A PROPOSAL FOR AN ENERGY CONSCIOUS COMMUNITY CENTER FOR ANGOLA INDIANA.

ARCHITECTURAL THESIS
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ABSTRACT

The community center in Angola Indiana is a hypothetical project, a model of what could be built. The actual construction is at least five years off.

The community center is a 45,000 square foot building on four levels. The site contains 37,000 square feet of buildable area and the building uses most of the site. The building contains a gym floor for basketball and volleyball, a roller skating rink, a senior center, four racquetball courts, a weight training center, lobby and lounge areas for table tennis, pool, and pinball. The building utilizes roof decks. All spaces are open to each other.
With the dwindling supply of natural resources and materials, buildings are going to have to be designed efficiently with respect to materials and energy use. Government agencies are researching and testing concepts and materials of energy conservation. Architects must be able to use these new technologies. They must mass buildings to take advantage of natural energies that every site contains. It is these two concepts that I am concerned with.

Through this architectural thesis; it is my goal to develop an energy conscious design of a community center fully utilizing passive solar systems and energy conserving design concepts.
PRESENTATION DRAWINGS
The site is located seven blocks east of the city square along a major U.S. highway. A Ford dealership is located to the south of the site, a city park is located to the southwest, and residential areas to the northeast and north.
LOWER LEVEL
This level contains active areas. The south half of this level is 10 feet below street level and opens onto a courtyard. The gym and lockers are 4 feet below street level. A ramp near the center of the plan, elevator and stairs to the south of the plan, and the courtyard provide access to this level. The back wall of each racquetball court is glass for spectator viewing along the seating area adjacent to the courts.

LIST OF SPACES
1. Skate Rental
2. Roller Skating Rink
3. Concessions
4. Mechanical Equipment Room
5. Racquetball Courts
6. Basketball/Volleyball Courts
7. Showers/Lockers
8. Stage
9. Outdoor Courtyard
MIDDLE LEVEL

The middle level is at street level which provides easy access to the Senior Center/Greenhouse located to the left as one enters the front door. The main circulation corridor takes one to a landing/ramp system for an overall view of the facility. This level contains passive areas which overlook active areas. The entire south side opens up to bring the outdoors in.

LIST OF SPACES

1. Community Center Director/Parkboard Offices
2. Roller Skating Rink Below
3. Pool Tables
4. Council On Aging Offices
5. Racquetball Below
6. Basketball/Volleyball Below
7. Showers/Lockers Below
UPPER LEVEL

This level is 12 feet above street level. The mezzanine opens to the south and east to aid in ventilating the building in the summer and heating it in the winter. The mezzanine functions as an area for table games and areas for groups to meet.

LIST OF SPACES
1. Mezzanine
2. Basketball/Volleyball Courts Below
3. Running Track
4. Weight Training/Wrestling mat
5. Roof Deck/Tennis practice courts
6. Pinball
7. Sun Deck
8. Pool Tables Below
The rectangle and the division of the rectangle into smaller rectangles was utilized as design criteria to visually organize the facades.

The North wall has insulated ventilators near the roof to exhaust air during breezy days and vents at the ground to let in air to induce cooling of the building by thermosiphoning.

The West wall incorporates a plenum to help draw stale air from the gym area.

The South facade has mostly glass doors which open in the summer to naturally ventilate the building and let sunlight in to help heat the building in the winter.

The East wall is partially sheltered by earth berming up to the roof deck. A plenum is used on the north half of the facade to move air out of the weight training area.
In section AA, the floor of the senior center/greenhouse functions as a heat storage unit. Two feet of field stone which are common to the area act as a base. Brick pavers with pea gravel used instead of mortar serve as a walking surface. The doors that open to the roof deck on the upper story are shaded in the summer by a 5 foot overhang and insulated by 10 foot paneled garage doors on the inside.

