WOODLAND PARK:
A RESIDENTIAL COMMUNITY

ARCHITECTURAL THESIS
GREGORY A. DRENNEN
AUGUST 11, 1986
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ABSTRACT

ABOUT THE THESIS PROGRAM

Ball State's College of Architecture and Planning has a five year architecture program leading to a Bachelor of Architecture degree. The fifth year design studio is devoted entirely to individual thesis projects. This book is the documentation of my thesis year.

ABOUT THE BOOK

This thesis book is divided into four chapters covering initial research and analysis, through final designs.

Chapters one and two cover the first quarter of thesis which consists of site selection and analysis. Chapter three covers the bulk of design development during the second quarter of thesis. Chapter four covers design development and final designs which round out the third quarter of thesis.

The thesis project is a suburban residential development on a twenty acre site near Muncie, Indiana adjacent to an existing housing development called Woodland Park. The project utilizes solar and wind schemes as a basis for site planning and home designs.
ACKNOWLEDGMENTS

I would like to thank:

Tony Costello, Thesis Chairperson, for pushing me in the right direction, and for "raising the red flag" if I happened to go astray.

Bob Koester, Thesis Committee Member, for his analogous insights and for assuring me that some confusion was good.

Steve, Ed, and Chad, for putting up with me in studio.

Aleesa, for her love, confidence, patience and friendship.

My parents for their love, support and peanut butter.

I would also like to thank:

Jerry Bode, of the Sociology Department, and Mike Lunsford of Allardt, Dailey, and McKibben Realtors for taking time out of their busy schedules to talk to me.
INTRODUCTION
INTRODUCTION

This thesis book is the culmination of nine months of research, analysis and design investigations of the architectural implications of residential planning and design. My interest in this genre of study actually began while formulating ideas for my thesis. I wanted to pick a subject area that would test my role as an architect. To do this, I picked an issue and a subject very close to most of us but usually outside the realm of the architect or planner. This area of interest was housing, specifically suburban housing.

The initial impetus for my thesis stemmed from my dissatisfaction with suburban America (most of it at least). I wanted to find out, through my thesis project, just how an architect might create a better suburban environment. Eventually my thesis expanded to include the issue of energy. The ultimate goal, to create a residential development based on human needs, energy, and the interaction of these two in creating a satisfying and responsive environment and a sense of neighborhood and community.

Just prior to my first quarter of thesis, I wrote a paper on the subject of suburban residential housing. In that paper I traced the history of suburbs to the industrial revolution and then back to contemporary America. While researching this paper I found out (not surprisingly) that the spread of the suburbs from the industrial revolution to today, is so closely related to the advancements in transportation. From trains to automobiles, transportation played a major role in shaping our cities and neigbhoods. In contemporary subdivisions the automobile is the dominating force.

PROJECT GOALS

Create a housing development that will improve the quality of life, give a sense of place, and exist in harmony with nature.

Reinforce the social structures of the family, the neighborhood, and the community.

Satisfy the energy needs of the development through the use of renewable sources of energy such as the sun and the wind.

PERSONAL GOALS

Improve my abilities as an architect through a careful analysis of the environmental and social impact of the built environment.

Expand my knowledge of solar and wind energy systems.

Test my beliefs about architecture and my role as a designer.
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THESIS PROJECT

My thesis project is to design a prototypical residential development based on human needs, energy concerns, and environmental issues. This tripartite approach to design is an attempt to address the problems of current housing that lie outside the concerns of most developers and contractors. I will explore alternatives in housing design and residential planning that will lead to a redefinition of housing concerns and housing standards. Suburban housing is the area in which I will explore these alternatives. Factors such as the changing characteristics of the American family, development of renewable sources of energy, and protection of the environment are all parts and principles of my project. Based on these criteria I hope to accomplish the following goals.

RESPONSIVE DESIGN

In order for architecture to be truly responsive, architects must incorporate human needs, energy concerns, and environmental issues into all phases of planning and design. A responsive architecture should attempt to improve the quality of life, give a 'sense of place', and exist in harmony with nature. Most contemporary architecture, however, fails to recognize these issues and their underlying relationships. These issues are usually considered as separate entities and seldom in conjunction with design. As a result, we have housing developments and office buildings that are built to satisfy programming requirements but do little to improve the quality of life. Energy concerns are satisfied by utility companies and seldom utilize "renewable" sources of energy such as the sun and the wind. Environmental issues, if they are considered at all, usually deal only with the immediate site.

In reality, human needs, energy, and environmental issues are closely interrelated. Human needs affect the energy demands of a building. The demand for these non-renewable sources of energy affect the environment. The environment, in turn, affects human needs. The cyclical nature of these relationships, like a healthy ecosystem, must maintain a balance. It is essential, then for architecture to respond to these issues interdependently, to assure responsive design and to improve the quality of life.
Woodland Park

Suburban life doesn’t have to be dull. A new residential development just east of Muncie on State Road 32 has everything your looking for, and more. Located on twenty acres of land, WOODLAND PARK SOLAR DEVELOPMENT offers the best of two worlds. First, WOODLAND PARK SOLAR DEVELOPMENT is a planned community, offering jogging and walking paths, a Community Center with a store, meeting house and pool. There is a recreational lake as well, for boating and fishing. Second, WOODLAND PARK SOLAR DEVELOPMENT is an energy conscious development. There are twenty-six condominium units, perfect for the young professional who is looking to buy a home but doesn’t want the maintenance and upkeep that most traditional homes require. There are also thirteen single family home lots available for the progressive family that wants to break away from the traditional subdivision. All homes incorporate passive solar systems into the design of the structure. Interior room arrangement, finish materials and landscaping are designed and built to the owner’s specifications from several standard options.

On the right are some of the residents at Woodland Park enjoying themselves at our community center.
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If you are interested in seeing WOODLAND PARK for yourself, just call 284-9347 for an appointment. Our on-site office is located just north of 32 on Truitt Road. See you soon!

On the left is a general view of our picturesque, hillside community.

On the right are some of the residents at Woodland Park enjoying themselves at our community center.

