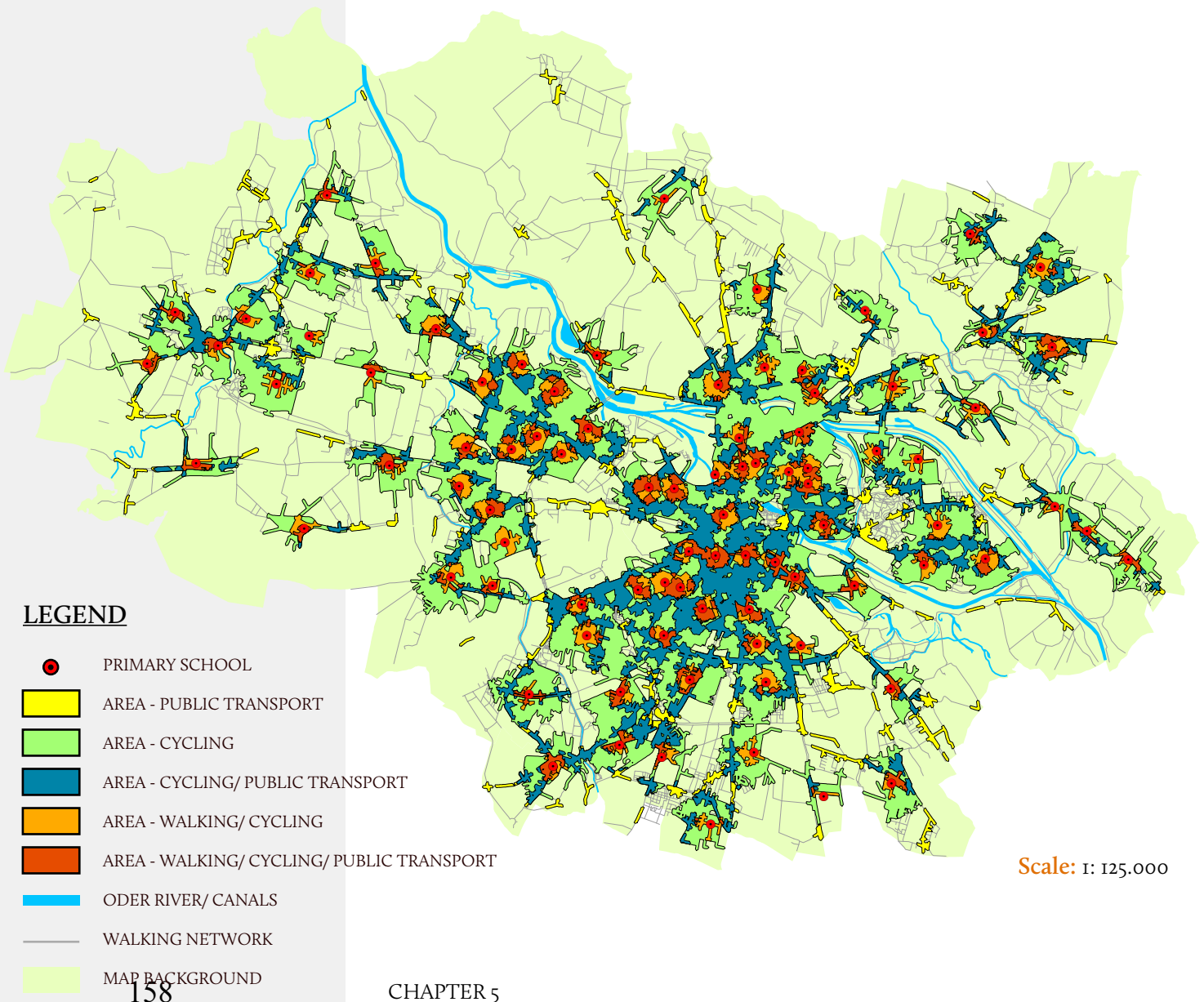
209. Description in the text

210. Description in the text.

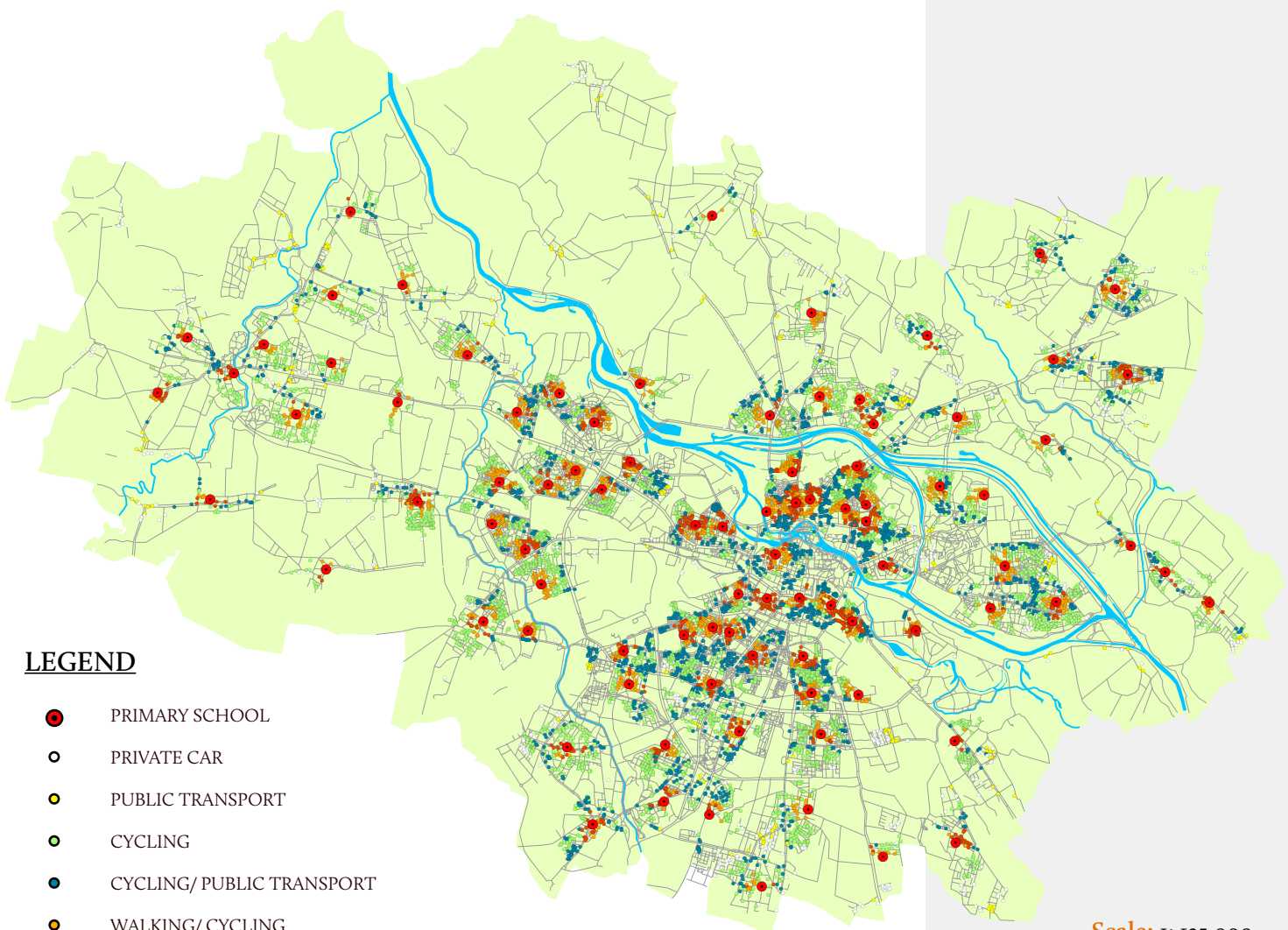
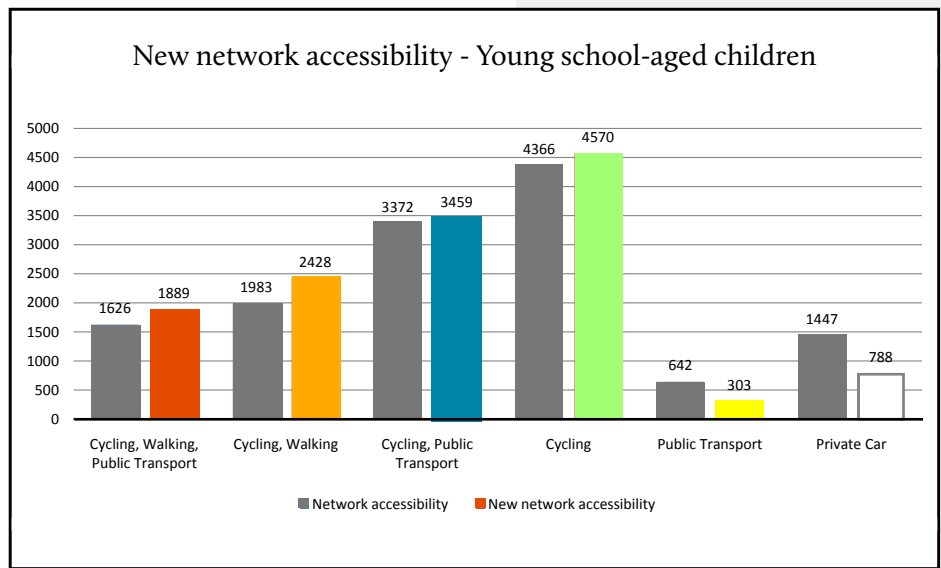
211. Description in the text.

► New network accessibility

Due to the implemented interventions, the new network accessibility to primary school has not only changed the need for young school-aged children to travel by car, but also their ability to travel by foot, bicycle or public transport. Figure 209 shows the new catchment areas that have been created around the existing and new primary schools and the public transport access points. These have once again been projected on the building entrances where young school-aged children were living, like shown in figure 211. The results of this analysis are shown in figure 210. The ability to walk to primary school has increased from 3619 to 4317 young school-aged children, which is an increase of 698 children, from who 263 have gained network accessibility to primary school by public transport. The ability to cycle to primary school, without the ability to walk, has increased from 7738 to 8029 young school-aged children, which is an increase of 291, from



who 87 now also gain network accessibility to primary school by public transport. From the 2089 young school-aged children that were reliant on the car to travel to primary school, only 1091 still are, from who 303 also have network accessibility to primary school by public transport. This means a reduction of 998 young school-aged children that are now able to walk or cycle to school. There are still 778 young school-aged children that are reliant on the car to travel to primary school.



LEGEND

- PRIMARY SCHOOL
- PRIVATE CAR
- PUBLIC TRANSPORT
- CYCLING
- CYCLING/ PUBLIC TRANSPORT
- WALKING/ CYCLING
- WALKING/ CYCLING/ PUBLIC TRANSPORT
- ODER RIVER/ CANALS
- WALKING NETWORK
- MAP BACKGROUND

