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**PLANNING FOR THE GLOBAL URBAN AGENDA**

# Urban regeneration through adaptive reuse:

# redevelopment strategies for the former Don Leoni school site in Mantova

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# INDEX

1. INTRODUCTION ..... 4
1.1 Framing of the topic ..... 4
1.2 Thesis objectives ..... 6
1.3 Methodology ..... 8
1.4 Structure of the thesis ..... 9
2. CHAPTER 1 - THEORETICAL AND REGULATORY FRAMEWORK ..... 10
2.1 Urban regeneration and the reuse of already urbanised land ..... 10
2.1.1 From urban expansion to urban regeneration ..... 10
2.1.2 Neighbourhood-scale regeneration and housing ..... 12
2.2 Adaptive reuse and the transformation of disused public building stock ..... 12
2.2.1 Adaptive reuse as an urban and environmental strategy ..... 12
2.2.2 Reuse and complete redevelopment as alternative strategies ..... 13
2.2.3 Former schools as neighbourhood assets ..... 14
2.3 Planning and regulatory framework ..... 15
2.3.1 European and national orientation ..... 15
2.3.2 Lombardy and Mantua planning framework ..... 16
2.3.3 Regulations as design inputs and evaluation criteria ..... 16
2.4 Case-study selection and transferable lessons ..... 17
2.4.1 Selection criteria ..... 17
2.4.2 Cenni di Cambiamento, Milan ..... 18
2.4.3 Kalkbreite, Zurich ..... 20
2.4.4 Caserne de Reuilly, Paris ..... 22
2.4.5 DeFlat Kleiburg, Amsterdam ..... 24
2.4.6 Synthesis of transferable principles ..... 25
2.5 Translation of theory into analytical and design criteria ..... 26
3. CHAPTER 2 - URBAN AND TERRITORIAL ANALYSIS ..... 28
3.1 Analytical approach and data sources ..... 29
3.2 Urban structure and planning context ..... 30
3.2.1 Urban fabric and built-form structure ..... 30
3.2.2 Planning framework and landscape constraints ..... 32

3.3 Neighbourhood systems: services, mobility and green infrastructure ..... 34
3.3.1 Urban services and neighbourhood functions ..... 34
3.3.2 Mobility network, accessibility and critical issues ..... 36
3.3.3 Green infrastructure and ecological connectivity ..... 38
3.4 Socio-demographic structure and implications for housing ..... 40
3.4.1 Population density and household structure ..... 40
3.4.2 Predominant age groups and long-term adaptability ..... 42
3.5 Urban opportunities, critical issues and design implications ..... 44
4. CHAPTER 3 - DESIGN STRATEGY AND PROJECT DEVELOPMENT ..... 48
4.1 Definition of design objectives ..... 49
4.1.1 From neighbourhood analysis to a regeneration framework ..... 49
4.1.2 Common design requirements ..... 51
4.2 Intervention strategy ..... 52
4.2.1 Development of the two alternative scenarios ..... 52
4.2.2 Option A - Adaptive reuse and extension ..... 53
4.2.3 Option B - Demolition and complete redevelopment ..... 55
4.3 Design of the building volumes ..... 56
4.3.1 Option A - Existing school and new residential volume ..... 56
4.3.2 Option B - New residential complex ..... 59
4.3.3 Residential organisation and adaptability ..... 61
4.4 Relationship between built elements, open spaces and the surrounding context ..... 62
4.4.1 Access, mobility and the public-space interface ..... 62
4.4.2 Green structure, permeability and parking ..... 65
4.4.3 Relationship with the surrounding context and public realm ..... 67
4.4.4 From design alternatives to comparative evaluation ..... 70
5. CHAPTER 4 - COMPARATIVE EVALUATION AND SELECTION OF THE PREFERRED OPTION ..... 74
5.1 Evaluation methodology ..... 75
5.2 Baseline quantitative comparison ..... 77
5.3 Environmental and land-use performance ..... 79

5.4 Preliminary economic feasibility ..... 81
5.4.1 Cost estimate for Option A ..... 82
5.4.2 Cost estimate for Option B ..... 83
5.4.3 Comparative economic interpretation ..... 84
5.5 Urban and neighbourhood impact ..... 86
5.6 Multi-criteria evaluation ..... 91
5.7 Preferred option and final considerations ..... 94
6. CONCLUSIONS ..... 98
7. BIBLIOGRAPHY ..... 104

# 1. **INTRODUCTION**

## 1.1 Framing of the topic

In recent decades, European cities have increasingly faced the challenge of managing abandoned, underused or functionally obsolete urban areas. Former public buildings, vacant plots, decommissioned schools and industrial sites are frequently located within consolidated urban fabrics. They therefore represent not only a problem of physical degradation, but also an opportunity to transform the city from within.

Processes such as deindustrialisation, demographic change and the reorganisation of public services have produced a substantial stock of vacant buildings and underused land. In this context, urban regeneration has emerged as a fundamental strategy for improving the quality of cities while limiting further land take and promoting more sustainable forms of development.

Among the different approaches to urban regeneration, the reuse of former public buildings has a particularly relevant role. Schools, administrative buildings and other public facilities often occupy strategic positions within neighbourhoods and maintain a strong relationship with their local identity. Their transformation can respond to contemporary housing needs while recovering neglected spaces and introducing new collective, environmental and social functions.

However, the redevelopment of an individual property does not automatically constitute urban regeneration. A building-scale intervention can contribute to a broader process only when it responds to the demographic, spatial and environmental characteristics of its surroundings and improves its relationships with services, public space, mobility networks and green infrastructure.

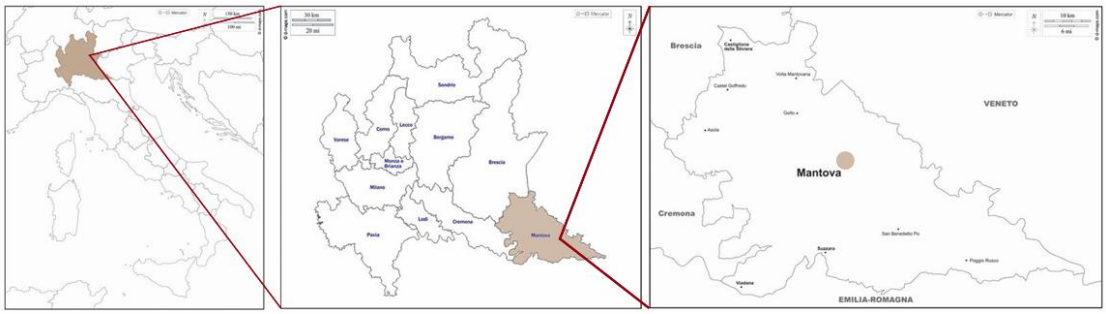



*Figure 1 - Location of the city of Mantova. Source: d-maps.com cartographic base; elaboration by the author.*

This thesis investigates the redevelopment of the former Don Leoni school site in Mantua. The site is currently underused and occupies a potentially strategic position within its surrounding residential and productive urban fabric. Its transformation therefore provides an opportunity to examine how a relatively small intervention can contribute to neighbourhood-scale regeneration.

The research develops and compares two alternative transformation strategies. Option A retains and converts the former school building and introduces a new residential volume, whereas Option B removes the existing building and reorganises the site

through an entirely new residential complex. In both cases, the transformation includes the redesign of the open spaces, accesses, pedestrian circulation, parking provision and green and permeable surfaces.

The two alternatives are not considered as isolated architectural solutions. They are developed within a shared urban and planning framework derived from a multi-scalar analysis of Mantua, the surrounding neighbourhood and the intervention site. The analysis considers the distribution of services, demographic conditions, accessibility, mobility barriers, green infrastructure, urban morphology and planning constraints.

Against this background, the thesis addresses the following main research question:

How can the redevelopment of the former Don Leoni school site contribute to neighbourhood-scale urban regeneration in Mantua by responding to local demographic, spatial, mobility and environmental conditions, rather than remaining a building-scale intervention?

A secondary question guides the comparison between the two alternatives:

Which redevelopment strategy, adaptive reuse combined with a new volume, or demolition and reconstruction, provides the most balanced response to the urban needs identified through the analysis?

The underlying hypothesis is that the site can become a local regeneration node only if its transformation is connected to the surrounding systems of services, pedestrian accessibility, green continuity and neighbourhood relations. The project is therefore understood as the result of the analytical process rather than as its starting point.

The initial design work was developed during an internship at Studio ABnorma. Within the thesis, this professional experience is critically reframed through theoretical research, urban analysis, regulatory assessment and comparative evaluation. The study consequently connects academic investigation and professional practice without taking the architectural project as its sole subject.

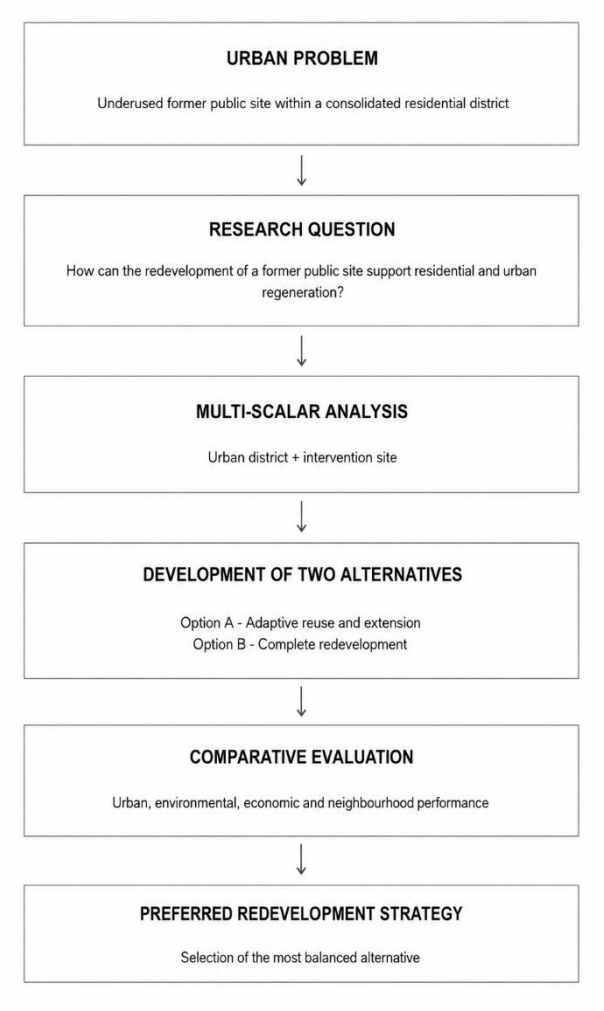



*Figure 2 - Research logic. Source: Author's elaboration.*

## 1.2 Thesis objectives

The main objective of the thesis is to investigate how the transformation of the former Don Leoni school site can function as a neighbourhood-scale regeneration action and to assess which of the two proposed redevelopment strategies provides the most balanced response to the conditions identified through the research.

More specifically, the thesis aims to:

- establish a theoretical framework concerning urban regeneration, adaptive reuse, housing-led transformation and the reuse of former public buildings;
- examine four relevant European case studies through a consistent analytical framework and identify principles that can be transferred to the Mantua context;
- construct a multi-scalar evidence base moving from the city and neighbourhood to the individual intervention site;

- analyse the relationship between the site and demographic conditions, urban services, mobility networks, green infrastructure, urban morphology and physical barriers;
- identify the principal planning requirements and constraints affecting the transformation;
- translate the results of the analysis into a neighbourhood regeneration framework and a set of common design requirements;
- develop two comparable design alternatives based respectively on adaptive reuse and complete redevelopment;
- critically compare the urban, environmental, economic, neighbourhood and residential implications of the two alternatives;
- identify the preferred strategy and clarify the conditions under which a site-specific project can contribute to a broader process of urban regeneration.

The research therefore explores the relationship between small-scale physical transformation and broader urban change. Its purpose is not to claim that a single intervention can regenerate an entire neighbourhood, but to determine how a strategically positioned site can support a wider network of services, accessibility, green continuity and collective spaces.

## 1.3 Methodology

The methodological approach combines theoretical research, case-study analysis, urban and territorial investigation, regulatory assessment, strategic synthesis, design development and comparative evaluation.

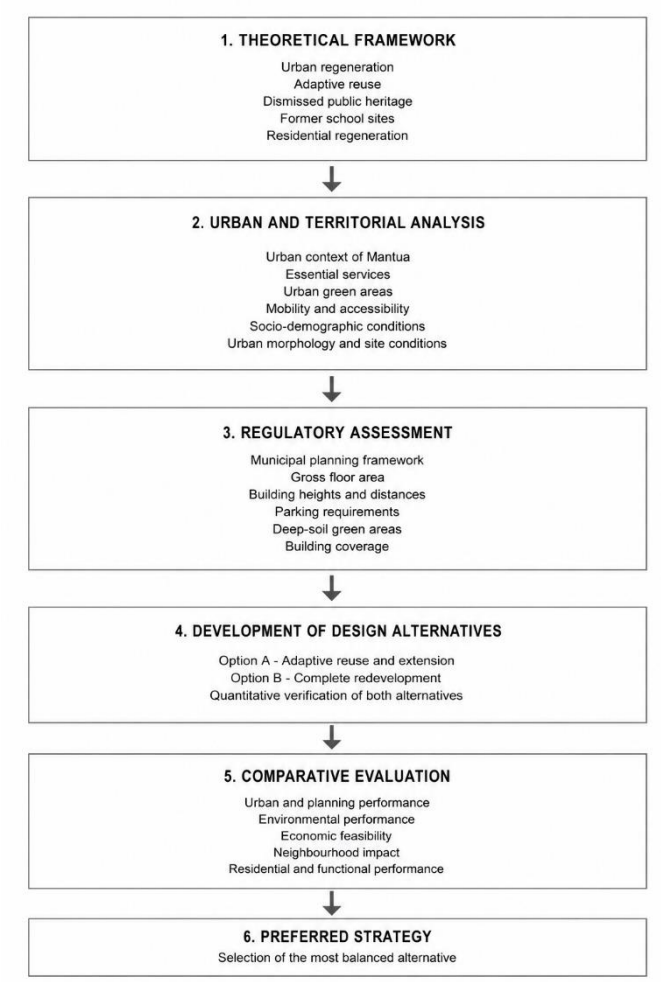



*Figure 3 - Methodological framework. Source: Author's elaboration*

The first phase establishes the theoretical framework through the study of literature concerning urban regeneration, adaptive reuse, former public heritage, housing and sustainable neighbourhood development. Four European case studies are selected according to their relevance to the research problem. They are examined through a common analytical structure considering the previous condition, transformation strategy, housing programme, treatment of existing buildings, collective spaces, mobility and relationship with the surrounding neighbourhood. The purpose is to extract transferable principles rather than to rank the projects.

The second phase develops a multi-scalar analysis of Mantua. The investigation moves from the municipal and neighbourhood scale to the former Don Leoni site. It considers the distribution of urban services, demographic characteristics, accessibility and

mobility, cycling and pedestrian networks, green areas, urban morphology, building structure and the principal physical barriers. GIS-based maps are used to examine both the immediate surroundings and the wider area within the adopted study radii.

The analysis is based on official municipal, PGT, DBGT and ISTAT datasets, supplemented where necessary by direct observation and the author's interpretation. This combination makes it possible to distinguish between documented conditions and strategic deductions developed within the thesis.

The third phase examines municipal planning instruments and technical regulations. It identifies admissible uses, building capacity, height and distance requirements, parking provision, deep-soil green areas and the other parameters relevant to the redevelopment of the site.

The fourth phase synthesises the analytical results in a neighbourhood regeneration framework. This framework identifies the site as a potential local regeneration node and establishes the main strategic directions: strengthening pedestrian connections with services, improving green continuity, increasing permeability and safety at critical crossings, and mitigating the barriers created by the ring road and railway. These directions provide the link between the urban analysis and the subsequent architectural development.

The fifth phase translates the strategic framework and planning requirements into two design alternatives. Option A is based on the adaptive reuse of the former school with the addition of a new residential volume. Option B considers complete demolition and the construction of a new residential complex. The alternatives are verified through the same set of spatial, functional and quantitative criteria, while preserving their different design approaches.

The final phase consists of a critical comparative assessment. The two alternatives are examined in relation to planning compliance, land use, environmental performance, preliminary economic feasibility, neighbourhood relationships and residential quality. A weighted multi-criteria matrix is used as a transparent synthesis tool rather than as an autonomous scoring exercise. The comparison highlights the principal trade-offs and supports the final response to the research questions.

## 1.4 Structure of the thesis

The thesis is divided into four main chapters, followed by the conclusions.

Chapter 1 establishes the theoretical and regulatory framework. It discusses urban regeneration, adaptive reuse, housing-led transformation and the reuse of former public buildings. It also presents four European case studies, Cenni di Cambiamento, Kalkbreite, Caserne de Reuilly and DeFlat Kleiburg, examined through a common reading structure in order to identify transferable principles.

Chapter 2 analyses the urban and territorial context of Mantua and the specific conditions of the former Don Leoni school site. It examines services, accessibility, mobility barriers, green infrastructure, socio-demographic conditions, urban morphology, building characteristics, neighbouring relationships and planning constraints. The chapter concludes with a synthesis of urban opportunities, critical issues and design implications, which provide the basis for the regeneration framework developed in Chapter 3.

Chapter 3 moves from the urban strategy to project development. It presents the shared objectives of the intervention and illustrates the two alternatives, explaining their different approaches to the existing building, residential programme, accesses, circulation, open spaces, green areas and parking provision. Their principal quantitative and planning parameters are also verified.

Chapter 4 provides a critical comparison of Option A and Option B. It considers planning and land-use performance, environmental implications, preliminary economic feasibility, urban and neighbourhood impacts and residential suitability. The multi-criteria evaluation summarises the trade-offs between the alternatives and supports the identification of the preferred redevelopment strategy.

The conclusions explicitly answer the main and secondary research questions. They discuss the contribution that the former Don Leoni site can make to neighbourhood-scale regeneration, explain the reasons for selecting the preferred alternative and identify the limits and potential transferability of the research.

# 2. CHAPTER 1 - THEORETICAL AND REGULATORY FRAMEWORK

## 2.1 Urban regeneration and the reuse of already urbanised land

### 2.1.1 From urban expansion to urban regeneration

During the second half of the twentieth century, urban development in Europe was largely associated with physical expansion, infrastructure construction and the progressive occupation of previously undeveloped land. This model supported economic and demographic growth but also contributed to urban sprawl, soil sealing, fragmented settlement patterns and increasing dependence on private mobility. In more recent decades, demographic change, economic restructuring and the transformation of public services have produced a different urban condition, characterised by the coexistence of occupied neighbourhoods, underused plots and disused buildings.

In this context, urban regeneration has progressively replaced expansion as one of the principal approaches to urban transformation. Urban regeneration can be understood as a coordinated process intended to produce lasting improvements in the physical, environmental, social and economic conditions of an existing urban area. [1,5]

It therefore differs from conventional redevelopment when the latter is limited to the replacement of buildings or the modification of land uses. A regeneration strategy must consider how a transformation affects its wider context, including accessibility, public space, ecological continuity, housing provision, local services and the identity of the neighbourhood.

The emphasis on existing urbanised land is particularly relevant because land is a limited and non-renewable resource. The continued conversion of agricultural or natural surfaces reduces soil permeability and ecosystem services while increasing the infrastructure required to support dispersed settlements. European policies consequently promote the renovation of the existing building stock, the recovery of underused land and the progressive reduction of net land take.[9,10] At the Italian level, the monitoring conducted by ISPRA similarly highlights the environmental consequences of continued soil consumption and the need to direct urban development towards already transformed areas.[16]

However, the reuse of urbanised land should not be interpreted as automatically producing sustainable results. Densification may reduce land consumption but can also increase pressure on infrastructure, reduce permeable surfaces or produce poor living conditions if it is not supported by appropriate design. The quality of regeneration therefore depends not only on the quantity of floor area created but on the relationship established between buildings, open space, mobility, services and environmental systems.

For this reason, the redevelopment of an underused lot should be considered at more than one spatial scale. At the building scale, the project must address structural condition, functional organisation, energy performance, accessibility and adaptability. At the site scale, it must organise entrances, circulation, parking, collective areas and permeable surfaces. At the neighbourhood scale, it must respond to existing routes, services, urban barriers, green networks and local demographic conditions. The connection between these three scales represents a central principle of this thesis.

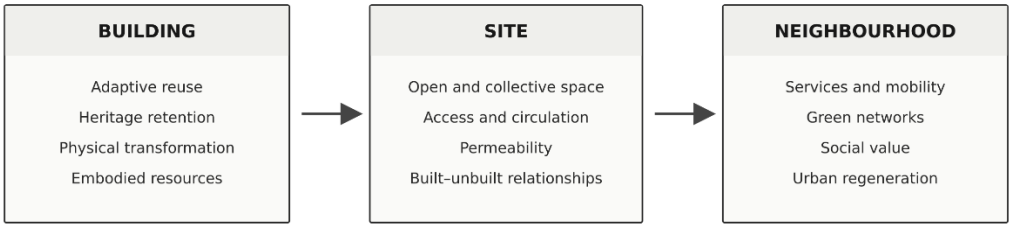



*Figure 4 - Regeneration across scales: from building transformation to neighbourhood effects. Source: Author's elaboration based on Roberts & Sykes (2000), Gehl (2010), Bullen & Love (2011) and Fioretti et al. (2020).*

### 2.1.2 Neighbourhood-scale regeneration and housing

The neighbourhood is an important scale for evaluating the effects of urban regeneration because it connects individual buildings with everyday urban life. It is at this scale that residents encounter public transport, pedestrian routes, green areas, schools, commercial activities and other essential services. The quality of the neighbourhood is therefore determined by the accessibility and continuity of these elements as much as by the architectural characteristics of individual buildings.

Gehl emphasises that the quality of urban life depends significantly on the spaces between buildings and on the conditions that encourage walking, social interaction and everyday use. [31] Residential development should consequently be understood as more than the provision of private units. It includes the system formed by dwellings, shared spaces, entrances, paths, streets, parking areas, vegetation and local facilities.

This relational interpretation is especially important when housing is introduced into a former public site. A public building may have ceased to perform its original function, but its location, open areas and relationship with the surrounding district may still possess collective significance. Its transformation into housing can therefore influence not only future residents but also the spatial organisation and perception of the wider neighbourhood.

Neighbourhood regeneration does not necessarily require a large-scale masterplan. A strategically located intervention of limited size can contribute to broader urban objectives by reconnecting pedestrian routes, improving the edge of a street, increasing permeability, reinforcing green continuity or introducing new forms of collective space. Its effectiveness depends on whether these local actions respond to conditions identified through contextual analysis.

Housing is consequently treated in this thesis as both a residential programme and a component of neighbourhood infrastructure. The quality of a residential project is evaluated through the characteristics of the dwellings, but also through their relationship with external spaces, accessibility systems, existing services and the surrounding urban fabric.

## 2.2 Adaptive reuse and the transformation of disused public building stock

### 2.2.1 Adaptive reuse as an urban and environmental strategy

Adaptive reuse refers to the transformation of an existing building so that it can accommodate a function different from the one for which it was originally designed. The intervention may involve different levels of alteration, ranging from limited internal adaptation to extensive structural, spatial and envelope modifications.[7],[8]

The reuse of existing buildings can provide significant environmental advantages. Retaining structural components reduces the demand for new materials and may prevent the production of demolition waste. It can also preserve the embodied energy and resources already invested in the building. These considerations connect adaptive

reuse with the principles of the circular economy, which seek to prolong the useful life of buildings and materials rather than treating demolition and replacement as the default response to functional obsolescence. [2,3]

Adaptive reuse may also retain elements of urban memory and local identity. This does not mean that every existing building possesses formal heritage value. Rather, a former public building can remain recognisable to the local community through its previous civic function, its position or its relationship with surrounding open spaces. Reuse can make this continuity visible while accommodating new needs.

The benefits of adaptive reuse nevertheless depend on the actual qualities of the building. Existing structural grids, floor depths, ceiling heights, circulation systems and façade openings may support a new use, but they may also impose significant constraints. Residential conversion requires adequate daylight, ventilation, privacy, acoustic separation and efficient vertical circulation. It must also comply with contemporary requirements concerning accessibility, fire safety, energy performance and structural reliability.

For this reason, adaptive reuse should not be presented as an inherently superior strategy. Studies of reuse projects identify regulatory, technical, economic and organisational challenges that can reduce their feasibility or environmental benefit.[7,8] A project requiring extensive structural replacement, major envelope reconstruction and complex internal alterations may not necessarily produce a better whole-life result than carefully planned redevelopment.

### 2.2.2 Reuse and complete redevelopment as alternative strategies

The decision between retaining and replacing an existing building should be understood as a continuum rather than a simple opposition. Possible strategies include maintenance, refurbishment, adaptive reuse, partial retention, extension and complete redevelopment. [6] Each strategy combines different degrees of physical continuity and transformation.

