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New trends in health architecture for children and the effects of the built environment on young patients

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NEW TRENDS IN HEALTH ARCHITECTURE FOR CHILDREN AND THE EFFECTS OF THE BUILT ENVIRONMENT ON YOUNG PATIENTS

A thesis submitted in partial fulfillment of the

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MASTER OF ARCHITECTURE

by

Luis Felipe Barahona

2001

To: Dean William McMinn
School of Architecture

This thesis, written by Luis Felipe Barahona, and entitled New Trends in Health Architecture for Children and the Effects of the Built Environment on Young Patients, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this thesis and recommend that it be approved.

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DEDICATION

I dedicate this thesis to my children Erika, Alessandra, Luis Fernando Barahona as well as my parents Lila Teresa Pizzino and Victor Barahona and my girlfriend Liliana Murillo. Without their patient, understanding, support, and most of all love, the completion of this work would not have been possible.

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I wish to thank the members of my committee for their guidance, support and professionalism throughout this thesis. The valuable assistance, reviews and comments by major professor Mario Valbuena, professor Kevin Smith and Architect Jose Camero have helped me make this thesis possible.

ABSTRACT OF THESIS

NEW TRENDS IN HEALTH ARCHITECTURE AND THE EFFECTS OF THE BUILT ENVIRONMENT ON YOUNG PATIENTS

by

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Professor Mario Valbuena, Major Professor

The objective of this thesis was to investigate the effects of the built environment on the outcome of young patients. This investigation included recent innovations in children's hospitals that integrated both medical and architectural case studies as part of their design issues. In addition, the intervention responded to man-made conditions and natural elements of the site. The thesis project, a Children's Rehabilitation Hospital, is located at 1500 N.W. River Drive in Miami, Florida.

The thesis intervention emerged from a site analysis that focused on the shifting of the urban grid, the variation in scale of the immediate context and the visual-physical connection to the river's edge. Furthermore, it addressed the issues of overnight accommodation for patient's families, as well as sound control through the use of specific materials in space enclosures and open courtyards. The key to the success of this intervention lies in the special attention given to the

integration between nature and the built environment. Issues such as the incorporation of nature within a building through the use of vistas and the exploitation of natural light through windows and skylights, were pivotal in the creation of a pleasant environment for visitors, employees and young patients.

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Introduction

Throughout time, we have looked for ways to accommodate the sick and the needy. This investigation looks into the development of children's hospitals and how they have evolved from the time of their inception in the mid-nineteen century to the present. The investigation shows the transformation of children's hospitals throughout their history, investigates current trends in health architecture that is dedicated specifically to children, and focuses on recent research that demonstrates how the designs of healthcare environments affect children's responsiveness to treatment. The investigation acknowledges the dramatic population growth of Miami-Dade County since the 1980s, and the resulting need to develop healthcare facilities that are dedicated exclusively to children's health. The site analysis of the project addresses three important issues: accessibility to the site; the site's adjacency to a major medical center; and the integration of nature into the project. The project covers a rehabilitation hospital for children that promotes healing through the built environment. It emphasizes using natural elements in and around the project through which the patient can interact both physically and visually in such a way as to achieve relaxation, calmness, and peacefulness, and thereby stimulate the healing process.

History of Children's Hospitals

"...founders of infant Asylums and children's hospitals share with other reformers the conviction that removing children from slum treatments - where they imbibed impure milk and water, breath foul air, and were exposed daily to and unhygienic environment - would not only cure them of their ills but would make them better citizens."

Janet Golden 1989[1]

During the mid- nineteenth century, as urban sprawl developed, reformers created institutions for the care of sick and poor children. As a result, the creation of medical institutions for children began for children as part of a larger child-saving movement. During the mid- nineteenth century infant asylums, the oldest and most controversial of children medical institutions began in Europe as refuges for foundlings. They were traditionally run by religious orders. Critics of that period view those institutions as being promoters of illegitimacy since they made it easy for women to dispose of their unwanted newborns. In the United States, the debate was centered on efficacy rather than on morality.

The founders of American infant asylums believed their mission to be the removal of babies from almshouses' where the infant mortality rate at was nearly one hundred percent. Dr. J. Lewis Smith a New York physician recalled that the superintendent of Blackwell's Island Almshouse said, "It would be an act of humanity if each foundling were given a fatal dose of opium upon its arrival."[2] The miserable situation on Blackwell's Island and elsewhere, as well as suspicions about Protestant institutions claiming to be non-denominational, led religious groups and individual reformers to create infant asylums in the mid-nineteenth century.

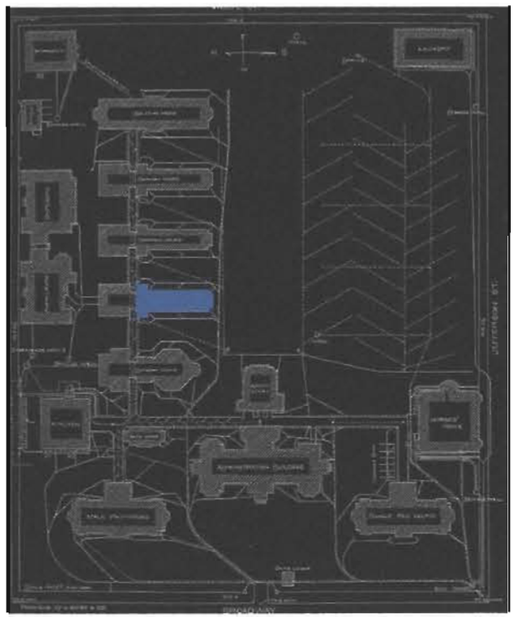


Fig.1 Johns Hopkins, site plan 1885

Despite the sincere efforts of their founders, asylums proved to be no better than almshouses. High death rates caused by infections and feeding problems forced many physicians to conclude that no form of congregate care was appropriate for the very young. By the late nineteenth century, the creation of new social welfare programs and advances in medicine allowed healthy infants to be placed in foster care, while the sick infants were admitted to hospitals. In addition, physicians in hospitals began to learn how to control of infection and prevent the spread of

[1] J. Golden, *infant Asylums and Children's Hospitals medical dilemma and developments 1850-1920,* (New York, Garland Publishing, inc.) 1989 p. 1

[2] J. Golden, *infant Asylums and Children's Hospitals medical dilemma and developments 1850-1920,* (New York, Garland Publishing, inc.) 1989 p. x

disease in wards, which meant that hospitals could begin the admitting children under the age of two.

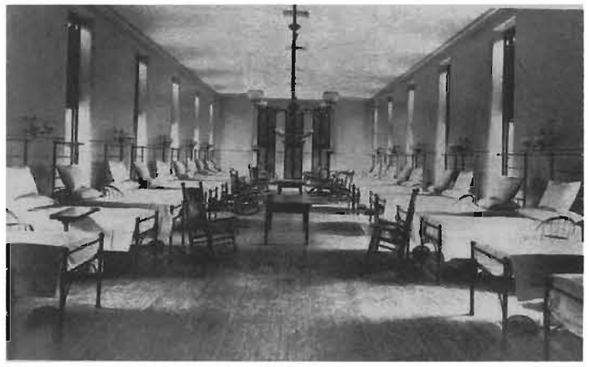


Fig.2 Johns Hopkins, boys Ward

An innovative hospital during that time was Johns Hopkins in Baltimore, Maryland, which opened in 1890. Its design layout consisted of a series of one-story Nightingale pavilions that were linked by a one-third mile long corridor to the administrative and serviced buildings and to the nurses' home.

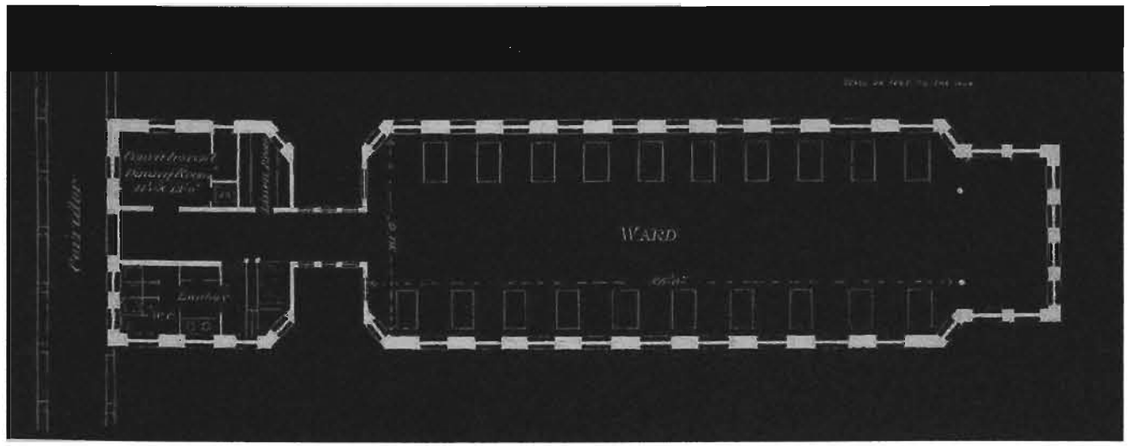


Fig.3 Johns Hopkins, boys Ward Floor plan 1885

Within these corridors, emphasis was placed on fresh air and ventilation. "The Nightingale Ward was a long narrow room with beds against each wall, tall windows ensuring sunlight and good cross-ventilation."[3] The bathrooms were located at the far end and were ventilated on three sides. The kitchen and linen area was located at the other end of the corridor. Johns Hopkins set the pattern for large medical institutions in the United States for a quarter-of-a-century.

I. Rosenfield in his 1969 book, Hospital Architecture and Beyond, writes that most patients in hospitals throughout the United States were treated and cared for within the same areas, without any differentiation of age. Under those circumstances, children were not only exposed to the diseases of adult patients, but also to the sights, sounds and odors of adults, which were sources of anxiety to them. Doctors who understood what the situation demanded drew public awareness to their claims that children could expect better recovery results if they were placed in special environments rather than in crude, general hospitals.

According to Janet Golden's in the 1989 book, Infants Asylums and Children Hospitals, the first pediatric hospital, Children's Hospital of Philadelphia, was opened in 1855. It was a small hospital consisting of only 12 beds; most of its effort was based on outpatient care. A new facility was built in 1867 that had a capacity of thirty beds. By 1874 there were 39,508 children who had received care in the dispensary, while the hospital had admitted only 2,069 patients. Early children hospitals provided a mixture of free inpatient and outpatient care to children of the urban poor. The type of care they offered was designed to simultaneously improve the patient's moral and medical condition. In 1873, the United Stated had 120 hospitals; by 1910 there were over 4,000

hospitals, of which children hospitals were a very small number. Children hospitals, like other hospitals, changed radically during the late nineteenth and early twentieth centuries in terms of scale and technology, among others. "Development of the germ theory and advances in asepsis led to an increased ability to control infection and allowed for the admission of those suffering from contagious illness."[4]

According to Golden (1989), medical advances spurred the hospital's growth in both size and complexity. Institutions added patient beds, operating rooms, medical laboratories, and medical equipment. As with other hospitals, children hospitals inaugurated nurse-training programs in the decades from 1870 to 1920. Medical staff grew as hospitals created internship programs. By 1930, there were 70 children hospitals, some of which provided 6,597 patient beds and treating nearly 10 percent of all hospitalized children. The other 90 percent received care in general hospitals, which sometimes had pediatric wards that specialized in orthopedic surgery.

Following the end of War World II, the arrival of high-rise urban hospitals were necessary due to the dramatic increase in of the price of land in urban centers. Children hospitals, as well as general hospitals, adopted the new architectural International Style, which became a sheer container of volumetric machines. "As hospitals grew more specialized, containing newly formed departmental groupings or zones, each with unique functional planning requirements for diagnosis, treatment, surgery, administration, meals, and other support functions, it grew exponentially in size and spatial complexity. The advent of long-span structural systems and sophisticated heating, ventilation, and air conditioning systems encouraged the abandonment of the Nightingale wards in favor of large "block hospitals"..."[5] This new architectural style produced a double- loaded corridor that was created by repeating the room blocks along the two sides of the corridor and then inserting a core of support amenities in the center.

In the 1950s, Variety Children's Hospital in Miami, Florida, was created as a health facility for people suffering from polio. Soon thereafter, the facility changed its program, switching its emphasis toward providing care for children, in general. Its internal configuration, which was virtually mandated by the Hill-Burton guidelines, had double-loaded corridors. In this arrangement, all rooms opened into the corridor, which facilitated easy access to the rooms. Virtually all children hospital both public and private, followed this plan. By the early 1960s, however, the double-loaded corridor had given way to what became know as the as the racetrack plan. This design pulled apart the room blocks along the two sides of the corridor and inserted a core containing program support amenities in the center.

[3] I. Rosenfield, *Hospital Architecture and Beyond*, (Van Nostrand Reinhold Company) New York, 1969 p. 25-26

[4] J. Golden, *infant Asylums and Children's Hospitals medical dilemma and developments 1850-1920,* (New York, Garland Publishing, inc.) 1989 p. x

[5] Verderber and Fine, "*Healthcare Architecture in an era of radical transformation*", Yale University press, 2000 p. 13

In 1976, John Thompson wrote "The service core contained elevators, nurses' stations, closets for clean and soiled linen, mechanical shafts, general storage, staff offices, treatment rooms, and conference rooms."[6]

A counter-current to the International Style became evident by the end of the 1960s and into the 1970s. The emerging iconoclastic hospitals began to reject the absolute minimalism to the conventional modern block hospitals.

