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Regeneration of the Built Environment from a Circular Economy Perspective

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Preface

The chapters included in this book give a kaleidoscopic selection of conceptual, empirical, methodological, technical, case studies and research projects, which implement the concepts of circular economy to the regeneration of the built environment. This means enhancing the understanding of sustainability to a broader paradigm, developing a number of practices concerning energy, raw materials, waste, health and society. In particular, a set of theoretical and methodological contributions introduce the theme of the socio-economic development of territories, while the three following sections deal with the challenge of closing the loops of the construction sector—on the one hand, focusing at the larger scale of urban regeneration and, on the other hand, deepening new ways of activating sustainable and resilient paths at the level of the building materials' production, and eventually foreseeing novel policies, tools and organizational models of the building performances' improvement through the reusing, recycling, up-cycling and remanufacturing strategies, applied to the built environment.

This book belongs to a series, which aims at emphasising the impact of the multidisciplinary approach practised by ABC Department (Architecture, Built Environment and Construction Engineering) scientists to face timely challenges in the industry of the built environment. This book presents a structured vision of the many possible approaches—within the field of architecture and civil engineering—to the development of researches dealing with the processes of planning, design, construction, management and transformation of the built environment. Each book contains a selection of essays reporting researches and projects, developed during the last six years within the ABC Department of Politecnico di Milano, concerning a cutting-edge field in the international scenario of the construction sector. Following the concept that innovation happens as different researches stimulate each other, skills and integrate disciplines are brought together within the department, generating a diversity of theoretical and applied studies.

The papers have been selected on the basis of their capability to describe the outputs and the potentialities of carried out researches, giving at the same time a report on the reality and on the perspectives for the future. The cooperation of ABC Department scientists with different institutional and governmental bodies (e.g.

UNESCO, UIA, EACEA, EC-JRC, ESPON, DG REGIO) as well as their participation to sectoral boards and committees (e.g. ISO, CEN, UNI, Network Android-Disaster Resilient, IEA, Stati Generali della Green Economy, Green Public Procurement, Associazione Rete Italiana LCA, Lombardy Energy Cleantech Cluster) and their dialogues with institutions (e.g. national ministries, regional government, local administrations) led and motivated the selection of the essays.

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Contents

Socio-Economic Development and Regeneration of Territories	
A Research Programme on Urban Dynamics	3
Roberto Camagni, Roberta Capello and Andrea Caragliu	
Cultural Heritage, Creativity, and Local Development: A Scientific Research Program	11
Roberta Capello, Silvia Cerisola and Giovanni Perucca	
Urbanization and Subjective Well-Being	21
Camilla Lenzi and Giovanni Perucca	
EU Regional Policy Effectiveness and the Role of Territorial Capital	29
Ugo Fratesi and Giovanni Perucca	
Demolition as a Territorial Reform Project	39
Chiara Merlini	
The Evaluation of Urban Regeneration Processes	47
Leopoldo Sdino, Paolo Rosasco and Gianpiero Lombardini	
New Paradigms for the Urban Regeneration Project Between Green Economy and Resilience	59
Elena Mussinelli, Andrea Tartaglia, Daniele Fanzini, Raffaella Riva, Davide Cerati and Giovanni Castaldo	
The Technological Project for the Enhancement of Rural Heritage	69
Elena Mussinelli, Raffaella Riva, Roberto Bolicci, Andrea Tartaglia, Davide Cerati and Giovanni Castaldo	
Real Estate Assets for Social Impact: The Case of the Public Company for Social Services “ASP City of Bologna”	77
Angela S. Pavesi, Andrea Ciaramella, Marzia Morena and Genny Cia	

