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PLANNING TOOLS AS AN INTEGRATED QUALITY CONTROL DEVICE IN URBAN SUSTAINABLE PROJECTS. THE CASE OF THE NEWS PDZ IN ROME

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Summary

The housing market finds itself facing an emergency due to the difference between supply and demand, in particular in the social housing market. Faced with a demand for cheap social housing, that runs the risk of creating new situations of poverty and profound social marginalisation, the residential buildings market is proposing, at the medium and high end, to turn to the private market and a set of requirements and questions that are more easy to resolve.

At the dawning of a new era in social housing, the quantity requirements have to be viewed alongside research that privileges many aspects of environmental and technological quality, characterised by both interactivity and its relationship with the natural environment.

The reflections on the technological aspects of the building organism are reflected in the transformations it aims to assist: the new materials introduced on to the market are joined to conventional technology, the new and elevated performance levels required have to face up to the behaviour patterns and functional schemes of contemporary life.

In this context, we consider the experience of the Municipality of Rome, an experience that marks a very important step in an initial stage of innovation and sensitivity to the new mode of conceiving and managing building elements.

1. New actions for social housing

1.1 Actual urban planning: the new Zone Plans (PdZ) in Rome

In the last twenty years, the City of Rome, like all other administrative bodies of big European metropolitan areas, has had to confront, at various times, the housing crisis, in other words, the problem of a strong demand for social housing in response to the housing needs of many parts of the population in marginal social or economic conditions.

The City of Rome confronted these questions by drawing up the Plans for Popular and Economic Buildings (Piani per l'Edilizia Economica e Populare – PEEP) that were used from time to time to determine the quantity of buildings to be constructed; in particular, the 2nd PEEP, proposed in 1985, was redefined and refinanced many times until 2005. At this point, the City, due to the requirements of regulations aimed at alleviating the "housing problem" (Law 8, February 2001, n 21), passed a new series of measures to launch a truly valid Plan to deal with the Housing Crisis.

Under this plan, the City identified various initiatives, including the promotion of the transformation of 36 areas within its territory. In these territories it promoted detailed town planning, local urban planning, Zone Plans (Piani di Zona - PdZ) which are prerequisites for the operative planning of the building and infrastructure interventions that are necessary for the creation of new residential installations and their services. In this case, an in-depth study of quality definitions for the interventions to be carried in the territory was carried out, in such a way as to supply the citizen with a services and housing offer that doesn't merely satisfy a need for quantity, but also satisfies the aspects of housing relating to greater environmental quality.

In order to achieve this, the administration proposed accompanying the traditional structure of actual urban planning with a "code of practice", as a set of guidelines for the planning of future installations to be built; the code will gather together and place at the disposition of the planners and promoters of future installations all of the indicators and tools for the definition of an integrated planning strategy, to control the overall quality of the interventions. In this way, alongside the traditional indications of technical regulations relating to the construction of residential buildings it is possible to place a system of best practices, of innovative guidelines about environmental quality of constructions, about energy and environmental management systems for sites and buildings, about the knowledgeable use of technological solutions aimed at the overall improvement of the performance of the building and the urban complex.

1.2 The need for quantity and the demand for quality: the qualification of the project

Despite the housing market always reporting an emergency due to the gap between housing supply and demand, in particular in the social housing market, faced with a need for low-cost social housing, that runs the risk of creating new situations of poverty and profound social marginalisation, the residential buildings market is proposing, at the medium and high end, to turn to the private market and a set of requirements and questions that are more easy to resolve.

In both the social requirement for quantity and the private demand for quality, the market responds in a uniform and unimaginative way, using very traditional technological definitions and typological solutions, blocked partly due to current regulations, offering as an added value only extra space or fittings. Faced with this picture of the relationship between housing supply and demand in the market, it is possible to state that the need for quantity springs from the perception of the inadequate quantity of the existing housing stock, while the demand for quality springs from the knowledge of the necessity to establish a new relationship with the surrounding neighbourhood, on the scale of the building and the urban complex.

Quality is not an objective characteristic, it's not the qualifying characteristic of a product; instead it is the response to the expression of a need. Therefore, a new demand for quality presupposes a dissatisfaction among the users of current building stock; when speaking of the quality of an architectural or urban project, its level of quality must be discussed, the degree to which it responded to the need that generated it.

It is possible to acknowledge at least two different levels of quality in a project: the intended quality and the end quality.

