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Environmental Science Center, Greenville, S.C.

James Carl Hambright III
Clemson University

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environmental science center greenville ——— S. C.

December 1979


James Carl Hambright, III

A Terminal Project submitted to the Faculty of the College of Architecture in partial fulfillment of the requirements for the degree of Master of Architecture.


Approved:




Donald L. Collins, Committee Member



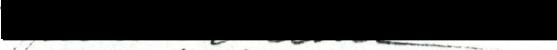
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acknowledgements

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dedication



BRITISH MUSEUM
LONDON

To my parents.

In memory of my grandfather,
James Carl Hambright

problem statement

An essential part of any school system is the capability to provide a good education with a broad base. Because of contemporary concerns for an increased awareness of the environment, the Board of Trustees of the Greenville County School District implemented a study to develop a program of environmental education. This program is viewed as a supplement to the science curriculum already in existence within the school system. It is designed to give instruction in various aspects of the environment to students from kindergarten through high school.

One result of this ongoing study, which has been in process for seven years, is the concept of an environmental science center. The center, of which there are few prototypes, is intended as an additional resource for Greenville and surrounding school districts, and as an information display for public use.

Objectives:

- to provide a continuing education resource center for environmental studies that will strengthen the concept of community education.
- to provide a training center that allows teachers to viably supplement the science program in their respective schools.
- to provide "on-site" opportunity to observe and experience nature, and the practical aspects of its resources.

background

In 1970 three sites were selected by the South Carolina Parks, Recreation, and Tourism Commission (SCPRT) to display exhibits commemorating the 300th anniversary of the State of South Carolina. One of these sites was a 62-acre tract of land located on Roper Mountain near the city of Greenville. At the exhibition's end, this tract of land was deeded to the Greenville School District to be used for a source of continuing education. A large paved parking lot, a road system, a covered tram waiting station, an unfinished 35,000 square foot exhibition building with an adjoining entrance tunnel, and support sewer treatment facilities came with the land transfer.

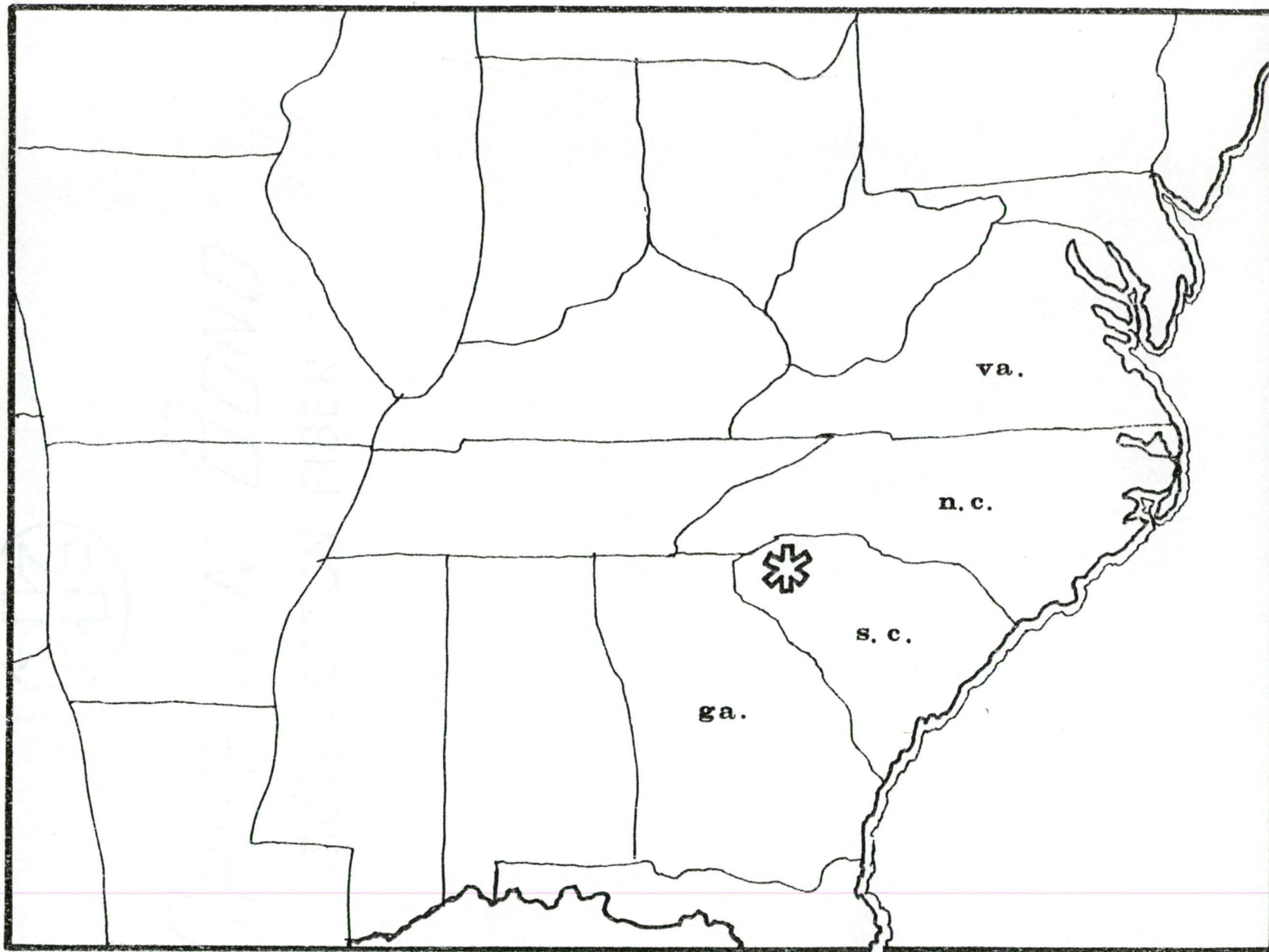
The Greenville County School District's decision to utilize the site for a study of the environment was accompanied with a desire to evaluate these existing improvements to the site to determine if they would be of use in the development of an environmental science center.

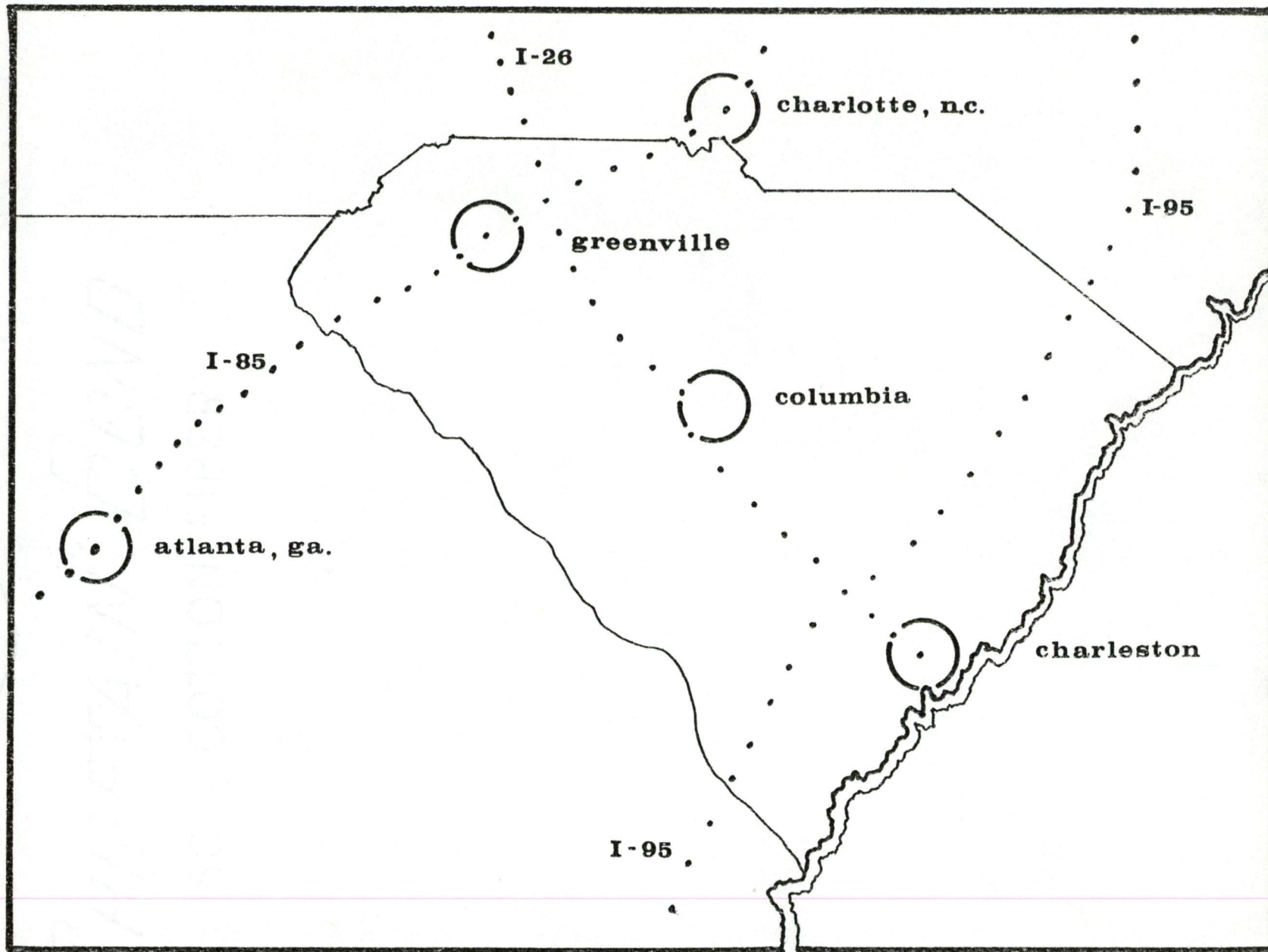
Unfortunately, the original plans for covering the exhibition building with a space frame structure were never completed due to structural failure, and as a consequence the exposed structure has deteriorated beyond the point of reasonable economic repair. Sun, wind, and water damage as well as damage incurred by vandals has caused plans for an adaptation or reuse of the structure to be abandoned. The

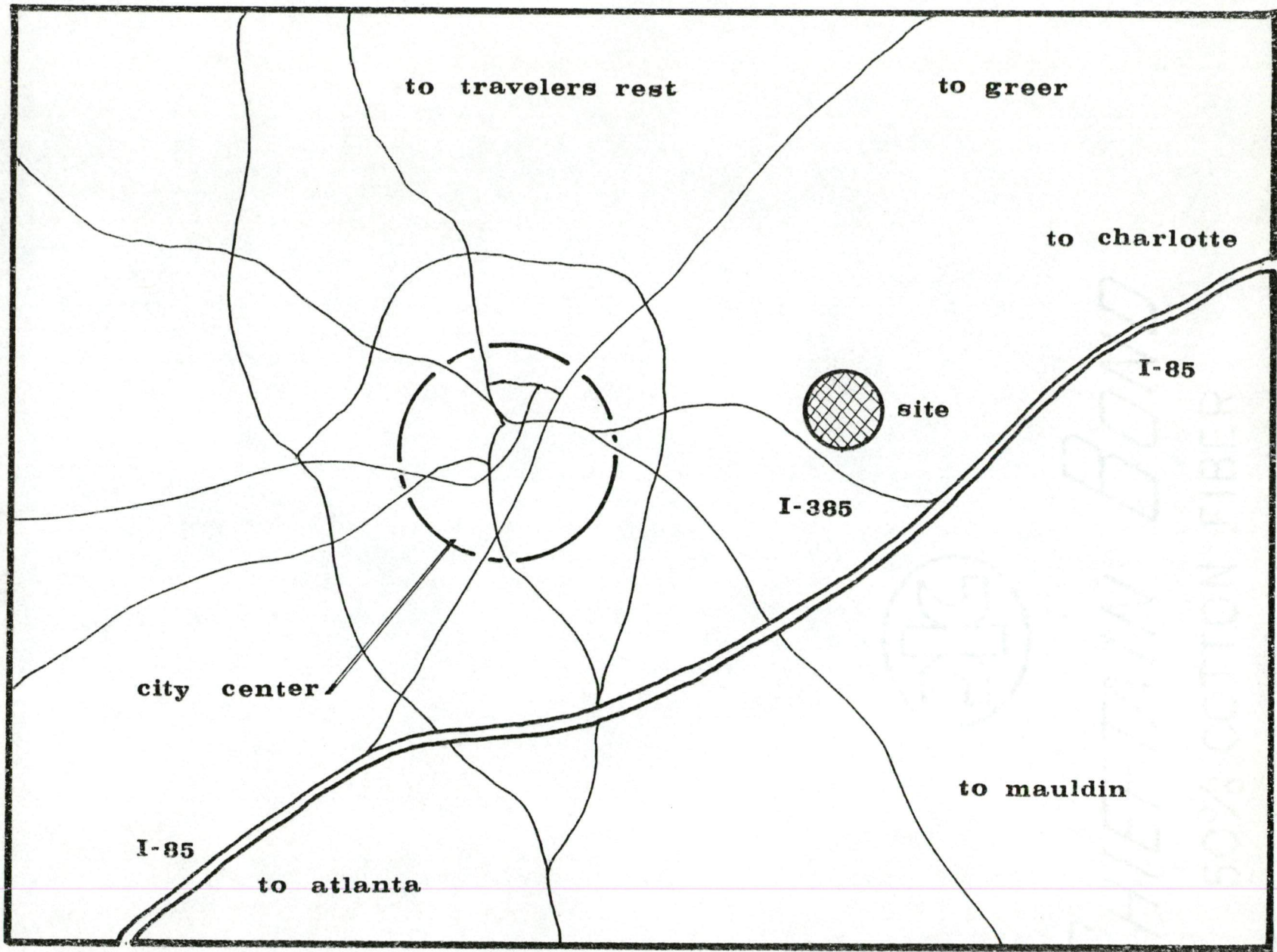
parking lot and portions of the paved road system are in reasonable repair and will be incorporated into the planning and design of the new facility to minimize further impact on the site's natural state.

The site is currently being used as an undeveloped classroom by the students of the Greenville School District. Special lectures and selected field trips to the Roper Mountain site are being scheduled throughout the district in an attempt to fill the deficiencies in the existing environmental studies program. This "on-site" instruction is supplemented prior to each visit by the use of existing school equipment and supplies.

The center's value lies in its capacity to provide a place for people to learn about and experience the environment. The maintenance of the existing condition of the mountain is important for a viable program in environmental studies. It is also important that the form of the mountain be retained and continue to be a focus of the community.







greenville , s.c.

case studies

CASE STUDY ONE

Florida State Museum
Gainesville, Florida
Architect: William Morgan
Date: 1974

Program: to house exhibits depicting the history and archaeology of Florida consisting of:

- exhibition/gallery spaces
- auditorium
- lounge and meeting areas
- administration
- studio spaces
- shipping, receiving and storage

Concept: to integrate the building and its functions into the University of Florida campus for public and private use.

to incorporate exterior terraces as major modes of pedestrian circulation and gathering.

Building
Design/Response:

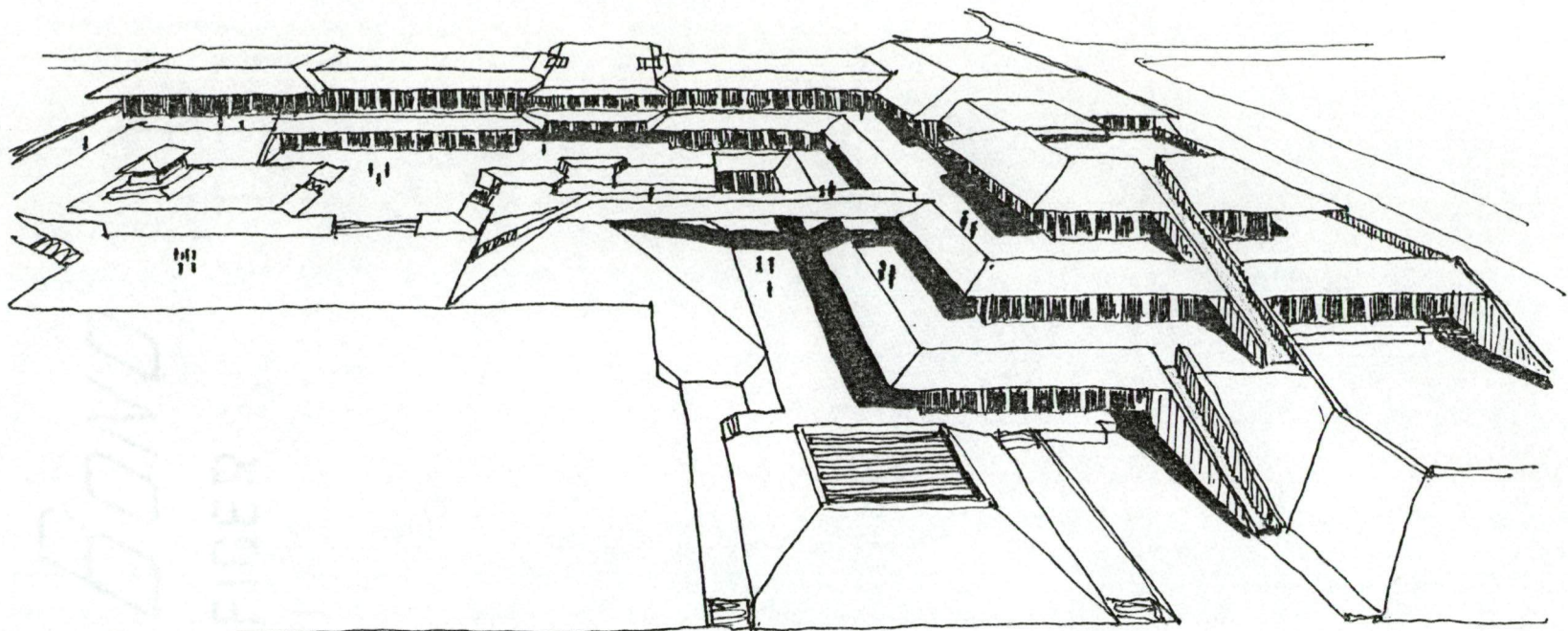
The building is composed of descending terraces and earth berms which closely follow the contours of the southerly sloping site. Exhibition spaces are on the upper level while studios and support facilities are on the middle and lower levels. A waffle slab is used to accommodate the variety of spans and ceiling heights.