Reuse and Regeneration of Urban Spaces From a Resilient Perspective	
Participated Strategies for Small Towns Regeneration. The Case of Oliena (Nu) Historic Centre	89
Laura Daglio, Giuseppe Boi and Roberto Podda	
Living and Learning: A New Identity for Student Housing in City Suburbs	99
Oscar E. Bellini, Matteo Gambaro and Martino Mocchi	
PolimiparaRocinha: Environmental Performances and Social Inclusion—A Project for the Favela Rocinha	111
Gabriele Maserà, Massimo Tadi, Carlo Biraghi and Hadi Mohammad Zadeh	
Urban Renovation: An Opportunity for Economic Development, Environmental Improvement, and Social Redemption	125
Paola Caputo, Simone Ferrari and Federica Zagarella	
Regenerative Urban Space: A Box for Public Space Use	137
Elisabetta Ginelli, Gianluca Pozzi, Giuditta Lazzati, Davide Pirillo and Giulia Vignati	
Slow Mobility, Greenways, and Landscape Regeneration. Reusing Milan’s Parco Sud Decommissioned Rail Line as a Landscape Cycle Path, 2019	149
Raffaella Neri and Laura Anna Pezzetti	
Nature and Mixed Types Architecture for Milano Farini	159
Adalberto Del Bo, Maria Vittoria Cardinale, Martina Landsberger, Stefano Perego, Giampaolo Turini and Daniele Beacco	
Rehabilitation Projects of the Areas of the Decommissioned Barraks in Milan, 2014	169
Raffaella Neri	
An Experience of Urban Transformation in Multan-Pakistani Punjab	181
Adalberto Del Bo, Daniele F. Bignami, Francesco Bruno, Maria Vittoria Cardinale and Stefano Perego	
The Transformation of the Great Decommissioned Farini Railroad Yard: The Research for a Modern Housing Settlement	191
Raffaella Neri and Tomaso Monestiroli	

**Toward Sustainable Product and Process Innovation
in the Construction Sector**

**Design Strategies and LCA of Alternative Solutions for Resilient,
Circular, and Zero-Carbon Urban Regeneration: A Case Study** 205

Andrea Campioli, Elena Mussinelli, Monica Lavagna and Andrea Tartaglia

**Circular Economy and Recycling of Pre-consumer Scraps in the
Construction Sector. Cross-Sectoral Exchange Strategies for the
Production of Eco-Innovative Building Products** 217

Marco Migliore, Ilaria Oberti and Cinzia Talamo

**Re-Using Waste as Secondary Raw Material to Enhance
Performances of Concrete Components in Reducing
Environmental Impacts** 229

Andrea Tartaglia

**Bio-Based Materials for the Italian Construction Industry:
Buildings as Carbon Sponges** 237

Olga Beatrice Carcassi, Enrico De Angelis, Giuliana Iannaccone,
Laura Elisabetta Malighetti, Gabriele Masera and Francesco Pittau

Sustainable Concretes for Structural Applications 249

Luigi Biolzi, Sara Cattaneo, Gianluca Guerrini and Vahid Afroughsabet

**Closing the Loops in Textile Architecture: Innovative Strategies
and Limits of Introducing Biopolymers in Membrane Structures** 263

Alessandra Zanelli, Carol Monticelli and Salvatore Viscuso

**Performance Over Time and Durability Assessment of External
Thermal Insulation Systems with Artificial Stone Cladding** 277

Sonia Lupica Spagnolo and Bruno Daniotti

Multi-scale Approaches for Enhancing Building Performances

**Circular Economy and Regeneration of Building Stock: Policy
Improvements, Stakeholder Networking and Life Cycle Tools** 291

Serena Giorgi, Monica Lavagna and Andrea Campioli

Re-NetTA. Re-Manufacturing Networks for Tertiary Architectures 303

Cinzia Talamo, Monica Lavagna, Carol Monticelli, Nazly Atta,
Serena Giorgi and Salvatore Viscuso

Reusing Built Heritage. Design for the Sharing Economy 315

Roberto Bolici, Giusi Leali and Silvia Mirandola

**Public Health Aspects' Assessment Tool for Urban Projects,
According to the Urban Health Approach** 325

Stefano Capolongo, Maddalena Buffoli, Erica Isa Mosca, Daniela Galeone,
Roberto D'Elia and Andrea Rebecchi