Scale: 1: 125,000

5.3.3 ADJUSTED NETWORK ACCESSIBILITY

5.4 OLDER SCHOOL-AGED CHILDREN

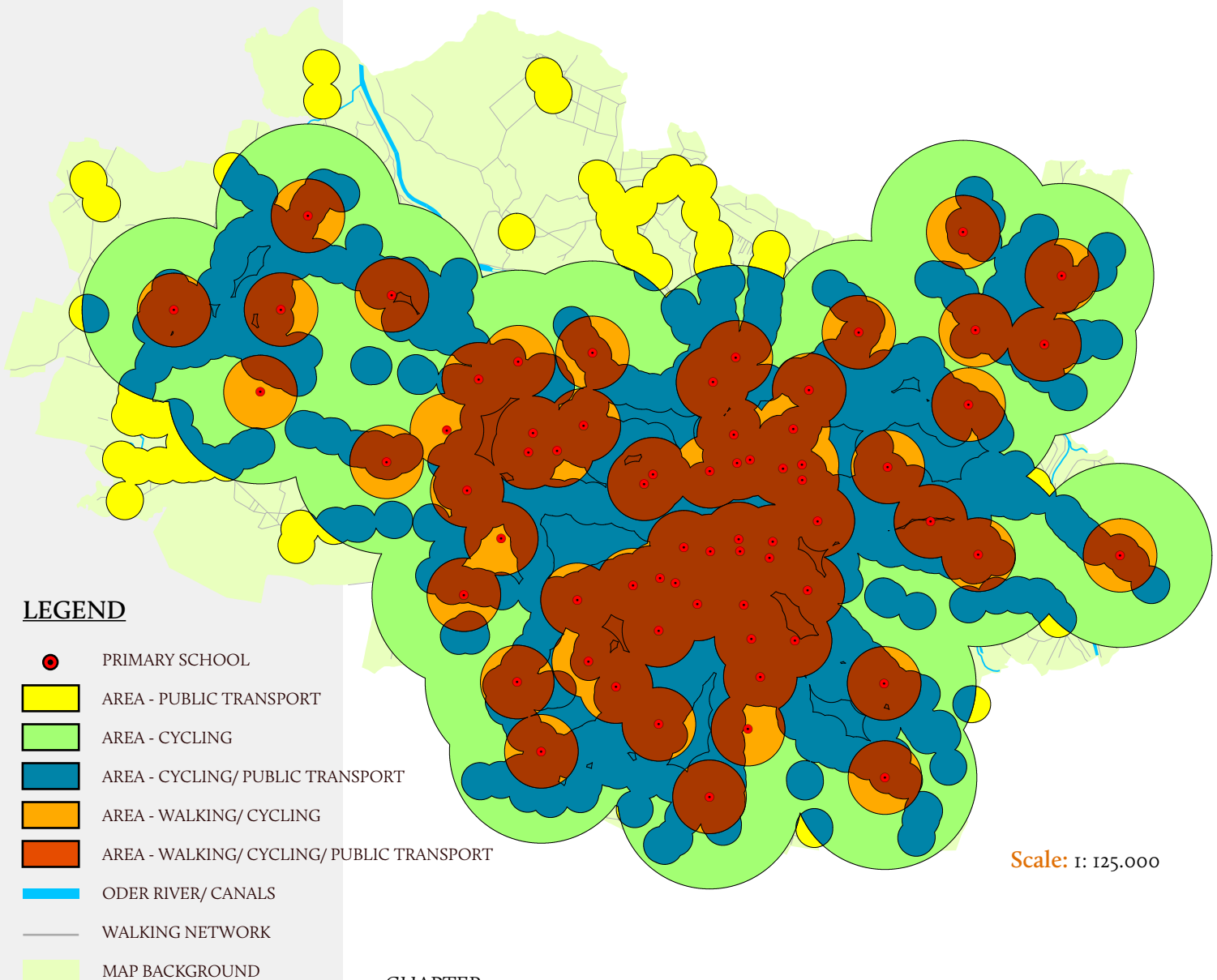
220. Description in the text

221. Description in the text

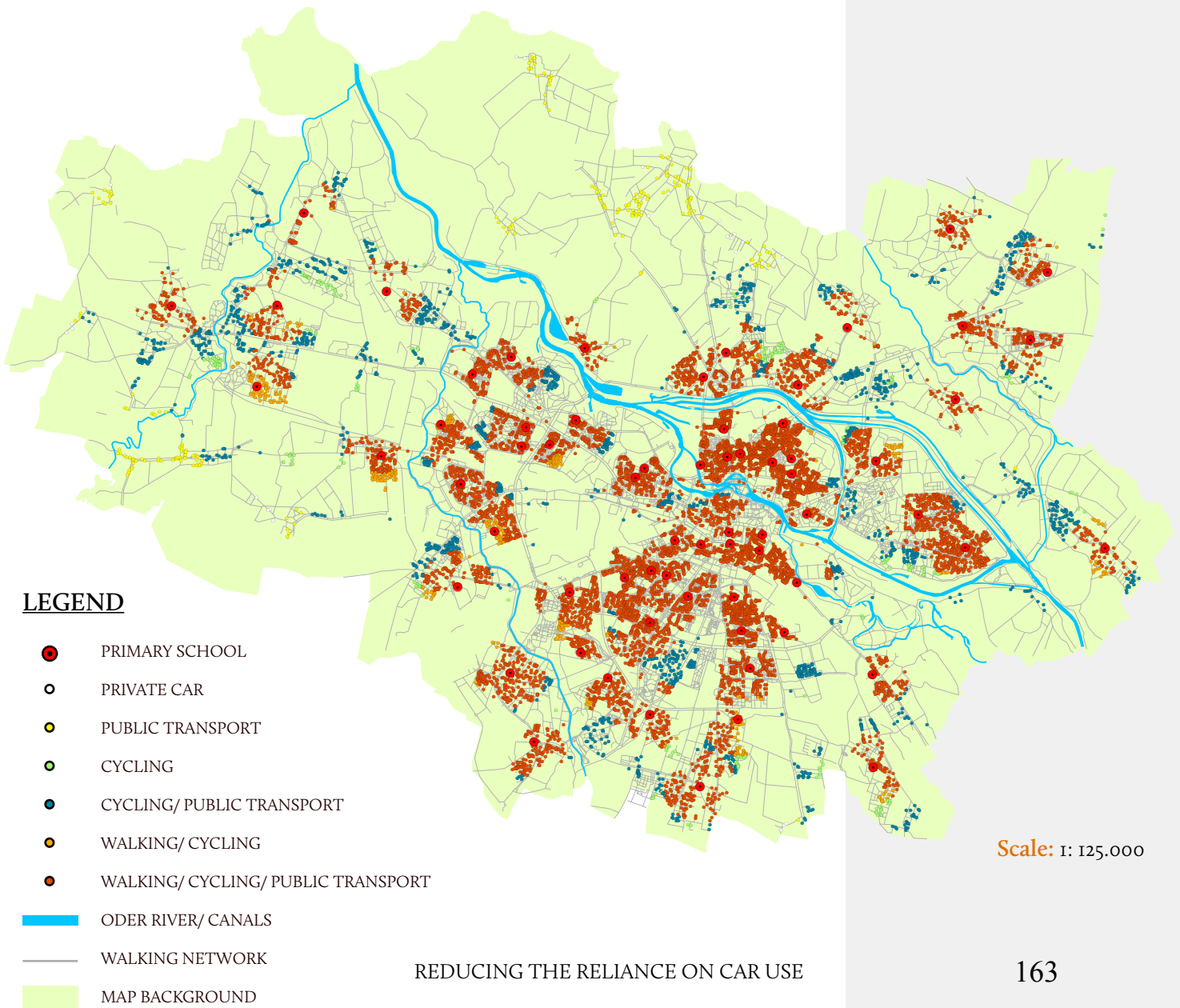
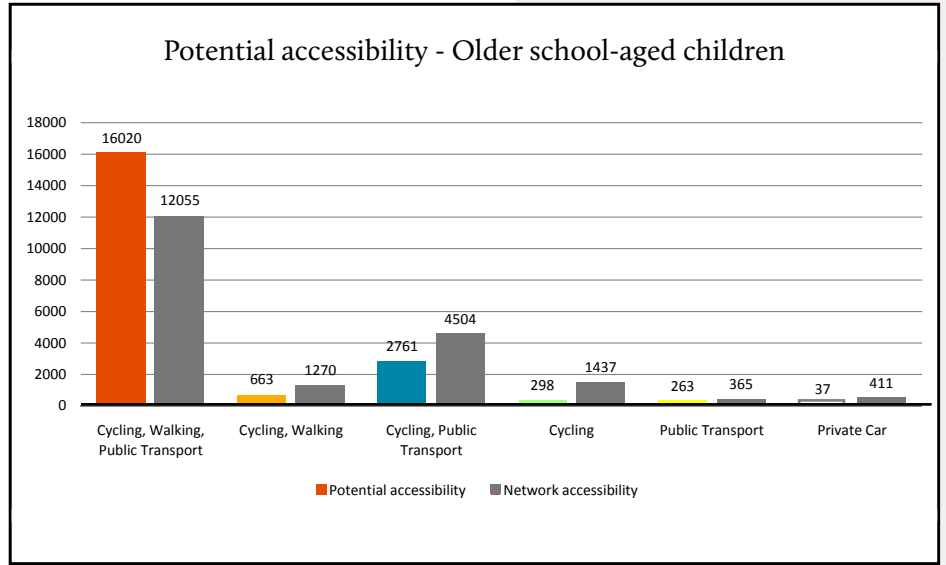
222. Description in the text

