To the Graduate Council:

I am submitting herewith a thesis written by John Daniel Lattimore entitled "Connecting Self-Contained Urban Neighborhoods." I have examined the final paper copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Architecture with a major in Architecture.

Mark Schimmenti, Major Professor

We have read this thesis
and recommend its acceptance:

John McRae

Barbara Klinkhammer

Accepted for the Council:

Vice Chancellor and
Dean of Graduate Studies

Thesis
2006
.L29

CONNECTING SELF-CONTAINED URBAN NEIGHBORHOODS

A Thesis
Presented for the
Master of Architecture Degree
The University of Tennessee, Knoxville

John Daniel Lattimore
August, 2006

DEDICATION

This thesis is dedicated to all the future students that are required to search through past projects in order to formulate some concept of what an architectural thesis includes. Best of luck improving on what you find here.

ACKNOWLEDGMENTS

Without the encouragement and support of my family none of this would have been possible, thank you all. A special thanks to my committee for their help and patience, and to professor Sigismund Sliwinski who teaches for the right reasons, and seeks above all for his students to learn. Lastly, thank you to my classmates for making the last three years worth it.

THESIS STATEMENT

The world today has physical, social, and economic problems that can be solved, at least in part, through architectural design. This thesis argues that designing our neighborhoods with equal weight given to environmental, social, and economic issues can help solve larger global problems. The goal of sustainability can happen if we create neighborhoods that contain basic needs in all these areas for their inhabitants without jeopardizing their necessary connectivity to other neighborhoods and the larger urban fabric.

TABLE OF CONTENTS

Chapter	Page
Chapter 1 Setting the Stage	1
Chapter 2 Site	21
Chapter 3 Program	29
Chapter 4 Precedent Analysis	32
Chapter 5 Design	39
References	48
Vita	52

LIST OF TABLES

Table		Page
1	Service Population	30
2	Entry and Gathering Program	30
3	Children's Program	30
4	General Collections	31
5	Service and Totals	31

LIST OF FIGURES

Figure		Page
1	Burning Amazon Rainforest	1
2	Johannesburg	2
3	Historical New Lanark	4
4	Contained Community	5
5	Town-Country	6
6	Connections	6
7	Letchworth	7
8	Radiant City	8
9	Unite	9
10	Sao Paulo Brazil (megacity)	10
11	Suburban Sprawl	11
12	Trefoil Diagram	14
13	BedZED Exterior	15
14	Room Layout	15
15	Kolding Treatment	16
16	Pyramid	16
17	Metabolism	17
18	Knoxville Aerial	21
19	Site Proximity	21
20	Neighborhoods and Barriers	22
21	Gaps in Street Edge	22
22	Building Site	23
23	Site Emptiness	23
24	Northwest Corner, Site	24
25	Northeast Corner	24
26	Southwest Corner	24
27	Southeast Corner	24
28	Site Emptiness 2	24
29	No Corner Presence	24
30	Pedestrian Possibilities	25
31	Land Use	25
32	Existing Public Space	26
33	Proposed Public Space	26
34	1917 Corner	27
35	2006 Corner	27
36	Proposed Corner	27
37	1917 Site	28
38	2006 Site	28

39	Proposed Site	28
40	BedZED Housing	33
41	BedZED PV's	33
42	BedZED Diagram	34
43	BedZED Diagram 2	34
44	Munster Site	35
45	Munster Interior	35
46	Munster Plaza	36
47	Munster Plan	36
48	Munster Entry	36
49	Delft Site	37
50	Delft Entry	37
51	Delft Night	38
52	Delft Entry 2	38
53	Delft Stacks	38
54	Study Model	39
55	Sketch Plan	39
56	Site Plan	40
57	Ground Floor Plan	41
58	Second Floor Plan	42
59	Third Floor Plan	43
60	Fourth Floor Plan	44
61	Broadway Elevation	45
62	Longitudinal Section	45
63	Central Elevation	46
64	Plaza Elevation	46
65	Cross Section	47
66	Wall Section	47



"We must acknowledge and seek to understand the connection between poverty, social injustice, and environmental degradation...between rootlessness and environmental irresponsibility...between the loss of functional human communities and the inexorable decline in the state of the Earth" (Orr, 2004, p. 89).

Figure 1 Burning Amazon Rainforest
Source: Girardet, p. 121

Chapter 1 Setting the Stage

Environmental problems are no longer inventions of extremists. Ozone depletion, climate change, deforestation, species and biodiversity loss, and pollution are the realities of the modern world. We are just beginning to see the full ecological costs of the Earth's rapid industrialization over the past three centuries. This rapid development, driven almost solely by economics, continues today as many developing nations race to catch up. In a typical day on our planet we will lose 188 square miles of rain forest (figure 1), 40 to 250 species will become extinct, and we will release 2,700 tons of chlorofluorocarbons and 15 million tons of carbon dioxide into the atmosphere (Orr, 2004, p. 7). By year's end we will have lost 24,000 acres of wetland, and in the U.S. alone we will lose 1 million acres of greenfield to urban sprawl, parking lots and roads (Gillam, p. 10). This damage threatens the natural balance of our ecosystems that all living creatures depend on for survival.

The destruction is not limited to the physical environment. Poverty, poor public health, and social unrest are no doubt linked to environmental problems. Consider that in the span of

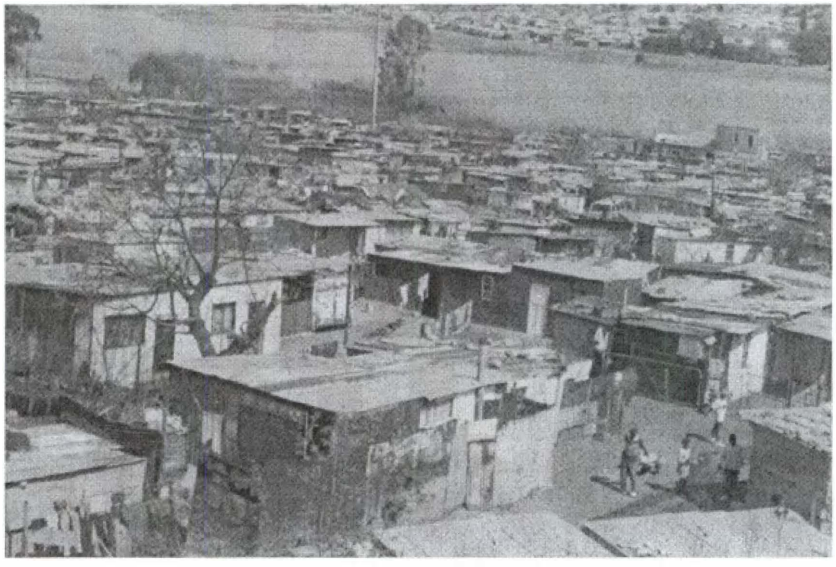


Figure 2 Johannesburg
Source: Girardet, p.101

one day the global population will increase by 250,000 even though 20,000 will die due to factors of extreme poverty. These deaths are largely from treatable diseases such as cholera, typhoid, and TB spread through contaminated water and food sources (Sachs, p. 1). Following the 2002 Earth Summit, the United Nations' Environment and Poverty Initiative stated that "poverty and environmental degradation were earlier seen as a relationship, moving in a downward spiral. The focus was on eradicating poverty, which would, subsequently, address environmental issues. Now with deeper understanding and empirical knowledge, the world view has changed. It is now held that environmental conservation can eradicate poverty" (www.undp.org/pei). Importantly, this makes environmental conservation the focus instead of a fringe benefit. Impoverished areas and shantytowns (figure 2) are not only characterized with poor health, however, they are also considered a stage for international terrorism. According to Secretary of State Colin Powell, "the war against terror is bound up in the war against poverty" (Sachs, p. 11). Therefore, there is great reason to protect and heal the physical environment, and this goes well beyond saving our most pristine natural places as isolated parks and preserves. Human survival depends on understanding that our physical, social, and economic environments are interdependent complex systems that must be equally considered when we look to solve problems of human sustainability. It is our solutions to these problems that specifically involves architecture.

We live on a planet of systems that can no longer be thought of in policy or design as separate. Environmental, social, and economic problems are caused by the human presence on earth, and architecture is concerned with the design of this presence. As William McDonough states, "nature does not have a design problem. People do" (McDonough, p. 16). The way we build our communities and cities and extract resources and food from the earth's surface is a matter of design and planning. Thus, we can view these issues as design problems. This gives us hope because it means they are solvable. "How and how intelligently we weave the human presence into the natural world will reduce or intensify other problems having to due with ethnic conflicts, economics, hunger, political stability, health, and human happiness" (Orr, 2002, p. 15).

This thesis argues for an intelligently designed human presence driven by a sustainable mindset as opposed to the haphazard and destructive habitation that characterizes the majority of our world today. Specifically, this can be accomplished through design in the American context that equally responds to environmental, social, and economic health within self-contained urban neighborhoods. I will investigate Knoxville, TN as a typical American city that is characterized by expansive urban sprawl, and the placeless identity caused by increasing global dependence. To this end it is important to first understand the solutions of architecture, town, and urban planning that have been presented in the past to solve similar issues to those we face today. For the purposes of this document, this history begins with reactions to the Industrial Revolution that quickly and immensely changed the landscape of the Western world.

The 19th Century

The ugliness, unhealthiness, and insecurity of 19th century boom cities in Europe and the United States gave rise to many individual ideas that stand as the foundation to modern town planning and design. Experiments were initiated in urban improvement as some governments, businessmen, and reformers became fearful of slums becoming breeding grounds for revolution, crime, and plague. In 1816, factory owner and social reformer Robert Owen attempted to create a society "without crime, without poverty, with health

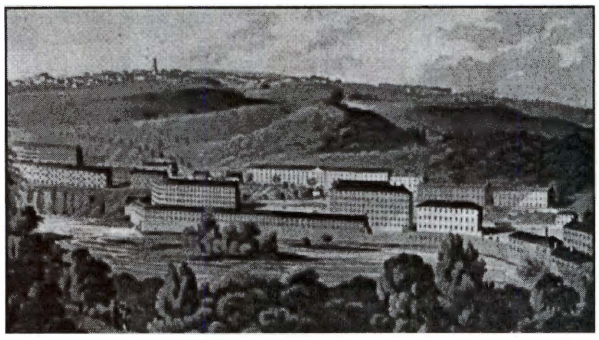


Figure 3 Historical New Lanark
Source: www.newlanark.org

greatly improved, with little if any misery, and with intelligence and happiness increased a hundredfold" (Owen, 1816). The New Lanark community (figure 3) at Owen's cotton mill in central Scotland established an infant school for working mothers, free medical care, comprehensive education, recreation and extensive gardens for the entire community. Owen's ideas about centralized social programs were accomplished by providing program for public, social, and economic health all within the borders of the community. His ideas likely inspired James Silk Buckingham and his plans for the utopian town of Victoria in 1849. Victoria was to unite "the greatest degree of order, symmetry, space, and healthfulness, in the largest supply of air and light, and in the most perfect system of drainage, with the comfort and convenience of all classes" (Buckingham, 1849). For Buckingham this meant building on only one tenth of the allotted land, leaving the rest for an agricultural estate to feed the inhabitants. Here, environmental factors of sunlight, fresh air, and water management were focused on in regards to public health, as well as the inclusion of all social classes for social and economic health. Buckingham's ideas of clustering Victoria's inhabitants into smaller areas for sociability and leaving the majority of the land for agriculture and nature certainly impacted many later designs.

Continuing on this idea of social reform through design was Sir Titus Salt in 1853 with his community of Saltaire. Though it took 20 years to build, Saltaire was a complete town,



Figure 4 Contained Community
Source: Barton 2003, p. 11

including 800 houses for 3000 inhabitants, a school, library, hospital, church, park, and shops. At the center of the community was the textile mill, the largest and most modern in Europe, "designed to minimize pollution and noise" (Girardet, p. 156). Here again the idea of self-contained community is present, and importantly in a human-centered model (figure 4). Saltaire was designed as a closed system, which provided for all basic needs of its inhabitants. This included physical needs of food, water, and shelter, as well as social needs of community and interaction. Economic needs were met by the textile mill, making Saltaire dependent on its survival. An important adaptation to Salt's plans occurred in 1876 with Benjamin Ward Richardson's book, *Hygeia, a City of Health.* Though Hygeia also stressed the importance of fresh air, sunlight and clean water for healthfulness it contrasted Saltaire by removing industrial uses from the town center. Though never built, Hygeia stood as an early example of zoning that had great impact on town planners and designers of the 20th century. It is important to note that the design solutions presented here focused heavily on social welfare and public health often only to the economic benefit of the mill or factory owner, and the health of the physical environment was of little concern beyond anything more than sustaining physical needs and aesthetic values. Nevertheless, these precedents were an important foundation for the 20th century.

