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MILANO 1863

# INTEGRATING TRANSPORT AND PUBLIC SPACE DESIGN:

## The new BRT line in Piacenza

Amirhossein Roustaei 10689304

Fernando Torres Pérez 10662842

Relatore: Prof.ssa Paola Pucci

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## **Abstract:**

In 2020 a project for a Bus Rapid Transit (BRT) line in the city of Piacenza, connecting the local train station with the New Hospital, was proposed by the local administration in order to get the national funds for new rapid transit lines. This master's degree thesis seeks to realize a critical analysis of the study to the Italian Ministry of Infrastructure, with the aim of optimizing the integration of the BRT line into the urban fabric it crosses, while proposing integrated interventions of public spaces and abandoned and underused areas along the route.

This work is based on the theories, courses and lessons that were taught during the two years Master's degree in Sustainable Architecture and Landscape Design in Politecnico di Milano. The most relevant of them being: Territorial and local analysis through Geographic Information System (GIS) tools; Detection, treatment and strategies for vacant lands; Employment of nature-based solutions as well as different theories of architecture and landscape design.

At first, the thesis proposes an analysis of the technical requirements relating to the BRT system derived from international guidelines in order to insert the new line in the Piacenza Road network, and then proceeds to an in-depth analysis of the territory involved in the new route. The analysis concerned both land uses and densities of functions along the route, and the distribution of current and planned traffic generators or attractors to understand if the BRT stops were useful in responding to the demand for public transportation. This was essential to define the critical issues related to the

insertion of the line into the existing fabric, the location of the BRT stops, the strategies for transforming the public space and abandoned areas that could benefit from redesign interventions related to the construction of the BRT

An examination of the morphology of the BRT route, through on-site surveys, highlighted points of conflict, relative to the real width of the carriageway, the intersections with the ordinary roads, and the presence of areas to be redeveloped. This critical framework and set of opportunities have allowed us to propose an urban integration strategy for the BRT line which considers the functional and morphological characteristics of the line and the urban context and the changes in the city mobility system. Finally, the thesis explores two architectural projects that offer useful and testable solutions in other areas along the new BRT line in the project.

Nel 2020 l'amministrazione comunale di Piacenza ha proposto un progetto per una nuova linea di Bus Rapid Transit (BRT) che collega la stazione ferroviaria con il Nuovo Ospedale in progetto, al fine di ottenere i fondi nazionali dedicati alla realizzazione di nuove linee di trasporto rapido in sede propria. Questa tesi di laurea magistrale propone un'analisi critica dello studio di inserimento della linea BRT in Piacenza presentato al Ministero delle Infrastrutture, con la finalità di ottimizzare l'integrazione della linea BRT nel tessuto urbano attraversato e proporre interventi integrati di riqualificazione degli spazi pubblici e delle aree dismesse e sottoutilizzate, lungo il percorso.

Questo lavoro si basa sulle teorie, i corsi e le lezioni che sono stati tenuti durante la Laurea Magistrale in Architettura Sostenibile e Progettazione del Paesaggio del Politecnico di Milano. I più rilevanti sono stati: Analisi territoriale e urbana attraverso l'utilizzo del Sistema Informativo Geografico (GIS); Politiche e progetti di riqualificazione di aree sotto-utilizzate e dismesse; Impiego di *Nature Based Solutions* e diverse teorie dell'architettura e della progettazione del paesaggio.

La tesi propone dapprima un'analisi dei requisiti tecnici relativi al sistema BRT desunti da Linee guida internazionali, per l'inserimento della nuova linea nella rete della viabilità di Piacenza, per poi procedere ad una analisi approfondita del territorio interessato al nuovo tracciato. L'analisi ha riguardato sia gli usi del suolo e le densità di funzioni lungo il percorso, sia la distribuzione di generatori o attrattori di traffico attuali e in progetto per capire se le fermate del BRT fossero

utili a rispondere alla domanda di trasporto. Questo è stato fondamentale per definire le criticità legate all'inserimento della linea nel tessuto esistente, la localizzazione delle fermate del BRT, le strategie di trasformazione dello spazio pubblico e delle aree dismesse che potrebbero beneficiare di interventi di ridisegno legati alla realizzazione del BRT.

Un esame della morfologia del percorso BRT, attraverso rilievi in loco, ha evidenziato punti di conflitto, relativamente alla larghezza reale della carreggiata, agli incroci con la viabilità ordinaria, e alla presenza di aree da riqualificare. Questo quadro di criticità e insieme di opportunità, ha permesso di proporre una strategia di inserimento urbano per la linea BRT che considera le caratteristiche funzionali e morfologiche della linea e del contesto urbano e i cambiamenti nel sistema di mobilità della città. La tesi infine approfondisce due progetti di architettura che offrono soluzioni utili e sperimentabili anche in altri ambiti lungo la nuova linea BRT in progetto.

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## **I - Introduction**

## I.I - Piacenza

Piacenza is a medium size Italian city located in the Emilia Romagna region, it is the capital of its province. Based on its location at a major crossroads, between the highway E35 between Bologna and Milan, and between highway E70, between Brescia and Turin. It is characterized by a good territorial accessibility. It is also at the confluence of the Trebbia River with the Po River.

Its location makes the city a very important logistic pole, hosting numerous enterprises at the industrial settlements. Nevertheless there is a very large agriculture production in the southern part of the city. The city also hosts an important number of industries, two universities, Politecnico di Milano and Università Cattolica del Sacro Cuore, and the historical center with monuments and historical buildings such as Palazzo Farnese.

The city was originally contained between the Roman Walls, which are inside the historical center. Across the centuries it has expanded, being contained in different walls, until being surrounded by the Farnese walls, an oval system of barriers which currently enclose the Historical center. Outside of the previously mentioned walls we can find a mainly orthogonal urban trace, which hosts mainly contemporary buildings and different land uses.

The population of the city is around 102 000 inhabitants, with a median age of 46 years old. The median density of Piacenza is 569 inhabitants per square kilometer.



Fig. 1 - Piacenza's location in Italy



**Piacenza and its walls**

- ..... Roman Wall
- - - Medieval Walls
- Farnese Wall

Fig. 2 - Piacenza and the its ancient walls



## I.II - Project Background: The Municipality BRT Project

In 2020 a project for a Bus Rapid Transit (BRT) line in the city of Piacenza was proposed by the Local Administration in order to get the national funds for the new rapid transit lines.

The study of the new BRT line has been done to the Politecnico di Milano which initially proposed two BRT lines studied in a comparative way, in order to find the best solution. Through this study it would be possible to foresee a more efficient and reliable mode of transportation for the city, ensuring connectivity between the Piacenza train station and the Nuovo Polo Ospedaliero and with the Polo del Ferro area.

The trace of both lines was proposed, which will pursue existing streets, which currently are used by the local and extra urban public transportation systems.

The first line, connecting the train station with the Nuovo Polo Ospedaliero would pass along the via della Conciliazione, Emilia Parmese, Strada Farnesiana, Via Radini – Tedeschi and Strada delle Novate. Passing through residential and commercial areas of the city.

The second project, which would connect the train station with Polo del Ferro and having the Nuovo Polo Ospedaliero as a final destination would go through the eastern part of the city, in a mainly industrial area.

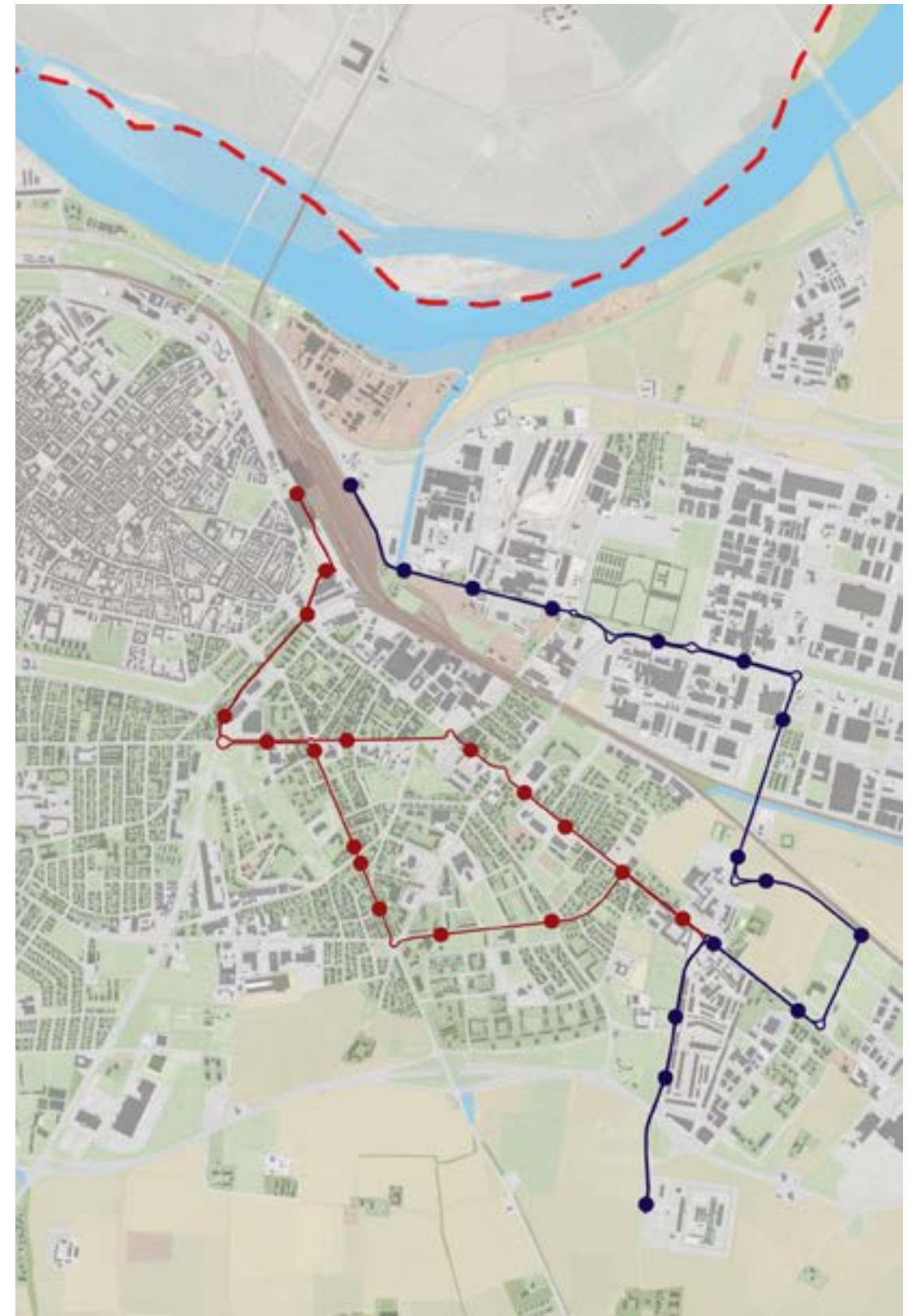


Fig. 3 - The proposed BRT lines

The chosen project for continuing the development of the city was the first line, ever since it offers the possibility of recovering some vacant lands of the city, while passing through many existing projects, but also because it travels within the consolidated urban fabric, which poses a greater travel demand.

The goal of this master's thesis is to fully develop this BRT line, clearly defining the spatial configuration of the infrastructure in the road, as well as in the necessary facilities for its correct functioning, interpreting the new line also as an opportunity to redevelop vacant or underused areas along its path.

### I.III - Motivation and definition of the project

The main objective of this master thesis is to develop the BRT line not only as a trace in a map, but as realizable project that takes in consideration the urban, social, economic and morphological context of the city.

In order to achieve this goal an in-depth analysis of the current situation has to be realized, which will lead to a coherent proposal of the proposed transportation infrastructure.

After the two years masters degree in the city of Piacenza, we have realized that even though the city has a working public transportation system, a great part of the mobility is based on private mobility, which translates to a large amount of areas that are used as parking spaces. In addition, an important surface of the city can be considered as underused or abandoned areas, which have the potential to host different activities.

There are future projects of regional scale proposed by the city authorities, such as the new hospital and Polo del Ferro, which will demand a larger amount of parking places and private vehicles traveling across the roads of the city. The project proposed in this masters degree thesis could be a counterweight for this situations, acting as reflection about this changes, proposing an efficient mobility infrastructure that could decrease the demand of private mobility means by making most of the above mentioned areas reachable in an easier, more efficient way.

We believe that the proposed infrastructure has the potential to re-imagine the city not only through its mobility infrastructure and public spaces, but also from an urban development point of view. The path of the BRT line can lead us to identify areas that should be developed or whose actual uses could be changed.

The public spaces along the corridor have to be re-design, giving less importance to the private mobility, expanding the pedestrian areas and recovering urban areas that are exclusive for the motorized vehicles.

## **II -Theoretical Framework**

## II.I- Theoretical Framework

This masters degree thesis is based on three major theoretical frameworks:

The first one of them is the Infrascap, which is an analytical tool for addressing infrastructure projects. Through this tool we seek to conceive the transport infrastructures as a landscape.

The infrastructure in the contemporary cities are specialized places with defined functions and specific roles. Nevertheless, they are also public spaces, in which we can find different practices, users, and uses that are not only exclusive to transport supply. The mobility infrastructures also have indirect outcomes, such as the redistribution of land prices, migration of population, an urban developments. We can consider them as incubators of new spatial forms, or all inclusive landscapes, being vehicles for the transformation of urban and landscape spaces.

In order to follow this kind of approach we have to consider different aspects of the infrastructure, such as its rhythm, thickness, permeability, materials and practices along it.

The second theory that we have followed for this work is the *Drosspace*, which is an analytical tool defined by Alan Berger in "*Drosscape, wasting land urban America*", for mapping the vacant lands.

In his work, he has defined three characters of the urban spaces, the first one of them being the Dross: "*Ignored, undervalued,*

*unfortunate economic residues of the metropolitan machine.*"

The second is the Stim: "*Places, buildings, programs & events that most people would identify as being developed or built for human uses.*"

And finally he presents us with the Stimdross: "*Hybridization area where the attributes of Stim and Dross overlap.*"

This theory has been extremely important for the realization of this work since it has given us a theoretical tool to identify and classify areas that seem underused or abandoned, making it possible to imagine new uses or their relation with the proposed infrastructure.

Finally, we have considered essential to take in consideration the teaching from the Politecnico di Milano masters degree program in Sustainable Architecture and Landscape Design.

From the use of Geographic Information System (GIS) tools for mapping the areas where we would focus, to the different theories studied during the two years of the program.

A special focus has been taken on the proff.sa Paola Pucci's course, "*Urban Design Studio*" where we were introduced to the main two theories on which this work is based, but also with the lectures given by Proff.sa Paola Sturla "*The Kaleidoscopic Infrastructure*", in which the idea that an infrastructure is not a point or a line in a map was highlighted.

## II.II -The BRT Standard.

In order to approaching the topic of our research, we deal with the design guideline for a Bus Rapid Transit set in place by the Institute for Transportation and Development Policy. In this extensive document it is possible to find all the necessary aspects in order to design a functional and efficient BRT infrastructure.

The main components that will be taken in consideration from the BRT Standard are the Cross-section design (Roadway and station configuration), which refers to the way the corridor and the stations are settled in the context.

The document also treats the he intersection and signal treatments, aiming to design the way the infrastructure relates to the existing roadways, ever since it has to be a very efficient transportation system, that cannot cause interference with local traffic.

Another component is the station and terminal design, which seeks to design each of the individual BRT stops, based on the capacity of the system, as well as with the road configuration.

Finally, the depots and the control center: These large-scale components have to be designed, since without them it would be impossible to have a working BRT system.



Fig. 4 - The BRT Guideline

### II.II.I - The BRT Scorecard.

The BRT Standard provides us a Scorecard for the possible Road way configuration. This is a core subset of elements that has been categorized as essential to the definition of BRT, and is divided in six categories. This qualification can allow the corridor to receive a gold, silver or bronze ranking, nevertheless a corridor may only qualify as a Basic BRT

In order for the corridor to be considered as a BRT it has to be of a length of at least 3 km with dedicated lanes, while scoring a minimum of 20 points across all five BRT basic elements, four or more points in the dedicated right-of-way element, as well as four or more points in a bus-way alignment element.

The BRT Scorecard categories are the BRT Basics, which treats the physical aspects of the BRT corridor. This are the right-of-way, the bus-way alignment, the fare collection, the intersection treatments and the platform level boarding.

The second category is the Service planning, which implicates the existence of multiple routes, the scale of the service, the control center, as well as the hours of operation and demand profile. The third category, Infrastructure, scores the individual aspects of the system. This can be the passing lanes at stations, the bus emissions, the center stations or even the pavement quality.

The fourth category are the Stations, which are scored by the distance between each of them, their comfortability, the number of doors on the buses, docking bays and even the existence of sliding doors. The fifth category are the communications, which refer to the branding and information communicated to the passengers.

The sixth and last category is the Access and integrations, which aims to score the way the passengers will access and interact with the system. This the existence of bicycle lanes, bicycle sharing integration, secure bicycle parking, pedestrian access, universal access and the integration with other public transport.

It is important to consider that are a set of points deductions, which are of different nature. This can be of design aspects such as a significant gap between bus floor and station platforms. Of regulatory nature such as the lack of enforcement of right-of-way, a poor maintained bus way, buses, stations and technology systems. And of planning nature such as a low peak and low-off peak frequencies, overcrowding, a minimum peak passengers per Hour per Direction below 1000, or the existence of commercial speeds along the dedicated right-of-way.

### **II.II.II -Cross Section Design: Roadway and Station configuration.**

The roadway, which is also known as right of way, refers to the public space of the city where mobility takes place.

It is usually composed by a mixed lane traffic, a pedestrian lane (or sidewalk). Nevertheless, it can also contain parking lots and bicycle lanes. In order to implement a BRT infrastructure, it has to host a BRT corridor, which at the same time is composed by the bus-way, its stations of stops, the barriers or curb separators as well a passing lane. It is very important to consider how easily people will access the station for using the BRT System.

In the BRT Standard we can find the minimum recommended width per direction, which tell us the individual measure for each of the components. It is important to point out that while this are minimum recommended measures, they should be adapted to the existing conditions, especially in a compact city such as Piacenza, where in addition, the existence of several historical buildings presents a set of important physical barriers that can hardly be modified.

Ever since the key factor about the configuration of the BRT lane is that the bus has the least conflict with the mixed traffic, turning vehicles, parking lots, stopping taxis or delivery vehicles, the median bus-way is preferred to the curb side bus-way. Nevertheless, in a situation where a roadway is bordered by green spaces, or when there may not be turning conflict for long distances, case side alignment might be preferable to median alignment.



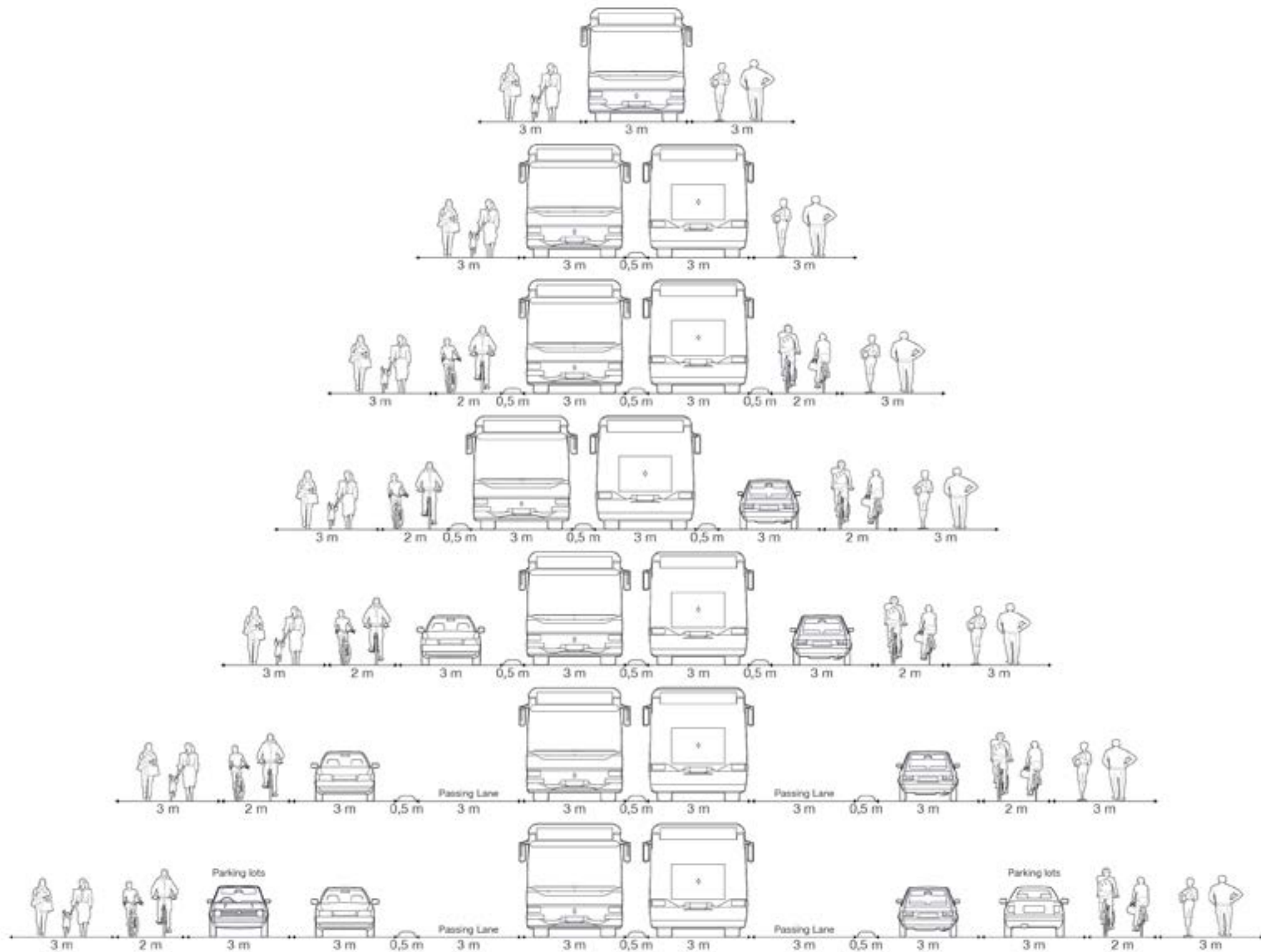


Fig. 5 - The Cross section design

### II.II.III -Road configuration for narrow corridors.

It is necessary to ask ourself the question of how to implement a BRT infrastructure in a compact and dense city such as Piacenza, where the existing context is hardly modifiable. There are a number of solutions which have been used in different cities around the world that share this same situation.

One of the first options is to decrease the number of mixed traffic lanes. By doing so the we can generate enough space for the BRT corridor, while allowing a minimum amount of mixed lane traffic to transit the streets.

Another possibility is to transform the chosen roadways into bus-only corridors. The challenge that this solution represent is to relocate the local traffic in other roadways, without posing a problem to the mobility system. It is important to consider the minimum width of the corridors, which should be at least seven meters for a two-way only bus corridor and three meters is appropriate for a one-way bus corridor.

Building a fixed guide way, which is a physical barrier that guides the bus around the turns, can reduce its turning circles and overall need of space for maneuver. “Under normal operating conditions, a driver will require approximate 3,5 meters to safely maintain position within the lane. However, if a vehicle is physically restrained by a guidance mechanism, then a lane width of 3 meters is possible.”

There is also the possibility to create a grade separation system, which represents a corridor built in a different level than the street, however this solution can be much more expensive than

the rest of the solutions, while also being longer to implement. Another possible option is the one-way pairs configuration corridor, in which the BRT system operates in two different and typically parallel roads. The advantages of this system are that private vehicles retain some form of direct access to the corridor, but the main disadvantage is the need to build the twice the number of stations as the in the rest of the configurations.

The elongated stations can also be an attractive option that can be implemented in a narrow context. In this kind of stations, the doors facing the buses are not aligned, meaning that the space required by the passengers is considerably lower (2,5 meters instead of 3m). The downside is that these stations have twice the length than a common station.

An offset station is also a way to address the constraints in a narrow road. In this configuration the directions of travel are separated in two separate bus stops, which allow the docking of the buses independently. This configuration allows the transfer of passengers in both directions, and might even include passing lanes. It also reduces the required road width by one lane and still delivers full passing capabilities at the station.

It is also possible to implement a BRT infrastructure in a narrow corridor is the virtual bus-way. This solution is composed by a single bus lane in the middle of a roadway that is non-reversible but is shared between the two directions of travel. “At the intersections, a separate public – transport vehicle phase will allow the BRT vehicles to leave the virtual lane and access the general traffic lane, after which it will proceed in the general traffic lane until the virtual lane is once again dedicated to the BRT vehicles’ direction of travel”

#### II.II.IV -Station types.

It is possible to organize the BRT stations in four different kinds: Standards, transfer, terminal and stops. It is by having a clear understanding of their individual roles and needs in a BRT system that we can propose an efficient infrastructure for the city.

The first category is a Standard station, which provides the services for the local area. This kind of stations vary in dimension according to the capacity they need.

The second category are the transfer stations, which are at the same time a standard station and a facility that allows the connection between another BRT line station, or other kind of public transportation. This kind of stations are thus an intersection point of the mobility infrastructure, having an important role in its infrastructure.

The terminal stations are the structures that represent the end or starting point of a corridor. In this kind of stations there is usually the availability for a larger facility, while also being transfer stations for different mobility systems.

Finally, the stops are usually defined as having a totem and/or a bus shelter, but no real infrastructure. The stops are not usually recommended for BRT systems. Nevertheless, in case they are implemented it is important that they are branded as part of the system, ensuring that they can be distinguished from a regular bus lane stop.

There are two possibilities concerning the configuration of the stations, which are the median island station and the split side aligned station.

The Median Island Station is located in the middle section of the right-of-way, in between BRT lanes. One of the main aspects to consider for this kind of station is the need of buses with doors on the opposite sides from conventional buses, which normally have the doors on the curb side. It is for this reason that these stations cannot be shared by the two mobility services, thus working exclusively a BRT infrastructure. We also have to consider that the spaces required by a Median Station is around 9 meters total, considering 3 meters for each bus, and 3 meters for the station itself.

The second configuration is the split side aligned station, in which the buses are boards from the curb side of the road. This kind of station allows the use of existing buses fleet for the BRT system, nevertheless it requires more space, since an extra station has to be built.

Another aspect that should be considered concerning the stations is the existence of a passing lane, which is necessary for services to be split between various local and limited-stop routes. In this situation multiple stopping bays have to function, and the vehicles must be able to pass one another at the stations. The passing lane may just exist as a second lane in the station area, or it can be extended all along the corridor.

Concerning the length of a station, the minimum spacing should be approximately 1,7 times the length of the vehicle. As an example, in the case of an 18-meter articulated vehicles. This distance would be approximately 30 meters.

The length of the buses is calculated by the load factor, which is the percentage of the vehicle capacity make a reasonably comfortable trip, it is usually 85% for planning purposes.

Lastly, the platform vehicle alignment refers to the boarding platform of the station, which should have the same height as the bus floor. It is necessary to decrease this gap as much as possible, which can be achieved by the use of boarding bridge's, alignment markers, or a platform edge treatment, which is a common practice that provides a protective edge on the platform that does not damage the bus tires.

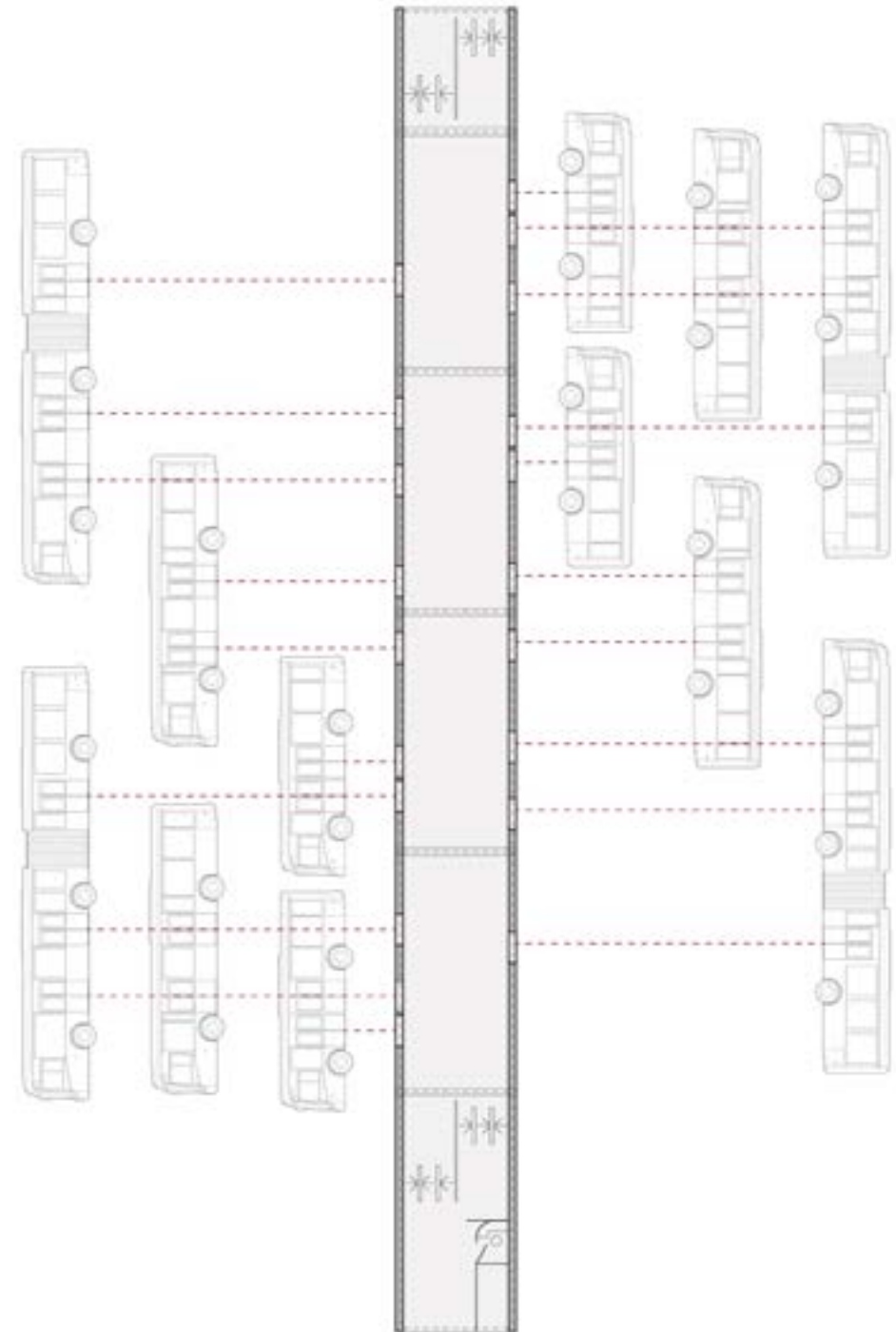


Fig. 6 - Station Design

### II.II.V -BRT Depot.

One important component of the BRT system is the Bus depot, which refers to the area where the buses are stored, refueled and maintained. These infrastructures are generally, but not always, adjacent to the terminals.

Normally, the BRT vehicles will enter the terminal several times a day, but they will enter the depot only if taken out of service. It is important to take in consideration that the depots can consume a considerable amount of space, which is the reason why the location is usually dependent on the economical acquisition of a property with an adequate surface.

At the same time, the terminals and depots for BRT can be integrated with other transport facilities, an opportunity that can be attractive with cities that have an extensive bus network.

The BRT depots are organized in different areas, which work in a logic but very specific way. The buses will arrive through a gate and a visual inspection area, from this point they will go to a refueling zone, and eventually to a vehicle washing and cleaning area.

In case its necessary, there is also an area for major repairs, where the buses need to spend considerable time, as well as minor repair area, from where they can leave sooner. After the end of the service, the depot has an area for bus parking, which has to be closed to the gate for a rapid reactivation of the system.

The BRT depot might also host the control center, as well as tan area with administrative offices and a private parking for the operators.



Fig. 7 BRT Depot in Bogotá - Oscar Díaz & Por el País que Queremos

### II.III - Case Studies: The Nantes Busway

In order to understand the impact that a public transportation infrastructure can have in the city's public space, we have decided to analyze a case studies of a similar scale. The Nantes Busway.

This is a 7 km, 15 stations BRT line that was inaugurated on November 2006. Currently its passenger flow is about 28 000 passengers per day, It counts with its own right of way and interconnects with the city Light Rail Transit (LRT) system and the railway station.

Originally conceived as a tramway line, the city authorities required a public transportation infrastructure that should interconnect the city and its metropolitan area, offering a high level of service, which couldn't be lower than the one of the tramway system. It had to provoke a great urban integration, and finally, it had to be realizable in a commercial and economic way.

After the initial studies, conclusion was that this objectives could be achieved with a BRT line, having a cost of 7 million euros per km, instead of the 33 euros per km of a tramway line. In addition, instead of the originally proposed length of 4 km, it would be of 7 km, offering the service to a larger extent of the population.

One of the most interesting aspects of this line is the changes that it has had in its public space: While the public space was almost exclusive to the mixed traffic line, with the implementation of the BRT line it is being shared with all the users and different mobilities: cars, buses, BRT, bicycles and pedestrians. The platforms are located in the middle of the street, and when the width of the roads are not large enough, the Busway shares the mixed traffic lane in one direction, having a dedicated traffic line in the opposite sense.

The stations are light structures that have come up with pedestrian solutions to assure the security of the users. The busway crosses the existing roads intersections through the center of roundabouts, making the mixed traffic lanes stop when they cross with the BRT system.

Another interesting factor is that the demand of the service has been extremely high, which has led to increase the passage frequency to less than 3 minutes between buses at peak times. Potentially, if the saturation recurs, the BRT line could be converted into a tramway line in the future.



Fig. 8 - Nantes Busway

### **III -Site Studies**



### III.I - Framing the urban context

The goal of this chapter is to better understand the current situation of the city, through its land use, population density and public transportation system.