> "The old idea of one hospital to satisfy all needs is a thing of the past. We need a series of institutions. We'll always need some health factories of efficient, short-term, intensive care stays, but we'll need others where humanity won't have to overcome the technical apparatus."[7]

[6] Verderber and Fine, "*Healthcare Architecture in an era of radical transformation*", Yale University press, 2000, p. 26
[7] Ibid, p. 133

Recent Health Facilities for Children

In the 1920s and 1930s, private insurance plans were introduced. The expansion of community hospital systems was fed by Hill-Burton, which gave grants and loans from the mid-1940s through the mid-1970s. The arrivals of Medicaid and Medicare in the 1960s were a large liberal injection of money for children hospitals in the United States. However, in the 1980s, the federal government began to cut funding for health care.

Consequently, children hospitals in the United States were feeling internal pressure not only to better manage costs and improve efficiency but also to compete for patients. Ambulatory-care institutions grew and began competing with existing hospitals for patients. "Reinforcing this trend was the advances in medical technology that made it feasible to provide on an outpatient basis, and at less cost, many diagnostic, medical, and surgical procedures that no longer required hospitalization. "[8]

The emergence of alternative health architecture for children implied re-inventing programs and settings for specific groups of patients. The following four projects will show a repetitive desire to address children healing environments.

[8] Reinventing the hospital, Architectural Record, V.173 (October 1985), 121

The Shriners Hospital for Crippled Children in Los Angeles California is a clear example of this new trend in programs that is dedicated specifically for children. Designed in 1985 by Bobrow/Thomas and Associates, Architects, the hospital's main purpose was not to design for sick children but, rather, for youngsters with mechanical problems. The facility required relatively lengthy periods of hospital care, with an average stay of ten days or more. The intervention was viewed as a boarding school with medical components.

Fig.4 Shrine's Hospital for Crippled Children 1985

As the hospital sits on an elevated hill, the main entrance and parking is located below the main level. The project was required to keep a low profile in order to blend with neighboring hilltop stucco bungalows and modest apartment housing. The creation of an environment that would reduce stress in children was an important issue for the architect. Spaces used materials that were rarely seen in hospital settings, such as oak paneling, parquet floors, closely-set oak slats that lined the ceiling of the two-story gathering rooms, and a two-sided travertine fireplace that divided the central atrium. To

accomplish the owner's intention, the south end of the existing building was demolished in order to make way for the 60-bed hospital and underground garage. The remaining U-shaped structure was remodeled to house outpatient services, administrative offices, a surgical suite, and guest quarters for visiting parents. The inpatient treatment area, located on the second level, had rooms that included four beds divided from each other by sliding privacy curtains, a shared bath with a skylight, and a south-facing sitting room that can doubled as a visitor's sleeping space.

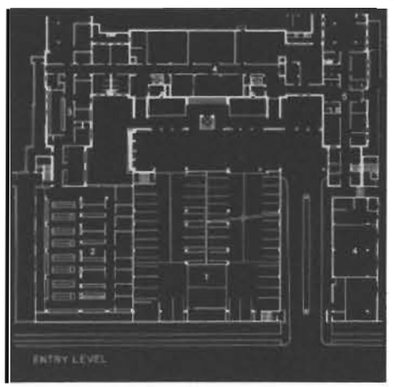


Fig.5 Ground Floor Plan

Program consists of:

Entry Level
Parking
Laboratory
Staff/records
Storage/Mech.
Housekeeping

First Level
Terrace
Radiology
Outpatient
treatment
Lobby/waiting
Administration
Boardroom
Food preparation
Cafeteria
Therapy
Auditorium
Multipurpose

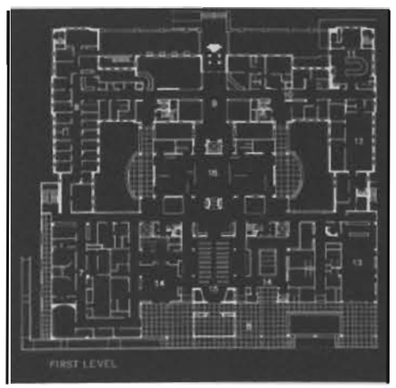


Fig.6 First Floor Plan

Second Level
Inpatient treatment
Nurse's station
Staff
Medical library
Surgical suite
Visitors suite
Patient library
Lounge/play

Fig.7 Second Floor

The project dealt with the challenging integration of a new typology into the existing fabric and the articulation of unique site constraints. In addition, the architect incorporated existent building conditions with new program requirements.

Another challenging project was the convertation of outdated office building into a primary-care children's clinic. Ratcliff Architects from Los Angeles, California designed the primary care clinic for Children's Hospital in Oakland, California, in 1993. According to the February 1994 Architectural Record article entitled, "Primary care clinics," the design focuses on not only a face-lift but also shows the building's original form in the facade. " The purpose was twofold: to put potentially reluctant young patients at ease and help revive a deteriorated neighborhood."[9]

Fig. 8 Front facade

Not only does the addition of the skylight over an open space contribute to the saving of electricity, it also creates a bright interior atmosphere that provides a clear sense of orientation on each level. Four medical units on the ground floor surround a central waiting area. This is repeated throughout the perimeter of the building, and the center is used for vertical circulation, conference rooms and a discharge area. The second level has smaller rooms for psychiatric care, as well as for doctors' offices. The exterior uses stainless-steel mesh resembling paper-doll cutouts to not only protect the windows, but also to enliven the atmosphere. These playful elements used by the architect show his intention to invite unenthusiastic young patients into the hospital.

Fig.9Entrance

First floor

Examination rooms
Offices
Charting
Conference areas
Discharge area

Second floor

Examination rooms
Offices
Conference areas
Interview rooms
Staffs lounge
Screening

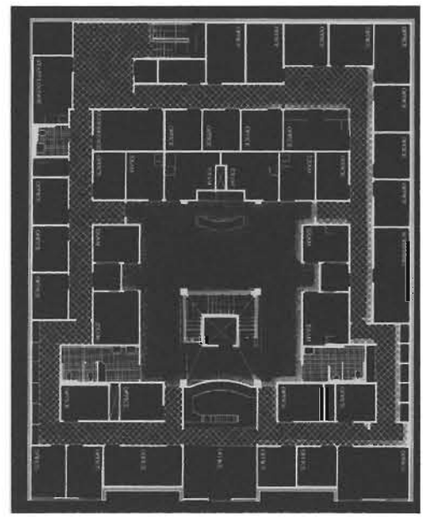


Fig. 10 Second Level Floor Plan

Similar to The Shriners Hospital for Crippled Children, the Primary Health Clinic in Oakland, California has dealt with the challenging task of integrating its revised building facade with the neighborhood. Both share the desire to create an inviting, pleasant, friendly and welcoming environment to their child patients. The intent of the project briefly touches on current architectural aspirations of creating space where young patients feel better.

In 1991, Ove Arup & Partners designed Lucile Salter Packard Children Hospital at Stanford University. This hospital uses children-oriented architecture. This children hospital was the 1992 AIA Winner of the Modern

Fig. 8 Front View

Healthcare Design Award. The design focuses on providing the building with a humanizing and nurturing environment by using soft materials, natural light, and a

[9] Primary care clinic, Architectural Record, V.182 (February 1994), 119-120

playful color scheme. The design recognizes the importance of facilitating areas that provided relatives with a place to sleep, do laundry, and prepare meals. In addition, nursing units are based upon the age of the patient.

The hospital includes: "inpatient facilities (50 medical/surgical acute care beds in 3 age-based nursing units, a 10-bed psychosomatic unit, a 14- bed comprised host unit, a 20-bed pediatric ICU, 31 neonatal intensive care isolettes); neonatal outpatient clinics including an 8-bed day hospital, diagnostic and treatment areas, and administrative and support areas. The ambulatory care center is composed of six modules: primary care center, hematology/oncology, orthopedics, allergy/pulmonary, and miscellaneous sub-specialties."[10] The hospital also includes a labor and delivery department, which lies adjacent to the well-baby nursery and postpartum beds.

[10] www.e-architect.com/pia/acadjour/, "*A NICU That feels Like Home,*" November, 2000

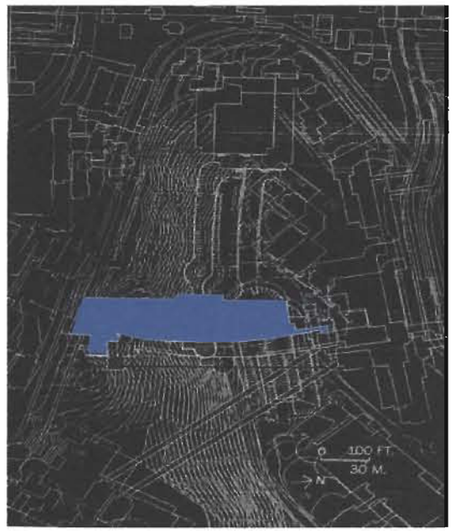


Fig. 11 Site plan

A new children's hospital that was built in 1999, the Doernbecher Children's Hospital in Portland, Oregon, designed by the architectural teams of Zimmer Gunsul Frasca Partnership of Portland, Oregon and Anshen and Allen of San Francisco, took the approach of seeking input from dozens of groups including the Department of Pediatrics, parents and children. The hospital was designed according to their needs and subjections.

Doernbecher Children's Hospital is comprised of 126 inpatient beds, which include 24-beds for school-age children and adolescents, 24 beds for infants and toddlers, the 16-bed Compromised Host Hematology/ Oncology Unit, and a 16 bed Pediatric Intensive Care Unit. Five operating rooms serve both inpatients and day-surgery patients.

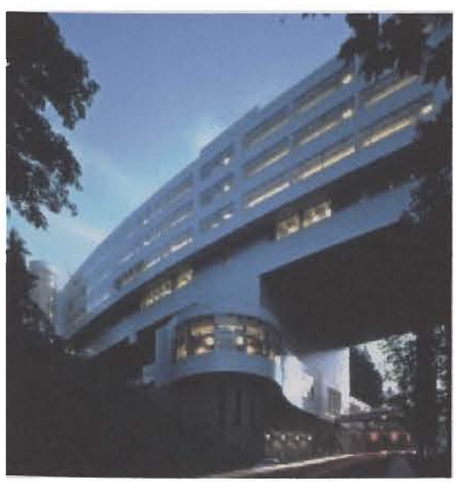


Fig. 12 Level 9th

The building is located on a hillside, and is designed in a form of a bridge that connects to the emergency rooms of the existing hospital to the north with the existing Child Development Rehabilitation Center to the south. The entrance

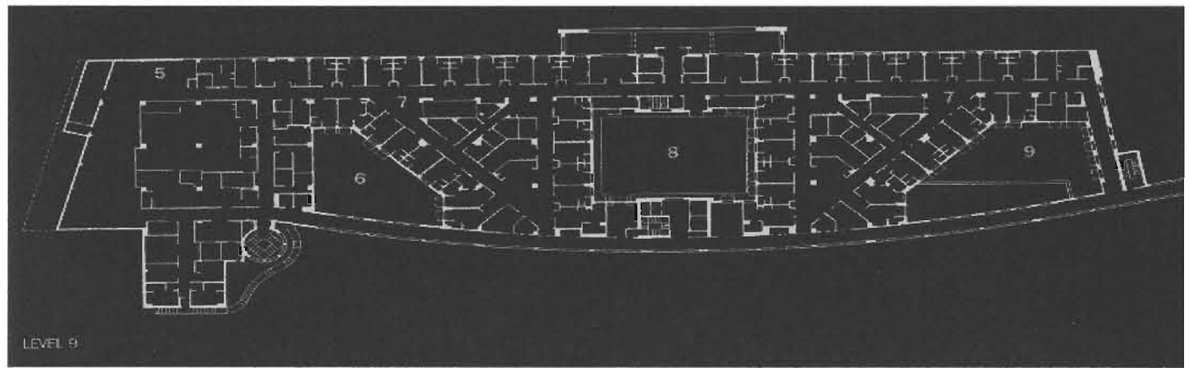


Fig. 13 Level 9th
Areas: 5. Sterile processing, 6.Quiet courtyard, 7. Surgical Unit, 8. Play Ground, 9. Staff Courtyard

lobby is located at ground level. An elevator takes outpatients up to the first clinical floor (called the seventh level, in order to correspond with floors of connecting buildings). At this level, patients are segregated from the more seriously ill children on the higher floors. The 8th level houses surgery and intensive care units. The 9th and 10th levels are reserved for inpatient rooms, and each of the rooms has a view either to the outside or to an interior courtyard. As a result of the step terrain, the 10th level connects to a service road that extends along the hilltop. In addition, at every level, the public corridor expands along the east-facing curve, offering views of downtown Portland, Mount Hood and the ravine below.

The design includes accommodations for families by adding extra beds in patient rooms, which enables parents to stay with their children around-the-clock.

Fig.14 View of patient's typical room

At the same time, the architects acknowledge in the design the latest children treatment concept: that patients do better when they feel secure and are surrounded by their families.

Fig. 15 Level 9th corridor

Another important issue is the use of art throughout the hospital; the art pieces were specifically chosen to appeal to both children and adults. "It's important to remember that when you hospitalize a child, you hospitalize a family."[11] Parents have their own beds and showers in patient rooms, and siblings have play areas. The building also houses a medical library, a classroom staffed by public-school teachers, a game room for teenagers, and many small lounges with contemporary furniture. These features are an attempt to disassociate the interior from the usual concept of an institutional environment. Low windows sills provide for views to even the youngest patients and bring daylight to the interior. The upper patient floors are organized around three landscaped courtyards: the first courtyard is dedicated as a children's play area; the second is used for patient families; and the third one is for the staff. The 10th level has a meditation room and serves as a quiet retreat area. "Throughout the hospital, art with nature as a theme is on display."[12] According to the Architectural Record article, local teams of artist were commissioned to work on spaces such as lobbies, waiting areas, and courtyards. These art pieces include bronze a animal sculptures that children could climb upon, plants and animals etching on exterior windows, stenciled designs on exam-room walls, and ceiling murals in elevator lobbies.

