TECHNICAL, ENVIRONMENTAL AND ARCHITECTURAL STUDY FOR AN ONCOLOGICAL MEDICAL STRUCTURE

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Contents

1. INTRODUCTION

The decree n*f*502 of December 30, 1992, modified and integrated in the decree n*f*517 of December 7, 1993, has profoundly renewed the Italian National Health Service with the intention of surpassing the crisis in the Italian healthcare system that happened in the previous years. The new legislation means to elevate the services to match the efficiency, effectiveness, budget, competitiveness and trustworthiness that today¶ society requires. The need of novelty also arose from the fact that people are becoming less and less tolerant of unsatisfactory services not only in the Healthcare system but in every service that deals with both individuals and the community.

The new law confirms the fundamental principals which were introduced through L. n*f*833/78:

- The globality of interventions in the field of prevention, treatment and rehabilitation;
- Equality of treatment in the Italian National Health Service;
- The protection of healthcare as one of the fundamental human rights and as one of the main interests of the community which is to be performed by respecting human dignity;
- Structural unity of the national healthcare system concerning the functions, the structures, the services and the activities meant to assure the physical and psychological care and rehabilitation of the population, and the distribution of the system's competencies among the state, the regions and other territorial entities;
- National planning of health service activities;
- The necessary and personal involvement of the citizens in the activities carried out by the Healthcare Services, a protected constitutional law.

THE GOVERNMENT establishes the three-year National Healthcare Plan that comprises:

- The fundamental objectives for the disease prevention, the treatments and the rehabilitation programs;
- The guide lines for the national planning of health services;
- Assures a uniformity of healthcare services throughout the country;

THE REGIONS also have legislative functions concerning healthcare and hospitals. These functions set:

- The organizational principles for the healthcare services;
- The funding criteria for local health authorities and for hospitals;
- The guide lines for promoting and supporting the management and evaluation of the health services.

THE USL[1] is no longer a health structure operating in small towns and in communities in the mountain regions the way it was defined in L. n*f*833/78. Today the USL is an authority with legal personality, organizational, financial, accounting, managerial and technical autonomy. Its responsibility is to assure the implementation of the Government and regional policies on a local level.

The Hospitals are divided into the following categories:

- Public hospitals and specialized hospitals; Emergency hospitals
- Hospitals intended for the training of medical school graduates known as University Hospitals.

The structural problems of a hospital network, in this context, give rise to the necessity for a level division in order to respond better to demands of a various nature such as:

- Urban planning to ensure a widespread distribution of health services and to focus on specialized institutions;
- Healthcare to afford the same services for the whole population in the area;
- The technical and economic demands that cope with the burden of the construction costs and the management of a hospital.

The location of a hospital must either respect the territorial coordination and other regional plans; either it must correspond to the urban plans and local legislation. These aspects take various forms.

- Firstly, by respecting the social, economic, demographic and geographic characteristics of the territory;
- Secondly, by respecting the connection between the population and the health facilities in order to rise up to the present and future urban standards, keeping in mind the territorial distribution and dynamic of the population and above all the diagnostic information.

The location of a hospital depends on multiple factors:

- The nature, stability and elevation profile of the terrain, the direction and wind speed, the average amount of sun exposure per month, the presence and the nature of surface waters, the characteristics of the soil in both states, wet and dry, the richness of trees in the area and the South- East exposure.

This paper is, in fact, the result of a thorough research that comprises projects and works of doctors, engineers and administrators. Therefore the structure that is described in this project will definitely be functional and will answer the markets¶ demands and will be able to compensate for the lack of specialized structures for specific pathologies for which people in southern Italy have to go north in order to find the medical care they require. This medical structure will provide the people in the area suffering from an incurable disease the opportunity to get treated close to home, in this case, in regards to the location chosen for this clinic comprise the following regions: Campania, Molise, Lazio and the coast.

Both experience and an extensive research have emphasized the extent to which the territory needs a medical structure that will specialize in the research and the treatment of oncologic pathologies which has sadly known in the last few years a growth tendency in the area.

This tendency has shined a light on the discrepancy that exists in the area between offer and demand.

In fact, in this territory (south-east Italy) there is no hospital for tens of kilometers that could properly respond to the needs of the population. It is thus imperative to build a medical structure suitable to the needs of the

people in order to avoid wasting time and causing any sort of delay that might lead to a change for the worse in the diagnostic.

Therefore building a medical structure is an undeniable requirement which shouldn't be delayed for too long. Such a structure should not be seen as a replica or as the competition by the existing public, private and university hospitals (such as those in Rome and Naples), its build should be carried out by keeping in mind only the interest of the patients.

This project tries to imagine a structure considering not only the present needs but also the future of hospital construction and management.

In conclusion the perfect hospital should be small, functional, easily manageable, computerized, surrounded by green areas, with wide open spaces; moreover it should be built horizontally rather than vertically in order to minimize the risk of spreading an infection and to ensure the isolation of every ward. The hospital should also have a diagnostic and intervention center supplied with only the best in high technology medical equipment which allows for a fast and correct diagnosis. Moreover the patient rooms should be occupied in exchange for a very small price per day.

Therefore, considering all the functional and architectural characteristics listed above, the hospital will be able to offer services for preventing disease, setting a diagnostic, treating and rehabilitating a patient and also offer hospitality for those confined to bed.

2. LOCATION AND CARACTERISTICS OF THE AREA

Following an accurate survey and considering that from southern Italy approximately 200.000 people emigrate every year to the northern regions in order to find the medical care they need, in the Campania Region alone, about 70,000 people migrate to the north on the famous trips of hope, because the region lacks the qualified structures for to treat some diseases, it was decided to locate the medical facility in question, \ in the Campania region, at an altitude of 60 meters above the sea level, in the village of Rocca d'Evandro (Caserta Province), where one can enjoy a quiet and pleasant panoramic but especially healthy position; surrounded by the Mediterranean in a dense vegetation on a 120,000 square meters area (Annex 01).

The location is on a gentle mountain side and it follows the curve at the foot of the mountain without being obstructed by it and thus enjoying the sun rays as much as possible. The structure is south-east oriented which allows constant sun exposure for all four sides of the building.

This way excessive shading of the soil on the north side of the area can be avoided and also the structure can benefit from natural heating during winter and moderate heating during summer. In the morning the sun will shine on the south-east side of the building and in the afternoon the north-east side. The axis of the structure forms a 25° angle from the north.

