



## METRO M4, THE NEW GREEN-BLUE BACKBONE OF MILAN. FROM AN INFRASTRUCTURE DESIGN TO AN URBAN REGENERATION PROJECT

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### Abstract

The aim of this work is to demonstrate how it is possible to transform the infrastructural project of the new Milan metro line (M4) into an occasion for the reconfiguration of public spaces and the enhancement of local identities, i.e. into an urban regeneration project.

The goal is to integrate 5 different objectives in order to:

1. bring the city centre closer to the suburbs and enhance the more peripheral neighbourhoods by using the new (highly accessible) metro stations;
2. connect two metropolitan environmental systems (Parco Agricolo Sud Milano in the South-West and Grande Parco Forlanini in the East) by identifying green and blue corridors at urban scale and promoting minimal re-greening interventions adaptable to different urban fabrics;
3. assign new urban values/meanings to the infrastructural nodes, working on the physical urban space of metro stations, making it available to new populations and different social uses;
4. implement slow mobility networks by supporting the urban policies aimed to reduce vehicular traffic;
5. integrate different existing urban projects by coordinating specific and/or sectorial interventions.

The paper presents a research developed at the Department of Architecture and Urban Studies of Politecnico di Milano. The research is based on a design approach aimed at the physical transformation of the city and focused on improving the liveability of the contemporary city. The approach used updates the methodology of the so-called "land project". It consists of influencing urban policies through the physical prefiguration of the "space among things" (the one available for civil life) and is a way to conceive of the project as a useful tool for building up material and immaterial relationships.

The output of the research is a Masterplan at urban scale, obtained from the analysis of the local resources and opportunities identified through a systemic approach based on the recognition of infrastructure, settlement and environmental components. The analysis of the urban environment has been integrated by studies on the urban functions able to attract or generate users and the functional roles of neighbourhoods, developing specific analyses on the accessibility to the metro station for pedestrians and cyclists.

The set of these analytical and interpretative operations led to the definition of a pedestrian and cycle platform (the green-blue backbone) qualifying the new urban mobility. It doesn't exactly overlap the underground line, but accompanies it, enwraps it and expands it, connecting important places of the city, i.e. the most relevant places from the point of view of infrastructures (systems and nodes of urban mobility), environment (areas and green axes, water system), services and public equipment (expression of history and memory of the place), integrating them and bringing them closer to the station area.

The data used are provided by the urban planning tools of the Milan Municipality, available from the regional database, while for the analysis of the mobility flow and the role of neighbourhoods as generators or attractors of users for the new green-blue backbone the data of the National Statistical Institute (such as the number of companies and population registered in the census sections of Milan) were used.

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To sum up, this paper outlines the outcome of the integrated analyses developed for the research; the project proposals for 3 pilot stations; the Masterplan that defines the new green and blue backbone inside the urban fabrics crossed by the metro line. With the Masterplan, a project theme is formulated and articulated for each of the 21 stops, together with the first Design Guidelines useful to improve pedestrian and cycle access to the stations.

The research outcome is a Masterplan of paths and actions for the revitalization of public spaces next to the M4 stations (i.e. the green-blue backbone). The stations become real urban thresholds, hubs of connectivity that collect, bring to the surface and distribute urban and metropolitan flows. The green-blue backbone Masterplan captures the opportunity generated by the new infrastructure to rethink a complex and diversified system of urban spaces and relationships. The backbone reveals urban places and their connections with the metropolitan landscape. The result is a unitary but articulated design of pedestrian and cycle paths alternative to the vehicular mobility. It is a unique itinerary for different city users, that connects the regional environmental systems with the modern districts and the city centre.

**Key words:** metro line, urban design, mobility network

## 1. Introduction

Milan built the first metro line (the M1 red line) between 1957 and 1992 (the last extension being added in 2005). Afterwards, the M2 green line was built between the mid-1960s and 1994 (with extensions in 2005 and 2011), the M3 yellow line was built between 1981 and 2003 (with an extension in 2011), and the M5 lilac line was built between 2007 and 2013 (with an extension in 2015).

Since 2012, the city of Milan has been building the fifth metro line, the M4 blue line, which should have been opened in time for Expo 2015, but whose first section will actually open in 2021 and the last in 2023. Before the opening of the entire M4 line, the Municipality has got enough time to understand how the infrastructure's nodes, i.e. its 21 stations, can represent an opportunity for urban regeneration.

This paper is the outcome of a research carried out between March and December 2018. The research was developed by a group of researchers at the Department of Architecture and Urban Studies (DAStU) of the Politecnico di Milano on behalf of the Municipality of Milan. The research contract has been entrusted by Metropolitane Milanese SpA. At the moment, the research contract has been renewed to deepen the integration between the M4 metro line project and the project of reopening the historic Milanese canals called *Navigli* (Boatti&Prusicki, 2018).

