# Bioclimatic design of a residential complex for the elderly

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ABSTRACT

Traditionally, a home for the elderly aimed exclusively at the accommodation and care of people of the 3rd and 4th age. In a modern and continuously evolving society, how this can remain stagnant?

This design, which was presented as a diploma design work at the Architecture Department of the University of Patras, constitutes a new idea, a revision and redefinition of the meaning of a 'home for the elderly'.

A strong emphasis is placed on modern way of life and how this can influence the needs of old people and be influenced by them. The basic concept is based on an open plan system, with bioclimatic features. The aim is to create a secure, pleasant and modern environment fulfilling the requirements of a contemporary building while keeping some elements of the past so as to achieve a balanced aesthetic result.

## 1. INTRODUCTION

Patras is the third largest city in Greece, after Athens and Salonica. In 2006 it will be the Cultural Capital of Europe. Culture however does not only consist of the Arts, but also of the quality of political and social security. For this reason we collaborated with sociologists of the Municipality of Patras, aiming at the selection of the most suitable site for our building according to the theoretical research that we had undertaken in preparation of our diploma.

The plot area is 15.000m², of which the Municipality wanted to use 3.000m² as a park, and this had a direct impact in the architectural solution, which should be developed in height (ground floor, 1st, 2nd, 3rd). The site is located north-west of the centre of Patras, roughly a block above the city harbour. It is bordered by major streets providing direct access to public transport. The surrounding region is quiet with few green squares and mostly residential buildings. Adjacent to the plot there is a three storey school with a large courtyard and tall fence, an abandoned warehouse and finally a social insurance agency, providing also medical care (IKA).

## 2. BASIC DESIGN CONCEPT

As far as the form of the complex it concerned the main design idea, is based on a contrast with the regularity of the surrounding building stock.

The combination of three irregular and elongated, volumes different in height with a central curved building of public character, creates a cluster of buildings with various functions (residences, public services, kindergarten) (Fig. 1).

The form combines modern standards and materials (metal columns and glazed surfaces) to traditional ones (concrete and timber) so that a balanced aesthetic result is achieved. The scale

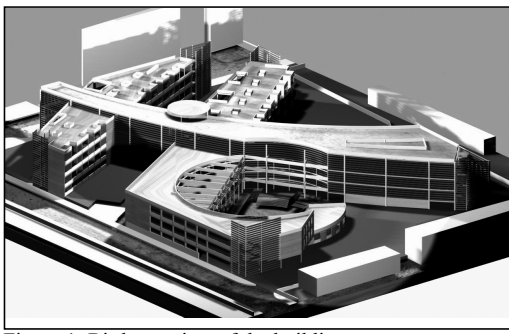

Figure 1: Birdseye view of the building.

varies depending on the type of use, so that the building becomes friendlier to its users. The addition of elements like water and vegetation create a sense of familiarity and can contribute to the stabilisation of internal and external environmental conditions.

The centrally located curved building (Fig. 2) joins the Main Street and bus stop to the back node of pedestrian streets creating a pleasant passage. The curve opens towards the school aiming at attracting the attention of school children. The ground floor, (Fig. 3) constitutes the main axis to the building, leading to the main nodes of vertical movement or to ramps that comprise small walks with view. The metal columns of the gallery add to this movement since all operations such as shops, residence entries and vertical movements are assembled here. On the other floors there are mixed uses a wing for single old men and an atrium.

The types of residences, included in the program, are autonomous residences for couples as well as single rooms with communal spaces. The big public corridors are used as common rooms for conversation and gossip, in order to develop the sociability of old people. As far as colour is concerned, soft tones of green are preferred for the interior walls and warm tones of brown for the floorings in the rooms in order to create a comfort atmosphere. In order to solve the problem of low intense western lighting a second skin 50 cm was added outside of the exterior skin of the building composed of vertical blinds made of wood and supported by a metal frame.