Analysis:
Positive

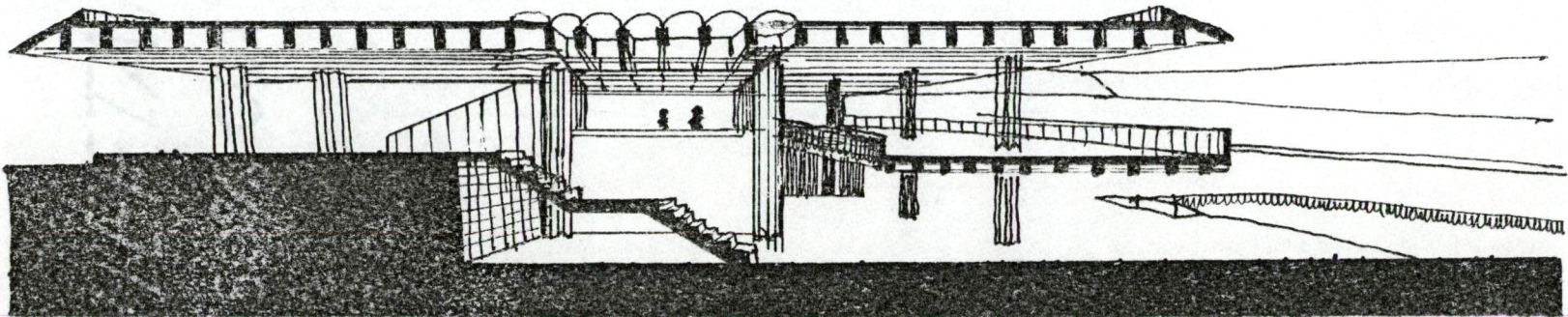
The Florida State Museum fits well into the site by terracing with the contours. The angle of the slope of the land is reinforced by the angled exterior walls of the terraces. Exposed concrete expressed in the interior and on the exterior fits with visual and environmental criteria established by the building's location on campus. The wide overhangs are effective for both sun control and protection against rain.

Negative

Although a certain amount of flexibility is achieved in the design, the use of demountable wallboard partitions does not allow for the desired flexibility of use, wear, or economy.



aerial view



section

CASE STUDY TWO

Oakland Museum
Oakland, California
Architect: Roche and Dinkeloo
Date: 1976

Program: to house exhibits of art and provide community facilities including:

- exhibition spaces
- theater
- classrooms
- offices
- bookstore
- workshops
- restaurant and outdoor eating area
- shipping, receiving, and storage

Concept: to create a people's park for the city of Oakland.

to integrate a system of richly planted terraces into a unified, four-block structure in the midst of the older, southern section of the city.

to create a continuum of low, horizontal forms and private green spaces which relate to the context of a single structure.

Building Design/Response: Originating from the need for three types of municipal museums, a building concept was developed to integrate

the three museums into a single three-level structure--one museum on each level. The lowest level contains exhibits displaying the natural aspects of the region. The middle level houses a gallery of history and technology, showing the influences of people, institutions, and machines on the region. The upper level houses exhibits of creative arts.

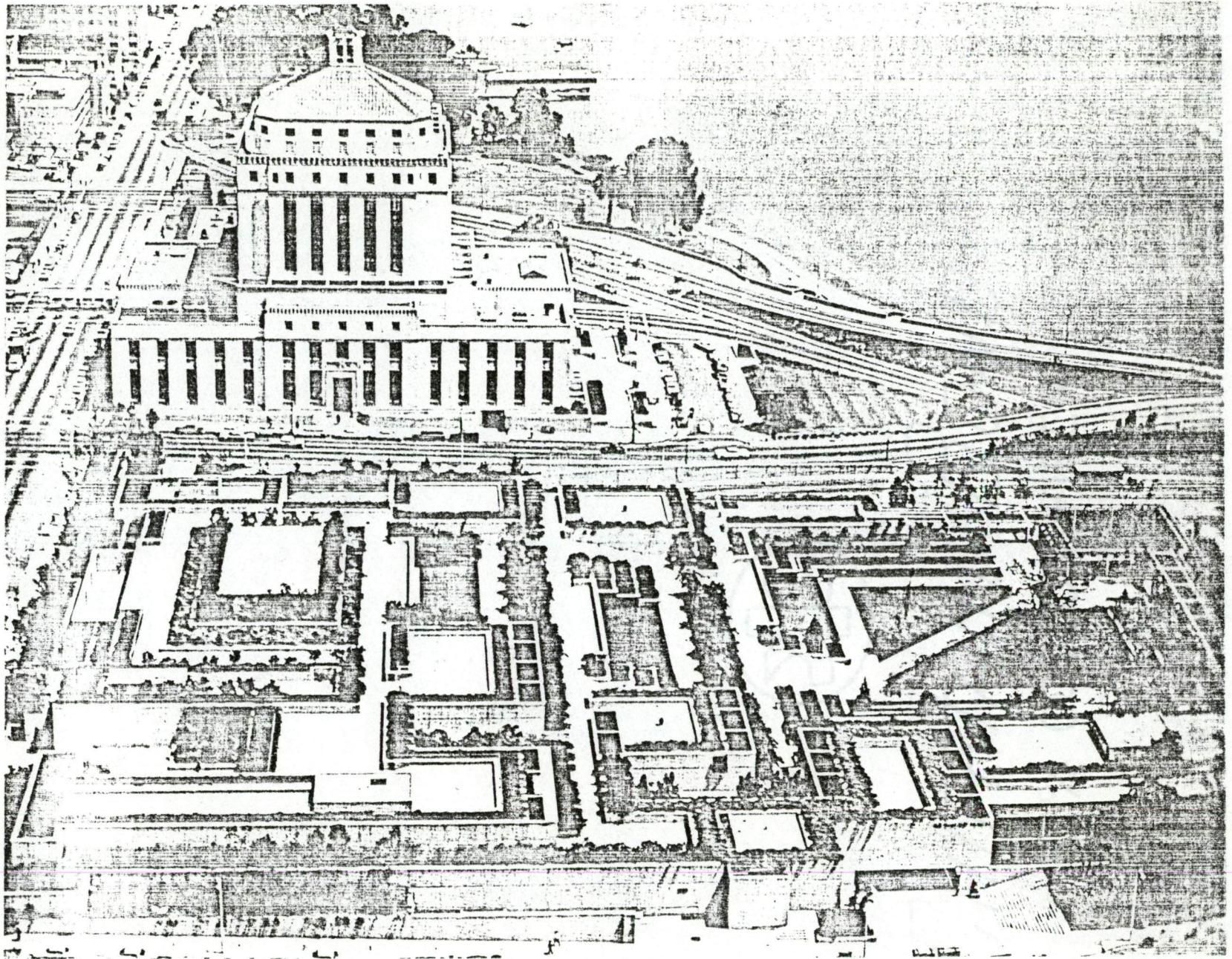
Three materials are used throughout--reinforced concrete, plate glass, and wood. The interior wood is primarily oak with rough-sawn redwood used on the exterior. Major pedestrian circulation is by a series of interior and exterior stairs which lead from one level to another.

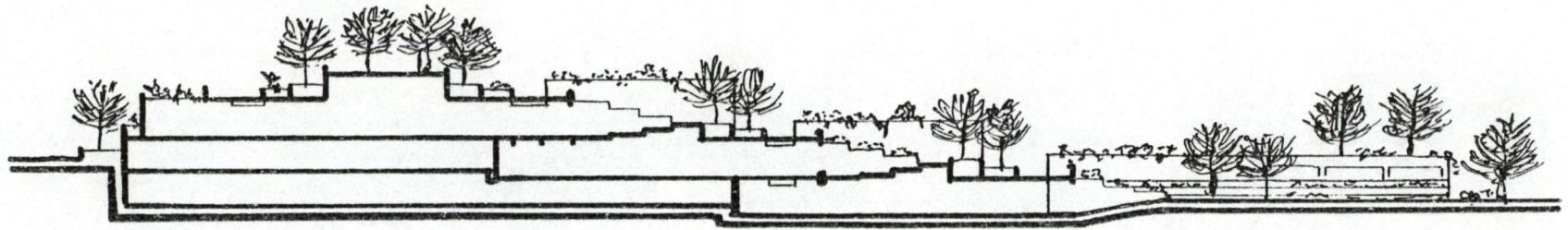
Analysis:
Positive

A strong point of this facility is its ability to reinforce a positive attitude in the environment. The materials are appropriately durable and allow the building to fit well into the urban fabric. The dichotomy of hard versus soft edges gives the building a less massive appearance and provides a good human relationship of building to user.

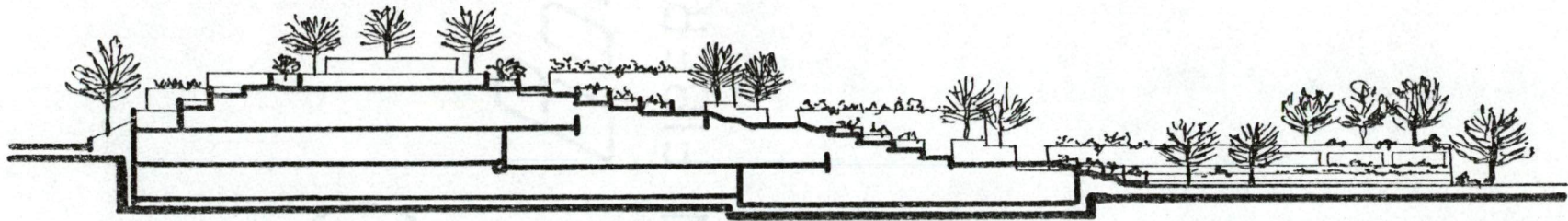
Negative

The coffered ceiling and exposure of some of the mechanical conduit eliminate the flexibility for direct ceiling lighting. Construction and/or detailing on the planter troughs has led to isolated instances of leakage.

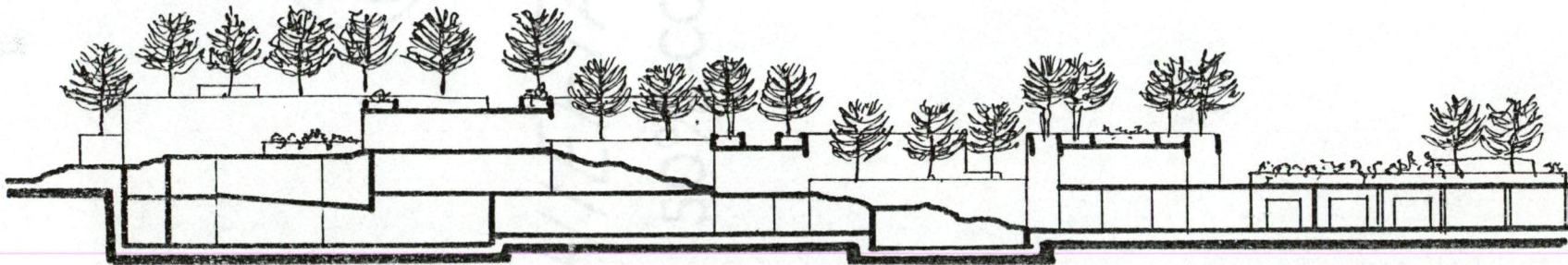




galleries at garden



galleries at overlooks



pedestrian street

sections

CASE STUDY THREE

Fernbank Science Center
Atlanta, Georgia
Architect: Toombs, Amisano and Wells
Date: 1973

Program: to provide a center for environment studies for use by the school district and the community providing:

- exhibition spaces
- planetarium and observatory
- classrooms
- laboratories
- offices
- workshops
- shipping, receiving, and storage

Concept: to provide a center for environmental studies that will have a minimal effect on the natural state of the site.

to utilize the remainder of the site for the study of nature.

Building
Design/Response:

The building is a single-story structure veneered with stone panels. The site is relatively flat; therefore the separation of the planetarium and observatory has been on a linear basis. The exterior of the planetarium dome is articulated by a four-sided shed enclosure. This denotes the main entrance of the building. The observatory dome is the same height as the

planetarium dome on the opposite end of the building. The observatory enclosure is indented from the front and rear walls and denotes the central bay of technical support for the facility.

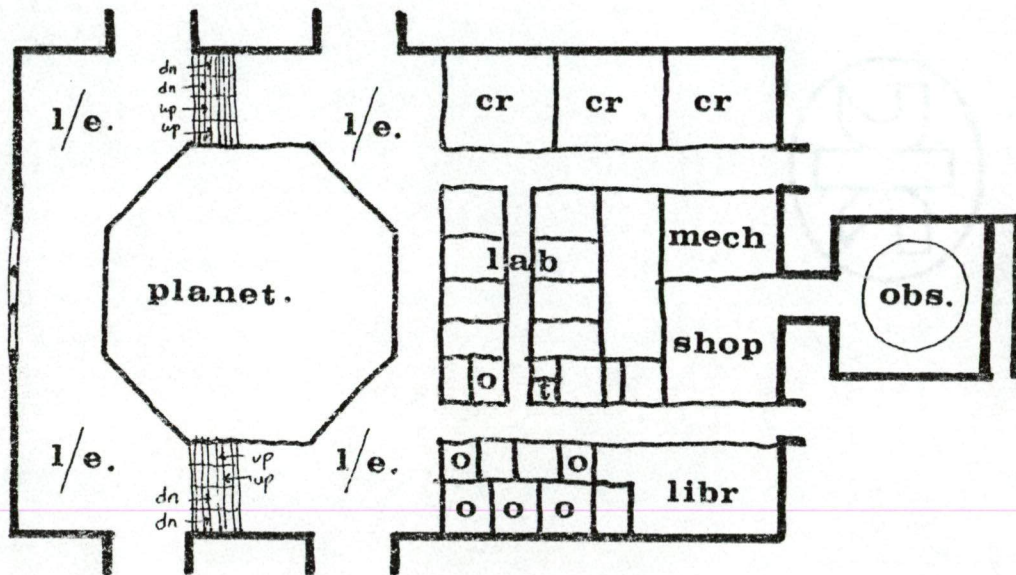
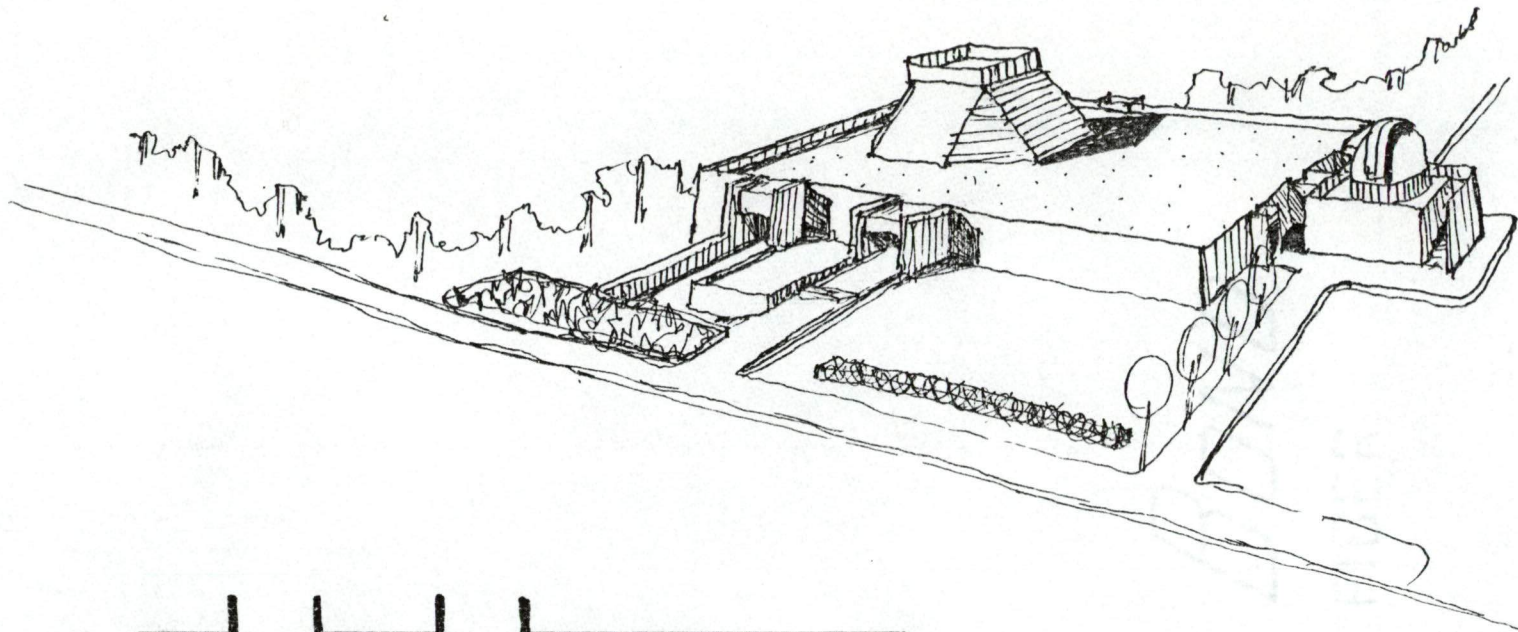
Analysis:

Positive

The building acts as a buffer and separation element between vehicular and pedestrian circulations. Its low profile fits into the scale of the surrounding neighborhood.