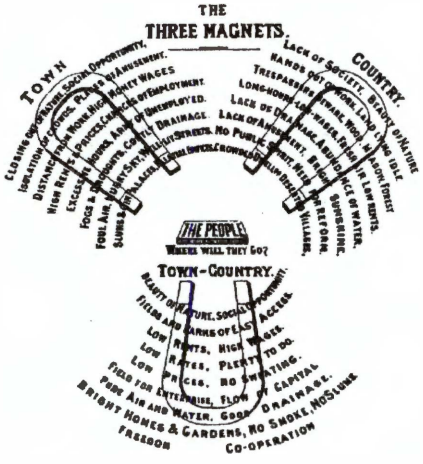


Figure 5 Town-Country
Source: www.letchgardencity.net

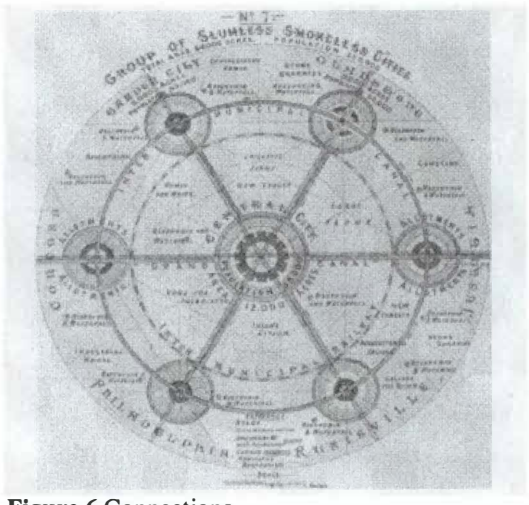


Figure 6 Connections
Source: www.oliviapress.co.uk

The 20th Century

British reformer Ebenezer Howard was arguably the greatest influence of the early 20th century for modern town planning. *Garden Cities of Tomorrow* published in 1902 brought important advances in the planning movement. Howard dealt with the social and environmental ills of industrial cities not by abandoning them for utopias set in the countryside, but instead sought a union of urban and rural form for new and existing cities (figure 5). "Town and country must be married and out of this joyous union will spring new hope, a new life, a new civilization" (Howard, 1902). Howard specifically proposed his garden cities for a maximum of 32,000 inhabitants housed on 1,000 acres with an additional 2,000 inhabitants residing on 5,000 acres of agricultural estate that surrounded the circular town plan. Howard also separated pedestrian streets from vehicular ones, as well as residential and industrial zones much like Richardson's Hygeia. He planned for a new garden city to form as each one filled instead of allowing a sprawling growth. "The town will grow; but it will grow in accordance with a principle which will result in this--that such growth shall not lessen or destroy, but ever add to its social opportunities, to its beauty, to its convenience" (Howard, 1902). Garden cities were to be connected by rail lines allowing different towns to remain as one community (figure 6), and to connect to larger cities such as London. The notion of communities as closed systems is challenged here in theory by Howard, but

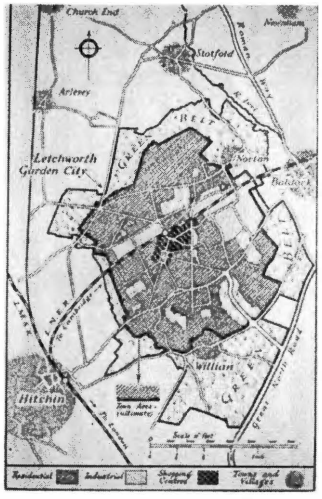


Figure 7 Letchworth
Source: www.letchworthgardencity.net

largely upheld in design as each garden city was to supply the basic needs for its inhabitants. The surrounding agricultural land once again provided food for the inhabitants, and each Garden City contained commercial and recreational opportunity for social interaction and economic stability. But, as is often overlooked, Howard also stipulated that this land be owned by the community as a whole. "But the land around Garden City is, fortunately, not in the hands of private individuals: it is in the hands of the people: and is to be administered, not in the supposed interests of the few, but in the real interests of the whole community" (Howard, 1902). This public responsibility promoted sustainable community as money earned from increasing land value was put back into the community for municipal improvements. Both Garden cities Howard managed to see built continue today as important icons of this movement. For example, the citizens of Letchworth, England (figure 7) still jointly control 5,300 acres including two farms and 118 shops, with all money earned remaining in the community (Girardet, p. 158).

Any discussion of the Garden City Movement and Town Planning theory of the early 20th century is not complete without attention to both Sir Raymond Unwin and Camillo Sitte. Raymond Unwin joined the Garden City Association early in his career as an engineer in 1901. Interested primarily in social welfare and specifically in worker housing, Unwin became the lead designer for Howard at Letchworth in 1904. It was under the mentorship

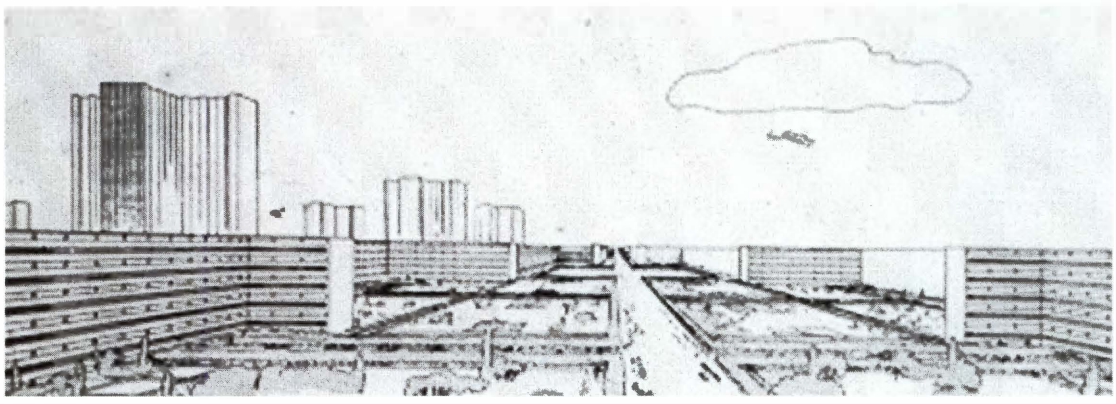


Figure 8 Radiant City
Source: www.morrischia.com

of Howard and simultaneous study of the Austrian planner Camillo Sitte (1843-1903) and his book *The Art of Building Cities* (1889 in German) that Unwin formed his core ideas of town planning that continue to influence urban theory today. Evident in Unwin's later drafts of Letchworth is the influence of Sitte's "thorough study of streets, urban squares, and city patterns of the past" (Wurzer, p. 6). This is especially noticeable in Unwin's treatment of the town center. Here, Unwin explored the irregular and informal qualities that Sitte found so inspiring in medieval towns built for the pedestrian. The importance given to pedestrian scale and a city's walkability by both Sitte and Unwin found opposition as the automobile gained prominence in the middle of the 20th century.

The destruction of World War II brought the opportunity for further expansion in town and city planning. Not only were there still concerns of public health and hygiene from industrial filth, but now there was also a housing shortage. French-Swiss architect Le Corbusier took similar ideas behind Howard's garden cities into the machine age in response to the housing shortage. A strong critic of Sitte, Le Corbusier challenged his ideas as romantic and out of date for the modern city. He claimed Sitte "confounded the picturesque with the conditions vital to the existence of the city" (Le Corbusier, p. 8). Le Corbusier's urban planning (figure 8) was centered around the age of the automobile and celebrated its efficiency of mobility. Thus, the street for Le Corbusier was functional only for motor

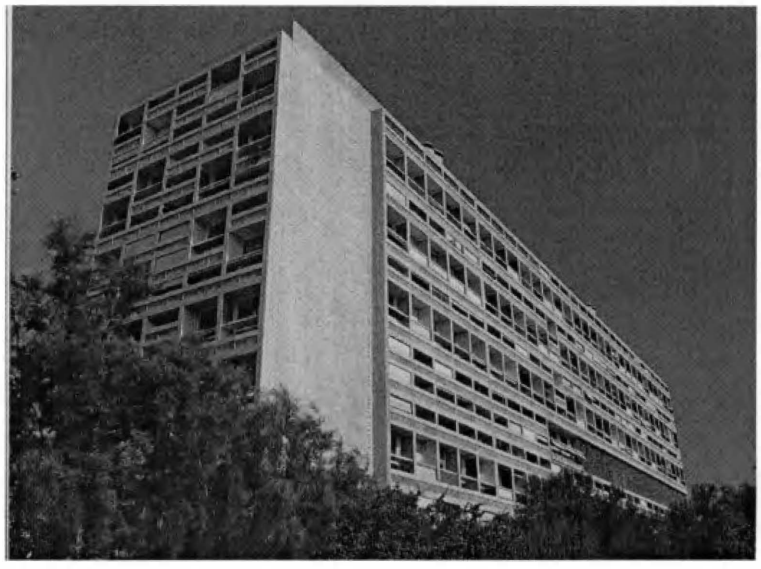


Figure 9 Unite'
Source: Moffet, p.528

transport and speed, as opposed to Sitte's place of social gathering. Le Corbusier's Radiant City plan in 1922 consisted of skyscrapers of concrete and steel that housed some 1,200 people per acre set in "leafy parks." Connecting these "Living Machines" to the city was an elaborate maze of tiered highways for the car. The grand apartment blocks also contained social amenities such as cafes, restaurants, shops and nurseries. Here again we find an attempt to supply basic commercial, and thus social needs within the boundaries of the neighborhood, or building in this case. The Unite` d' Habitation (figure 9) in Marseilles, France is the only portion of the grand plan ever realized in built form. The ferro-concrete structure housed diverse apartments for families of all sizes, each with access to plenty of light and air for reasons of health and hygiene. The imitations that sprang up across Europe and the United States, however, were not as elegantly designed for such needs and often only artificially referred to Le Corbusier's ideas for healthy living. Instead these standardized designs replaced vernacular architecture built for local climates with local materials. They were often poorly built, lacked any form of multi-use functionality, and "tended to become dumping grounds for the less fortunate in society" (Girardet, p. 160). Many such buildings lasted only a few decades as they became characterized by crime, vandalism, and drug use. As the 20th century came to a close it became increasingly obvious to designers that most modernist attempts at urban planning lacked the convivial community that Sitte realized was a basic human need since the beginning of the city. Specifically, the modernist

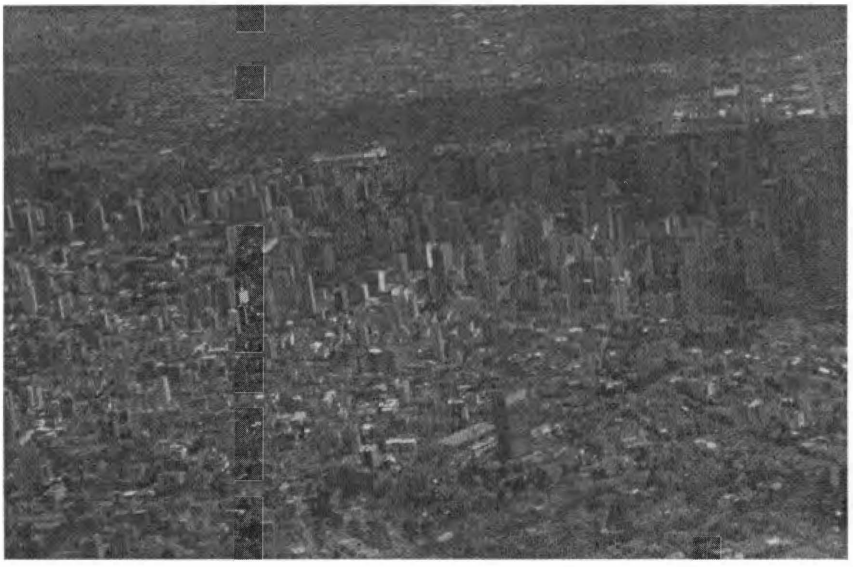


Figure 10 Sao Paulo Brazil (megacity)
Source: Girardet p. 5

attempts, such as Le Corbusier's lacked connection from one concrete block to the next. The challenge for the looming century, however, added the variable of a rapidly increasing urban context.

The 21st Century

"The battle to ensure that our planet remains a hospitable and sustainable home for the human species will be won or lost in the major urban areas." (Maurice Strong, Director, 1992 Rio Earth Summit)

In the last 100 years humanity has largely moved to the city. In 1900, 15 % of the global population of 1.5 billion (225 million people) lived in cities. By 2000, 47 % of the global population of 6 billion (2.8 billion) were city-dwellers. In that span of time, the earth went from four cities of around one million people (Beijing, Tokyo, Delhi, and London) to 200 cities of one million, 100 between one and ten million, and some 20 mega-cities (figure 10) of more than ten million. By 2030, 60 % of the global population, or 4.9 billion people, are expected to live in urban areas (UN, 1999). This new urban landscape only occupies 2 % of the earth's land surface, yet it uses more than 75 % of its resources (Girardet, p. 3). The challenge, then, for the 21st century "is to create a new relationship between cities and nature, while also creating a more equitable relationship between people" (Girardet, 17).

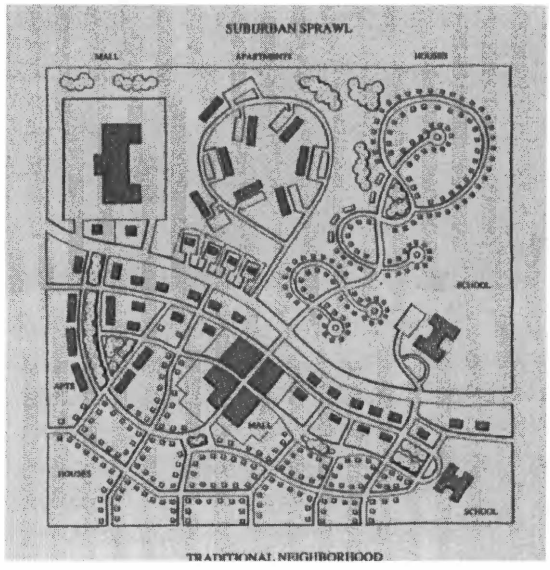


Figure 11 Suburban Sprawl
Source: Katz

Again, the 20th century paid little attention to the environmental health as designs continued to seek solutions to social, economic and public health. The physical environment was still only considered for conservation based on its aesthetic values. The 21st century is now left with inadvertent environmental decline that must be actively answered in new design solutions. "We intended merely to be prosperous and healthy but have inadvertently triggered a mass extinction of other species, spread pollution throughout the world, and triggered climate change—all of which undermines our prosperity and health" (Orr, 14).

