1992

Physical development of the open space system on ISU main campus

Xia Gu
Iowa State University

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Physical development of the open space system on ISU main campus

by

Xia Gu

A Thesis Submitted to the
Graduate Faculty in Partial Fulfillment of the
Requirements for the Degrees of
MASTER OF ARCHITECTURE
and
MASTER OF COMMUNITY AND REGIONAL PLANNING

Majors: Architecture
Community and Regional Planning

Iowa State University
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CHAPTER 1. INTRODUCTION

Introduction

Study of architecture and community and regional planning in the United States allows a search for urban design methods. The objectives of some methods are to find the design effects of human behavior and to study space aesthetics. "Open Space" is a major concern in urban design. This thesis attempts to guide the future physical development of the ISU campus in terms of open space amenity.

Open space is a very important public amenity on a university campus. Usually our collective perception of a campus depends mostly on the landscape of its open space system. In our imagination of a university campus, it is these open spaces, rather than the buildings that surround them, that we remember.

Amenity is a kind of beauty, not only in the classically accepted sense of beauty but also in the sense that nature is perceived as beautiful. With this, the campus develops an almost human personality, as people relate to it in a biological sense. The campus no longer is only a place where people learn and teach; it becomes more. It is a world in itself, a temporary paradise, a gracious stage of life.
Statement of Problem

From the history of ISU campus development, we can see that before 1930, the central lawn provided a wonderful image, a harmonious relationship between people and the natural world, of the whole campus. But later, with more rapid development, the central lawn image is seldom repeated in the newly developed areas. No significant spatial and visual linkages have been created between the central lawn area and the denser academic areas. I do not mean that the rest of the campus has to be like the central lawn area. The point is that each part of the campus should be connected to each other, should work well together and should be part of the whole campus.

We should know that a society is an active organism, always in the process of becoming, always in the process of change. So are the forms and orders it creates. An urban environment cannot be discussed in a void, but within a particular social system. So a university campus must be discussed within its social context. Therefore, the changes of the society should have certain influences on the development of our campus.

In historical societies, there have been dramatic changes in value systems and their associated forms.

Between the Middle Ages and the modern era, there have been three distinct approaches to the organization of the city. Referring to these as "orders" of organization, they have reflected changing value systems. In addition to expressing different modes of usage and different modes of human interaction, these orders also expressed different ways of relating to the natural environment (Curran, 1983, p. 5).

There are four orders including the modern "open" order. Of the three
pre-modern orders, the earliest, the "closed" order (10th-15th centuries), is associated with the medieval era. A small number of cities (and portion thereof) built within this order remain intact today.

The second order, the "structured" order (15th-18th centuries), is found in Renaissance cities and their derivatives, the Baroque and Neoclassic cities. Heavily influenced by earlier Greek and Roman concepts, this order provided organizational principles for many of the cities we live in today.

The next order, the "pragmatic" order (18th-19th centuries), is associated with the industrial era. This order is the basis of many cities in America (Curran, 1983, p. 8). In the last period, ISU's campus was started. But the "pragmatic" order did not affect much of the original form of the ISU campus, because the Iowa State College was located in a rural area, and the earliest developments on the campus concentrated on the needs of the Model Farm. The informal and open prairie image was originally formed by Doctor A. S. Welch.

The fourth order, the "open" order (20th century), is associated with the modern era.

...by the end of the nineteenth century the constraining rigidity of the industrial city was no longer perceived as an acceptable reflection. With the turn of the century, a new age dawned and with it came images that expressed the hopes and dreams of societies ready for change. From "garden" cities and suburbs to "radiant" cities and new towns, it has encapsulated a new freedom and a new life-style. A high level of mobility, personal isolation, and independence from a communal context–these are the chief characteristics of the open order. It has provided the isolation of people and activities, as well as the buildings that contain them, and spread them out thinly on a wide and apparently limitless landscape (Curran, 1983, p. 9).

As soon as the ISU campus started its growth, American society was already
at its “open” order period.

While personal space and its real benefits were greatly increased, the advantages and supports of collective life, which cities had provided prior to the industrial period, faded from the popular memory of modern societies. Nuclear-family and car oriented, the open order has provided for the isolation of people and activities, as well as the buildings that contain them (Curran, 1983, p. 9).

This change did affect the formation of the open space system on campus. Buildings have been invariably conceived as isolated and unrelated structures, such as spaces left between buildings, whether dedicated to the car and its storage or left for other uses. Urban design was based on ideals of pure forms and unbounded, democratic, or free flowing space. And the urban environment, as a collection and system of open spaces having multiple social as well as functional roles, was lost.

In the many recent debates about the urban environment, one point of agreement is becoming increasingly shared: that the true value of the environment is not measured only in terms of its real estate, but also in terms of its use value, that is, in terms of how it affects people in their day-to-day experience, while modern architecture and urban design are often criticised as inhuman and repressive. By the mid-1960s, Robert Venturi set the stage for the “Post-Modern Movement”. In his book Learning From Las Vegas, he expressed:

An architecture of complexity and contradiction has a special obligation toward the whole—its truth must be in its totality or implications of totality. It must embody the difficult unity of inclusion rather than the easy unity of exclusion (Trancik, 1986, p. 37).

So, this study deals with the following problems:

1. Lack of linkages between open spaces,
2. Lack of space aesthetics in the later developed areas.

“Space aesthetics” emphasizes social values for people who are using open spaces. Because any open space, without considering human behavior and social context, will lose its vitality. Six elements identified by Bentley and four partners, in their book *Responsive Environments*: permeability, variety, legibility, robustness, visual appropriateness, and richness are used to represent social values.

**Purpose of the Study**

Every school and college has an atmosphere, a quality of personality that makes a lasting impression on students, teachers, employees, and visitors (Brewster, 1976, p. 229-230).

Iowa State University has great potential to have a more beautiful campus. In the 1950s and the 1960s, social scientists argued that the physical form had very little to do with the social form of the environments. The role of urban design was seen essentially as a matter of visual aesthetics. In the long list of social and economic priorities, design values were relegated to the status of window dressing—something frivolous and worth attending to only after the “real” problems were solved. In this thesis, I tried to show the importance of the design values of the physical environment on a university campus, in terms of studying its open space system.

The object of this study is to make a guide for the future physical development of ISU campus, in order to keep its physical environment whole, meaningful and beautiful.
Research Design/Methodology

In this research, there are three steps.

The first step is: a general review of the history of the open space system development on the ISU campus. The history helps me to understand the development patterns of the University and the reasons behind them.

The second step is: a review and a general analysis of the existing public open space system on campus, including building mass, visual corridors, pedestrian and street circulations. This is based on the new master plan done by Sasaki Associates, Inc.

In this step, the study utilizes the three approaches to urban design identified by Trancik (1986), they are:

1. Figure-ground method
2. Linkage method
3. Place method

The figure-ground method attempts to understand relationships in terms of physical geometry and patterns, in addition to understanding the hierarchy of spaces for the main campus. This is done by analyzing the figure-ground map of the main campus, and walking through the area myself. The linkage method uses linking elements which are evaluated as a system of interconnected spaces. This is done by analyzing maps of the street system, the pedestrian system, diagrams of visual corridors and buildings’ front and back.

The place method is used to analyze a smaller area: the Marston Water Tower area, on campus. The place method and other approaches identified in the book
“Responsive Environments” is used to examine social, historical and cultural forces that affect the formation of the area. Six different qualities are addressed. They are:

1. Permeability: paths in environment.

2. Variety: uses in an environment.

3. Legibility: understanding of an environment.


Along these lines of analysis, the context of the urban fabric can be identified and its success or failure can be evaluated.

The third step is the redesign of the Marston Water Tower area. It carries out the final conclusion of this research.
CHAPTER 2. LITERATURE REVIEW

The concepts of space aesthetics, in terms of how design affects human behavior are shown by examples of successful urban open space. The traditional cities of Europe and Asia offer numerous places that work wonderfully well. Current research finds that the examples fall into two primary types: "hard" spaces and "soft" spaces. Hard spaces are those principally bounded by architectural walls; often these are intended to function as major gathering places for social activities. Soft spaces are those dominated by natural environment (Trancik, 1986, p. 60).

From my point of view, designers must think about not only physical dimensions of a space but also psychological dimensions of the space. From both dimensions comes the idea of "Responsive Environment" in which human behavior is most important in the design thinking process. Six elements are involved in achieving the "Responsive Environment": permeability, variety, legibility, robustness, visual appropriateness, and richness. The explorations of the six elements will be addressed in this chapter.

Before we go into the detail of the "Responsive Environment", it is necessary to explain the importance and purposes of achieving it.

