

## **The Teaching of Construction and The Environment in the Faculty of Architecture in Genova, Italy**

### **Technology and the environment**

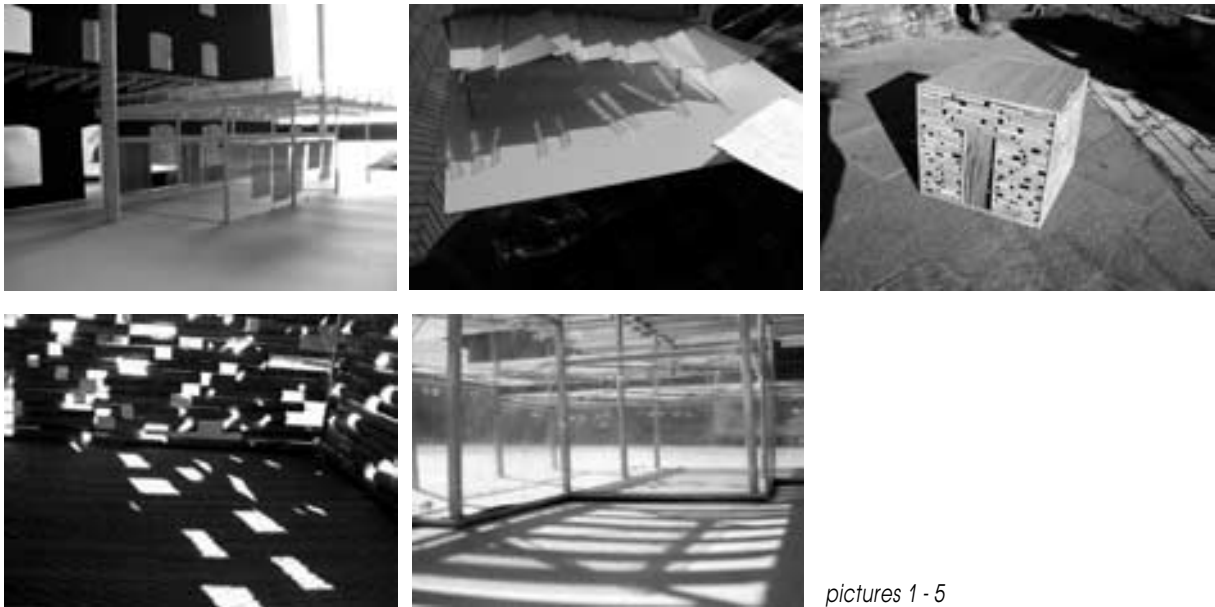
*(Adriano Magliocco)*

One of the aspects of architectural planning which is mostly linked to construction is certainly the connection with the environment, according to various aspects. The complexity of architecture requires the subordination of constructive aspects to the principles of reduction in energy consumption and to an awareness in the exploitation of exhaustible material resources at the various stages of the process: production, usage, maintenance and casting off. As a result the new architects must get basic knowledge relating to the impact which the building industry can have on the environment. They must be able to set up a plan correctly – from the point of view of ecology, in the broadest sense of the word - through simple and immediate instruments and ask suitable consultants the right questions, if necessary.

The teaching activity, about the inquiry on the link between architecture and the environment in the Faculty of Architecture in Genova, takes place at different stages of the students' curriculum. The subject is mainly dealt with by those lecturers who teach Architecture Technology<sup>1</sup>. I wish to point out that teaching hours in the five-year course are 360 and that many subjects are concerned with technology. During the first year, in the few hours which are dedicated to this matter, we explain the concept of sustainable development regarding the activities linked to the building industry. It is important to let the students notice that each sign on the paper made by an architect corresponds to a transforming flow of resources, materials and energy, from raw materials to final products, and this inevitably implies the production of polluting substances, and more often the materials may not be available any longer, if they are not renewable. The sustainable approach to planning can be carried out at different levels. Often you may not be involved in urban planning, an important aspect to identify the use of resources. It is possible, however, to set up the project and fix technological choices capable of reducing at best the use of renewable resources in accordance with the available technologies in a particular socio-economical situation. Finally we attempt to explain the meaning of the terminology used in this field, sometimes so "fashionable", and to outline the differences in meaning (bioclimatic architecture, bioarchitecture, biobuilding, eco-friendly building, etc.), when they really exist...

In the second year a first approach to the problem of the environment is discussed in the "Laboratorio di Costruzioni 1", thanks to the planning of small buildings with simple functions, paying particular attention to the

passive control of building climatic conditions. Students are given simple instruments to control sun radiation and airstreams. For instance, we show how to survey precise building orientation by using an anglemeter equipped with a compass; we show how to survey the horizon line from a point of observation by vertical angles (solar height) and horizontal angles (azimuth) and, by drawing it on a solar chart, we identify the periods of the year and of the day when that point is not directly lit by the sun, in order to assume the adoption of active or passive solar technologies. It's very important that the future professionals can understand the environmental implications of their projects even when they deal with secondary work. We can't expect the architects to refer to first-rate research laboratories for their environmental analysis and as a result I think we must show them this can be done through user-friendly and low cost equipment, by supplementing environmental analysis with the design procedure. In pictures 1-5 you can see some students' projects.



