INTERPRETING STRUCTURE THROUGH INTUITION:
A Light Rail Campus Crossing in Seattle

by David L. Gipstein

Bachelor of Arts in Architectural Studies
University of Washington, Seattle, WA
June 1989

Submitted to the Department of Architecture in partial fulfillment of the requirements
for the degree Master of Architecture at the Massachusetts Institute of Technology.
February 1992

© David L. Gipstein 1992. All rights reserved.
The author hereby grants to M.I.T. permission to reproduce and distribute publicly copies of this
thesis document in whole or in part.

Signature of author

David L. Gipstein
January 17, 1992

Certified by

Fernando Domeyko
Lecturer
Thesis Supervisor

Accepted by

Renee Chow
Chairperson, Departmental Committee on Graduate Students
DISCLAIMER OF QUALITY

Due to the condition of the original material, there are unavoidable flaws in this reproduction. We have made every effort possible to provide you with the best copy available. If you are dissatisfied with this product and find it unusable, please contact Document Services as soon as possible.

Thank you.

Both the Library and Archival copies of this thesis contains grayscale pictorial images only. This is best available copy.
INTERPRETING STRUCTURE THROUGH INTUITION:
A Light Rail Campus Crossing in Seattle

by David L. Gipstein

Submitted to the Department of Architecture on January 17, 1992 in partial fulfillment of the requirements for the Degree of Master of Architecture

ABSTRACT:

Common to all people is some degree of intuition into aspects of the natural physical laws by which we are bound to the earth. To a large degree this intuitive sensitivity is grounded in our visual registration of the horizon and in the inescapable rooting of ourselves and our structures in gravity. Whether we realize it or not, in some capacity we continually experience, either physically or visually, aspects of these natural structural phenomena. Ultimately, the subconscious and sometimes conscious registration of these observations and experiences, provides an intuitive basis by which we interpret and understand structure and form.

While observing architecture, we both intuitively and rationally respond to the expression of structure within the design. Depending on the extent of structural expression and clarity, we may consequently respond at a rational or conscious level, interpreting meaning in the structure and the design. At these points, where the structure transcends its fundamental purpose of resolving the gravitational forces to the ground, the structure expresses the ideas and spirits driving the design.

It is my contention that through a clear understanding of the qualities and intentions of the design, and thorough structural consideration and attention to detail at an intuitive level, structure can ultimately be interpreted and understood at an intuitive level. As a means of exploring this subject, I have selected the design of a Light Rail Station as the project, primarily due to the dominant structural requirements of rail stations in general.

Thesis Supervisor: Fernando Domeyko
Title: Lecturer of Architecture
Acknowledgements:

In deep gratitude and appreciation for their unyielding love and support, this thesis is for: 
*My parents.*

I would like to extend my sincere thanks to those people who have supported and helped me complete this work:

To Fernando Domeyko for his insight, enthusiasm, and passionate inquiry into a sensitive understanding of architecture and design

To Jim Axley for his practical and succinct design criticism and support of a structured exploration, so to speak

To Shun Kanda for his attention to fundamental design issues and concern for clarity and meaning

To my wonderful office mates Luke and Murat, for their friendship, support, and laughter; whose company kept us sane, healthy, and alive.

To my close friends and housemates Geoff and Greg for their skilled hands, late night thoughts and criticism, comradery, and pats on the back.

To my old buddy Tom for his diligent long distance work back in Seattle

To Emily for her long hours in the darkroom and Albert for his photography back at the site

To Ani for his relaxing support and the use of 'the machine' the classic black X1/9

To the Roy's for the generous use of their car, warm support, and quiet dinners

And especially to Soni for whose tremendous caring, dedication, and love provided the strength to see the work to the end. For her drawing, beautiful rendering, modeling, typing, editing, xeroxing, cutting and pasting, and so much more, I am grateful.
TABLE OF CONTENTS:

Abstract 3
Acknowledgements 4

Chapter I: Thesis Exploration 7

Chapter II: The Project
I. Selection of Rail Station as Project 15
II. Meaning in Rail Station Design: Historical Background 21
III. Contemporary Context and Agenda 23
IV. Contemporary Context - Seattle - Rail Planning 25
V. General Site Area Selection - University of Washington - University District 33

Chapter III: Urban Analysis - Site - Program
I. Analysis of Urban Forces - Site Selection 39
II. Site and Program 62

Chapter IV: General Site Considerations
I. Connections 71
II. Circulation 72
III. Relationships and Qualities of the Station Crossing 75

Chapter V: Design
I. Initial Moves/First Pass 79
II. Second Phase: entering the site 86
III. Third Phase: overbuilding the site 91
IV. Fourth Phase: clarification of site and structure 99
V. Fifth Phase: Resolution and Refinement: 110

Bibliography 145
List & Source of Illustrations 149
CHAPTER I: THESIS EXPLORATION

Common to all people exists some degree of intuition into the natural physical laws by which we are bound to the earth. To a large degree this intuitive sensitivity is grounded in our visual registration of the horizon and in the inescapable rooting of ourselves and our structures in gravity. Our intuitive understanding often spans a great distance from aspects of general natural physics to those specifically of structure and construction. Whether we realize it or not, over the course of our daily lives, we, in some capacity, both physically and visually experience aspects of these natural physical and structural phenomenon, either directly in nature or in the built environment. From seeing a tree deflect in the wind to walking across a suspended bridge, our days are filled with experiences, often not registered consciously, that contribute to the development of our intuitive understanding of structure.

This structural intuition develops primarily as a synthetic process over time, often initially stemming from visual perception and physical experiences of structural forms and actions found directly in nature.\(^1\) Over time, this usual subconscious, but sometimes conscious, registration of these observations and experiences contributes to our intuitive understanding of structure and form. For example, the natural structural form of a cantilever is visible in every tree limb

---

bending under the force of gravity. We see that the cross-sectional dimension of the limb decreases as the distance from the trunk increases. Verification of this intuitive registration emerges as one feels that a cantilever with a larger cross-section at the tip of the projection seems structurally "incorrect," or unnatural. In comparison, on a physical level some degree of intuitive understanding can be recognized as one eases across a plank spanning two supports. At some internal level one senses at what point the board will fail. In both cases there seems to exists some level of intuitive and rational understanding into natural structural laws. In a similar manner, when viewing a column with a smaller base than its capital, we sense a discord in terms of structural rationality. This recognition of form in part can be traced to our visual recognition of the physical form of a tree trunk.

Aspects of natural structural form can be learned from our own body framework. Every time we hold out our arms for extended periods or walk up many flights of stairs, we feel the stresses and strains associated with the loads on the skeleton. These too, though to a lesser degree, add to our intuitive understanding of structure and form. We often register structure at an intuitive level when viewing, for example, a piece of machinery with a mechanical 'arm'. It seems that in our daily lives if we intuitively register some natural structural form, it may either 'feel right' or somehow seem structurally 'incorrect'. These responses stem from a direct intuition into structure. If the structure of a building is expressed either through its entire system or just the details, we too often

---

(4 -opposite top) "Application of the joints of the bones to mechanics" - and structure
(5 -opposite bottom) "Application of the play of muscles and tendons to mechanics" - and structure

(6) Relating structural forms and forces to the human body
intuitively respond to the expression of the structure. At that point if the stimulus is great enough, we may respond at a conscious level often resulting in our developing an associated meaning. At these moments due to our understanding, we often feel in accord with natural laws that transcend the mere physicality of the structure itself. This point exists where the structure visually transcends its purpose of resolving the gravitational forces to the ground, and expresses some specific ideas or spirits driving the design. Christian Norberg-Schulz refers to this type of phenomenology as "genius loci" or the spirit of the
place which, in his terms, gives one an "existential foothold" through the physical experience. Consequently, if some understanding or meaning can ultimately be read through structure at some level, then it seems that in terms of design, structure can directly express certain design intentions.