By having a general understanding of this aspects we can develop a more complete strategy, not only concerning the precise placement of the Transport infrastructure, but also generating strategies for the treatment of the areas surrounding it.

We believe that it is possible to define the thickness of the infrastructure by developing the above mentioned analysis, which will lead us to a strategy for the implementation of the BRT system as a tool for requalifying the urban settlement.

One of the first steps that should be done is to define the infrastructure's thickness, which refers to the surface that is affected by it. This is not only characterized by a physical distance, but also by the attractors and generators that will have an influence in the infrastructure.

It is by defining the thickness of the BRT line that it will be possible to identify different vacant, abandoned and underused areas, whose actual uses could be changed or optimized.

We believe that this way the whole project of the BRT system will be correctly implemented with the future development of the city, acting not only as a mobility infrastructure, but as a detonator for changes in the urban development.

### III.I.I -Generators and Attractors for reading the land uses

Land use analysis represents an important tool for analyzing the distribution of attractors and generators of travels that can interact with the new BRT line.

For understanding the spatial configuration of the city of Piacenza a Land use map, has been realized with information provided by the Regione Emilia Romagna (2017). Almost the entire city of Piacenza is contained between two high-speed roads in the north - south direction (highway E70 and Strada Tangenziale). In the northern part we can find the Po and Trebbia River, as well as the Parco del Fiume. In the meantime, in the south there is the presence of agricultural fields. The west border of the city is also the Trebbia River, while there is an expansion towards the East with some industrial settlements.

The historical center of the city is contained in the trace of the old Farnese walls, nevertheless there has been an urban extension mainly to the south. This area is characterized by a more regular grid, with more isolated buildings.

It is interesting to point out that most of the city industry is in the north- east and eastern areas, mainly because of the presence of the railroad. This area has an important logistical role in the north of Italy.

#### Land Use:



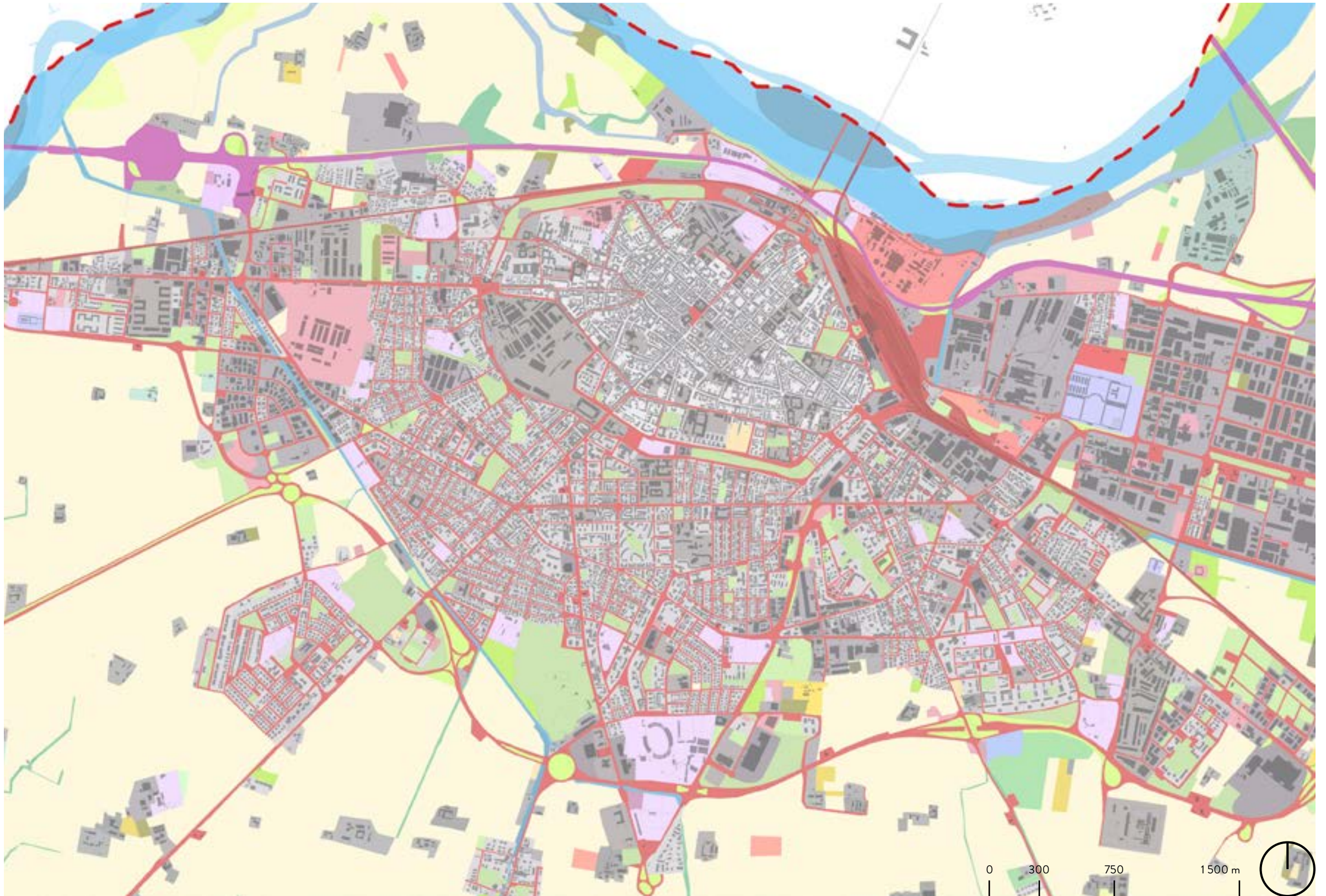


Fig. 9 - Land Uses

### III.I.II -Land Use Forecast

The different future projects for the city of Piacenza, are mainly located in the south east part of the city.

In the area known as Consorzio Agrario there will be a mixed used project, which will host residential, commercial and residential functions. Approximately 164 inhabitants will live in the area, while more than 1 400 people will work there. At the same time, the complex is expected to receive around 7 900 people per day, with a minimum ammount of 2 870 parking places.

Some meters to the south of Consorzio Agrario, we can find the area AID 30 “Campo Ostacoli” this area will host residential and tertiary activities. It will host between 74 and 138 inhabitants, with a number of workers between 101 and 243. Once again we find a large parking place area of minimum 307 places.

The northern expansion of Università Cattolica del Sacro Cuore will also host residences, once again we will wind between 47 and 88 inhabitants, with a number of workers between 65 and 155. There won't be less of 196 parking places.

A very large complex, consisted of three areas, (AL 9 Cascine, AID 20 Camuzzi and AL 8 Germoglio) is one of the largest future projects of the city. In this mixed use development, located next to the Tangenziale and just some meters south of the BRT path, will host between 510 and 956 inhabitants. Between 700 and 1 683 people will work in the area. The whole

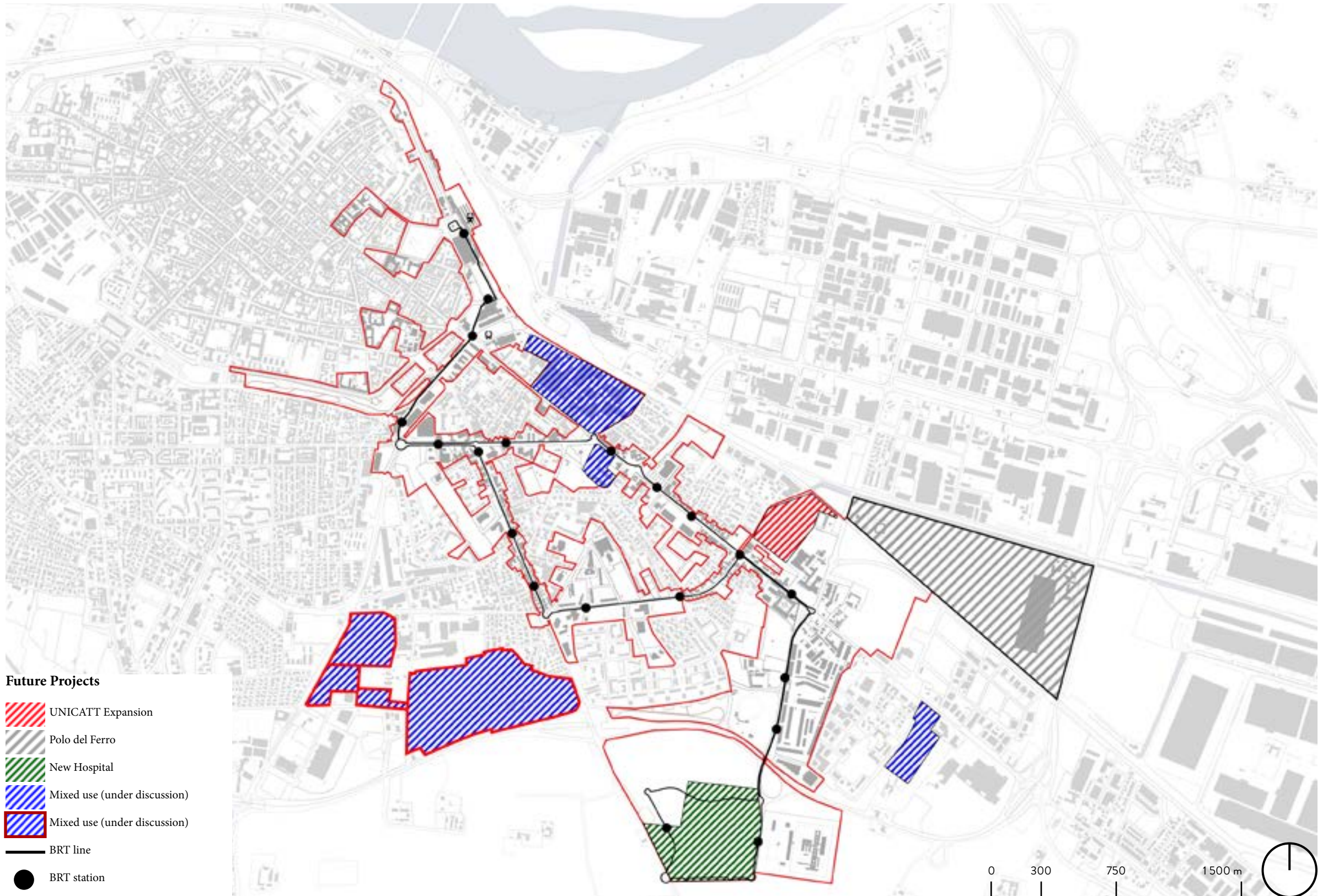
complex is envisioned with a minimum amount of 2 124 parking places.

Some meters south of the Università Cattolica del Sacro Cuore, we can find a smaller area, “AL 5 Casazza”. This area will be a mixed use development, which will host between 102 and 191 inhabitants. Between 140 and 336 will be hired in this area, which requires at least 425 parking places.








It is interesting to point out that around 6 000 new parking places will be built in the city, all of them required by this future projects. This represent an area of around 75 000 square meters, which could be used in a different way with the implementation of the BRT lane.

We can also find productive future projects, such as Piacenza new hospital. It will be located in the southern part of the city, across the bypass road. I will be the first Italian post-Covid infrastructure and it will serve the whole Province of Piacenza.

In the meantime, the Polo del Ferro project, located at the intersection of the two railroads that connect Piacenza with Cremona and Bologna, will act as a major transport infrascuture, confirming the imporantce of Piacenza as a logistical pole for the whole country.



**Future Projects**

-  UNICATT Expansion
-  Polo del Ferro
-  New Hospital
-  Mixed use (under discussion)
-  Mixed use (under discussion)
-  BRT line
-  BRT station

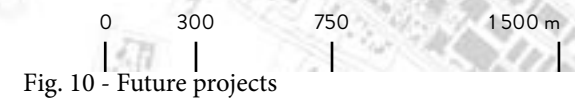


Fig. 10 - Future projects

### III.I.III -Public Transportation system

The city of Piacenza has a quite good public transport supply, with a well distributed bus stops. The main urban and extra-urban lines interchange with the railway station in the north of the city, which works also as a hub for the local bus system.

Most of the bus lines pass through Viale Sant’Ambrogio, connecting the train station with the “Lupa” roundabout, an important nod of the city. Viale Risorgimento is also a road where several bus lanes pass. This street connects Via Roma with Via Emilia, which is the only way to cross the Po river towards Lombardy.

Most of Piacenza local bus lanes have as a final destination the train station, a situation that confirms the central role that the railway has in the local transportation system.

On the contrary, by observing the Extra-Urban bus lines map, it is possible to see that via Emilia Parmese, Emilia Pavese, Str. Farnesiana, Str. Agazzana, Str. Bobbiese and Str. Val Nure connect Piacenza with the surrounding cities through its public transportation system. We can also observe that the street that goes around the Farnese wall has an important role in the regional transportation system.

All of the lines that pass-through Piacenza have as a departure or final point the Extra-Urban bus station, which is located in via Cristoforo Colombo, just some meters south from the train station. Nevertheless, it is interesting to point out that the train station is not a hub for the extra urban bus lines, while Piazza della Cittadella is. This Piazza hosted a proper bus station, which has been closed since a couple of years.



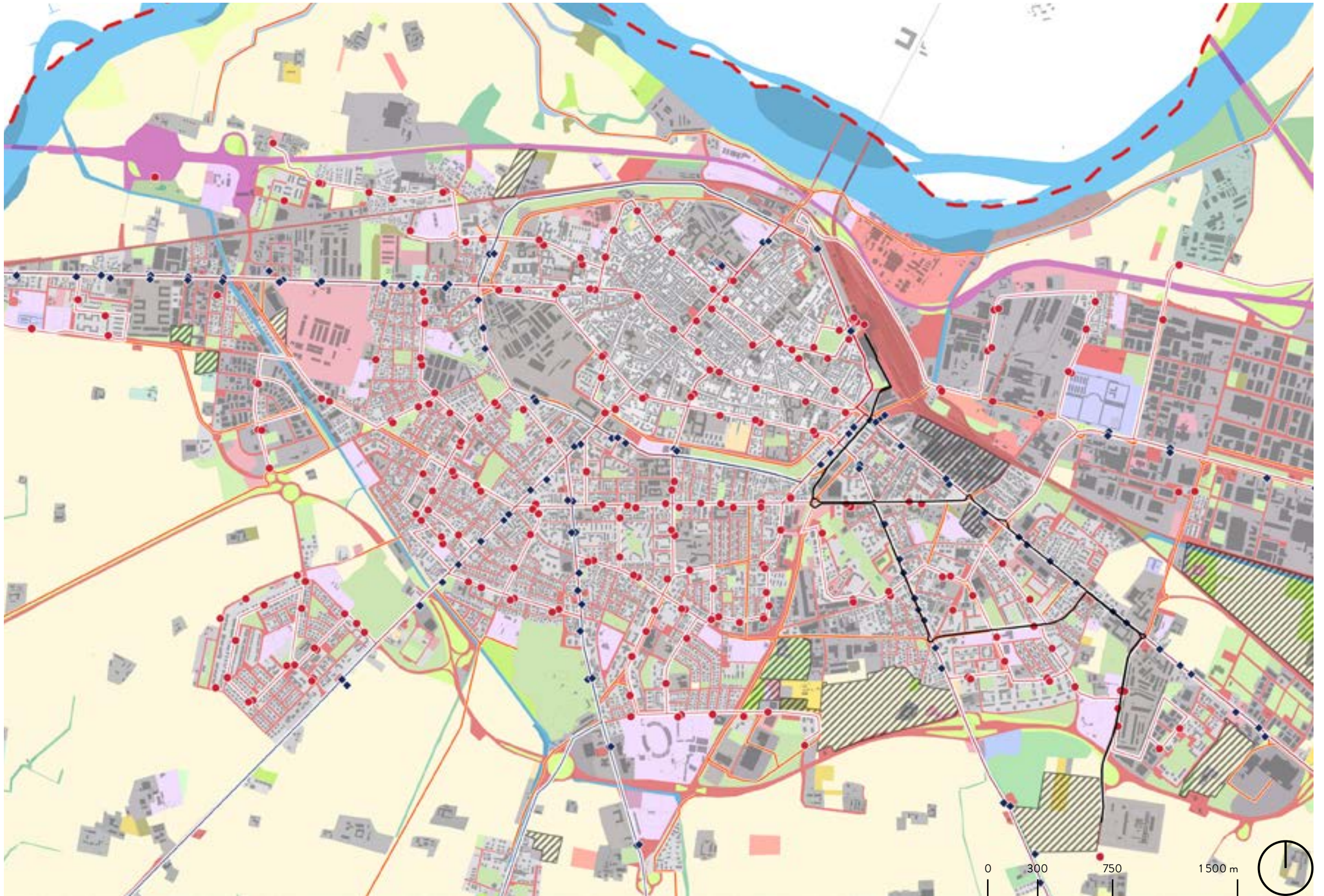


Fig. 11 - Existing transportation system

### III.I.IV -Population density

The distribution of the inhabitants represents an important information for assessing the travel demand affecting the BRT line.

In the population per Subcomune map we can see the approximate number of people that live in each of the Subcomune areas according to the 2011 ISTAT census.

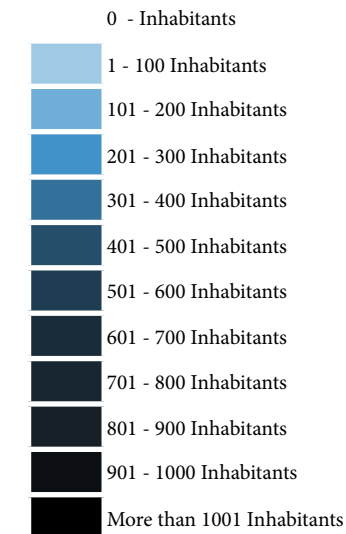
We can observe that there is very important number of people living in the southern part of the city, while the eastern part has a very little number of inhabitants. This is due to the land-use characterizing the east part of the city where a lot of industrial and commercial sites are located. It is also interesting to see that there are some populated areas in the south eastern part of the city, in the area located next to the shopping center.

In the population density map, we can observe that the most densely populated areas are the city center and the southern part of the city.

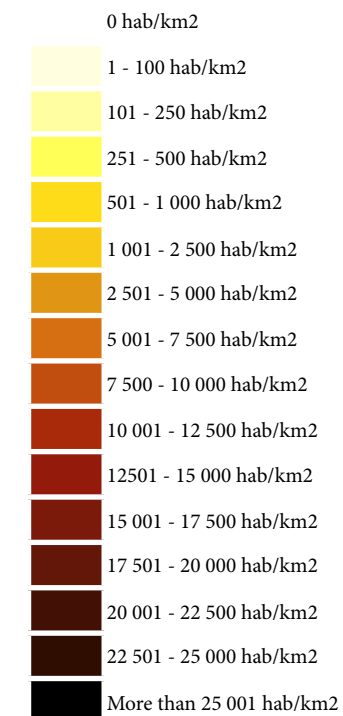
This is due to the presence of high-rise buildings in the southern part, while in the city center there is a lack of separation between them.

Once again the area located at the north east part of the city has a very low density of population, almost comparable to the agricultural lands. This is due to the productive profiles of the build-up areas.

#### Total population:



#### Population Density:





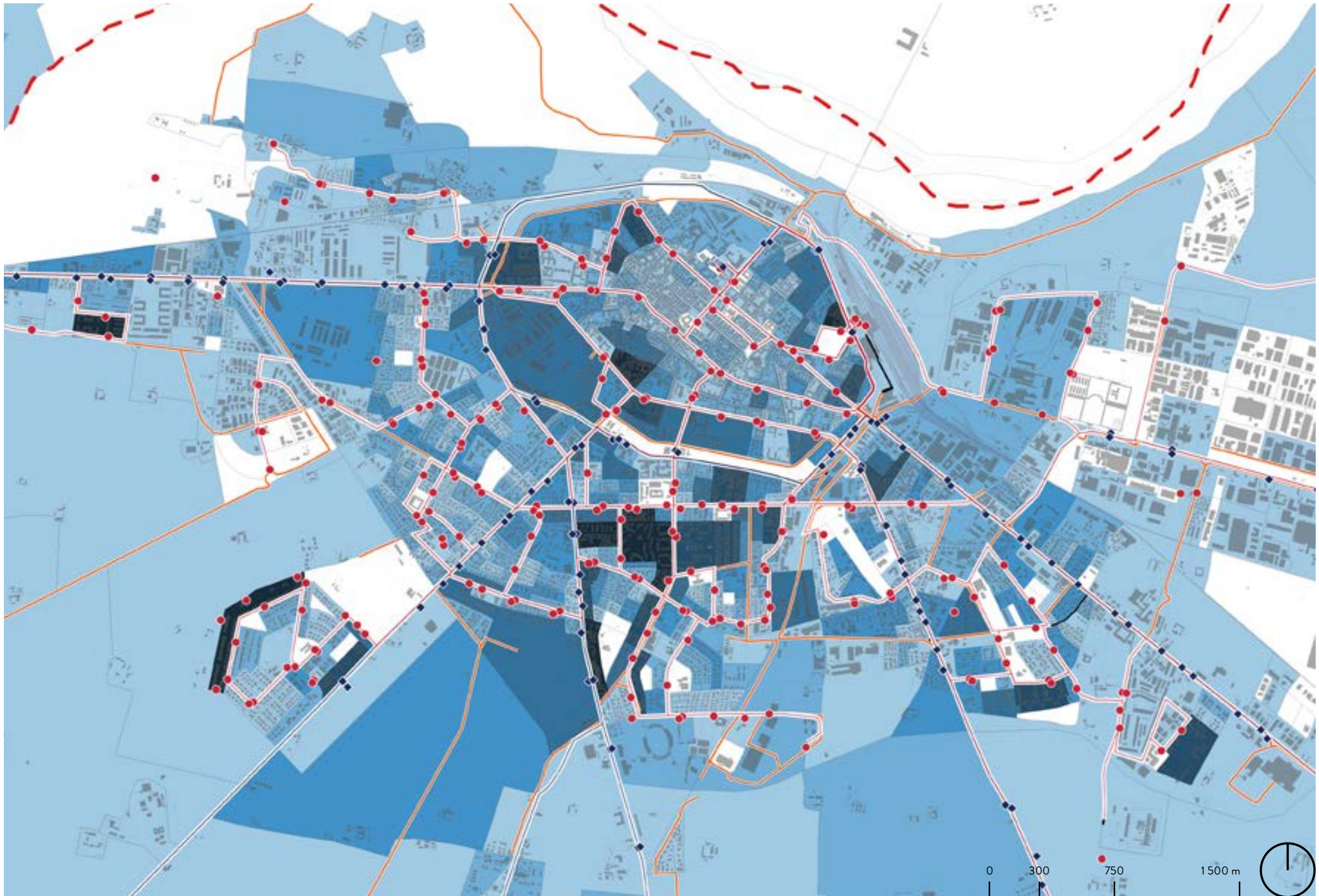


Fig. 12 - Total population

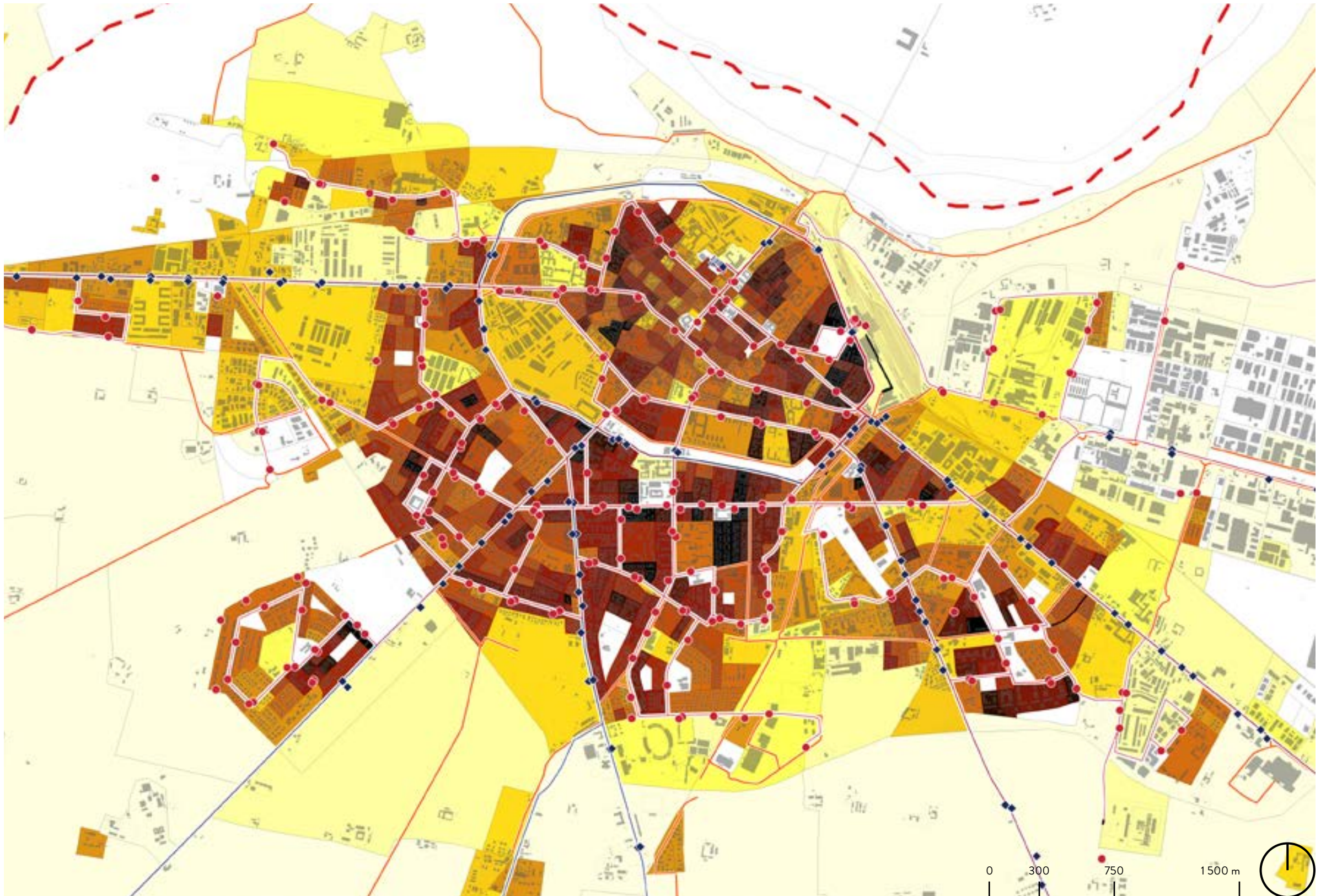


Fig. 13 - Population Density

### III.I.V -Actors involved and interested in the project

In the project area we can find different possible stakeholders, whose importance is of local and supra- local magnitude.

They have been categorized according to their main role, which vary from educational, commercial, institutional or service sectors. They are also based on their public or private profile.

The BRT line has the potential to connect the two main universities of the city, Politecnico di Milano campus Arata and Università Cattolica del Sacro Cuore and the Liceo Artistico Statale Bruno Cassinari, with the train station and the new hospital. This higher education facilities host an important number of students not only from the city of Piacenza but also from surrounding cities, thus posing the opportunity to decrease the use of private mobility in favor of public transport.

This is the same situation for many of the areas middle schools, nurseries and kindergartens. With the implementation of the BRT line parents and children will have an alternative and reliable option for reaching the facilities, decreasing the use of the car and the traffic jams at peak hours such as the beginning and ending of the courses.

At the same time we can find an important number of commerces, which vary from local retailers and shopping centers, to national and multinational business such as ESSELUNGA, Lidl, Eurospin, etc. This commerces will certainly benefit from the existence of the BRT infrastructure, not only because of the easier way to access their locals, but also because



Fig. 14 - Potential attractors and actors for the project

of the direct views from the transport system to them. There is also the possibility that they can change the use of a percentage of their parkings spaces since it will be easier to join them with public transportation.

Since the train station will be the starting point of the BRT line, Ferrovie dello Stato will also profit from the implementation of the infrastructure, since it will be easier to arrive to the service with public transport, posing the opportunity to reduce the number of parking places in their facilities, and also potentially increasing the number of passengers for the regional mobility system.

The recreational areas, such as public parks, sports facilities, whether private or public, will be easier to reach with the BRT line, increasing the number of users and offering an easier and potentially faster way for reaching them not only through the BRT line, but also through the city's mobility system.

Finally, many of the productive areas, such as the mixed use projects and offices buildings will also benefit from the BRT line, since reaching the facilities will be easier for their workers, once again decreasing the use of private mobility and posing the opportunity to change the use of a part of the areas currently used as parking spaces.

Regarding the future projects, the BRT line offers an opportunity to decrease the number of necessary parking places for the projects, providing also a chance to change the use of these areas. This could be replaced with more recreation areas, or even more built areas, a situation that will be certainly attractive for the investors of the projects and for the city authorities.

**Actors involved or interested in the project:**



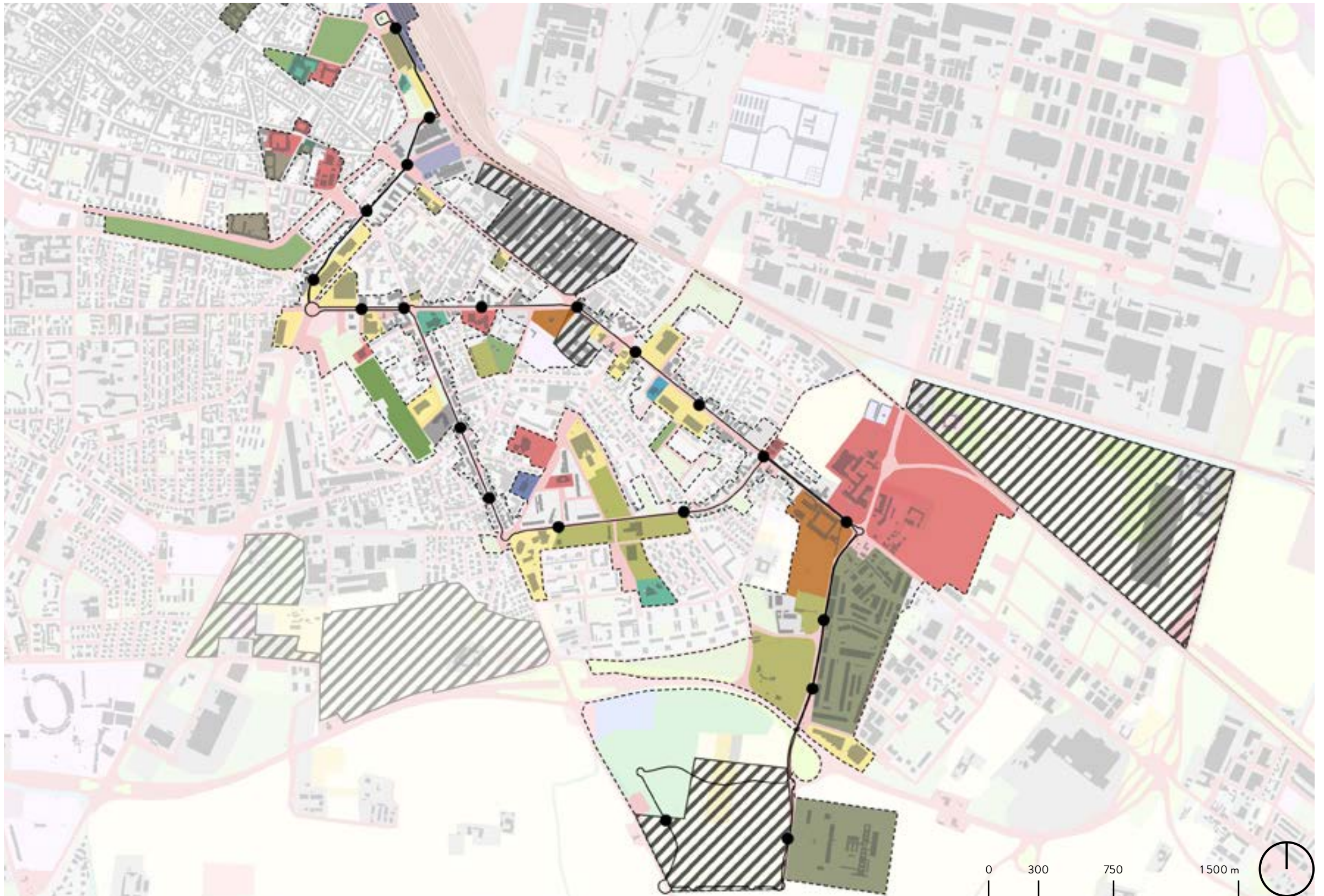


Fig. 15 - Potential actors & attractors in the project

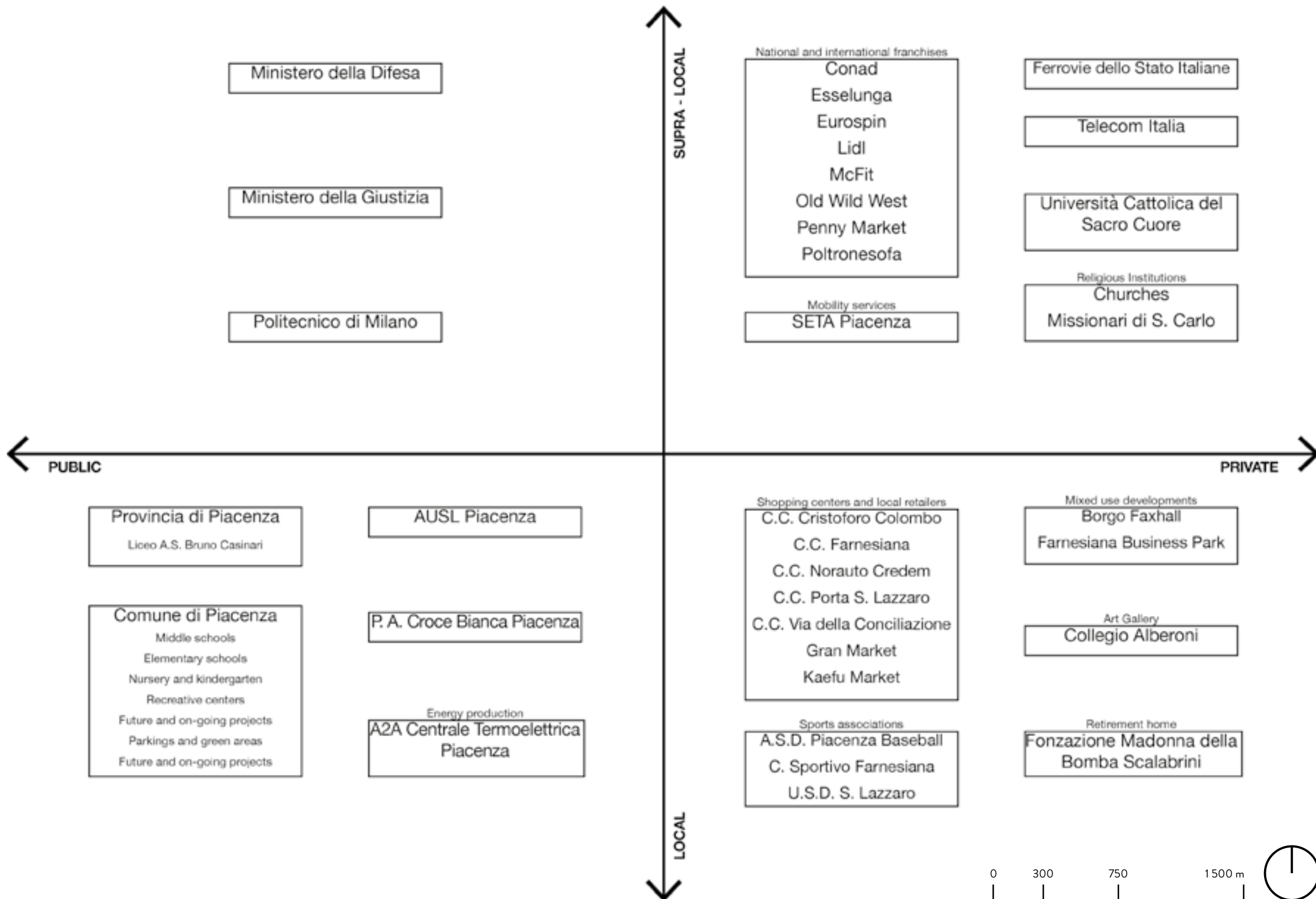
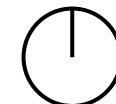
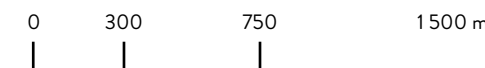


Fig. 16 - Scheme of governance in the project



### III.I.VI -Definition of the thickness.

In order to define the thickness of the BRT corridor a two step process was implemented.