A responsible decision should consider at least five groups of evidence:

1. Structural condition and residual service life, including the capacity of the structure to accommodate new loads and current safety requirements.

2. Spatial adaptability, considering floor depth, structural grid, orientation, openings, circulation and the ability to create appropriate residential layouts.

3. Environmental performance, including retained materials, demolition waste, operational energy requirements, soil permeability and the potential for ecological improvement.

4. Economic and technical feasibility, including construction complexity, lifecycle cost, maintenance requirements and the risk associated with unknown existing conditions.

5. Urban and architectural performance, evaluating the relationship between the building, open spaces, entrances, neighbouring properties and the surrounding street network.

This framework avoids two opposing assumptions: that preservation is always environmentally and culturally preferable, or that demolition automatically produces a more efficient solution. The most appropriate strategy is the one that provides the most balanced response to the complete set of site conditions and project objectives.

In the present thesis, adaptive reuse and complete redevelopment are therefore examined as two legitimate alternatives. Option A retains and converts the former Don Leoni school while adding a new residential volume. Option B removes the existing structure and reorganises the lot through new construction. Both options are assessed through the same planning, environmental, economic, urban and residential criteria. The theoretical framework does not establish a preferred solution in advance.

| Dimension | Adaptive reuse and extension | Complete redevelopment |
|---|---|---|
| Existing resources | Retains structural and material value; may reduce demolition waste and preserve embodied impacts. | Replaces the existing stock; creates demolition flows but allows a fully coordinated new building system. |
| Identity | Can preserve recognisable civic and spatial memory. | May redefine the site's identity but risks losing continuity with its former public role. |
| Spatial flexibility | Works within existing grids, depths, heights and access constraints. | Allows orientation, circulation, density and dwelling layouts to be reorganised. |
| Environmental performance | Benefits depend on the extent of retention and the feasibility of energy and accessibility upgrades. | Can achieve high operational standards, but whole-life impacts must include demolition and new materials. |
| Urban relationship | Can reinforce continuity if new additions and open spaces connect the retained building to its context. | Can restructure the entire lot, but neighbourhood integration must be deliberately designed. |
| Feasibility | May involve uncertainty, phasing and additional investigation of the existing structure. | May simplify design coordination while increasing initial material and demolition requirements. |

*Table 1 - Adaptive reuse and complete redevelopment: comparative theoretical framework*
*Source: Author's elaboration based on Bullen & Love (2011), Douglas (2006), Wilkinson et al. (2014) and Plevoets & Van Cleempoel (2019)*

### 2.2.3 Former schools as neighbourhood assets

Former schools represent a specific category of disused public building. They are frequently located within residential districts and were originally connected to neighbourhood routes, public services and collective life. Their plots may include courtyards, gardens, sports areas or other open surfaces that extend their spatial importance beyond the building footprint.

Certain characteristics of school buildings can support adaptive reuse. Classrooms may provide regular structural grids, repeated openings and generous internal dimensions. Corridors and shared spaces may be reinterpreted as collective residential areas or circulation systems. Existing external areas can support gardens, pedestrian connections and communal functions.

At the same time, conversion from educational to residential use presents considerable challenges. Classroom depth and orientation may not correspond to suitable dwelling layouts. Long corridors can produce inefficient circulation, while the position of windows may limit subdivision. Residential conversion also introduces requirements for private external spaces, acoustic separation, bathrooms, kitchens, vertical service distribution, accessibility and fire compartmentation that differ substantially from those of the original school.

The analysis of a former school must therefore distinguish among three forms of value:

- its material value, associated with the condition and reusability of the structure and envelope;
- its spatial value, associated with the adaptability of its internal organisation and external areas;
- its relational value, associated with its position and potential role within the neighbourhood.

This distinction is important for the former Don Leoni site. The absence of formal heritage protection would not eliminate the need to investigate its material and neighbourhood value. Conversely, its previous public function would not alone justify retention if the building could not support an appropriate residential transformation.

## 2.3 Planning and regulatory framework

### 2.3.1 European and national orientation

The European Renovation Wave identifies the improvement of the existing building stock as a central component of environmental transition. Its objectives include increasing renovation rates, improving energy efficiency and enhancing the quality of buildings used for housing and public services.[9] This policy orientation reinforces the general preference for evaluating existing resources before considering further land consumption.

The Italian regulatory framework establishes the fundamental conditions within which urban regeneration and building transformation must occur. The *Testo Unico dell'Edilizia*, D.P.R. 380/2001, defines the principal categories of building intervention and the related administrative procedures.[19] These categories are relevant to the distinction among maintenance, renovation, demolition and reconstruction.

D.M. 1444/1968 establishes national minimum standards concerning public facilities, urban density, building heights and distances.[17] Although local planning instruments provide more specific rules, the decree remains an essential reference for evaluating the relationship between development capacity and the urban services required by new residential programmes.

Accessibility requirements are established through Law 13/1989 and D.M. 236/1989.[14],[15] These provisions address the removal of architectural barriers and the accessibility, visitability and adaptability of buildings. In residential redevelopment, accessibility must influence the design from its earliest stages rather than being treated as a later technical adjustment.

### 2.3.2 Lombardy and Mantua planning framework

In Lombardy, regional planning legislation increasingly connects regeneration with the reduction of land consumption. Regional Law 12/2005 establishes the general framework for territorial government and defines the structure of municipal planning instruments.[11] Regional Law 31/2014 promotes the reduction of soil consumption and directs transformation towards already urbanised, disused or degraded areas.[18] Regional Law 18/2019 further supports urban and territorial regeneration and the recovery of existing building stock.[12]

At the municipal level, the Piano di Governo del Territorio of Mantua represents the principal planning reference for the redevelopment of the former Don Leoni site. The PGT comprises the Documento di Piano, Piano dei Servizi and Piano delle Regole, together with their related technical provisions and cartographic documents.[13]

These components perform different but complementary roles. The Documento di Piano defines the principal strategic objectives for municipal transformation. The Piano dei Servizi evaluates the provision and distribution of public and collective facilities. The Piano delle Regole governs the consolidated urban fabric and specifies the admissible interventions and dimensional requirements affecting individual sites.

The redevelopment alternatives must therefore be verified against the regulations effectively applicable to the lot. Relevant parameters include admissible uses, gross floor area, building coverage, maximum height, distances, parking requirements, permeable or deep-soil green surfaces and relationships with neighbouring plots. The exact values are addressed in the site-specific regulatory analysis rather than being anticipated within the theoretical discussion.

### 2.3.3 Regulations as design inputs and evaluation criteria

Planning regulations are sometimes treated as external limitations applied after a project has been developed. In a regeneration process, however, they should be

considered design inputs. Parking requirements influence the location of buildings and permeable areas. Distance rules affect massing, privacy and daylight. Accessibility provisions influence routes, entrances and vertical circulation. Requirements for green and permeable surfaces affect environmental performance and the spatial quality of the lot.

The same regulatory parameters should be applied consistently to all alternatives. This allows the comparison to distinguish between differences produced by the design strategies and differences caused by unequal assumptions.

The regulatory assessment therefore performs three functions within the thesis:

- it establishes the legal and quantitative feasibility of the alternatives;
- it translates planning requirements into common design constraints;
- it provides measurable indicators for the final comparative evaluation.

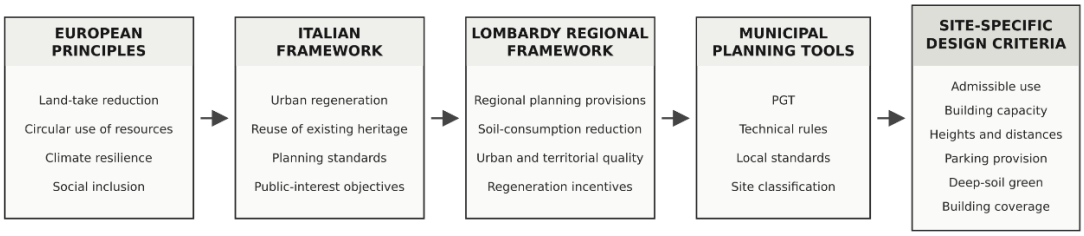



*Figure 5 - From policy principles to site-specific design criteria. Source: Author's elaboration based on European, national and regional legislation and the Municipality of Mantua PGT.*

## 2.4 Case-study selection and transferable lessons

### 2.4.1 Selection criteria

Case studies are used in this thesis to investigate how comparable projects have addressed the relationship between housing, reuse, public space and neighbourhood transformation. They are not selected as formal models to reproduce, nor are they used to demonstrate the superiority of one design strategy.

Four projects are examined in order to represent different positions within the transformation spectrum. Their selection is based on the following criteria:

- intervention on already urbanised or previously occupied land;
- introduction or substantial reorganisation of residential functions;
- significant relationship between buildings and collective or public space;
- relevance of accessibility, mobility or neighbourhood connections;

- presence of transferable design principles applicable to the former Don Leoni site.

The selected projects differ in scale, ownership structure and national context. This diversity is useful because it allows the theoretical framework to identify recurring principles without reducing the analysis to a direct comparison between only two formally similar projects.

### 2.4.2 Cenni di Cambiamento, Milan

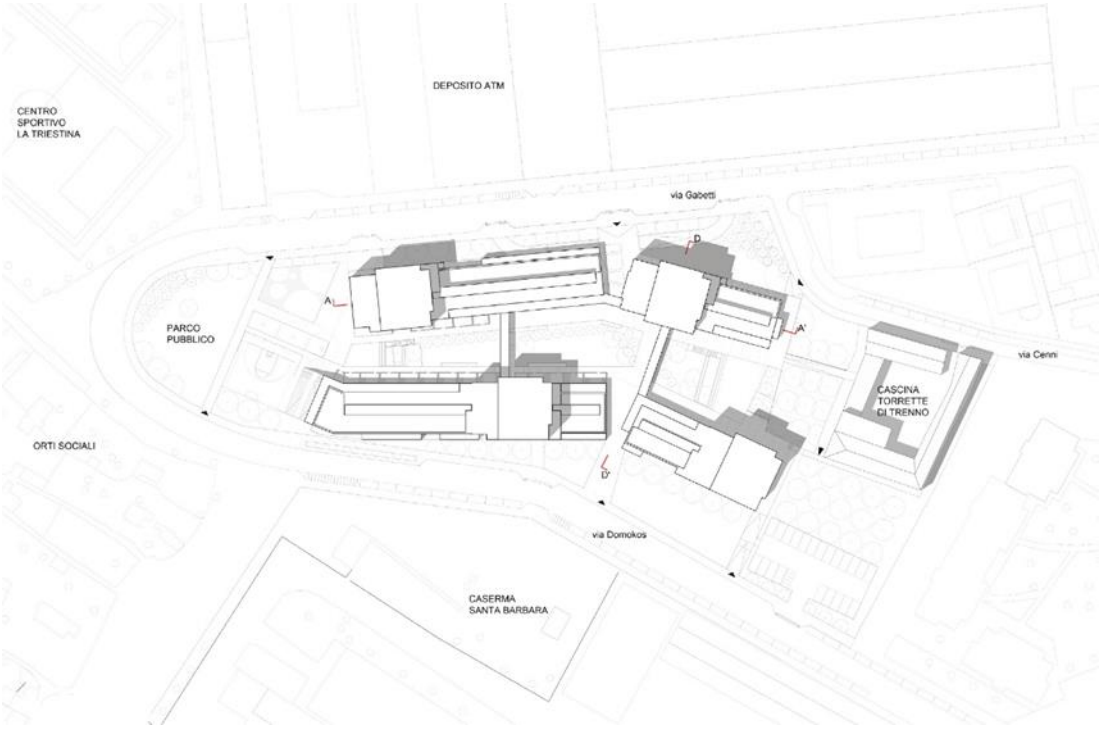



*Figure 6 - Cenni di Cambiamento, Milan. Source: Rossi Prodi Associati.*

Cenni di Cambiamento is a social and affordable housing development located in the western part of Milan, on a previously urbanised site formerly occupied by industrial facilities. Designed by Rossi Prodi Associati and promoted within the Italian social housing system, the project was completed in 2013 and represents one of the early large-scale applications of timber construction to multi-storey residential housing in Italy. The complex consists of four nine-storey towers built with XLAM timber technology, connected by lower two-storey volumes, and accommodates 123 dwellings of different sizes. The residential programme is complemented by commercial spaces, services and a landscaped area of more than 1,000 m².[20]

The intervention was conceived around the idea of collaborative living, in which the quality of housing is not determined exclusively by the characteristics of the individual dwelling. Particular importance is instead given to the spaces situated between the private home and the wider neighbourhood. Terraces, loggias, circulation areas,

collective rooms and outdoor spaces create different degrees of privacy and provide opportunities for informal interaction among residents.[21]

This approach is reinforced by the organisation of the open spaces. The central green area functions as a common spatial reference for the residential complex and is connected to pedestrian spaces, play areas and other collective facilities. Rather than treating greenery as a residual surface remaining after the positioning of the buildings, the landscape becomes part of the overall organisation of the settlement.[21]

An additional element concerns the social composition of the development. Cenni di Cambiamento was intended for different groups, including young people, new households, families and older residents, with dwellings offered through controlled-rent and rent-to-buy arrangements. The project therefore connects spatial design with broader questions of housing accessibility and social inclusion.[21]

The environmental dimension of the project is also relevant. In addition to the timber structural system, the development incorporates green roofs, pedestrian-oriented external spaces, environmentally conscious materials and energy-efficient systems.[20]

From the perspective of this thesis, Cenni di Cambiamento is particularly useful because it demonstrates that residential density and environmental quality do not necessarily represent opposing objectives. A relatively intensive residential programme can coexist with accessible green areas and shared spaces when building volumes and external surfaces are considered as parts of the same system.

This principle is relevant to the redevelopment of the former Don Leoni site. Although the scale of the Milan intervention is considerably larger, both alternatives developed in this thesis must balance residential capacity with green surfaces, pedestrian movement, parking and collective outdoor space. Cenni therefore suggests that the assessment of the two Don Leoni alternatives should not be based only on the amount of floor area produced. The quality of the relationship between buildings, open space and everyday residential life is equally important.

### 2.4.3 Kalkbreite, Zurich

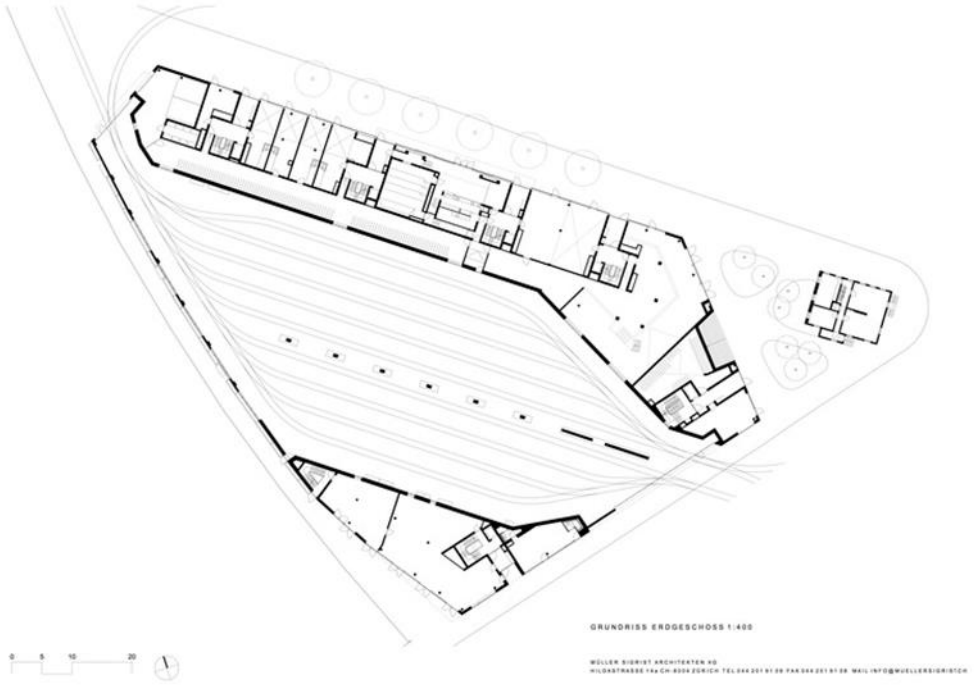



*Figure 7 - Kalkbreite Cooperative Housing, Zurich. Source: Müller Sigrist Architekten / Genossenschaft Kalkbreite.*

Kalkbreite Cooperative Housing is a mixed-use development located in Zurich between the Wiedikon and Aussersihl districts. Designed by Müller Sigrist Architekten and completed in 2014, the complex occupies a highly constrained infrastructural site and incorporates an operating tram depot within its base. Above and around this infrastructure, the project combines housing, commercial spaces, offices, cultural activities and collective facilities within a compact urban block.[22]

The origins of the project are closely connected to a participatory process promoted by local residents and professionals. The Kalkbreite cooperative was established with the ambition of creating a new piece of city: a development capable of combining affordable housing, ecological objectives, collective forms of living and activities accessible to the surrounding neighbourhood.[23]

From an urban-planning perspective, one of its most significant characteristics is the intensive reuse of already urbanised land. Instead of considering the tram depot as an obstacle to development, the project incorporates the infrastructure within a larger building system. The resulting block contains 93 residential units alongside a broad range of commercial, social and cultural functions.[22]

The arrangement of functions reinforces the relationship between the complex and the surrounding city. Shops, restaurants, offices and cultural uses contribute to an active interface with the streets, while residential and communal spaces occupy the upper levels.[22]

Open space plays an equally important role. Covering the tram depot creates a large elevated courtyard of approximately 2,500 m², conceived as a green recreational space connected to both the residential community and the neighbourhood. Communal terraces and roof gardens further extend this system of collective outdoor areas.[23]

The residential programme also introduces considerable diversity. Different apartment sizes and shared housing configurations respond to a variety of household structures, while communal facilities complement the private dwellings.[23]

Mobility represents another defining component of the intervention. The location is strongly connected to public transport and the project intentionally promotes a low-car lifestyle. Combined with high environmental standards and the compact use of land, this makes Kalkbreite an example of sustainability understood at the scale of everyday urban behaviour as well as building performance.[22]

For the former Don Leoni site, the direct transfer of Kalkbreite's scale and programme would clearly be inappropriate. Its relevance lies instead in its planning principles. The project demonstrates how housing can contribute to creating a more integrated piece of city when residential functions, mobility, collective areas and services are considered together.

The case therefore supports several aspects examined in the Don Leoni alternatives: compact use of already developed land, diversification of dwelling types, integration of movement and open spaces and the importance of collective areas within relatively dense residential development.

### 2.4.4 Caserne de Reuilly, Paris



*Figure 8 - Caserne de Reuilly, Paris. Source: Paris Habitat.*

The redevelopment of the former Caserne de Reuilly in the 12th arrondissement of Paris represents a particularly significant example of the transformation of a former institutional compound into a new residential neighbourhood. Historically used as a military barracks, the approximately two-hectare site was characterised by large buildings arranged around a central parade ground and by a perimeter wall that physically separated the compound from the surrounding urban fabric. Its redevelopment transformed this previously enclosed site into a mixed residential area containing 582 dwellings together with commercial activities, a childcare facility and new public and collective spaces.[24]

The project is particularly relevant to the theme of adaptive reuse because it does not adopt a uniform approach to the existing built fabric. Five nineteenth-century buildings were retained and extensively transformed, while other portions of the site were demolished and replaced by new buildings. Preservation and new construction therefore operate as complementary components of one regeneration strategy.[25]

This selective approach allows the project to maintain traces of the previous identity of the site without preventing substantial functional and spatial transformation. The retained buildings preserve historical continuity and contribute to the recognisability of the former military complex, while the newly constructed volumes introduce additional housing and respond to contemporary requirements.[25]

An equally significant transformation concerns the former parade ground. The previously controlled and predominantly mineral interior of the barracks has been

converted into a large landscaped public space. The development contains approximately 5,600 m² of planted areas, including a public garden of around 4,800 m² and more than 500 m² dedicated to urban agriculture.[24]

The transformation of the site's boundaries and permeability is perhaps its most important urban-planning contribution. Sections of the enclosing wall were removed and three new pedestrian routes were introduced, connecting the former barracks with the surrounding streets.[24]

The housing programme also contributes to the urban character of the intervention through a combination of different tenure models and resident groups. Social, intermediate and controlled-market housing are incorporated within the overall development, together with commercial activities and a childcare facility.[25]

For the Don Leoni thesis, Caserne de Reuilly provides a particularly important reference because its basic transformation problem is closer to that considered in the two design alternatives. It demonstrates that redevelopment does not always require a binary choice between preservation and replacement.

This idea is closely related to Option A, where the former Don Leoni school is maintained while a new residential volume is added. Caserne de Reuilly shows that the success of such a strategy depends not only on the architectural relationship between old and new buildings, but also on the organisation of the spaces created between them.

A second lesson concerns the relationship with the surrounding neighbourhood. The Paris example highlights the importance of considering access, permeability and pedestrian movement as part of regeneration. The transformation of a former public compound should therefore be evaluated not only in terms of what happens within the lot, but also in terms of how the intervention changes its relationship with streets, neighbouring properties and the wider urban fabric.

### 2.4.5 DeFlat Kleiburg, Amsterdam



*Figure 9 - DeFlat Kleiburg, Amsterdam. Source: XVW Architectuur / NL Architects.*

DeFlat Kleiburg is the renovation of one of the largest residential buildings in the Netherlands, located in Amsterdam's Bijlmermeer district. The approximately 400-metre-long slab contains around 500 apartments and forms part of the large-scale modernist housing district developed from the 1960s onwards. Following decades of transformation of the Bijlmermeer, Kleiburg itself was threatened with demolition when conventional renovation was considered economically difficult.[26]

Rather than replacing the structure, the winning strategy developed by NL Architects and XVW Architectuur was based on maximum retention and minimum intervention. The main concrete structure, access galleries, balconies, lifts and building systems were repaired and upgraded, while unnecessary later additions were removed.[26]

The economic strategy was closely connected to the physical intervention. The apartments were sold as unfinished shells through the *Klusflat*, or do-it-yourself housing, model. Future residents were responsible for completing the interiors according to their own needs and financial possibilities.[27]

This strategy also produced a high degree of residential flexibility. Residents could modify internal layouts and, in some cases, combine adjacent units horizontally or vertically. The existing structural framework was therefore not treated as an obstacle to contemporary living but as a stable support within which different residential solutions could develop over time.[26]

Intervention was nevertheless more substantial where the original relationship between the building and its surroundings was considered weak. At ground level, storage areas were relocated and new residential and local-business spaces were introduced, creating more active entrances and a stronger connection between the building and the surrounding park.[28]

The significance of this approach was recognised through the 2017 European Union Prize for Contemporary Architecture – Mies van der Rohe Award.[26]

For the Don Leoni project, DeFlat provides a useful counterpoint to strategies based on complete redevelopment. Its principal lesson is that the existing building represents not only a constraint but also a stock of already available material, structure and embodied resources.

At the same time, Kleiburg also demonstrates the limits of direct transferability. Its repetitive residential structure, large dimensions and original housing function made incremental adaptation particularly suitable. The former Don Leoni school has a different scale, construction system and original programme, and its conversion into housing therefore requires different spatial and technical modifications.

For this thesis, the case supports a more critical interpretation of Option A. Retaining the former school should be justified by the actual adaptability of its structure, its capacity to accommodate appropriate residential layouts and the environmental and economic advantages generated by avoiding demolition. Conversely, if these benefits are outweighed by significant functional or technical limitations, Option B may provide greater flexibility.

### 2.4.6 Synthesis of transferable principles

The four projects do not constitute a ranking. Each responds to a different urban condition and adopts a distinct redevelopment model. Together, however, they identify several principles relevant to the former Don Leoni site:

- regeneration should prioritise already urbanised land;
- existing structures should be assessed before demolition is proposed;
- housing density should be evaluated together with open-space quality;
- collective and public spaces should form part of the residential system;
- accessibility and mobility should be integrated with site organisation;
- boundaries and pedestrian routes can determine the neighbourhood impact of a project;
- residential layouts should respond to different household structures and future adaptation;
- environmental, urban and economic advantages should be demonstrated through evidence rather than assumed.

| Case | Transformation strategy | Reason for inclusion | Transferable theme |
|---|---|---|---|
| Cenni di Cambiamento, Milan | New social-housing complex on a former industrial site | Italian example of housing-led regeneration with timber construction, shared facilities and a pedestrian open-space system. | Housing diversity; collective space; environmental construction; relationship between density and landscape. |
| Kalkbreite, Zurich | High-density cooperative mixed-use development over transport infrastructure | Combines housing, services, participation and reduced car dependence within a complex urban site. | Shared facilities; mobility strategy; adaptable housing; active ground-floor uses. |
| Caserne de Reuilly, Paris | Combination of heritage reuse, selective demolition and new residential buildings | Transforms a former military enclosure into a connected residential quarter with a public garden and mixed housing. | Opening an institutional site; old–new integration; public green space; social mix. |
| DeFlat Kleiburg, Amsterdam | Large-scale retention and incremental refurbishment of an existing housing block | Demonstrates a resource-conscious alternative to demolition through minimal collective works and resident-led fit-out. | Selective intervention; affordability; embodied value; adaptable implementation. |

*Table 2 – Synthesis of case studies and transferable principles*

*Source: Author's elaboration based on the case-study sources listed in References 20-28.*

## 2.5 Translation of theory into analytical and design criteria

The theoretical framework becomes operational only when its principles can be connected to the subsequent urban analysis and design evaluation. For this reason, the concepts discussed in the chapter are translated into a set of shared criteria for the former Don Leoni site.