"The Engineer's Aesthetic and Architecture, are two things that march together and follow from the other....The Engineer, inspired by the law of Economy and governed by mathematical calculation, puts us in accord with universal law. He achieves harmony....The Architect [on the other hand]...realizes an order which is a pure creation of his spirit....by the relationships which he creates he wakes profound echoes in us, he gives us the measure of an order which we feel to be in accordance with that of our world, he determines the various movements of our heart and of our understanding; it is then that we experience the sense of beauty".4

It is my contention that through a clear understanding and definition of the experiential qualities or intentions sought in the design, the spirit or ideas can be explicitly expressed and read in the structure.

---

Robert Maillart: Salginatobel Bridge, Switzerland - 1929-30: graceful structural dynamics, clear expression of structural members, sympathy with the landscape.
CHAPTER II: THE PROJECT

I. SELECTION OF RAIL STATION AS THE PROJECT:

The decision to explore the ideas of the thesis in the design of a light rail station stems from many points.

To give strength to the exploration, the intuitive reading of meaning in structure, the building or project should fundamentally depend upon the dominance of the structure and its construction. While architecture cannot exist without structure, there are varying degrees to which structure can be utilized or expressed in...
design. The potential of structure to be expressed depends, in part, on the degree or complexity of structural resolution required in the design. For example, in the design of a residential home, the structural system could consist of traditional wood framing, steel construction, concrete construction, or a combination thereof. For the most part, the structural concerns are quite basic, with simple loads and spans. Since the structural requirements are minimal, the development of the design can progress with little restriction from structure or construction. Therefore, the degree of structural expression is then left to the discretion of the designer and consequently, the structure may not figure strongly in driving the design. In general, since meaning can be read in structure at any level and at any scale, working on a project where the structural considerations are substantial, and dominant, would provide a strong point of departure.

Due to the advancements in technology with respect to materials and construction techniques, designers often have a number of construction techniques and systems at their disposal to solve each problem. The designer is therefore freed from some of the engineering restrictions inherent in different structural systems. As a result, the expression of design intentions is not as tied to the choice of structural system.

Carried a step further, the project could consist of a dominance of structure and very little 'fill', that is, controlled enclosed space. A rail station offers potential in the design to work almost exclusively with structure to resolve and define spaces. This is primarily due to the fact that programmatically, a rail station is
quite simple in its minimal form. The primary elements are the track and platform, circulation across the tracks, points of security/token purchase, and handicapped accessible areas with elevators. Depending on the sectional configuration of the station - at grade, above grade, or below grade - the layout of these basic elements will change. In addition, since complete weather protection is not required, the structural elements could, in theory, be used to express functional concerns such as the definition of ground form, covering.
circulation, public and private, and security areas. In other words, the resolution of the project could occur exclusively through the structure itself. In a similar vein, structural engineer and professor, Mario Salvadori, writes regarding structural aesthetics:

In considering the influence of structure on architectural aesthetics one must distinguish those buildings in which structure is relatively unimportant, and hence not uniquely determined, from those in which structure is essential. The appearance of a one-family house rarely depends on its structure, which may be of steel, concrete, wood, or stone, but that of a large suspension bridge is inherent in its structural requirements. 5

Another factor in determining the project stems from my personal desire for a high level of reality in the project, which is brought about by working within the given context and physical constraints. In this respect, the design of a rail station carries many basic physical constraints which must be met. This includes platform, rail car, and sectional dimensions; requirements of access, circulation, and security; and careful integration at the urban scale. Dealing with these constraints brings, for me, a needed dimension of reality to the academic exercise.

The physical constraints also limit the configuration of the station at the urban level. They result in quicker urban scale resolution, allowing more time to be

allotted for the development of the structure at a detailed scale. Ultimately, this is the scale at which the thesis investigation will unfold.

Reinforcing the reality of the exploration is the fact that the city of Seattle is currently developing plans for a light rail system. Today the City of Seattle and METRO, the Municipality of Metropolitan Seattle, are several years into the process of developing and implementing a high capacity light rail transit system that would serve the greater Seattle area. Options for the exact layout of the three main corridor track alignments are still being considered. However, most
of the station site locations have already been pinpointed or narrowed to specific block areas. The exact site selected will be discussed in a later section. In addition, research work has already been completed to propose general guidelines and criteria for the station designs. These studies contain the necessary information in terms of the requirements and restrictions of station design which will be followed in the project.

At a more academic level, the selection of the rail station as the project will allow for a continued exploration of issues with respect to an 'urban crossing,' raised in an earlier design studio with Shun Kanda. The studio focused on developing an understanding of a built crossing within an urban fabric, both at the city scale and, more importantly, at the building and pedestrian scale. While the studio maintained a broader reach, that of a new 'urban village' within which the crossing would be developed, those ideas and considerations are much the same in an existing city. As a primary example, a major component in both is some interchange with rail and pedestrian transportation systems. Clearly, the exploration into a 'crossing' could further be developed with a careful site selection for a rail station.

Finally, as I have always loved trains, my interest and enthusiasm abounds.
II. MEANING IN RAIL STATION DESIGN: HISTORICAL BACKGROUND

In the 19th century, the railroad emerged as the new primary mode of long distance transportation. At once, distances previously requiring weeks to cross could be traveled in a fraction of the time. Cities expanded rapidly as the train provided the first mass means of accessing the central city. Due to the developments in rail, the central city emerged as the important social, cultural, civic, and economic heart of American society. Within this new cosmopolitan context, rail became directly associated with the developing culture, and thus, the terminal rail station became in itself an architectural landmark, a symbol of American culture and society on a civic scale.

The architecture of the terminal station in the heart of the city began to reflect the cultural, social, and civic importance that the central city had gained since the proliferation of the rail system in general. A classic example is New York City's Grand Central Station. The station itself became a civic and cultural symbol of the cosmopolitan society. It not only stood monumentally as a visual landmark, but as a symbol of the rapidly developing technological and industrial age.

These ideas were reflected in the architectural and structural design of the station, its visual and physical experience. At Grand Central Station, the architecture and structure resonate at an intuitive level with meaning. Here, the design and construction captured ideas of monumentality, civic importance,
stability and power of both locomotive and man himself, as well as the cultural explosion in the central city. In its construction, it related the importance of newly developing technology in materials: steel and reinforced concrete. All of these ideas and meanings became completely synthesized in the structural definition of the architecture. Then, with the development and proliferation of the automobile in American society, came a decline and almost extinction of rail as mass transit within the city.

(18) Grand Central Terminal, New York -1903-13: Power of central space established by light and structure; a sight that disappeared with the erection of the surrounding skyscrapers.
III. CONTEMPORARY CONTEXT AND AGENDA:

If the late 19th century and early 20th century were considered the industrial age, then we can consider ourselves living in the tele-communication and information age. Today we are caught among the transfer of huge volumes of electronic information through computers, faxes, phones, videos, and any other means of affecting audio and visual perception. American society in urban centers is now
bustling around a digital clock where it can plug into the information or system desired at any time. As the rate of transfer and access to information and services increases, so does our awareness of time and convenience in meeting our needs. Lifestyles are revolving around getting what we want and when we want it. This extends to the demands upon the city with respect to time and information; all of which is happening in conjunction with normal growth, development, and their repercussions on transportation systems.

In the bustle and scurry of this communication and information age, we are once again seeing the emergence of the rail system in some cities formerly without rail transportation systems, for example, Los Angeles, Portland, Atlanta, and Seattle. This time, however, there exists a new element in the agenda of the rail system and ultimately, the station. With the importance of time and direct access to information, goods, and services, the ideas related to 'crossings' within the urban fabric are becoming more complex. These urban crossings must strive to address the demands of contemporary cultural, social, and economic needs in today's fast paced information age. The design of these crossings need to integrate the transportation systems and the continuous flow of movement with other daily routines such as commercial, retail, civic, and cultural activity.