5.4.1 POTENTIAL ACCESSIBILITY

Figure 220 shows the potential accessibility catchment areas that have been created for older school-aged children. These are buffers of 800 meters for walking and 2000 meters for cycling around primary schools and buffers of 400 meters for walking around public transport access points. The catchment areas have been overlaid, which has resulted in the 5 catchment areas. Figure 222 shows the projection of the catchment areas on the entrances of houses and building where older school-aged children were living at the end of 2005. The results are shown in figure 221. From the 20042 older school-aged children that lived in Wrocław, 16683 (83,2%) were in potential able to travel by foot and by bicycle to primary school, from who 16020 were also able to walk to public transport access points within these constraints. 3059 (15,3%) older school-aged children were in potential able to travel by bicycle to primary school, but not by foot, from

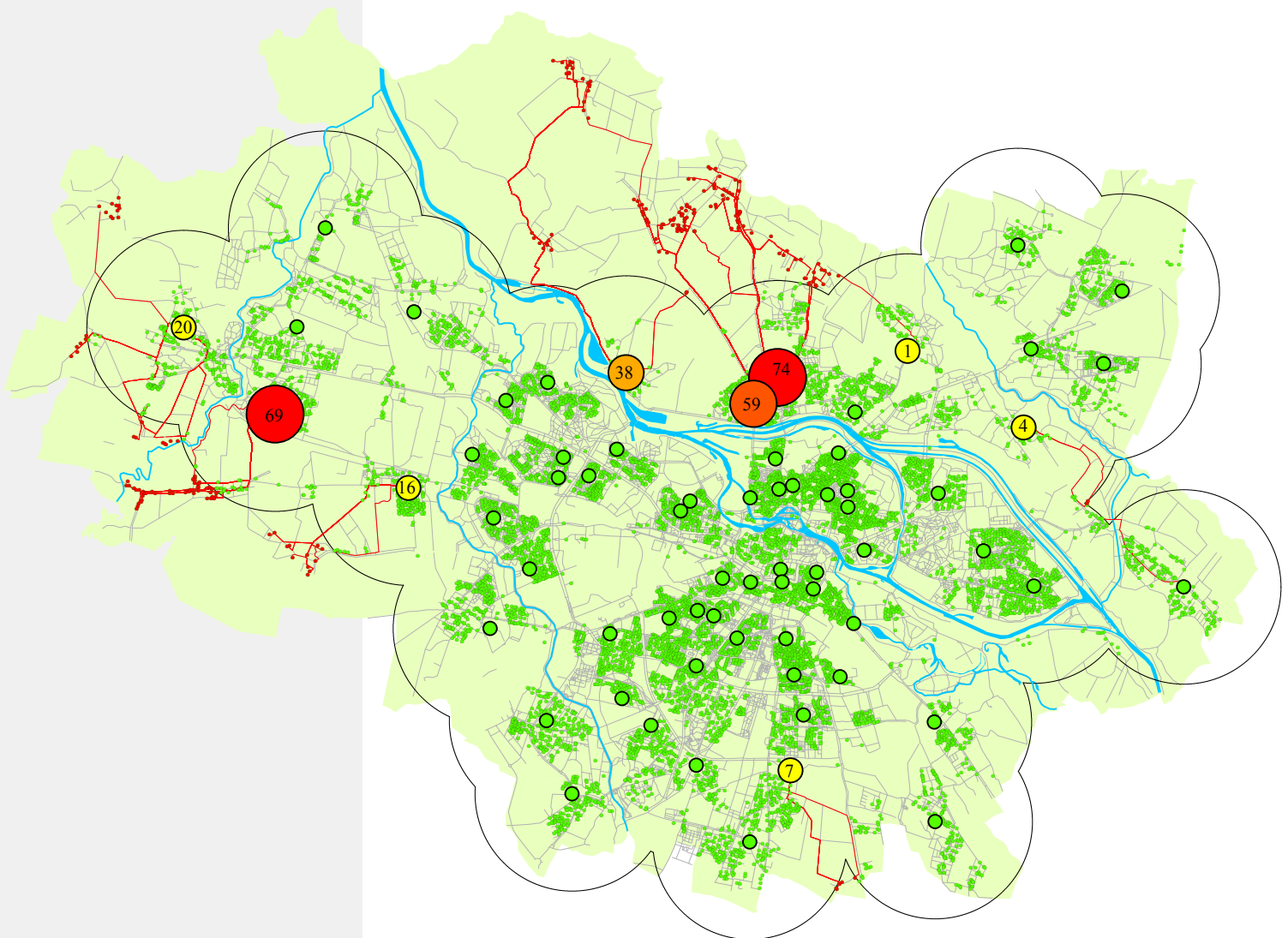


who 2761 were also able to walk to public transport access points. And 300 (1,5%) older school-aged children were in potential not able to travel by bicycle, nor by foot to primary school from who 263 were able to walk to public transport access points. The conclusion is that 37 (0,2%) older school-aged children were in potential reliant on the car to travel to primary school, which leaves 274 older school-aged children that were reliant on the car to travel to primary school by a lack of network accessibility.