To achieve the "Responsive Environment" is the best approach to achieve several university goals and strategies. A responsive outdoor place can provide
opportunities for all students, faculty, and staff in all levels and different fields to get together:

1. to share values of honesty, justice, equality, respect and others;

2. to debate new ideas; and

3. to share different points of view of the world or life.

Another important aspect is related to our changing society. With the development of new technology, not only the nature of architecture, but the social nature of our society itself has changed. Before the 20th century, cities were primarily horizontal, consisting of tightly packed low buildings that formed alleys and plazas. The horizontal movement pattern encourages the activities along the street, forming exciting, continuous, visual and active experiences for the pedestrian. The new technologies such as tall buildings bring vertical movement into our society. Then we realize that this change has introduced a new social phenomenon into our urban lives: isolation. People are isolated from one another as a result of lack of ground level human interaction. Therefore, a well designed responsive outdoor space system is one way to bring social life back to people. Especially for a university campus where learning happens, a well designed open space system provides an environment for emphasizing the potentials of the university as a communication and information network, as well as a contemporary life style.
Responsive Environments

What is a “Responsive Environment”

Modern architecture and urban design are often criticised as inhuman and repressive, despite the high social and political ideals shared by so many influential designers over the last hundred years. The same tragedy also happened in university campus planning and designing. It seems that designers never made a concerted effort to work out the form implications of their social, cultural, historical and political ideals. Ideals would not exist, if they had not been linked through appropriate design ideas to the fabric of the built environment itself. Therefore, the definition for “Responsive Environment” is:

...the idea that the built environment should provide its users with an essentially democratic setting, enriching their opportunities by maximizing the degree of choice available to them. We call such places responsive (Bentley, 1985, p. 9).

For an open space system on a university campus, there are six different kinds of quality that affect the choices people can make. And practically, they are the steps of design for a responsive place.

1. Permeability: is the number of alternative ways through an environment. It is therefore central to making responsive places.

2. Variety: is particularly a variety of uses. It is a second key quality.

3. Legibility: how easily people can understand the layout of a place depends partly on how legible it is. This is considered in the third stage of design.
4. Robustness: places which can be used for many different purposes offer their users more choice than places whose design limits them to a single fixed use. Environments which offer this choice have a quality we call robustness, the fourth stage in design.

5. Visual appropriateness: This is important because it strongly affects the interpretations people put on places. Whether designers want them to or not, people do interpret places as having meanings. A place has visual appropriateness when these meanings help to make people aware of the choices offered by the qualities we mentioned before.

6. Richness: Richness is the most detailed level of decisions about appearance. It can increase the experiences which users can enjoy (Bentley, 1985, p. 10).

The following are the explanations of the six elements for a responsive environment, according to the book *Responsive Environments*.

**Permeability**

The permeability of any system of public space depends on the number of alternative routes it offers from one point to another. But these alternatives must be visible, otherwise only people who already know the area can take advantage of them. So both physical and visual permeability are important. They depend on how the network of public space divides the environment into blocks (Bentley, 1985, p. 12).

There are some principles for achieving permeability:
1. The advantages of small blocks: a place with small blocks gives more choice of routes than one with large blocks.

2. The decline of public permeability: a) increasing scale of development; b) use of hierarchical layouts; c) pedestrian/vehicle segregation.

There are two design implications that can be used to achieve permeability:

1. Analysis and using existing links: analyze the location of the site in the whole campus circulation system.

2. Design the street/block system: use the above information to achieve high permeability to and through the site (Bentley, 1985, p. 16-17).

Variety

The second key quality to be considered is variety which gives places experiential choice (Bentley, 1985, p. 27).

Variety of experiences implies places with varied forms, uses (functions) and meanings. Variety of uses unlocks other levels of variety:

1. A place with varied uses has varied building types of varied forms.

2. It attracts varied people at varied times for varied reasons.

3. Because of different activities, forms and people provide a rich perceptual mix, different users interpret the place in different ways: it takes on varied meanings (Bentley, 1985, p. 27).
Therefore, variety of use is the key to variety as a whole. It must be considered early in design (see Figure 2.1).

The first step in designing for variety is to establish which uses exert a demand for space on the site: there is obviously no point in proposing uses for which no demand exists (Bentley, 1985, p. 32).

For my research, the social demand is the first priority. But practically, within a commercial society, people forget space aesthetics and social demand quite often. So designers and planners need to remind people that there is something else besides money, working and studying in our daily life especially on a university campus. In fact, social life is very important in any society.

Human beings require and depend on contact with other human beings. Simply to know others and be known by others affirms and maintains one’s identity as a special person, in a special family, kinship, or group identity (Lennard, 1984, p. 7).
But a lot of student life is running between classes and spending the rest of the time working somewhere to support themselves; students do not have much time to go to well designed places, which are not on their way. So the pedestrian system has to be carefully studied to make a design really useful.

In the real world, variety becomes a problem. Both developers and planners want efficient environments. Developers are interested in economic performance, while planners want places which, among other things, are easy to manage. Both see their interests as served by two key concepts: specialization and economics of scale. Together, these seriously coarsen the grain of variety. For example, variety within districts is reduced, as they become specialized zones of single use-zoning (see Figure 2.2); variety within blocks is reduced, as sites are amalgamated into large units of modern architecture (see Figure 2.3).

Variety is not achieved merely by dumping a mixed bag of activities on a site. To work well, the uses should give each other mutual support.

Legibility

Legibility is the quality which makes a place understandable. It is important at two levels: physical form and activity patterns. Places may be read at either level separately. For example, it is possible to develop a clear sense of the physical form of a place, perhaps enjoying it only at an aesthetic level. Equally, patterns of use may be understood without much sense of form. But to use a place’s potential to the full, awareness of physical form and patterns of use must complement one another. This is particularly important to the outsider, who needs to grasp the place quickly (Bentley, 1985, p. 42).
Figure 2.2: Zoning (Bentley, 1985, p. 30)
Figure 2.3: Large units-modern architecture (Trancik, 1986)
Legibility is a problem in modern cities. Because in modern cities, buildings are often so much alike, no matter how important they are as public buildings or as publicly-irrelevant private ones. This was different before the Twentieth Century; cities worked well in terms of legibility. Places that looked important were important, and places of public relevance could easily be identified (see Figure 2.4).

The point of a legible layout is that people are able to form clear, accurate images of it. Note that it is the user, rather than the designer, who forms the image: the designer merely arranges the physical layout itself.

There are certain sorts of physical features which play a key role in the content of shared images. Kevin Lynch, the American planner who pioneered studies of this topic in 1960s, has suggested that these features can be grouped into five key elements. They are paths (channels of movement), nodes (focal places), landmarks (point references which most people experience from outside), edges (linear elements which are either not used as paths, or which are usually seen from positions where their path nature is obscured) and districts (medium-to-large sections of the city, recognizable as having some particular identifying character) (Bentley, 1985, p. 43-45).

As well as playing a role in the legibility of the city as a whole, each district needs to be internally legible. At a small scale, the district will itself contain minor paths, nodes, edges, and landmarks. So these concepts are relevant even to small sites, which make no obvious contribution to the image of the city as a whole.
Figure 2.4: Legibility is a problem in modern cities (Bentley, 1985, p. 42)
Robustness

Environments which can be used for many different purposes offer their users robustness (Bentley, 1985, p. 56).

In public outdoor space, different activities act as the most important supports for each other. People come there to experience other people. So if public space is chopped up into separate compartments for separate activities, most of its robustness is removed.

In urban situations, the design of public outdoor space is a complex matter. But for most people, in most places, the edge of the space is the space. Because it is here that most activity takes place. For example, watching other people becomes in itself one of the most common activities. This mostly happens at the edge of the space, which offers a sense of refuge as well as a prospect of what is going on (Bentley, 1985, p. 59) (see Figure 2.5).

The following three design considerations will be addressed later in this thesis.

1. The edge of the space (activities, edge shape, outdoor furniture)

2. Pedestrian spaces (outdoor furniture, dimensions of activities)

3. Microclimatic (shelter, sun and shadow, trees)

Visual Appropriateness

Visual appropriateness is a quality of more detail appearance of an environment. It comes from the interpretations people put on the place: whether designers want them to or not, people will interpret places as having meanings (Bentley, 1985, p. 76).
Figure 2.5: Photos of the Parks Library and the Hub on ISU campus
Visual appropriateness is particularly important in the places which are most likely to be frequented by people from a wide variety of different backgrounds. Therefore, it is mostly important in the more public spaces. The interpretations people give to a place can reinforce its responsiveness at two different levels:

1. By supporting its legibility, in terms of form and use. Form: the detailed appearance must now be designed to reinforce the legibility of the area in which it is located (urban contact). Use: the detailed appearance of the place must help people read the pattern of uses it contains.

2. By supporting its variety. The detailed appearance of the place must help to make it possible for a wide variety of uses to co-exist in an area.