Urban and neighbourhood criteria

The project should respond to the relationship between the site and the surrounding district. Relevant indicators include proximity to services, pedestrian and vehicular access, possible urban barriers, connections with public transport and continuity with the existing street and green networks.

Environmental and land-use criteria

Both alternatives should limit additional soil sealing and organise appropriate permeable and deep-soil green areas. The assessment should consider retained structures and materials, demolition requirements, building coverage, open-space continuity and the potential for vegetation and sustainable drainage.

Residential and functional criteria

The alternatives should provide appropriate dwelling layouts, daylight, privacy, accessibility and circulation. They should also consider the relationship between private dwellings, collective areas and external spaces and respond to the demographic and household conditions identified in the contextual analysis.

Planning and quantitative criteria

Both options must be verified using the same definitions and planning parameters. These include gross floor area, building coverage, maximum height, distances, parking provision and green-area requirements. The use of consistent data is essential for a transparent comparison.

Economic and technical criteria

The evaluation should consider demolition, structural adaptation, new construction, external works and technical complexity. At this stage, the analysis represents preliminary economic feasibility rather than a complete construction estimate. Lifecycle implications and uncertainty associated with existing conditions should be acknowledged.

These criteria create a direct connection between theory, analysis and design. The neighbourhood study identifies the conditions to which the project must respond. The design phase translates those conditions into two alternatives. The final evaluation then measures the performance of the alternatives through a common set of indicators.

## 3. CHAPTER 2 - URBAN AND TERRITORIAL ANALYSIS

The redevelopment of the former Don Leoni school requires a reading of the site that extends beyond the physical characteristics of the existing building and the dimensional capacity of the lot. As discussed in Chapter 1, the regeneration of already urbanised land concerns a broader system of relationships involving the built environment, accessibility, open spaces, ecological structures, public services and the social characteristics of the surrounding population. The site is therefore considered not as an isolated property, but as part of an existing urban system whose conditions influence the possibilities and limits of transformation.

Urban analysis has long represented a fundamental component of planning and urban design because it provides the interpretative framework through which individual sites can be understood as parts of larger spatial structures. Lynch's interpretation of the city emphasised the role of paths, edges, districts, nodes and landmarks in constructing the experience and legibility of urban space.[29] Although the present research does not directly apply Lynch's perceptual methodology, his work remains relevant in understanding urban form as a system of relationships rather than as a collection of independent objects.

A similar relational perspective can be found in Jacobs' interpretation of neighbourhood life. For Jacobs, urban quality cannot be produced through the isolated optimisation of individual buildings; it emerges from the coexistence of activities, streets, people and everyday uses.[30] This is particularly relevant to the transformation of the Don Leoni site. The quality of the future residential intervention will depend not only on the internal organisation of the apartments, but also on the connections that residents will establish with the existing neighbourhood.

The analysis consequently moves between different spatial scales. The wider neighbourhood is examined in relation to services, infrastructure, vegetation and demographic structure, while a more detailed reading of the immediate context investigates the morphology of the built fabric and the position occupied by the former school. The purpose is not to provide a complete description of western Mantua, nor to accumulate independent thematic maps. Instead, each analytical layer contributes to answering a common question: which existing urban conditions should guide the transformation of the former Don Leoni site?

This distinction is particularly important for the methodology of the thesis. The analytical process precedes the development and comparison of the two design alternatives and is therefore not intended to justify either adaptive reuse or demolition in advance. Its role is to establish a common urban evidence base from which both strategies can be developed and subsequently evaluated.

### 3.1 Analytical approach and data sources

The analytical framework was developed through a combination of cartographic interpretation, GIS-based spatial analysis and the review of municipal and regional planning information. The principal spatial datasets include the Database Geografico Topografico of Regione Lombardia, the planning and service datasets provided by the Municipality of Mantua and the demographic information of the 2021 Permanent Population and Housing Census produced by ISTAT.[35]

The study adopts two main spatial references: 500 metres and 1,000 metres from the former Don Leoni school site. The 500-metre radius is mainly used to investigate the immediate morphological context, where relationships between individual buildings, plots and local streets become particularly significant. The 1,000-metre radius broadens the analysis to include services, mobility infrastructure, green systems, planning conditions and demographic patterns that influence the site at neighbourhood scale.

These radii should not, however, be interpreted as objective boundaries of a neighbourhood. They are analytical devices that make different datasets comparable around a common point of reference. This distinction is especially relevant when dealing with accessibility.

The classical definition proposed by Hansen considers accessibility as the potential for interaction with opportunities distributed across space.[32] Distance is therefore relevant, but it is only one element of accessibility. A destination that is geographically close may remain difficult to reach when the street network is fragmented, crossings are limited or major infrastructure interrupts pedestrian movement.

For this reason, the 500 m and 1,000 m circles used in the analysis represent Euclidean proximity areas, rather than network-based pedestrian catchments. Their interpretation is complemented by a separate examination of pedestrian areas, cycling routes, road infrastructure, the railway and critical crossing points. The thesis therefore avoids equating proximity automatically with accessibility.

The same distinction between quantitative measurement and qualitative interpretation applies to the other analytical themes. The presence of vegetation, for example, cannot be assessed only through its total surface; continuity, location and connection with other green elements also matter. Similarly, population density alone cannot explain housing requirements without considering household structure and age composition.

This approach reflects the wider understanding of urban analysis as an interpretative process. Moudon describes urban morphology as the study of the city through its constituent physical elements and their transformation over time, stressing the relationships between buildings, plots, streets and open spaces.[36] The analytical maps used in this research therefore represent different components of the same urban structure rather than unrelated datasets.

A final methodological distinction concerns the origin of the information represented. Buildings, roads, planning designations, census sections and mapped vegetation originate from official datasets. Other elements, including potential green connections, critical mobility nodes and identified discontinuities, result from the author's spatial interpretation. They are therefore presented as analytical hypotheses rather than formally established planning designations.

This is especially important in the transition from Chapter 2 to Chapter 3. The analysis identifies existing conditions and interprets opportunities; only after this stage are these findings transformed into strategic directions.

## 3.2 Urban structure and planning context

The first level of analysis concerns the physical and regulatory structure within which the former Don Leoni site is located. Before considering accessibility or demographic conditions, it is necessary to understand the type of urban fabric in which the transformation will occur and the planning framework that regulates it.

The site lies within the consolidated urban area of Mantua, outside the dense historic core and within a twentieth-century urban fabric characterised by a combination of residential neighbourhoods, larger specialised buildings, infrastructural corridors and open areas. This condition is relevant because regeneration within an already established district involves a different planning problem from development on previously unurbanised land. New residential capacity must be integrated into existing spatial relationships rather than creating an entirely new urban structure.

### 3.2.1 Urban fabric and built-form structure

Urban morphology provides an appropriate theoretical framework for interpreting this relationship. Rather than evaluating buildings individually, morphological analysis examines the way in which buildings, streets, plots and open spaces combine to produce recognisable urban fabrics.[36] Differences in footprint size, spacing and grain can therefore indicate transitions between residential, productive and specialised areas.

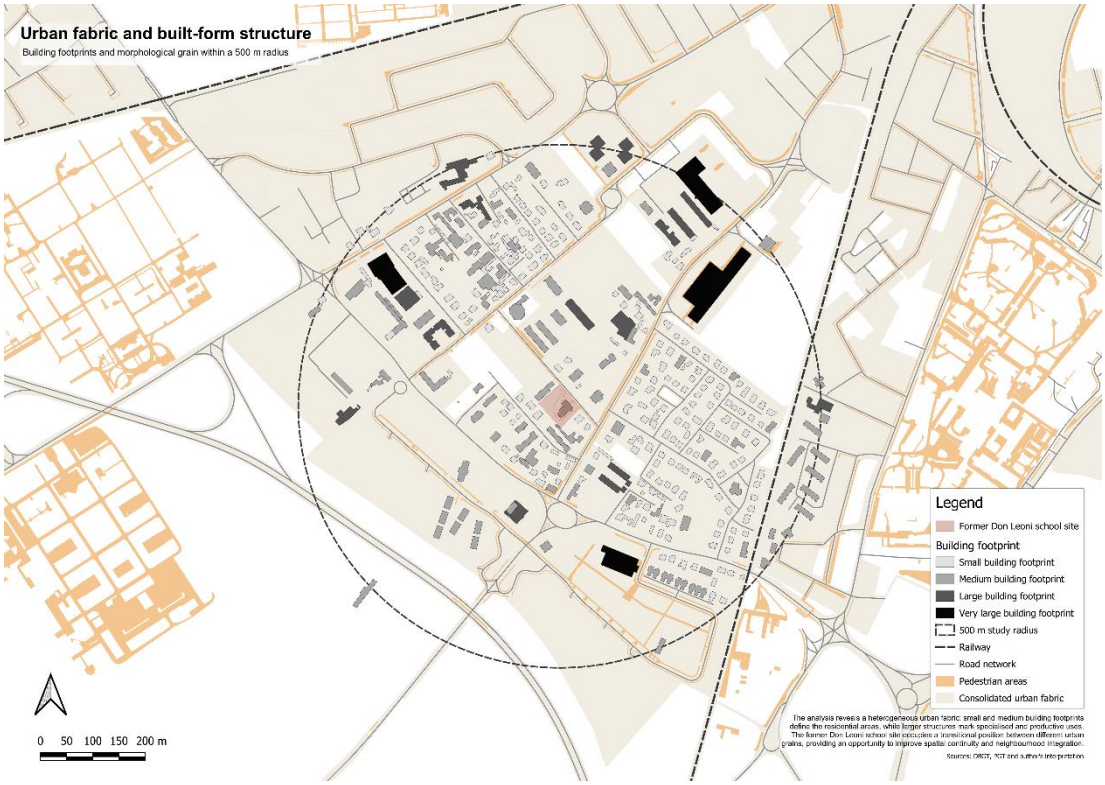



*Figure 10 - Urban fabric and built-form structure. Source: Regione Lombardia DBGT, Municipality of Mantua PGT and author's elaboration, 2026.*

The morphological structure surrounding the former Don Leoni school is notably heterogeneous. Within the 500-metre study radius, the area immediately surrounding the site is primarily characterised by small and medium building footprints associated with residential uses. These coexist with considerably larger structures towards the margins of the neighbourhood, where commercial, productive, infrastructural and other specialised functions introduce a different urban grain.

The former school occupies an intermediate position within this structure. Its footprint is more substantial than those of many surrounding detached residential buildings, yet significantly smaller than the largest specialised complexes visible within the same area. The site can therefore be interpreted as part of a transition between different morphological grains, rather than as belonging to a completely homogeneous residential fabric.

This condition has consequences for the redevelopment strategy. Compatibility with the surrounding city should not be interpreted as the need to reproduce the exact dimensions or form of neighbouring buildings. A new residential intervention may introduce a recognisable contemporary configuration while remaining coherent with

its context through the articulation of volumes, the relationship between built and unbuilt space and the treatment of the edges of the lot.

The open character of the neighbourhood is particularly important. The residential fabric surrounding the former school is not defined only by buildings, but also by the spaces between them: private gardens, setbacks, courtyards and planted surfaces contribute substantially to its spatial character. In this sense, the unbuilt area of the Don Leoni site should not be considered merely as available residual development capacity.

This interpretation changes the way density is approached. The objective is not simply to occupy as much of the lot as permitted by the regulatory framework, but to establish a balance between additional residential capacity and the continuation of an urban structure in which open space remains significant.

The morphological reading therefore anticipates one of the questions that will later distinguish the two project alternatives: how can different building configurations accommodate housing without losing the spatial qualities created by the relationship between built volumes and open ground?

### 3.2.2 Planning framework and landscape constraints

Urban form is not determined exclusively by existing morphology. Transformation takes place within a regulatory and landscape framework that identifies different degrees of protection, sensitivity and development potential.

The regulatory instruments discussed theoretically in Chapter 1 are therefore reintroduced here only in their spatial dimension. The intention is not to repeat the

contents of the NTA or PGT, but to understand how the former Don Leoni site relates geographically to the planning conditions affecting the wider neighbourhood.

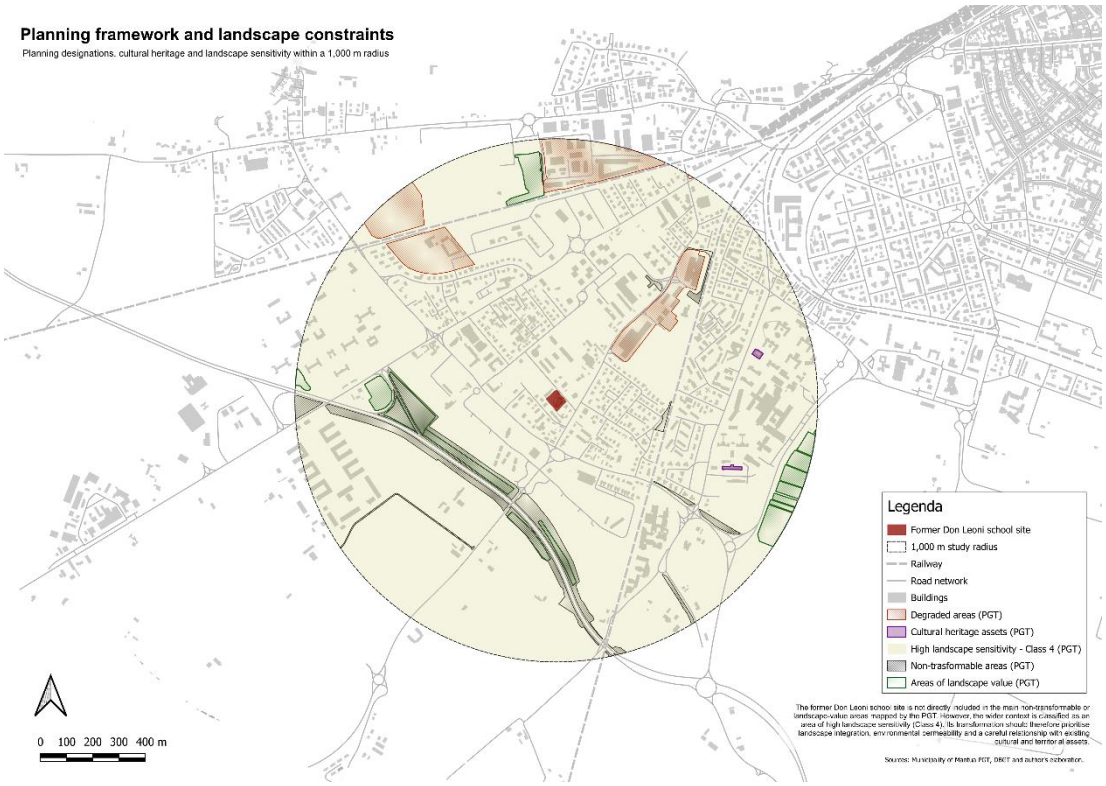



*Figure 11 - Planning framework and landscape constraints. Source: Municipality of Mantua PGT, Regione Lombardia DBGT and author's elaboration, 2026.*

The surrounding area contains a combination of degraded areas, cultural heritage assets, non-transformable areas and areas identified for their landscape value. These elements illustrate the heterogeneous regulatory conditions present around the study site and reinforce the need to situate the intervention within a broader landscape context.

The former Don Leoni property is not directly included within the principal non-transformable or landscape-value areas represented in the analysis. This provides a comparatively favourable condition for transformation. Nevertheless, the wider study area is classified within a high level of landscape sensitivity, which introduces a qualitative dimension to the planning framework.

Landscape sensitivity should not be interpreted exclusively as a restriction. It implies that transformation needs to respond carefully to the character of the existing environment, including its scale, vegetation, visual relationships and established urban structure.

This distinction is important in the context of the thesis because regulatory compliance and urban quality are not equivalent. A development may comply with maximum floor area, building height, setback or permeability requirements while still producing an inappropriate relationship with neighbouring buildings and open spaces.

Planning regulations therefore define a minimum common framework, while the analytical reading developed in this chapter provides additional qualitative criteria.

For the Don Leoni site, the planning context supports transformation but at the same time reinforces the need for a redevelopment strategy attentive to the continuity of open spaces, the articulation of building volumes and the relationship between the site and its surroundings.

This framework is deliberately common to both design alternatives. Whether the former school is retained or replaced, the intervention remains part of the same landscape and planning context and must therefore respond to the same broader conditions.

## 3.3 Neighbourhood systems: services, mobility and green infrastructure

If morphology describes the physical structure of the neighbourhood, its everyday functioning depends on the systems that connect people to services, public spaces and other parts of the city.

This dimension is particularly relevant for residential regeneration. Jacobs' critique of functionally segregated planning emphasised the importance of everyday activities and the coexistence of different urban uses,[30] while more recent neighbourhood-planning approaches similarly associate sustainable urban environments with functional integration, connected street networks and the possibility of reducing dependence on private cars.[38]

The former Don Leoni school is already located within an urbanised neighbourhood. The central question is therefore not whether the redevelopment can independently provide all the functions required by its residents, but how effectively the future housing can become part of the existing network of services, mobility and green spaces.

### 3.3.1 Urban services and neighbourhood functions

The distribution of everyday services represents an important component of residential suitability. Housing located within an established urban area can potentially benefit from existing educational, healthcare, recreational, civic and mobility infrastructure, reducing the need for new service provision and supporting a more compact model of urban transformation.

The importance of such proximity is not based exclusively on efficiency. It also relates to the social role of neighbourhood space. Jacobs' work demonstrated how the presence of different activities can support more continuous patterns of use and contribute to the vitality of urban environments.[30] In contemporary planning, this idea has become closely connected to the concept of integrated and walkable neighbourhoods.[38]

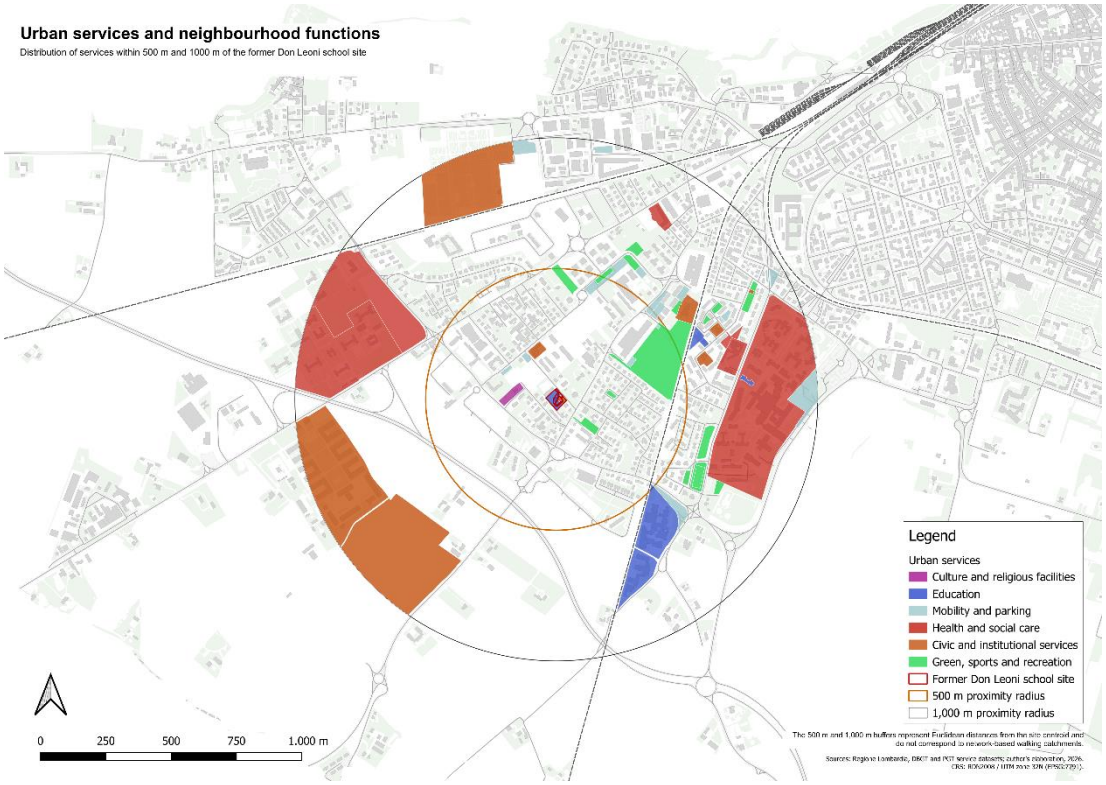



*Figure 12 - Urban services and neighbourhood functions. Source: Regione Lombardia DBGT, Municipality of Mantua PGT service datasets and author's elaboration, 2026.*

The spatial distribution represented in the analysis indicates that the former school is not located within a mono-functional or isolated residential periphery. Within the wider study area there is a diversified presence of educational facilities, civic and institutional services, health and social-care functions, mobility facilities, cultural uses and green, sports and recreational areas.

These functions are not distributed uniformly. Larger service concentrations appear in specific parts of the 1,000-metre radius, while other facilities are located closer to the site. This uneven distribution is itself characteristic of an existing neighbourhood whose functions have accumulated over time rather than being created through a single comprehensive development.

For the redevelopment project, the relevance of the service structure lies precisely in this existing urban capital. The conversion of a disused public site into housing can introduce new residents without requiring the construction of an entirely autonomous system of facilities.

This strengthens the argument for regeneration within the consolidated city: existing land, streets and services can support new residential capacity while limiting the need for outward urban expansion.

At the same time, the analysis makes clear that geographical proximity cannot be treated as sufficient evidence of accessibility. The circular buffers do not reproduce

actual pedestrian routes and several elements of infrastructure affect movement across the neighbourhood.

The service map should therefore be read not as an isolated inventory but together with the mobility analysis that follows. The two analyses address complementary dimensions of the same question: what opportunities surround the site, and how easily can they be reached?

This relationship produces a direct implication for the project. Future residents should encounter a site organisation that facilitates movement towards the neighbourhood rather than turning inward. Pedestrian entrances, internal paths and collective open spaces can therefore contribute to connecting the residential intervention with the existing system of everyday functions.

### 3.3.2 Mobility network, accessibility and critical issues

Accessibility is not simply a property of distance. It results from the interaction between the distribution of destinations and the networks through which people move. Hansen's concept of accessibility already emphasised this relationship between opportunities and spatial separation,[32] while Southworth later identified connectivity, route continuity, safety and integration between movement systems as essential characteristics of walkable urban environments.[33]

The human-scale perspective developed by Gehl further reinforces this interpretation by arguing that urban environments need to be evaluated according to how they are experienced at pedestrian speed, rather than exclusively through large-scale traffic or land-use patterns.[31]

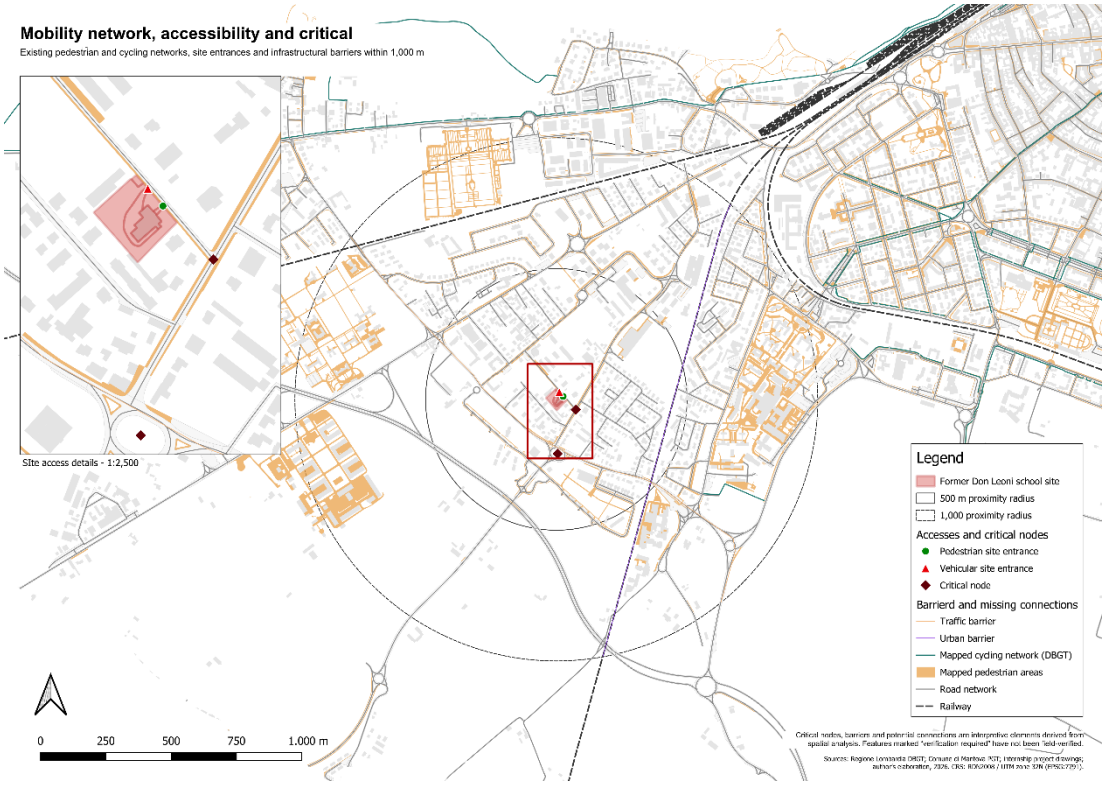



*Figure 13 - Mobility network, accessibility and critical issues. Source: Regione Lombardia DBGT, Municipality of Mantua PGT and author's interpretation and elaboration, 2026.*

The mobility structure surrounding the Don Leoni site demonstrates why this distinction between proximity and actual connectivity is necessary. Local roads, mapped pedestrian areas and cycling infrastructure form a relatively extensive network, but this network is intersected by larger infrastructural systems that operate at a different scale.