> "Plenty of daylight and curving forms help soften the institutional aspect of the hospital such as a nurses' station and a long corridor. Windows with mullions add a residential touch to a patient's room. Local artist fills lobbies with play sculptures."[13]

Fig. 16 Level 9th children playground area

[11] Doernbecher Children's Hospital, Portland, Oregon, Architectural Record, *(August 1999) p.128*
[12] Ibid, *p.132*
[13] Doernbecher Children's Hospital, Portland, Oregon, Architectural Record, *(August 1999) p.129*

Healing Environment

Fig. 17 Oberrheinischer Mainster, 1415

For thousands of years, we have been discussing the benefits that people can derive from plants, contact with nature and their environment. In the Middle Ages, hospitals within monasteries utilized the garden cloister as a place of healing. Patient rooms typically bordered courtyards that offered sunlight, a lawn, seasonal plants, and places to sit or walk.

According to James W. Varni, Ph.D., Sandra Whitehouse, M.S., Paul S. Kurtin, M.D., & Blair Sadler R.A AIA, "there has been renewed interest in the healing environment as we have increasingly come to believe that the hospital environment can affect the mood, stress level, and well-being of patients and their families."[14]

Varni, Whitehouse, Kurtin and Sadler design and built The Leichtag Family Healing Garden at Children's Hospital and Health Center in San Diego, California as a healing environment that would affect the mood, stress level, and the well-being of the patients and their family.

To prove the healing effects of the environment created, they survey and interview people who had used the garden. The majority of the people surveyed endorsed going to the healing garden as a place that relieved stress, relax and rest, brought rest and relaxation, and helped to improve a person's mood. Ninety percent of the people reported that they experienced a positive change in mood after visiting the garden including feeling more relaxed, less stressed, more content, more refreshed, rejuvenated, more positive, and better able to both think and cope.

In the interviews following the surveys, people shared more of their perceptions of the garden. For example, one father said, "This is a better place to wait than the waiting room, we couldn't stand being in there, wondering if she'd make it. This is quiet and peaceful, the greenery, the colorful flowers, the sound of the water."[15]

The staff also reported coming to the garden, "We had something really stressful happen just prior to coming here, and we came here to debrief," said one. "It's a good setting to get away from the hospital stress, to feel more peaceful," said another. Parents expressed similar feelings. The mother of one pediatric patient observed, "The feel of the wind, the noises, just being outside. She becomes more alert. It's so important for her to have a place like this to be outside."[16]

[14] www.healthdesign.org, *"Patients, Staff & Families Find Comfort in Healing Garden,"* December, 2000

[15] www.healthdesign.org, *"Patients, Staff & Families Find Comfort in Healing Garden,"* December, 2000

[16] Ibid, December 2000

According to Bard and Lutkus in their book *Mind Child Architecture*, "physicians such as pediatrician and psychologists believe that stimulus impoverishment causes perceptual and learning deficits in the developing child."[17] On the other hand, it is believed that enriched environment will accelerate the development of perceptual, motor and cognitive abilities. "Landscape, buildings, people and animals possess their own scale of size and semantic value, relevant in capturing the attention of children."[18]

In a follow up case done by Festinger, Shachter, and Back (1981) data was gathered that suggests that the physical and the built environment, exerts a powerful influence over the perceptual and social development of the child and young adult. "Because in most cases these individuals have little or no control over the nature of this environment, it is especially important that those adults who do have control exercise wisdom in selecting among alternative structures (including toys and furniture)."[19]

According to Gerlach-Spriggs, Kaufman and Wagner in the 1998 book entitled Restorative Gardens, gardens for the sick have been part of the landscape of healing since medieval times. By the nineteenth century, cities in the United States became crowded with buildings, giving green spaces and gardens negation or sometimes denial. In the past, gardens had been used as places for the relief of pain, to assist in a patient's struggle, for orientation and for achieving equilibrium. These types of gardens were labeled as restorative gardens by Roger S. Ulrich in the 1984 book View through a window may influence recovery from surgery. The book emphasize that restorative gardens are intended for the healthy as well as for the sick. For the healthy, such gardens encourage sociability among companions, promote relaxation and contemplation for the solitary visitor, or create a sense of community among residents who live near or around the garden. For the sick of body or troubled in spirit, the same garden relaxes and soothes and thereby encourages the body and the mind to restore themselves.

Fig. 18 Hospital for Crippled Children Milwaukee, Wisconsin, 1930, sun treatment terrace.

In the early part of the twentieth century, hospitals tried to recapture green open spaces. Even children hospitals and tuberculosis sanitariums of the 1920s and 1930s gave way to nature in the form of terraces for sun therapy, such as the Hospital for Crippled Children in Milwaukee, Wisconsin. "Such institutions typically had only one level, with a symmetrical floor plan.[20]"

[17] Bard and Lutkus "*Mind Child Architecture*," University press of New England, 1982 p. 3
[18] Ibid, p. 4
[18] Ibid, p. 13

[20] W.E Campbell, "Work of the crippled children's hospital," Modern tradition, 15, no.5 (November 1920), p. 424-425

Terraces were also included in the outdoor solariums at the ends of each floor of high-rise hospitals, and as adjuncts to courtyards during the period before World War II. The pressures of rising land prices, the urban location of many institutions, and the accommodation of new technology in hospitals eventually forced out these types of spaces where patients, staff, neighbors and nature could interact. According to Verderber and Fine in the 2000 book called Health care architecture in an era of radical transformation, the lack of green spaces became part of the rejection against modern hospitals. In the late 1960s and early 1970s, researchers began to emphasize the importance of nature to the patient, staff and the community well-being. By the mid-1980s this research demanded reform of hospital architecture though patient-centered planning and design. Among the most important research conducted in terms of site planning and design were studies regarding the therapeutic importance of views. "Well-being was reported as significantly lower in situations assessed as low in **windowness**".[21] Related work examined the relationship between contact with the exterior from various points within the circulation network of children hospitals, directional signage, and indoor nature. It concluded that a clear configuration with interval contact with nature through windows located at the ends of corridors promoted a sense of location and direction.

According to Verderber and Fine (2000), other research conducted in Sweden around the same time found that recovery rates were more accelerated in patients whose rooms overlooked nature. These patients had shorter post-operative stays, took fewer analgesics, and had fewer negative comments recorded in nurses' notes than those patients in rooms that lacked a view of nature. From a thorough review of 38,000 potentially relevant titles from medical database, researchers Haya Rubin and Amanda Owens of the Johns Hopkins University Program for Medical Technology and Practice Assessment, identified only 270 articles that appeared to describe investigations into the impact of environmental elements on health outcome, and only 43 articles or reports were identified that specifically detailed the relation between patient well-being and environment factor. "Many of these 43 documents were concluded to be of limited applicability owing to a host of methodological limitations."[22] Nonetheless, by the 1990s this work had become disseminated among providers and designers, and it was generally accepted that nature contents, views, windows, and appropriate colors needed to be giving priority in renovation and new construction.

New facilities in the 1990s incorporated a variety of artificial lighting with a mix of incandescent and ambient lighting in patients' rooms and other parts of the facility, including surrogate views, which had been called for by researchers. Such surrogate views included photographic scenes of nature, complete with windowsill panes and blinds. A computer-driven light box replicated the cycle of night and day in scenes of photo transparencies, which could be rotated to reflect the four seasons.

[21] Stephen Verderber, "Designing for the Therapeutic Functions of Windows in the Hospital Rehabilitation Environment," in *Knowledge for Design,* 13 (1982), 23

[22] David O. Weber, "Life-Enhancing Design," *Healthcare Forum Journal (*March-April 1996): 3-11.

Research Studies

The Academy of Architecture for Health states that, over the last decade, advances in health care have accounted for significant increases in survival rates for infants of very low birth weight. The traditional neonatal intensive care unit (NICU) in which infants develop and grow is typically characterized as a sterile, bright, and loud environment. Researchers have shown that this type of environment can have a detrimental effect on an infant's development. An environmentally sensitive unit, on the other hand, enhances an infant's growth, produces a shorter hospital stay and reduces hospital costs. The following research studies will show how the environment affects the medical outcome of the patient.

The newborn intensive care unit at The Children's Medical Center (CMC) in Dayton, Ohio is a 31-bed, Level III nursery. Staffed with five full-time, neonatalogists, the unit is a regional referral center for low-birth-weight and sick newborns.

The neonatal intensive care unit at CMC was built in 1982, during the time when new technologies to save infants of very low birth weight was introduced. " The primary focus on medical intervention that led to sterile, highly technical, brightly lit, and noisy environments was prevalent in most NICUs."[23] The nursery was visually enclosed, and visitors, upon arrival, spoke to staff through an intercom in a solid wall. "The impact of the environment on the infants' sensory and cognitive and on their families' well-being and interaction were secondary to purely medical concern."[24] In 1997 the existing unit did not meet the new requirements outlined in the 1997 State of Ohio Quality Rules or in the report of Consensus Conference on Newborn ICU Design.

"The stresses encountered by neonates have been shown to cause physiological changes that impede their progress."[25] The Journal of the American Medical Association reported that infants who were provided with developmentally supportive care through control of the environment and individualized attention benefited from having a significantly shorter duration of mechanical ventilation and supplemental oxygen support, were able to feed earlier, had reduced incidences of complications, improved daily weight gain, and had shorter hospital stays than those infants in the control group who were not provided with this type of care. Since these children were released from the hospital earlier, their hospital charges were less.

Researchers at Stanford University Sleep Research Center hypothesized that the deficits in sensory and cognitive functions that often persist in preterm infants may largely be due to the erratic patterns of NICU stimulation. "The environment within the NICU is completely foreign to the preterm infant who, until the time of birth, has been

[23] C. Burger, S. Williams, "A Research-Based Environment: A NICU That Feels Like Home," The Academy of Architecture for Health. (1997) 2

[24] C. Burger, S. Williams, "A Research-Based Environment: A NICU That Feels Like Home," The Academy of Architecture for Health. (1997) 4

[25] www.e-architect.com/pia/acadjour/, *"A NICU That feels Like Home,"* November, 2000

protected within an intrauterine environment"[26] The overwhelmingly clinical focus of the NICU environment is not conducive to development of the fragile central nervous system of infants with very low birth weight.

The study of biological rhythmic events can have important implications for neonatal health. Researchers have known that, while in the uterus the fetal circadian system receives its cues from the mother. In most nurseries, infants are exposed to intense ambient, cool, white, fluorescent lighting for 24 hours per day. A premature infant, severed from his or her mother's cues, may receive inappropriate cues from the nursery environment. This intense and constant lighting raises concerns about resting patterns and day-night rhythms.

The American Academy of Pediatrics (2000) recommends 100-foot-candle lighting for adequate illumination and visualization of infants in a NICU. In contrast, the intensity of lighting varies up to 2,500 foot-candles in an actual NICU. Abundant evidence from studies of human adults and animals indicates that both the timing and magnitude of changes in light intensity have profound effects on circadian rhythms and sleep. These effects have been the basis for recent implementation of new clinical therapies for shift work, jet lag, seasonal affective disorder, and depression.

In the uterus, the fetus is exposed to constant and regular auditory sounds (up to 72 decibels, or dB), which are muffled by their passage through amniotic fluid. The sounds of normal adult conversation typically measure between 45 and 55 decibels (dB). Adults exposed to intermittent noise levels above 80 dB for a duration of eight hours per day in industrial settings have developed hearing loss.

Researchers have found that NICU sound levels can be compared to "light auto traffic" at 70 dB, with highs up to 180 dB. Infants are often exposed to these continuous high decibel levels, with no opportunity for recovery.

The American Academy of Pediatrics reported that hospital noise, including incubator noise, must be considered a possible cause of childhood deafness. The Academy recommends consideration of sound control in renovating facilities and purchasing new equipment for NICUs.

Caregiver voices and activities are a major component of the noise created in an NICU environment. Education of staff on the stressful effects of the environment can have a measurable impact.

The stressful impact of the NICU environment on parents and families cannot be underestimated. Giving birth to a premature or sick infant is not usually the family's expectation, and the intimidating environment of the NICU can reinforce the shock and sense of loss that families feel in the face of reality. A family may feel displaced and

[26] www.e-architect.com/pia/acadjour/, *"A NICU That feels Like Home,"* November, 2000

alienated from its own infant. For the developmental health of the infant, it is critical that the parents feel comfortable in their infant's temporary "home" and feel that they are still a primary part of their infant's care.

Although, NICUs were created to save premature and sick babies, elements within the environment of the modern NICU can actually be detrimental to a baby's recovery. Nursery design now needs to take the direction of emphasizing reduced light and sound levels, increasing accommodation for patient and family needs, and educating of staff. This new design, as seen in the renovation of The Children's Medical Center, should be an environment based on research and scientific inquiry. It should provide an environment conducive to family-centered developmental care of sick newborns, to decreasing stress for the infant, the family, and the caregivers, and to improving short-term and long-term outcomes.