Negative

The relationship of classrooms, laboratories and offices to the public exhibition areas is direct, yet displays an un-ordered, uncomprehendable relationship as to their function within the center. The entrances to the exhibition spaces around the planetarium chamber are through four separate sets of double doors. This results in a lack of definition of the main entrance. The complexity of external forms does not bely the building's internal simplicity.



floor plan

CASE STUDY FOUR

Minnesota Zoological Garden
Minneapolis/St. Paul, Minnesota
Architect: Interdesign, Inc.
Date: 1969

Program: to develop a zoo which houses naturalistic exhibits and demonstrates an increased awareness of the relationships between man and animal.

- exhibition spaces
- zoo geographic area
- northern trek area
- farm area
- orientation theater
- restaurant
- education facilities
- administration/management area
- mass transit system
- shipping, receiving, storage

Concept: to provide public recreation and education through animal displays.

to provide a plan accommodating phasing development over a period of years.

to provide a facility that can be used any time of the year.

Building

Design/Response:

An interconnected complex of facilities housed under one roof is a result of the desire to reduce construction area on the site. It also satisfies the requirement for an all-weather zoo. The cable and truss reinforced pneumatic structure responds to the basic requirements of translucency, insulation and snow melting run-off. Concrete columns and beams support the roof structure, and, because of the large spans, provide flexibility and openness. A pedestrian concourse was designed to accommodate large numbers of people and forms a multilevel spine connecting the entry/orientation space, exhibits, public spaces, and education facilities.

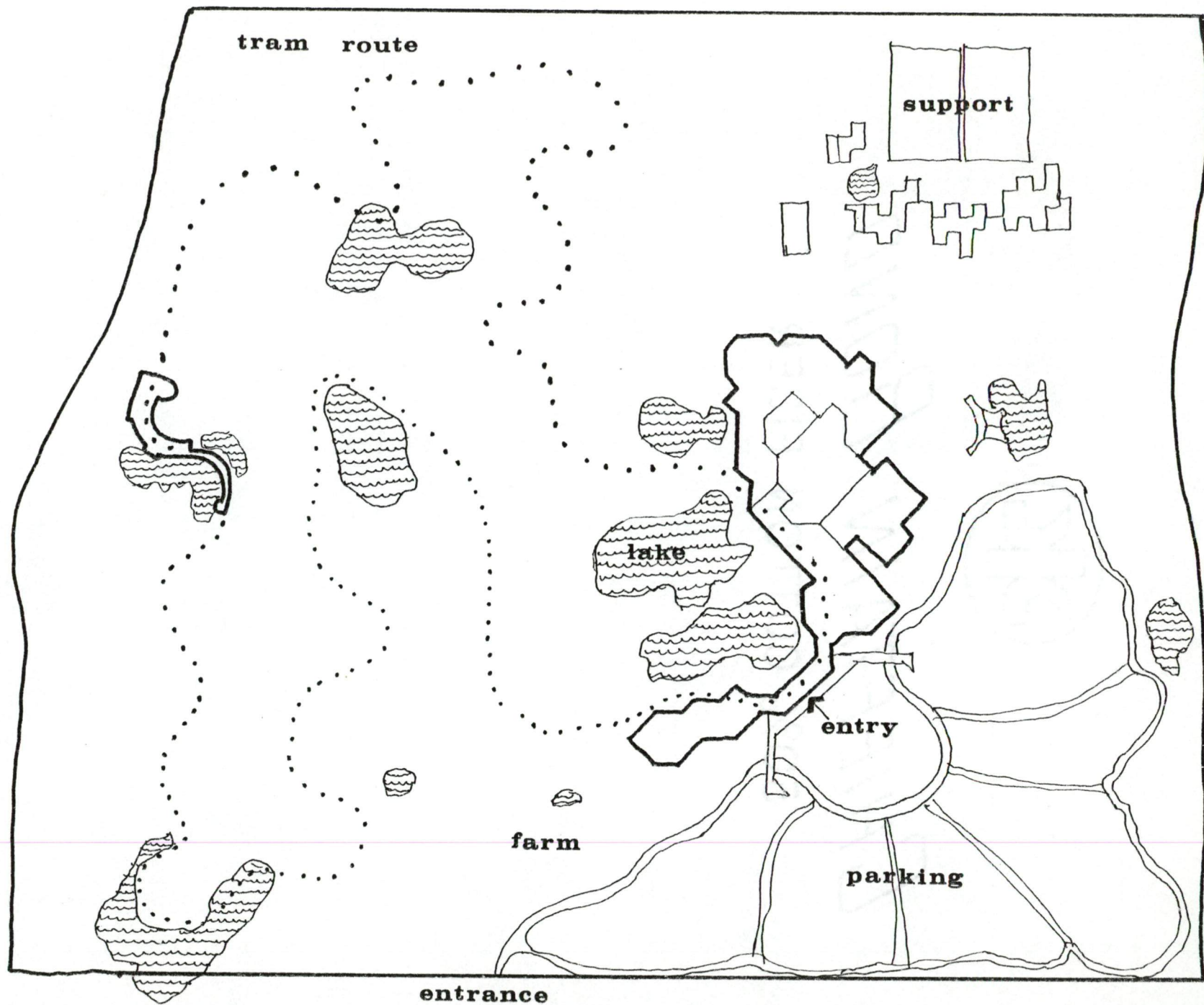
Analysis:

Positive

The public is channeled from the parking areas into the main entry of the building. Orientation exhibits at this entrance, as well as the entrances to all the other spaces, describe what the viewer will see, its importance, and its relationship to the other exhibits. These exhibits reinforce the sequence of exhibits and provide meaningful understanding of the relationship of man to animal. The building serves as a buffer between the parking areas and the exterior display areas, thus separating public circulation from private. The form of the building complements the existing landform and maintains a minimal physical and visual impact on the site.

Negative

There is an incongruity in the structure in that control of lateral light or poor views is limited. The location of the farm area at the main entry also seems undesirable due to high noise levels. The location of the tram service area has a visual impact which is greater than desired.



physical requirements

HEIGHT AND AREA
RESTRICTIONS

ALLOWABLE HEIGHTS

(type construction used)

	Story height	1st fl.	2nd fl.
TYPE I	no limit	no limit	no limit
TYPE II	80 feet	no limit	no limit
TYPE III	two	18,000	12,000
TYPE IV	two	12,000	12,000
TYPE V	two	12,000	12,000
TYPE VI	two	8,000	8,000

Type II construction allows for the omission of fireproofing on Group A and E (Assembly and Education) where structural members support on a roof and are twenty feet or more above above any floor or balcony. It also provides for good fire protection rating guidelines for human safety in a facility of this nature.

A N S I REQUIREMENTS
FOR THE HANDICAPPED

- Entrances at least one primary entrance to each building shall be usable by individuals in wheelchairs.
- Doors doors shall have a clear opening of no less than 32 inches when open and shall be operable by a single effort.
- Ramps ramps shall not have a slope of greater than one foot rise in twelve feet run.
a ramps shall have a handrail 32 inches in height.
ramps shall have level platforms at thirty-foot intervals, and level platforms where ever they turn.
- Stairs stairs shall have handrails 32 inches high and at least one handrail that extends 18 inches beyond the top and bottom steps.
- Parking spaces shall be twelve feet wide and be identified.
- Toilets toilet rooms shall have at least one toilet that shall:
- have a door that is 32 inches wide and swings out.
 - have a stall which is at least three feet wide and four feet three inches (preferably five feet) deep.
 - have handrails on each side, 33 inches high and parallel to the floor.
 - have a water closet with a seat 20 inches above the floor.

SPECIAL CONSIDERATIONS

Traffic

The very nature of the center requires that as much of the land be left for observation and study as possible. Vehicular traffic should therefore be as limited as possible on the site, and as separate from the pedestrian traffic.

Acoustics

Sound transmission ratings should be such that there is optimum hearing of speech. This is most critical in the classrooms where the walls should be rated at a minimum (maximum) of 40 dB. In most other areas, except for the studios where sound transmissions are much lower, sound transmissions through the walls should be in the range of 50 db(+).

Reverberation time should be in the 0.6-0.8 range.

Lighting

A mixture of artificial and natural lighting is considered best for most instances. It is important that in the area of the planetarium chamber, where audio/visual aids will be employed, and in the photography, T.V., and microscope laboratories, that lighting must be highly controlled. A recommended light level at a work surface is 60-80 foot-candles. The recommended reflectances are:

- | | |
|-------------|--------|
| • ceilings | 70-90% |
| • walls | 50-70% |
| • floors | 10-40% |
| • furniture | 25-50% |

Thermal Comfort

The mechanical system should be designed so that all spaces are within the "comfort zone" established by M. David Egan to be between 70-79 F at 20% relative humidity, slowly decreasing to 73-77 F at 60% relative humidity. The air handling system should also conform to expressed acoustical guidelines.

Fire Safety

All portions of the center should conform to the guidelines set forth in the Standard Building Code.

The center is both Group E educational and Group A assembly.

The following codes should be noted:

- No point in the building shall be located more than 150 feet from an exit.
- No classroom shall occupy a basement area which is more than 50% underground.
- Storage and handling of flammable liquids is prohibited.
- Minimum occupant content - floor area per person:
 - Classrooms 20 sq. ft.
 - Small assembly (fixed seats) 6 sq. ft.
 - Libraries 30 sq. ft.
 - Dining 15 sq. ft.

activities statement

PLANETARIUM

This facility requires direct public access and is the primary focus of the center. Its major function is audio/visual presentation beginning with an orientation lecture and continuing with planetarium showings of the relationship of man to the universe. These programs are attended on an hourly basis and are open to the public during the hours of 11 a.m. to 3 p.m. daily. Saturday, Sunday, and evening schedules will be determined after the center's operation has been established. Special showings for large groups will also be provided at arranged times.

The public is brought from the parking and drop-off areas to a main entry foyer. At this point there is a reception area for orientation and movement into the building. Prior to entering the planetarium chamber, there is a sequence of introductory exhibits designed to familiarize the public with the center and the scope and subject matter of the planetarium's programs. These exhibits vary from two-dimensional to three-dimensional displays of inventions, mathematics, and other related fields pertinent to understanding the relationship of man's existence with nature. A gallery/exhibition space is located adjacent to the entry of the

planetarium and is large and flexible enough to provide space for large groups and temporary exhibits. Planetarium offices have direct access to and from this space.

Movement from the exhibition space to the planetarium chamber is through a light lock. This passageway is used to control light and sound and is used as a transition from an area of gallery light to one of subtle light. Preferred sloped auditorium seating will maximize the design flexibility of this chamber by allowing this space to function as a lecture hall as well as planetarium chamber.

OBSERVATORY

The observatory is both public and private in function. Its major function is to house a two-story, 36 inch reflecting telescope (circa 1890), acquired from Harvard University, in such a way as to allow both the viewing of and instruction in the use of the instrument. Small groups are brought into the telescope chamber and are given the opportunity to view through the telescope. The primary focus will include the planets of the earth's solar system, selected stars and galaxies, and special phenomena such as nebula, nova, and other events in space.

The use of this facility is rigidly controlled and consists of a greater number of viewing periods at shorter intervals than the planetarium shows. To avoid an overlap of people at the entry to the telescope chamber, the exit directs people to an observation deck and to a point away from the entry.

GEOLOGY LAB

This component encompasses three elements of use: public, semi-public, and semi-private. It is composed of an exhibition space (public), a classroom/lecture space (semi-public), and a laboratory space (semi-private). The exhibition space is accessible to the public at all times during regular operation of the center. The classroom is used on a scheduled basis and consists of short instruction periods. This instruction employs audio/visual aids to introduce and emphasize specific points of interest concerning rock formations and compositional elements of the earth's structure.

WATER RESOURCES LAB

This component is composed of two- and three-dimensional displays that exhibit the composition and uses of water in relation to the environment. The exhibition space has direct public access and provides for convenient movement around and viewing of these displays. The classroom space adjacent to the exhibition space is used to introduce and explain water's relationship to man and the environment. The laboratory space is adjacent to the classroom space and provides material for experimentation of the principles discussed in the classroom.

HORTICULTURE LAB

This component has an exhibition space that has direct access to the public. Displays consisting of two- and three-dimensional models and selected natural samples are viewed here. The classroom space is adjacent to the exhibition space and is used on a regularly scheduled basis. Audio/visual techniques are used to instruct the student in the relationship and applications of plants in the environment. The laboratory space is adjacent to the classroom space for the illustration of plant material, cell structure, and related experimentation.

ENVIRONMENTAL MANAGEMENT LAB

This component has an exhibition space for the display of two- and three-dimensional models of the relationships of man and the environment. These displays illustrate principles of land use, conservation, and manipulation of the environment with emphasis on the effects each has on man. The classroom space is adjacent to this space and is used for instruction on techniques and applications of environmental management through audio/visual methods. The laboratory space is adjacent to the classroom space providing material to show the effects that a variety of forces has on the environment

ENERGY LAB

This component consists of an exhibition space which is directly accessible to the public. Different forms of energy, from photosynthesis to lighting, are illustrated by two- and three-dimensional displays. The classroom space is adjacent to the exhibition space for use on a scheduled basis and provides audio/visual illustrations of the relationship between man, energy, and the environment. The laboratory space is connected to the classroom space and provides for further description and experimentation in the forces of energy.

METEOROLOGY LAB

This component is composed of an exhibition space which is directly accessible to the public. Two and three-dimensional models of cloud formations and the effects that sun, wind and rain have on the environment are displayed here. The classroom space is adjacent to this area and employs audio/visual aids to discuss and explain the effects and results of different atmospheric influences on man and the environment. The laboratory space is linked to the classroom space and provides material to construct models that reinforce theories discussed in the classroom concerning the relationship of man to the environment.

ADMINISTRATIVE SUPPORT OFFICES

This component consists of administrative offices for the director of the center and his staff. It is located near the main entrance and in close proximity to the lobby and exhibition space giving it both servicability and control. The main functions of the office area are administration of the center and public relations. This element is connected visually to the center, yet it remains separate from the public 'tour route.' The hours of administration coincide with the center's operating hours.

TECHNICAL SUPPORT AREAS

This component deals with the mechanical support of the planetarium, observatory, and environment of the center. It also supplies the classrooms, laboratories, and exhibition spaces with the necessary audio/visual materials. This is done through workshops, a closed circuit television studio, and storage/receiving areas. This component is the area most separate from the public and provides service access to all areas during the regular operation of the center. It also serves as a link between the administrative and technical personnel and allows a continuous monitoring of systems and security of the center.

OUTDOOR FACILITIES

The integration of the building into the environment is a major criterion of the nature of this project. An integral part is the direct relationship of things learned in the controlled environment of the center and things experienced in the natural environment of the site. The development of nature trails is based on criteria generated by this project in conjunction with the efforts of natural scientists. These trails are a system of movement from heavily wooded areas to open areas and consist of intermediate areas for gathering, resting, and viewing. These trails are used during the operation of the center and are used on a guided tour basis.

An amphitheater and picnic area are located adjacent to the main parking lot and are for use during the operation of the center or through special scheduling. These elements are an integral part of the center as a community-related place and serve as a place for outdoor plays, musical events, and other community or school related functions.

site

EXISTING SITE

The site is a 62-acre tract of land located on the southern slope of Roper Mountain in Greenville, South Carolina. On its northern boundaries is a developed residential area, on its east is a partially developed commercial office park, and on its south and west extremities, it is bordered by a frontage road and Roper Mountain Road, respectively.

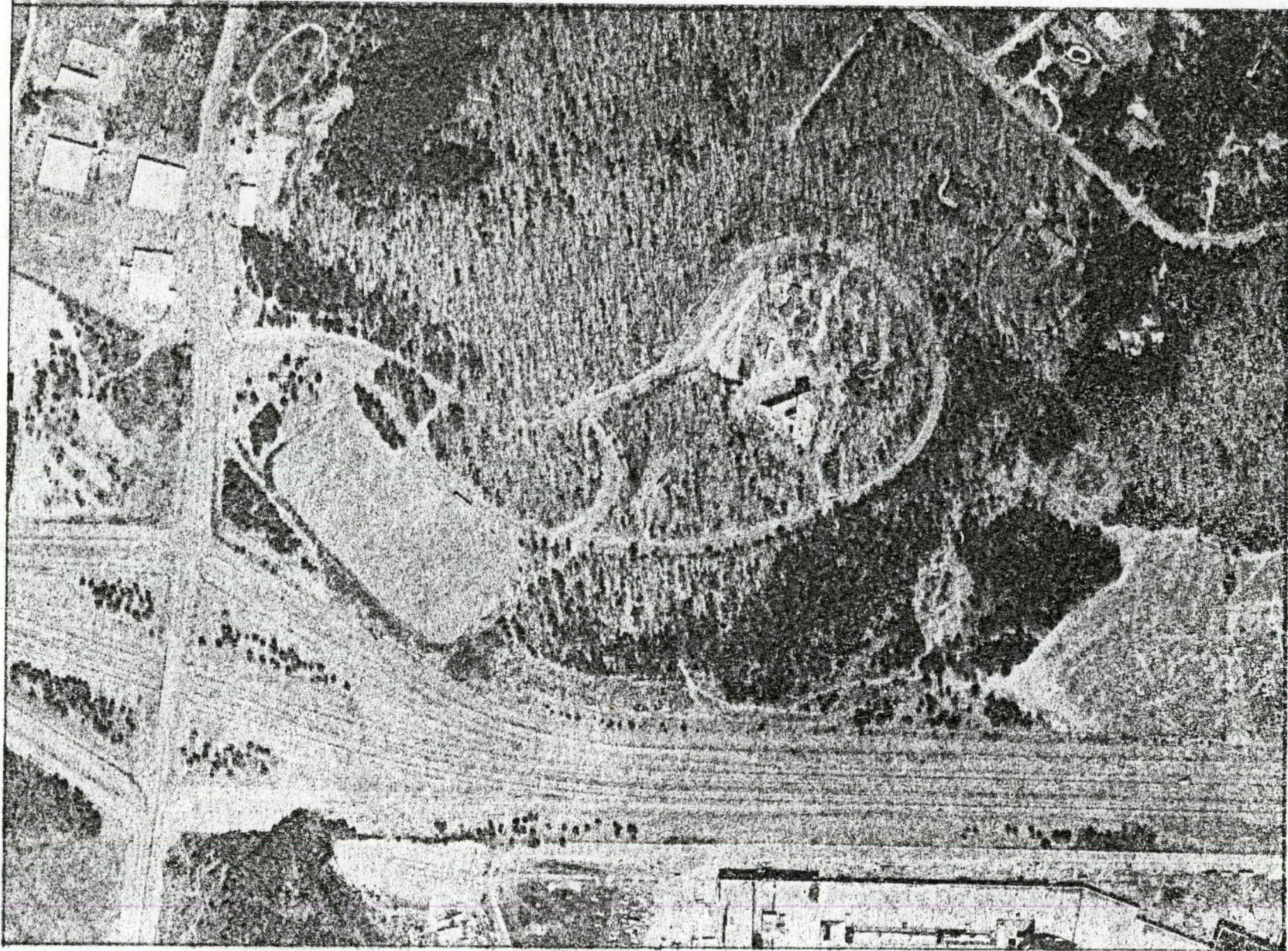
The land gently slopes from an elevation of 1201 feet at its peak to an elevation of approximately 1055 feet at its lower east and west base. Roper Mountain is basically a stable landform composed of a granite base covered by an average of 15-25 feet of clay and mineral deposits. There is a catch area for natural drainage in which silt and mineral-rich topsoils have collected. This area is located around the 1075 foot elevation and is a result of north to south drainage off of the mountain. Throughout the site, slopes vary from 5% to 35%. Most of the site is buildable. The site is heavily covered with oaks, pines and cedars, as well as an understory of dogwoods, ferns, and a large variety of other plant growth.