The Municipality of Milan wants to make a useful contribution to the future urban planning agenda and, for this reason, the DAStU research has an operational and theoretical goal. The first aim is the drafting of a report that contains analysis and design guidelines aimed at studying and transforming the topside of M4 stations (at ground level). The research identified the design features to be taken into account during the final design of the top area of the 21 stations that constitutes the public space surrounding the stations. As concerns the second goal, DAStU's research has the scientific-disciplinary aim to better understand in which way a mobility infrastructure project can improve the quality of urban space through the identification of pedestrian and bicycle paths. By enhancing the public space, such network of paths redesigns the sense of places and «*transforms the urban form into an image*». (Rykwert, 2003:307). This network of routes is called "the new green-blue backbone of Milan". The green-blue backbone flanks, runs alongside, intercepts and exchanges relations with the M4 metro line creating ecological, environmental, landscape, fruitive, socio-cultural, historical and functional relationships between the two dimensions.



This paper's aim is to describe how a mobility infrastructure project can become an opportunity for the city to rethink urban space by enhancing the liveability and the sense of identity for the inhabitants, thus initiating a real process of sustainable urban regeneration (Roberts, 2000).

The paper is structured in three parts in addition to the introduction and conclusions.

The first part reconstructs the state of the art on three important themes of the green-blue backbone project: 1) the role of mobility nodes as spaces that trigger urban regeneration; 2) the development of "green infrastructures" within the existing urban fabric as a system of ecological connections and social use; 3) the design of public space at the "human scale", i.e. a design wherein the physical dimension of the context becomes a solution to the inhabitants' needs (the material dimension of public space) and to people's historical integration into society (the immaterial dimension of the public space).

The second part illustrates the methodology used in the research. The activities carried out for the project have been the territorial analysis for the infrastructural, environmental and settlement systems, the study of the degree of pedestrian accessibility to the stations, and an urban analysis at human scale. These steps were followed by the design of the green-blue backbone Masterplan and the development of detailed projects for each station.

The third part describes the design choices of the green-blue backbone, i.e. the creation of a network of paths for a sustainable mobility which, by integrating the metro line transport, operates at two levels: at the territorial scale, the green-blue backbone implements the relations between neighbourhoods and the ecological and environmental systems. At the local scale, the green-blue backbone restores the meaning of public space or space for public uses. If on a larger scale the M4 line and the green-blue backbone acquire a wide meaning for city users, on a local scale the green-blue backbone acquires a deeper meaning for inhabitants. The green-blue backbone provides new value and meaning to underestimated urban areas, forgotten parts of the city or areas excluded from the great processes of urban transformation.

## **2. Project framework: infrastructural nodes, green infrastructures and public spaces**

Within the green-blue backbone project, there are three main topics to be studied. Firstly, the issue of infrastructural nodes as crucial elements for establishing a relationship between the transportation network and the urban context (Pucci, 1996). Secondly, the need to clarify the concept of "green infrastructure" at the urban scale as an ecological and user-friendly system necessary for a sustainable development (Benedict & McMahon, 2002). Finally, the project of public space as a space in which resources and design energy must be focused to improve the quality of the contemporary city (Gehl, 2017), also with interventions aimed at coordinating and consolidating the tactical urban planning approach (Lydon&Garcia, 2015) already started by the Municipality of Milan with the reorganization of some public spaces.

### *2.1 Public transport nodes as an engine for urban regeneration*

In 2009 the European Commission approved the first *Action Plan for Urban Mobility* (CCE, 2009b) remarking that more than half of the population lives in urban areas and that these areas need efficient transport systems because mobility determines the levels of urban



competitiveness and sustainability. Since then, several reconsiderations on transport and urban mobility have been promoted in Europe. Since the 2000s, many publications have rediscovered the interest in cycling and walking within cities as more sustainable ways of using urban spaces. (Augè, 2009; Cresswell&Merriman, 2011).

The most interesting aspect is to understand how the new urban mobility – based on the strengthening of public transport, the reduction of cars and the encouragement of slow mobility – can trigger urban regeneration processes. Even at a time when the city was compact and not as scattered as today (Indovina et al., 2005; Oliva, 2010), big infrastructure projects had the ambition to affect the context framework they were crossing, creating relations with the landscape (Gasparrini, 2009:59-61). With the emergence of the sustainability principle (UN WCED, 1987), in order to reduce the costs of the dispersed city and improve its quality (Camagni et al., 2002), the challenge of lifestyle changing has involved the mobility issue, too. The recent White Paper for Urban20 puts the efficiency of the built-up city as a goal for local policy agendas and, in particular, recognises how roads hide a potential multifunctional public space that goes beyond the mere transport mobility use. Streets can become a place for people and for the enhancement of the environmental and ecological system at the urban scale (Targa et al, 2018:10). The conversion of car roads into multifunctional public spaces for pedestrians and bicycles has a clearly positive effect on the city and on human health. Less obvious is the benefit of an underground infrastructure such as the metro line.