The Municipality intends to go precisely in this direction with the planning process for the interventions included in the new Zone Plans, by supplying guidelines to improve the intended quality of a project to improve its end quality, thanks to this more finely tuned and more complex control tool relating to expected performance. In this instance, all of the planning indicators in force today can be applied in an organic way by the city with single measures and the new regulations of the General Regulatory Plan regarding environmental sustainability of building interventions, overcoming at the same time a certain traditional rigidity in these same urban instruments.

The code of practice is conceived as a support tool and pointer for the realisation and control of sustainability in constructions, in particular social housing, that proposes a highly integrated approach to planning. The code looks again at housing requirements in terms of economic, social, functional, environmental and energy sustainability; these proposals for innovative functional "add-ons" to the creation of urban spaces are analysed in terms of both the comfort of public spaces and as a functional and social mix, in a way that obviates the phenomenon of social and economic segregation that is typical of metropolitan suburbs.

The code also appraises the appropriate and measured technological solutions to the types of buildings to be constructed in a way that doesn't differentiate them from the current approach of local promoters, though it does require a higher level of final technological performance for the environmental sustainability of the interventions. An analysis of the innovative technological solutions in the construction of residential buildings needs to be carried out, including the study of the construction materials used, in such a way as to direct intelligently the choice of the construction solutions and successive control in phases of building through management procedures. Using the same logic, the most appropriate system devices for efficiency in light of the indications of recent regulations regarding energy control management were analysed and evaluated. To support these indications, the code proposes an integrated model of analysis of the sites where interventions are being carried out that includes all of the environmental aspects and characteristics of the single sites, and to bring to the project and planning strategy the indications that derive from the natural and cultural characteristics of the sites in question.

2. Technical solutions to adopt in the planning of sustainable residential housing

2.1 The role of environmental analysis in the identification of the technical solutions to be adopted

The code of practice for the Zone Plans of the city of Rome foresees a reasoned appraisal, because good architecture depends on informed energy choices. The role of the architect, from this point of view, has to necessarily tend towards integrated planning, even if the specific object of the project is the planning of a city or on the scale of industrial design. Underlining the importance of logical planning throughout in terms of needs analysis, evaluation of requirements, and optimisation of performances, any architectonic element that doesn't look for a balance between the building system and the environment in which it is to be found and on which it will have an impact should be considered incoherent.

The experience of the code of practice for the Zone Plans of Rome explicitly inserts into this logic: an organised sequence of work phases in which every option, to do with timing or systems, is a consequence of the analysis of the environmental variables and their possible synergetic interaction in with planning. Environmental parameters, typological models, approved technical solutions, requirements, technical norms, synergy and compatibility matrices all assume great value within this research, in full coherence, therefore, with the objectives of the programme.

Specifically, with regard to methodology, as with environmental analysis, the use of Ecotect software (with particular attention on the Weather Tool module) is placed alongside traditional bibliographic research.

The idea on which the entire study of the code of practice is structured is as follows: to analyse the potential of a building-environment system, identify its eventual compatibility or incompatibility with the technical possibilities present on the market. A fundamental role, therefore, is assumed by the very concept of compatibility, intended in its widest sense, in terms of regulations, technology, economics and use. To delineate a process in this sense inevitably imposes a preliminary survey in merit of the characteristics of the urban environment, but this implicitly means looking at the technical performance of the functional models of the building envelope, successively defined as compatible.

