Ecologically oriented urban architectural renewal: three case studies[1]

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Abstract

In Italy, the complexity of regulations and of bureaucracy and the lack of an organic overall program make it difficult to carry out interventions aimed at safeguarding infrastructures and buildings against both seismic and hydrogeological risk and at making them more energy efficient.

Besides municipal permits, in protected landscape areas or in the case of protected historical or artistic buildings, any modification of the landscape or architectural intervention is subject to the authorization of the Ministry of Cultural Heritage. Unfortunately, there are no objective criteria for these authorizations and the subjectivity of the evaluation of the proposals often leads to different results in very similar cases. Also, while there are time constraints within which decision should be made, the deadlines are often extended. All this leads to an increase in management and operating costs, which are becoming increasingly unsustainable.

The present methodologically oriented paper deals with urban renewal and architectural renovation, presenting three case studies as examples of innovative approaches to the modernization of urban areas. In all three case studies, the traditional contents of urban planning are developed taking into account the guidelines imposed by regulations. In Italy, so-called "detailed executive urban plans" (piani urbanistici particolareggiati) often provide insufficient or uncertain indications with regard both to implementation and financial and management aspects. The present paper hypothesizes interventions to upgrade buildings technologically based on a multi-scalar and unitary idea of renovation, necessarily obtained through an interdisciplinary approach, which could be usefully adopted in actual practice.

SECTION 1 – UNDERLYING PHILOSOPHY

1.1 Introduction

Italian urban areas have a number of recurring elements: an historical center whose origins date to the Greek, Roman and/or Medieval period, in which (or on which) newer buildings were built up to the 1940s. Around this historical center we find a dense network of post-WWII buildings; this early modern area is succeeded by lower density areas and finally by the dispersed buildings in open countryside. Along with these areas, mostly reserved for housing and services, there are industrial and commercial areas, sometimes juxtaposed with residential ones and sometimes distinct from them, though generally contiguous with other urban areas.

With a few noteworthy exceptions, both historical and post-WWII buildings have a number of problems, which require different solutions depending on their age and construction technique. However, in Italy there is no general long-term program for safeguarding urban areas against seismic and hydrogeological risk and making them compliant with modern standards of energy efficiency, waste management, soil permeability and emission reduction.

The present paper discusses the urban and architectural renewal of three urban areas as methodologically useful case studies. Our goal is to demonstrate the possibility of regulating the modernization of urban centers in such a way as to make it more feasible while significantly reducing resource consumption.

Italian legislation makes it impossible to carry out extensive interventions based on general criteria; this is an obstacle to risk prevention and building maintenance in many areas of the country, including a sizable percentage of buildings deemed of historical and architectural significance.

For these buildings, any intervention must be first approved by the Ministry of Cultural Heritage. Specifically, any project must be examined and approved by ministry functionaries, who can also provide mandatory indications.

In the vast areas of the country declared of natural or environmental interest, any change in land use must be first approved by the local authorities. This authorization is then sent to the Ministry, which can approve or reject it. The authorization is not required, however, for ordinary or extraordinary maintenance, for static consolidation or for restoration interventions that do not result in a change in land use. Unfortunately, there are no objective criteria for such authorizations and the subjectivity of the evaluation of the

1. This work is the result of collaboration between two authors: Loreto Colombo has written section 1, Pasquale De Toro has written section 2.

projects often leads to different results in very similar cases. Also, while there are time constraints within which decisions should be made, these are often extended through requests for additional information and documents.
This system was created at the end of the 1930s and has remained basically the same in its approach (the citizens make a request, the government responds). However, it has become increasingly complex due to the growing legislation and the complexity of the relations between central and local administrations.
If one also takes into account the lengthiness of even the ordinary local authorization process, it becomes clear that the uncertainty and excessive duration of the procedures are a major obstacle to systematic urban and architectural renovation, notwithstanding its importance and urgency. This translates into unsustainable costs for individuals and society as a whole, and delays the modernization of the country.
What is more, while it is true that, even in protected areas, maintenance interventions are not subject to central authorization, many interventions aimed at making buildings more energy efficient, limiting resource consumption and ensuring seismic and hydrogeological safety do not always comply with legal requirements for ordinary and extraordinary maintenance, restoration or static consolidation and must be therefore authorized by the Ministry. For example, to install photovoltaic or thermal roof-tiles, insulate the walls, or lay a permeable external paving, each co-owner of a building must submit a individual application, which the bureaucracy often rejects for incomprehensible reasons.
It is necessary to overcome the centralist view for which citizens cannot take the initiative, but must be constantly monitored and controlled by the authorities through a complicated regulatory system, like a minor or a potential criminal. Eco-compatible interventions must be liberalized, freeing them from cumbersome authorization procedures that slow down the process and multiply the costs, to the point of making them unsustainable. In order for this to happen, it is necessary to subvert the long-standing relation between citizens and the authorities, replacing authorization with a general obligation to respect general guidelines, taking into account local traditions and styles. These should consist in regional or inter-municipal regulations for homogeneous areas, based on geographical, environmental, architectural and typological characteristics, specifying the technologies, materials and styles to be used for retrofitting buildings. Citizens will be responsible for applying these regulations.
The following case studies are all aimed at further developing and integrating the traditional content of urban renovation projects. The third planning level, that of executive plans, is often insufficient and uncertain in relation both to implementation and to financial and management aspects.
The present paper hypothesizes interventions of technological retrofitting of buildings based on a multi-scalar and unitary idea of renewal, which can only be ensured by an interdisciplinary approach, and which could be usefully adopted in actual praxis.

1.2 The historical center of Gaeta: the area of Sant'Erasmo[2]

The present condition and the research goals

The peculiar geography of the promontory of Sant'Erasmo, east of Mt. Orlando, led to the development of military fortifications and the construction of a mausoleum already in the Roman period. The urban settlement, surrounded by defensive walls, began to develop towards the end of the sixth century AD. Starting with the tenth century, the settlement began to extend increasingly outside the walls.
The study of current plans regulating the use of the municipal land and analysis of the buildings found in the historical center of Sant'Erasmo evidence a number of features: a type of tourism tied exclusively to the bathing season; isolation of the historical center notwithstanding its extraordinary potential; the presence of buildings in a poor state of repair or even in ruins and of others that are unused or used only partially.
The project goals are to acquire further knowledge concerning the art and historical heritage in order to promote tourism beyond beach holidays; develop a new form of hospitality that will promote local history and tradition; improve existing buildings and building standards.
Only 67 of the 172 residential buildings are used year round (figure 1). The absence of services is both the cause and effect of the absence of tourists in the low season and the decrease in residents and one of the reasons for the general lack of vitality of the town.
The above goals can be achieved through the *Distributed Hotel* model: a horizontal hotel, with a single management, based on rooms and services distributed among different but neighboring buildings to exploit the charm of the historical center. The aim is to promote, besides the usual recreational activities, new cultural experiences through the discovery of local identity.
For each building, the structure, the roof, the plastering, the technological services, and the decorative elements were examined, assigning to each of the aspects a weight based on its condition (figure 2).
This analysis allows us to evaluate necessary interventions for each building. Based on Italy's General Building Law (*Testo Unico sull'Edilizia)*, these interventions are distinguished in

2. Summary of the study by architects Agostino Buonomo and Laura Paone: *Recupero del Centro Storico Sant'Erasmo di Gaeta con destinazioni residenziali e ricettive*, 2012.

ordinary maintenance (*manutenzione ordinaria*); extraordinary maintenance (*manutenzione straordinaria*); restoration and conservative repairs (*restauro e risanamento conservativo*); building restructuring (*ristrutturazione edilizia*); urban restructuring (*ristrutturazione urbanistica*).

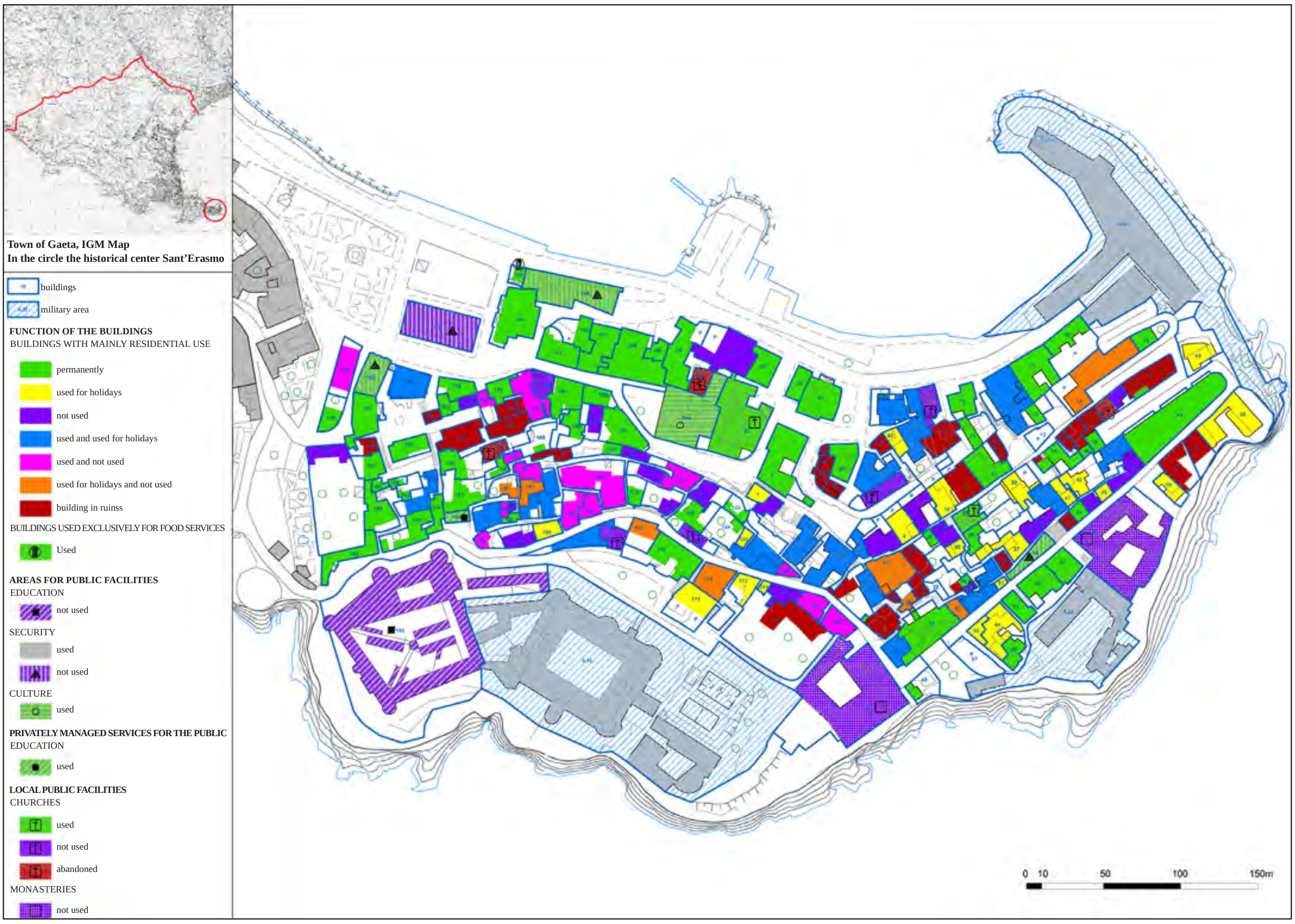


Figure 1 – IGM map. Use of buildings (summary of detailed catalog).

Unused or partially used buildings are reserved for: independent residential use, if sufficient in size; in other cases, if their characteristics allow, they are reserved as rooms and apartments for the distributed hotel or as services exclusively reserved for or having special agreements with the distributed hotel (figure 3). Uncultivated or abandoned land is to be transformed into parks with leisure facilities.

From the perspective of the protection, preservation and promotion of the architectural heritage, conceived as a testimony of historical and cultural values, requalification can be considered as the type of construction work with the greatest level of sustainability. However, requalification of small historical centers like Gaeta must be planned and carried out very carefully, since these are often the delicate product of the stratification of smaller elements, with strong ties to the local landscape, history and economy.

The historical center of Sant'Erasmo, starting with the post-WWII period, underwent much construction work that took little or no account of the importance of the traditional context. This has made it necessary to renovate it, respecting the character and historical importance of the place, reducing environmental impact, ensuring compliance with current environmental and energy standards, limiting the impact on resources and climate change.

Energy and environmental issues are global but our response must be local, taking into account specific climatic conditions, architectural culture, and traditional construction techniques.

Energy efficiency interventions

Since most roofs in Sant'Erasmo are pitched, the project calls for the installing, on the southern sides, of photovoltaic tiles, with embedded photovoltaic cells, or thermal tiles with embedded hot-water collectors (figure 4). The tiles are attached with aluminum elements or pre-mounted on thermally and acoustically insulated panels; their integration into existing roofs allows for a very limited aesthetic impact.