The direct integration of the ideas and contemporary requirements of the crossing with the emerging rail system leads to a new agenda for the design of the rail station. There exists a rich potential for the exploration of these ideas in terms of the structural and architectural design.
IV. CONTEMPORARY CONTEXT - SEATTLE - RAIL PLANNING:

Over the past decade the city of Seattle has experienced phenomenal growth not only in population but also in infrastructure, both in the Central Business District (CBD) and in the outlying areas of the city. While Seattle has maintained its high ranking on the list of the most 'liveable' and 'desirable' cities in the U.S., it also ranks high on the list of cities with the worst traffic congestion problems and potential air pollution problems.

(22) Commentary on Seattle's increasing transportation problems
For many years the City of Seattle and the Municipality of Metropolitan Seattle (METRO) have been studying the possibility of developing and implementing an alternative means of high capacity public mass transportation. Initially, three alternatives were being considered: (i) independent busways, (ii) transitways - buses, High Occupancy Vehicles (HOVs), (iii) light rail. Today, further exploration of a new light rail system is under way by both the city and private sector consultants.

The system - basic information:

Due to the expansive layout and organization of Seattle, METRO oriented the system toward arterial commuter service between important urban nodes, rather than a more capillary-oriented network of tracks and stations, more suited to denser urban fabric. As a result, the system consists of three corridor track alignments stemming from a newly constructed downtown core bus tunnel to the outlying areas of the city. Along each corridor, every station location corresponds to a specific urban area or community location, an urban crossing. The only exception to this occurs along the North Corridor in the University District, the area around and including the University of Washington, where two stations are planned. This is due primarily to the size of the university and its topographic layout. The only other change in frequency of stations occurs along the bus tunnel under the CBD where there are five stations.
The now operational bus tunnel, which is equipped with at-grade rail tracks and overhead power lines, serves the bus system, allowing for a significant reduction in traffic at the street level. The city's extensive bus system consists of routes served by conventional gas powered buses as well as a large number serviced by electric buses. The electric buses that serve downtown utilize the overhead power lines in the tunnel, while the gas powered routes that serve downtown have been supplied with a costly new fleet of buses with both gas and electric propulsion systems. At the end stations and before entering the tunnel, the gas powered buses are manually connected to the overhead lines. They use electric power in the tunnel to eliminate harmful fumes until they reach the last tunnel station, at which point they are disconnected and returned to gas power. When the new rail system is ready to link into the tunnel, the buses will again return to street level, further congesting downtown while the tunnel is given exclusively to the light rail system.

At the time the tunnel was planned and constructed a goal was to alleviate some downtown traffic congestion by eliminating buses from the streets. While some consideration was given to a future conversion into a rail system, the tunnel configuration and its stations were primarily designed for the use of buses. The design of these stations is based on a different set of criteria and constraints from that for the design of rail stations. The only rail considerations were the late addition of the track which could only be placed at grade so as to allow for buses, as well as the overhead electric equipment which could serve both modes of transport. Thus, as a result of the now existing tunnel configuration the only
The type of light rail system possible is that using an overhead power supply, as opposed to one using a heavier car with a third rail for its power.

The system is already at a disadvantage in terms of capacity and service of a commuter type structure. The heavier, third rail system would prove much more cost effective and efficient for the city of Seattle. However, the proposed system is restricted to a newer version of rail car similar to Boston's famous Green Line cars, as opposed to a faster, higher capacity car such as those used in Washington.
D.C.'s Metro system or Boston's Red Line. This predetermined decision not only directly affects the design of the existing station in the tunnel but also that of the stations that are yet to be constructed. The heavier system, due to its third rail, requires the station platform to be elevated, with level entry from platform into the car. This entry reduces critical dwell time, the time required to load and unload the passengers at each station stop, and increases the frequency and efficiency of the system as a whole. In addition, it allows handicapped access to every car along the length of the platform. Since all of the existing tunnel stations were built with at grade platforms and entry for the buses, all of the

Interview with Bruce Ellison, Seattle, 26 March 1991.

(25) Elevated loading platform; Red Line, Boston: level entry reduces dwell time and provides handicap access at each door; clear space adjacent to train allows for direct unobstructed lateral movement in/out of cars
stations would require major reconstruction. Some at-grade access to the cars would, therefore, have to be maintained in the tunnel stations.

In an effort to avoid using all at-grade loading cars, METRO is considering a new type of technology which has provided an answer. It is a hybrid rail car with the speed and capacity of the heavier car. It is equipped with both high and low level entry doors on both sides of the car, overhead power equipment, and a central pivot point to allow tighter turning radii and maneuverability. This ultimately would allow for both types of station platform configurations to exist on the same line. While the selection of this type of car grew from the given tunnel restrictions, it is projected that all new stations beyond the tunnel will incorporate upper level platforms due to increase efficiency and accessibility.

Another global aspect of the system rests in the variety of station typologies available and the fact that the natural topography of the city allows for the full range of typologies to be built somewhere within the system. The spectacular hills on which Seattle was built provide a beautiful and rich topographic landscape throughout the city; mountains, hills, evergreens and water in every direction. The steep slopes of downtown challenge the slopes of San Francisco while the prominent hills are cherished like those of Rome.

As a result, the threading of rail lines through the topography requires careful consideration from both an engineering and environmental point of view. Since
the slope of the earth often exceeds the rail's maximum service grade of 6%\(^7\), the rail lines will run at grade, below grade, or above grade, often spanning bodies of water. Consequently, the station's configuration will also exist in varied forms. The four basic sectional station typologies are: subway, at-grade, aerial, and retained cut.

Currently there are two or three possible track alignment options being considered for each of the corridors. However, METRO has already selected most of the sites or specific block areas. In some cases the sectional typology of a given station depends on the track alignment to the site. Therefore, in the thesis exploration, decisions regarding track alignment and station location were made in response to early research, analysis and site visits.

WASHINGTON – U. DISTRICT: 

After observing most of the corridor alignments and station targets, it appears that while to a certain degree all of the sites maintain the capacity to support or strengthen crossings within the urban fabric, only two areas clearly possess the potential within the existing context. It turns out that the rail system planners also targeted these two site areas as those lending programmatically more towards development and urban integration than being a station. The first site, located near the Seattle-Tacoma airport lies in the newly emerging city of Sea-Tac itself. I ruled out that site due to the lack of any built context or historical depth. The other site, one of two stations to serve the university, is located on the southwest side of the University of Washington campus. It lies within University's South Campus Development Plan. This ten year master plan focuses primarily on redevelopment and expansion to the south side of campus, which would include the projected station site. It is interesting to note that this published master plan fails to include the south university station, while at the same time the METRO plans fail to consider the expansion plans of the university.

It was my intention, initially, to develop the station crossing within the context of the master plan. After analyzing it, however, the tremendous shortcomings of the plan directed me away from that specific site. The general unrefined nature of the plan at the building level left a lot to be desired and very little to work
University of Washington including the South Campus Master Plan additions - lower middle-to left; from the water to the dividing line of N.E. Pacific St.

with. However, it became clear while doing some preliminary site analysis and conceptual design, that the station would ultimately play a vital role in the direct physical connection between the university and the city, regardless of the site chosen.

The powerful associations of both stations and major universities to aspects of today's information and communication age provide a strong cultural basis for the project. By cultural basis I refer to some of the defining characteristics, values, and attitudes related to basic communication and interaction between people. Some characteristics of accessing and exchanging electronic information today include a clear organization or structure of the system, a sense of orientation, direct and efficient access - the importance of time, and a multitude of options. Whether by phone, video, computer, fax, or satellite, the way in which people communicate and share ideas has, in some sense, been digitized into a global network which can now be accessed by the individual himself.