Both have a similar problem: different groups of people may have different opinions about the same appearance.

In order to achieve visual appropriateness, we must understand how people interpret places. People interpret visual cues as having particular meanings because they have learned to do so. But people do not learn in a social vacuum. A great deal of learning, both formal and informal, is shared by groups of people, whose members will therefore tend to make similar interpretations of a given place. But members of different social groups may make different interpretations of the same place. This happens for two main reasons:

1. Their environmental experience differs from that of other groups.

2. Their objectives differ from those of other groups.

This means that if we are to design visually appropriate places, using cues which different groups of users are likely to interpret as supporting legibility and variety,
we have to enquire into the likely experience and objectives of a place's users, looking for visual cues relevant to each user group (Bentley, 1985, p. 77-78).

There are two kinds of cues: contextual cues and use cues. To support legibility, we need contextual cues which will be interpreted as relating a building to its context: either reinforcing or standing out from the paths, nodes, landmarks, edges or districts concerned. To support variety, we need use cues which will be interpreted as appropriate to the various uses concerned (see Figure 2.6) (Bentley, 1985, p. 78).
Richness

Richness is the most detailed level of decisions about appearance of an environment. It can increase the variety of sense-experiences which users can enjoy.

Sense-experiences include the sense of sight, the sense of notion, the sense of smell, the sense of hearing and the sense of touch. Among these, the sense of sight is the most important one. Because most of the information we handle is channelled through our eyes, visual richness is the dominant sense (Bentley, 1985, p. 89).

Here, the first question we should ask is how users can choose different sense-experiences from a fixed environment. There are only two ways people can choose from different sense-experiences, if the environment itself is fixed: 1) by focusing their attention on different sources of sense-experience on different occasions; and 2) by moving away from one source towards another. The effectiveness of each method depends on whether the sense concerned can be directed in a selective way, or whether it picks up information indiscriminately, from all sides at once (see Figure 2.7) (Bentley, 1985, p. 89).

Because current design thinking is almost entirely preoccupied with visual concerns, there is little useful theory about designing for non-visual richness. So my analysis on richness will concentrated on visual richness.

Vision is both the dominant sense in terms of information input, and the one most under human control. Visual richness depends on presence of visual contrasts in the surfaces concerned. The most effective means of achieving such contrasts depends on two main factors: the orientation of the surface concerned; the likely positions from which it will be seen (Bentley, 1985, p. 90).

Furthermore, viewing distance is very important. The range of likely viewing
Figure 2.7: Sense-experiences (Bentley, 1985, p. 89)
distances affects the range of scales at which richness must be considered. Where the surface will be seen at long range, large-scale richness is necessary; while at close range, richness must be achieved by small-scale elements subdivisions. So to maintain richness from long-range we need a hierarchy of elements from large-scale to small-scale (Bentley, 1985, p. 91).

By now, we have described the elements of “Responsive Environment”. From them we can see that the qualitative judgment of how well a space is designed comes from its communicative capability with its users and its surroundings. Eliciting social criteria and translating them in design process leads to creation of a social space appropriate to the activities it contains. Ignoring human input leads to “lost spaces” (Trancik, 1986), which are the areas that are in need of redesign—antispaces, making no positive contribution to the surroundings or users.

In the fifth chapter, the concepts described in this chapter, which are identified by Bentley, are used to analysis and redesign the Marston Water Tower area on the ISU campus and to show how to avoid lost space and to make responsive environment on our campus.
CHAPTER 3. BRIEF HISTORY OF ISU CAMPUS DEVELOPMENT

The past is not dead history; it is the living material out of which man makes himself and builds the future.

This brief summary of the campus development history covers its physical growth from the passage of the Land Grant or Morrill Act of 1862 to its present condition of over 120 buildings. This history helps me to understand the development patterns of the University and the reasons behind them, which are even more important. The history will be divided into seven periods of time, according to its different development periods.

1858–1880

In 1858 the Iowa General Assembly enacted a law establishing the “State Agricultural College and Model Farm” with provisions for a Board of Trustees to manage the college. Governor Ralph P. Lowe signed the bill on March 22, 1858, the date now recognized as the founding of Iowa State University. Trustees searching for a site for the new institution picked 658 acres of land in Story County west of Squaw Creek. A shaky financial beginning was reinforced with the passage of the Morrill Land Grant Act in 1862 which made federal lands available for sale to endow colleges whose aim was to promote ‘liberal and practical education ... in the several pursuits and professions of life.’ The new college opened its doors to a preparatory class in 1868 and in 1872 a class of 26 graduated at its first commencement (Sasaki Associates, Inc., 1991, p. 13).
The earliest developments on the campus concentrated on the needs of the Model Farm rather than the academic aspects of the new college. Of particular significance to future planning was the “creation of extensive natural landscape on the college grounds” by President A. S. Welch (Sasaki Associates, Inc., 1991, p. 13).

He planned a unique campus. It was his idea to have a road circle the campus, around which the buildings were to be located (see Figure 3.2). "He conceived the landscape as an environmental composition in which a harmonious relationship between man and the natural world had been established" (Werle, 1966, p. 22). The original form of the campus was informal and open prairie (see Figure 3.1).

By breaking up the prairie into a number of pleasing spaces, and the judicious placement of groups and masses of trees, President Welch established a basic format for future campus growth and expansion (Sasaki Associates, Inc., 1991, p. 13).

1880–1900

In this development period, Iowa State College experienced a rapid expansion of both its physical plant facilities and student enrollment. These were under the direction of President W. M. Beardshear.

Enrollment increased from 252 students in 1880 to 1,062 students in 1900. The pressure of this growth resulted in the construction of numerous buildings which still stand today. These buildings were located somewhat haphazardly around a center green with an elaborate system of campus pedestrian paths to connect one another. Each building with its surrounding landscape was treated as an entity unto itself. Significant decisions made during this time which have had a lasting effect on the pattern of campus growth include the preservation of the Central Lawn, the north-south orientation of buildings, and the creation of clear academic zones for the specific colleges (Sasaki Associates, Inc., 1991, p. 14) (see Figure 3.3).
1900–1915

Rapid campus growth and expansion continued throughout the early twentieth century. Student enrollment increased 135 percent from 1,062 students in 1900 to over 2,500 students in 1915. Enrollment increases, coupled with the burning of the remaining wing of Old Main in 1902 created housing and instructional demands that could not be met with the existing buildings and temporary structures. In order to accommodate the increased demands, a significant number of new buildings were constructed during this period (Sasaki Associates, Inc., 1991, p. 14).

The location of a new agricultural building prompted the institution to address the question of permanent planning. In 1906, the College invited J. C. Olmsted, noted landscape architect from Massachusetts to visit the campus and submit a report discussing its future requirements for campus development. In his report Olmsted proposed “specific ideas about the form of the college as an integrated park-town” (Sasaki Associates, Inc., 1991, p. 14).

Olmsted’s plan was not formally adopted by the College. But his plan did influence later thinking about how the campus should be planned and where buildings should be located (see Figure 3.5). The point is that the differences between Mr. Olmsted and the College were differences in design principles.

Mr. Olmsted proposed a reciprocal reposal and, respectively, a symmetrical arrangement of College buildings. On the other hand, the College desired a staggered reposal and, respectively, an informal arrangement of College buildings (Werle, 1966, p. 50a) (see Figure 3.4).

1915–1930

In 1915, Mr. Laverne W. Noyes, an alumnus of the College, donated a substantial sum of money for the purpose of retaining O. C. Simonds of Chicago to design a lake on the southern edge of campus (Sasaki Associates, Inc., 1991, p. 15).
By doing this, Mr. O. C. Simonds brought his “sculptural landscape concept” (Werle, 1966, p. 51c) into the campus. He believed that the greatness of a landscape was the power of its aesthetic scenery to “enrich one’s spirit and feed one’s soul” (Simonds, 1920, p. 233). He conceived the College landscape as a sculptured natural park, and developed a refined landscape concept to dramatize a personal aesthetic experience of the College (Werle, 1966).

Student enrollment increased to approximately 4,300 by 1930. The general scheme for development of the campus during this period provided for the housing of agriculture departments on the east side of campus; engineering departments on the west side; veterinary medicine on the north; fundamental sciences on the north and central part of campus; and home economics on the central mall. By 1930, the main campus was surrounded on three sides by stone buildings, opening to the south with the exception of the Campanile, trees and Memorial Union (1927). Outside of the circle of stone buildings were a large circle of brick buildings including the Veterinary Buildings, Science Buildings, Chemistry Building, Engineering Shops and Animal Husbandry/Agriculture Labs (Sasaki Associates, Inc., 1991, p. 15) (see Figure 3.6).