► Closest facility analysis

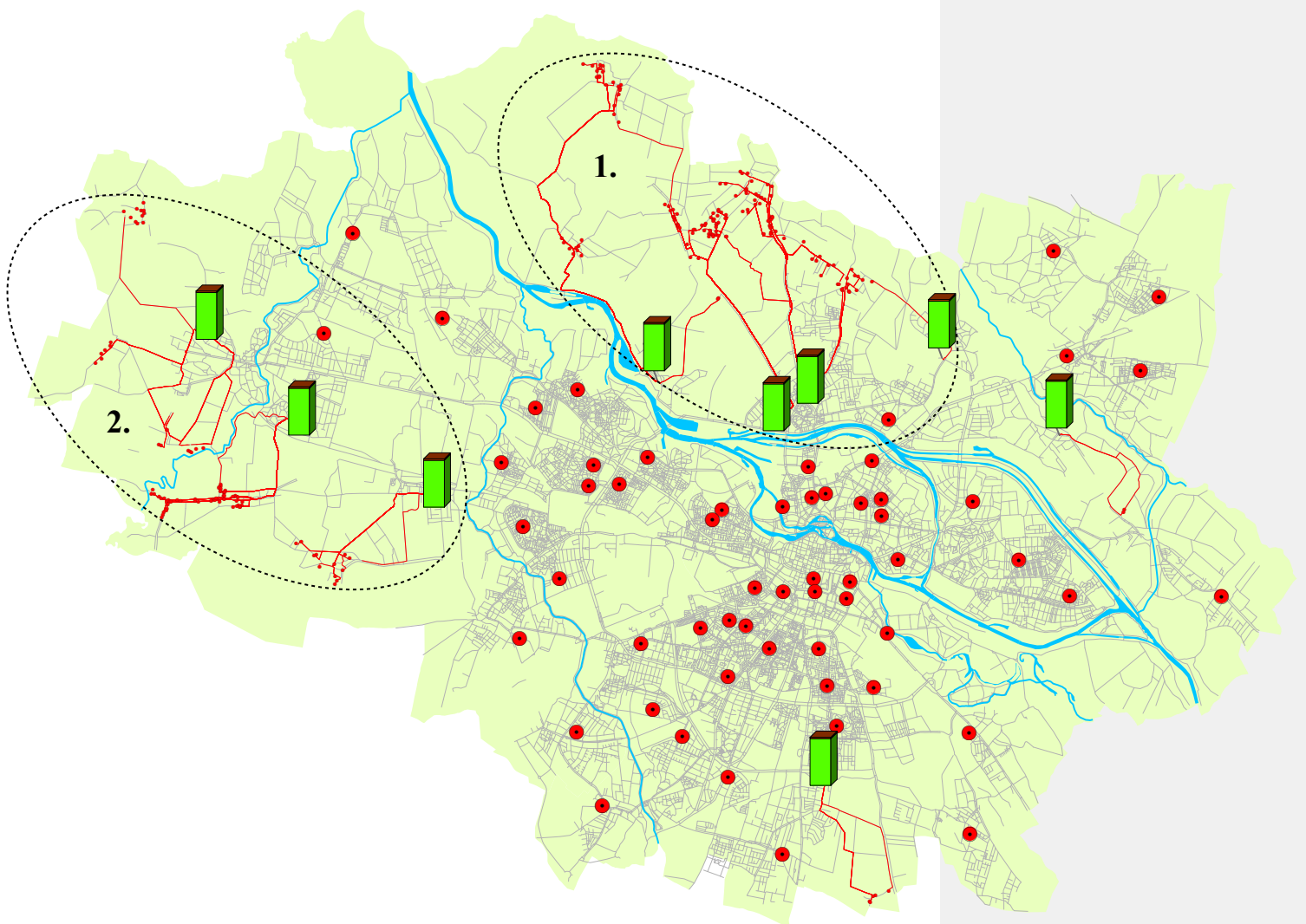
Figure 223 shows the closest facility analysis that has been carried out for older school-aged children's potential accessibility to primary school. The shortest routes between their homes and primary schools have been measured and defined. Only those routes where they did not have potential accessibility by bicycle or foot have been drawn in figure 223. The older school-aged children that did not have potential accessibility have been projected on the closest primary schools, wherewith 7 primary schools have been selected to research. Figure 224 shows that with this selection, the aim is to reduce the 300 older school-aged children that were reliant on car use or public transport at the end of 2005 with 277. Figure 225 shows that the primary schools to research have been divided over 2 research areas where interventions in the spreading of schools are needed. The research and proposed interventions are shown in the next pages.



District name	# primary sch.	# older s.a.	# car reliant
1 Swiniary	4	895	172
2 Lesnica	3	935	105
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
TOTAL	7	1830	277