A fundamental connection exists between the image and perception of a university in general and aspects of today's information age. Major universities such as the University of Washington are often thought of as places 'in touch' with new technologies and new ideas. There is a connection and linkage to information and systems of information that are often not as accessible in professional and private realms. Just physically approaching a university campus or building often alters or widens one's mind from thinking locally to more globally. This could be linked into the perception and experience of a rail
station located in a campus as a point of arrival, a gate, or a connection to the urban fabric.

There is also a relationship between the intentions of the emerging new rail system and the aspects of the information age. Here, aspects such as a sense of immediate orientation, efficient and direct access, clear organization, the presentation of many options, and the monitoring of time, are easily translated into the physical design intentions of the station. On another level, there will be associations with the latest rail technology used within the system. This will be
supplemented by the nostalgic wonder and charm associated historically with most forms of rail transportation.

As I began to develop a sense of the whole project both in terms of actual physical design as well as the larger cultural significance and context, it became clear that the University area would prove a rich and challenging context for the exploration of the project. Given the powerful natural and built context, as well as the complexities of cultural connections, I resolved to explore the project at a site within the University area.
CHAPTER III: URBAN ANALYSIS-SITE-PROGRAM

I. ANALYSIS OF URBAN FORCES - SITE SELECTION:

I. Track Alignment:

The first requirement in analyzing the university and the University district in order to select the exact site is determining the track alignment of the North corridor. Currently, METRO is planning the track to cross under Portage bay with a stop at Brooklyn and Pacific avenue, and continue north under 15th avenue N.E., the edge of campus. It stops again in the U-district at the corner of N.E. 45th and 15th avenue. Another less likely option that would still run under 15th is to have the tracks cross over the bay on a low draw bridge and then submerge underground at the Brooklyn station before crossing under N.E. Pacific St.

The current planning efforts by METRO fail to consider the South Campus Master Plan. They recommend two university stations, due to the volume of passengers and the physical size of the university. Both these station locations would receive a high volume of pedestrian movement, but both are isolated and lack potential in creating a physical connection between the campus and the city. The south station is too far from the activity of the district while the north station...
Aerial view of the University District over Portage Bay, note the tall ventilation towers marking Red Square - which borders the site; top, left of center.
is too far from the academic core of campus. Given the alignment of the track along 15th avenue, one clear site stands out as a logical location for a station crossing that would serve both the university and the city - the intersection of N.E. Campus Parkway and 15th avenue.

Today, a physical crossing already exists at the site. The tree-lined N.E. Campus Parkway axis, which crosses the linear edge of campus along 15th avenue, sets up a clear urban visual connection to the heart of the campus, Red Square. While the site already functions as a primary pedestrian entrance due to its location in relation to the campus and the U-district, the connection is merely a pedestrian overpass, a constricted and temporary link to the city. At one point an effort was made to develop the site with landscaping and terraced stairs. However, there is a contradiction in seeing the 'no crossing' signs in the intersection and the steel railing physically blocking the crosswalk.

At this point a series of analyses began to reveal the rich potential of the site to harmoniously support such a large urban intervention such as the development of a light rail station.

II. Identification of primary urban and campus elements:

A strong physical urban structure exists in the University District which clearly defines areas and is easily read in plan on a map. This structure includes:
- the campus itself; literally a natural hill in which the university is woven into the landscape
- 15th avenue, the north-south hard edge of the gridiron urban fabric bordering the natural landscape of the campus with a concrete retaining wall
- University Avenue, The Ave, a dense bustling retail area serving the needs of the tens of thousands of students
- N.E. Pacific St.: a tree-lined parkway following the topography that serves as the south edge of the 'main campus' and the edge of the 'south campus', including the University Hospital and medical school
- Burke Gilman bike and running trail - part of the twelve mile pedestrian trail converted from a former rail line
- Red Square: the brick lined central square of the University modeled directly after the Campo at Pallazo Pubblico in Siena. Bordering the square are the main Graduate Library and reading room, the main undergraduate library, a performance theater, the administration building, and the primary lecture hall building. From Red Square extend four major visual axes which organize the campus:
  - Ranier Vista which frames a view toward Drumheller Fountain and Mt. Ranier to the south-east
  - George Washington Monument which frames the view due West to the Olympic Mountains
  - Arts and Social Sciences Quadrangle: traditional campus form framed by Campus Gothic style buildings
  - Memorial Way: Majestic tree lined main entrance gate axis

(34) Analytical map of the University District and the campus identifying the primary urban scale elements: the campus itself with its two relevant boundaries, the eastern boundary - 15th avenue N.E. running north/south, and the southern boundary - N.E. Pacific St. following the topography running southeast; Red Square which connects the three campus axes; and University Avenue, the primary retail development of the district
Pastel sketch from memory of the tree-lined boundary, N.E. Pacific St., with the campus rising up to the Burke Gilman running trail on the right and the solid wall of the University Medical Center on the left, and the pedestrian overpass providing a connection.
(36) Campo di Pallazo Pubblico, Siena: The urban model for Red Square, including the red brick paving and irregular radiating paving pattern

(37) University Avenue, The Ave., looking south to the waters of Portage Bay
After identifying the elements, I began to analyze how they were related and in what capacity they related to or affected the site. The first analytical pastel sketch attempted to identify, through color and intensity, the qualities of the elements and their relationships in plan, the relationships of the components, the points at which forces or movements intersected, and how the site figured in the context.

The second pastel sketch began to map the urban forces:
- the campus existed as a natural rock or outcropping within the grid of the city
- 15th avenue represented the dominance of the city grid at this campus boundary
- the movement of the city ran parallel to 15th avenue south toward the water as the intensity of the retail area along The Ave. was diminished at the cross axis of N.E. Campus Parkway
- N.E. Pacific St. provided a natural topographic boundary separating south campus from the main outcropping of campus
- Red Square existed as a central radiating point that connected visually with the city
- the area south of N.E. Pacific St. and west of 15th avenue (lower left in the sketch) was cut off from the rest of the area. It then became clear that the South Campus Master Plan was striving to connect the areas south of N.E. Pacific St.
First urban analytical sketch: color pastel drawing identifying the important urban forces both physical and visual, their magnitude, intensity, direction, and relationship to the site.
(39) Second urban analytical sketch: color pastel drawing clarifying my perceptions of the urban context.
It was not until exploring the area in model form that the relationships became clear and more real. The analytical model stressed the information gained in pastel exercises by focusing on and exaggerating the third dimension. This led to an understanding of the topography, the orientation, and the axial connection from N.E. Campus Parkway, through the statue of George Washington, up to Red Square. The prominence of the site in terms of the city fabric as well as the campus was undeniable, as was the importance of balancing the natural elements with the built environment.

(40) 1:200 Urban analysis: This model explored the main urban forces of the University District three dimensionally. Included are: the hill of campus, Red Square, the massive University Hospital and Medical Center, the grid of the U.-District, The Ave., the Burke Gilman Trail, N.E. Campus Parkway, and the site.
(41 -left) View on axis down N.E. Campus Parkway, through the site and the statue of George Washington, up to Red Square

(42 -right) View of site in relation to Red Square, the topography, and the grid of the city.
III. Campus Layout:

The campus has undergone significant development since the university moved to its current site, often in large formal pieces. Recognizable in the layout are several important structural pieces, which maintain their own integrity and uniqueness of spatial and architectural qualities, but also respect their surrounding context. The Quadrangle, composed of six campus gothic style masonry buildings, encloses a beautiful and tranquil cherry tree lined grassy area. Red Square, while architecturally eclectic, bustles as an old-world Italian pedestrian piazza, complete with red brick paving (thus the name), a central orientation to the major axes of its surrounds, and a campanile helping define the space (actually a cluster of three brick ventilation stacks for the enormous three story central parking garage below.). To the south, the Hospital and medical school have, over time, formed a monolithic structure anchoring this area of the campus, not by a public space but by its sheer physical size.

