A PROJECTION FOR A PUBLIC FRAMEWORK ACCESSIBLE TO WHEELCHAIR USERS

by

Marshall Kinkead Audin
B.S. Civil Engineering, Lafayette College 1967

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARCHITECTURE at the

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ABSTRACT

The principal objective of this thesis is to explore issues relevant to the design of a public framework which is accessible to the wheelchair user and conducive to his social integration with the general public by supporting a range of specific communal activities, (commercial, office, institutional, recreational and entertainment) as well as private dwelling units. This framework enables the wheelchair user to move about the built environment without being dependent on assistance from others, therefore, providing him with social independence and the ability to fully participate in the public communal realm which he is often denied.

The focus of this work is the development of a possible design concept for a site in Woburn, Massachusetts. The documentation of this concept includes diagrams of the principles used to develop the concept, and several sections as well as plans, coded to illustrate the various social and territorial associations inherent in the use of a public framework.

Thesis Supervisor: Arthur Bernhardt
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1.0 INTRODUCTION

Research and the development of guidelines intended to aid the design of "barrier free" built environments for wheelchair users, by necessity, concentrates on quantifiable facts and figures. According to Goldsmith\(^1\) even these "facts" require re-evaluation. The dearth of examples of built environments developed according to specific guidelines makes it, as yet, impossible to adequately research the effectiveness of these guidelines under actual daily use. This lack of built examples not only impedes the refinement of guidelines but also means there is a lack of images of what the quality of such built environments can be like. Unfortunately, the few examples available are not inspiring.\(^2\) They are primarily designed exclusively for the needs and, therefore, the use of chair-bound people. As a result, the isolation of the wheelchair user from the mainstream of public activity is re-enforced. Even within these special environments, fundamental oversights are not uncommon.

\(^1\)Goldsmith, Selwyn; Designing for the Disabled; McGraw Hill Book Co., New York 1967.

For example, in several cases the sole means of emergency egress in a high rise apartment building for handicapped people was a fire stair.

It seems as if the dwelling units themselves get the attention of the designer while the design of the public framework that supports them is often inadequately considered. This is a strange ordering of priorities when one considers that the individual can exercise the greatest and most direct ordering of a physical environment when it is his own place while he can least directly affect the public environment which he shares in a transient manner with the rest of society.

In addition to the above, the examples that I have seen or examined lack spatial definition. Circulation is only for circulation, there is little or no three-dimensional association and the places seem to have little contact with nature or even their immediate surroundings.

I do not believe that these examples provide us with a rich enough image of the potential quality of spatial organization particularly in the public realm. Furthermore, I believe that as long as the wheelchair users mobility is restricted to specific environments which tend to isolate him from the general public environment or at least let him participate through the "back door", he has no choice but be dependent on others.

The work of this thesis attempts to address these apparent shortcomings in existing public frameworks and to provide a
projection of what a public environment more responsive to chairbound people might be like.
2.0 OBJECTIVES

The principal objective of this thesis is to explore issues relevant to the design of a public framework which is accessible to the wheelchair user and conducive to his social integration with the general public by supporting a range of specific communal activities, (commercial, office, institutional, recreational and entertainment) as well as private dwelling units. This framework enables the wheelchair user to move about the built environment without being dependent on assistance from others, therefore, providing him with social independence and the ability to fully participate in the public communal realm which he is often denied.
3.0 NEEDS OF THE WHEELCHAIR USER: MAJOR DESIGN IMPLICATIONS

There is a vast array of requirements that must be dealt with when building a "barrier free" environment. The vast majority of them are detail issues that do not have a significant effect on design at the framework level, (i.e., a wheelchair requires 5' clearance to turn around).