224. Description in the text

225. Description in the text



5.4.2 NETWORK ACCESSIBILITY

5.5 TEENAGERS

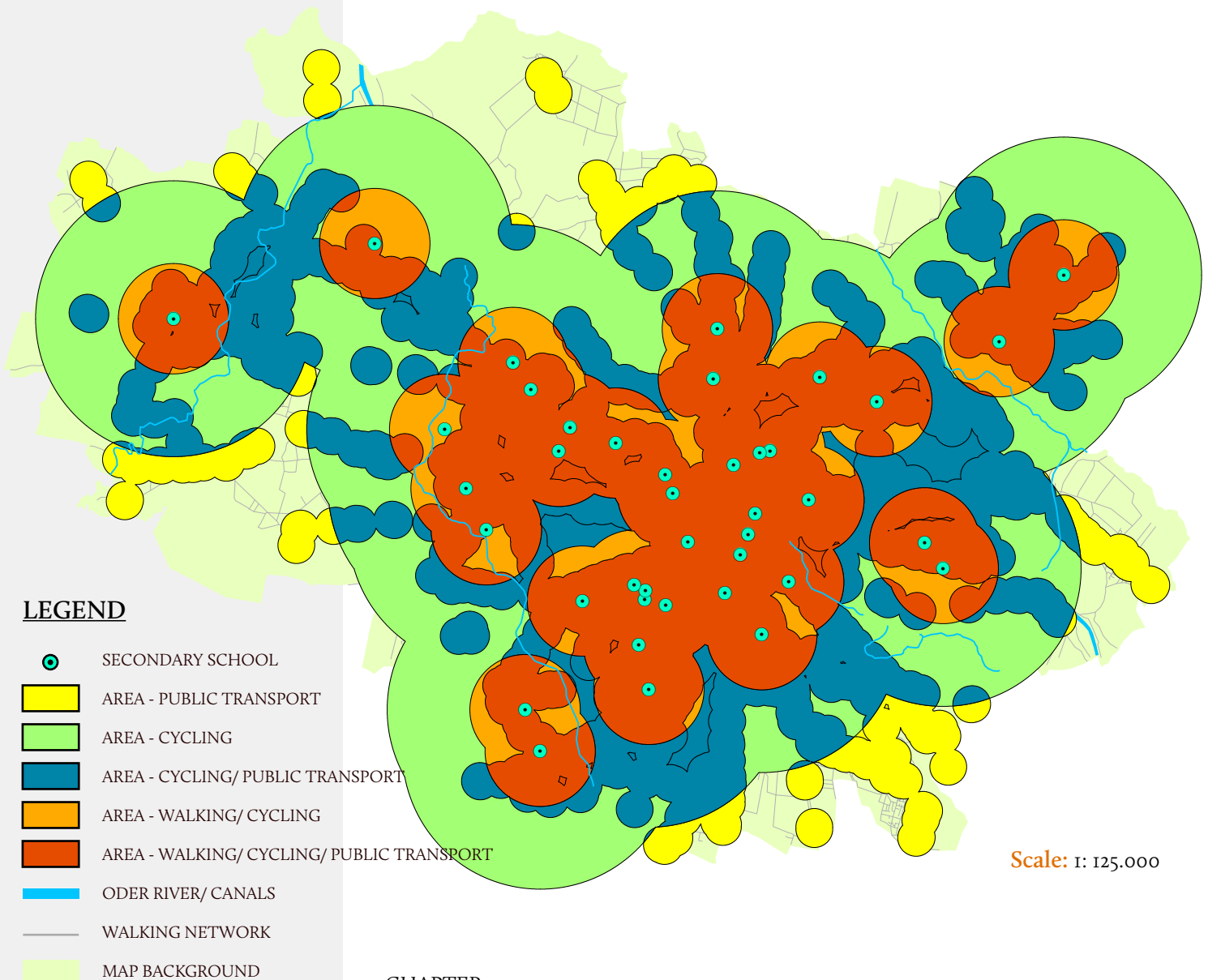
226. Description in the text

227. Description in the text

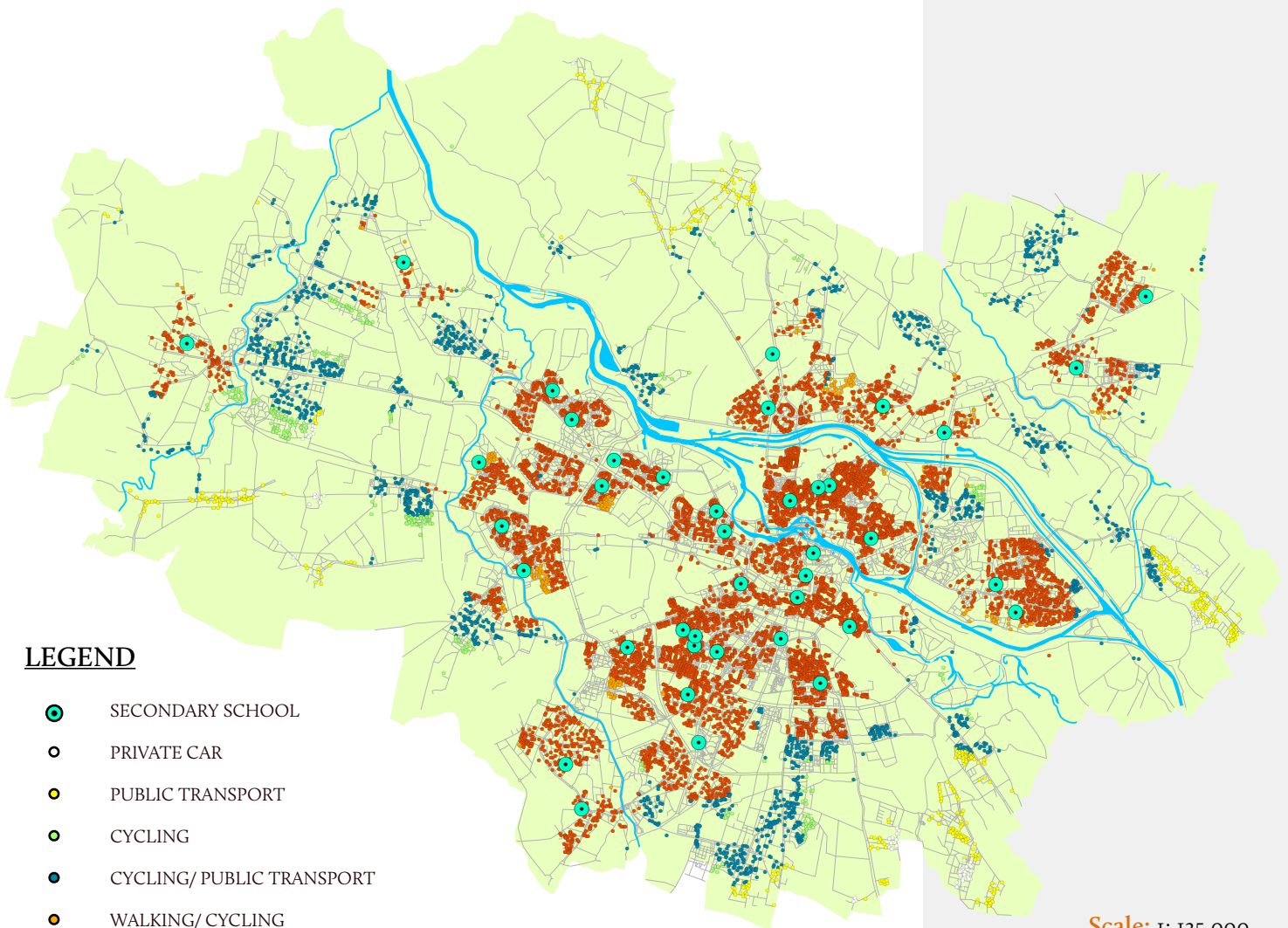
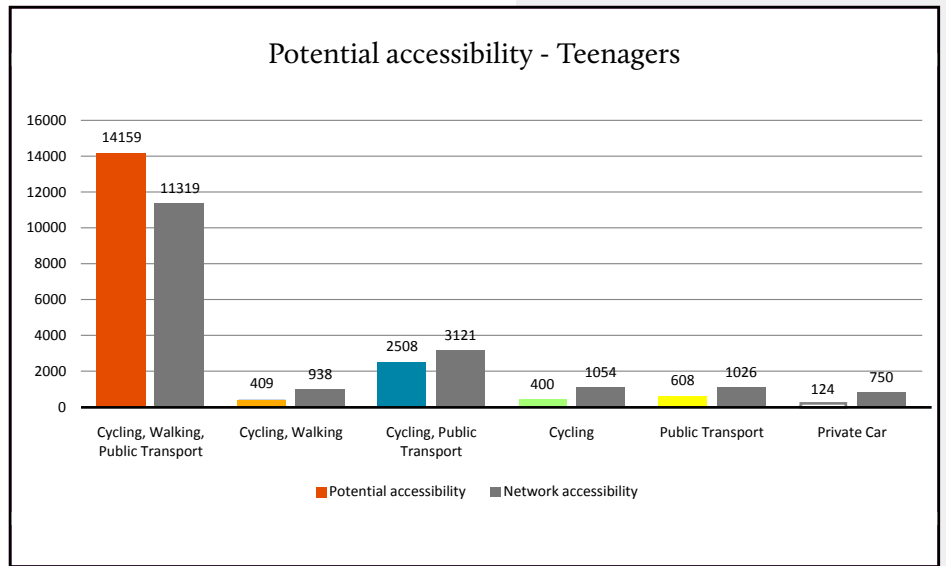
228. Description in the text