In section BB, the relation of the street level to the roller rink can be seen. The skylights are insulated with 4 feet of air between the double glazing.
Inlets for the heating system of the gymnasium are located in the soffits of the upper story on the south. They draw warmed air from the roof deck. There is a major skylight above the ramp system and two smaller ones above the pool tables.
The major structural elements are concrete block walls, laminated wood beams 20 feet on center, laminated wood purlins 10 feet on center, 2 x 6 stiffeners 2 feet on center spanning 10 feet. The greenhouse is wood post and beam utilizing 2x framing lumber. The roll-back insulated metal roof panels are operated by chain hoist mechanisms. The rolling shutters cover the south facade in 5 foot sections, and are crank operated. The exterior wall is red glazed tile.
MODEL PHOTOGRAPHS
MODEL PHOTOGRAPHS

The photos below are ariel views of the community center. The top two are taken from the south. The bottom is a view from the east.
MODEL PHOTOGRAPHS  The following three photos focus on the main entrance of the community center.
MODEL PHOTOGRAPHS

The top photo is a view of the community center taken from the park.

The middle photo is a view of the south and east facades.

The bottom photo is a view of the north and west facades.
BUILDING PROGRAM
An architectural thesis needs to be something more than a design of a building. It should be an effort that fully utilizes the accumulated knowledge of past architectural experience and schooling plus an exploration into an area that will significantly contribute to the field of architecture.

My interests lie in the area of energy conscious design and passive solar systems. I strongly believe that active collectors used in this region of the country are not efficient enough to support their use. The cost of active systems is too great compared to the benefits the collectors give. Technology of solar collectors is still at a basic level. It is not the architect's duty to develop better collectors, but to use what becomes available on the market. It is the architect's duty to be conscious of the natural energies and make use of them in his design.

With the dwindling supply of natural resources and materials, buildings are going to have to be designed efficiently with respect to materials and energy use. Government agencies are researching and testing concepts and materials of energy conservation. Architects must be able to use these new technologies. They must
mass buildings to take advantage of natural energies that every site contains. It is these two concepts that I am concerned with.

There are basic ideas on how to make a building more energy conscious. They are common to all architects. Each idea seems to work at one scale of a building or another, but they are hard to grasp at times because there has not been a concise tool of design developed to deal with the energy conscious design of a building. To be more specific, small multi-use public buildings.

It is my intent to develop this design tool in conjunction with the design of an energy conscious community center. I will use the design of the community center to interject concepts into the design tool. At times the design tool will be used to interject ideas into the design of the community center.

The design tool will take the form of a book. The format of the book will be based on another source book entitled *A Pattern Language* by Christopher Alexander. The book will contain a number of patterns that can be used when planning and designing. Each pattern describes a problem which occurs over and over in energy conscious planning. It will then describe the core of the solution to that problem in a way that one can use the solution over and over without ever doing it the same way twice. The book will be organized from general conditions such as climate, wind, and sun, down to specific conditions such as wall construction, available materials, and construction details. This book, successfully written will be a very valuable design tool.

Through this architectural thesis; it is my goal to develop a tool to use while designing energy conscious buildings; and develop an energy conscious design of a community center; in the areas of energy conscious design and passive solar energy pertaining to small building types.
Angola Indiana is located in the northeast corner of the state. The city with a population of 5,117, (1970 U.S. census) is the county seat of Steuben county. Two major highways, U.S. 20 and U.S. 27 pass through the city intersecting at the center of town. This area is known as the Mound. The Mound is significant because of the memorial that stands in its center. The monument is 70 feet tall and made of barre granite.

The land around the city is hilly and contains many kettle lakes. Many of these lakes are over 1000 acres. These lakes provide recreation for thousands of people during the summer months. Many of these people travel to Angola to shop, creating traffic jams, especially on Saturdays.

The lake visitors provide a source of income to the businesses of Angola. Many small industries are located in the city. There are farms surrounding the entire area.

The community center is to be an addition to a system of recreational facilities located throughout the city. Tri-State University which is located on the west side of the city, has an Olympic sized pool that is open to the public. There
is to be an outdoor park at the south edge of the city for ice skating. Various fields and gymnasiums are used by many intramural teams. The center will add to the community many of the recreational facilities that are missing from the system, or presently overused.