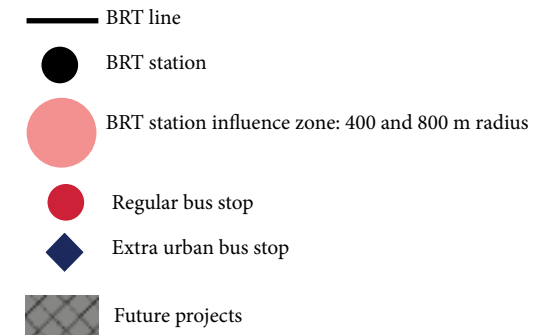
At first we defined a radius of influence for the individual stations and the terminals. The first one would be of 400 meters, or around 5 minutes walking. For the terminals it was considered as 800 meters, or 10 minutes walking.

The second step was to identify the most relevant attractors and generators inside this radius of influence, ever since there as very high possibility that the BRT passengers will use the system to reach this destinations.

We also considered the a series of vacant, underused and abandoned areas inside the radius of influence, ever since the BRT line could act as a detonator in order to optimize or change their actual uses.

Finally, we also considered the potential areas that could be improved by the implementation of the BRT project. This refer to the future projects, who could change the potential use of many of their planned parking areas for an alternative activity, ever since the need of the car could be drastically decreased with the implementation of the public transportation system.

#### Definition of Thickness:



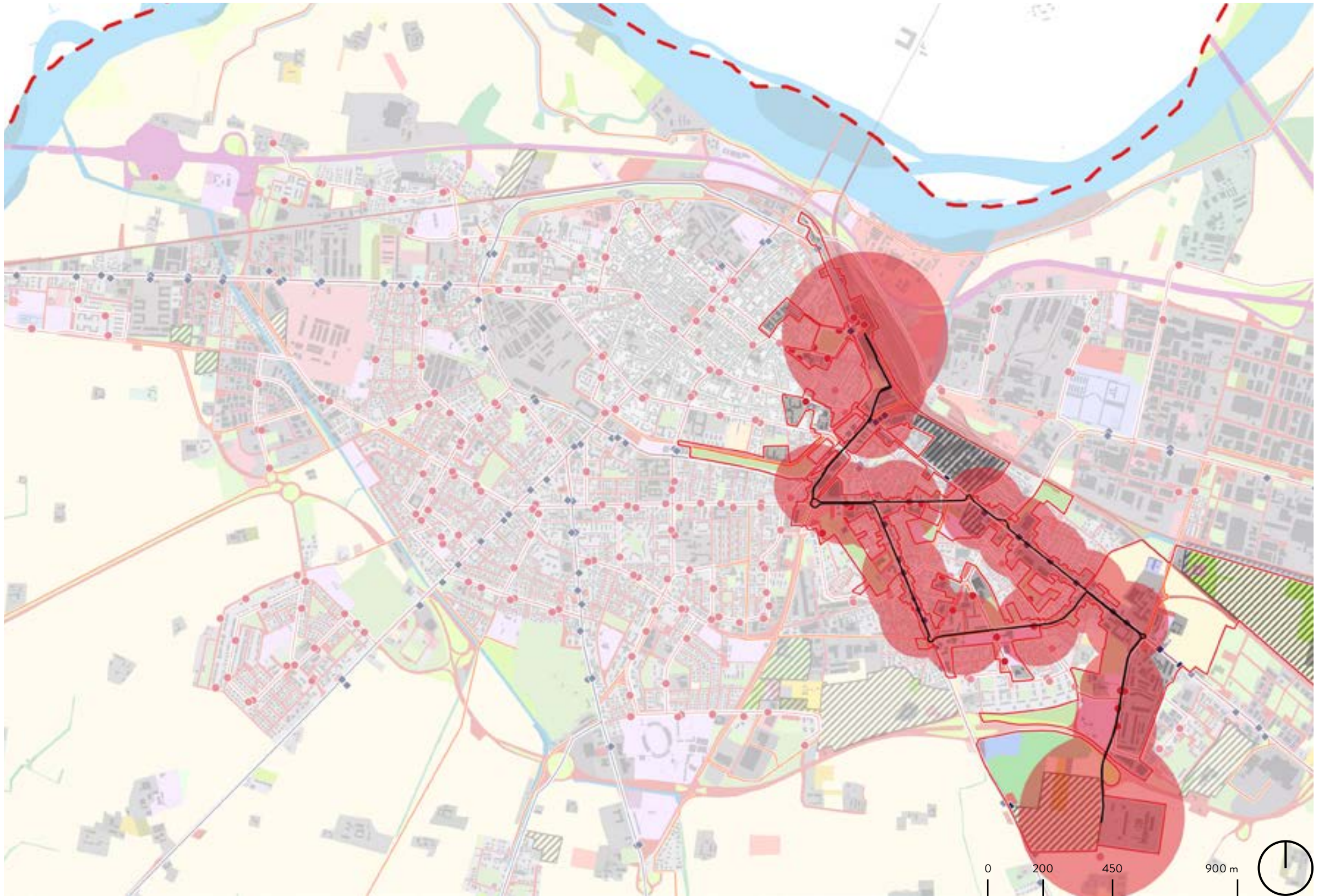


Fig. 17 - Defining the thickness of the infrastructure



### III.I.VII - Vacant Lands

After the analysis of the thickness of the infrastructure we have proceeded to identify the vacant lands within its boundaries. These are areas whose current situation varies, making it possible to classify them in four different categories.

The first of them are the parking areas, which use could be decreased after the implementation of the BRT line. It is important to identify them, ever since they offer the potential to have a change of use, whether being part of the mobility infrastructure, or having a different activity than its current one. If we do not foresee as strategy for them before the construction of the BRT line, they might become abandoned areas, posing an urban problem that is already existing.

The second category are the abandoned areas. This are surfaces that currently have no use. A change for their use is necessary, since they are spaces that generate urban degradation, regardless of their location and the potential uses that they could host.

The third category are the underused areas. These are surfaces that currently have a defined use, nevertheless they do not fulfill it at its full potential. With the BRT line it could be possible to potentiate their uses, whether by making them more accesible from different points of the city, this making them more attractive, or by generating areas with that potentiate its current use, thanks to their connection with generators and attractors through the BRT infrastructure.

The final category is the vacant lands. This are lands without a visible current use, in some cases they are spaces that belong to the infrastructure system of the city, by working as buffer zones or transition spaces. Nevertheless, it is imperative to generate a strategy that can assign them a role in the urban system, ever since they risk of becoming urban degradation spaces. The BRT system could help us to generate a strategy for them, by finding a potential role to be fulfilled at a larger scale, once again being helped by the connection with the rest of the urban area.



Fig. 18 - Vacant lands along the corridor

### III.II - Mapping the BRT corridor.

In order to propose a coherent solution for the BRT system we decided to study its characteristics by traveling along its path in the two directions, taking a series of pictures and pointing out the changes in its taxonomy.

To better understand the challenges posed by the implementation of the infrastructure this trip was done with bicycles, going along the existing traffic lines, in order to be as close as possible to the proposed BRT path.

Once we had a physical understanding of the actual situation, a series of sections was realized, describing the width, uses and taxonomies of the path.

We could observe different changes of its taxonomy, which vary from the actual width of the street, to the different level of the paths. Sometimes this would be at street level, while in some situation it would be at an underground level, going through underpasses or along an abandoned train corridor.

Another interesting discovery was the potential points of conflict, such as the intersections with other streets and the important number of private housing and car entrances to commerces along the path.

This situations confirmed the need to have a median station BRT system, since having curb side stations will only hinder the accessibility to the above mentioned elements, potentially causing conflict with their owners and users.

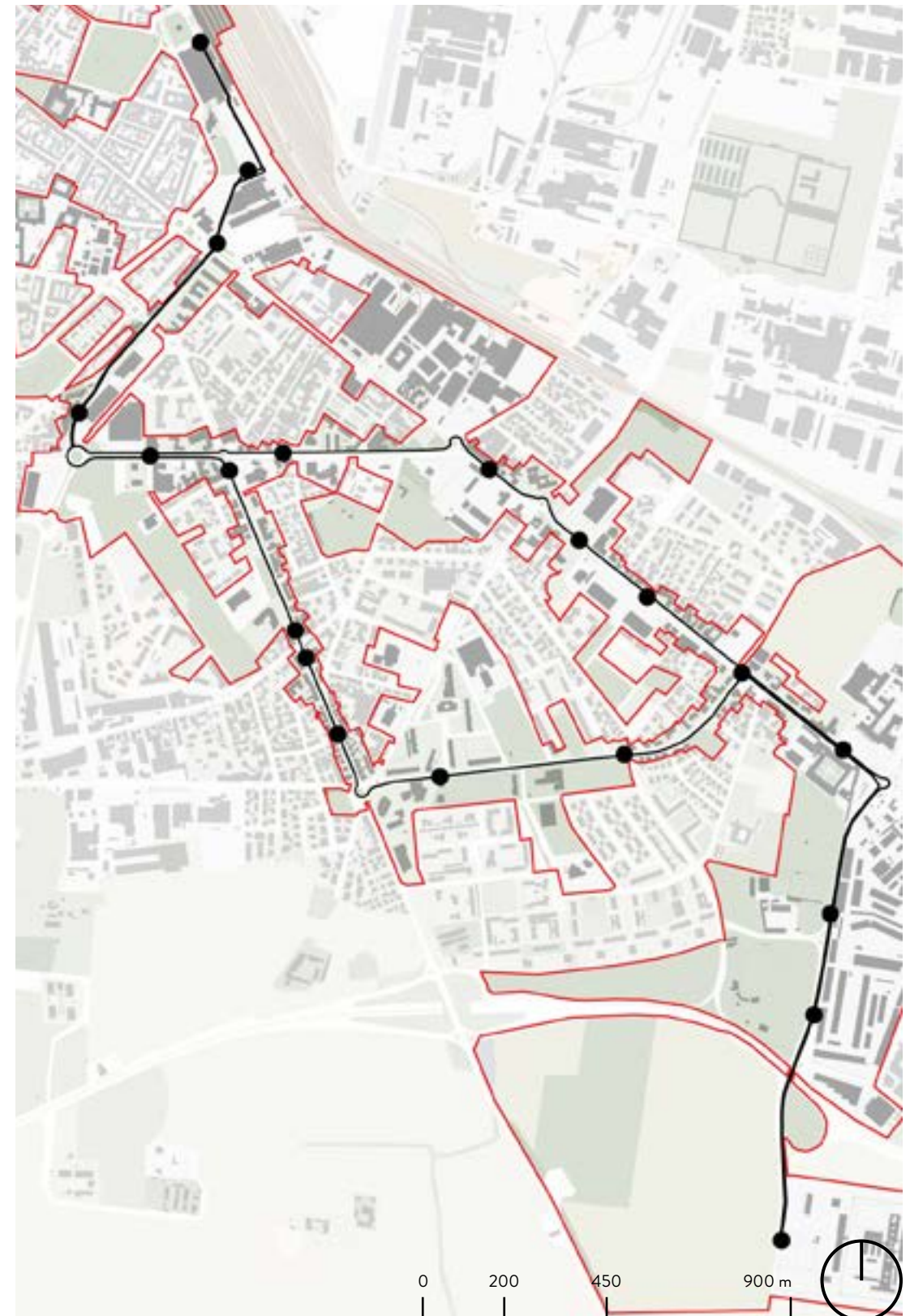


Fig. 19 - The proposed BRT path

From the train station to the New Hospital



Fig. 20 - Stills from the Train station towards the new hospital

From the New Hospital to the train station



Fig. 21 - Stills from the New Hospital towards the Train Station

### III.III - Taxonomy of the corridor

After traveling along the BRT path it was possible to categorize it in nine different segments, whose taxonomy vary according to the width, number of traffic lanes and the presence of sidewalks or dedicated parking lanes.

The first segment, which can only be found along the train station is a wide corridor with 2 way mixed traffic lanes, with the presence of public transportation buses on both directions, nevertheless there aren't any dedicated parking lanes but there are existing sidewalks.

The second category, which goes along Borgo Faxhall, is a very narrow corridor, with the presence of traffic lanes in two directions, there isn't any buses passing along the corridor, has dedicated parking on both sides and hasn't any existing sidewalk.

The third segment goes along the existing parking behind Borgo Faxhall. It is a wide corridor with traffic lanes in both directions, there aren't any buses along it, because of its nature it has parking spaces all along it but hasn't got any sidewalks.

The fourth segment, going along the unused railroad until its intersection with Via della Conciliazione is a very narrow corridor, it has no traffic lanes along it, no public transportation system and no parking places. Nevertheless it has a bicycle lane and a pedestrian path.

The fifth category, which refers to Via della Conciliazione is a very wide corridor, it has mixed traffic lanes on both directions and the public transportation system passes along them. There are dedicated parking places along it, as well as bicycles lanes and very wide sidewalks.

The sixth segment, which goes along Strada Farnesiana and Via Radini - Tedeschi, in a mainly residential area, is a wide corridor with mixed traffic in both directions, the public transportation system travels along them and has dedicated parking places on both sides. There are also wide sidewalks along it.

The seventh category, going along Via Emilia Parmese, is once again a wide corridor with mixed traffic lanes in both directions, with presence of public transportation system along it. In some areas there are dedicated parking places and there are also sidewalks along it.

The eighth category, located in Strada delle Novate from its intersection with Via Emilia Parmese and Tangenziale is a very narrow corridor, there are mixed traffic lanes in both directions, the public transportation system travels along it but there aren't any existing sidewalks. This segment is contained on both sides, making it virtually impossible to be widened.

The last segment is Strada delle Novate after Via Tangenziale until the location of the New Hospital. Currently there are two mixed traffic lanes that also host public transportation system, there aren't any dedicated parking spaces or sidewalks. Nevertheless there is the possibility to make it wider in the future.

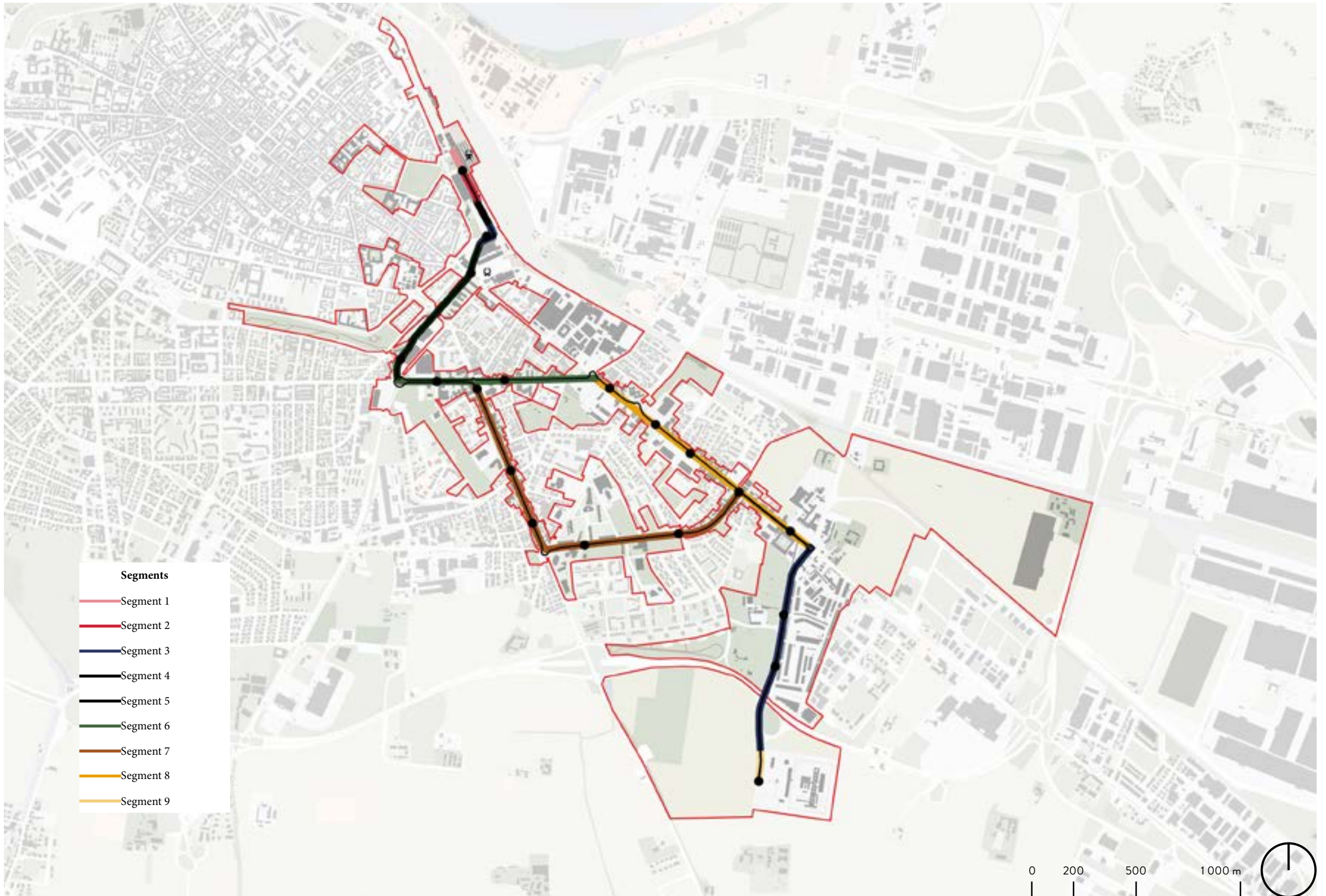
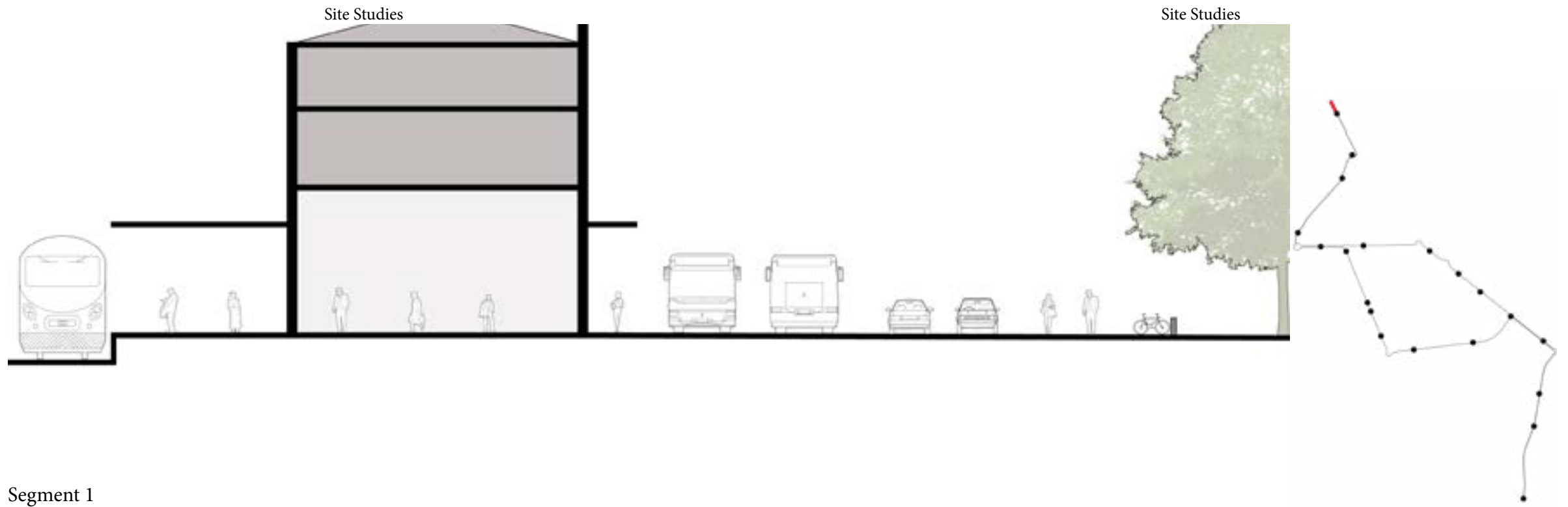


Fig. 22 - Existing segments of the BRT corridor



Segment 1

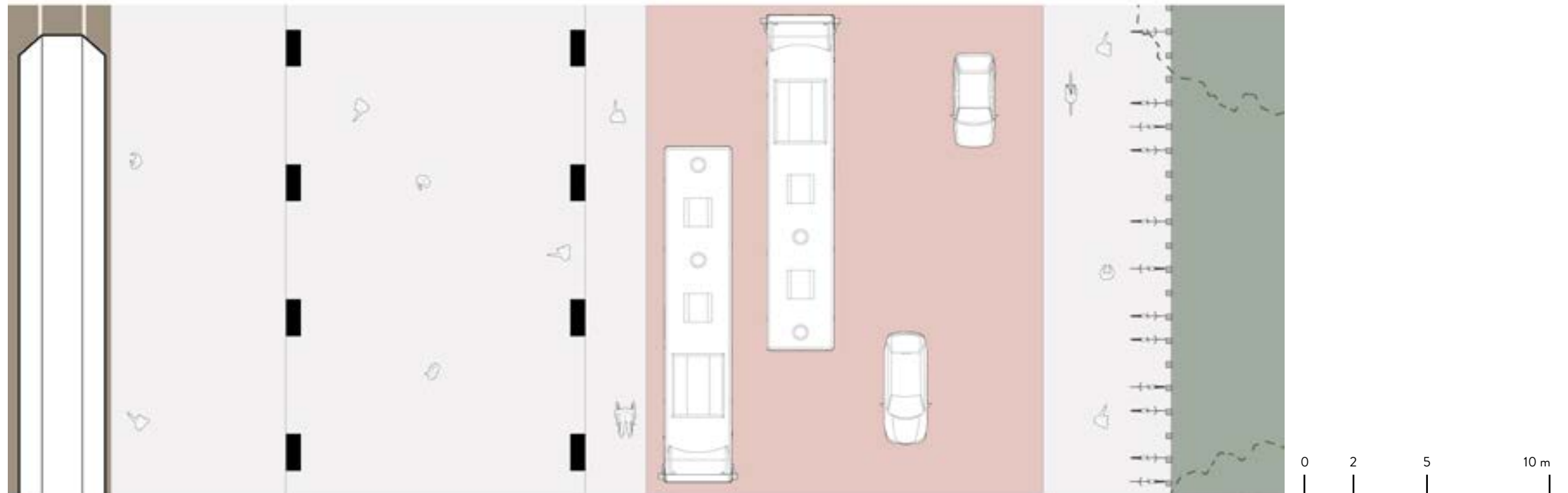
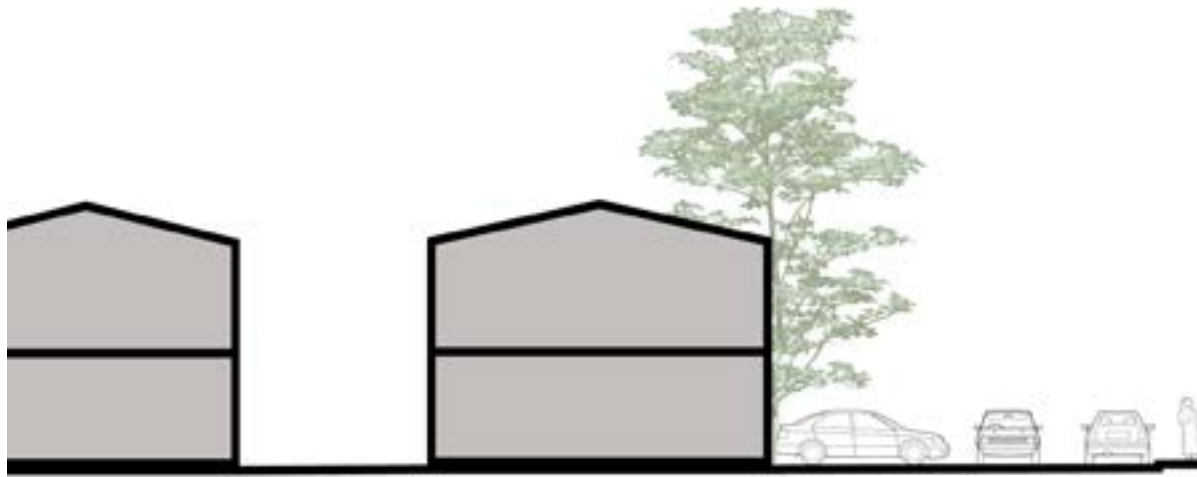


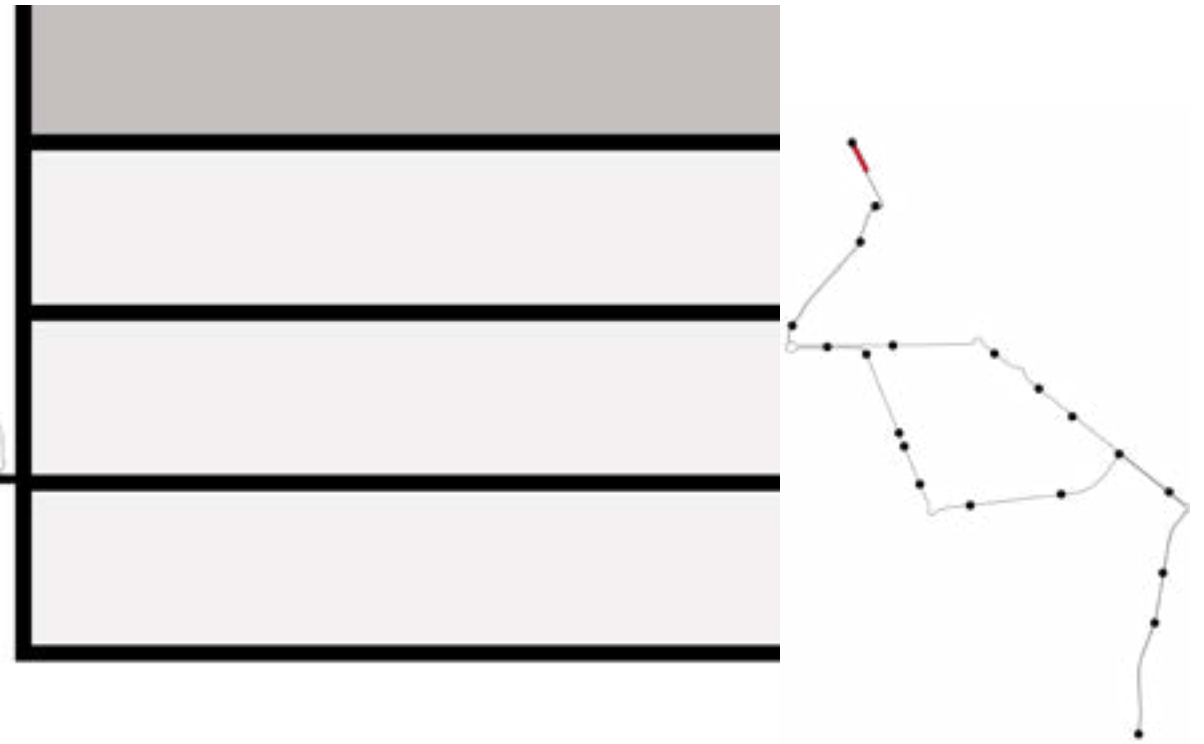
Fig. 23 - Current taxonomy of the segment 1



Site Studies



Site Studies



Segment 2

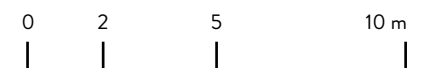
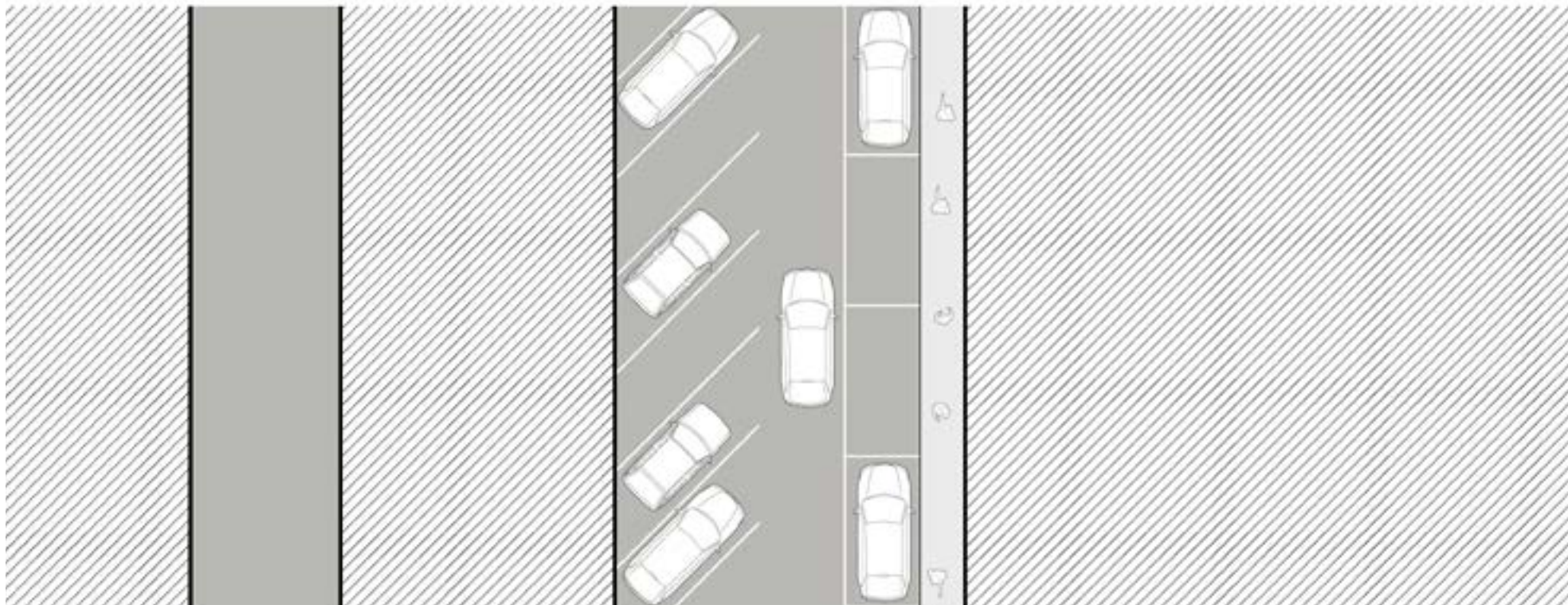
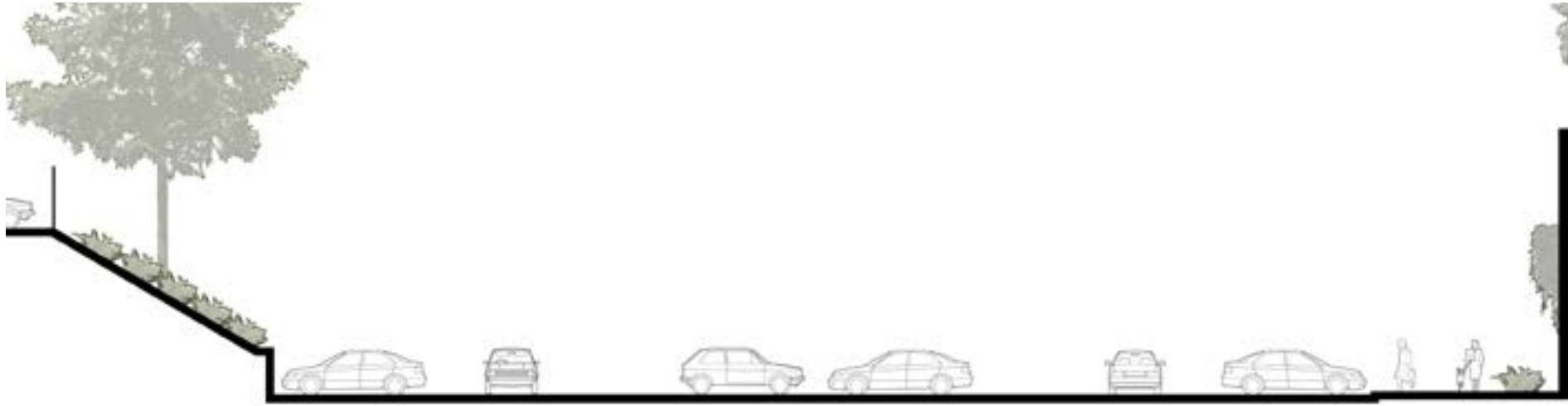
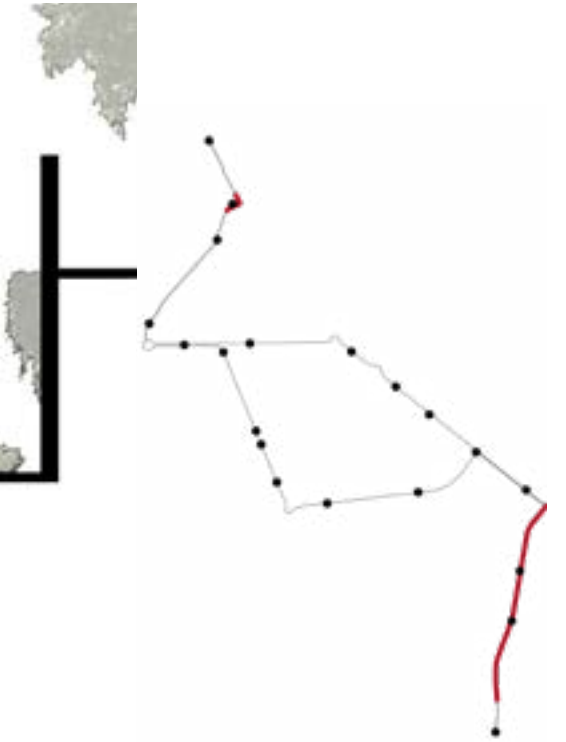