The common vision of the planning team of The Children's Medical Center was key to the success of the renovation. The following goals were established to reinforce the vision:

Promote family-centered care:

- Provide a welcoming, comfortable, home-like setting and decrease visiting restrictions;
- Increase family support spaces, including waiting area, overnight transition room, and lactation room;
- Increase family space and privacy at each infant's bedside; and
- Educate families on developmental care and its impact on the infant's well-being.

Provide a developmentally supportive environment for infants:

- Decrease overall light levels;
- Include day-night cycling of natural light;
- Provide individually controlled light at each bed space;
- Decrease noise level to 50 dB or less;
- Reduce stress and improve efficiency of caregivers;
- Provide an efficient, organized space for staff at each infant's bedside;
- Educate caregivers on developmental care and its impact on the infant's well-being.

Reduce stress and improve efficiency of caregivers:

- Provide an efficient, organized space for staff at each infant's bedside;
- Educate caregivers on developmental care and its impact on the infant's well-being.

Initial space planning revolved around the proportions of the patient care area and the use of existing windows for natural light. The goal for low-level lighting and the need for day-night cycles were juxtaposed. Staff needs for natural light tilted the final decision toward spanning the patient care area the full width of the unit and incorporating both the north and the south window walls. Public and private functions were grouped accordingly from this point and organized around the patient care area.

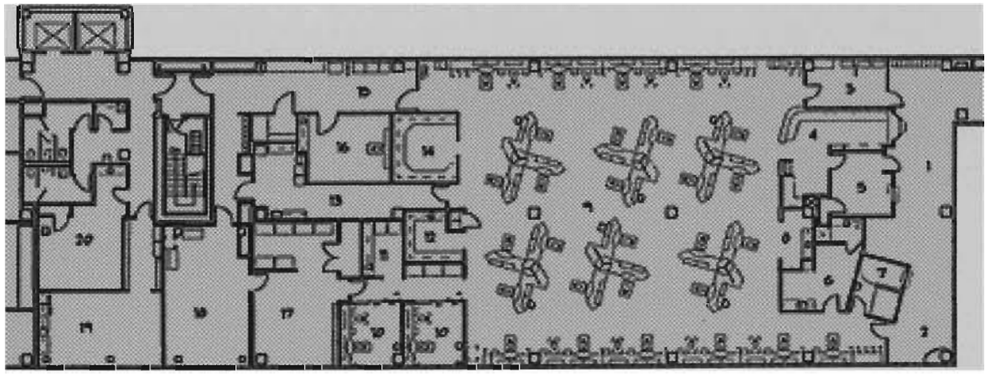


Figure 19: Floor plan.

The organizational concept of the infants' bed spaces was a key element in designing the entire unit. Traditional layouts were investigated as well as "outside the box" geometrical configurations. The original pinwheel concept represented a pure geometric form that housed four infant bed spaces. This design was modified to house three bed spaces because of space limitations. Concepts were presented with a floor plan showing the layout of the patient care area and a scale model was built of an individual headwall unit. The model created a more hands-on presentation and provided better understanding to team members of how the bed space would function.

FAMILY SPACE

The new unit provides a greatly expanded waiting area consisting of a linear series of spaces that provide families with the opportunity for both interactive and solitary groupings. The spaces allow for watching television, family eating, and even looking out the window. Lockers for storage of personal belongings provide a sense of private space. A separate children's play area entertains siblings.

LIGHTING

A primary goal was to bring the overall foot-candle level down to an acceptable level. While adequate lighting is inherent to the basic function of a NICU but every effort was made to maintain dim lighting overall. The use of indirect lighting in both the ceiling and the headwalls provides ambient lighting throughout the NICU. High-intensity procedure lights are located directly over each bed space and can be operated locally. Task lighting for caregivers is available at each bedside.

A unique feature of the lighting in the unit is a widely curved light soffit that represents clouds and appears to be floating. A lower ceiling of clouds, which is

necessary due to existing conditions, is balanced with higher areas of sky and provides for a softer indirect light. Switchable for variable intensity, these lights provide a warm and interesting ambient light.

The large numbers of existing windows in the patient care area address the need for cycled light to serve the circadian rhythms of the infants, as well as the needs of staff and families. However, the implementation of implementing this feature called for the control of both light and heat gain throughout the nursery. The solution was achieved by the installation of a motorized system of roll shades. After its installation, this product provided the ability to quickly lighten/darken areas for procedures and limit daylight as necessary, yet the translucent fabric still allowed for a view to the outside. The entry of sunlight through large glass windows on the south required the installation of window tinting to control heat gain.

CONTROL OF SOUND

Both the overall reduction of noise and the increased use of sound-absorbent materials contributed to lowering sound levels within the nursery. The clinical aspects of a NICU can generate a tremendous amount of noise from monitoring and life-support equipment. This noise was reduced through the use of visual alarms in conjunction with low-level audible alarms. The visual alarms are creatively incorporated into a chimney at each of the bed spaces' house gables.

The idea of carpeting in an intensive care unit is diametrically opposed to the concept of a high technology, sterile environment. However, carpeting is a very good sound absorber. Advances in carpet manufacturing have led to better products with antimicrobial properties, static control, and stain guard. Working within hospital standards, carpet squares were selected over roll goods for their ability to be readily replaced in problem locations. Carpet squares also allowed for flexibility in creating patterns and reinforcing design concepts, like the 15° rotation of pinwheels.

"The ceiling tile used throughout the patient care area was upgraded from the hospital standard tile, with a 65-noise reduction coefficient (NRC) to an insulation-backed tile with a 95 NRC."[27] Installation of this non-rectangular tile functioned well in the curvilinear cloud ceiling system. In addition, it worked well with the overall esthetics of the patient care area.

Choice of equipment and furnishings also played a part in the reduction of noise throughout the unit. A wireless communication system for bedside caregivers was implemented, eliminating the need for phones and intercoms in the clinical area. Strategically placed, low-level intercoms were used for the hospital-wide emergency paging system. Porcelain sinks were used instead of standard stainless steel ones in the nursery and family scrub area (pedestal sinks were used at staff stations in each pinwheel to reinforce the Victorian house theme). Headwalls included fabric-covered access panels

[27] www.e-architect.com/pia/acadjour/, "*A NICU That feels Like Home,*" November, 2000

that doubled as sound absorbers and bulletin boards. Upholstered stools and rockers, as well as fabric-paneled portable privacy screens, offered additional sound absorption.

In 1996, a study was conducted by University of Notre Dame psychologist, Cynthia Miller, and obstetrician, Robert White, M.D., on how the environment affects a patient's outcome. The research was entitle "Life Enhancing Design"; looked at ways in which the environment has a healing effect on patients.

The setting: a Level-III neonatal intensive care unit in a mid-size, Midwestern community hospital. The space was divided into two virtually identical rooms; each room having with the same dimensions and equipped similarly in order to accommodate the same number of infants. Each was lit by two banks of indirect cool-white fluorescent lights over the nurses' charting area and a bank of direct fluorescent lights over the patient care perimeter; and each punctuated by windows that run the length of the south wall and a clerestory skylight above.

The experiment: With their parents' consent, 21 premature infants were assigned to one of the NICU rooms, which was illuminated to the degree that is considered "normal" with same bright intensity around-the-clock, both day and night. Twenty similar infants were cared for in another control room, where the lighting was "cycled" to coincide with the natural diurnal rhythm of sunlight and darkness. This NICU was allowed to dim with the gathering dusk outside the windows, and was darkened further at 11:00 p.m. by switching off one of the banks of indirect fluorescent lights. They remained off until around 7:00 a.m. the next morning.

The results: Compared to the infants who experienced only unvaryingly bright hospital light, the babies nurtured in cycled light gained more weight, began to suckle sooner, spent fewer days on ventilators, needed fewer days of photo therapy, and showed better motor coordination. All of the babies received similar nursing care.

The conclusion, as drawn by University of Notre Dame psychologist Cynthia Miller, obstetrician Robert White, MD, and colleagues who conducted research at Memorial Hospital of South Bend, Indiana, over a two-year period was that "[These] findings lend support to the hypothesis that cycled lighting provides an optimal healthcare environment for infant growth and development. The lighting environment of the NICU has a different impact on the behavioral development and health of preterm infants."[28]

The experiment clearly shows of how a well-informed architect/designer can have an influential effect when designing a built environment capable of assisting a positive response of patients.

Site development

According to Burgun in the 1994 book Introduction to Healthcare planning design, and construction, a critical factor in the deveplopment of any health care facility for children consists in the quality of site and its relationship to other communities-based facilities. The importance of the site being easily accessible is a simple jet a key site location factor.

Children health facilities that have been developed within the ground of hospitals have advantages in that centralized and expensive technical facilities of a hospital are easily accessible for any specialist health care treatment.

Burgun went on to say, "the site should be carefully analyzed as to size, shape, contours, and characteristic of the plot."[29] The site should be large enough to accommodate parking for hospital staff, employees, visitors and ambulatory care patients. In addition, the use of landscaping, including trees, lawns, berms and water is not only aesthetically pleasant, but should be used in a functional manner as well. Streets should be wide enough to provide easy access to the site by ambulances, supply trucks, vehicles and pedestrians.

Another important aspect of site analysis is the relationship of the facility to its surroundings, paying specific attention as to whether the neighborhood is residential or commercial or both.

According to hospital reformist and futurist Wanda J. Jones who wrote an article called "Hospital of the Future," a new health facility should not be looked at as an isolated entity, but as part of its surroundings; it should create a unifying role in the community.

> Jones writes, "To make hospitals more hospitable, the edges of their campuses should be live coral reefs-full of energy and activity, pulling neighborhood residents in rather than shutting them out...so in addition to offering traditional treatment, healthcare providers in the city have a public health role to play..."[30]

According to Burgun, apart from the site analysis, including the route/access to the front door demands, and the community integration, a particular attention to demographic profiles, which may demand upon the type of medical service required. Addressing the demographic issue, the 1990 census, there are over 391,000 children, age 14 or less, in Miami-Dade County. This number is expected to increase 23 percent to nearly 480,00 by the end of the year 2000.

[28] www.hga.com/division/healthcare/trends/design.html, *"Life-Enhancing Design."* September 2000.
[29] J. Burgun, *"Introduction to Healthcare planning, design, and construction."* American Hospital Association, Chicago, Illinois (1994) p. 25

[30] Wanda J. Jones, "Hospital of the Future," Architecture 82 (March 1993): p.39

"Approximately 140,00 (36percent) of the children in Miami-Dade County are uninsured or Medicaid-ineligible. These children are at high risk of illness and comprise nearly 60 percent of all pediatric hospital discharges... There are a limited number to inpatient care alternatives for pediatric patients."[31]

This demographic study performed by South Florida Regional Planning Council of Miami-Dade County will be part of this investigation shows that 36 percent children population growth in Miami Dade County since the 1980's, and there is a need to develop more healthcare facilities dedicated exclusively to children's health.

[30] Health Council of South Florida, Inc. *State of Florida District XI HIV prevention plan"*, 1995

Site location

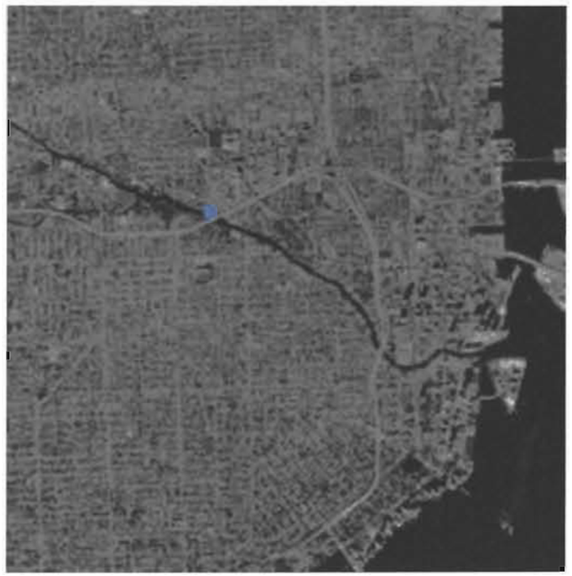


Fig.20 Site Arial (area in blue)

The site was chosen because it satisfied three important conditions: it is easily accessible to major roadways; it is located near a major medical center; and it contains natural features both on and around the site.

The site is located at 1500 N.W. North River Drive in Miami, Florida, at the intersection of Miami River Drive and the 836 Expressway, near Jackson Memorial Medical Center. It is seven-acre parcel of land, of which 875 feet is riverfront property.

Accessibility to the site is the most important element that connects patients to the project. Furthermore, quick and direct access to the site by major roads or expressways enhances the desirability of the site.

A site's proximity to a major medical center is also a key issue when dealing with specialty healthcare treatment for children. A large medical facility can provide additional support systems to a children's specialty healthcare facility.

Fig.21 Intersection of Miami River and 836 Expressway (looking east).

Fig.22 Intersection of Miami River and 836 Expressway (looking northwest).

The natural features of the site correspond to the concept of integrating nature as part of the project. Nature, and how the patient connects both physically and visually with it, is believed to benefit the healing process.

Site Analysis

The site investigation used three ideas in which it addressed visual connection, variation of the immediate urban scale and the site as a catalyst or shifting of the urban grid. By reacting to these ideas, the project began form or take shape.

The large aerial map of the site shows the two major roadways or connectors (I-95 and 836 Expressway, in red) in relation to the actual site (in blue). The yellow lines represent the orthogonal configuration of Miami-Dade County's urban grid. Miami River is represented in green, and flows in a diagonal direction from northwest to southeast.

Fig.23 Site location in blue- adjacent urban grid in yellow – mayor roadways in red- Miami River in green.