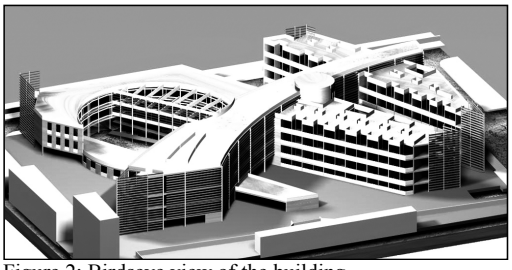

Figure 2: Birdseye view of the building.

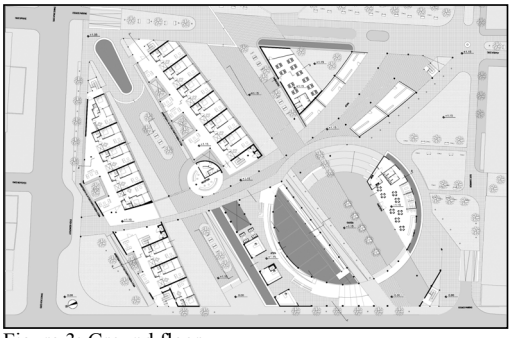

Figure 3: Ground floor.

In order to help old people feel more creative we included art laboratories as well as study spaces in the program so that they spend their free time sometimes in the company of the younger people. Thus on the first floor a library was created for children and older people. A computer section in the library will certainty constitutes a pole of attraction for the children in the neighbourhood.

There are two restaurants placed one on the ground floor and one on the first floor next to the library in order to have the best possible view. This break off became necessary in order to attract both the younger generations and the old people. On the department with a restaurant on the 1st floor there are rooms for the altsheimer patients and a small consulting room, for better control and protection (Fig. 4).

A multi-purpose room is placed on the basement with an independent access via a ramp.

This room can be transformed to a small amphitheatre with a circular scene, which goes up to the floor level, in the centre of the room. This solution allows visual contact with the spectators. This space can constitute the intellectual centre of the area. In the basement a gym and a small swimming-pool visible from the ground floor are placed.

The creation of playgrounds is also considered important because of the need of contact of interns with younger generations. In public spaces in order to highlight nodal points and entries it would be interesting to use sculptures

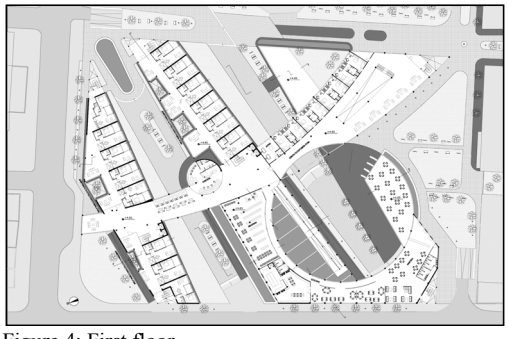

Figure 4: First floor.

with appropriate lighting. All this will help create the atmosphere of a ‘modern village’ in the city, conceived of a meeting point of all generations".

## 3. PRINCIPLES OF BIOCLIMATIC DESIGN IN THE BUILDING

### *3.1 Orientation*

The building is designed to maximize the use of solar radiation in the interior during winter. On the other hand it must be avoided during the summer using suitable solar protection.

This can be also achieved with the design of appropriate sizes for the openings, in combination with their orientation.

The three linear units sheltering the residences have their main axis running east-west. As a result the surface of the Eastern and western sides is minimised. Nevertheless, where openings existed, because of the view external vertical shades have been used (Fig. 5).

The residences of the elderly are placed on the southern side, with large openings, so as to enjoy better solar access as well as thermal comfort and energy conservation. The southern openings are shaded with external horizontal shades (Fig. 6). Northern openings were also used in order to benefit of diffuse lighting in the interior of the building, depending on the use.

### *3.2 Natural lighting and ventilation*

Day lighting and natural ventilation of the building are achieved with suitable orientation, design and geometry of the openings as well as their juxtaposition.

In the southern part of the curved volume an atrium was used for the improvement of internal microclimate.

In the residences solar chimneys were used, for ventilation as well as for day lighting, converting them to skylights. On the corners of each volume, fire exits are exists which can also be useful as wind-towers (Fig. 7).

