ABSTRACT

Title of thesis: BRIDGING THE ANACOSTIA: INTEGRATING A SCIENCE CENTER

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Degree and year: Master of Architecture, 2004

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This thesis explores the science center as the materialization of institutional ideals for a science-literate society in a building design challenging the role of architecture as a vehicle for communication. This investigation operates with the fundamental notion that architecture is an effective communicator when facilitating the experience of the built environment, rather than relying on its power as a centerpiece. Therefore I intend to investigate how this built form engages with the landscape, serving as a ‘backdrop’ that heightens the experience of transitioning between the man-made and the natural landscape condition, while revitalizing the riverfront and serving as a gateway between currently disparate neighborhoods.

The science program allows further exploration of the extent to which the transmission of information exists in the architecture itself, or whether the architecture, with the intention of remaining versatile, again serves as the backdrop, therefore allowing the communication to occur solely through the exhibition design.

BRIDGING THE ANACOSTIA: INTEGRATING A SCIENCE CENTER

By

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Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park in partial fulfillment
of the requirements for the degree of
Master of Architecture
2004

Advisory Committee:

Associate Professor Matt Bell, Chair
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DEDICATION

Dedicated to my Family

ACKNOWLEDGEMENTS

Special thanks to my family, who always supported and encouraged me to go for it; loved ones and friends who have stayed by my side; the wonderful people who have helped me through the process and production of this thesis; and my thesis committee for their guidance throughout this process.

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INTRODUCTION

To simply state that science affects our lives is a gross understatement. To more succinctly say that it can uniquely and simultaneously impact our lives on both a personal and global level begins to recognize that we simply cannot exist without being touched by the innovation of science. In an age when the scope and amount of information constantly increases and changes, society must accommodate and support a society whose needs change as innovation continues.

This thesis explores how the built environment can be designed to serve as the vehicle for a greater social agenda. It will investigate how the science center, as the materialization of a science-based institutional ideal, can answer the challenges science places on our society by fostering social responsibility, and visibly expressing a strong social identity within its community, while maintaining utmost sensitivity to the changing demands of a diverse audience. I posit that social initiatives can be strengthened by the image of its architecture, as much as the built environment can be designed to influence people's movements and thoughts. In other words, our architecture reflects our society, but architecture can also *shape* our society. Architecture reflects who we are, but also who we *can be*. As designers of architecture, we must accept this responsibility!

Chapter 1 will begin with a study of the image and nature of science as it permeates our society historically and today, and its implications on the social awareness and literacy of our 'scientific culture'. In addition, the role of alternative educational facilities in the formal education infrastructure will be discussed, as well as their roles within society and the community.

Chapter 2 begins to look at the science center specifically as an alternative means for science education. Its potential as a cultural amenity within the community and a multicultural symbol at a larger scale for the city begins to introduce a new scope of audience in addition to children: adults and family. With descriptions of existing typologies, an analysis of precedents is included, which examines relevant examples of projects and places which offer typological and formal direction for the design of this building.

Chapter 3 addresses site in terms of its selection based on location and need. In addition, the historical and social context is discussed in order to gain an understanding of its character. A description of existing conditions and current and future planning efforts in the area are introduced, and an analysis of the site and its surrounding context provides a foundation on which to base a design approach and determine an appropriate design solution.

Chapter 4 discusses the role of programmatic elements in determining the form of the building. Specific to the science center, areas such as the entry, exhibition spaces, administration, educational, and outdoor areas will dictate spatial adjacencies, arrival sequence, promenade, and circulation. Spatial organization will also be largely designed based on the distinction between private and public areas. Part of the thesis is an exploration of how the built form itself can become an instructor for learning, which will be conveyed in the architectural design through an honest expression of materials and structural connections, as well as exposed mechanical systems, whenever possible.

Chapter 5 presents relevant design precedents which have offered a typological, cultural, and functional direction for the design approach, and Chapter 6 explores three different possible design solutions to the thesis.

Chapter I. Our Scientific Culture

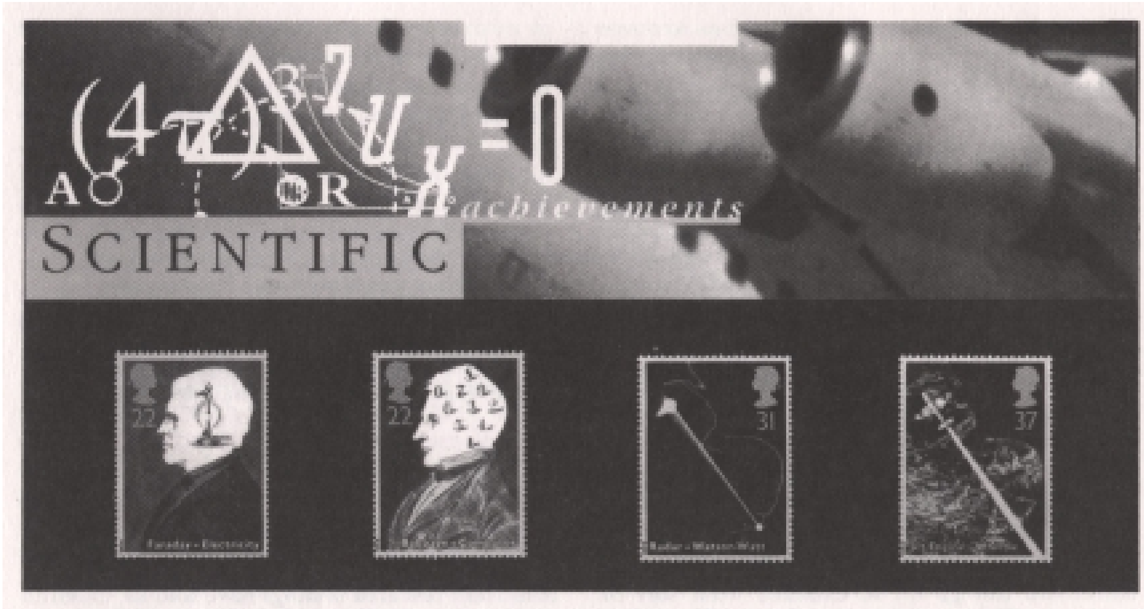

Figure 1.   Scientific achievements carry much value for a society, and can be glorified and assimilated into the everyday realm of life through its printing on stamps.

We exist in a culture of tremendous scientific knowledge and technological advances, and we identify with an image of our society that is valued largely by our scientific and technical triumphs. This places the pressure for future achievements in this rapidly-progressing domain heavily on the passion of our youth, whose vivacity for exploration and thirst for innovation, we hope, will propel us even further into a future of scientific discovery. To ensure that this next generation of scientists is prepared with a solid educational background and the ability to understand and utilize new information, we traditionally rely on educators in the classroom environment to establish the intellectual foundation and drive for scientific knowledge into the minds of our youth.

Yet we must remember that the realm of science reaches much deeper than memorizing the theorems and scientific principles found in the pages of a textbook; to understand its application in a purely academic or professional setting is a grave disservice to the name of science, as it impacts our everyday lives on all levels of the human psyche. Science, as a way of thinking and a way of life, instills self-reliance to seek out solutions to problems we encounter in the everyday world.

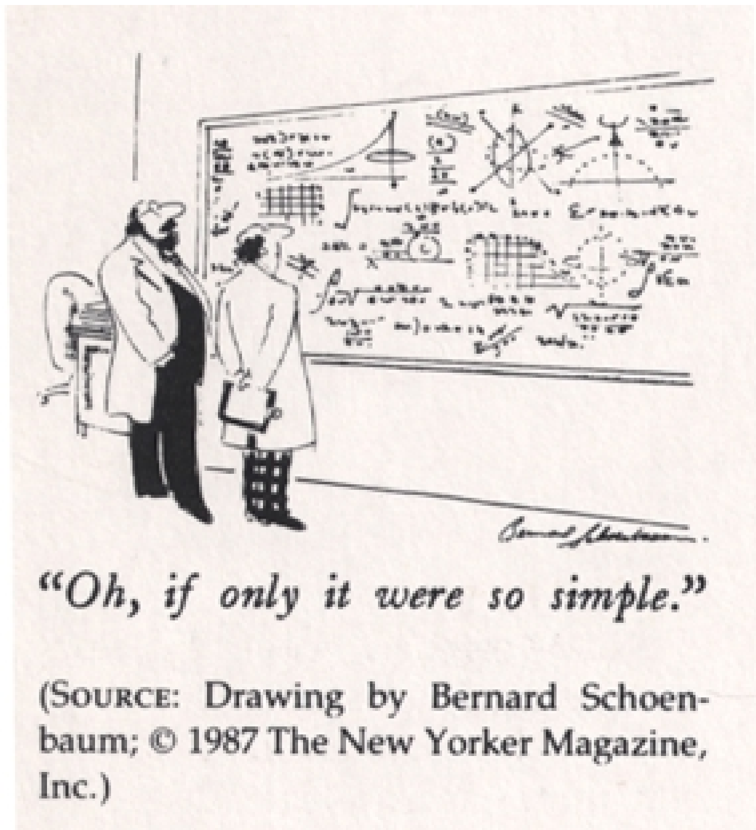

Figure 2. The puzzles that are the nature of science only reflect the challenge placed on society to instill a collective courage to overcome them.

The nature of science as an exploratory field can encourage minds to become inquisitive, creative, and resourceful when challenged by adversity and mediocrity, both on an individual level as well as in the larger context of societal and political life. The confidence to proactively seek out solutions to a question or task is essential in establishing self-motivated thinking, rather than feeding the habit of simply relying on others for answers. In addition, it coaches critical evaluation of information and policy over complacency with simply acquiring new information. This level of inquiry applies to children in particular in terms of comprehending new information; not just simply accepting the word of adults, but sparking curiosity beyond the question of, 'Why?' to the more inquisitive, '*How?*'.   So *how* then, can we instill this confidence in the hearts of our communities, when we live in a time when science anxiety is prevalent, the role of women in the science profession is invisible, and the image of science has become unapproachable, even feared? As this thesis intends to explore, one way is through architecture.

Fig. 3.1 Discrimination against women.

Figure 3. Science carries a stigma against women in the field, not highlighting contributions by women and therefore not providing equal gender role models for young girls today.

Chapter II. The Science Center

Today's young generation is developing in an 'information age', one in which we are bombarded with all forms of media that impact not only the information we acquire, but also how we acquire it. We, more now than ever, accumulate knowledge in alternative learning environments, from radio and television to televised educational courses, to museums and of course the internet. Learning through the process of exploration, trial-and-error, and lateral problem-solving benefits the general population in the sense that a successful science education gives children the foundation from which to bring their knowledge and understanding of science, in both methodology and content, to bear on everyday issues that affect people of all ages (Reiss, 33). How we learn science outside of school becomes as imperative to our life-long learning process as our acquisition of knowledge in the traditional classroom from the curriculum of the formal educational infrastructure.

Informal learning institutions have emerged as necessary places of learning, educating not only student populations but also informing the general public, and they play a vital societal role as public educational resources for the enrichment of entire communities.

The role of the science and technology center as a non-traditional learning institution serves two primary missions. One seeks to improve the public understanding of science and increase public awareness of, and interest in, science and technology subjects. The other is directed towards school audiences, and aims to supplement the school curriculum with programs, activities, and equipment that are unavailable in the traditional classroom.

The 'science center' itself as an educational venue can be broken down into two very distinct types of facilities. One is a learning environment that serves an educational agenda exclusively to students and educators in the public school system, staffed by teaching specialists and instructional programs specifically designed to enrich and supplement a science curriculum mandated in the jurisdiction's formal educational infrastructure. Many of this type of facility were built in the late twentieth century, and only a handful is left standing today.

The more popular version is that of the family-style museum venue, open to the general public, and largely designed to excite the curiosity and engage the attention of children. While classroom wings are common, the largest percentage of floor area is given to displays and interactive exhibits, which school group share with the general public.

Thus visitors to science centers can be divided into two general categories, one of which is the general visitor, and the other, the organized group, the largest percentage being from schools. The largest number of general visitors belongs to families, comprised of parents, grandparents, friends, and single-parent families. Historically, visitors to interactive science centers are predominantly from the professional classes and who are predisposed to visiting attractions with educational or learning agendas. This thesis intends to explore site selection based on reaching underserved communities with limited means of transportation.

Chapter III. Site Selection

As our nation's capital, Washington, DC exists as one of the world's most influential and prominent cities. The symbol of cultural diversity, the image of political leadership, and a place of architectural tradition, it also leads the world in advances in science, technological achievement, and innovation. Indeed, civilization is, by nature, a product of its own progress, and such an environment relies heavily on the scientific literacy of its society.

Therefore in a city of such a diverse mix of history, language, socio-economic background, and education, there is a need for a place that will facilitate this initiative and instill collective confidence, to serve as a powerful educational resource and a regional symbol of identity. It is only fitting for Washington DC, with its long-established reputation as a city of museums and cultural institutions, to maintain its richness and epitomize innovation in architectural design by serving as the location for a civic center dedicated to the public understanding of science.

I have chosen a location in Southeast Washington, along the west bank of the Anacostia River and in an area known as the Capitol Hill East district for this exploration. Based on an urban masterplan proposed by the city for the revitalization of the area known as Reservation 13, the site lies at the terminus of Massachusetts Avenue and serves to complete the edge of the city fabric. This point however, has the potential to act as a transition, and connection, between the man-made environment and the natural conditions to the east, including the proposed parklands, the Anacostia River, and Anacostia Park.

Site History

The origin and culture of Washington, DC is rooted in the history of its surrounding waters, and the capital city has gained its identity within the geographical context of the Potomac and Anacostia Rivers. The southeast quadrant of the city, the area of the proposed site, is historically identified in relation to the Anacostia River and its surrounds, which have drastically transformed from a once-rich natural resource to its current state of ecological concern.

In the early 17th century, the Anacostia wastershed region was a thriving center of Indian life. The Nacotchtank Indians settled at the confluence of the Potomac and Anacostia rivers in what is now known as Washington, DC, and the crystal clear waters of the Anacostia River offered abundant wildlife, lush forests, and streams full of fish to the tribe and its surrounding neighbors. These waters, along with the Chesapeake Bay and the Potomac River, were eventually charted by Captain John Smith, the first European explorer to reach and survey the Anacostia basin in 1608. But opening the door for European settlement along the river meant changes in the use of its land, and the successive waves of cultivation and urbanization which were to occur over the next centuries would sadly deteriorate the ecological system and pristine character of the Anacostia watershed region.

The initial wave of change occurred as the densely forested Anacostia region was progressively cleared for agriculture, and by 1860 most of the area had been cultivated for tobacco, corn, and cotton farming. This wave led to increasing sedimentation of the Anacostia River; soil eroding from upland agricultural fields was transported downstream to the tidal river, resulting in the formation of extensive mud-flats along the river's banks. Although Congress approved funding for the U.S. Army Corps of Engineers to dredge the Anacostia in 1902, the Anacostia would still suffer ecological deterioration caused by the next surge of human civilization.

Urbanization in the Anacostia region has cost the river its forest and wetland habitat and resulted in the overall decline of the ecological welfare of the area. The expanding human population, increases in non-point source pollution, industrial waste, and sewer overflow has contributed to the changing land use and land cover, destroying the beauty and diversity of the Anacostia. This severe collapse of the health of ecosystems present in the waters and land has affected the identity of the Anacostia region and its residents today, having lost its presence as a natural and physical amenity to the city and its people.

Recently however, there have been efforts to restore the Anacostia to its natural beauty as well as to revitalize the Anacostia region of Washington, DC from a forgotten piece of the city to a thriving neighborhood and urban space livened by pedestrian activity.

Figure 4. The site is recognizable in L'Enfant's Plan of 1791, on the upper west bank of the river formerly known as the Eastern Branch.

Site Context

The exploration of this thesis is predicated on a proposed urban master plan for the Capitol Hill East waterfront area, historically known as Reservation 13 (DC General Hospital Site). This area has undergone planning efforts led by the DC Office of Planning towards the revitalization and beautification of the Anacostia Waterfront. The Public Reservation 13 Hill East Waterfront Draft Master Plan is the product of the unprecedented collaborative effort between District Agencies and neighborhood residents.

Incorporating prior architectural studies as well as other related building projects and initiatives in progress, two of the ongoing planning efforts directly related to the Reservation 13 planning process are the Anacostia Waterfront Initiative (AWI) and the Neighborhood Planning Initiative (NPI). Both are dedicated to the vision of maintaining a thriving, livable community and improving the environment around the waterfront to highlight the Anacostia River as a key and natural resource of the District of Columbia.

Located in the southeast coastal plain region of the District of Columbia, Public Reservation 13 is a government-granted parcel of land that sits on the west bank of the Anacostia River and serves as the easternmost edge of the Capitol Hill East neighborhood. This area is most commonly known to area residents as the site of the DC General Hospital, which has been in use as a health care facility since the mid-1900's.

Figure 5. Aerial view of DC General Hospital grounds, nestled between the DC Armoy (right) and Congressional Cemetary (left).

In a context characterized by dense urban fabric which abruptly stops short of the river, Reservation 13 appears in Washington DC's earliest plans as an isolated campus set apart from the traditional street grid of the city. Initially slightly smaller than its current size, the area has always remained severed from the Hill East neighborhood and continues to exist as a physical and spiritual barrier between the residents and the waterfront.

The land's use for health care facilities originated with the relocation of the Washington Asylum from Judiciary Square to Reservation 13 between 1843 and 1846. Shortly thereafter under the 1877 Act, the grounds south of the Asylum along 19th Street were designated for new workhouses for the use of the District in connection with the asylum. The McMillan Plan of 1902, also known as the Senate Park Commission Plan of

1902-1902, proposed a new continuous park system for the city along the water's edge with intention of preserving the wildlife and natural resources of the Anacostia River.

Figure 6. McMillan Plan of 1902.

Construction of the main buildings of DC General Hospital was completed in the 1930's and 1940's. The complex grew to over 1 million gross square feet of hospital and health related uses as more buildings were added over time. Reservation 13 also served in the 1870's as grounds for the DC Jail, which has since been replaced by the new Central Detention Facility in 1976 and a Correctional Treatment Facility located southeast of the DC Jail. These correctional facilities are still in use, unlike the majority of buildings which are either vacant or only partially occupied, since the closing of DC General Hospital in 2001.

Located on the edge of the Southeast residential district, Reservation 13 is the termination point of the prominent Massachusetts Avenue and Potomac Avenue. This campus is clearly defined by its adjacent streets, and is bordered on all sides by different land uses. To the north across Independence Avenue are sports-related uses such as RFK Stadium and the DC Armory, to the west across 19th Street is the residential Hill East neighborhood, to the south is Congressional Cemetery, and to the east is the Anacostia River waterfront.