In the collective imagination, the metro remains a “tunnel network” for travel. Its main purpose is to “circulate” people rather than “connect” places. (Pucci, 1996:50). Stations are the touching points between the physical network space and the urban surroundings. Thanks to the touching points that this infrastructure has in common with the ground level, its regenerative potentiality is revealed to the “land project” (*progetto di suolo*) (Secchi, 1986). In particular, public space is constituted by the link between the underground station and the ground level. It is characterized by light vertical elements (stairs, escalators, lifts, ramps), and becomes essential in order to rethink an urban environment which is often lacking pleasant elements, such as the shade of a tree or the comfort of sitting on a bench, because it is the compact fabric of the existing city, now layered and resistant to change, yet still rich in attractive uses and facilities (Di Biase, 1989).

## 2.2 *Green infrastructures in dense and historical urban spaces*

Among the most difficult changes to achieve in a dense and historical built environment, such as the one under which the M4 line passes, there is also a sustainable urban development based on improving the environmental and ecological quality of the city.

Since the 90s, the theme of “green infrastructures” has been known in America by the U.S. Environmental Protection Agency. (<http://water.epa.gov/infrastructure/greeninfrastructure/>). Later, the issue has found wide development in the UK through the definition of the “green belts” as an urban policy to ensure ecosystem services (Costanza et al,1997). Europe officially introduced the concept of “green infrastructure” in 2009 with a climate change guide (CCE, 2009a) and in 2013 the European Commission would publish one of the first document on this topic (CE, 2013).



Usually, green infrastructures implement the concept of ecological network (see Directive 92/43/CEE Habitat) with usable and social aspects. Green infrastructures are multifunctional and interconnected systems of areas (agriculture, parks, gardens), vegetation (rows of trees, woods, hedges) and green-buildings (green roofs, permeable floors, rain gardens, green trenches), which provide environmental and social benefits to built-up areas. These benefits include processes of infiltration, sedimentation, evapotranspiration and/or recycling of rainwater; reduction of air pollution; mitigation of heat island effects, all of them helping reduce the energy demand. In addition to these environmental benefits, there is an improvement the representation of urban spaces from an aesthetic/landscape, perceptual in, and identity point of view. On a social level, London's Town and Country Planning Association (TCPA) highlights that green infrastructure can contribute to improving people's mental and physical health by encouraging active travel by bicycle and on foot (<https://www.tcpa.org.uk/green-infrastructure-definition>).

Green infrastructures play a fundamental role in urban systems at the territorial scale by connecting large suburban green areas and encouraging their use. Today, green infrastructures are becoming strategic at the local scale, where ecological relations and human benefits are even more valuable. Today the challenge is to use the concept of green infrastructure both at the strategic level (policies aimed at the sustainability of settlement systems), and at the spatial-project scale while maintaining the concept of "network". In order to have the benefits of green infrastructures in the city it does not suffice to have, for instance, a large park: this must be connected with other green systems. Within a dense and stratified urban fabric, the connection must consider all the linear elements potentially useful to link the network nodes. Among these elements are the roads: along them, it is possible to add trees and vegetation contributing to the ecological continuity of the network. But this operation is ineffective if the circulation in these roads remains for car-use only. To make the road a connector of green infrastructures, it is necessary to implement and enrich its functions and in particular those related to pedestrians and cyclists.

### 2.3 *The design of public space to give new meaning to places*

As J. Gehl stated, planners and architects have to make cities for people (Gehl, 2017). According to Gehl, the scale of an urban project is the point where it is possible to evaluate the effects of design on people because it is the scale at which people's behaviours are measurable. In other words, it is the "human scale" where the physical relationships not only among things, but also between space and people, are defined.

In both the fields of study of urban planning and architecture, the term "human scale" is used to distinguish places that can be used by pedestrians and those that can be used by cars because walkable spaces are used to construct an "happy city" suitable for pedestrians and cyclists (Montgomery, 2003). The attention focuses on this type of slow mobility because pedestrians and cyclists are more likely to establish relationships within a space. In fact, pedestrians and cyclists move slowly within the city and they pay attention to urban materials, urban furniture, space dimension, etc. (<https://www.pps.org/article/placemaking-and-the-human-scale-city>). Taking physical space into consideration, public space is the place chosen for the strengthening of human relations. It is a space made up of sidewalks, squares, parks and equipped areas. If these are connected, they guarantee greater continuity, ease of movement, and comfort. According to the Public Space Charter, *«It is essential to look at urban public spaces as a*



*continuous, articulated and integrated system, developing from the scale of the neighbourhood to that of environmental systems, to promote the diffusion of their enjoyment to the entire community and raise urban quality» (art. 19) (<http://www.biennalespaziopubblico.it/la-carta-dello-spazio-pubblico/>).*

Public space, slow mobility and environmental quality become the key design concepts in rethinking the future of cities in a transcalar way. When investigated individually, these three issues find a correspondence in many design experiences around the world. The challenge of the Milanese green-blue backbone project is to combine these three topics in a single network project, generating a system of relations among urban spaces that is necessary for the contemporary urban mobility and ecological regeneration (Secchi&Viganò, 1998).