Fig. 24 - Current taxonomy of the segment 2

Site Studies



Site Studies



Segment 3

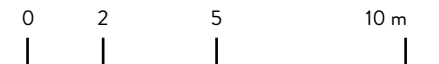
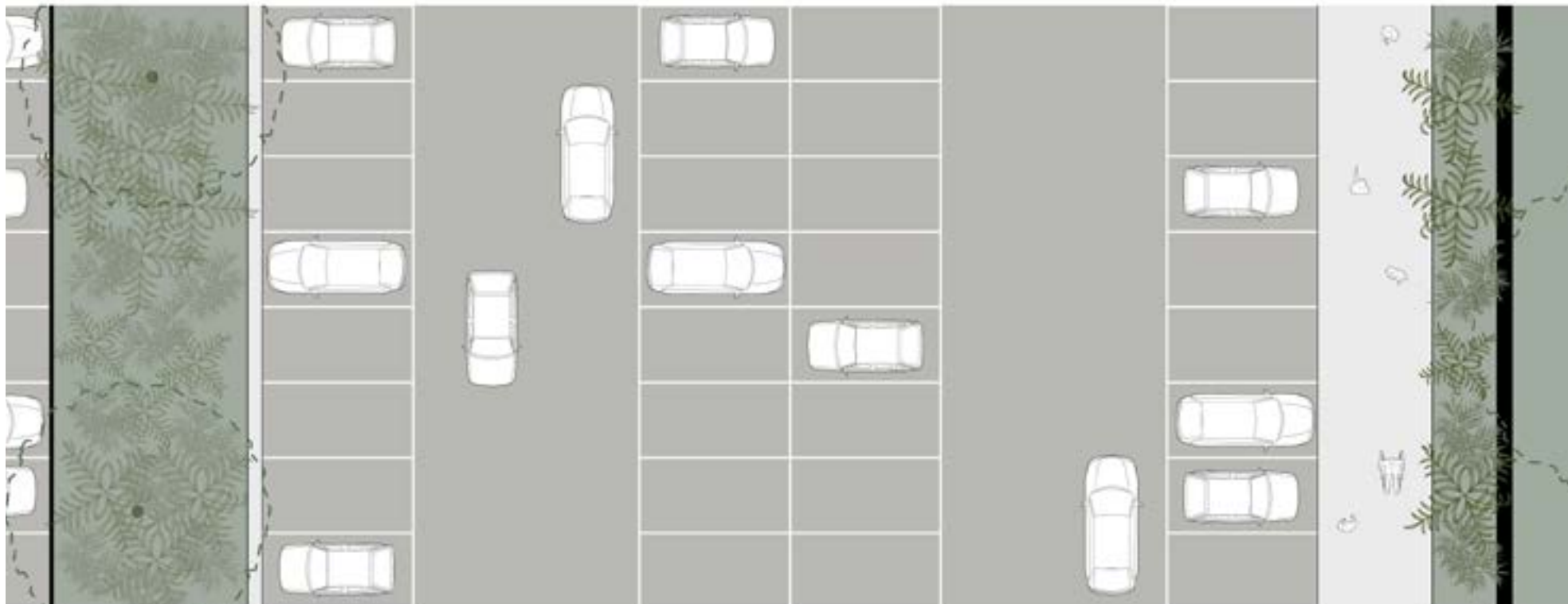


Fig. 25 - Current taxonomy of the segment 3

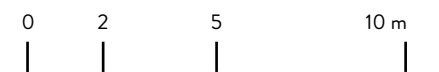
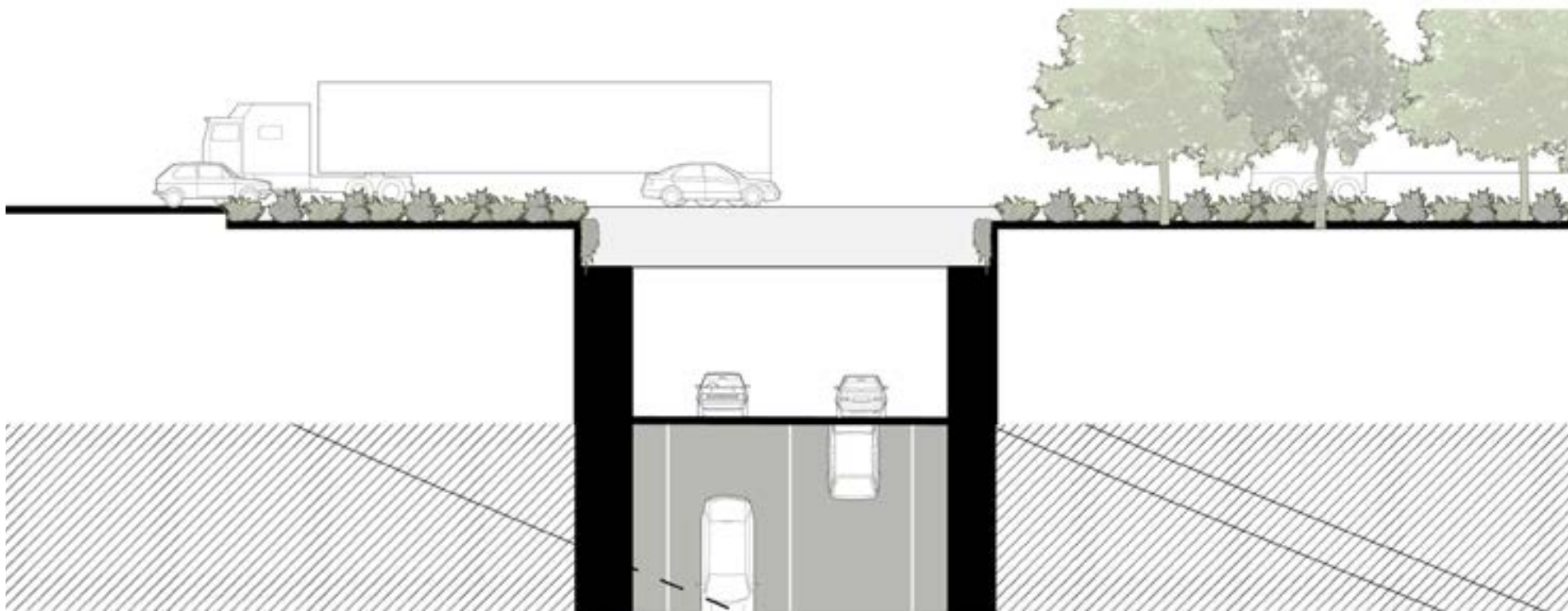
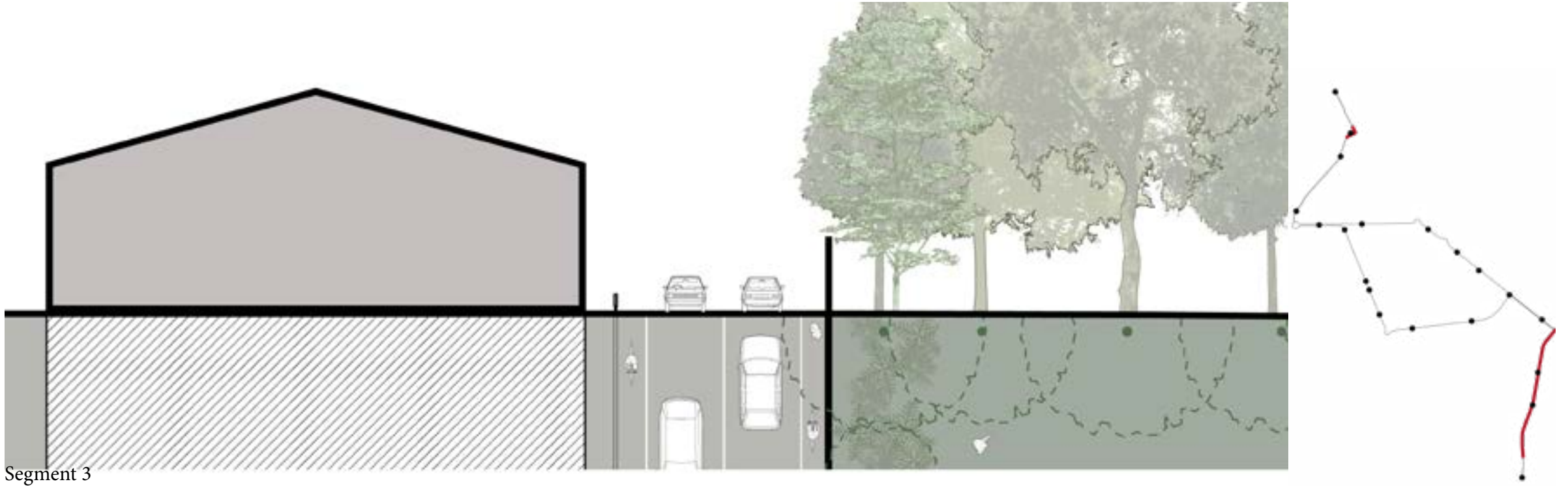
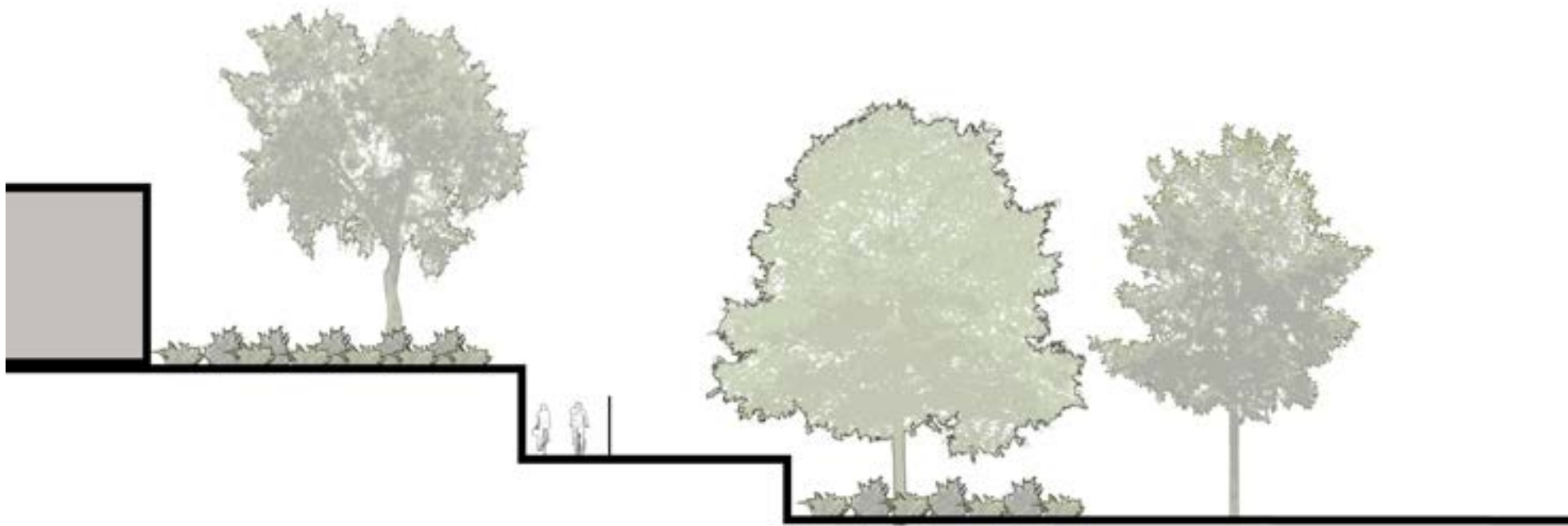


Fig. 26 - Current taxonomy of the segment 3



Segment 4

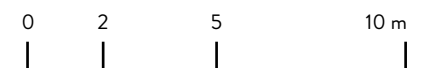
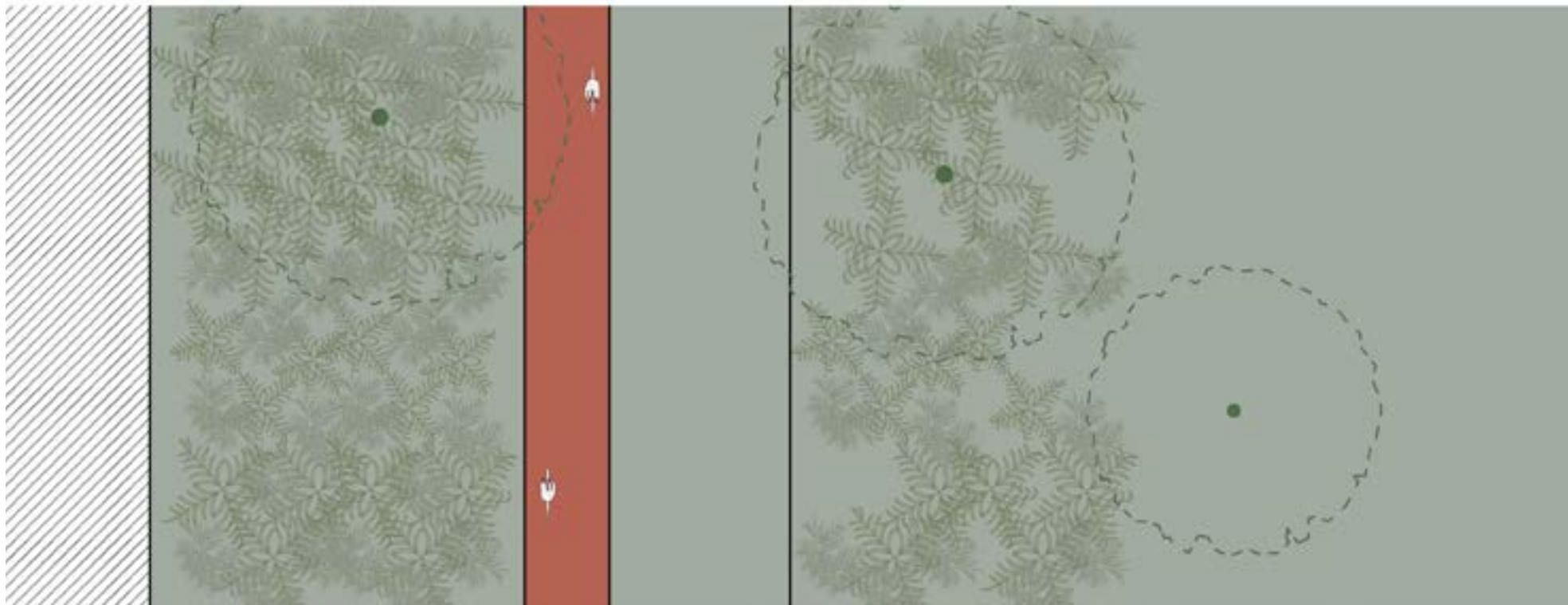


Fig. 27 - Current taxonomy of the segment 4

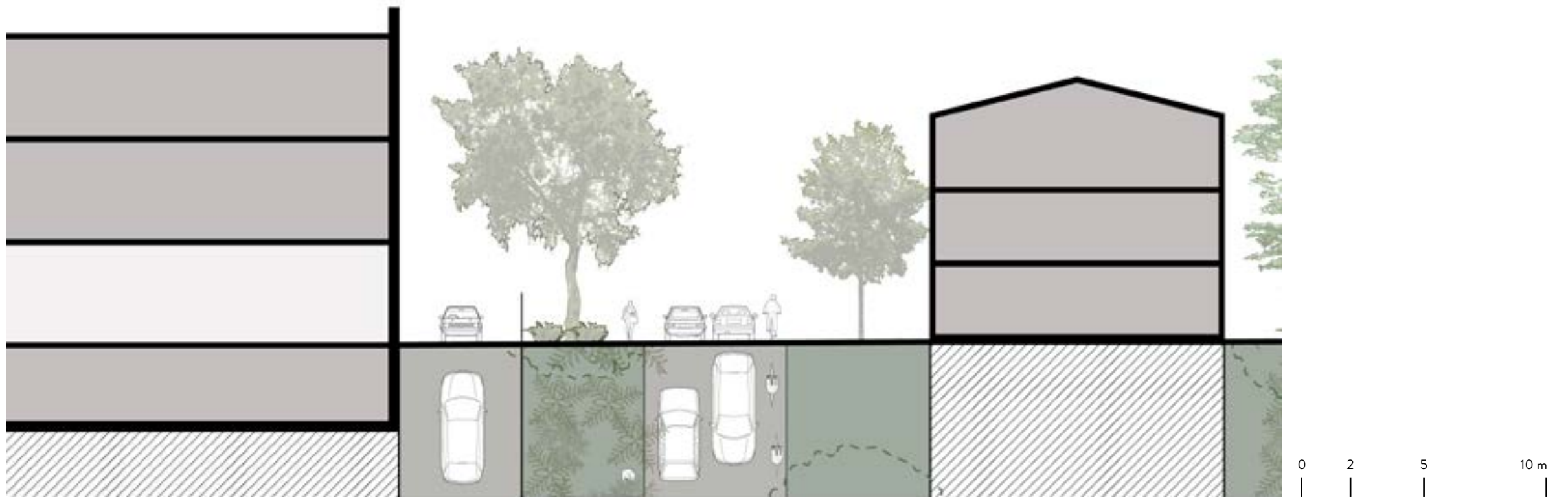
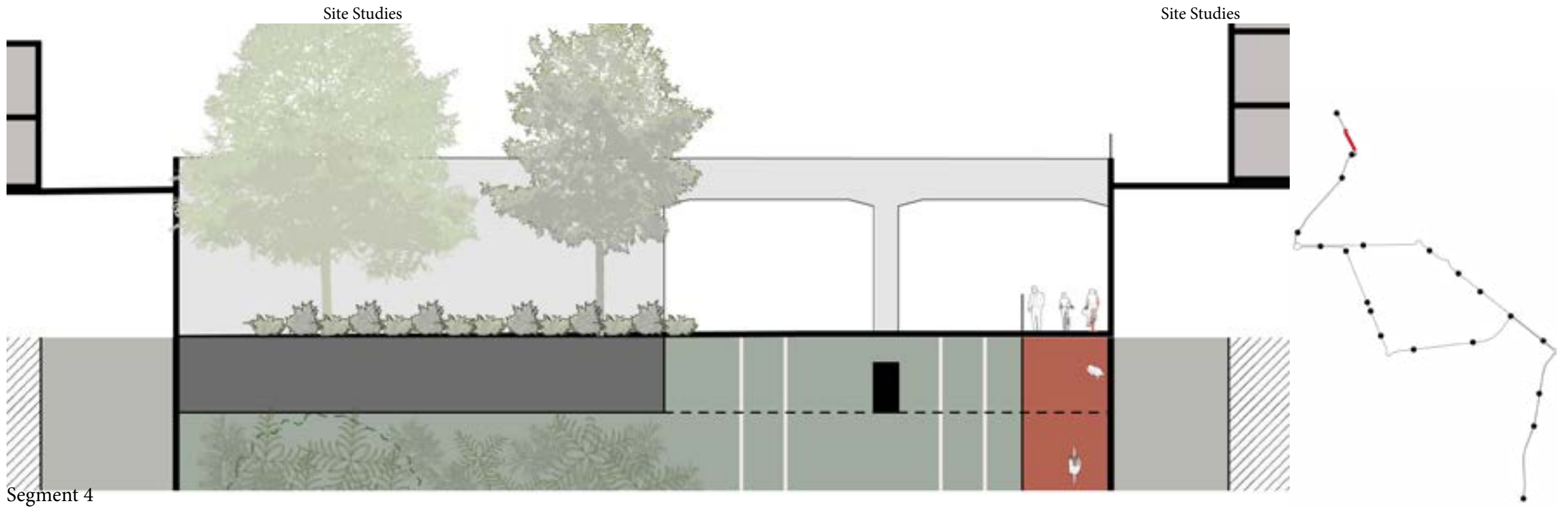
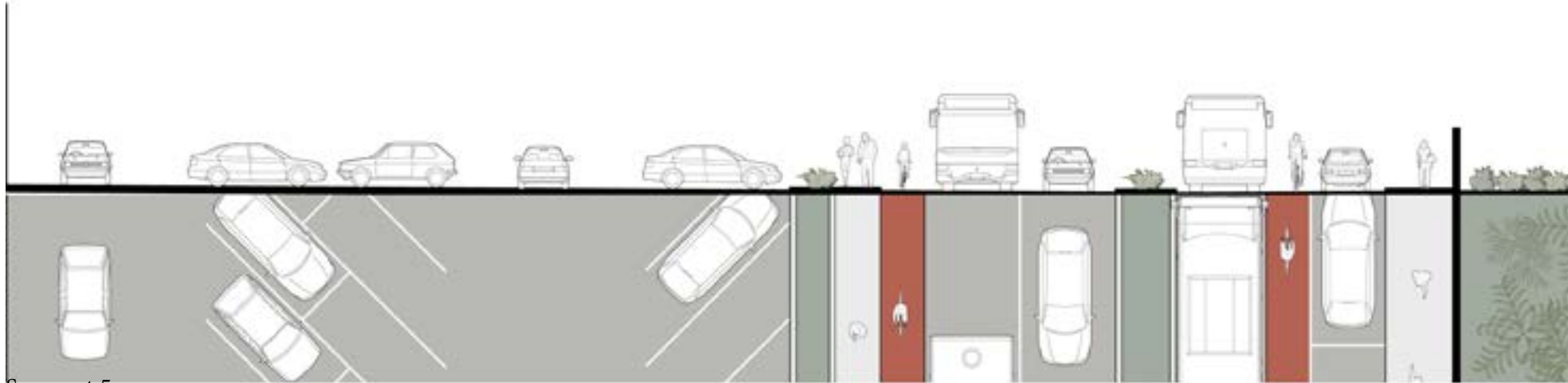


Fig. 28 - Current taxonomy of the segment 4



Segment 5

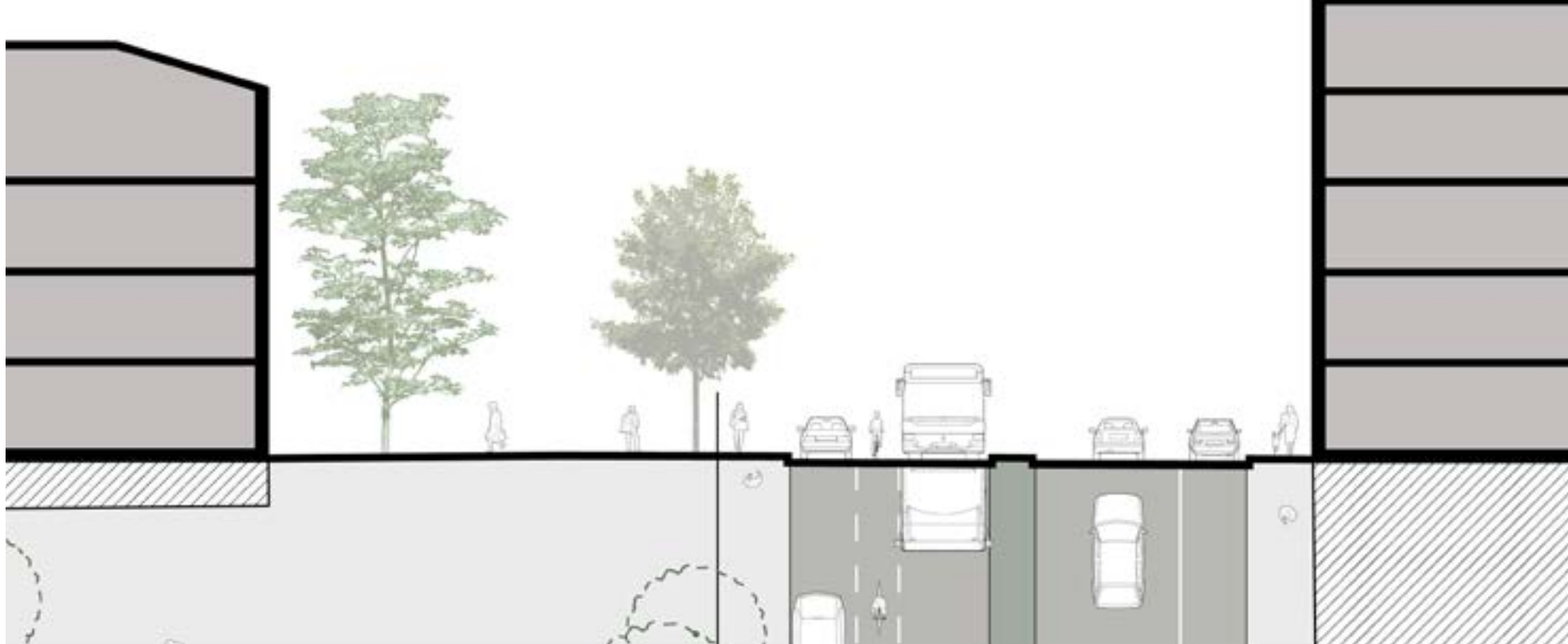
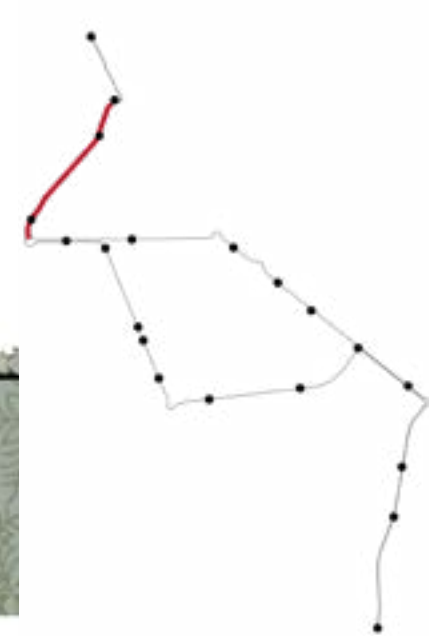
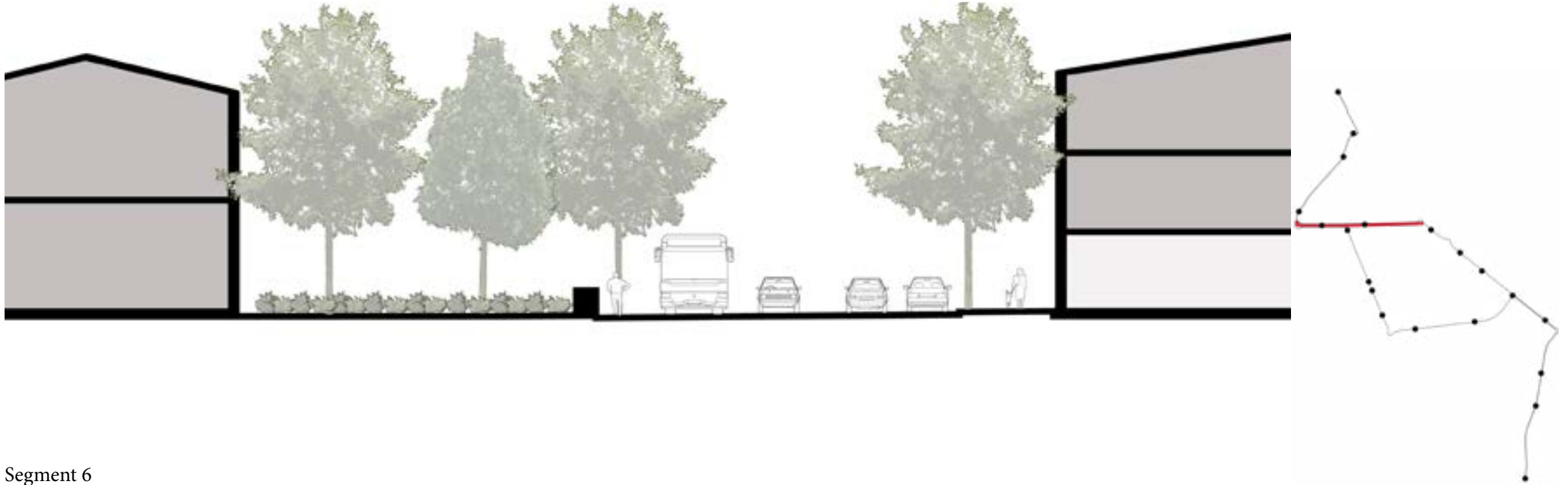


Fig. 29 - Current taxonomy of the segment 5

Site Studies

Site Studies



Segment 6

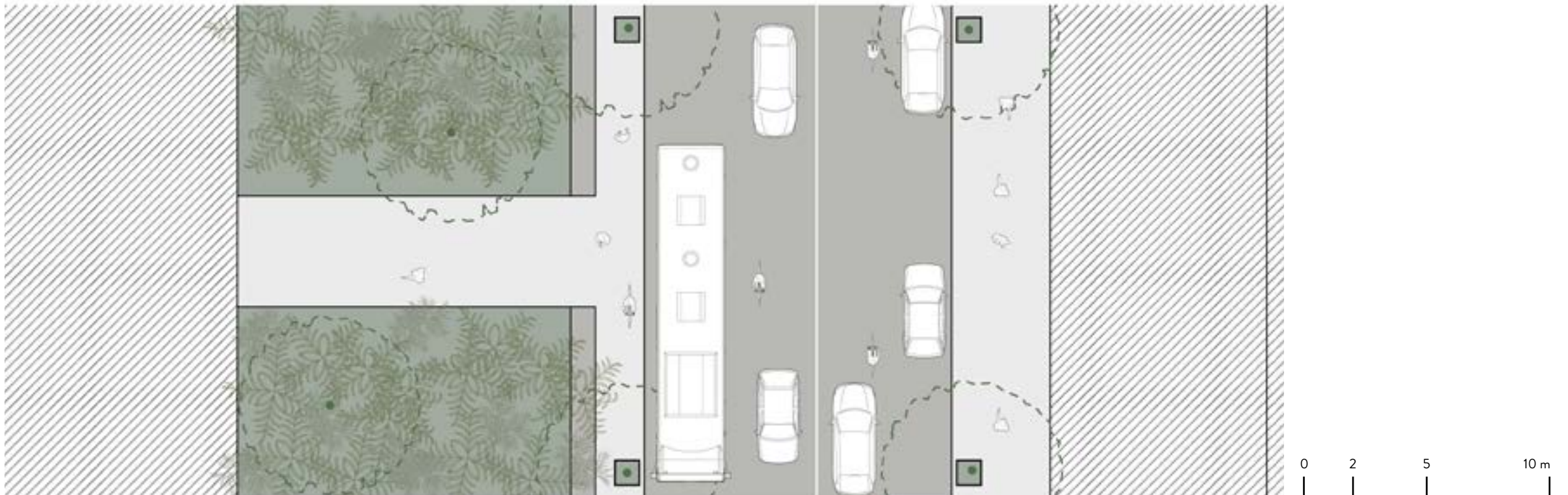
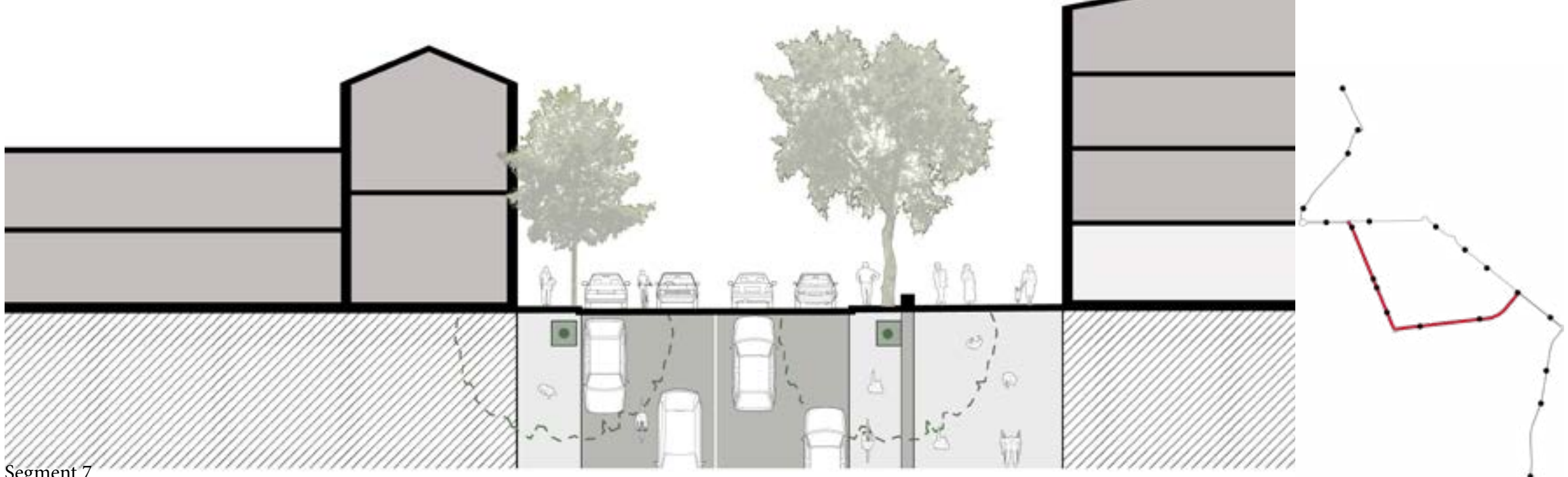