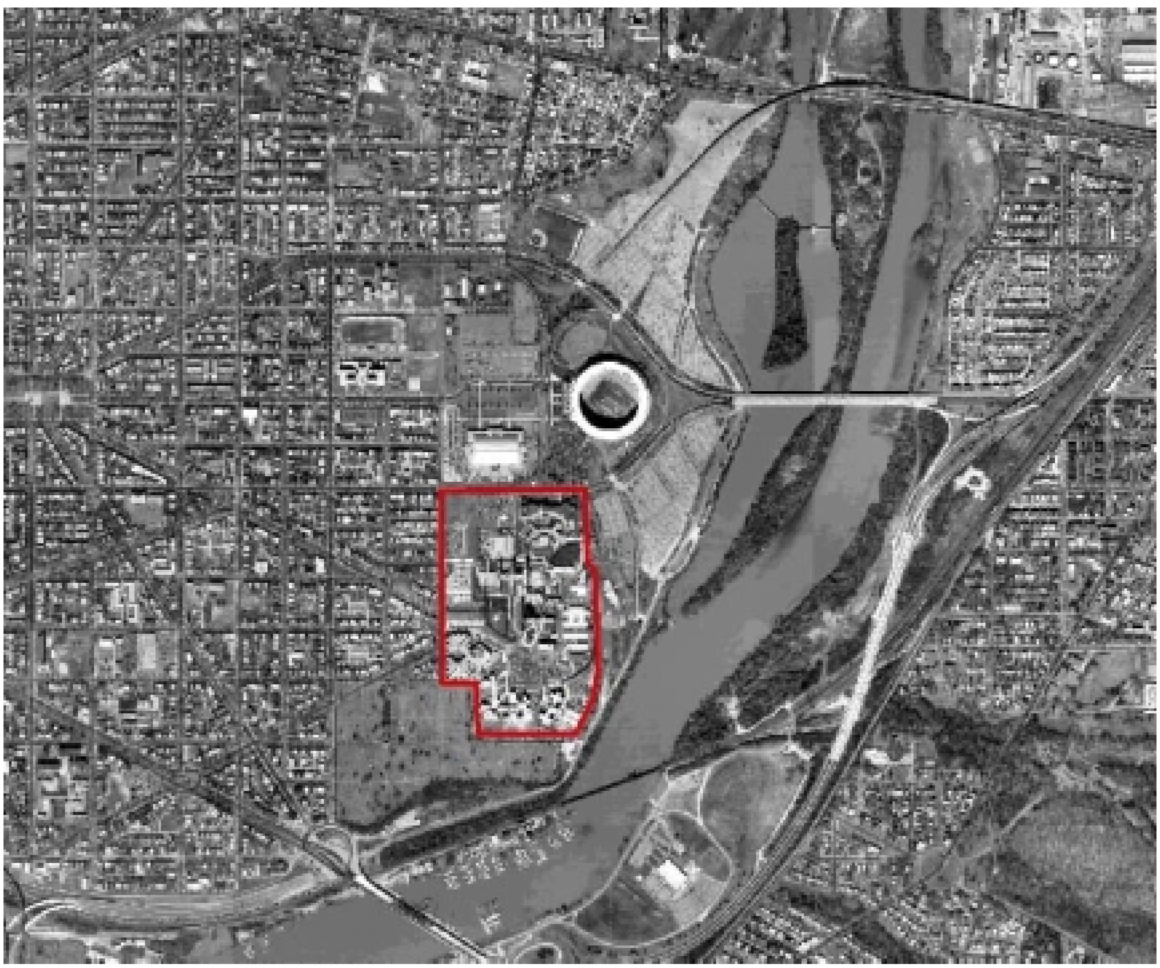

Figure 7. Aerial view showing the physical boundaries of Reservation 13.

Since the closing of the DC General Hospital in 2001, few buildings on this campus are in full use, and the majority of vacated buildings have deteriorated over time, contributing to a deserted atmosphere. The abandonment of buildings has transformed a once-busy complex into a forgotten campus that not only turns away from its neighbors, but conceals the Anacostia River behind its walls and vast parking lots.

Figure 8. Aerial of Reservation 13, showing buildings and parking lots preventing and discouraging access to one of Washington, DC's natural amenities.

The residential district of the Hill East area consists of homes built between the late 1800's and 1900's. Primarily built by the Thomas A. Jameson Company in the 1920's, the standard S-type rowhouses were located along East Capitol Street, Kentucky Avenue, Massachusetts Avenue, and Potomac Avenue. The surrounding neighborhood is largely a low-income residential district whose residents have made the Capitol Hill East area their home for generations.

This area is comprised mostly of African-American residents, many of whom can be found chatting outside with neighbors under the shade of trees or keeping watch over the neighborhood from their front porches. This high-density neighborhood dynamic is typical of the entire community, and actually extends slightly into the Reservation 13 area, where a local bus stop is located, and also where visiting friends and relatives congregate outside the DC Correctional Facility.

Congressional Cemetery, located southeast of the site along the Anacostia and the first national cemetery in the nation, is slowly slipping into poor shape, having only community volunteers to maintain its grounds. There is also an area between the DC Jail and the cemetery that has surfaced as archaeological sites, uncovering artifacts of the Native American tribes that once inhabited the area.

In relation to other familiar sites, scale comparisons indicate that Reservation 13 is approximately the same size as the historic district of Alexandria, Virginia, and is also comparable in size to the main campus of Howard University.

Figure 9. Typical Hill East neighborhood rowhouses (E Street), showing a gentle slope east toward the DC General Hospital site.

Figure 10.   Rowhouses on Burke Street, featuring raised ‘front yards’ that help establish semi-private zones.

The Site- Existing Conditions

Figure 11. Site Plan

The specific site for the design proposal consists of only 112,500 square feet (about 2 acres) of Reservation 13's total 67-acre area. Located approximately 400 feet inland from the west bank of the Anacostia River and southwest of RFK Stadium, the actual site presently sits on the easternmost edge of the campus. It is currently the location of a 3-story brick structure that houses the Medical Examiner's Office, among various other medical services.

The building, at approximately 40 feet tall, sits in a unique location that acts as a transition point between the built environment and the natural landscape, but does not capitalize on its potential to revitalize the area by establishing physical and visual corridors from the Hill East neighborhoods towards the Anacostia.

Figure 12. Aerial of proposed site shown in the context of Reservation 13's boundaries.

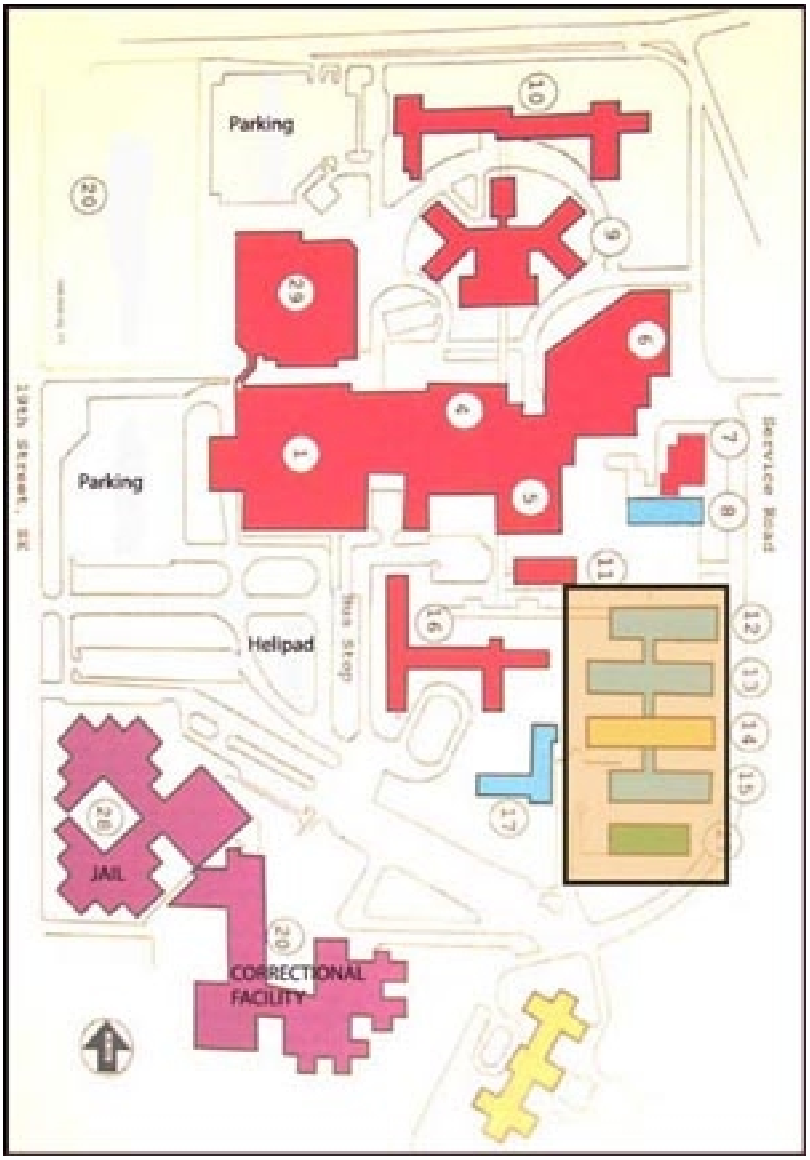

Figure 13. The DC General campus master plan. The site creates the easternmost edge of the campus, among other medical care and correctional facilities.

Since buildings on the health campus were added as the need for more medical facilities arose, a campus sprawl resulted, leaving buildings apparently devoid of any spatial relationship with each other and with the adjacent neighborhoods.

Figure 14. Medical facilities on the DC General Hospital Health Care Campus

Figure 15. View of the correctional facilities, located southwest of the site.

This proposed site location is easily the most visible piece of the campus, allowing exposure to views from north and south of the site along the Anacostia, and particularly from areas across the river. In addition, the site itself capitalizes on its location and maintains a view corridor to the north, terminating in a framed view of RFK Stadium.

Figure 16. Buildings located on the site are clearly visible from the east side of the river on the Anacostia Freeway, a main artery for motorists in the District.

Figure 17. View from Pennsylvania Avenue, which, as a highly traveled path into the District, allows the site high visibility.

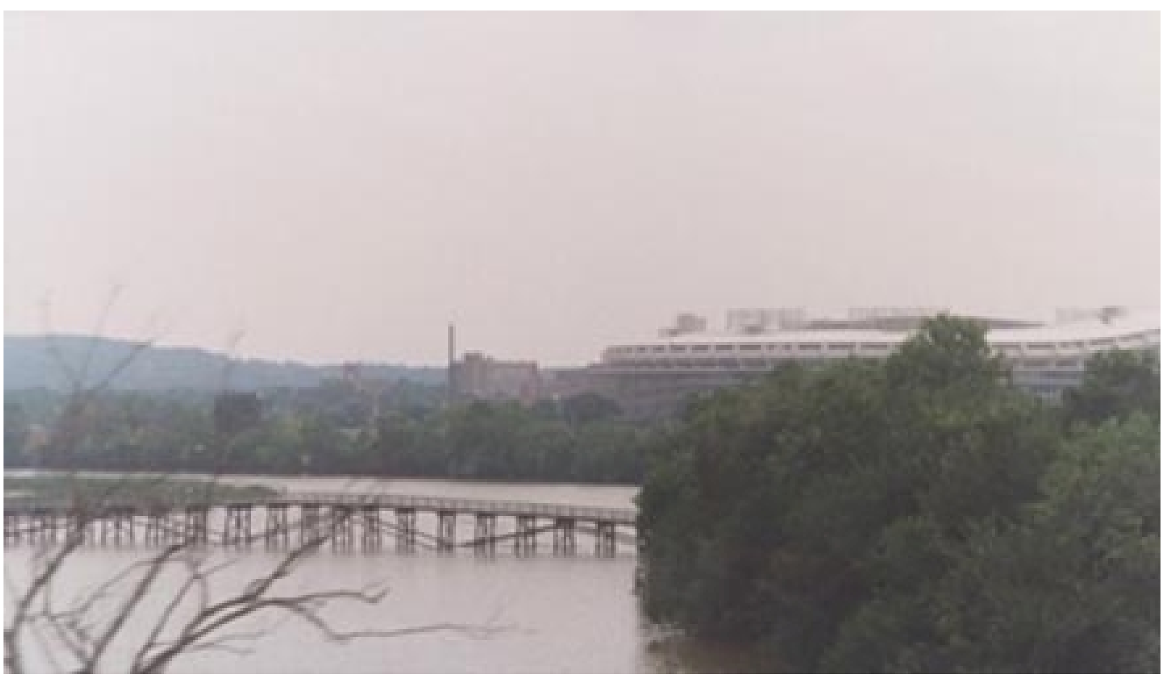

Figure 18. Metro commuters and visitors traveling on the Blue Line train towards DC can easily see the site, just to the left of RFK Stadium.

Figure 19. View looking north from the easternmost edge of the site, ending in a clear view of RFK Stadium.

Figure 20. View of Massachusetts Avenue towards the DC General Hospital grounds, showing tree-lined streets and wide lanes allowing on-street parking.

Figure 21. The view from the intersection of 19^{th} Street and Mass Avenue, which is the main entrance onto the hospital grounds and also a stop for the Metrobus, captures a vista across the Anacostia River.

Figure 22. The thesis site is a five-minute walk from the Stadium-Armory Metrotrain Station, whose architecture is a slight reflection of the correctional facilities nearby.

Site Analysis

The proposed site sits in a barren context of derelict buildings with no apparent relation to one another besides their proximity, and is perceived as a sterile environment that is shut off from the rest of the city fabric. Its potential for waterfront activity is grossly underutilized, and serves as a barrier visually and physically severing the adjacent Hill East neighborhoods from the Anacostia River.

It is the intention of this thesis to establish a public space that facilitates the neighborhood connection with its built environment and instills a sense of identity for the community, while supporting the vision of the Reservation 13 Draft Master Plan by re-activating Massachusetts Avenue as a grand boulevard highlighting the presence of the Anacostia River.

The following analysis of the proposed site and its context highlights both its merits and limitations, with the intention of understanding its character and potential for an appropriate design solution.

Figure 23. Existing Street Grid

Washington DC's regular grid and diagonals allow one to easily orient oneself, particularly in relation to the DC General Hospital campus. Yet the urban grid abruptly stops at 19th street, creating a vehicular and pedestrian barrier to the waterfront's use as an area amenity.

Figure 24. Street Hierarchy

Southeast Washington, DC s not currently viewed as a destination stop, and many of the arterials that penetrate the Hill East area do so to accommodate various volumes of traffic towards or away from downtown areas. Pennsylvania is a heavy thoroughfare, and Constitution, Independence and East Capitol Streets serve as east-west streets while Potomac and Massachusetts are principle diagonals, although Massachusetts is the main access path to the site.

Figure 25. Metro Rail Stations

There are four metro rail stops between the Capitol and the proposed site, allowing access to the Capitol East neighborhood by a potentially wide population. The most convenient yet underutilized access to the site is the Stadium-Armory station, located on C and 19th Street; a five-minute walk southeast of this station reaches the edge of the site. This mode of transport is highly advantageous in reaching a diverse crowd, many of whom use this station to reach athletic and community events at RFK Stadium and the DC Armory.

Figure 26. Site Boundaries

The site's soft boundaries include the proposed extension of Massachusetts Avenue to the south and the swath of natural green landscape that will create its edge to the east.

Figure 27. Site access

From the downtown area of DC, Massachusetts Avenue directly accesses motorists and pedestrians to the main entrance of the campus, while Potomac and Independence Avenues serve as secondary modes of access to the vicinity, using 19th Street as a corridor to the entrance. A small access road from Independence Avenue leads to the service side of the site, although it is only used to reach surface parking during sporting events.

Figure 28. Adjacent Land Uses

The site is in the unique position to take advantage of the various land uses which surround it, potentially creating a public space which will be utilized by a wide audience as well as drawing a community from a diverse population.

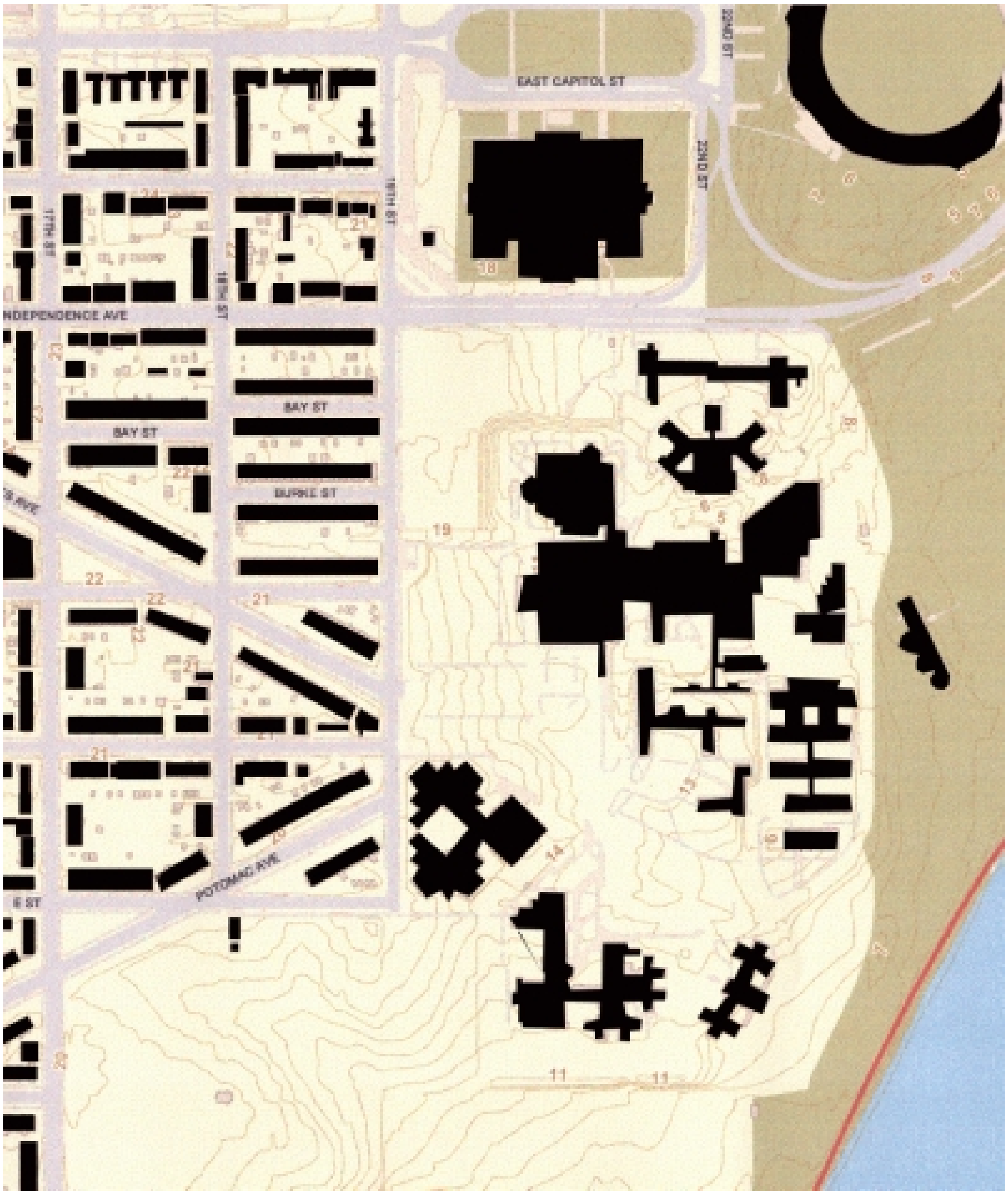

Figure 29. Figure-ground diagram

The clarity of the dense urban fabric stops abruptly at 19th Street. At this point, the buildings near the site and on the site itself are purely peripheral, with no relationship to the urban pattern and no apparent spatial relationship to each other or their surroundings. This area is poorly defined; the building orientation does not facilitate spatial coherence and makes no gesture neither towards the river nor to the neighborhood.

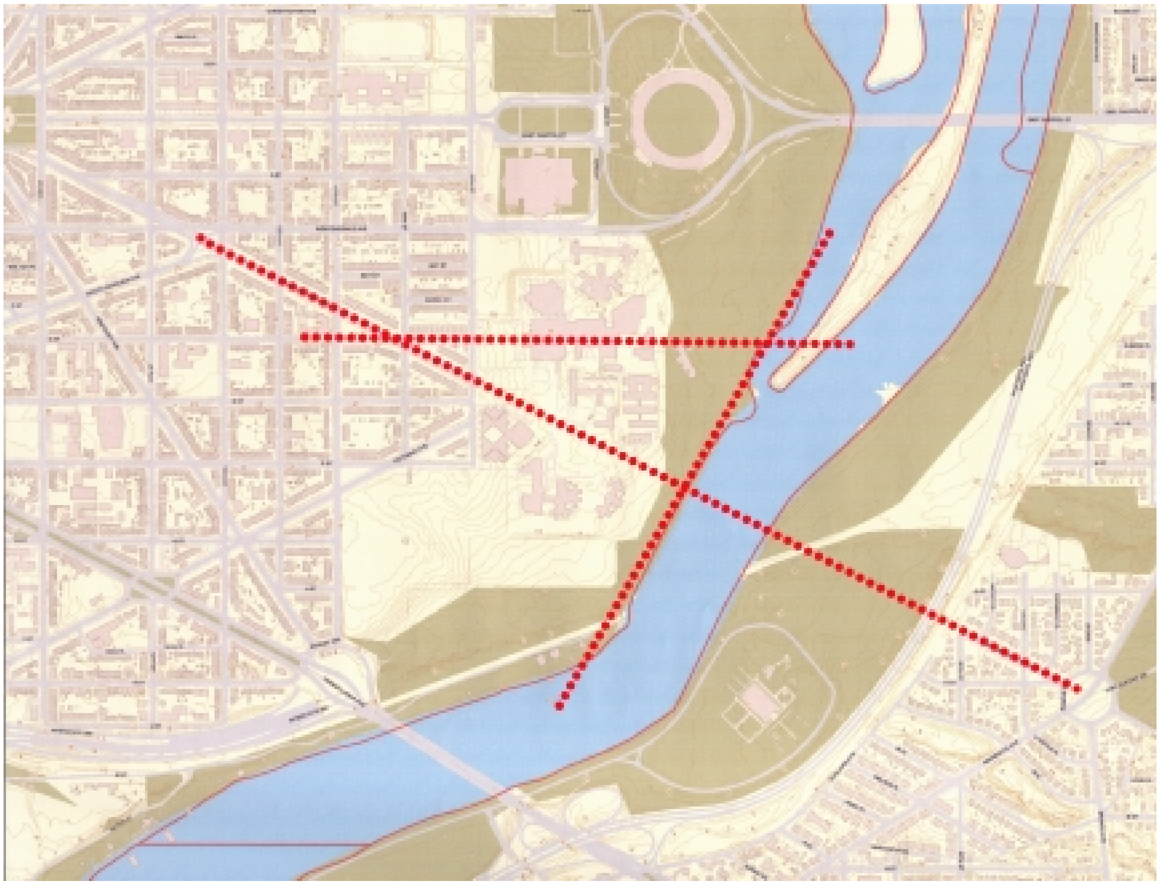

Figure 30. Geometries

The design of the science center can be largely informed by the site, which responds to three prominent geometries: the orthogonal DC grid, the powerful diagonal of Massachusetts Avenue, and the natural edge of the Anacostia River.