Two emerging urban theories have explored a new relationship between the city and nature over the past few decades. The Urban Village theory in Great Britain and New Urbanism in the United States have gained a loyal following of practitioners and acceptance by the public for their adaptation of the historical European village or American town to contemporary urban context. Figure 11 shows the revival toward traditional neighborhood development that the New Urbanists seek, as opposed to the sprawling American landscape. "The alternative to sprawl is simple and timely: neighborhoods of housing, parks, and schools placed within walking distance of shops, civic services, jobs and transit – a modern version of the traditional town" (Calthorpe 1993).

The filth of industrialization still exists and now we are running out of room to escape it.

Sprawl was the default solution that has now created further problems, as people sought the economic and social benefits of the city, and simultaneously the security and openness of the country. The reality of suburbia as a disconnected placeless homogenization has begun to give way to ideas of New Urbanism. In October 1993 the first Congress for the New Urbanism gathered in Alexandria, Virginia to discuss and debate the placelessness of the American landscape created by increasing urban sprawl. By 1996 the fourth Congress met, this time in Charleston, South Carolina to sign the Charter of the New Urbanism. The preamble (in part) for this Charter follows:

"The Congress for the New Urbanism views disinvestment in central cities, the spread of placeless sprawl, increasing separation by race and income, environmental deterioration, loss of agricultural lands and wilderness, and the erosion of society's built heritage as one interrelated community-building challenge...We stand for the restoration of existing urban centers and towns within coherent metropolitan regions, the reconfiguration of sprawling suburbs into communities of real neighborhoods and diverse districts, the conservation of natural environments, and the preservation of our built legacy...We recognize that physical solutions by themselves will not solve social and economic problems..." (Leccese and McCormick)

New Urbanism presents a framework for which social, economic, and physical health can be equally demanded in design. This framework, however, is not enough. Design must go beyond New Urbanism to discover the full potential of the urban neighborhood as a foundation for revitalizing our cities into convivial, sustainable places where people want to live. The urban neighborhood can be designed as a network of self-contained systems supplying environmental, social, and economic health at the greatest potential of our technology. There must, however, remain an interdependency among these neighborhoods that design of the 19th and 20th centuries did not fully account for. The truly sustainable city depends on Jane Jacobs poetic analogy of the city as "an intricate ballet in which the individual dancers and ensembles all have distinctive parts which miraculously reinforce each other and compose an orderly whole" (Jacobs, 117). This balance of environmental, social, and economic health is described in an ecosystem approach.

The Ecosystem Approach

*"The neighborhood is an ecosystem in the sense that it is the essential local habitat for humans, providing not only shelter but also a network of social support and opportunities for a wide range of leisure, cultural, and economic activities. It is also a natural habitat, where humans and other species live in a symbiotic relationship. Physical systems – part natural, part constructed – control energy and water flows, affect soil and air quality, and influence climate" (*Barton, 2003. P. 10).

Ecosystems: The complex of an ecological community and its environment functioning in nature.

Ecology: A branch of science concerned with the relationships between organisms and their environment. (Merriam Webster Dictionary)

These dependent, ecological relationships are described by William McDonough in his notion that in nature waste equals food.

"Nature operates according to a system of nutrients and metabolisms in which there is no such thing as waste. A cherry tree makes many blossoms and fruit to (perhaps) germinate and grow. That is why the tree blooms. But the extra blossoms are far from useless. They fall to the ground, decompose, feed various organisms and microorganisms, and enrich the soil" (McDonough, p. 92).

Therefore our communities and neighborhoods can be viewed as complex systems of interaction between people and nature, with each dependent on the other for survival. As Herbert Girardet poetically put it, "ecology is the science of home making" (Girardet, p. 6).

In order for an ecosystem to be considered healthy all members of that system must be healthy. In terms of neighborhoods this means that physical, social and economic systems must have an equitable relationship for continued sustenance (figure 12).

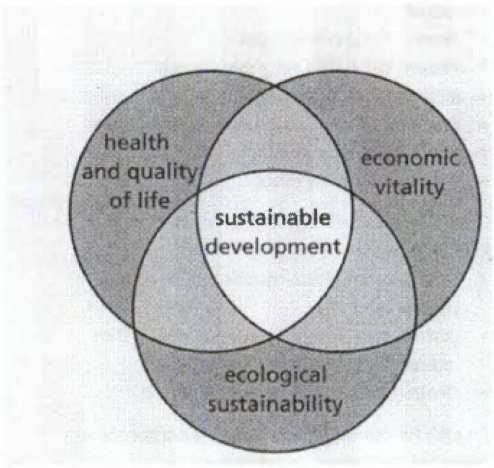


Figure 12 Trefoil Diagram
Source: Barton 2003, p. 7

Physical Environment

Physical environmental health must be promoted in design at the same priority as social and economic health. This means that environmental health must be questioned at every level of design. This involves more than reducing car dependency through neighborhood layout as New Urbanism seeks to do. We need to ask how we can promote environmental healing and production, not just how we can be "less bad," as William McDonough put it. Technology and knowledge exists specifically in the areas of energy, water, waste, and food production for urban neighborhoods to become less globally dependent and thus move toward a network of self-contained systems.

Energy

Specific to the physical environment, neighborhood and building design should incorporate systems for energy, water, waste, and food, with consideration also given to materials and climate. Buildings can be designed to produce clean energy from renewable resources such as the sun, wind, or earth. Likewise, they should be sited to take advantage of passive heating and cooling. This in turn will reduce dependence on fossil fuels and central utility companies. This is significant considering that buildings are responsible for nearly 45 % of

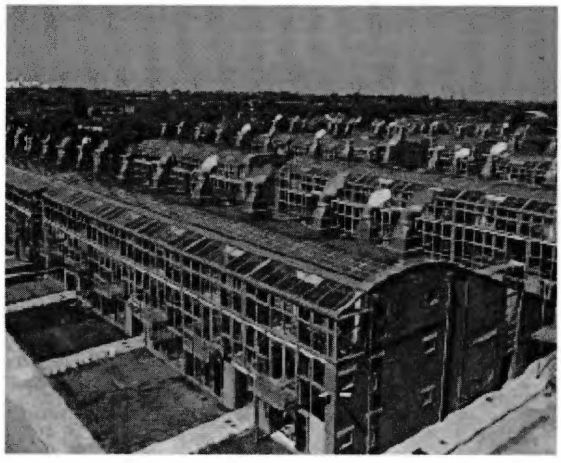


Figure 13 BedZED Exterior
Source: www.bedzed.org



Figure 14 Room Layout
Source: www.bedzed.org

the energy used in the United States, which uses almost one third of all energy used in the world (Coates, p. 5). Energy has been a specific concern for architect Bill Dunster and the inhabitants of his Beddington Zero Energy Development (figures 13 &14) in Sutton, England. BedZED's philosophy involves energy efficiency at every level of design. Building orientation is used for passive heating strategies and Photovoltaic efficiency. Vehicles are discouraged with live/work apartments, a public electric car pool, and proximity to public transport and communal amenities. Building materials are largely recycled or local, and appliances and lighting meet the highest standards of energy efficiency. BedZED stands as an example of actively pursuing environmental health at the neighborhood scale far beyond designing for less automobile dependence.

Water

Increasing demand (mostly in urban areas) and inappropriate methods of disposal threaten the natural water cycle. Neighborhoods and the buildings within them can be designed to treat and reuse water much more effectively, again lessening dependency on centralized systems and the energy embodied in running them. White water (piped from utilities) can be recycled as grey water after use in cooking and bathing to be used in toilets, yard watering, and car washing. Likewise, water trapped from roofs can also be used for grey water

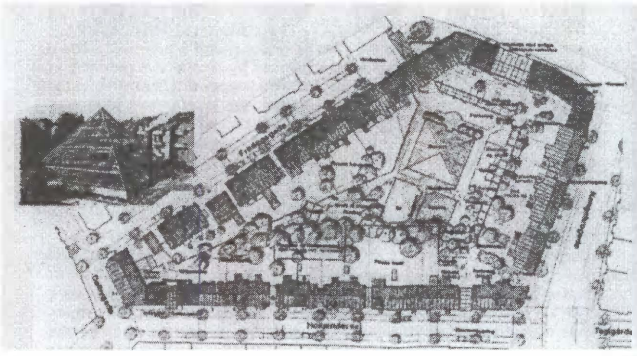


Figure 15 Kolding Treatment
Source: www.cf.ac.uk

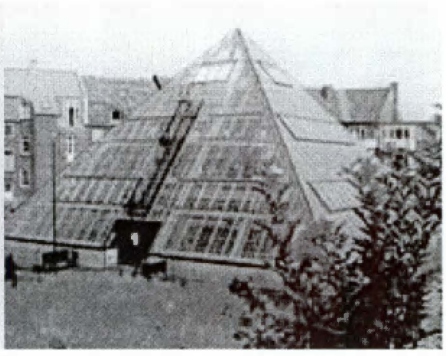


Figure 16 Pyramid
Source: www.cf.ac.uk

needs. Water treatment can also take place at the neighborhood scale through reed beds, algae ponds, and other biological treatment. Beyond reuse, waterless or dual-flush toilets, water-efficient appliances, and creating permeable surfaces can aid the water cycle at the building scale.

Water has been effectively dealt with on both the neighborhood and building scale in the Kolding, Denmark Ecological Renewal Program (figure 15). The first of many blocks to be redesigned for ecological concerns consists of 40 three-story houses, 129 apartments, and six businesses all with urban street presence. The middle of the block is occupied by the pyramidal bioworks greenhouse (figure 16), a pond/algae system for treating wastewater to reusable grey water. Half of the houses use collected rainwater for toilet-flushing as well. Kolding has also enjoyed success in solar energy production, passive solar heating, and community interaction due to newly provided public and commercial space.

Waste

Until we design all our products as truly biodegradable or recyclable, there will always be waste. In the self-contained neighborhood, the goal is to reduce the amount of waste. As stated earlier, cities consume more than three quarters of the earth's resources. Therefore,

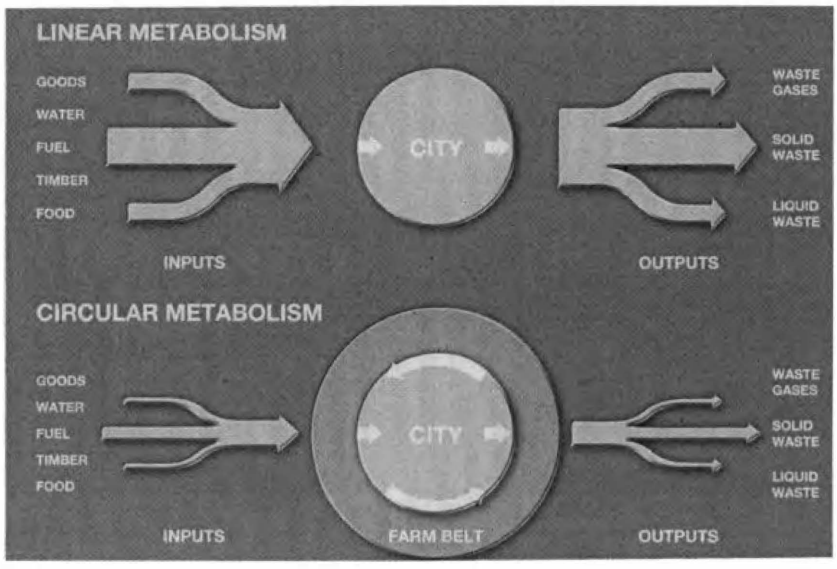


Figure 17 Metabolism
Source: Girardet, 105

we can significantly impact environmental health by viewing urban metabolism in as a circular system characterized by reuse and recycling (figure17). The diagram above exemplifies a city built of self-contained neighborhoods. In concept this includes the materials we build out of and the lifespan we build for. Constructing with green roofs, rammed earth, adobe, stone, or other uncontaminated materials reduces waste that must be treated. Design should also account for local materials that make sense according to embodied transport energy and local climate. Lifespan can also reduce waste by designing buildings for flexible use to reduce the possibility of tear down as uses change. Lastly, organic waste can also be composted at the building or neighborhood scale instead of being sent to landfills. Again, there is existing technology to accomplish huge reductions in waste from the scale of the individual to the neighborhood.

Food

Self-contained systems for food come in two forms: agriculture and the neighborhood market. Community urban farming benefits the physical and social environment in many ways. First, the food produced can at the very least supplement family fruit and vegetable needs. This in turn reduces energy use that is hidden in the transport of much of the American food supply. For example, in the United States food typically travels between 1,500 and 2,500

miles from farm to plate, as much as 25 % further than it did in 1980 (Orr, 2002, p. 27). Furthermore, community gardens create interaction between neighbors, as well as creating permeable green space that can add to water cycle health. The community market, on the other hand, provides jobs for local inhabitants, reduces the dependence on the automobile and thus fossil fuels if it is within walking distance, and again fosters community interaction that leads to convivial, secure neighborhoods. This exemplifies the overlap of physical, social, and economic systems at work in a sustainable neighborhood.

Social Environment

Designing the traditional town in a contemporary context is the method used by New Urbanists to revive our social environments. Andres Duany and Elizabeth Plater-Zyberk have specifically dealt with neighborhood design. Duany and Plater-Zyberk design neighborhoods that contain a strong civic core, or center, and definable edges generally made with transportation lines or greenbelts that are within a quarter mile walking distance of the center. They incorporate diversity of use and economics, pedestrian scale, positive public space, and a network of interconnecting streets for the car as well. Again, it is within the framework of New Urbanism that social systems contained within each neighborhood can thrive.