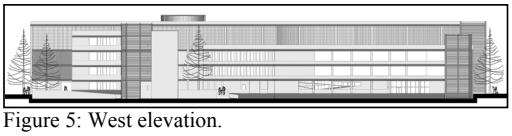

Figure 5: West elevation.

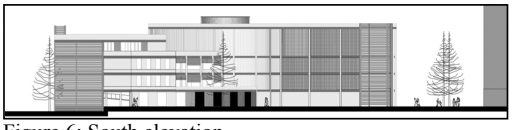

Figure 6: South elevation.

### *3.3 Buffer zones*

On the northern part of the residences long corridors are placed, useful as buffer zones of the building in two ways: They reduce heating losses due to mass wall as well as overheating through ventilation (Fig. 8).

### *3.4 Storage and distribution of heat*

Most rooms are placed on the southern side of building as their temperature should remain as stable as possible between morning and evening. The floors, internal walls and furniture should provide adequate thermal mass (Fig. 9).

Thermal mass moderates temperature fluctuations, absorbing heat from places exposed to the sun and from the air. The heat stored is given back to the space right through the first morning hours.

### *3.5 Construction materials*

Construction materials used in the linear parts of

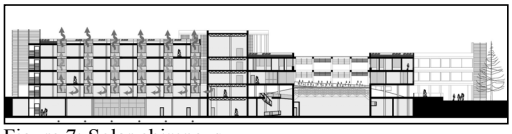

Figure 7: Solar chimneys.

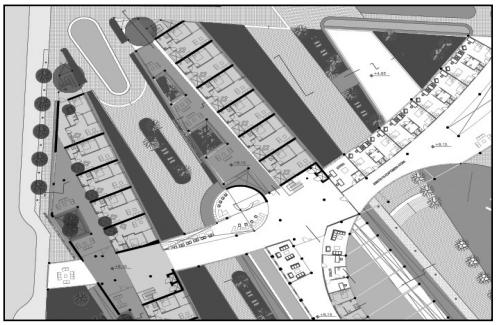

Figure 8: Buffer zone.

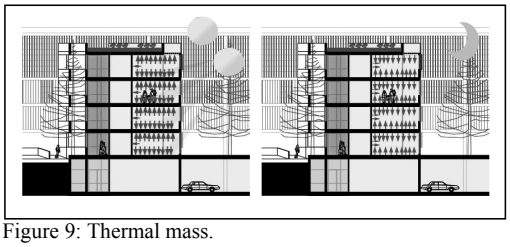

Figure 9: Thermal mass.

the complex are exposed concrete on the exterior walls, 30cm thick, paint of high absorbency and low emission indicator, glass partitions and windows. As large curtain walls offer transparency and contact with the outside space they should be double glazed to avoid heat losses and be equipped with wooden shutters on the outside as night insulation.

Materials used in the circular part of the complex are metal trusses and columns with a diameter of 40cm, big glass partitions and windows with double glazing and dry air in the middle, with external vertical shades. Heat insulation provides improvement of thermal comfort, energy conservation and protection from bad manufacturing. The insulation used in this part of the complex has a thickness of 5 to 7cm, recommended also for medical reasons, because of the sensitivity of the tenants.

Materials for the interior finishes should behave like insulating materials for reasons of health as well as safety. Such materials are wooden floors and moquettes. Materials such as tiles must be carefully selected so that they do not cause glare due to reflection of natural or artificial lighting.

## 4. COOLING STRATEGIES

### *4.1 Solar control*

Solar control in the building will consist of a combination of fixed, moveable and adjustable shadings.

Fixed shadings are used on the southern openings of residences on the top floors of each unit and are assisted by wooden pergolas. This allows the access of solar radiation during the winter period deep into the spaces.

At the same time is used for the same spaces instead of the use of awnings in the balconies and southern openings. Fixed shadings are used, called ‘cool shades’ (Fig. 10). These are placed in metal moveable frames on the external skin of the building. ‘Cool shades’ do not allow the access of solar beams in the space during the summer and allow the view, because of the inclination of their metal blades.