Fig.24 Site area in blue- non-orthogonal urban grid in yellow – 836 Expressway in red.

Visual Connection or view orientation

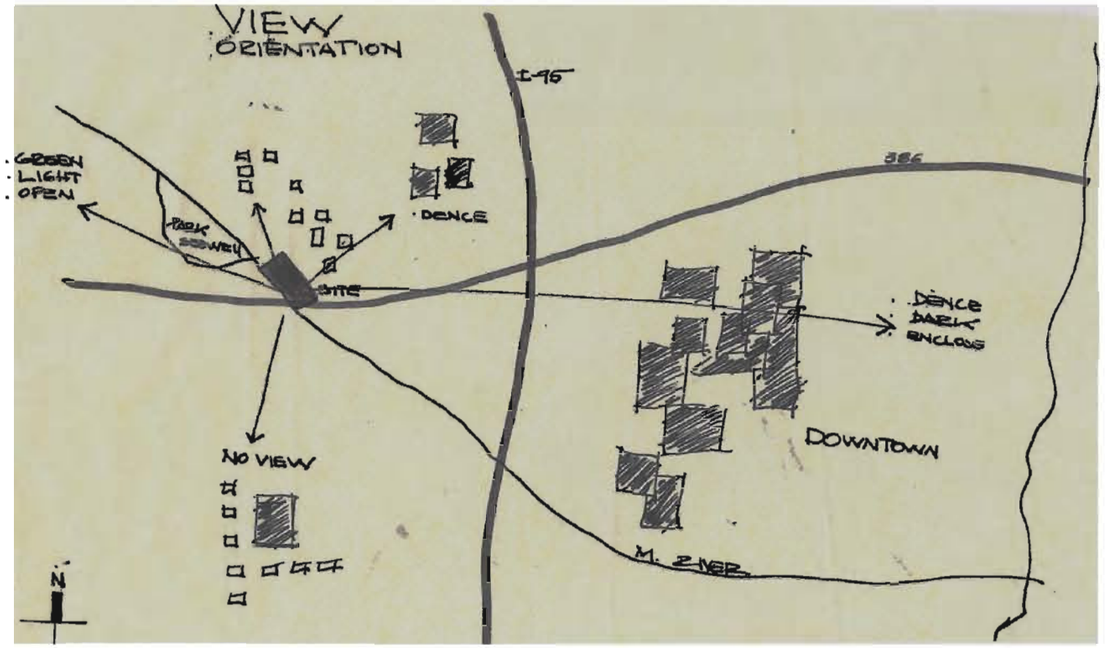


Fig.25 Visual Connection

In sharp contrast to the high urban density found around the medical complex, the residential area across the river mixes with tropical vegetation and nearby Seewell Park to evoke a pleasant, serene vista and visual orientation. The project-intervention gives way to a visual connection from the river's edge to the opposite side of the site.

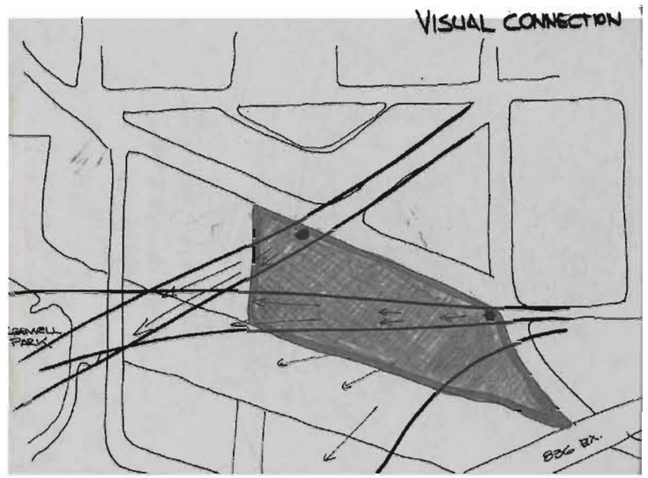


Fig.28 Visual Connection and Seewell Park

This first sketch compares the massiveness of downtown Miami (to the east) and the density of the Jackson Memorial Medical Center (on the northeast) to the transparency of the residential area lying across the river.

Fig.26 Site and Downtown Miami

Fig.27 River's edge A

Fig.29 River's edge B

Fig.30 River's edge C

Scale

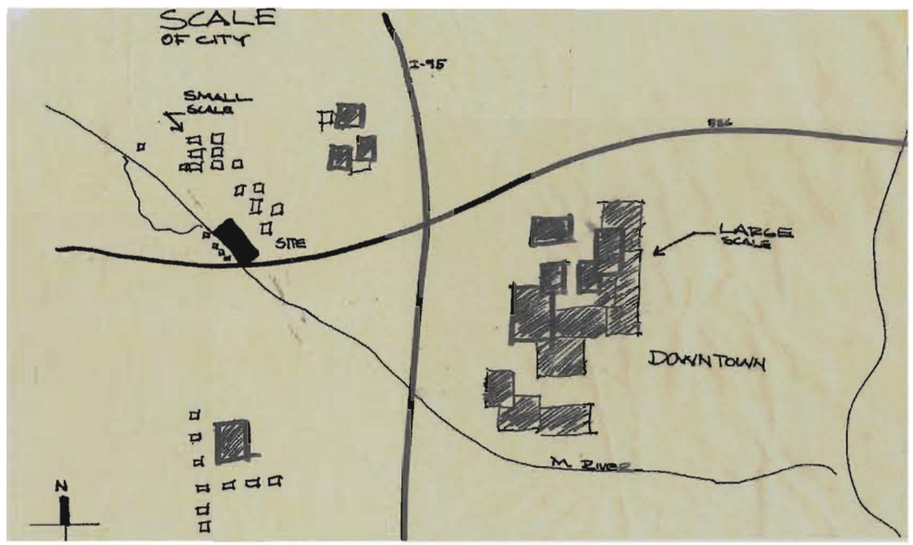


Fig.31 Scale Analysis

The scale of the urban context around the site changes from a large commercial one on the east to a smaller residential one on the west. It continues to scale down with few variations to a zero elevation, diagonal to the site across the river at Seewell Park. A more immediate view of the variation of scale is represented in Figure 33. It represents a larger scale of the medical center to the right of the site, and the smaller residential scale in the other areas

.

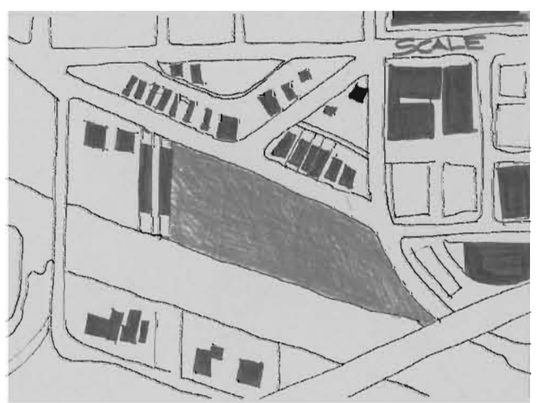


Fig.32 Site and the urban scale.

Site as a catalyst or shifting of the urban grid

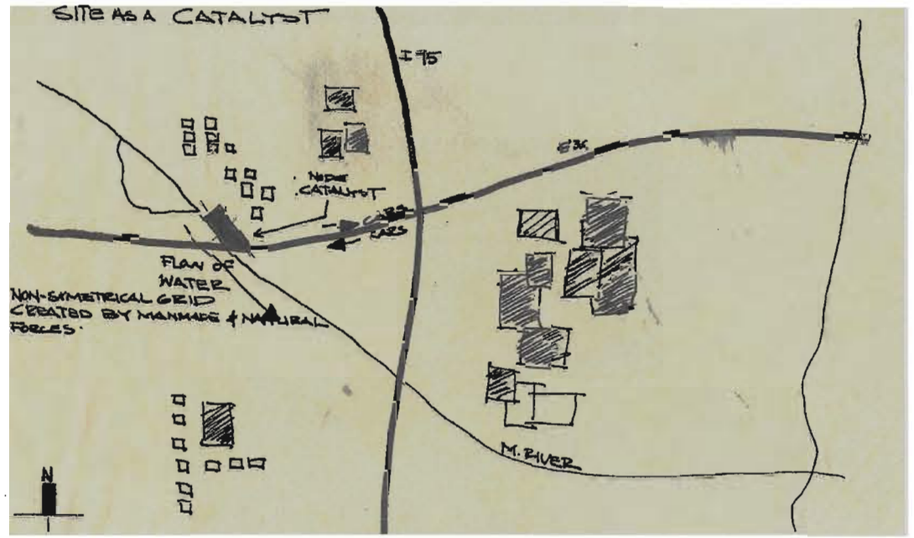


Fig.33 Catalyst Analysis

Miami-Dade County has a predominant orthogonal grid configuration. But conditions on the site are variable due to two major axes that generate the existing condition of the site. The first axis is Miami River, the waters of which flow from the northwest to the southeast, cutting through the urban grid at an approximate 135-degree angle from west to east. The second axis, 836 Expressway, travels in a diagonal direction to the typical urban grid and the river. Both of these axes contribute to the non-orthogonal grid around the site.

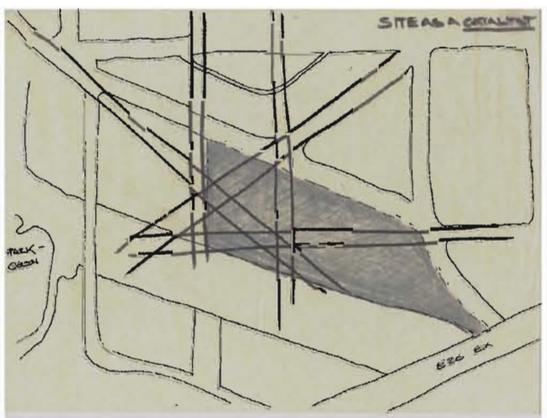


Fig.34 Catalyst and Seewell Park

Project-Intervention

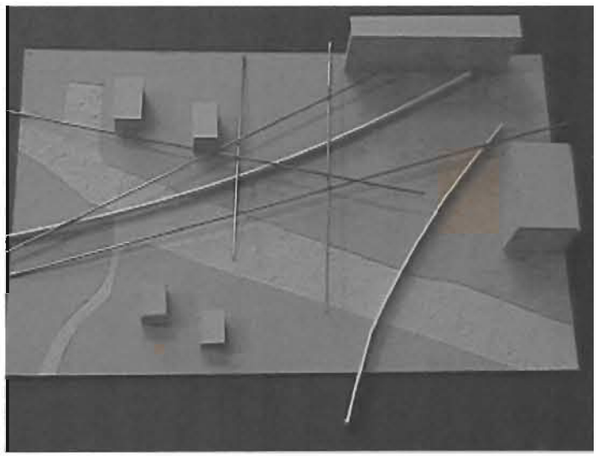


Fig.35 Conceptual model: View-Grid-Scale

The thesis intervention emerged from a site analysis that focused on the shifting of the urban grid, the variation in scale of the immediate context and the visual-physical connection to the river's edge. Furthermore, it addressed the issues of overnight accommodation for patient's families, as well as sound control through the use of specific materials in space enclosures and open courtyards. The key to the success of this intervention lies in the special attention given to the integration between nature and the built environment. Issues such as the incorporation of nature within a building through the use of vistas and the exploitation of natural light through windows and skylights, were pivotal in the creation of a pleasant environment for visitors, employees and young patients.

The project covers a rehabilitation hospital for children promoting healing thought the built environment.

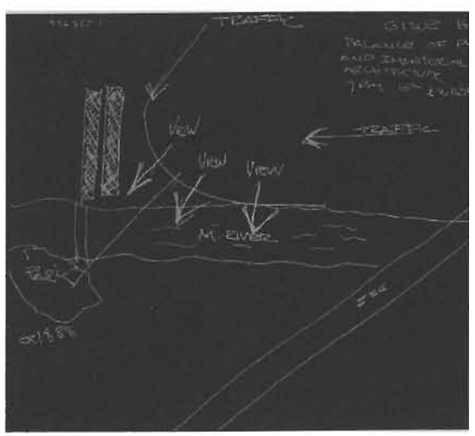


Fig.36 View orientation

The river's edge and Seewell Park plays a predominant visual connection-orientation for the project. It focuses on natural elements promoting relaxation, calmness, and peacefulness by which to create a healing environment. It also incorporates the idea of visual connection an access to the site as the driven force of the project.

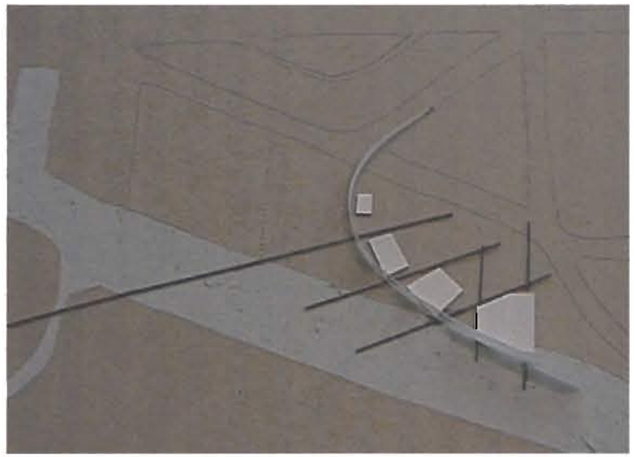


Fig. 37 Project- Intervention

This children rehabilitation Hospital starts by continuing the main vehicular circulation that flows into the site. This flow or axis is extended and transformed into a curvilinear form that best respond to the notion of visual connection of the river's edge. In addition, this curvilinear shape transforms from a main vehicular circulation into the site to a main circulation area with in the project. Visual connection is not only through the use of a curvilinear translucent wall but also by series repetitive voids that connects the site as a hole with natural elements of the river's edge and Seewell Park.