1930–1950

This period began a new era in which campus planning was guided by the long range plans of design consultants. According to Werle, the design team composed of Professors P. H. Elwood, A. H. Kimball and R. R. Rothacker developed plans for an inter-connecting system of symmetrical and asymmetrical landscape spaces or outdoor rooms, together with a hierarchy system of roads and related parking areas (Sasaki Associates, Inc., 1991, p. 15).

From this period of time, the design thinking has changed from a poetic philosophy to a more prosaic and functionalism philosophy.
In 1935, a Twenty-Year Plan for the physical development of Iowa State College was prepared by Professor P. H. Elwood and A. H. Kimball. From this plan, we can see that the concept of it emerged out of a two dimensional abstraction of the College's practical needs and goals.

It reflected a desire for order and a desire for increased meaning for the College's collective purposes. It began with the grouping of related physical objects and human activities into distinguishable use areas and with the arranging of the use areas into a logical sequential organization. In fact, not only were the uses arranged according to logic but the designing process itself was organized according to exacting logic (Werle, 1966, p. 61) (see Figure 3.7).

In general, this plan acknowledged certain basic categories or zones of activities which are still prevalent today. These included the following: Passive Areas such as the central park and preserved Pammel Woods and College Creek; Academic Use Areas; Residential and Physical Education Use Areas; Administrative and Social Activities; Integrated College-Public Activities (Sasaki Associates, Inc., 1991, p. 16) (see Figure 3.8).

1950–1980

Student enrollment at Iowa State University skyrocketed from 8,100 in 1950 to 24,200 in 1980. With the increase in enrollment came a dramatic growth in facilities, with close to 75 new buildings constructed during the 30-year period. This period was characterized by residential expansion north of the railroad tracks to accommodate the needs of married students and the development of the ISU Center and football stadium south of Lincoln Way. By 1980 our university had become a complex amalgamation of academic, recreation, research, residential and service functions (Sasaki Associates, Inc., 1991, p. 16).
Figure 3.7: The twenty-year development plan-1935
In 1968, the firm of Johnson, Johnson and Roy was selected by the University to develop a long-range development plan for the campus. Their plan was never formally adopted or rejected by the University administration but did serve as a basic framework for campus growth throughout the 60’s and 70’s (Sasaki Associates, Inc., 1991, p. 17).

In this Long-Range Plan, the concept for the development of a university campus is essentially the merging of academic programs with site characteristics. It suggests a logical pattern for growth and establishes certain basic parameters and guidelines for day to day decisions about the future. The most dominant theme of physical organization is that the density of buildings on central campus should be increased to allow for greater enrollments without significantly increasing the time/distance relationship between functions. It is not suggested that a fixed plan has evolved; rather, a framework has been established within which day to day decisions can be made with assurance that such decisions will relate logically to past and future campus organization.

For the open space system on campus, the basic idea of the Johnson, Johnson and Roy Plan retained the way it was in the last plan (twenty-year development plan). The difference at this time is that the circumstances were quite different. Johnson, Johnson and Roy had to deal with about 105 buildings instead of 30. They were concerned with 8,100 students instead of 4,300. As it suggested,

...in the history of planning at Iowa State University, the need to modulate these spaces and link them one to another has been recognized by past administrators and faculty members—the Twenty Year Development Plan suggests, for example, that “the central space is conceived as linked to the surrounding prairie through the penetration of ecological spaces..., agricultural spaces..., and forest plots... Outdoor rooms should flow one into the other visually as well as spatially.” The contrast in the scale of open space, from vast intramural fields to
intimate courtyards—the contrast in the use of open space, from a narrow walkway to a plaza designed for relaxation and conversation—the contrast in the materials of open space, from lawns and trees to paving and sculpture—all enhance the interest, pleasure and sense of well-being which people feel. Open spaces, linked together in designed sequence, impart order and vitality to the campus scene (Johnson, Johnson and Roy, 1968) (see Figure 3.9).

But what makes for us a disappointment is that most decisions which followed dealt with other "real" problems, such as funding. And the "last" concern was about the amenity of the open space system. The only thing which has been considered about open spaces is the basic framework. From a social context point of view, the major reason for this comes from the influence of the Modern Movement which makes the "city-making" process fragmented into separate and specialized professions, including city planning, road and highway engineering, landscape architecture, architecture, etc. As a factory-line production, each is concerned with a single aspect of a process, while the effects of their input within the community has been lost to abstraction. Just like the open space system on the ISU campus, it should be concerned not only in the whole organization of the campus, master plans, but also with the circulation system, traffic control and even single building design. Unfortunately, it has been of concern to nobody instead of to everybody. Another point, architects usually do not have much time to work on research; and in a short period of time, it is hard for them to know what the campus was and what it is should be. They usually make their design decisions by talking to the clients, the deans of the colleges and the director of the physical plant. But from past experiences, they may not help these architects to understand what they are doing at all. One solution for this problem is to keep a whole set of valuable
Figure 3.9: Johnson, Johnson and Roy's plan-1968
information updated by facility services people and provided to architects as
guidelines for their design decisions.

1980–Present

The 1980's were characterized by a peak enrollment of 26,500 students
in 1985, followed by a downward trend that is projected to extend to the
mid-1990's. Total student enrollment in 1990 was approximately 24,500
(Sasaki Associates, Inc., 1991, p. 17) (see Figure 3.10).

Approximately 25 new buildings were constructed during the 1980's with the
focus primarily on research related activities. In 1990, the Sasaki Associates, Inc.
was selected by the University to update the campus master plan, in order to deal
with future construction, traffic and landscape ideas. This new master plan was
completed in the summer of 1991 and reaction from the University was very
positive (see Figure 3.11).

The Sasaki did a good job of analysis of the existing campus and found some
very important problems, such as wayfinding for the university, traffic and parking
problems. The landscape ideas remain the same as in the past plans.

The concern is how to follow the planned open space system in day-to-day
decision-making process. Designing one sample area to show what a single project
can contribute to the achievement of the whole campus master plan is the final
purpose of my research (see Figure 3.12, 3.13, 3.14).
Figure 3.11: Sasaki's master plan 1991
OLD MAIN WAS THE WHOLE COLLEGE.
CENTRAL LOOP DEFINED THE CENTRAL CAMPUS.
OLD MAIN AND CENTRAL LOOP DEFINED THE COLLEGE CAMPUS.
BUILDINGS WERE BUILT AROUND THE CENTRAL LOOP - THEY GAVE THE CENTRAL LAWN SOME BUILT BOUNDARIES.
CAMPANILE WAS BUILT IN 1896.
- IT GAVE THE CENTRAL LAWN A VERTICAL FOCAL POINT.
CENTRAL LAWN WAS THE WHOLE CAMPUS.
CURTISS HALL GAVE THE CENTRAL LAWN NEW BOUNDARIES FROM THE EAST.
LINEAR STREETS DEFINED THE CENTRAL LAWN FROM THE SOUTH.
UNION GAVE THE CENTRAL LAWN ITS NORTHERN BOUNDARY.
A NEW IDENTIFIABLE OUTDOOR SPACE WAS CREATED SOUTHEAST OF THE CENTRAL LAWN. BUTTILLA WAS NO CONNECTION TO THE CENTRAL LAWN.
A LINEAR STREETGRID STARTED.
FREES ON THE CENTRAL LAWN AND AROUND THE LAKE LAVERNE GAVE THE COMPANY NATURAL GREEN BACKGROUND ON THE SOUTH SIDE.
LINEAR STREETGRID BECAME MORE CLEAR.
THE ADDITION OF LAGOMARCINO HALL FORMED AN AXIS TOWARDS THE CENTRAL LAWN, CONNECTION.
LINEAR STREETGRID FINALLY SHAPED THE QUADRANGLE WEST TO THE CENTRAL CAMPUS.

Figure 3.12: Open space developments.
Figure 3.13: Open space plans
CHAPTER 4. STRUCTURAL ANALYSIS OF THE OPEN SPACE SYSTEM ON THE MAIN CAMPUS

The purpose of this chapter is to review and analyze the existing conditions of the open space system on the ISU main campus using the techniques presented by Trancik, Bentley and others. The analysis will be addressed along three methods identified by Trancik:

1. Figure-ground method
2. Linkage method
3. Place method

The six of seven issues presented by Bentley are used in Trancik's place method. The seventh issue is personalization. In Bentley book, this issue is mostly about private properties, such as a house. For public places, it is about interior space. But for outdoor public space people can only personalize a place temporarily. This kind of personalization is covered by his fourth issue, robustness. So for my research, the personalization is covered under robustness.
Brief Methods Background

Trancik’s approaches depend on principles and critical responses to problems of the modern city grouped into three methods (figure-ground method, linkage method and place method). based on studies done by Lynch, Cullen, Bacon and others. Each method has its own values, and taken together they provide a strategy for integrated urban spatial design.