Each of these pieces exist as separate elements with their own qualities and identity. Due to the required scale of intervention, the development of the rail station crossing would be introduced as a similar type of addition to the campus. Two questions then immediately arise. The first addresses the issue of the quality or sense of the place as a part both of the university and the city. The second deals more specifically with the actual siting of the station, whether it should be 'on campus' or 'off campus'.
IV. On or off Campus?

In order to answer these questions I began to study the implications and effects of the placement of the station relative to the boundary of the campus. Given the linear edge of 15th avenue as the boundary between the campus and the city, three configurations exist. The station is either on campus, in the city, or physically between the two.

A rail station and the rail system as a whole inherently belong to the city and are directly associated with it. They exist as an urban phenomenon, weaving or cutting their way through the urban fabric, with the stations linked inseparably to the line. If the intention of the station is the direct association of the city with the university, and if the station sits within the city, then mere proximity to the campus may not be enough to establish a strong connection. At best, it will be adjacent to the entrance of campus and most likely be making a positive connection to the campus only in a gestural manner.
The possibility of the station belonging to both the city and the campus as an independent piece may in fact be impossible, given the linear boundary. Being located on the edge, the perception of a station and its siting will probably tend toward one or the other, city or campus, depending on the physical definition of the boundaries of the station. This type of solution seems difficult in this situation given the unforgiving linearity of the edge. If the boundary were irregular, the introduction of a third piece may have proven worthy.

If the station is to make the connection between the campus and the city, it must site within the campus because, given the inherent traits of a rail system, there will always exist a connection to the city, both physically and experientially. This is especially true since the train will run along the boundary within the urban grid. A station on campus could then focus on relating both physically and associatively to the specific qualities of the campus and university in general.

V. Unique Sense of Quality and Place:

Locating an urban rail station within the campus would, by nature, provide an opportunity to develop a place with unique character within the campus as a whole. In terms of the quality or image of the place it most certainly would not belong to the architectural and physical quality of the Quadrangle. Nor would it belong to the strongly defined Italian urban plaza that is Red Square. It would exist as a separate element, maintaining its own physical character but respecting the existing context, just as the other large campus developments over the last
one hundred years have done. Due to the technical, mechanical, and nostalgic associations of rail systems as well as the substantial structural requirements of a station, the quality of the place expressed in the structure will ultimately stem from these deep origins. In addition, the project will try to maintain and promote the natural physical beauty of the campus in general.
(45) Barcelona Termino Station -1924: sense of power in the station and the trains
VI. Context and Use:

The area around the site is quite important in terms of the building uses relating both to the city and to the campus. The area contains a high concentration of culturally-related public buildings. First, there are two massive and relatively new brick buildings framing the statue of George. One is the Odeguard Undergraduate Library, which has a bustling cafe/deli on the ground floor - appropriately named 'By George'. The other is the Meany Hall Performance Center, which not only serves the university but the city as a whole. The Henry Art Gallery, a gem of a building that sits freely and proudly on its own, is considered one of Seattle's fine galleries. Across the street, the massive, concrete Schmitz Hall dominates the last block of N.E. Campus Parkway. Schmitz Hall, the university's student administrative building and one of the most important buildings to any student, circulates thousands of students daily through its doors, often on their way to and from school through the site. Also in the area is the small Hughes Playhouse Theater, and the ticket office where tickets for performances at the university and throughout the city can be purchased. Finally, two popular campus spots, the College Inn Pub and the Last Exit Cafe, serve the community through all hours of the night, including late night theater patrons.
VII. Circulation:

The site functions currently as one of the primary entrances to the campus, giving rise to pedestrian circulation that is heavy and important. The busiest pattern of movement is that connecting The Ave through Schmitz Hall, across a small overpass in front of the Henry Art Gallery, and past George up to Red Square. Secondary routes connect paths feeding in from the south, across 15th avenue at street level, and on to Red Square. Tertiary north-south cross connections exist beside George in front of Meany Hall and the library.

Automobile access to campus in this area frames the north and south boundaries of the site. One of three auto entrances to the campus loop road, Stevens Way, provides the southern boundary of the site at the corner of 15th avenue and N.E. 40th St. The auto entrance at the north edge of the site on N.E. 41st St. continues under the natural upward slope to the massive underground parking garage below Red Square. A preliminary section cut along 15th avenue revealed that the slope allowed for the rail line to pass over Stevens Way, stop on the site in a retained cut station configuration, and continue under the auto entrance at N.E. 41st St.
II. SITE AND PROGRAM:

In addition to being important to the campus and the city, the site is quite spectacular. The orientation and topography provide a very strong context within which to work. Standing next to the statue of George on a cool summer's night before leaving campus, one can't help but pause and absorb the view of the sun setting behind the rugged Olympic Mountains.
I. Topography and orientation:

As is evident from the photographs, the change in level is significant in both the north/south section and the east/west section. There is a 37-foot rise along the axis from the level of the street to the level of Red Square, with a 21-foot mid level change to the base of George. From south to north, the earth rises a substantial 42-feet from the intersection of 15th avenue and N.E. 40th St. to the level of the ground above the auto entrance at N.E. 41st St. The general orientation of the site, other than the ceremonial axis, is to the south. This direction offers a view of Portage bay and even the tips of the downtown skyline above the hilltops. In terms of sunlight, the slope falls to the south and west, leaving only a fraction of the site in shadow for just a few hours in the morning.

II. Definitions and Uses of the site:

One of the problems with the site today is the lack of defined space for use by the thousands of people who circulate through the site daily. The only defined spaces include the small trellised outdoor eating area and grassy knoll adjacent to the library and serving By George, as well as the small private terrace accessed only from the theater lobby. Secondarily, part of the space adjacent to the performance center has been left natural, but due to its seclusion and steep slope it is used little by passers-by. While there are some defined spaces, an important space is missing with relation to the statue. The statue of George, which faces due west, fails to define any public space in which to gather, watch the sun set, or just catch a breath before heading back home to the city. Since it faces the
city, it seems natural that some defined space exist with relation to the statue and the axial view. Today, 'George's space,' the brick paving between the front of the statue base and the landscaped slope down to 15th avenue, lacks any definition due to the fact that it is merely a paved fire lane.

III. Basic needs of the site:

On the basis of my extensive knowledge of the site, and continued analysis, it appears that a set of basic needs should be addressed within any project developed here. These will ultimately comprise some of the practical criteria with which to evaluate the final design. They include:

- developing an appropriate gate and crossing to campus
- developing a sense of orientation for any pedestrian
- establishing appropriate campus intervention with its own quality and integrity
- defining clearly both public and private spaces
- anchoring George within the site
- defining a public space in relation to George and the axis
- replacing an emphasis upon the Henry Art Gallery and its southern entrance which now serves as a landing for pedestrians passing over the foot bridge
- providing a system of clear pedestrian connections
- establishing a direct street-level pedestrian crossing from 15th avenue - removing the overpass
- maintaining the natural qualities of the site as well as the outdoor grassy areas
IV. Rail Crossing Program:

The formal program of such a crossing is rather simple and can be broken into transportation requirements and programmatic uses.

**The transportation requirements include:**

- a single pair of light rail tracks with handicapped accessible platforms
- a connection to the parking garage under Red Square
- an open air bus stop at the corner of 15th avenue and N.E. 40th St.

**The new uses include:**

- a visitors information center for the university
- a cafe and newsstand with indoor and outdoor areas
- a ticket office for performances and gallery exhibitions
- a new addition to the art gallery (a version included in the South Campus Master Plan)
CHAPTER IV: - GENERAL SITE CONSIDERATIONS

I. CONNECTIONS:

The basic types of connections considered fell into two categories, physical and visual. The physical connections primarily dealt with circulation and the complex movement system that required a clear and ordered solution in a transportation project. Visual connections and associations on the other hand, are more subjective, and developed with the exploration of the project.