Considering that, in the historical center of Sant'Erasmo, the total surface area available for solar elements is around 9,200 m^2 and that there are around 2,000 users in the high

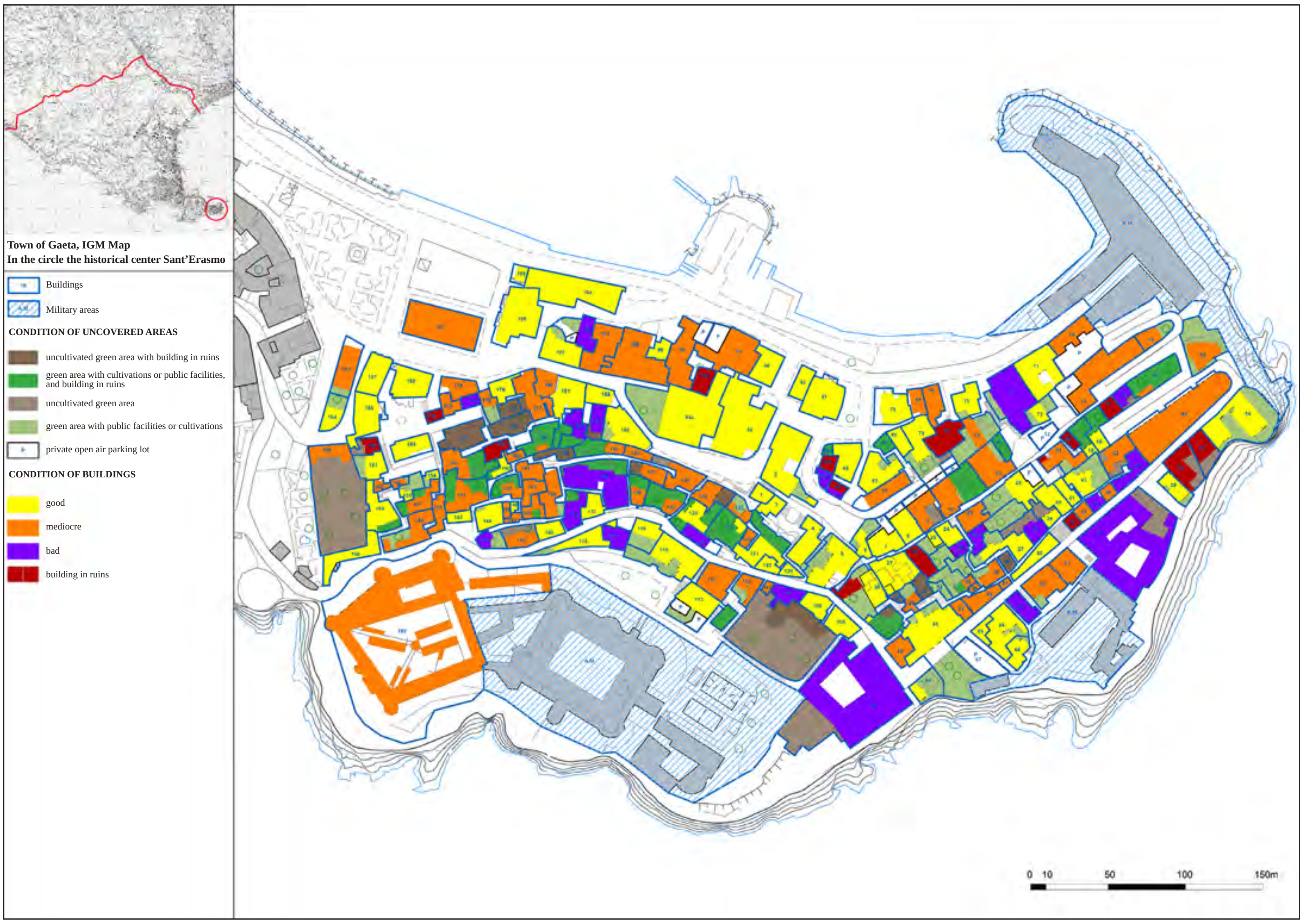


Figure 2 – IGM map. Condition of buildings and open areas (summary of detailed catalog).

season, two technological solutions, photovoltaic tiles and thermal tiles, were taken into consideration.

Photovoltaic tiles produce 1kWp for every 18 m^2 of tiles. Considering that an average four-member family requires 3kWp, using the entire available surface would satisfy the requirements of 700 people, i.e. 1/3 of the total population in the high-season. Instead, thermal tiles produce 50 l/h of warm water every 1 m^2 of tiles. They also require storage tanks to feed the hot water and heating systems. A four-member family requires 150 l/h. Using the total available surface area for thermal tiles would result in the production of 460,000 l/h which, even during the high-season, would exceed the total requirement.

Photovoltaic tiles allow for excess electricity to be fed back into the grid. By contrast, thermal tiles can distribute hot water only to the buildings they are installed on. Therefore, it is preferable to use thermal tiles for buildings that are permanently inhabited, opting for photovoltaic systems for all other buildings.

Recovery and recycling of rainwater

The recovery and recycling of rainwater to reduce waste, prevent water shortages and cut water provision costs, is highly conditioned by the natural environment and by the quantities required. The requirements of the population must be considered along with the average rainfall in the area and the possibility of installing storage tanks.

In the historical center of Sant'Erasmo, for example, we have planned a rainwater recyling system for a residential building, currently in ruins, which, in our project, is part of the distributed hotel with a capacity of fourteen guests. Given that the average annual rainfall in the municipality of Gaeta is 1,300 mm and that the building has a flat roof of 220 m^2, the system allows recovery of 280 m^3/year of rain water. Given that, in residential buildings, rainwater can be used for: water closets; washing machines; watering gardens and washing cars, the total rainwater requirement per person amounts to 18 m^3 / year per person. The 14 people in the building would therefore require 250 m^3/year.

Based on regulation E DIN 1989-1: 2000-12[3], a 12,000-liter

3. A. Campisano, C. Modica, *Performance of rooftop rain water harvesting systems for domestic use in Sicily* (Venezia, 2011).
Abdulla Al-Shareef, *Roof rainwater harvesting systems for household water supply in Jordan* (Elsevier, 2009).
C. Alvisi, M. Scagliarini M., *Progetto Non c'è acqua da perdere a Castel San Pietro Terme* (Provincia di Bologna, Settore Ambiente, 2008).

Figure 3 – IGM map. Use of the areas. Distributed hotel.

tank is required. In general, storage tanks can be positioned as follows:

- above ground: vertical tanks placed alongside the building beneath the downspouts;
- inside the building: tanks on the ground floor or in the basement;
- below ground: tanks buried in order to free up space and allow for greater capacity.

In the present project, the tanks are positioned in two existing rooms on the ground floor. Based on the products available on the market and the size of the rooms, we opted for three tanks connected in parallel per room, each tank having a capacity of 2,000 l, to be used for filtering and storing water. Being vertically positioned, the tanks use space efficiently and can be easily brought into the rooms. All devices that are to use recycled rain water must have a dual system, to be able to use recycled or regular water depending on availability.

Permeable paving

To help maintain the natural water cycle, and reduce the problems created by impermeable covering, it is preferable to use dry-laid paving techniques. A first layer of granular draining material is positioned with a thickness suited to the soil properties. Above this goes a layer of gravel and then the paving (figure 6).

This technique offers a series of advantages: rainwater drainage; adequate and constant level of naturally fed water tables; elimination of superficial water rivulets, increased safety during storms; more favorable microclimate since the land captures less heat during sunlight hours and irradiates less heat after sunset; less maintenance compared to asphalt. Historical paving can be restored and integrated to prevent total replacement, notwithstanding the practical impossibility of using the old techniques. An artisanal intervention can be used to improve the quality of the base product and of paving techniques. For new paving, local or in any case traditional materials are preferable. When traditional materials are not available or do not comply with functional or quality standards, a study must be carried out to identify compatible alternative materials.

In the historical center of Sant'Erasmo, for example, the durability of traditional paving is deemed insufficient for the parking areas of the distributed hotel. We therefore hypothesized the use of dry-laid concrete pavers, filling the spaces

Figure 4 – Example of pitched roofs: a) Thermal solar system integrated into tiles; b) Photovoltaic system integrated into tiles.

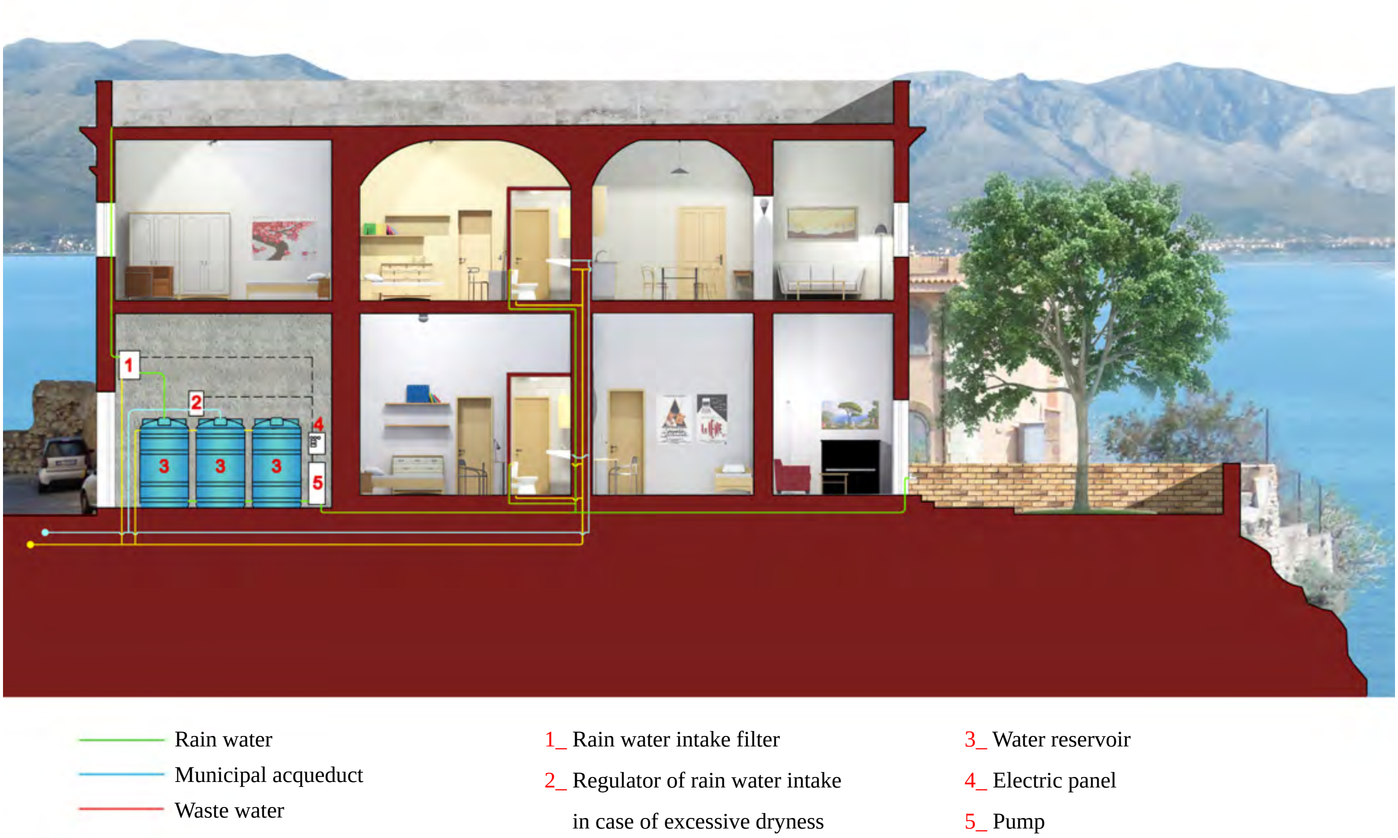


Figure 5 – Recovery of rainwater.