The south-east exposure in the area is one of the fundamental elements in keeping ambient cleanliness and in inducing a psychological wellbeing for the recovering patients. Actually, considering the temperate climate, a

good exposure in the health related meaning of the word, is that which allows the sides of the building where the patients' rooms are located to make maximum use of the sun rays and heat in the winter and to be protected by excessive sun light and heat in the summer months whilst considering the temperate climate.

The area where the structure is to be built is adjacent to S.S. Casilina highway and in the vicinity of multiple town centers; however, the area still is far away from any sources of noise pollution or air pollution that may arise in the merging point of all the ways of access in the neighboring towns.

Protected by any type of street noise and any other form of noise pollution, especially those related to traffic and city life, the area is far from the highway juncture Rome-Naples (A1).

The road system that grants access to the structure is composed of the SS Casilina Highway, which is connected to a railway station, highways and fast local roads such as La Trignina, Bifernina, Cassino-Formia, Cassino-Avezzano.

It is thus very clear that the strategic placement of the medical structure benefits from a vast catchment area which comprises three provinces from three major regions, Frosinone Latina (LAZIO), Caserta (Campania), Isernia (Molise).

3. BUILDING DESCRIPTION

The medical structure is situated in the center of an area of 60.000 m² surrounded by trees and divided into independent gardens.

The hospital is divided into pavilions which are linked to each other through corridors or passageways (tunnels).

This type of building is more difficult to build and maintain as well as a little more costly since al the basic technical services will have to multiply (electricity network, waterworks, air conditioning, heating system, fire protection installation). However, the pavilions allow better ventilation and reduce the risk of a contagion spreading out to a minimum; moreover, separate pavilions induce a quicker recovery, an easier convalescence and it protects the psychological aspects of the patients who are confined in bed.

Furthermore, by analyzing the project it becomes clear that by using this type of pavilion division connected to each other through corridors, there are notable advantages in regard to the elevation profile and the type of terrain. In this instance special attention will be paid to respecting the regulations in force in the architectural domain.

The eight pavilions, indicated through letters A-B-C-D-E-F-L-M, are built facing south-east and are parallel with each other thus offering the same elevation profile and type of terrain for all of them.

Pavilion "A" is the first ward and it houses: the administrative services, the reception, a vast waiting room, a bar, a conference room and public restrooms. The total surface amounts to 1300 m².

One level below pavilion “A” there is pavilion “A” with a surface of 1480 m² that holds: the emergency room with the operating block, the adjacent post-operative intensive therapy rooms, X-ray diagnostic along with other similar techniques of image forming (ultrasound scan, C.T. scan, MRI) and the laboratory for chemical, clinical and pathological analyses. Lastly, the radiation oncology room immediately next to an operating theatre for the ongoing radiation treatments can be found in an independent area of this pavilion. A more detailed description is rendered in latter chapters.

Pavilion “B”, connected to pavilion “A” through corridors, is entirely composed of patient rooms, each of them equipped with a bathroom that has a shower, a toilet, a sink and a bide. Pavilion “B” has a surface of 1047 m².

Pavilion “C” is divided into two parts: the first one is connected by corridors to the pavilion “B” but it also has an independent entrance. This part holds one-bed rooms and two-bed rooms. Every room has its own

bathroom fully equipped as previously shown; the second part of the pavilion which measures approximately 500 m² has mini apartments with independent entrances from the park and to the ward. The total surface for pavilion “C” is 1047 m².

Connected to pavilion C by corridors is **pavilion “D”** which holds physical therapy room and an adjacent poll for the recovery and rehabilitation of the patients. Thos recuperation ward is equipped with an adequate number of bathrooms, showers and locker rooms. The surface covered measures 855 m². Pavilions **“E” and “F”,** each measuring 1047 m², are intended as nursing homes. **Pavilion ³L´** is meant for the patients who are terminally ill.

Finally **pavilion "M"** will house the mortuary service, which will be discussed specifically in a separate chapter.

In addition there is a facility of about 110 square meters and another for technological services with an area of about 200 square meters.

The total area of the entire construction project totals approx 11,978 sq m.

4. WAYS OF ACCESS

It is a well known fact that in every medical structure there is a constant flow of people and things and that all the comings and goings must be orchestrated according to a set of rules in order to facilitate an easy transition.

In fact the complexity and the differentiation of these flows in relation to the amount of space occupied by routes of access have an influence of 15-20% on all the spaces.

Regarding the compatibility of these routes they are divided into: ways of access that are partially compatible with that space and also ways of access which are partially incompatible with the space. In the case of the medical structure there are three routes of access: the corridors which connect the operating rooms with the patient rooms, the direct access to the patient rooms for the visitors and the routes used for equipment and materials.

It becomes very clear that the solutions found (numerous routes of access, mechanization of some of these routes) were adopted with the specific purpose to minimize waiting time and to lower the costs for personnel.

On the other hand, following the American example it is possible to create two separates routes of access for clean materials and waste. This solution allows for a more rational and simple use of the routes which results in lower costs and a higher efficiency.

From a technical view point the American example is the right one seeing as how in the past multiple routes of access have proved to be confusing, and less efficient.

5. RECEPTION

The reception is the pre-hospitalization service which deals with recording all the interventions that a patient who is not in state of emergency must undergo. This service evaluates the situation, and provides the administrative side for the admittance and the discharge of a patient.

In effect, the reception service intervenes by carrying out medical visits, medical exams and controls that are compulsory in order to evaluate the patients¶ recovering stage and to make the recovery as short as possible.

It also intervenes in the bureaucratic phase of a patient's recovery, diagnostic setting and treatment. It organizes the discharges, it handles that accounting part, it gives information about the treatments and illnesses and it draws out the waiting lists for those who want to be admitted.

Because of its responsibilities, the reception service will have an adequate and functional connection with the in-patient wards.

The access point is located in the proximity of the public entrance in the hospital and it will be visible in the road signs on the access roads that will lead to a one way route up to the entrance in the building.

Close to the entrance there will be a reception point that will take the patient's epidemiologic information by filling in an implied contract and a questionnaire.

The reception point opens into a vast waiting room for the patient and for his/her relatives and friends.