A Development and Management Model for “Smart” Temporary Residences	337
Liala Baiardi, Andrea Ciaramella and Stefano Bellintani	
Extra-Ordinary Solutions for Useful Smart Living	347
Elisabetta Ginelli, Claudio Chesi, Gianluca Pozzi, Giuditta Lazzati, Davide Pirillo and Giulia Vignati	
Rethinking the Building Envelope as an Intelligent Community Hub for Renewable Energy Sharing	357
Andrea G. Mainini, Alberto Speroni, Matteo Fiori, Tiziana Poli, Juan Diego Blanco Cadena, Rita Pizzi and Enrico De Angelis	
Adaptive Exoskeleton Systems: <i>Remodelage</i> for Social Housing on Piazzale Visconti (BG)	363
Oscar E. Bellini	
Assessing Water Demand of Green Roofs Under Variants of Climate Change Scenarios	375
Matteo Fiori, Tiziana Poli, Andrea G. Mainini, Juan Diego Blanco Cadena, Alberto Speroni and Daniele Bocchiola	
Comparison of Comfort Performance Criteria and Sensing Approach in Office Space: Analysis of the Impact on Shading Devices’ Efficiency	381
Marco Imperadori, Tiziana Poli, Juan Diego Blanco Cadena, Federica Brunone and Andrea G. Mainini	

Slow Mobility, Greenways, and Landscape Regeneration. Reusing Milan's Parco Sud Decommissioned Rail Line as a Landscape Cycle Path, 2019



Raffaella Neri and Laura Anna Pezzetti

Abstract This study is part of the EU-GUGLE project FP7 and aims at integrating a demonstration pilot case for the improvement of the efficiency of buildings with experiences of mitigating urban connection system and cycling lines on a district scale along with peri-urban landscape recovery. This is achieved through the correct management of the distributed green areas in order to improve the overall efficiency and the optimization of slow mobility pathways (cycle and pedestrian) in order to reduce the use of cars, while guaranteeing the best conditions of usage (mitigation, shading, resting points and services, safety, etc.), and coherent insertion within the public transport network. The study explores a peri-urban connection system in Milan integrating different kinds of green infrastructure while also analyzing them through specific design solutions. The recovery of a dismissed railway is explored through design for its landscape potential, thus proving the resilience of the city's urban palimpsest.

Keywords Slow mobility · Mitigation paths · Green infrastructure · Decommissioned railway recovery

1 The District's Scale

The research is part of the EU-GUGLE FP7 project for improving existent districts' and buildings' energy efficiency through retrofitting and develops the integration of mitigated urban paths and spaces, reusing existing railway lines and roads while connecting to major district facilities. The scale of the analyzed area allows to reconsider the relationships with public space and territorial transport networks to optimize the transport system by establishing a hierarchy between the different types of paths

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(pedestrian, cycling, driveways, etc.) and levels of roads (highway, crossing, local, zone 30 km/h, etc.), to realize an effective connection with the public urban mobility systems, and thus to reduce the use of cars in favor of slow mobility systems designed as greenways. Furthermore, slow mobility and greenways aim at ensuring the interconnection of both urban and local services in order to avoid peripheral conditions and guarantee the presence of green and collective urban spaces.

The intervention at district scale is also decisive in ensuring the economic sustainability of existing buildings' energy retrofit interventions. On the other hand, the district scale is also appropriate to explore interventions that reaffirm the urban identity of peri-urban places. The need to ensure the optimization of the existing buildings thus involves the relationship with the city, taking into account both functional integrations (the complementarity between housing and facilities, schools, leisure and commercial activities), urban-scale facilities, and accessibility.

A city is 'smart' if the sustainable renewal of the whole promotes a vision of urban, architectural, and environmental quality that impacts positively on the life quality of its inhabitants, their sense of belonging, and the resulting urban and civil behaviors (ISPRA 2015; XI Rapporto ISPRA 2013; UNHS 2009; RETICULA 2013).

2 The Demonstration Areas and Their Historical Transformation

The demonstration areas of EU-GUGLE belong to a wide urban–rural system in the southeastern region of Milan, between two strategic areas for urban transformation (ATU), Porto di Mare and Rogoredo. The areas are endowed with mixed features ranging from high environmental, heritage and landscape quality, to a segregated district near a new development area.

The municipality of Milan has identified three buildings on which to apply retrofitting initiatives with regard to the research project. These are two residential buildings and a school located in two neighboring but clearly distinct areas: a residential building and a kindergarten in the Rogoredo area, near the transformation site of the Santa Giulia District and two residential buildings belonging to a single unit in the Chiaravalle area.