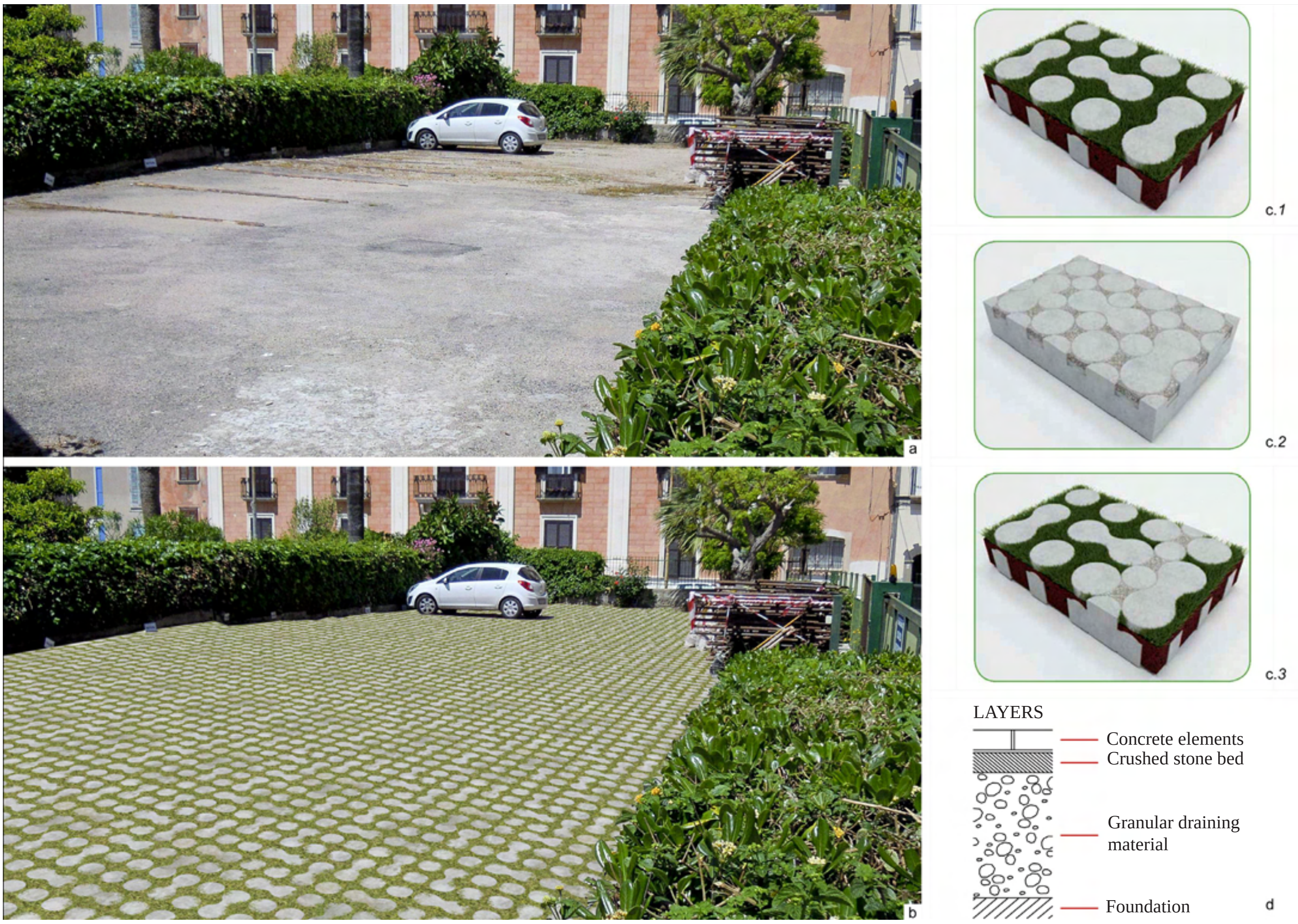


Figure 6 – Permeable paving made of concrete pavers, soil and gravel. a) Area reserved for parking in Via Pio IX, present state; b) Area reserved for parking in Via Pio IX, project; c) Type of filling for spaces between concrete pavers: c.1 soil; c.2 gravel; c.3 gravel and soil; d) Layers.

with either soil, to obtain a 'green' paving; gravel, to improve drainage; gravel and soil, for mixed paving.

Pedestrian routes are given priority over car routes since the historical center has few main streets crisscrossed by a dense network of stairways and alleys, which are too narrow for cars. This network should be preserved for its historical significance.

1.3 A '*vicinato*' in the Sassi of Matera[4]

Historical ecosystem

The so-called 'Sassi' (literally, 'rocks') of Matera are part of the historical center of the town of Matera. The Sassi are divided into two neighborhoods, the 'Sasso Caveoso' (figure 7) and the 'Sasso Barisano' (figure 8), which occupy two valleys separated by a small plateau where the 'Civita', the ancient acropolis, stands.

The two valleys, with their numerous lodgings partially dug into the hillside and underground, descend towards the 'Gravina' (figure 9), a ravine where the torrent of the same name flows, beyond which lies the Park of the 'Murgia Materana'. Beyond and above the Sassi, there is a plateau, 'il Piano', where the modern city stands.

Human occupation of the Sassi dates back to the Paleolithic period. They were inhabited up to the mid-twentieth century when the authorities decided to relocate the population for health reasons. Towards the end of the 1940s, the Sassi had about 13,000 inhabitants, mostly farmers, who occupied 2,997 houses, 2,552 of which consisted of a single room. There was an average of 4.36 people per room; 80% of the single-room houses were also used to house farm animals (figure 10). About 55% of the houses were dug into the cliff rock and were very damp, with little light or air.

Hygienic conditions were critical: the infant mortality rate was 44%; malaria, trachoma and tuberculosis were still very common. The publication of the autobiographical novel

4. Summary of the study by engineer Giuseppe Musano, *L'adeguamento tecnologico dell'edilizia storica. Una sperimentazione nei Sassi di Matera*, 2012.

Christ Stopped at Eboli by Carlo Levi[5] set in the area, marked the beginning of an intense debate on the condition of rural southern Italy, and Matera became the symbol of an archaic society. It was decided to provide the inhabitants of the Sassi with proper lodgings and since the Sassi were considered beyond restoration the people were relocated at the expense of the government.

Figure 7 – Sasso Caveoso.

Figure 8 – Sasso Barisano.

Figure 9 – The Gravina.

5. Written by Carlo Levi, an antifascist physician from Turin, and published in 1945, this autobiographical novel describes the discovery of the peasant world in the south of Italy during the author's exile by order of the Fascist government to Aliano, a small town in the province of Matera. The novel described a relatively unknown reality bringing to the attention of intellectuals and the wider public the problem of backwardness in provincial southern Italy.

Three special laws were passed to relocate the population (619/52, 299/58 and 126/67). Only later were another two laws were passed for the restoration of the Sassi (1043/71 and 771/86). The 1956 Urban Plan (*Piano Regolatore*) outlined the future layout of the town. The relocation of the population was carried out in the 1950s and 1960s; the unsanitary habitations were expropriated by the government; new neighborhoods (Spine Bianche, Serra Venerdì and Lanera) and rural villages (La Martella, built with money from the Marshall Plan, and Venusio) were built and became symbols of the urban reforms of the post-WWII period.

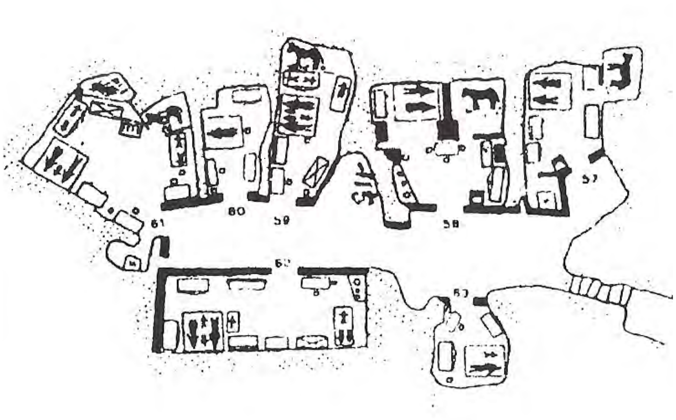


Figure 10 – Examples of houses dug into the slope.

For many years, nothing was done to restore the old houses, expropriated and abandoned. Only under Law 1043/71 was an international competition launched for the restoration and re-use of the Sassi, but none of the participating projects was deemed worthy of the first prize and therefore no project was approved. In the 1980s, however, initially through pilot plans and then with the two-year plans established under Law 771/86, the restoration began, still to be concluded.

In 1993, the Sassi became the first place World Heritage site to be listed by UNESCO in southern Italy. The following motivation was given: *The Sassi make it possible to time travel through all the ages of humanity. They bear witness to the capacity of humankind to create an environment suitable for living, while carefully and parsimoniously managing natural resources. The Sassi and the natural archeological park are a perfect testimony of ancient human activities. Their exceptional universal value springs from the symbiosis between cultural and natural values.*

More than simply an ancient historical town, the Sassi of Matera are an actual ecosystem (figure 11) made up of caves, cisterns, tunnels and galleries. Their present conformation is the result of building choices functional to the practical needs of everyday life. This extraordinary ecosystem allowed inhabitants to: gather rainwater into cisterns through a system of troughs; preserve food and mitigate the outside temperature during the rigid winters and torrid summers; ventilate the houses, thanks to the dense network of passages and tunnels; prevent erosion of the slopes of the Gravina through a system of terraced gardens. All building materials were obtained on site by excavating the caves or nearby quarries.

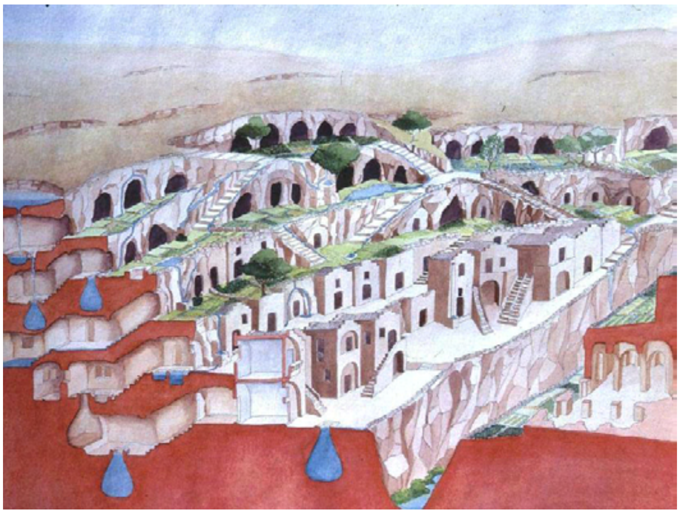


Figure 11 – The ecosystem of the Sassi.

The study of the ecosystem of the Sassi belies the idea of Matera as a backward place: this extraordinary settlement made the most of the harsh conditions imposed by the arid environment. The Sassi represent a living alternative to a notion of 'modernity' founded on the immoderate use of water and energy. They are an example of a 'low consumption' community, surviving in a harsh natural environment without wasting resources.

For all these reasons, any restoration of the Sassi cannot focus solely on individual buildings or areas but must acknowledge and preserve the unity of the ecosystem. The urban system can be subdivided for operative reasons only if the original relations between the parts are preserved, integrating different functions: a multifunctional town has a better chance of success compared to a monofunctional one. The residential function must be integrated with carefully evaluated tourism, productive, service and cultural functions, overcoming the historical divide between the Sassi and the new area of the Urban Plan, which has always excluded the ancient neighborhoods from the rest of the city.

Technological aspects

An organic legal framework for the restoration of the Sassi is found in the fifth and last special law for the restoration of the Sassi, Law 771/86, integrated by implementation regulations such as the Restoration Manual (*Manuale del Recupero*)[6] or the Code of Practice (*Codice di Pratica*).[7] However, there is still no systematic law governing the evaluation of environmental impact of interventions based on innovative technologies. Consider for example a hypothetical restoration of a typical '*vicinato*,' i.e. a public or private open space (courtyard, square, hanging garden, terrace) meant for collective use and surrounded by other rooms and dwellings. Various domestic and working activities took place here, making the *vicinato* a socializing space for various families.

Our case study is the *vicinato* in the area between Madonna delle Grazie and via San Clemente, in Sasso Caveoso (figures 12 and 13).

Figure 12 – *Vicinato* in Sasso Caveoso, in a photo from the 1950s.

Figure 13 – The same *vicinato*, today.

The buildings underwent static consolidation in the early 1990s but are still unused. The upper levels are suitable for social housing. At the lower level, some of the underground rooms could be used as basements or cellars (figures 14, 15, 16).

As in other *vicinati*, a cistern is found in the central court under the level of the house floors, collecting the rainwater that flowed through a network of troughs. The rainwater collection system could be reactivated by restoring the troughs, located inside or outside the outer walls, which could be lined

6. A. Restucci, *Matera: i Sassi, manuale del recupero* (Electa, 1998).

7. A. Giuffrè, C. Carocci, *Codice di pratica per la sicurezza e la conservazione del centro storico di Palermo* (Laterza, 1999).

Figure 14 – Maps of the *vicinato*.

Figure 15 – Maps of the *vicinato*.

with curved clay tiles and positioned on metal supports or on bricks inserted into the walls. The rainwater could be used to water a garden in the courtyard.

The thermal inertia of the underground rooms naturally regulates the temperature, providing cool air in the summer and warm air during the winter. As in the fingers of a hand, the central caves are deeper than the rest because they are the ones where the sunlight can penetrate the furthest. It is likely that even the inclination of the caves deliberately corresponds to that of the low winter sunrays, allowing the caves to capture the maximum heat during the winter, while preventing the near vertical summer rays from penetrating the caves, keeping the terminal areas of the caves cool during the hot season.

The caves are often interconnected by small tunnels, which favors air circulation; using raised pavements it is possible to create a forced ventilation system. When the old pavements cannot be restored, new ones should be made using terracotta tiles or local stones, while the vaults should be painted with quicklime, which allows the stone to transpire. The typical plaster used in the kitchen and bathrooms can be replaced with a plaster of *opus signinum*, which, once dried, has the characteristic of collecting humidity without absorbing it. To provide energy, the project calls for the use of photovoltaic tiles and glass (figures 17 and 18).