The reception comprises:

- The access Heated area (covered and pedestrians and vehicles); heated area for access
- Emergency Room;
- Exam Rooms;
- Observation Rooms;
- Waiting room for the invalid patients;
- Waiting room for patients on stretchers;
- Nurse assisted rooms;
- Restrooms;
- Storage room for clean materials;
- Storage room for laundry;
- Registration and archive;
- Two small rooms for medical examinations which are equipped with a bed, a sink, file cabinets, a wheelchair, a desk and two chairs.
- This examination room will measure approximately 20 m^2;
- Restroom and locker room for the medical personnel.

In the vicinity of the reception point there can be found the Archive for all the medical charts and is equipped with a microfilming device. The responsibility for the archive is attributed to the medical Director.

In this hospital ward the technical installations are the following:

- Emergency illumination; Gas detectors and alarms; Fire alarms;

- Phone line and intercom;

  Air conditioning.

Regarding the organizational and technical requirements the norms to apply are those of D.L. 14/01/97, of the Regional legislation.

6. LABORATORY

The laboratory's medical activity provides information which is obtained through chemical, physical and biological methods performed on human tissue and liquids or on materials connected to human typology. The purpose of the analyses is to prevent an illness, to set a diagnostic, to monitor the treatment, or to observe the evolution of the illness. The results of the laboratory work and the quality of the equipment have as only goal the finding of the right diagnostic.

There are two specialized sectors:

- The research in the field of biochemistry, clinical pathology, toxicology, hematology, immunology and microbiology.
- Provides specialized diagnostics in the field of biochemistry, clinical pathology, toxicology, hematology, immunology, microbiology, virology, cyto-pathology, molecular biology and genetics.

The laboratory is situated in pavilion “A” and is equipped as follows:

- Waiting area with an adequate number of chairs and with restrooms for the patients;
- Rooms where the samples are collected, rooms which are individual and very private and are connected to the waiting room through a direct entrance;
- Analysis rooms for each of the above-mentioned fields;
- Restrooms for the personnel;
- Locker rooms;

- Archive and administrative rooms;

- Rooms for waste materials;
- Rooms for new and clean materials;
- Rooms for cleaning the used materials;
- Rooms for medical examinations.

The laboratory has also a special section reserved for the field of histopathology and the microscopic analysis of surgical tissue samples and for biopsies. This section is independent from that mentioned before. Even in this section there is a center for analysis and one for setting a diagnostic.

The organization and the technical equipment will be equal to the volume of activity carried out and in accordance with the norms in D.L. nƒ 37/97.

7. RADIOTHERAPY

The recovery percentage of all tumorous pathologies is still dependent on the size and the degree of spreading of the neoplasms.

The ability to diagnose a tumor in its early stages means that the neoplasm that will be treated is of very small proportions.

In the treatment of a tumor there are a few factors which have to be considered: The response the patient might have to chemotherapy, radiation therapy and eventually the eventuality of a surgical intervention.

At present, for treating certain types of neoplasia and for better controlling the illness all three procedures are used together. However the cost for a treatment like this should be equal to the results.

The surgical procedure is suggested if the tumor has become more aggressive and if removing it won't cause the organ on which it developed any irreparable harm so as to worsen the patient's life quality.

Radiotherapy can be a valid alternative to surgery in cases, in which the tumor responds to x-ray treatment, or if the stage of the tumor doesn't allow a surgical procedure or even if the results of surgery can't be certain about how the main organs will be affected.

The disadvantage of radiotherapy is that it is very difficult to treat only the sick cells, the healthy tissue and organs in the vicinity will most definitely be affected.

Even today, in spite of the technical evolution of radiotherapy, it is still impossible to limit the X-ray effect to only the sick cells.

In the interest of remedying this defect, at present this technology is being perfected so that the treatment will be able to accurately treat only the neoplasms without affecting the surrounding healthy cells.

One of the devices that we intend to install is a Multileaf collimator (MLC) used on a linear accelerator to provide very accurate treatment beams.

The neoplasia is first of all identified as a result of a C.T. scan and then irradiated with the radiation beam. The advantage to this procedure, while using the Multileaf collimator, is that the radiation beam can attack the same area from various points and guarantees minimal damage to the healthy tissue surrounding it.

Considering all the advantages shown above it is clear that the hospital will have a linear accelerator that will be able to perform all the radiation treatments required by the patients.

Adjacent to the radiotherapy room there is an operating theatre where the surgical removal of the tumor will take place. The reason for the proximity of these two rooms is that after the operation the collimator will be used to sterilize the remaining tissue or to irradiate any cells that were impossible to remove by surgical means.

The ward will also be equipped with an open MRI so as to perform this analysis even on claustrophobic patients.

Moreover a device that shouldn¶t be absent is the CT scan, actually the Spiral computed tomography that has replaced the old version of this medical equipment. The spiral CT scan minimizes the time used to perform this procedure. This version can scan the examined body area through multislice scanners that can reproduce an accurate image on the computer.

Having medical devices that cause radiations from betatron energy and working with a linear and synchrotron accelerator, means that the facility should be isolated and one level below the other pavilions, the control and observation rooms should be well protected and the ways of access should be underground corridors.

These norms are in fact the solutions used to protect the exterior from primary and secondary radiation exposure. The measures taken here are, however, more than a hospital actually needs.

These protective measures are always complex and very costly but they are necessary when dealing with radiations that result from such powerful energy sources.

This hospital section is organized according to the activity performed and it is composed of:

- Waiting room for the patients and bathrooms;
- Admittance, administrative office and archive;
- Simulation room;
- Therapy bunker;

- Room for leveling the ionizing radiation, for the containment and protection of the patient during the therapy and for the dosimetric measurement of the absorbed radiation during treatment.
- Examination rooms with cabins for undressing;
- Pharmacy;
- Storage room for radioactive substances;
- Restrooms for the patients;
- Changing rooms for patients which are connected to the therapy room and the waiting room where the parents and friends might be;
- Personal waiting room with bathroom;
- Room for clean materials; Room for waste materials.

In the surrounding external areas outside the protective walls the radiation level detected will be minimized: 0,125 mrad/minute and 300 mrad/week (40 working hours).

The cement is the material chosen to diminish the spread of radiation outside the treatment room. Its light anatomic weight and richness of hydrogen atoms are qualities that withstand even against electron beams and neutrons. In fact, cement is also the less costly choice.