Although the two areas are relatively close, their characteristics and history show almost opposite developments, transformations, and conditions. The two sites are now separated by several major infrastructures, such as the southern railway that also includes the high-speed line and the junction to the east expressway. They are almost insurmountable infrastructures that highlight the historical division and the factor of isolation from the center and 'consolidated city.' They have developed according to different logics: Chiaravalle preserved its agricultural characteristics, while Rogoredo-Santa Giulia became an industrial site.

The historical transformations of the site explain the present characteristics while providing valuable indications concerning the main criticalities and the possible points of intervention.

The Chiaravalle District, thanks to its isolation, limited development, agricultural nature, many green areas, and the Vettabia Park, does not require significant mitigation issues but lacks adequate and equipped social spaces. The few existing paths are not shaded and do not provide any kind of additional service. Due to the proximity to the ancient Abbey and the agricultural land, the Chiaravalle hamlet is not affected by expansion projects. The north part of district, instead, is part of the ATU Porto di Mare's redevelopment project.

In the perception of its inhabitants, the district suffers from isolation with respect to other parts of the city, laying beyond the railway and lacking urban connection to the road network and public transport system.

The Rogoredo station (suburban railway, high-speed railway line, and underground yellow line) although relatively close is separated by the presence of the expressway that makes the access to the station difficult, limited to a one-lane road. The area has a tourism potential due to the presence of the historical Chiaravalle Abbey and the potential connection to cycling trails and paths leading to the countryside and the Abbeys of the territory (Valle dei Monaci).

Between the village and the Abbey is the abandoned Rogoredo-Poasco railroad track. The project demonstrates the potential of this infrastructure that has been thus far considered as a barrier. At present, the first effect of its dismantling is the elimination of the crossing between the Abbey and the hamlet, which re-establishes better connections and favors the tourism relaunch of the site (Fig. 1).



Fig. 1 Areas of the EU research with the exiting and designed cycle paths

The Rogoredo-Santa Giulia area faces an opposite situation: is an industrial brownfield that has lost the identity of the nucleus that developed around it. It is fenced in by the road interchange system and the railway, which represents a potential but also a problem. The area has captured the interest of an ambitious project for the construction of the new Santa Giulia District (in the area of the former Montedison steelwork company Redaelli, PII 2005, Project N. Foster, P. Caputo partnership), which, left unfinished, failed to renew the identity of the area. A new project is now ongoing.

Urban and social segregation, disorder, heterogeneity, and lack of social spaces and facilities characterize this part of the city, although it enjoys both rail and metropolitan connections (underground yellow line).

3 Integration of Green and Cycling Paths in Milano's Smart Districts

Mitigated and cycling paths form the support structure for 'slow mobility' intercepting and directing consistently the localization of district facilities while assuring new uses of the city and urban relationships. Advanced communities have started to rethink their own development processes, leading to new open strategic options in view of a change in their overall behavior. One of the benefits is a new rising sensibility toward 'slow mobility (Croce et al. 2017).'

The part of the city in which the EU-GUGLE interventions are carried out has therefore emphasized the need to rethink and reorient the slow and cycling mobility not only in a radial direction, connecting the suburbs to the downtown, but also in a circular direction to reconnect districts which are isolated from infrastructures, enhancing their proximity to peri-urban parks and their access to connection hubs (FS Rogoredo station, subways), opening green lines and finding a new use for neglected infrastructures, such as disused railways, provides an opportunity for low carbon travel experiences since reconversion policies promote new uses, arrest decay processes, and re-establish continuity in the environmental system, using existing linear infrastructures. Consequently, the decommissioned railroad recovery has become a focus of redevelopment projects in many European countries. Green lines implementation and Rogoredo-Poasco decommissioned railroad recovery has been assumed by the research and Milan Municipality as a major opportunity to connect with the many ATU (urban transformation areas) and peri-urban projects that so far were not considered in a comprehensive frame of the smart city and low-carbon city concept.

Pedestrian and cycle connections are also means to trigger sustainability processes relating not only to mobility and transportation but also to the subject of a 0-km production chain. The project may connect to other existing projects such as OpenAgri, the 'Open Innovation Hub on Peri-Urban Agriculture,' Sharing Cities, and Lighthouse, which are located in the area.