The basis on which the tiles rest is a thermally and acoustically insulated panel on which the curved tiles are placed. These frames can support both regular tiles and photovoltaic

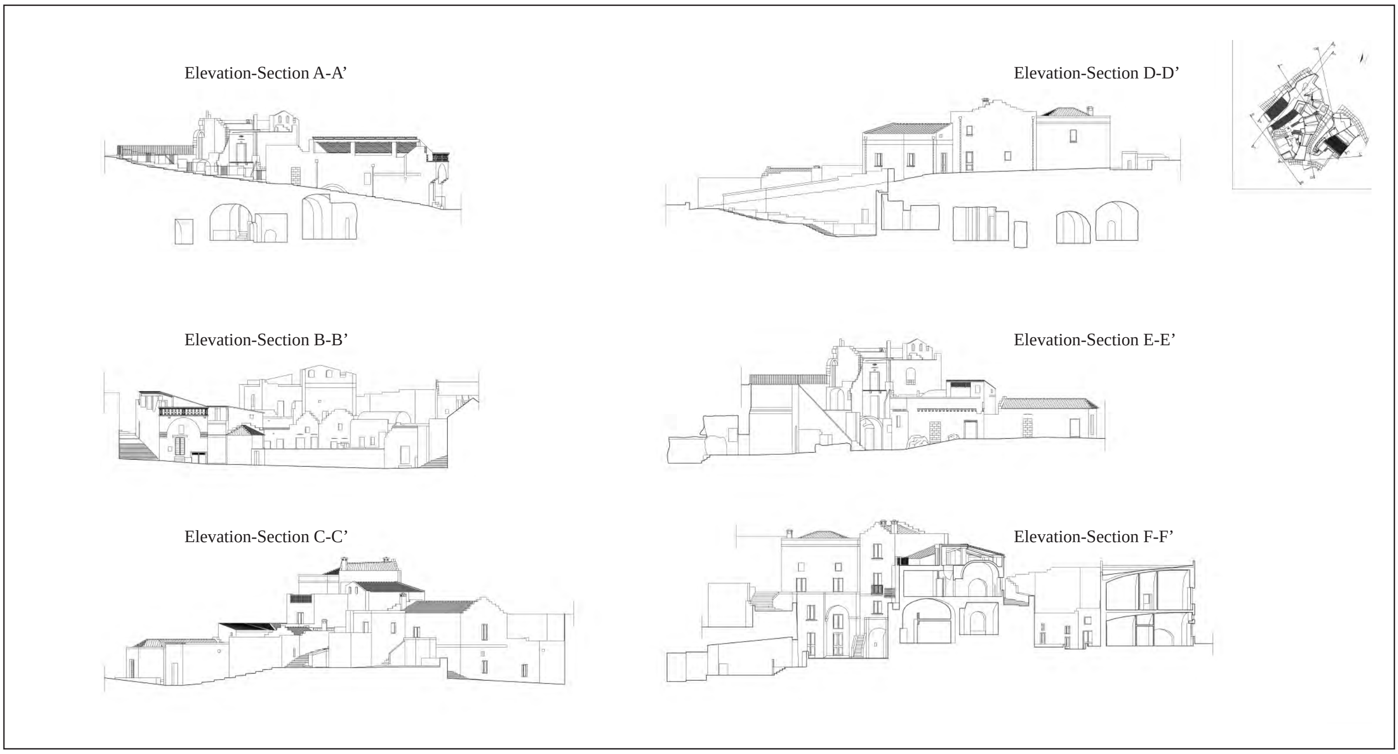


Figure 16 – Cross-section of the *vicinato*.

or thermal ones. The traditional tiles can also be installed without any need for structures or mortar. Curved tiles can be attached to the aluminum structures through joints.
The peak power of photovoltaic tiles is 3.8 Wp, obtained under standard conditions of 1000 W/m^2, 25°C and AM 1.5. To produce 1 kWp of electricity, 18 m^2 of photovoltaic tiles is necessary, i.e., about 250 tiles, each of which produces between 17 and 50 watts. The modules are joined both to the curved tiles underneath and to the other photovoltaic tiles further above and below on the roof, creating a single electric connection with the central system.
An electronic control unit collects data and identifies malfunctioning modules. A thermal tile has an embedded pipe through which a liquid flows. The sun heats it and the liquid warms the water used for washing or heating. The pipes in the tiles are connected to a main pipe, which in turn is connected to the building's water system.
Part of the roof has been used for photovoltaic tiles and part for thermal ones. To reduce the visual impact, lines of normal tiles alternate with photovoltaic or thermal ones.
For the windows, wooden shutters identical to the original ones were chosen, while the panes consist of multilayer photovoltaic glass made up of:
- two external layers of glass;
- two films of Polyvinyl butyral (PVB), to prevent breaking;
- a central stratum of photovoltaic cells connected to the main electrical system.

In conclusion, non-invasive restoration techniques, applied while respecting and preserving the environment, the underground areas, the water network, the natural ventilation system and the hanging gardens, and the use of solar energy with adequate materials and techniques, can guarantee the future of this historical site, confirming the philosophy that underlies its ecosystem.

1.4 The conurbation of the Campanian plain: Densification, redesigning, consensus[8]

The area

The following emblematic case study concerns the plain south-west of Caserta, in Campania, occupied by a sprawling and continuous, mainly unregulated urban area, which extends west from Aversa all the way to Villa Literno. It is a tentacular conurbation, which includes seven municipalities whose urban centers have progressively extended over the countryside. Each town includes a historical center, surrounded first by a consolidated urban area and then by a sprawl that becomes progressively less dense as one moves towards the countryside. Unauthorized and unplanned construction is a typical trait of the area, especially in the peripheral urban areas (figure 19).
The expression 'suburban sprawl' can be used to describe this type of growth in peripheral or rural areas. There are, however, several types of suburban sprawl, which can be distinguished

8. Summary of the study by Marcello Ferrara, *Piano consensuale di assetto della città lineare diffusa Villa Literno - San Marcellino. Tutela, densificazione, trasformazione*, 2012.

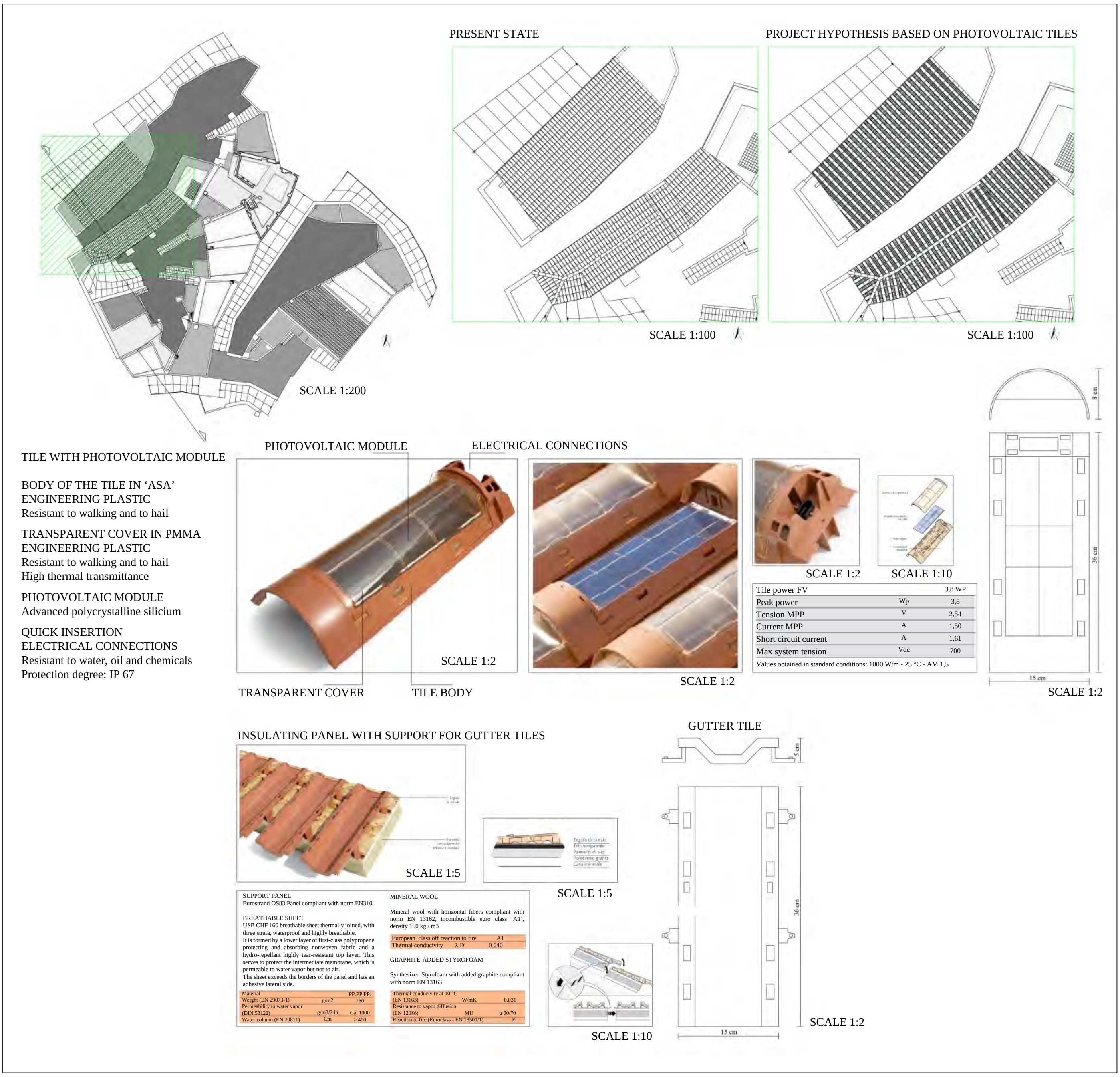


Figure 17 – Photovoltaic tiles.

based on their density, infrastructures, the old rural layout conditioning the present one, the type of buildings and the degree of authority control. The type of urban development described is typically present in the central-southern plains of Italy, where the presence of unauthorized buildings is at its peak.

Analysis of land use and the type of construction allows us to identify geometrical patterns and abaci (figure 20). First the fields are left uncultivated. Then they are divided into strips of width varying in size from 38 to 54 meters, which are then divided into building lots that are sold individually. Every two strips, room is left for a service road, of the necessary width (from 6 to 9 meters). The size of the lots varies, with an average of 20 m x 24 m (480 m^2). The houses usually take up half the available area (250 m^2) (figure 21). When all lots are built up, the average density is 4.2 m^3 / m^2. The typical buildings are one-family or two-family houses, made of reinforced concrete, with one or two stories, and possibly a basement, built at the center of the lot or along the boundary (figure 22).

Given the size of the phenomenon there is an urgent need for alternative solutions. At present these areas are almost entirely devoid of any urban or building quality. Specifically: There is a lack of even the most elementary services and infrastructures; old-fashioned, illegal and wasteful building technologies have been used; valuable agricultural land has been lost and the soil has been made increasingly impermeable; there is serious pollution from toxic waste dumps. New