On the left is a view of some of the distinguished and contemporary condominium units available at Woodland Park.
SOCIAL RESEARCH

The primary purpose of a building is to provide shelter for man. However, for a building to be called architecture, it must go beyond mere shelter and provide for man's social needs as well. These social needs include such concepts as home and property. A house is a building. A home, on the other hand, is a place for man and the institution of family. Each of the social institutions of family, neighborhood, and community are strongly affected by the built environment.

Just as any group of people don't make a family, a grouping of houses don't necessarily make a neighborhood. A neighborhood has a social structure, not a physical one. Architecture can either reinforce or destroy this structure. On the family level a home should foster healthy relationships between family members. The neighborhood should reflect the values of the people living there and encourage social interaction between neighbors. At the community level there should be a sense of harmony between its various parts. Since family, neighborhood and community are integral parts of an even larger social structure it is the responsibility of architects and planners to reinforce this structure.

CHAPTER ONE
HUMAN NEEDS
CHAPTER ONE
HUMAN NEEDS
This chapter is devoted entirely to my initial research into the social and environmental issues of suburban housing. The purpose of this research is to give a better understanding of the issues involved in my thesis and (by its inclusion in this book), give the reader some background on the precedents that influenced my approach to the thesis project.

I began my research by looking at the social and environmental issues that affect the suburbs. At the community scale, I wanted to find out just what role the automobile plays in linking the suburbs to the city and in creating a sense of community. At the neighborhood scale, I looked at the affect of the automobile on the streetscape. At the scale of the individual home, I looked at the affect of the automobile on the design of the house. And, at the human scale I wondered what affect the auto has had on our perception of the house, the neighborhood and the community.

In the course of my research I studied two planned communities which deal with similar issues. The first was the community of Riverside, a suburb of Chicago. Designed and built by Olmstead in 1868 it represented the first planned community in America. (see fig. 1)
The second planned community I studied was Radburn, New Jersey. Planned in 1926, it was the first to deal effectively with the automobile. It was also the first modern residential development to incorporate such things as cul-de-sacs and a complete separation of vehicular and pedestrian paths. (see fig. 2) 2

Radburn, like Olmstead’s Riverside, incorporated environmental as well as social goals into the planning of these communities.
SUBURBAN NEIGHBORHOODS

In some older neighborhoods, some of the quality of Radburn can be seen. On the street-side, there was consideration given to both pedestrian and automobile, creating what I call an automobile zone and a pedestrian zone. The auto was restricted to the street and separated from the pedestrian zone by a grass or tree-lined median between the sidewalk and street. This helped to screen off traffic from the socially interactive zone between the sidewalk and the front porch. This arrangement offered protection for the pedestrians and helped create a transition from the public street to the more private areas near the house.

The sidewalks became the socially interactive space serving a similar social function as had the parks at Riverside, or the recreation areas at Radburn. Because of a lack of a well-defined auto zone, this common ground is almost non-existent in contemporary subdivisions. Sidewalks are rare, and where they do exist, they are functionally part of the street.
SUBURBAN BACKYARDS

Automobile access and service functions at Radburn, for instance, were addressed in the initial scheme. In the older neighborhoods these functions occur on the backside of the homes through an alleyway. While in more contemporary subdivisions these functions occur on the street-side, creating mixed use areas that become auto, pedestrian and service zones. On the backside of these houses some social interaction does occur but it is discouraged by a need for privacy fences, shrubs, etc.

SUMMARY

I have addressed these issues and adapted some of the planning principles found in Radburn and Riverside to my own thesis in hopes of creating a quality living environment.
BABY BOOMERS

This demographic profile of the past three decades and predictions for the next two was the result of a compilation of many factors. Population trends and other related trends and events were combined in order to achieve a better understanding of the relationships and potential impact of these trends on housing and the family.

The purpose of this research was to have a basis for choosing what housing types I might incorporate into my project and creating a 'client' profile for the design of individual homes. For instance: in the decade from 1990-2000, 40 percent of the population will be retirement-aged, the average age will be 35, and two-person households shall make up the majority of all households. With this in mind, it might be appropriate to design a home for a couple in their mid-thirties as well as a consideration for the retired person.

1990-2000
• 4 percent growth in the 5-14 year old age group.
• Average age drops from 30.2 years to 29.3 years old.
• Major shift of population from the cities to the suburbs.

1990-1990
• 5 percent growth in the 15-24 year old age group.
• By 1990 the average age was 28 years, a housing 'boom' occurs in the suburbs.
• Colleges are unimpressed relative to labor-enrollment.

1970-1990
• The 'query boom' are between the ages of 25 and 30.
• The housing 'boom' continues.
• Inclinations in primary schools drop, at a high, part time schools within close by community.
• The average family size is about 2.75.

1990-2000
• The average age increases to 30 years.
• The 'query boom' are between 35-40.
• The number of 5-14 years drops drastically.
• 50 percent of all family households are two worker families.

1990-2000
• By 1990, 20 percent of the population will be 55 years of older.
• The average age will be 35.5 years.
• The 'query boom' are between 30-50 years old.

2000-2001
• By the year 2000, there will be a greater number of retirement persons.
• The number of 5-14 years old will increase due to the 'query boom' effect.
• The 'query boom' will remain.

Muncie Housing Study
• 3 bedrooms, 1-2 bathrooms, 1-2 car garage.
• Interior features of the home are important:
• Maintenance-free materials.
• Exterior spaces: front yard or back yard.
• Most homes are simple level, single family homes.
• 95 percent of homes on the market are existing homes.
• 1500 homes are currently on the market in Muncie.
• The average cost of an existing home is $19,300-$54,000.
Muncie Housing Study

- 3 Bedroom, 1-1/2 Bathrooms, 1-2 Car Garage.
- Selection of Materials is Important.
- Maintenance-Free Materials
- Extends Space: Front Yard or Back Yard.
- Most Homes are Single Level, Single Family Homes.
- 95 Percent of Homes on the Market are Existing Homes.
- 1500 Homes are Currently on the Market in Muncie.
- The Average Cost of an Existing Home is $34,000-$45,000.