Fig. 30 - Current taxonomy of the segment 6

Site Studies

Site Studies



Segment 7

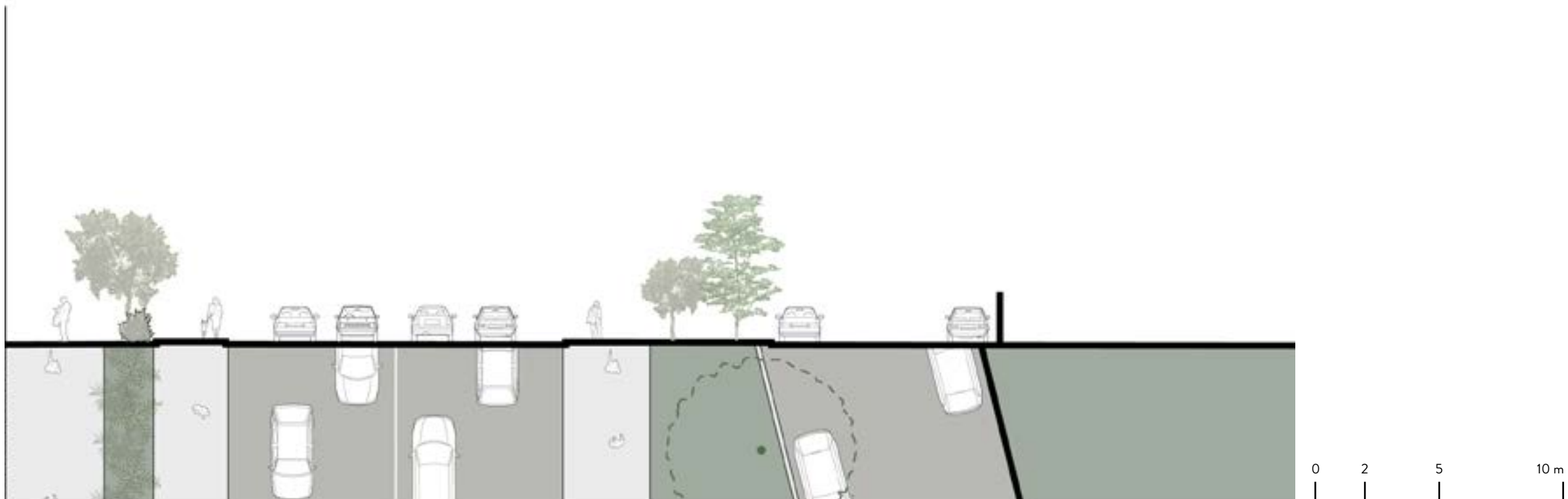


Fig. 31 - Current taxonomy of the segment 7



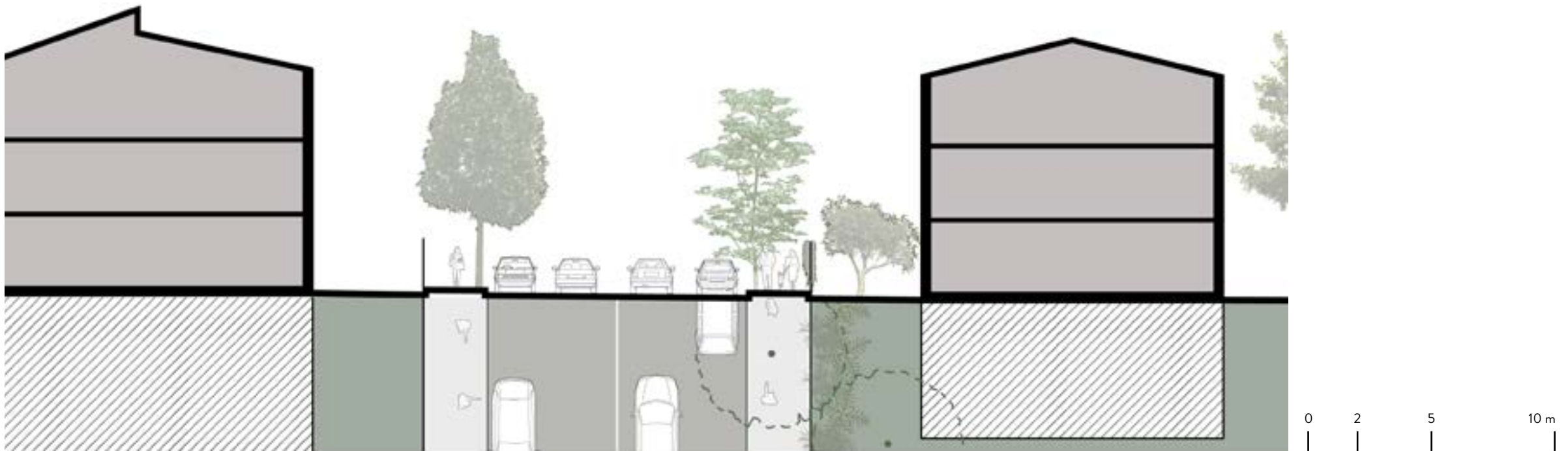
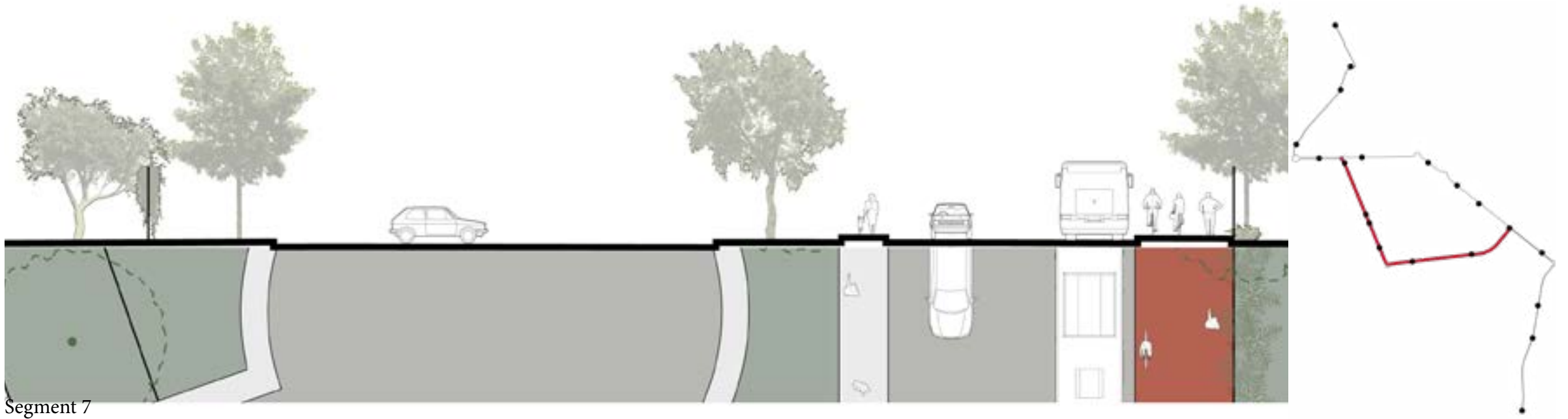


Fig. 32 - Current taxonomy of the segment 7



Segment 8

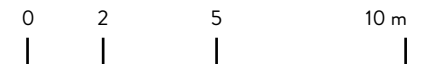
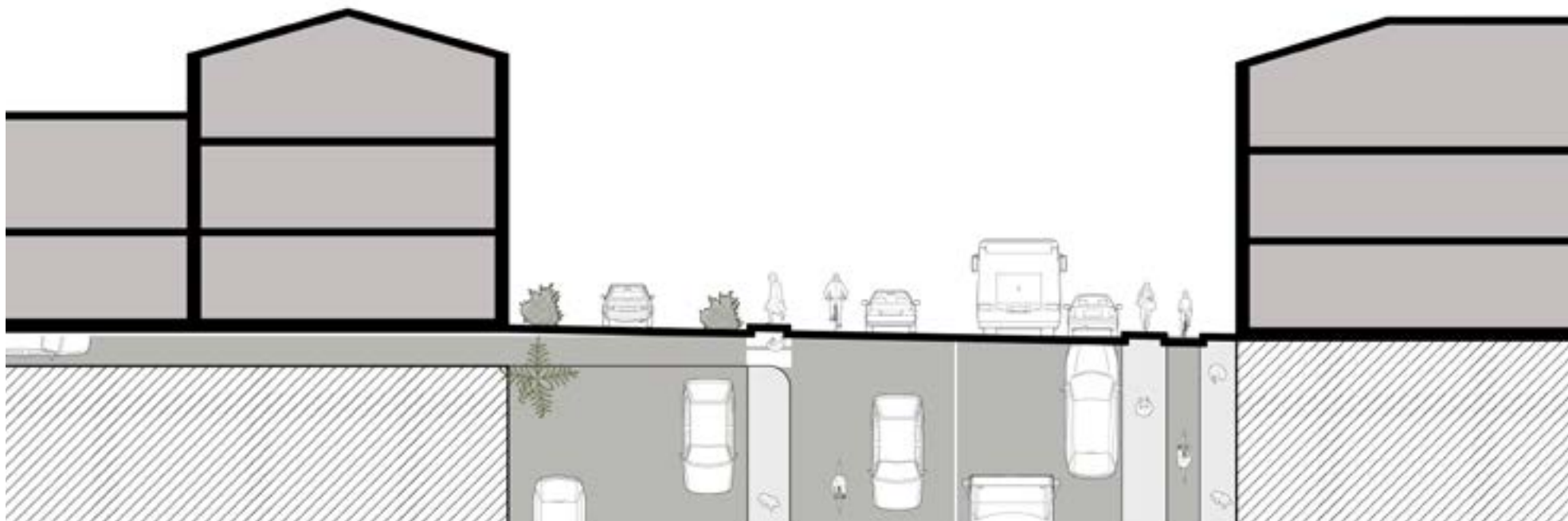
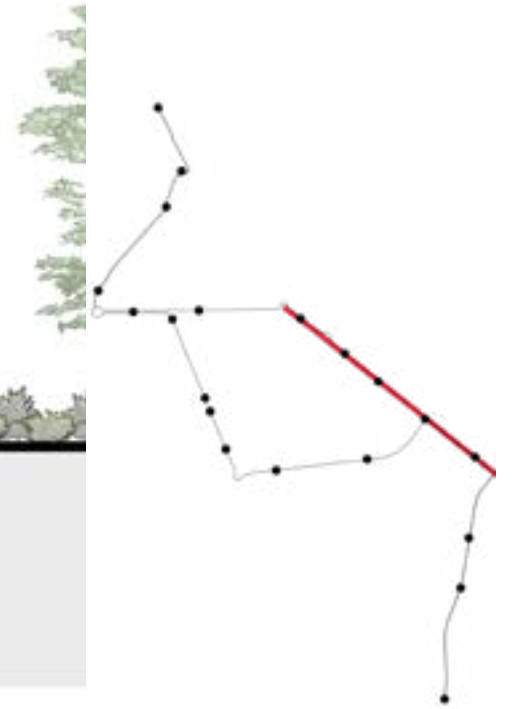
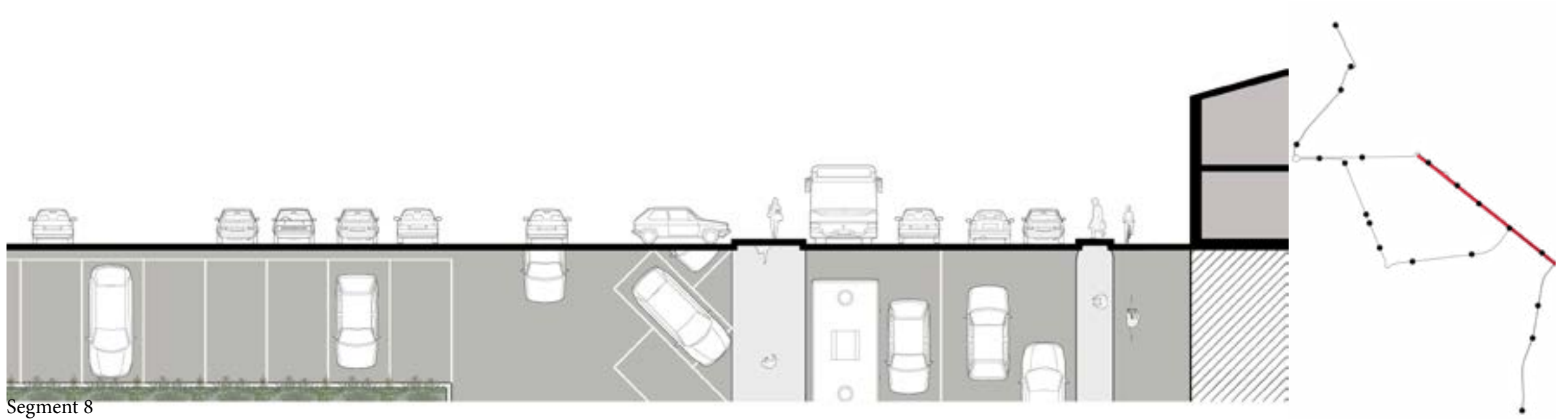


Fig. 33 - Current taxonomy of the segment 8



Segment 8

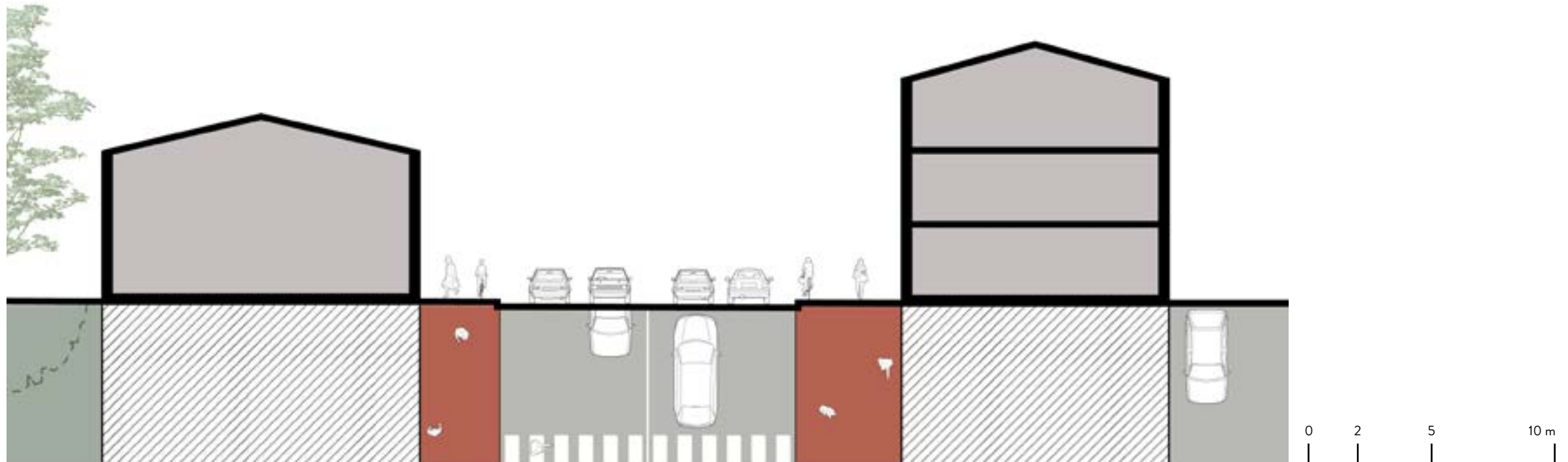
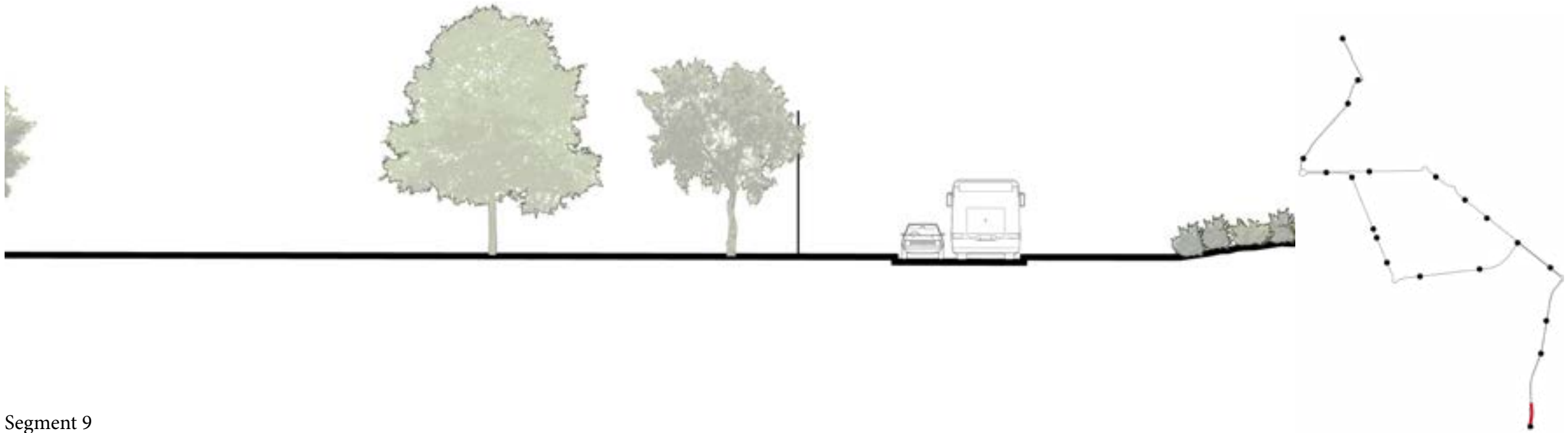


Fig. 34 - Current taxonomy of the segment 8



Segment 9

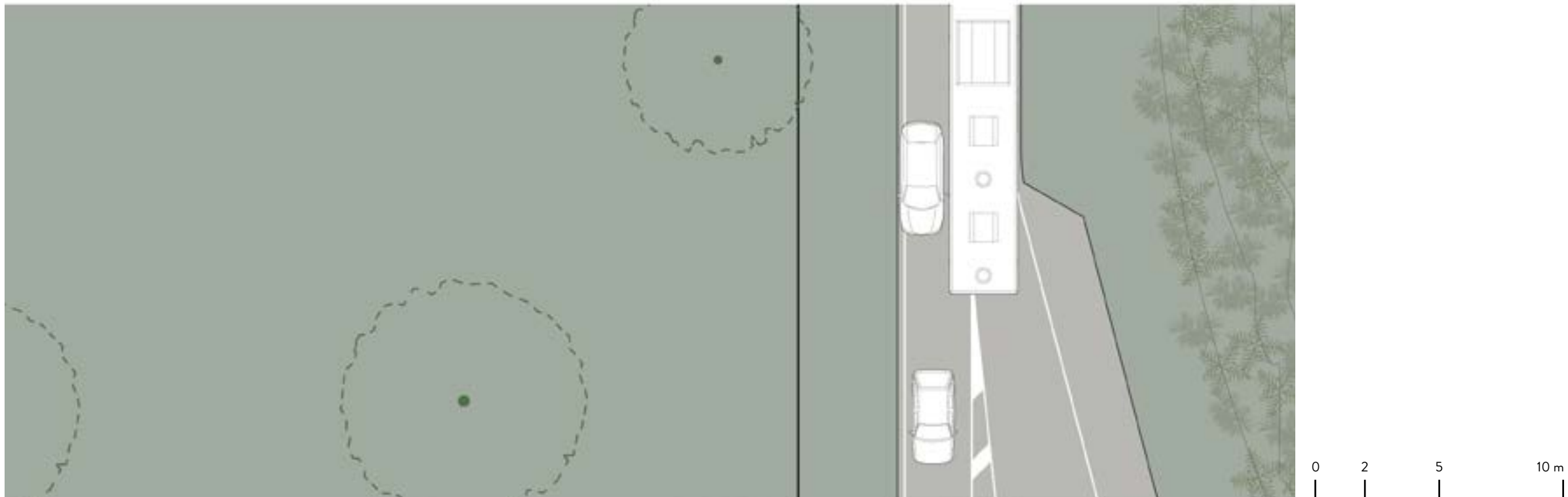


Fig. 35 - Current taxonomy of the segment 9

#### **IV -Strategy**

#### IV.I - Mobility Strategy

The mobility strategy can be translated into two categories. The first of them being the removal of existing parking places, in order to host a larger surface for pedestrian use. Secondly, the expansion of the soft mobility network through the implementation of new bicycle lanes and shared mobility services.

Both of these situations can only be achieved by changing the taxonomy of the streets where the BRT line will be traveling, as well as in the roads that link the corridor within itself, but do not count with its existence.

By removing the existing parking places along the corridor we will not only generate additional space for the BRT line, but also add more pedestrian surface to the ground level of the buildings along the path. This can make it more attractive for the commerce in the ground level to open up towards the corridor, generating a more active urban life and also changing the image of the city. This will also decrease the attractiveness of the use of the car in this areas of the city, by increasing the difficulty to park in the areas, and inviting the people to use the public transportation system or the bicycle lanes along it.

In order to achieve this objective, we have to expand the existing bicycle lanes system, which is currently disconnected in several segments. After the first strategy has been implemented, we will also count with space for allocating additional bicycle lanes, as well as hubs for shared mobility in some of the existing vacant lands and intersections along the corridor. The location of these hubs have been defined by the existence of relevant attractors and generators, which are densely populated areas, educational or productive areas of the city. A wider bicycle lane system should not only be exclusive to the existence of the BRT corridor, but also to the rest of the city, nevertheless. The implementation of the BRT line and its soft mobility strategy can work as a detonator for this situation to happen in the rest of the city.

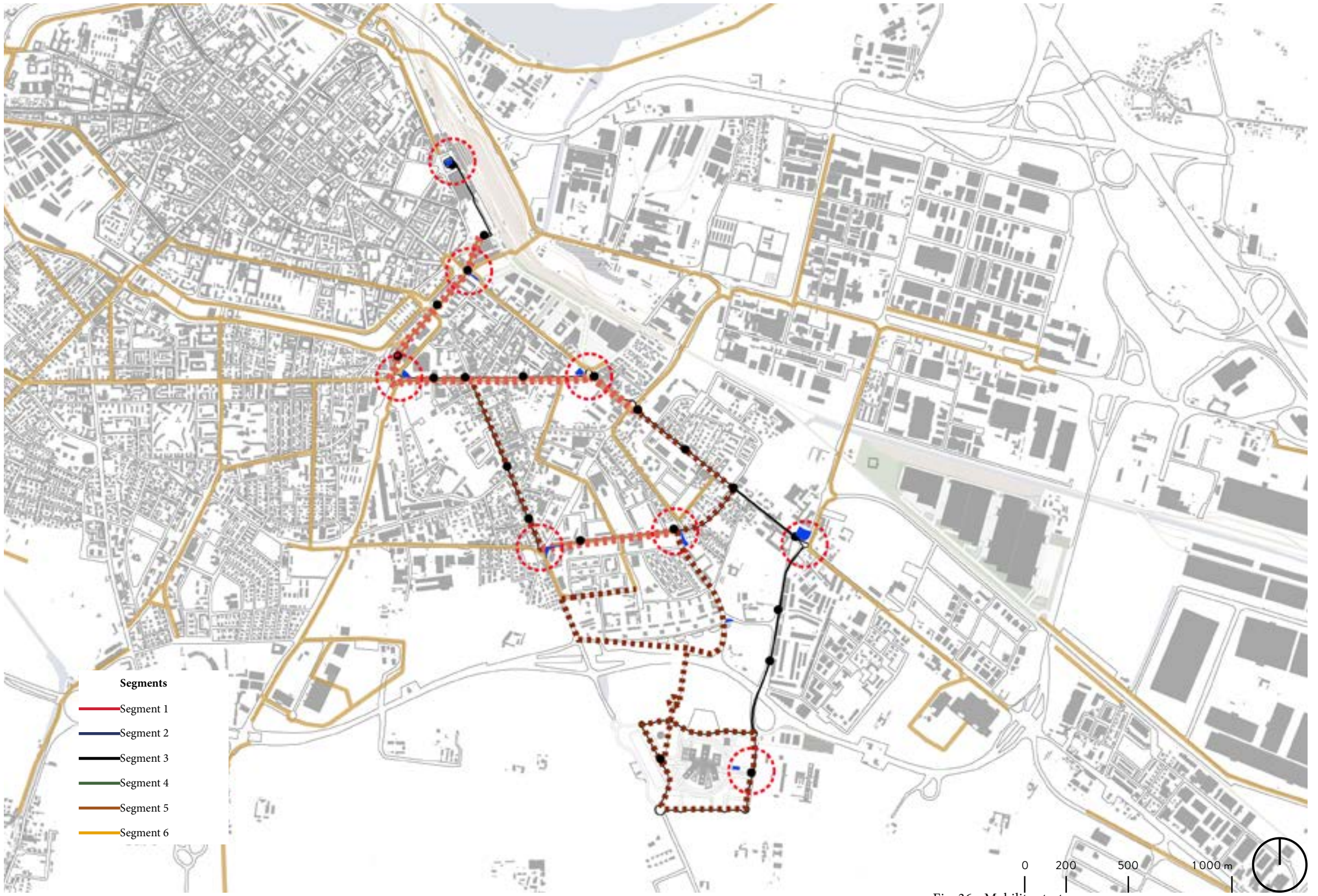


Fig. 36 - Mobility strategy

**IV.II - Modifications to the existing transportation system**

Ever since the BRT line will pass on the same streets as several of the local bus lines, specifically the lines number 2, 3, 5, 10, 11, 12 and 18, there is the necessity to modify their path.

This situation poses an opportunity to deviate this bus lines paths from the proposed BRT, on previously unused streets, such as Corso Europa, improving the overall connectivity of the city.







Nevertheless, since the site of the main Extra Urban bus line station will not be changed, the buses will need continue passing thorough the same streets in the mixed traffic lane.

The solution proposed for this situation is to remove the existing bus stops along the BRT path, offering the possibility to board the later in the intersections between the two systems.

This way the flow of local traffic will not be hindered, but improved, since a lesser number of stops will exist in the above mentioned streets.

With this two solutions the BRT line doesn't seek to replace or degrade the existing public mobility system, but to improve it and also to integrate it in a local and Extra Urban scale.

**Modification to the existing public transportation system:**

-  BRT line
-  BRT station
-  Regular bus line
-  Regular bus stop
-  Extra urban bus line
-  Extra urban bus stop

**Actors:**

-  Educational
-  Commercial
-  Church
-  State services
-  Infrastructure Services
-  Health Services
-  Foundation
-  Cultural
-  Sport Area
-  Park and Garden
-  Office
-  Future projects





Fig. 37 - Modifications to the local transportation system

### IV.III - Taxonomy of the proposed corridor

After the analysis of the infrastructure path, and departing with the decision of using a median station BRT system, we are proposing a corridor whose taxonomy has six different segments:

The first segment, which can be found at the departure station, along Borgo Faxhall, as well as along Strada delle Novate, will become a very narrow corridor, without any mixed traffic lanes, the BRT lane will travel in its two directions, and without any parking places.

The second segment, which starts from the existing parking behind Borgo Faxhall, finishing in the intersection with Via della Conciliazione, will become a very narrow corridor, with the BRT traveling in its two directions, no parking places but with sidewalks and a bicycle lane along it.

The third segment, going along Strada delle Novate, until the intersection with Strada Farnesiana is a very wide corridor, with two mixed traffic lanes, the BRT will travel in its two directions, with the presence of sidewalks and bicycle lanes. Nevertheless there won't be any parking places along it.

The fourth segment, going along Strada Farnesiana, as well as Via Radini Tedeschi and a part of Via Emilia Parmese, is a wide corridor with 2 way mixed traffic, the BRT will only travel in the station - hospital direction. There will be some dedicated parking places and sidewalks in the two directions.

The fifth segment, going across Via Emilia Parmese, and around the New Hospital, will become a wide corridor with 2 way mixed traffic lanes, the BRT system will travel along its two directions, there will be some designated parking places, as well as sidewalks in its two directions.

Finally, the sixth segment, which will go around the remaining part of Via della Conciliazione, is a very wide corridor, with two way mixed traffic lanes, the BRT system will only travel in the Hospital - Train Station direction. It will also have designated parking places, as well as sidewalks and bicycles lanes.