Figure 31. Topography

The general area of the site, starting at 19th Street, slopes down toward the river's banks approximately forty feet. This allows the neighborhoods excellent views to the river's landscape and islands, utilizing visual corridors created by the east-west orientation of the residential streets. 19th Street also provides visitors to the area with vistas highlighting the tree-top skyline on the eastern side of the river.

Figure 32. Vegetation

The site itself does sit on much vegetation, although it is the nearest to the dense brush and trees that line the banks of the Anacostia. The sporadic trees in Congressional Cemetery to the south and very few trees by the stadium are the only signs of green surrounding public buildings. The residential area however, enjoys tree-lined streets.

The largest type of forest cover in the region are deciduous stands, followed by mixed stands, and regenerating shrubs and coniferous trees. In general, less than 10 % of the Tidal Anacostia Area is forested.

Figure 33. Pedestrian Access

Pedestrian access in this area of the Hill East neighborhood is easily accommodated and safe—sidewalks are in good condition, trees line the residential streets, and the grassy, and private and public ways are clearly defined. Yet no sidewalks exist for foot traffic approaching or on the site. Those walking to the bus stop on campus grounds must share the road with vehicular traffic.

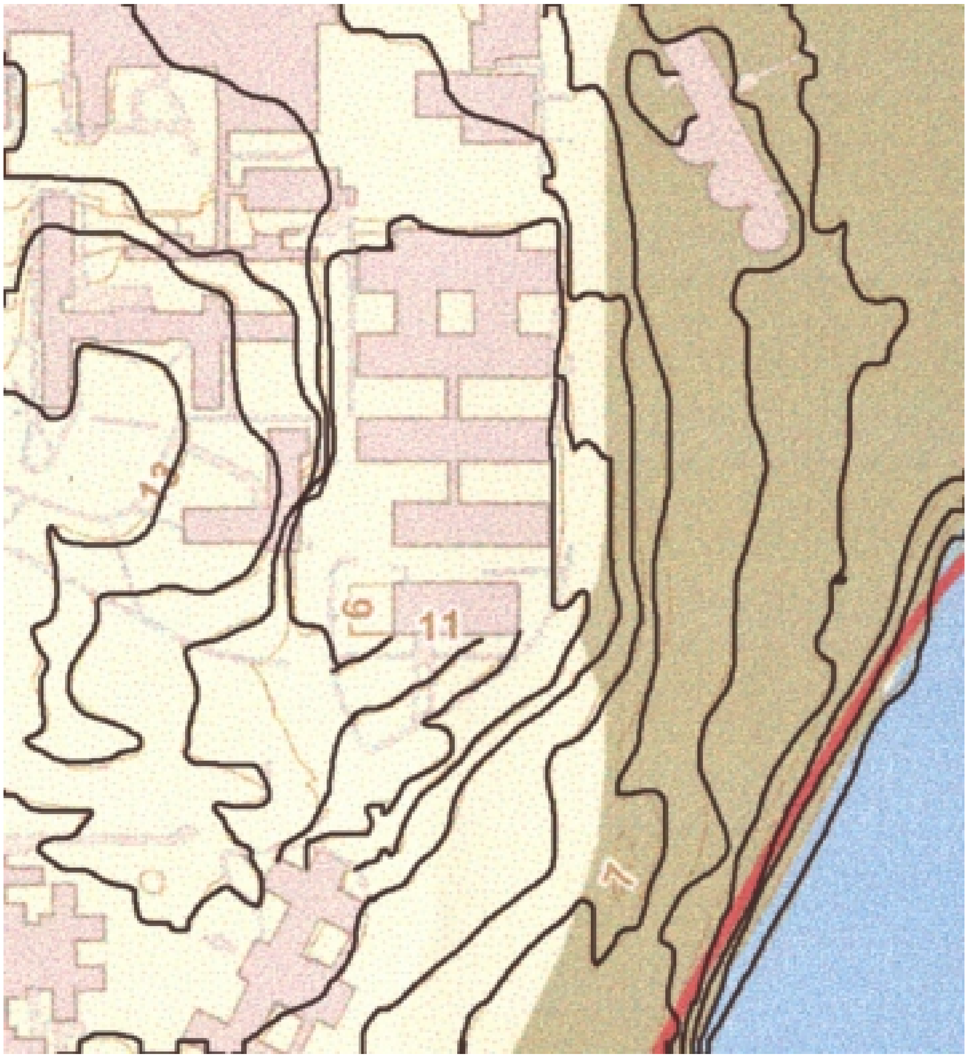

Figure 34. Site Topography

The site itself does not have drastic grade changes, but it does have the opportunity to maximize views from the steep slope towards the river bank. The slight rise in grade from its surrounding land also allows it to be seen on a plinth, not only giving it prominence within its immediate environment, but also affording it visibility from a distance across the river.

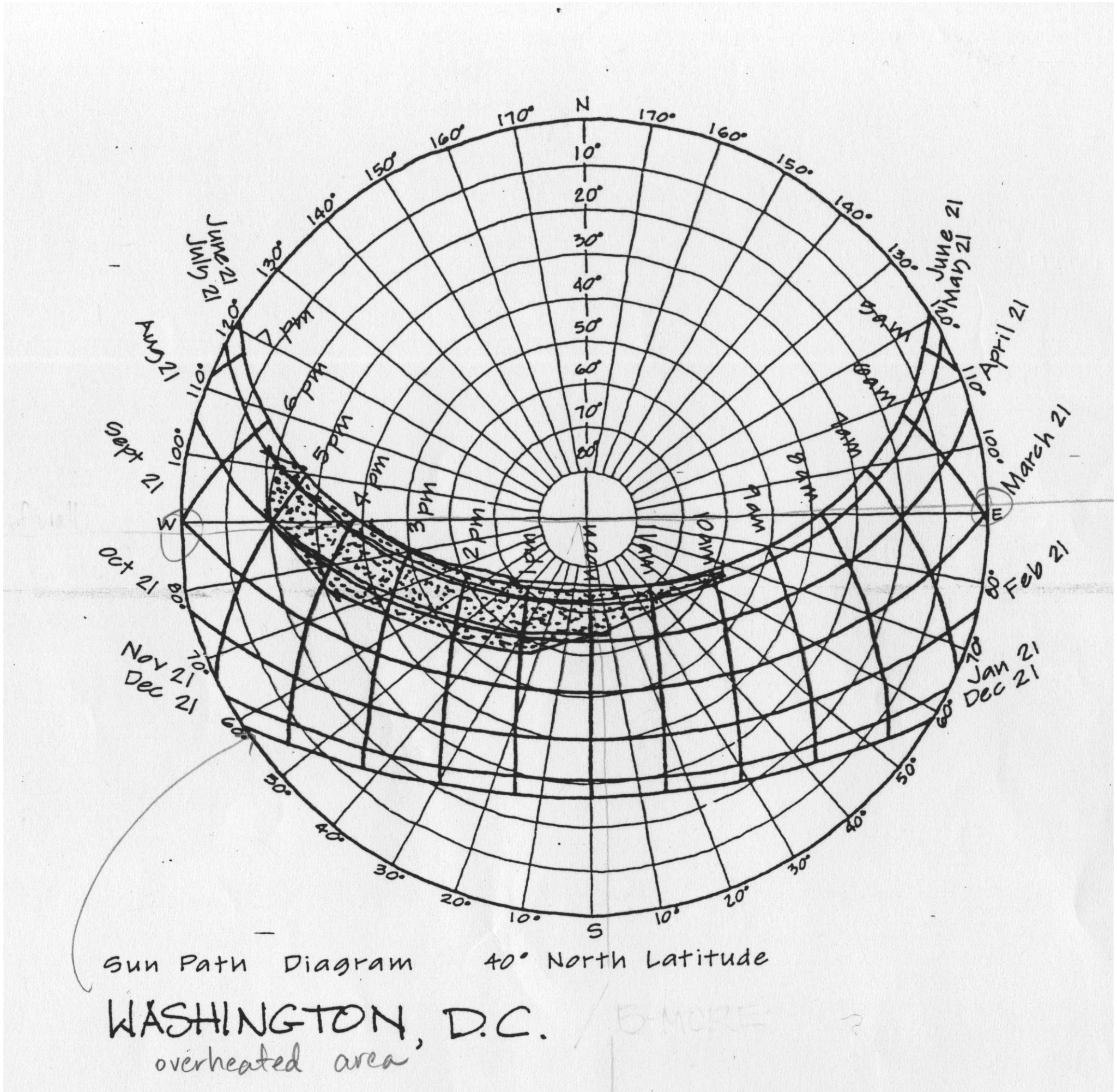

Figure 34a. Solar Diagram

Chapter IV. Program

The organization of programmatic components must be flexible enough to satisfy the broader educational expectations of the general visitor as well as the more directed instructional needs of the visiting school groups and organizations. Since this thesis explores how the built form can influence human thought and behavior, promenade is the key element in the shaping of space and time. It is intended as a 'thread' that spatially and strategically links volumes and points such that the visitor's experience can be enhanced through the manipulation of timing and spaces. The museum's program is divided into five major components: entry, main exhibition space, instructional space, administration, and outdoor space. These spaces are described in further detail below, as well as a tabulation of square footage.

Entry/Lobby Space

The visitor's experience of science begins upon arrival, and the entrance lobby is clearly the first opportunity to provide a welcoming physical and psychological first impression. Such a pivotal space serves many dimensions, the most salient being a literal nodal point; a place where the visitor can orient oneself to the immediate surroundings, and a place of departure from which the visitor can continue the scientific journey. The lobby space also physically, and has the potential to subliminally, serve as a gateway to usher the visitor into a different realm of consciousness, acting also as a figurative signal to what adventure lies ahead. More literally, the lobby must accommodate a large capacity, and this building houses a greeting area to function as the point source of information for the center's schedule of exhibits and events, in addition to educational opportunities available to the community and the city at large.

Exhibition space

One of the primary spaces of the science center is that of the exhibition space, organized in such a fashion to highlight discovery and contemplation. With the intent of this thesis to explore the circulation patterns of spaces and promenade, this potentially overwhelming area may be divided into smaller, more compact exhibit spaces to allow a larger opportunity for architectural play with approach and exit. This design allows a natural integration of temporary exhibit space with the permanent displays. Exhibits in the center will act both as points of destination as well as implied pathways to other termini, and can allow views back toward the entry, facilitating reflection on the museum journey. Experimenting with pedestrian flow also allows the chance to create moments of anticipation for the visitor by allowing views to an upcoming exhibit before actually entering the exhibit space itself.

The center houses a lecture theater designed to accommodate approximately 150 visitors, and is to be used mainly for educational shows for the public as well as lectures for the professional community. In contrast, a smaller demonstration stage is included in the program for interactive experiments, to provide an intimate setting for a specific audience or for smaller groups of people.

As an integral part of the community, this science center involves community members in activities within the center, but it also encourages various other community events and functions by providing a public space that may serve a variety functions from reception hall to meeting and conference room. Utilizing movable partition walls, this space affords the flexibility of expanding and collapsing to fit the anticipated capacity of any particular event.

Instructional space

Instructional spaces include areas designed to accommodate computer lab settings, science laboratory settings, and classrooms. These facilities are to be utilized mainly by organized school groups, providing access to scientific instruments and resources that may not be part of their school's available resources. Activities here are intended to supplement the academic agenda taught in the traditional classroom, and in conjunction with the teaching methods of the classroom teacher. Computer labs are exclusively for groups with a school-guided curriculum, although hours may be scheduled for organized groups to participate in net-based programs that are relevant to the understanding of any particular exhibit in the science center.

Classrooms accommodating an ideal class size of 25 students per teacher ratio, are available for guided instruction by the teaching specialists of the center, and placed to optimize views towards the landscape and provide natural lighting. Classroom teachers are encouraged to stay with the class, in the center's effort to model ideal teaching techniques. The reading library houses a range of resources from elementary textbooks to professional science journals, primarily for science professionals and staff to research scientific work, but also available for use by pupils to supplement their classwork . Bookstacks are located away from expansive windows to prevent overexposure to direct sunlight, and group study tables are placed along clerestory windows overlooking the demonstration area.

Administration

Administration spaces are comprised of staff and directors' offices, as well as work spaces designated for support programs such as community outreach, marketing, security, and technical services. Adequate spaces for research facilities are placed nearby, to be used by visiting science professionals and in-house personnel alike.

Outdoor space

A holistic science-based learning experience is one which is not confined to only interior spatial experiences. In fact, the natural environment is a necessary learning instrument in understanding the world which surrounds us, and is a beginning step in the process of discovering our role of responsibility in sustaining the environment. Therefore, visual, spiritual, and physical access to the outdoors is imperative in the design of a responsible science facility. The division of land into parcels based on a particular teaching agenda is composed of a science garden, placed adjacent to the classroom wing and science laboratories; a nature trail, leading visitors throughout the site to experience plant life; and a recreational natural landscape area, for respite from the journey as well as destination area symbolizing that science in all its forms inevitably returns to nature.

Introducing a center for science into an urban context affects the dynamics of the surrounding area, in terms of the anticipated volume of people. Crime and privacy are major concerns whenever a building is designed to attract a wide audience, especially for the Hill East neighborhood in such a high density environment, and within such close proximity to the area of activity. Yet these ventures are beneficial in terms of generating income for local businesses as well as increasing the property value of the surrounding area; indeed, such high activity may even deter crime in otherwise abandoned or desolate pockets of the neighborhood. In addition, the science center will accommodate space for community functions, which will only draw the residents together and increase solidarity among its visitors.

TABULATION OF SPACES

Components	Square footage
Entry lobby	4800
Information desk/Ticketing Booth	250
Greeting Area	1000
Exhibition space	
Permanent	55,000
Temporary	22,000
Auditorium	4800
Demonstration Area	2600
Educational	
Classrooms (3@600)	1800
Library	1400
Administration	3700
Outdoor Space	
Science garden/open courtyard	16,700
	114,050 Subtotal
Mechanical, Circulation, Service	
(@20% of total program)	(22,810)
	136,860 TOTAL

Chapter V. Design Precedents

This thesis encompasses and integrates a variety of design ideas in addition to the science center typology, and the scope of investigation has led to a wide range of precedents including circular buildings, underground structures, traffic circles, freeway structures, pedestrian bridges, and pavilions.

The primary resource for this project began with science centers.

Maryland Science Center (140,000 sq. ft.)

Baltimore, Maryland
Architect: Design Collective

The Maryland Science Center's location within downtown Baltimore's dense city fabric highlights important site issues in terms of the building's relationship to its surrounding urban pattern, pedestrian and vehicular access, public space, and views. Situated along the waterfront in downtown Baltimore's Inner Harbor, MSC enjoys the high visibility and pedestrian activity inherent in any popular tourist destination spot. Its ideal location on the corner of two major thoroughfares, Key Highway and Light Street, advertises the center to vehicular traffic through the city, a factor in the center's strong civic presence to passing motorists and pedestrians alike.

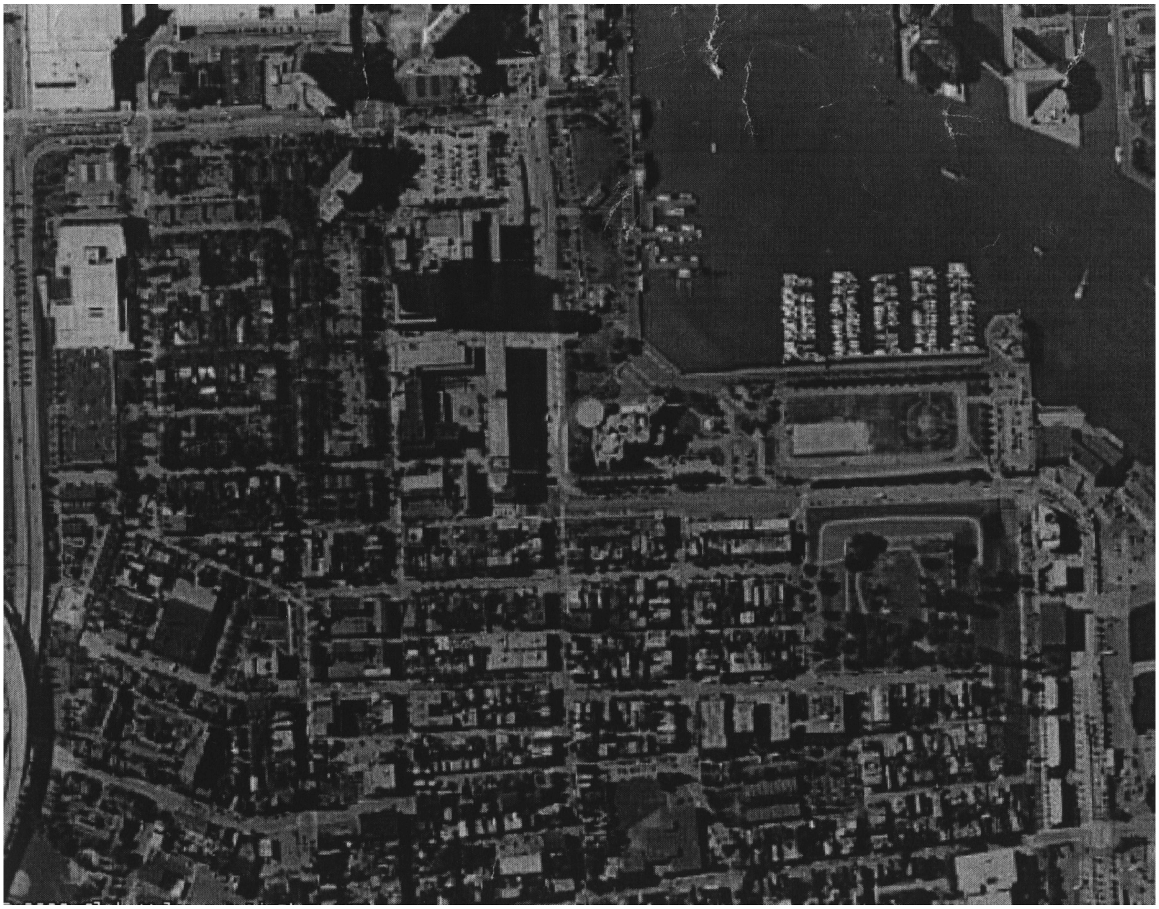
Figure 35. Site plan

Primary access to the science center is by stair and ramp to the main entrance of the building, and is primarily pedestrian from the Inner Harbor's promenade. Capitalizing on its location fronting the water, MSC becomes the immediate focal point for passengers traveling by Water Taxi, which provides access to the promenade at the corner of the Harbor to the north of the main entrance.   A secondary, less defined entrance located on the south side of the building faces Key Highway and residential neighborhoods, and is the designated point of entry for staff, members, and school groups.