HOUSING STUDY

This information was the result of some of my own observations and somewhat realistic depiction of the typical suburban ranch home. The information on the Muncie housing market was the result of an interview with a local real estate agent. Both my own observations and that of a professional real estate agent helped to define the Muncie housing market and the wants and needs of the Muncie home buyer.

This information aided somewhat in the planning and design of homes and lots in my thesis project.

2. "Roof" Fiberglass, three tab shingles: 30 year warranty.
3. "Garage" Home of the family auto/s: bike storage, lawn mowers, and garbage.
5. "Shutter" Wood, plastic or metal: applied decoration, not operable.
CONCLUSIONS

The information I have compiled and the knowledge gained during the course of this research has contributed greatly to my understanding of the larger issues involved in my thesis. Not all of the information can be directly linked to the final design, but as a starting point, this research and analysis gave me greater confidence in dealing with the issues at hand.

Some of the problems that have been identified and the issues that have been raised serve as a basis for setting problem-solving goals, and as a checklist for final designs. Some of these goals are as follows.

THE NEIGHBORHOOD

1. Provide opportunities for social interaction.
   - Public open spaces, parks, meeting places, community activities center.

2. Maintain the self-esteem of the individual through home ownership, identification with the neighborhood, and flexible living conditions that allow personal adaptation.

THE HOME

A home must:

1. Provide security and shelter.

2. Allow for some modifications of form and or materials for personalization and identification.
   - Materials must be adaptable and interchangeable if possible.
   - The home design should allow for group as well as private activities and should provide a stable background that fosters healthy family relationships.
ENVIRONMENT

This chapter deals with site selection and site analysis. The chapter is broken down into two parts. The first part is an analysis of existing site characteristics, such as buildings, vegetation, land forms as well as areas bordering the site. The second part of this chapter deals with the utilization of the sun and the wind.

SITE SELECTION

Even before my thesis, I had an interest in the potentials for utilizing wind energy, so in selecting a site I added the criteria of wind energy to my search. Eventually I chose a site just outside Muncie, adjacent to and existing residential development called Woodland Park. The site was close enough to visit often, which allowed me to get a real feel for its character.

The site was about twenty acres and represented one of the few high elevations in Muncie (1000 feet). The site offered a thirty-five foot change in elevation from one end to the other and, due to its elevation, a good wind energy potential. (not to mention the greater design potential of a sloping site)
SITE ANALYSIS

Site analysis is the inevitable beginning to most design projects. Becoming familiar with the site is critical in the early stages of any project. With my site, I was especially concerned not only with the site area itself, but also with the surrounding neighborhood and countryside. In the following site analysis I have broken down the twenty acre site into three distinct zones, Zone 1, 2, and 3. In the surrounding area I have defined four distinct zones, Zone A, B, C, and D.

The idea is to look at each zone separately, then look at the relationship of each zone to one another. The information from each zone is broken down into three categories.

CATEGORY 1: Characteristics:
- Soils, slopes, existing vegetation and existing man-made features.

CATEGORY 2: Concerns:
- Potential problems that might be encountered, such as bad views, erosion, high water etc..

CATEGORY 3: Design Implications:
- Possible solutions to problems, design goals, suggestions.

This system of analysis helps to organize a great variety of information and also serves as a design resource.

CHARACTERISTICS

FLAT, GREEN, CULTIVATED FIELD.
SLOPES RANGE FROM 0-2%. SLOPES WIDER THAN 2% ARE LIKELY TO ERODE.
ZONE 1 BORDERS THE SITE ON TWO SIDES; TO THE NORTH AND TO THE WEST.
ALLOW UNOBstructED VIEW TO THE WEST.
INTERMITTENT HIGH WATER IN SOME PLACES.

BLENDED AREA:
GENERALIZED OPEN AREA WITH A FEW SCRUB TREES, TALL GRASS. SLOPES SLOWLY GRADE TO 3-10%.
THERE IS A PARTIALLY EXCAVATED GRAVEL PIT, BEFORE ENTRANCE PRESS.
DESIGNER BUILDING MATERIALS, STONE, RUBBLE AND TRASH.

EXISTING RESIDENTIAL EDGE, A TOTAL OF NINE HOUSES.
PRIVATE PROPERTIES SEPARATED FROM SITE BY A RIDGE ON THE NORTH.
RESIDENTS: BACKYARD BORDERS SITE. CLUSTERS OF TREES.“
GRASSY AREAS, STAND OF NATURE TREES ON EAST END
END ROAD ON OTHER END OF ZONE C.
APPROXIMATE HOUSING DENSITY BASED ON ONE ACRE.
SEE HOMES/GARAGES: 25% @ AVG. 30% OF AREA.
*LOOK AT FULL COMPARISON*

RESIDENTIAL AREA SEPARATED FROM SITE BY TREATT ROAD.
APPROXIMATE HOUSING DENSITY BASED ON ONE ACRE.
APPROXIMATE HOUSING DENSITY BASED ON ONE ACRE.
CHARACTERISTICS

FLAT, OPEN, CULTIVATED FIELD.
SLOPES RANGE FROM 0-3%.
ZONE A BORDERS THE SITES ON TWO SIDES; TO THE NORTH AND TO THE WEST.
ALLOWS UNOBSTRUCTED VIEW TO THE WEST.
INTERMITTENT HIGH WATER IN SOME PLACES.

CONCERNS

SEASONAL EFFECTS OF CROPS, CULTIVATION AND HARVESTING ON SITE. DUST, CHEMICAL TREATMENTS, GRASSING.
THE FLAT, OPEN FIELD OFFER NO PROTECTION FROM SEVERE WINDS.
INTERMITTENT HIGH WATER.

DESIGN IMPLICATIONS

VARIATIONS IN TYPE AND HEIGHT OF CROPS SHOULDN'T BE UGLY WITH IN TERMS OF VIEW, WIND SPEED.
PROTECT ZONE THROES FROM DUST, NOISE AND EROSION FROM FIELDS.