The only clear areas on the site are those around the existing exhibition structure, the paved parking lots and the paved road system between the two. Tree

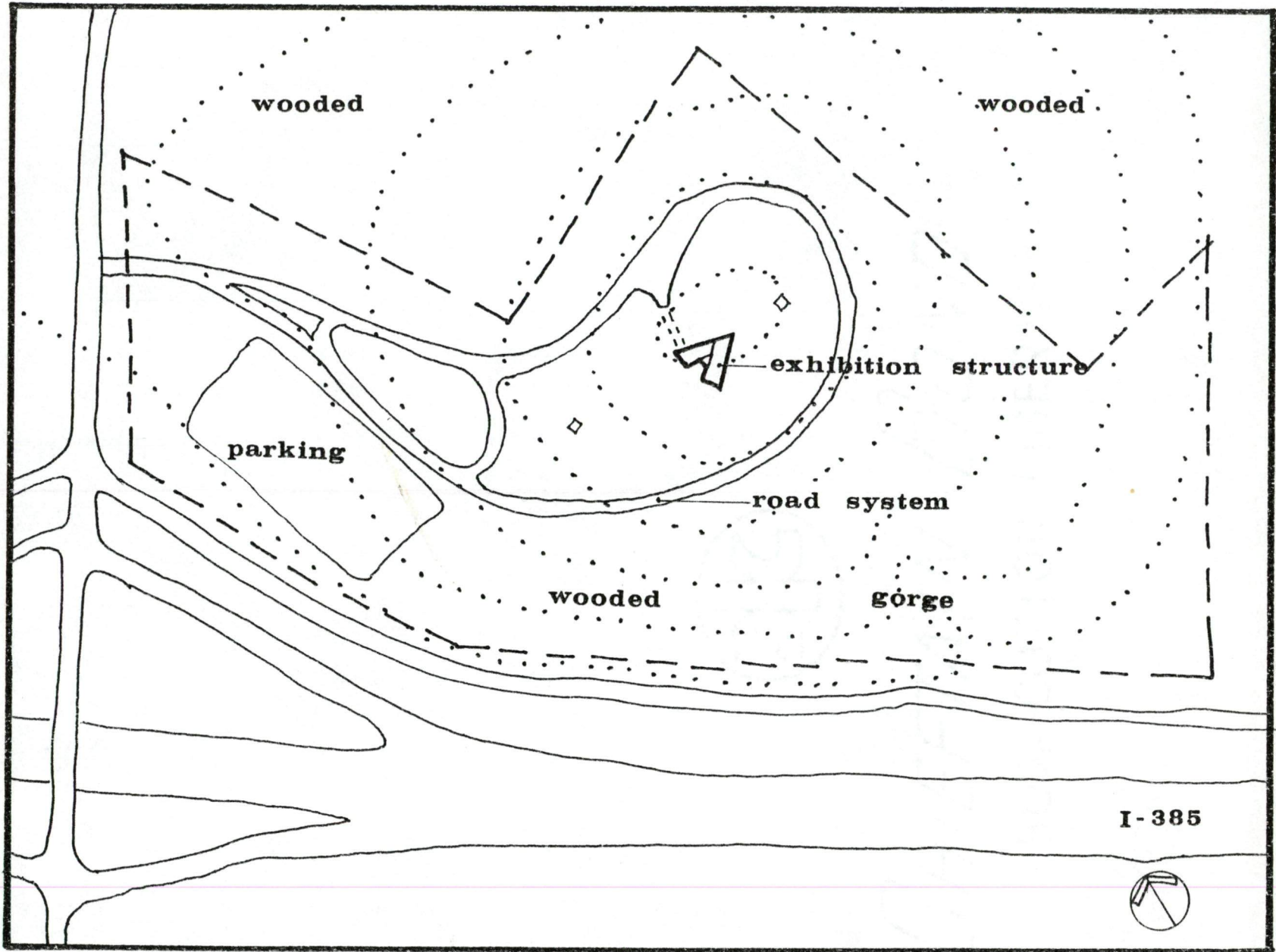
heights are estimated at 50-75 feet at the crest and 35 feet at the lower elevations.

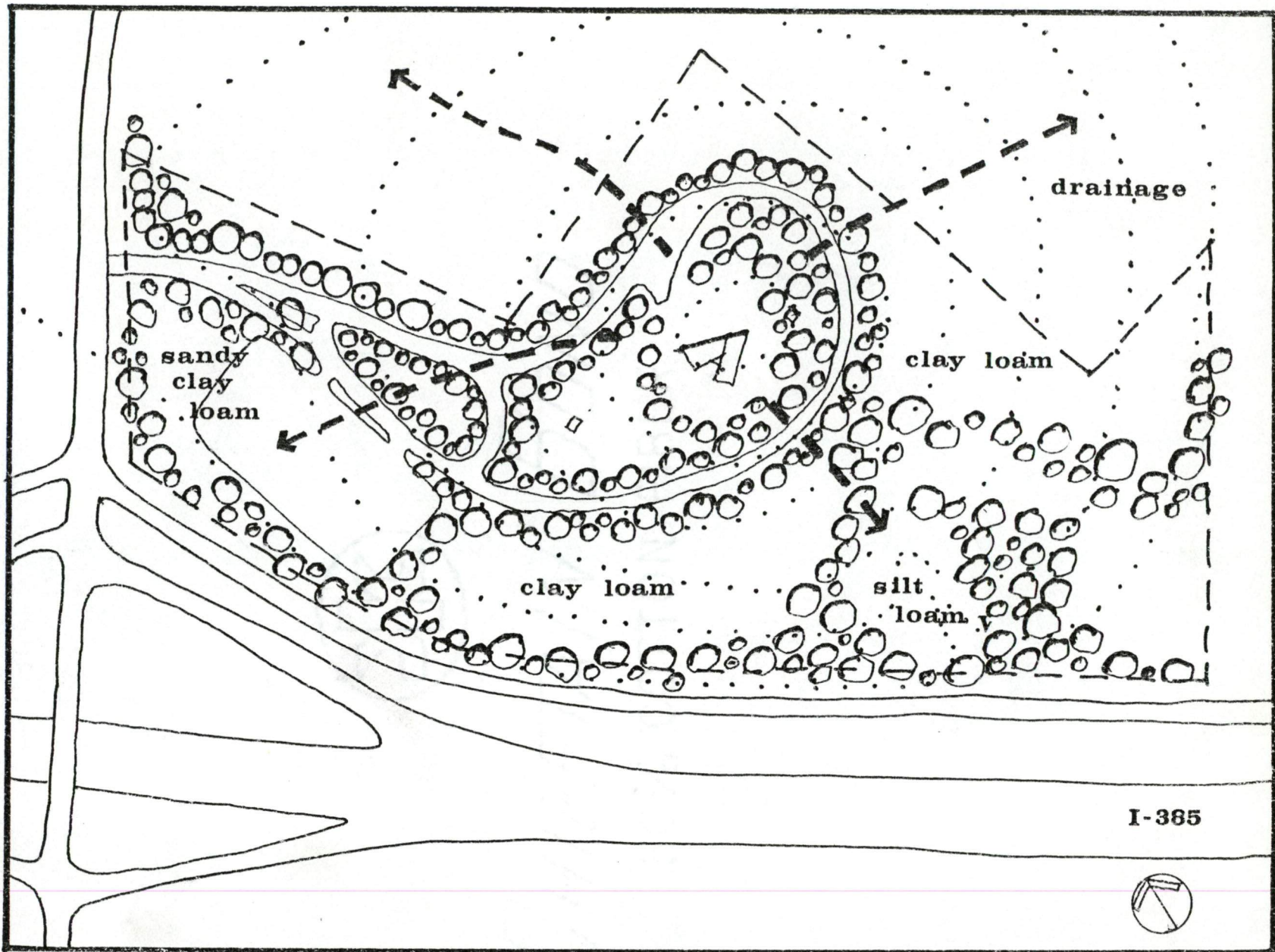


WHITFIELD BOND
50% COTTON FIBER

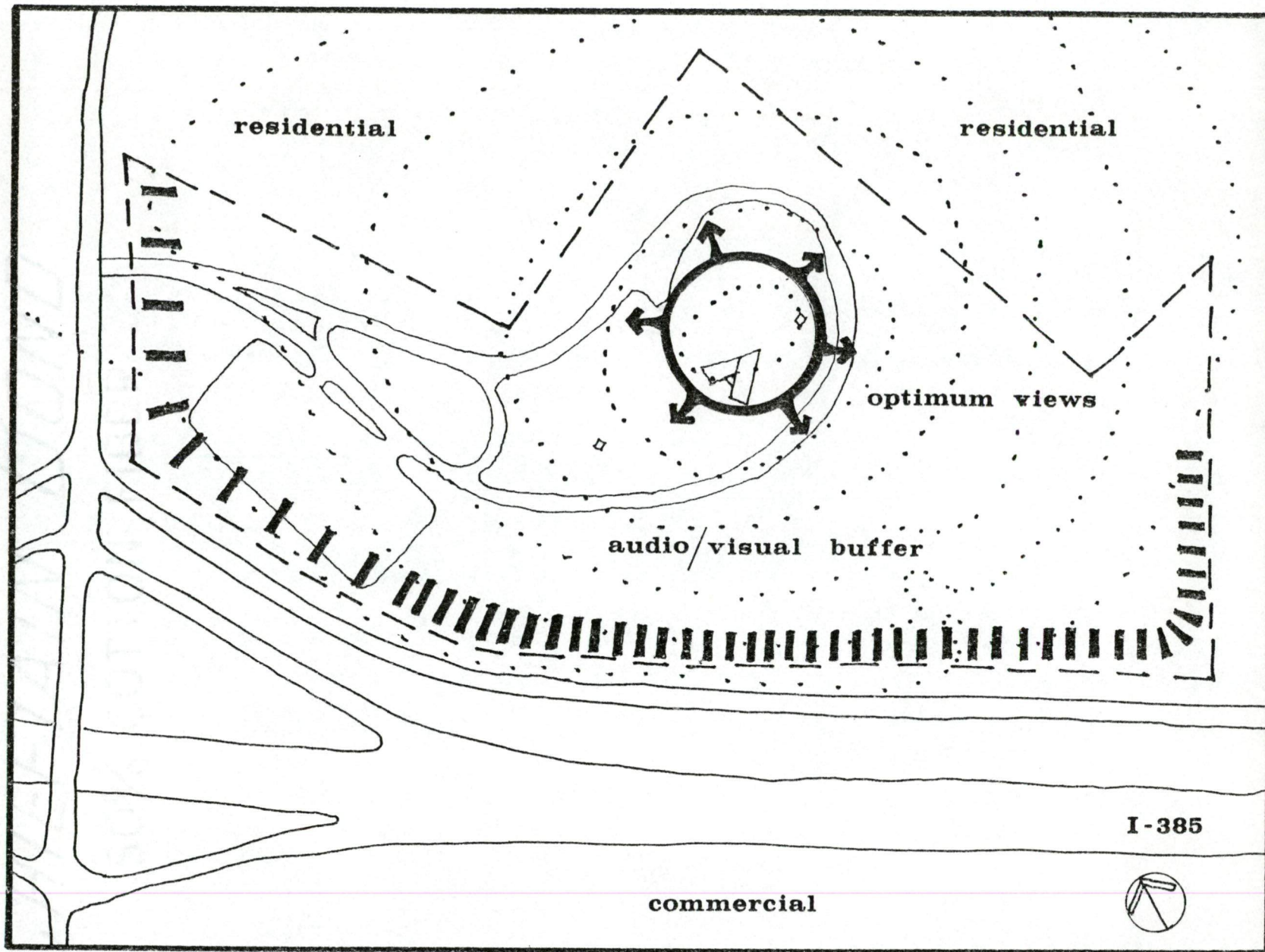


aerial photo





I-385

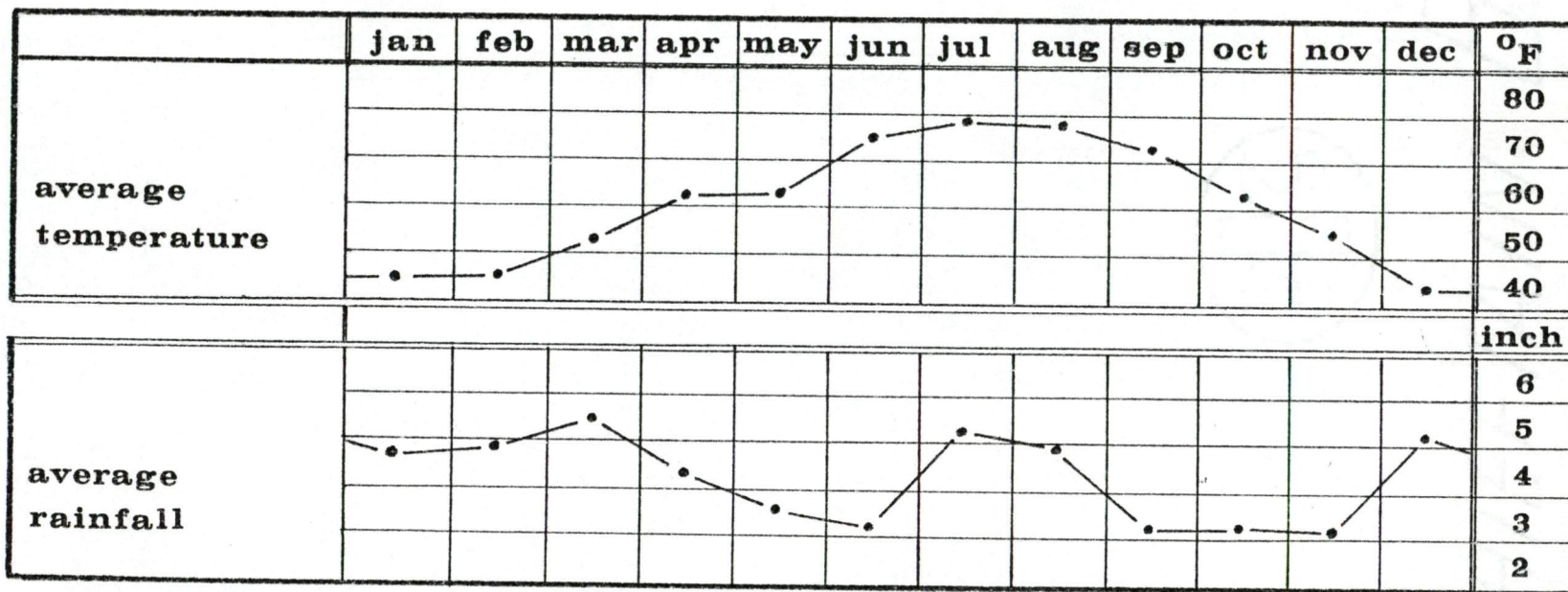
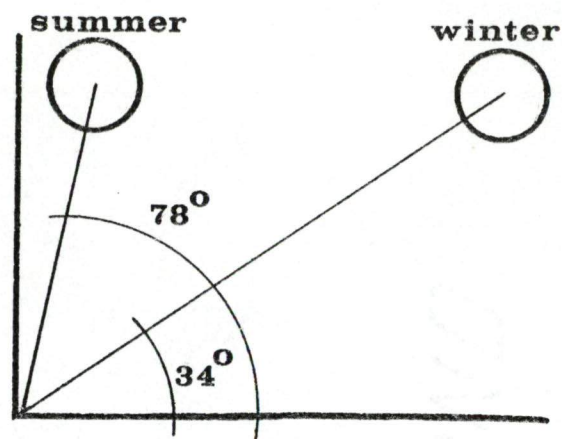


CLIMATE

Longitude- 81°

Latitude - 34°

Sun's Altitude



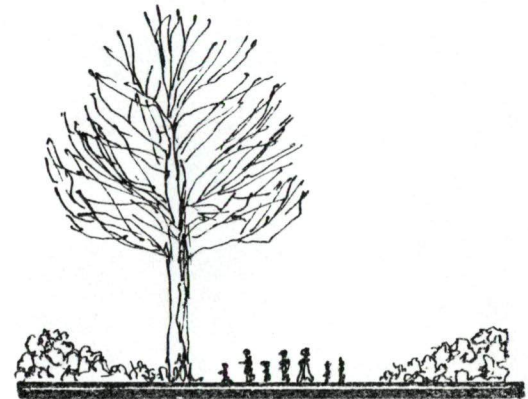
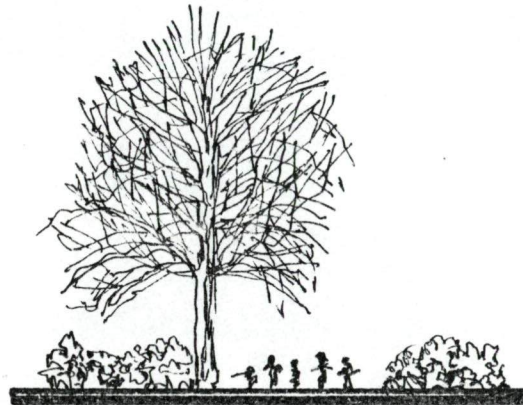
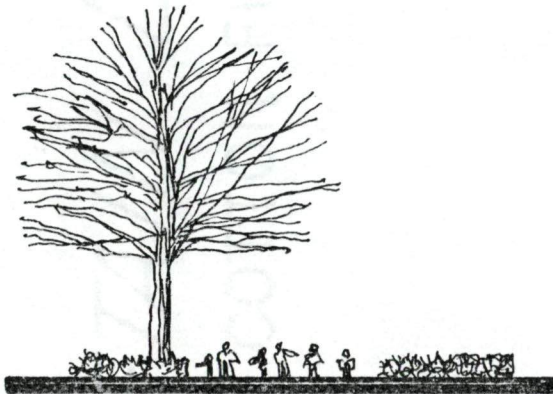
Average wind velocity is 6.8 miles per hour and is generally from the southwest during the months from January to June, and from the northeast during the months from July through December.

problem definition

In the study of environmental science, it is important to retain as many of the natural, undisturbed portions of the land as possible. Previous development of Roper Mountain for the Tricentennial exhibition has resulted in clearing of a portion of the natural vegetation. The use of these cleared areas as the site for construction of a new environmental science center is established in order to minimize further deterioration of the site's natural state. This also retains the character of the shape of the mountain by maintaining the north, southwest and southeast ridges' tree line. A strong visual image of the center will be created by the juxtaposition of recognizable architectural forms against the backdrop of the mountain.