In rooms where there are used radioactive compounds such as radium 226, cobalt 60 and cesium 137, are kept in an adjoining room where they held in storage and prepared for each procedure.

In the actual therapy rooms special protective measures will be taken.

The floors are covered with smooth tiles, the edges are rounded and walls are covered in paint.

The work tables are made of stainless steel.

There is also a shielding screen made out of 1-2 cm thick lead.

A special attention is paid to the disposal of radioactive and contaminated waste for which special containers are used. The disposal of liquid waste is also treated separately.

According to D.L. nƒ 230/95, the disposal of radioactive waste will be made only by specialized companies.

In regard to the organization and technology used in this section of the hospital, the rules respected are those of the regional legislation and of D.L. nƒ 37 of 14/01/97.

8. X-RAY DIAGNOSTIC

It is necessary to mention that for this ward the authorized supplies receive authorization from the hospital seen as a whole, not as independent sections.

The rooms are sufficiently vast; the walls are sufficiently thick and along with the ceiling and the tiled floor, form a protective barrier that renders the area as very secure.

In order to guarantee the efficiency of this barrier there will be designed an additional lead screen that will provide extra protection. The doors and the windows will be as reinforced as any other part of this section.

Special attention will be paid in securing the darkroom and the control room so as to avoid causing any harm to sensitive materials.

This section relies most of all on its functionality. It is accessible in an autonomous way for all patients in need of it and is delimitated through visible and emphatic signs.

This section contains:

- Waiting room with a number of chairs;
- Admittance and archive;
- Hygienic areas for both patients and staff;
- Room for ultrasound scans equipped with changing rooms and independent access to the waiting room;
- Room for CT scans equipped with changing rooms and independent access to the waiting room;

- Room for MRI scans equipped with changing rooms and independent access to the waiting room;
- A control room;
- A storage room for sensitive materials;
- Test results center;
- A technical area for the express use of the medical and technical staff;
- Rooms for clean materials and for waste;
- Personal changing room with bathroom;
- Storage room.

In regard to the technological requirements the norms that apply are D.L. ɱʃ 37 of 14/01/97 and the regional legislation.

9. OPERATORY WARD

The operatory ward is part of a functional, general project that is intended to rise to the requirements of a medical structure of this kind.

This ward comprises:

- Operating theatres;
- Sterile rooms;
- Storage rooms for surgical instruments;
- Preparation rooms for the medical staff;
- Preparation room for the patient;
- Temporary post-operatory room;
- Intensive care;
- Room for used laundry;
- Room for clean laundry;
- Locker room for the staff equipped with showers and restrooms;
- Medical cabinets.

This ward's location was chosen so as to avoid excessive heating of the walls and in order to have a direct connection to the ward containing only patient rooms. Its position also isolates this section of the hospital from the unwanted traffic of both people and things, thus keeping it constantly decontaminated.

The tiled floor and the walls are built according to the sanitary norms with materials that have an increased mechanical, surgical and physical resistance.

The medical substances used are stored according to the regulation by respecting the cleanliness norms, the temperature and any other requirement.

The ceilings are dressed in plaster because it is a material that doesn't attract dust.

The doors are specially made and allow an easy passage for beds and other surgical equipment and have self closing mechanism.

All the installations, medical equipment and materials are in accordance with norm nf46 of 15/05/1990.

The electrical system in this ward is adapted to the needs of the activities performed here. A special attention is paid to guarantee the continuous flow of energy which is possible through the installation of both a backup and an emergency system.

This last installation guarantees a constant energy supply even for the other installations.

The electrical installation is divided into two networks: one for lighting and one that powers the electromotive force.

The electrical wires are so powerful that can withstand the highest estimated demand of energy and more.

The switch lights are placed on the outside of every operating theatre at a height of 150 cm.

In order to avoid any type of accident among patients and staff, the wiring will be completely isolated and so will any outlets and light switches. Moreover the installation will be grounded.

Special measures will be taken even to prevent any misuse of electrical surgical equipment. The outlet powering the electrical medical instruments will have a constant flow of energy but on a lower intensity.

The advantages of air conditioning are of interest for both patients and staff.

The air conditioning installation will maintain the temperature as follows:

- During summer 24 ± 25 ƒC and during winter 21 ± 22 ƒC;
- The estimated humidity during summer and winter will be 40 ± 60%;
- Air changing /hour (external fresh air), 15 times/hour;
- Air filtering 99, 97%.

In order to sterilize the air there will be used a new laminar flow system that doesn't recycle the already existing air but it provides a constant, one way flow of fresh external air ensuring natural ventilation.

The lighting will take the form of spotlighting but in a recessed form because they are easier to keep clean.

The surgical lights of 10000lx are suspended in the center of the operating theatres and have multiple arms that rotate on various axes. On the main arm are installed some extra lights called satellites that are mobile or not.

The centralized distribution of oxygen is directed from the central storage to the operating rooms. The same process is used for nitrous oxide as well.

The central storage room for all medical gases is situated at the exit from pavilion A. From here the gas becomes available for every pavilion, be it surgery, patient rooms, emergency rooms, intensive care etc. The ward is also equipped with fire alarms and gas detectors. Every operating room respects the regulations listed in D.L. nf 37 of 14/01/97 regarding minimum technical equipment.

The intensive care unit raises a few problems because of its central position in the hospital and the internal division.

As mentioned earlier in the project, this section is the exact opposite of the Operatory ward. This part of the hospital houses rooms with recovering patients in need of constant assistance. Therefore the traffic here is increased as opposed to the surgical area.

The use of space inside the intensive care unit used to be open, allowing visual contact between patient and staff; however this type of arrangement was abandoned even by the Americans and was replaced by a distribution per box.

10. INTENSIVE CARE UNIT

The activity of this unit is meant for patients who experience acute health problems with one or more major organs and might develop complications or whose lives are in danger.

The internal division for this section is in private rooms and in rooms with multiple beds.

The ward is located in a wing of pavilion A, and adjoins the operatory ward and the emergency room. It is composed of:

- A filter zone for the patients;
- A filter zone for the personnel;
- Inpatient rooms;
- Rooms for patients with infectious diseases;
- Medical cabinets;
- Nurse Rooms;
- Storage room for medical supplies and clean materials;
- Visitor area;
- Storage for dirty laundry;
- Restrooms.