*pictures 1 - 5*

Some courses like Architectural Planning, which are usually focused on aesthetics, work with lecturers who teach Architecture Technology to associate their teaching support and deal with planning themes with a view to reducing energy use and increase the exploitation of low ecological impact materials. This is meant to make the design phase more aware and less abstract through the knowledge of materials and technological devices. To do that we often show particular projects, where the designer's attention is focused on low-impact materials but with a high power of formal fascination (bamboo, raw earth, cardboard, etc.).

In the fifth year a course in bioclimatic planning is given (see next paragraph) and it is split into two modules: environmental sustainability and bio-climatic technologies. Besides attending the lecturers' courses and the experts' seminars, students are supposed to do a simple exercise relating to open space and little buildings planning. Some easy instruments

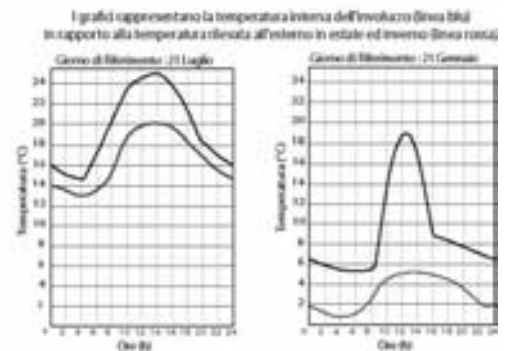
are suggested for a preliminary check of the project as well as some software for the quantitative settlement of the buildings energy use in order to analyse the efficiency of the systems adopted.

In addition, a lot of degree theses deal with environmental planning, and they are often provided assistance by lecturers of other subjects such as Building Physics and Mechanics, for a better quantitative settlement of the solutions effectiveness. In this case it's a matter of project in which the environmental aspects connected to the building process are outlined, without neglecting the other aspects. In fact we are not interested in making "monsters", machine-buildings where the problem of energy conservation or production is exaggerated. We must try and get rid of mere experimentation and enable the environmental issue to become a part of the planning activity if we want architects to care about the environment not only on the day of their degree and solely for normative purposes. Images refer to some recent theses where some topics are dealt with. Picture 6 portrays a working wind tunnel, a 1:9 scale model, created at the Politecnico di Milano; the design of a large greenhouse in order to reclaim three subsidized building blocks required the positioning of air locks according to the resulting external flows due to the action of the buildings morphology on the direction of winds in summer and winter. Picture 7



picture 6

## life box



picture 7

represents the diagram of temperature fluctuations in a house made up of a greenhouse intended to protect single mono-functional volumes. It's possible to see that temperatures rise a good deal in winter and they remain acceptable in summer (about 25°). Picture n°8 shows a school scale model where there are underground ducts for prior treatment of ventilation air for heating or cooling. Pictures 9 and 10 show some scale model experimentation for analysing the lighting conditions in classrooms characterised by dazzling.



picture 8

Our Department, thanks to some lecturers including myself, support ABITA, a university centre for bio-ecological architecture and technological innovation for the environment. It was established to do research activity

as a consortium into the building industry sustainability, but also to go through post-academic teaching with a Master in Sustainable Design. So new architects may continue their studies in order to get the right qualifications to cope exhaustively with the elements of a project which are mostly connected with respect of the environment.

### **How the principles and the devices of sustainable architecture are taught in the course of Bio-climatic Design.**

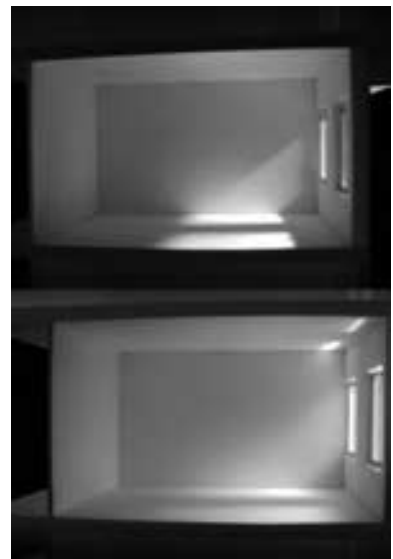
*(Andrea Giachetta)*

One of the most important tasks for a Faculty of Architecture nowadays is to make students approach design from the point of view of the environment and focus on the search for technological sustainable solutions aimed to fit the project into the climatic context involved, to control airstreams, ventilation, heat and sunlight, and with a view to saving energy and water, and reducing the traditional sources of pollution brought about by the present plants. The future planners are bound to cope with these themes because of the growing interest in the environment and its resources in contemporary society. As a consequence of that there's an evolution of regulations at the base of the building industry and the urban and regional development based on the principles of the environmental sustainability. But teaching these principles and devices is at present very difficult because:

- It must be connected with an environmental ethics of design, to be learnt by students, but it cannot be taken for granted in Italy
- It doesn't have outstanding historical references from a teaching point of view, as the interest in sustainability is relatively young, as far as the basic vocational training in architecture is concerned (this subject has been taught so far only in doctoral and post-graduates studies).
- It hasn't got a point of reference in the present subject areas and even though in Italy it can naturally refer to those subjects relating to technology, it's also relevant to urban planning and landscape architecture.
- New teaching devices and facilities, now missing, should be employed. It must be possibly directed to the project's diverse actors, times and phases at the same time, because this is the only way to train people who not only can work on the environment but for it, and decide what interactions are necessary to the project: among designers, innovative building materials manufacturers, and all sorts of specialists who have a say in the matter; the interactions among the project organisation, the building site impact and the building lifecycle: between the local effects of the building activity and those on the surrounding territory, since a single building may either have an impact on a large area or vice versa. In fact design undergoes the obligations of regional planning with regard to the environment,
- It deals with a branch of design in which there are steady changes and so it must also be proposed as a design methodology, flexible enough compared to the predictable changes in design strategies, in the market, in the available technologies and in legislation.



picture 9



picture 10

The Faculty of Architecture of Genova, which had so far reserved some time to the sustainable approach mainly within such subjects as Construction Technology, is going to start a course of bio-climatic design from next year, which is split into two six-month modules (environmental sustainability and bio-climatic technologies) both intended for students in architecture (five-year degree) and students in landscape architecture and urban planning (three-year course). The aim is to involve the diverse fields of study, dealing with specific themes.

After analysing the cultural context in which the new interest in the environmental sustainability has been growing recently, and the reasons why architects can take the eco-friendly approach into consideration, the course will supply the students with a picture of the bio-climatic strategies which may be used for design of open spaces (1<sup>st</sup> module) and limited spaces (2<sup>nd</sup> module), through careful study of the diverse methods of analysis (survey and environmental modelling equipment), on natural elements (1<sup>st</sup> module) and the building components (2<sup>nd</sup> module), the building elements employed (windbreaks, sunbreaks, greenhouses, solar panels, etc.), on the possibilities offered by the innovative market of building products, on the way to organise an ecological building site and the diverse lifecycle of building products, on monitoring techniques, on environmental and urban regulations (1<sup>st</sup> module) and building regulations (2<sup>nd</sup> module), on national and E.C. policies supporting sustainable planning.

The course will provide some experts' contributions in such areas as environmental science and innovative building materials' manufacturing, as well as architects, engineers and planners who have already experienced environmental planning in their careers. During lessons students will have to do practical classes in order to be able to manage the diverse aspects of sustainable planning, with regard to analytical and calculation problems (even if their monitoring system is simple and made through friendly-user software because of the current shortage of proper equipment and lack of time). They must get experience in order to make aware design choices with regard to the environment, its resources and conservation.

These are the matters dealt with at the bio-climatic planning course: the general meaning of an ecological approach to built-up environment design (ethical, social and economic reasons); the historical evolution of ecological design; energy saving policies; procedures of environmental impact evaluation (VIA) and environmental strategy evaluation (VAS); sustainable planning on territorial scale (with references to the regional urbanistic regulations in force); sustainable tourism; interrelationships between environmental-bioclimate analysis of a site and sustainable planning; environmental analysis (ecosystems, pollution, waste material, etc.); bio-climatic analysis (climate, air temperature, site locations, solar radiation, pluviometry, humidity; etc.); passive cooling; the use of water in the natural climatic control; strategies of water recycling and phitodepuration; the use of natural elements in the monitoring of the natural climatic control of a site; the basic principles of passive solar heating; passive solar systems; natural lighting (principles and elements); use of glass (main features of innovative products for solar radiation control); bioclimatic functioning special doors; sun protections; "intelligent buildings"; the users' role in how

to use this equipment; thermal insulation; supplementary plant design and installation to the solar passive systems; photovoltaic panel; sustainability of existing building requalification; simplified calculation systems and software; the final energy balance of sustainable design management; green building site management; principles of bio-architecture; eco-friendly use of wood; an outline of the use of bamboo; recycled material. Some seminars will be given by experts about: environmental analysis and sustainable design. They will discuss reclamation plans, experimentation in environmental wind tunnel, the natural climatic control through the choice of vegetal species; innovative technological elements and solutions suggested by manufacturers, research, theses and projects. Practical classes will deal with these themes: environmental-bioclimate practical analysis and design solutions with case studies on real building sites; bio-climate project of a building (with the calculations on the productivity of the passive solar systems).

#### Notes

1. In Italian university Architecture Technology and Construction Theory are two distinct subject areas. Even if the whole teaching staff are involved in construction matters, each of them has distinct knowledge.
2. At the first-year course Technology is taught as an integrated course, split into two modules and with two lecturers, even though belonging to the same subject-area; the first module is about building materials and components, the second one is about the role played by technology during the design process and construction.