Neighborhood safety, or security, along with education concerns are two main criteria that people use to choose where they live in the United States. Security, however, must be accomplished before education can thrive. This can be accomplished in urban neighborhoods with street and sidewalks that promote security and simultaneously the convivial community interaction that humans seek. The well known city promoter, Jane Jacobs specifically calls for "eyes on the street" (Jacobs, 116). This is done, according to Jacobs, by building design that does not turn its back to the street. Jacobs further calls for a clear demarcation between public and private space on the street, and a good mix of uses for all times of the day to promote sidewalk traffic (Jacobs 116). Specifically, creating stoops, porches, window seats, and benches creates a place for eyes to watch that is close to the street, but still separate from the public. Likewise, it is important to create a community of activity that

people want to watch. This keeps the need for and presence of outside help such as police out of the equation. Community safety is fostered when neighbors interact with each other, thus increasing their awareness of foreigners to the community.

Secondly, people seek interaction and inclusion in community. Neighborhoods can incorporate places of worship, recreation, shopping, working, and schooling, as opposed to only dwelling. This allows for neighbors to interact and thus create community without depending on the automobile to take them outside the neighborhood for these needs. This social self-containment is sought after in traditional neighborhood development because active neighborhoods are also sustainable neighborhoods. "People's love of watching activity and other people is constantly evident in cities everywhere" (Jacobs, 117).

Economic Environment

Economics are closely tied to both the social and physical environment. Incorporating self-containment into the economic environment can be done by creating employment opportunities and supplying community owned land. Neighborhoods should supply basic commercial needs to their inhabitants; this not only creates community interaction, but also supplies employment. Here again, each neighborhood should be thought of as a small town, supplying for all the community needs. Adjacent neighborhoods can share commercial zones to supply enough traffic for economic stability, but this requires strong connectivity and easy pedestrian access. This in turn, however, can enhance interaction.

Community owned land, such as that called for by Ebenezer Howard, creates a responsibility shared by all to the continued health of the community as a whole. This concept negates the need for outsiders to decide on use and care of this land. Construction and funding of projects for this land are supplied by social capital and community collection. For Howard this was agricultural land, but in this could also be extended to parks and water and waste treatment facilities. Here again the Kolding Denmark Ecological renewal program is a good example. The sales of plants produced through the community greenhouse pays the salary of the full-time treatment facility technicians. This interdependence increases com-

munity knowledge, responsibility, and ultimately sustainability.

Implementation

"For many decades, architectural educators and practitioners have observed with increasing alarm the decline in significance of architectural work. Especially acute is the diminishment of architecture's power for social and cultural transformation...Our profession, verging on irrelevance, has reached a critical juncture." --Frances Bronet

Building self-contained urban neighborhoods that strive for physical, social, and economic sustainability can give architecture a new relevance. Considering that 98% of new home-buyers do not work directly with an architect (Bell, p. 1) and that in the next 50 years the world is expected to build more homes than it has in the last 5,000 (Coates, p. 5), architects have a responsibility as stewards of the built environment to take a more proactive role. In our mobile society traditional architecture does not meet the need. As people move from city to city seeking better economic lives, they need housing at a faster rate than architects provide. People do not have time to buy land, hire an architect, and wait for their home. They have no alternative to the cookie-cutter house and neighborhood because they need a yard for the dog, good schools for their kids, and safety for their family. Architects must present an alternative; we must design and build for the faceless client if we truly desire to change the physical, social, and economic future. "When given the opportunity, people choose something other than that which they are typically offered in most one-size-fits-all designs: the strip, the subdivision, the mall. People want diversity because it brings them more pleasure and delight" (McDonough, p. 91).

For Duany and many other New Urbanists implementation begins with rethinking, and ultimately rewriting our zoning codes. Existing zoning codes are often contradictory to traditional neighborhood development that no longer needs outdated separation of commercial, industrial and dwelling that arose from industrialization. In fact, it is the need for inclusion that self-contained urban neighborhoods seek. The following project will attempt to rewrite local zoning to promote environmental, social, and economic health in an urban neighborhood in Knoxville, TN.

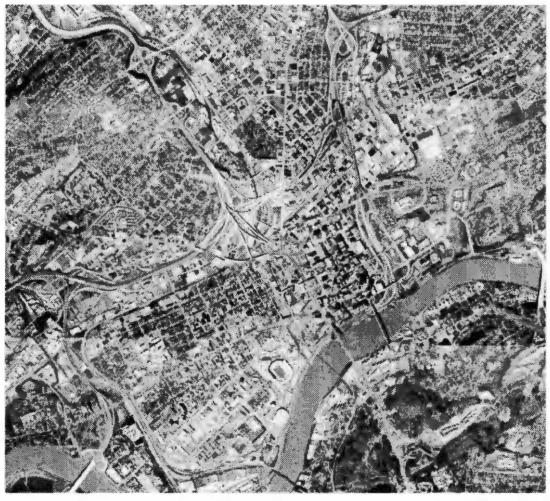


Figure 18 Knoxville Aerial (Author)

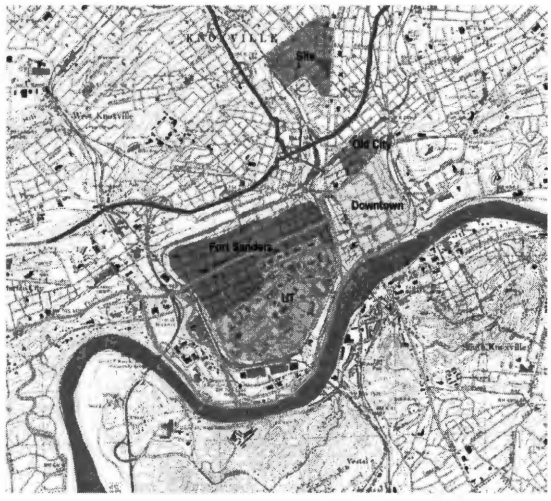


Figure 19 Site Proximity (Author)

Chapter **Site**

2

Physical Environment

Knoxville (figures 18 & 19) is located in the Appalachian Climate Zone. Neighbored by the Cumberland Mountains to the northeast and the Smoky Mountains to the southwest, Knoxville enjoys a temperate climate. Summers are warm and humid, winters are mild with average lows between 29-32F. Spring and fall are generally long and pleasant allowing many days with no need for extra heating and cooling. Rainfall averages 50 inches/year and snowfall around 10 inches/year, making water catchment a design emphasis. The sky is generally overcast, but there is sufficient sunlight for passive heating in cool months. Prevailing wind direction fluctuates between the southwest and northeast. Wind speed, however, is always greater than 5 mph giving the ability to cool in warm temperatures, but also the need to protect building in winter.

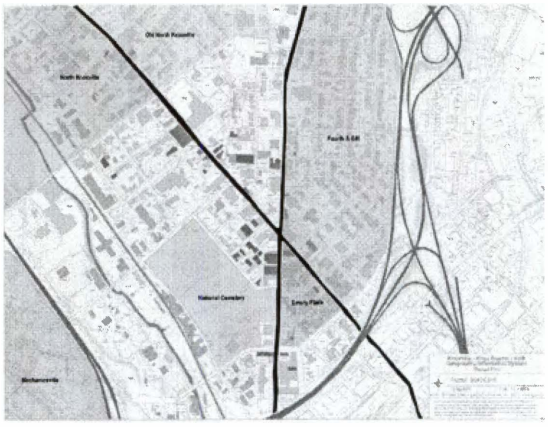


Figure 20 Neighborhoods and Barriers (Author)



Figure 21 Gaps in Street Edge (Author)

Social Environment

The city of Knoxville is currently undergoing a renewed interest in its downtown neighborhood, similar to many cities across the country. The goal is to return the once vibrant and convivial downtown community to its earlier prominence as a destination for dwelling as well as commerce. Many new residential units have been added in recent years to attract 24-hour participation in the area. A new movie theater and city bus transit center are currently in the design phase as are many new retail spaces. The Old City Entertainment District and the revived Market Square have experienced new life as the downtown residential population has steadily grown. More attention has also recently been given to Knoxville's inner-ring neighborhoods, though most of this attention has been from the not-for-profit sector. This thesis is specifically concerned with the redesign of an inner-ring area, and its development into a self-sufficient neighborhood.

The area surrounding the intersection of Central and Broadway, adjacent to the thriving 4th and Gill neighborhood, the Old City Entertainment District, Old North Knoxville, and the revived Mechanicsville neighborhood is the focus for this thesis (figures 20 & 21). This area is within a 10-15 walk of downtown, and will be within a 5 minute walk of the proposed extension to the Knoxville greenway system. The specific site for the building



Figure 22 Building Site (Author)



Figure 23 Site Emptiness (Author)

project will be the northwest corner of the Central and Broadway intersection. This site is the only corner of the four without a good urban street presence. The site is currently occupied by a one-story bank and a surface parking lot in front (figure 22). Behind the existing bank are various commercial and industrial properties and vacancies (figure 23). The site is on the eastern edge of the proposed neighborhood, but can solidify a commercial core that already exists on the other corners (figures 24-27) and between the surrounding neighborhoods.

Economic Environment

The specific site and its surrounding context is mostly zoned as commercial property, with residential zones separated into the 4th and Gill, Mechanicsville, and Old North Knoxville neighborhoods. I will propose a change in zoning ordinances to allow commercial and residential, as well as public open space to exist within this neighborhood in a cohesive pattern as opposed to their condition of separation that has created the current desolation of the site (figures 28 & 29).



Figure 24 Northwest Corner, Site (Author)



Figure 25 Northeast Corner (Author)



Figure 26 Southwest Corner (Author)



Figure 27 Southeast Corner (Author)



Figure 28 Site Emptiness 2 (Author)



Figure 29 No Corner Presence (Author)

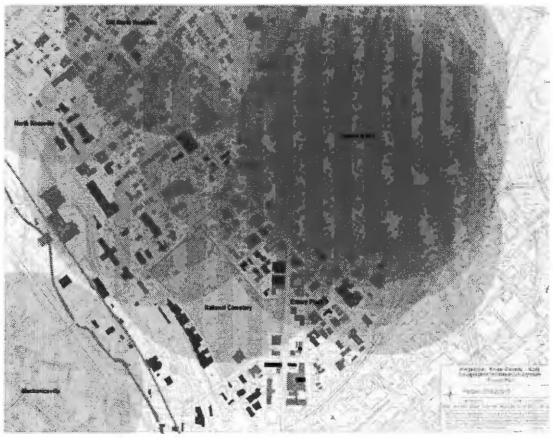


Figure 30 Pedestrian Possibilities (Author)

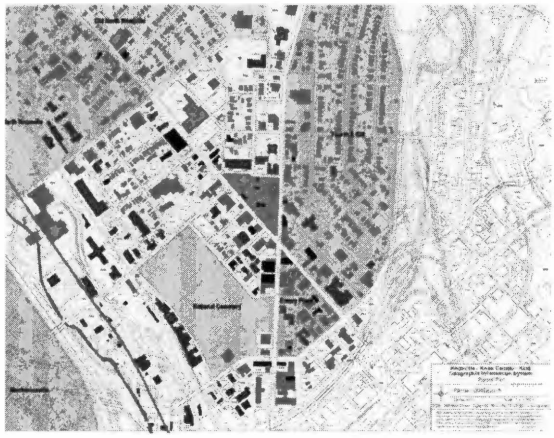


Figure 31 Land Use (Author)

Lessons from Site Analysis

Diagrams such as those shown in figures 30 and 31 helped determine the significant pedestrian zones and possible programming needs of the area. The once active commercial street edges of Central and Broadway are no longer associated with a surrounding neighborhood density. The design project attempts to regain this density and graining within the site to act as a catalyst for the larger surrounding blocks. There are three specific motivations for the design project that came from the site analysis. The first intention is to activate the existing public space and expand and connect that space. Currently the surrounding neighborhoods have a few small playgrounds that are inadequate and unconnected. The National Cemetery acts as the only large green space for the neighborhoods. Figures 32 and 33 show the design intentions to expand and add public outdoor space to the site. The second motivation for design is to once again hold the corner of the intersection with built structure much like the other three corners, this is shown in figures 34-36. Lastly, The site design is intended to help re-establish a neighborhood density on the site as mentioned above. Figures 37-39 show the historical patterns that the design can help to bring back, which in turn can help activate pedestrian movement.