ZONE A

ELEVATED AREA.
GENERALLY OPEN AREA WITH A FEW SCRUB TREES, TALL GRASSES. SLOPES RANGE FROM 3-10%.
THERE IS A PARTIALLY EXCAVATED GRAVE PIT, SIGNIFICANT DEBRIS PROBLEM.
DEPARTMENT BUILDING MATERIALS, STONE, ROBBLE AND TRASH.

POTENTIALLY A DANGEROUS AREA FOR CHILDREN.
EASILY VIEWED FROM SITE, A GENERAL STEREOTYPE.
INTERACTING WITH THE ENTIRE NEIGHBORHOOD.

MAKE PROVISIONS TO EITHER IMPROVE EXISTING CONDITIONS OR SCREEN VIEW FROM SITE.
IF ZONE B WERE CLEANED UP IT MIGHT MAKE FOR A COMMUNITY AREA. FIELD SPORTS, POSSIBLY A SARA, PLAYING AREAS. IT COULD SERVE AS A LINK BETWEEN WOODLAND PARK AND ANOTHER SUBDIVISION JUST WEST OF ZONE B.

ZONE B

EXISTING RESIDENTIAL EDGE, A TOTAL OF NINE HOUSES.
PRIVATE PROPERTIES SEPARATED FROM SITE BY A MATURE BUSH ON THE WEST.
RESIDENTIAL BACKYARDS BORDERS SITE. CLUSTERING OF THREE GRASSY AREAS, STAND OF NATURE TREES ON THE EAST END TAKING ROAD ON WEST END OF ZONE B.
APPROXIMATE HOUSING DENSITY, BASED ON ONE ACRE.
SIX HOMES/ACRE AVERAGE 2,180 SF, AVG. 3,000 SF AREA.
*LOOK AT FULL COMPAREHISON

PRIVATE, BACKYARD AREAS CAN BE DIRECTLY AFFECTED BY SITES DEVELOPMENT.
USE OF SALT-END ROAD AS AN ACCESS POINT COULD CAUSE PROBLEMS AND MAY NOT BE DESIRABLE AS SUCH.

MAINTAIN PRIVACY OF BACKYARD AREAS BY SCREENING-OFF SITE FROM VIEW WITH TREES.
DO NOT USE, OR LIMIT THE USE OF EXISTING ROAD AS AN ACCESS POINT.

ZONE C

RESIDENTIAL AREA SEPARATED FROM SITE BY TRUITT ROAD DIRECTLY ACROSS FROM ZONE TWO.
APPROXIMATE HOUSING DENSITY BASED ON ONE ACRE AREA.
FOUR HOMES/ACRE: AVERAGE 2,180 SF, AVG. 3,000 SF AREA.

VISUAL IMPACT OF SITE IS THE MOST PROMINENT.
RELATIONSHIP BETWEEN EXISTING BUILDINGS AND SITE DEVELOPMENT.
ACCESS ORIO SITE FROM TRUITT ROAD MIGHT AFFECT TRAF- FIC PATTERNS.

CAREFULLY ANALYZE THE VISUAL IMPACT OF SITE DEVELOPMENT ON ZONE C.
MINIMIZE VEHICULAR ACCESS PROBLEMS. ACCESS ONLY AT INTERSECTION.
POSSIBLY DEVELOP ZONE TWO INTO A COMMUNITY SHARED IN ORDER TO THE TWO AND EXISTING DEVELOPMENTS TOGETHER.

ZONE D
**Characteristics**

**Soils:** Mu, SIA
- Merlin Silt Loam 3-66 SLOPES
- Blakley Silt Loam 0-26 SLOPES

Slopes toward the North-West and West (100'-975')

Open, cultivated fields bordering on three sides of buildings and on the East by Truitt buildings and private residences.

The best views are to the North and to the West.

A dead-end road stops just short of the South property line. This is the only direct, existing access into zone one.

---

**Soils:** Mu, SIA
- Merlin Silt Loam 3-66 SLOPES
- Blakley Silt Loam 0-26 SLOPES

Cultural slope toward the South.

Partially open, grassy areas.

Three farm buildings: livestock barn, drying shed, equipment storage barn. All are in fair condition.

A private residence and 60 acres of private property on the northern-most part of zone two.

Zone two is bordered on the East by Truitt Road. There is an existing access into the barn lot off of Truitt Road. (See Map)

---

**Soils:** Fe3c, Ma2d, Mu
- Fox Gravelly Clay Loam 0-26 SLOPES
- Merlin Silt Loam 0-26 SLOPES
- Blakley Silt Loam 0-26 SLOPES

Slopes toward the North-West (990'-955')

Open, cultivated fields bordering on the North and West by open fields, on the North by buildings, and on the East by Truitt Road. Intermittent high water at the 965' contour.

Lowest point on site.

Best views toward the West.

Unlimited solar access.

---

**Concerns**

There is a direct view of the elevated area just south-west of zone one.

Any development along the South property line can directly impact existing residences.

Development on slopes could cause erosion problems.

Access onto site from existing road would cause traffic and noise problems for existing homes.

Zone 1

---

**Concerns**

Any development in zone two is highly visible from Truitt Road and existing residences across the road.

Maintaining character of zone two will be difficult.

Maintain the privacy of private residences.

Zone 2

---

**Concerns**

This zone is totally unprotected from views out of the West and North.

Agricultural activities in the surrounding fields may cause noise and pesticide exposure.

Seasonal changes in the type and type of vegetation due to cultivation and harvesting of crops in zone A.

Intermittent high water could cause problems with construction and siting of homes, drainage and high water table problems.

Zone 3

---

**Design Implications**

Minimise views toward the South-West or create a buffer zone to block view of elevated area.

Create a buffer zone along the South property line to screen off existing homes and protect privacy of their back yards.

Minimise views toward the West and North.

Minimise vehicular access on the slopes.

Maintain and enhance existing roads now.

Construction techniques and siting must be carefully considered on slopes in order to minimize erosion.

Zone 1

---

**Design Implications**

Maintain farm buildings and character of area as much as possible.