However, there are some issues which do effect the form of the framework. These issues are outlined in this section.
3.1 **HORIZONTAL MOVEMENT CONSIDERATIONS**

Wheelchair users who push themselves can not be expected to accept pedestrian distances designed for the able bodied, and the same holds true for the elderly and other ambulant disabled people. It is extremely difficult to lay down specific standards, as there is much individuality involved in one's ability, design, and energy levels. Many can cover as much ground as an able bodied person, the only difference being the time taken to get between two points and the physical effort involved. Others can barely walk at all and tire very quickly.¹

3.2 **VERTICAL MOVEMENT CONSIDERATIONS**

3.2.1 **Ramps**

One's first impulse is to plop ramps (1/12 ratio vertical/horizontal) everywhere and..."voila!" the problem is taken care of. Unfortunately, it is not that simple. For the disabled and chairbound person, strength, coordination, determination etc. which effect horizontal movement, are even more acute when dealing with vertical movement. Ramps and even gentle slopes present some very significant problems. For the wheelchair-bound person a ramp presents a continuous commitment to the expenditure of energy. Periodic platforms can provide resting places but they may not be placed at sufficient intervals to compensate for the lack of strength.

an individual user may have.

Going down a ramp has its problems, too. The force of gravity may cause a wheelchair user to move too rapidly, loose control, and turn over his chair. Even the awareness of this potential may inhibit general use of ramps and therefore severely limit the mobility of the wheelchair user. This is not to say that ramps are to be avoided completely. Rather, they should not be employed as a general means of vertical movement; and there ought to be gently inclined stairs and lifts as alternate modes of vertical travel.

3.2.2 Stairs

Stairs, if designed and detailed properly, are usable as long as they are deployed judiciously and always in combination with lifts and ramps.

3.2.3 Lifts

The term lift in this case includes devices that might move in an inclined manner such as a finicular railway or an elevator which moves perpendicular to the ground plane. Lifts are expensive to install and to maintain. They are susceptible to breakdown as well, and are, therefore, less reliable in case of emergency. Their impact on the form of a built environment which is "barrier free" is quite significant. While they provide gross vertical mobility that neither ramps or stairs can match, they, by their nature and expense, cause vertical movement to be concentrated at selected points. The economics of elevator installation are such that the cost of
providing all the support paraphernalia such as hoist room, mechanical room, cab, plunger etc., are substantial relative to the cost of adding additional stops. Therefore, the tendency is to make a building more vertical in order to concentrate the installation of elevators.

3.2.4 Escalators

Escalators are not being considered for the following reasons:

1. They are most efficient when used to transport very large volumes of people. Such volumes are not anticipated by this project.

2. Because they are continuously moving, a vast number of infirm people could not use them.

3.2.5 Fire Egress

The conventional approach used for providing fire egress is fire stairs. Clearly fire stairs are not a valid means of egress for the chair-bound person. These people are taking a substantial risk whenever they are in buildings which rely on fire stairs for emergency egress. How then can fire egress be provided? Ramps are dangerous enough under normal use let alone panic conditions such as escape from a fire. Elevators, too, if employed as they normally are, are not a safe means of egress. One alternative is to build the entire environment using the same building codes as hospitals. Codes designed for hospitals are very restrictive and do not permit even a reasonable degree of visual association vertically. In addition, the cost of building to hospital
code is extremely expensive. So much for that alternative. What strategy, then, can we employ? Perhaps vertical egress is not the proper approach. Instead, we should rely principally on a horizontal egress system (see Diagram #5). The overall implication of relying on horizontal fire egress on the form of a built environment is significant, but, it can also be an asset if full advantage is taken of it. If horizontal movement constitutes one's primary orientation to movement, then vertical movement becomes a matter of choice, not necessity. If no particular bank of elevators need provide the sole means of egress then the location and form of the built place around the elevator shaft is not restricted substantially by fire egress requirements and can therefore relate more directly to the social and convenience needs of the users.
4.0 THE PROGRAM

This section outlines the program, the reasons for the development of this particular program as well as planned expansion and changes to existing facilities.

First, under 4.1, the program that governs the design projection of this thesis is summarized; it represents a wide range of communal activities that are potentially compatible and when aggregated will provide a rich and varied environment.

This program has been developed, as outlined under 4.2, by considering existing facilities and by integrating and modifying several disjointed development plans actually pursued by different interests.