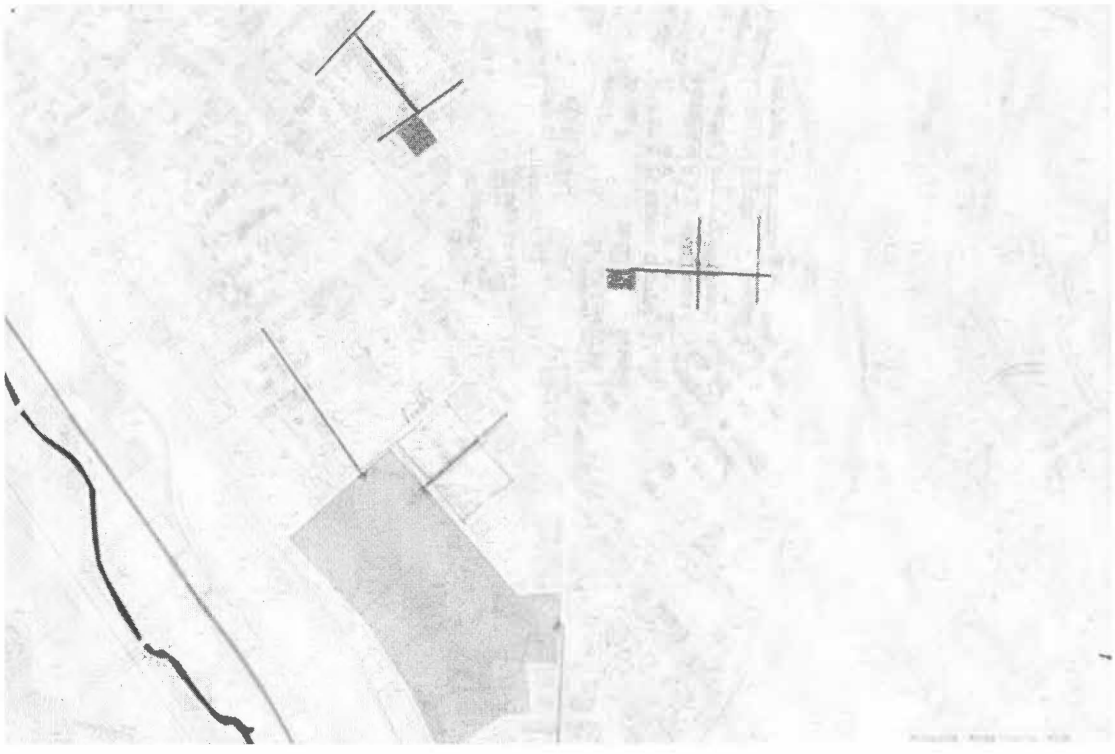


Figure 32 Existing Public Space (Author)



Figure 33 Proposed Public Space (Author)

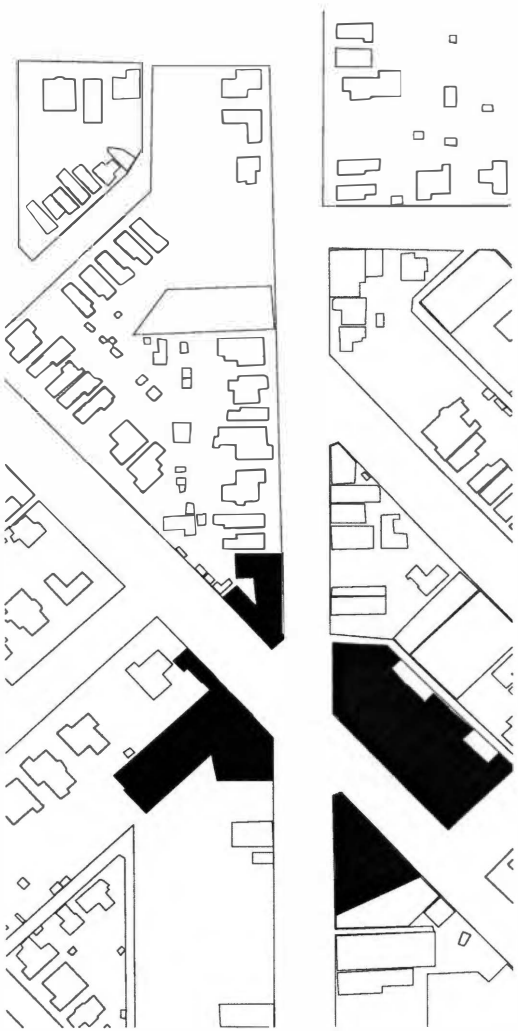


Figure 34 1917 Corner (Author)

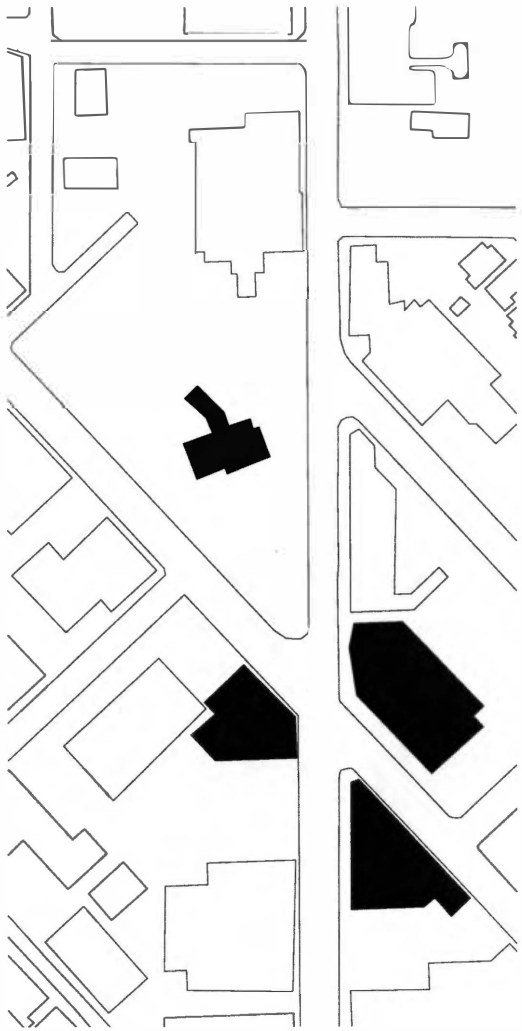


Figure 35 2006 Corner (Author)

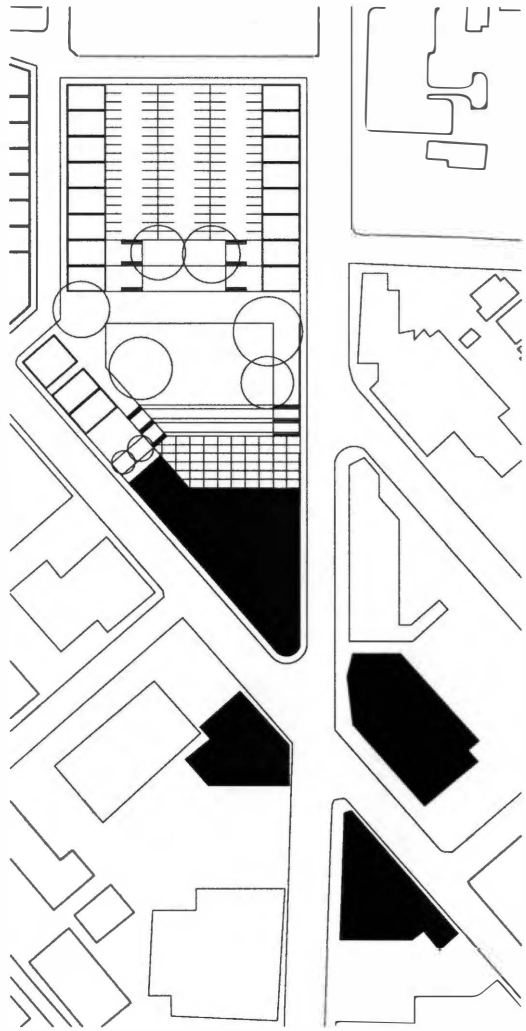


Figure 36 Proposed Corner (Author)



Figure 37 1917 Site (Author)



Figure 38 2006 Site (Author)



Figure 39 Proposed Site (Author)

Chapter **Program**

3

As argued above, the neighborhood program should include physical, social, and economic needs. Program for a self-contained neighborhood should therefore include space for dwelling, recreating, shopping, working, worshipping, and relaxing. The intent of this thesis project is to create a connection between the existing neighborhoods through program that is lacking in all, and with the new additions future development can fill in gaps not addressed in this specific design. This project, however, will concentrate on indoor and outdoor public space that can be shared by all of the surrounding community. The program of a community library with meeting space for various local groups will serve to create a space of gathering and interaction that is a key component to creating sustainable community. Space is delegated in the urban design proposal for new housing, retail, and open space, but the specific building site will house the library and a public plaza with greenscape. The library size and program is based on figures derived from extensive study on surrounding demographics and community needs.

The program components of the library are important to the design concepts. The quiet and more private library program of the stacks, and reading spaces are viewed as a separate piece to the more open, noisy public gathering space with cafe, browsing, and breakout space from the auditorium. This space is considered a continuation of the public plaza. These spaces, though conceptually separate are connected and dependent on each other in various ways much like the neighborhoods they represent. These concepts are discussed further in chapter five. A quantitative program analysis follows in tables 1-5.

Table 1 Service Population (Author)

Service Population	Adults	Children	Elderly
Site/ South 4th & Gill	1,270	250	76
Old North/ N 4th & Gill	1,904	557	264
Mechanicsville	1,382	420	191
North Knoxville	3,538	666	570
Totals	**8,094**	**1893**	**1101**

Table 2 Entry and Gathering Program (Author)

No.	Area	Capacity	SF	Notes
1	Entry Lobby	20	100	5 sf per person
1	Circulation Desk	2	150	75 sf per person
1	Workroom	3	150	50 sf per person
2	Lecture rooms	20	1,000	25 sf per person
1	Auditorium	150	1,800	10 sf per person +stage/props
1	Cafe	30	750	20 sf per person
1	Copy Center		80	40 sf each
	Total SF		**4,030**	

Table 3 Children's Program (Author)

No.	Area	Capacity	SF	Notes
1	Children's collection		800	4 volumes per person
1	Reading room	20	200	10 sf per person
1	Help Desk	1	100	100 sf per person
1	Work room	2	100	50 sf per person
	Total SF		**1,200**	

Table 4 General Collections (Author)

No.	Area	Capacity	SF	Notes
1	Help desk	1	100	100 sf per person
1	General Collections		6,000	6 volumes per person
1	Non-print collection		3,000	3 volumes per person
1	Periodicals collection		160	9 volumes per 1,000 people
1	Public computer space		600	15 terminals @ 40 sf each
1	Access station space		375	5 stations @ 75 sf each
1	Reading room		3,000	10 seats per 1,000 users
1	Microfilm space		105	3 stations @35 sf each
1	Quiet room	4	100	25 sf per person
1	Work room	3	150	50 sf per person
	Total SF		**13,590**	

Table 5 Service and Totals (Author)

No.	Area	Capacity	SF	Notes
1	Loading Dock		250	
1	Maintenance office	3	150	50 sf per person
3	Storage room		300	
1	Kitchenette		100	
1	Server room		120	
2	Bathrooms		600	
	Total SF		**1,520**	
	Total Library SF		**20,340**	
	Mechanical, walls, etc		**7,119**	35% of gross
	Gross SF		**27,459**	

Chapter 4 **Precedent Analysis**

Beddington Zero (Fossil Fuel) Energy Development
Sutton, England

BedZED, as it is commonly called, is the first large-scale carbon neutral (no addition of CO2 to the atmosphere) community to be built in the world (figure 40). The community, built on the site of an old waste treatment facility, consists of 100 live/work units for both sale and rent, a childcare facility, and open green space and private gardens. Designed by architect Bill Dunster, BedZED attempts to be bring sustainable development into every aspect of the scheme. Its goal is to be a beacon for more and more communities that strive to meet housing demand, yet not destroy the environment in the process. It stands as an example of an "eco-friendly" lifestyle, and hopes to show that this is "easy, affordable and attractive" (bedzed.org).

Specifically, BedZED has a three-prong approach to achieving carbon-neutrality. Their first approach is through transportation. The live/work approach takes vehicle-dependent commuting out of the equation. The community is planning more on-site facilities for daily needs, and is within safe walking distance to railway, bus, and tramlink. BedZED is also connected to the Sutton cycling path. The 10 year plan is to produce enough energy from rooftop photovoltaics to power 40 electric cars that can be shared by the community. Street design is done with the goal of keeping vehicles to a walking speed, with well-lit, generous sidewalks to promote pedestrian traffic.

The second approach is through energy consumption. BedZED's zero energy goal is to not use more energy than it produces. Layout, materials, and heating supply all reflect this goal. Large south facing PV roof panels (figure 41) and glazed solariums take full benefit of solar energy. Natural, recycled, and reclaimed materials are used whenever possible. Mate-



Figure 40 BedZED Housing
Source: www.bedzed.org.uk



Figure 41 BedZED PV's
Source: www.bedzed.org.uk

rial transport is kept to a strict 35-mile radius to reduce embodied energy, and retain local identity. Energy efficiency is also supplied by triple-glazed windows and energy-saving appliances and lighting. All BedZED's heat and electricity comes from a combined heat and power unit fuelled by waste timber, a biomass fuel. This biomass has no carbon emissions and saves the waste from taking up landfill space.

Lastly, BedZED is concerned with water conservation. The community seeks to cut household water main use by a third compared to typically English homes. This is accomplished in many ways. First, water-efficient appliances such as washing machines and dual-flush toilets are used. BedZED also uses rainwater for an estimated 18% of water needs. This water is trapped from the roof and porous parking surfaces, funneled into underground tanks, and used along with recycled main water for toilet-flushing. Highly visible water meters are present in each kitchen to promote conservation as well. Waste water is treated on site by a small scale sewage treatment known as the "Living Machine." This biologically based system extracts nutrients for plant food and treats the water to a grey water standard for toilet-flushing. This approach is further explained in figures 42 and 43.