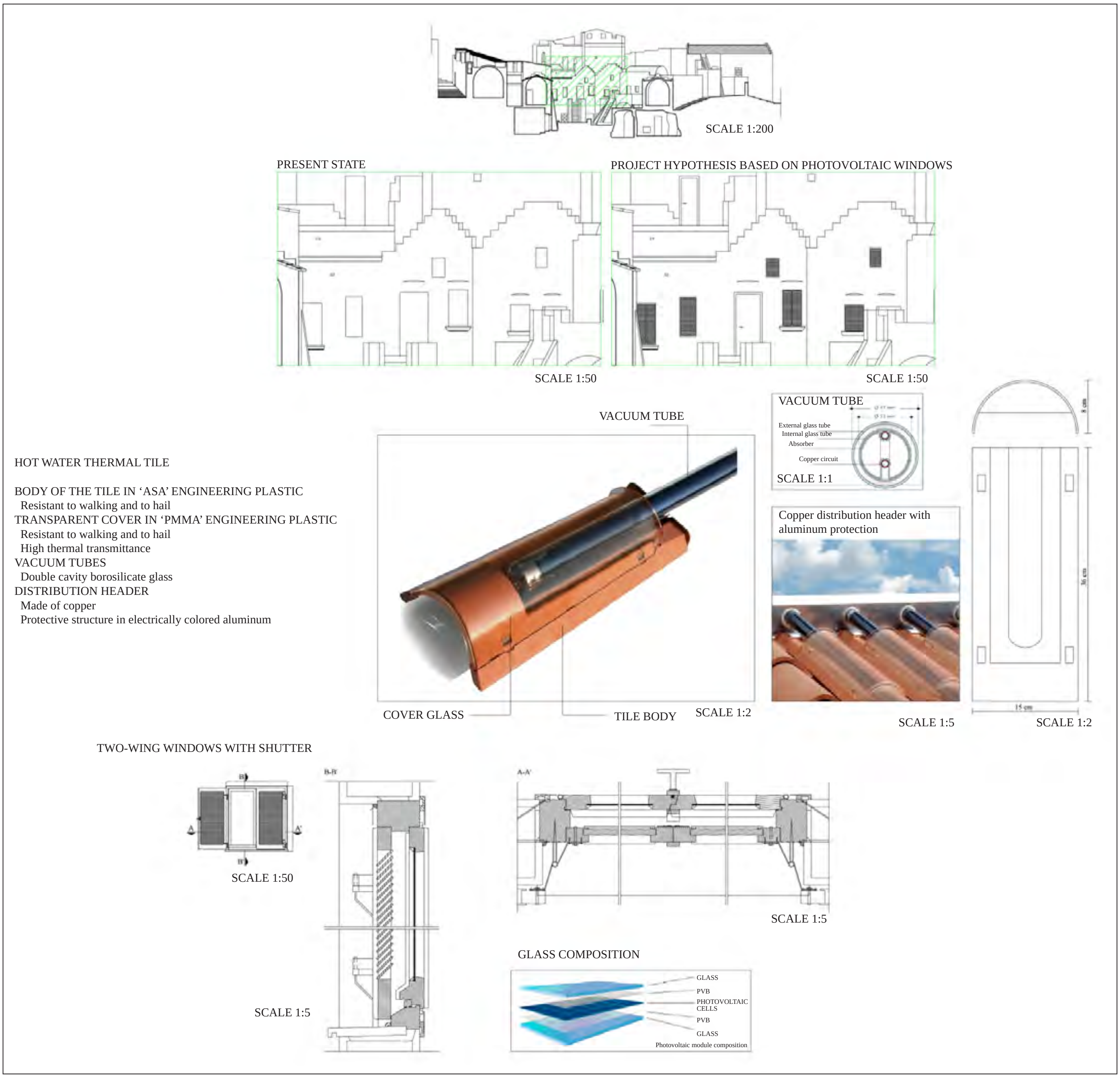


Figure 18 – Thermal tiles.

methods and approaches must be identified to improve the area moving from the urban scale to that of individual buildings (Lettieri, 2008).

The requalification plan[9]

The goals

Notwithstanding the enormous number of illegal buildings, we can assume that the normal measures prescribed by the law (confiscation and demolition) will not be applied (Totaforti, 2012; Nuvolati and Piselli, 2009).

It is necessary to ensure that, along with a rigid curtailing of any further illegal construction and a return to the rule of law, all the actors that have a legal or practical role be involved in regulating future land use.

The objective is to prevent further illegal construction while increasing the building concentration in urban-rural areas based on precise indications. Along with the general renewal, the plan establishes clear boundaries between town and country and the urban sprawl is to be provided with services and infrastructures that are currently absent or insufficient.

9. A work oriented in the same direction as the present study is the thesis– from which the text takes some contents and images – written under the supervision of the author, at the Department of Architecture at the University of Naples Federico II, by Marcello Ferrara; co-supervisor for economic and management aspects, Prof. Pasquale De Toro.

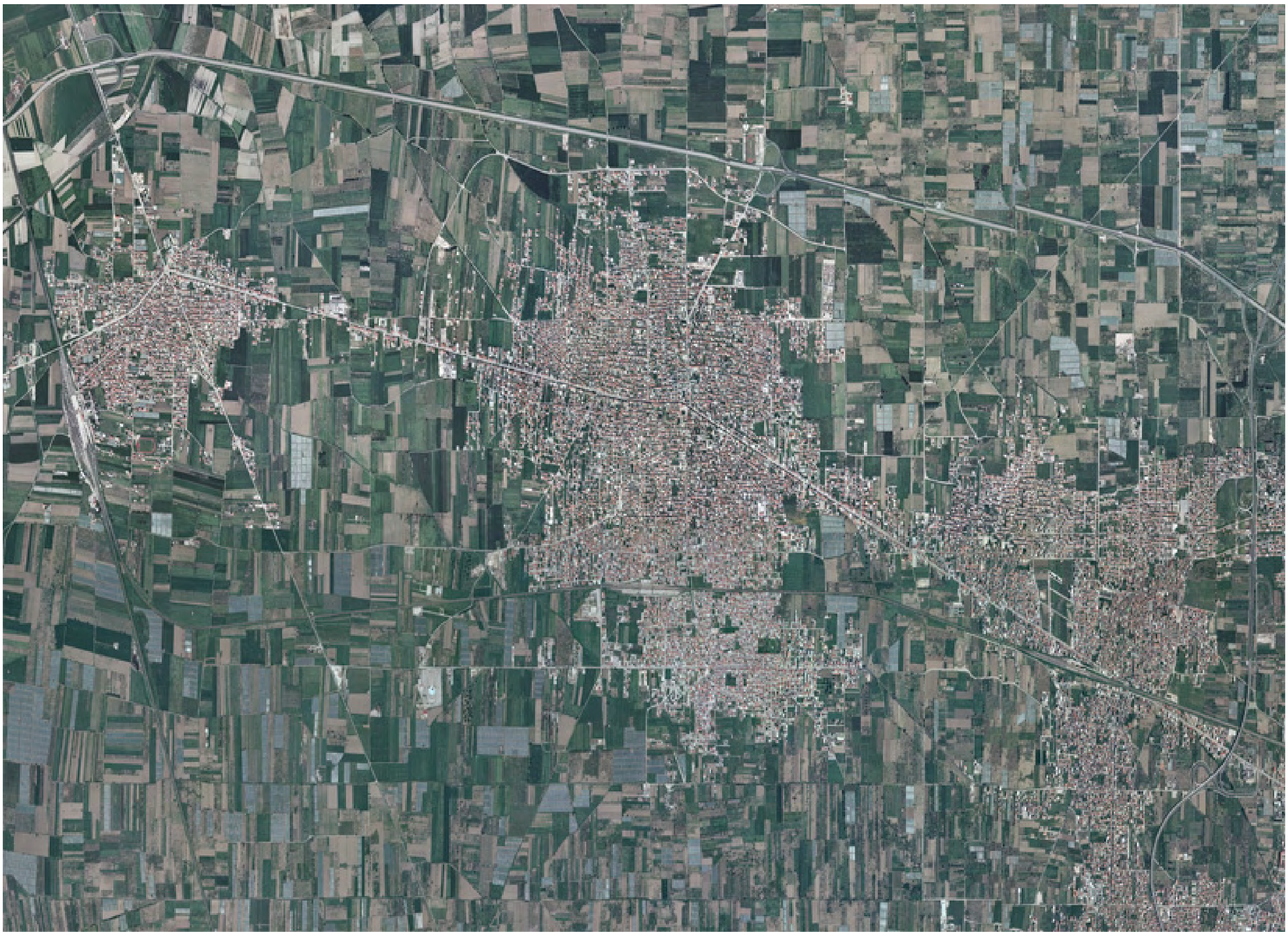


Figure 19 – The area of the case study is the conurbation that goes westward from Aversa all the way to Villa Literno.

These choices result in a plan that goes beyond the responsibilities of single municipalities and is necessarily of a special nature in terms of its goals and its management. There are no precedents in Italy, and the plan cannot therefore be directed following the complex ordinary laws governing urban planning.

Its ultimate goals are: to establish the boundaries between the urban sprawl and the country; preserve environmental, cultural, architectural quality through the preservation and promotion of natural, cultural and environmental values; preserve the quality of urban and extra-urban landscape as an aspect of historical and cultural identity; restore buildings and renovate settlements and non-urbanized areas, especially the more degraded ones, while furthering economic and social development.

The present plan is based on consensus: a necessary premise of the plan program is a series of public-private agreements to be reached through debate among all parties concerned. A fundamental role in the program is played by the professionals who will manage participation and by the facilitators, on account of the issues among the local population along with the objective complexity of the plan.

A significant percentage of public works are financed by the private sector which, in exchange for giving land to be used for public purposes, receives more extensive building permits and tax breaks. The plan therefore regulates the development of the area leveraging on the personal interests of individuals to promote the interests of society.

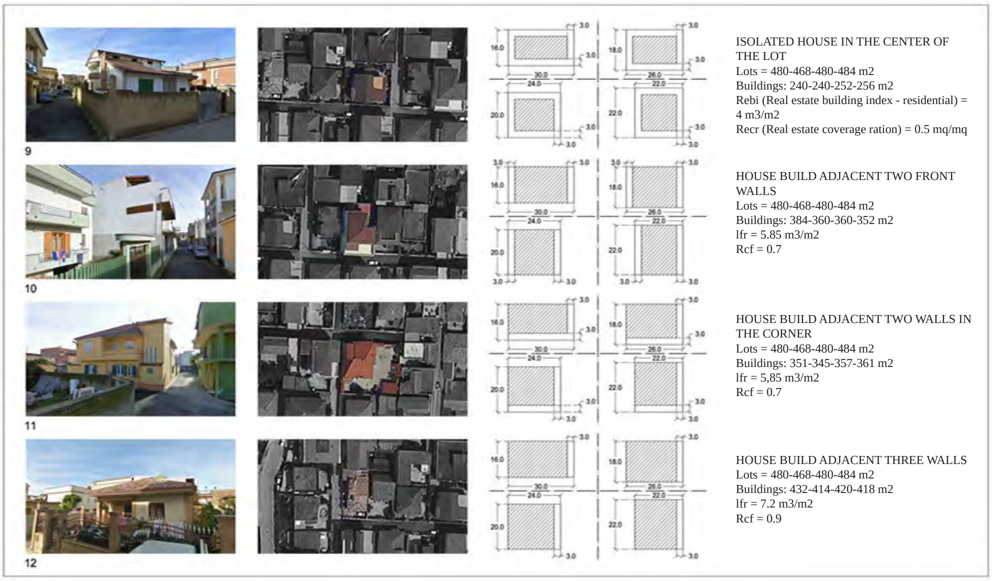
Population and requirements

The tendency that emerges from recent demographic analysis, i.e. constant level of internal factors (rate of birth and mortality) and external factors (immigration and emigration), shows a population increase in the seven municipalities (table 1). A variation in the composition of the average family is also foreseeable, which would result in an increased demand for housing and public services.

Based on more than one type of projection, we can foresee a population increase of 18% over the next 20 years, corresponding to 14,500 people. This implies the need for standard public infrastructures, which based on the criterion of 22 m^2 / inhabitant as necessary for an acceptable quality of living, results in more than 1,825,000 m^2 of surface.

Considering a unitary volume per room of 80 m^3, a ratio of

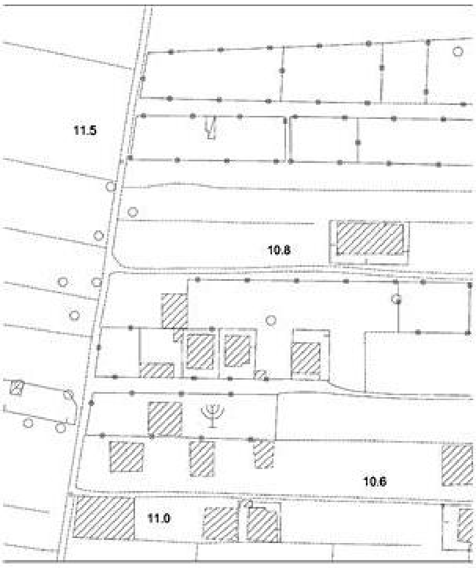
Abacus of building structures in the historical center



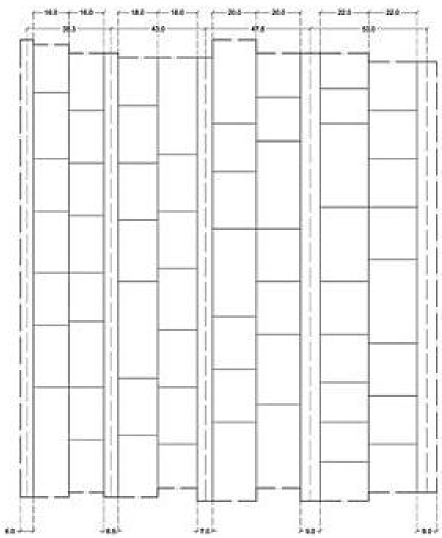
Abacus of the building surface / covered surface in the consolidated urban area

Abacus of the building structures in the spontaneous urban area

Figure 20 – The abacus of the buildings typically found in historical centers, in the consolidated city and in the developing city.