I have selected a specific real-life situation to work with as a vehicle for this exploration for two basic reasons. One, I believe that any built environment must have an association with its immediate surroundings. Any projection without being affected by its surroundings or even worse, having no surroundings is isolated and not continuous with the rest of our physical environment. Secondly, I chose this specific site on Route 3 in Woburn MA near the Winchester town line because several developers are independently
expanding the present Woburn Shopping Center, building a new professional office building, a high rise housing project for the handicapped and the New England Rehabilitation Center is planning potential expansion of its facilities all within this area. The potential for this area to be developed as a cohesive and viable multi-use place is obvious. Unfortunately, as things often go, this potential is not being taken full advantage of. However, it is not my intent to redirect work already under way. Instead, I have rolled back the clock to the early 1970's to the period when each of these proposals was in its infancy and thus more flexible and assume that these independent developers have been convinced that they ought to see if they could coordinate their efforts.
4.1 Outline of Program

This program is essentially the integration and modification of four independent development projects either underway or in the early stages of planning. (See Section 4.2 and 4.3 for a description of these projects).

4.1.1 Commercial

Existing

New

4.1.2 Office

4.1.3 Recreation and Entertainment

Movie Theaters (2)

Swimming Pool (indoor)

Structured Outdoor Recreation (i.e., basketball court, football field, gardens)

Unstructured Outdoor Recreation (i.e., plazas)

4.1.4 Housing (about 150 units)

4.1.5 Community Function Room

4.1.6 Day Care (for about 80-100 children)

4.1.7 Parking

Open Lot (1 car/300 sq. ft. of commercial and office = 486 cars)

Parking Garage (1 car/unit = 100 cars)

Guest Parking for Housing (about 40 cars)

4.1.8 Additions to N.E. Rehabilitation Center

Relocation of out-patient department

Expansion of dining facilities

Additional patient wards and lounges
4.2 EXISTING FACILITIES

4.2.1 The New England Rehabilitation Center and Clinic (N E R.C C.)

The New England Rehabilitation Center and Clinic was founded to provide comprehensive rehabilitation to patients primarily in need of physical restoration. Under the guidance of the Director of Rehabilitation, physicians, nurses, physical, occupational and speech therapists, social workers, and volunteers are specially oriented towards returning the patient to as near normal life as possible. Evaluation, restoration and follow-up services are provided to assure that the maximum potential is reached by each individual physically, psychologically, socially, vocationally, and in the case of young patients, educationally. In addition to the primary goal of patient care, the Center is committed to use its facilities and services to train professionals in the rehabilitative disciplines. The Center provides an environment which is supporting and sympathetic and, at the same time, firmly directive.

4.2.2 Woburn Shopping Center

The Woburn Shopping Center consists of three elements: the Star Supermarket (approx. 25,200 sq. ft.); the North Block (approx. 40,000 sq. ft of retail specialty stores), a Chinese restaurant, laundromat, and department store (Boston Baby) and a Friendly's Ice Cream Shoppe. The Star Market is a single story structure supported by laminated wood arches forming nine equilateral triangles 70 feet on a side and a
service structure which is masonry bearing wall and built up roofing. The Boston Baby Store is a single story structure with 4" square lally columns 24 ft. on center, metal bar joists and a conigated metal deck and built up roofing. The remainder of the shops in the North Block are supported by masonry block bearing walls ranging from 15 ft. to 40 ft. on center.

4.2.3 Professional Office Building

The same people who developed N.E.R.C.C. are building a six story (approx. 35,000 sq. ft) professional office building just north of the Junction of Rehabilitation Way and Route 3.

4.3 PLANNED FACILITIES EXPANSION

4.3.1 Expansion of Woburn Shopping Center

Recently the Giant Store chain went bankrupt. One of its outlets was at the Woburn Shopping Center. Presently, the store shell remains vacant at the easterly end of the North Block. A developer is planning to rehab the shell (approx. 36,000 sq. ft.) into a series of specialty shops, cafes and boutiques and possibly a movie theater complex.

4.3.2 Handicapped Housing

The same developer who has built the N.E.R.C.C. and is building the professional office building is planning to build a high rise 67-unit handicapped housing apartment building just to the east of the Giant Store shell. This building, being designed now, will include a community function room and a laundramat.
4.3.3 Additions to N.E.R.C.C.

Recently, the Center added extensive kitchen facilities to the east of the dining room and converted the old kitchen in the basement to a pharmacy. Within the next ten years the Center will probably expand its bed capacity beyond its present 200 beds as well as expand its therapy, out-patient clinic and dining facilities.
5.0 THE SITE

The site selected as the vehicle for this design projection was chosen primarily because it is capable of supporting a variety of communal activities. (See Section 4.0, The Program).