The physical connections required are either between two locations or general access to a given point:

**General connections:**
- the direct connection from the upper level of George down to street level in order to facilitate the primary existing movement through the site
- connection to the station platform from the upper level, street level, as well as the longitudinal direction of north/south
- north/south connection across the site
- establishing a new connection between the art gallery and performance theater

**Point connections:**
- directed path toward Schmitz Hall across 15th avenue
- main southern entrance of the Henry Art Gallery
- western ground level access to the By George Cafe and Art Gallery Shop
General visual or associative connections include:
-visual connection on axis to landscape and city scape
-visual connection to Portage Bay and the downtown skyline
-global reference of George Washington in terms of the university, the state, and the country
-local reference of the university with a sculpture defining the space at the lower level
-associative reference to the aspects of the university in terms of technology, and the information age specifically in terms of physical orientation and efficiency of access and movement

II. CIRCULATION:

The resolution of the complex circulation proved extremely challenging and fundamental to the development of the project. Given the approximately 380' of track platform length at the lower level as well as an even greater length at the upper level, multiple options for circulation were required. Thus the station crossing could not exist at one point but had to be linear with a system of hierarchical circulation. In addition, the station platform needed to be a secure area, a place in which access was restricted to token or pass holders only. This

(54) Section drawing of Grand Central Station exemplifying the complexity and importance of circulation in stations
in turn required careful consideration as to the placement of the points of security, at the upper level circulation corridor and down at the track level. Then there were the pedestrians who only needed to traverse the site in a direct path, bypassing the station all together. When extracted into three dimensions the questions arose as to which levels would carry certain movements, were there unnecessary redundancies, and to what degree did handicapped access figure?

On top of all of this was the issue of closure and protection against the elements. Anyone who has visited Seattle has probably experienced the rain. The track platform obviously required protection from direct rain but could still be open to light and air. Then, there was the consideration of the beautiful sunny days and the need for open circulation just as the rest of the campus enjoys. Basically, a solution was needed to protect the track platform and some of the circulation corridors, all of which could not obstruct the natural views from the different levels set up by the topography.

Listed here are only some of the direct circulation requirements to point out the complexities:
- Red Square to Schmitz Hall - (-37' elevation change)
- George to station (-37')
- George to 41st street crossing
- Steven's Way to north campus - (+22')
- 15th to: Henry Gallery entrance (+15'), George and by George (+22'), station (-18')
- bus stop to: station (+20' then -18'), George and By George (+42')
III. RELATIONSHIPS AND QUALITIES OF THE STATION CROSSING:

First and foremost the station crossing is the gate to the university. The site will be the arrival point for thousands of people each day, going directly to the university or to the adjoining U-district. The design of the crossing should bear
some clear relationship to aspects and qualities of the university, as well as associations between the university and the contemporary information age.

Due to its central location, the station will function as a primary information and orientation node, acting as the key transition point between the city and the campus. It will not only serve people who are new to the area but daily passengers seeking information regarding the day’s events or happenings within the university or the district. It will become a place of direct interaction and engagement with the campus. Thus, there exists a need for a central point of meeting or orientation which would include or be related to the information center.

If you were in Manhattan and someone said, "Let’s meet at the station (Grand Central)," there would be no question of meeting in the main central space of the station unless specifically stated otherwise. Within the main space, the central clock above the information booth provides a spatial and ordering focus. Here however, given the differences in scale, physical and cultural context, as well as the differences in the programmatic and architectural agendas - a twentieth century heavy rail terminal station verses a twenty first century light rail open air campus crossing, the means of providing a sense of physical orientation and order will differ. Here, the statue of George can be used not only to define a central point of orientation but also to effectively serve to physically organize the crossing within the site. Today the statue is merely floating on a plane serving in a cosmic sense the grand physical axis at an urban scale. It fails to relate to the site in terms of movement or definition of place.
View of George on site: current placement and lack of spatial definition and visual grounding of the statue and the ground plane.
The site also allows for strong cultural connections. In terms of the greater Seattle cultural realm the station would provide direct access to the prominent Henry Art Gallery and the Meany Performance center. The placement of the station would only strengthen the cultural ties between the city and the university, greatly benefitting both. At the site level, the station could develop a link between the performance center, the gallery, and the information center, via a new addition to the art gallery. Further relating to the university and providing an opportunity for direct campus involvement, the gallery addition could feature student and faculty works and exhibitions. The crossing would then begin to develop into more than simply a framework for pedestrian movement.

Another important consideration deals with the inclusion of natural elements in design of the site. On the whole the university is blessed with beautiful trees, earth, and views toward the surrounding landscape. Historically, this has been an important quality of the university and therefore requires sensitive treatment in light of such a large intervention. Upon initial consideration, since the site slopes in two directions, a natural possibility would be the partial entrenchment of the station within the earth allowing for a sympathetic relationship to the natural elements, including light.
CHAPTER V: DESIGN

I. Initial Moves/first pass:

After completing the site analysis and observations, I chose to begin the design process by considering the natural topography, solar orientation, and the experience of the rail passenger. In order to proceed I followed a partially intuitive and partially reasoned track in selecting the basic sectional station typology. All along, the retained cut section seemed the most potentially interesting in terms of exploring the spatial and structural qualities of a station. It allowed for the direct orientation to light, a visual reference to some contextual landmark such as George, a visual orientation from the train to the city, a difference in elevation on either side of the station allowing options for crossing, and the opportunity to work with the earth and retaining walls as natural structural forms with lighter structure for covering or closure. Kenneth Frampton refers to these two types of classifications of material construction as 'stereotomic' and 'tectonic,' where the 'stereotomic' refers to anchoring foundation or earth construction while 'tectonic' refers to a lighter system of construction not associated with earth but with frame and closure.8

Beginning work at the site level, I discovered through section, the positive clearance of the tracks over Steven's Way, through a level station, and under the entrance to the parking garage. The retained cut then seemed a natural selection. The station would occur at the point where the train emerged from the earth to

8 Kenneth Frampton Lecture, "Notes on the Scope of the Tectonic," MIT
(59) Sketch of point at which rail emerges from the earth to the light, extension of the earth form 'stereotomic'
the light or submerged into darkness. The ideal slope allowed for a natural progression of light from the earth to the modulated covering of the station, and on to open sky. Early sectional sketches tried to capture the progression from heavy earth construction of the rail tunnel underground, through a retained earth section with frame and canopy, ultimately opening to the southern light.

(60) Sussex tunnel entrance: celebrated point of entry/exit into/from the earth within the natural landscape
Throughout history, the point at which trains entered or exited the earth was celebrated or formally marked even though passengers had no way to directly experience the transition except for the sudden change of light. With a retained cut section the potential exists for a modulation of light by the structure along the length of the station from 'stereotomic' to 'tectonic' - earth to frame, concrete to steel.
In general, I thought about the crossing in terms of the two major forces inherent in the project; the university and the city. It then occurred to me that one way to read this polar distinction in the structural design was to distinguish one from the other in terms of their material. Given the strength of the gridiron streets and retaining wall holding back the earth along 15th avenue, and visual association of the cross axis and established movement, a conceptual sketch emerged. It represented the city as 'stereotomic' and the campus as 'tectonic.' At a basic level the distinction between the two forces of the city and campus could be clearly readable in the structural system.