As discussed in Chapter 2, in their book, Responsive Environments, Bentley and partners present seven issues to evaluate and design a responsive environment (permeability, variety, legibility, robustness, visual appropriateness, richness and personalization), based on their own practice and studies done by Lynch, Cullen, Bacon and others. Their approaches depend on the critical responses to inhuman and repressive problems of modern architecture and urban design. Their book is a practical attempt to show how to link design ideas to the fabric of the built environment itself.

Main Campus Structural Analysis

Iowa State University has a rich design history, dating back to the middle of the 19th century. The dominant image of the central campus is informal and picturesque. The image of the central campus has been changed little throughout its development; in contrast, formal geometric relationships, common alignment of buildings, and the grid streets typify the north and west parts of the central campus. The central lawn, which provides the dominant image of the whole campus, has always played the same role on the campus (see Figure 3.12).
Unfortunately, the problems of linkage between outdoor spaces and their defining qualities are becoming bigger for three major reasons. First is influence from the social context: the “open order” which I have described before. Second is pressures from “real” problems, such as funding, university budgeting, and academic needs. Third is the way the University treated the central lawn area. The central lawn has been respected almost as the only open space on campus until 1980 when the Parks Library addition finally formed the library-alumni quadrangle. This quadrangle is a very successful outdoor place which is right next to the central lawn. Its size, form and scale, etc. are different from the central lawn, and have a positive relationship to it. The quadrangle does not reduce any of our respect for the central lawn. On the other hand, it increases the respect from the physical environment itself. For the west side of the campus, the library-alumni quadrangle is a very good transforming step from the informal, open, relaxing, symbolic, and naturally landscaped open space to the denser academic areas. The campus needs more open spaces like this.

Figure-ground Method

From the campus maps, we can see the tremendous growth of this campus.

The original plan appears to have been the simple and natural one of housing the college at first in a large long building. It was located on the highest available spot, with its long axis north and south and faced east so as to command a good view down a gentle slope, across a wide grassy river bottom, toward the object in the vicinity having the greatest human interest, namely the little town of Ames, embowered in trees (Olmsted, 1906, p. 403).

We could say the earliest form of the ISU campus was a “college within a natural park”. Much of the character has resulted from its location in an
agricultural state, Iowa, which has plenty of farm land, and the concept of the pictorial landscape of President Welch, who "brought to Iowa Agriculture College a sincere desire for an ideal farm landscape" (Werle, 1966). With the growth of the student enrollment, more buildings were demanded.

According to Werle, Dr. Beardshear brought the garden landscape concepts to the college. The visual focal point was on the central lawn. This resulted in the location of some important buildings, such as Curtiss Hall, which closed the east side of the central lawn, and located Marston Hall slightly north of Beardshear Hall in order to have a view to the central lawn.

From the beginning of the 20th century, ISU was urbanized by its increasing student enrollment. This urbanization required a more dense building arrangement in order to keep the walking distance between on-campus activities within 10-15 minutes. However, it brought the conflict between the requirement of the further development and the original informal, park image.

In 1906, Olmsted's proposed "park-town" was the first plan which was concerned with the formal solution for building arrangement. In 1935, the twenty-year development plan was the second one. Neither plan was formally adopted. However, the "park-town" organization did affect the later development of the ISU campus. Today's campus map is a "central park within a university". But the dominant image of our campus is still informal and picturesque. This is accountable for three reasons as described by Sasaki.

First, the Central Lawn area generally defined by Beardshear, the Union, Curtiss and Mackay is a mature coherent, and unspoiled picturesque landscape. The Central Lawn area is about twenty acres in size and is both the physical and symbolic core of the campus. Its
mature trees, campanile, and surrounding landmark architecture make it the most coherent and memorable area of the campus. Its serves to identify the campus as a whole. Second, the naturalistic planting style of the Central Lawn area has been employed elsewhere on campus as one moves away from the Central Lawn. The layout of trees and shrub masses in informal massings runs counter to any formal structuring of space that the streets or buildings may suggest. And the third, the arrangement of buildings in the areas away from the Central Lawn does not seem to follow any particular open space concept wherein the spaces between buildings are consciously conceived. Rather, the spaces between buildings tend to be a by-product of building placement. Thus, with few exceptions the campus, as one proceeds away from the Central Lawn, does not possess a clear legible form. Few spaces outside the Central Lawn are as memorable (Sasaki Associates, Inc., 1991, p. 19-20).

Buildings began to be built in a more dense pattern toward the west, east and north of the main campus about 1930, following no particular plan. And these buildings were built side-by-side and face-to-back independently of one another. At the same time, the rectilinear grid on the western and northern sides of the main campus became more noticeable. Parking lots covered more and more ground. Decisions of those year-to-year projects were made without concern for the context of the campus as a whole (see Figure 4.1).

Relatively well defined open spaces, besides the Central Lawn, include the library-alumni quadrangle, the park space around Lake Laverne, Carrie Lane, the agronomy courtyard, and the Lagomarcino courtyards (see Figure 4.2).

The figure-ground diagram of our main campus illustrates a two-dimensional abstraction in plan view (see Figure 4.3). It shows us that open spaces are much too independent of each other. And it seems that there is no system at all, only individual spaces. For instance, the central lawn is isolated, and rest of the relatively well defined open spaces are incidental to it. Most open spaces tend to be
For example, Spedding Hall and Gilmore Hall almost become one structure and face both French Dr. and Osborn Dr., across the whole block. Science Hall and Science II are in the same block, but face to their own slowly, away and back-to-back to each other.

Spence Hall is an important landmark located at the intersection of Science Rd. and Osborn Dr. There is no difference between its four facades, an example of neutral solution in composition.

For instance, Coates Hall has a main front facing Osborn Dr., but its main front is facing the central area. Science Hall has two towers on both sides and were each which opposed to both the central axes and Science Rd.

Figure 4.1: Architectural axes diagram
Figure 4.2: The open space system

Notes:
* This diagram shows that open spaces are not always independent of one another, and it seems that there is no system at all, only individual spaces. For instance, the central area is isolated, and the rest of the relatively well-defined open spaces are occasionally around it. Most open spaces tend to be by-products of building placements, or have a more historic character: free flowing along streets and pedestrian paths, or between buildings.
by products of building placement, or have a modern character: free flowing along streets and pedestrian paths, or between buildings.

Theoretically, the basic ingredients of urban environmental design consist of two elements: mass and space. The essence of design is the interrelation between these two. The figure-ground method is founded on the study of relative land coverage of buildings as solid mass (“figure”) to open spaces (“ground”). Each urban environment has an existing pattern of solids and spaces, and the figure-ground approaches spatial design to manipulate these relationships by adding to, subtracting from or changing the physical geometry of the pattern. The objective of these manipulations is to clarify the structure of urban spaces in an urban environment by establishing a hierarchy of spaces of different sizes that are individually enclosed but ordered directionally in relation to each other. A predominant “field” of solids and voids creates this urban pattern, often called the fabric. Punctuated by object buildings and spaces, such as major landmarks or open spaces the pattern is to provide focal points and s within the field.

The ISU figure-ground diagram together with the street and pedestrian system diagram show us two geometric patterns: rectilinear grid, and informal loop and curves. In general, the buildings in the denser, late-developed areas respond to the rectilinear streets and pedestrian paths. For example, Spedding Hall and Gilman Hall almost become one structure and face both Pammel Dr. and Osborn Dr. across the whole block. Science Hall and Science II are in the same block, but face to their own nearby streets and back-to-back to each other. In the central area, buildings face the central park mainly around three sides (east, north, and west) of the closed central loop. The south side of the central area are some gentle hills and
Figure 4.3: The figure-ground map
areas of densely planted trees. These trees act as a green boundary between main
campus which is an informal green and the urban character of the campus town.
The Union is hiding in the trees and its major mass is behind a hill. So it can
hardly seen from the central lawn area. In the central area, buildings respond to the
central loop with locations and frontages sharing views of the central lawn.
Therefore, building frontage is confused at the translating area of the two different
grids. For instance, Coover Hall has a minor front facing Osborn Dr. But if you
walk around it, you will find that the major front is facing the central area.
Sweeney Hall has two fronts on both (east and west) ends which respond to both the
central area and Bissell Rd.. Bessey Hall is an important landmark located at the
intersection of Stange Rd. and Osborn Dr.. There is no difference between its
four facades, an example of natural solution to translation.

Linkage Method

Unlike the figure-ground method, which is based primarily on patterns of
solids and voids, the linkage method is derived from “lines” connecting one element
to another. These lines are formed by streets, pedestrian paths, linear open spaces,
or other linking elements that physically (or visually) connect the parts of an
environment.