Vehicular traffic areas are not an integral part of the site other than acting as reinforcements to the northern boundary. Due to the nature of this center, vehicular and pedestrian traffic will be separated as much as possible. This will reinforce the integration of nature trails as a viable element of the overall design. Through "on-site" observations and research by natural scientists, appropriate plant formations will be identified and labeled and will form the basis for layout of these trails.

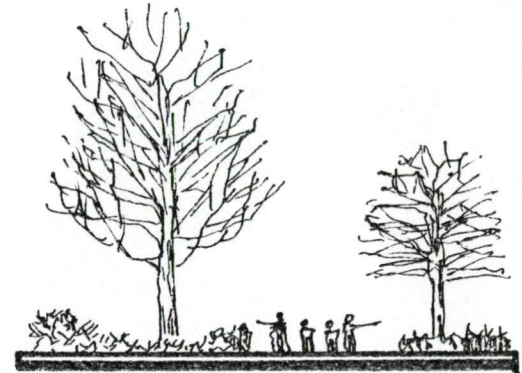
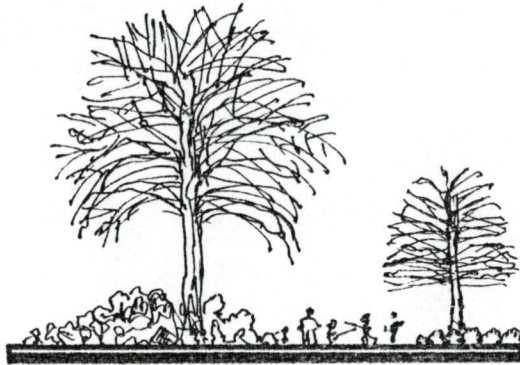
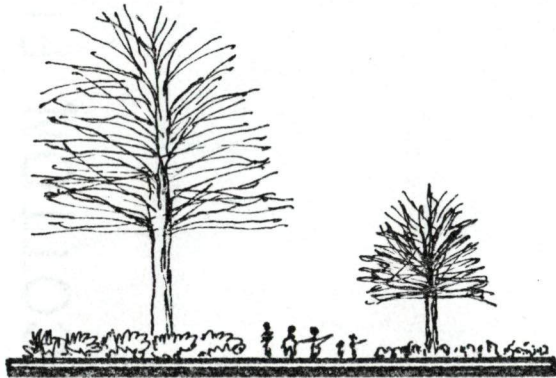
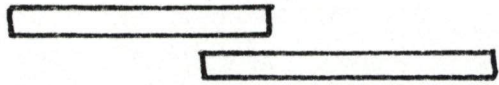
The utilization of the existing natural gorge as an artificial lake with underwater viewing ports will also be incorporated into the development of the nature trails. This will allow observation and study of the natural development of marine life and act as a complement to the nature trail experiences. It also provides a direct relationship with the center and allows for a total integration of the artificial instruction in the center with the natural instruction in the environment.



horizontal form

convex form

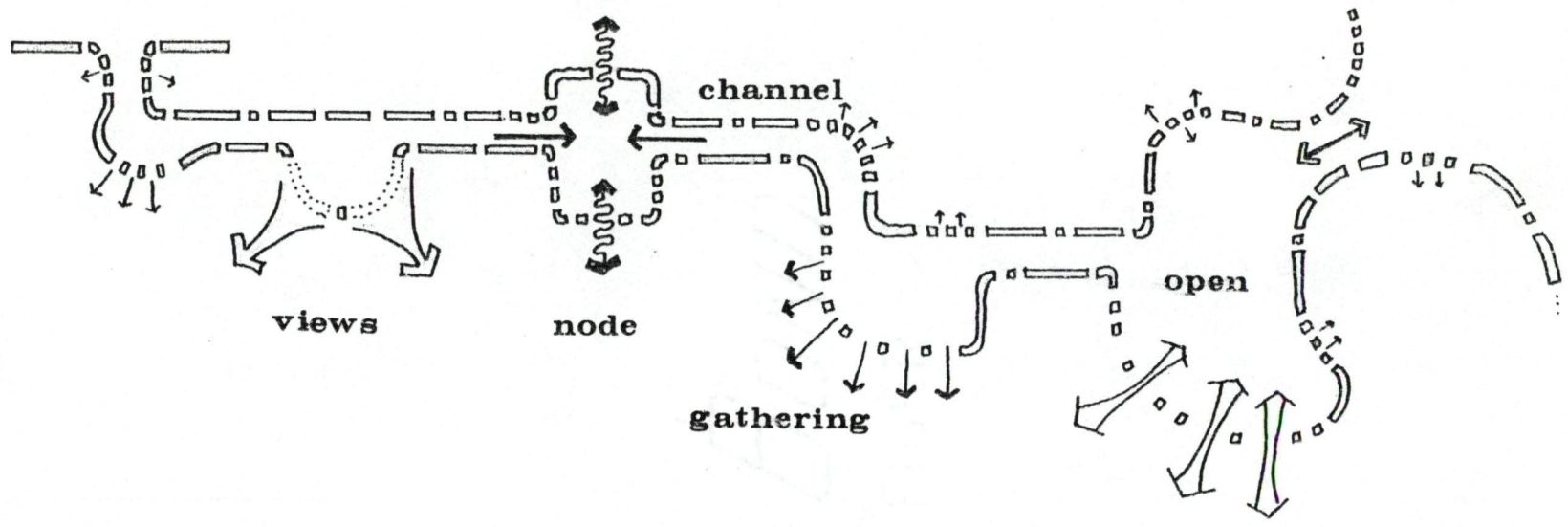
concave form



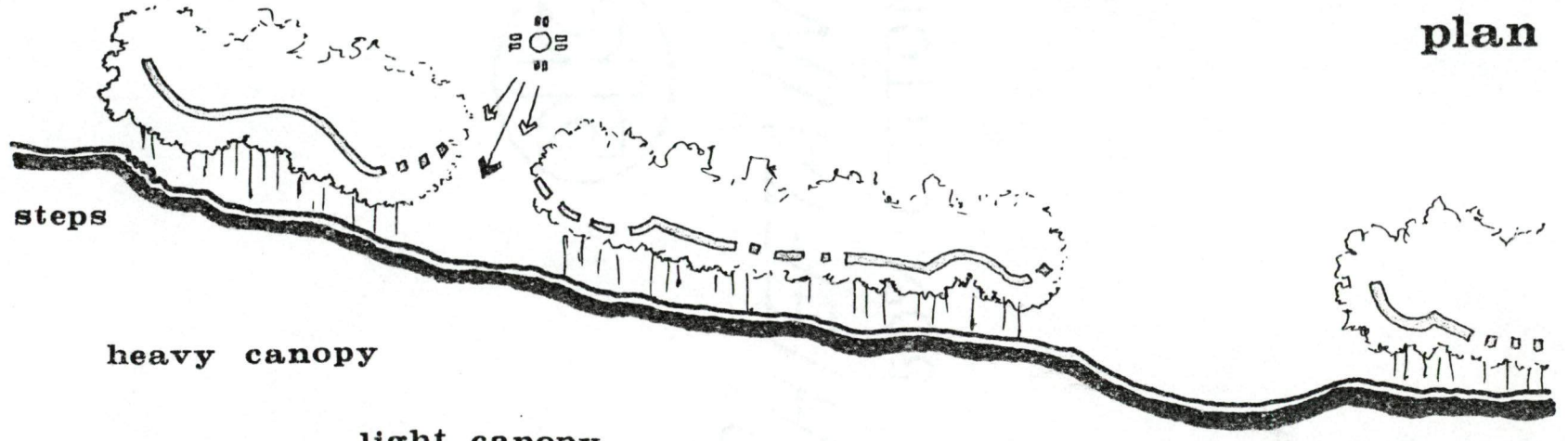
horizontal-layered form

convex-horizontal form

concave-horizontal form



views
plan



steps
heavy canopy
light canopy
medium canopy
open

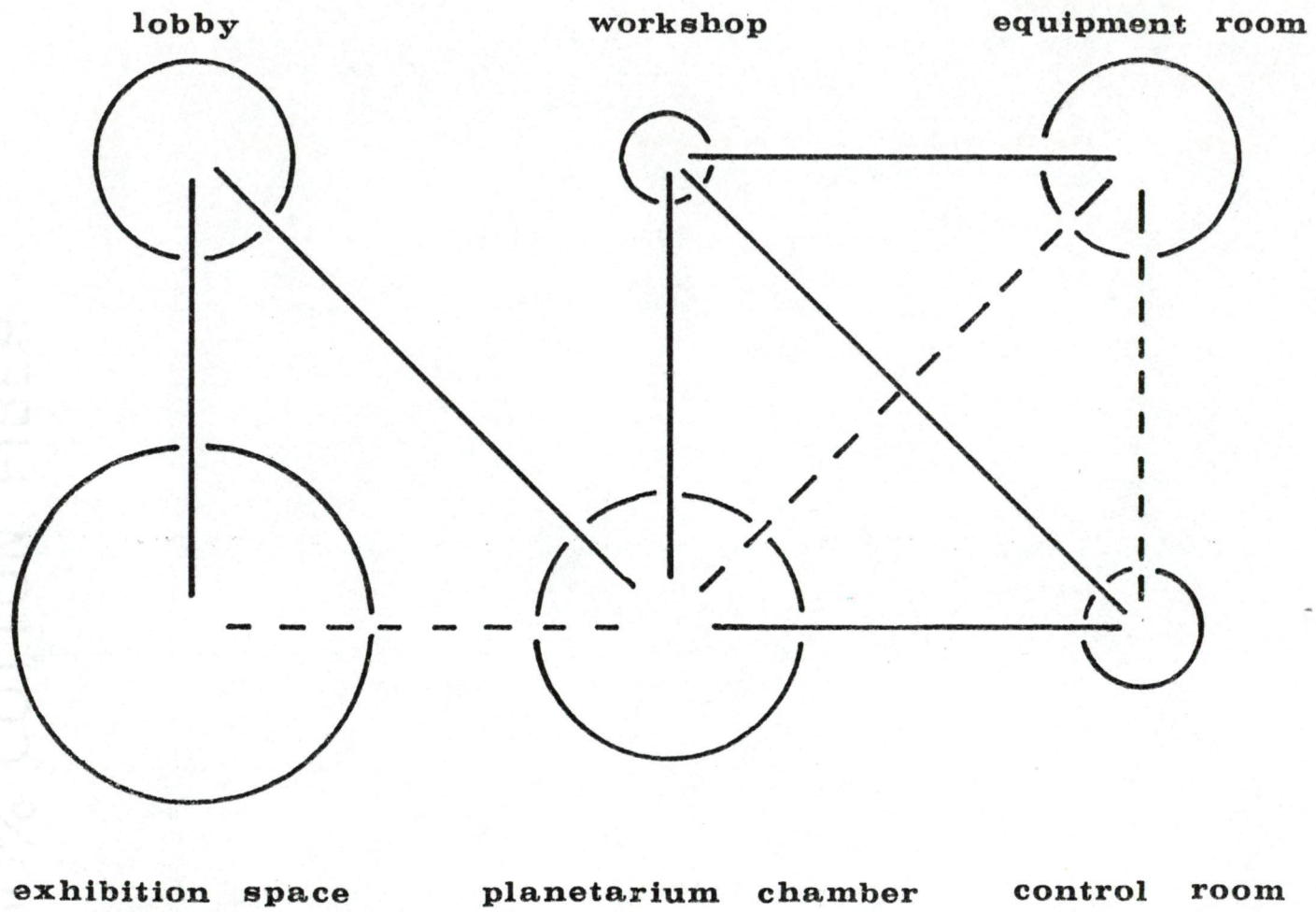
section

program

PLANETARIUM

The planetarium chamber is accessible through a light lock passageway which controls undesirable light into the chamber. Wheelchair platforms are located near the entry into the chamber. The chamber floor is sloped to allow optimum viewing of the dome shows as well as to provide auditorium/lecture capabilities. The chamber must have excellent acoustical properties. The immediate area behind the domed projection ceiling will be used for stage settings and special effects.

Lobby	2,000 sq. ft.
Exhibition space	7,500 sq. ft.
Receptionist	200 sq. ft.
Planetarium chamber	4,000 sq. ft.
Projection/control room	400 sq. ft.
Workshop (including storage)	800 sq. ft.
Equipment room	2,000 sq. ft.
Offices 3 @ 200	600 sq. ft.
Toilets 2 @ 300	600 sq. ft.
TOTAL	18,100 sq. ft.



lobby

workshop

equipment room

exhibition space

planetarium chamber

control room

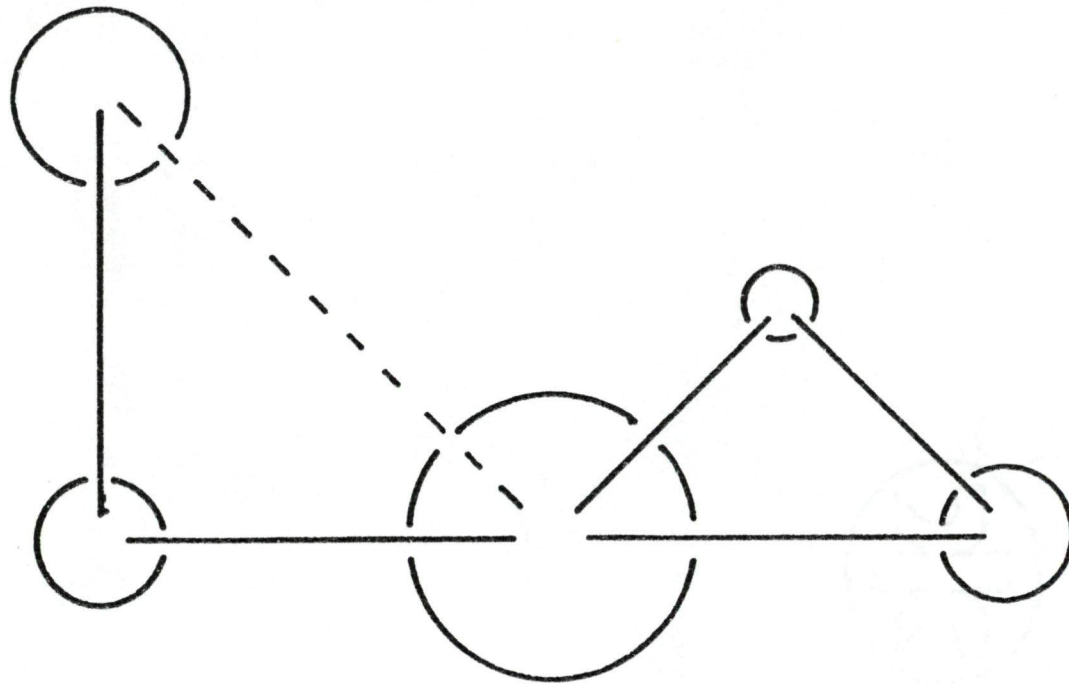
OBSERVATORY

The two-story, 36-inch reflecting telescope acquired from Harvard University will be incorporated into this facility. The instrument must be mounted structurally isolated from the rest of the building for vibration control. A laboratory/work space is located adjacent to the telescope chamber and provides office space for the telescope's technician. An observation deck is located in close proximity to the changer and is located to take best advantage of views of the horizon from the mountain's peak.