Urban periphery in the initial urbanization phase (Villa Literno)



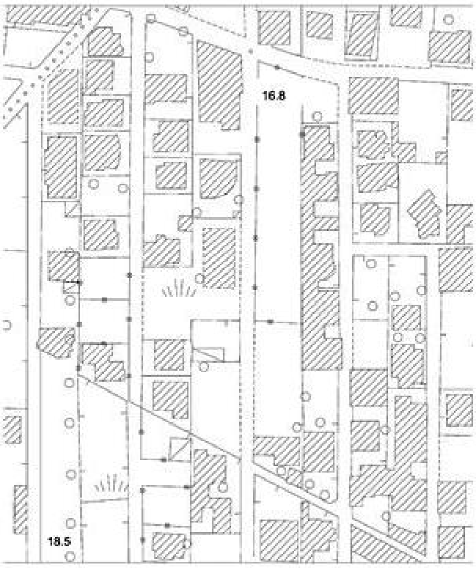
TYPICAL SURFACE DISTRIBUTION

Total surface
Ts = 38,260 m2

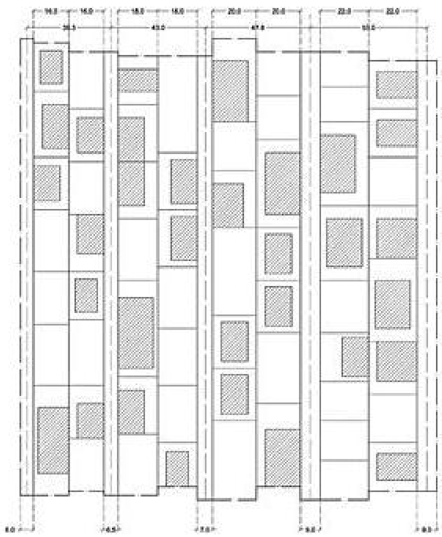
Public surface (streets)
Ps = 7675 m2

Real estate surface
Res = Ts – Ps = 30,584 m2

Geometrical matrix of the urban periphery in the initial urbanization phase



Spontaneous urban area in its final phase (San Cipriano Aversa)



TYPICAL SURFACE DISTRIBUTION

Total surface
Ts = 38,260 m2

Public surface (streets)
Ps = 7676 m2

Real estate surface
Res = Ts – Ps = 30,584 m2

Used land surface
Uls = Res – Fres = 17,612 m2 (60%)

Free real estate surface
Fres = 12,972 m2 (40%)

Territorial building index (residential)
Tbi = Vtr / Ts = 71,096 m3 / 38,260 m2 = 1.8 m3 / m2

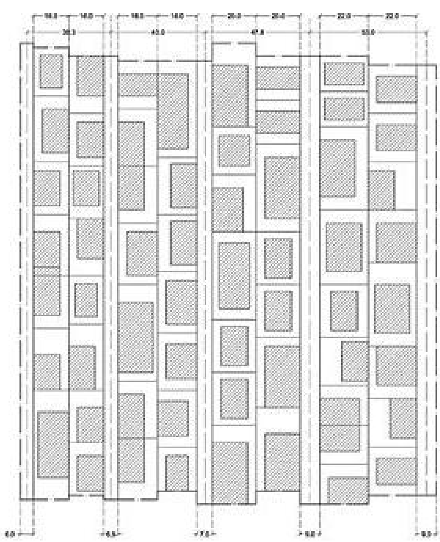
Real estate building index (residential)
Rebi = Vtr / Ts = 71,096 m3 / 30,584 m2 = 2.3 m3 / m2

Territorial coverage ratio
Tcr = Cs / Ts = 8,887 m2 / 38,260 m2 = 0.2

Real estate coverage ratio
Recr = Cs / Ts = 8,887 m2 / 17,612 m3 = 0.5

Geometrical matrix of spontaneous urban area in its final phase

Saturated spontaneous urban area (Frignano)



TYPICAL SURFACE DISTRIBUTION

Total surface
Ts = 38,260 m2

Public surface (streets)
Ps = 7676 m2

Real estate surface
Res = Ts – Ps = 30,584 m2

Used land surface
Uls = Res – Fres = 30,584 m2 (100%)

Free real estate surface
Fres = 0 m2 (0%)

Territorial building index (residential)
Tbi = Vtr / Ts = 125,032 m3 / 38,260 m2 = 3.1 m3 / m2

Real estate building index (residential)
Rebi = Vtr / Ts = 125,032 m3 / 30,584 m2 = 4.2 m3 / m2

Territorial coverage ratio
Tcr = Cs / Ts = 15,629 m2 / 38,260 m2 = 0.4

Real estate coverage ratio
Recr = Cs / Ts = 15,629 m2 / 38,564 m3 = 0.5

Geometrical matrix of saturated spontaneous urban area

Figure 21 – Layout resulting from urban growth.

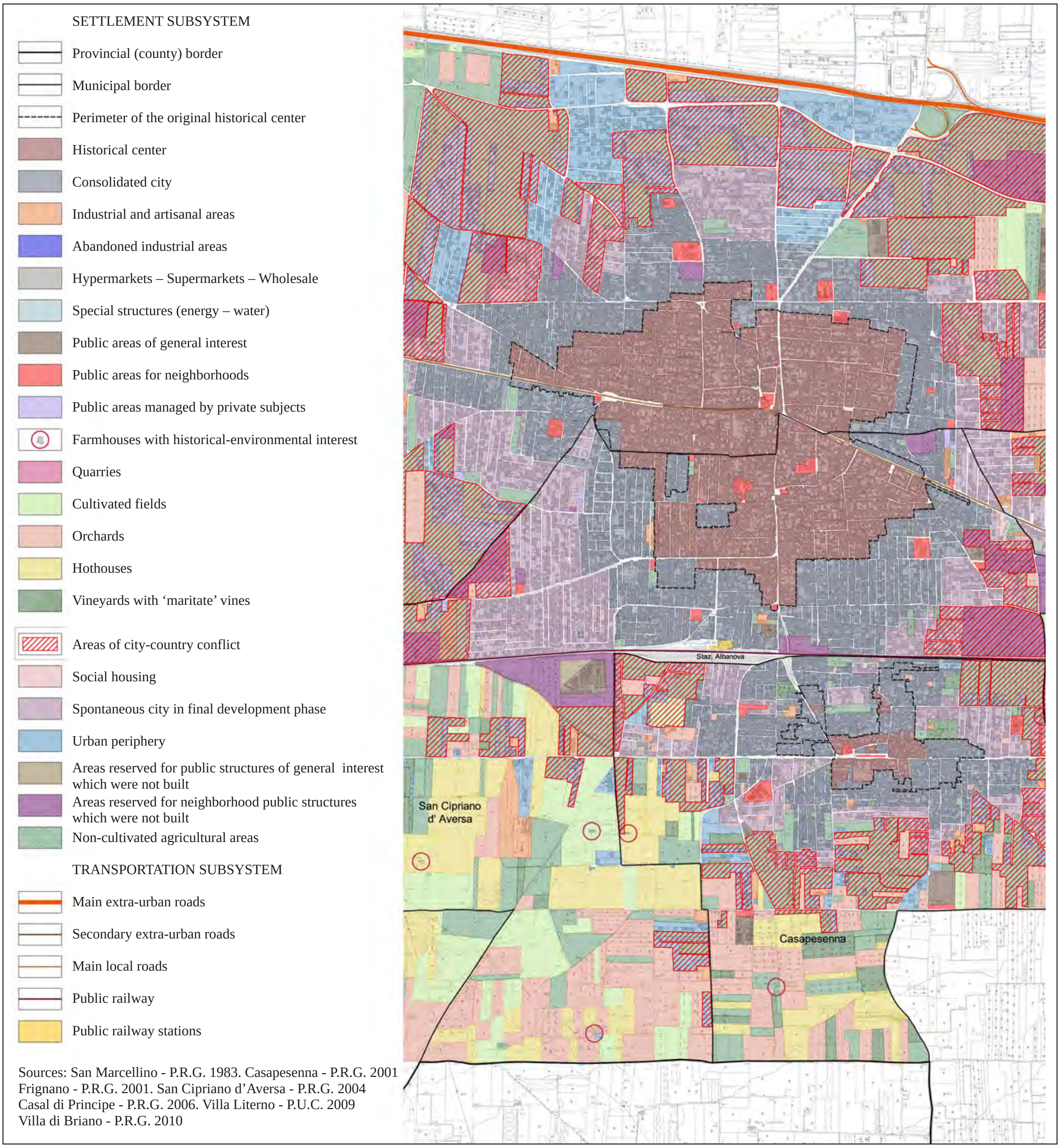


Figure 22 – Extract from existing urban plans Inside the Agricultural Zones of the plans the red-striped areas are the ones characterized by country/city conflict.

real estate coverage (*Rapporto di copertura fondiario*) of 0.3 m^2 / m^2 and an index of real estate building allowance of 1.3 m^3 / m^2, the total gross paved surface comes to 391,500 m^2 (table 2).

The contents

A complete restoration of degraded and altered historical centers is called for, to be achieved through the renewal of public spaces, the protection and restoration of surviving buildings of interest, a decrease in traffic, the modification of incongruous buildings. Recent buildings in reinforced concrete are restructured or replaced in line with pilot projects oriented towards sustainability (figure 24).

Consolidated urban areas, spontaneous sprawl and public buildings will undergo urban-architectural renewal and densification through architectural restructuring or replace-

Table 1 – Demographic projection to 2032.

MUNICIPALITIES	RESIDENT POP. 2011	VARIATION 2011-2032		RESIDENT POP. 2032
	ab	%	ab	ab
Casal di Principe	21.404	17,2	3.681	25.085
Casapesenna	6.874	8,1	557	7.431
Frignano	8.659	2,5	216	8.875
San Cipriano d'Aversa	13.085	10,4	1.361	14.446
San Marcellino	13.308	28,8	3.833	17.141
Villa di Briano	6.522	29,4	1.917	8.439
Villa Literno	11.676	26,7	3.117	14.793
TOTALE	**81.528**	**18,0**	**14.683**	**96.211**

Source: Istat data

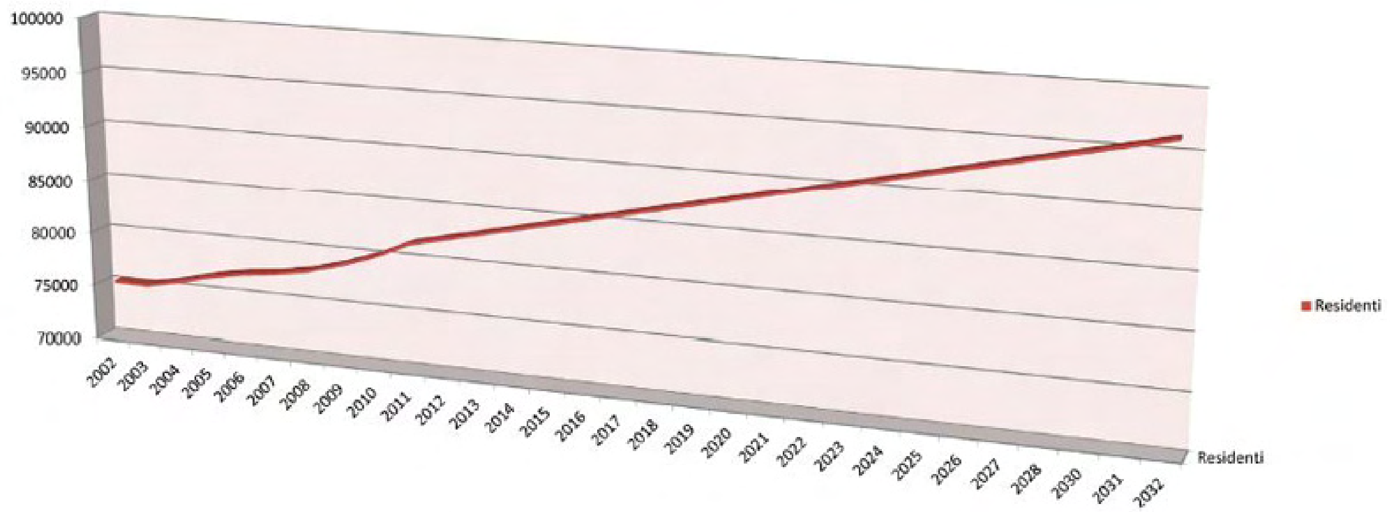


Table 2 – Housing requirements based on estimated population increase.

MUNICIPALITIES	Pop. variation 2011-2032	Housing requirements		Real estate surface	Real estate building index	Real estate building ratio	Gross Coverage surface	Max Heigt above ground
	pop.	mc/pop.	mc	mq	mc/mq	mq/mq	mq	m
Casal di Principe	3.681	80	294.480	277.108	1,06	0,3	98.160	12
Casapesenna	557	80	44.560	49.089	0,91	0,3	14.853	12
Frignano	216	80	17.280	36.447	0,47	0,3	5.760	12
San Cipriano d'Aversa	1.361	80	108.880	69.410	1,57	0,3	36.293	12
San Marcellino	3.833	80	306.640	95.090	3,22	0,3	102.213	12
Villa di Briano	1.917	80	153.360	101.507	1,51	0,3	51.120	12
Villa Literno	3.117	80	249.360	250.306	1,00	0,3	83.120	12
TOTAL	**14.683**	**80**	**1.174.640**	**878.957**	**1,3**	**0,3**	**391.520**	**12**

ment, with increases of up to 30% of the present volumes as incentives. Replacement and densification are integrated with density reduction schemes, with the compacting of volumes and the setting back of buildings to create green areas (figure 23).