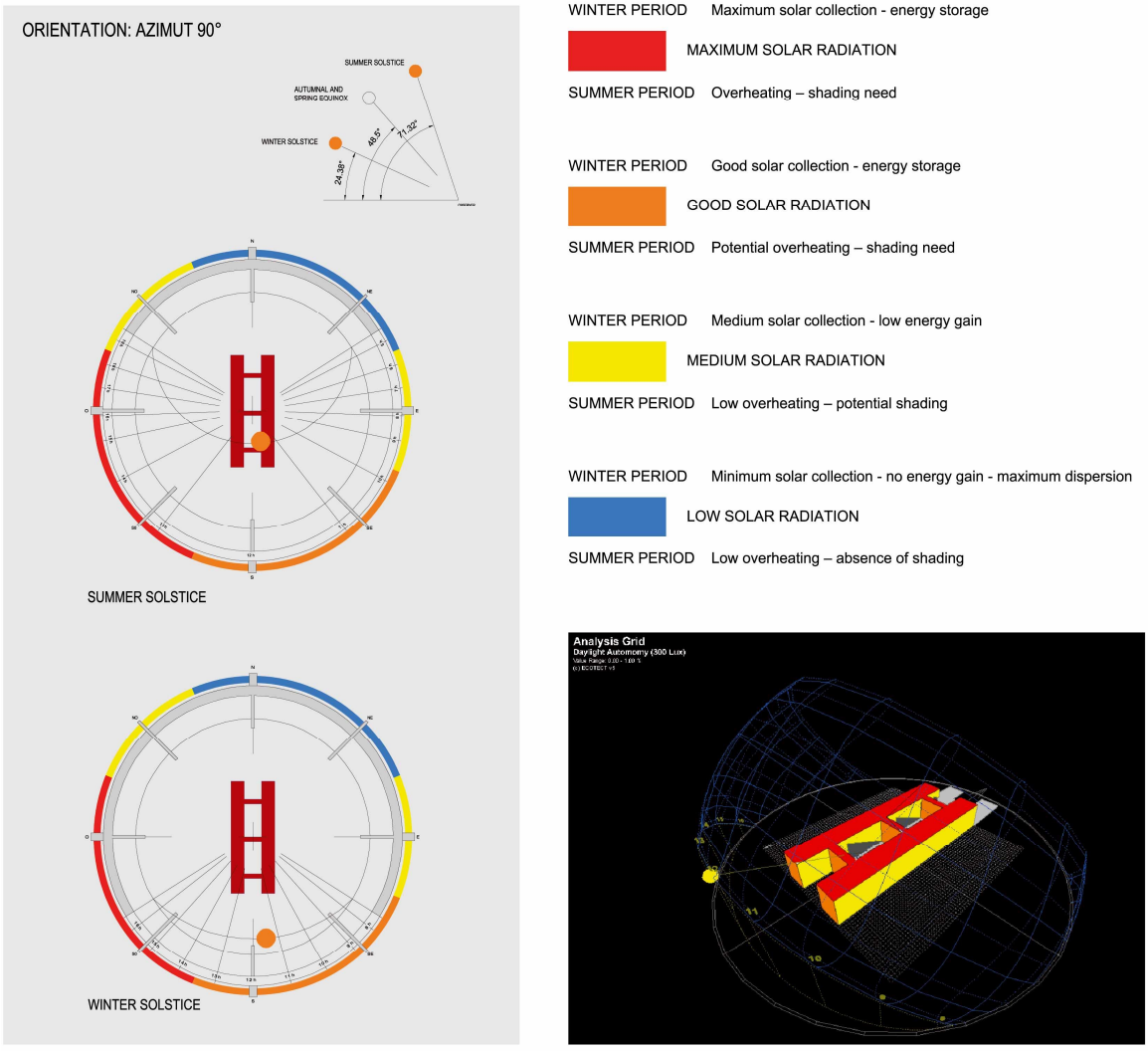

Figure 1 Building system solar analysis

The objective is to draw from the valid planning indications on both the scale of the neighbourhood and the scale of the single building: with this in mind, it should not be limited to a single vision of the phenomenon in a generalist and quality key, the imposition, rather than the option, of a specific deepening of knowledge where conditions are verified that require particular attention. These intentions are made concrete by means of a timely appraisal of the adoption of methods that verify and consolidate matters primarily concerned with solar radiation. It is a considered choice to deepen that environmental parameter over others: firstly, solar radiation is configured on the scale of the whole building, as having major significance in relation to the passive performance of closure packets and to their potential in terms of solar panel systems. In support of this position, it is necessary to underline the analysis of pre-existing urban environmental data: for example, the code has agreed from the outset to exclude an approach on the theme of energy optimisation in terms of the exploitation of wind systems; the reviewed data clearly show that wind phenomena are substantially negligible in terms of intensity and frequency in the City of Rome. The analysis of solar radiation at the level of the building gives quality indications for the exteriors of buildings, shared public spaces and the divisions of the project.

The promotion of an integrated approach to the sustainable planning is translated therefore into the suggesting of multi-level intervention strategies that take into consideration the planning and possible interactions between all the elements of the interaction between the urban and natural environment.

2.2 Integration of technical solutions in building design

The sustainability of a project and the quality of the construction from the energy point of view depend largely on, among various factors, how the building is built.

The reflections on the technological aspects of the building organism are reflected in the sometimes profound transformations that accompany it: new materials introduced on to the market are added to conventional technology, the new and elevated performance levels asked for are compared with the behaviour and functional schemes of contemporary living.