Entry	600 sq. ft.
Telescope chamber	2,500 sq. ft.
<u>Workroom/office</u>	400 sq. ft.
Storage	200 sq. ft.
Observation deck	<u>1,000 sq. ft.</u>
TOTAL	4,700 sq. ft.

observation deck

storage



entry

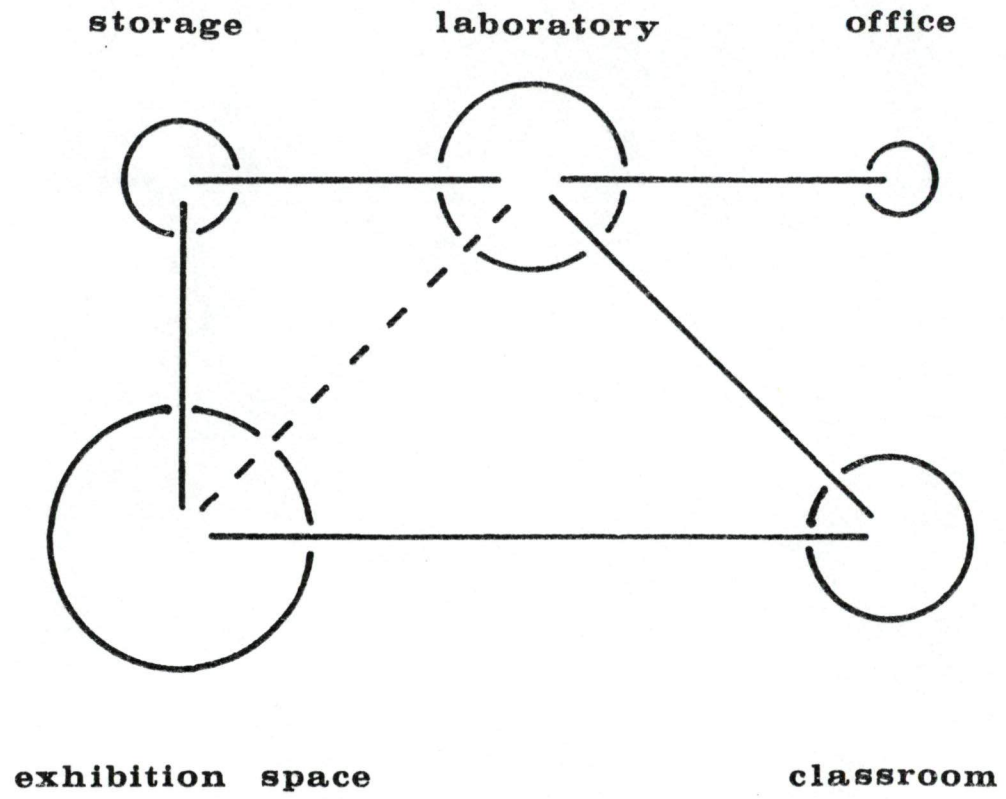
telescope chamber

workroom

GEOLOGY LAB

The sequence of movement is from an exhibition space to a classroom space to a laboratory space. The exhibition space and laboratory space have adjacent areas for material storage and supply. The laboratory also has an adjoining laboratory instruction office and is equipped with specialized tables and counter space appropriate for conducting experiments. The classroom is equipped with a projection alcove for displaying audio/visual material. The alcove will contain a closed circuit television monitor and rear screen projection equipment.

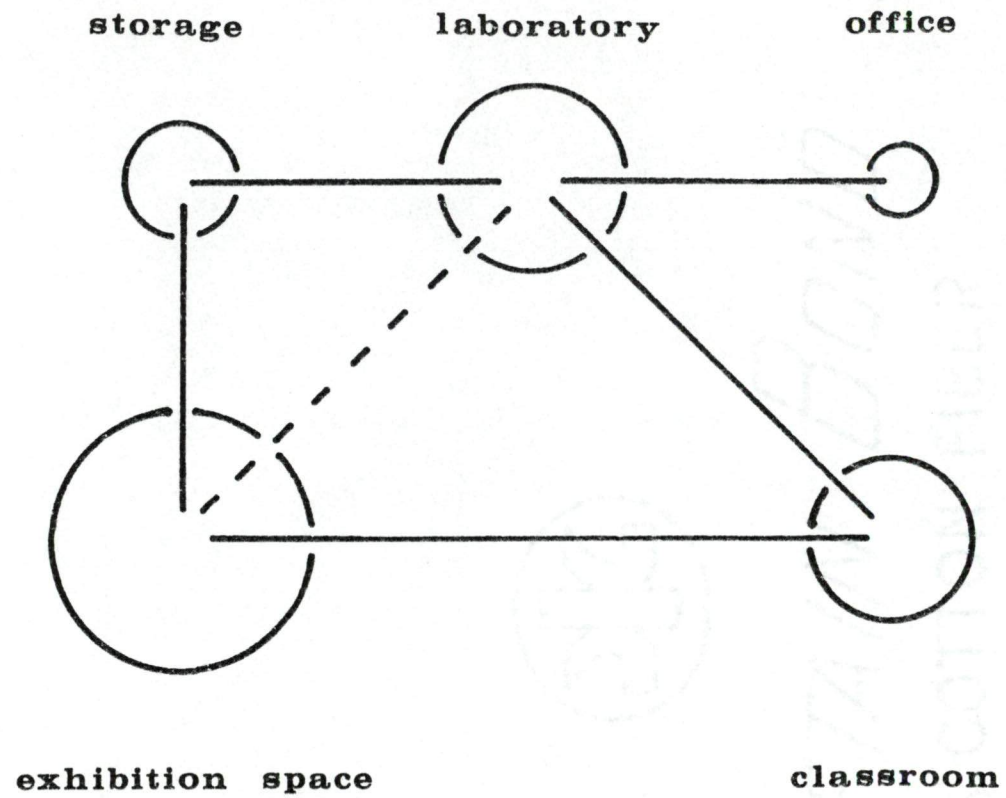
Exhibit space	3,000 sq. ft.
Laboratory	2,000 sq. ft.
Electron microscope	1,000 sq. ft.
Classroom	1,000 sq. ft.
Storage	600 sq. ft.
Office	200 sq. ft.
Toilets 2 @ 75	<u>150 sq. ft.</u>
TOTAL	7,950 sq. ft.



WATER RESOURCES LAB

In this component there is a sequence of introduction through exhibits, instruction through audio/visual aids, and experimentation through models. Adjacent to the exhibition and laboratory spaces are storage areas. An office is directly connected to the laboratory space. The classroom space is located adjacent to both the exhibition and laboratory spaces and is provided with a communications alcove for audio/visual instruction capabilities.

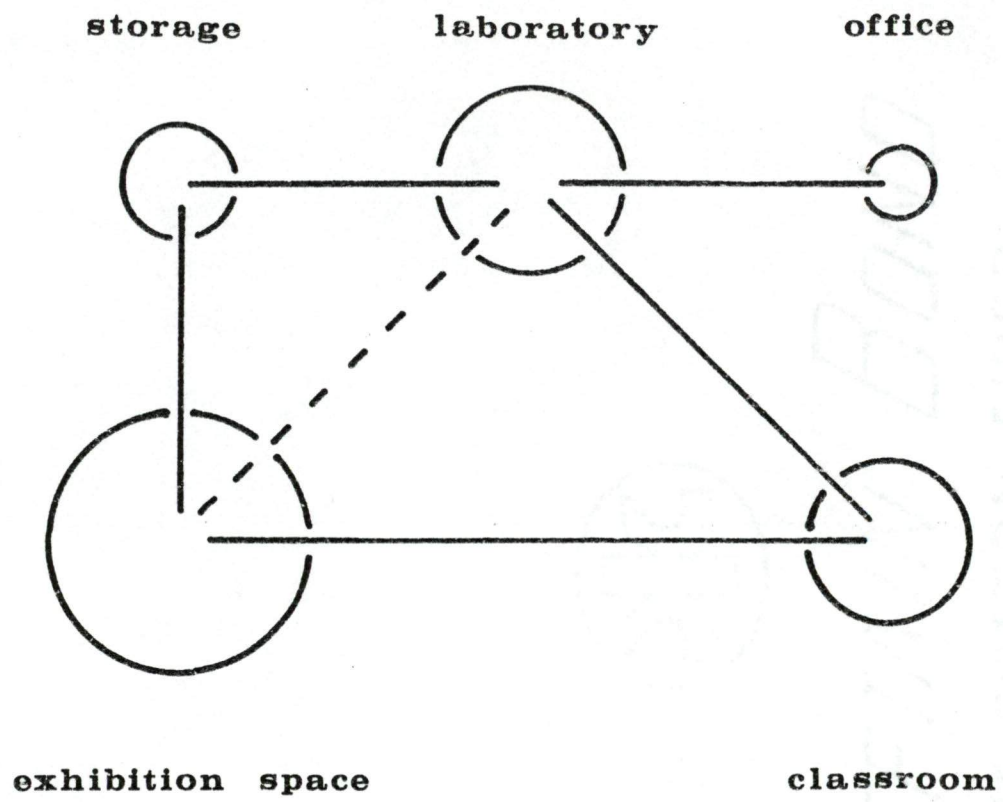
Exhibition space	3,000 sq. ft.
Laboratory	2,000 sq. ft.
Classroom	1,000 sq. ft.
Storage	600 sq. ft.
Office	200 sq. ft.
Toilets 2 @ 75	<u>150 sq. ft.</u>
TOTAL	6,950 sq. ft.



HORTICULTURE LAB

After an introduction in the field of horticulture, there is a sequence of movement into a classroom space then into a laboratory space. This sequence is based on public, semi-private, and private access. Storage areas are provided adjacent to the laboratory and exhibition spaces. Office space is provided for the laboratory space. The classroom is provided with an alcove consisting of a closed circuit television and rear screen projection equipment.

Exhibition space	3,000 sq. ft.
Laboratory	2,000 sq. ft.
Classroom	1,000 sq. ft.
Storage	600 sq. ft.
Office	200 sq. ft.
Toilets 2 @ 75	<u>150 sq. ft.</u>
TOTAL	6,950 sq. ft.



ENVIRONMENTAL MANAGEMENT LABS

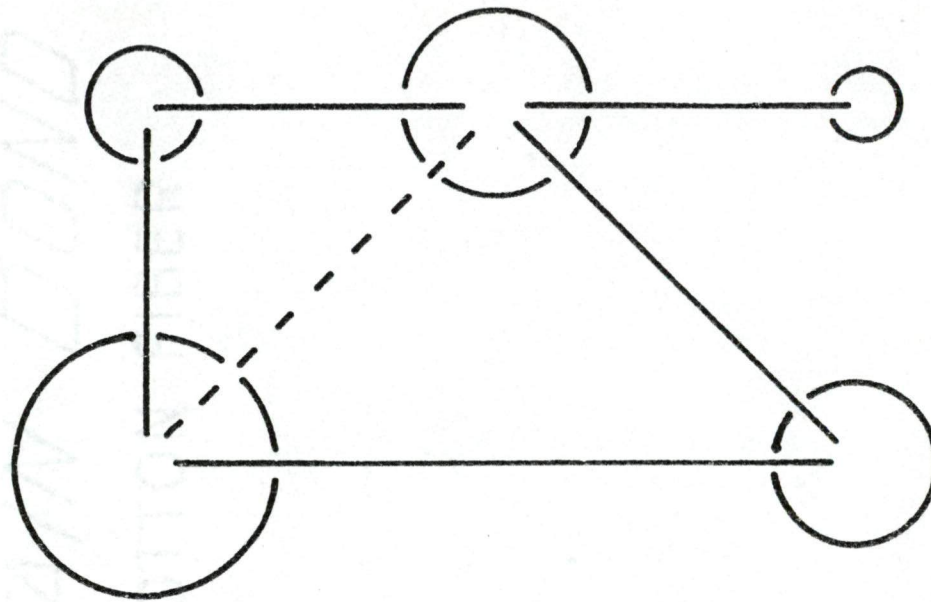
This subject is illustrated by two-and three-dimensional exhibits that are directly accessible to the public. Storage space is located adjacent to this space. A classroom space is located adjacent to the exhibition space and is equipped with an audio/visual alcove for presentation of materials relating to the field of environmental management. A laboratory space is adjacent to the classroom space and contains office space, storage space, and specialized laboratory work tables.

Exhibition space	3,000 sq. ft.
Laboratory	2,000 sq. ft.
Classroom	1,000 sq. ft.
Storage	600 sq. ft.
Office	200 sq. ft.
Toilets 2 @ 75	<u>150 sq. ft.</u>
TOTAL	6,950 sq. ft.

storage

laboratory

office



exhibition space

classroom

ENERGY LAB

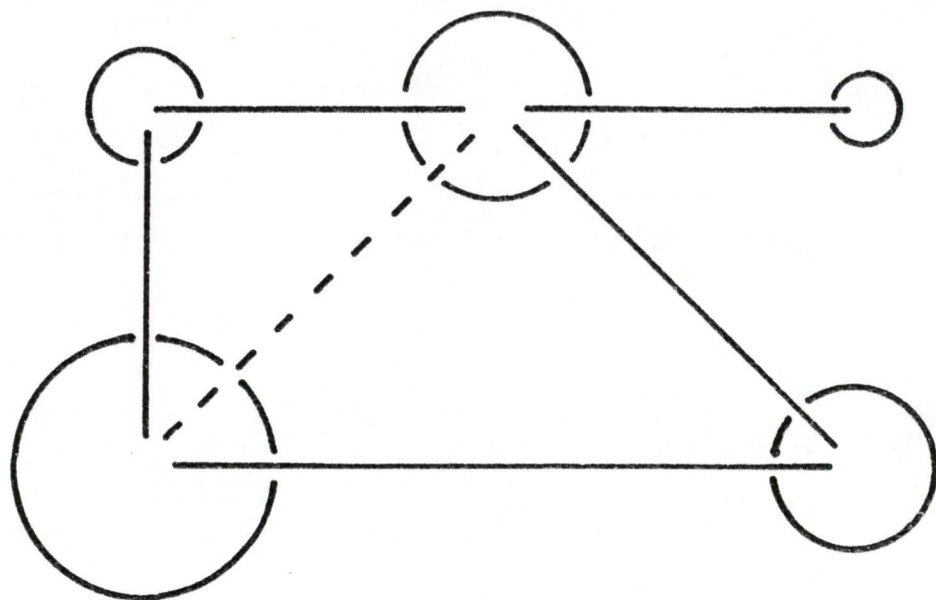
The sequence of movement in this component is from an exhibition space to a classroom space to a laboratory space. The exhibition and laboratory spaces are serviced by adjacent storage areas, while the classroom space is serviced by a communication alcove. This alcove contains space for rear screen projection equipment and a closed circuit television monitor. The laboratory is equipped with special countertops and an office is provided directly off of this space.

Exhibition space	3,000 sq. ft.
Laboratory	2,000 sq. ft.
Classroom	1,000 sq. ft.
Storage	600 sq. ft.
Office	200 sq. ft.
Toilets 2 @ 75	<u>150 sq. ft.</u>
TOTAL	6,950 sq. ft.

storage

laboratory

office



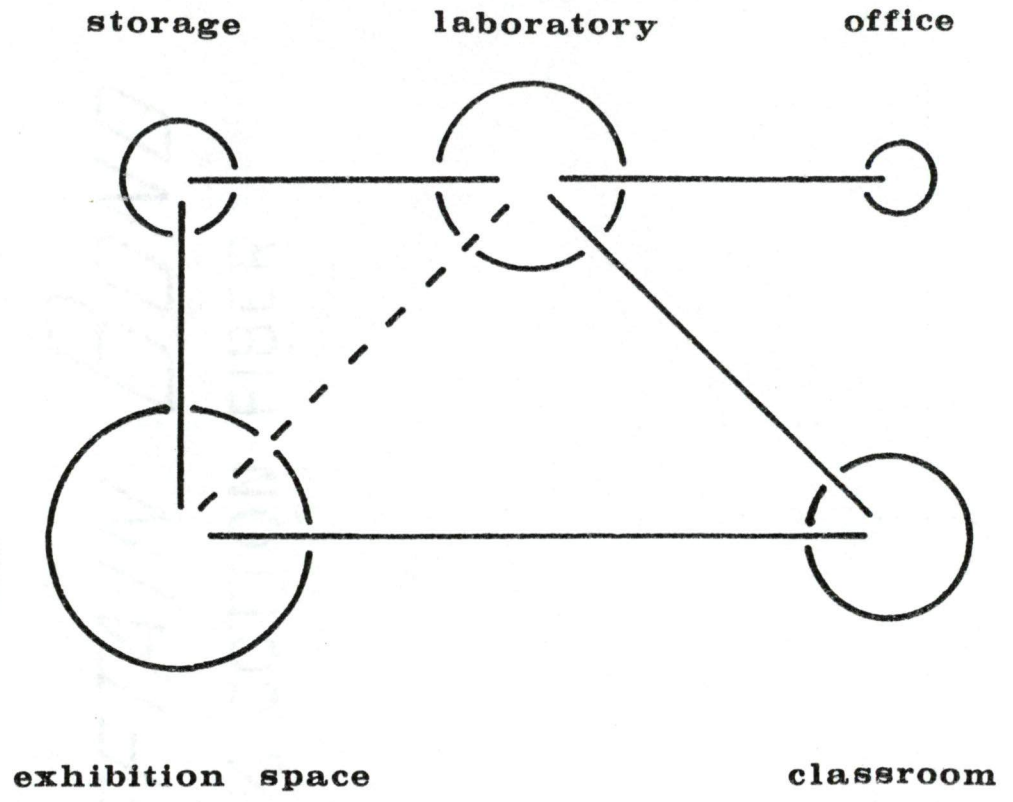
exhibition space

classroom

METEOROLOGY LAB

This component displays a variety of exhibits on the composition of the earth's atmosphere. This public exhibition space has an adjacent storage area. A classroom space is connected to the exhibition space and contains an audio/visual alcove comprised of a closed circuit television and rear screen projection equipment. A laboratory space is adjacent to the classroom space and contains space for an office and storage/supply room.

Exhibition space	3,000 sq. ft.
Laboratory	2,000 sq. ft.
Classroom	1,000 sq. ft.
Storage	600 sq. ft.
Office	200 sq. ft.
Toilets 2 @ 75	<u>150 sq. ft.</u>
TOTAL	6,950 sq. ft.