All changes are aimed at reducing consumption, through passive energy-efficiency and water systems (solar hothouses, solar screens, triple-pane thermally insulated windows, water reclaiming and recycling) and active systems (photovoltaic), and through the use of recycled and renewable materials (figure 24). The boundary between town and country is established: inside the built-up areas, the plan calls for architectural densification and compacting, along with the integration of infrastructures and services, and compensatory transfer of building volumes. Densification is achieved by offering builders the possibility of increasing volumes in exchange for the creation of public infrastructures, complying with eco-compatible building standards and aiming for architectural quality (figure 24).

With a view to architectural renewal, the project identifies: areas for neighborhood public infrastructures in urban areas; run-down farmhouses in rural areas of historical and envi-

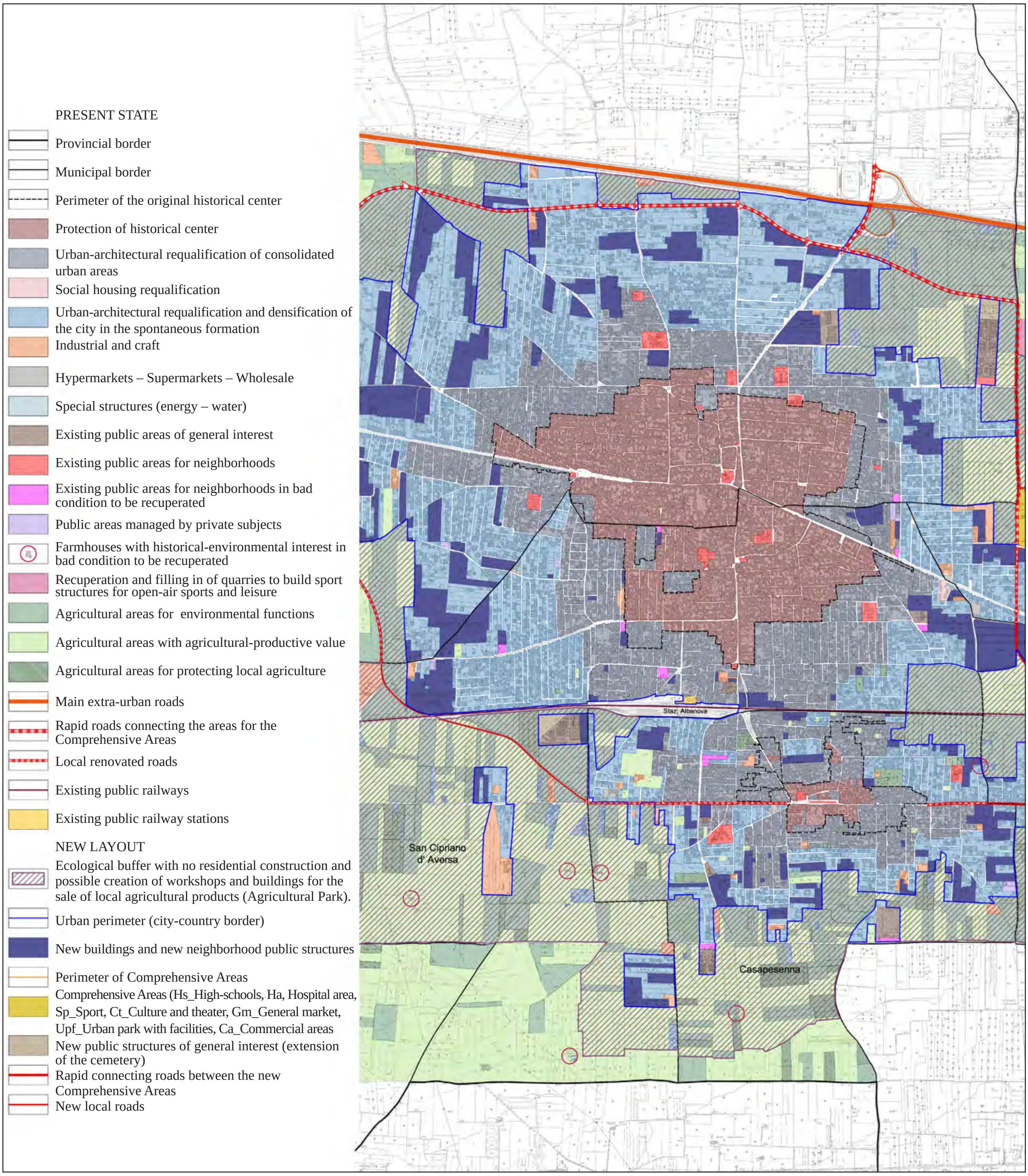
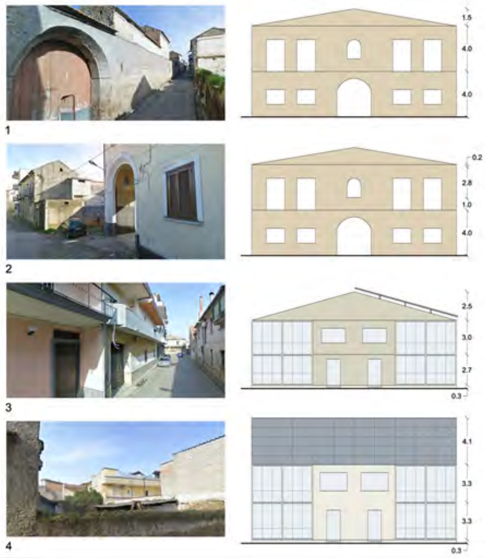


Figure 23 – Extract from the zoning map of the public consultation plan (*piano consensuale*).

ronmental interesting. Promoting artisanal and commercial activities likely to revitalize town centers is also envisaged.
An agricultural park along the town-country boundary functions as an ecological buffer between the urban sprawl and the prevalently green areas. Within the park, building is limited to farm production requirements (labs, silos, places for presenting and selling local products).
For the rural areas, the existing strategy of the Regional Territorial Plan (*for a new alliance between urban and rural areas*) is confirmed, in which rural areas are treated as a 'common good' regardless of ownership. There is focus on the multifunctionality of rural areas, on their capacity to produce



ORDINARY AND EXTRAORDINARY MAINTENANCE
Interventions on preserved buildings
Ordinary maintenance: interventions for reparation, renovation and replacement of the building finishes and to integrate or maintain the efficiency of existing technological systems.
Extraordinary maintenance: interventions necessary to renovate and replace parts, including structural parts, of buildings, as well as installing and integrating sanitary and technological systems, without however altering the total volume and surfaces of individual buildings and modifying their function.

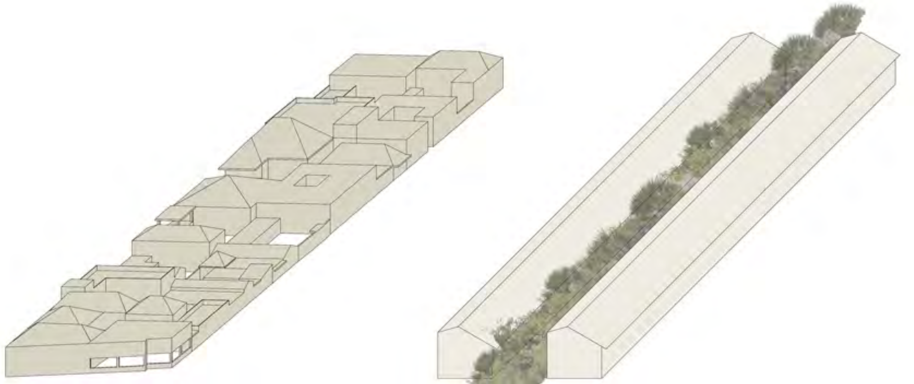
CONSERVATIVE RESTORATION
Interventions on altered buildings
Preservation of buildings and their functionality, through an organic series of interventions which, while respecting the type, and formal and structural characteristics of the buildings, will allow them to be used for compatible functions. The interventions include consolidation, restoration and renovation of the constitutive elements of the buildings, the introduction of accessory elements and of the systems required for their functions, the elimination of extraneous elements such as projecting verandas, reinforced concrete slabs, etc.

ARCHITECTURAL RESTRUCTURING
Interventions on new or replaced buildings
Interventions aimed at transforming buildings through works aimed at replacing or eliminating the constitutive elements of the buildings to improve their energy efficiency, their sanitary system, by inserting new eco-sustainable constructive elements and systems. The plan calls also for interventions of structural updating and partial demolition, through vertical thinning, of the number of floors exceeding the environmental characteristics. Within the historical center, all architectural restructuring is performed without any increase in volumes.

ARCHITECTURAL REPLACEMENT
Interventions on replaced and new buildings
Demolition of buildings that alter the environmental context, built in reinforced concrete, without eco-sustainable criteria, and replacement with new buildings,. The volumes of the new buildings must be in line with contemporary architecture, based therefore on modern construction methods, in terms of sustainability, technology and energy efficiency. Within the historical center the replacement of buildings is carried out with no increase in volumes.

Protection of the historical center

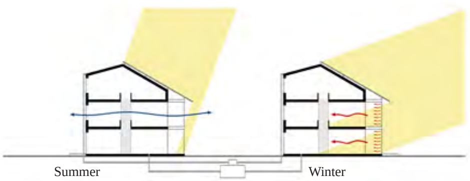
The project promotes restructuring and replacement interventions based on mechanisms of urban rewarding, offering compliant subjects the possibility of increasing the volumes of the new buildings up to 30%. Interventions of replacement and densification of the buildings must be accompanied by interventions of urban thinning, making buildings more compact and distant from the streets, in order to create space for green areas, improve roads and urban quality. Furthermore, all transformation work must have as its goal the reduction of consumption, incrementing energy and water efficiency in the buildings, through the use of passive and active construction systems, recycled and renewable materials.



Present state

Project

Urban-architectural requalification and the densification of the city.



Summer

Winter

Bioclimatic diagram

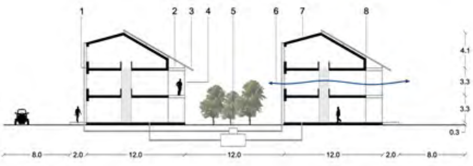


Diagram of passive and active systems

Neighborhood “Gneis Moos” Salisbourg - Austria

Solar neighborhood “Vauban” Fribourg - Germany

ENERGY AND WATER EFFICIENCY – PASSIVE SYSTEMS
1. EXTERIORS OF BUILDINGS
To reduce environmental impact, it is possible to use structures with wooden frames and claddings with high standards of thermal insulation, based on stratified elements. Furthermore buildings can be fitted with fiber cement panels, capable of creating an internal microclimate and a high transmittance level compared to traditional paneling.
2. SOLAR HOTHOUSE SYSTEMS
The creation of solar hothouse systems will contribute to the energy efficiency of the buildings causing a reduction in consumption and costs. These systems accumulate heat in wintertime and favor ventilation in the summer.
3. SOLAR SCREENING
The main facades of the buildings can be made with the so-called ‘double skin’ or brise soleil system, based on sheet metal panels placed in front of balconies. Panels can be regulated and serve to screen the apartments from the sun by filtering the light. Furthermore, photovoltaic panels, integrated in the architectural structures, can serve also as protection and canopies.
4. GLASS
Buildings can be fitted with triple glazed window panes with very high thermal insulating capacity.
5. RECLAIMING AND RECYCLING OF WATER
It is possible to install water reclamation systems that feed the water and gas system, through systems capable of transforming sewage into biogas to be used in kitchens.
6. VENTILATION
An excellent transversal ventilation of the interiors can be obtained through windows placed east and west with a direct passage through the area and therefore a cooling of the air due to air drafts.
ACTIVE SYSTEMS
7. THERMAL INSULATION
Buildings must be planned with a vast array of characteristics providing insulation. This is particularly important for protecting buildings from excessive heat during the summer and to reduce heating requirements during the winter.
8. PHOTOVOLTAIC SYSTEMS
Photovoltaic systems can be placed on the roofs and oriented towards the south, covering the roof almost entirely.

USE OF RECYCLED AND RENEWABLE MATERIALS
Materials must comply with the following characteristics: non-polluting origin, use of renewable and possibly natural raw materials, durability, ease of recycling and de-assembling, produced close to building site to cut transportation.

Abacus of the construction systems used for the urban-architectural requalification and the densification of the city.

Figure 24 – Urban-architectural renewal and densification: Abacus of pilot projects.

goods and services for society, not only through primary production but also, and more importantly, by recycling and replenishing primary resources (air, water, soil), through ecosystems and biodiversity conservation, through landscape protection, and by offering a chance for open-air recreational activities. This approach is also in line with the basic philosophy of the regional plan of Caserta as a *plan for the recreation of environmental quality.*

The preservation of rural areas includes those which currently risk urbanization, because they lie close, between or within the urban sprawl, as well as more extensive remote areas. Such areas have a dual function, serving as primary productive reserves and as a bridge between green areas. The plan calls therefore for the environmental restoration of abandoned agricultural areas, the protection and promotion of agriculturally more productive areas, and the promotion of local agriculture.