Concerning the installations, this unit is equipped with:

Air conditioning and ventilation system that assures the following ambient features:

- Temperature during winter and summer between 20 ± 24ƒC;

  Humidity (winter and summer) between 40 ± 60%;

- Air changing /hour (external fresh air), 6 times/hour;
- Emergency electrical system;
- Power wiring;
- Intercom;
- Telephone line;
- Medical equipment;
- Gas detectors;
- Fire alarms;

In what the technical requirements are concerned, the norms used were that of D.L. nƒ37 of 14/01/97 and the regional legislation.

11. INPATIENT WARD

This hospital section houses only rooms for patients.

Nowadays it is inadmissible to have hospital rooms with a great number of patients and therefore in order to satisfy all the preventive and therapeutic demands and to ensure a state of nightly and daily state of tranquility and privacy, the best solution is the use of private hospital rooms in a functional, rectangular shape.

In the case of the two-bed rooms the same demands are met by the use of appropriate mobile devices, such as separating walls that will provide the privacy required by every patient during all moments of the day.

Every bed is placed in an area of at least 12 m² and every room is 3 m high so as to provide the patient with plenty of room. To these measurements we must add the 7 m² used for the bathroom. Every room has its own restroom.

The windows in every room are as wide as possible considering the ratio between the size of the window and the surface of the floor which shouldn't be higher than ¼ and smaller than 1/8. The depth of the room as opposed to the windowed wall is never higher than 6m in order to provide a sufficient view of the sky.

The type of windows preferred are the ones that open both as normal window and as a pivot-hung window which are capable of adjusting the desired ventilation. The window frame is divided into three each part having a transom on the on the upper and on the lower end.

The furnishings of every room is made up of metal framed beds, placed 30 ± 40 cm from the wall, a small table with two chairs and a small closet, all of them very simply designed to facilitate the disinfection.

The floors covered in easy to clean and easy to disinfect surfaces. The walls are varnished and covered with enamel to make them easily washable.

The bathrooms have either window for natural ventilation, or a very effective ventilation system similar to the one in the rest of the hospital.

The toilets are made of porcelain, and have a height of 35 ± 50 cm, an elliptic shape. The sinks are fountain type so as to prevent the contact from patient to patient.

Every room is equipped with:

- Emergency electrical system;
- Power wiring;
- Fire detector and alarms;
- Calling system with audio or visual signals;
- Telephone lines;
- Gas detectors;
- Air conditioning;
- Alarms;
- TV cable.

In every section of the inpatient ward there can be found:

- A medicine storage of 15- 20 m²;

- Room for dirty laundry with sink and bedpan washer;
- Storage room for clean laundry;
- Examination room;
- Charge nurse;
- Working area;
- Storage;
- Common room;
- Staff restrooms and lockers;
- A bathroom;
- Every section will have a mobile stretcher complete with cardio monitor and an external defibrillator;
- Treatment carts;
- Medicine and surgical carts;
- Waiting room for visitors;
- Safe space in case of fire.

12. PHYSIOTHERAPY AND REHABILITATION

Adjoining the medical structure there is a rehabilitation service and also a center for physiotherapy and physical reeducation.

The last two make use of a huge space and are composed a gym and a hydrotherapy room. The physical reeducation is an important step in a treatment and for it to be successful it requires designing spaces in which the patient will be able to regain the functionality of movement that will allow him/her to lead a life as close to normal as possible.

After a close examination of the problems arising from applying rehabilitation treatments for those in need, it has become clear that patients very often don't benefit from a correct care during the sessions or from having the right treatment applied in their condition. These mistakes are made in spite of the patients being in an acute state, or in the pre-operatory or post-operatory state, or even in other recuperating stages.

Very often the lack of an appropriate rehabilitation therapy can prolong a patient¶ stay in the hospital. Moreover, a lot of discharges are made without offering the patient a guided recovery in order to help him/her regain an amount of self sufficiency; therefore having a physical rehabilitation center inside the hospital will allow the discharges to be made in a safe manner.

Furthermore, having a very efficient rehabilitation center in the territory will benefit others such centers as well through the exchange of the observations and the research into the best and more efficient

methods used. The therapy may also include the involvement of family members and friends.

It is very clear that having a physical rehabilitation therapy center is an appropriate and wise answer to the area's demands because it could be used by other people outside the hospital, keeping in mind that the structure is placed in the center of a very productive and large region.

The rehabilitation center will be in placed in pavilion D which is connected to pavilion C by a transparent corridor and is connected to the outside through independent exits.

The construction materials used for this pavilion are all used according to the norms.

The floors are covered with non-slip materials. The ward is also equipped with sliding doors.

There will be an appropriate number of restrooms and locker rooms adequately equipped for the activities performed in this hospital section. The equipment required for the therapy center will be made up of tubs, mirrors and training aids for the rehabilitating activities and a computer for improving language skill for the patients who are unable to communicate.

The center will also have adequate exercise areas with appropriate gym mattresses that facilitate the proper use of kinesiotherapy for improving the neuromuscular body functions.

In pavilion "D", separate from the gym and the rooms attached to it, there will be a swimming pool for aqua therapy, constructed with all the

latest features for hydrotherapy activities. The dimensions will be adequate and responsive to the needs of the entire complex.

13. NURSING HOME

It is clear that after the diagnostic, the treatment and rehabilitation activities the condition of some patients may have to require non medical assistance but assistance from qualified personnel in a special environment. The nursing home was introduced for those with stabile but chronicle conditions.

Actually, the medical structure offers everything a patient needs to have a continuous and smooth passing through all the stages of a disease, diagnostic, treatment, recuperation, recovery, without making the patients move from one hospital to another in search of proper medical services. That is why the nursing home will be seen by every patient as just another stage in the treatment and not another treatment as such.

The medical structure aims not just to encapsulate everything better in technological, architectural and managing fields but also to offer solutions for all the problems that may arise in the evolution of a disease.

The main goal of this hospital is to answer all the demands of the patients without cutting them off from the outside world but rather by trying to cure and rehabilitate them in order to provide them with a safe and self sufficient reintegration in their everyday life.