### **3. Methodology**

The green-blue backbone project followed three main phases: the analytical phase, the design of the thematic Masterplan at the urban scale, the design studies for the 21 stations. For the territorial-scale analysis we used the geo-referenced data available in the Lombardy Region databases (<http://www.geoportale.regione.lombardia.it/>) plus data provided directly by the Municipality of Milan. The maps drawn up describe the territory crossed by the new metro line, using a systems-based approach. The systems analysed are the natural, environmental and ecological ones as well as the system of transport infrastructure and urban mobility, and the system of public services and uses. Furthermore, we developed a pedestrian accessibility study for each of the M4 stops at the territorial scale. We used census data provided by the National Institute of Statistics to understand which urban areas generate metro line users (mostly residential areas) and which one attract metro line users (mostly commercial/tertiary areas). Accessibility was calculated considering pedestrian isochrones (5, 10 and 15 minutes) which allowed to map the catchment area of each station. The construction of isochrones started from the OpenStreetMap street graph. The location of the entrances to the metro line, as defined in the executive or final design for the stops, was added to the road graph to calculate the correct catchment area.

The analytical-interpretive phase ended with the drawing of a map of the surrounding of each station (scale ratio 1:5,000). The approach used is the urban planning one, taking into account public services and strategic uses, open spaces, land uses, existing and planned cycle paths, the local public transport and its stops. The aim is to get to know very well the urban context contained in the isochrone areas previously identified, trying to understand what the strengths and weaknesses of each station's surroundings are.

21 meta-design maps anticipated the design phase. In those maps we combined information arisen from the (existing or planned) pedestrian/cycle network and the urban environment. Following this step, we suggested design actions such as the consolidation, expansion or improvement of the existing cycle-pedestrian routes or of those already planned by the urban planning tools in force (Local Plan 2012 and Sustainable Urban Mobility Plan adopted in 2017 – PUMS 2017). These meta-projects have been the basis for the final choice of the green-blue backbone route and the related paths that connect the surroundings of the 21 stations. Thanks to the meta-design maps, each station has been characterized by design themes based on the resources, peculiarities and characteristics of the urban context. We identified 7 design themes,



and their aim is twofold: to identify the paths of the green-blue backbone and to differentiate the project of the 21 stations top area (the public space).

Afterwards, we drew the Masterplan for the green-blue backbone project (scale ratio 1: 20,000). The result is the design of a pedestrian/cycle network that can be included in the new Local Plan of Milan. The green-blue backbone is an operation of synthesis and systematization of planning actions already planned by the Municipality, in addition to micro-interventions for the maintenance of existing public spaces. The green-blue backbone Masterplan covers the entire route of the M4 underground line, with a variable thickness but still limited to the pedestrian isochrones (15 minutes from the stations). The Masterplan contains 8 actions for its implementation, concerning the paths identified in the meta-design maps. The Masterplan was subsequently implemented, returning 21 urban projects, consistent both with the continuity of the green-blue backbone and with the themes identified for each station. Besides, the DASTU research has included a specific design for the top area of three pilot stations in which, from a strategic guideline, the green-blue backbone becomes an urban project for the public space. This paper provides an example of the project developed for the Sforza-Policlinico station.

The Sforza-Policlinico station is one of the most complex urban projects because the station will become an interchange with the existing M3 metro line. The connection will be at the ground level redesigning a public space of about 400 m with a high attendance by students, researchers, workers, and hospital users. Furthermore, the project will be an opportunity to redesign the public space arising from the project of reopening of historic canals.

The research was published in a report, delivered to the Public Administration in February 2019, which explains the design process and the results. It is important to highlight the graphic representation style used for the analytic and design maps as well.

These maps have been elaborated using a language which is “conventional” but intuitive even for non-experts (Gabellini, 1996). Their aim is to allow the widest dissemination of the work to both technical experts and citizens in order to inform them about the opportunities offered by the new M4 metro line.

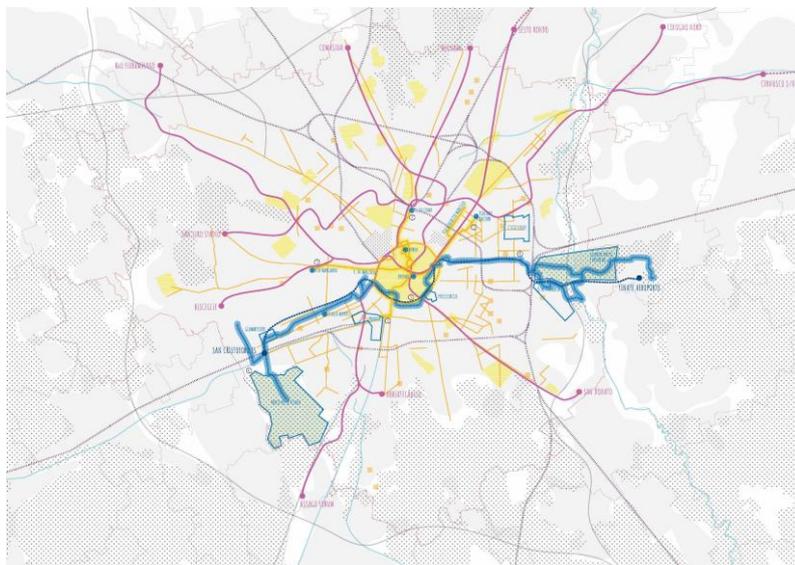
## **4. The new green-blue backbone of Milan**