The site boasts the best panoramic view of the city across the Inner Harbor to the north, which can be seen not only from the terraced entrance plaza but also from inside the building on every level.

Figure 36. View from the entry plaza of the Maryland Science Center, looking toward the Inner Harbor.

Figure 37. View of south façade, showing the MSC's proximity to the street and downtown Baltimore in the background.

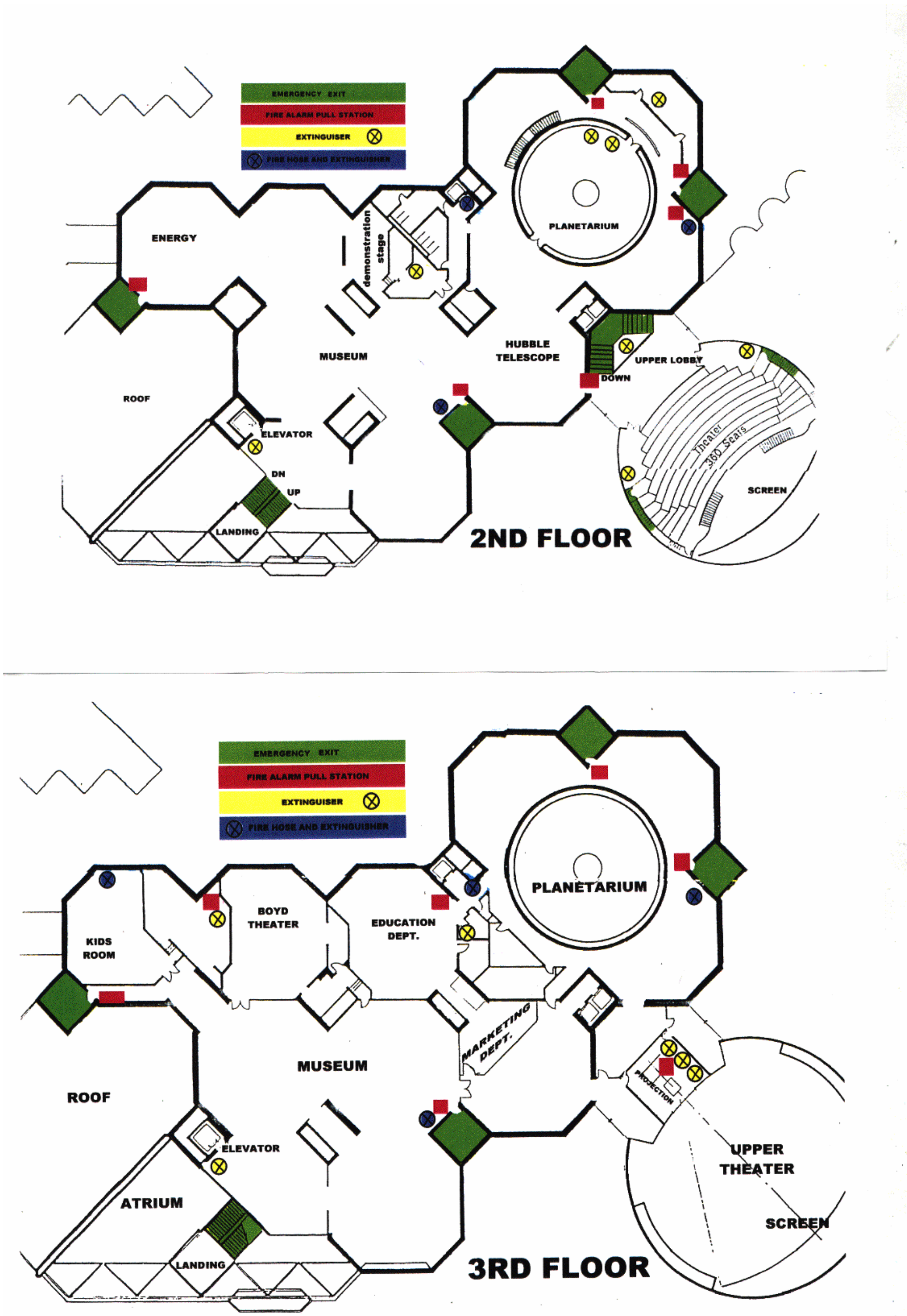

Figure 38. Typical floor plans showing spatial organization

California Science Center (245,000 sq. ft.)
Los Angeles, California
Zimmer, Gunsul, Frasca Associates

In response to its dense urban context, the California Science Center anchors itself among other institutions on the 160-acre civic campus of Los Angeles's Exposition Park. As a public resource that, by nature, must accommodate a large and increasing volume of people, CSC brings forth the issue of urban plazas and their implications on open green space, which may erode from the growing center of activity. This concern is highly applicable to the thesis site proposed along the Anacostia waterfront, in terms of preserving the river and vegetation as natural amenities alongside a built environment designed for recreation and activity.

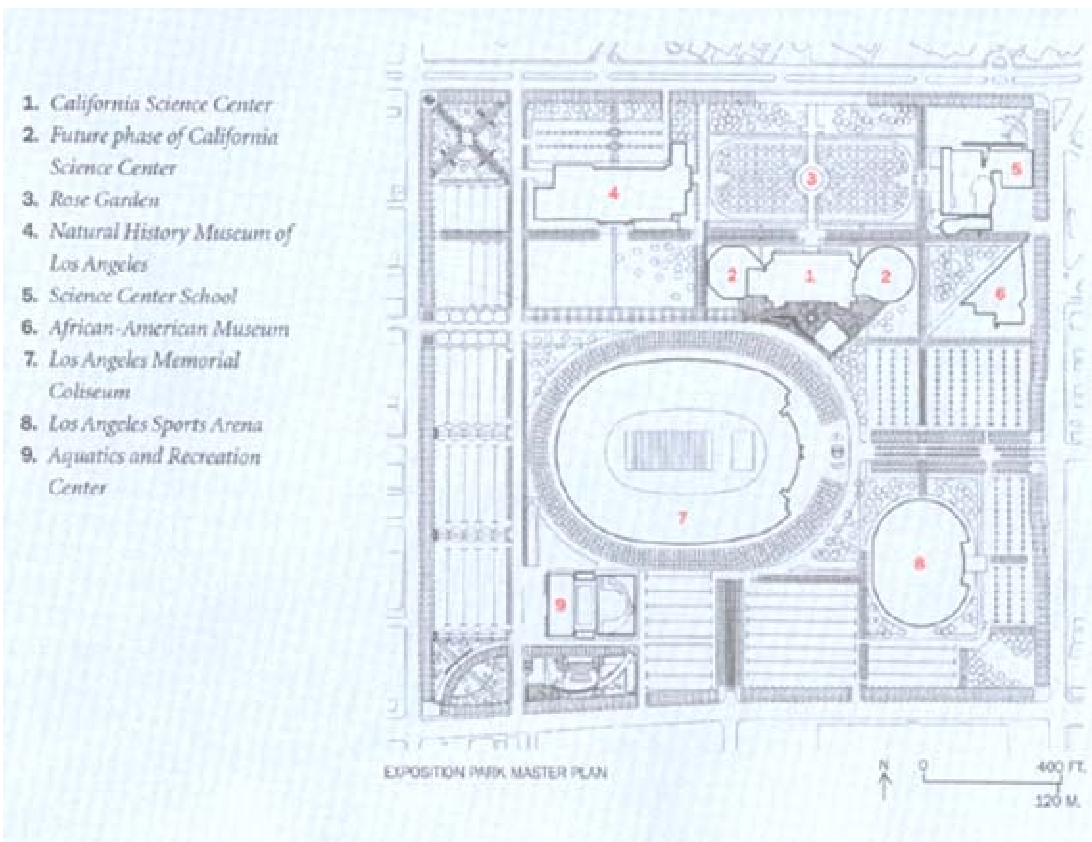

Figure 39. Site plan of CSC in the context of Exposition Park

Figure 40. Aerial view

Situated between the south central neighborhoods of Los Angeles and the historic University of Southern California campus, the CSC can also inform the thesis in terms of its approach to architecturally resolving the needs of diverse worlds. A center for science in this context has the unique potential to establish a civic presence while maintaining an identity that is appropriate in scale to its surrounding neighborhoods and community.

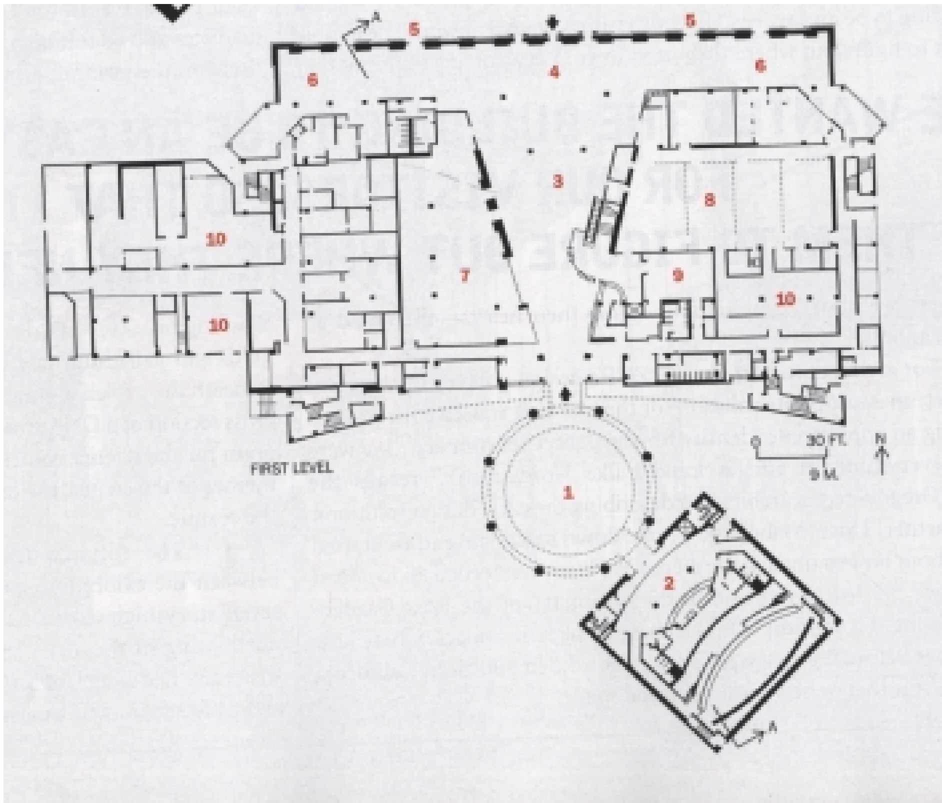

Figure 41. Ground floor plan

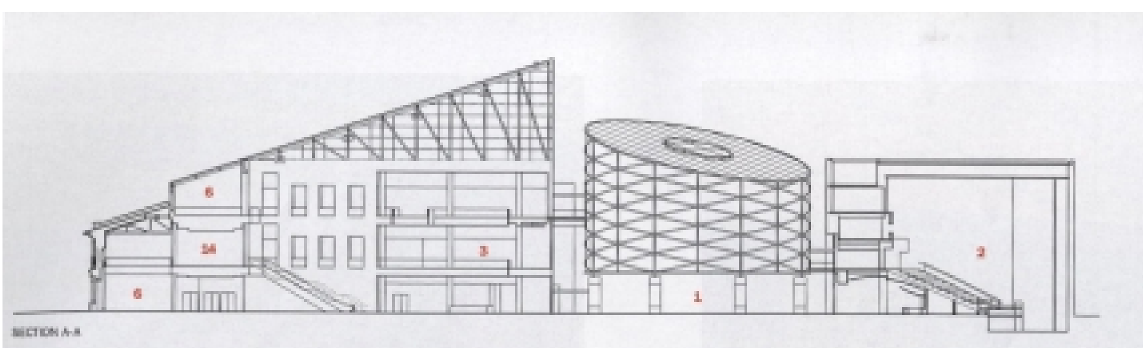

Figure 42. Section

Figure 43. Entry plaza highlighting the pavilion

Rose Center (335,000 sq.ft.)
New York City, NY

The Rose Center offers valuable guidance in terms of expression of material and construction. With today's rapid pace of innovation, science centers have the challenge of reflecting modern-day technology and construction techniques while communicating the energy brought to life using a clear, understandable image of science.

Figure 44. View of front façade, showcasing the Hayden Sphere within the Rose Center's 95-foot-high glass cube. The sphere is clad in fabricated aluminum panels containing acoustic-enhancing perforations, and is 87 feet in diameter, weighing four million pounds.

Figure 45. Hanging from the roof of the structure and anchored by 1400 steel “spiders”, the cube clads the Rose Center in the largest suspended glass curtain wall in the United States, using an acre of glass (36,000 sq.ft.) and two and a half miles of rod rigging.

Circular building precedents:

Figure 46. Hirshhorn Museum

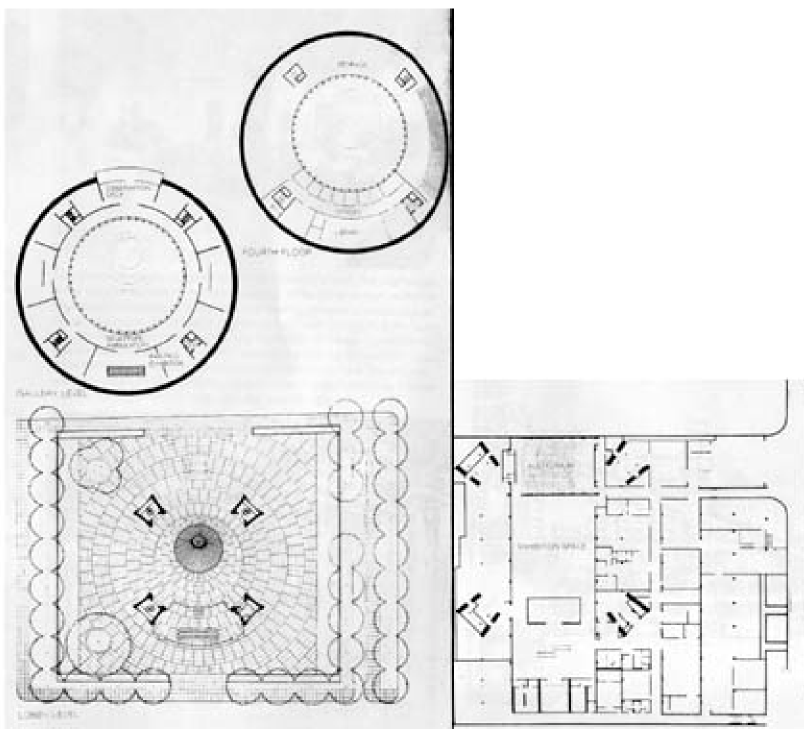

Figure 47. Floor plans of the Hirshhorn Museum

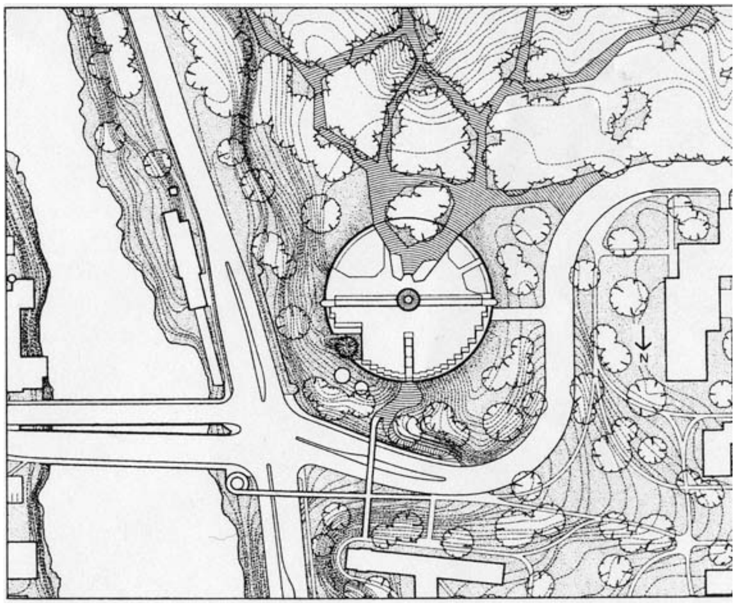

Figure 48. Site Plan of the University of Iowa's College of Law (Gunnar Birkert)

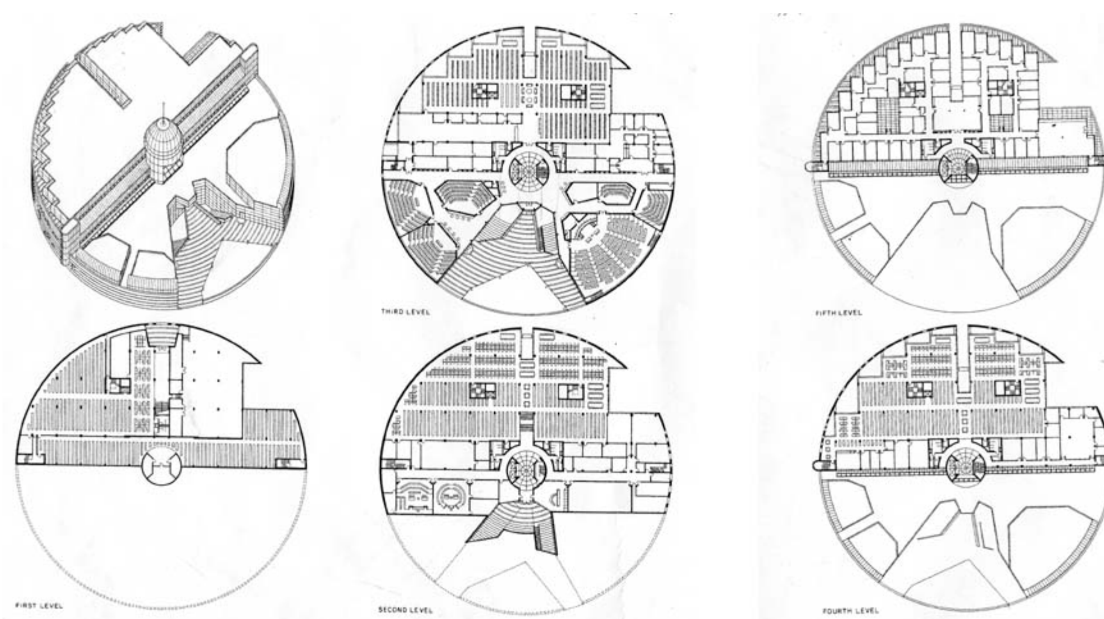

Figure 49. Floor plans, University of Iowa College of Law

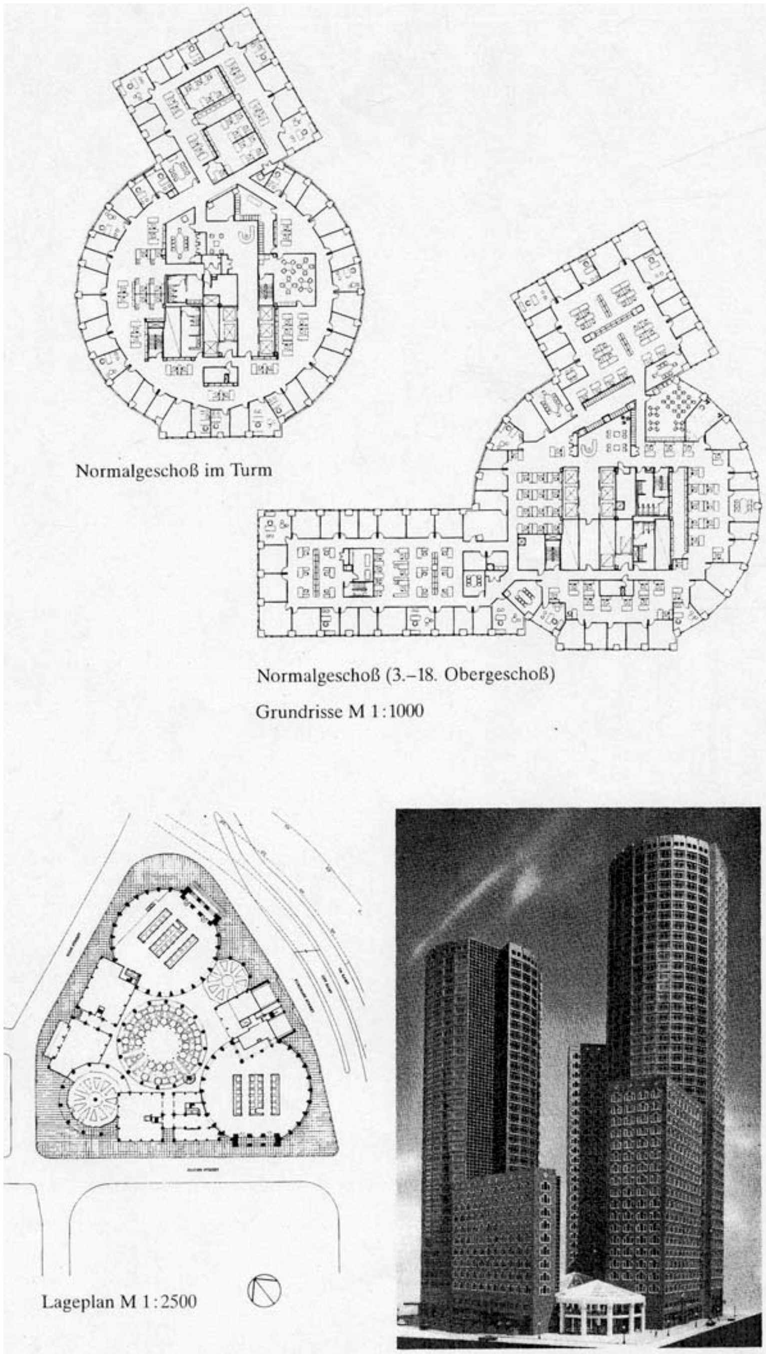

Figure 50. International Place, Boston, MA (Philip Johnson and John Burgee)