First conceptual model:

In order to engage the entire site as well as the true complexity of the project, I made a first conceptual model pass at the site. The issues addressed were:
- the size of the crossing within the site
- the nature of the two structural systems and their general organization
- the sectional qualities of modulation from dark to light
- the placement of the statue of George with relation to defined space
- the relation to the city and campus in terms of movement from one to the other
- the sectional relationship between the street and the mid-level of George
- the definition of the points of command, or view maximizing orientation
From this study it became clear that developing the crossing on the site here was indeed possible and in fact quite exciting. Even though little attention was paid to programmatic issues or formal spatial development, a project on that site seemed reasonable and practical. The primary insights I gained related to the fact that a crossing such as this station develops along the length of the platform as opposed to a literal crossing at a point. There was also a need to anchor George on the site. The consensus, due to the complex nature of rail station
circulation systems in general requiring multiple points of access, crossing, and circulation, was that the 'crossing' would not exist at a point but rather along the length of the train. In terms of the statue of George, its placement relating to the organization and definition of the site was important, as well as the anchoring of its base to the ground. In the first model a loose screw represented George. Somehow it seemed fitting that it slid around on the aluminum plaza with the slightest vibration.
II. Second Phase: entering the site

The initial model included the tracks and platform running parallel to 15th avenue. Three problems emerged from this alignment. First, little space existed for the actual platform and adjacent circulation and public spaces. Secondly, the track would need to pass through the existing Art Gallery's underpinnings. Finally once measuring the 360' length of the four rail cars, the platform needed

(64) 1/32"=1'-0" First pass at site: brought rail onto site, statue anchoring site and retaining wall, crossing expanding along length of station, opening of site from north to south
to sit further north on the site for structural and acoustic reasons. This prompted
the second phase, which focused on pulling the station platform back into the
site along a curved retaining wall. The center loading track platform widened at
the center in order to create a useable, dynamic platform space which changed
along the length of the curve.
The generation of the first 1"=1/32' scheme centered on the curved retaining wall buttressed by the base of the statue, which now extended to the track platform level at the widest section. The intention was that George could begin to organize all of the various levels by giving a vertical registration directly to the ground. At the platform level, the base would provide a marking of the space as well as a much needed visual orientation for passengers emerging from the trains. At the mid-level, the base of George could be revealed to automobiles which pass along the library and turn toward Red Square, at the light by the statue. At the upper plaza level, the intention was for George to define a major outdoor space which would extend over the track platform to a smaller urban space relating to the street. The structural system retained the initial idea of a lighter steel system of the campus projecting out over the heavy masonry elements of the train and the city.

Providing a sense of constant orientation was one of the underlying considerations in the development of all aspects of the project. When stepping off a train after having only laterally-controlled orientation there seems a sense of visual release, and often a glance upward to regain orientation with the light, if at all possible. At the least, most passengers, look both right and left in order to gain their bearings and a sense of access to circulation. Therefore, if the platform curved, the orientation would be different in both directions and could ultimately be defined and modulated by the structure and the introduction of natural light. In a similar desire to provide a clear sense of orientation along the length of the curve, either in a retained cut or at grade station where light can be

(66) Early conceptual sketch of development and organization around retaining wall spine
introduced, a visual reference to the city or campus could be established. A powerful example can be experienced at the Amtrak platform in the Back Bay Station in Boston. From the platform, the structure of the station frames a spectacular view of the John Hancock tower, an orienting landmark for the city in general.

In a similar example from the new International District bus tunnel station in Seattle, an orienting view is possible from the loading platform of the Columbia Center building, the tallest building in Seattle and on the west coast. Here also the modulation of light with the structure can be seen, along the length of the platform.
III. Third Phase: overbuilding the site

The third phase consisted of a second 1\(\frac{1}{32}\)"=1'-0" model which in fact did project the project further but became muddled as too many physical questions were trying to be resolved without a clear overall general scheme or system of construction. The scheme retained the curved track platform but experimented with moving George off the axis in an effort to define the systems of movement at the upper level. The primary advancement of the design occurred with the intention of organizing the entire site around a spine which related to the curved retaining wall. This began to allow an upper level pedestrian path to be defined. It also allowed the important introduction of an addition to the Henry Art Gallery, running at a mid level along the spine and making a physical and cultural connection between the existing gallery and the Meany Performance Center. Behind, the auto traffic passed the curved gallery wall still turning at the indirect light at the statue.
Second pass at site - upper level: building along retaining wall spine, George anchoring site, large open plaza, direct connection from upper level to street level, new front to Henry Art Gallery

Sketch of developing structural plan along spine
(72 -left) Sketch of end condition of platform under ground, at the north end, marking the space with natural light from above.

(73 -right) 1/32"=1'-0" Second pass at site -mid-level: showing colonnaded gallery addition and parking entrance behind gallery.
At this point the parallel solid modeling work on the computer proved helpful. With a model of the retaining wall and the statue, the differences in space and path could be mapped and evaluated quickly. This plan study revealed that the closer placement to the buildings allowed for clearer definition of the space between the library and theater, as well as the path.

This pass also included an attempt at developing the circulation using a pedestrian bridge spanning from the street level to the upper level, completely bypassing the station. The plaza level platform now included a connection to the beginnings of a free standing information center and overscaled bus stop. Even though the independent pieces were being developed as ideas, the physical transformation in the model became disjointed and out of scale. In addition, after constructing a section of the track platform, it became painfully clear that the tremendous width and lack of structure deprived it of any definition.

After the frustration of the third phase I focused on developing a structural system that stemmed from the inherent physical and intuitive strength of the retaining wall. Given the curved spine of the new gallery and the need for bracing the retaining wall, I developed a structural system of monolithic concrete fins that cantilevered over the tracks and supported a lighter steel framed deck. The gallery acted as a steel frame box beam, acoustically isolated from the rail vibration by a floating slab. The intention was to have the cantilever extend over the platform with a slender steel member which would merely pick up the vertical loads. The horizontal bracing would be achieved by the deck. In order

(74) Solid model computer plan -1 of 2: placement of retaining wall and statue in proximity to library and performance theater
to visualize and test this repeated element along the retaining wall, again the solid modeler proved helpful. At the same time while the structural system advanced in section, the plan remained static.
From this point on, the working method shifted to simultaneous development at two scales. A clay site model was used to test the development of the site organization and layout while $\frac{1}{8}'=1\text{-}0''$ and $\frac{1}{4}'=1\text{-}0''$ sections were used to resolve the site and structure in section. This working method proved most beneficial.

**Fourth Phase: Clarification of Site and Structure:**

At this point the design really developed strongly and quickly. First, in terms of the site, several changes occurred. While the configuration of the platform remained center loading, the maximum width reduced dramatically from 60-feet to 32-feet, 8-feet more than the required 24-feet. Secondly, due to the inevitable problems of the rail crossing Steven's Way at grade and the security problem of a station open at one end, the level of the tracks was depressed. This allowed the alignment to pass under Steven's Way and provided the opportunity for more of the site to remain natural. It also reduced the scale of the overall intervention. In terms of the circulation at the crossing, the reduction in size opened more opportunities with respect to clarifying the organization of the circulation.

The primary breakthrough occurred as I focused on the development of the structure and the structural system. As shown before, the generation of the retaining wall was based on the outer of the two walls and a structural piece projected into the curve. However, reexamining the natural physics of arches with the inner surface in compression and the outer in tension, a structural

(77) Static plan incorporating the structural system of the monolithic fins, transforming along the length of the spine
concept emerged. If instead the structural piece extended from the inner retaining wall outward in a radial geometry, then by its natural physical properties it would intuitively read. The initial system consisted of a large continuous torsion bar to which some form of light weight steel trusses were connected. This unified system was then anchored as a radiating extension/support of the retaining wall.
From working on the 1/32"=1'-0" model as well as a 1/8"=1'-0" section model, the project finally began to congeal both structurally and organizationally. By maintaining the spinal organization of the site, the circulation system developed in the computer model shifted to a structural support system from the inner wall. This organization responded to the need for linear access to the station platform at many points. The continuous deck was to become the central mid level circulation core from which all points on the site could be accessed. These included: the entrance to the new art gallery addition and cafe, the information center at the statue, the upper level areas and circulation paths to Red Square, as well as a direct connection to 15th avenue. In terms of the perception and orientation of the rail passengers, the continuous mid level deck was to appear as a suspended platform where by its dimensions and bridge like cross-connections, would read as a temporal place.