On the one hand, the need for greater operative clarity in the aiming of adoptable planning choices is gained, and, on the other, the importance of an explication of the criteria that subtend the choice of the technological solution, privileging one alternative over another.

In particular, it is necessary to pay particular attention to the definition of the superficial and border elements through the external and internal ambience of buildings (the envelope) that determine the requirements of the building and respond to the needs of the users who will live there.

On this theme, the most evident aspect is the emergence of environmental and economic advantages that have an impact not only on the external environment, but place first the user's quality of life. The adoption of new rules and new performance requirements will lead to a reduction in energy consumption for heating and air conditioning, therefore a notable reduction of electricity bills (installation of air conditioners, hot-water plant for cleaning, electrical plant) in the course of the useful life of the building.

On the other hand, the environmental advantages are a direct consequence of improving the efficiency of buildings and their plant systems: lower fuel consumption in fact means less emission of gas into the atmosphere and a lesser impact of materials used in the environment.

The theme of eco-efficiency should be attacked head on not just through the technological qualities that the technical solutions will be able to guarantee. The importance of building management - highlighted in the objectives of the European Council on spring (OR. EN 7224/07 of March 8th 2007), taken up then by national (Legislative Decree 311/2006) and local regulations (Del. 48/2006 City of Rome) - underline an ulterior element of reflection: the constantly growing role and importance of plant in the management of building stock. In this discussion we find the growing incidence of alternative plant needed to sustain buildings, as much from the point of view of initial costs as the dimensional impact of the same on an area under consideration.

The increase in requests to use renewable sources along with the demand to reduce energy consumption and CO2 emissions into the atmosphere, translates therefore into the need to think about the integration of plant both as a means to reduce the country's energy demands and as a source of co-generation able to guarantee positive economic returns in the conduction of the buildings.

In this context, the existing ties between plant systems and the building envelope assumes particular importance: every choice made in one of the systems weighs significantly on the planning and dimensions of the other.

The most evident aspect of the evolution of the legal framework for building activity is, therefore, the beginning of a demand for legal performance that can prime a "normal" practice of intelligent planning that is energetically and environmentally sustainable.

This leads to an evaluation not only of the immediate cost but also, and above all, for the projected future cost with regard to any of the fundamental components such as health, efficiency, life cycle and maintenance, that will continue to be evaluated case by case in single projects in relation to the urban context of the building.

The choice of the planner will undoubtedly be that of finding the most suitable solution within a combination of conditions, opportunities, and links that are reference points for the environmental characteristics of the site in the course of the seasons during the year, with a control of the external part of buildings in relation to

their orientation and to the activities carried out internally, as well as - in virtue of the errors of the past – attributing to the morphological quality of buildings the specific character that distinguishes the history of each and every place.

The problem of sustainability encroaches on many distinct disciplines and demands their inter-relationships be taken into consideration.

In light of this last consideration, the control of environmental and technological requirements, as well as their satisfaction, are both essential objectives that should be reached in respect of architectural language proper to and expressed in each single culture.

Among the innumerable aspects contemplated in the concept of project sustainability, the aspects that relate to the different needs of individual countries should not be overlooked. This theme, which in the past was partly ignored, led to the problems that the current recovery of buildings tries in a diffused manner to overcome.

The monotony, the repetition and continued lack of aesthetic appeal of buildings in the recent past, in Italy as much as in other European countries, are the evident results of an approach to planning that is distant from the context into which it is to be inserted.

From the point of view of this “virtuous” planning in residential buildings, new building is assisted by research into envelopes that are characterised by innovative forms, technologically and formally, that encourage planners towards a careful analysis and conceptual experimental flexibility in both the search for new rules for the codified distribution of living spaces, as well as often importing construction techniques from other types of buildings.

The technological transfer of some solutions from analogous building sectors leads to an increase in its repertoire, performance and systems on offer, and, on the other, to the introduction of material that is more or less sophisticated and has the ability to satisfy the required performance levels with a minor impact on its environment but that is not always easy to control over time.

In this historic period, it is well known, in fact, that there is a construction industry with the ability to always offer new products that gives the planner many choices from a catalogue of more or less complex elements.

This last consideration points to the fact that, on the one hand, the more components become complex, the more they are composed of individual layers, or sub-elements; on the other, it is established that as much more of the element’s technical performance is the sum of its layers’ individual performances, it will be of great importance to control their final technological quality. It will also be necessary to verify analytically the performances that respond best to both the requirements and actions that define the needs picture of the residence, and the priorities that are used to define the objectives of the effective sustainable plan.