In his landmark treatise, Investigations into Collective Form, Fumihiko
Maki discusses several factors that go into the creation of a framework of spatial linkages. Maki addresses linkage as the most important
characteristic of urban exterior space, stating that: Linkage is simply the
glue of the city. It is the act by which we unite all the layers of activity
and resulting physical form in the city.... urban design is concerned with the question of making comprehensible links between discrete things. As
a corollary, it is concerned with making an extremely large entity comprehensible by articulating its parts (Trancik, 1986, p. 106).

My major concern about linkage on the ISU main campus is with street and pedestrian systems, which connect different parts of the whole campus. These two systems, especially the pedestrian system, take care of the major movements on the main campus.

The street and pedestrian system diagrams shows three existing conditions:

1. Pedestrian system (see Figure 4.4):

   The primary pedestrian zone on campus is the area between Lincoln Way, Bissell, Pammel and Wallace Roads. This core area is an efficiently shaped pedestrian zone of approximately 200 acres, requiring a reasonable 10-15 minutes to traverse. A comprehensive network of paths provides access throughout campus. However, there is a hierarchy of movement. Concentrations of pedestrian movement link peripheral areas of parking, bus activity and residences, with the central campus open spaces. The most concentrated pedestrian activity occurs on paths within the quadrangle and around the central lawn where surrounding classroom and student service buildings feed the system (Sasaki Associates, Inc., 1991, p. 32).

2. Street system (see Figure 4.5):

   Older parts of the street system are curvilinear and fitted to the contour of the land. Later streets establish a regular north-south, east-west grid that now frames the older street system to the north, west, south, and partly to the east (Sasaki Associates, Inc., 1991, p. 19).

   Perceived from its streets, the campus thus has two distinct grid patterns; one being an informal order along the curvilinear roads where ones view and
orientations constantly shifting, and the other a more formal order consisting of straight street corridors lined with buildings.

Vehicular circulation on the street system is characterized by severely limited access to the inner core of the campus.

This limitation of access is as a result of a "Walking Campus" Plan implemented in the early 1970's due to significant growth in both campus vehicle and pedestrian volumes, with serious repercussions regarding conflict between the two (Sasaki Associates, Inc., 1991, p. 27).

Currently, the new master plan continues this limitation of vehicle traffic access for the same reason.

3. The Pedestrian and Street system shows the conflicted nodes between the street and pedestrian systems. The new master plan really improves this conflicting problem (see Figure 4.6).

The open space system associated with the pedestrian system plays a major role in forming an image on campus for everyday experiences. The spatial and visual quality of the open space and pedestrian sequence becomes the issue. For example, one of the problem areas identified by Sasaki is "pedestrian movement between Bissell Road and the quadrangle must filter through a maze of service" (Sasaki Associates, Inc., 1991). This rest of my thesis focuses on this problem area.

Place Method: Open Space Qualities

The place method goes one step beyond figure-ground and linkage methods in that it adds the components of human needs and natural contexts (Trancik, 1986, p. 97).
The primary pedestrian zone on campus is the area between Lincoln Way, Bissell, Pammel and Wallace Roads. This core area is an efficiently shaped pedestrian zone of approximately 200 acres, requiring a reasonable 10-15 minutes to traverse. Complementary networks of paths provide access throughout campus. However, there is a hierarchy of movement. Concentrations of pedestrian movement link principal areas of parking, bus activity and residence with the central campus open spaces. The most concentrated activity occurs on the paths within the quadrangles and around the central lawn where surrounding classroom and student service buildings feed the system (Swales, 1995 31).

"My major concern about linkages on the ISU main campus is with streets and pedestrian systems, which connect different parts of the whole campus. These two systems, especially the pedestrian system, take care of the major movements on the main campus.

"The linkage method is derived from those connecting one element to another. These links are formed by streets, pedestrian paths, sidewalks, or other linking elements that physically or visually connect the parts of an environment."
Figure 4.5: The street system

"Older parts of the street system are curvilinear and oriented to the contour of the land. Later, streets establish a regular north-south, east-west grid that now frames the older street system on the north, west, south, and partly to the east. Perceived from the streets, the campus has two distinct grid patterns: one being an informal order along the curvilinear roads where most view points define a quiet,Clean, and the other a more formal one consisting of straight street corridors lined with buildings (Sasaki, 1991: 19).

"Vehicular circulation on the street system is characterized by severely limited access to the inner core of the campus. This limitation of access is as a result of a "Walled Campus" plan implemented in the early 1970s due to significant growth in both campus vehicle and pedestrian volumes, with serious repercussions regarding conflict between the two. Currently, the new master plan continues this tenet of vehicle traffic access for the same reason (Sasaki, 1991: 27)."
Figure 4.6: The pedestrian and street system
The amenity of the open space system (open spaces and pedestrian sequences) of the whole campus depends not only on the system structure, but also on each single cell out of which forms the whole system. In next chapter, the six elements identified by Bentley are used to analysis the problem area-Marston Water Tower area-and to propose a redesign for this area based on the analysis.

Sasaki planned the general structure or framework of the open space system like each long-term plan before. It is necessary to take one step further: to pick one cell out of the whole system, and try to turn it into a positive cell for the whole system.
The Marston Water Tower area is analyzed in this chapter, and a redesign is proposed. Both the analysis and redesign use the six elements identified by Bentley. The analysis is presented by comparing existing conditions, Sasaki’s new master plan and my own redesign idea.

Permeability

The permeability of any system of public space depends on the number of alternative routes it offers from one point to another. But these alternatives must be visible, otherwise only people who already know the area can take advantage of them. So both physical and visual permeability are important.

The Marston Water Tower area (site A) is a very important access between western residential and parking areas and central campus (see Figure 5.1). For the site, three measurements compare permeability among the existing condition, Sasaki’s master plan and my redesign.

1. Number of pedestrian paths linking to the site from nearest main pedestrian paths,

2. Visual directness of these paths,
3. Number of conflicting points between vehicle traffic and pedestrian path (within the site) (see Figure 5.2-5.5).

The existing pedestrian permeability is adequate (see Figure 5.3). There are nineteen pedestrian paths and one vehicle access to the site. But the spatial quality of its outdoor spaces, pedestrian paths is not good at all. Further a total of four conflicting points exist between pedestrian flow and vehicle traffic.

In Sasaki’s new master plan (see Figure 5.4), pedestrian flow and vehicle traffic has been separated. There are seventeen pedestrian paths and two vehicle accesses to the site with only three conflicting points between pedestrian flow and vehicle traffic. The plan is an improvement, but it ignores the diagonal between north-west and south-east corners of the site, which is an important path for students, faculty and staff in Colleges of Design and Engineering.

For my redesign, a pedestrian traffic survey gave the real picture of pedestrian activity on the site (see Figure 5.6). A reasonable separation of pedestrian flow and vehicle traffic is retained from Sasaki’s plan as well as the real pedestrian diagonal across the site (see Figure 5.5).

Variety

Variety gives places experiential choice. Variety of experiences imply places with varied forms, uses and meanings. The following three checklists show the differences among the existing, master plan (1991) and redesigned varieties (see Figure 5.7-5.9).

The existing uses of this area are too functional, such as parking, walking though, working on site, etc.. There are no enjoyable uses. There are almost no
Figure 5.1: Major pedestrian flows towards the central campus
Figure 5.2: Location of the site
EXISTING PEDESTRIAN PERMEABILITY

- NEAREST MAIN PEDESTRIAN PATHS (BEYOND THE SITE) THROUGH MAIN CAMPUS.
- LETTERS INDICATE PEDESTRIAN PATHS LINKING TO THE SITE FROM NEAREST MAIN PEDESTRIAN PATHS.

19 PEDESTRIAN PATHS

- CONFLICTING POINT BETWEEN VEHICLE TRAFFIC AND PEDESTRIAN PATH (WITHIN THE SITE).
- COMPARE THE 19 PATHS TO SEE WHICH CONNECT THE SITE MOST DIRECTLY TO THE MAIN PATHS (BASED ON VISUAL DIRECTNESS). THE NUMBER OF CHANGES OF VISUAL DIRECTION IS PLACED UNDERNEATH THE LETTER IN THE FOLLOWING TABLE.

<table>
<thead>
<tr>
<th>ABCDEFGHIJKLMNOPQRST</th>
<th>3 2 1 2 2 2 4 1 1 1 2 2 2 2 2</th>
</tr>
</thead>
</table>

For example, path A:

Figure 5.3: Existing pedestrian permeability
Figure 5.4: Master plan (1991) pedestrian permeability
REDESIGNED PEDESTRIAN PERMEABILITY

- NEAREST MAIN PEDESTRIAN PATHS (BEYOND THE SITE) THROUGH MAIN CAMPUS.