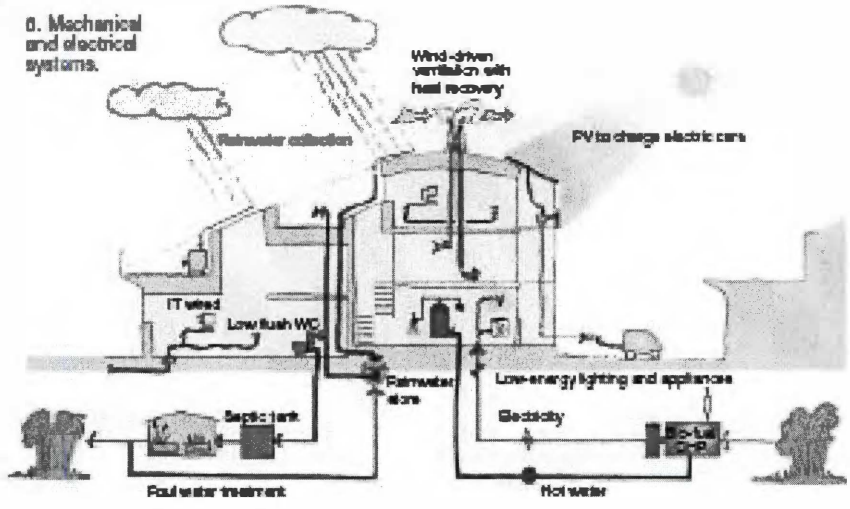


Figure 42 BedZED Diagram
Source: www.bedzed.org.uk

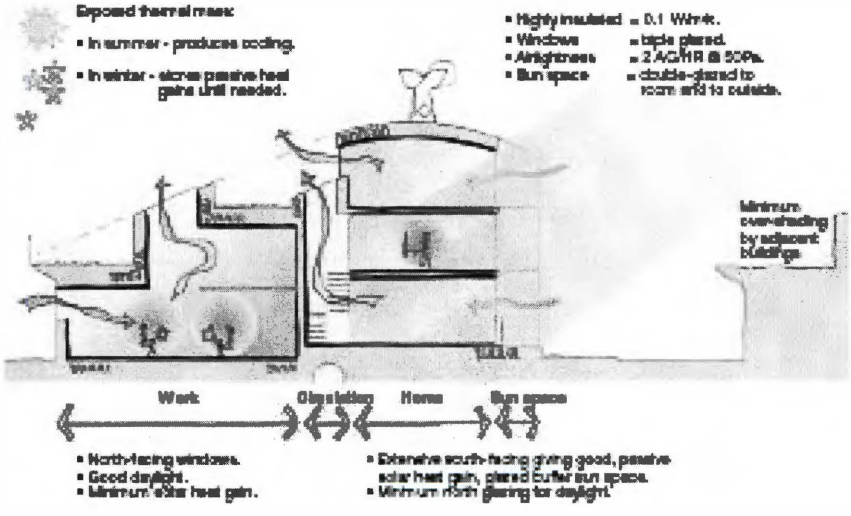


Figure 43 BedZED Diagram 2
Source: www.bedzed.org.uk

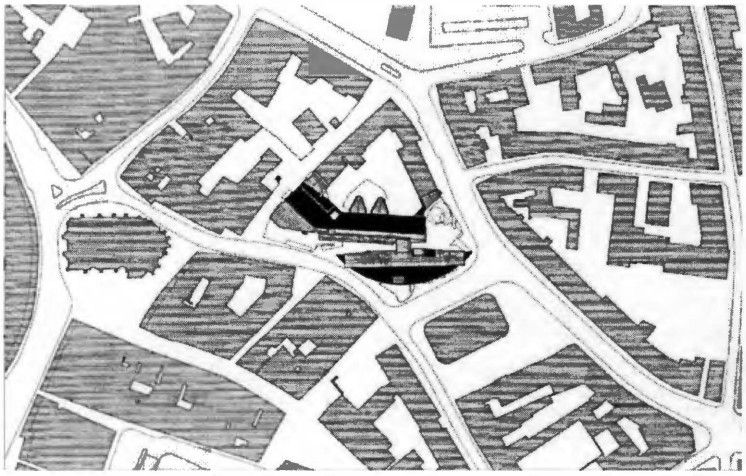


Figure 44 Munster Site
Source: www.bolles-wilson.com

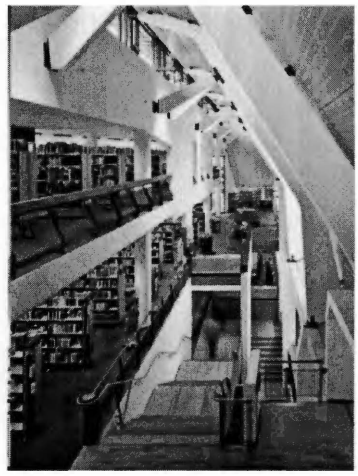


Figure 45 Munster Interior
Source: www.bolles-wilson.com

Munster Municipal Library 1993

Munster, Germany

Bolles, Wilson & Partner

The Munster Municipal Library was Bolles + Wilson's first major public commission. The project split the mass of the library to allow for a pedestrian street to carry through the site, bringing more life to the library site.

The Munster Municipal Library was an important precedent for the design project for two major reasons. First, the project was used for program analysis to determine correct program parts and sizing as it also serves a relatively small user population. Secondly, the Munster Library is sited on a corner lot in an urban condition. The library allows for the public plaza area to proceed through the site and allow passageway for pedestrian movement. Figures 44-48 show the site and building characteristics.



Figure 46 Munster Plaza
Source: www.bolles-wilson.com

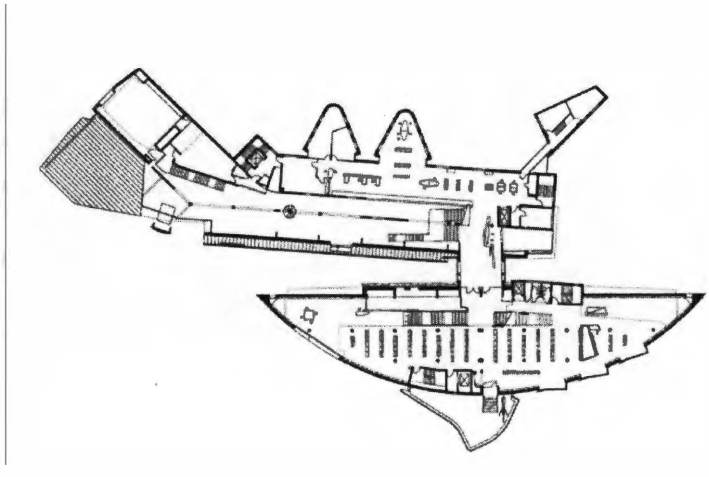


Figure 47 Munster Plan
Source: www.bolles-wilson.com

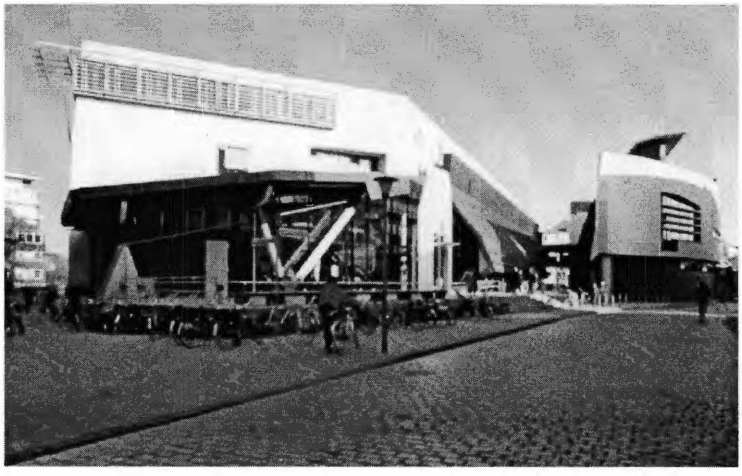


Figure 48 Munster Entry
Source: www.bolles-wilson.com



Figure 49 Delft Site
Source: www.mecanoo.nl



Figure 50 Delft Entry
Source: www.mecanoo.nl

Delft Technical University Library 1998

Delft, Netherlands

Mecanoo Architecten

The Delft Technical University Library was used as a design precedent because of its careful use of the site. This Library was specifically designed to allow the landscape to come into the building site by having the landscape take over the roof (figure 49). My design did not use the roof as landscape to this extent, but was concerned with allowing the landscape to penetrate the building to give a more open access to the often closed program of a library. The delft project also separated the stacks from the grander reading space. This idea became an integral part to my design in order to separate program, and connect it through structure and circulation. The exterior and interior images of the delft project (figures 50-53) show the scale and character of its space.

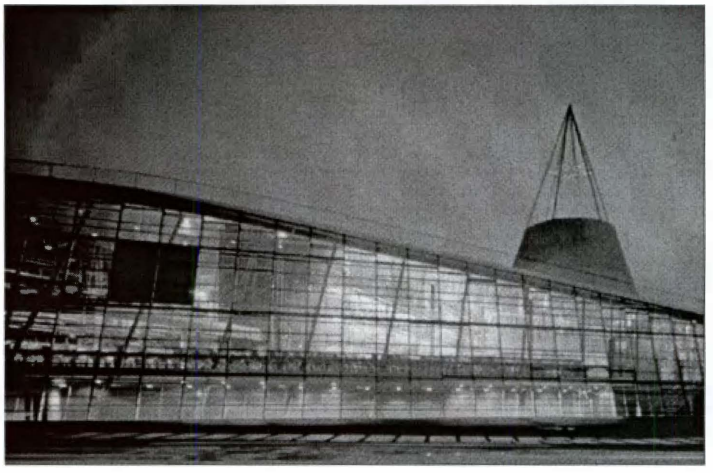


Figure 51 Delft Night
Source: www.mecanoo.nl

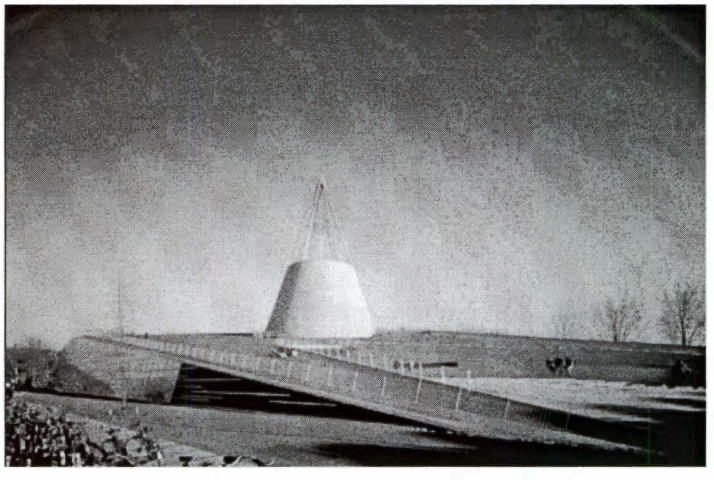


Figure 52 Delft Entry 2
Source: www.mecanoo.nl



Figure 53 Delft Stacks
Source: www.mecanoo.nl

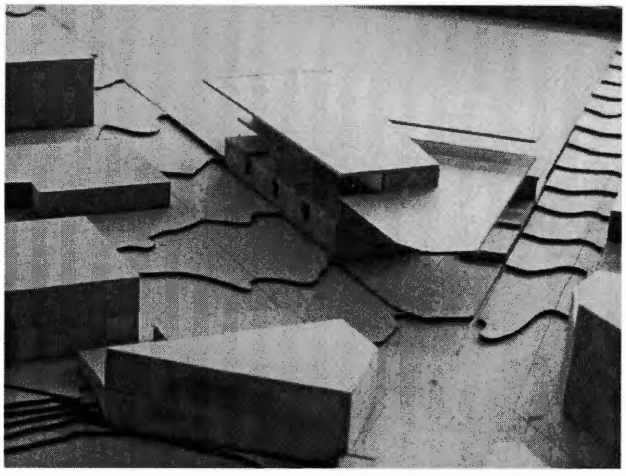


Figure 54 Study Model (Author)

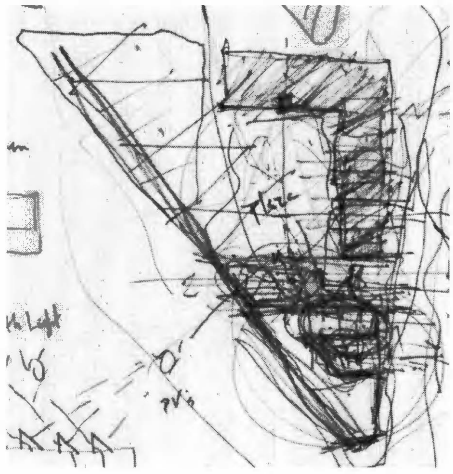


Figure 55 Sketch Plan (Author)

Chapter 5 Design

The Library design is meant to show that the public and private program within the library can act as separate pieces, but must depend on each other to form a complete building (figures 54-55). The library needs the public component because of its site in the middle of the four neighborhoods, though most branch libraries do not include such an extensive plaza and public indoor space. These pieces were thought of as separate but interdependent throughout the design. The public component is composed as a glass box enclosing the landscape of the continuous plaza. This piece is structured with round steel members and open web joists or trusses. The private component has a stone facade for the first two stories and is structured with square concrete columns to reinforce the different character of the stacks and reading space. Though these components are structured differently, their structures connect over the major circulation zone. They also share a similar rhythm on the facade and roof structure to further reinforce their dependence on one another, much in the same way a sustainable community and city is dependent on neighborhoods that interact and share space and program. The library design is shown in figures 56-66.