5.5.1 POTENTIAL ACCESSIBILITY

Figure 226 shows the potential accessibility catchment areas that have been created for teenagers. These are buffers of 1200 meters for walking and 3000 meters for cycling around secondary schools and buffers of 400 meters for walking around public transport access points. The catchment areas have been overlaid, which has resulted in the 5 catchment areas. Figure 228 shows the projection of the catchment areas on the entrances of houses and building where teenagers were living at the end of 2005. The results are shown in figure 227. From the 18208 teenagers that lived in Wrocław, 14568 (80,0%) were in potential able to travel by foot and by bicycle to secondary school, from who 14159 were also able to walk to public transport access points within these constraints. 2908 (16,0%) teenagers were in potential able to travel by bicycle to secondary school, but not by foot, from who 2508 were also able to walk to public transport



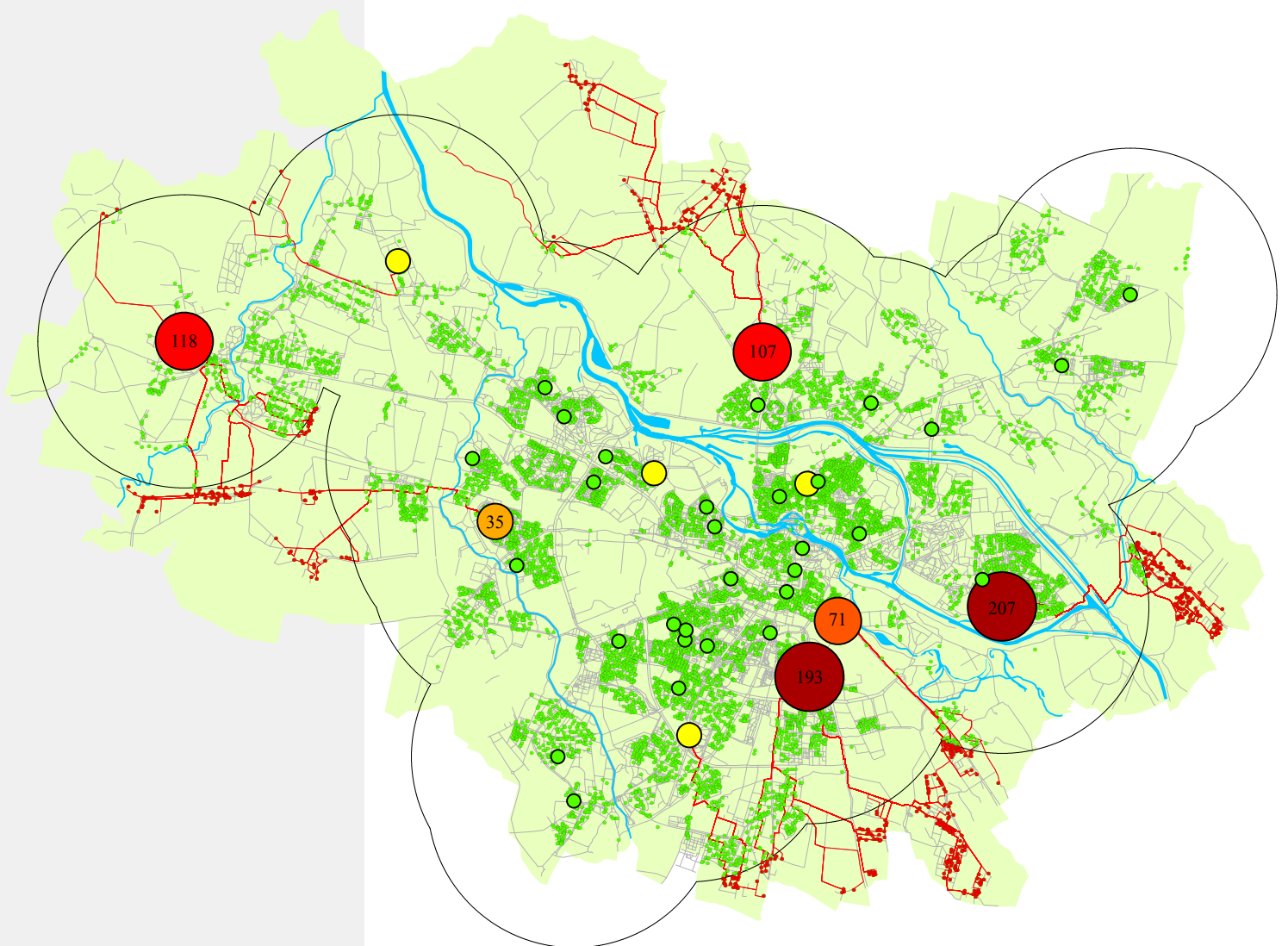
access points. And 732 (4,0%) teenagers were in potential not able to travel by bicycle, nor by foot to secondary school from who 608 were able to walk to public transport access points. The conclusion is that 124 (0,7%) teenagers were in potential reliant on the car to travel to secondary school, which leaves 626 teenagers that were reliant on the car to travel to primary school by a lack of network accessibility.