The project also reconnects the EU-GUGLE-renovated buildings to the new ongoing masterplan of Santa Giulia, extending the connection of mitigated cycling and pedestrian paths to the surrounding areas and the intermodal Rogoredo station. Mitigated and cycling paths form the support structure for ‘slow mobility’ intercepting and directing consistently the localization of district facilities while assuring new uses of the city and urban relationships (Figs. 2 and 3).

4 The Plan: New ‘Green Lines’ Combined with Smart City Concepts

The PUM (Milan’s Mobility Plan, Osservatorio PUMS—Piano Urbano della Mobilità Sostenibile) establishes the general network and defines priorities. It is developed on a large urban scale, so it is not consistently related to urban transformation projects nor specifically defined on a district scale.

It has been analyzed and integrated by the project concerning the green and cycling paths, introducing a number of modifications in order to connect it consistently to the opportunities emerging from site-specific conditions and smart district concepts. The new cycling paths aim to be innovative green infrastructures, identifying different levels of complexity and smart city concept integration according to each specific urban situation (ISPRA 2010).

The project has provided a set of principles capable of combining holistically the issues relating to ‘slow mobility,’ to ‘green infrastructures’ (GI), and to ‘urban forestation’ (UF), while enhancing their role as ‘green social streets’ within urban and landscape redevelopment projects. The goal of these principles is to reduce the ecological impacts of urban space fragmentation and support the multifunctional potential of green trails in organizing urban connections and heat island abatement.

In order to achieve these goals, greenways, ecological corridors, and ecological networks need to be planned and constructed within the concept of ‘connectivity.’

On the other hand, the aim of the greenway strategy has been related to three ecosystemic services: cutting air pollutants, cutting risks of water outflow, and reducing temperatures.

The masterplan identifies a set of cycling and pedestrian lanes that are connected in a unique network with already existing and planned paths in the new Santa Giulia District. The green streets system consists of a network of shaded streets that connect residential and public buildings in the two parts of the district that are still suffering from isolation and a lack of services and are the focus of *urban oases* that link mitigated parking areas within a 300-m radius and district facilities (especially schools). These lanes are intended as ‘green social streets,’ intercepting a number of social places, and are endowed with urban oases where different facilities are provided according to their hierarchy (level of the street) and specific urban situation: shade, seating, bio-ponds, water and electricity supply, bike sharing or car sharing,