We can see, therefore, how the external envelope is one of principle areas called upon to satisfy a building project’s sustainability. At the same time, the elements that make it up are called on to provide, in a coherent manner, all those aspects of volumetric and spatial composition the building was not able to respond to.

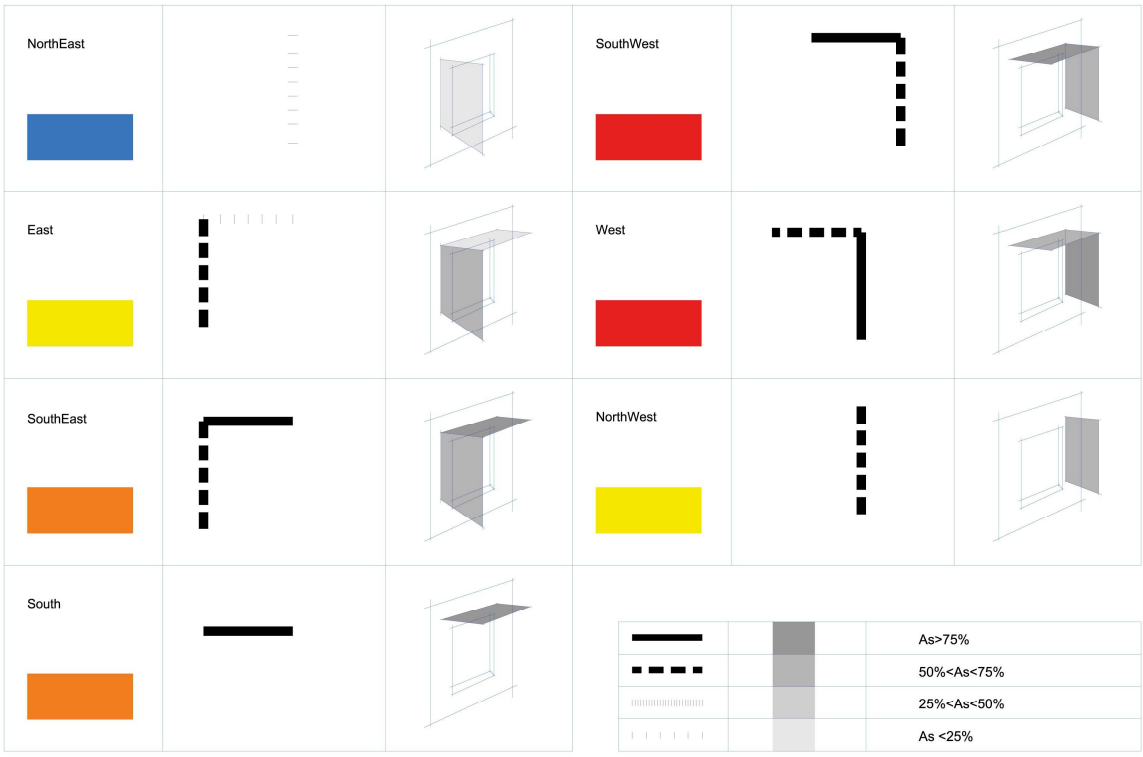

Figure 2 Design of solar shading in respect of façade orientation

Research into the envelope elements has therefore led to a moment of reflection and analysis about the morphological characteristics and specific performances of the solutions that may be considered meaningful and adoptable.

Given the great variety and complexity of systems and elements, it was felt necessary within the code of practice to include a methodological-operational indication guide and support for the choices to be made, through which to identify and choose the solution considered most suitable within currently available technology.

The new manner of thinking about technological sustainability is sought in the acknowledgement process of the values of architecture and in the adoption of a new planning method appropriate to the transformation of the natural environment into a man-made environment aimed at a new more knowledgeable community.

A similar approach modifies the planning of the technical elements, which must be thought of not only as a connection and/or separation from the other elements of the building system, but also as effectively "able to be integrated" thanks to an interdisciplinary meeting of the various specialists involved in the planning process.

2.3 Construction materials. Product and process innovation for residential buildings.

The code of practice for the Zone Plans of the city of Rome foresees a reasoned evaluation of construction materials to employ in projects; the identified evaluation criteria don't aim to construct an abacus of materials to use or not to use for these buildings, but intends to supply tools to the person who will plan and realise these buildings to choose materials and construction solutions in a way that will answer a system of technical requirements identified as determining for the efficiency and sustainability of the proposed solutions. The choice to use or not to use a certain product is reached through various selection criteria that are defined to satisfy the need to obtain good physical-technical performance but at the same time guarantee a low impact on the environment.