Carefully consider visual impact of development in zone two on existing residences in zone D.

Maintain privacy of residence in zone two by screening off area.

Minimise vehicle impact.

Ensure any development in zone two to the West of woodland area.

Zone 2

---

**Design Implications**

Provide wire break on the West and North edges of zone three in the form of a buffer zone three grass lots.

Carefully consider the changing, seasonal crops in zone A.

Study drainage patterns in order to deal with the intermittent high water at the 965' contour.

Provide a buffer zone to screen off homes from Truitt road on the East.

Minimise vehicular impact on slopes.

Zone 3
### Zone C

<table>
<thead>
<tr>
<th>HOUSE ONE</th>
<th>2600 S.F.</th>
<th>6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWO</td>
<td>2000 S.F.</td>
<td>3%</td>
</tr>
<tr>
<td>THREE</td>
<td>2600 S.F.</td>
<td>6%</td>
</tr>
<tr>
<td>FOUR</td>
<td>2200 S.F.</td>
<td>3%</td>
</tr>
<tr>
<td>FIVE</td>
<td>1800 S.F.</td>
<td>4%</td>
</tr>
<tr>
<td>SIX</td>
<td>1600 S.F.</td>
<td>4%</td>
</tr>
<tr>
<td>DRIVEWAYS</td>
<td>4600 S.F.</td>
<td>11%</td>
</tr>
<tr>
<td>ROADWAY</td>
<td>5200 S.F.</td>
<td>12%</td>
</tr>
<tr>
<td>OTHER</td>
<td>21081 SF.</td>
<td>47%</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>43681 SF.</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

| HOUSING | 12800 SF. | 30% |
| VEHICULAR | 9200 SF. | 22% |

### Zone D

<table>
<thead>
<tr>
<th>HOUSE ONE</th>
<th>1950 S.F.</th>
<th>5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWO</td>
<td>2800 S.F.</td>
<td>6%</td>
</tr>
<tr>
<td>THREE</td>
<td>3200 S.F.</td>
<td>7%</td>
</tr>
<tr>
<td>FOUR</td>
<td>1575 SF.</td>
<td>4%</td>
</tr>
<tr>
<td>DRIVEWAYS</td>
<td>6000 S.F.</td>
<td>14%</td>
</tr>
<tr>
<td>ROADWAY</td>
<td>5000 S.F.</td>
<td>11%</td>
</tr>
<tr>
<td>OTHER</td>
<td>23156 SF.</td>
<td>53%</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>43681 SF.</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

| HOUSING | 9525 SF. | 22% |
| VEHICULAR | 11000 SF. | 25% |

### HOUSING

This analysis deals with the existing housing in Woodland Park. The purpose of this analysis is to achieve a better understanding of the exact amount of space devoted to various functions. By doing so, I am more fully aware of the amount of space devoted to such things as driveways, roads, houses and yards. This analysis concerns zones C and D and is indicated on the key plan.

The analysis is based on a one-acre section of land in Zone C and Zone D. My basic assumptions are as follows:

Yards and open spaces (non-paved areas), are preferable to driveways and roads.

The percentage of house area to open space should be at least equal.

The total percentage of house area should be greater than that of driveways or roads.

These assumptions may seem somewhat arbitrary, however they are based on my feelings about proper land use and are influenced by my research of suburban development and the automobile.
EXISTING

EXISTING BUILDINGS

Existing buildings on the site include a house with a garage, two barns, drying shed, three corn cribs and an old silo. The farm buildings were in fairly good shape. The drying shed was especially well preserved. The placement of these buildings near the main road provided a screen for the rest of the site. I decided, almost immediately, to save these buildings and to reuse them in some way. I did this partially because of my fondness for old barns and partly to preserve their basic relationship with that stretch of Truitt Road. (See design implications for Zone Two.)

SKETCHES

These sketches show the existing buildings from various directions, from the south, southwest, and from the west.
Above: the farm buildings before the project.

Below: the farm buildings after the project.
CONCLUSIONS

Some basic conclusions can be drawn from this site analysis.

1. Because the site is surrounded by open fields on the West and the North, proper site planning is critical in order to minimize the effects of the cold winter winds.

2. Vehicular access onto the site is very critical because the position of existing roads and the characteristics of the site don't allow many options.

3. Development of this site will strongly affect the character of its immediate surroundings. Therefore, it is important to preserve as much of the privacy and character as possible along the edges bordering Woodland Park.

For a more detailed look at the design implications, refer to the zone by zone analysis.
The second part of this chapter deals with the utilization of natural or 'renewable' sources of energy such as the sun and the wind. Specifically, I have looked at how a building form might respond to solar and wind patterns. This is certainly not a new concept, but it is, nevertheless, part of the process leading to a site-specific design. The basic principles of solar energy utilization is covered first and then the utilization of the wind.
SOLAR ENERGY

This information as well as much of the research and analysis so far was part of my first quarter thesis presentation. My approach to the utilization of solar energy began by gathering data and resources on solar energy. Basic information such as solar altitudes, (angle above the horizon) azimuths, (direction of the sun at a given time of the day) and average weather conditions, are critical in determining building form and orientation. This section on solar energy summarizes that information and, through the use of various illustrations, outlines the principles of proper placement and form that the final design should follow.

The diagram at the right illustrates the position of the sun at sunrise and sunset for both the summer and winter solstices. The use of such tools enables one to pinpoint the position of the sun at any time of the day and in any season. I was able to utilize this information to determine the placement of windows and the proper orientation of thermal mass.

The summer solstice: azimuth 30 degrees NE, altitude 72 degrees above the horizon.
The winter solstice: azimuth 38 degrees SW, altitude 27 degrees above the horizon.
The diagram on the left is a representation of the solar altitudes and the path of the sun across the sky during the summer solstice (June 21st.) and the winter solstice (December 21st.). These are the maximum and minimum altitudes of the sun.