In particular, the railway line and the major road infrastructure visible within the study area introduce significant spatial discontinuities. Their presence does not make the neighbourhood inaccessible, but it limits possible crossings and channels movement towards a smaller number of specific points.

This changes the interpretation of nearby functions. Two places may be located at a similar Euclidean distance from the former school while having very different levels of practical accessibility because one can be reached through a continuous local network and the other requires negotiating a major barrier.

The critical nodes represented in the analysis should consequently be understood as places where different movement systems and discontinuities intersect, rather than as objectively demonstrated traffic-safety blackspots. Their identification derives from

spatial analysis and therefore indicates where permeability may be weaker or where further verification could be required.

The site itself presents a more local accessibility question. Existing pedestrian and vehicular entrances reflect its previous use as a school, but residential conversion will alter the type and temporal distribution of movements. Unlike a school, which tends to concentrate access at specific times of day, housing produces continuous and diversified flows involving residents, visitors, vehicles and service functions.

The transformation therefore requires more than retaining the previous entrances. It requires reconsidering their role within a new hierarchy of movement.

From an urban-design perspective, the site should establish a clear relationship between the surrounding street network and its internal pedestrian system. Vehicular access remains necessary, particularly in relation to parking, but it should not become the spatial principle around which the entire lot is organised.

This issue is especially important when the two alternatives are later compared. The different parking strategies adopted by Options A and B produce different relationships between vehicles, ground-level open space and permeability. The mobility analysis does not determine which strategy is preferable, but establishes that their evaluation must consider more than the number of parking spaces provided.

What matters is the extent to which each configuration enables the site to function as a connected residential environment rather than as an internally organised parking and building compound.

### 3.3.3 Green infrastructure and ecological connectivity

The environmental structure of the neighbourhood introduces another layer of connectivity.

Contemporary green-infrastructure approaches understand urban vegetation as more than a collection of individual parks or landscaped surfaces. Tzoulas et al. describe green infrastructure as a system capable of supporting both ecosystem functions and human well-being, emphasising the importance of connections between different green elements.[34]

This perspective is useful for the Don Leoni site because the surrounding area does not contain a single dominant green system. Vegetation is instead distributed through public and recreational spaces, tree-lined routes, private gardens and other planted surfaces

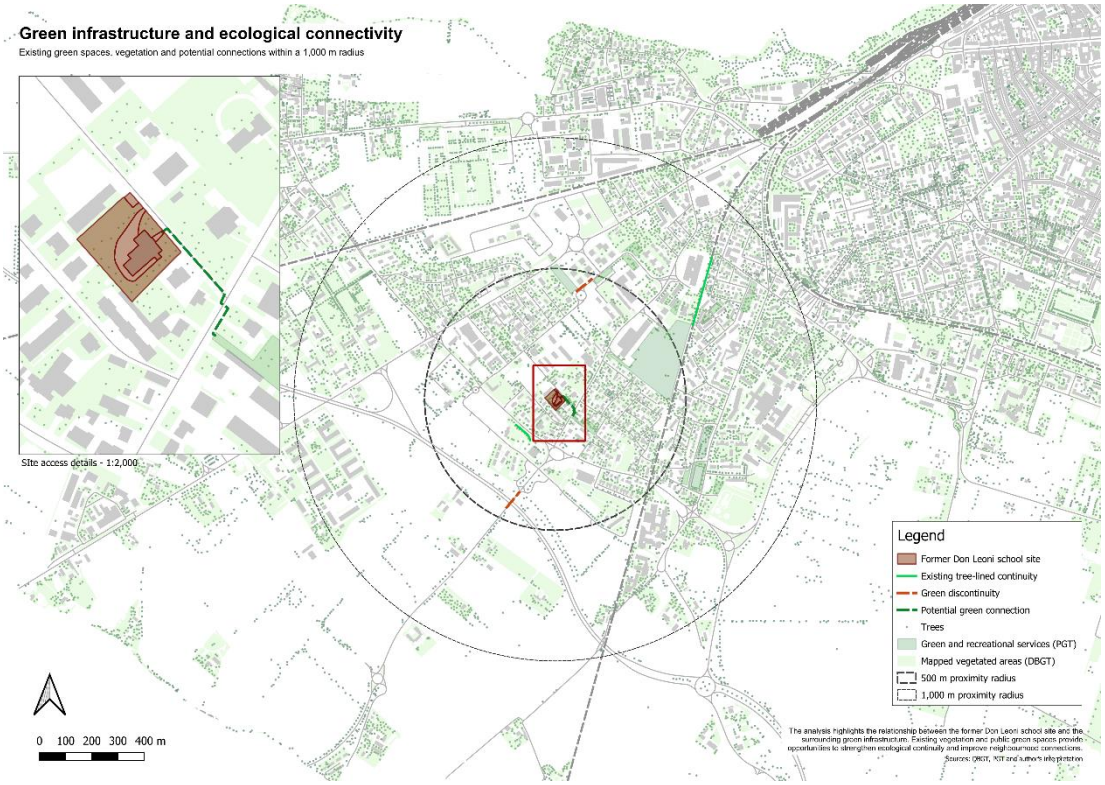



*Figure 14 - Green infrastructure and ecological connectivity. Source: Regione Lombardia DBGT, Municipality of Mantua PGT and author's interpretation and elaboration, 2026.*

The analysis reveals a neighbourhood with a substantial presence of vegetation but with an uneven degree of continuity. Existing tree-lined elements create identifiable local structures, while interruptions caused by roads, infrastructure and changes in land use prevent them from forming a completely continuous network.

This distinction between quantity and continuity is central to the environmental reading.

The presence of vegetation on a map does not necessarily imply the existence of an ecological corridor or of an accessible green network. A private garden, a public recreational area and a roadside tree line contribute differently to environmental quality and have different relationships with everyday use.

For this reason, the potential green connection represented in the analysis is deliberately identified as a potential connection, rather than as an existing ecological corridor. It is an interpretative element derived from the spatial proximity of existing vegetation and should be understood as an opportunity for strengthening local continuity rather than as a formally recognised ecological infrastructure.

The former Don Leoni property is relevant within this system because its redevelopment can either reinforce or further fragment the existing pattern.

At the scale of the individual site, this does not require the creation of a major ecological corridor. Such an objective would be disproportionate to the dimensions of

the intervention. Its contribution can instead occur through the maintenance of substantial deep-soil surfaces, tree planting and the organisation of planted spaces in relation to existing vegetation around the site.

The analytical consequence is therefore qualitative as well as quantitative. The amount of green space provided by the project remains important, especially in relation to the regulatory requirements discussed in Chapter 1, but where that green is positioned and whether it forms usable, continuous areas is equally significant.

A design that technically complies with the required green percentage through a series of narrow residual strips would not respond to the same environmental objectives as one that creates a more coherent planted area capable of supporting trees, shade and collective residential use.

Green infrastructure consequently becomes one of the elements through which the two alternatives can later be compared: not simply through total surface values, but through the spatial relationship between buildings, parking, deep soil and vegetation.

## 3.4 Socio-demographic structure and implications for housing

The physical structure of a neighbourhood provides only part of the information required to assess residential redevelopment. Housing is also connected to demographic structure, household composition and the capacity of the built environment to respond to different stages of life.

The demographic analysis is not intended to predict the exact future population of the Don Leoni development. Nor should the present population be translated mechanically into a predetermined number of apartment types.

Its role is instead to provide a broader social context within which the residential programme can be assessed.

This distinction is particularly important because the data operate at two scales. Census-section information allows spatial patterns around the site to be represented, whereas the accompanying household and age-distribution charts provide a broader municipal reference.

ISTAT's 2021 census data are therefore used as a contextual planning input rather than as a direct forecast of housing demand.[35] Official census-section releases include population and family variables at sub-municipal scale, allowing the spatial differences represented in the analysis to be examined

### 3.4.1 Population density and household structure

Population density provides an indication of the intensity with which different parts of the study area are inhabited. Its value is not simply quantitative: when read alongside urban morphology, it helps explain how different built forms and land uses contribute to contrasting residential conditions.

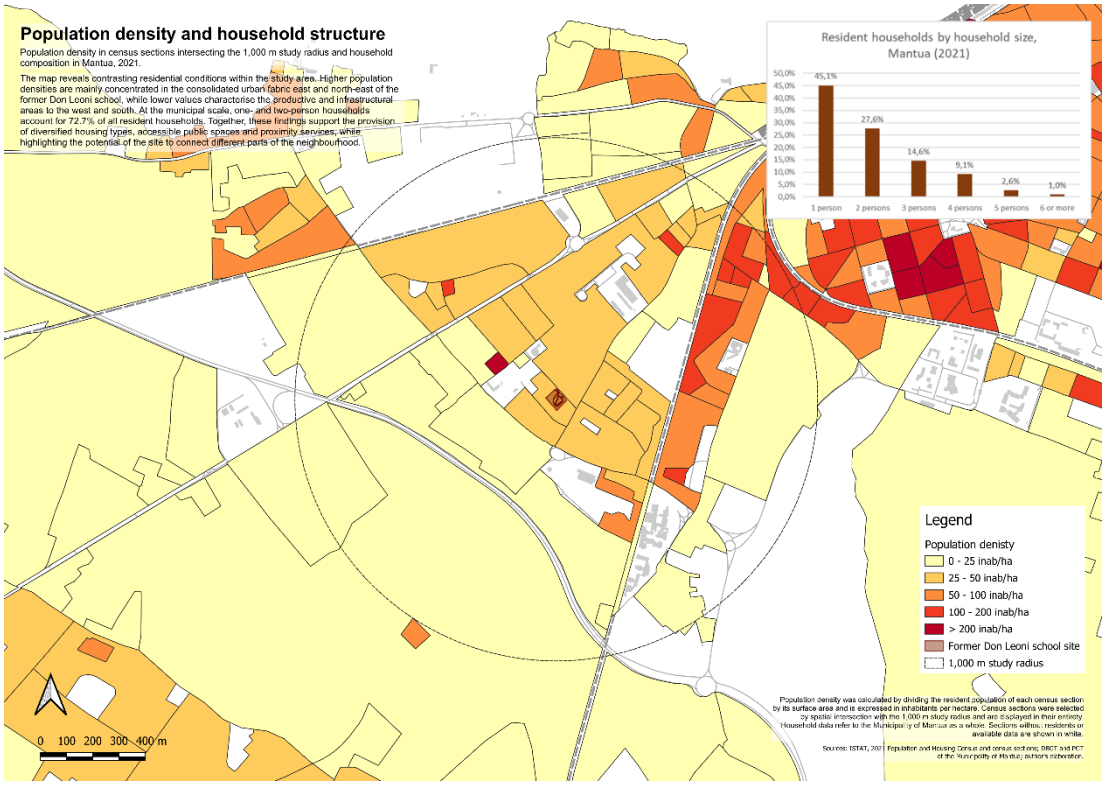



*Figure 15 - Population density and household structure. Source: ISTAT, 2021 Permanent Population and Housing Census; Regione Lombardia DBGT and Municipality of Mantua PGT; author's elaboration.*

The spatial distribution of population density reinforces the heterogeneous character already identified through the morphological analysis.

Higher densities are predominantly associated with the more consolidated urban fabric to the east and north-east, while several areas influenced by productive activities, major infrastructure or larger unbuilt surfaces present substantially lower residential densities.

The former Don Leoni site is located between these conditions rather than within one uniform density pattern. This strengthens its interpretation as a transitional site where new housing could contribute to consolidating residential use without generating an entirely new urban expansion.

Density, however, should not be interpreted as an objective to maximise independently of other urban qualities. A higher number of dwellings can contribute to more efficient use of already urbanised land, but only when it remains compatible with accessibility, open space and the capacity of the surrounding context.

This point is particularly relevant to the two alternatives, which do not produce the same amount of residential floor area. The alternative that accommodates more inhabitants cannot automatically be considered more sustainable simply because it uses the development capacity of the site more intensively. The quality and environmental implications of that additional capacity must also be considered.

Household composition adds an important social dimension to this question.

The municipal data represented in the accompanying chart show that one-person households constitute 45.1% of households, while two-person households represent a further 27.6%. Together, smaller households therefore form a substantial majority of the municipal household structure. Three- and four-person households nevertheless remain significant, while larger households represent a more limited proportion.[35]

This distribution provides a rationale for avoiding an excessively homogeneous residential programme.

The prevalence of small households supports the inclusion of compact dwelling types, but the presence of couples and families means that the project should not be reduced to a development composed predominantly of very small apartments.

The implication is therefore diversity rather than specialisation.

This interpretation also corresponds to broader sustainable-neighbourhood principles, which emphasise social mix and the provision of different housing types as components of more inclusive urban environments.[38]

The combination of studios, medium-sized apartments and larger units considered in the project can consequently be understood not merely as an architectural choice, but as a response to the broader demographic diversity identified through the analysis.

### 3.4.2 Predominant age groups and long-term adaptability

Household structure describes only one dimension of residential diversity. The age structure of the population introduces questions of accessibility, adaptability and the ability of housing to remain usable during different stages of life.

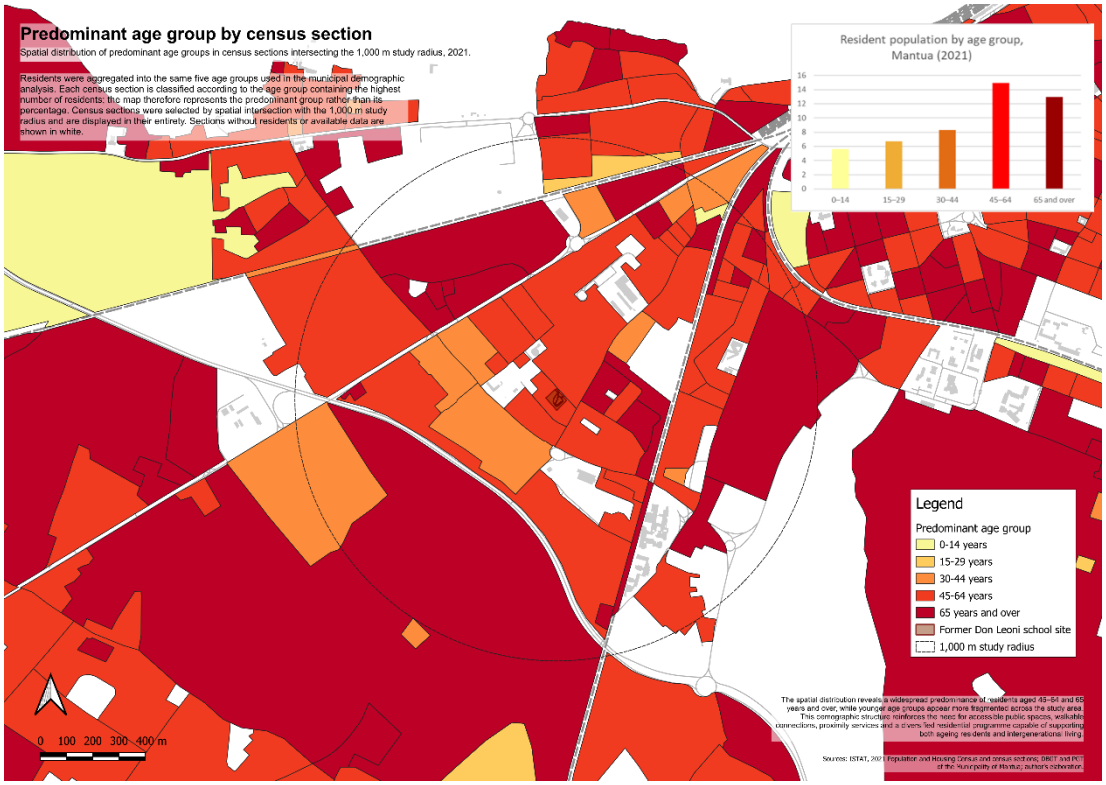



*Figure 16 - Predominant age group by census section. Source: ISTAT, 2021 Permanent Population and Housing Census; Regione Lombardia DBGT and Municipality of Mantua PGT; author's elaboration.*

The map classifies each census section according to the age group containing the highest number of residents. It should therefore not be interpreted as a map of the percentage of older people in each area. Rather, it identifies which age group is numerically predominant within each section.

Within the study area, the spatial pattern indicates a widespread presence of the 45–64 and 65+ age groups, while younger age groups appear in a more fragmented distribution. The municipal chart provides a broader reference and confirms the importance of mature and older population groups within Mantua.

These conditions have implications beyond the provision of specifically designated elderly housing.

The World Health Organization's age-friendly city framework emphasises that accessible public space, walkable routes, proximity to services and housing capable of responding to changing needs benefit the wider population as well as older residents.[37]

For the Don Leoni project, this supports an interpretation of accessibility as a long-term quality of ordinary housing rather than as a specialised requirement.

Step-free paths, clearly identifiable entrances, accessible vertical circulation and usable collective open spaces make the residential environment more adaptable to different ages, temporary mobility limitations and changing household conditions.

At the same time, the presence of younger age groups within the neighbourhood argues against an exclusively age-specific residential model. The project should instead support an intergenerational environment in which different dwelling sizes and shared external spaces can accommodate changing needs over time.

This reading introduces another criterion for the comparison of the alternatives. The flexibility of the residential layouts should not be assessed only according to the number of units they contain, but also according to their ability to accommodate a heterogeneous population and adapt to future change.

### 3.5 Urban opportunities, critical issues and design implications

The analytical layers examined so far describe different dimensions of the same neighbourhood. Their full planning significance emerges when they are considered together.

The Don Leoni site is located within an already urbanised area containing existing services, residential neighbourhoods and a substantial presence of vegetation. At the same time, the surrounding territory is affected by major road and railway infrastructure, discontinuities in pedestrian and green networks and marked differences in urban grain.

These conditions are not contradictory. They describe a neighbourhood with existing urban resources but incomplete spatial continuity.

The synthesis of opportunities and critical issues therefore represents the final stage of analysis before the development of the design strategy.

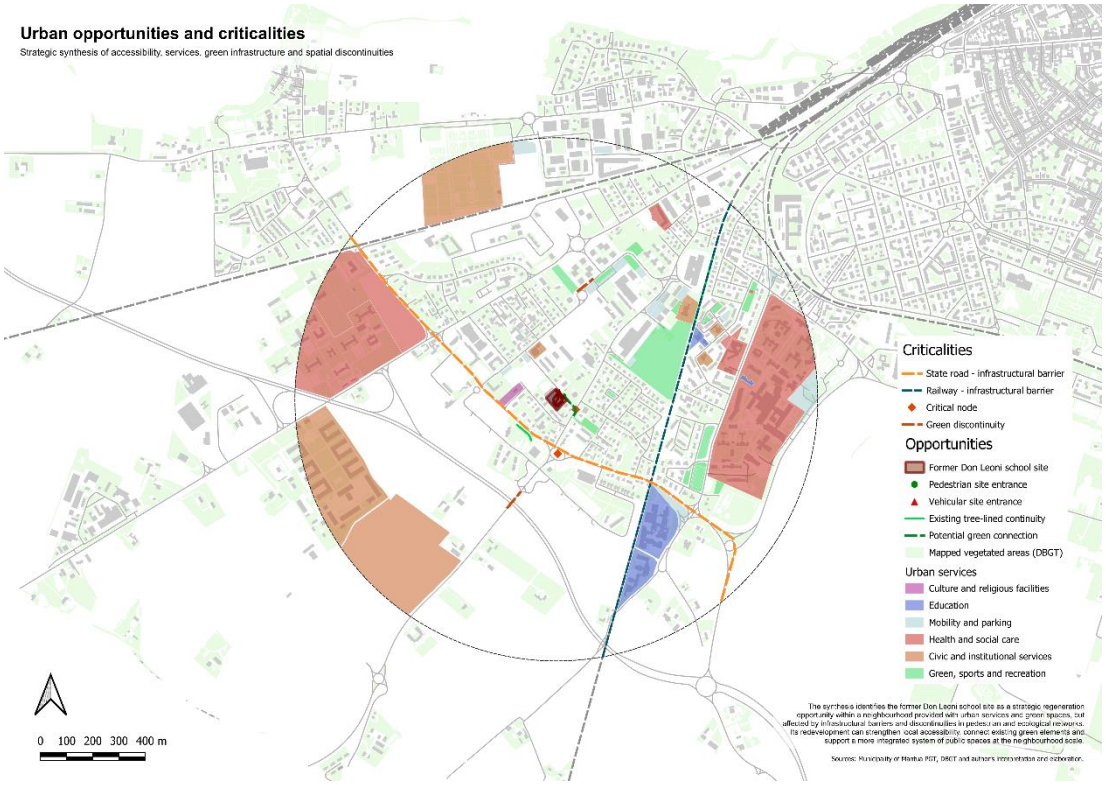



*Figure 17 - Urban opportunities and critical issues. Source: Municipality of Mantua PGT, Regione Lombardia DBGT and author's interpretation and elaboration, 2026.*

The former school emerges from this combined reading as a potentially significant local regeneration site.

Its value is not produced by one exceptional condition. Rather, it derives from the simultaneous presence of several favourable factors: an already developed parcel, proximity to different urban functions, established residential areas and the possibility of reinforcing existing vegetation.

These opportunities are counterbalanced by structural limitations that operate at different scales.

The railway and the main road infrastructure create barriers that the redevelopment of a single property cannot realistically eliminate. Presenting the Don Leoni project as capable of resolving these metropolitan or district-scale discontinuities would therefore overstate its potential impact.

The contribution of the intervention should instead be located at the site and immediate neighbourhood scale.

It can improve the quality of the connection between the lot and surrounding streets. It can avoid introducing additional internal barriers. It can organise open and planted spaces in relation to existing vegetation. It can transform a currently underused former public site into a new residential component of the neighbourhood.

This distinction is central to the urbanistic argument of the thesis.

Regeneration does not necessarily depend on a large-scale transformation. Smaller interventions can contribute to the functioning of the consolidated city when they strengthen existing networks rather than operate as isolated objects.

The Don Leoni site can therefore be interpreted as a local node within a wider network, rather than as an autonomous redevelopment enclave.

This interpretation also creates a bridge back to the case studies presented in Chapter 1. Cenni di Cambiamento demonstrated the importance of balancing residential capacity with collective and open space; Kalkbreite illustrated the relationship between housing, accessibility and collective functions; Caserne de Reuilly showed how the transformation of an institutional site can modify its relationship with the surrounding urban fabric; and DeFlat Kleiburg raised the question of whether existing structures can remain resources within processes of contemporary adaptation.

The relevance of those cases does not lie in replicating their forms at Don Leoni. Instead, they provide principles that can now be reconsidered in relation to the specific evidence produced by the Mantua analysis.

The morphological reading requires attention to scale and open space. The service and mobility analyses require accessibility and connection. The environmental analysis requires continuity and meaningful planted surfaces. The demographic analysis requires residential diversity and adaptability. The planning framework requires compliance but also contextual sensitivity.

Taken together, these findings establish a common basis for design.

The redevelopment should therefore make more effective use of already urbanised land while retaining meaningful open space; reinforce the relationship between the site and existing neighbourhood services; organise pedestrian access as a primary component of residential circulation; prevent parking from dominating the external environment; maintain substantial and coherent deep-soil and planted surfaces; respond to the heterogeneous but predominantly residential urban grain; provide housing capable of accommodating different household structures and stages of life; and evaluate the existing former school according to its real capacity for adaptation rather than assuming either preservation or demolition as an automatically preferable solution.