The actual construction of the community center is at least five years away.

The community facilities that were researched all contained the following organizational elements.

All spaces were open to each other. This encouraged interest in all the activities. It also avoided a feeling of isolation when spaces were underutilized.

The director's office was located centrally for surveillance and convience.

All examples used natural lighting.

The building form usually followed the shape of it's interior spaces.

The lobby was used as a general gathering space.

Facades were defined by interior spaces and skylights.

Activity rooms were capable of dividing into smaller rooms. (folding walls)

Ramps were used as major passage ways.

Heating and air conditioning ducts were painted in bright colors with bold graphics. These systems were exposed.
Designers exploited and made understandable the nature of off the shelf catalogue components.

The structure was designed to impart knowledge about how a building goes together.

Vandalism was considered in the design, but because the communities were involved in the centers from the moment of their inception, none of the precautions were necessary.

CLIENT DESCRIPTION

Mr. Craig A. Rice, City Planner of Angola is acting as my client. He is a relatively new employee to the city, with progressive ideas compared to the conservative community he serves. He feels that a community center is needed in Angola in the near future.

The City Park Board may have its operation located in the community center. This staff of three will run the activities at the community center, depending on available revenue to operate the facility. The staff consists of a director, secretary, and student help.

The primary users are the people of the community. They range from small children to the very elderly. They come from all different backgrounds. Realizing these conditions, there is a need for social cohesion, which in turn creates civic enthusiasm. To accomplish this, various community groups, and student groups from all local schools should act as advisory committees to the architects.
Functions

List of Functions:
Service
Youth
Adult
Senior Citizen
Parking

Youth Functions
A place that becomes their common meeting ground. Pinball, pool, table tennis, handball, racquetball, basketball, volleyball, skateboard, rollerskating weight-training, meeting, gardening.

Adult Functions
Meeting, handball, racquetball, volleyball, basketball.

Senior Citizen Function
A meeting place from 10 am to 3 pm. Eat lunch, playcards, ceramics, macrame, crocheting, knitting, needlepoint, oil paint, water color, wood carving, exercising.

Parking Functions
2 vans, 4 spaces for staff and guests. On site parking should be supplied for users. Further site analysis is needed to determine the number required.
Passive Activities

Meeting.
Various community groups will have meetings at the center.
Maximum 200 people, usually 10 to 50.
Equipment: 200 chairs
            tables
Environmental: overall lighting
                cool space
                well ventilated
Points of origin, destination:
From car to meeting room
from parking lot to meeting

ACTIVITY DESCRIPTION

List of Activities.

Passive: meeting
eating
arts and crafts
pool
pinball
table tennis
gardening
lounging

Active: basketball
         volleyball
         racquetball
         weight training
         wrestling, judo, karate
         shower, shave, toilet
         roller skating
         skateboarding
         parking
From dining to meeting.
Peak Periods: early evening
          late afternoons
          Saturday mornings

Eating:
Daily lunch for the elderly. "nutrition site"
Need one person to run operation, 2
volunteers.
Refrigerator, stove, sink, ovens for
warming food.
Food is carted in on a daily basis.
Overall lighting, natural ventilation.
Points of origin, destination:
  From van to eat to meeting room.
  From drop-off area to eat.
A portion of daily routine of elderly
visitors.

Games: Pinball, Pool, Table Tennis
Pinball. Dark space.
Pool Table. 5'9" x 10'9"
   end clearance 6'6"
   side clearance 5'0"
   spot lighting above table
Table Tennis. 5'0" x 9'0"
   end clearance 7'0"
   side clearance 4'0"

Arts and Crafts.
ceramics, painting, drawing, weaving.
ceramics. clay storage shelves, sink.
painting, drawing, paints, paper,
illustration board, storage area, sink,
hang space.
weaving. looms, yarn, jute, storage area
for supplies.
Member of staff would periodically check
in on area, or area might be observable
from office.
Environmental: natural lighting
               natural ventilation.
No kiln, greenware will be transported
to middle school or high school kilns.