The cleanliness of the air, the position, the panoramic view of the area, the vicinity with multiple town centers, the railway station and the highway, the rich vegetation, the lack of air and noise pollution and the lack of intense traffic and the noise of a busy city life, the low humidity and the temperate temperature as well as the perfect amount of sun exposure, turn

this hospital into the best choice for a complete medical care and the perfect choice for a nursing home.

Type of structure: Multifunctional Nursing Home

The Nursing home is composed of two pavilions E and F. which are positioned parallel to the other pavilions and on the same elevation level as the preceding pavilion. Both buildings will be built according to the norms and legislation in the field and by respecting the sanitary and medical requirements.

The pavilions¶ position is independent from the other hospital wards and the architecture is kept as simple as possible so as not inconvenience the full use of its spaces by both staff and patients.

The nursing home facilitates wheelchair movement and pays special attention to developing appropriate, vertical and horizontal access routes. The wide spaces make social interaction easier for patients and family. In the central area between the two pavilions the nursing home will have a park and special areas for various recreational activities.

Inside, special attention will be paid to developing easy to access vertical and horizontal routes that allow a wide range of movement and the easy use of the services provided by the nursing home.

Most of the guests here will obviously not be partially or totally self sufficient (no matter their age). This means that the majority of them will experience physical pathologies, sensorial depravation, and stabile or chronicle conditions that require a medium level of medical assistance, a

proper level of rehabilitating assistance and above all, an optimum level of assistance in managing the everyday tasks and living conditions.

This hospital section will provide the guests with the appropriate hospitality in order to complete the rehabilitation treatment, even if the treatments were started in another hospital.

Pavilions E and F are composed of single and double rooms and of 40 m^2 apartments that are made up of a bedroom, small kitchen, hallway, living room and bathroom. Each apartment may accommodate a single person or a couple and it has an independent exit towards the park. Inside the halls E and F is placed Oncology Day Hospital and Physician: there are 16 beds (with an autonomous Pediatric ward); MAC beds/armchairs (**Macroattività Ambulatoriale Complessa**) and BIC (Low **Bassa Intensità Chirurgica**).

In addition, two single rooms are destined for patients with infectious diseases and are equipped with a filter zone and restrooms.

In the double rooms the privacy of each individual is still guaranteed by the use of mobile partitions.

Every room is equipped with bathrooms that are appropriate for the physical challenged.

In addition this hospital sections offers rooms with medical tubs and services for the physically challenged.

Every room has a functional rectangular shape.

The dimensions of every room are in full agreement with the legislation and measure 3 m in height.

The rooms receive a generous amount of natural light and sun exposure.

The windows are precisely 1/8 of the total surface of the room.

The window frames allow for the perfect ventilation adjustment and are very easy to keep clean.

The waste disposal for pavilions E and F is carried put according to the legislation.

D.L. nƒ254/2003 is applied for solid waste disposal.

In the case if liquid waste disposal, a purification installation is used.

The waterworks, the electrical system and all the other installations used in the pavilions respect the norms set for this type of structure.

The cooking, washing and cleaning are services provided by the hospital personnel. However for these services only there is the possibility of accepting an accord with other private companies.

Nursing Home ± General organization

The criteria which determine the general organization are the functionality and the possibility to improve living conditions for the patients and to offer them a better quality of life even after they leave the nursing home.

The nursing home offers medical and pharmaceutical services. Special attention is given to the service quality offered by the nurses in everyday situations or in cases of infections or accidents (falling down).

The quality of the services offered by this part of the hospital is connected also with the rehabilitation activities in pavilion D. In fact, pavilion d is directly linked with pavilions E and F and renders the use of the pool and of the gym available for everyone.The patients' diet will be closely monitored and there will be a constant flow of recreational activities that will provide psychological support and will keep the guest familiarized with the environment or introduced to new things.

Considering that the two pavilions E and F are linked to each other by an access route, the services regarding common use are:

One single main entrance with a reception area, post, telephone;

An administrative office that is a subordinate administration office in the institute; of the general Sanitary services for common use;

- Common room (music, reading, games);
- Bar;
- Chapel;
- Hairdresser and barber;
- Special activities room;
- Cultural activities room and mini cinema.
- Sanitary services:
- Medical cabinets;
- Physical therapy and kinesiotherapy;
- Podiatry;
- Gym and locker rooms, physical therapeutic pool;
- Restrooms;
- Storage room for pharmaceuticals.

- General services
- Kitchen and sanitary services for the staff; Fridges;
- Closets;
- Staff locker room; Shops;
- Area for trash collectors; Bedpans washer;
- Charge nurse;
- Medical offices with adjoining sanitary services; S
- torage for equipments, wheelchairs etc;
- Rooms for dirty and clean laundry.

Considering all the general service, the sanitary installations and the technical one as well, it is important to add that some of them will be autonomous. The same can be said about the administrative services, the room for minor surgical interventions, the medical cabinets etc.

The park in the nursing home area is independent from that of the institute. They are apart in order to separate the gravely ill from the recuperating patients who might suffer from shock after seeing more difficult medical cases.

The park is rich in ornamental trees, evergreen plants and fruit trees.

There are also numerous flower beds and strolling alleys that are wide enough so as not to inconvenience those using wheelchairs.

The park also has two fountains, one for drinking water and one for ornamental purposes. There benches and other supplies for recreational activities during warm weather, two bowling alleys and a tennis court.

The apartments and the rooms will be equipped with fire alarms and smoke and gas detectors so as to render the stay here as comfortable, safe and as efficient as possible.

14. PALLIATIVE TREATMENT

Taking into account that the institute was intended for curing destructive illnesses the need for a ward that offers palliative cure was imperative. This pavilion is called ‘L’ and will be used to treat pain.

The pavilion is a three storey building, each level having a surface of 360 m² and is divided into mini apartments of 50 m² that have a camera, a kitchenette, a living room, a bathroom and a terrace.

The apartments are integrated in the whole sanitary structure and are fully functional.

The patients' temporary stay is part of the therapeutic process. This structure type allows the hospital stay to be a dignified one while offering the patient the help he needs and at the same time creating a home-like feeling that usually leads to a faster recovery.

In cases in which the patient wants to personalize the room the hospital allows it with certain restrictions. As for the general services and the technical, medical and sanitary installations, these rise to the same standard as the ones in the rest of the hospital and moreover some of them are autonomous.

15. PREMISES FOR FOOD AND BEVERAGES

There is no central kitchen for preparing the food. The hospital uses an external catering company specialized in food for various diets. This solution helps lowering the costs for this service.