The area hubs (*poli comprensoriali*) in which the major public infrastructures are to be located,[10] are positioned in non built-up areas of the sprawl, in order to function as attractors for future construction. They are connected to the main urban centers of the integrated system both through the road network project (Fabian, Morandi, Piazzini, Ranzato, 2012; Fabian, Pellegrini, 2012) and the present-day main extra urban road (Asse di Supporto Villa Literno - Nola and SS 265 dei Ponti della Valle). Streets have a hierarchical structure: intermunicipal ones connect the *Poli comprensoriali* with scarce and general services; local streets are obviously part of the residential network. The plan also calls for the restoration and filling in of abandoned quarries to create infrastructures for sports and open-air recreational activities.

SECTION 2. INTEGRATED ASSESSMENT FOR URBAN TRANSFORMATION PROCESSES

The case-studies depicted above, albeit on different scales and treating specific issues, all relate to the rehabilitation and development of urban areas. In these cases it is necessary to plan a number of interventions, which, to be implemented, must be supported by appropriate regulatory mechanisms and accompanied by a financial feasibility study, as well as a study of their social and environmental impact.

In urban transformation processes, the complexity and structure of programs, the huge financial resources required and the qualified expertise required for their technical and economic management make it advisable, in many cases, to implement the initiative through the establishment of an urban transformation company with public-private capital.

According to Italian national legislation, municipalities can formally establish an inter-municipal body, which draws up projects, identifies intervention areas and proposes the transformation program, specifying the shares of capital stock assigned to public and private partners. The selection of the private participants (lenders, contractors or their associations, individuals who are able to provide services for the feasibility, sale and management of the program) is done through public procedures.

Thus, the urban transformation company is sponsored by the municipalities, also with the participation of the regional authority and/or other public/private agencies. Its objectives are to acquire real estate, carry out projects, manage the structures or sell them.

In order to determine the financial feasibility of the projects, a timeline chart is usually drawn up to assess the costs and revenues to be used in the financial analysis.

In general, conducting a financial analysis is a technique for evaluating financial costs and revenues related to the implementation of one or more options (including the so-called "zero alternative," i.e. non-intervention) in order to establish the return on the investment to be realized and identify the options for maximizing profits, i.e. the difference between revenues and costs. It must also be borne in mind that revenues and costs do not occur at the same time, but are spread out over many years. For this reason, they are discounted at present value, at a determined rate, and the difference will provide the net present value (NPV) of each option being evaluated.

The financial analysis of a plan/program/project consists of an evaluation of investments and subsequent revenues for all operators, bodies and enterprises (public and/or private) involved in planning and/or implementation of a measure. It is conducted with reference to market prices (actual and/or expected). Thus, the result of the evaluation is expressed in monetary terms and can highlight the utility of the various operators gained from participating in planning, implementation and/or management of the proposed actions.

In order to accept an option, the NPV must be positive and if several alternatives are present, the one with the highest NPV is preferable. The internal rate of return (IRR) of each option, defined at the discounted present rate for which NPV is 0 (zero), must also be taken into account.

Financial analysis does not take into account whether after the realization of a given option, some social sectors will receive advantages (benefits) or others will suffer disadvantages (costs). The first will have a willingness to pay for the benefits, whereas the second will have a certain willingness

10. The *Poli* combine public infrastructures of the size prescribed by current legislation and commercial areas: high-school buildings for 3,000 students, day-hospital (3.4 beds / 1,000 inhabitants); open-air sports center and sports arena with 5,000 seats; music-hall with 2,000 seats; library for books and visual media for 700 users; market with 1,200 stands; urban parks totaling 146,000 m^2; commercial areas for a total of 91,500 m^2.

to accept compensation for the loss. Hence, a certain option will be desirable if the benefits exceed the costs, in this case too, discounted at the present value.

Cost benefit analysis (CBA) is a technique that takes into account the fact that while not all costs and benefits are financial, many can be adequately translated into monetary terms. Thus, it tries to consider all the gains and losses of all the members of society affected by a plan/program/project. CBA has the advantage of expressing on a single (monetary) evaluation scale the impacts of the various alternatives. In this case, the difference discounted at present value between costs and benefits provides for each alternative its "economic" net present value (NPV) (Figure 25).

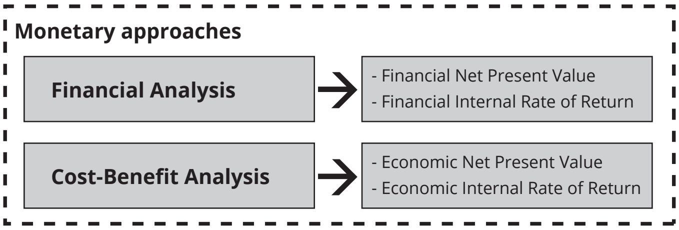


Figure 25 – Financial and economic analysis.

CBA however, cannot take into account impacts that cannot be transformed into monetary terms. For this reason, multicriteria analysis (MCA) has been developed; MCA takes into account both monetary and intangible impacts, expressing them in quantitative and qualitative terms, viz. on cardinal or ordinal evaluation scales.

In the case of urban transformation options, the possibility of using MCA is based on a preliminary "impact analysis," that is the prediction of the effects of each alternative option from all relevant perspectives (economic, social, natural-environmental) and according to a specific period. These impacts can be transformed into monetary amounts or can be expressed in other evaluation scales, even using adimensional indexes. Thus, a multicriteria approach permits a systematic construction of impact matrices and the transformation of qualitative-quantitative data to compare alternative options.

However, each evaluation method has its specific features, particularly with reference to:

- how the problem is structured (objectives and adopted criteria and their interrelations);
- how the available information is used (quantitative, qualitative, fuzzy indicators);
- how the results are aggregated (mathematical procedures);
- the possible participation and involvement of local communities in decisional processes.

It should be noted that it is not always possible to maximize all objectives simultaneously and that often the maximization of an objective implies the minimization of others; through MCA it is possible to recognize existing conflicts and search for more satisfying solutions. Thus, it is essentially an "integrated" evaluative approach, which takes into account different options involving impacts in various sectors and, at the same time, involves many different perspectives in the decisional processes.

Within this perspective, "integrated evaluations can be defined as an interdisciplinary approach able to combine, interpret and communicate knowledge starting from different scientific disciplines so that the cause-effect chain can be evaluated synoptically considering that it is possible to: a) obtain an added value with respect to evaluations based on one single discipline; b) supply decision-makers with useful information" (Rotmans and Dowlatabadi, 1995).

Especially in the field of territorial and urban planning, evaluation implies the need to operate in the framework of integrated assessment, conceived as a procedure needed to achieve an informed capacity to evaluate different courses of action with regard to environmental, social and economic issues. Integrated assessment is a methodological approach that benefits from the synergy of a variety of fields of knowledge and from different sources within society. Such evaluation methodologies allow social cost-benefit analysis to incorporate different aspects referring both to impact assessment and to local community participation in the decision-making process, while integrating subjective and objective components, tangible and intangible values, "hard" and "soft" data (i.e. coming from scientific knowledge and lay knowledge). Integrated assessment, conceived as a "learning process," helps take into account uncertainty, risk and complexity in the decision-making process, to which a broad range of expertise can contribute.

Therefore, integrated evaluations can be defined as structured processes that allow complex issues to be addressed using knowledge from different disciplines and elaborated by subjects involved in the decisions. It is a multidisciplinary approach in which different dimensions of value can come into conflict and any social decision will distribute positive and negative consequences among various groups over time and space. Indeed, integrated evaluations do not consider only the impacts of the alternative solutions but are open to broad public participation, in order to gain further information for the evaluation, facilitate the decision-making process and better ensure the desired results (Castells and Munda, 1999; Golub, 1997).

Participation becomes essential not only to examine and assess the effects of choices at the social, ethical, political, economic, environmental, etc., level, but also to legitimate and make all choices acceptable to the community. Within this context, good use can be made of "social multicriteria evaluations" (Munda, 2008), which have the following features:

- inter/multi-disciplinarity, since they integrate a plurality of

scientific approaches;
- participation, because they take into account new knowledge through citizen involvement;
- transparency, which ensures ethical and responsible approaches;
- coherence, to ensure that the desired results truly follow from the premises.

Social multicriteria evaluations adopt a cyclic evaluative approach which adapts evaluation elements on the basis of continuous feedback, obtained at various stages through consultation among stakeholders (Nijkamp et al., 1990).

In particular, in urban transformation processes, a very useful integration is that between multi-criteria analysis (MCA) and problem structuring methods (PSMs); these are methods providing a useful support for the information used to deal with a variety of non-structured problems and situations, going beyond traditional approaches and espousing communicative conceptions of planning (Rosenhead, 1996; Rosenhead and Mingers, 2001).

In particular, PSMs are useful for dealing with:
- multiple actors;
- multiple points of view;
- incommensurable or conflicting interests;
- significant intangible values;
- uncertainty.

In these situations, through PSM it is possible to represent a problem so that participants can clarify their positions and focus on one or more aspects potentially capable of creating consensus. Through PSMs it is possible to graphically represent the complexity of issues at hand, to explore solutions, compare alternatives, and take into account uncertainty, in terms of "possibilities" and "scenarios." PSMs are based on explicit modeling of cause-effect relations and their technical simplicity allows them to be used in "facilitated groups" and workshops.

Moreover, it should be noted that nowadays "hard" values – tangible, material and monetary values – are dominant, and "soft" values – intangible, immaterial and non-monetary values – are often ignored. Acknowledging both tangible and intangible values is the basis for collective decision-making processes, including the development and definition of goals, sharing of knowledge, negotiation and compromise, problem-setting and problem-solving, attention to issues of justice and equity (Sinclair et al., 2009). This means helping stakeholders and communities clarify values, become more adaptive and pro-active, respond to change, set personal and collective goals, and participate in the planning and designing of decision-making processes. An integrated evaluation approach can go beyond spatial and hierarchical limits to consider the different components, clarify weights, recognize different priorities and define appropriate strategies while also allowing for social participation and a dynamic dialogue among different experts (Lee, 2006).

Integrated assessment can become a "key tool" in supporting the decision-making process especially when uncertainty, complexity and values of different social groups are many, differentiated and conflicting. Integrated evaluations not only consider the input of data expressing the impacts of different solutions but they require broad public participation in order to offer more information for the evaluation process itself and, in addition, to make decision-making processes and their results more acceptable (Munda, 2008).

In this light, integrated spatial assessment (ISA) (Cerreta and De Toro, 2010) can be useful in decision-making as a tool that allows one to perform technical and political evaluations and deal with complex value systems in conflicting and changing contexts. Since ISA consists in the integration of multi-criteria analysis (MCA), multi-group analysis (MGA) and geographic information systems (GIS), it can become extremely fruitful in urban transformation, where the role of local agents, their relations and objectives may be considered a structuring element for the process of information construction in a spatial and dynamic evaluative model (Figure 26).

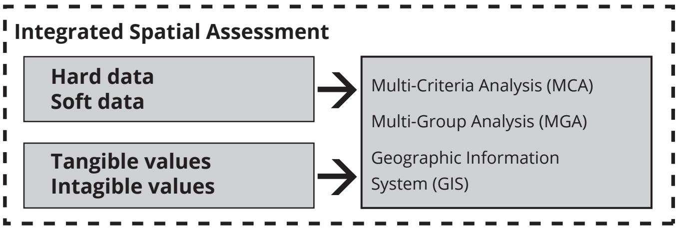


Figure 26 – Integration of tools.

The proposed approach may help communities clarify values, be more adaptive and pro-active, respond to change, set personal and communal goals, and participate in planning decision-making processes. At the same time, the application of spatial tools, such as GIS, is a useful support to identify territorial references and link values and planning choices with reference to:
1. the spatial characteristics of options proposed;
2. the temporal modification of data following the implementation of options;
3. the expressed preferences of local agents;
4. the analysis of conflict among the various stakeholders;
5. the evaluation of various options in order to obtain a priority list.

From this perspective, ISA can be a useful tool for decision-making, including technical and political evaluations, when dealing with complex value systems, in a conflicting and changing reality. It corresponds to a decision-making process that allows for the complexity of human decisions within a variable environment, in which collective knowledge and learning assume a significant role, and offers the possibility to explore the transformation strategy definition in a spatial planning field according to sustainable and complex values.

Indeed, in decision-making processes relative to projects and plans, evaluation can help recognize values, interests and needs, explore the different aspects influencing decisions, and making the final choices. Evaluation can integrate approaches, methods and models that respond to the different needs of the decision-making process and helps take into account different goals and multidimensional values, in order to take into consideration the nature of the stakes and identify preferences and priorities. Consequently, evaluation becomes a tool for stimulating the identification of innovative solutions, and the evaluation activity takes on a significant role in urban and non-urban transformation processes, while integrating economic, ecological and socio-cultural assessment.

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