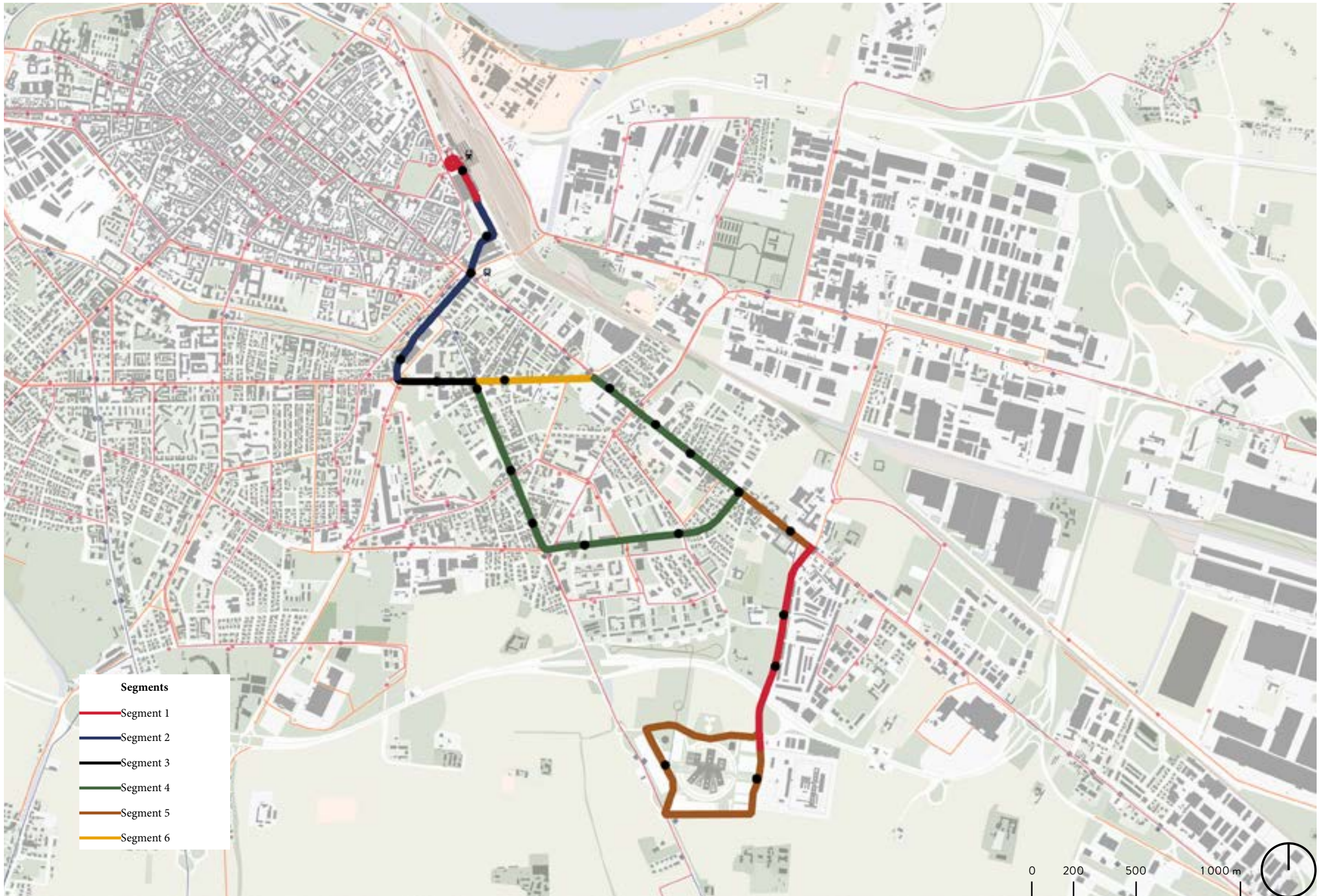


Fig. 38 - Proposed taxonomy of the BRT corridor

Strategy

Strategy

Segment 1

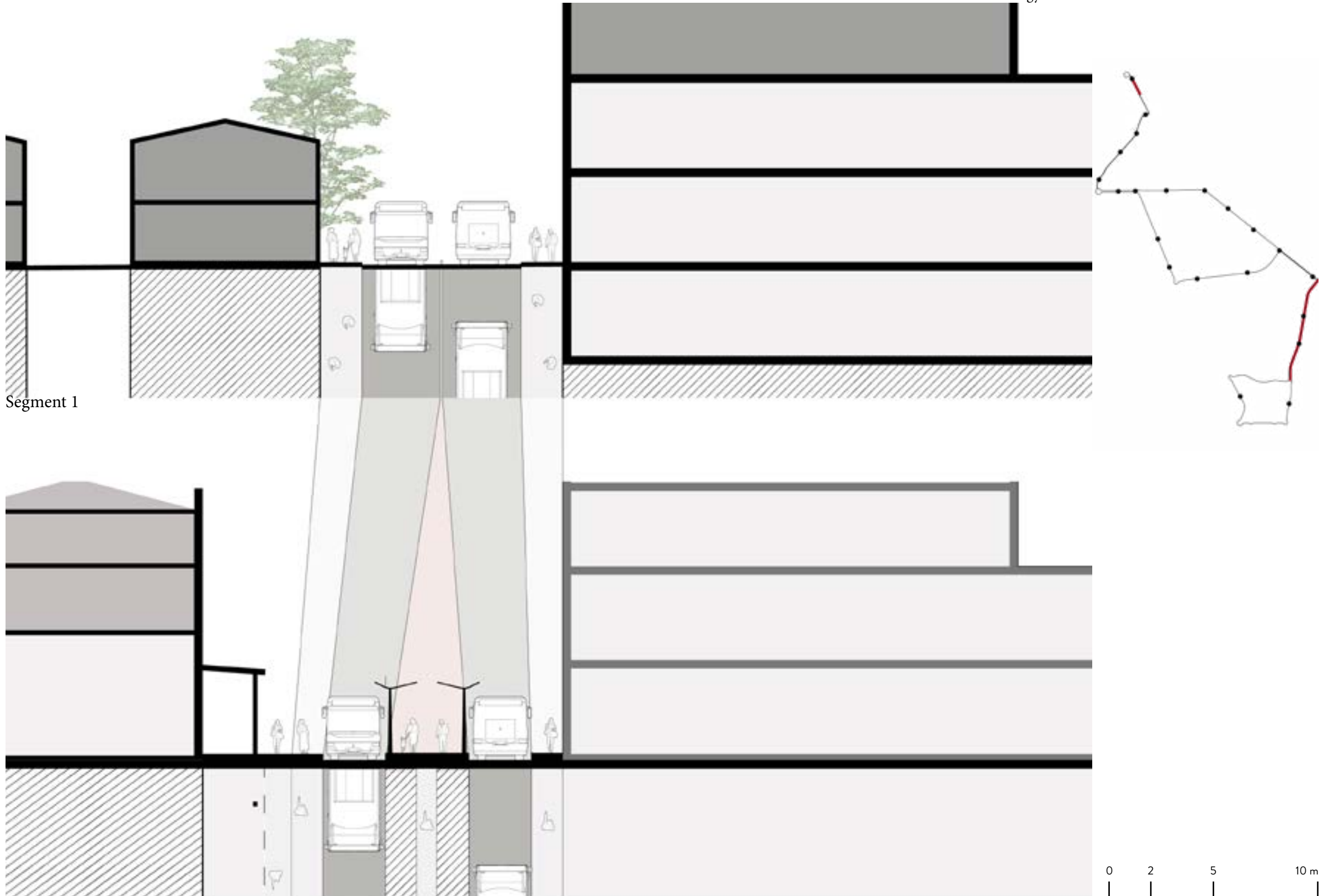
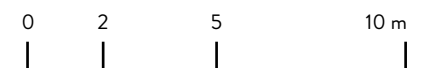


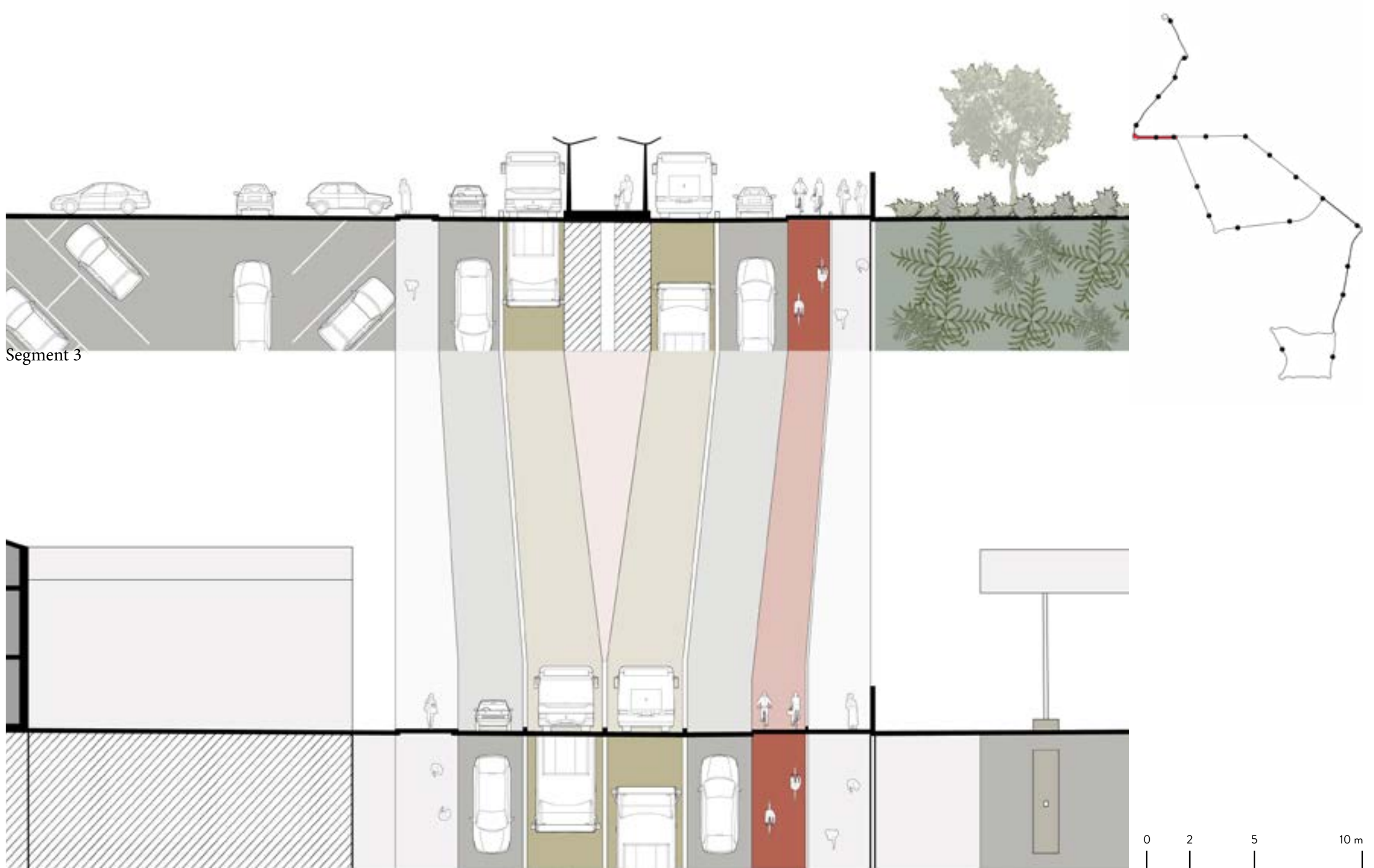
Fig. 39 - Proposed taxonomy of the BRT corridor segment 1



Segment 2



Fig. 40 - Proposed taxonomy of the BRT corridor segment 2



Segment 3

Fig. 41 - Proposed taxonomy of the BRT corridor segment 3

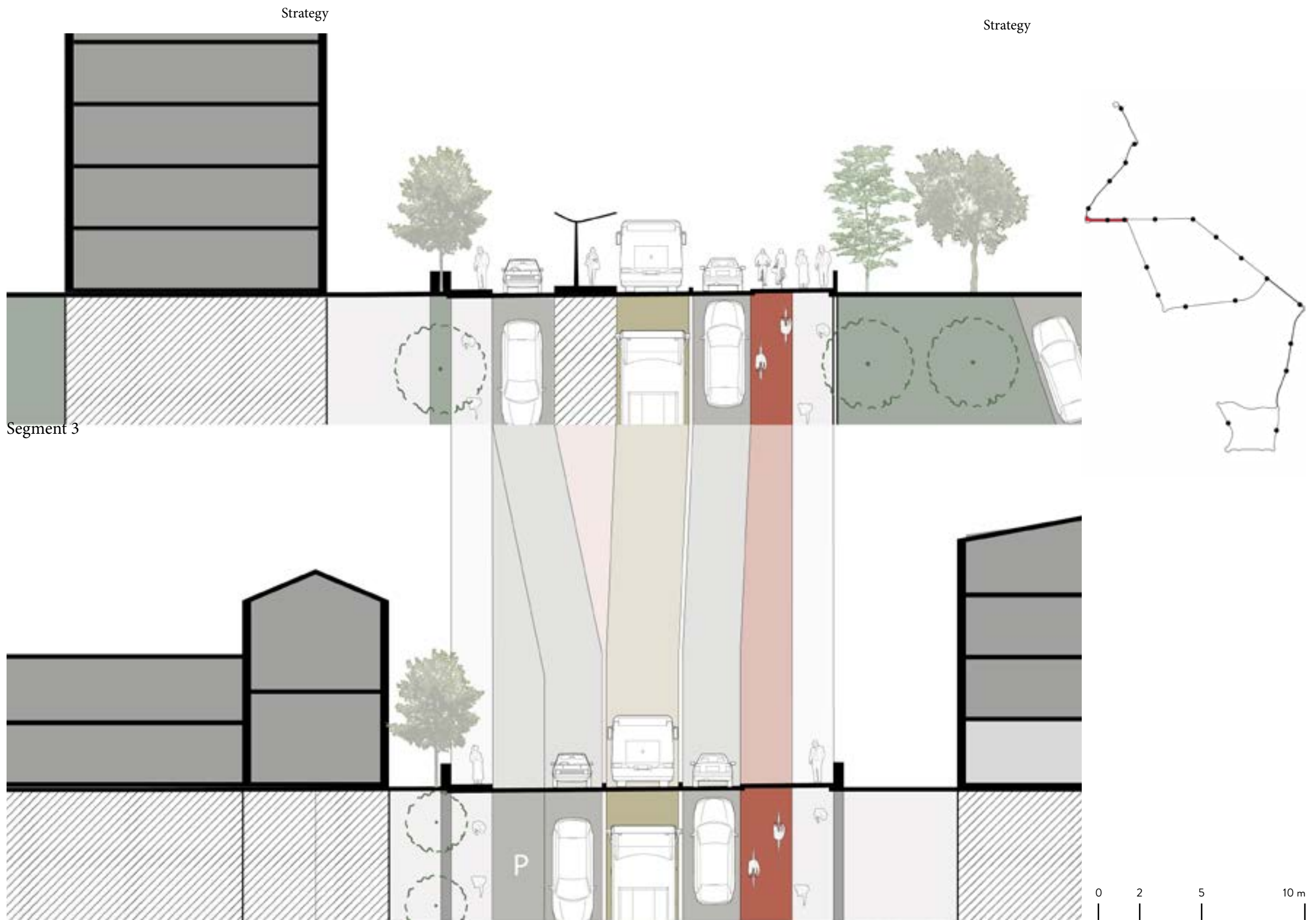
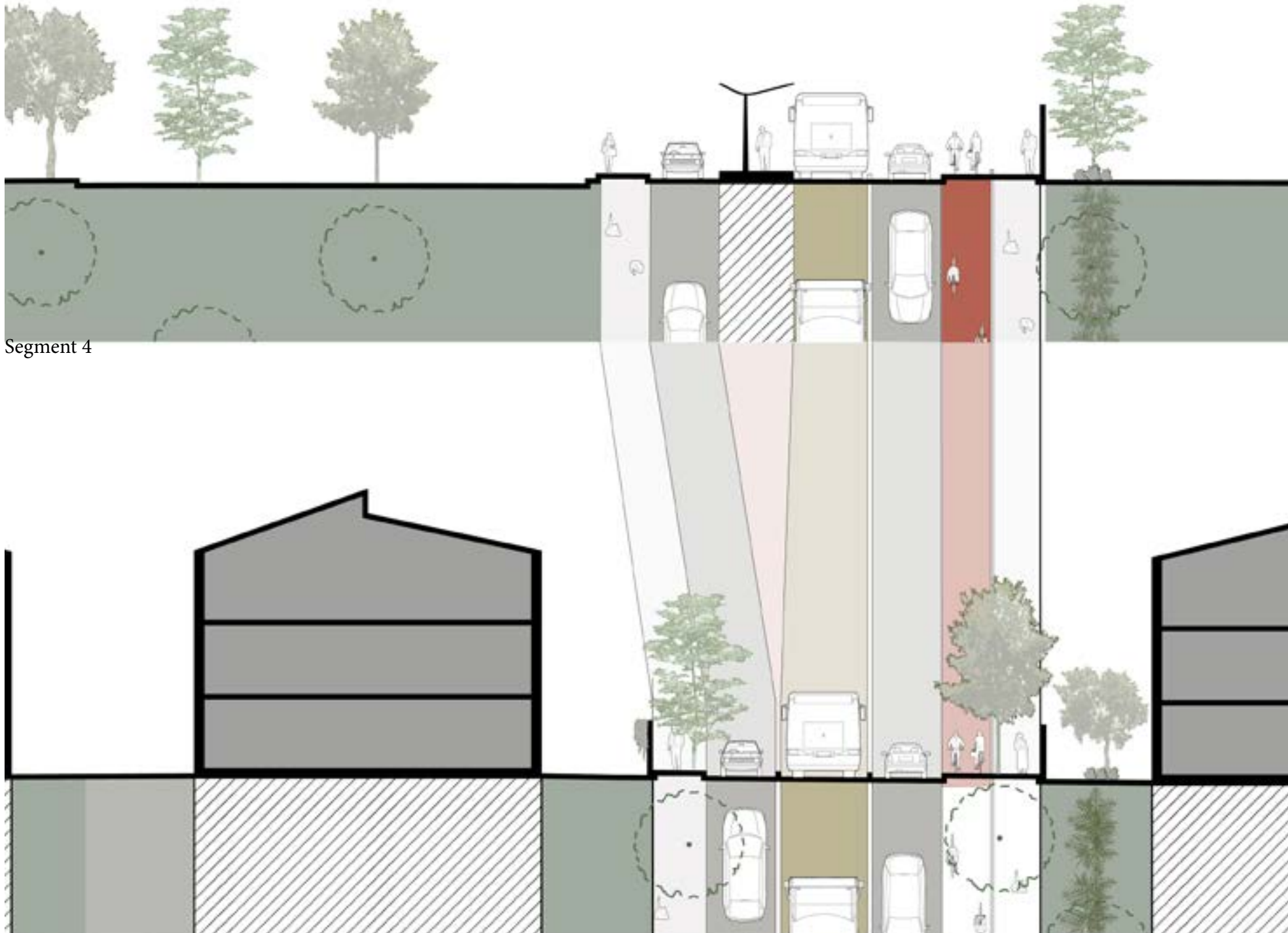


Fig. 42 - Proposed taxonomy of the BRT corridor segment 3



Segment 4

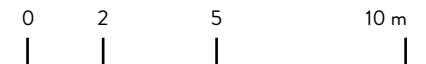
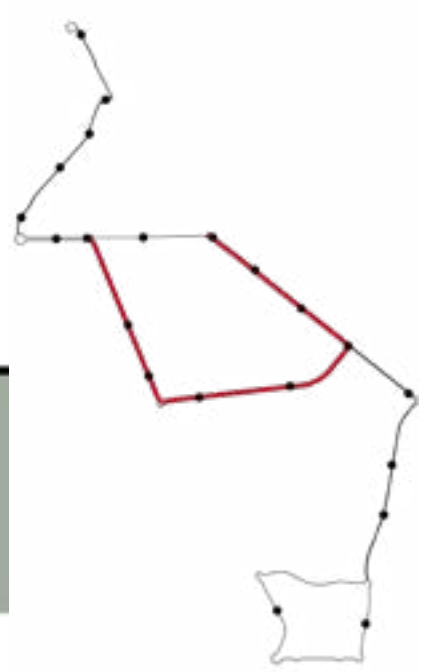


Fig. 43 - Proposed taxonomy of the BRT corridor segment 4



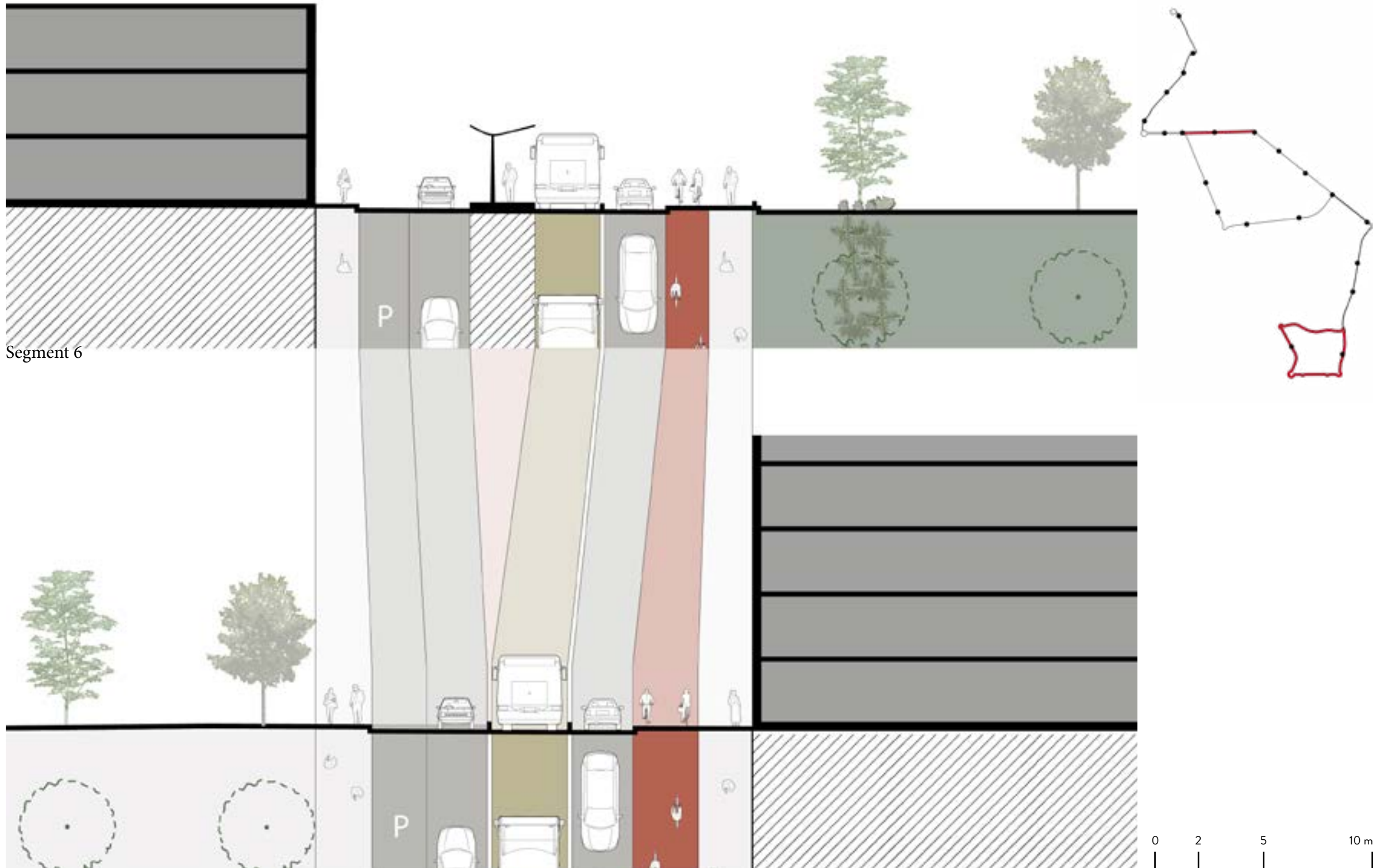
Strategy

Strategy

Segment 5



Fig. 44 - Proposed taxonomy of the BRT corridor segment 5



Segment 6

Fig. 45 - Proposed taxonomy of the BRT corridor segment 6

#### IV.IV - Green connection strategy

We can find a very important number of areas, some of them with a very large surface, of existing green patches along the BRT corridor, which can all be part of a cohesive green infrastructure strategy.

This situation poses the potential for these areas to become a green corridor in the eastern part of the city. We believe that the BRT can act as a detonator for the implementation of this strategy.

In order to implement this strategy, there is the need to recover some of the existing vacant areas which are currently abandoned or severely underused. The most relevant of them being the Borgo Faxhall parking lot, the parco della Via Beotti and the abandoned railway underpass that connects Giardino delle mure Farnese with the remains of the wall in Borgo Faxhall. By doing this we can generate a veritable spine of green public spaces that goes from the future park in the north of the new hospital, to the Giardino Margherita in front of the local Train station.

Most of the existing green areas are interconnected between each other, nevertheless, in the situations where this connection is not existing, the BRT line can work as the “fill rouge” that assures this physical link. This strategy is translated into the implementation of dense vegetation and the use of renewable energy for the illumination of the streets and the stations along the BRT corridor.

By doing so, the BRT path will not only work as a mobility infrastructure, but as a green corridor of vegetation, public space, and energy production. A strategy that will not only influence the urban image of the city, but in its energy production and carbon emissions.



Fig. 46 - Green connections strategy

#### IV.V - Public space strategy

After doing the analysis of the vacant, abandoned, underused lands and the parking places along the BRT corridor, we have come up with a strategy regarding the public spaces along the infrastructure path.

The BRT lane will not only work as an infrastructure to connect several points of the city, but as a detonator to change the existing public spaces and future projects along it.

As explained before, the large number of parking places foreseen by the city should be reduced, since the BRT path has the potential to transport a large number of users of its future projects. Nevertheless, we have to understand what will happen with the existing parking places. If we do not change their uses in the future they could become abandoned areas. A strategy should be set in place to prevent their degradation, which could lead to a large urban problem.

The BRT corridor should not be conceived as a designated-way lane with stations along its path. The infrastructure has the potential to detonate urban regeneration, as seen in the cases of the Nantes Busway. In the city of Piacenza, the corridor will remove the existing parking places along it, in order to host larger sidewalks. These will invite the existing commerces to be more opened-up towards the public spaces, generating a more dynamic urban life. A large number of tall and dense vegetation will be implemented along the corridor, which will reduce the temperature during the warm seasons of the year, generating shelter and also increasing the amount of vegetation in the city.

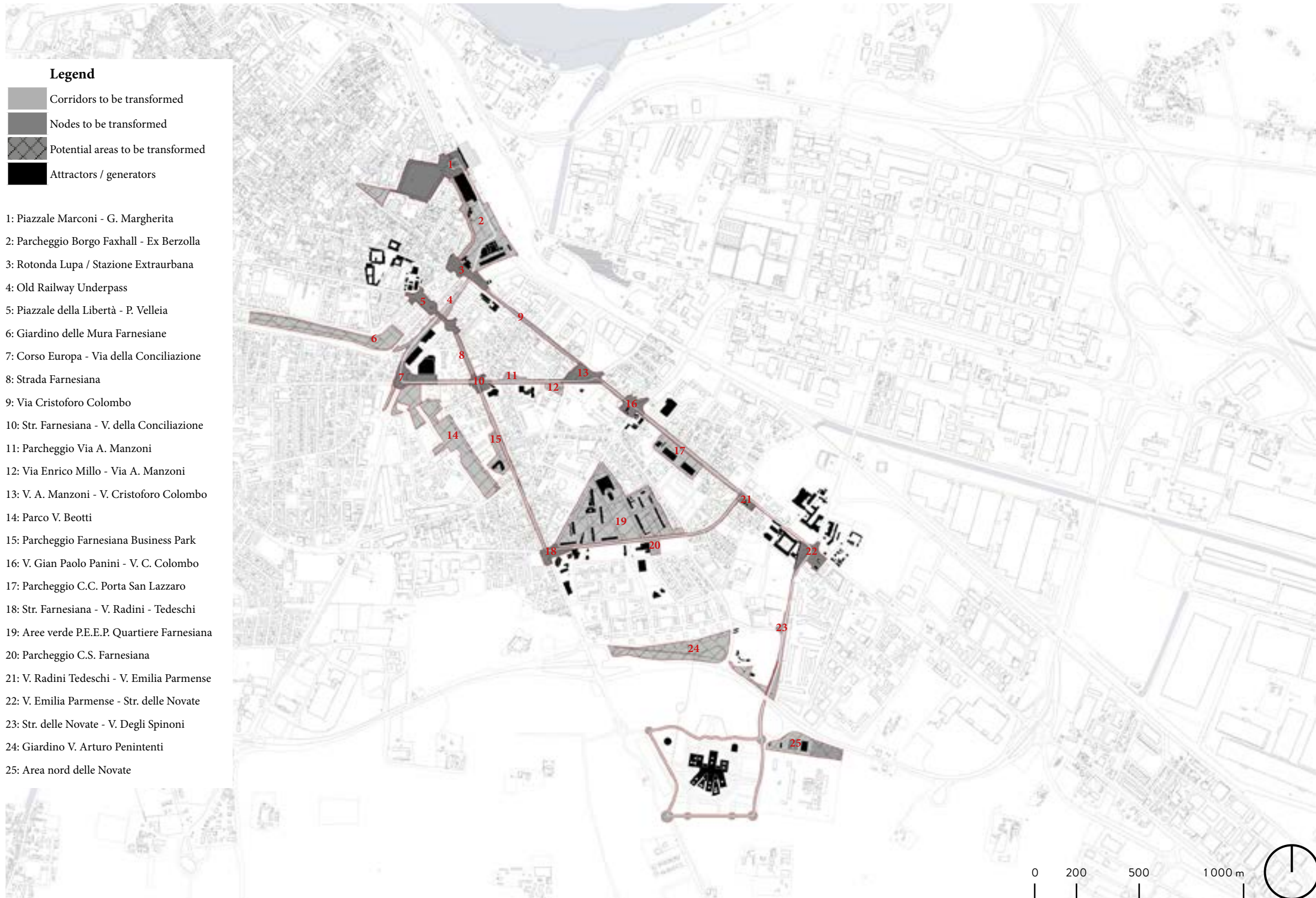
The private and public mobility spaces in the intersections across the BRT line should also be modified with a common strategy. Nevertheless their particularities make their pedestrian spaces be conceived as individual architecture projects. Once

again, we can learn from the French cases on how to treat them while having some guidelines to make them part of an homogenized master plan.

The common strategy is to make the mixed traffic lane share the same street level as the pedestrians, thus preventing them from traveling at high speeds. At the same time, the connection of the different streets will be through roundabouts, which will not allow them to stop and interfere with the passage of the BRT lane. In some particular points, especially in those close to educational, and productive attractors, these new Piazzas should also count with some bicycle sharing stations, which can be part of the existing system of Piacenza.

Finally, there are some very large areas to be redeveloped. In particular the parking place next to Borgo Faxhall with Ex Berzolla, Parco della Via Beotti, the ground level in the P.E.E.P. Piacenza Quartiere Farnesiana public housing, as well as the Giardino via Arturo Penitenti.

The parking lot located in the Borgo Faxhall can become a large urban park connected to the Giardino delle Mura Farnesiana, through the underpass that will also host the BRT lane. This area is also characterized by the existing e of some remaining parts of the wall, which can also be found in the ground floor of the Borgo Faxhall shopping center. This would become the largest urban park of the city, becoming another major attractor for the area, while benefiting not only the existing neighborhood but also the project for the Ex Consorzio agrario, which lacks green public spaces.



**Legend**

- Corridors to be transformed
- Nodes to be transformed
- Potential areas to be transformed
- Attractors / generators

- 1: Piazzale Marconi - G. Margherita
- 2: Parcheggio Borgo Faxhall - Ex Berzolla
- 3: Rotonda Lupa / Stazione Extraurbana
- 4: Old Railway Underpass
- 5: Piazzale della Libertà - P. Velleia
- 6: Giardino delle Mura Farnesiane
- 7: Corso Europa - Via della Conciliazione
- 8: Strada Farnesiana
- 9: Via Cristoforo Colombo
- 10: Str. Farnesiana - V. della Conciliazione
- 11: Parcheggio Via A. Manzoni
- 12: Via Enrico Millo - Via A. Manzoni
- 13: V. A. Manzoni - V. Cristoforo Colombo
- 14: Parco V. Beotti
- 15: Parcheggio Farnesiana Business Park
- 16: V. Gian Paolo Panini - V. C. Colombo
- 17: Parcheggio C.C. Porta San Lazzaro
- 18: Str. Farnesiana - V. Radini - Tedeschi
- 19: Aree verde P.E.E.P. Quartiere Farnesiana
- 20: Parcheggio C.S. Farnesiana
- 21: V. Radini Tedeschi - V. Emilia Parmense
- 22: V. Emilia Parmense - Str. delle Novate
- 23: Str. delle Novate - V. Degli Spinoni
- 24: Giardino V. Arturo Penitenti
- 25: Area nord delle Novate

0 200 500 1000 m



Fig. 47 - Public Space strategy

**Intersections - Roundabouts**



7: Corso Europa - Via della Conciliazione

**Intersections - Roundabouts**



10: Str. Farnesiana - V. della Conciliazione

**Intersections - Irregular**



11: Parcheggio Via A. Manzoni

**Transportation interconnectivity**



1: Piazzale Marconi - G. Margherita



13: V. A. Manzoni - V. Cristoforo Colombo



16: V. Gian Paolo Panini - V. C. Colombo



21: V. Radini Tedeschi - V. Emilia Parmense



3: Rotonda Lupa / Stazione Extraurbana



18: Str. Farnesiana - V. Radini - Tedeschi



22: V. Emilia Parmense - Str. delle Novate



23: Str. delle Novate - V. Degli Spinoni

**Corridors without BRT presence**



5: Piazzale della Libertà - P. Velleia

**Parking places**



15: Parcheggio Farnesiana Business Park

**Green Areas**



2: Parcheggio Borgo Faxhall - Ex Berzolla

**GreenAreas**



14: Parco V. Beotti



8: Strada Farnesiana



20: Parcheggio C.S. Farnesiana



4: Old Railway Underpass



19: Aree verde P.E.E.P. Quartiere Farnesiana



9: Via Cristoforo Colombo



17: Parcheggio C.C. Porta San Lazzaro



6: Giardino delle Mura Farnesiane



24: Giardino V. Arturo Penitenti



**Vacant lands**



**12: Via Enrico Millo - Via A. Manzoni**



**25: Area nord delle Novate**

## **V - Design Solutions**

## VI - Design solutions to be developed

This chapter seeks to develop four different design solutions, which could be the most relevant for the development of the BRT line.

The first of them being the train station, which acts as an inter modal connection hub, working also as the first station of the BRT line.

The second area to be developed is the Borgo Faxhall parking lot, as well as the abandoned railway line. We consider this areas relevant ever since they are part of the green infrastructure strategy, as well as a global strategy to implement in the large, underused vacant spaces along the railway.

The third area, which is of a less important scale, is the intersection of Via della Conciliazione and Str. Farnese. In this area we can find some of the pedestrian strategies that will be repeated along the BRT corridor, working as a general guideline for the whole infrastructure.

Finally, the BRT deposit should be addressed, ever since it's location is fundamental for the implementation of this kind of public transportation infrastructure.

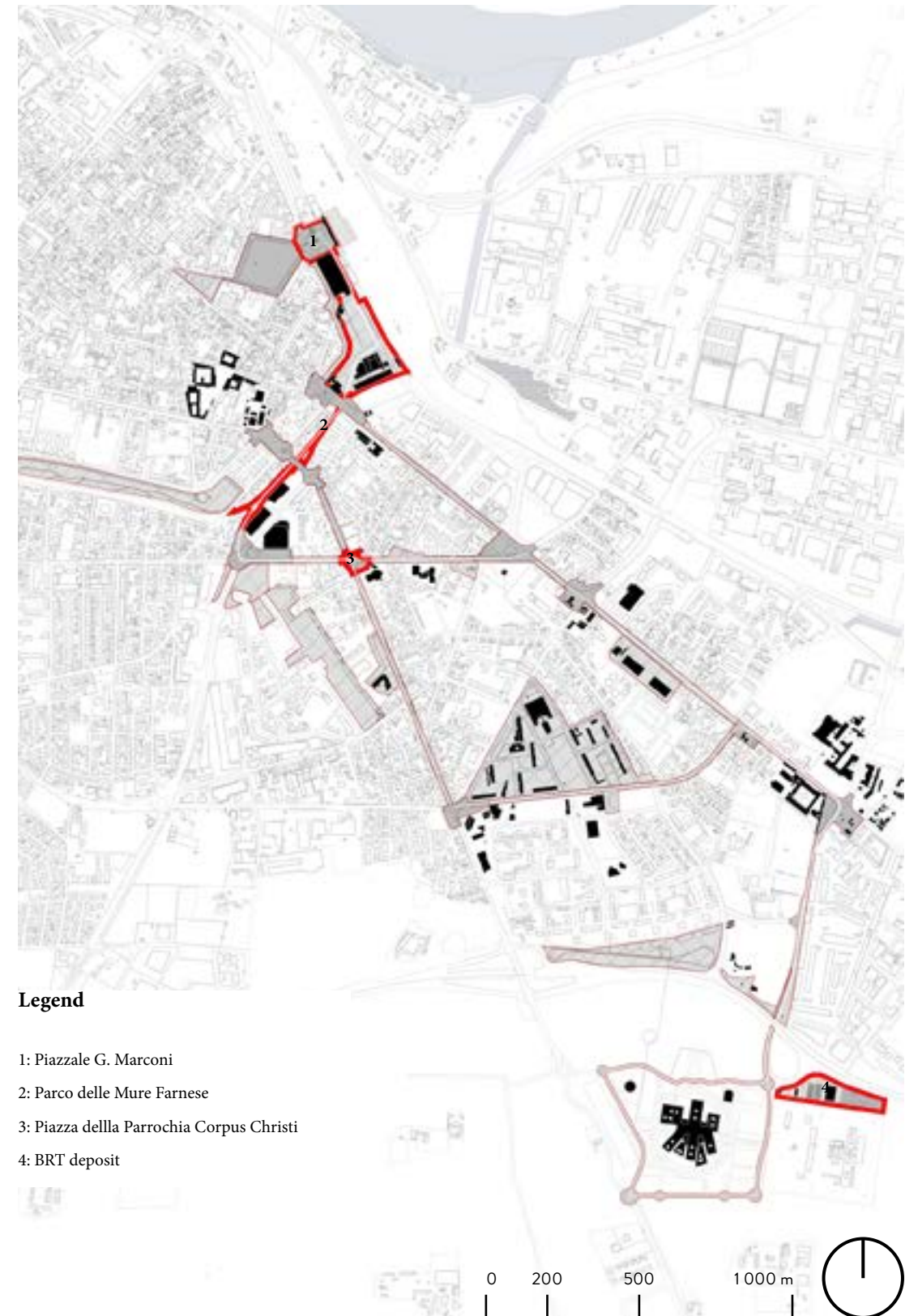


Fig. 51 - Areas to be developed as design solutions

## V.II - Design Solution 1: Piazzale G. Marconi

Piazzale G. Marconi is one of the most relevant points in the project, ever since it is the first station of the BRT system, as well as the inter modal connection point with the railway system.