ADMINISTRATIVE SUPPORT

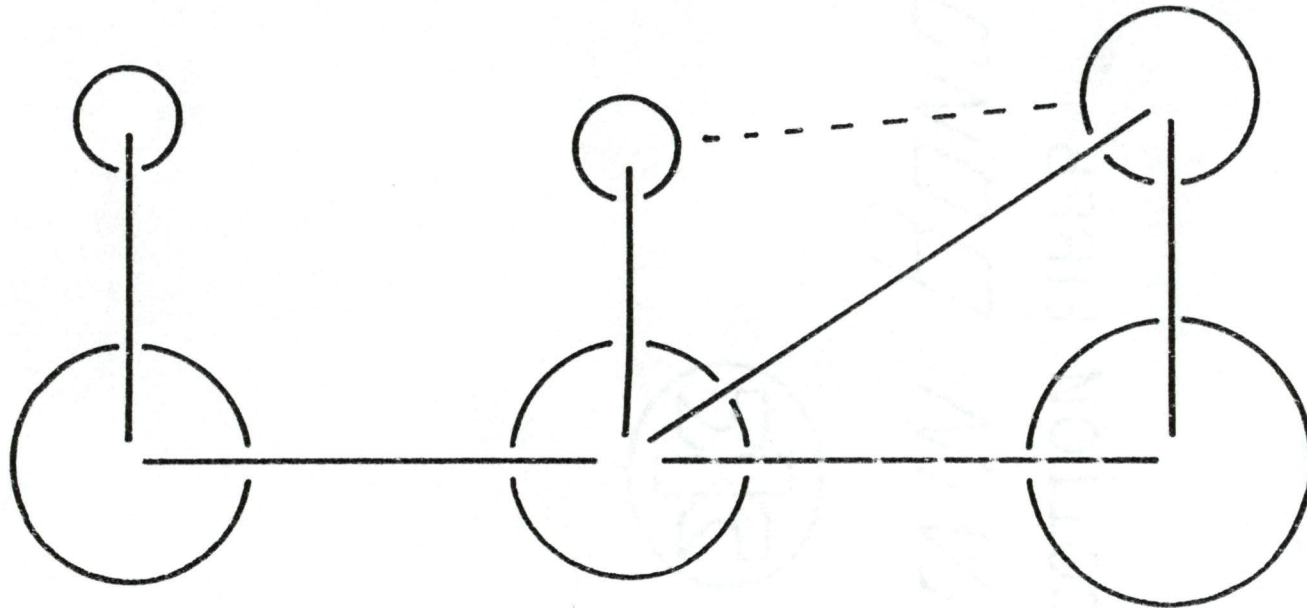
This area has direct access from the public lobby space. A receptionist and waiting area are located at the entrance to this area. Staff offices have a direct relationship to the waiting area as well as to the research library. A dining area will be provided that will serve approximately 100 people on special occasions. A food preparation area has direct access to the dining area and provides space to assemble food for catered events.

Lobby/waiting	2,000 sq. ft.
Receptionists 2 @ 200	400 sq. ft.
Research library	3,000 sq. ft.
Dining area	2,000 sq. ft.
Food preparation	400 sq. ft.
Offices 7 @ 200	1,400 sq. ft.
Toilets 2 @ 300	<u>600 sq. ft.</u>
TOTAL	9,800 sq. ft.

food preparation

receptionist

offices



dining area

lobby waiting

research library

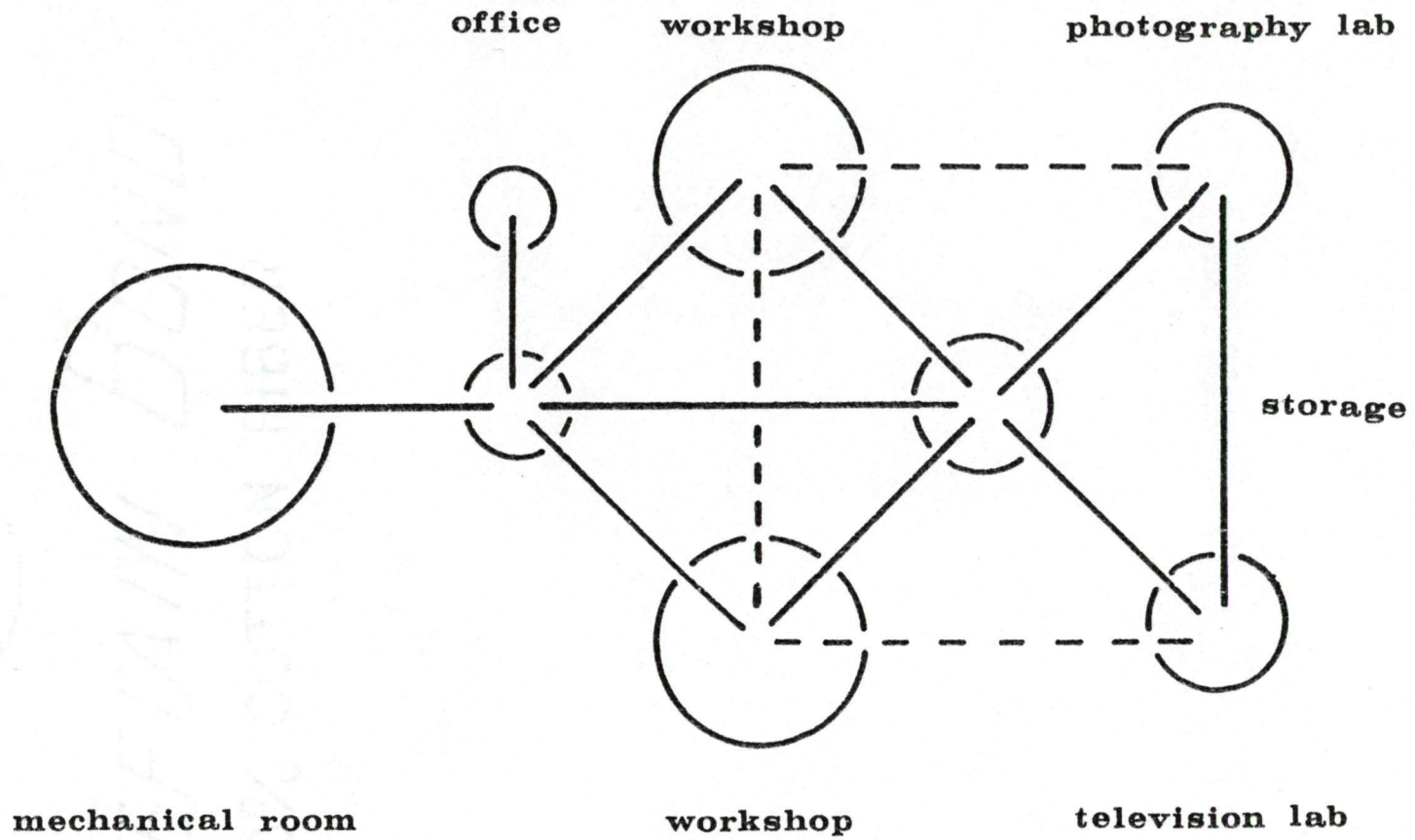
TECHNICAL SUPPORT AREA

This component has no direct access to the public. There is a direct relationship of physical and mechanical service to the building. This service occurs during the operation of the center and links the administrative and technical staff. Storage areas are directly related to the shipping and receiving platform and to the workshops and working laboratories. The mechanical equipment area is serviced directly from the loading platform. An office is provided at the entrance to the service area for supervision and control.

Loading platform	800 sq. ft.
Workshops 2 @ 2500	5,000 sq. ft.
Storage	1,000 sq. ft.
Closed circuit TV lab	1,000 sq. ft.
Photography lab	1,000 sq. ft.
Mechanical equipment room	7,500 sq. ft.
Office	200 sq. ft.
Toilets 2 @ 200	400 sq. ft.
TOTAL	16,900 sq. ft.

total bldg. → 92,200 \$

admin. supp. 9 800
 meteorology lab 6 950
 energy lab 6 950
 environ. man. lab 6 950
 horticulture lab 6 950
 water res. lab 6 950
 geology lab 7 950
 observatory 4 700
 planetarium 18 100



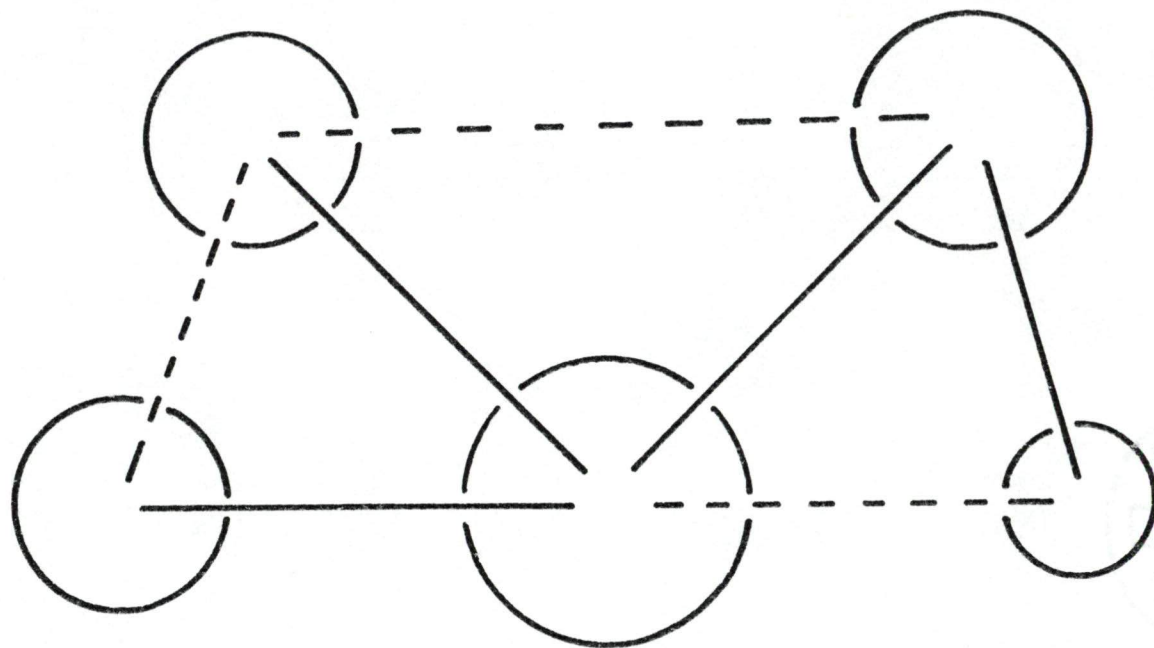
OUTDOOR FACILITIES

These facilities are an integral part of the environmental science center. The nature trails directly relate to the building and parking areas and are located throughout the site on paths established by natural scientists in conjunction with criteria set forth in this project. The amphitheater and picnic areas have direct access to the parking areas and are visually and acoustically separated from the remainder of the site by the southwestern ridge of the mountain.

Nature trails	1½ miles (+)
Lake	1 acre (4 million gallons)
Picnic area	2 acres
Amphitheater	2 acres
Parking - cars	400
- buses	30

picnic area

nature trails



amphitheater

parking lot

lake

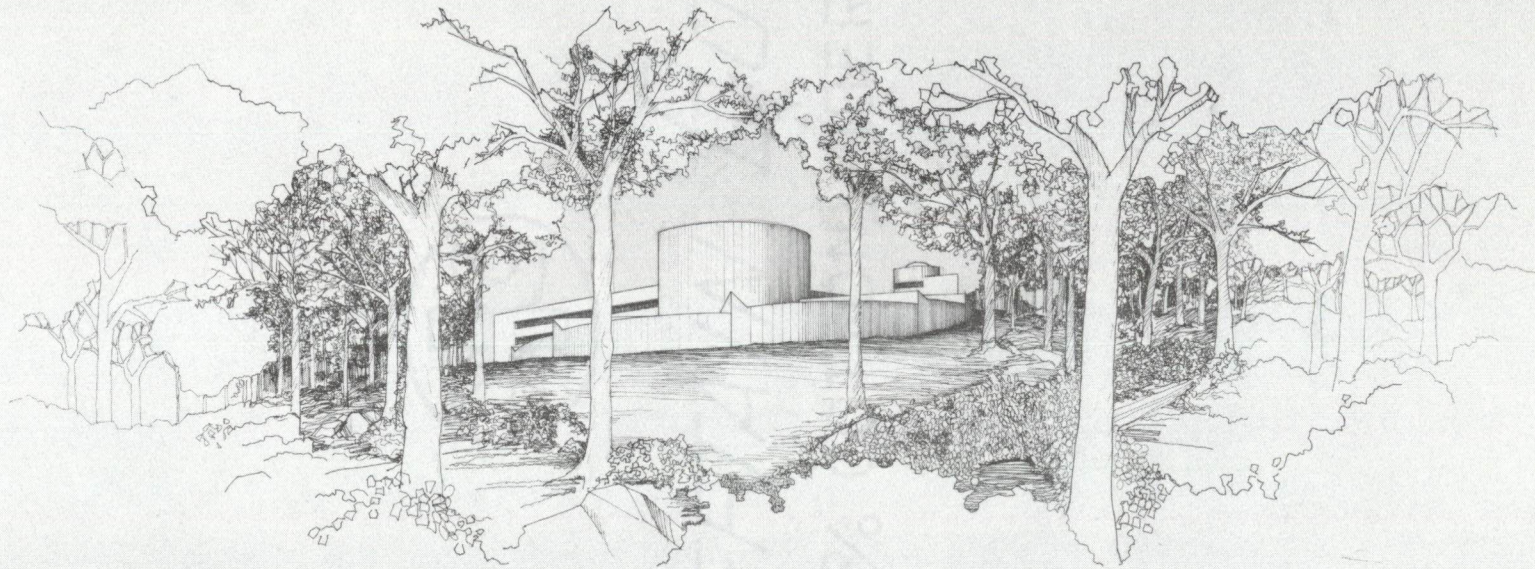
50% COTTON FIBER
MADE IN U.S.A.

PROPOSED STAFFING

	S&N	Director	1
	earth	Planetarium	
		Astronomer	1
		Technician	2
		Engineer	1
	life	Electron microscope	1
	life	Horticulturist (+4 staff)	5
	S&N	Materials production (artists)	4
	S&N	Television coordinator	1
(all)	S&N	Secretaries	3
	S&N	Clerks	3
(all)		Receptionists	2
	S&N	Security	2
(all)		Custodians	<u>5</u>
		TOTAL	30 people
		photographers	

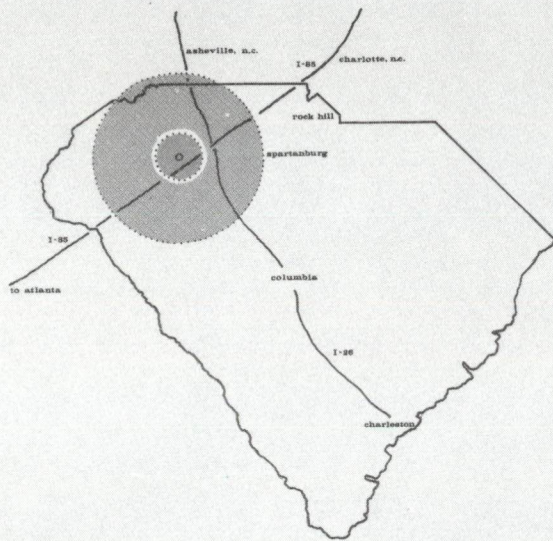
7 offices

graphic solution





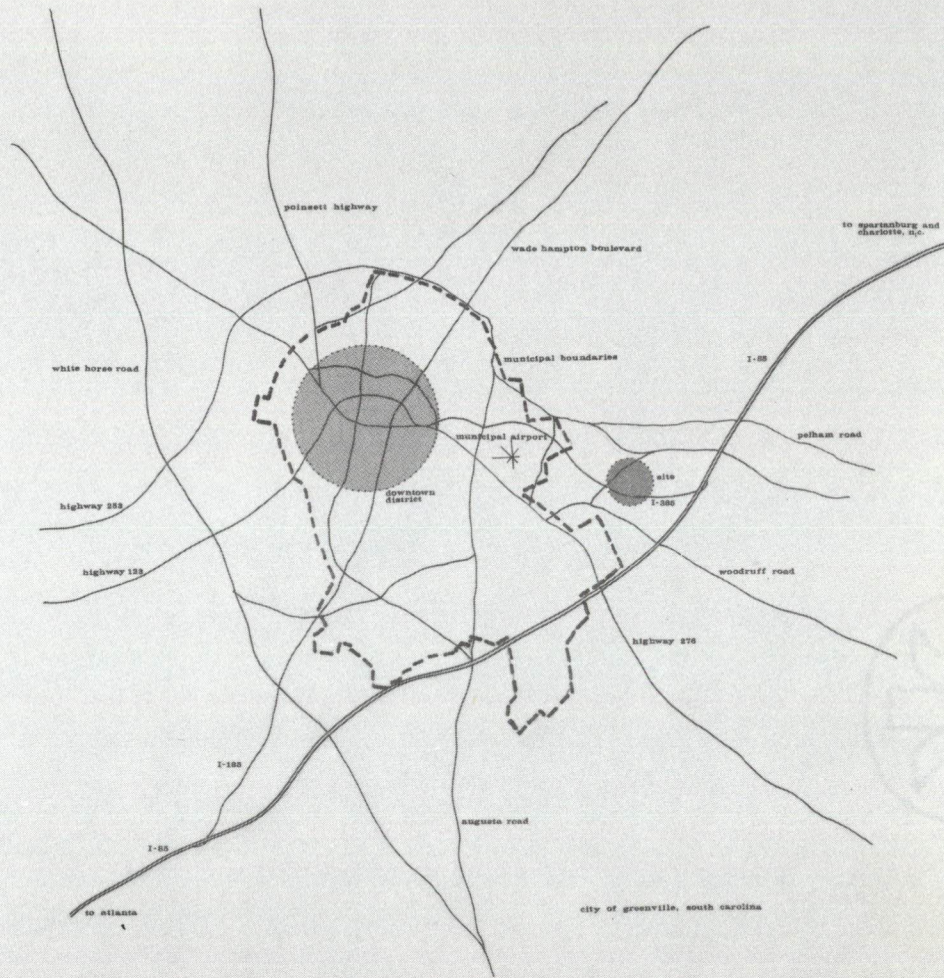
AN ENVIRONMENTAL SCIENCE CENTER

a terminal project submitted to the faculty of the college of architecture, Clemson University in partial fulfillment of the requirements for the degree of master of architecture. _____ James Carl Hambright, III *James Carl Hambright*



legend




-  approximate immediate area to be served by the center
-  approximate radius of impact and potential utilization of the center

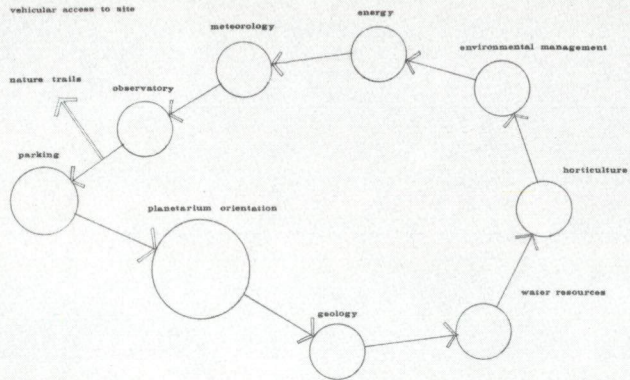


LOCATOR



greenville, s. c.