### *4.1 The opportunity to implement walkability in Milan*

The M4 subway line is 15 km long and will connect the historic center with the eastern part (Forlanini district and Linate airport) and the western part (Lorenteggio district and San Cristoforo station) of the city, using a driverless system (<https://www.metro4milano.it/>). The green-blue backbone project integrates the M4 metro line creating a new soft-mobility network. Such network is characterized by greenery and combines the city's main attractions and urban services, while offering residents better equipped and usable spaces. Both the M4 and the green-blue backbone layout have been divided into three sections: the western (8 stations from San Cristoforo to Parco Solari), the central (6 stations from Sant'Ambrogio to San Babila) and the eastern one (7 stations from Tricolore to Linate airport). The green-blue backbone is a network of pedestrian and cycle paths that completes and integrates the path forecasts already contained in the 2017 PUMS from East to West, thus promoting a city based on the needs of pedestrians and cyclists (Figure 1).

The green and blue backbone does not precisely overlap the underground route of M4 but accompanies, envelops and expands it, connecting relevant urban places, such as infrastructural spaces (urban mobility systems and nodes), environmental systems (green areas and axes, water network), areas for services and public facilities as well as places rooted in the history and memory of the city. The M4 metro line and the green-blue backbone generate an integrated mobility network characterized by 4 speeds: 1) very slow speed (pedestrian areas for those who want to travel and observe the city on foot); 2) slow speed (cycle paths for those who want to enjoy the city on two wheels); 3) medium speed (the railway service for those who exchange with urban and suburban railway lines); 4) very high speed (the metro line for those who need to move quickly).

Figure 1. **Map of the new green-blue backbone of Milan and planned pedestrian itineraries**



Source: Report edited by DASTU Politecnico di Milano, February 2019, p. 8. The blue line represents the new green-blue backbone, the blue dotted line is the M4 metro line, the pink lines correspond to existing metro lines, the yellow lines are urban planned pedestrian itineraries (PUMS 2017); yellow areas are predominantly pedestrian neighbourhoods (as planned in the Local Plan adopted in 2019), while orange squares stand for pedestrian plazas (as planned in the Local Plan adopted in 2019).

#### 4.2 Territorial systems to be crossed and connected

The M4 metro line route will represent an opportunity for the environmental connection if it is flanked by a soft mobility network. The green-blue backbone connects the *Grande Parco Forlanini* and the entire Lambro river system (in the eastern part of Milan) with the agricultural lands belonging to the *Parco Agricolo Sud Milano* (in the South-West). These two regional environmental systems constitute the “natural tanks” from which green routes innervate the dense urban fabric, thus creating an ecological network. The idea of combining underground transport and soft mobility allows to amplify the beneficial effect of public transport in terms of environmental sustainability. Existing or planned pedestrian areas and cycle paths allow to design a network of public spaces around the M4 stations. These interconnected spaces create a unique cycle-pedestrian path between the main green areas and the historic centre.

Connecting the East and West of Milan with the city centre is an important operation to both increase the accessibility of the most peripheral residential areas, and promote the practice of

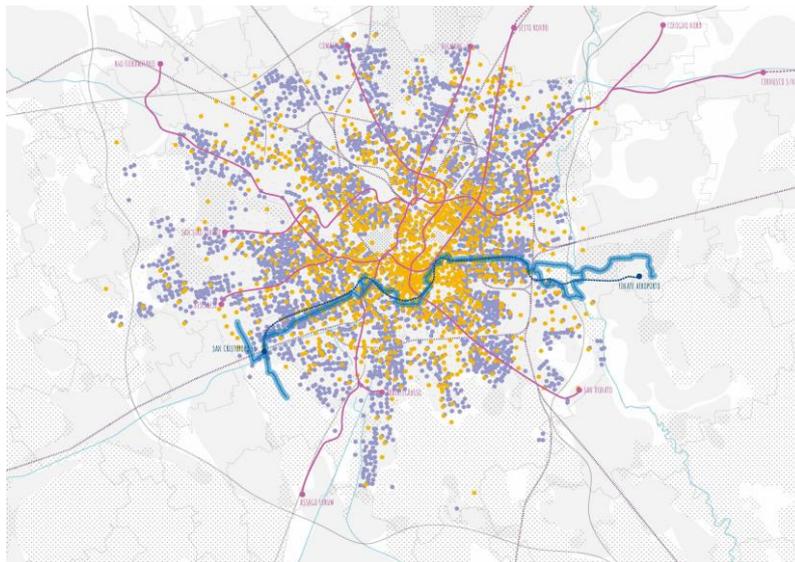
the most attractive places of the city such as the historic centre and its monuments. In the built-up area, the presence of services, shopping malls, cinemas, theatres, conference centres, churches, monuments, modern and historical heritage, etc., has been analysed. If in the peripheral areas the green-blue backbone allows greater accessibility to activities for the inhabitants (bars, restaurants, shops but especially schools, clinics, welfare services, recreation centres, etc.), in the central section the green-blue backbone allows to enjoy the Milanese strategic facilities such as museums, universities and hospitals. In this scenario, the green-blue backbone gives a new meaning to some urban places.