This section briefly outlines the principal effects that the topology of the site and the regional climatic conditions have on the organization of the design. (See Plate 4, Climatic Data).
5.1 **LOCATION (See Plate 1)**

The site is located along Route 3 just behind the Woburn Shopping Center, Woburn, Massachusetts.

5.2 **SITE AREA (see Plate 2)**

The site is nearly 15 acres (750' x 900').

5.3 **SITE TOPOLOGY (See Plate 3)**

5.4 **CLIMATE (See Plate 4)**

The area's climate is tempered by marine influences of the ocean. Average seasonal temperatures are 72°F in July and 28°F in January. The region receives 55% of the maximum possible sunshine. However, daily variations are at times extreme; freezing and thawing cycles are frequent, and tropical heat waves are often followed by intervals of cold weather.

Prevailing winds are from the northwest and west during the underheated period and from the southwest during the overheated period. The annual precipitation is about 40 inches (27-67 inches) and the annual snowfall is 42 inches (about 9 to 96 inches).
6.0 DESIGN CONCEPT DEVELOPMENT

This section documents the development of the design concept to date as well as illustrates the process used. The section is divided into four parts.

Part one simultaneously traces the chronological evolution of six design concepts (designated A, B, C, D, E and F) and my interpretation of the original program (See Section 4.0).

Part two documents the major principles that guided the development of concept scheme (F).

Part three provides the reader with illustrations of how these principles were employed in the development of scheme F, via a series separation overlaid on reductions of the site plan.

The final part of this section is a presentation of several key plans and sections illustrating how scheme F might be further developed.
6.1 PART ONE: EVOLUTION OF THE DESIGN CONCEPT
Scheme A focuses on the organization of the housing units as extensions of the Rehabilitation Center. The scheme was developed according to a very simple image. I viewed the valley as a harbor and the housing as wharves extending like fingers into the harbor.

The scheme was quite simple-minded and therefore ignored many critical issues. The most obvious problem was the discontinuity between the housing and the shopping center generating a "no-man's land" and the weak connection with Horn Hill.
Scheme B still focuses exclusively on the organization of the housing. The image of wharves projecting into the harbor and the connection to the Rehabilitation Center weakens as an attempt is made to reach out to the shopping center and Horn Hill.

Many of the shortcomings of Scheme A still remain un-resolved in this scheme, even though an attempt is made to connect with the shopping center in order to eliminate the "no-man's land".
Scheme C represents the first major re-interpretation of The Program, while Schemes A and B focused exclusively on the housing. This scheme recognizes the need to include the expansion of the shopping center. Instead of merely reaching out toward the shopping center, the housing is integrated with the center and the hill as well as being a bridge to the Rehabilitation Center. Once the need to integrate the housing and the expansion of the shopping center became apparent, it became obvious that the greatest weakness in this scheme was a lack of a sense of a public place.
In this scheme, the last remnants of the wharf image disappears.

Another re-examination of the Program involved the recognition of the need to integrate the office space as well as the shopping center with the housing in order to provide easier access to the different elements of the project. This design also represents a first attempt at making a public place that can be shared equally by the residents and the public.

The principal shortcoming of this scheme is that it uses the elements merely as beads on a string connecting the Rehabilitation Center to the shopping center.
Scheme E attempts to address two weaknesses in Scheme D. This scheme focuses on the Development of a shared public space and the unstringing of the beads. Unfortunately, in an effort to scatter elements of The Program all over The Site in order to reach as many parts of the site as possible, the scheme becomes disjointed and overly complicated. The distances between elements of The Program tend to create barriers.
Scheme F differs from Scheme E in that it is a simpler, less scattered organization of the elements. Instead of trying to reach the hillside and bridge the valley between the shopping center and the Rehabilitation Center. This scheme is organized along the hill and bridges to the Rehabilitation Center via the swimming pool.

