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Sustainable buildings in significant architectural contexts: a proposal for the area of "La Martella" in Matera.

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ABSTRACT

Each architectural project is arranged as an organised process according to a sequence of phases, which are in turn characterised by different procedures; from the initial cognitive analysis and the expressive synthesis, to determining the construction techniques and the most appropriate materials, all of which make it possible to define and manage the proposal. Within the course of the project, each phase is connected to the previous and following one according to different criteria but not necessarily according to a set temporal articulation.

The course of the modern bioclimatic project is characterised by two specific factors, the first being the necessary attention to the reaction of each individual element and of the whole building in relation to physical phenomena; the second factor required is that of providing the occupants with a high level of satisfaction: each choice made during the planning stage is dependent on the physiological and psychological well-being of the possible users.

The building plan cannot exclude evaluations regarding the consequences connected to choice of specific constituent methods and materials. Another fundamental requirement of the building materials is their durability and maintainability so as to avoid energy and economic waste.

Sustainable planning is based on the environmental conscience which belonged to traditional construction traditions. Their reproposal today does not mean a return to the past but a modern rereading of their use, as a normal evolution of techniques whose final aims are both the reduction of energy consumption and the restoration of a cultural identity characterised by a general state of well-being.

According to these criteria, the sustainable planning implemented during the course of this research has demonstrated an application contextualised in an area with profound environmental-architectonic characteristics, the village of La Martella of L. Quaroni in Matera (Italy).

Key words: Environmental sustainability; bioclimatic project; sustainable buildings; durability; maintainability.

1 INTRODUCTION.

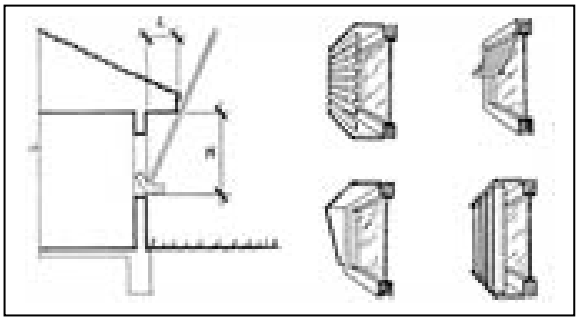
The relationship between an installation and the surrounding environment has always been governed by specific rules whose respect is the main condition to survive inside the "man-nature" system.
The environmental and ecological equilibrium between the possibilities and the limits of the resources and the necessities and the desires of the man, relatively to his need "to live" a place and the limited availability of resources "on the spot", have given as a result to privilege the employment, as construction elements, of available materials in the immediate proximities of the places of building.
The characteristics of the human installations and the architecture, in their formal, morphological and technical-constructive aspects, have been substantially conditioned therefore by the specificity of the places in which they have been realized and by the availability of natural products, (wood, clay, stone, straw, etc.).
During the time, but mainly with the advent of the Industrial Revolution and the production of electric energy, the human installations have evolved more and more in very complex open systems whose inputs are the energy and the materials and the outputs other materials and refusals in a lot of different forms. Such evolution has also seen the dramatic growth of the quantity of the inputs and, accordingly, of the outputs, due both to the technological progress and the availability of energy, not perceived as a scarce resource.
This has determined the break-up of the symbiotic relationship between places and materials of the building and the loss of the permanence of the natural building products in their original place, guarantee of the operation of a cyclical trial of collecting, use and re-release in the global ecosystem, historically supported by the continuous activities of recycle and recovery of materials and buildings.
The construction of the installations, to be more precise the building activity, has so widened its role in the environmental impact as consumer of territory, raw material, energy (around 50% of the materials and 40% of the energy) and as producer of voluminous heavy and partially dangerous discards (around 50% of solid discards): the buildings cycle of life dramatically influences, therefore, the cycle of life of the whole planet: the speed with which the man environment has devoured the natural environment, in fact, has produced the diminution of the "changing capacity", to be more precise of the ability of the planet to absorb the discards of the constructions.
It follows that the rate of consumption of the renewable material resources, of the water and energetic ones, must not exceed the rate of reconstitution assured by the natural systems and that the rate of consumption of the non renewable resources must not overcome the rate of substitution of the renewable resources: environmental sustainability means, therefore, to preserve and to use to the best the natural capital of the system in relationship to the processes of economic, social and productive development.
Then it is in consideration of the remarkable incidence that the sector of the constructions assumes in the planetary energetic equilibriums, that the diffusion of the sustainable architecture becomes very important, an architecture that, through