Gardening.
grow vegetables, fruits, and flowers
year round in a solar greenhouse.
Open to the other spaces.
Tools. shovels, hoe, water buckets or
hose and nozzle.
Lounging.
indoor, outdoor
street level, associate to the street.
protection from wind in off months
trees planted close together
triangulation (sculpture, paintings)
sitable space, use moveable chairs
Important: people attract more people,
frontal exposure along Hwy. 20.

Basketball.
half court games
4 basketballs to be kept in office
organized community league play in
evenings.
Environmentally: well lit
well ventilated

Volleyball.
3 courts on gymnasium floor
organized community teams during winter
months.
net storage
standard storage
Environmentally: well lit
well ventilated

Racquetball.
close to shower
20' x 40' x 20' tall.
Environmentally: well lit (artificial)
well ventilated
this space could be sunk into ground.

Weight Lifting, Judo, Karate.
2 universal machines
10' to 12' ceilings
Environmentally: well lit
well ventilated
natural

Shower, Shave, Toilet.
showers to be used by businessmen as
well as school kids.
lockers, sinks, showers
men, 2 urinals, 2 waterclosets.
women, 3 waterclosets.
Environmentally: natural light with
artificial
natural ventilation

Roller Skating.
community rink, skate rental, vending
machines, seating area, music system.
Environmentally: accent lighting
            good ventilation

Points of Origin and Destination:
Parking to lobby to rink
drop off to lobby to rink
walk in to lobby to rink

Skateboarding.
cement ramps at minor slope with
bank turns.

Parking,
3 spaces for staff
2 spaces for vans (nutrition site)
visitor parking, at least 8 spaces
drop of area, pick up area.
10 min parking.
12 spaces general parking.

Lobby: gathering, pinball, pool, table
tennis (indoor, outdoor) 2,000 sq. ft.

Meeting Rooms: 4 small rooms that
convert into one large room to accommodate
200 people, chair storage. 3,000 sq. ft.

Park Board Offices: 600 sq. ft.

Nutrition Site: sink, refrigerator,
        stove, ovens, counter space. 200 sq. ft.

Gymnasium: 72' x 104', basketball,
        volleyball, dances. 7,488 sq. ft.

Handball, Racquetball:
        4 courts at 800 sq. ft. 3,200 sq. ft.

Exercise Room: 2 weight machines,
20' x 40', throw mat for judo, karate,
wrestling, 74' x 74'. 2,000 sq. ft.

Locker Rooms, Restrooms: 1,500 sq. ft.

Arts and Crafts: no specific space,
but storage area for materials.
200 sq. ft.
Roller Skating Rink: 60' x 120'
6,430 sq. ft.

Solar Greenhouse: 1,000 sq. ft.

Net Floor Area 27,618 sq. ft.
Walls (3% NFA) 828 sq. ft.
HVAC (10% NFA) 2,762 sq. ft.
Circulation (12% NFA) 3,314 sq. ft.

TOTAL SQUARE FOOTAGE 34,522

BUILDING CODE

Angola uses the Uniform Building Code. The code varies depending on the construction type and spaces. I will research the code book as I look at various designs. For now, a few basics are given.

Occupancy: Group A, Division 3
Exits: one exit per area
two in large meeting room
Stairs: Minimum width - 44"
Rise, less than or equal to 7½"
Run, greater than 10"

Ramps and Elevator for Barrier Free Design.
No specific budget has been set up. The Mayor of Angola voiced his concern for an inexpensive building. Strategies need to be developed to finance this building. Various ways should be considered and dealt with.

Self Help. This program requires community participation in the project from initial planning up through construction. Monetary contributions or volunteering work and time are examples of self help.

The community center should be designed for incremental growth over time. Design the project in phases, determining priorities of spaces. It will be an economic decision concerning what gets built.

Life-Cycle Costs should be considered. Two types of cost must be evaluated, economic life-cycle cost. Most buildings that provide for optimized energy conservation and the use of climatic energies have high initial costs, but once they are operating, they are anti-inflationary. The net result will be long term savings of money and a reduction in the overall use of resources.
A few federal funds are available to qualified groups. Community Development Block Grant Program is funded through H.U.D. It's major emphasis is on housing, but community centers have been accepted before. Community Facilities Program is a 5% loan over 40 years. Applicants must be of a non-profit organizational structure.