#### 4.3 Accessibility and attraction of the stations

The idea of thematizing the design of each station implies evaluating their level of pedestrian accessibility. The choice to consider pedestrian accessibility stems from the nature of the stations, which are embedded in the dense urban fabric. Considering the current conditions of the context, we evaluated the catchment area of the stations to guide its expansion. The current width of the pedestrian catchment area and the constraints for its extension (barriers, interrupted connections, problematic intersections, etc.) have suggested where to implement the security of paths, as well as how to solve the discontinuity of the paths.

The organization of uses, which generates and attracts people to the metro line according to the catchment area of each stations, is very interesting to analyse. An analysis of the distribution of the generators of users (residential areas) and attractors of users (including productive activities, commercial areas and services), is useful both to estimate the potential people flows and to understand the distribution of people over the time (Figure 2). For the mapping of people generators, the indicator used is the resident population (2011 Population Census) split by census sections; as regards user attractors, the indicator is the number of employees in each census section (2011 Census of Economic Activities), aggregating data for productive, tertiary-commercial activities and services.

Figure 2. Map of neighborhoods with people-attracting and people-generating functions



Source: Report edited by DASTU Politecnico di Milano, February 2019, p. 22. The blue dotted line is the new green-blue backbone, the blue line represents the M4 metro line, orange dots are tertiary and commercial uses (people-attracting functions), while lilac dots stand for residential areas (people-generating functions).

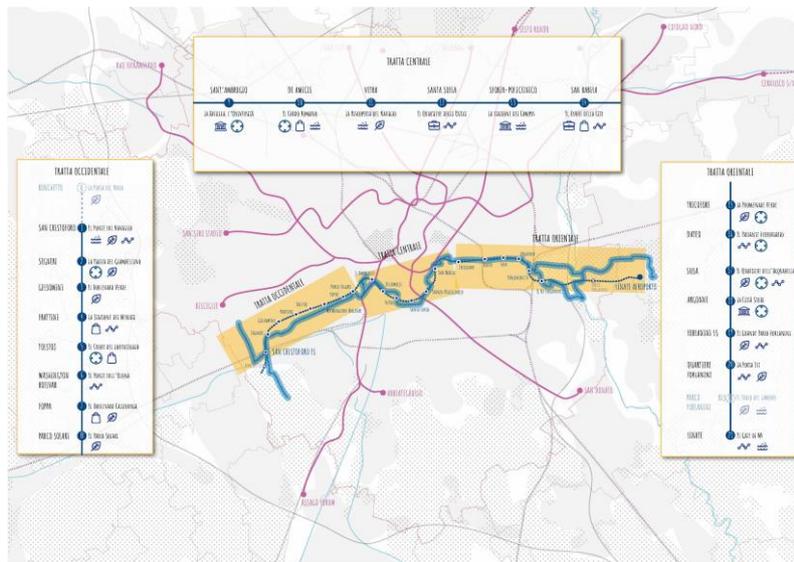
#### 4.4 Contextualising and thematizing stations: The Sforza-Policlinico case study

Each station meets a part of the city and thus structures a theme. For instance, the theme of the Segneri station is “The new square of Giambellino”, while the theme of the Frattini station is “The station of the markets”. In the first case, the station and its top area represent the occasion for public space, i.e. the square for the Giambellino historical residential district, to “become an urban core”. In the second case the fabric surrounding the station, rich in commercial activities, is the element that has given the station its role as an urban place for recreational uses.

Each theme has been divided into specific sub-themes, which refer to the main identity and uses that characterize the local urban context (Figure 3). They are:

1. the relationship with water and, in particular, with existing or future sections of the Milanese canals (*Navigli*);
2. the presence of green urban systems such as boulevards and tree-lined avenues, parks and public gardens;
3. the construction of an intermodal node for urban mobility (buses, trams, trains, subways, as well as ring roads and main streets);
4. the creation of an urban centrality or a public space necessary for the attractiveness and vitality of social activities (of inhabitants or city users);
5. the presence of an articulated commercial system (market areas, neighbourhood shops and shopping malls);
6. the existence of strategic and attractive uses of supra-local importance, such as hospitals and universities, or monuments and architectures with high historical value;
7. the characterization of some urban areas by tertiary activities with a high level of people attraction.

Figure 3. Map of the new green-blue backbone of Milan and the design themes for each station



Source: Report edited by DASTU Politecnico di Milano, 2019 February, p. 26. The blue dotted line is the new green-blue backbone, the blue line represents the M4 metro line, orange squares are the three sections of M4 metro line. At the edge of the map, line stops are described through the project themes.