the employment of appropriate technologies and opportune criterions of the planning for the new constructions and for the energetic recovery of those existing, can satisfy the building performance demands.
The sustainable architecture deals with the study of the typological solutions and with the performances of the technological systems that mostly answer to the environmental and bioclimatic characteristics of the site and they allow to reach conditions of comfort inside the buildings; such objectives are pursued through a planning activity that is aware of the use of the available resources.
Analysing the origin of the term bioclima, and accordingly the adjective bioclimatica that derives from it we can see that it is composed from two Greek words: bios that means life and clime that literally means inclination of the earth from the equator to the poles and in the current meaning the complex of the meteorological conditions of a given zone.
The bioclimatic term, is born instead from the meeting of the architectural regionalism and the bioclimatology, and it expresses a type of approach aimed to face, with interdisciplinary contributions and with orderly and systematic methodology, the problem of the regulation of the climate: out of this we get the concept of bioclimatic architecture, an architecture that minimizing the necessary energetic consumptions for the climatization (heating, summer conditioning and diurnal illumination), it limits the environmental pollution.
It follows that achieves that the bioclimatic architecture can be seen, therefore, as a complex of planning solutions allowing to assure the maintenance of conditions of environmental comfort inside a building - understood as satisfaction of the requisite of control of the inside microclimate of the buildings, of the natural illumination of the same – strongly limiting the intervention of the plants that involve energetic consumptions from conventional sources. Such architecture submits in prevailing way to the structure, to the physical conformation of the building, to its orientation and the climatic context in which it is realized, the assignment to gain or to postpone the solar radiations and to exploit the local (for instance the prevailing winds) microclimate to get the environmental comfort.

2 METHODOLOGICAL APPROACH TO THE BIOCLIMATIC PROJECT.

The theory of a methodological approach for the definition of planning criterions for the editing of a bioclimatic project, moves from the analysis of the principles of the environmental sustainability and founds him on a complex whole values that to the traditional indicators of the quality in the building trial, in terms of economy of the resources, Life Cycle Design, Human Design and retraining of the natural environment and built, it unites the criterions traditional of design of the same trial, considered a conceptual application of the principles of sustainability.
Every architecture project, in fact, is structured as a process organized according to a sequence of phases, characterized by different operations, from the first cognitive analyses to the expressive syntheses, up to the definition of the constructive techniques and the fittest materials, that allow to define and to manage the proposal.

Inside the way of planning, each of the phases is connected to the preceding ones and to the following ones according to different criterions, but not necessarily according to a predetermined temporal scanning. The modern bioclimatic plan in the substance is characterized by the presence of two specific qualities, the first one of which is the necessary attention to the behaviour of the single elements and the whole organism built in relationship to the physical (thermal, of movement of the air and the damp) phenomena; the second part is that to give a good level of gratification to the occupants: every choice operated during the process of planning is function of the physiological and psychological comfort of the possible users. If it is true that the guarantee of the conditions of comfort is by now a requisite to which every building must respond, must nevertheless be highlighted that in the bioclimatic case, the interest is predominant toward the general levels of the optimal status of the users inside the environments. The other principal character of the bioclimatic project that differentiates it from the conventional one, that is to say the control of the operation of a building during the cycle of useful life. Today many buildings plans ask for deepened studies related to the systems of control of an organism that works to satisfy some demands and to make the carrying out of some activity possible: one of the most important among such systems, it is the control of the inside environmental conditions both microclimatic and visual.
Nevertheless it doesn’t exist a standardized modus to proceed; it doesn't exist, that is, a solution that is more biocompatible than the other in absolute sense: to build in dogmatic sense blocks the possibility to have intelligent and appropriate solutions.
It needs, therefore, again and again to use different criterions and guidelines through technical solutions to create conditions of habitability and adjustment to the demands expressed from the users into practice, it needs, in other words, to guarantee the shadowing (brise-soleil, vegetation with leaf trees, etc.), the ventilation, the isolation and the thermal inactivity the cooling (related to the shadowing and the ventilation), the humidification and/or the dehumidification, the defence from the winds and from the precipitations, the reduction of the thermal dispersion, the solar (active and passive) captation, the natural illumination and the conservation of heat, keeping in mind that the bioecologic architecture doesn't accept supinely the technology record on the nature, but it tries to make the building interact with the external elements.