These principles are deliberately formulated before the comparison of the two alternatives.

Option A and Option B are not intended to respond to different objectives. They are two spatial strategies tested against the same conditions.

Option A investigates whether the retention and conversion of the former school can achieve the identified urban, environmental and residential objectives while introducing an additional volume.

Option B tests whether complete redevelopment can respond more effectively to the same objectives through a new configuration, while accepting the greater material and construction consequences associated with demolition and replacement.

The analysis therefore does not identify a preferred alternative. Instead, it establishes the criteria through which that preference can later be argued.

This methodological separation is essential to the research question: the preferred redevelopment strategy should emerge from the comparative evaluation of how each alternative responds to the same urban evidence, rather than from a predetermined preference for either reuse or new construction.

# 4. CHAPTER 3 - DESIGN STRATEGY AND PROJECT DEVELOPMENT

The analytical framework developed in Chapter 2 demonstrated that the former Don Leoni school site should not be interpreted as an isolated development parcel. Its transformation is embedded within a heterogeneous residential neighbourhood characterised by an existing network of services and vegetation, but also by discontinuities generated by transport infrastructure, differences in urban grain and locally fragmented pedestrian connections.

The design strategy therefore begins from the relationship between the property and this wider system. The objective is not simply to replace an abandoned function with housing, but to investigate how the redevelopment of an already urbanised site can contribute to the consolidation and qualitative improvement of the surrounding neighbourhood.

This perspective shifts the project from a predominantly architectural question towards an urban-regeneration problem. The design of the buildings remains important, but it becomes one component within a broader system including access, public and collective space, green infrastructure, parking, permeability and the relationship with existing residential areas.

In this sense, a relatively small intervention may still produce effects beyond the boundaries of its plot. Attoe and Logan use the concept of the urban catalyst to describe interventions whose importance lies not simply in their individual form, but in their capacity to stimulate or support further transformations within the surrounding urban structure.[40] The former Don Leoni redevelopment clearly operates at a much smaller scale than many strategic urban projects, but the principle remains relevant: the site can be interpreted as a local point through which existing neighbourhood relationships are reinforced rather than as an autonomous residential enclave.

The project consequently develops two alternative scenarios from a common set of urban objectives. Option A investigates adaptive reuse, retaining the former school and combining it with a new residential volume. Option B explores complete redevelopment, replacing the existing building with a newly organised residential complex.

The comparison between the two does not begin from the assumption that reuse is necessarily preferable to demolition, or that new construction automatically provides a better spatial solution. Adaptive reuse has to be evaluated in relation to the actual capacity of an existing structure to accommodate new functions, while new construction has to justify the additional material and environmental consequences associated with replacement. Plevoets and Van Cleempoel emphasise precisely this relationship between the existing built environment, transformation and wider urban regeneration.[41]

The two scenarios should therefore be understood as alternative planning hypotheses tested against the same site and neighbourhood conditions. Their relative performance will only be evaluated in Chapter 4.

## 4.1 Definition of design objectives

### 4.1.1 From neighbourhood analysis to a regeneration framework

The transition from analysis to design is not a direct translation of individual maps into isolated project solutions. Urban analysis identifies relationships, potentials and conflicts; design then interprets these findings and determines which of them can realistically be addressed at the scale of the intervention.

This distinction is particularly relevant for the former Don Leoni site. Chapter 2 identified major infrastructural barriers associated with the railway and the road system, together with interruptions in pedestrian and green continuity. The redevelopment of a single residential lot cannot remove these structures or solve mobility problems at district scale. Its contribution must therefore be more specific and credible.

At the local scale, the project can improve the relationship between the site and surrounding streets, reinforce existing pedestrian and planted connections, organise clearer entrances, reduce internal conflicts between cars and pedestrians and transform an underused property into an active part of the neighbourhood.

The regeneration framework developed from Chapter 2 therefore identifies the former Don Leoni site as a potential local regeneration node.

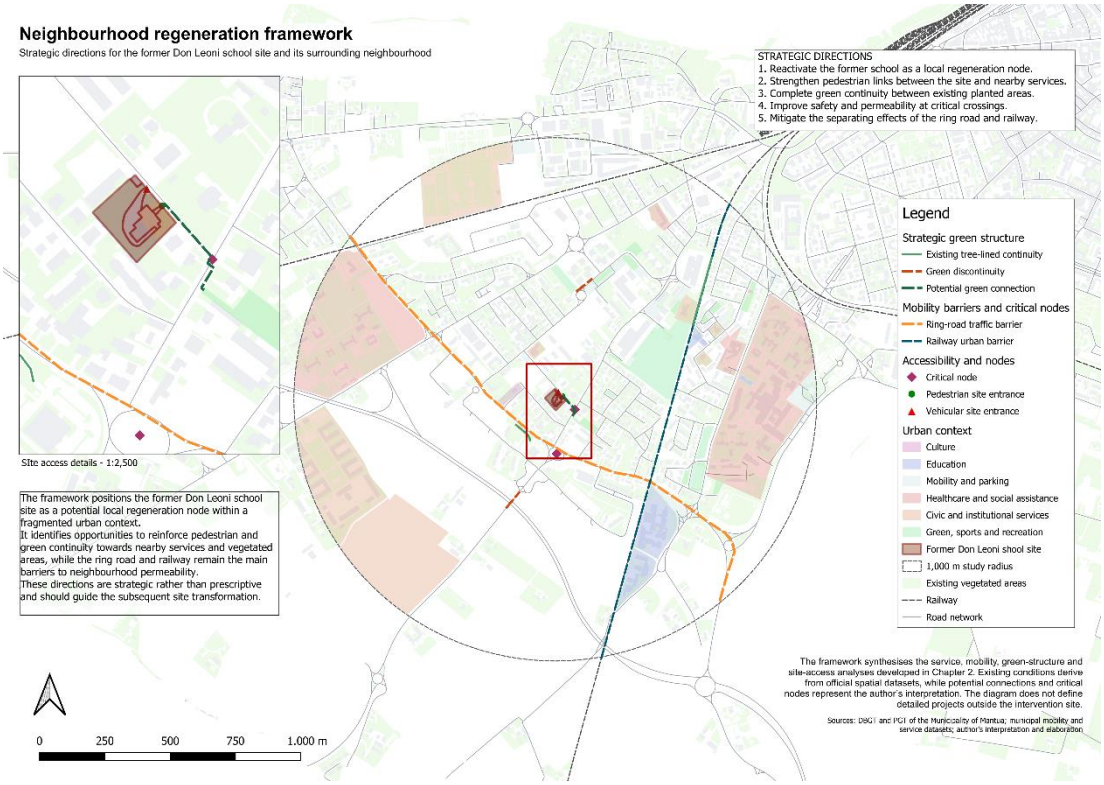



*Figure 18 - Neighbourhood regeneration framework. Source: Author's elaboration based on the urban and territorial analyses developed in Chapter 2.*

The framework identifies five complementary directions: reactivation of the site, reinforcement of pedestrian relationships with nearby services, improvement of local green continuity, attention to critical crossing points and mitigation of the separating effects of major infrastructure.

These directions operate at different scales.

Some can be addressed directly through the redevelopment. The organisation of the site can improve pedestrian permeability, concentrate vehicular access, extend existing vegetation and create a clearer relationship between residential entrances and the surrounding street system.

Other objectives exceed the physical boundaries and decision-making capacity of the project. Improvements to critical crossings or to the relationship with the ring road and railway would require interventions by the municipality or other infrastructure authorities. They are therefore interpreted as longer-term neighbourhood recommendations, not as works directly delivered by the Don Leoni project.

This distinction makes the strategy more realistic. The thesis does not claim that a single housing project can eliminate structural fragmentation across the district. Instead, it positions the intervention within a possible wider process of incremental regeneration.

The site can therefore contribute to neighbourhood transformation by acting where its influence is strongest: at the interface between the private residential development and the surrounding public realm.

### 4.1.2 Common design requirements

Both alternatives are developed from the same set of design requirements. These requirements derive from Chapter 2 and establish a common basis for comparing the two scenarios.

The first concerns the reuse of already urbanised land. Regardless of whether the existing building is retained, both alternatives transform a previously developed property rather than extending the urban footprint of Mantua. In this sense, the regeneration of the site contributes to a more compact model of urban development.

Compactness, however, should not be interpreted simply as maximising built floor area. UN-Habitat's principles for sustainable neighbourhood planning associate adequate density with connected streets, social diversity, mixed functions and efficient land use.[38] Density therefore needs to be considered in relation to the quality of the environment it produces.

For Don Leoni, the relevant question is consequently not:

Which alternative builds more?

but rather:

Which alternative uses the available urban land more effectively while maintaining appropriate open space, accessibility and compatibility with its surroundings?

A second requirement concerns the relationship with the existing urban grain. Chapter 2 identified an area composed predominantly of small and medium residential buildings alongside larger specialised structures. The project should therefore avoid both extremes: it should neither imitate neighbouring detached buildings mechanically nor introduce a scale completely detached from the residential character of the area.

The new volumes are consequently kept within the established maximum of three above-ground storeys and are articulated so that their relationship with surrounding buildings remains legible.

A third objective concerns accessibility at the human scale. As Gehl argues, urban quality depends strongly on how environments are experienced through everyday pedestrian movement.[31] The entrances to the future residential development should therefore establish direct and understandable relationships with the surrounding streets rather than forcing pedestrians to navigate spaces organised principally around cars.

A fourth objective concerns green and open space. Landscape is not treated as the residual surface remaining after the positioning of buildings and parking. Instead, it forms part of the spatial structure of the project and provides environmental, visual and collective value.

Finally, both alternatives should maintain the capacity to accommodate different forms of housing over time. The demographic analysis of Chapter 2 supports a diversified residential programme, but the design strategy does not prescribe a rigid correspondence between demographic groups and individual apartment types. Residential diversity is interpreted more broadly as the capacity to provide different dwelling dimensions and adaptable living conditions.

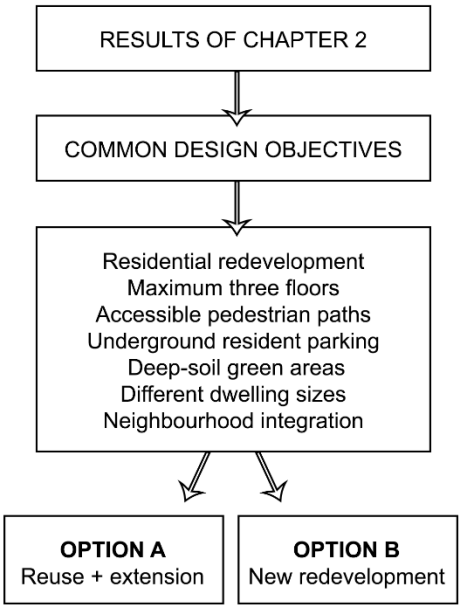



*Figure 19 - Common design objectives for the redevelopment of the site. Source: Author's elaboration based on the findings of Chapter 2.*

## 4.2 Intervention strategy

### 4.2.1 Development of the two alternative scenarios

The decision to develop two alternatives is itself part of the research methodology.

The original school building represents simultaneously a resource and a constraint. Its retention preserves already constructed material and maintains part of the physical identity of the former public facility, but it also limits the freedom with which the residential programme, circulation and open spaces can be reorganised.

Complete redevelopment reverses this condition. Demolition removes the constraints created by the existing building and allows a new spatial configuration to be

developed, but it also eliminates an existing material resource and requires a more extensive construction process.

The purpose of the two scenarios is therefore to make this tension explicit.

Option A asks:

How far can the existing structure be adapted while still producing an effective residential and urban configuration?

Option B asks:

What additional spatial qualities are made possible by complete redevelopment, and are they sufficient to justify replacement of the existing building?

This approach is consistent with adaptive-reuse theory, which increasingly treats existing buildings not simply as objects to be preserved, but as resources whose capacity for transformation must be assessed in relation to new requirements.[41]

The alternatives are therefore not two stylistic proposals. They represent two fundamentally different approaches to the management of the existing built environment.

| | OPTION A | OPTION B |
|---|---|---|
| Existing school | Retained and adapted | Demolished |
| Transformation | Reuse + addition | Complete redevelopment |
| Built form | Two related volumes | Unified U-shaped system |
| Parking | Mainly surface | Underground |
| Open-space logic | Space between existing and new | Central and perimeter open spaces |
| Main question | Adaptability of existing structure | Benefits of complete reorganisation |

*Table 3 - Overview of the two design alternatives*
*Source: Author's elaboration based on the two project scenarios.*

### 4.2.2 Option A - Adaptive reuse and extension

Option A develops the site through the coexistence of retention and transformation.

The former school is maintained and converted to residential use, while an additional volume provides new floor area and reorganises the spatial structure of the property.

Rather than treating the existing building as an obstacle around which a new building is placed, the strategy considers the relationship between the two volumes as the primary spatial condition of the proposal.




*Figure 20 - Option A - Transformation strategy: adaptive reuse and extension. Source: Author's project elaboration, 2026.*

The transformation can be understood as a process of selective continuity.

The former school preserves part of the physical memory of the previous public use, while the new construction introduces the spatial and functional capacity required by the residential programme.

The architectural difference between the two elements is therefore not necessarily a problem to conceal. The intervention can allow the phases of transformation to remain legible, provided that old and new are integrated through a coherent organisation of ground-level spaces.

This approach recalls the lesson identified in Caserne de Reuilly in Chapter 1. There, retention and new construction operate as complementary components of one regeneration strategy rather than as mutually exclusive alternatives.

At Don Leoni, however, the scale is considerably smaller and the public-space implications are different. The primary issue is therefore the space created between the retained school and the new residential volume.

This intermediate area should not become leftover space generated by two unrelated buildings. It represents the central element through which the two phases of the site are connected.

Pedestrian circulation, entrances, planted surfaces and areas of collective use should therefore contribute to making this space part of a coherent residential environment.

The different heights and geometries of the two volumes also allow the intervention to mediate between the scale of the existing building and the new development capacity.

In this sense, Option A is based not on formal uniformity but on relational coherence.

Its success depends on whether an existing institutional building with an originally different spatial logic can become part of a contemporary residential system without producing excessive compromises in circulation, orientation or open-space organisation.

That question will remain central to the later evaluation.

### 4.2.3 Option B - Demolition and complete redevelopment

Option B begins from the opposite hypothesis.

The existing school is removed and the site is treated as a single field within which building volumes, open space, circulation and parking can be reorganised together

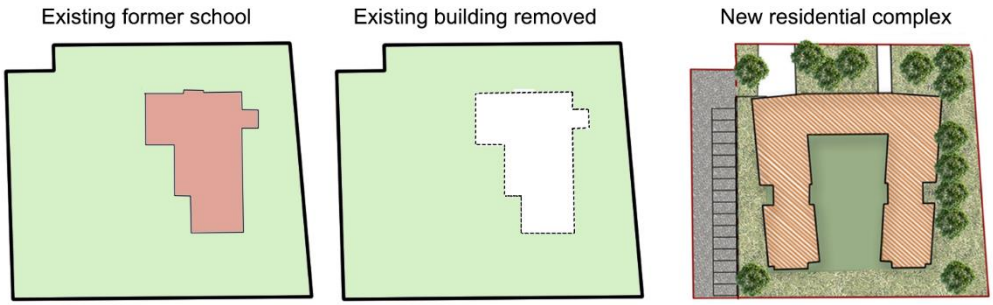



*Figure 21 - Option B - Transformation strategy: demolition and complete redevelopment. Source: Author's project elaboration, 2026.*

The absence of the existing structure provides a greater degree of spatial freedom.

Rather than establishing a relationship between two different construction phases, the project can define a unified residential system from the beginning.

The proposed U-shaped configuration uses the building itself to structure the external spaces. The residential wings define a more contained internal environment while the open side of the composition maintains a relationship with the rest of the property and the surrounding neighbourhood.

This configuration creates a different type of spatial hierarchy from Option A.

Where Option A develops through the dialogue between existing and new buildings, Option B uses a continuous architectural system to define the relationship between built and unbuilt space.

The new development reaches up to three storeys, but the upper volume is articulated rather than treated as an entirely continuous mass. This reduces the perception of a uniform block and allows the built form to respond more carefully to neighbouring residential properties.

The possibility of designing circulation, parking and residential volumes simultaneously also represents one of the principal spatial advantages of complete redevelopment.

In particular, the introduction of underground parking allows a larger proportion of the ground level to be organised independently of resident car storage.

However, this spatial benefit is not environmentally or economically neutral.

The underground structure requires additional excavation, materials and construction and therefore introduces impacts that will need to be considered in Chapter 4.

Option B consequently tests a different proposition:

whether the greater spatial freedom generated by complete redevelopment produces sufficiently significant urban and environmental benefits to compensate for the loss of the existing structure and the greater intensity of construction.

## 4.3 Design of the building volumes

The volumetric development of the two alternatives should not be interpreted primarily as an architectural composition exercise.

At neighbourhood scale, building form influences the proportion of open space, relationships with neighbouring properties, visual permeability, the position of entrances and the distribution of movement.

Carmona's interpretation of urban design emphasises that urban form should be understood through overlapping morphological, social, functional and perceptual dimensions.[42] The value of a volume therefore depends not only on its form as an object, but on the places and relationships that it produces around itself.

For this reason, the following sections focus on the relationship between volumes and site organisation, rather than on the detailed distribution of individual apartments.

### 4.3.1 Option A - Existing school and new residential volume

In Option A, the retained school remains an identifiable element of the site.

Its original geometry establishes one part of the new composition, while the additional residential volume occupies the opposite portion of the property.

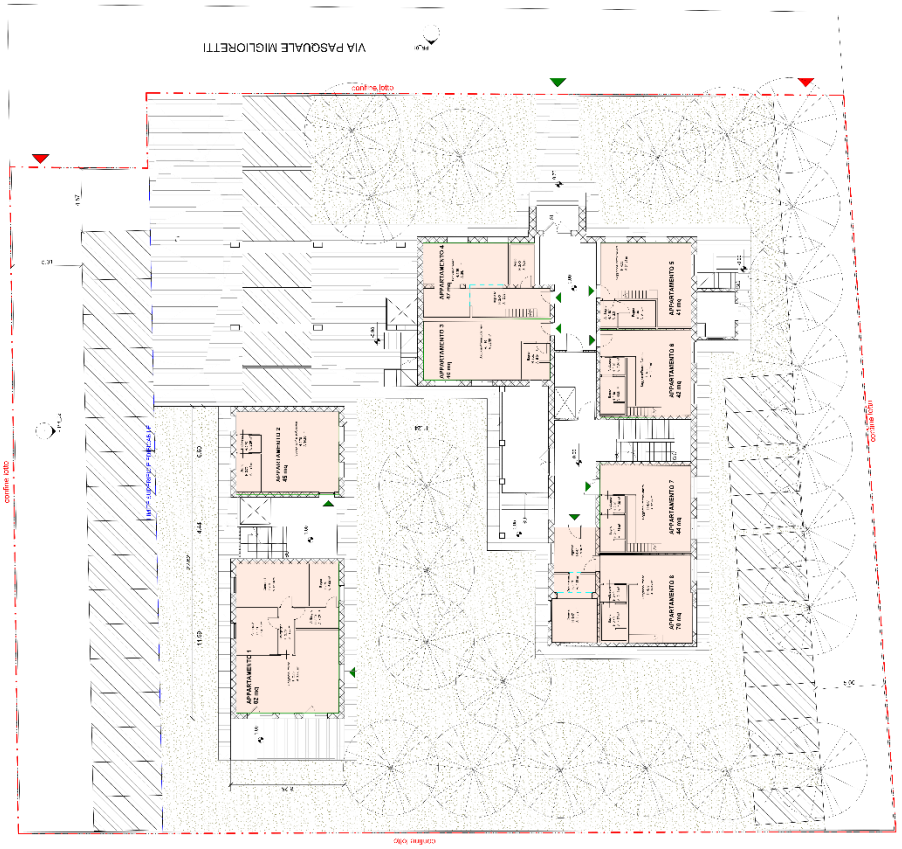



*Figure 22 - Option A – Ground-floor and site organisation. Source: Author's project elaboration developed during the internship at Studio ABnorma, 2026.*

The ground-level organisation is particularly important because it is here that the relationship between the two buildings becomes part of everyday residential experience.

The open areas perform several functions simultaneously: they provide access, establish distance between façades, contain planted surfaces and mediate between pedestrian circulation and parking.

The new building therefore does not simply increase the development capacity of the property. Its position changes the spatial structure of the entire lot.

The former school is transformed from an isolated institutional building surrounded by residual external areas into one component of a more articulated residential ensemble.

This is where the adaptive-reuse strategy acquires an urban dimension.

Retention is meaningful not only because an existing structure survives, but because that structure becomes part of a new system of relationships.



*Figure 23 - Option A - Elevation 1. Source: Author's project elaboration developed during the internship at Studio ABnorma, 2026.*



*Figure 24 - Option A - Elevation 2. Source: Author's project elaboration developed during the internship at Studio ABnorma, 2026.*



*Figure 25 - Option A - Aerial view. Source: Author's project elaboration developed during the internship at Studio ABnorma, 2026.*

The contrast between the existing pitched-roof building and the new residential volume keeps the transformation process visible.

The design does not attempt to recreate the architectural language of the former school. Instead, continuity is established through scale, distance, landscape and ground-level organisation.

This reflects a broader principle of adaptive reuse: continuity does not necessarily require stylistic imitation. Existing and new components can remain distinguishable while contributing to a coherent whole.

### 4.3.2 Option B - New residential complex

Option B establishes a different relationship between building form and open space.

Because the entire structure is newly designed, the volume itself can be used to organise the site according to a more unified spatial logic.

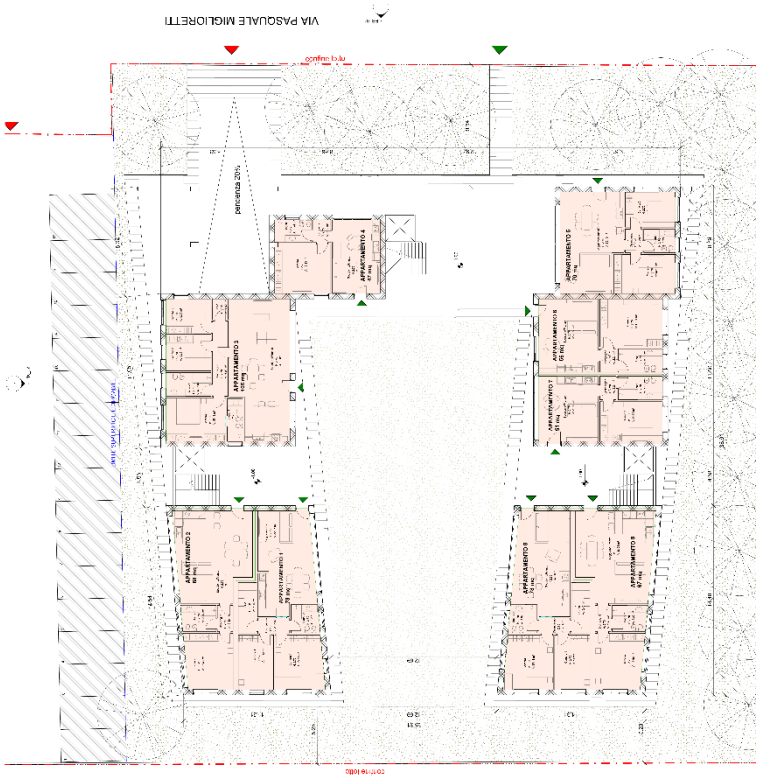



*Figure 26 - Option B - Ground-floor and site organisation. Source: Author's project elaboration developed during the internship at Studio ABnorma, 2026.*

The U-shaped form creates a more clearly defined internal space than Option A.

This configuration can increase spatial legibility by establishing a recognisable relationship between the residential wings and the central open area.

At the same time, greater enclosure requires attention to orientation, visual relationships and the possibility that the internal space might become overly private or detached from the surrounding neighbourhood.

The quality of the configuration therefore depends on maintaining a balance between definition and permeability.

A residential courtyard or semi-enclosed space can provide greater environmental control and collective identity, but it should not result in an introverted enclave.

Carmona's work on public and collective space stresses the importance of legible relationships between public and private domains and of achieving an appropriate balance between pedestrian use and vehicular movement.[39]

Although the Don Leoni internal spaces will principally serve residents rather than function as public squares, this principle remains relevant. The interface between residential space and the surrounding neighbourhood should remain readable rather than excessively closed.