- LETTERS INDICATE PEDESTRIAN PATHS LINKING TO THE SITE FROM NEAREST MAIN PEDESTRIAN PATHS.

17 PEDESTRIAN PATHS

- CONFLICTING POINT BETWEEN VEHICLE TRAFFIC AND PEDESTRIAN PATH (WITHIN THE SITE).

- COMPARE THE 17 PATHS TO SEE WHICH CONNECT THE SITE MOST DIRECTLY TO THE MAIN PATHS (BASED ON VISUAL DIRECTNESS). THE NUMBER OF CHANGES OF VISUAL DIRECTION IS PLACED UNDERNEATH THE LETTER IN THE FOLLOWING TABLE.

![Diagram showing pedestrian paths]

Figure 5.5: Redesigned pedestrian permeability
<table>
<thead>
<tr>
<th>Time</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>AVERAGE</th>
<th>D1</th>
<th>D2</th>
<th>AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30-8:30AM</td>
<td>84</td>
<td>149</td>
<td>112</td>
<td>105</td>
<td>201</td>
<td>230</td>
<td>216</td>
</tr>
<tr>
<td>8:00-9:00AM</td>
<td>91</td>
<td>91</td>
<td>63</td>
<td>85</td>
<td>312</td>
<td>387</td>
<td>349</td>
</tr>
<tr>
<td>11:00-12:00PM</td>
<td>41</td>
<td>58</td>
<td>24</td>
<td>44</td>
<td>303</td>
<td>476</td>
<td>369</td>
</tr>
<tr>
<td>1:00-2:00PM</td>
<td>64</td>
<td>157</td>
<td>121</td>
<td>101</td>
<td>239</td>
<td>259</td>
<td>249</td>
</tr>
</tbody>
</table>

Figure 5.6: Pedestrian traffic survey
social activities in the open spaces because of their uses and visual qualities. For example, there is no pedestrian visual focal point, no outdoor furniture and incompatible uses such as mixed pedestrian flow and service traffic, parking, etc. (see Figure 5.7).

Sasaki's new master plan adds non-vehicle outdoor open spaces to the site by separating pedestrian flow and service traffic, and removing existing parking lots (see Figure 5.8).

Besides non-vehicle outdoor open spaces, the redesign creates more space types such as linear space and square space, open and semi-open spaces (see Figure 5.9, 5.10). Compatible building entrances are also concerned in the redesign (see Figure 5.11). Users can feel that their surrounding is a living environment. Places where people can stop, can sit, can have a nice conversation are created by carefully designing space edges and space furnishing. Further, three major spatial sequences are created based on pedestrian flows on the site (see Figure 5.12, 5.13a, 5.13b, 5.13c, 5.13d, 5.14a, 5.14b, 5.14c, 5.15a, 5.15b). A real space has not only its three spatial dimensions, but also time, the fourth dimension. People's spatial experience is a changing experience. It changes while he (or she) moves. It changes while the sun moves. It changes while the season changes.
Variety: varied forms, uses, and meanings
(Differences between the existing condition, the new master plan and the redesign are underlined.)

Use:
*Land use: This area is zoned as an engineering court by the university. Most buildings in and around this area this area belong to engineering departments (totally about 16 departments in 9 buildings).

*Building use: Academic
               Administration
               Service
               Historical landmark

*Outdoor space use: Service roads
                     Pedestrian path
                     Parking (vehicle, bicycle, motorcycle)
                     Dumpsters
                     Loading areas
                     Green areas

Form:
*Outdoor space form: Linear space
                     Square space (parking)

*Building material(color)
                     Brick--dark red
                     Stone--white
                     Wood--yellow (painted)
                     Steel--gray, black (painted)
                     Marble--dark red

*Building style: Traditional style
                 Modern style

Meaning:
*People: Faculty -pass through only (often or occasionally)
          Staff -working and studying in the area permanently
          Student
          Other -working and studying in the area occasionally

*Meaning: Parking lots
          Service area
          Passing through space
          Poor visual and spatial quality

Figure 5.7: Existing variety checklist
Variety: varied forms, uses, and meanings
(Differences between the existing condition, the new master plan and the redesign are underlined.)

Use:
*Land use: This area is zoned as an engineering court by the university. Most buildings in and around this area belong to engineering departments.

*Building use: Academic
   Administration
   Service
   Historical landmark

*Building style: Traditional style
   Modern style
   ?

Meaning:
*People: Faculty -pass through only (often or occasionally)
   Staff -working and studying in the area
   Student permanently
   Other -working and studying in the area
   occasionally

*Meaning: Parking lots
   Service area
   Architectural defined open space (non-vehicle)
   Pedestrian spaces

Figure 5.8: Master plan (1991) variety checklist
Variety: varied forms, uses, and meanings
(Differences between the existing condition, the new master plan and the redesign are underlined.)

Use:
*Land use: This area is zoned as an engineering court by the university. Most buildings in and around this area belong to engineering departments.

*Building use: Academic Administration Service Historical landmark

*Outdoor space use: Service roads Pedestrian path Parking (vehicle, bicycle, motorcycle) Dumpsters Loading areas Green area Social places

Form:
*Outdoor space form: Linear space
Square space (paved areas and green areas)
Semi-outdoor space
Small yard space

*Building material(color)
Brick--red Stone--white Steel--gray, black (painted) Marble--dark red

*Building style: Traditional style Modern style

Meaning:
*People: Faculty -pass through only (often or occasionally)
Staff -working and studying in the area
Student permanently
Other -working and studying in the area occasionally

*Meaning: Parking lots Service area Architectural defined open spaces (non-vehicle) Pedestrian spaces Gateway to the central campus Sheltered outdoor spaces

Figure 5.9: Redesigned variety checklist
Figure 5.10: Outdoor space types

OUTDOOR SPACE TYPES:
- SEMI-OUTDOOR SPACE
- GREEN SPACE
- PAVED OUTDOOR SPACE

REDESIGNED BUILDING
ROOF PLAN

SITE PLAN
Figure 5.11: Building entrance compatible design
Figure 5.12: Spatial and visual sequences
VERTICAL ELEMENT IN A SPACE (NOT A MASSIVE ONE)

FEELING AN ARCHITECTURALLY DEFINED SPACE

SOFT SPACE EDGE

NICHES
Figure 5.14: Sequence 1.b

Vertical element in a space (not a massive one)

Feeling an architecturally defined space

Soft space edge

Leading
ENTERING ANOTHER GATEWAY SPACE

INTERFACE WITH A LINEAR SPACE AT CROSSING

LEADING (LEAVING THE OPEN SPACE)
Enjoyable spatial and visual sequence

Spatial depth (layers of spaces)

Human scale

Direction leading

Transperience space translating to the inside space
MARY OPEN SPACE AT ANOTHER SIDE

SMALL YARD AT ONE SIDE

VISUAL FOCAL POINT

LINEAR SPACE (SHELTERED OPEN WALL)
ONE SIDE: TRADITIONAL BUILDING FACADE (VISUAL RICHNESS)

INTERFACE OF TWO MAIN PEDESTRIAN PATHS (PLEASURE OF CHOICES)

LEADING LINE

ONE SIDE: OPEN SPACE
Figure 5.21: Sequence III-b
Figure 5.21: Sequence III-b
Legibility

Legibility is the quality which makes a place understandable.

For testing the existing legibility, I designed an image map survey (see Figure 5.22). Besides the survey, I went to the site many times. I found there was almost no social activities on the site. Nowhere invited people to stop, to sit and to have a conversation between friends. Nothing was enjoyable on the way passing through. Also, there was a lot of conflict between service traffic and pedestrian flow. Therefore, what we need to do is:

1. Create memorable spaces and pedestrian paths,

2. Create non-vehicle outdoor spaces.

According to Bentley, a place’s legibility could be increased by:

1. Linking with existing (or other) nodes or landmarks,

2. Creating strong self-identity.

In Sasaki’s master plan, the open space on the site is linked with the quadrangle and other nodes to its north through pedestrian paths (see Figure 5.23). The plan is not detailed enough to design self-identity for the space.

In the redesign, both linking with existing nodes or landmarks (see Figure 5.24) and creating self-identities (see Figure 5.25) to deal with the legibility problem were useful. But the only way to test whether a place is legible or not is by its users in the future.
Image map survey report:

* Return rate: 28 of 30 (93.33%)

  student: 21 (75.00%)
  staff: 5 (17.86%)
  faculty: 2 (7.14%)

* What I found from the survey:

  1. **Common elements**
     - Water tower: 17/28 (60.71%)
     - Parking: 23/28 (82.14%)
     - A path: 13/28 (46.43%)
     - B path: 21/28 (75.00%)

2. Almost everybody knows there are buildings on the site. But the building shape and relationships between them are hard to tell. This means:

   1) building shape has no identity,
   2) building relationship has no clear patterns, neither do open spaces which are defined by these buildings.