However, for emergency cases only the hospital does provide a small kitchen properly equipped (adequate lighting and ventilation for smells and vapors, varnished walls and easy-to clean floors and surfaces that are disinfected with ease).

In the center of the kitchen there are a stove, a hot plate and a bain-marie.

This kitchen also has all the cooking utensils and appliances necessary which are kept in a constant state of cleanliness and disinfection.

The dish washing room is a very small room adjacent to the kitchen. The dish washing machine is also installed in this small room.

The machine uses water heated up to 60 ƒC for the wash cycle and temperatures between 70 ± 90 ƒC for rinsing.

16. LAUNDRY ROOM AND DISINFECTION SERVICES

The laundry is cleaned by an outside service because only by using an industrial type of washing machine the laundry is not only cleaned but also disinfected. This solution helps lowering the costs.

The only part of the process that the hospital undertakes is the sterilizing of all laundry.

The dirty laundry will be first of all sorted out in the hospital as it is being collected. It is then put into different color bags according to the treatment that the patient using it was going through.

The bags are then sent to the laundry room where the bags containing infectious bacteria are sterilized.

The disinfection area is next to the laundry room but is separated from it and even has its own ventilation system.

The area where the laundry is separated for the sterilization process is equipped with horizontal slides, tubes and liquid disinfectants and a closet for disinfection using formaldehyde.

The personnel working in this section will be protected by the proper equipment, clothes, gloves, masks etc.

17. HEATING INSTALLATION

The air conditioning and the climate settings are interconnected to the changes in temperature and humidity associated with the air filtering process and the renewal of the external air.

In order to cope with the heating demands for the entire hospital it becomes compulsory the use of mixed systems for heating and climate changing, without affecting the humidity.

The humidity is controlled by the furnace situated next to the hospital and that is powered by liquid and gas fuels.

The furnace transmits heat through the use of are radiant heat units otherwise known as radiators that are composed of even smaller metal parts, mostly steel and aluminum.

The radiators are fixed into the walls all throughout the hospital at a height of 10 cm form the ground so as to allow the air to circulate and to facilitate the cleaning.

The form used for the radiator's elements will be the one that will allow the best passing of heat. Another alternative for heating will be the use of thermo convertors that create a sensation of draught. Another choice may be air converters that allow the possibility to freshen the already existing air.

The norm followed in this respect is L. n/ 10/91 and the following changes. This norm regulates the functioning of furnaces, the size of the furnace, the number of radiator etc.

The part of the thermo installation that functions with water will be equipped with water softeners in order to extend its usage for a very long time.

The temperature will be controlled by thermostats.

The technical characteristics are used according to D.L. nƒ37 of 14/01/97.

In regards to the bacterial pollution for which the admitted level must not surpass 30-100 calories/m², it is used a ventilation system called laminar flow system that always brings in fresh air.

The energy production for the health facility will be equipped with all the new technological standards in order to achieve the highest level of automation and energy saving, in perfect alignment with today's national and international objectives in the field of sustainable energy: photovoltaic system with polycrystalline silicon modules with a capacity of approximately 500 kW = 0.5 MW, set to service the parking area, capable of delivering an average annual electric power next to a total of 750 MW; photovoltaic plant with a capacity of about 1500 kW = 1.5 MW composed of membrane with amorphous silicon photovoltaic cell, positioned in adherence to the coverage area of the constituents pavilions the structure to be achieved, capable of delivering an annual average electric power of 2,250 MW .

The tri-generation plant of the average potential equal to 2.0 MW, at the same time capable of delivering thermal energy, electrical energy and cooling energy of the entire structure.

So the health facility should be independent of both the electricity and water consumption.

18. WATERWORKS

The hydro installation is estimated to consume 220 l/ day for every patient.

The hospital has a reservoir that is estimated to hold 95 l for every patient.

Obviously the water will be changed daily and kept clean and sanitized.

19. SOLID WASTE

The disposal of hospital waste is a great polluting factor in Italy. This becomes even more serious when we consider the ignorance of some people and the total lack of action on the government¶ side.

The hospital director is the one in charge with the procedures of gathering, sterilizing, packing, handing over the hospital waste, having it leave the premises and the disposal performed by specialized companies.

The waste that comes from hospitals and other medical centers is a possible source for bacteria and infections and therefore it is submitted to another treatment than regular waste.

The amount of hospital waste adds up to 0,2 tons/year in all of Italy and is the source of a major problem because of the nature of the waste and because there are very few companies that will dispose of it according to the legislation.

The amount of waste produces as a result for treating a patient is between 1-13 kg of waste/day.

The Italian legislation (nƒ254 of 15/07/2003 and L. nƒ31 of 31/07/2003, art 25) defines the hospital waste as waste that is produced by public and private structures that are not town structures. The waste is divided into categories waste that can be assimilated, special waste and toxic waste.

- Waste that can be assimilated in the town waste: are disposed of in the same manner as regular waste, without any prior treatment. Office trash, food and leftovers; a patients trash, apart from those suffering from an infectious disease. It is important to mention that in order to be treated as regular trash, this type of waste must be disposed of immediately so as not to putrefy, form odors and bacterial.
- Special waste that cannot be assimilated into the same category as regular trash. This type of waste undergoes a sterilization process before being sent to special installations to be burned. The special waste is produced by operating rooms, delivery rooms, pharmacies, the ward for infectious diseases and the laboratory and dialysis room. Components: medication, pathological tissue, biological liquids (blood, urine, bacterial cultures), used materials, (syringes, needles, flasks), blood, plasma etc. This category amount to 25-30% of all solid waste in a hospital. After being sterilized the waste is categorized and packed into special containments and are stored on the premises for no more than 5 days until they are sent to the disposal unit. During this time the storage room is disinfected daily.
- Toxic waste is all waste which is partially or entirely contaminate and may endanger a person¶s health or the environment. The compounds in this type of waste may be flammable, explosive, radioactive,

corrosive, toxic, infectious, non biodegradable, lethal or irritating. They come from radiology, biological and pharmaceutical research. Toxic waste is disposed of and transported by respecting the legislation in the field. Components: chemical residues, corrosive substances etc.

- Radioactive waste: are a result of radiotherapy treatment and laboratory residues from nuclear medicine. They are solid and liquid as it will be shown in the following chapter.