The diagrams below show the most basic uses of the sun's energy: direct use of the sun for personal comfort, allowing the building envelope to respond to the sun by capturing its warmth, and indirect use of solar energy through a storage medium.
The illustrations on this page show the design implications of the utilization of solar energy in building form.

The general principles involved are as follows:

Proper placement of the buildings in relationship to each other and to surrounding objects.

Creating a building that responds to the angles of the sun at certain times of the year.
WIND ENERGY

The goal of utilizing all available sources of natural energy includes wind energy as well as solar energy. So, as a part of my thesis project, I investigated not only the wind potential to generate electricity, but also its potential as a design factor in both site planning and building design.

Much of the research involved gathering data on my sites wind energy potential, and on various types of wind powered generators. Some of this data is shown on the right and the general notion of placement on the site, shown below. However, during the course of investigation I discovered that utilizing the wind to generate electricity created several problems. First, in order to operate a SWEC (small wind energy conversion system) safely and efficiently, I would need a much larger site and/or more available wind power. Second, the current available SWEC systems were not designed for Indiana's wind regime. Most of the machines need a much greater average wind speed to be both efficient and cost effective. As a result of these discoveries, I decided to scrap the idea of generating electricity with the wind. Instead, I concentrated on the more conventional uses of the wind.

### Wind Speed Table

<table>
<thead>
<tr>
<th>Month</th>
<th>Median Speed</th>
<th>Mean Speed</th>
<th>Power Density</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M/S</td>
<td>MPH</td>
<td>Watts/ft²</td>
</tr>
<tr>
<td>Jan</td>
<td>5.7</td>
<td>12.7</td>
<td>6.2</td>
</tr>
<tr>
<td>Feb</td>
<td>4.2</td>
<td>9.3</td>
<td>4.6</td>
</tr>
<tr>
<td>Mar</td>
<td>4.0</td>
<td>9.9</td>
<td>5.2</td>
</tr>
<tr>
<td>Apr</td>
<td>4.0</td>
<td>9.0</td>
<td>4.5</td>
</tr>
<tr>
<td>May</td>
<td>3.3</td>
<td>7.3</td>
<td>4.6</td>
</tr>
<tr>
<td>June</td>
<td>2.5</td>
<td>5.6</td>
<td>4.5</td>
</tr>
<tr>
<td>July</td>
<td>2.3</td>
<td>5.1</td>
<td>2.9</td>
</tr>
<tr>
<td>Aug</td>
<td>2.1</td>
<td>4.7</td>
<td>2.8</td>
</tr>
<tr>
<td>Sep</td>
<td>2.6</td>
<td>5.7</td>
<td>3.0</td>
</tr>
<tr>
<td>Oct</td>
<td>3.9</td>
<td>8.8</td>
<td>4.4</td>
</tr>
<tr>
<td>Nov</td>
<td>3.7</td>
<td>8.3</td>
<td>4.1</td>
</tr>
<tr>
<td>Dec</td>
<td>4.3</td>
<td>9.7</td>
<td>4.6</td>
</tr>
<tr>
<td>Max.</td>
<td>5.7</td>
<td>12.7</td>
<td>6.2</td>
</tr>
<tr>
<td>Avg.</td>
<td>3.6</td>
<td>8.1</td>
<td>4.3</td>
</tr>
</tbody>
</table>

This table gives values for average wind speeds and the corresponding power density at 20m or 67ft above the ground.

**Power Density:** The available wind power per unit area of wind stream.
This table gives values for average wind speeds and the corresponding power densities at 30m or 75ft above the ground.

Power Density: The available wind power per unit area of wind stress.

<table>
<thead>
<tr>
<th>Month</th>
<th>Power Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>23.3</td>
</tr>
<tr>
<td>Feb</td>
<td>14.6</td>
</tr>
<tr>
<td>Mar</td>
<td>16.3</td>
</tr>
<tr>
<td>Apr</td>
<td>18.3</td>
</tr>
<tr>
<td>May</td>
<td>20.0</td>
</tr>
<tr>
<td>Jun</td>
<td>22.3</td>
</tr>
<tr>
<td>Jul</td>
<td>24.6</td>
</tr>
<tr>
<td>Aug</td>
<td>26.9</td>
</tr>
<tr>
<td>Sep</td>
<td>29.3</td>
</tr>
<tr>
<td>Oct</td>
<td>31.9</td>
</tr>
<tr>
<td>Nov</td>
<td>34.6</td>
</tr>
<tr>
<td>Dec</td>
<td>37.3</td>
</tr>
</tbody>
</table>

The diagrams on pages 33 and 34 illustrate the general notion of how a buildings form and operation can respond to the wind. The techniques and principles involved are rather straightforward and appropriate to my thesis. I have utilized these concepts in the site planning strategies as well as the building designs. (see pp. 70-71)
In order to utilize the wind to maximum benefit, the design of a building must respond to local wind patterns and characteristics. Building form, in both plan and section, should respond to the wind by deflecting harsh winds in the winter, capturing the cooling breezes in summer. By utilizing very simple techniques, such as is shown on the right, the wind can be a great benefit to the functioning of the building and the comfort of its occupants.

The drawing above shows a very simple technique for ventilating a space. On very warm, summer days, the movement of air through a space can increase the comfort of its occupants.
CHAPTER THREE

DESIGN DEVELOPMENT
SITE DEVELOPMENT

This chapter is devoted entirely to design development and is divided into two phases. The first phase being site development. The second phase is housing development.

In order to design a responsive residential development one must deal with the overall design as several, smaller designs with an underlying framework that ties them all together.

In this thesis project design investigation occurs at different scales and at different levels. First, there is the global scale which deals with the forces of nature acting upon the site such as the sun and the wind.

Second, there is the site scale that deals with the specific microclimate effects, topography, soils, and existing manmade features. In my thesis I dealt with two smaller scales as well; the neighborhood and the home scales. At this level the relationships between scales becomes very complex and intertwined. It is my role as a designer, to discover the underlying pattern in order to make sense of the overall fabric of the site.

In the first two chapters of this book I looked at the larger issues such as the solar and wind criteria and the site specific criteria. What I have done during design development can be directly linked to these larger scaled issues.