The themes arise from the interpretation of the contexts in which each station is located. For example, the Sforza-Policlinico station is characterized by theme no. 6, and the title is “The station of the Campus” because the station will be useful to reach two important metropolitan facilities: The Università Statale di Milano and the Policlinico Hospital. The M4 segment that connects Sant’Ambrogio station to San Babila station overlaps the historic Milanese canals (*Cerchia dei Navigli*). M4 metro line intercepts a part of the canal that will be reopened near the Vetra and Sforza-Policlinico stops. Furthermore, in the latter station, the M4 line intercepts the existing M3 line. The green-blue backbone route crosses some places relevant for their historical and artistic value.

Those places are within an urban fabric rebuilt in the twentieth century due to the Second World War boom and the typical Fascist planning actions (such as demolition), as well as to the partial implementation of the Local Plan (known as the *Piano della Racchetta* for its famous new road, *racchetta*, that destroy part of the city) in the 30s. The green-blue backbone intercepts some attractive uses of space: The Università Statale di Milano, public and private health centres (Policlinico, Gaetano Pini, Clinica Madonnina), the Central Synagogue, the Sormani Library, the Palace of Justice, the Chamber of Labour, the Conservatory as well as the tertiary-commercial system of Piazza San Babila with the so-called “fashion quadrilateral” (*quadrilatero della moda*). In the area, there are also important buildings from the monumental and historical point of view.

The in-depth analysis of the urban context (Figure 4) highlights the richness in uses, such as educational institutions (Diaz, Marcelline, Leonardo da Vinci, Collegio delle Fanciulle, etc.), public offices (Municipality, A2A, Acli, etc.), and cultural facilities (House of Culture, Villa Necchi Campiglio, Teatro Carcano and Teatro Lirico, State Archives in the Senate Palace, etc.). The presence of residential and green areas (Guastalla Historic Garden) is small but helpful. Therefore, the Sforza-Policlinico station is a very important urban node for the presence of attractive uses, with high daily flows of workers, students, hospital users as well as tourists.

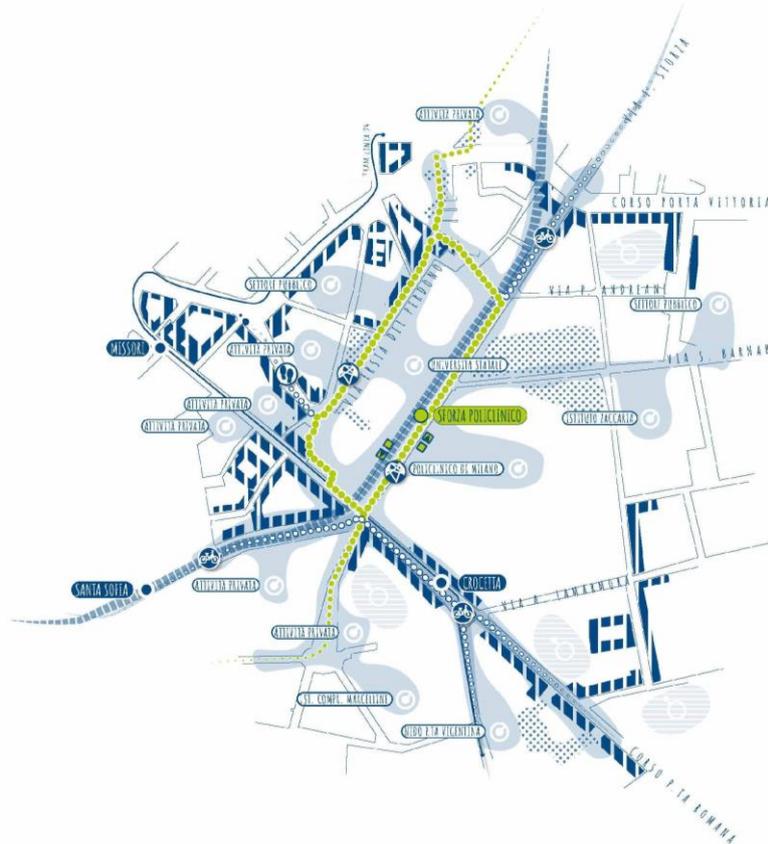
Figure 4. Map of the Sforza-Policlinico station and its surrounding



Source: Report edited by DASTU Politecnico di Milano, February 2019, p. 117. The blue line represents the M4 metro line.

The Masterplan for the Sforza-Policlinico station (Figure 5) consists of a qualitative improvement of the existing roads, the confirmation of the planned cycle paths, the paving and safety of the sidewalks, and the creation of a shared street between the two university campuses (via F. Sforza). Besides, the coordination with the works planned for the reopening of the historic canal will provide an opportunity to enhance the identity of the urban landscape, and strengthen the livability of public space.

Figure 5. Masterplan of the Sforza-Policlinico station



Source: Report edited by DASTu Politecnico di Milano, February 2019, p. 127. The dashed blue line stands for the M4 metro line, the green dotted line represents the new green-blue backbone, the light blue area is the influence area of green-blue backbone, blue buildings are characterized by commercial uses.