20. LIQUID WASTE

The liquid waste from a hospital is divided into the following categories:

- White waters (roofs, terraces, alleys);
- Black waters (service waters, plumbing, kitchen, laundry).

The legislation states that the disposal of hospital liquid waste should be assimilated to that of any town, the only difference being that before the wastes merge, the hospital liquids must pass through a sterilization factory. Moreover the liquid residues from the infectious diseases ward must undergo an additional treatment and be disinfected for a second time so as not to contaminate the people or the environment.

Considering their origin, the hospital waste waters are divided as follows:

- The water resulted from the air conditioning installation, from the dish washing room, from the kitchen and from the furnace;
- Water used for services such as diagnosing, chemical and biochemical laboratory work, hematology department, pathology analysis, microbiology, pharmaceutical work;
- Waters form the patient rooms.

In a modern hospital the quantity of liquid waste measures between 500-1200 l/patient/day, which is five times more than a regular person. The quantity, however, includes the liquid waste produced by the day hospital, the medical cabinets, the visitors, the medical staff and the patients who don¶t remain at the hospital.

The liquid waste can also contain substances that can seriously affect the ecosystem and become a bacterial hazard for people, animals and the environment. Such substances are: antibiotics excreted by the patients, chemical reactive from laboratories, disinfectants, radioactive residues from patients who have undergone radioactive treatments.

The dangerous biological residues pass through the sterilization factory. In order to be properly disposed of these liquids undergo a mineralization process to neutralize the organic compounds.

It is assumed that in certain moments of the day the deployment of toxically charged substances are in a bigger quantity and can endanger the use of all treatment installations and the damage may be irreversible.

The main goal in the successful deployment of the liquid waste is to avoid becoming a risk to both people and the environment. That is why the substances must be thoroughly neutralized before depletion.

21. RADIOACTIVE WASTE

Managing the disposal of radioactive waste may be approached in various manners:

- Waiting for them to decay then dispose of them;
  Dilute and disperse and then dispose of them;
- Gather it in special containments and keep them in an adequate place.

The collecting point for liquid waste is not directly linked to the drainage system and the special tubs for the process of decay. At the temporary storage room there are also containments for liquid waste. The same solution is used for the liters in the ventilation system and for the removal of sheets, clothes and dishes used by the patients.

A solution would be to use the local deployment systems that manage the disposal of residues from the practice of nuclear medicine. However, this method can only be used if the number of patients treated per year is very small. Otherwise the preferred method should be a complex one in which there are a number tubs connected between them and as one tub fills the suction pumps that connect the tubs should transfer the waste from one tub to the next and so one. The deployment of the last tub should be carried out only by the person in charge with monitoring the levels of waste in each tub. The deployment should be made only in the limits set by the legislation which is very small quantities.

There is also the possibility that the hospital, after keeping the residue for a long time, during which it has decayed, to dispose of the waste in the

same manner as of any other non radioactive residues. Even in this case the regulations in this field should be respected mainly Leg. D. ŋƒ 230/95 regarding the disposal of harmful and toxic waste.

22. MORTUARY SERVICES

The mortuary services are located in the last pavilion, ³M´, and is connected to the hospital by short passageways and knows very little traffic. The internal routes of access are divided into two: the passage for the corpses and the passage for the hearse. The last one has an independent exit.

The mortuary service is divided into three sectors:

- The acceptance of corpses, their conservation and preparation and their sending towards the autopsy department or towards the funeral service;
- The Autopsy department and autopsy rooms;

  Funeral service

The rooms where the bodies are kept are equipped with means through which the potential reviving of someone is immediately observed. The rooms have many windows and are well ventilated and the tilled are tiled or varnished and very clean. The rooms are 1, 80 m tall.

The same as with any other section of the hospital, the mortuary has an air conditioning installation which changes the air in the room multiple times in one hour.

The observation room is where the bodies are victims of an accident or have not yet been identified by a familiar. This room also serves as place where the body is dressed and prepared for the funeral rites. This room has the same structural characteristics as the previous one.

The autopsy room is essential for performing the legal autopsies imposed by the Judicial Court.

This room will be equipped with an anatomic table covered in marble or metal and with its own hydro installation, small ducts for the disposal of any type of body liquids and trays for washing the organs.

Adjoining the autopsy room is a freezer room where the bodies are kept or the organs that have to be examined, a small laboratory for analyzing sample tissues and a restroom and a locker room for the personnel.

The funeral service is composed of:

- Room for the family and friends;
  Crematory;
- Room for personal preparation;
  Restrooms for the family members;
  Restrooms for the staff;
- Storage room;
  Mortuary authorities;
  Chapel.

The funeral service is equipped with the following installations:

- For the possible revival of a body;
  Fire alarms;
- Emergency electric system;
  Power wiring;
- Telephone and intercom;
  Air conditioning.

The visitors have a special entrance, independent from the main entrance in the hospital.

The waste is disposed of as described in the chapters above.

23. CONCLUSIONI

This project has been written while keeping in mind all the demands of a new culture in a vast territory that is in a continuous state of progress, evolution and development.

The medical structure represents a positive shift and a turning point that places the requirements of the patients above all else and offers the people in the south ± east regions a chance to find treatment next to home and to not have to go in the northern regions to find decent medical care.

In order for this to be a useful study, at the time of the build there will definitely be a few adequate and changes to avoid any shortcomings that might have been overlooked in the creation stage of this project.

The aspiration of this study was to create a relief in knowing that proper medical care can be achieved if the right medical structure exists.

The institute described in this paper is meant to end the paradox according to which because of this explosion of technology in the medical field there can no longer be found an institution that is close to patients and responds to their demands in a human, dignified manner while using the modern technologies to treat them.

Whatever aspect may have been overlooked in the writing of this paper, the reader must be certain that the aspects that were discussed are 100% researched and the legislation used completely valid.

- The minimum structural and technological demands are as

  follows:

- Earthquake proof;
- Fire alarms and smoke detectors;
- Sound proof;
- Electrical safety and continuity;
- Constant hygiene in the work place;
- Barriers against radioactivity;
- Architectural efficiency;
- Solid and liquid waste disposal;
- Microclimate;
- Gas distribution;
- Explosive materials.

The study is written according to the national, regional and local legislation.