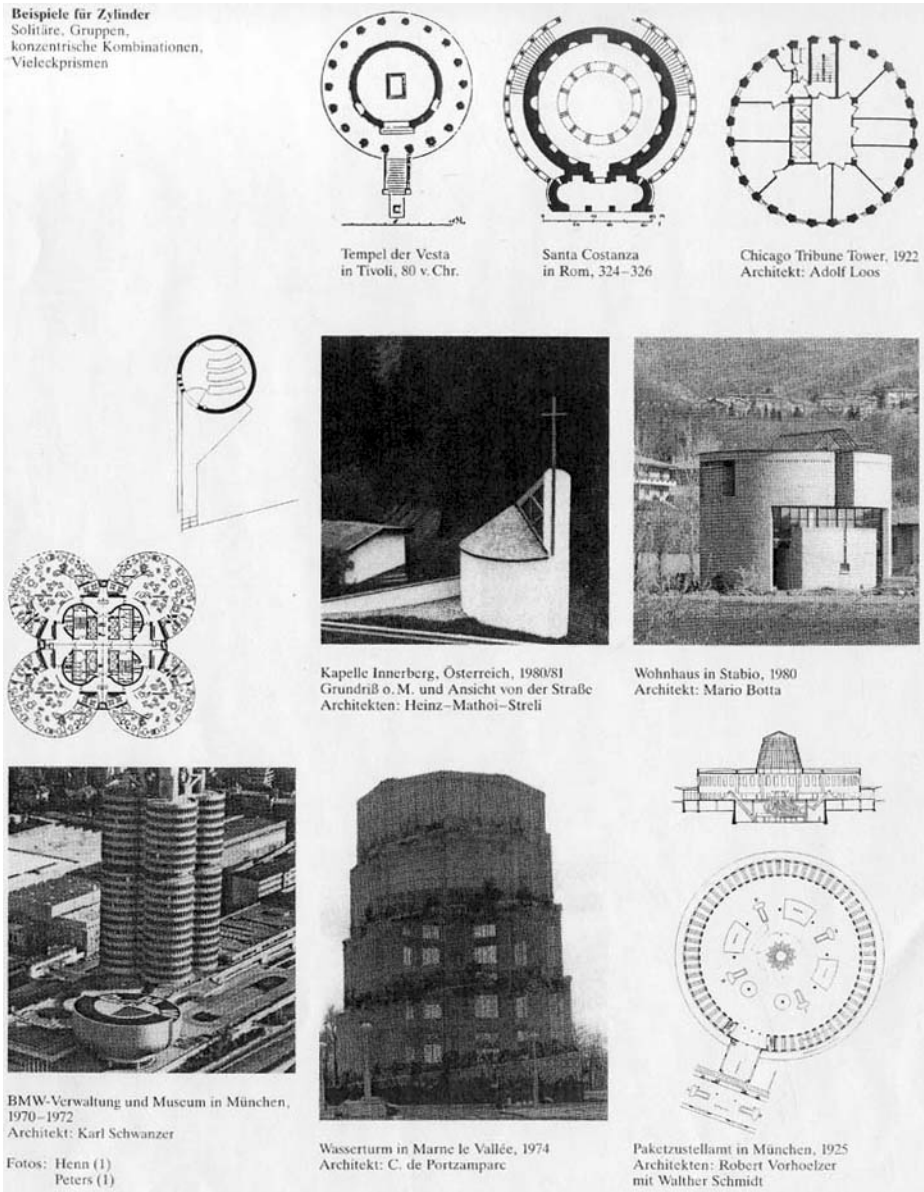

Figure 51. Circular building precedents showing a variety of uses and meanings

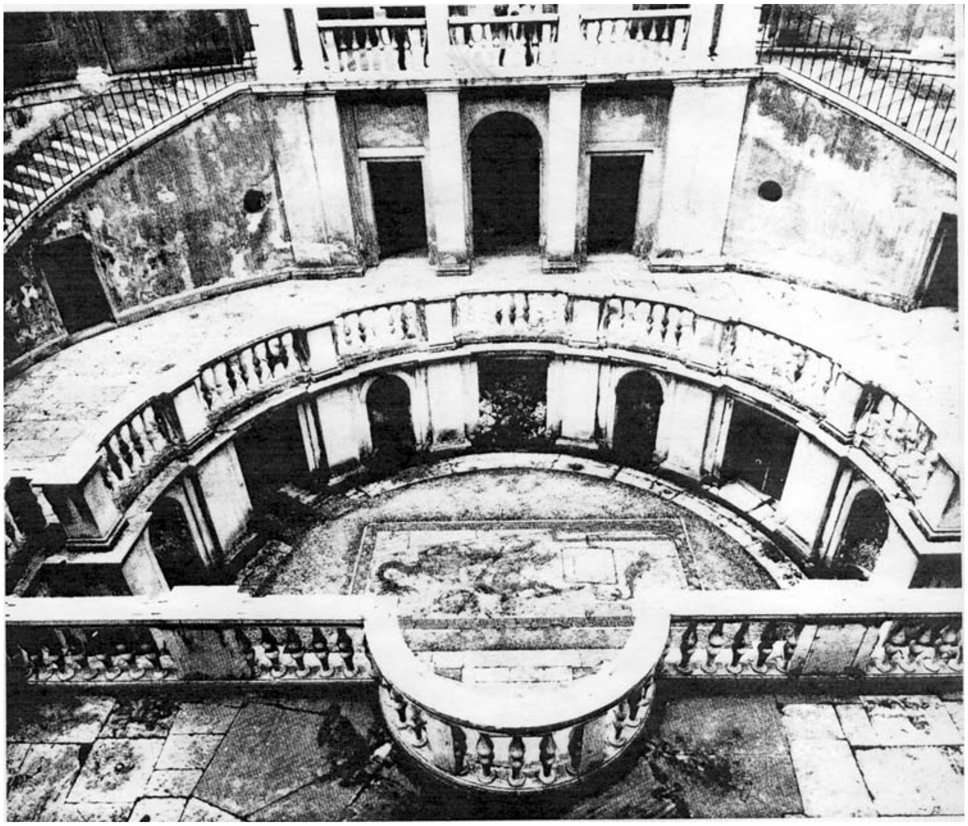

Figure 52. Sunken Courtyard Precedent

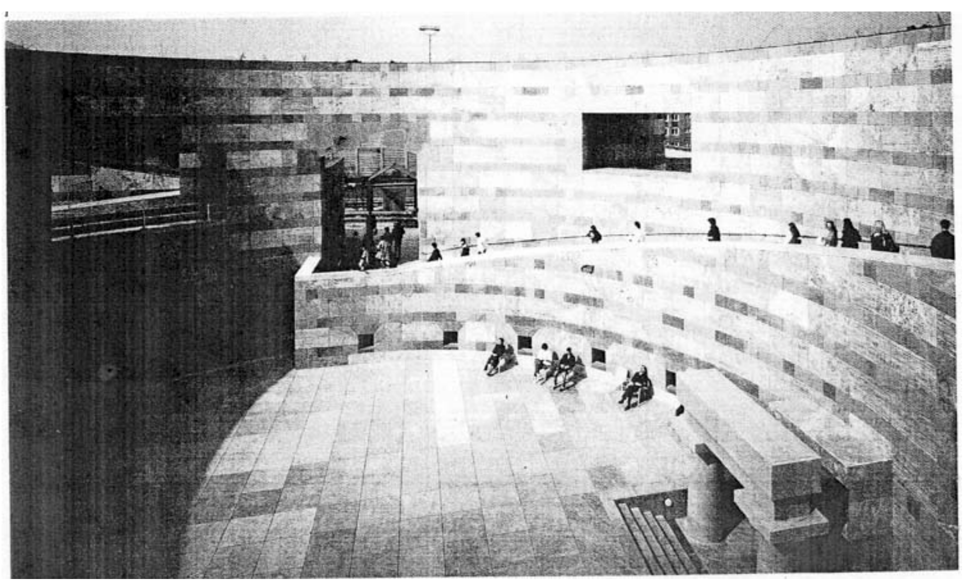

Figure 53. Stuttgart Galerie precedent for exterior circulation

Figure 54. Bryn Celli Ddu Tomb (third millennium BC)

Figure 55. Treasury of Atreus (c. 1300-1259BC)

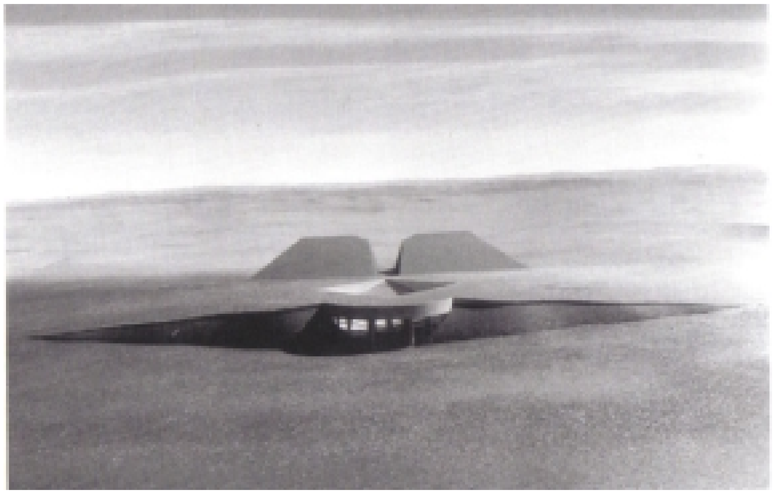

Figure 56. House for Leo Castelli, 1980 (Emilio Ambasz)

Figure 57. The ‘second’ Herbert Jacobs House, 1943-48 (Frank Lloyd Wright)

Figure 58. Geier House, 1965 (Philip Johnson)

Figure 59. Tobu Golf Club, 1993 (Masayuki Kurokawa Architect & Associates)

Roadway Structure

Figure 60. Freeway structures and overpasses supported by concrete piers

Traffic Circles in Washington, DC

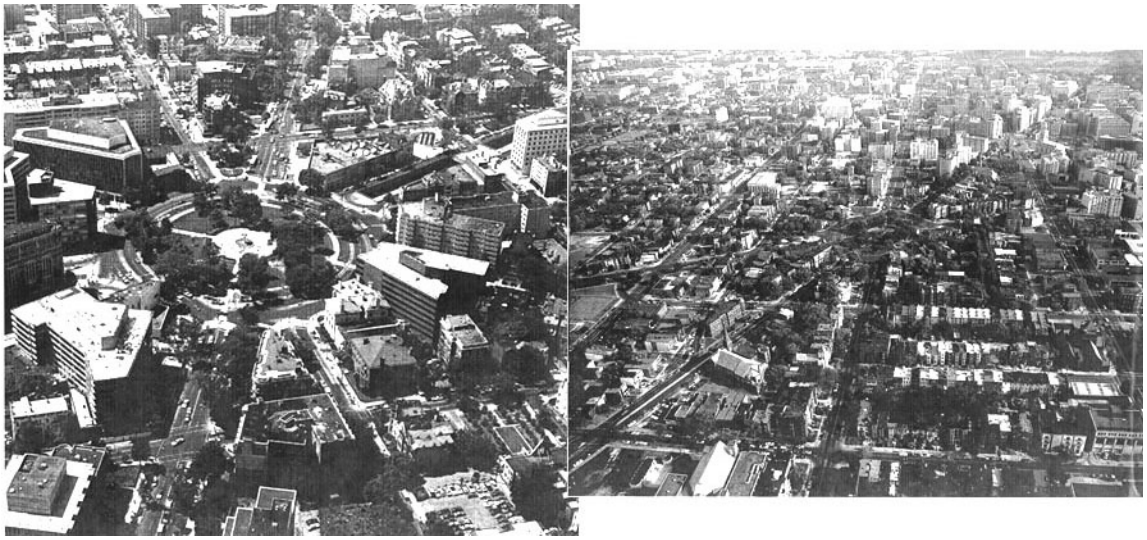

Figure 61. (l-r) Dupont Circle, Logan Circle

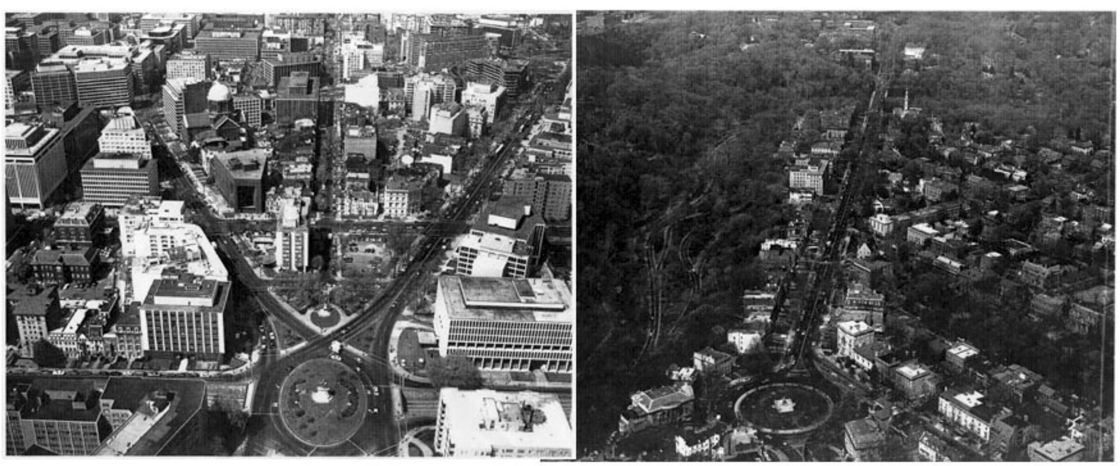

Figure 62. (l-r) Scott Circle, Sheridan Circle

Figure 63. Washington Circle

Pedestrian Bridge Precedents

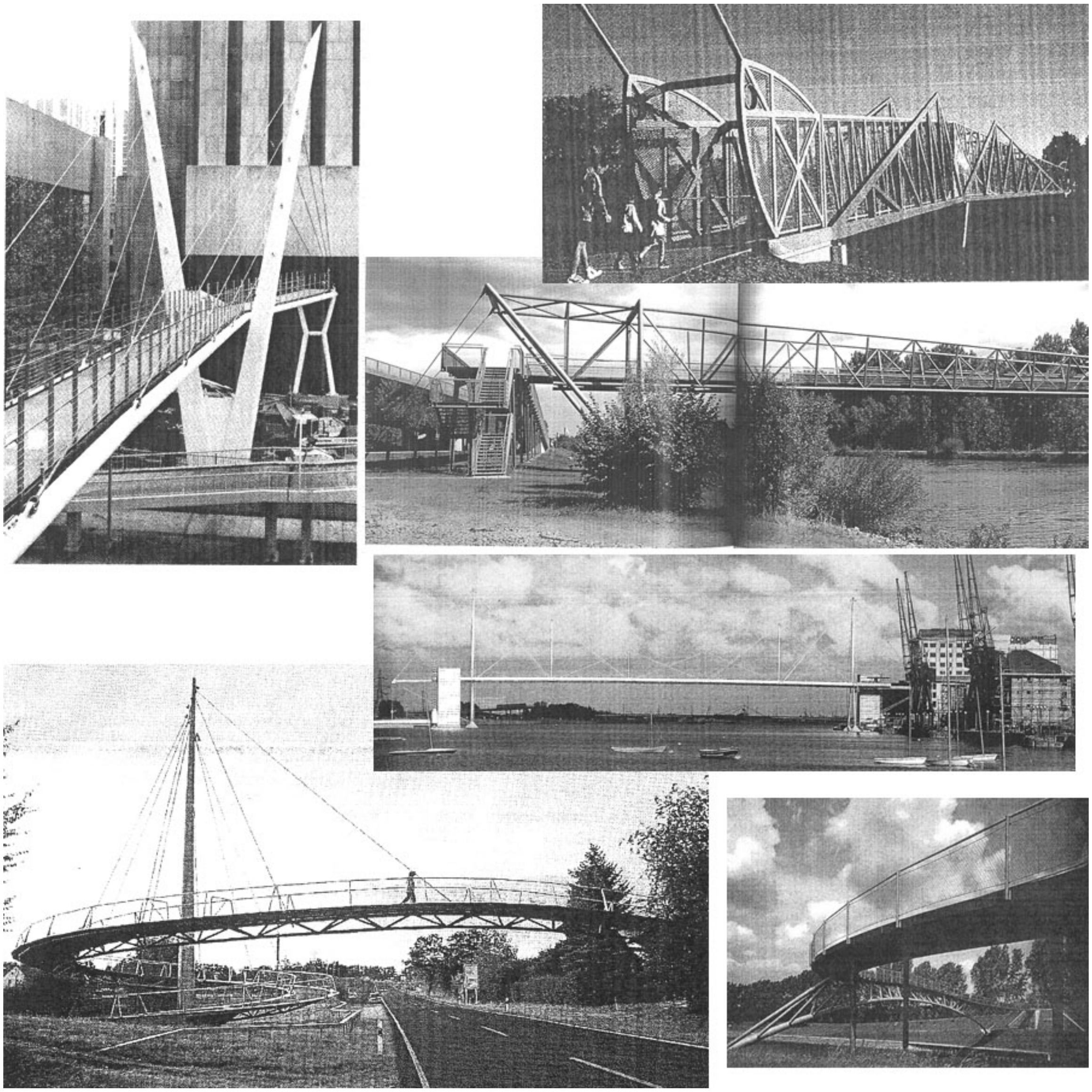

Figure 64. (clockwise, from top left) Rockefeller University Bridge, New York City; Grasshopper Pedestrian Bridge, Phoenix, Arizona; Bridge over the Rhine-Main-Danube Canal in Regensburg; Pedestrian Bridge at Royal Victoria Dock, London; two views of Pedestrian Bridge in Weiden

Chapter VI. Partis

Scheme #1

This approach utilizes a central enclosed atrium as the main organizing element, serving as a knuckle between two essentially separate wings. One, oriented orthogonally to fit within the block, and the other, to address the natural diagonal of the Anacostia River, are visually attached by balcony spaces overlooking the great hall. Exhibit spaces flow around the atrium, and are located to the north and east to take advantage of the vistas across the Anacostia River.

This scheme also utilizes the building's massing to complete the block pattern's density and continue the urban grid. Keeping the street edge, it still allows ample room for an entry plaza as a place for respite for travelers by foot reaching the monumental circle, as well as a gathering place for the center's visitors.