Site design progressed in three general stages. The first stage was primarily a response to my desire to minimize the vehicular impact on the site. Housing clusters and cul-de-sac schemes were employed in an effort to achieve this end. (fig. 1)

The result, however, was a lack of responsiveness to the topography of the site and to the climatic factors of the sun and the wind.

In the second stage of design I took a step back and looked at various ways to respond to the climatic factors while still utilizing housing clusters and cul-de-sacs. I responded by creating buffer zones of trees along the west and north edges of the site. (fig. 2)

In the third and final stage of site design, I tried to integrate all design goals into the site plan. Open spaces, pedestrian pathways, buffer zones, etc. The final result is shown in figure 3. A larger plan can be found on pages 58-59.
GOALS:

1. Minimize vehicular impact on the site, in order to create a sense of a pedestrian-oriented neighborhood. I believe I have achieved this by:
   - creating a complete separation of pedestrian and automobile zones.
   - the use of cul-de-sacs to discourage through traffic and to privatize, to some degree, the drives leading into the housing clusters.
   - utilizing a perimeter access road as the only vehicular link from one end of the site to the other.

2. Create a sense of neighborhood and community by:
   - providing public grounds accessible from all homes by pedestrian pathways. These grounds include a community center, outdoor space such as a recreational lake and a playground.
   - clustering housing units to provide individual homeowners with a smaller social group to which they may relate more easily.
HOUSING CLUSTERS

Moving from the site scale down to the scale of the housing, many more factors come into play. For instance, individual homes begin to take shape. Their spacing, orientation and form become critical factors in the utilization of the sun and the wind. Other criteria for dealing with privacy, access, parking and social interaction must also be met.

In my initial investigations, I looked at various housing types including semi-detached homes, rowhouses, and condominiums. In all three, I looked for efficiency both spatially and from an energy standpoint. In general, they all shared common walls, either structurally or functionally, and they could be clustered to minimize impact on the site and maximize energy conservation by reducing the number of exterior surfaces exposed to the heat and cold.

The illustrations on these two pages correspond to the site planning concept at the top of page 39. This scheme utilizes an auto court and begins to deal somewhat with the creation of transition zones between the private living spaces and the public auto court.
CONDOMINIUM CLUSTERS

I began development of the condominium clusters by looking at various other related types of housing. Some of the design features of the semi-detached house, the rowhouse and the typical condominium unit can be found in the cluster arrangements. The intention was to create a cluster of housing types that would be responsive to solar and wind criteria individually as well as in a group. Also, the higher density of these units, as compared to the single family home, allows me to explore their potential within the context of the suburban neighborhood.

The basic organizing concepts consisted of a thirty degree west of south orientation for optimum heat storage performance, a response to seasonal wind patterns for ventilation in the summer and deflection of harsh winter winds. In addition to these organizing concepts, I wished to create separate auto and pedestrian zones to correspond with the overall site planning concepts.

These drawings show two possible arrangements for the housing clusters. The basis for comparison is a one acre section of land. Each of the units represents 1200 square feet of floor area.

The top drawing shows a six unit arrangement, individualized parking, and access on the south side.

The bottom drawing shows an eight unit arrangement with clustered parking areas and access on the north side.
CONCEPT

Diagram one, illustrates the concept of streamlining the cluster into an aerodynamic shape. This concept came about after the research into wind energy systems. The shape seemed to be an appropriate response to the wind and to the character of the sloping site.

Diagram two shows how the clusters might be arranged and how the access road and cul-de-sac might be incorporated into the scheme.

Diagram three shows garages, parking areas and the introduction of north entry units into the scheme. This general arrangement offers greater diversity and choice for the potential owner.
The drawing on the left shows the general arrangement of the housing clusters on the site. The collector road runs parallel to the contours of the hill, while the individual cul-de-sacs run perpendicular. The curve of the road allows for variation in housing unit setbacks and is generally more appealing, visually than a straight road.

The drawing on the right shows a further development of the clustering scheme. The introduction of buffer zones of trees and the north entry condominium units.
The final layout of the condominium clusters from an energy standpoint seems to respond well to the solar and wind criteria as well as the sloping site. This arrangement also continues the notion of vehicular and pedestrian separation established in the site planning.

In general, the clustering concept is successful, meeting all of the requirements set forth. The final design, shown on page 43, shows some of the features and relationships of the condominiums to the pedestrian pathway.

The drawing on the right shows a further development of the clustering scheme. The introduction of buffer zones of trees and the north entry condominium units.
I approached the design of the single family home lots with the goal of addressing those problems I found in the typical suburban neighborhood. I did this in two ways. First I addressed the issue of the automobile by creating a very well defined auto zone. All service functions and parking would occur within this zone. Secondly, I addressed the issues of energy by creating an underlying framework of orientation, setbacks, and buffer zones. The placement of these lots on the site was an attempt to relate them to the existing housing in Woodland Park.

The drawing above shows the basic relationship of house to the auto zone. The transitional zones include such things as garages and outdoor spaces. The sketch below illustrates the early notions of these relationships.
The general layout of the lots corresponds to the solar and wind criteria established earlier. In the development of these lots, the issues of privacy, and ownership were primary concerns. I dealt with the issue of privacy by incorporating into the layout, well defined property boundaries. Walls, vegetation and the homes themselves helped to define these boundaries. I utilized a zero lot line planning scheme which creates tighter, more well defined edges than the typical suburban planning scheme. Open space would occur on the south side of the homes in either the north lots or the south lots. And, again there is the separation of the automobile and the pedestrian zones by including pedestrian paths around the perimeter of the lot development.

In the sketch at the top of the page the general plan development is shown. At this point the lots were simply rectilinear in shape. But, as the design progressed it began to loosen the form of the walls in order to create more variety in the lot plans. In the final design, shown below, each lot takes on its own character. The homes can also begin to vary in orientation from south to the prime orientation of 30 degrees west.
The diagram at the right shows the underlying planning scheme of the final design. The shaded areas represent the zones devoted to garages, service activities and transitional spaces which might be anything from grass to parking, or even garden space. The purpose of this space is to create a separation of the auto zone from the home. Since these lots will be owned by individuals the final use of this space cannot be determined.