SITE ANALYSIS

The project site is located at the edge of the city limits. The area schools are located to the north, south, and east of the site. This makes it ideally located for youth interaction. There is a city park located to the southwest of the site, which should be connected to the site in some way. A State Highway runs along the south edge of the site, and it must be crossed to get to the park and the middle school. The surrounding area is mostly residential, and the future plans for Angola are to keep that area residential. A Ford auto dealer is located to the south of the site.

The climate of Angola is very temperate. The land is flat to rolling hills. Various types of hardwood trees are common to that area.

The soil at the site is sandy gravel with a clay base. Its characteristics are good perk, humid, good base, poor top soil for vegetation.

The site is basically flat. It slopes about three feet to the south over 200 feet.
Precipitation:
Rain - mean annual - 36"
- 130 days with rain
Snow - 32" annually
- 15 days with snowfall

Temperature:
Air - spring - 52
- summer - 70
- fall - 48
- winter - 27
Sun Days - clear - 117
- partly cloudy - 120
- cloudy - 128
Hours of Sunshine - 4490 possible
2647 actual
59% of possible available
Solar Radiation - 330 langleys annually
  Jan. - 125 langleys
  April - 375 langleys
  July - 525 langleys
  October - 250 langleys
langley = gram calories/cm²

75F cooling degree day
625F heating degree day
109 days below 32
8 days below 0
11 days above 90

Accessibility to the site and major regional activities are found on the maps near the beginning of this program.
Listed on the following pages are some statements that I found in issues of architectural publications.

Building becomes a gaint piece of play equipment.
Ramps used as major passage ways, extend through building.
Series of inclines used for running, roller skating, and bike riding.
Structure is designed to impart knowledge about how a building goes together.
Heating and air conditioning ducts painted in bright colors with bold graphics to note supply and exhaust.
Exploit and make understandable the nature of off the shelf catalogue components. Industrial wall panels, clip-on greenhouse skylight.
Facades are defined by interior spaces and skylights.
Gym takes up north side of site.
Buildings outward form follows the shape of it's interior spaces.
Lobby is used as a general gathering place. Senior Citizens arts and crafts group work in lobby on tables.
Art room windows face north.
Building scale recognizes both the nearby large single-family residences and the fact that the building is institutional in nature.
Dynamic appearance relies on the molding of traditional construction methods.
BUILDING TYPE STUDY

Recreation Center, Highland Park, Ill, 1954

Space: Hierarchy - gymnasium
Composition - rectilinear
Zoning by function - active down
passive up
Zoning, public to private - private
down

Structure: steel frame
Enclosure - brick veneer over
concrete block.
Span - steel I beams

Circulation: Entry - one only
Hierarchy - passive spaces
Distribution - linear

Siting: Entry - front of building
Orientation - overlook wooded area
Boundaries - park property on
slope of hill.
BUILDING TYPE STUDY

Miami Beach Youth Center, 1977.

Space:  Hierarchy - openness
Composition - rectilinear
Zoning, function - active off of central lobby.
Zoning, public to private - private on perimeters.
Structure - steel frame
  Enclosure - grid
  Span - 24'
Circulation - entry to all areas off of main lobby
Siting - unknown, shape, triangular.
BUILDING TYPE STUDY

Lancaster Neighborhood Center, 1977.

Space: Hierarchy - swimming pool
Composition - rectilinear
Zoning, function - passive up
Zoning, public to private - private up

Structure: steel frame
Enclosure - glass blocks
Span - steel joists

Circulation: entry - both ends
Hierarchy - activities
Distribution - linear

Siting: country
BUILDING TYPE STUDY

Community Recreation Center, Baltimore 1977.

Space:  Hierarchy - circulation
        Composition - rectilinear
        Zoning by function - active up
        Zoning, public to private - private up.