*Figure 27 - Option B - Elevation 1. Source: Author's project elaboration developed during the internship at Studio ABnorma, 2026*



*Figure 28 - Option B - Elevation 2. Source: Author's project elaboration developed during the internship at Studio ABnorma, 2026.*



*Figure 29 - Option B - Aerial view. Source: Author's project elaboration developed during the internship at Studio ABnorma, 2026.*

### 4.3.3 Residential organisation and adaptability

The residential programme is intentionally diversified, but the purpose of the thesis is not to optimise or compare individual apartment layouts.

For this reason, dwelling types are not analysed quantitatively in this chapter.

Instead, residential organisation is considered according to three broader criteria:

diversity, adaptability and relationship with the external environment.

The demographic analysis presented in Chapter 2 indicates that Mantua contains a substantial proportion of small households alongside couples and families. The project therefore avoids a residential model oriented towards a single household category.

At the same time, present demographic conditions should not be translated into excessively specialised layouts.

Buildings generally have a considerably longer life than the household structures for which they were initially designed. Residential flexibility therefore contributes to the capacity of the project to remain relevant under future demographic change.

In Option A, this adaptability is conditioned partly by the dimensions and structural organisation of the former school.

The project therefore tests whether the existing configuration can accommodate contemporary residential use without requiring transformations so extensive that the original advantages of reuse become questionable.

Option B begins without this inherited spatial constraint and consequently allows dwelling organisation and circulation to be developed together with the new structure.

This produces greater freedom but should not automatically be confused with greater long-term adaptability.

The relevant distinction is therefore between freedom at the moment of design and capacity for future transformation.

This provides another criterion that can subsequently be considered in the comparative evaluation.

## 4.4 Relationship between built elements, open spaces and the surrounding context

The most relevant urban-design differences between the two alternatives emerge at ground level.

It is here that building form interacts with pedestrian movement, parking, vegetation and the surrounding streets.

Public-space research emphasises that good urban environments depend not only on the formal quality of individual spaces, but on their connections, their interfaces with surrounding uses and the balance established between pedestrians and vehicles.[39]

This perspective is particularly important for Don Leoni because most of the external area will be residential or semi-private rather than fully public. Nevertheless, its organisation contributes to the quality of the neighbourhood interface and to the everyday experience of the development.

### 4.4.1 Access, mobility and the public-space interface

Chapter 2 demonstrated that the site is located within reach of several neighbourhood services, but also that local accessibility is influenced by infrastructural barriers.

The project cannot modify the wider railway and road systems. It can, however, improve the local relationship between the property and the pedestrian network.

The first principle is therefore to make pedestrian access spatially legible.

Entrances should be perceived as an extension of existing neighbourhood movement rather than as residual gaps between parking areas.

Gehl's human-scale approach is particularly relevant here: the quality of access is determined by the experience of movement at walking speed, including continuity, visibility and the relationship between paths and surrounding activities.[31]

Vehicular circulation follows a different logic and should therefore be distinguished as clearly as possible.

The objective is not to remove cars from the project, which would be inconsistent with the parking requirements and mobility characteristics of the area, but to prevent them from determining the entire organisation of the lot.

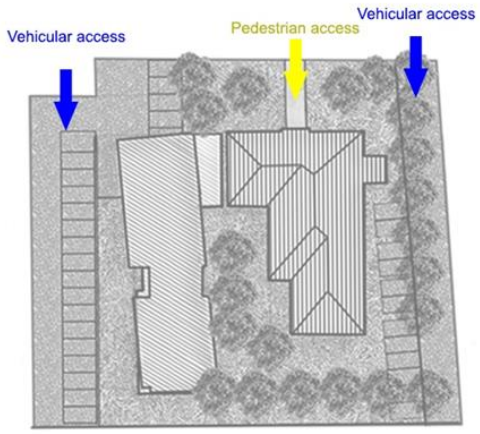



*Figure 30 - Option A – Access and circulation strategy. Source: Author's project elaboration, 2026.*

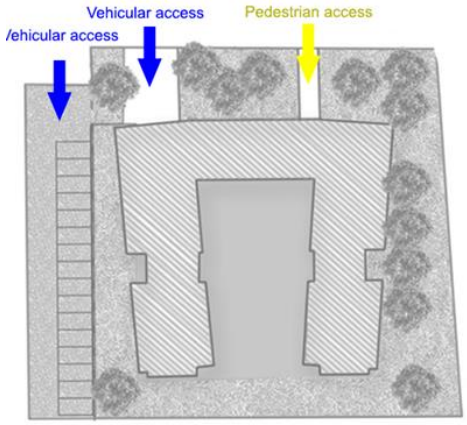



*Figure 31 - Option B - Access and circulation strategy. Source: Author's project elaboration, 2026.*

Option A accommodates resident parking mainly at surface level. This creates a stronger interaction between vehicular circulation and the open spaces and makes the landscape treatment of parking particularly important.

Parking areas should therefore be concentrated and visually integrated through planting rather than distributed indiscriminately across the lot.

Option B relocates a substantial part of resident parking underground.

This reduces the pressure of parked vehicles on the surface and provides greater freedom in organising planted and pedestrian spaces, but introduces an underground ramp and additional construction below ground.

The mobility strategy therefore demonstrates a recurring characteristic of the comparison: an advantage at one level may introduce a cost or impact at another.

This is why the spatial advantages of underground parking cannot be evaluated independently from its environmental and economic implications.

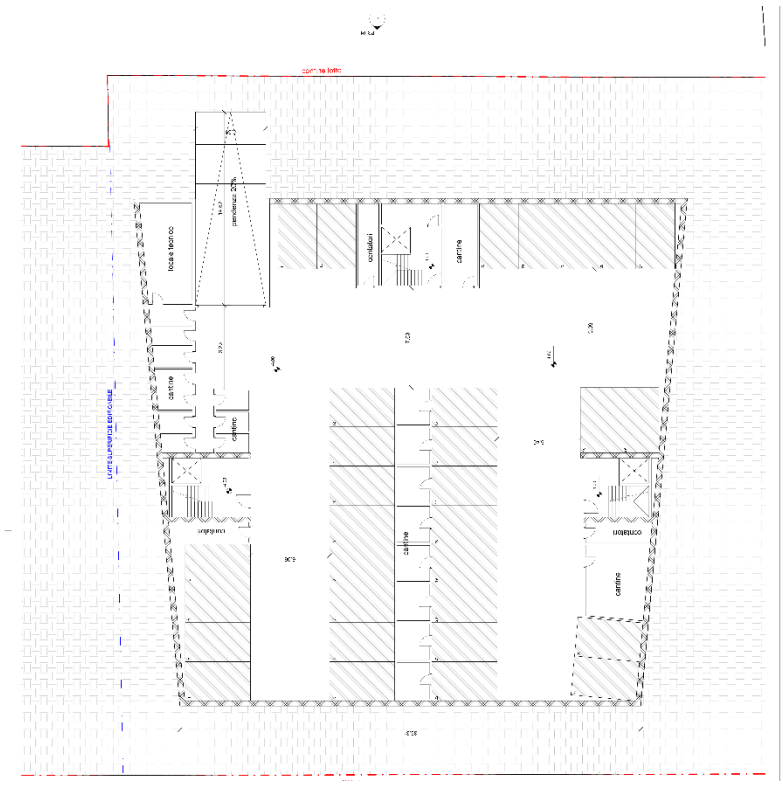


*Figure 32 - Option B - Underground parking layout. Source: Author's project elaboration, 2026.*

The mobility analysis developed in Chapter 2 revealed that the former Don Leoni site is embedded within a neighbourhood where local pedestrian and cycling networks coexist with larger infrastructural elements that reduce spatial continuity. While the redevelopment of a single property cannot directly resolve the separating effects of the railway or the main road infrastructure, it can contribute to improving accessibility at the scale at which the intervention has a realistic capacity to operate.

This distinction is important in defining the role of the project within the wider neighbourhood. Urban regeneration should not be understood only through large-scale infrastructural transformations. Smaller interventions can contribute to improving everyday urban conditions when they reinforce existing connections, reduce local discontinuities and establish more legible relationships between private developments and public space. In this sense, the Don Leoni site can become part of an incremental process of neighbourhood improvement rather than functioning as an autonomous residential enclave.

Particular attention should therefore be given to the frontage of the site and to the relationship between the main pedestrian entrance and the surrounding street network. The entrance should not be conceived merely as the point at which the private property begins. It represents the interface between the residential development and the neighbourhood and can therefore contribute to the continuity and recognisability of pedestrian movement.

Gehl's human-scale approach is particularly relevant in this respect. The quality of an urban connection depends not only on its geometric efficiency but also on its legibility, comfort and continuity when experienced at walking speed.[31] A short route may still perform poorly when it is interrupted, difficult to identify or dominated by vehicular movement. Conversely, relatively simple interventions to pavements, crossings, vegetation and street edges may considerably improve the everyday experience of accessibility.

For this reason, the redevelopment suggests the opportunity to evaluate, at neighbourhood scale, a series of complementary improvements along the site frontage. These could include greater continuity of pedestrian surfaces, clearer crossing conditions, reinforcement of street planting and a more recognisable relationship between the principal entrance and the routes leading towards nearby services.

Such interventions are not presented as directly designed road works within the scope of this thesis. Their detailed definition would require traffic analysis, technical verification and coordination with the Municipality of Mantua. They should therefore be understood as strategic recommendations generated by the redevelopment, rather than as components already resolved within the design of the lot.

This approach allows the project to establish a realistic relationship with the wider mobility system. The redevelopment does not claim to resolve neighbourhood-scale transport problems, but it identifies specific points where a future public-space strategy could strengthen pedestrian continuity and reinforce the connection between the former school site and the surrounding urban fabric.

### 4.4.2 Green structure, permeability and parking

The organisation of green and permeable surfaces represents another fundamental connection between the neighbourhood-scale analysis and the internal design of the site.

Chapter 2 demonstrated that vegetation is relatively widespread throughout the surrounding area, but that this presence does not correspond to a completely continuous green network. Tree-lined elements, private gardens, recreational areas and other vegetated surfaces form a fragmented environmental structure interrupted by roads, buildings and infrastructure.

The redevelopment of the former Don Leoni site cannot by itself create a neighbourhood-scale ecological corridor. It can, however, determine whether the transformation reinforces or further fragments the local environmental structure.

This interpretation is consistent with the concept of green infrastructure, which considers urban vegetation not simply as decorative open space but as a network capable of contributing simultaneously to ecological processes and human well-being.[34] At the scale of an individual residential development, this implies that planting, deep-soil areas and permeable surfaces should be considered as components of the spatial structure of the project rather than as residual surfaces remaining after the positioning of buildings and parking.

The distinction between quantity and spatial quality is particularly important. A project may technically provide a sufficient percentage of green area while distributing it through narrow or disconnected surfaces that offer limited opportunities for substantial planting, shade or collective use. Conversely, larger and more coherent planted areas can perform several functions simultaneously: supporting vegetation, increasing soil permeability, improving summer microclimatic conditions, mediating between residential buildings and neighbouring properties and reducing the visual presence of parked vehicles.

The two alternatives address this relationship in different ways.

In Option A, the retention of the former school and the introduction of a second residential volume create a more articulated organisation of the lot. Open and planted areas are distributed around and between the two buildings, and therefore play an important role in connecting the different parts of the intervention. At the same time, the presence of surface parking creates stronger competition between vehicular functions and the quality of the external residential environment.

Landscape design consequently becomes especially important in Option A. Planting can help distinguish pedestrian areas from parking, mediate the relationship with neighbouring properties and prevent vehicular surfaces from becoming the dominant visual element of the project.

Option B establishes a different relationship between ground-level space and parking. The introduction of underground parking reduces the direct presence of vehicles on the surface and provides greater freedom in organising the external areas around the new residential complex. The U-shaped building also creates a more clearly defined internal space, allowing planted and pedestrian areas to become part of a more unified spatial composition.

This represents an important spatial advantage, but it is not environmentally neutral. Underground construction requires excavation, additional structural material and a substantial occupation of the subsoil. The improvement of the ground-level environment must therefore be considered together with the greater material, economic and construction impacts associated with the underground parking structure.

The comparison between the two alternatives consequently demonstrates why environmental quality cannot be reduced to a single numerical indicator.

The relevant question is not simply which alternative provides the greatest quantity of green surface, but how buildings, parking and planted areas interact to produce a coherent residential environment.

This distinction will become particularly important in Chapter 4, where the amount of deep-soil surface can be considered together with its spatial configuration, the presence of underground construction and the overall environmental implications of each redevelopment strategy.

#### 4.4.3 Relationship with the surrounding context and public realm

The transformation of the former Don Leoni site also raises a broader question concerning the relationship between the new residential environment and the surrounding neighbourhood.

Residential redevelopment necessarily produces a distinction between public, collective and private space. The objective is therefore not to eliminate the boundaries of the property or to transform its internal areas into public space. Rather, the project should establish a legible and gradual transition between the street, shared residential areas and individual dwellings.

The quality of this transition is an important component of urban design. Carmona emphasises that successful urban environments depend not only on the formal characteristics of individual spaces but also on the management of interfaces between public and private domains, pedestrian and vehicular uses and different degrees of accessibility.[39]

For the Don Leoni redevelopment, this principle means that the perimeter of the site should not be treated as a uniform boundary.

Different edges respond to different surrounding conditions. Where the lot faces the street, greater visual openness and clearly identifiable access points can strengthen the relationship with the neighbourhood. Where it directly faces neighbouring residential properties, a higher degree of privacy and environmental mediation becomes appropriate.

The landscape strategy can support this differentiation. Planting along sensitive residential boundaries can increase privacy, provide shade and reduce visual conflict,

while more permeable and recognisable treatment near the main entrance can reinforce the relationship with the public realm.

The positioning of the building volumes contributes to the same objective. Distance between new construction and neighbouring properties should not be understood only through regulatory compliance. It also affects sunlight, visual privacy, perceived scale and the general integration of the development within the existing residential fabric.

This is particularly significant because Chapter 2 identified the Don Leoni site as part of a heterogeneous but generally open urban structure. Maintaining meaningful unbuilt areas between new development and surrounding properties therefore contributes to continuity with the existing morphology.

Option A and Option B establish different types of relationship with their boundaries.

Option A maintains the former school as an existing reference within the site and introduces a second volume. The resulting arrangement produces multiple open spaces and a more fragmented relationship with the perimeter. This creates opportunities for differentiation between planted, pedestrian and parking areas, but also requires careful coordination to avoid the appearance of residual spaces.

Option B produces a more defined internal organisation. The U-shaped building creates a stronger distinction between the central residential space and the surrounding edges of the property. This can provide a clearer collective identity but may also produce a more introverted spatial condition if connections with the surrounding street are not sufficiently legible.

The difference between the two alternatives can therefore be interpreted through the relationship between openness and enclosure.

Neither condition is intrinsically preferable. A more open arrangement can strengthen continuity with the neighbourhood but may reduce the definition of collective residential spaces. A more enclosed configuration can increase spatial identity and privacy but risks becoming detached from its surroundings.

The design challenge lies in balancing these conditions according to the characteristics of the site.

This interpretation also reflects the lessons derived from the case studies examined in Chapter 1. Cenni di Cambiamento showed the importance of intermediate spaces between private dwellings and the wider residential environment, while Kalkbreite demonstrated how different degrees of collective and public use can coexist within a compact development. Caserne de Reuilly highlighted the transformation of boundaries as a fundamental component of the regeneration of a former institutional site.

The relevance of these references to Don Leoni lies not in their architectural forms, but in the principle that the boundary of a residential development can become an active component of urban integration rather than simply a line of separation.

## The site as part of a wider public-space regeneration strategy

The relationship between the project and the surrounding public realm suggests a broader interpretation of the former Don Leoni redevelopment.

Although the intervention is concentrated within a single property, the analytical framework developed in Chapter 2 identified several neighbourhood conditions that could benefit from a more coordinated long-term strategy: pedestrian discontinuities, infrastructural barriers, fragmented vegetation and an uneven relationship between residential areas and local services.

The redevelopment can therefore be considered one component within a possible incremental regeneration of neighbourhood public space.

This concept differs from a comprehensive masterplan. The thesis does not propose the complete redesign of the surrounding district and does not assume that all identified critical issues can be resolved through the transformation of the former school.

Instead, the project identifies a number of principles that could potentially inform future interventions in the surrounding public realm: reinforcement of pedestrian continuity, increased tree planting, greater attention to critical crossings and stronger spatial relationships between residential areas and neighbourhood facilities.

The concept of the urban catalyst developed by Attoe and Logan is useful in understanding this relationship.[40] A catalytic intervention does not necessarily transform a large urban area directly. Its significance may instead lie in initiating, reinforcing or demonstrating a process that can influence subsequent interventions while remaining responsive to the specific character of its context.

Applied to Don Leoni, the concept should be interpreted cautiously. The redevelopment is not assumed to generate widespread transformation automatically. Its potential catalytic role lies in demonstrating how the reuse of an underused public property can simultaneously address housing provision, land reuse, pedestrian relationships and environmental quality.

This interpretation also reinforces the importance of considering the ground level of the project as more than a private residential arrangement.

The treatment of entrances, planted areas, street frontage and boundaries determines how the development participates in the everyday spatial structure of the neighbourhood. Even when the majority of the open spaces remain collective or private, their configuration influences the quality of the wider urban environment.

The Don Leoni site can therefore be understood as a local interface between residential regeneration and public-space improvement.

This broader perspective prevents the project from being evaluated exclusively through internal efficiency. The number of dwellings, gross floor area or parking spaces remains relevant, but these indicators do not fully describe the urban performance of the alternatives.

A planning-oriented assessment must also consider whether the project strengthens or weakens existing neighbourhood relationships.

#### 4.4.4 From design alternatives to comparative evaluation

The development of the two alternatives demonstrates how the same analytical findings and planning objectives can be translated into substantially different spatial strategies. Both proposals reactivate an already urbanised site and introduce new residential capacity within an established and serviced neighbourhood. Both seek to maintain a scale compatible with the surrounding residential fabric, organise accessible pedestrian entrances, provide substantial planted and permeable surfaces and satisfy the functional requirements associated with residential mobility and parking.

The principal difference lies in how these objectives are achieved and in the consequences generated by each transformation strategy.

Option A accepts the former school as an inherited condition and attempts to incorporate it into a new residential system. Its strategy is based on continuity, adaptation and selective transformation. The existing building is therefore interpreted as a material and spatial resource whose value depends on its capacity to accommodate a new function without requiring modifications so extensive that the advantages of reuse become marginal.

This interpretation reflects the broader understanding of adaptive reuse discussed in Chapter 1. Plevoets and Van Cleempoel emphasise that reuse should not be regarded simply as the physical preservation of an existing structure, but as a process of negotiation between inherited characteristics and contemporary requirements.[41] In the case of Don Leoni, the question is therefore not whether preserving the former school is desirable in abstract terms, but whether its spatial configuration, material presence and relationship with the site can effectively contribute to the new residential programme.

Option B begins from the opposite condition. By removing the former school, the entire property can be reorganised according to a single spatial strategy. Building volumes, circulation, parking and open spaces can therefore be conceived simultaneously rather than adapted around an inherited structure.

Its strategy is based on replacement, integration and spatial reconfiguration. This provides greater freedom in organising the relationship between built and unbuilt areas

and makes it possible to concentrate parking underground, reducing its direct occupation of the ground level. At the same time, these advantages require demolition, excavation and a greater amount of new construction.

The two alternatives therefore represent two different interpretations of urban regeneration:

regeneration through the transformation of existing resources, in Option A, and regeneration through replacement and spatial reorganisation, in Option B.

Neither approach can be considered preferable exclusively on the basis of the resulting architectural form.

The theoretical discussion developed in Chapter 1 and the urban analysis of Chapter 2 indicate that regeneration must be evaluated through the interaction of several dimensions. Land-use efficiency, environmental performance, accessibility, open-space quality, compatibility with neighbouring properties, material consumption and economic feasibility all contribute to determining the overall effectiveness of a redevelopment strategy.

One of the first issues concerns the relationship between retention and resource consumption. Reusing an existing structure can reduce demolition and preserve part of the material investment already embedded in the site. However, these advantages depend on the degree of transformation required to accommodate the new function.[41] If extensive structural, spatial or technical modifications become necessary, the effective benefits of retention may be reduced.

Complete redevelopment creates the opposite condition. New construction allows the building to respond more directly to contemporary residential requirements, but requires the replacement of an existing material stock and therefore generates additional demolition waste, new construction materials and associated economic costs.

A second issue concerns development intensity.

The sustainable use of already urbanised land supports the principle of concentrating new development within existing settlements rather than generating further outward expansion. However, density cannot be evaluated independently from the quality of the environment it produces. The sustainable-neighbourhood principles discussed by UN-Habitat similarly associate density with accessibility, connected street systems, adequate public and open spaces and a diversity of urban functions.[38]

For Don Leoni, greater residential capacity is therefore not automatically equivalent to better urban performance. The amount of floor area produced must be assessed together with the proportion and configuration of open space, the relationship with neighbouring buildings and the quality of pedestrian circulation.

A third dimension concerns the relationship between mobility and ground-level space.

Option A relies more strongly on surface parking. This reduces the need for underground construction but introduces a greater presence of vehicles within the everyday external environment of the residential development. Landscape design and the organisation of pedestrian routes consequently become particularly important in preventing parking from dominating the site.

Option B relocates a significant component of resident parking underground. This allows greater freedom in organising the surface around planted and pedestrian functions, but requires excavation and additional structural construction.

The comparison therefore cannot be reduced to a simple opposition between surface and underground parking. Each solution produces benefits and costs at different scales. The appropriate criterion is the overall balance between accessibility, use of ground-level space, construction impact and economic feasibility.

The same principle applies to the environmental performance of the open spaces.

The amount of deep-soil and planted surface represents an important indicator, but it does not fully describe the environmental quality of the alternatives. Continuity, location, capacity to support trees, relationship with pedestrian routes and interaction with buildings and parking are equally relevant.

As discussed through the concept of green infrastructure, vegetation performs ecological and social functions when it is understood as part of an interconnected spatial system rather than as isolated decorative surfaces.[34] The comparative evaluation must therefore consider both the quantitative provision of green area and the way in which that area contributes to the overall organisation of the site.

Another important dimension concerns the relationship with the surrounding neighbourhood.

Option A maintains part of the physical continuity of the former public site through the retention of the school building. Its configuration is more articulated and produces a sequence of spaces between existing and new volumes.

Option B establishes a more unified residential environment, with a clearer internal spatial hierarchy generated by the new U-shaped configuration.

These differences affect the relationship between the development and its boundaries, the degree of openness towards the surrounding streets and the way collective residential space is defined.

Neither openness nor enclosure represents an absolute measure of quality. A more open configuration can support stronger relationships with the surrounding urban fabric, but may provide less spatial definition internally. A more enclosed arrangement may reinforce residential identity and privacy, but risks becoming more introverted if connections with the neighbourhood are weak.

The relevant question is therefore how effectively each alternative establishes a balanced transition between public, collective and private space.[39]

These considerations demonstrate that no single indicator can determine the preferred solution.

Greater floor area does not automatically represent better regeneration. Retaining an existing building is not automatically the most sustainable strategy. Underground parking does not necessarily produce the lowest environmental impact simply because it improves the organisation of the surface.

Each benefit must be considered together with the resources, compromises and impacts required to obtain it.

For this reason, the following chapter moves from design description to a comparative and multi-criteria evaluation. The two alternatives are assessed according to a common framework derived directly from the theoretical principles introduced in Chapter 1, the urban and socio-environmental findings of Chapter 2 and the design strategies developed in the present chapter.

The comparison addresses the economic implications of reuse and replacement, the different levels of construction and demolition required, the organisation of parking and open space, environmental performance, compatibility with neighbouring properties and the broader contribution of each proposal to the regeneration of the site.

This methodological sequence is essential to the research. The preferred alternative is not determined by an initial ideological preference for preservation or demolition. It emerges from the extent to which each strategy responds to the same regeneration objectives and from the balance between its advantages and limitations.

The Don Leoni project therefore provides a specific case through which a broader planning question can be investigated: under which conditions can adaptive reuse represent a more effective strategy than complete redevelopment, and when can the spatial advantages offered by replacement justify the loss of the existing structure?

Chapter 4 addresses this question through the systematic comparison of the two alternatives and leads to the identification of the strategy that provides the most balanced response to the urban, environmental and economic conditions of the site.

# 5. CHAPTER 4 - COMPARATIVE EVALUATION AND SELECTION OF THE PREFERRED OPTION

The two redevelopment alternatives developed in Chapter 3 represent different responses to the same urban-regeneration problem. Option A is based on the adaptive reuse of the former Don Leoni school combined with a new residential addition, while Option B replaces the existing structure and reorganises the property through a completely new residential complex.

The comparison developed in this chapter moves beyond a purely dimensional or architectural assessment. The amount of floor area produced, the number of dwellings and the efficiency of individual layouts are relevant, but they are not sufficient to determine the effectiveness of an urban-regeneration strategy. As discussed throughout the previous chapters, redevelopment also involves the use of existing resources, land consumption, accessibility, environmental performance, economic feasibility and the relationship between the intervention and the surrounding neighbourhood.