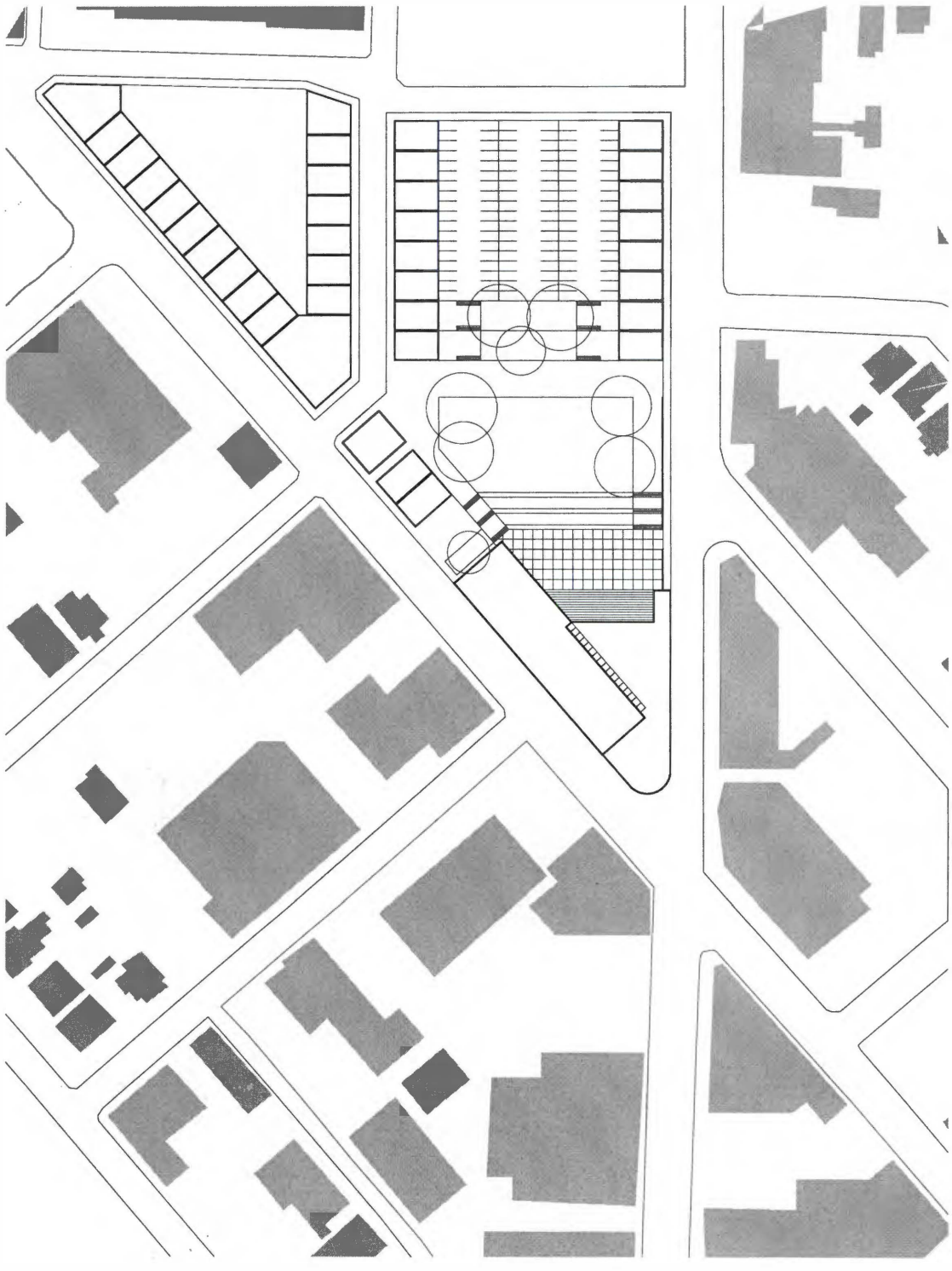


Figure 56 Site Plan (Author)

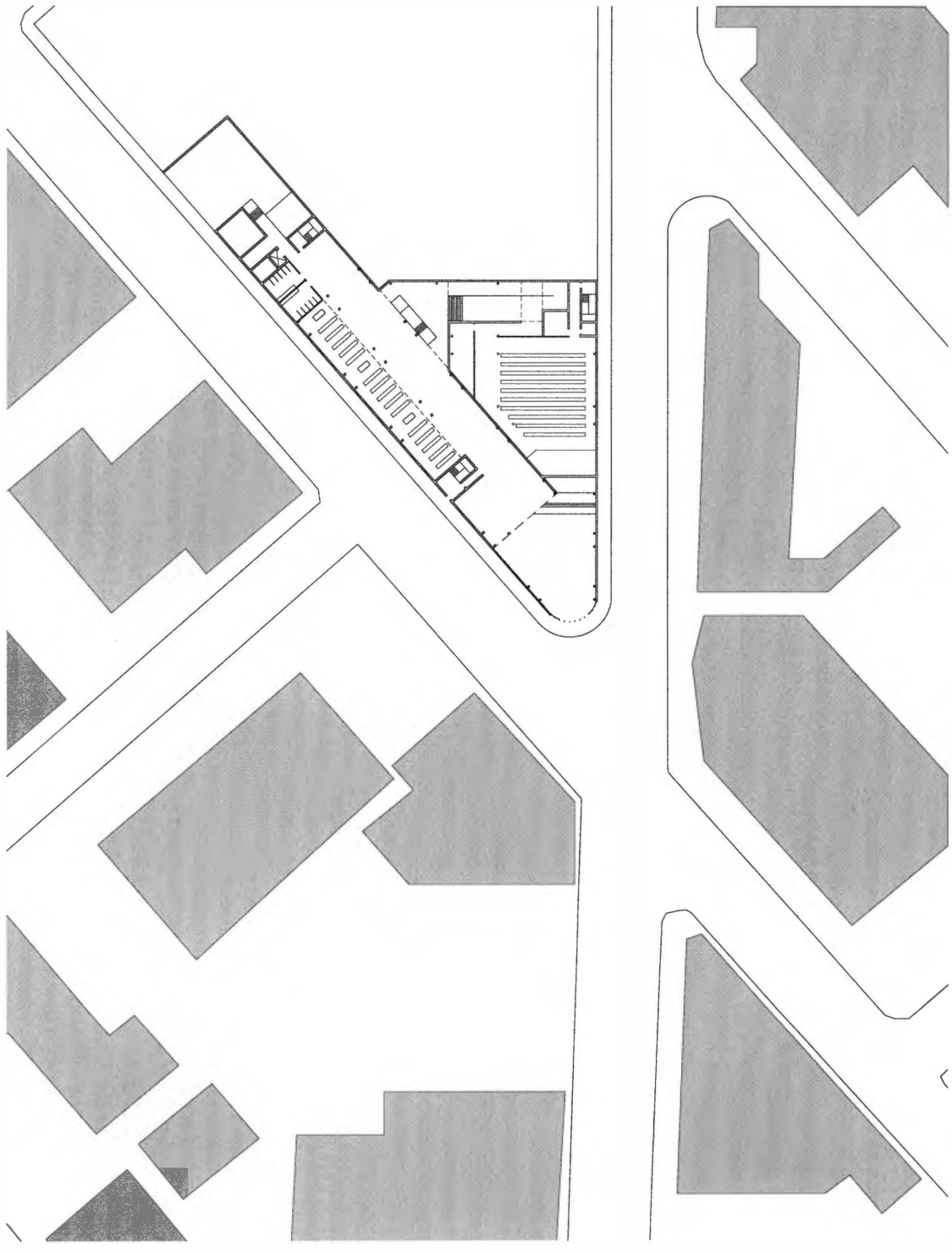


Figure 57 Ground Floor Plan (Author)

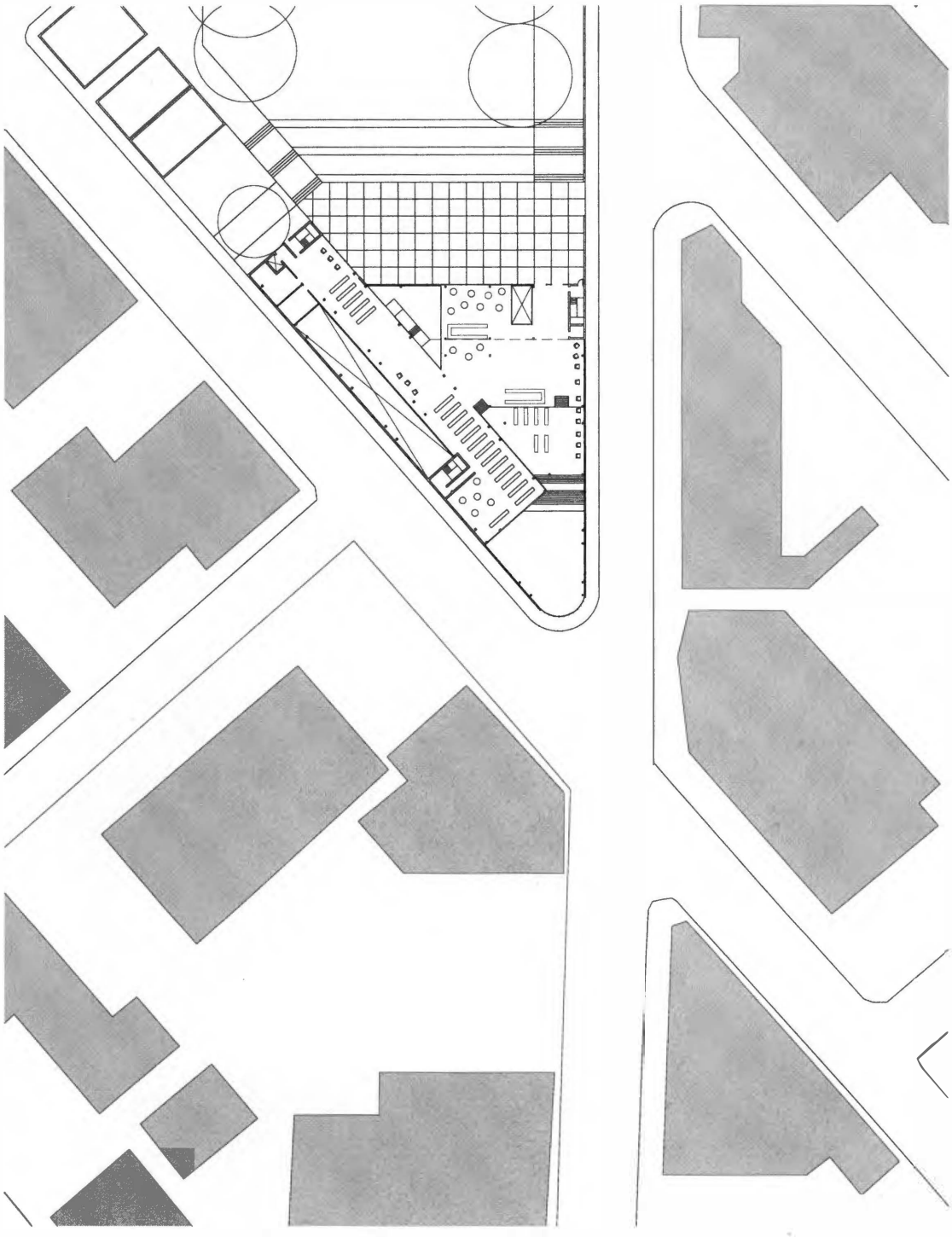


Figure 58 Second Floor Plan (Author)

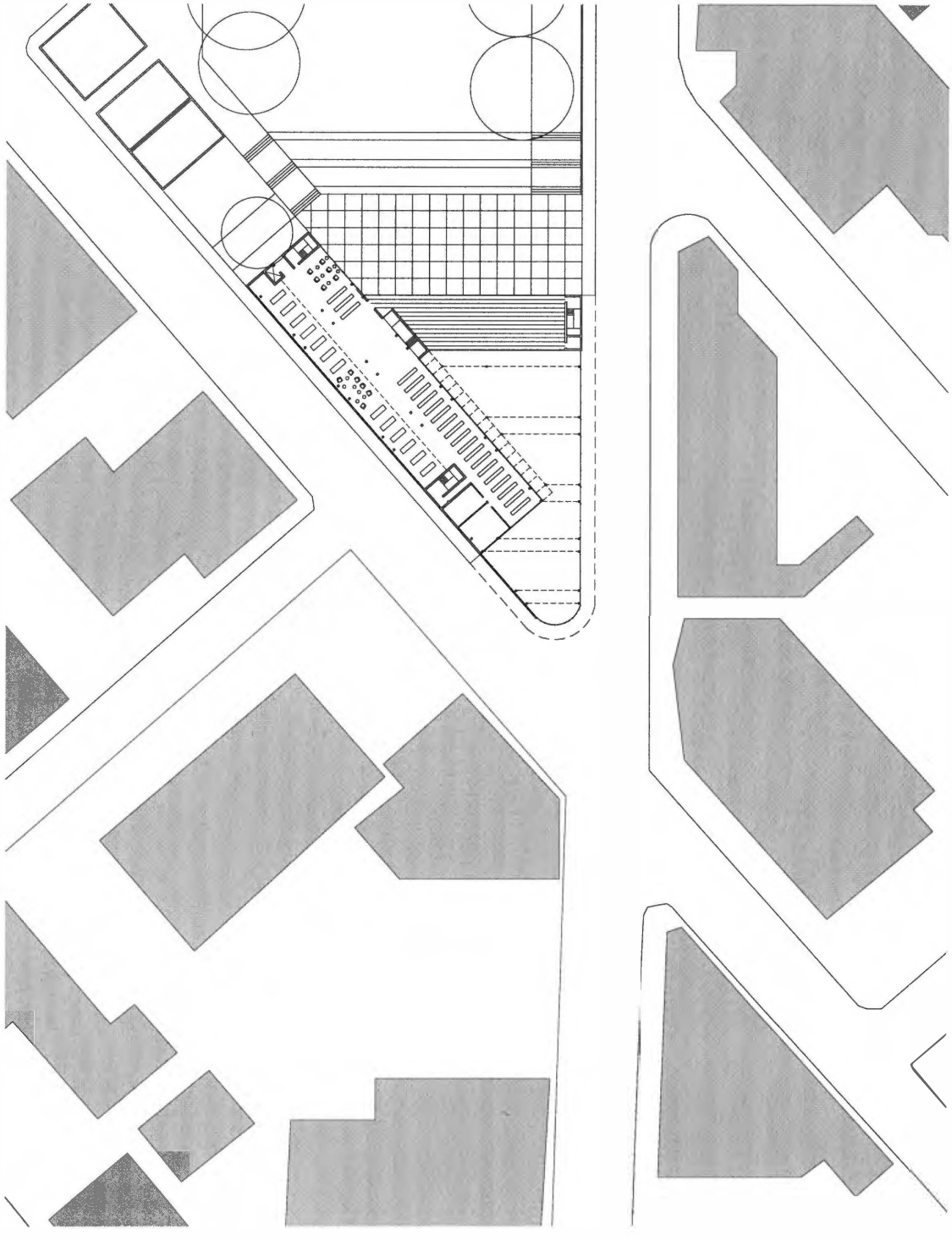


Figure 59 Third Floor Plan (Author)