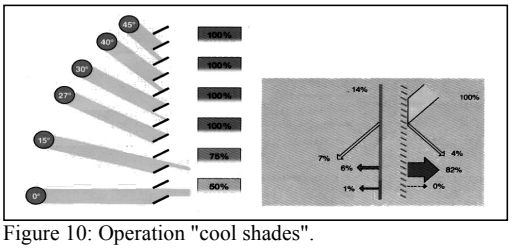

Figure 10: Operation "cool shades".

On the Eastern and Western openings operable external vertical metal and wooden shades are used. Around the central curved volume metal shades are used while wooden is used for shades in all other spaces. The same solution is used for the central volumes where metal or wooden horizontal shades are used (Fig. 11).

At the same time shading is also created by vegetation. Deciduous plants are used so that interior spaces are protected in the summer and have maximum solar access in the winter.

### *4.2 Natural cooling*

The final step of cooling strategies is the guarantee of cooling with natural means. This is achieved in the main building in three ways: a) roof planting, b) evaporative cooling and c) ground cooling.

Roof planting helps achieve cooling in the summer and protection from the cold in the winder. Roof insulation should be carefully placed so no harmful problems are created (Fig. 12). Solar collectors will be placed on some roofs for the supply of hot water.

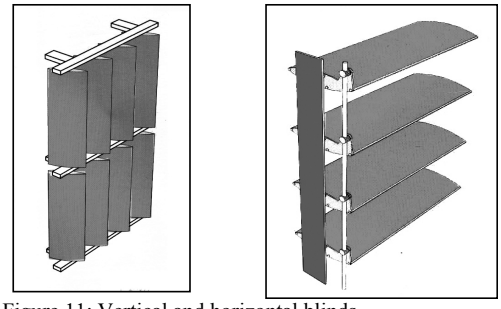
Figure 11: Vertical and horizontal blinds.

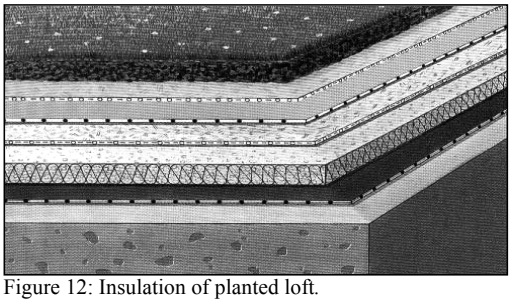
Figure 12: Insulation of planted loft.

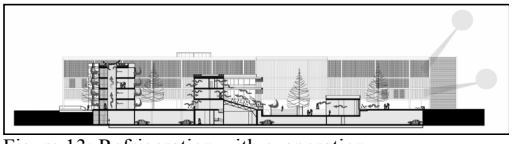

Figure 13: Refrigeration with evaporation.

Planting is also used on the ground floor level, where a square is created with deciduous and evergreen trees depending on the orientation, in order to assure cooling and wind protection of the space. This way air pollution and noise from heavy traffic streets is also prevented from entering the interior of building.

Water is planned in outdoor spaces near the buildings so that it contributes to cooling the air used for ventilation before it enters the building (Fig. 13).

Another system of cooling used is under ground cooling. Since the temperature of the earth below a certain depth is colder than the temperature of the air and has a constant temperature the year round the air can be cooled if it passes through an underground pipe.

This pipe passes under the whole length of the building and is connected to the solar chimneys on the main hall of the residences.

## 5. CONCLUSIONS

It is important to use renewable energy sources on the design of a building in order to minimize energy consumption for the benefit of the occupants and the environment. Our aim is to create the best possible internal and external living and increase thermal and visual comfort conditions (microclimate) for the complex for the elderly. We achieved this by using bioclimatic principles for the design of the building, such as the choice of the appropriate orientation, the use of natural lighting and ventilation.

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Notes of the lesson ‘Bioclimatic Design Of Buildings’ University of Patras-Department of Architecture Tutor: E. Triantis.