This distinction is particularly important for the former Don Leoni site because both alternatives are technically plausible and respond to the same planning framework. The difference between them does not lie in whether redevelopment is possible, but in how transformation is achieved and which consequences it generates.

Option A preserves part of the existing material and spatial structure of the site but accepts the limitations involved in converting a building originally designed for another function. Option B removes these constraints and provides greater freedom to organise housing, circulation, parking and open spaces, but requires complete demolition, a larger amount of new construction and a more intensive transformation process.

The evaluation therefore addresses the two alternatives as different planning strategies rather than competing architectural solutions.

This type of decision inevitably involves criteria that cannot be expressed through one common unit of measurement. Economic cost, environmental performance, neighbourhood compatibility and spatial quality cannot be reduced to a single quantitative indicator. Multi-criteria evaluation is particularly useful in this context because it makes it possible to structure complex planning decisions by identifying different objectives and making the trade-offs between them explicit.[43]

The purpose of the chapter is consequently not to demonstrate that one redevelopment model is universally superior to the other. Instead, it seeks to determine which strategy provides the most balanced response to the specific conditions of the former Don Leoni site and its surrounding neighbourhood.

## 5.1 Evaluation methodology

The comparative assessment adopts a qualitative and semi-quantitative methodology appropriate to the preliminary planning and design stage of the research.

The evidence developed in the previous chapters provides the basis for the evaluation. Chapter 1 established the theoretical framework concerning urban regeneration, adaptive reuse, housing and sustainability. Chapter 2 identified the morphological, environmental, mobility and socio-demographic conditions surrounding the site. Chapter 3 translated these findings into two alternative redevelopment strategies.

The evaluation therefore represents the final step in a sequence that moves from theory to analysis, from analysis to design, and from design to critical assessment.

Five main dimensions are considered:

urban and planning performance, environmental performance, economic feasibility, neighbourhood impact, and residential and functional performance.

Urban and planning performance evaluates how effectively each proposal uses the available development capacity while remaining compatible with the surrounding morphology, planning framework, accessibility conditions and organisation of open space.

Environmental performance considers both the final configuration of the site and the transformation process required to achieve it. The assessment therefore includes the retention or demolition of existing structures, intensity of new construction, underground occupation, deep-soil provision and the relationship between parking, vegetation and permeable surfaces.

Economic feasibility evaluates the preliminary investment associated with the two transformation strategies. Particular attention is given not only to total cost but also to the uncertainty associated with the conversion of the existing building.

Neighbourhood impact examines how the alternatives relate to the surrounding residential fabric. This includes permanent spatial effects, pedestrian accessibility, relationship with neighbouring properties and the public realm, as well as temporary construction disturbance.

Residential and functional performance concerns the broader adaptability and organisational flexibility of the two proposals. It deliberately receives less emphasis because the objective of the thesis is not to establish which alternative provides the most efficient individual apartment layouts.

The weighting system reflects this disciplinary focus.

Urban and planning performance and environmental performance each represent 25% of the final assessment. Economic feasibility and neighbourhood impact each represent 20%, while residential and functional performance accounts for the remaining 10%.

Taken together, the urban, environmental and neighbourhood dimensions therefore account for 70% of the evaluation. This ensures that the final result reflects the urban-planning objectives of the research rather than being dominated by architectural or real-estate considerations.

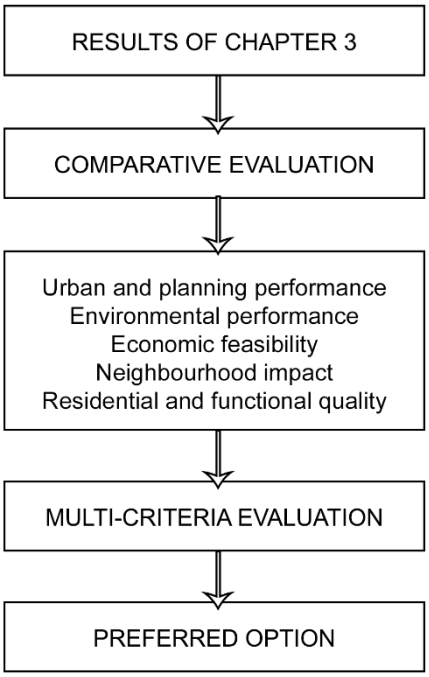



*Figure 33 - Comparative evaluation framework. Source: Author's elaboration based on multi-criteria evaluation approach of Nijkamp, Rietveld & Voogd (1990).*

The assessment proceeds progressively. The two alternatives are first compared through a quantitative baseline. Their differences are subsequently interpreted through environmental, economic and neighbourhood criteria. The findings are finally combined through a weighted multi-criteria matrix.

Each evaluation dimension is scored from **1 to 5**, where 1 represents very poor performance and 5 represents very good performance.

The weighted value is calculated according to the following formula:

Weighted score = (assigned score / 5) × criterion weight

The resulting values should not be interpreted as objectively measured performances. They represent structured judgements based on the available evidence.

This distinction is important. Multi-criteria evaluation does not eliminate value judgements from planning decisions; rather, it makes them explicit and therefore open

to interpretation and discussion.[43] A different weighting system could legitimately produce a different ranking if the objectives of the redevelopment were changed.

The matrix is consequently used as a decision-support instrument, not as an automatic decision-making mechanism.

## 5.2 Baseline quantitative comparison

The first stage of comparison establishes the main physical differences between the two alternatives.

Both proposals are developed on the same 2,781.25 m² lot and respond to the same planning framework. They nevertheless differ substantially in the treatment of the existing building, development intensity, parking strategy and relationship between above-ground and underground occupation.

Option A retains the former school and combines its conversion with a new residential volume. The existing building contributes 890.00 m² of GFA, while the new construction adds 716.13 m², producing a total project GFA of 1,606.13 m².

Option B removes the existing school and develops the entire residential programme through new construction, reaching a total GFA of 2,033.94 m².

| Parameter | Option A | Option B |
|---|---|---|
| Intervention strategy | Adaptive reuse and extension | Complete redevelopment |
| Total project GFA | 1,606.13 m² | 2,033.94 m² |
| Use of available GFA | 77.0% | 97.5% |
| Total dwellings | 19 | 25 |
| Theoretical inhabitants | 32 | 41 |
| Parking spaces | 36 | 48 |
| Deep-soil green area | 1,121.00 m² | 1,025.13 m² |
| Deep-soil green ratio | 40.3% | 36.9% |
| Building footprint | 1,028.00 m² | 1,056.00 m² |
| Underground occupation | 0.00 m² | 1,323.00 m² |
| Treatment of the former school | Retained and converted | Demolished |

*Table 4 - Baseline quantitative comparison*
*Source: Author's calculations based on project data and the planning parameters adopted for the former Don Leoni site.*

Option A uses approximately 77.0% of the available development capacity, while Option B reaches approximately 97.5%.

The second alternative therefore makes substantially more intensive use of the development potential of the lot. It provides 25 dwellings for 41 theoretical inhabitants, compared with 19 dwellings and 32 theoretical inhabitants in Option A.

This difference is important from a planning perspective.

More intensive use of an already urbanised property can contribute to reducing pressure for outward urban expansion. Compact development and appropriate density are recognised as important components of more sustainable neighbourhood planning. However, density cannot be interpreted independently from accessibility, open-space quality, infrastructure and environmental performance.[38]

The relevant question is therefore not simply which alternative produces more floor area, but whether the additional residential capacity generates an overall improvement sufficient to justify the greater physical transformation required to achieve it.

Parking provision illustrates this difference particularly clearly.

Option A accommodates 36 parking spaces at ground level, whereas Option B provides 48 spaces through an underground parking system.

The relationship between residential capacity and parking provision remains broadly comparable, but the spatial implications are considerably different.

In Option A, parked vehicles remain a visible component of the everyday external environment. Their integration therefore depends strongly on planting, pedestrian organisation and the distribution of open space.

Option B largely removes parking from the ground plane, but this advantage requires 1,323.00 m² of underground construction, corresponding to approximately 47.6% of the lot.

Deep-soil provision also differs.

Option A provides 1,121.00 m², corresponding to 40.3% of the lot, while Option B provides 1,025.13 m², corresponding to 36.9%. Both alternatives exceed the adopted minimum requirement of 35%, but Option A provides approximately 95.87 m² more deep-soil surface.

By contrast, the difference in building footprint is relatively limited. Option A occupies 1,028.00 m², or approximately 37.0% of the lot, while Option B occupies 1,056.00 m², or approximately 38.0%.

This suggests that the principal distinction between the alternatives does not concern building coverage alone.

It concerns the combination of development intensity, treatment of the existing building, organisation of parking and occupation of the subsurface.

The quantitative comparison therefore establishes a series of trade-offs rather than an immediate ranking.

## 5.3 Environmental and land-use performance

The environmental comparison considers both the final condition of the project and the physical transformation required to achieve it.

This distinction is fundamental when comparing adaptive reuse and complete redevelopment.

A new building can potentially achieve high operational performance because its envelope, orientation, technical systems and structural configuration can be optimised from the beginning. Adaptive reuse, however, has the potential to reduce demolition, material replacement and the demand for entirely new construction.

The environmental value of existing buildings is increasingly connected to the principles of circularity within the construction sector. Extending building lifespans and adapting existing structures can reduce the demand for new materials and limit part of the embodied impacts associated with demolition and replacement.[44]

This perspective is particularly relevant to Option A.

The strategy retains 890.00 m² of existing GFA and limits new construction to 716.13 m². The former school is therefore interpreted not only as an inherited spatial constraint but also as a stock of materials and embodied resources that remain available for future use.

Retention avoids complete demolition and reduces the amount of new above-ground construction required to reactivate the property.

However, this environmental advantage cannot be assumed automatically.

The school was not designed for residential use. Its conversion may require structural strengthening, seismic adaptation, energy upgrading, modification of the building envelope and replacement of technical systems. The extent of these interventions can only be determined through more detailed investigations.

The environmental performance of reuse therefore depends on the actual adaptability and technical condition of the existing structure, reinforcing the context-dependent interpretation of adaptive reuse developed in Chapter 1.[41]

Option B represents the opposite strategy.

Removing the former school allows the new residential complex to be designed as one coordinated system. Structural design, orientation, envelope characteristics and technical installations can be optimised according to contemporary requirements.

This provides a potential advantage in relation to operational performance.

At the same time, the strategy requires complete demolition of the existing building, 2,033.94 m² of new above-ground construction and a 1,323.00 m² underground parking structure.

The environmental implications therefore extend beyond demolition waste. New structures require extraction, production and transport of additional materials, while underground construction introduces excavation, reinforced structural elements and a more intensive transformation of the soil.

The European Level(s) framework emphasises the importance of evaluating buildings through a broader life-cycle perspective, including greenhouse-gas emissions, material and resource use, adaptability and end-of-life processes.[45]

A complete Life Cycle Assessment would therefore provide the most rigorous means of comparing the two alternatives.

Such an assessment is beyond the scope of this thesis because verified quantities, material specifications, energy simulations and life-cycle scenarios are not available at the required level of detail.

For this reason, no numerical carbon-saving claim is attributed to either proposal.

The environmental evaluation remains comparative rather than carbon-accounting based.

| Indicator | Option A | Option B |
|---|---|---|
| Existing structure retained | 890.00 m² retained | No existing structure retained |
| New-build GFA | 716.13 m² | 2,033.94 m² |
| Complete demolition | No | Yes |
| Deep-soil green area | 1,121.00 m² | 1,025.13 m² |
| Deep-soil green ratio | 40.3% | 36.9% |
| Building coverage ratio | 37.0% | 38.0% |
| Underground occupation | 0.00 m² | 1,323.00 m² |
| Underground occupation ratio | 0.0% | 47.6% |
| Material conservation | Higher | Lower |
| Potential energy performance | Existing building requires upgrading | Entirely new envelope |
| Construction intensity | Moderate | High |

*Table 5 - Environmental and land-use performance*
*Source: Author's elaboration based on project data, European Environment Agency (2022) and the European Commission Level(s) framework.*

Environmental performance also concerns the relationship between the project and the ground on which it is developed.

As discussed in Chapters 2 and 3, green space should not be evaluated solely through its total percentage. Its continuity, capacity to support planting and trees, relationship with pedestrian spaces and interaction with building and parking systems also affect its environmental quality.[34]

Option A provides the larger deep-soil surface and avoids all underground occupation. This maintains a more direct relationship between a greater proportion of the unbuilt site and natural soil.

Its principal limitation is the stronger presence of vehicles at ground level. Surface parking competes spatially with pedestrian and planted areas and therefore requires careful landscape integration.

Option B reduces the visibility of cars and provides greater freedom in organising the surface around pedestrian and landscaped functions. However, a substantial proportion of the site is occupied below ground by the parking structure.

The environmental comparison therefore reveals a fundamental trade-off:

Option A limits the physical intensity of construction but requires greater coexistence between vehicles and open space at ground level; Option B improves the spatial freedom of the ground plane through a significantly more intensive transformation below it.

Overall, Option A performs more positively in relation to material conservation, limitation of demolition, reduced new construction, deep-soil provision and absence of underground occupation.

Option B performs more positively in terms of technical design freedom and the possibility of optimising the operational performance of an entirely new building.

The result does not demonstrate that reuse is environmentally superior in absolute terms. It suggests that, provided the existing structure can be adapted without disproportionate intervention, Option A achieves the redevelopment objective through a lower level of physical and material transformation.

## 5.4 Preliminary economic feasibility

Economic feasibility provides another essential dimension of the comparison.

The assessment is developed as a preliminary parametric estimate, rather than as a detailed bill of quantities. Its purpose is therefore not to establish the definitive construction price of either alternative but to identify the different investment implications generated by reuse and complete redevelopment.

Project quantities derive from the design alternatives, while the adopted unit costs are aggregated planning-level values calibrated against the Regione Lombardia 2026 Regional Public Works Price List and broader construction-market references.[46] [47]

The regional price list provides detailed official prices for individual construction resources and works, rather than a single turnkey cost per square metre for an entire residential building. Consequently, the macro-rates used in the thesis should be

understood as author-adopted parametric assumptions, not as official residential construction prices.

The estimate includes the principal direct components that distinguish the two strategies:

renovation and residential conversion, new above-ground construction, demolition, underground parking, surface parking and circulation, and deep-soil landscaping.

VAT, land acquisition, professional fees, municipal charges, financing costs, utility connections, environmental remediation, furniture and development revenue are excluded.

A 10% contingency allowance is applied to both alternatives in order to reflect the preliminary level of design and the uncertainty of the available information.

| Cost component | Low scenario | Base scenario | High scenario |
|---|---|---|---|
| Existing-building renovation and conversion | €1,250/m² | **€1,450/m²** | €1,700/m² |
| New residential construction | €1,700/m² | **€1,900/m²** | €2,150/m² |
| Complete demolition and standard disposal | €120/m² | **€160/m²** | €220/m² |
| Underground parking construction | €750/m² | **€900/m²** | €1,100/m² |
| Surface parking and circulation | €90/m² | **€120/m²** | €150/m² |
| Deep-soil landscaping | €40/m² | **€55/m²** | €75/m² |

*Table 6 - Adopted parametric unit costs*
*Source: Author's parametric elaboration based on Regione Lombardia (2026) and Turner & Townsend (2025).*

Three scenarios are used: low, base and high.

The low scenario represents favourable construction conditions, the base scenario provides the central working estimate and the high scenario reflects greater technical complexity and cost uncertainty.

Using a range rather than a single value is particularly relevant to adaptive reuse because the exact cost of converting the former school depends on conditions that cannot be fully verified at this stage.

### 5.4.1 Cost estimate for Option A

The cost structure of Option A combines refurbishment and new construction.

The proposal involves the renovation and residential conversion of 890.00 m² of existing GFA, the construction of 716.13 m² of new residential floor area, 825.70 m² of surface parking and circulation, and 1,121.00 m² of deep-soil landscaping.

No complete demolition or underground parking is required.

Selective removal and internal demolition associated with the conversion of the former school are assumed within the adopted renovation rate in order to avoid double counting.

| Cost component | Quantity | Base unit cost | Estimated cost |
|---|---|---|---|
| Renovation and conversion of former school | 890.00 m² | €1,450/m² | €1,290,500.00 |
| New residential construction | 716.13 m² | €1,900/m² | €1,360,647.00 |
| Surface parking and circulation | 825.70 m² | €120/m² | €99,084.00 |
| Deep-soil landscaping | 1,121.00 m² | €55/m² | €61,655.00 |
| Underground parking | 0.00 m² | — | — |
| Complete demolition | 0.00 m² | — | — |
| Direct works subtotal | | | €2,811,886.00 |
| Contingency (10%) | | | €281,188.60 |
| **Total estimated cost – Option A** | | | **€3,093,074.60** |

*Table 7 - Preliminary cost estimate - Option A*
*Source: Author's calculations based on project quantities and the parametric unit costs adopted in Table 6.*

In the base scenario, renovation and residential conversion account for approximately €1.29 million, while the new residential addition represents approximately €1.36 million.

Surface parking and circulation are estimated at approximately €99,084, while deep-soil landscaping represents approximately €61,655.

The direct-works subtotal is approximately €2.81 million. After the 10% contingency allowance, the base estimated construction cost reaches approximately €3.09 million.

The principal economic strength of Option A lies in its lower overall volume of new construction and in the absence of complete demolition and underground parking.

Its principal weakness is uncertainty.

Existing buildings may contain conditions that cannot be identified through preliminary drawings alone. Structural deficiencies, extensive seismic works or more demanding energy upgrading could increase the cost of conversion substantially.

The economic advantage of Option A should therefore be considered conditional on the results of detailed structural and technical surveys.

This uncertainty is not a secondary issue. It represents one of the main differences between adaptive reuse and new construction: reuse potentially avoids significant capital expenditure but accepts a greater level of uncertainty associated with the inherited building.

### 5.4.2 Cost estimate for Option B

Option B concentrates most of its investment in new construction.

The proposal requires complete demolition of the 890.00 m² former school, construction of 2,033.94 m² of new residential GFA, a 1,323.00 m² underground parking level and 1,025.13 m² of deep-soil landscaping.

Surface resident parking is not calculated as an additional independent component because the principal parking provision is already incorporated into the underground structure, avoiding duplication of the same function within the cost assessment.

| Cost component | Quantity | Base unit cost | Estimated cost |
|---|---|---|---|
| Complete demolition of former school | 890.00 m² | €160/m² | €142,400.00 |
| New residential construction | 2,033.94 m² | €1,900/m² | €3,864,486.00 |
| Underground parking structure | 1,323.00 m² | €900/m² | €1,190,700.00 |
| Deep-soil landscaping | 1,025.13 m² | €55/m² | €56,382.15 |
| Surface parking separately calculated | — | — | — |
| Existing-building renovation | — | — | — |
| Direct works subtotal | | | €5,253,968.15 |
| Contingency, 10% | | | €525,396.82 |
| **Total estimated cost – Option B** | | | **€5,779,364.97** |

*Table 8 - Preliminary cost estimate - Option B*
*Source: Author's calculations based on project quantities and the parametric unit costs adopted in Table 6.*

The new-build strategy provides greater cost predictability because most building systems can be defined independently of the conditions of the former school.

However, this greater predictability does not imply a lower investment.

The project requires a larger volume of new residential construction and introduces two cost components absent from Option A: complete demolition and underground parking.

The underground level is particularly significant because its cost includes not only the parking surface itself, but also excavation, retaining elements, foundations, structural slabs, ramp construction, drainage and technical systems.

The improved organisation of parking at ground level is therefore achieved through a substantial investment below ground.

This relationship demonstrates again why individual design advantages need to be interpreted together with the resources required to produce them.

### 5.4.3 Comparative economic interpretation

The economic comparison should not be reduced to the difference between two total project costs.

Option B provides a larger residential GFA and six additional dwellings. A higher total construction cost is therefore partly associated with greater development capacity.

For this reason, the comparison considers different indicators and three cost scenarios.

| Scenario | Option A | Option B | Difference B - A |
|---|---|---|---|
| Low | €2,693,981.40 | €5,057,528.52 | +€2,363,547.12 |
| **Base** | **€3,093,074.60** | **€5,779,364.97** | **+€2,686,290.37** |
| High | €3,586,670.45 | €6,711,051.33 | +€3,124,380.88 |

*Table 9 - Preliminary cost scenarios*
*Source: Author's calculations based on the low, base and high parametric cost scenarios.*

Across all three scenarios, Option A remains the less expensive alternative.

The low scenario produces an estimated total of approximately €2.69 million for Option A and €5.06 million for Option B.

In the base scenario, the estimates rise to approximately €3.09 million and €5.78 million respectively.

In the high scenario, the total reaches approximately €3.59 million for Option A and €6.71 million for Option B.

The difference therefore remains substantial throughout the sensitivity range, at approximately €2.4–3.1 million.

In the base scenario, Option B requires approximately 86.9% more capital investment than Option A.

This premium is primarily explained by the larger amount of new residential construction and the underground parking structure.

However, this result should not be interpreted as evidence that Option B is economically inefficient in absolute terms.

The alternative also provides greater residential capacity and a completely new building system. The relevant finding is instead that the additional capacity and spatial freedom require a considerably higher initial investment.

| Indicator | Option A | Option B |
|---|---|---|
| Total estimated cost | €3,093,074.60 | €5,779,364.97 |
| Cost per project GFA | €1,925.79/m² | €2,841.46/m² |
| Cost per dwelling | €162,793.40 | €231,174.60 |
| Cost per theoretical inhabitant | €96,658.58 | €140,960.12 |

*Table 10 - Economic performance indicators*
*Source: Author's calculations based on the base cost scenario and project quantities*

When total base construction cost is divided by above-ground project GFA, Option A records approximately €1,925.79/m², while Option B reaches approximately €2,841.46/m².

The comparison requires some caution because the Option B figure includes the cost of underground parking in the numerator while the underground floor area is not included in residential GFA.

A complementary indicator is therefore useful.

| Complementary indicator | Option B |
|---|---|
| Cost per total above and below ground constructed area | €1,721.62/m² |

*Table 11 - Complementary economic indicator for Option B.*
*Source: Author's calculation based on the total above- and below-ground constructed area of Option B.*

When the underground level is included in the total constructed surface, the Option B indicator decreases to approximately €1,721.62/m².

This value does not replace the previous indicator. It provides an additional interpretation of where the greater investment is concentrated.

At dwelling level, the base estimate corresponds to approximately €162,793 per dwelling for Option A and €231,175 per dwelling for Option B.

These figures reinforce the relative economic advantage of Option A at the current stage of analysis.

Nevertheless, none of these indicators represents development profitability.

The assessment does not include selling prices, rental revenues, financing conditions, land value or discounted cash-flow analysis. The results therefore describe construction feasibility and investment intensity, not the financial return of the redevelopment.

## 5.5 Urban and neighbourhood impact

The urban and neighbourhood assessment is central to the thesis because the redevelopment has progressively been interpreted not simply as the transformation of a building, but as the reactivation of a former public site within an existing residential district.

Chapter 2 demonstrated that the neighbourhood contains a significant range of services and vegetation but is also affected by infrastructural barriers and discontinuities in pedestrian and green networks.

Chapter 3 translated these findings into a strategy based on improved local accessibility, continuity of planted areas, careful treatment of site boundaries and a stronger relationship between the redevelopment and the surrounding public realm.

The two alternatives should therefore be evaluated according to their capacity to contribute to these objectives.

Urban quality cannot be described only through dimensions or regulatory compliance. Carmona emphasises the importance of relationships between built form, movement, use and the interfaces between public and private domains in determining the quality of urban space.[39]

This perspective is particularly relevant to Don Leoni because the alternatives differ strongly in the relationship they create between buildings, open space, parking and neighbourhood edges.

| Criterion | Option A | Option B | Comparative interpretation |
|---|---|---|---|
| **Compatibility with surrounding heights** | Two-storey existing building combined with a new volume of up to three storeys | Entirely new complex of up to three storeys | Both respect the prevailing two- and three-storey context |
| **Relationship with existing urban identity** | Former school retained and converted | Former school completely removed | Option A preserves a recognisable element of the site |
| **Intensity of redevelopment** | 1,606.13 m² GFA and 32 theoretical inhabitants | 2,033.94 m² GFA and 41 theoretical inhabitants | Option B introduces greater density and settlement pressure |
| **Visual transformation** | Gradual combination of existing and new volumes | Complete replacement through a unified U-shaped complex | Option B produces a more substantial change in the image of the site |
| **Building footprint** | 1,028.00 m² | 1,056.00 m² | The difference in ground-level occupation is limited |
| **Relationship with neighbouring properties** | Two separate volumes allow differentiated setbacks and visual relationships | Continuous new configuration requires careful treatment of façades and boundaries | Both require privacy measures; Option B has a larger and more continuous built mass |
| **Potential overlooking** | Limited through façade orientation, setbacks and planting | To be controlled along the wings of the U-shaped building | Direct views towards private gardens should be reduced in both options |
| **Pedestrian accessibility** | Central pedestrian access connecting the retained and new buildings | Pedestrian access leading towards the central space of the new complex | Both provide clear pedestrian access |
| **Vehicular movement** | 36 surface parking spaces | 48 parking spaces within the underground system | Option B generates greater parking capacity but removes most cars from ground level |
| **Surface parking impact** | Greater visual presence of cars at ground level | Lower presence of parked vehicles within external residential spaces | Option B provides a clearer ground-level open-space arrangement |
| **Construction disturbance** | Renovation and limited new construction, without underground parking excavation | Complete demolition, full new construction and excavation for underground parking | Option B generates greater temporary noise, dust and construction traffic |
| **Preservation of local memory** | Higher | Lower | Option A maintains the former school as part of the new development |
| **Spatial coherence** | Relationship between two architecturally distinct buildings | Unified architectural and circulation system | Option B offers greater formal and functional unity |

*Table 12 - Urban and neighbourhood impact*
*Source: Author's comparative assessment based on the analyses developed in Chapters 2 and 3*

Option A produces a more incremental transformation.