The evaluation parameters proposed are constituted in part by measurable elements, referring to the quantity level, and in part derive from numerical data and considerations referring to quality.

The evaluation takes place on materials that are able to guarantee performance of good thermal and acoustic isolation; these material are entrusted with creating comfortable environmental conditions in the internal habitation space at a perceptive and sensorial level. In particular, the choice proceeds through the following three levels.

The first level is through the reading of a numeric value of thermal conductivity choosing materials with a low value and technological solutions with greater insulator capacity.

The second level considers the volume of the material. In Rome's climatic conditions, a high amount of mass guarantees comfortable internal living conditions contributing to limited energy consumption, supporting and in some cases rendering superfluous air-cooling systems.

The thermal inertia or mass effect uses the physical property of the materials to increase the time (thermal lag) that the heat wave takes to cross the walls; this produces a stabilization of the temperature, guaranteeing a lower internal temperature during the day as well. Along with the good thermal qualities materials with large mass are associated with a better capacity for noise reduction. The attenuation of noise, measured in decibels, grows in relation to the mass interposed between the source of the noise and the environment to be protected. A decent quantity of acoustic isolation material leads to a greater level of internal comfort and quality of life of the space.

The data relating to volume mass is moreover connected with the regime of preferred use. This regards the difference of performance offered in case of either summer or winter. The code of practice has opted for the hot season as its preferential regimen. Buildings in the city of Rome, as in Italy and the centre-south of Europe, due to environmental conditions in the Mediterranean basin, which is characterized by mild winters and hot summers, present a greater need to defend themselves from low temperatures, the need to minimize the use of artificial air conditioners during the summer season and finally to limit energy consumption and create good internal conditions of comfort.

The third level of selection is based on LCA (Life Cycle Analysis) and the PEC value (Primary Energy Consumption). Through the LCA, the complete life cycle of the material is evaluated, from the sourcing of the first materials to the completion of the project; to evaluate the LCA of a material, multiple aspects are examined, some of which can't be directly measured and compared. In particular, the consumption of primary energy (PEI) offers a partial evaluation of the product's lifecycle. This constitutes an ulterior parameter of comparison; it is always preferable, wherever possible, to use an isolating material that uses low energy consumption in the production phase, because of the total minor impact on the surrounding environment. Some synthetic insulators, for example, even with a good level of performance of thermal isolation are characterized by a high consumption of primary energy: in their place, insulators of a mineral (fibreglass) or vegetable (wood fibres) nature should be preferred.

The three levels of evaluation contain elements relating to quantity and quality don't answer definitively the question of what would be the best solution; rather, they supply some indications which provide the possibility to make a choice with the aim of arriving at technological solutions for the Zone Plans that adhere to the principles of sustainability and biocompatible construction.

Table 1 Comparison between insulator materials parameters

Material	Use	Conductivity (W/mk)	Volume mass (kg/mc)	Potential environmental impact PEI (MJ/K)
Fibre glass	insulator	0.040	55	34.60
Expanded Polystyrene (XPS)	insulator	0.035		107.15
Wood fibres (cork)	insulator	0.040-0.046	100-300	7.05

3. Conclusion

The experience of the code of practice for the Zone Plans of the City of Rome proposes an integrated methodology of approach to planning, an organised sequence of phases of work, in which each option, temporal or systematic, is the fruit of the analysis of environmental variables and their possible synergetic interactions. Environmental parameters, typological models, legal and technical solutions, needs, technical legislation, compatibility matrices, all assume a great value within this research in full agreement with the programme's objectives.

The strategic relationship of the code of practice to the process of planning, designing, building and managing interventions is that of impacting on the definition of a complex quality profile that is expected or required from interventions on buildings, supporting the administration up to the phase of urban planning in the definition and detailing of the level of technological and environmental quality in building interventions.

The code of practice, therefore, functions as a preliminary technical briefing document or as a strategic planning document aimed at obtaining high levels of urban and environmental quality, influencing both the quality of the use of space in buildings, as well as the management of the resources used by the integrated system formed by the surrounding urban complex, of the building and of the plant system in the whole life cycle of the surrounding planned system.

The promotion of an integrated approach to sustainable planning translates therefore into suggesting multilevel intervention strategies that take into consideration the planning and possible interactions between all the elements of the manmade and natural urban environment.

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