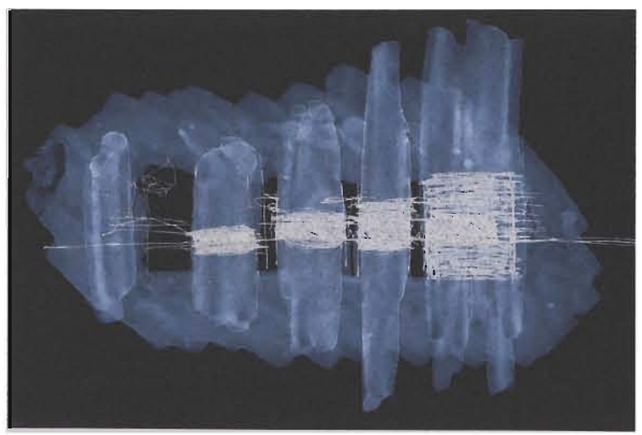


Fig.38 Conceptual Sketch:
Solid-Void-Scale

This conceptual diagram shows a sequence of solids in white, the scale variation, and voids in between solids. As a result, voids are interpreted as vistas, which emphasize a visual and physical connection. These vistas extend physically in form of circulation, gardens, rehabilitation pools and playground areas for children.

Zoning

The lot is considered an O Office zoning area. The O Office category allows the use of this lot for permanent and transitory residential facilities such as hotels, motels, general office uses, clinics and laboratories.

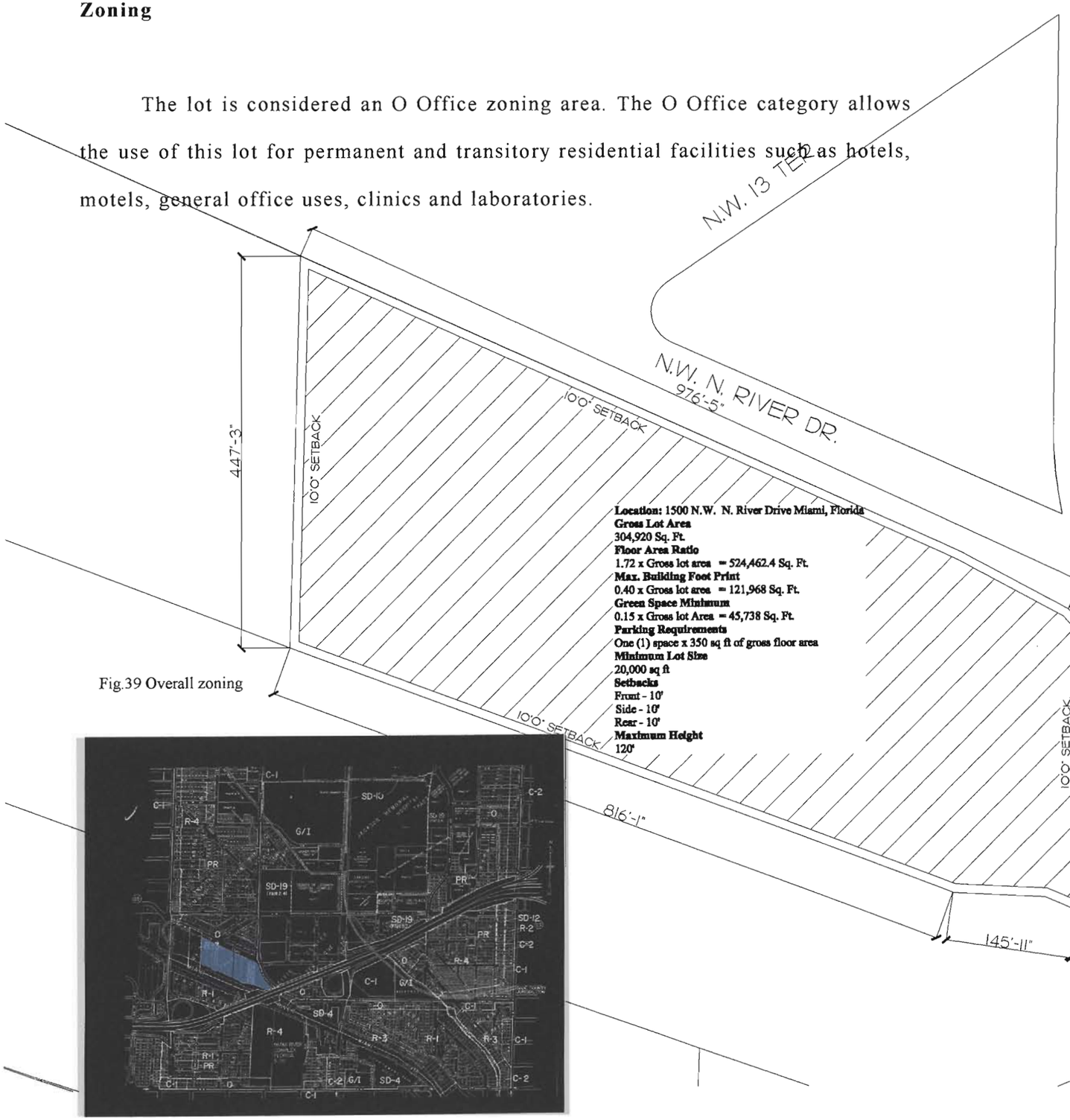


Fig.39 Overall zoning

Fig.40 Site zoning (O-Office)

Program-intervention

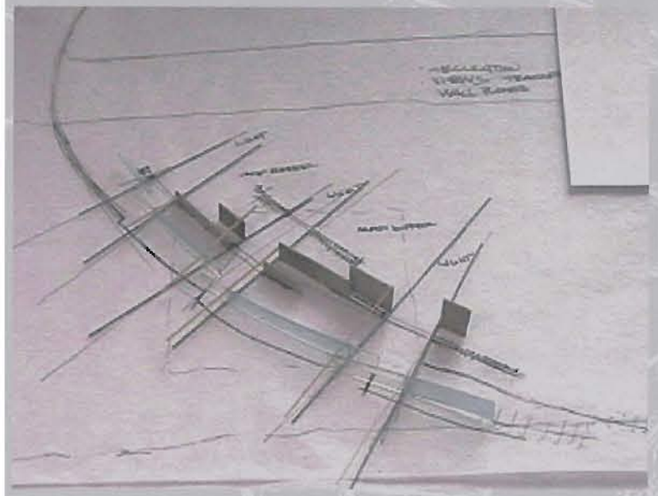


Fig.41 Sketch study (scale-void-solid) 1

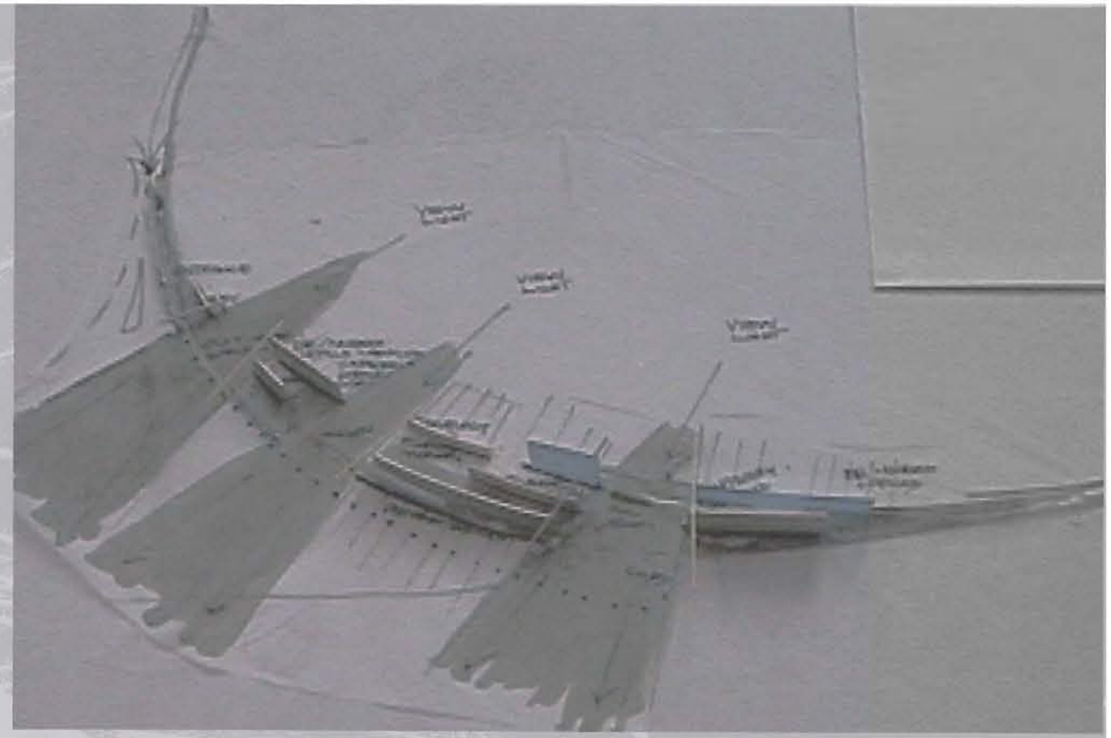


Fig.43 Sketch study (scale-void-solid) 3

These sketches are three-dimensional interpretations of conditions around the site. The urban scale is represented as solid vertical planes that changes scale from left to right and the visual orientation is shown as sequence of voids along the intervention.

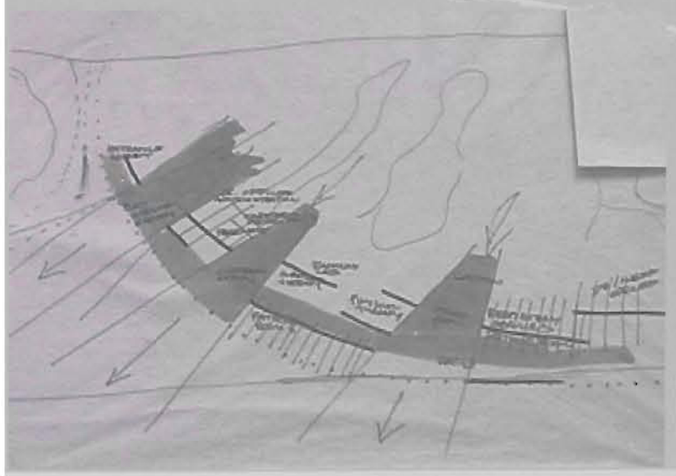


Fig.42 Sketch study (scale-void-solid) 2

The happiness and playfulness of children are represented in the articulation of the shifting roofs. These roofs shift from beginning to the end of the project creating movement.