The diagrams above help explain the layering of zones, property boundaries, and planning schemes.

The first diagram is a simplified version of the site plan itself. The footprints of the homes are shown as well as the footprints of the garages. In the second diagram the basic zones boundaries are
The diagrams above help explain the layering of zones, property boundaries, and planning schemes.

The first diagram is a simplified version of the site plan itself. The footprints of the homes are shown as well as the footprints of the garages.

In the second diagram the basic zones boundaries are

In the third diagram the outlines of the property lines are shown. These property lines could be walls, vegetation etc. Here one can begin to see the relationship between the original concepts and the final designs.

In the diagrams below, the solar and wind criteria are shown for the winter condition, the summer condition and the fall.
CONDOMINIUMS

The design development of the condominium units began with the general notions of appropriate building form derived from established energy criteria. From this raw form I began to look at the relationships between interior and exterior, public and private. I wanted to create spaces that would respond to those relationships and create transition zones between them.

The greenhouse spaces, for instance, serve as transitional spaces. The greenhouse has a dual purpose as both a solar collector and as an extension of the living space. It also acts as a screen between the public domain and the private, interior spaces. I carried this concept of multiple functions one step further by allowing the entire solar chimney to become an expression of the individual owner's taste and desires. All of this occurs within certain limits so as not to hinder the performance of the solar chimney.

The concept was to establish a framework based on the energy function of the building, and to allow flexibility within that system. This allows for personalization of spaces and facades without hindering the functioning of the building.

I achieved this by establishing a basic form for the building and provided a structural system that would allow maximum flexibility.
The drawing on the left shows the concept of extending the living space to the exterior through the use of a transitional space to interface interior and exterior.

Vertical as well as horizontal separation of the auto and pedestrian zones can help to define one from the other.

This early development sketch for the north entry units shows the transition from the north, entry side of the home to the south, greenhouse side.
Within the limits of the energy criteria and the structural system, the manipulation of the interior spaces and exterior skin can create a variety of expressions, (as shown below) or become a little more subdued, (as in the north entry unit above.) In either case the need for personal expression of the individual home is an important factor to consider. In the south entry units, shown on page 51, some possible ways to manipulate the facade are shown.
The floor plans of the units can be manipulated in a similar fashion. The structural system consists of masonry bearing walls between units, wood beams that span the 25 foot distance between walls, and standard floor joists that rest on top of the beams. With this system, a variety of arrangements are possible. And, the integration of HVAC equipment and ducting is easily done within the one to two foot floor depth.

The condominium unit is divided into two zones, a living zone and a utility zone. Within these zones I established a hierarchy of spaces ranging from the most public, on the south, to the most private, on the north side of the unit. The living zone includes the greenhouse space, great room and entry. The utility zone includes the kitchen, storage areas and bathrooms.
These diagrams show schematically, the planning notions of the condominium units. The elements shown are the basic footprint of the units, a buffer zone of trees on the north and west sides, pedestrian paths and roadway, and the overlay of solar and wind elements.

The first diagram shows the winter condition. The sunrise and sunset angles are shown as well as the winter storm winds. The trees on the north and west help to deflect much of the winds. The building cluster minimizes the number of exposed faces.

The spring and fall conditions are shown in the second diagram. In this condition, the north face of the units receive direct sun early in the morning. The prevailing wind from the west helps to ventilate the units in early fall and late spring.

In the third diagram, the units can open up to allow for natural ventilation of the spaces. The 30 degree orientation of the units captures the south western breezes.

In the diagram on the left, the winter condition is shown. The low winter sun is captured by the solar chimney and greenhouse. Some of the heat captured is stored in the thermal walls and floor, while the rest of the heated air is collected at the top of the chimney to be used in space heating directly or as a preheat for the return air.
In the third diagram, the units can open up to allow for natural ventilation of the spaces. The 30 degree orientation of the units captures the south western breezes.

In the diagram on the left, the winter condition is shown. The low winter sun is captured by the solar chimney and greenhouse. Some of the heat captured is stored in the thermal walls and floor, while the rest of the heated air is collected at the top of the chimney to be used in space heating directly or as a preheat for the return air.

These two diagrams illustrate the functioning of the solar chimney in both the winter and the summer.

In the diagram on the right, the summer condition is shown. The heat that is built up in the chimney in the summer months aids in the ventilation of the building. As the air is heated and rises, a vacuum is created at the bottom which draws outdoor air in to the rooms and exhausts room air out the top of the chimney. This action is aided by the prevailing breezes as shown.
CONCLUSIONS

The final design of the condominium units seem to satisfy the goals of adaptability and flexibility and the energy criteria of the utilization of the sun and the wind.

What I am the most satisfied about is the development of these units based on solar and wind criteria and the overlay of aesthetics and image. In both plan and section the form of the units respond to these criteria.

What I feel was the major flaw in the design development was the lack of design investigation on the interior of the units. Perhaps if this had been addressed from the beginning of the design development with interior perspectives, models etc., the final design investigation would have seemed more complete.
CHAPTER FOUR

FINAL DESIGNS
This thesis project dealt with some of the most complex issues that an architect could ever deal with. Very seldom does one find, in the practicing profession, the time or the money to delve into the varied and complex issues I have dealt with in this thesis. I have attempted to bring together a broad range of issues in order to create a more balanced design. I am satisfied with the outcome of this design investigation and the knowledge gained during the process.

The most important outcome of this thesis project has been the establishment of a process through which energy, social and environmental issues can be brought together, and utilized to create a more responsive environment.
NOTES

Riverside, Illinois:

Radburn, New Jersey:

Baby Boomers:

George Sterneleib, Demographic Trends and Economic Reality (Center For Urban Policy Research, 1982).

Wind Energy:
Toru Otowa, David A. Schoen, Stephen A. Justham, Indiana Wind Energy (Ball State University, 1982).

Solar Energy:
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