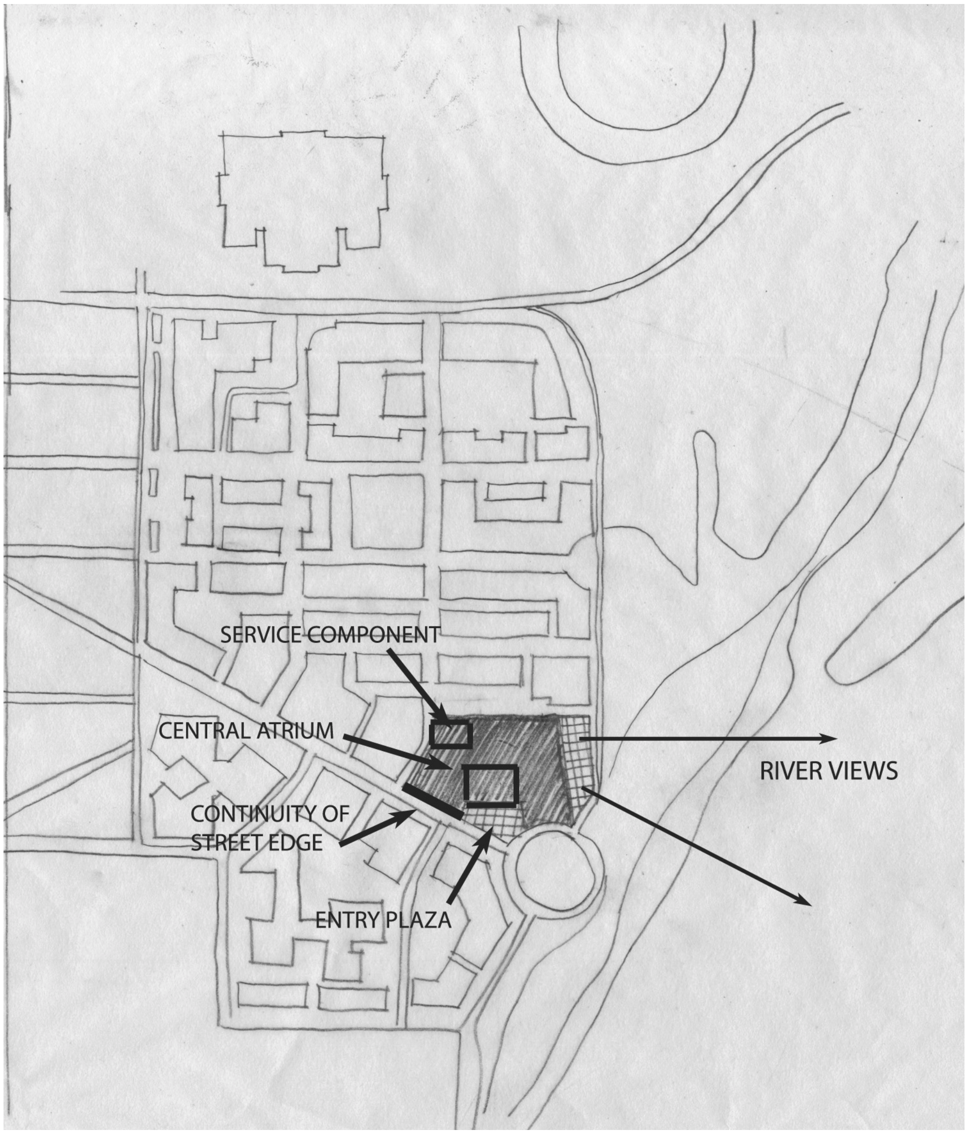

Figure 65. Site plan

This scheme holds the street edge along Mass Avenue, ending at an entry plaza fronting both the boulevard and the circle, therefore drawing its visitors east to the avenue's terminus and its views of the Anacostia before turning away from the street.

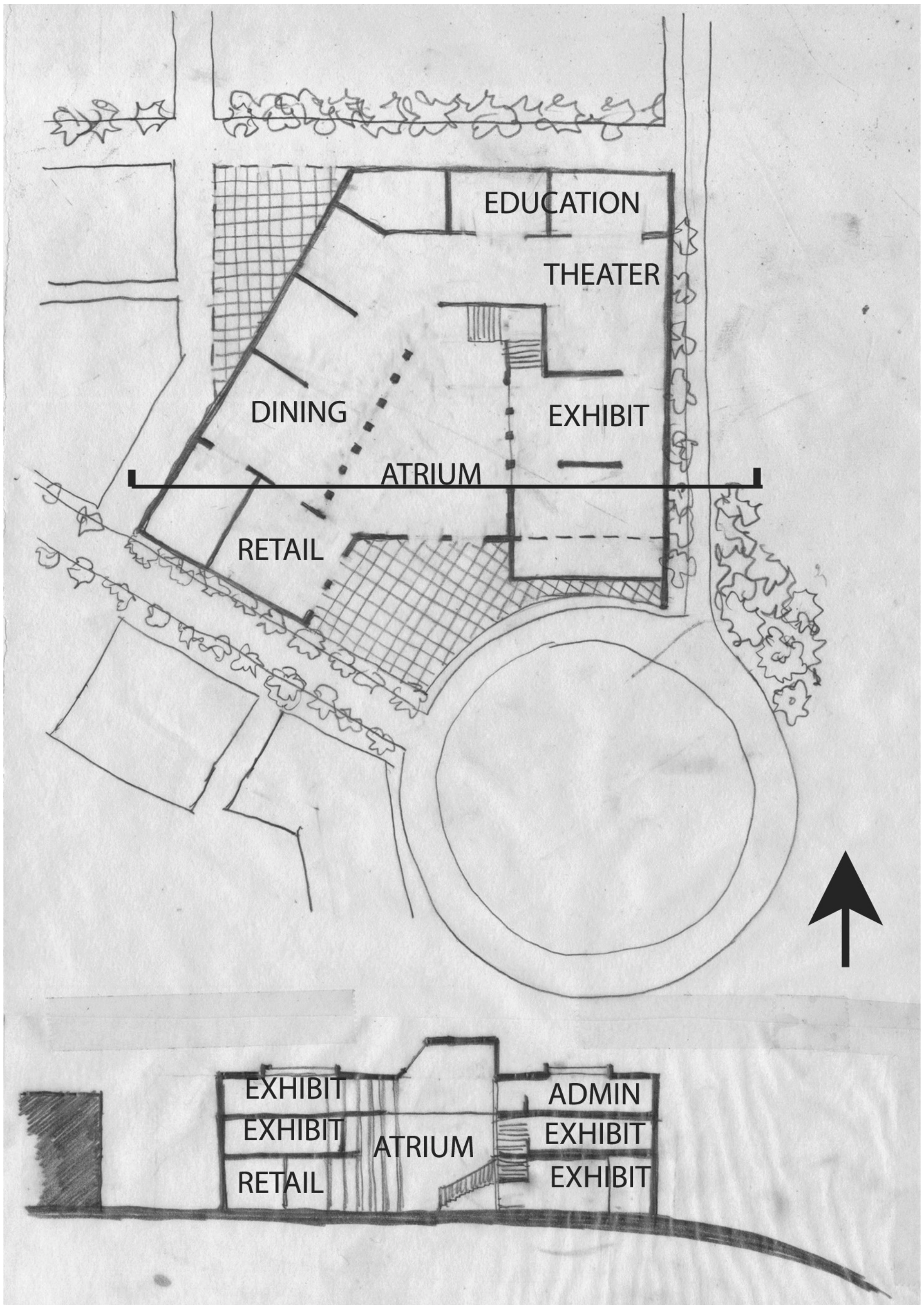

Figure 66. Ground floor plan and transverse section

Scheme #2

This second strategy uses exhibits in cellular spaces to embrace a central core, holding within it the object theater. Circulation occurs around this sphere, which is only accessible from the upper floor. This may reflect an interpretation of life that rationalizes space around chaos, yet all still revolving around a central core. The main entry court fronts the circle, using it as a focal pivot point and adding more energy to the termination of Massachusetts Avenue.

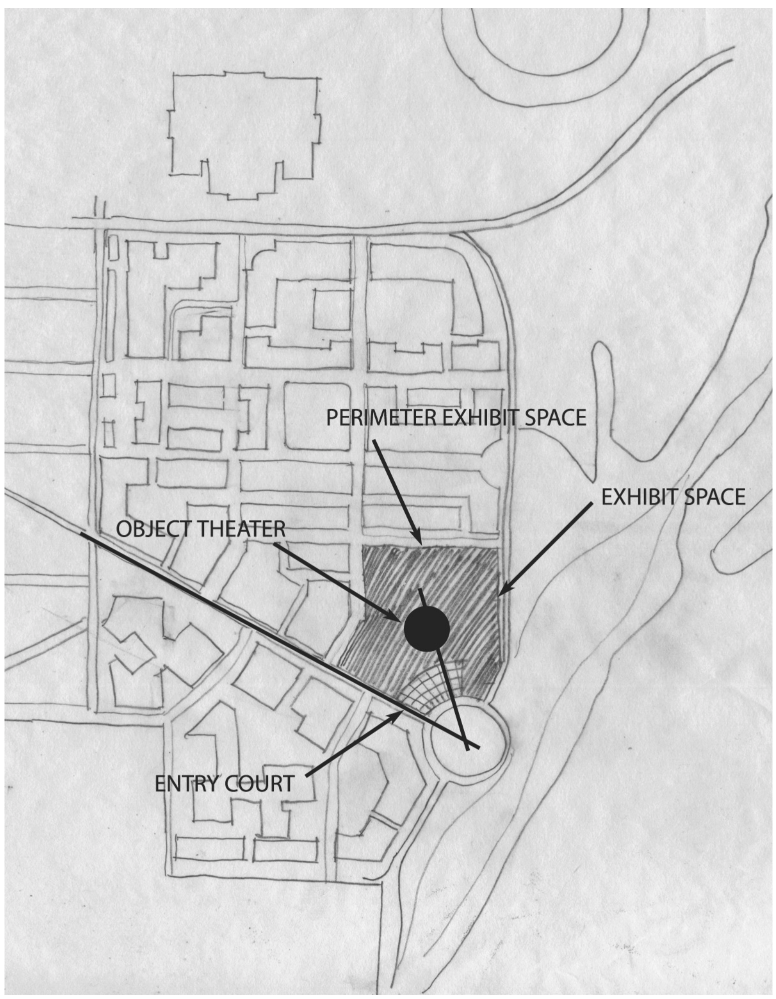

Figure 67. Site plan

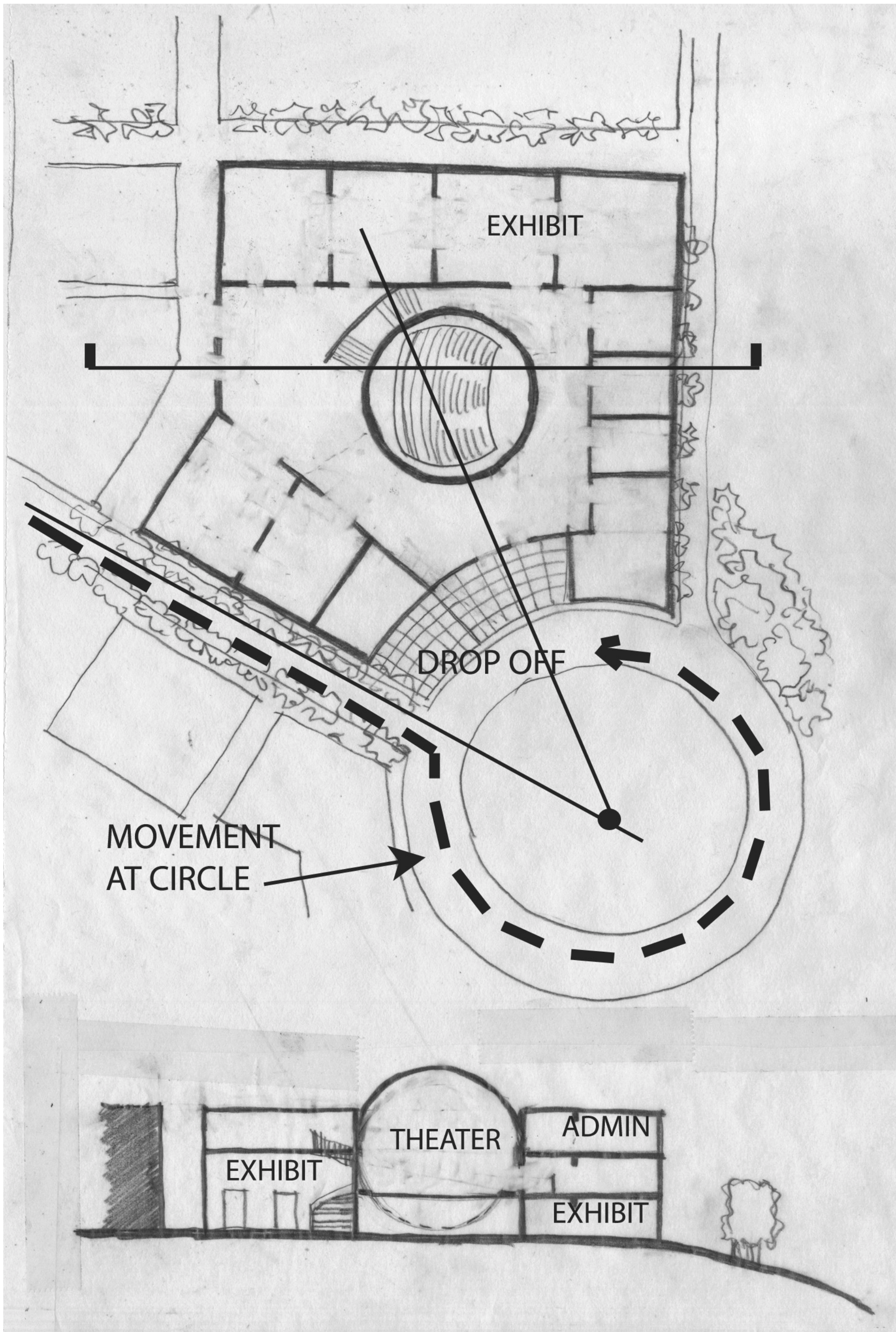

Figure 68. Ground floor plan and transverse section

Scheme #3

The last approach is a perimeter building, highlighting an interior courtyard around which the circulation path is circuitous. The path of travel is directly and immediately into the exhibition space, allowing a diversity of opportunities to emphasize the promenade. The primary exhibit elements are located in the northeast corner, which is immediately announced to the visitor on entry, from a transparency through the courtyard.

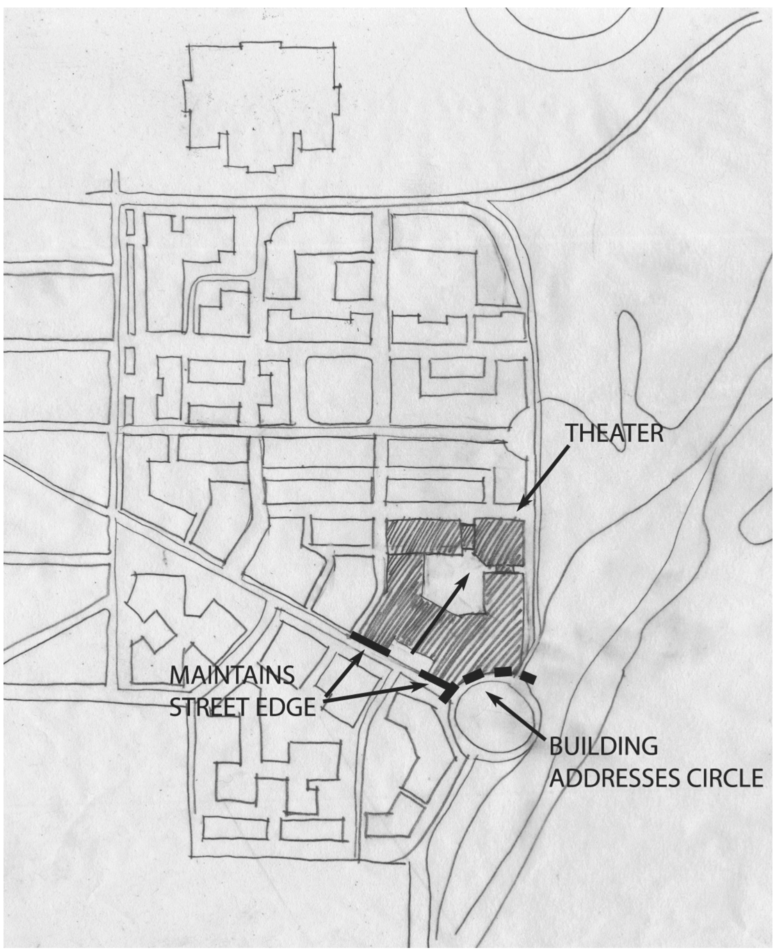

Figure 69. Site plan

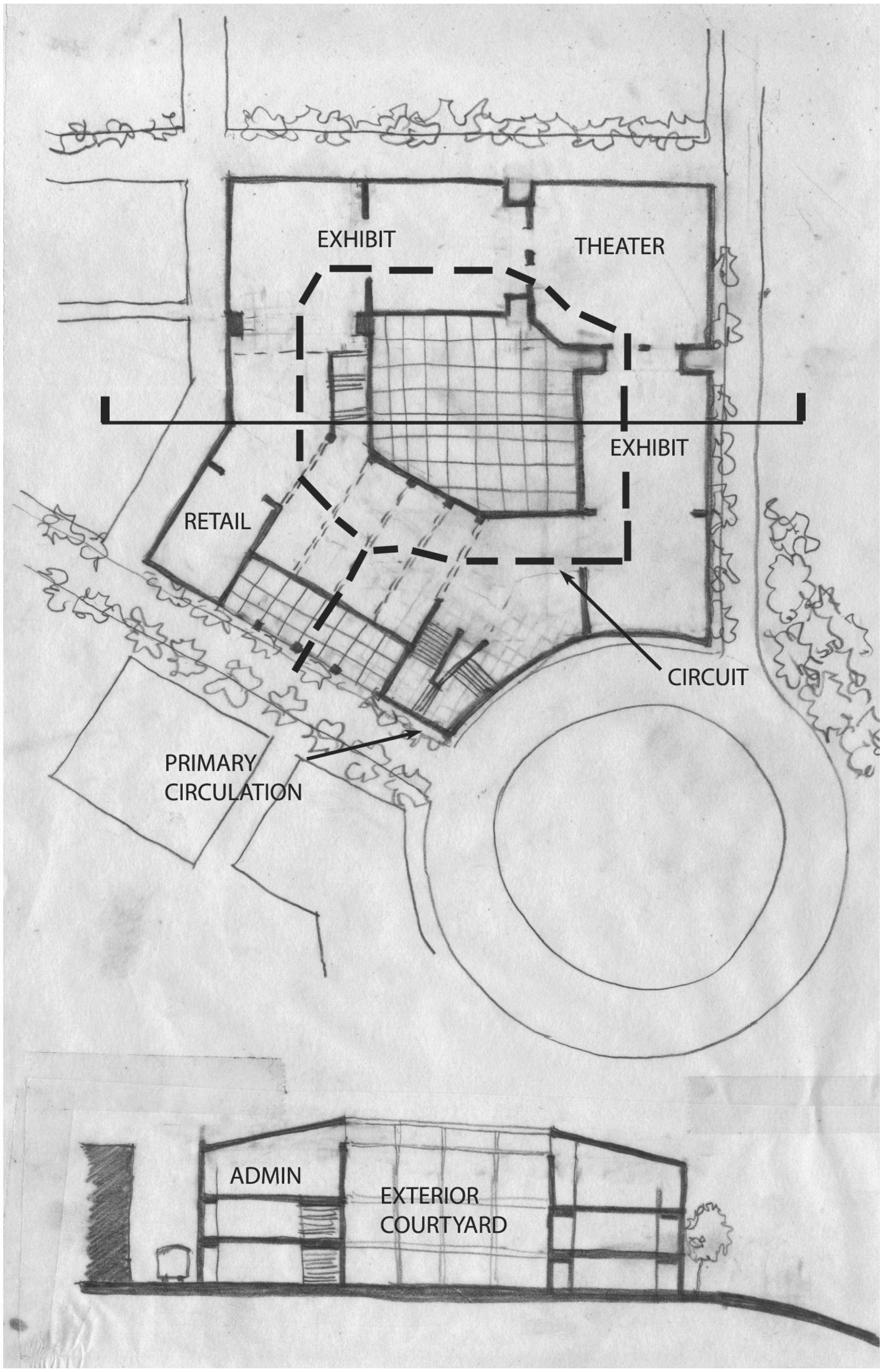

Figure 70. Ground floor plan and Transverse section

Chapter VII. Design Conclusion

Based on the final design and presentation of my proposal, I have come to several conclusions about the success of my exploration. These conclusions, informed by constructive critiques at both the urban and architectural scales, raise exciting possibilities for further study and development.