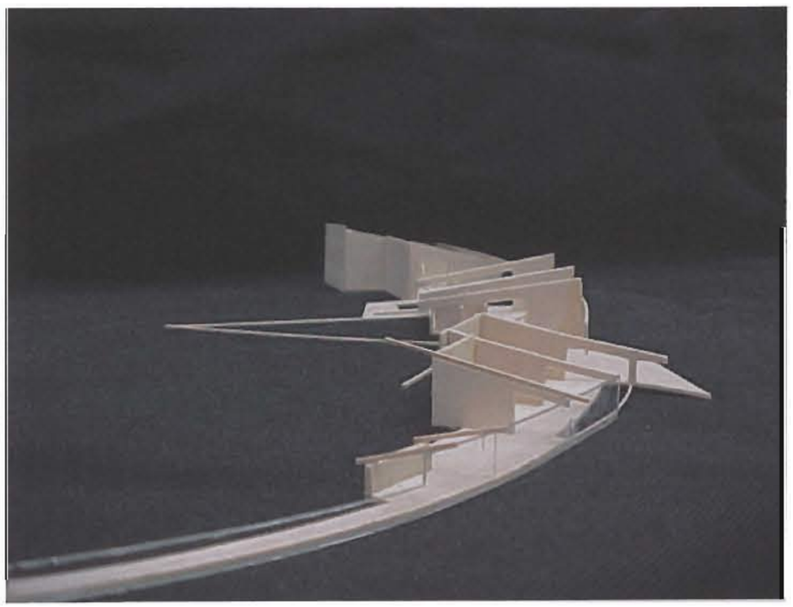


Fig.44 Model-shifting roof

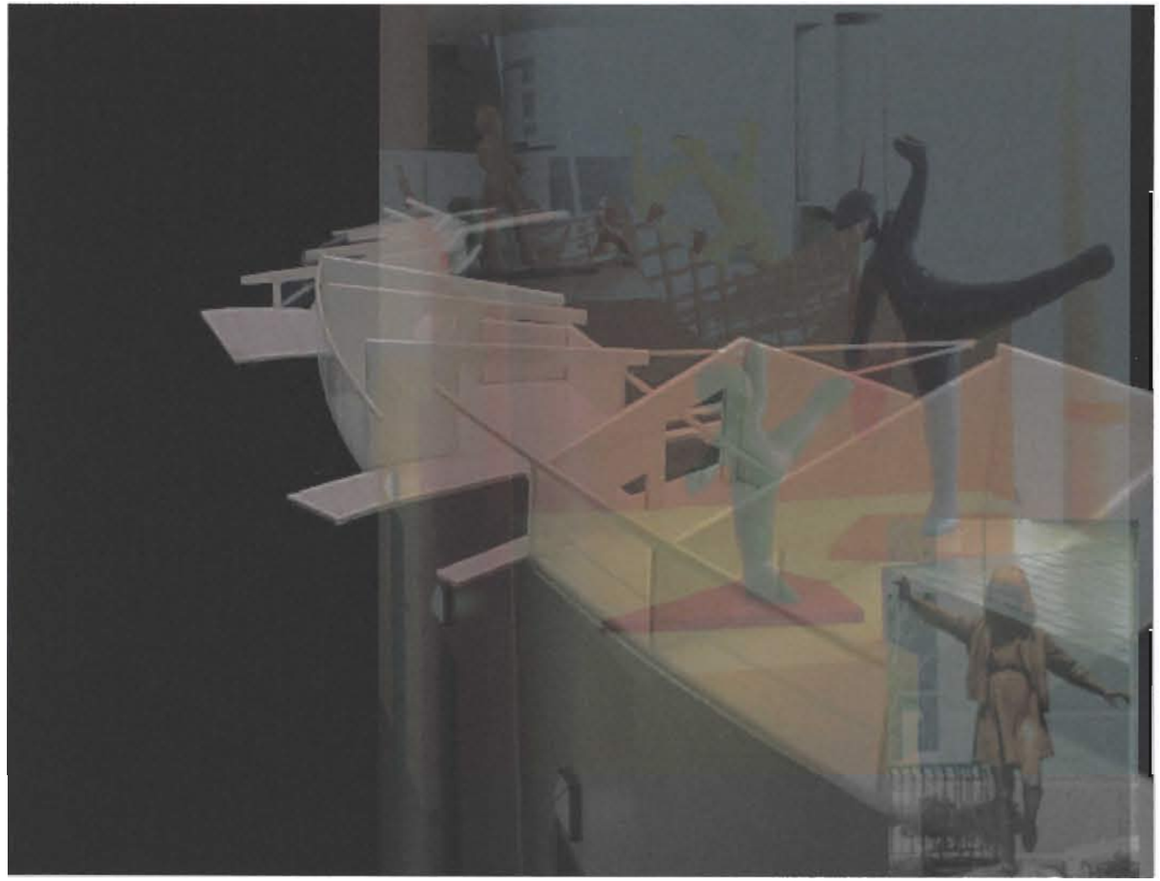


Fig.45 Playing roof

Program

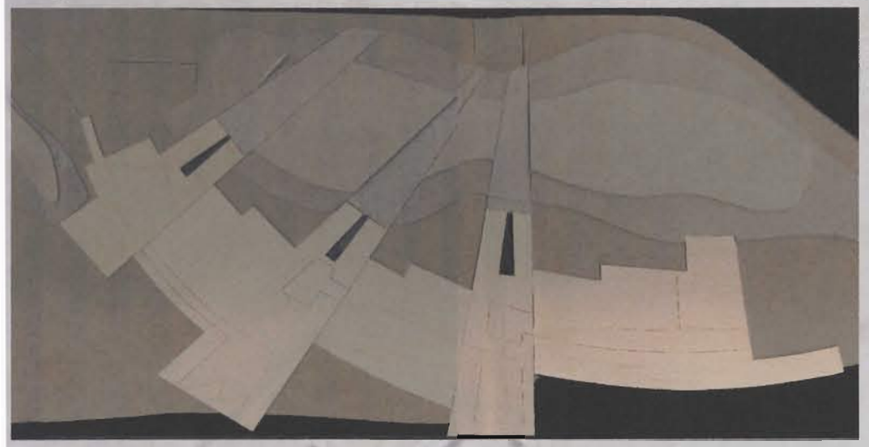


Fig.46 Model-voids transform into connecting spaces

Underground Parking that access the ground level through three ramps.
Entrance – Lobby.
Waiting Area.

Cover Playground – Garden.

Dr./ Nurses. Offices.
Emergency Care Area – 2 beds.
Administration Offices.
Cafeteria – Service Areas.

Water Garden – Playground – Public Area.

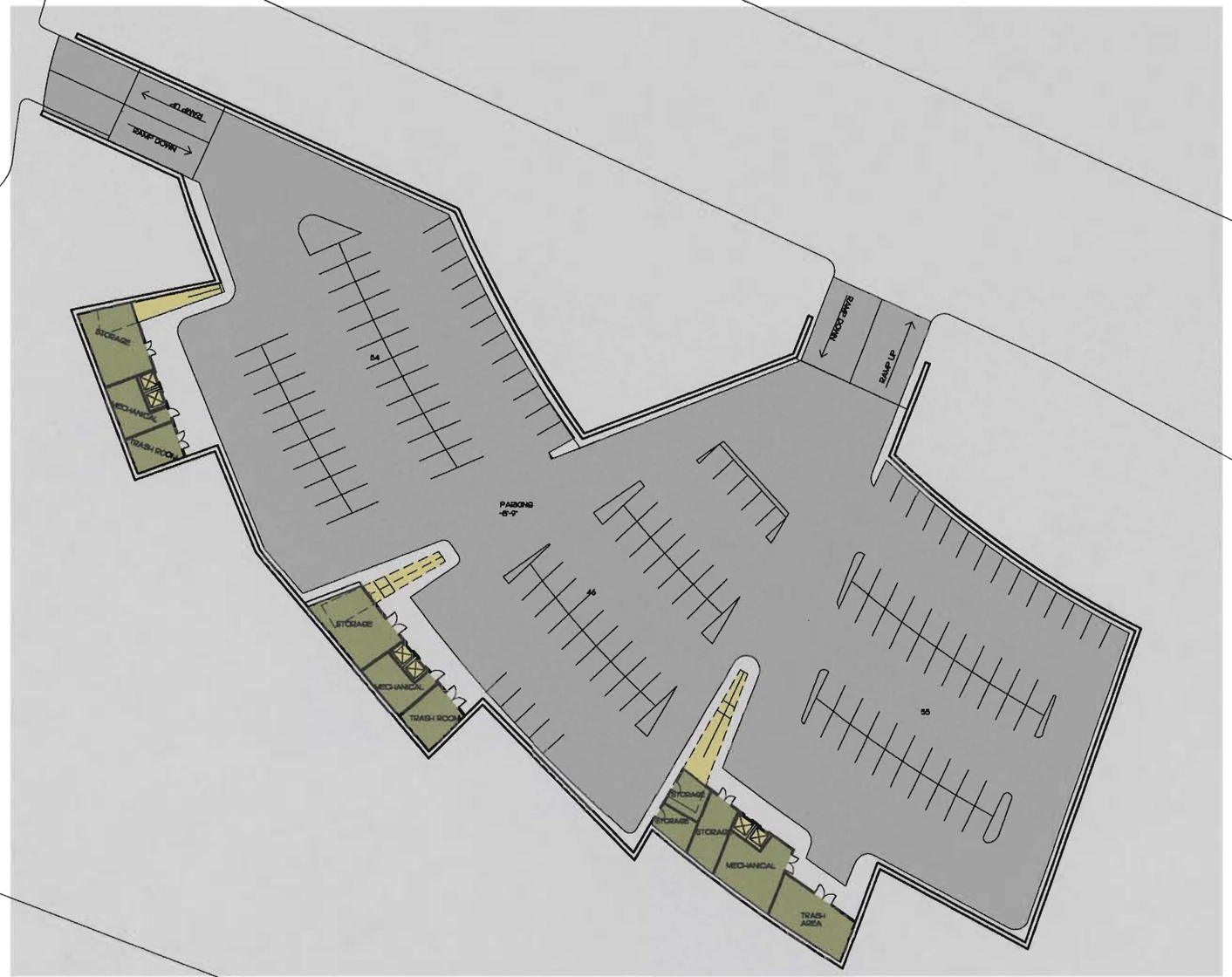
Short-term patient rooms - 16 beds plus family accommodations. (7days or less)
Pharmacy.
Laboratory Suite
Occupational Therapy.
Respiratory Therapy.
Physical Therapy.

Rehabilitation Pools.
Garden – Playground Areas.

Long-Term Patient rooms - 24 beds plus family accommodations. (7days or more)
Dr./ Nurses. Offices.
Main Administration Offices.
Meditation Area

Fig.47 Model- orientation


N.W. N. RIVER DR.
N.W. 13 TER.
N.W. 14 AVE.
N.W. 17 AVE.
N.W. 12 STR
SEEWELL PARK
MIAMI RIVER
EAST WEST 836 EXPRESSWAY
SITE PLAN
SCALE 1" = 100'



PARKING FLOOR PLAN

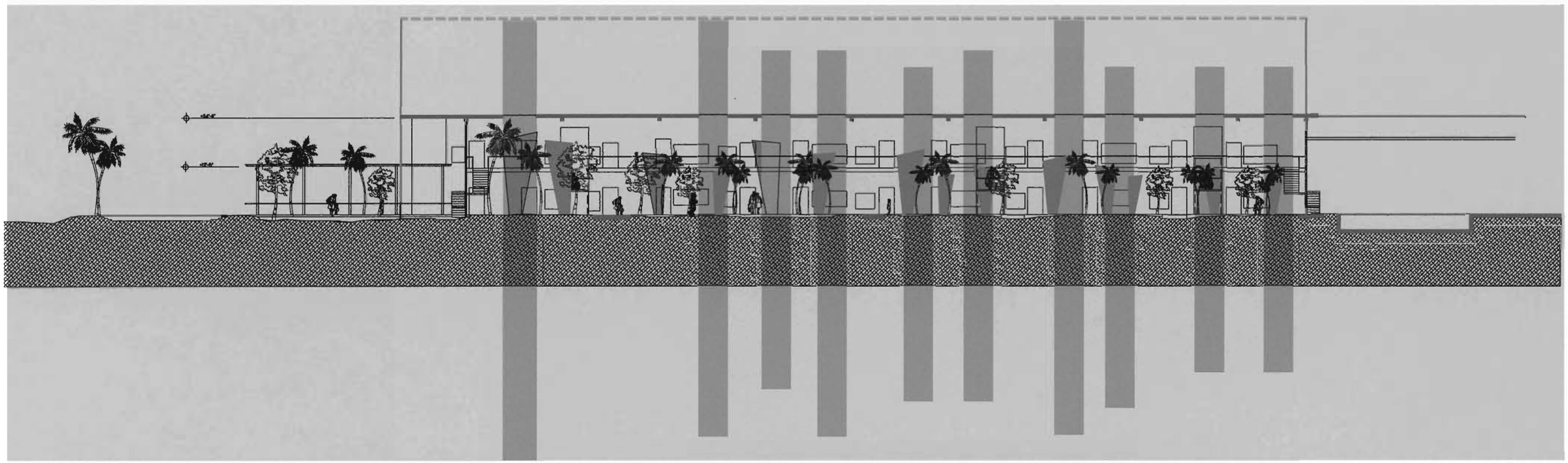
SCALE 1" = 20'

FIRST FLOOR PLAN

SCALE 1" = 20'

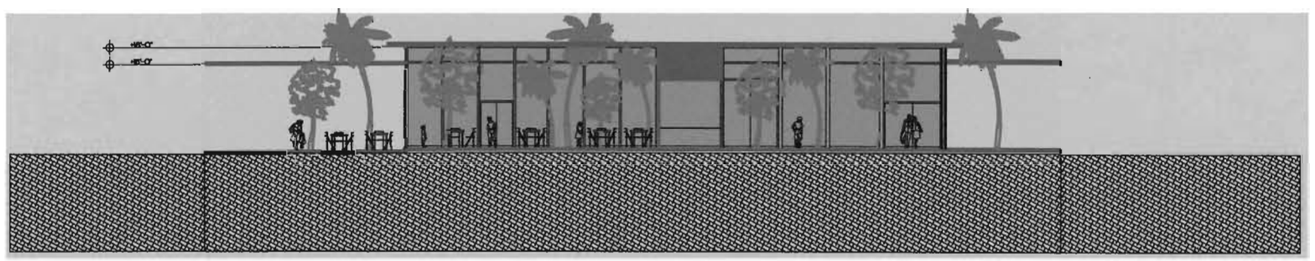
SECOND FLOOR PLAN

SCALE 1" = 20'



SECTION A-A

SCALE 1" = 10'



SECTION B-B

SCALE 1" = 10'

Sectional Sketches

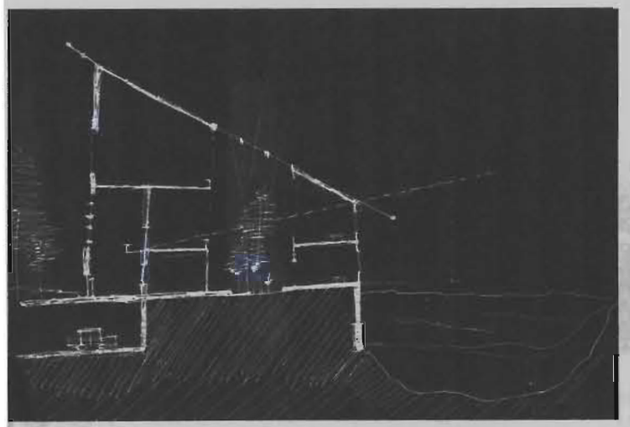
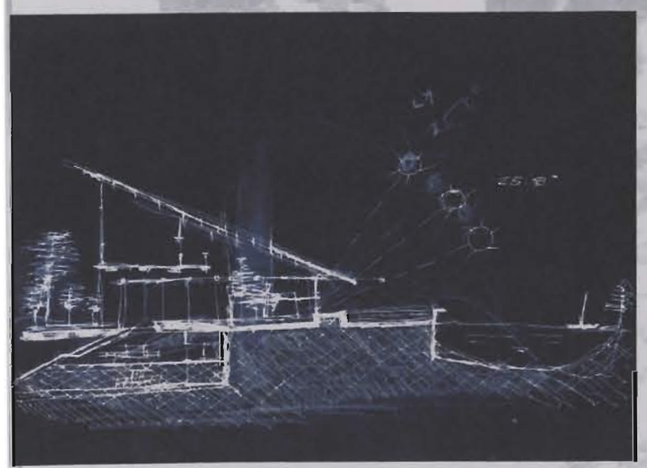


Fig.48 Sketch section – Bringing nature within the project

The main interior corridor mirrors the exterior natural elements by incorporating tangibles and intangibles components such as vegetation, water, light and sound.