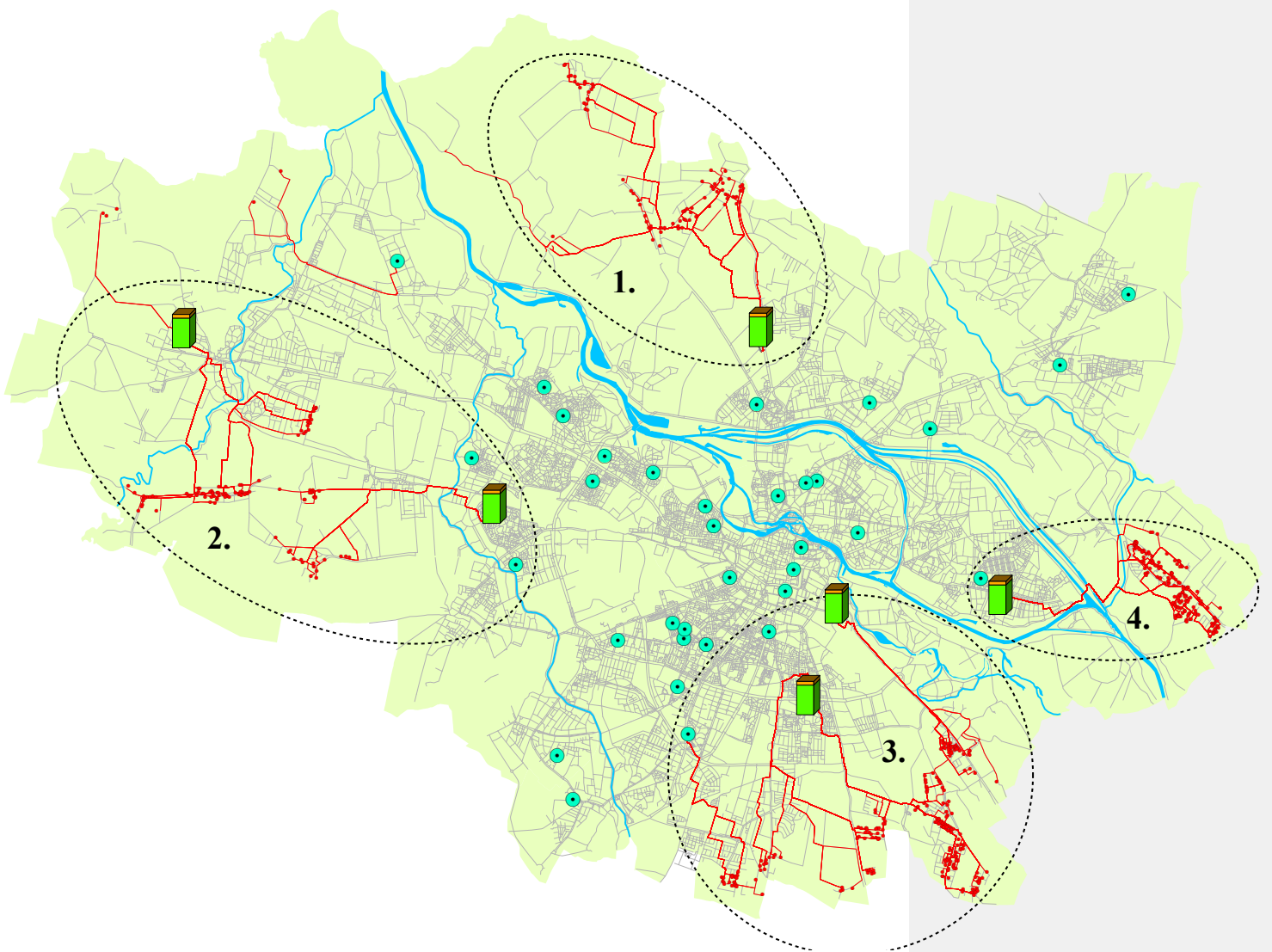


LEGEND

- SECONDARY SCHOOL
- PRIVATE CAR
- PUBLIC TRANSPORT
- CYCLING
- CYCLING/ PUBLIC TRANSPORT
- WALKING/ CYCLING
- WALKING/ CYCLING/ PUBLIC TRANSPORT
- ODER RIVER/ CANALS
- WALKING NETWORK
- MAP BACKGROUND

Scale: 1: 125.000





5.5.2 NETWORK ACCESSIBILITY

PLANNING TOWARDS THE P5

Chapter 5 - Reducing the reliance on car use	3 days
5.3 Finishing interventions young school-aged children	0,5 day
5.4 Finishing interventions older school-aged children	1 day
5.5 Finishing interventions teenagers	1 day
5.6 Conclusion	0,5 day
Chapter 6 - The effectiveness of planned measures	3 days
6.1 Methodology	0,5 day
6.2 Housing development	1,0 day
6.3 Cycling paths	1,0 day
6.4 Conclusion	0,5 day
Chapter 7 - The implementation of measures	3-4 days
Conclusion/ reflection	1 day
Finishing of the report/ Adjustments (references, summary, preface, lay-out, etc.)	2 days
Total estimated days	12-13 days

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