This station is the first public space we encounter while arriving to the city of Piacenza, representing the first impression that a foreigner might have from the city. Currently, this space is dominated by the car, ever since most of its surface is used as a parking place for the Borgo Faxhall and for the train station. It also counts with several bus stops, acting as a hub for the local bus system.

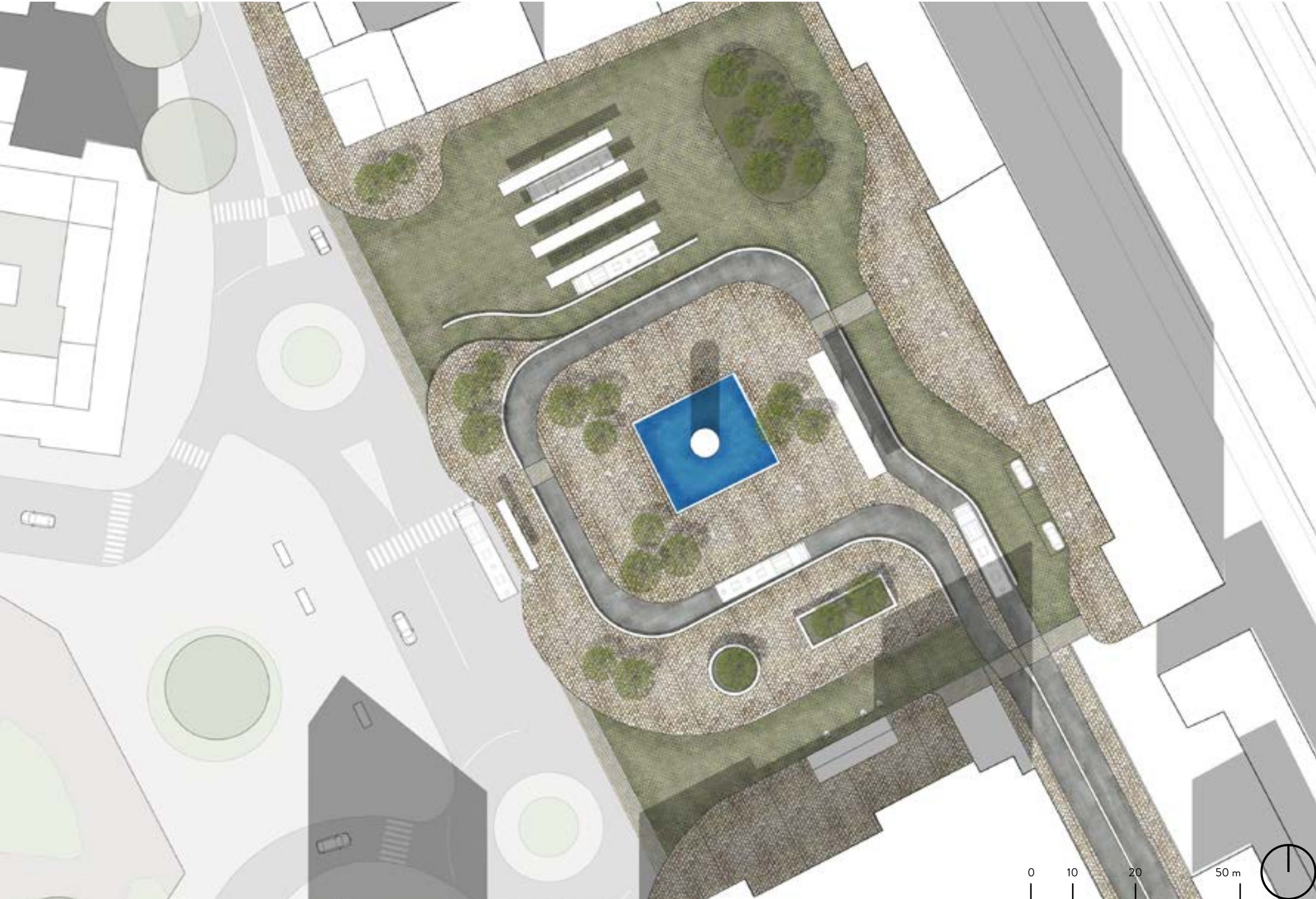
The Piacenza BRT line gives us the opportunity to change the station, not only by an aesthetic way, but also through its uses and spatial configuration.

The first approach that has been taken is the removal of the existing parking places, ever since there is a large public parking place within a few meters distance to the north. This can serve the train station, while an existing parking lot in the south can deserve the Borgo Faxhall shopping center. At the same time, the existing bus stations have been kept in the same location, ever since the BRT infrastructure does not seek to replace the existing mobility system, but to increase its efficiency and expand its reach.

The existing bike sharing stations have been also kept, since one of the main principles of the project is to expand the uses of the shared mobility systems.

Private mobility will still be able to drop off passengers in the station, accessing the piazza from the southern part of the area, the same way as the existing taxi station, which will be kept in its original location.

The pavement of the station has been replaced by a permeable concrete, which acts as a visual and material link the Giardino Margherita garden located a few meters west from it.



0 10 20 50 m

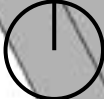
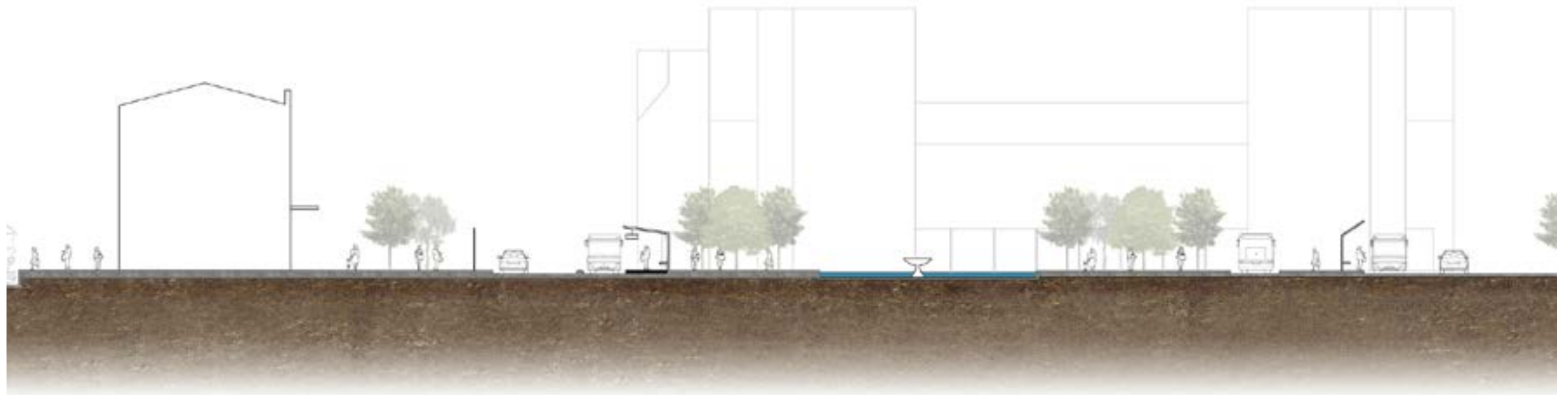


Fig. 52 - Piazzale Guglielmo Marconi Proposal



0 4,5 9 18 km



0 5 10 25 m

Fig. 53 - Piazzale Guglielmo Marconi Sections

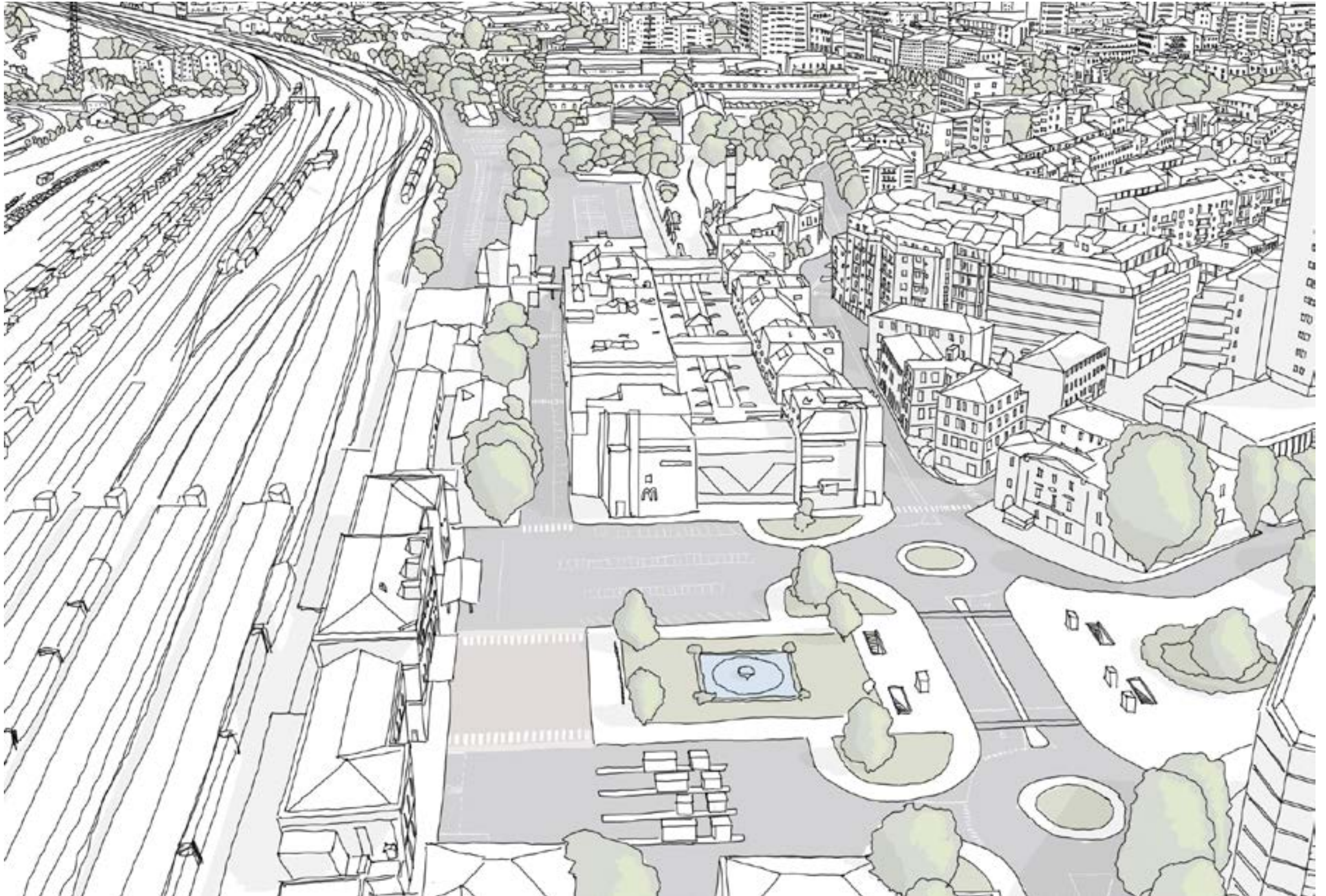


Fig. 54 - Aerial view of Piazzale Guglielmo Marconi

### V.III - Design Solution 2: BRT deposit

The BRT deposit has been located in the area in the north of the Novate prison, ever since this is a vacant land that does not really belong to the urban, agricultural or infrastructure landscape.

The decision to locate this equipment in this particular area is because of its closeness to the new hospital, which is also the final stop of the BRT system.

We believe that this is a reason for the BRT system to be implemented in a first time, without the need to wait for the new hospital to be built in order for its implementation.

We think that the BRT line can deserve the internal part of the city during the first years, and once the new hospital is completed it can make its full length trip.

The BRT depot is fundamental for the implementation of a BRT infrastructure, and this area is also connected directly with the tangenziale road, making it an ideal point for dropping off spare parts for the buses, without the need of building such an equipment inside the city.

This area will count with a system of agro voltaic infrastructures, in order to be working renewable energy. This situation is possible thanks to the surface of the area, and the lack of high density vegetation or built up spaces around it.

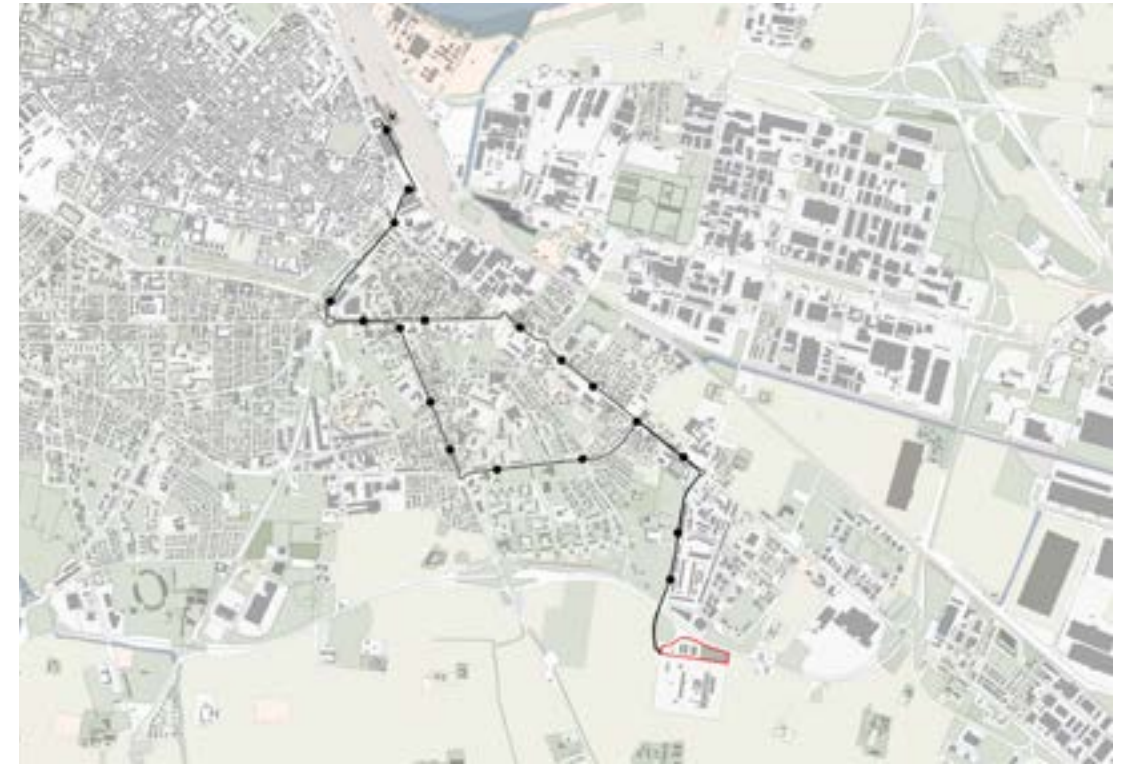


Fig. 55 - BRT system before the construction of the New Hospital

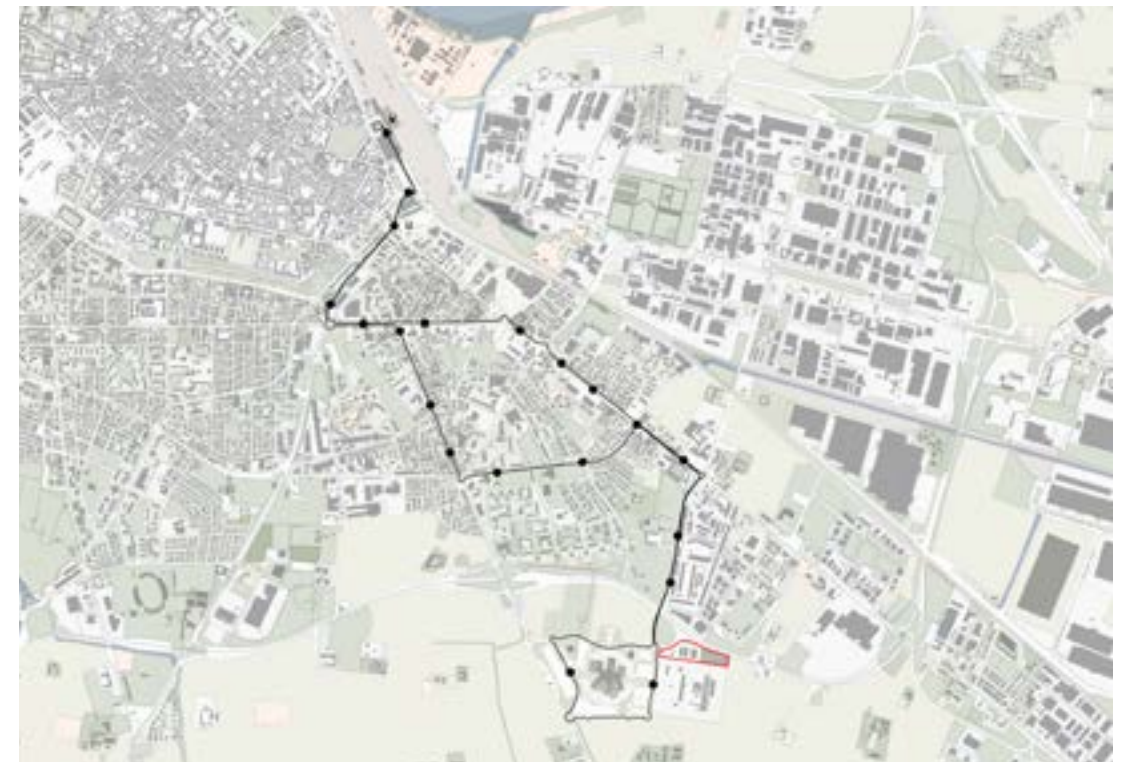


Fig. 56 - BRT system after the construction of the New Hospital



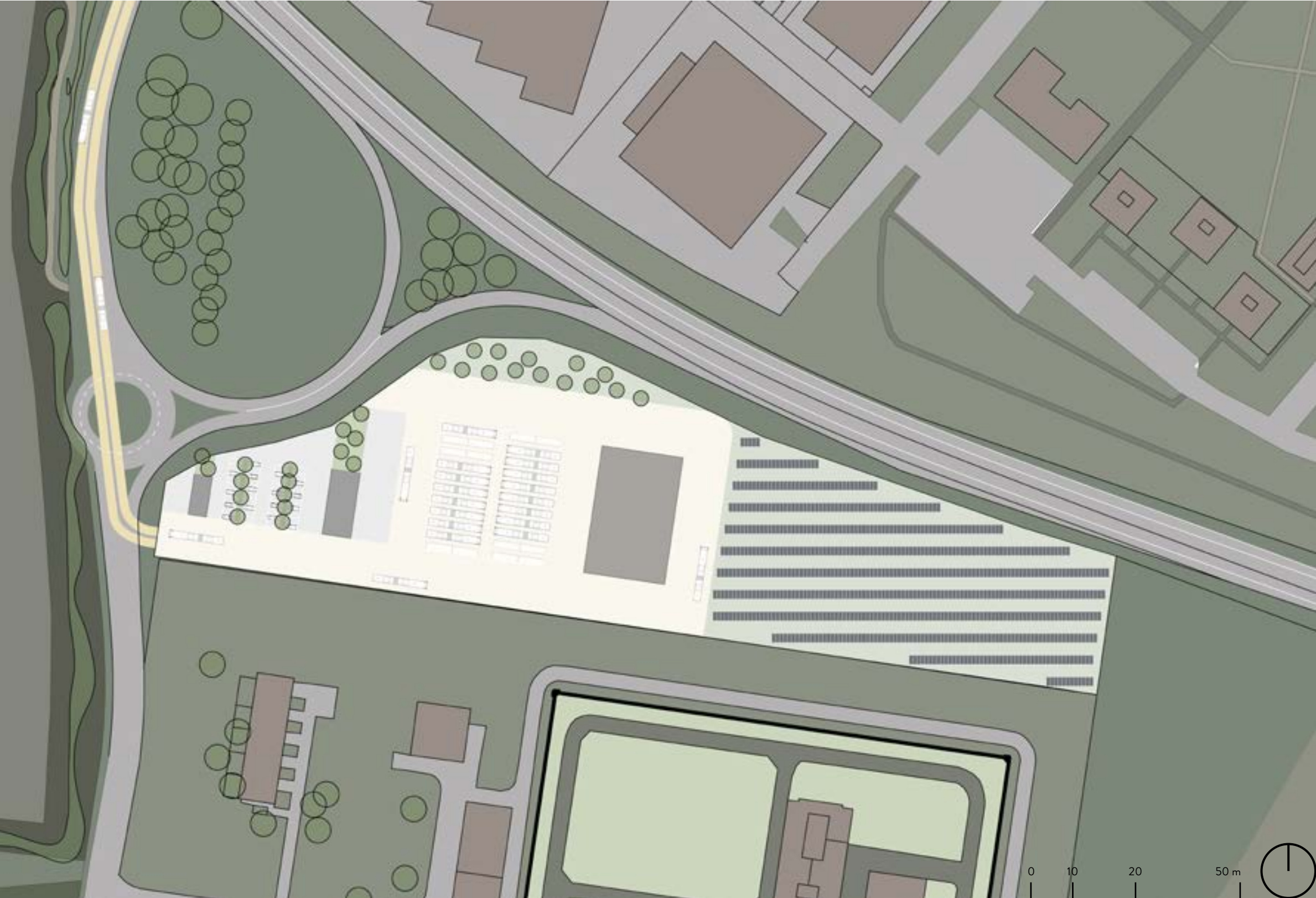


Fig. 57 - BRT deposit



Fig. 58 - Aerial view of Piacenza and the BRT deposit

#### V.IV - Parrocchia del Corpus Domini Piazza:

One of the areas selected to develop as an architectural project is the intersection between Via della Conciliazione and Strada Farnesiana. This area currently hosts a large number of parking places, with very few pedestrian areas. It is also the location of the Parrocchia del Corpus Domini, a very interesting attractor and landmark of the city. Because of its morphology, such of a piazza, the intersection has the potential to become a very enjoyable area.

This is also the point where the BRT line divides in two directions. The first of them coming from the new station, towards Via della Conciliazione, and on the other one towards the new hospital through Strada Farnesiana. This is one of the reasons why a BRT station will be located in front of the church, which is a landmark of this southern part of the city.

It is interesting that The Parrocchia del Corpus Domini lacks of a cloister, which is an aspect that has the potential to be explored in the architecture project for the piazza. Finally, we have decided to treat this Piazza as a model for the intersections across the BRT line.

The area has a presence of large parking places, which will be unused with the implementation of the BRT lane and the intersection of two primary roads of the city, whose traffic will be decreased, as well as a bicycle lane in two directions and a BRT station.

Regarding the public space project, most of the parking places have been removed, using them as large pedestrian areas. Some elements of street furniture have been located, as well as vegetation with very tall trees towards the street, making shelter for the pedestrians. These elements will convert the BRT lane into a green corridor that connects a large number of the green areas scattered through the infrastructure path.

The reason for shifting the parking places in this particular area into more pedestrian friendly ones, is that most of the buildings have commerce in the ground level. This will permit them to place activities with outdoors tables such as coffees or bars into the now expanded sidewalks, generating street life and making the area more attractive.

A central roundabout will also deviate the mixed traffic and bicycle lanes to their destinations. This zone will be at pedestrian level, with a ground treatment made to slow down traffic speeds. In the center of the roundabout we can find some sparse vegetation, which will work as a small landmark for the people traveling across the street.

Finally, in the area next to the Parrocchia del Corpus Domini we can find a space composed by a grid of short trees, which mirror the structure of a cloister with its central garden.



Fig. 59 - Parrochia del Corpus Domini Piazza:



Fig. 60 - Design solution: Roundabout

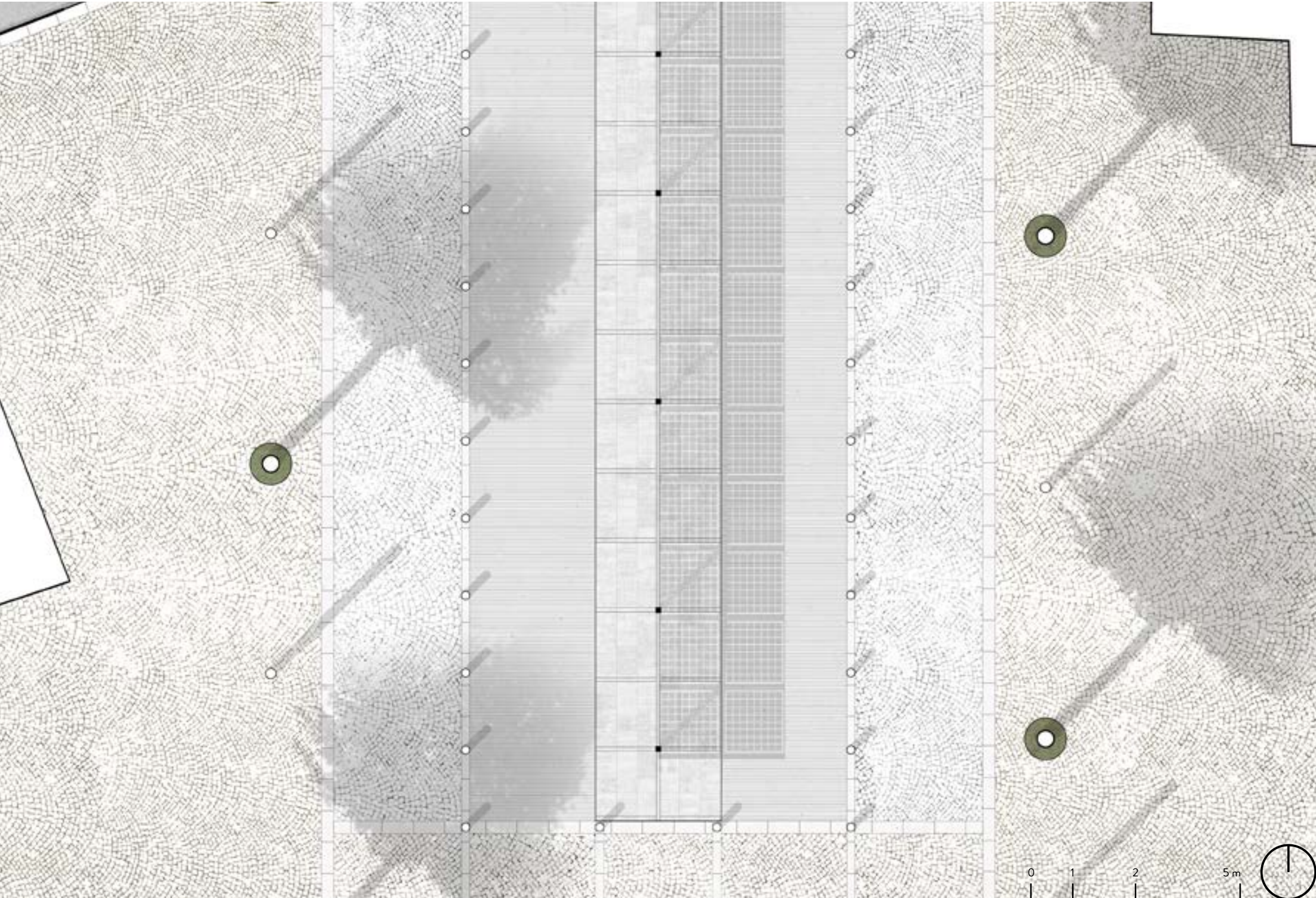


Fig. 61 - Design solution: Pedestrian cross and BRT Station

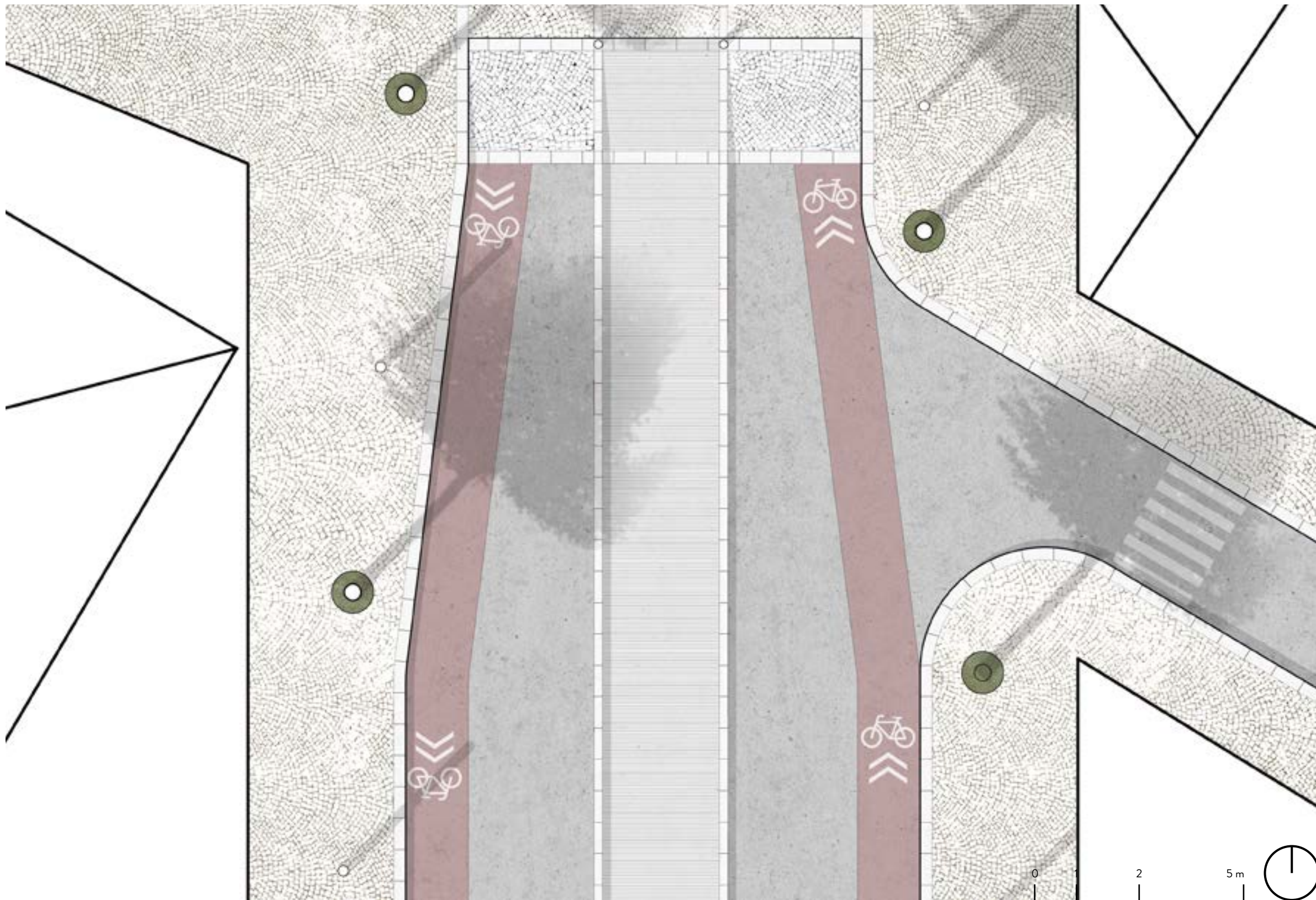


Fig. 62 - Design solution: Bicycle lane and intersection with the roundabout



Fig. 63 - Design solution: Pedestrian crossing at shared level





Fig. 64 - Piazzale Parrocchia del Corpus Domini before the intervention



Fig. 65 - Piazzale Parrochia del Corpus Domini after the intervention

### V.V - Parco della mura Farnesiana:

The parking lot located behind Borgo Faxhall has the potential to become one of the largest urban parks and major landmarks of the city of Piacenza. This area is characterized by the existence of the old Farnese wall, which can be found in the Giardino della Mura Farnese, as well as in the parking lot and ground level of the Borgo Faxhall shopping center.

The areas are linked by the remains of the old railway line; a narrow, below street level area that is currently abandoned, which can be accessible through a small entrance next to the Ex Berzolla, and on the other side from the back of the McFit shopping center.

Currently this area has a bicycle lane, however it is isolated since it does not lead to any other soft mobility path. At the same time, it is interesting to point that this section has an underpass that is close to Politecnico di Milano, in the segment of Strada Farnesiana that joins Piazzale della Libertà with Piazza Velleia.

These three situations have led us to take the decision of developing this area as a large green complex. One of the main reasons is to prevent it from being densified. A large built surface will be realized in the consorzio agrario area, which is just some meters south of it. The urban park will be composed of different areas, which will form a cohesive project, adding new uses to the city landscape and preventing it from becoming an underused area in the future.