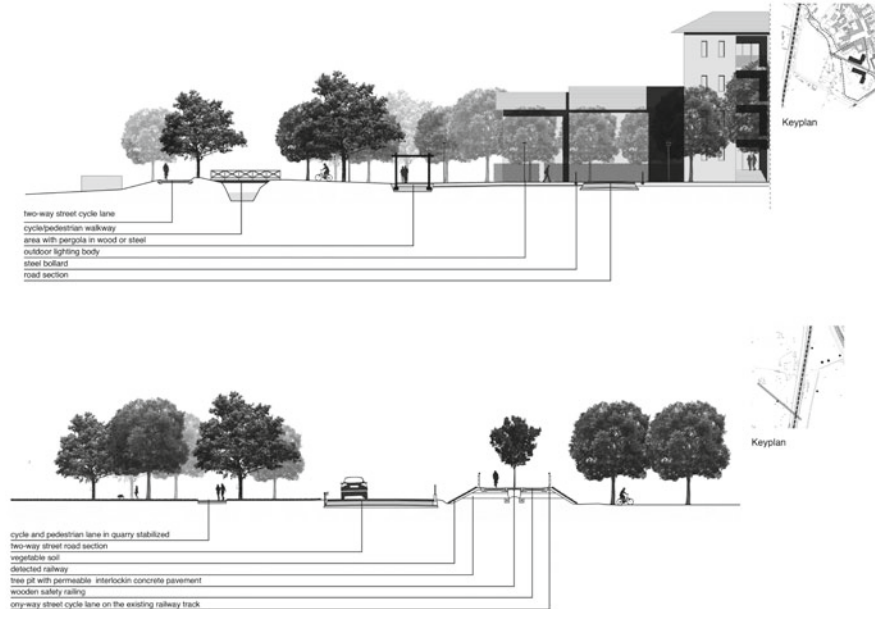


Fig. 2 Chiaravalle area: plan and sections of the cycle paths

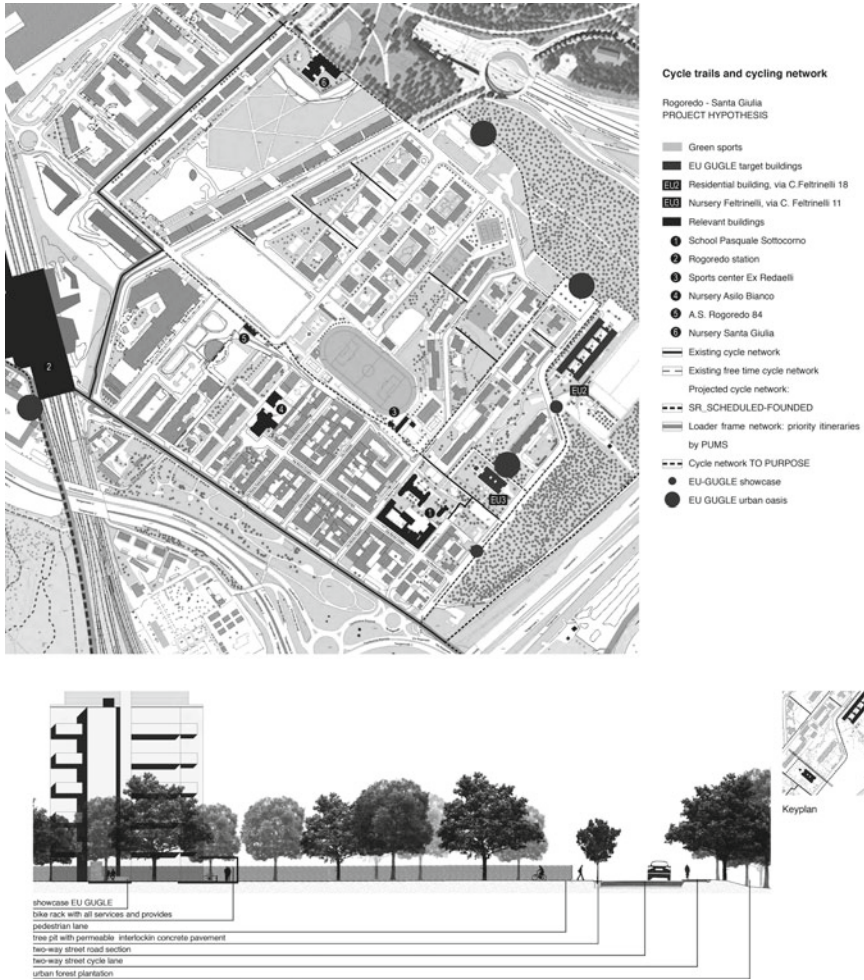


Fig. 3 Rogoredo—Santa Giulia area: plan and cycle paths

interchange with subways and railroads, LED public lighting, ICT platforms, smart parking control, and ‘zone 30’ areas.

The insertion of new collective places guarantees livability and safety to the routes, privileging green-planted spaces, reorganized and rehabilitated, strengthening the retrofit projects applied to the individual buildings and improving environmental quality and well-being.

In addition to the sequestration of CO₂ by the tree cover, which, however, to be significant cannot be separated from the reduction in its production, the tree structures provide shading and cooling. They also bring social, psychological, hygienic-sanitary, environmental, and energy-related benefits, along with induced labor-related benefits (Bonafè 2006; Morabito et al. 2015).