Figures 1-2: Shadowing systems

Further planning criterion is the "recycling" (what introduces the double advantage to limit the negative effects due to the disposal of the discards and to satisfy with the recycled ones the voracity of the raw material of the elements) even if the process must be realized with the awareness that you never get from these elements the original quality of the material, that must necessarily be destroyed after some cycles (down cycling).

3 BIOCLIMATIC PLAN AND CONTEXT (ARCHITECTURAL).

The fundamental elements of the bioclimatic plan, as already said, are the air (thermo-igrometric comfort) and the light; to these it has to be added another element that becomes fundamental to guarantee the compatibility of the intervention in comparison to the surrounding environmental context: the time, defined as the fourth dimension of living, that allows a procedural passage of notable importance, the passage, from a static conception to a dynamic architecture.
The dichotomy concerns the conservation of the behaviour and the operation of the building and the transformation of its characters to strengthen its requisite performance. It becomes, therefore, essential a type, subject and architectural analysis of the surrounding environmental context, from which to deduce a series of suggestions for the definition of the bioclimatic project.
Nevertheless an operation of this type is not always possible; in fact, given the shortage of the studies on integration of the bioclimatic project with the meaningful architectural contexts and gives the objective difficulty of conjugation of the bioclimatic rules with rigid architectural rules, dictated by the presence of a particularly notable area, it becomes complex to insert, for instance, a greenhouse or a plant photovoltaic plant in a building tied up to an architectural context already defined and characterized by peculiar subject-formal choices.
And although the architecture is "an exercise of resolution of problems" (Le Corbusier) not always, through the use of various forms and different dimensions, it succeeds in facing the huge problem casuistry list that introduces a bioclimatic project.
A further critical aspect derives from the attribution to the building of defined performance requisite, coming from the adjustment to the laws and the demands of the users related to the specific destination of use assigned to the manufactured article, and to the possible problems of compatibility of the choice made according to the surrounding environment. In fact the missed definition of a system of congruencies that ties the system of the values (the limitations that the existing one sets to the possibilities of change without losing the original characteristics) and the system of the uses (all of the technical and technological choices in the in demand of the performances), involves a substantial compromission of the correctness and the compatibility of the project that, as said, is connected to the sustainability of the whole way of the project.
But the complexity of the problem of this branch immediately shows the limits appraised of the concept of compatibility and makes the appeal necessary to the

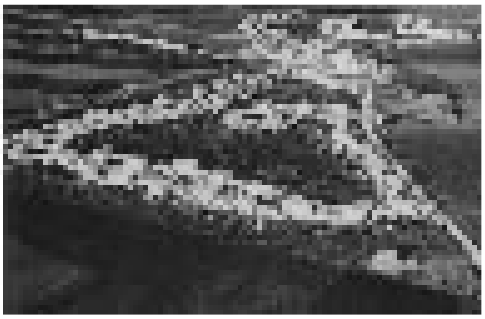
amplest notion of appropriateness.
The appropriateness, in fact, in comparison to the compatibility defines congruence better, understood in terms of technical and cultural acceptability, of a way of action, in how much it doesn't contrast the bioclimatic principles and the surrounding context as two autonomous factors, but it appraises them as they condition themselves mutually.

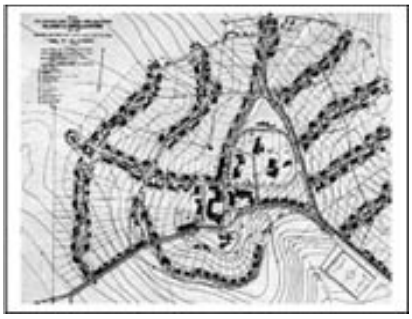
4 THE CASE OF LA MARTELLA SUBURB IN MATERA.