Of the six schemes, this one seems to be the most promising. As a result, I chose to develop this scheme further in order to explore the nature of the public framework in a more specific and detailed way.
6.2 PART TWO: DIAGRAMS OF PRINCIPLES

The following diagrams are intended to illustrate the basic principles used to develop Scheme F. These diagrams range from ideas concerning how the development of this site should tie into the regional development of Rte. 3 to ideas on the organization of the various elements on this particular site.
EXISTING DEVELOPMENT PATTERN

OPEN SPACE & RESIDENTIAL AREAS
ISOLATED BY NO-MAN’S-LAND BETWEEN COMMERCIAL STRIP DEVELOPMENT & OTHER USES.

TRANSITIONAL MUST BE BUILT...

IN ORDER TO AVOID NO-MAN’S-LAND AND INTEGRATE COMMERCIAL WITH THE COMMUNITY

ROUTE 3 DEVELOPMENT PATTERN

DIAGRAM NO: 1
COMMERCIAL SCHEMATIC

1. BUILT WALLS
   EXISTING ARCHETYPE
   FOR SHOPPING FACILITY

2. BUILT GROUND-FORM
   BEGINS TO REPLACE
   ROOF & WALLS

3. NATURAL GROUND-FORM
   CAVE
   PROPOSED IMAGE

DIAGRAM NO. 2
TYPE A

SCHEMATIC UNIT

BASIC CONCEPT
(L-SHAPED ENCLOSED SPACE DEFINES OUTDOOR LIVING SPACE)

LIFE DIAGRAM

ENTRY PLACEMENT AREA

KITCHEN-PATH CORE

INTERCHANGEABLE LIVING/ SLEEPING AREAS

OVERVIEW

DIAGRAM NO.: 3
DIAGRAM NO: 4

TYPE A
SCHEMATIC GROUPING

ENTRY POINT

DISTRIBUTION ZONE

TERRACE

DISTRIBUTION ENTRY

A

B

TERRACE

ENTRY

A

B
NODE CHARACTERISTICS

- Based on nature of fire exposure
- Ground rexess diagram
- Branch node

Type: A, B, C, D

Access to:
- on line
- fire walls
- isolates each node from next stages
6.3 PART THREE: EXPLANATORY DIAGRAMS FOR SCHEME "F"

The following diagrams are intended to provide an explanation of the deployment and use of the various elements in Scheme F. These diagrams consist of overlays on reductions of the site plan for Scheme F. The reader should understand that, despite the explicitness of these diagrams, they are merely meant to illustrate how the particular scheme, as developed to date, might function.
RECREATION & ENTERTAINMENT

A. Brook
B. Public Courtyard: Adjacent to restaurant, day care, shopping & offices
C. Twin Indoor Cinemas
D. Hard Surface Play
E. Gazebo - Overlook
F. Hard Surface Play Area: Over parking garage
G. Swimming Pool
H. Community Function Room
VEHICULAR DISTRIBUTION & PARKING

A. Visitor Parking for N.B.R.C.
   170 Cars

B. North Parking Lot (270 Cars)
   Parking Commercial Center
   1 N.E.R.C. Out Patient Dept.

C. Central Lot (122 Cars)

D. South Lot (145 Cars)

E. Resident Parking

F. Resident Parking Garage
FIRE ACCESS & TURNAROUNDS
VEHICULAR DROP-OFF POINTS
& MAJOR PEDESTRIAN DISTRIBUTION
COMMERCIAL FACILITIES

A. MAJOR STORE
B. SPECIALTY SHOPS
C. RESTAURANT
D. STAR SUPER MARKET
E. BOSTON BABY CARRIAGE
INSTITUTIONAL FACILITIES

A  EXISTING N.E.R.C.
B  EXISTING N.E.R.C. KITCHEN
C  PROPOSED RELLOCATION OF N.E.R.C. OUT-PATIENT DEPT.
D  PROPOSED RELLOCATION OF TRAINING FACILITIES FOR N.E.R.C.
E  DAY CARE FOR 50-100 CHILDREN
HOUSING UNITS
PREVAILING WIND DIRECTION
APPROXIMATE AVERAGE DAILY WINDS

CLIMATIC DATA

SUN DIRECTION
APPROXIMATE MID-MONTH DIRECTIONS

SUN HEIGHT
APPROXIMATE MID-MONTH ELEVATIONS

PLATE

JANUARY
APRIL
JULY
SEPTEMBER
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