* What to do:

   1) Create memorable spaces and pedestrian paths,
   2) Create non-vehicle spaces.

Figure 5.22: Image map survey report
REDESIGNED LEGIBILITY
LARGE SCALE
RELATIONSHIPS BETWEEN THE CENTRAL LAWN, THE QUADRANGLE
AND THE REDESIGNED OPEN SPACE
IDENTIFIABLE BETWEEN EACH OTHER AND RELATED TO EACH OTHER
LOOSELY DEFINED SPACE BOUNDARIES
ONLY FOUR IMPORTANT BUILDINGS DEFINE THE SPACE
BUILDINGS ARE INDIVIDUAL OBJECTS
THE SPACE BOUNDARIES ARE IRREGULAR
DISTANCE BETWEEN BUILDINGS ARE GREATER

TIGHT DEFINED SPACE BOUNDARIES
BUILDING SHAPE RELATED TO SPACE SHAPE
ONLY TWO BUILDINGS DEFINE THE SPACE

WELL DEFINED SPACE BOUNDARIES
BUILDINGS ARE INDIVIDUAL OBJECTS
BUILDING SHAPES ARE NOT DIRECTLY RELATED TO THE SPACE SHAPE
BUILDING LOCATION DOES AFFECT SPACE SHAPE
THE SPACE IS FORMED BY A GROUP OF BUILDINGS
THE SPACE IS A REGULAR RECTANGLE

Figure 5.24: Redesigned legibility I
SMALL SCALE

- SPATIAL IDENTITIES
- IDENTITIES OF PEDESTRIAN PATHS

(see perspective sequences)

Figure 5.25: Redesigned legibility II
Robustness

Environments which can be used for many different purposes offer their users robustness (Bentley, 1985, p. 10).

There is no robustness on the existing site, because most uses are fixed, such as parking lots, service roads, pedestrian paths, etc.. There are no social activities on the site. Sasaki’s plan is not detailed enough to consider robustness.

The redesigned robustness includes two different scales: large-scale robustness and small-scale robustness. The large-scale robustness concerns the ability of the space as a whole, or large parts of it, to be changed in use. For example, the whole site changes its owner (different departments or colleges) or use (see Figure 5.26). The small-scale robustness concerns more detailed design such as space edges, trees (see Figure 5.27).

Visual Appropriateness

Visual appropriateness comes from the interpretations people put on a place. It is particularly important in the more public places.

According to Bentley, there are two kinds of cues can be used to design a visually appropriate places: contextual cues and use cues. To support legibility, we need contextual cues which are interpreted as relating a place to its context, such as material, building facade rhythm, window and door details (see Figure 5.28, 5.23). To support variety, we need use cues. Here, University academic use is the major use cue (see Figure 5.29).
LARGE-SCALE ROBUSTNESS

LARGE-SCALE ROBUSTNESS CONCERNS THE ABILITY OF THE SPACE AS A WHOLE, OR LARGER PARTS OF IT, TO BE CHANGED IN USE.

CHANGING OWNER OR USE IN CERTAIN PERIOD TIME

LONG-TERM HISTORY

SHORT-TERM CONVENTION, CONFERENCE, EXHIBITION,

SMALL-SCALE ROBUSTNESS

SHELTERED SPACE: PROVIDING PROTECTION FROM CLIMATE (RAIN, SNOW, WIND, SUN, ....)

TREES CAN FORM SMALL ENCLOSURES WITHIN THE MAIN SPACE

INCREASE SPACE EDGE

Figure 5.26: Redesigned robustness I
Figure 5.27: Redesigned robustness II
Figure 5.28: Existing surrounding building facades
VISUAL APPROPRIATENESS:
WEST ELEVATION

CONTEXTUAL CUES:
1) BUILDING MATERIAL----RED BRICK
   (UNIVERSITY RED BRICK ZONE)
2) WEST ELEVATION----MAIN RHYTHMS:
   HORIZONTAL
3) SKYLINE: HORIZONTAL LINE
4) WALL DETAIL AND WINDOW----HORIZONTAL ORIENTED
5) FIRST FLOOR COLUMNS AND WINDOWS ARE VERTICAL ORIENTED (RECALL EXISTING RHYTHMS)

USER CUES:
UNIVERSITY ACADEMIC BUILDINGS

NEW BUILDING SKYLINE

WALL DETAIL (BRICK, RED)
WINDOW (VERTICAL ORIENTED)
GROUND LEVEL DETAILS

Figure 5.29: Redesigned visual appropriateness
Richness

Richness is personal enjoyment of an environment. Richness can be increased by different sense-experiences, such as the sense of sight, the sense of smell, the sense of hearing, etc.. Among these, the sense of sight is the most important one. It is both the dominant sense in terms of information input, and the one most under human control.

Visual richness depends on presence of visual contrasts in the surfaces concerned (see Figure 5.30). Further, viewing distance is very important. Where the surface will be seen at long range, large-scale richness is necessary; while at close range, richness must be achieved by small-scale elements subdivisions. So to maintain richness from long-range we need a hierarchy of elements from large-scale to small-scale (see Figure 5.30, 5.25).
Figure 5.30: Redesigned richness I
ORIENTATION CONTRASTS:

SAME MATERIAL
ONE IS: HORIZONTAL
STRAIGHT
OTHER IS: VERTICAL
CURVED

OTHER ORIENTATION
CONTRACTIVE ELEMENTS:
STEPS AND COLUMNS

Figure 5.31: Redesigned richness II
CHAPTER 6. CONCLUSION

Iowa State University has a beautiful central campus and a rich design history, dating back to the middle of the 19th century. The dominant image of the central is informal and picturesque. The central lawn, which provides the dominant image of the whole campus, has always played the same role on the campus, while formal geometric relationships, common alignment of buildings, and the grid streets typify the more mundane north and west parts of the central campus. From an outdoor environmental point of view, problems between the central lawn area and the later developed areas are not in their contrasts, such as the contrast between the dominant informal image and the formal geometric relationships or the contrast between curved street pattern and the grid street pattern. Problems are in “linkage and accommodation,” such as physical linkage, visual linkage and spatial quality linkage or consistency. The campus should be treated as a whole. Each part of it should connect to each other, should work well together and should be part of the whole campus. The future physical development of the campus should concentrate not only on the central campus, but also on subpopulations of faculty, staff and students who occupy peripheral areas and warrant open space environments of similar quality.

Further study on the potential of the central campus is recommended, as well,
in order to keep the ISU campus a walking campus. Encouraging human-scaled, ground level, activities offers an environment with social qualities. Today, social activity is a great part of the learning process. Students learn even more from other students, faculty and staff than from classes. A well designed open space system provides an environment for emphasizing the potentials of the university as a communication and information network, as well as a contemporary life style.

The use of Trancik’s and Bentley’s urban design methods has been emphasized during this study. Trancik’s methods are a combination of studies on urban design; they assist in problem solving as analytical tools and design guidelines. In this study, Trancik’s methods helped organize the line of thinking and established a relationship between the elements of urban fabric for the overall analysis of the campus. A series of maps reflecting the physical conditions and layout of the study area were constructed during the analysis. Bentley’s methods provided a step-by-step guide on the process of evaluation and redesign of the selected site on the campus. The concept of a responsive environment is the democratic relationship between an environment and its users. The methods (approaches) toward a responsive environment are practically leading design actions from the users point of view. The principles are general, yet they combine the parts for a unified approach towards urban spatial design.

From this study, I would recommend that the University maintain updated information, so that anyone who is working on a single project can have the whole picture of the campus. Detailed information on sites slated for development could be made available to guide design. At this point, I recommend a computer operation. GDS (Graphic Design System) and AutoCAD (release 11) were used in
this study. GDS is a very powerful system for facilities management. It uses an object structure to efficiently store and retrieve graphic and non-graphic data. This is useful for infrastructure applications because it allows geometry to be classified collectively or individually by name. The PCN entities (polygons, chains and nodes) can be assigned a meaningful name which serves as a "handle" for organizing later analysis and viewing activities. The University should take advantage of this system for its facilities management, because it will be worth it in the future. AutoCAD is a very popular computer-aided drafting and design software. Its features include ease of use, accuracy, intelligence, and customization. Comparing with GDS, AutoCAD is easier to use, but less powerful in analytical capability and management. Two-dimensional drawing files can be transferred from one to another.

It was the intent of this study to call attention to the open space system on ISU campus: a beautiful central campus. What the rest of the campus needs now and in the future are decision makers who understand the importance of the open space system and integrate its development into all related improvements. This study suggests a way to systematically think about the open space system on ISU campus which has great potential to be more beautiful, meaningful and supportive of campus life.
SELECTED BIBLIOGRAPHY


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