4.1 La Martella and the modern architecture: the origins.

The first half of the last century has been for the Italian architecture a moment of meaningful changes in which the experimentation of original architectural languages and the application of the modern principles of urbanism have been, for a verse characterized by the use of new materials and technologies and for the other tied up to particular social, politics and economic conditions deriving from the war events and the necessary reconstruction. The architectural patrimony of Basilicata has strongly been characterized by this experimentation of the "Modern", from the applications of the first decade of the 1900 in the diffused manufactured articles of specialistic architecture on the territory to those in the circle of the extraordinary operations of Reclamation and Land Reform that in the '50s of the same century have had their amplest development.
The Corporate body that intervened used some work of its own technicians, but often with direct charge or through contest they had the contribution of numerous planners, already affirmed or "future Teacher" of the engineering, of the urbanism and of the contemporary architecture, external to the administrations and coming from every part of Italy, which elaborated new organizational schemes, new forms of installation on the territory, of relationship with it and of exploitation starting from the resolution of hydrogeologic problems through important works of engineering, up to the definition of real housing models inside specific formalities of installation. In the space of few years a new image defined the identity of these "new places" replacing the dimensions of the latifundium with those of small and middle ownership and the strengthened farms with the Centres of Service. Just the choice of the model of installation for the population of the dispossessed countryside was the theme of the heated debate to that from the end of the '40s and up to the mid '50s animated the relationship among the Corporate body that intervened on the territory of Basilicata. The centralized installation model, favourably seen by urbanists and agrarian economists, was realized as nucleus inhabited place in centre of mass position in respect to one calculated extension of the grounds that every day the farmers had to reach the job in the fields. The suburbs of La Martella and Venusio are referable to this last model.
The village La Martella in Matera it is not only a contribution to the solution of the building problem. It is also and above all the symbol of a way to act. The Suburb La Martella re-enters among the numerous projects effected to the beginnings of the

'50s to relaunch the whole southern territory destroyed by the war; for Matera, particularly, an innovative fit architectural project was elaborate to propose, with best conditions, the life of the ancient Neighbourhoods Sassi, to transfer, without violent traumas, the big part of the population then resident there.
The history of its birth is as the story of the birth of a human being: an extraordinary fact, complex and delicate, but in conclusion, "a natural fact." "When in 1950 the UNRRA-CASAS had an allotment of 5 million from the Liras ERP fund it was definite, among the other initiatives, an intervention to Matera." In 1950 the President De Gasperi visited Matera and the building constructions and drainage that rose in the satellite zone, among which it showed up the project La Martella. In that occasion the President of the Council announced, in his speech, a program for the total improvement of the unhealthy districts of caves of Matera. La Martella was inserted in this program and it represented, already in action, the signal of opening."





Figures 3-4: La Martella: the original planning

4.2 Architectures and technologies.

This attitude brings to the spreading of a sort of "neorealism" in which, reproducing the neighbourhoods of the Sassi, it has tried to gain the peculiar characters of the country life translating them in architecture; nevertheless invading and equivocal ways are not missing: the "spontaneous" that aims to exhume the lines disappeared of the ancient installations, the "neoliberty" that expresses an artificial effort to recover an experience by now gone, of the European art and the "environmentalism", that expresses the mania to join the ancient one even before having formulated the new one.
The sketch of the Suburb takes back the installation typology "star shaped" in which the streets, following the morphological course of the ground, they divide radially from the centre toward the countryside connecting the blocks of houses.
The buildings are opportunely gathered in small groups that repeat, in the social situation, the spontaneous groupings that were consolidated in the Sassi. Also the roads have been projected so that, widening in determined places, they become points of meeting of the population in which the community life is developed.

Nevertheless the public buildings and the residential housing unities don't follow model slavishly; in fact, also realizing a sort of standardization of the building types, the buildings are introduced with dimensions slightly diversified, also maintaining some recurrent elements, as for instance the stall, equal for all the buildings.
And to obviate to the monotony of long lines of all equal houses, it has been used the stratagem to combine the rectangular houses connecting them by the short side and sometimes by the long side to get base volumes almost square or volumes of rectangular form lengthened, making the heterogeneous perception of the space.
A planning inserted in a context so characterized, cannot prescind from the knowledge of the materials and the technology constructive employed for the realization of the analysed architectural work. Researches effected in the analysis of the residential typologies of the rural suburbs built for the land Reform have revealed a general description of the static project of these constructions underlining as the early 90s building production has been affected from a continuous innovative process with the use of new materials what cement bindings and the use of the construction steels. It is in the case of the Suburb La Martella the adopted constructive technique overlaps to the described one, with the typology of the carrying masonries in square blocks of "local stone" and orizzontamenti with attics in putrelle and tiles or mixed and in some cases, kind in the stalls and barns, in irregular wood beams and wooden partition. To the outside the finish is that typical of "scialbatura" to base of mortar, that the tradition follows "hygienic" treatments of the façades, already used precedentely just in the ancient Sassi Suburb.

Figures 5-6: the “La Martella” work-site

4.3 The installation today.

Been originally born as rural suburb, La Martella is introduces as the natural pursuance of the city of Matera today, thanks to a series of industrial and handicraft activity that physically tended to reinstate the suburb in the city doing a real urban district of it. Today the Suburb is rather homogeneous and for formal characteristics and for type characteristics. A meaningful intervention of urban recovery. The contest EUROPAN - effected in the '90s, before, and the last apportionment - ECOPOLIS - realized recently, have given a new facing La Martella, the face of a modern urban district inserted in a meaningful urbanistic fabric, characterized by the indelible sign of the arch. L. Quaroni.