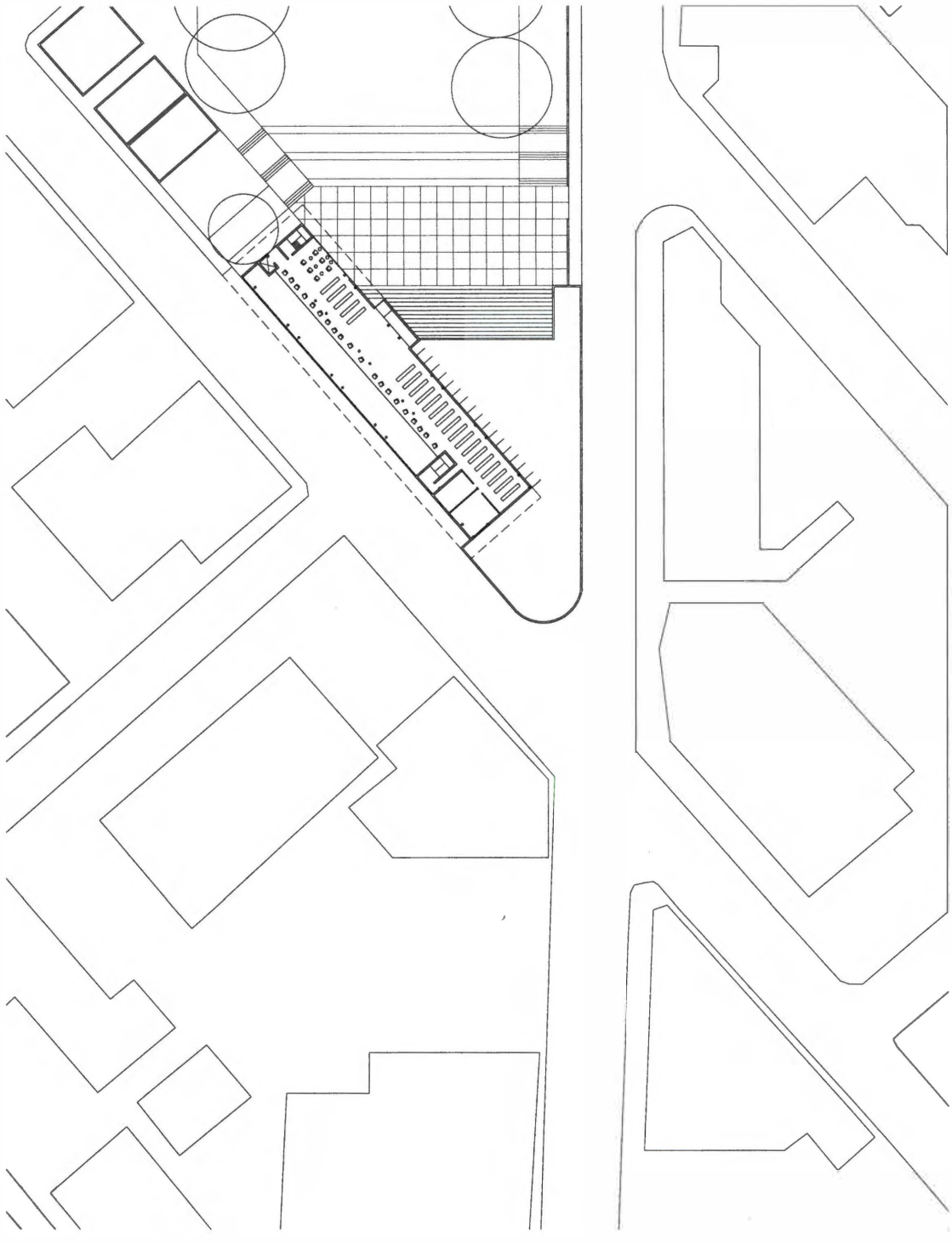


Figure 60 Fourth Floor Plan (Author)



Figure 61 Broadway Elevation (Author)

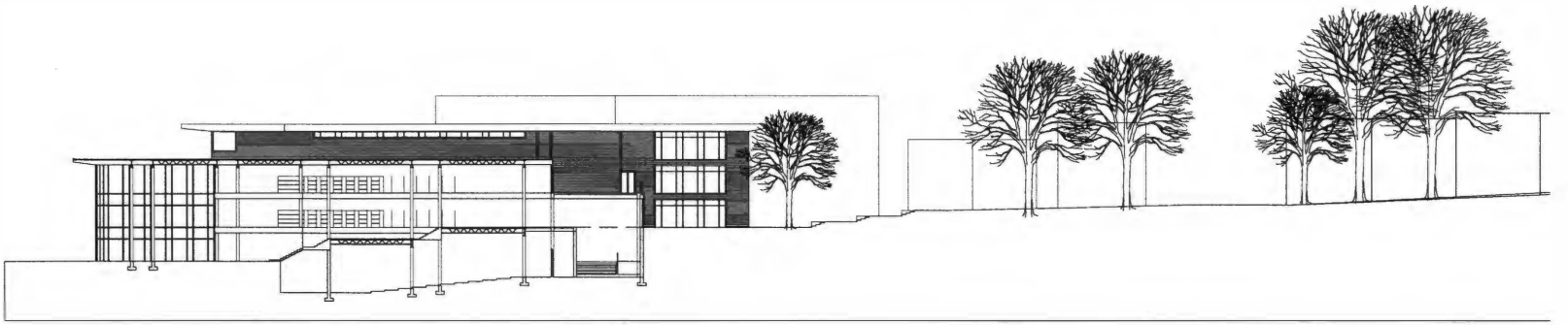


Figure 62 Longitudinal Section (Author)



Figure 63 Central Elevation (Author)



Figure 64 Plaza Elevation (Author)

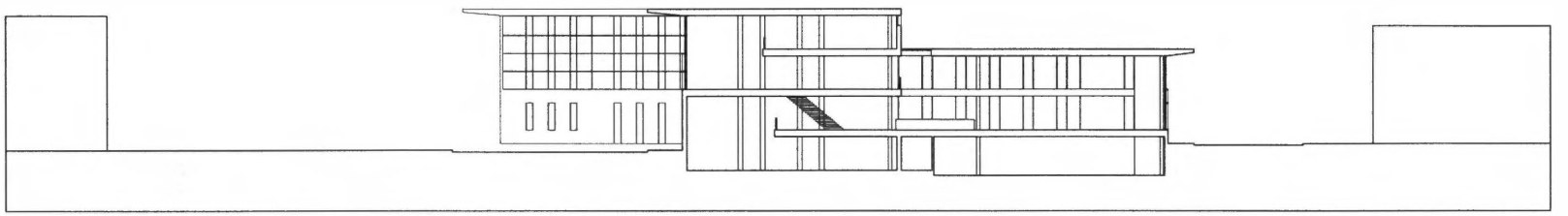


Figure 65 Cross Section (Author)

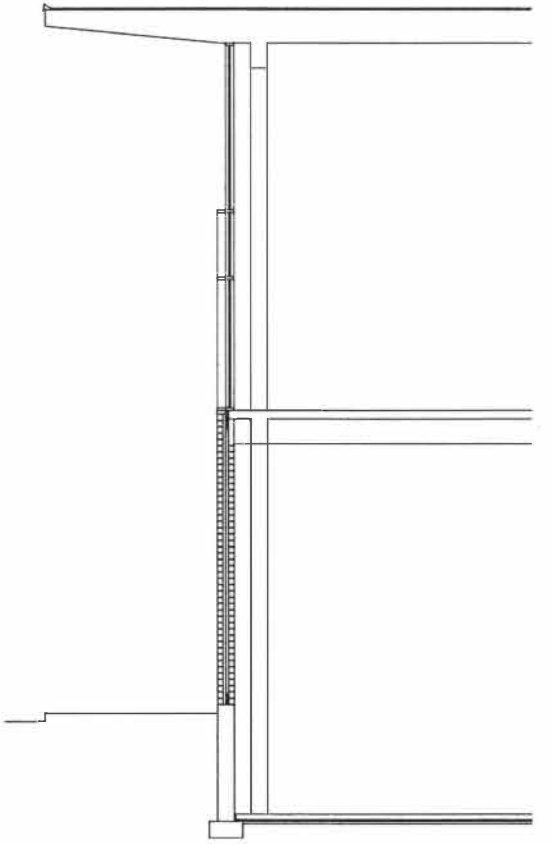


Figure 66 Wall Section (Author)

REFERENCES

Alexander, Christopher. *A Timeless Way of Building.* New York: Oxford University Press, 1979.

Barton, Hugh ed. *Sustainable Communities: The Potential for Eco-Neighborhoods.* London: Earthscan, 2000.

Barton, Hugh with Marcus Grant and Richard Guise. *Shaping Neighborhoods: A Guide for Health, Sustainability and Vitality.* London: Spon Press, 2003.

Bell, Bryan. *Good Deeds Good Design: Community service Through Architecture.* New York: Princeton Architectural Press, 2004.

Bronet, Frances, "Voices in Architectural Education: Cultural Politics and Pedagogy," *Journal of Architectural Education*, Ed. Thomas A. Dutton (ACSA, Inc.: September 1995).

Buckingham, James Silk. *National Evils and Practical Remedies with the Plan of a Model Town.* London: Fisher, Son, & Co. 1849.

Carson, Rachel. *Silent Spring.* Boston: Houghton Mifflin Company, 1962.

Coates, Gary. *Architecture, Ecology, & Energy.* Printed from www.ecodesignresources.net, 2005.

Dean, Andrea Oppenheimer. Rural Studio: Samuel Mockbee and the Architecture of Decency. New York: Princeton Architectural Press, 2002.

Duany, Andres. *Towns and Town-Making Principles.* New York: Rizzoli Inc., 1991.

Elkin, Tim. *Reviving the City: Towards Sustainable Urban Development.* London: Friends of the Earth, 1991.

Gillam, Oliver. *The Limitless City: A Primer on the Urban Sprawl Debate.* Washington D.C.: Island Press, 2002.

Girardet, Herbert. *Cities People Planet.* West Sussex, England: Wiley-Academy, 2004.
Lang, Robert. *Edgeless Cities: Exploring the Elusive Metropolis.* Washington D.C.: Brookings Institution Press, 2003.

Hetzel, Peter & Dhiru A. Thadani. *Windsor Forum on Design Education.* Miami: New Urban Press, 2004.

Katz, Peter. *The New Urbanism: Toward an Architecture of Community.* New York: McGraw-Hill, Inc., 1994.
Leccese, Michael & Kathleen McCormick (eds.). *Charter of the New Urbanism.* New York: McGraw-Hill, 2000.

McDonough, William and Michael Braungart. *Cradle to Cradle.* New York: North Point Press, 2002.

Miller, Mervyn. *Raymond Unwin: Garden Cities and Town Planning.* London: Leicester University Press, 1992.

Moe, Richard & Carter Wilkie. *Changing Places: Rebuilding Community in the Age of Sprawl.* New York: Henry Holt and Company, 1997.

Neal, Peter ed. *Urban Villages and the Making of Communities.* London: Spon Press, 2003.

Nozzi, Don. *Road to Ruin: An Introduction to Sprawl and How to Cure It.* Westport, CT: Praeger, 2003.

Orr, David. *Earth in Mind.* Washington D.C.: Island Press, 2004.

Orr, David. *The Nature of Design.* New York: Oxford University Press, Inc., 2002.

Owen, Robert. *A New View of Society* [1816]. London: Macmillan, 1973.

Palleroni, Sergio. *Studio at Large: Architecture in Service of Global Communities.* Seattle: University of Washington Press, 2004.

Rykwert, Joseph. *The Idea of a Town.* London: The MIT Press, 1988.

Sachs, Jeffery. *The End of Poverty: Economic Possibilities of Our Time.* New York: Penguin Group, 2005.

Smil, V. *General Energetics.* New York: Wiley-Interscience, 1991.

Sitte, Camillo. *The Art of Building Cities.* New York: Reinhold Publishing Corporation, 1945.

United Nations. *World Urbanisation Prospects*, New York: 1999.

Wright, David. *It Takes a Neighborhood: Strategies to Prevent Urban Decline.* Albany, New York: Rockefeller Institute Press, 2001.

Wurzer, Ralph. *Camillo Sitte and America: A Study of the Reception of Sitte's Ideas in American Planning Literature*. Knoxville: UT Press, 1988.

Zeiher, Laura. *The Ecology of Architecture*. New York: Whitney Library of Design, 1996.

VITA

John Daniel Lattimore earned his B.A. in History from the University of Tennessee in 1999. In 2006 he earned his Master of Architecture from the University of Tennessee, and despite more than seven years on the same campus, he still bleeds orange.

8768 6507 UA