Structure:  Masonry bearing walls, steel frame
            Enclosure - exposed block
            Corrugated alum. siding, acrylic skylight
            Span - steel joists

Circulation:  Entry - each end
              Orientation - overlook
              City block
              Hierarchy - activities
              Distribution - linear

Siting:  Entry - corner
         Orientation - look over city block
         Boundaries - city block
D. MAJOR ACTIVITIES

CBD, BUSINESS, SHOPS
PARKS, BALL FIELDS, TENNIS COURTS
SCHOOLS
A. ELEMENTARY
B. MIDDLE
C. SECONDARY
SCHEMATIC DESIGN
The following pages illustrate a process of developing basic ideas into a building form.

Design an energy conscious building using passive solar systems.

Use daylighting to create an every changing environment.

Design an efficient building.

Use structural elements of the building for heat storage.

Spaces open to each other, encouraging interest in all activities.

Use ramps as major vertical circulation.
PROBLEM DEFINITION

Develop a form for an energy conserving community center through performance characteristics of various environmental conditions, similar projects, indigenous architecture, and circulation.

Environmental Conditions:

1. Solar Insolation
2. Wind Regulation
3. Internal Air Flow
4. Natural Ventilation
5. Heating
6. Humidity
7. Lighting
8. Landscaping
SOLAR INSOLATION

Minimize east-west exposure
Use building shapes that are self shading.
Use greenhouse on south side.
WIND REGULATION

Reduce the exposed surface area. Utilize plantings to alter unwanted northern winds.

CLIMATE

REDUCE THE EXPOSED AREA SURFACE

DOUBLE SHELLS

OUTER SHELL REMOVABLE IN SUMMER RECONSTRUCTION

MOST EFFICIENT

FORM -

BEST

2ND

3RD

NEED TO CONSIDER RAISED BASEMENTS TO REDUCE NORTHWEST WINDS.
Various aspects of natural ventilation were studied. It's interesting to note the flow of monthly average winds.

**NATURAL VENTILATION THROUGH DOORS \& WINDOWS.**

- A FRESH BREEZE

- ADVERSE CONSEQUENCES

  - Natural ventilation requires operable windows to let smoke in \& out.
  - Incessant infiltration can increase heating \& cooling loads.

**Average Winds**

- **January**: 15 mph
- **February**: 10 mph
- **March**: 10 mph
- **April**: 12 mph
- **May**: 12 mph
- **June**: 10 mph
- **July**: 9 mph
- **August**: 10 mph
- **September**: 10 mph
- **October**: 10 mph
- **November**: 10 mph
- **December**: 10 mph
Important aspect of this area since the heating period is 6 months of the year.
This was a study of on site landscaping to enhance and control, solar insolation, wind regulation, heat loss and heat gain.

GROUND ON NORTHWEST, WEST, AND SOUTHWEST SHOULD BLOW AWAY FROM BUILDING

PROTECT NORTHWEST, WEST, AND EAST EXPOSURES FROM WINTER WINDS

AVOID MOST AREAS NEAR SOUTH AND WEST EXPOSURES

USE FENCES, CONIFEROUS VEGETATION AND HEDGES FOR WIND PROTECTION

DECIDUOUS VEGETATION TO SOUTH, SHADES POURED AREAS IN SUMMER, WINE IN WINTER
SIMILAR PROJECTS

In this exercise, functional organizing characteristics of various similar projects were studied. The various activities of this project were arranged to simulate those similar successful projects. Below are 6 arrangements.
Basic circulation patterns were set on the site from studies of students traveling from the middle school and people coming from the park.

Because of site size, conflicts developed between proposed circulation patterns and spacial relationships.

May be necessary to have longer or more extensive means of circulation.
This scheme places active areas to the north to act as a barrier for the passive areas. The open area to the south responds to the basic circulation pattern on the site.
The partial sphere minimized the exposed surface area. The form takes an interesting shape if you happen to be flying over in an airplane.
This scheme uses curved forms to take advantage of regulating winter winds. It placed active areas to the north, but placed too much emphasis on the roller skating rink on the south side.