Figure 7: the “La Martella” today

5 A PROPOSAL FOR LA MARTELLA.

5.1 The origin of the proposal.

The proposal to make an bioclimatic intervention in the suburb of La Martella finds its space inside the wider plan of “Programma di Quartiere”, a program financed by the Italian Government whose aims are the strategic building development, social requalification and economic growth of the suburb through high quality interventions in terms of architectural image relations with the outside on inhabited public buildings.
We took advantage of a national competition on the planning of an 8 lodgings building with biocompatible characteristics to develop a previous work proposal according to methodological guidelines underlined in paragraph 3.

5.2 The project.

In the position of the building unities inside the lots, seen the planimetric and dimensional tie, the elements of which is kept in mind, have been the relationship with the free space to disposition and the relationship with the solar run in the various months of the year. A pattern of planning has a particular reference made to the shades brought by the possible obstructions that can prevent the correct use of the passive and active solar systems especially in the winter period there. The second footstep has been that of the definition of such form that allows the solar rays to enter the winter period and to screen the tall rays in the summer, but that however and, not certain with smaller weight, could respect and conform around the forms of the building and the surrounding landscape. In fact the architectural sign and the history of the site, are bossily intrusive elements in the formal architectural approach. And it is in the name of the typologic and volumetric change of the sign of the modern architecture of the Quaroni architecture, that the architectural project of the new building unities is born, making the image of the insertion in the landscape prevail and in the building as non extraneous element. The project has been realized by playing with the staggering altitude of the volumes, typical of the Quoroni organization planning, alternated by empty destined parking lots, that accent the visual penetration among the building blocks to the spaces. The anterior prospectus,

positioned with south orientation manages the final image of the individualized architecture acting from principal element of the bioclimatic operation of the lodging. The back prospectus to north denies the anterior image, using little of surface glass, in operation of the balance of ventilation and natural illumination required by the projecting criterions assumed. The south façade has been anticipated with ample glass, behind in comparison to the external thread of the attics to optimise the winter captivation and the summer protection from the rays of the sun. Equally in the rear volumes, the glass door on the perspective plan are been decentralized for improving and to optimise the inclination of shadowing of the shades reproduced by the anterior volumes. Solar control is increased by a system of thin plates, brise-soleil, movable. The whole architecture is thought in "green" and the final image characterized by the garden roofs, conjugates form and function in the spirit of energetic optimisation proper of the "bioclimatic." Once defined the approximate form have been prepared, leaned out to south of the building, that the spaces that have the maximum requirement of heating and illumination like the living room, to the ground floor and the three rooms from bed to the upper floors. Just the staggering altitude of the levels served by the staircase inside has allowed the positioning of all the principal environments, with glass door directed to south. Along the north side has been inserted the pad zones or those that need the sun the least like the kitchen, the baths, the staircase. To guarantee that the sun penetrates the whole space through the windows, the parameter is respected in base to which the depth of the spaces along the south wall didn't overcome twice and a half the height of the windows from the floor (result of the studies effected by the Illuminating Engineering Society): this empirical rule is also guarantee of a suitable illumination of the inside spaces. Besides the parameter of the relationship is respected between surface of the floor and transparent surface of 1/8 and the factor of diurnal middle brightness. The distribution of the inside spaces has been studied in such a way by to conform to the requirement of solar light, this in relationship to the fact that also in the winter period less electric energy is consumed for the illumination of the environments and the heating. The east and west sides, of the line up headboards, are blind to prevent the strong heating during the afternoon hours in the summer. The architectural planning concerns both the functional-spatial aspects and those technological. Natural ventilation and illumination, inside and external colours, have kept into account the criterions of microclimatic comfort of all the environments as well as in operation of the reflecting effects of the colours of the horizontal and vertical inside surfaces. The windows, from the planimetric point of view, have been positioned only on two sides, to north and south, with the purpose to allow good ventilation. The south windows, of great surface in comparison to those prepared to north, they have been projected so that the solar thermal profit, in winter, is great of their thermal dispersion. It is anticipated the use of roll-up that in summer are also adjustable to screen the direct radiation minimizing the thermal earnings, but allowing passing the light. The entry to the single unities happens from the anterior private garden, to south, from the great glass door of the living room, and with the purpose to reduce the thermal exchanges with the external environment, both for management and for infiltration, a double