The overall plan was completed with all of the important pieces: the track platform, gallery addition, gallery cafe and newsstand, information center at George, upper level outlook and primary vertical circulation, frontal base for the Henry Art Gallery, new bus stop, grassy eating area and steps for By George, terrace for Meany Hall, and an open plaza overlooking the rest of the site in its natural state. Structurally, the gallery remained supported by a modified series of concrete fins from which columns extended to support kinetic sculptures. These columns penetrate through large openings which illuminate the structure and display area of the gallery. In a similar fashion, the steps above the gallery let diffused light down onto the display area.
First section model:
While this phase clarified the architectural and structural agenda, it also brought forth the shortcomings. First, while the ideas of the structural section model were very strong, dealing with the realities of materials and construction diluted the structural form. Primarily, the structural piece lacked clarity in terms of an intuitive reading. The introduction of a second vertical support at the end of the cantilever due to spanning restraints, ultimately denied the structural dynamics of the torsion bar and truss, replacing the system with a simply supported beam configuration. In the reading of the suspended platform, the form lacked clarity regarding which elements acted as roof and which as deck. However, I began to understand the relationship between the structural system, its form, and its reading through the process. The subsequent structural design decisions were then based on continual intuitive evaluation.

In terms of the site organization, the primary needs were those of circulation. In the prior model, redundancies existed in the circulation systems, which occurred at every level. There was also the lack of a direct connection from the upper level of George down to the level of the street. Finally, the circulation system from the track platform up to the suspended circulation path needed simplifying and clarifying in terms of the structural system.
First complete site model: showing upper level at George

Model with upper level removed revealing the new gallery addition
View from north revealing depth of site and relation to the level of the rail tracks
(86) Structure of crossing, connection down to the trains
Final Phase: Resolution and Refinement:

During the final phase I continued to work simultaneously at both the 1/32"=1'-0" scale revising the clay site model, and reworking the structural system in the 1/8"=1'-0" section model. The final form of the structural system evolved after much struggle and refinement. First, in an effort to give physical and intuitive distinction to each of the retaining wall structural systems, I separated the roof structure system from the suspended deck system.

The lighter and more dynamic roof system extends from the inner retaining wall, ultimately building on the conceptual structural model. The primary aspects of the conceptual model were: the projection of radial lines of structure that tie in with the retaining wall, the distinction between the earth related elements, the 'stereotomic' and the frame elements, the 'tectonic', the definition of spaces by the structural systems, and the intuitive dynamic tension of the system as a whole. In an effort to provide a system that would allow for the narrowing of the incision in the earth, the buttresses of the retaining wall frame the track and the loading area of the platform. Then in a separate extension, the steel frame system reaches up to support the pair of torsion bars which structurally function as a single element due to their independent connection. The idea behind the independent structure was to create a second layer of tension in the connection between the two systems. Even though the pair of angled structure reads as a single structural element with its own integrity, it receives support and transfers the loads directly to the earth and the retaining wall, thus connecting the system.
Each of the systems function physically and intuitively to the maximum capacity of the materials, steel in tension and concrete in compression.

Long hours were spent exploring the forms of the roof system. Initially, I discovered that the general form of the roof, putting aside the construction, related strongly to the successful resolution in section. Basically, the roof form could soar up in a 'flight like' gesture or shape downward in a protective form. In terms of making a connection up from street level to George, the upward form obviously was more suitable.
The structural system from the other retaining wall returned to a modified form of the monolithic cantilever framing the gallery. Here, in order to intuitively understand the cantilever, I recessed the retaining wall and brought the vertical support for the upper level existing structure down on the cantilever out and beyond the plane of the retaining wall. In this way an intuitive understanding of the cantilever could be enhanced. Finally, the pair of light supports toward the tip of the cantilever simply support the handrail above and define the direct passenger loading area of the track platform.
(91) Track platform and circulation deck
The plan basically remained the same except for the addition of: the overpass bridge which extends from the earth structure of the inner retaining wall and rests in a point load on the upper level, the expansion of the information center by George, and the restructuring of the circulation from the track platform to the suspended deck. Earlier, the circulation from the track to the deck was suspended from the deck itself. In an effort to emphasize the earth form of the track platform, a concrete arched bridge support carries the decking at the main level crossing by George. Leading to the cafe, a similar concrete arch connects with the concrete system supporting the cafe.

The most noticeable change occurred in the plan as the generating radii of the retaining wall curves changed in order to emphasize the opening up of the station from the north to the south. The exact geometry in fact resulted from the development at the most critical point of circulation and clearance, the axis of George. This gesture reaches back to a very early conceptual sketch done as the tracks moved into the campus. A fitting close to the circle.

(92) Early conceptual sketch depicting changing radii of curves; opening from the north to the south
(93) 1:200 Locus plan with project
(94) 1/32"=1'-0" Site Plan
(96) 1/32"=1'-0" Gallery Level Plan
(97) 1/32" = 1'-0" Track Level Plan
Plan and Section cut -north

Plan and Section cut -center

Plan and Section cut -south

(104) 1/32"=1'-0" Final Site Model
(105) On axis from N.E. Campus Parkway
(107) Upper level removed

(108) Structural spine removed
View from the north

Changing radii
(111) Gallery and Information Center level
Central crossing with structural spine removed; revealing trains
The End.
BIBLIOGRAPHY:


Dethier, Jean. All Stations, A Journey Through 150 Years of Rail History. London: Thames and Hudson, 1981.


Weisman, Gerald. "Designing to Orient the User." Architecture, the A.I.A. Journal, October 1989, pp. 113-114.

LIST & SOURCE OF ILLUSTRATIONS:

All photographs by author unless otherwise noted

Cover:
[1] Back Bay Station, Boston

Chapter I:
[9] Peter Behrens Turbinenfabrik (BUDDENSIEG, Tilmann: Industriekultur - Peter Behrens und die AEG 1907-1914, 1980)

Chapter II:
[12] Steel structure (BUDDENSIEG, Tilmann: Industriekultur - Peter Behrens und die AEG 1907-1914, 1980)
[14] Brighton Station (BINNEY, Marcus; PEARCE, David: Railway Architecture, 1979)
[15] Back Bay Station, Boston
[16] Back Bay Station, Boston
[17] Grand Central Terminal, exterior (NEVINS, Deborah: *Grand Central Terminal, City within the city*, 1982)
[18] Grand Central Terminal, interior (NEVINS, Deborah: *Grand Central Terminal, City within the city*, 1982)
[24] Red Line Train, Boston
[25] Red Line Train, Boston
[29] South Station, Boston

Chapter III:
[32] Aerial view of University District
[33] View of site
[36] Campo of Pallazo Pubblico (TRACTENBERG, Marvin; HYMANN, Isabelle: *Architecture from Prehistory to Postmodernism*, 1986)
[37] View of The Ave.
[44] Rail sculpture, Back Bay Station, Boston
[45] Barcelona Termino Station (DETHIER, Jean: *All Stations, A Journey Through 150 Years of Rail History*, 1981)
[48] View of site
[49] View of site
[50] View of site
[51] View of site -photo Albert Kong
[52] View of site -photo Albert Kong

Chapter IV:
[54] Section drawing of Grand Central Terminal (NEVINS, Deborah: *Grand Central Terminal, City within the city*, 1982)
[55] Painting of station and landscape (DETHIER, Jean: All Stations, A Journey Through 150 Years of Rail History, 1981)
[56] Grand Central Terminal
[57] View of George (The University of Washington Alumni Magazine 1989)

Chapter V:
[60] Tunnel entrance Sussex (BINNEY, Marcus; PEARCE, David: Railway Architecture, 1979)
[61] Back Bay Station platform
[67] International District tunnel station, Seattle
[68] John Hancock building from Back Bay Station, Boston
[113] Crashing train (DETHIER, Jean: All Stations, A Journey Through 150 Years of Rail History, 1981)