Fig.50 Sketch – Glass water walls-Vegetation

Fig.49 Sketch – Connection with exterior



Section Model

The integration of natural elements is best express in the articulation of the main corridor. The sectional model emphasizes the green central corridor thought the use of vertical translucent planes of water, tropical trees and shallow pools.

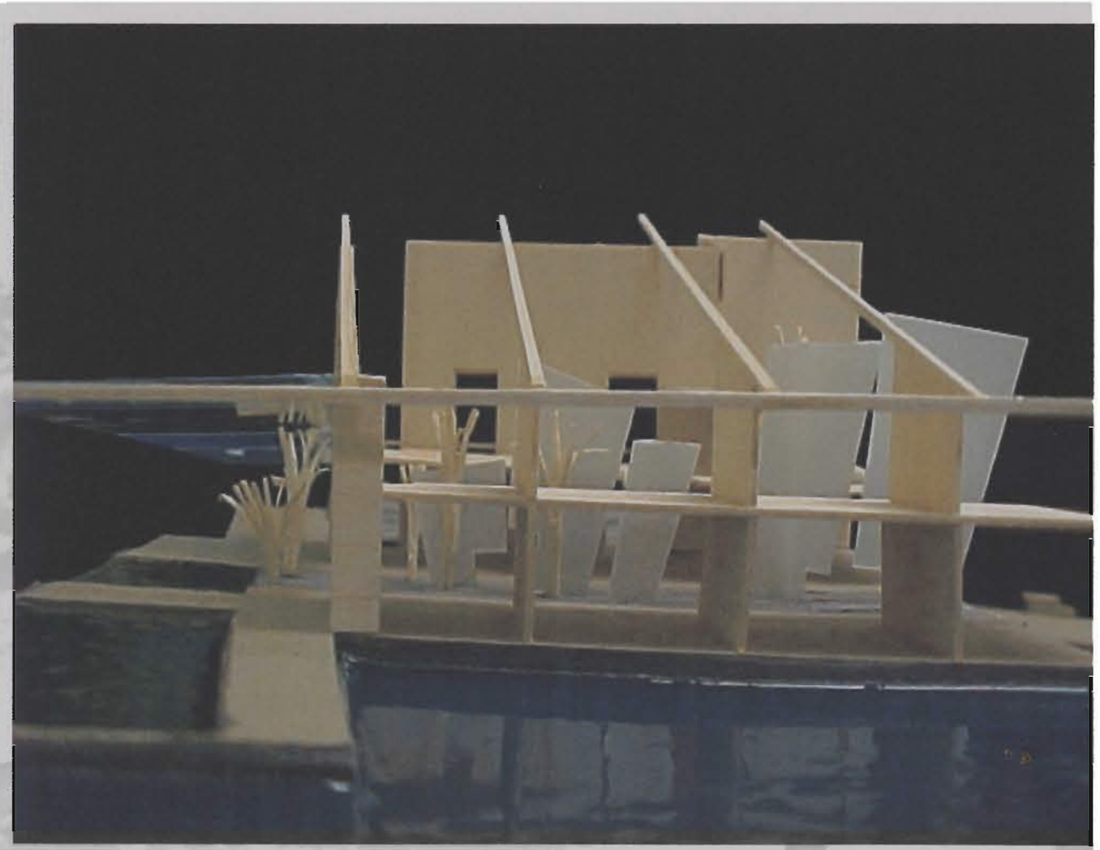
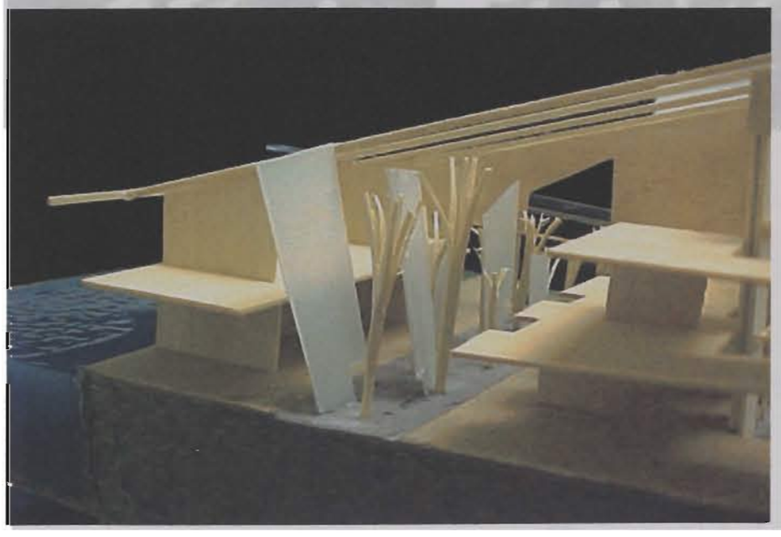


Fig.52 Sketch Sectional Model – creating a natural environment

Fig.51 Sketch Sectional Model – main corridor - connector



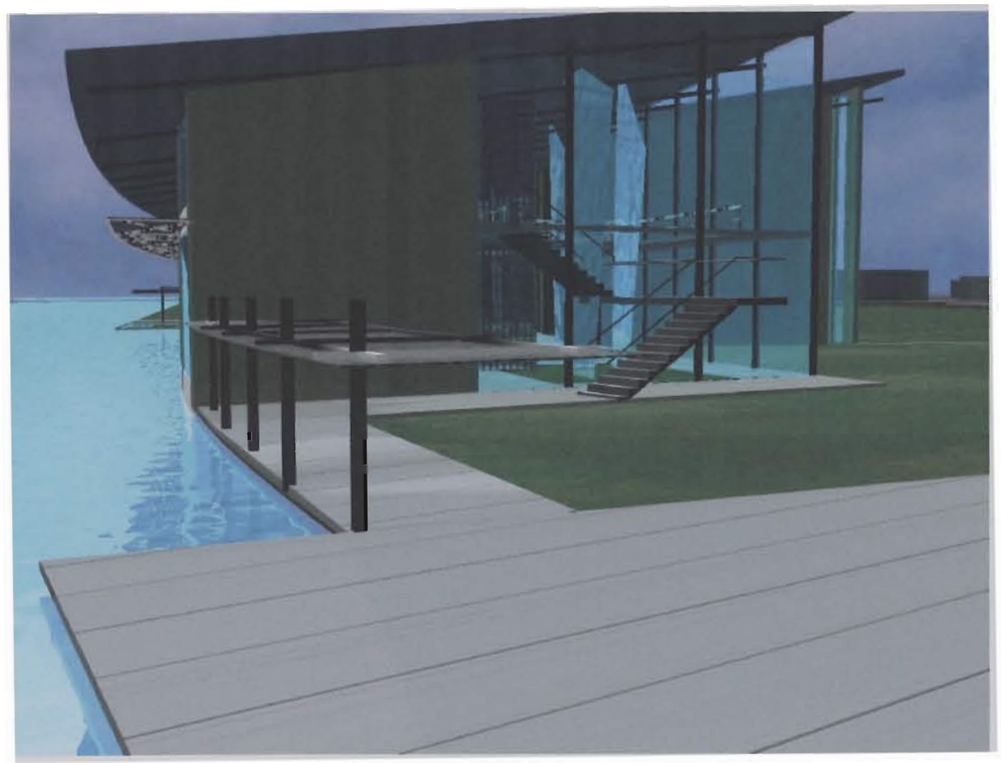
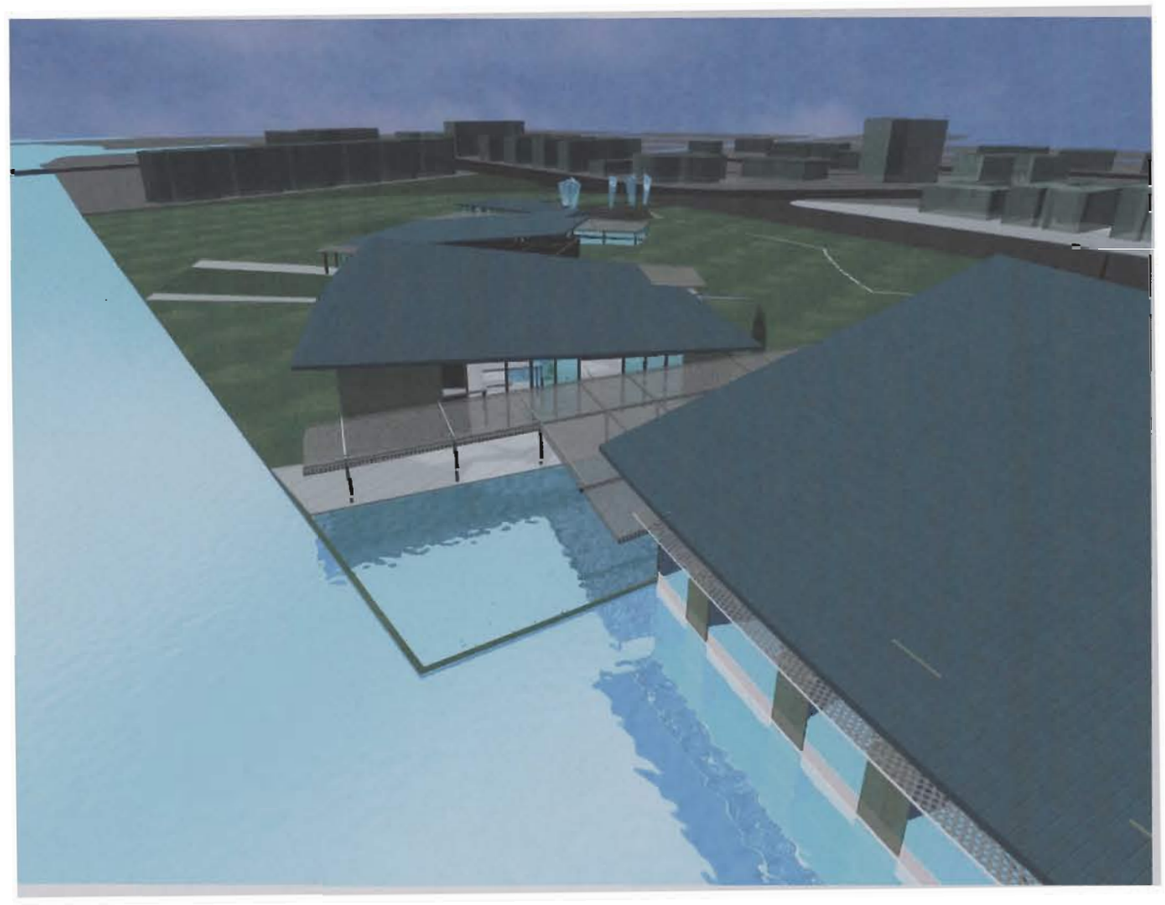


Fig.53 Meditation area

Fig.54 Shifting roof



Conclusion

In summary, the transformation of children health environments has been accomplished through the persistence of both physicians and architects in their attempt to improve the well-being of patients. It is important to recognize that changes in society, advances in technology and medicine and the ability of architecture to transform have produced positive changes in children built environments; these changes have been contributed to the evolution of children health facilities. Research findings in the field of children health facilities support the hypothesis that the built environment can have either a beneficial or detrimental affect on a young patient's outcome. As a result, the new trend in health architecture emphasizes: the creation of spaces for patient's relatives; incorporating aspects of nature into the design with the use of courtyards, gardens and vistas; using a mix of cycled and natural lighting; controlling sound levels in order to reduce patient stress and hearing loss. The use of soft and warm materials, such as woods and fabrics, has been successful in sound reduction and creating welcoming environments. The practical application of warm and soft materials can be found in the use of wood furniture, parquet flooring, oak ceiling-slats, fabric headwalls, and the use of carpeting in such areas as corridors, waiting areas, patient rooms and NICUs.

Research findings recommend that, in choosing the site location, important considerations should focus on: how the facility can be integrated natural features of the site to correspond to the concept of integrating nature as part of the project; its accessibility to major roadways; and its proximity to other medical facilities where specialized health treatment may be available.

The new propose project covers 16-bed short-term stay and 24-beds for long-term stay. This rehabilitation children's hospital focuses on healing through the built environment; it specifically incorporate various aspects of nature, nature gardens, lighting, sound control techniques, soft-warm materials, and physical - visual connection to these elements.

The project deals with the challenging integration of a new typology into an existing fabric taking in consideration unique site constrains. The site is located between N.W. 15 Avenue and the 836 Expressway, and adjacent to the Miami River at major road intersection near Jackson Memorial Medical Center.

The key to the success of this intervention lies in the special attention given to the integration between nature and the built environment. Issues such as the incorporation of nature within a building through the use of vistas and the exploitation of natural light through windows and skylights, were pivotal in the creation of a pleasant environment for visitors, employees and young patients.

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