My intention throughout this thesis, urbanistically, was to bridge the geographical and societal gap between the neighborhoods east and west of the Anacostia River by providing access to a shared revitalized waterfront, and to accomplish this by engaging with the landscape a building that heightens this experience, transforming the riverfront into a destination point, and serving as a gateway to and from this active area and surrounding neighborhoods. At the architectural scale, my intention was for a building design that serves as a backdrop to the experience of the man-made versus the landscape, rather than the built form itself becoming a figural object.

Given this set of criteria, I believe that through my explorations, I have proposed a successful design solution. Yet the design process exists as a continuum, and there is infinite room for more in-depth investigation, as the following analysis suggests:

My intention of providing access from the street-level city fabric to the natural parkland of the riverfront requires that the plaza serve as a node, to facilitate this transition from the built environment to the natural condition. Perhaps re-examining the placement of the entrance to the building and using the courtyard as an entry plaza, rather than the riverfront, will better heighten the visitor's experience of this transition. Rather than bring the visitor to the park's edge and then back into the building, the approach sequence would lead the visitor to the circle, into the courtyard, from there enter the building, and then experience the landscape as they leave the building.

As a radical urban intervention, the idea of extending Massachusetts Avenue east across the Anacostia River and relocating the traffic circle on the east bank alongside the Anacostia neighborhood is a possibility.

By allowing a traffic circle to dictate the circular form of the building, I have instilled in the building the symbolism inherent in the pure shape of the circle. Its association with temples, combined with its proposed location at the terminus of a grand boulevard in Washington DC, begs an architectural expression fitting of its context among the long-established building aesthetics in the nation's capital. As well, traditionally the traffic circles of Washington DC

The building itself evolved into an expression of the existing infrastructure of the road above, using concrete columns both for spatial organization and to support separate structural systems: one for the road and the other for the building structure. Use of expansion joints and isolation joints insured the minimal transfer of noise and vibration from live loads occurring at street level. Having these structural issues resolved, the architectural aesthetic, combined with a strong connection between the building form and the immediate landscape it frames, is a potential avenue for further research which will enhance the building's integration with its landscape.

The images on the following pages are documented final presentation drawings used in the thesis defense.

Figure 71. Proposed Site Plan

Figure 72. Site Section

Figure 73. Building Section

Figure 74. Plaza Level Plan

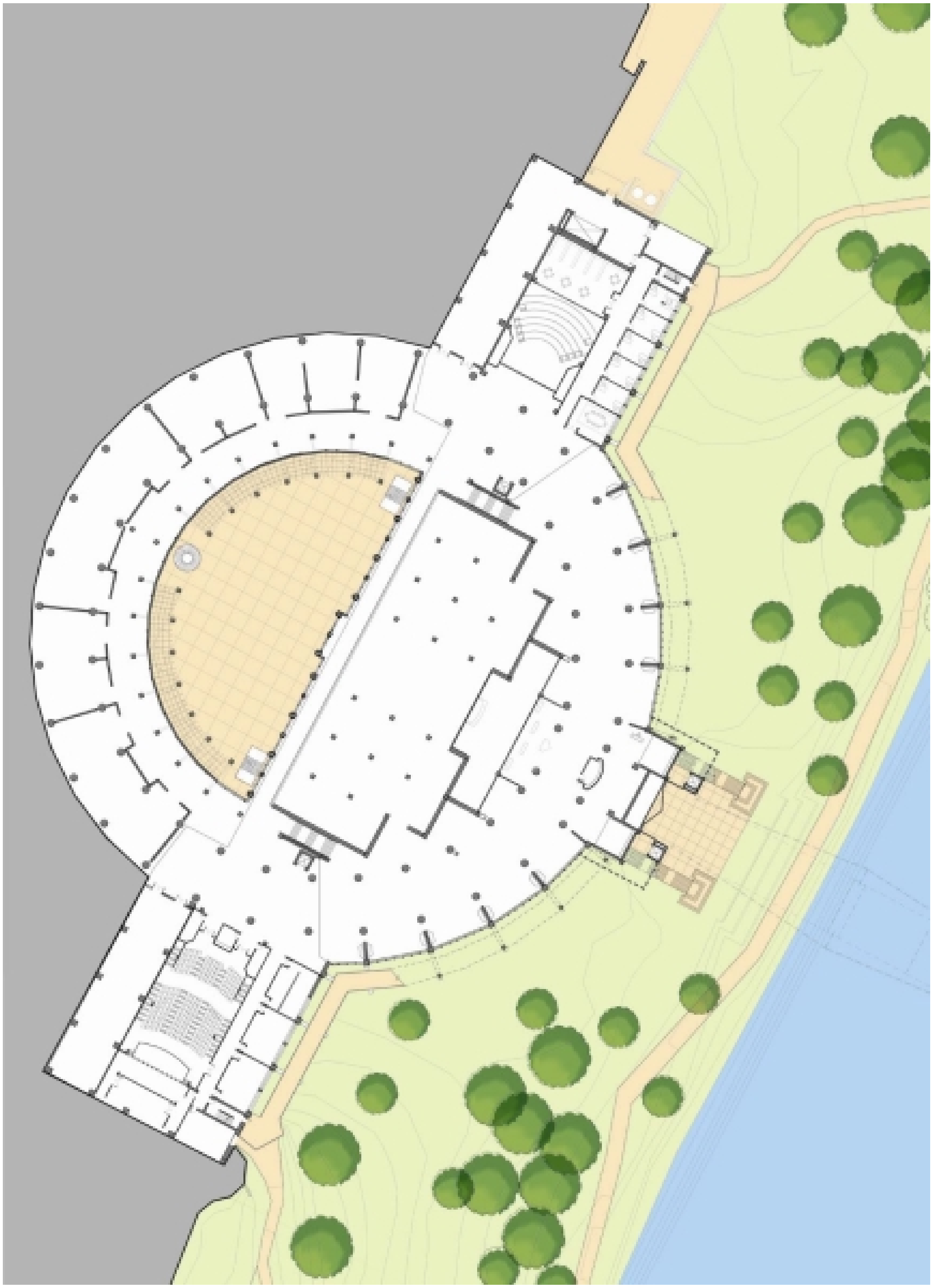

Figure 75. -14’ (Mezzanine Level) Building Floor Plan

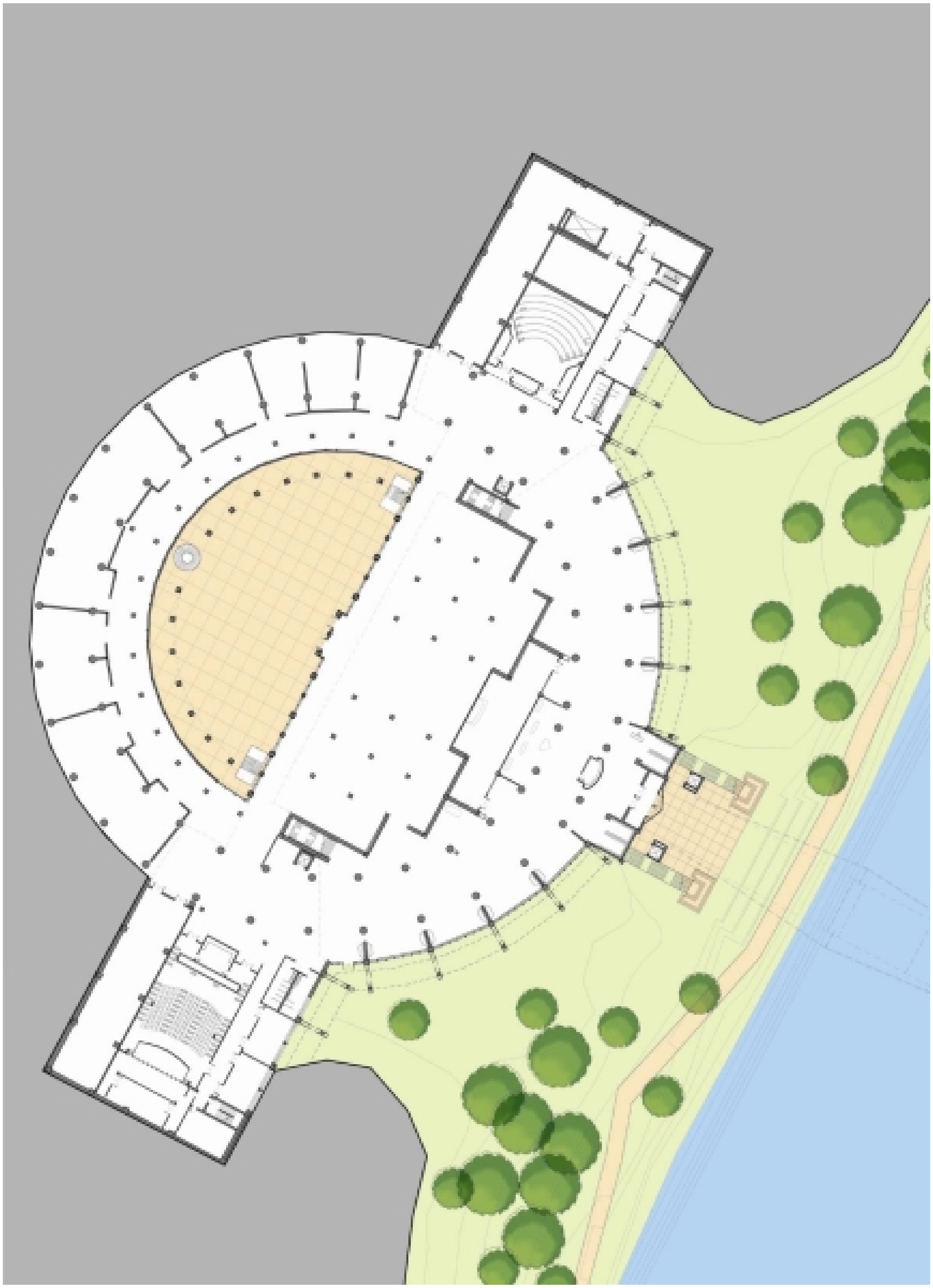

Figure 76. -28’ (Entry Level) Building Floor Plan

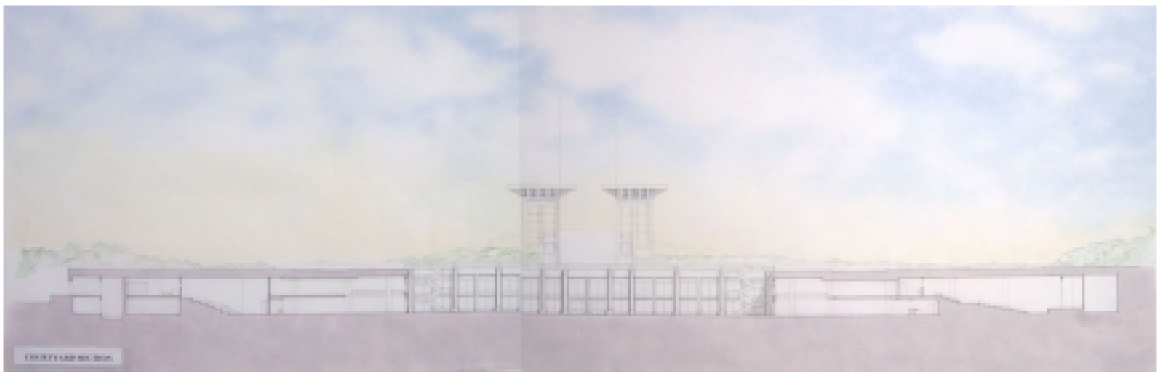

Figure 77. Courtyard Section

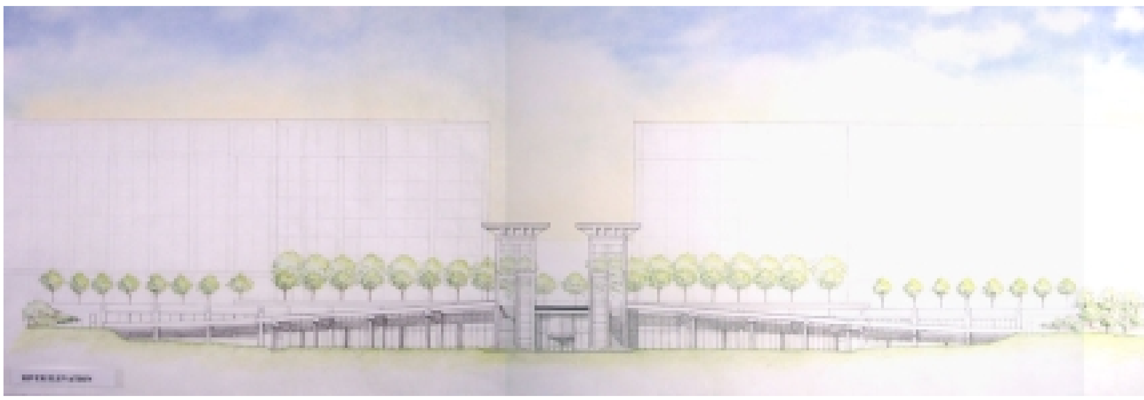

Figure 78. Waterfront Elevation

Figure 79. View of the pavilions towards the Anacostia River along Massachusetts Avenue, as if arriving on foot by Metro

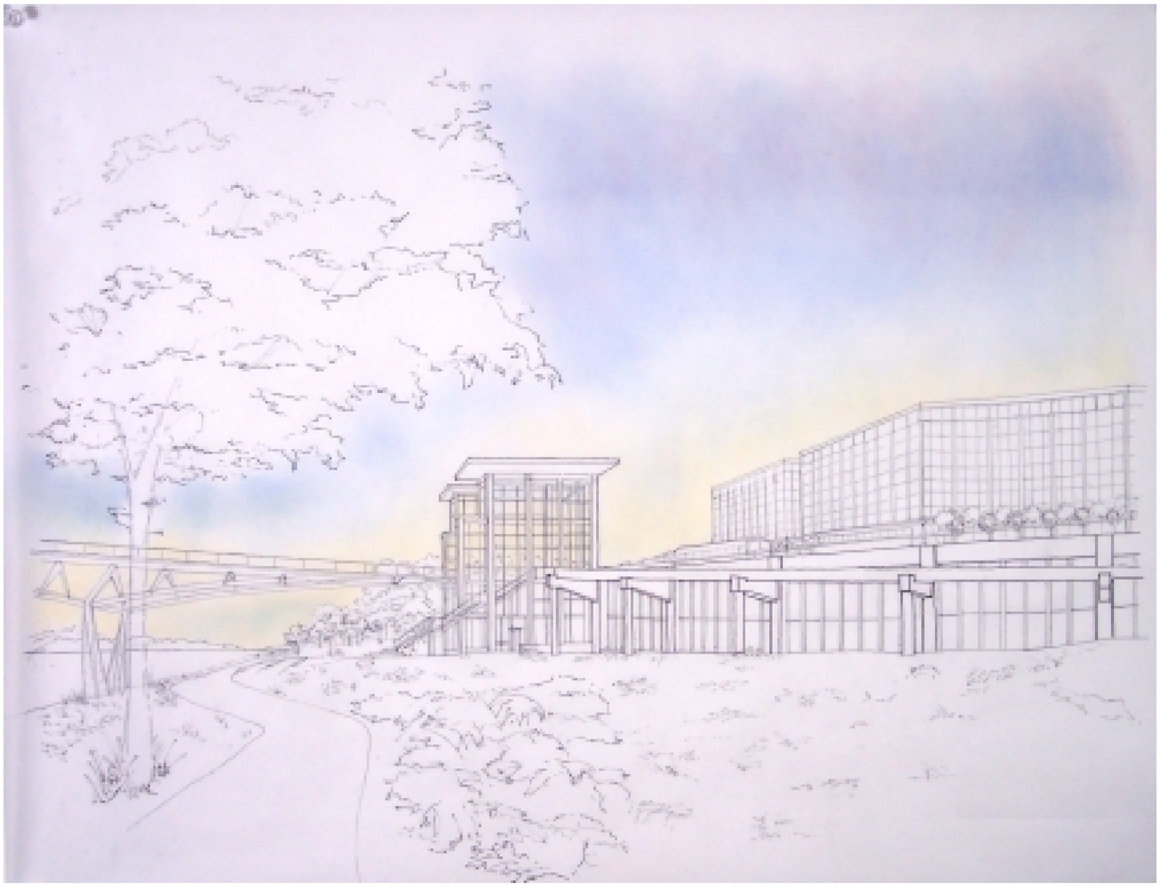

Figure 80. View of the entry seen in context with the pedestrian bridge, river, and landscape (as might be experienced by a jogger)

Figure 81. View of the science center and pedestrian bridge from the east side of the Anacostia River, as might be seen by residents of the Anacostia neighborhoods