The two-storey former school remains a recognisable component of the property, while the new residential addition introduces additional capacity without eliminating the entire previous spatial configuration.

The resulting relationship between existing and new buildings generates different setbacks and open areas rather than a single uniform building edge.

This provides opportunities to respond selectively to the surrounding conditions and contributes to a gradual transition between the redevelopment and neighbouring residential properties.

The continuity generated by retaining the former school should not be interpreted as formal heritage preservation.

The building is not retained because the thesis has established an exceptional architectural value. Its significance derives instead from its material presence and from its role as an existing element of a former public site.

Option A therefore allows the property to change function without completely erasing its previous physical condition.

Option B produces a different form of urban value.

The U-shaped residential complex creates a stronger and more unified spatial identity. Building form, circulation, entrances and central open space can be designed as one coordinated system rather than negotiated around an inherited structure.

This results in greater internal coherence.

At the same time, Option B represents a more complete physical break with the existing condition and introduces a larger residential intensity.

The distinction between the proposals can therefore be understood as a contrast between incremental adaptation and complete spatial reconfiguration.

Neither strategy is intrinsically superior.

Incremental transformation can support continuity but also preserve some of the limitations of the existing building.

Complete redevelopment can achieve greater spatial coherence but removes the existing material reference and intensifies the degree of physical intervention.

Pedestrian accessibility provides another important dimension.

Both alternatives organise pedestrian entrances in relation to the surrounding street network and respond to the accessibility principles identified in Chapter 2.

Their main difference concerns the role of vehicles within the ground plane.

Option A requires surface parking to coexist with planted and pedestrian areas. The quality of the external environment therefore depends heavily on the organisation and landscape integration of vehicle circulation.

Option B relocates most parking underground and consequently provides greater freedom in organising the surface around pedestrian and landscaped functions.

This represents an urban-design advantage, although the environmental and economic implications of achieving it through underground construction remain substantial.

The relationship with neighbouring residential properties also requires consideration.

Both alternatives remain within the maximum height of three above-ground storeys and comply with the dimensional framework adopted for the project.

However, Option B combines higher development intensity with a more continuous building configuration. Its relationship with neighbouring gardens and dwellings therefore requires particular attention to setbacks, façade orientation, balconies and vegetation.

Option A produces a less continuous arrangement and a lower overall settlement intensity, creating a more gradual transformation of the site.

Urban impact must also be understood temporally.

Neighbouring residents experience not only the completed project but also the transformation process.

Option B involves complete demolition, transportation of demolition material, excavation and construction of the underground level, followed by complete above-ground reconstruction.

These activities are likely to produce a more intensive temporary impact in terms of noise, dust, heavy-vehicle movements and disturbance.

Option A also requires substantial construction activity but avoids complete demolition of the principal structure and underground excavation.

From the perspective of construction disturbance, it therefore represents the more incremental strategy.

The neighbourhood-scale regeneration framework developed in Chapter 3 also provides a broader reference.

The Don Leoni project cannot remove the major railway and road barriers identified in the urban analysis. Its potential influence is more local: improving the interface between the property and surrounding streets, supporting pedestrian continuity, maintaining vegetation and demonstrating how an underused public site can be reintegrated within the neighbourhood.

This reflects the concept of the urban catalyst, according to which the significance of an intervention can lie in its capacity to contribute to a wider process of transformation without necessarily redesigning the whole surrounding area.[40]

Both proposals reactivate the site, but through different mechanisms.

Option A prioritises continuity, selective transformation and lower physical intensity.

Option B prioritises spatial coherence, greater residential capacity and the removal of most parking from ground level.

The comparison therefore concerns different forms of urban value rather than a simple opposition between a good and a bad project.

## 5.6 Multi-criteria evaluation

The preceding sections demonstrate that neither alternative performs more positively in every dimension.

Option A offers important advantages in relation to retention of existing resources, construction intensity, economic feasibility and neighbourhood continuity.

Option B provides greater development capacity, design freedom, functional flexibility and a more complete separation between parking and the ground-level residential environment.

The role of the multi-criteria evaluation is to combine these different performances through one transparent framework.

| Evaluation criterion | Weight |
|---|---|
| Urban and planning performance | 25% |
| Environmental performance | 25% |
| Economic feasibility | 20% |
| Neighbourhood impact | 20% |
| Residential and functional performance | 10% |
| **Total** | **100%** |

*Table 13 - Evaluation criteria and corresponding weights*
*Source: Author's elaboration based on the research objectives and the multi-criteria evaluation approach of Nijkamp, Rietveld & Voogd (1990).*

| Score | Meaning |
|---|---|
| 1 | Very poor performance |
| 2 | Poor performance |
| 3 | Acceptable performance |
| 4 | Good performance |
| 5 | Very good performance |

*Table 14 - Multi-criteria evaluation scale*
*Source: Author's elaboration based on the adopted multi-criteria evaluation methodology.*

The weighting gives the greatest combined importance to urban and environmental performance, reflecting the objectives established at the beginning of the research.

Economic feasibility and neighbourhood impact remain substantial components of the assessment, while residential and functional performance receives a lower weight because detailed architectural optimisation is not the central focus of the thesis.

| Evaluation criterion | Weight | Option A score | Option A weighted result | Option B score | Option B weighted result |
|---|---|---|---|---|---|
| Urban and planning performance | 25% | 4 | 20 | 4 | 20 |
| Environmental performance | 25% | 4 | 20 | 3 | 15 |
| Economic feasibility | 20% | 4 | 16 | 2 | 8 |
| Neighbourhood impact | 20% | 4 | 16 | 3 | 12 |
| Residential and functional performance | 10% | 4 | 8 | 5 | 10 |
| **Total** | **100%** | | **80/100** | | **65/100** |

*Table 15 - Multi-criteria evaluation matrix*
*Source: Author's elaboration and calculations based on the comparative assessment developed in Sections 5.2–5.5.*

Each score is assigned according to the evidence presented in Sections 5.2–5.5.

Urban and planning performance considers development intensity, planning compatibility, accessibility, morphological integration and the organisation of open space.

Environmental performance considers retention of existing resources, demolition, new material demand, deep-soil provision and underground occupation.

Economic feasibility considers total investment, comparative cost indicators and uncertainty.

Neighbourhood impact considers local continuity, construction disturbance, relationship with neighbouring properties and the wider regeneration strategy.

Residential and functional performance considers the general flexibility and adaptability of the residential configuration rather than individual apartment quality.

Option A receives 4 out of 5 in each evaluation dimension.

This does not imply that it performs identically in every respect. Rather, the score reflects a consistently positive but not maximum performance.

Its urban integration and relatively gradual transformation are balanced by lower use of the available development capacity and by the presence of surface parking.

Its environmental advantages are balanced by uncertainty concerning the extent of retrofit required.

Its economic performance is favourable, but the final renovation cost remains dependent on the actual condition of the former school.

The resulting weighted score is 80/100.

Option B receives 4 out of 5 for urban and planning performance because it makes efficient use of the available development capacity and establishes a coherent spatial organisation.

It receives 3 out of 5 for environmental performance, reflecting the benefits of an entirely new building but also the impacts associated with complete demolition, greater new construction and underground occupation.

Economic feasibility receives 2 out of 5 because the proposal requires substantially higher initial capital investment.

Neighbourhood impact receives 3 out of 5, recognising the improved organisation of the ground plane but also the stronger permanent and temporary intensity of transformation.

Residential and functional performance receives 5 out of 5 because complete redevelopment offers the greatest freedom to coordinate circulation, structure and the residential programme.

The resulting weighted score is 65/100.

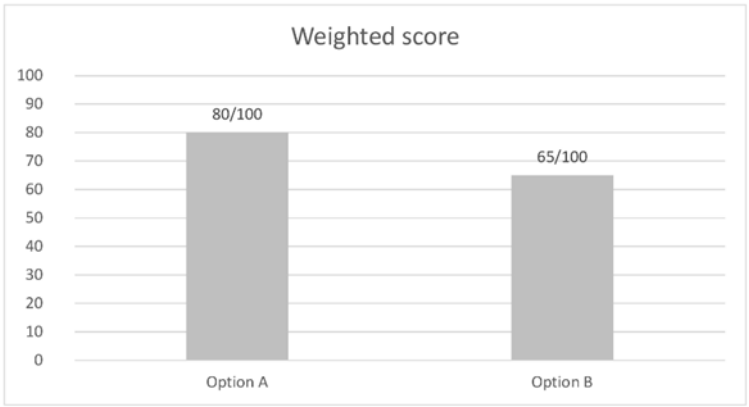



*Figure 34 - Final weighted scores of the two design alternatives. Source: Author's elaboration based on the multi-criteria evaluation matrix.*

The difference between the final scores should not be interpreted as evidence that Option B is unsuitable or non-compliant.

Both proposals represent feasible responses to the redevelopment objective.

The result instead indicates that, under the priorities established by this thesis, the benefits of Option B in terms of development capacity, functional flexibility and ground-level organisation do not fully compensate for its higher economic cost, complete demolition, greater material intensity and stronger construction impact.

The result is also sensitive to the chosen weights.

If maximum housing production, development capacity or private financial return were given substantially greater importance, Option B could obtain a more favourable evaluation.

Conversely, stronger weighting of material conservation or construction impact would reinforce the advantage of Option A.

This sensitivity is not a weakness of the method.

It demonstrates that planning decisions depend on clearly defined objectives and that evaluation criteria should correspond to the values that a particular regeneration strategy seeks to prioritise.[43]

Within the research framework adopted here, the matrix therefore provides a transparent explanation of why Option A achieves the more balanced overall performance.

## 5.7 Preferred option and final considerations

The comparative evaluation identifies Option A – adaptive reuse and extension as the preferred strategy for the redevelopment of the former Don Leoni school site.

With a weighted score of 80/100, compared with 65/100 for Option B, the proposal provides the most balanced response across the urban, environmental, economic, neighbourhood and functional dimensions considered in the research.

The result should not be interpreted as a general demonstration that adaptive reuse is always preferable to demolition and reconstruction.

The preference is site-specific.

Option A performs positively because the retention of the former school can potentially be combined with sufficient additional residential capacity without requiring complete demolition or underground parking.

The strategy retains 890.00 m² of existing GFA, limits new construction to 716.13 m², provides a larger deep-soil area and requires a substantially lower preliminary investment.

At the same time, it maintains a physical element of the former public site and introduces a more gradual transformation in relation to the surrounding residential neighbourhood.

Its principal value therefore lies not in preservation alone, but in the proportionality of the intervention.

Urban regeneration does not necessarily require maximising the physical transformation of a site. An effective strategy may instead introduce sufficient change to reactivate an underused property while avoiding demolition, construction or disruption that is not justified by a corresponding improvement in urban performance.

Option A more closely reflects this principle.

The strategy retains an existing material resource, introduces new housing and reorganises the site without completely replacing its previous physical structure.

This approach corresponds to the interpretation of adaptive reuse developed throughout the thesis: reuse is meaningful when the inherited building can become a productive component of a new urban programme rather than merely surviving as an object to be preserved.[41]

Option B nevertheless remains essential to the research because it demonstrates the real advantages of complete redevelopment.

It provides 2,033.94 m² of residential GFA, uses approximately 97.5% of the available development capacity, creates six additional dwellings and provides greater freedom to organise circulation and residential functions.

Its underground parking solution also improves the continuity and legibility of the ground-level open spaces.

The comparison is meaningful precisely because these benefits are significant.

The final decision therefore depends on whether the additional advantages provided by Option B are sufficient to justify the resources required to obtain them.

Within the criteria adopted in this thesis, they are not.

The additional residential capacity and design freedom are associated with complete demolition, a substantially larger quantity of new construction, 1,323.00 m² of underground occupation and a considerably higher preliminary construction cost.

The evaluation therefore suggests that the marginal benefits of maximum development intensity do not outweigh the combined environmental, economic and neighbourhood implications of complete replacement in this specific case.

The preference for Option A must nevertheless remain conditional.

A detailed structural, seismic, material and energy assessment of the former school would be required before adaptive reuse could be confirmed as technically feasible.

If future investigation revealed severe deterioration, contamination, major structural incompatibility or renovation costs substantially greater than those considered within the high-cost scenario, the relationship between the alternatives could change.

This condition is essential to the argument of the thesis.

Adaptive reuse is not treated as an ideological objective.

The research instead suggests that retention becomes particularly valuable when the existing structure is sufficiently adaptable to accommodate a new programme without disproportionate technical, environmental or economic intervention.

Where this condition is absent, replacement may represent a legitimate and potentially more effective strategy.

The limitations of the environmental assessment should be interpreted in a similar way.

No complete Life Cycle Assessment or operational-energy simulation was carried out, and the thesis therefore does not claim a precise carbon advantage for Option A.[45] The environmental preference is based on the relative intensity of demolition, new construction, underground occupation and material transformation.

The economic analysis is also preliminary. It compares construction strategies but does not constitute a full financial feasibility study. Land value, taxation, professional fees, financing, revenues and development return would need to be incorporated before determining the attractiveness of either alternative to a specific public or private actor.

The multi-criteria assessment therefore provides a planning-level decision rather than a final implementation decision.

Within these limitations, Option A is the proposal that most closely reflects the principles established throughout the thesis.

It reactivates an already urbanised site, introduces new residential capacity, retains an existing material resource, maintains a substantial green component and limits the intensity of transformation in relation to the surrounding neighbourhood.

The preferred strategy consequently prioritises balanced regeneration over maximum exploitation of development capacity.

The wider significance of this result extends beyond the selection of one alternative for Don Leoni. The case raises a broader question concerning the conditions under which adaptive reuse should be preferred to complete redevelopment in the transformation of disused public buildings.

The answer to this wider research question is developed in the Conclusions, where the findings of the case study are related back to the theoretical framework and used to identify the broader implications of the research.

## 6. CONCLUSIONS

This thesis investigated the redevelopment of the former Don Leoni school site in Mantua as a case through which to explore a broader question concerning the transformation of disused public buildings within consolidated urban areas. Rather than considering the property exclusively as an obsolete building requiring a new function, the research approached it as part of an existing neighbourhood and therefore as a potential component of a wider process of urban regeneration.

This perspective represents the central methodological position of the study. Urban regeneration cannot be reduced to the physical replacement or refurbishment of individual buildings. It concerns the interaction between existing resources, land use, accessibility, environmental systems, housing, public and collective spaces and the spatial relationships that connect an intervention to its surroundings.[1] [5] The transformation of a former public facility therefore becomes relevant not only because of what happens within its plot, but also because of the way in which the site is reconnected to the ordinary functioning of the city.

The theoretical framework developed in Chapter 1 demonstrated that adaptive reuse has gained increasing relevance within this discussion. Extending the useful life of existing buildings can conserve material resources, reduce the need for complete replacement and contribute to the regeneration of already urbanised areas.[2] [3] At the same time, the literature also demonstrates that reuse should not be assumed to represent the most sustainable solution in every situation. Its effectiveness depends on the physical condition of the existing structure, its capacity to accommodate a new programme and the scale of the technical and economic interventions required for its transformation.[4]

This distinction was fundamental to the research methodology. The thesis did not begin from the assumption that the former Don Leoni school should necessarily be preserved. Instead, adaptive reuse was treated as a hypothesis to be tested against a credible alternative based on complete demolition and redevelopment.

The four case studies reinforced this approach from different perspectives. Cenni di Cambiamento demonstrated how residential density can be combined with collective space, landscape and different forms of living. Kalkbreite illustrated the possibility of considering housing as part of a more complex urban system involving accessibility, shared spaces and mobility. Caserne de Reuilly provided an especially relevant example of selective transformation, where existing structures and new construction operate together while the regeneration process modifies the relationship between a formerly enclosed institutional site and the surrounding city. DeFlat Kleiburg demonstrated the potential of retaining an existing structural resource while also highlighting a crucial limitation of adaptive reuse: the effectiveness of retention depends on the actual adaptability of what already exists.

Taken together, these references did not provide architectural models to reproduce at Don Leoni. Instead, they established a set of principles through which the local case could be interpreted: efficient use of already urbanised land, preservation of

meaningful resources, integration between density and open space, accessibility, adaptability and attention to the relationship between the redevelopment site and its neighbourhood.

The urban and territorial analysis developed in Chapter 2 then translated these principles into the specific conditions of Mantua.

The former Don Leoni school is located within an already established urban district characterised by residential uses, existing services and a significant presence of vegetation. Its location therefore provides favourable conditions for residential regeneration without requiring further outward urban expansion.

At the same time, the analysis revealed a more complex spatial structure than a simple description of service proximity might suggest. Railway and road infrastructure create significant discontinuities, green elements are present but not always connected, and different urban grains coexist within a relatively limited area. Accessibility consequently depends not only on distance but also on the continuity and quality of the networks through which everyday movement occurs.

These findings were particularly important in responding to the urban-planning dimension of the research.

The redevelopment of Don Leoni cannot realistically solve the major infrastructural barriers affecting the wider district. A single residential project cannot eliminate the separating effect of the railway or substantially reorganise the larger mobility system. Claiming otherwise would overestimate the influence of the intervention.

Its contribution can instead occur at the scale of the site and immediate neighbourhood.

The project can improve the relationship between the property and surrounding streets, establish clearer pedestrian access, organise parking without allowing vehicles to dominate the residential environment, maintain substantial planted surfaces and strengthen the relationship between the redevelopment and nearby urban functions.

In this sense, the site can operate as a local regeneration node within a wider urban structure. The concept of the urban catalyst is useful here: the significance of a relatively limited intervention can lie in its ability to initiate or reinforce improvements beyond the individual building without requiring comprehensive redevelopment of the entire neighbourhood.[40]

Chapter 3 translated these analytical findings into two alternative spatial strategies.

Option A approached regeneration through adaptive reuse and selective addition. The former school is retained and converted to residential use, while a new volume increases the development capacity of the property and reorganises the relationship between buildings and external spaces.

Option B approached regeneration through replacement and complete spatial reconfiguration. Demolition removes the constraints of the former school and allows buildings, circulation, parking and open areas to be designed as a new coordinated system.

The alternatives consequently represent more than two different building configurations. They test two different interpretations of transformation: working with an inherited structure or replacing it in order to gain greater spatial freedom.

The comparison developed in Chapter 4 demonstrates that both approaches offer legitimate benefits.

Option B makes more intensive use of the available development capacity and provides greater freedom in the organisation of the residential programme. Its underground parking solution reduces the direct presence of vehicles at ground level and allows a more unified relationship between the new building and its external spaces.

These advantages are significant and confirm that complete redevelopment cannot simply be dismissed as the environmentally or urbanistically inferior solution.

However, obtaining them requires a substantially more intensive transformation. Complete demolition eliminates the existing material stock; the entire residential programme must be constructed from new materials; and the underground parking level introduces additional excavation and structural works. The preliminary economic assessment also indicates a significantly larger investment.

Option A does not maximise the theoretical capacity of the site and retains some of the spatial limitations associated with the original school. Its surface-parking strategy also requires greater attention to the relationship between vehicles, pedestrian movement and landscape.

Nevertheless, it achieves the principal objectives of the redevelopment through a lower overall intensity of physical transformation.

The multi-criteria evaluation reflects this balance. Option A reaches a final weighted result of 80/100, compared with 65/100 for Option B. The value of this result lies not in presenting the numbers as an objective mathematical truth, but in making explicit the criteria and priorities through which the two alternatives were assessed.[43]

The evaluation therefore provides a clear answer to the first central question of the research.

For the former Don Leoni site, adaptive reuse represents the preferable redevelopment strategy because the existing building can potentially contribute to a new residential programme while limiting demolition, new construction, underground occupation, initial investment and the intensity of change experienced by the surrounding neighbourhood.

The key word is, however, potentially.

The research does not demonstrate that adaptive reuse is universally preferable to demolition.

The preference for Option A remains conditional on the technical suitability of the former school. Structural, seismic, material and energy investigations are required before implementation. If those studies reveal severe deterioration, significant contamination, major spatial incompatibility or adaptation costs considerably higher than those assumed in the preliminary evaluation, the balance between the alternatives could change.

This condition is essential to the final argument.

The research therefore answers the broader question of when adaptive reuse should be preferred to complete redevelopment in a more nuanced way.

Adaptive reuse becomes particularly effective when three conditions occur simultaneously.

First, the existing building must retain sufficient physical and spatial adaptability to accommodate the new programme without requiring transformations so extensive that retention loses its material or economic advantages.[41]

Second, reuse should produce an identifiable urban benefit. Retaining a building is not sufficient in itself; the intervention must improve the relationship between the property, open spaces, accessibility and the wider neighbourhood.

Third, the environmental and economic resources required for adaptation must remain proportionate to the benefits generated by retention.

When these conditions are absent, demolition and reconstruction can represent a legitimate strategy rather than a failure of sustainable planning.

This leads to one of the principal conclusions of the thesis: the relevant planning question is not simply reuse or demolition, but rather how much transformation is necessary to achieve the desired urban result.

For Don Leoni, the additional capacity and spatial freedom provided by Option B do not appear sufficient to compensate for the greater intensity of demolition, construction, underground occupation and economic investment. Option A therefore provides the more proportionate response to the current conditions of the site.

This conclusion is also consistent with a broader shift towards circular approaches to the built environment, in which existing buildings are increasingly understood as stocks of materials and resources whose continued use should be considered before replacement.[44] [45] However, the thesis deliberately avoids assigning precise carbon

savings to Option A. A complete Life Cycle Assessment would be required to establish the embodied and operational impacts of both alternatives accurately.

Several other limitations should also be acknowledged.

The economic comparison is parametric rather than a detailed bill of quantities and does not include land value, professional fees, financing, revenues or a complete financial feasibility model. The project has not been tested through detailed traffic modelling, and the neighbourhood-scale recommendations concerning pedestrian crossings and public-space improvements would require further technical investigation and coordination with the Municipality of Mantua.

Similarly, the residential programme was informed by demographic tendencies rather than by a specific housing-demand study. A subsequent implementation phase could therefore examine affordability, tenure models and potential public, private or cooperative delivery mechanisms in greater detail.

These limitations do not invalidate the comparative methodology. Instead, they define the boundary between a planning-level investigation and the more detailed studies required for implementation.

Future development of the research should therefore begin with a structural and seismic assessment of the former school, followed by detailed energy analysis and a comparative Life Cycle Assessment. A more advanced economic feasibility study could then test different implementation models. At neighbourhood scale, the pedestrian and green connections identified through the thesis could be developed into a more detailed public-space strategy in collaboration with the municipality and local stakeholders.

The broader contribution of the Don Leoni case lies precisely in this relationship between site transformation and neighbourhood regeneration.

The project demonstrates that the redevelopment of a relatively small disused public property can still raise questions that operate at a wider planning scale: how to accommodate new housing without additional land consumption; how to use existing material resources more efficiently; how to integrate parking without sacrificing the quality of open space; how to respond to demographic change; and how to reconnect former institutional sites with the everyday structure of their neighbourhoods.

Urban regeneration does not therefore require every intervention to become a large strategic project. It can also proceed through incremental transformations that strengthen the existing city from within.

For the former Don Leoni school, this suggests a strategy based not on maximum exploitation of the available development capacity, but on a careful balance between continuity and change, density and open space, accessibility and privacy, existing resources and new construction.

Within the evidence and limitations of this thesis, Option A provides the strongest expression of this balance.

The final result should consequently be understood not as a defence of preservation for its own sake, but as an argument for critical and selective reuse: retaining what can continue to perform a useful urban, environmental and spatial role, transforming what needs to change and introducing new construction where it produces a clear additional benefit.

In this sense, the redevelopment of Don Leoni becomes more than the conversion of a former school into housing. It illustrates how decisions concerning the future of existing buildings can become part of a broader planning strategy for managing the transformation of the consolidated city in a more measured, resource-conscious and context-sensitive way.

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