#### 4.5 The new design of soft mobility and the redefinition of public space

A design action is attributed to each path that composes the green-blue backbone. The list of actions varies from the consolidation of existing routes to the creation of new roads in which the pedestrian and the cyclist are the protagonists. But the actions are also oriented towards the surrounding urban fabric that can be adapted to the new needs of users. The 8 design actions of the Masterplan are guidelines to be implemented in the executive architectural design phase (Figure 6). They are:

1. The maintenance of existing cycle/pedestrian paths. The action confirms the existing cycle-pedestrian routes considered important for the accessibility of a park or neighbourhood. The materials used for its realization (which, in this case, means a consolidation of the route)



vary according to the urban fabric they cross: in the historic city, stones are allowed materials typically used in historical squares and pedestrian areas (such as the *rizzata*, a surface paved with polished river pebbles), while cobblestones (*pavè*) is used on the roads shared by cars and trams; in the consolidated urban fabric, asphalt and bituminous material can be used.

2. The confirmation of the PUMS 2017 guidelines. The overall strategy of creating a soft mobility network (aiming to increase the accessibility of the new M4 stations) starts from the idea of confirming and strengthening the PUMS 2017 programmes and in particular, regarding the identification of pedestrian routes, the creation of a cycling and walking network combined with the expansion of the restricted traffic zone.
3. The creation of a new cycle path. This represents the design of cycle routes in three models: 1) a promiscuous path, when the road section does not allow the division between the cycle path and the pedestrian area, yet maintaining a recognizability of the route with respect to the roadway; 2) a protected path, where the separation from the roadway site is achieved through the use of curbs or guard-rail; 3) a protected path with green features, where the division between vehicle and cycleway is achieved through the inclusion of a set of trees.
4. The repaving or securing of existing pavements. This is the set of operations required to provide suitable areas for cycling and pedestrian traffic, as well as a series of interventions aimed at reducing risk factors for pedestrians and cyclists. These factors can be limited by the use of bollards, parapets, barriers, including plant barriers, which prevent the improper use of sidewalks and cycle paths while improving the use of urban space for cycling and walk.
5. The positioning of new trees. It represents the set of landscape projects aimed at inserting various types of tree and shrub along the existing cycle/pedestrian paths or those provided by PUMS 2017. In particular, trees with crowns up to 6 m in diameter are proposed to decorate the paths but also to increase the quality of the visual rhythm of the path.
6. The construction of new green parterres. Compared to the previous action (the positioning of new trees), this action proposes the inclusion of trees with crowns over 6 m in diameter and meadows along the existing or planned cycle paths. The action increases the sharing of permeable green areas while the passages represented by paths becomes themselves focal points.
7. The creation of a shared street. The shared street represents an approach to urban design that minimizes the clear division between the different uses of the road by removing the formal distinctions between spaces dedicated to pedestrians, cyclists, wheeled vehicles. The aim is to break down any architectural barrier, to significantly reduce speed in urban road sections, and to improve the perception of the urban landscape through the use of high-quality materials.
8. The construction of a new “showcase-road” (*strada-vetrina*). The action of creating a “showcase-road” is a way to emphasise the presence of commercial uses, as well as to increase the use by pedestrians and bicycles in the district characterized by this use. The design action foresees the reshaping of the road section in order to interrupt the straight perspective of the roads, increase the area of the sidewalks to allow the placement of the dehors, and relocate the parking areas to reduce the impact of cars on urban space.

Figure 6. Masterplan of the new green-blu backbone of Milan



Source: Report edited by DASTU Politecnico di Milano, February 2019, p. 28-29.

## 5 Conclusions

The idea of connecting cycle paths, pedestrian areas, squares, sidewalks, green areas, playground areas, historic parks and gardens, boulevards and tree-lined rows, etc. is a first step towards the creation of a green Milanese infrastructure at the “human scale”.

In addition to the improvement of some roads through the planting of trees, the green-blue backbone adds the construction of new cycle paths and/or the extension of pedestrian areas, the redesign of public spaces consistent with the project to reopen the Milanese canals, and the link to the subway line M4.

The implementation of this soft mobility network integrates different transport types (airport, metro, railway, cycle paths, pedestrian areas), links historical, modern, and thematic districts and connects strategic urban uses (hospitals, universities, schools, museums, cinemas, theatres, churches, libraries), as well as linking ecological systems (parks, canals, historic gardens, agricultural areas). Besides, the green-blue backbone becomes an opportunity to regenerate the public spaces crossed by the network. Moreover, the green-blue backbone becomes the way to improve the health of citizens by stimulating them to do physical exercise in taking advantage of cycle-pedestrian routes, promoting daily activities in more natural environments, and not polluting the air with CO<sub>2</sub> and noise.

The new green-blue backbone becomes a factor that structures the city's future, in a perspective in which the system of public spaces, especially those designed for soft mobility and those characterized by the presence of natural elements (green areas, trees and water), prevail over human functions and vehicular mobility.

This operation aims to build a city that reduces its ecological footprint, limiting the fragmentation of natural habitats, which are more ecologically and socially sustainable. A city that works on the cycles of urban metabolism, and copes with new climate changes through policies of resilience, but above all that manages to be liveable and comfortable for its daily users and future generations.



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