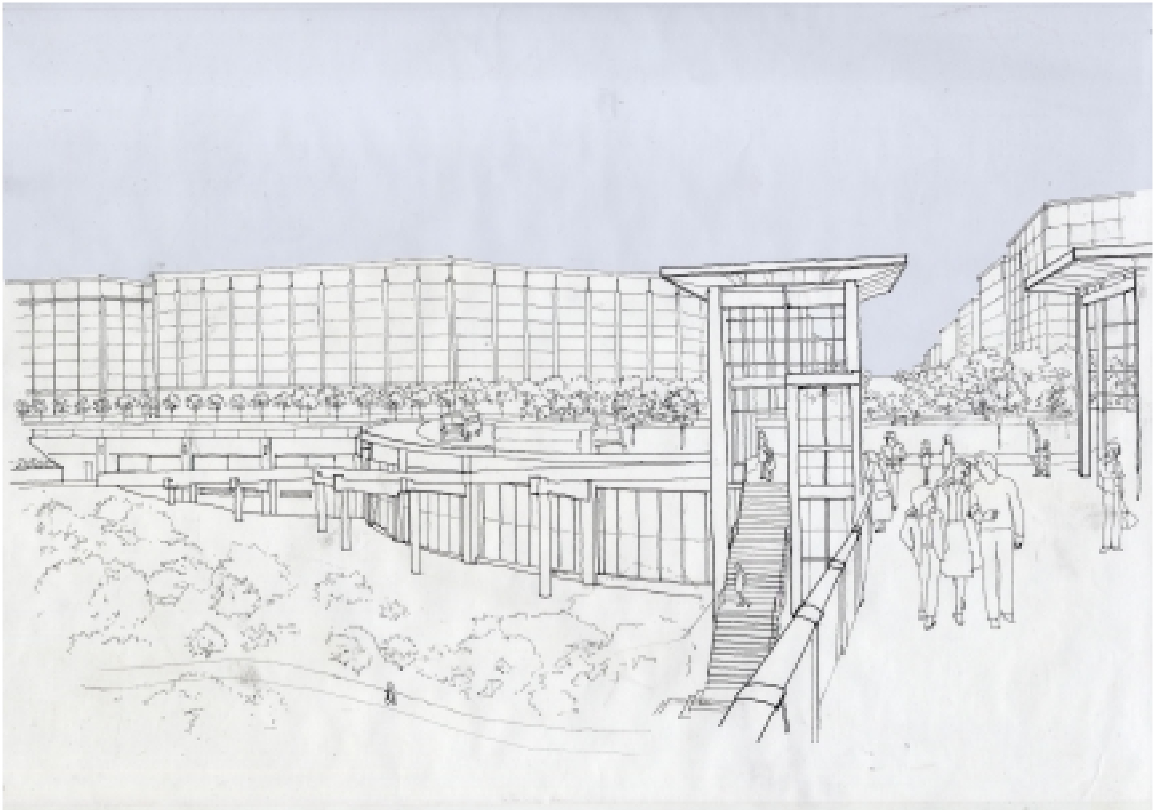

Figure 82. View of the approach to the pavilions as a pedestrian on the bridge

Figure 83. View of the entry into the science center

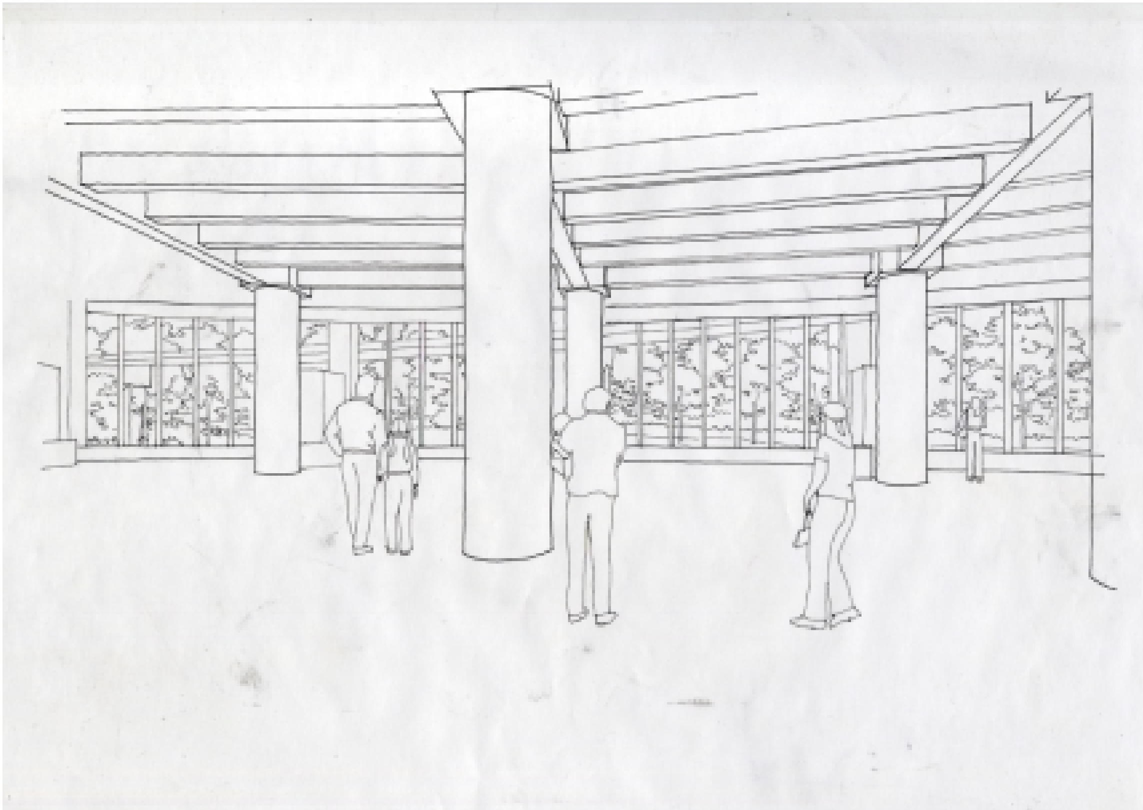

Figure 84. Panoramic view of the landscape

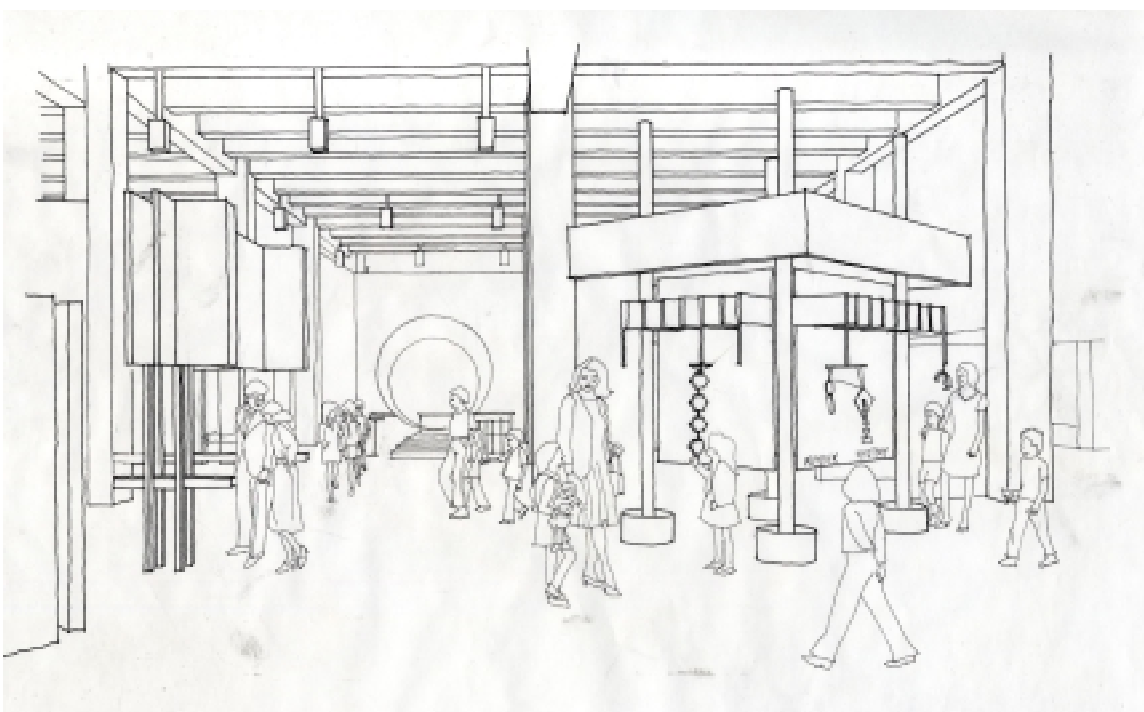

Figure 85. Exhibition Space

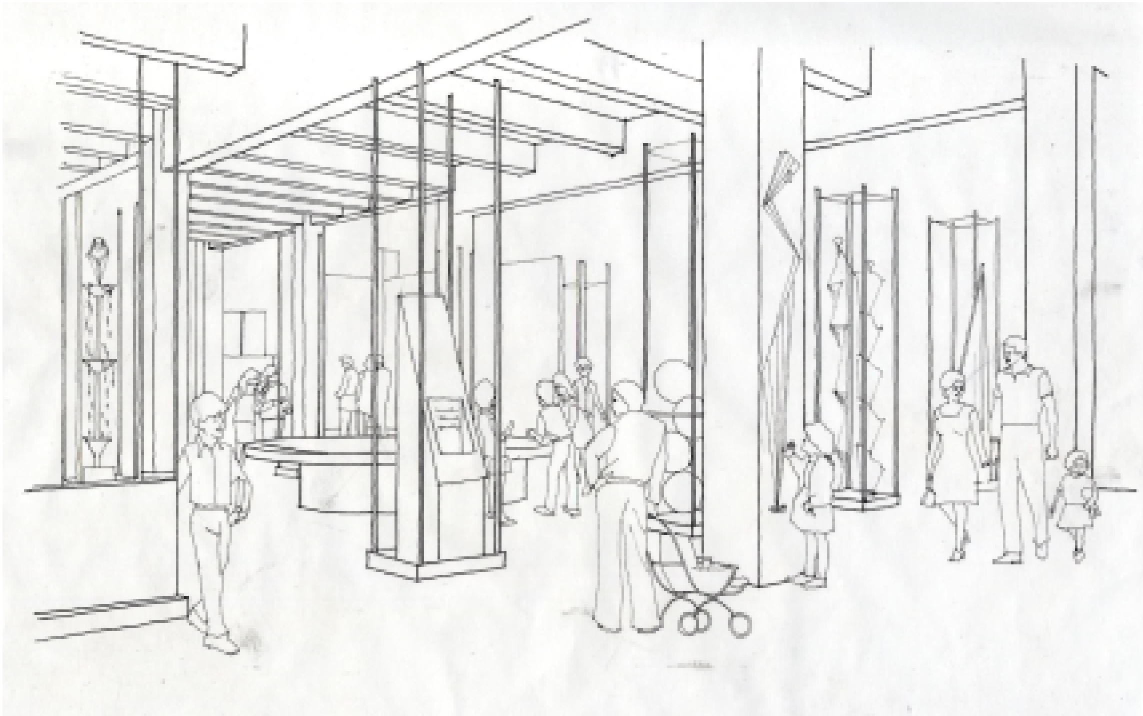

Figure 86. Exhibition Space

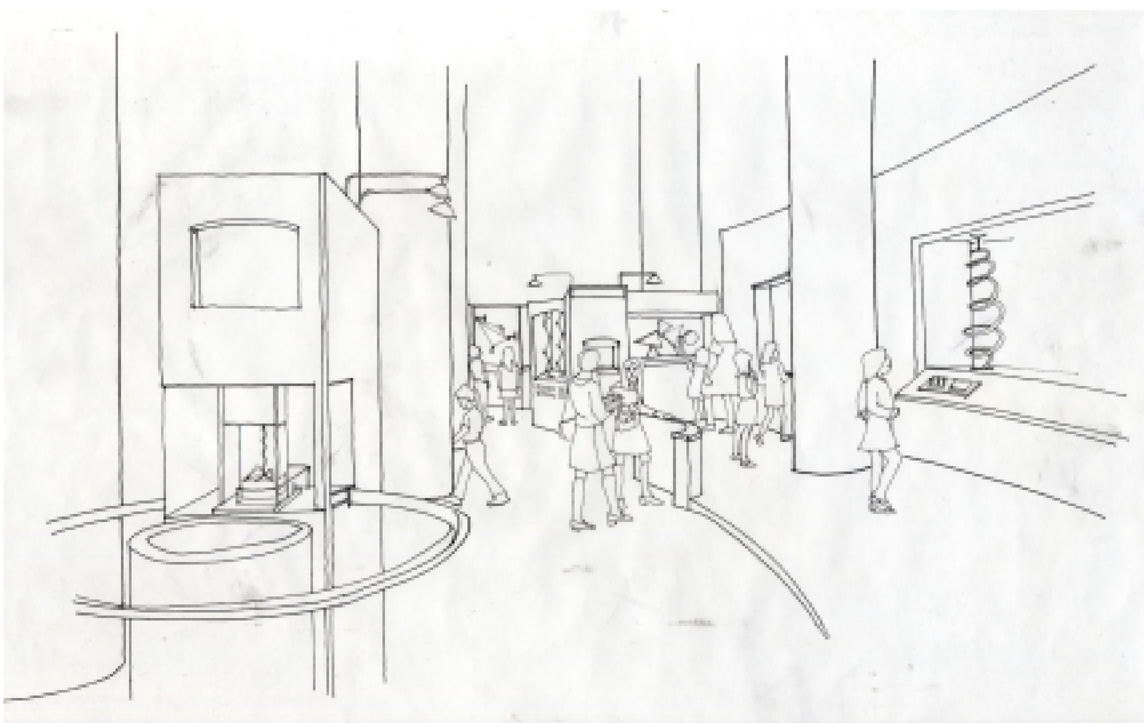

Figure 87. Exhibition Space

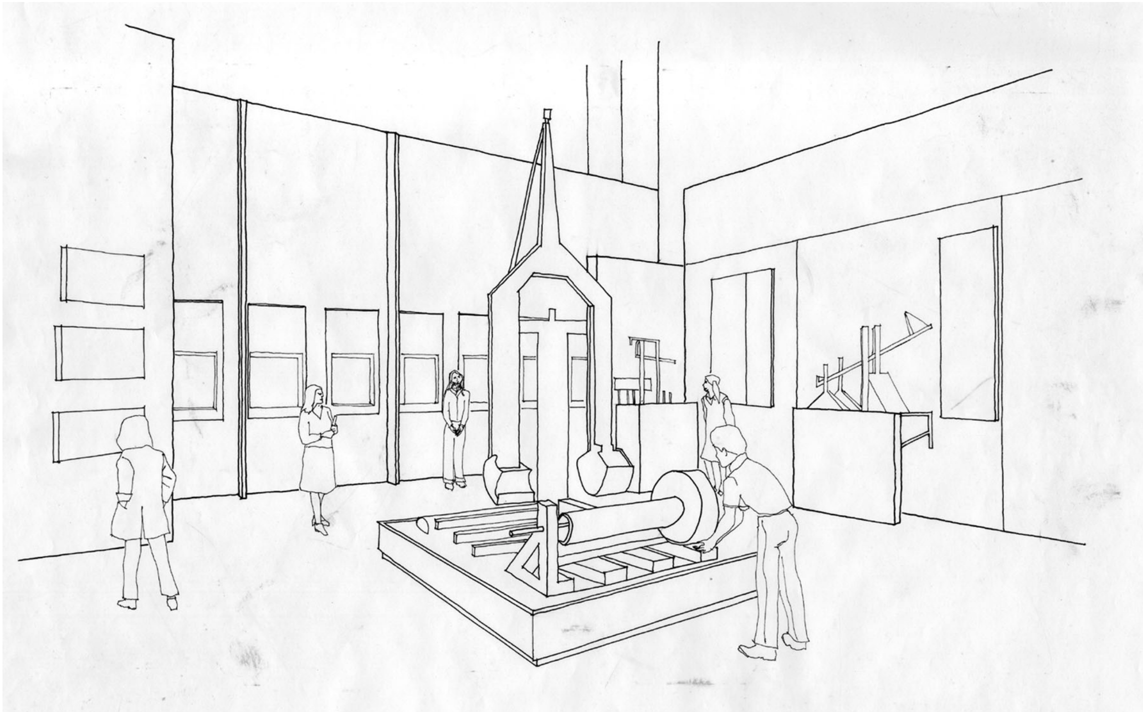

Figure 88. Exhibition Space

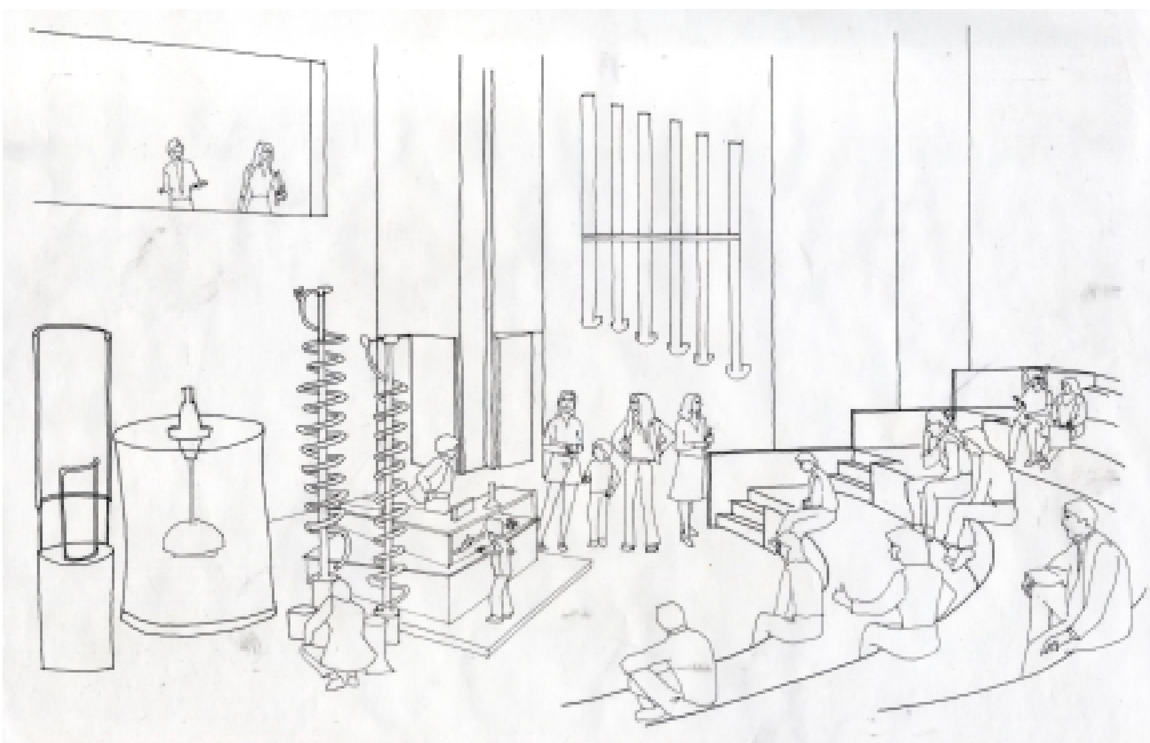

Figure 89. Demonstration Area

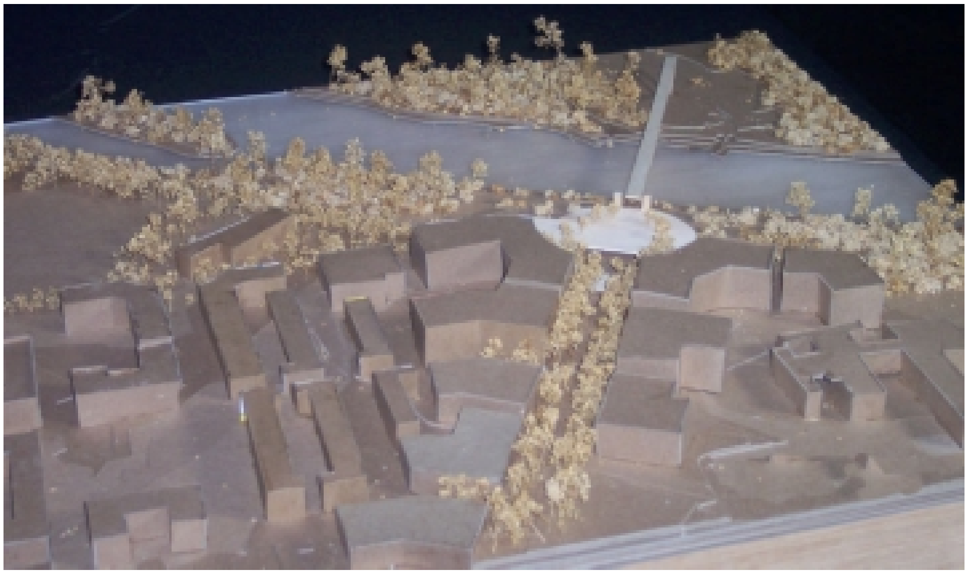

Figure 90. Model of site area, viewed from the northwest, highlighting Massachusetts Avenue and its extension via pedestrian bridge across the Anacostia River

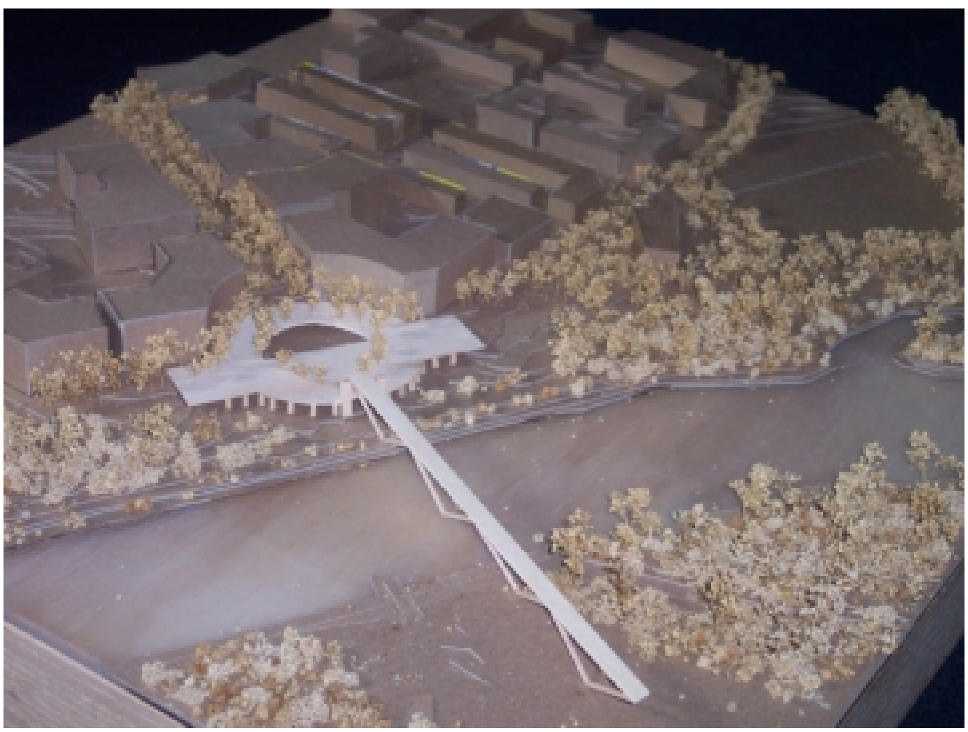

Figure 91. Model of site area, viewed from the southeast, showing the building’s role as transition element between the built environment and the natural landscape

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