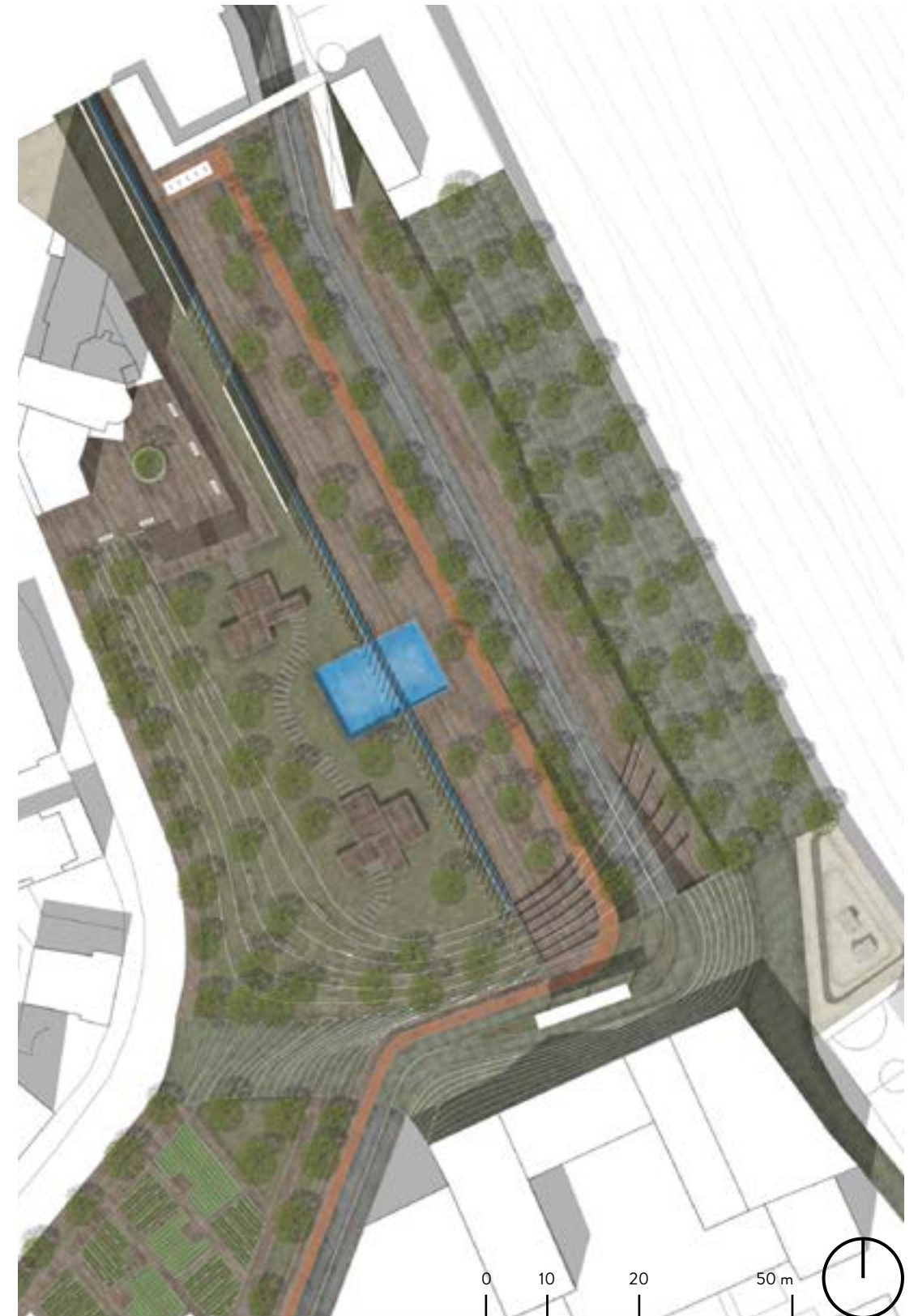


Fig. 66 - Parco della mura farnesiana segment A

Starting from the northwest part of the park, we can find a memorial park, whose surface is realized with permeable pavement. In this area it will be possible to contemplate the remains of the Farnese wall currently in the parking lot and ground level of Borgo Faxhall, thus acting as an extension of the public space in both directions

In order to add shelter from the sun during the warm months of the year, tall and dense vegetation will be placed in the area. It is important to point out that the BRT lane will pass in the east part of the area, being buffered by an additional layer of dense vegetation.

The project also seeks to reactivate the zone adjacent to the Chiesa di Santa Maria in Torricella, by connecting its backyard to the project through a wide staircase. This will act as a plinth for the church. The staircase leads to a sloped landscape characterized by urban furniture to contemplate the wall from the upper part, having shelter and making a pleasant atmosphere.

An existing green area under the church will be re qualified by adding wooden platforms, which will generate spaces for gathering and realizing communal activities. Once again, this area will be characterized by tall and dense vegetation, in order to take shelter from the sun. This zone has an important topographic difference with the memorial park, which generates an opportunity for water retention. In order to face this situation, we have implemented a water retention pond, which



Fig. 67 - Parco della mura farnesiana segment B

acts at the same time as a water mirror, and a resilient strategy against the flooding in the area.

Finally, a mineral Piazza will be set in place in from the Ex Berzolla building, which will be reactivated according to the city's future projects plans. Ever since this building will be a major attractor of the future, and it's location next to the extra urban bus station, a BRT stop will be built, acting as the station that will deserve not only this urban park and the previously mentioned attractors, but also the Ex Consorcio agrario project.

The abandoned railway underpass has the potential to become a green urban corridor, which will connect the remains of the Farnese wall. At the same time, in the underpass with Strada Farnesiana an additional station will be located, which has the potential to deserve Politecnico di Milano. Since this station is located in an underground level, it is important to design a strategy to make it accessible from the street, pedestrian level.

In order to tackle this problem we have realized a series of floating platforms, which connect the street level and its patios with the underground, linear park. It is through this light structures that we can access the BRT system, while also enjoying the views of the linear park, and the railway heritage, from a different, almost aerial point of view.



Fig. 68 - Parco della mura farnesiana segment C

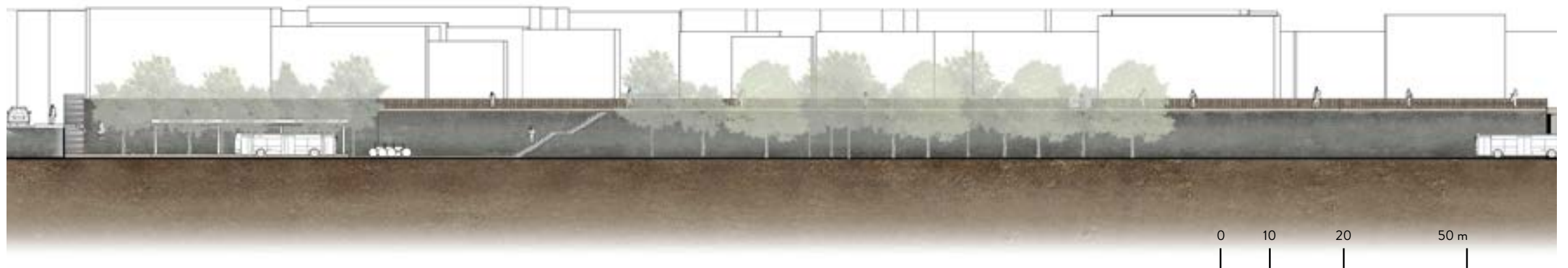
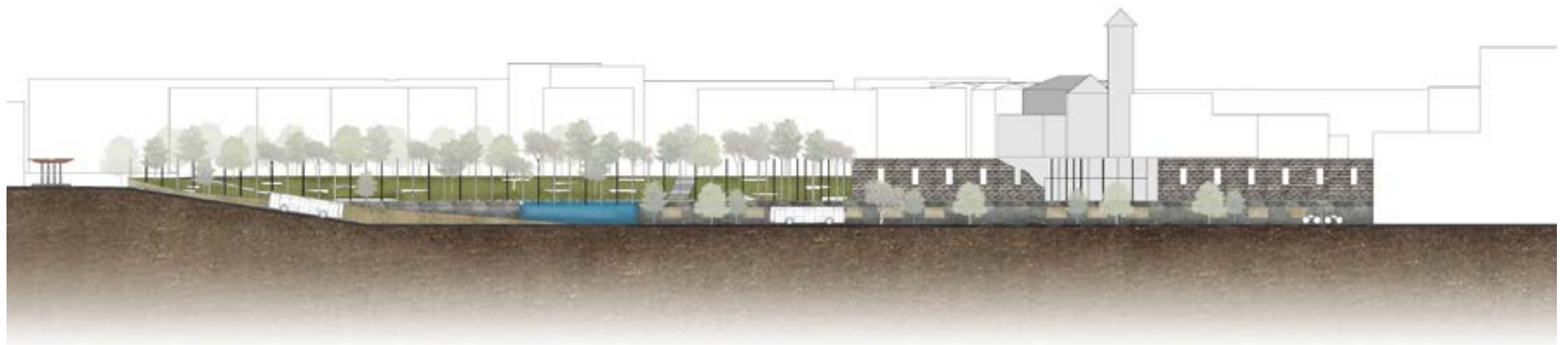


Fig. 69 - Parco della mura farnesiana Sections

## **V.VI - Individual BRT stations**

We can categorize the BRT stations in two categories: the first one being the stations where the mobility infrastructure travels in both directions, and the second one being those where it only travels in a single one.

Both kinds of stations will be composed by a light structure, lifted 30 centimeters from the ground, in order to reduce the gap between the station and the bus as much as possible. There will be some areas for sitting down while waiting for the buses, with signalization showing the estimated time of arrival and name of the stations.

In order to integrate the stations in the urban context, we have decided to cover them with a translucent roof. This element is composed of solar panels, which will provide the electric power necessary energy for the illumination and signalization of the stations, but also for lighting up the urban lightning along them.

Their measures will be 20 meters long for 3 meters wide, which correspond to the chosen size of the buses for the BRT system.

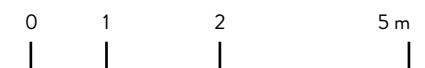
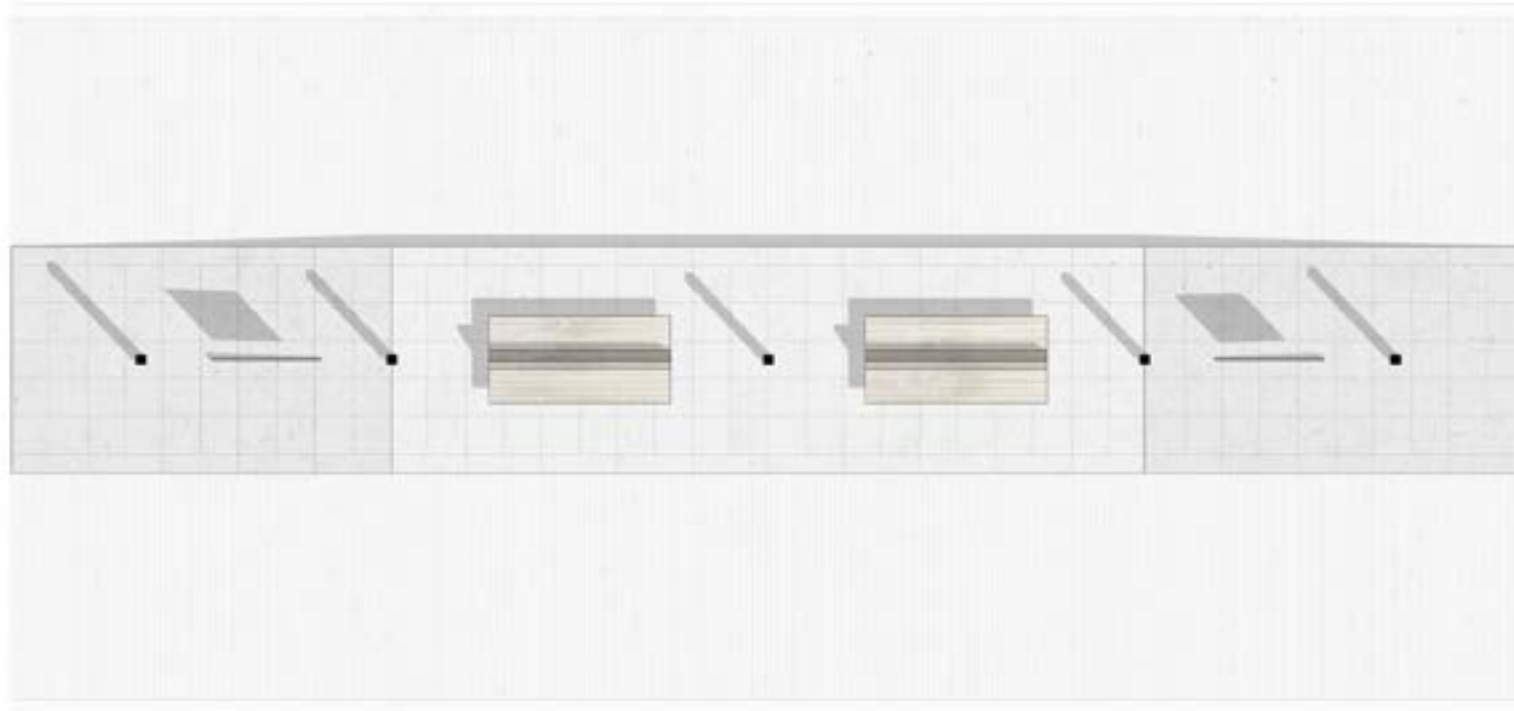


Fig. 70 - Two directions BRT station



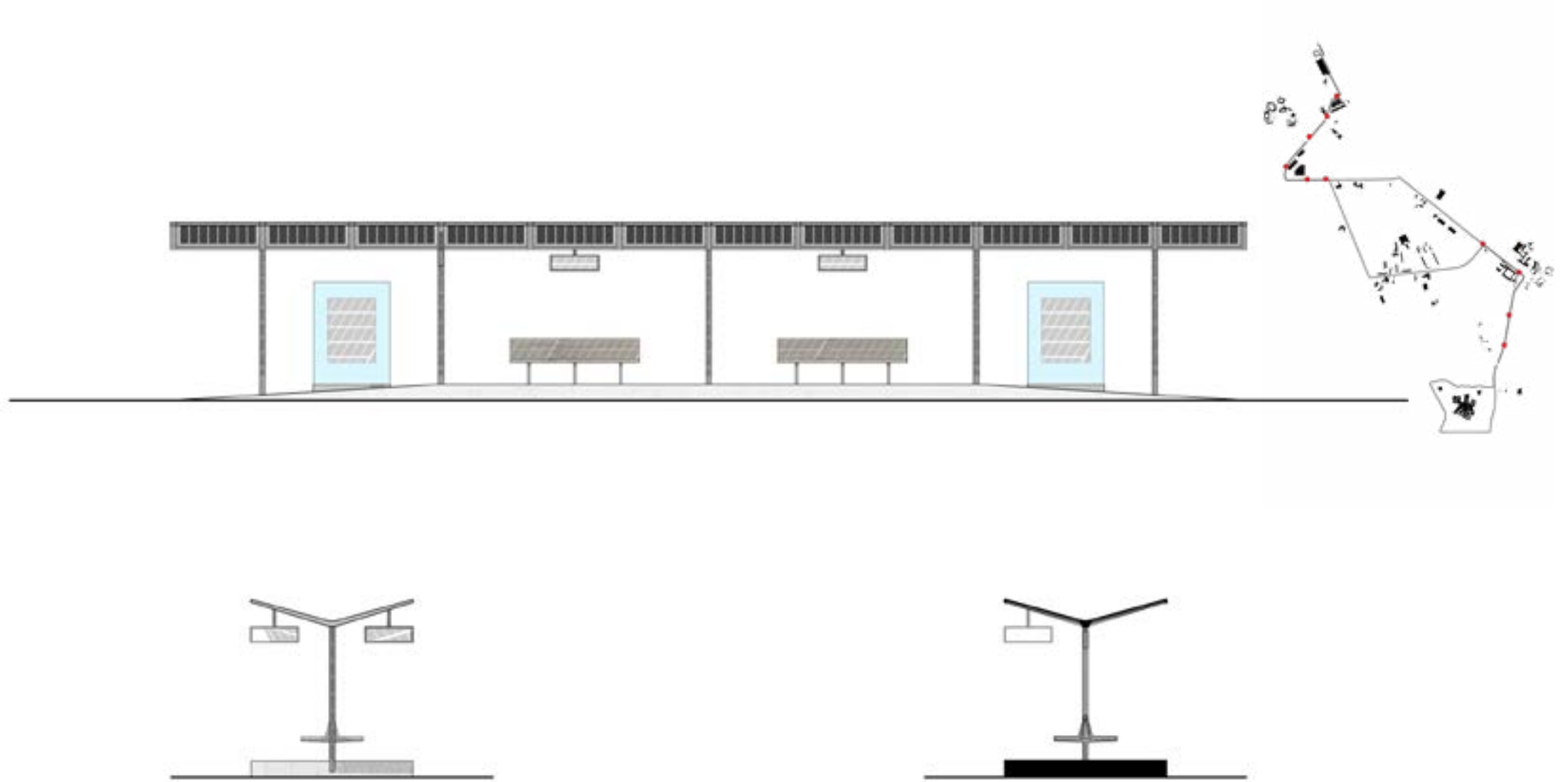
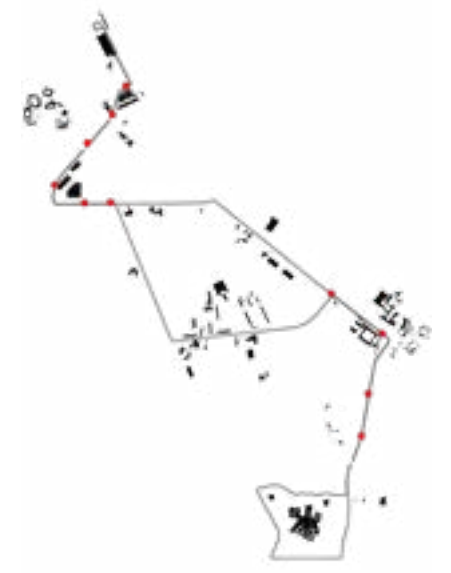
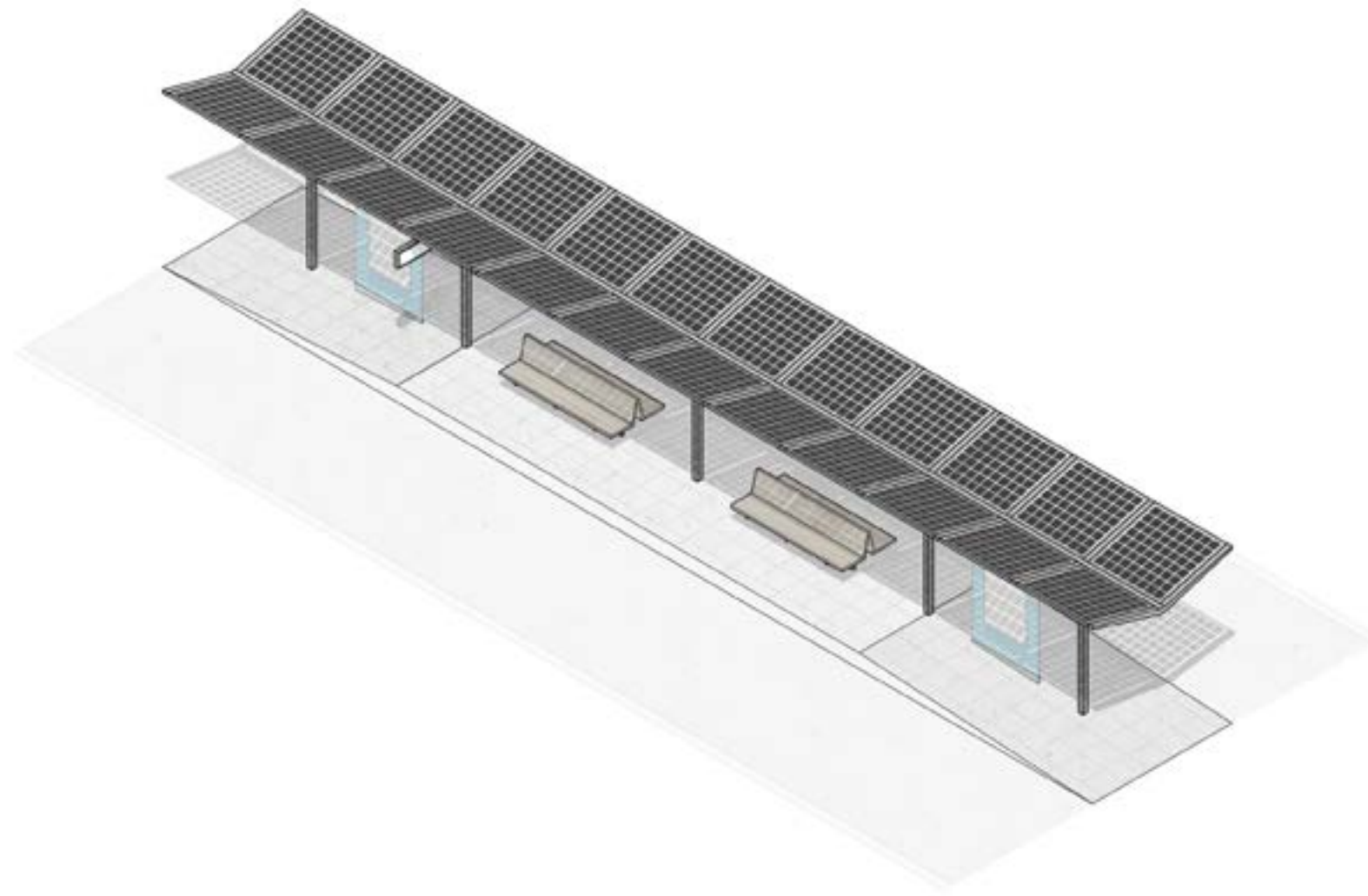


Fig. 71 - Two directions BRT station: elevations and section



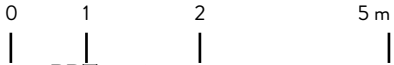


Fig. 73 - Single direction BRT station

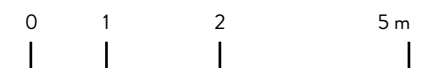
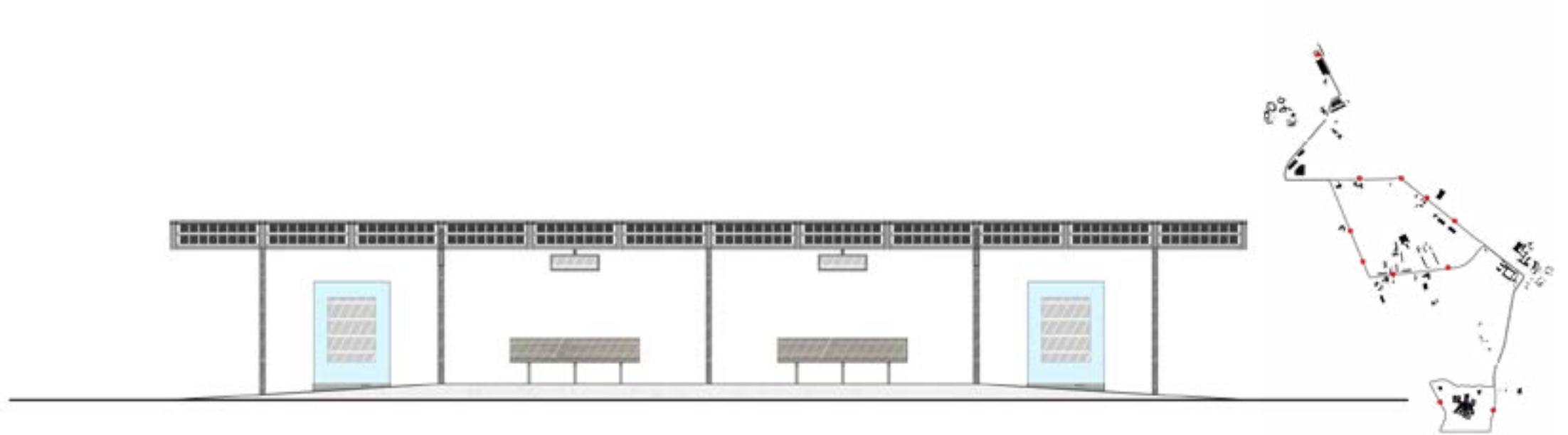
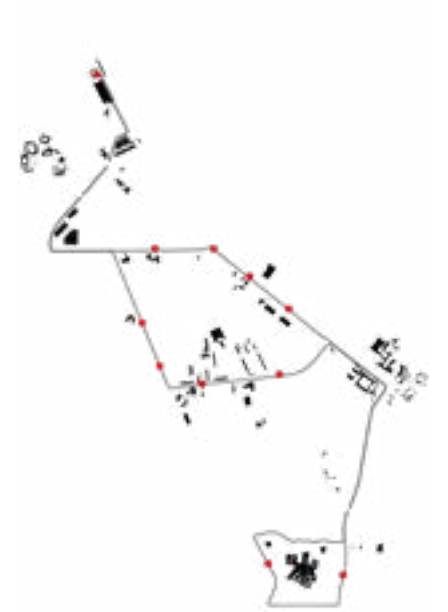
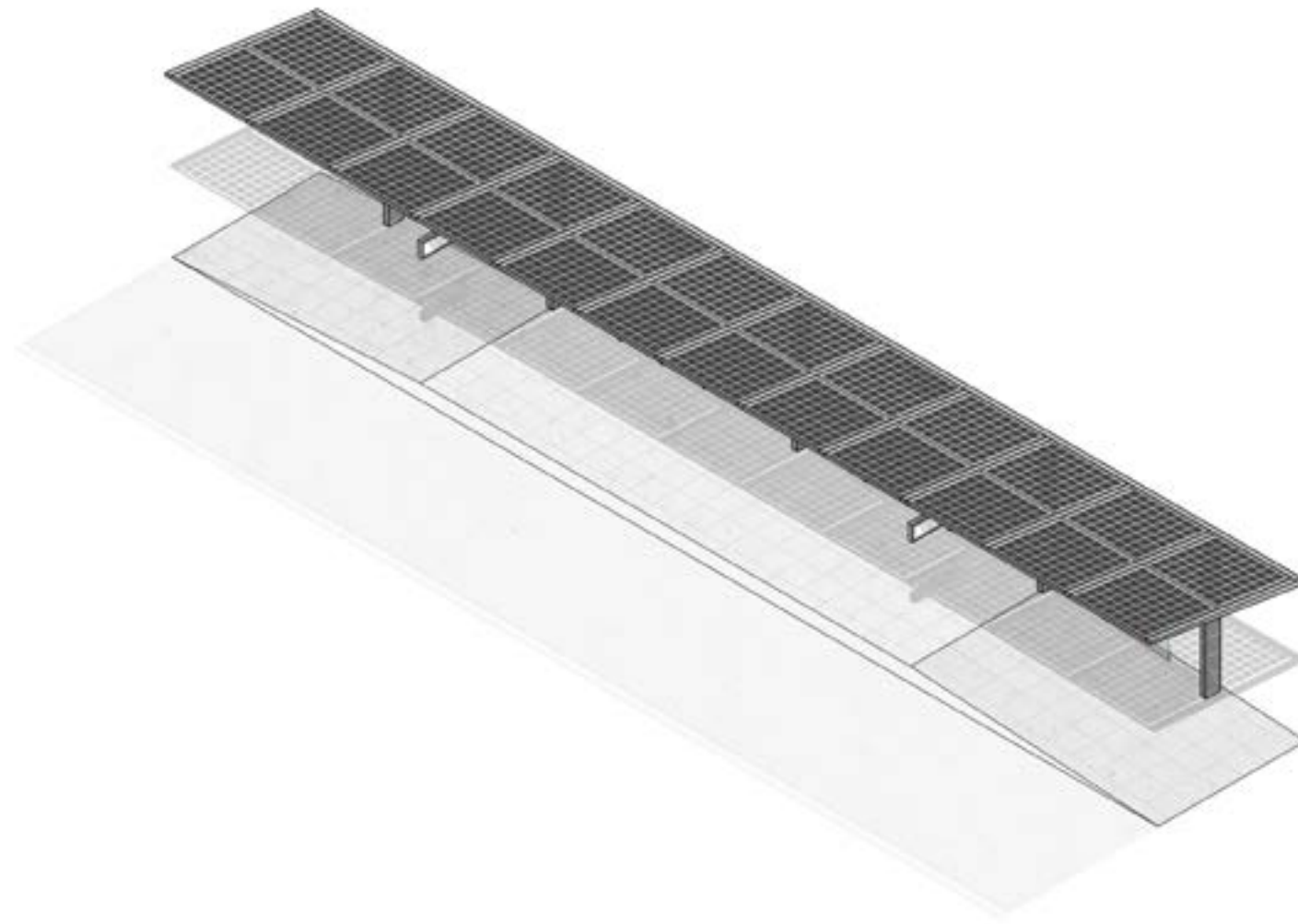


Fig. 74 - Single direction BRT station: Elevations and section



## **VI - Conclusions**

## VI - The impact of the BRT in the city

We can conclude from this work that the BRT infrastructure has the potential to change the way we use the city, not only from an infrastructural point of view, but also as a detonator for urban development.

It can generate new public spaces, addressing the problematic of the urban areas that are abandoned, or currently used exclusively by the car. With the implementation of this infrastructure we can generate more public space life, decreasing the surface foreseen as parking spaces, while adding more pleasant, livable spaces for the citizens.

The BRT line can also consolidate the connectivity of the existing natural, green scattered spaces along its path. This would make it work not only as a mobility infrastructure, but as an ecological corridor of territorial relevance. The green areas across the city would stop being isolated from each other, making the eastern part of the city work as veritable linear park.

The infrastructure can also change the Land Use forecast, reducing total number of parking places required by the future projects, which translate into a reduction of the surfaces originally intended for this use.

In the future, the remotion of parking spaces will lead us to a decrease of the private mobility system, guiding the city towards a more sustainable way of transportation. This does not only involve the augmentation of public mobility systems, but also an increase in the use of bicycles, car sharing, walking or even an expansion of the public mobility system.

The electric BRT line would be functioning with renewable energies, a situation that can be achieved in its geographic location. This makes the system a carbon neutral infrastructure, which not only reduces its environmental footprint, but also the one of the private vehicles it replaces. The mobility infrastructure saves more energy than it utilizes, being a veritable ecological project.

If the BRT line works as planned, which has generally been the case in the cities where this kind of system has been implemented, the infrastructural system could be replicated in different areas of Piacenza, which can be identified by a similar analysis than the one realized for this work. By detecting the areas where a mobility infrastructure is needed the most, and thus implementing a similar BRT infrastructure, the city would further reduce the carbon emissions generated by the private mobility, add more public spaces for their citizens and continue to connect the scattered green areas that are located all around the city. This way Piacenza could become a carbon neutral city of regional importance, and more important, a model of development that could be followed by settlements of a similar scale.



Fig. 76 - Aerial view of Piacenza from Via della Conciliazione





Fig. 77 - Aerial view of Piacenza from Via della Conciliazione



Fig. 78 - Aerial view of Piacenza from Via Emilia Parmense



Fig. 79 - Aerial view of Piacenza from Strada delle Novate

## **VII - Bibliography**

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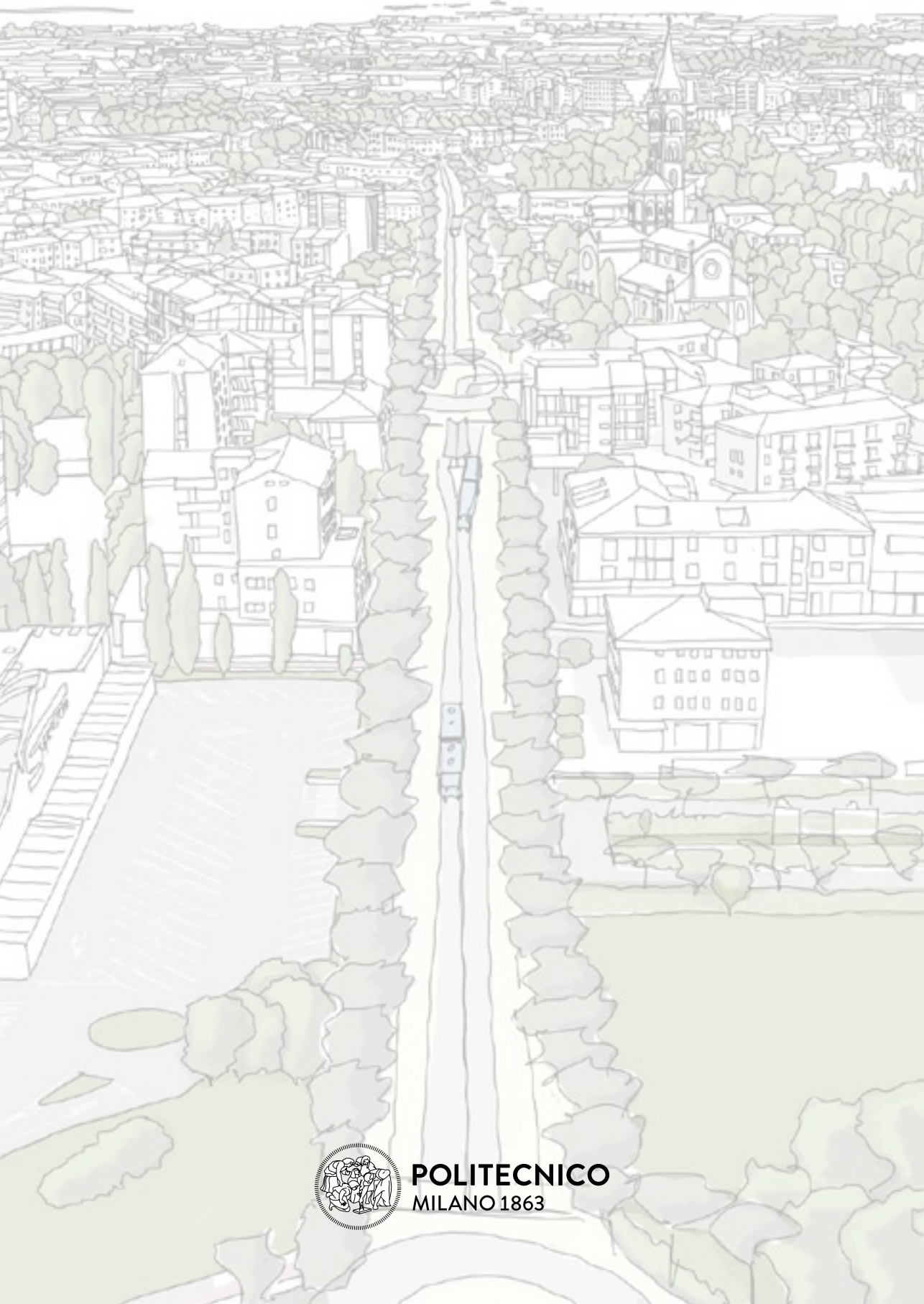
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