In addition to mitigating routes and providing shade for resting places, the planned trees provide green bands with the purpose of cooling and mitigating the noise pollution that is present in this area. Specifically, the cycling lanes and the break areas take on different meanings:

- the connection between the different parts and the Rogoredo station, which represents the closest metropolitan public transport hub. As it is significantly close to both areas, yet perceived as distant (especially from Chiaravalle due to the difficulty of access), the protected cycling lane represents the possibility of reconnecting to the center and to other parts of the city;
- the connection of the new routes to a system existing and planned urban cycling lanes, still fragmentary. In this way, the network would allow users to reach central parts of the city of Milan through a safe, secure, and relatively short cycling path, equipped with services and rest areas;
- the connection with external routes on a territorial scale, which concerns leisure activities, the relation with the agricultural countryside to the south and with the historical heritage, Abbeys, farms, hydraulic works, etc. The connection involves also the Forlanini and Lambro Parks. This would favor the development of slow and sustainable tourism, especially at Chiaravalle.

The planned continuity of green areas provided by the green lines and cycling paths allows for better air circulation within the urban and peri-urban districts. In addition to the implementation of the new planned green connections, the ecosystemic complexity of the areas will also be enhanced through a reforestation initiative along the northern tracks of the railroad (Porto di Mare southern area).

In cities, including Milan, the function of rows of trees is usually reduced to the mere shading of the streets. The mitigation of pedestrian areas, cycle paths, and neighborhoods' living spaces becomes a goal to guarantee conditions of thermo-environmental well-being in the urbanized space, a need induced by the urban heat island (UHI) phenomenon. Enhancing the cooling capability through vegetation along green lines and selecting vegetation with a high density of foliage and resistant to water scarcity will help to provide shade for the soil, which will stay moist and fresh for longer. This means to integrate this new conception of infrastructures in the regeneration or development projects for public spaces and an appropriate synergy with the location of district facilities (Comune di Firenze, no date).

5 The Recovery and Landscape Resilience of the Rogoredo-Poasco Decommissioned Railroad

A new crucial role is emerging for the reuse of disused rail lines worldwide. Italy has also proposed a law for the realization of a national network of slow mobility, based on intermodality between biking, walking, leisure trails, and local railways, which promotes green mobility, landscape resilience, physical activity of people, recreation, tourism, and safeguarding of the diffused territorial assets.

The recovery of a 4-km decommissioned railroad as a connection route and landscaping cycling appears to be a priority. It would assure a connection not only between districts, but also to a regional and national cycling system, stitching up a multitude of itineraries that are still fragmented.

The route would join the underground station and the interchange node of Rogoredo, intercepting the crux of the two major areas: the Abbey with the town of Chiaravalle and the large school and sports grounds, i.e., the very civic core of Rogoredo. The systemic potential of this short stretch extend, on the one hand, to the landscape enhancement of the system of the Vettabia valley, Abbeys, farms, parks, and paths to which the neighborhood of Rogoredo, which is today confined to an infrastructural enclave, would connect (Forlanini Park, Vettabia, and South Park).

The ‘landscape cycling’ project here developed looks to two strategies that are economically sustainable and focus on the resilience of the railway track: its reuse through special bicycles hooked on the rails, along the scenic stretch (from Chiaravalle as far as Nosedo); a cycling path flanked by a system of multipurpose mobile elements (pergolas, pedestals, chairs, small pavilions) along the flat stretch of the urban cycling route (from Chiaravalle to Rogoredo), so as to constitute an equipment in support of multiple initiatives that can take place throughout the year.

At the same time, the green railroad would constitute an effective permanent ‘showcase’ path of Milan’s sustainability agenda, aiming to promote education in sustainable behavior along the cycling path itself. Along the paths, a number of meaningful urban locations are identified that relate to the presence of existing facilities. The design proposes two kinds of showcase components: the larger ones are more complex and integrate panels disseminating EU-GUGLE’s good practices to be implemented in a smart city, seating, water supply; the smaller ones are simple as they consist only of replaceable panels. Together they give rhythm and continuity to the ‘sustainability’ landscape path (Fig. 4).



Fig. 4 Reuse of the decommissioned Poasco-Rogoredo railroad as a cycling trail passing through Chiaravalle

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- Disegno di legge n. 2383, *Contenimento del consumo del suolo e riuso del suolo edificato*.
- Legge 14 gennaio 2013, n. 10, Norme per lo sviluppo degli spazi verdi urbani (G.U. n. 27 dell'1 febbraio 2013).
- UNI/PdR 8:2014 Linee guida per lo sviluppo sostenibile degli spazi verdi - Pianificazione, progettazione, realizzazione e manutenzione.

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