entry has been anticipated with two doors that open one toward the outside and one toward the inside of the building, creating so a zone pad. In the bedrooms that have a blind external wall exposed to north, a wardrobe has been inserted with function of thermal isolation. The planning also concerns besides the external spaces to the building as for instance the private green, coherently prepared with the "bioclimatical techniques of the green" and to exploit in the summer period. All the external floorings are type permeable to allow the recharge of the underground waterbed. The following footstep has been the search of the most proper system to allow the attainment of the best conditions of comfort thermoigrometric and of the choice of the bioclimatic systems; in the base of the evaluation of the precedent planning principles. The building has been conceived as a passive system in which the building becomes a collector, its form is such to be opened to the south and close him to the north, further to have a great mass for the accumulation of energy. The accumulator of energy is the same building and the heavier the system the more efficient is the building. An important role is acquitted therefore from the materials. To prevent phenomena of overheating it is anticipated a more or less whole of complex systems of control of the natural thermal flows that goes from the screenings of the openings to prevent the solar profit to the forced inside ventilation that to the necessity can be also climatised through a system of treatment of the air fed by a solar thermal source.

Figures 7-8: The project of “La Martella”

5.3. The project and the context

Taking back the concepts previously stated in the paragraph 3, a fundamental consideration must be done on the spot, as context with many interactions, in which the project takes place.

The first evaluation is related to the winds from which to defend in the winter period and to exploit for the ventilation in the summer period. To regulate the flows of air plays a very important role the type of vegetation and its place on the territory. For the protection from the winter cold winds coming from north, in fact, there have been selected some evergreen essences that is positioned to the north of the buildings they create a protective barrier. On the south side, instead, vegetation has been selected composed by leaf trees that work as regulator of the solar radiation, producing shade in the summer and leaving the solar rays in winter when the trees have already defoliated to make the accumulation of solar energy possible. The fundamental elements that meaningfully influence the microclimate and, accordingly, the conditions of thermal comfort can be of a natural type, as the morphology of the

ground, the materials, the water and the vegetation, or of an artificial type as for instance the systems of shadowing. In this case it has been anticipated the planting of small leaf trees along the runs to allow the inhabitants to enjoy some winter sunny days and to be able to cool under the shade of the trees in the summer. The planning of the public green has been finalized to the constitution of an open space able to have a report with the environment. To get this result the public green has not been separated from private ones, a try was made to homogenize almost giving them the impression that the public green was penetrated among the private gardens and, equally, the private green ideally prolonged the public one through the pedestrian runs. Everything with the purpose never to create a natural space of quality monotonous that induced the inhabitants to the movement and to relate between them. The set-up of areas of standstill and relax, have been anticipated besides to harmonize the relationship among outside and residential insides.
Particular care has been set in the choice of the understood materials as elements able to define the local microclimate, with the awareness that the choice of non appropriate materials, for instance, on a pedestrian public space, as a street or a square exposed to south, can create, in some conditions, an island of heat that discourages the will to stay there, contributes to lower the level of comfort and to make less enjoyable. To the centre of the public green it is anticipated a level space to devote to playing activity for children, to health paths, to cultural initiatives as outside summer shows and folk meetings in general. With the purpose to facilitate the use of the equipped green areas, during the diurnal hours in the summer period, in the areas destined to parking lots, there have been anticipated of the arbours with climbing essences to guarantee zones of shade for the parked cars and they also act as elements of urban furnishment. Besides the set-up of the green has been studied in such way to attenuate the noises coming above all from the vehicular traffic. To such end has been valued attentively the disposition of trees and hedges along the roads in order to filter the sonorous waves.

6 CONCLUSIVE CONSIDERATIONS

The elaborate project is not anything other than the attempt to give an answer, univocal and repeatable at the same time, to an idea of a project that conjugates new constructive approaches and environmental installation, with a projected architectural context planned with great wisdom and mastery of the knowledge of the vernacular traditional architecture and as such planned and thought in the environment, with the environment, in the full respect of the most canonical criterions of sustainability.
The bioclimatic planning, finally therefore, is not only energetic saving, but a way to live in harmony with the environment and its changes as, unlike the traditional planning, it doesn't defend itself but it communicates with the environment and its energetic flows this form of comunication could be extended even to the “formal” aspects in meaningful architectural contests. Only in this way one is able to get the equal relationship with nature back to man, artificial as long as valuable which by now has been lost for a long time.

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