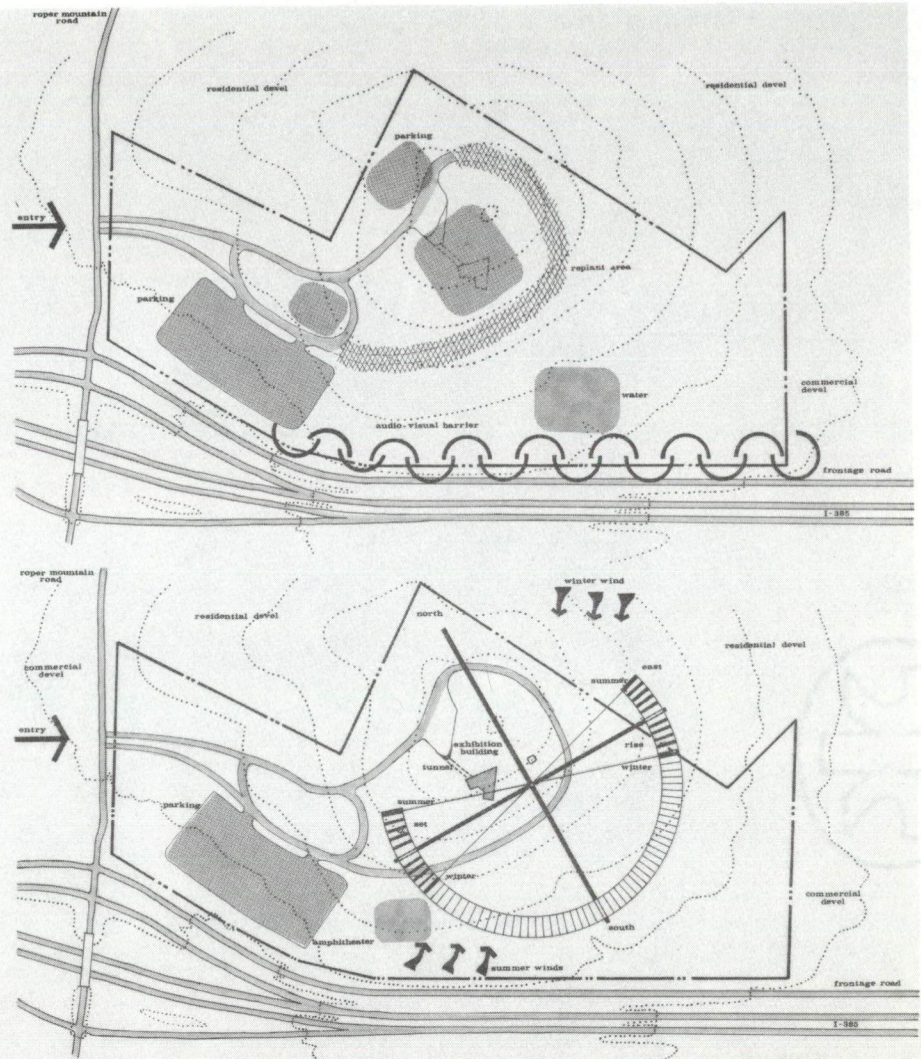
legend

-  proposed use areas
-  altered areas
-  vehicular access to site

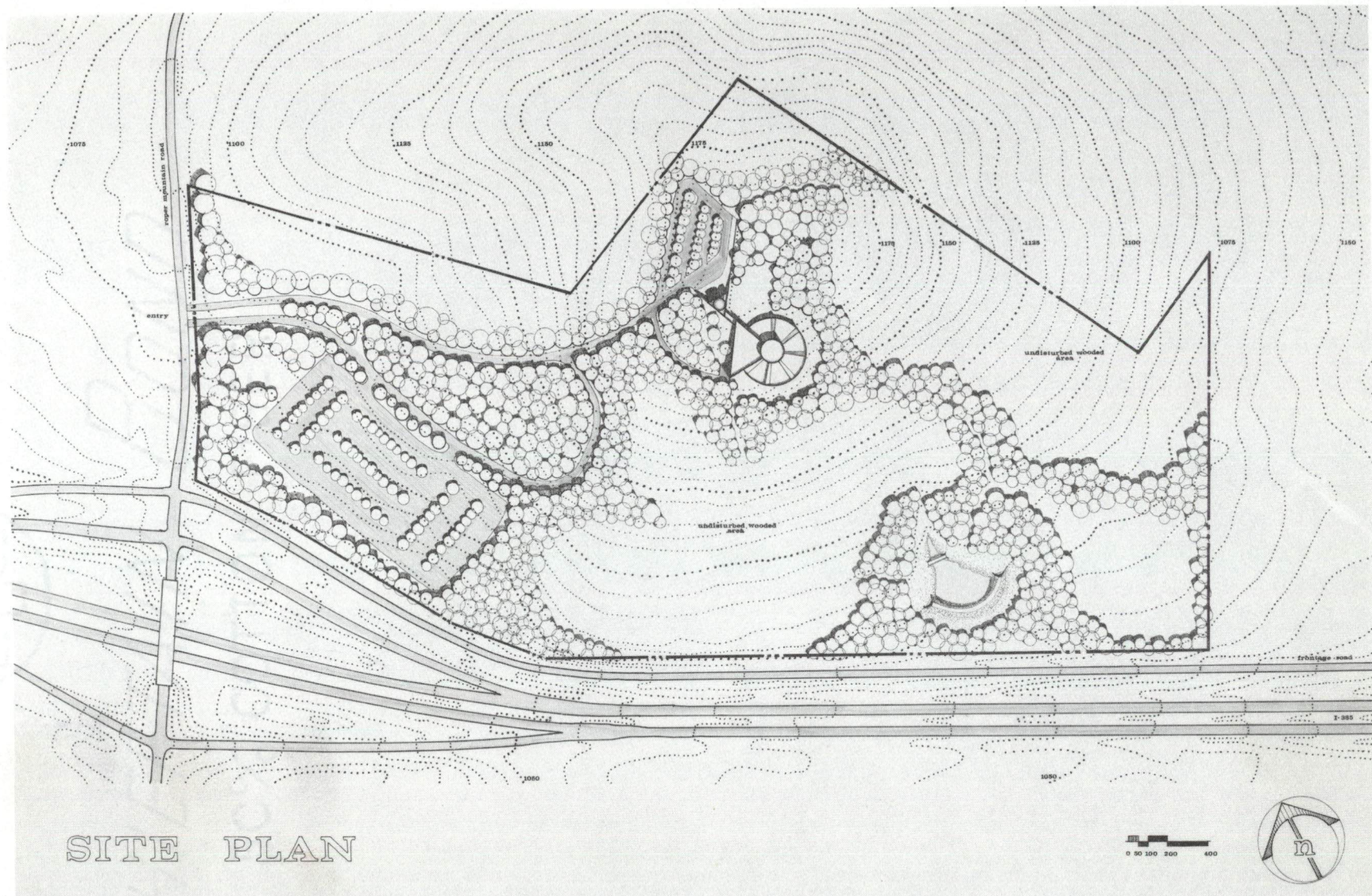


legend

-  existing factors
-  vehicular access to site

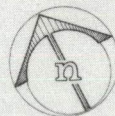


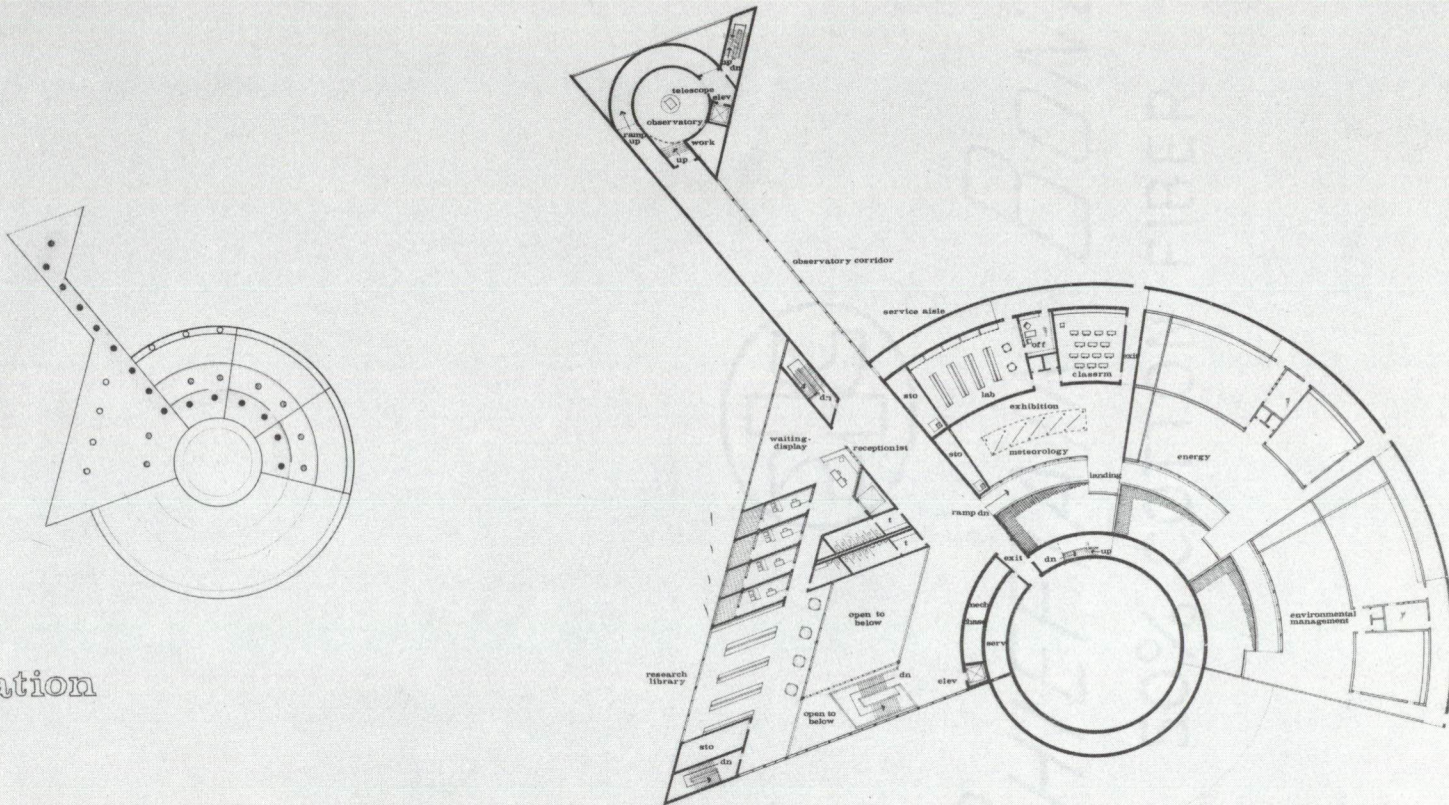
SITE - CONCEPTS



SITE PLAN

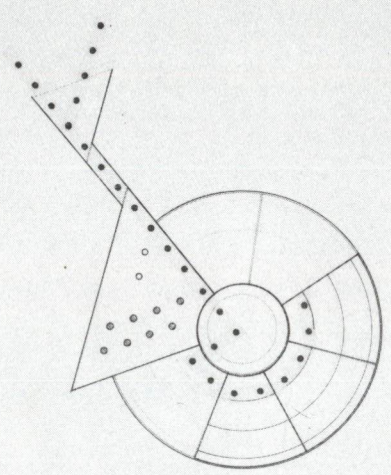
0 50 100 200 400





UPPER FLOOR PLAN

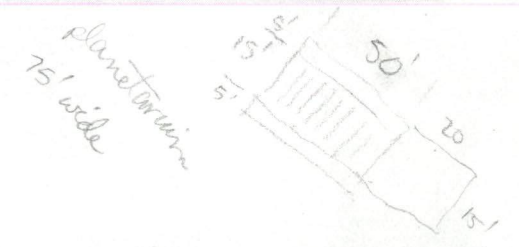
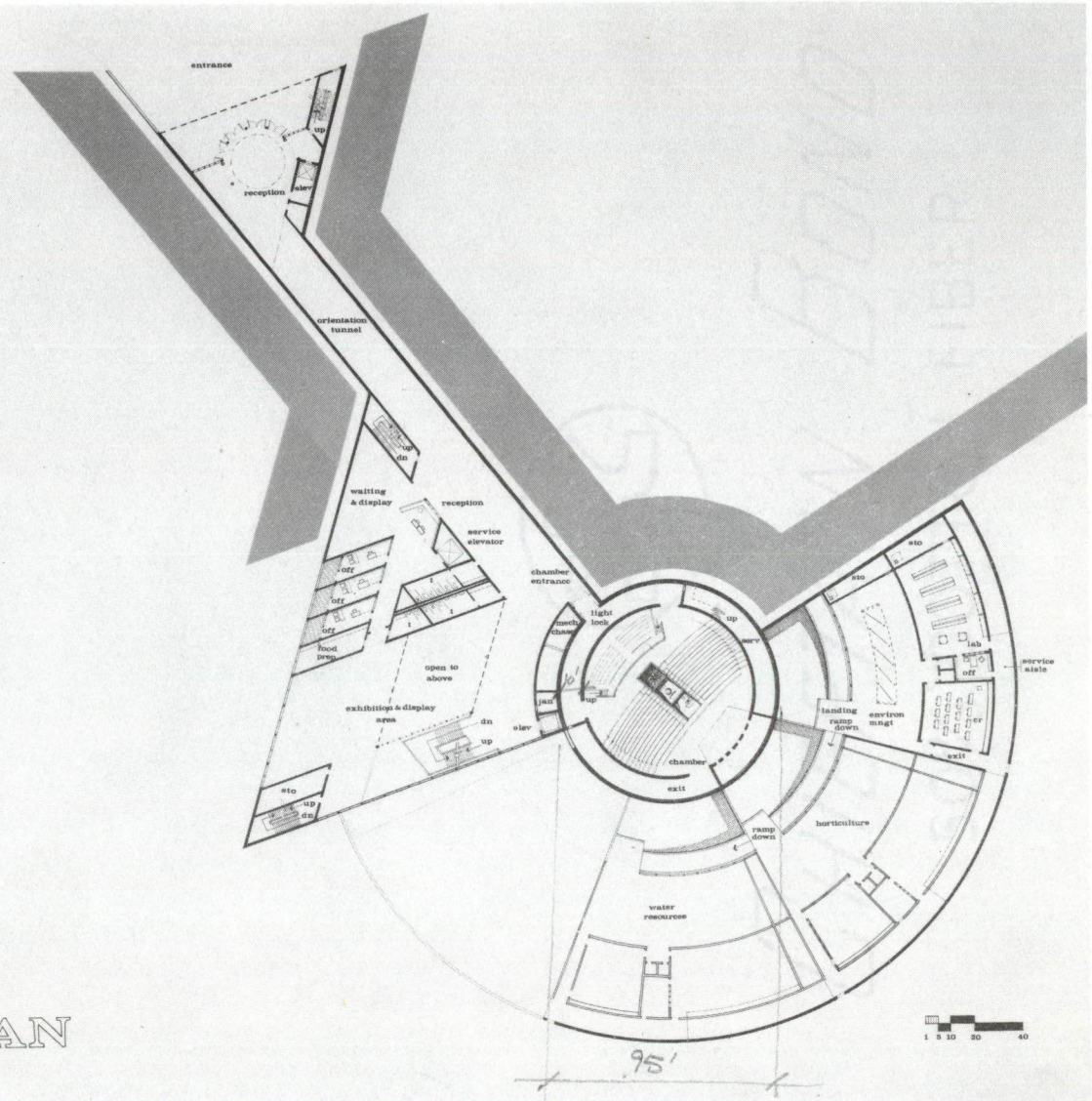
observatory with beam

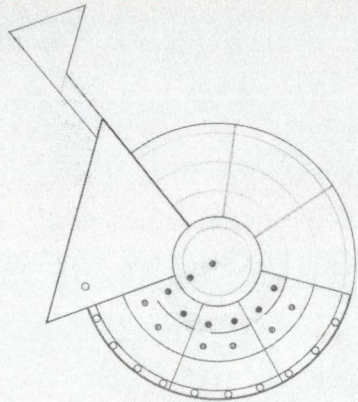


circulation

- primary
- secondary
- staff

MAIN FLOOR PLAN

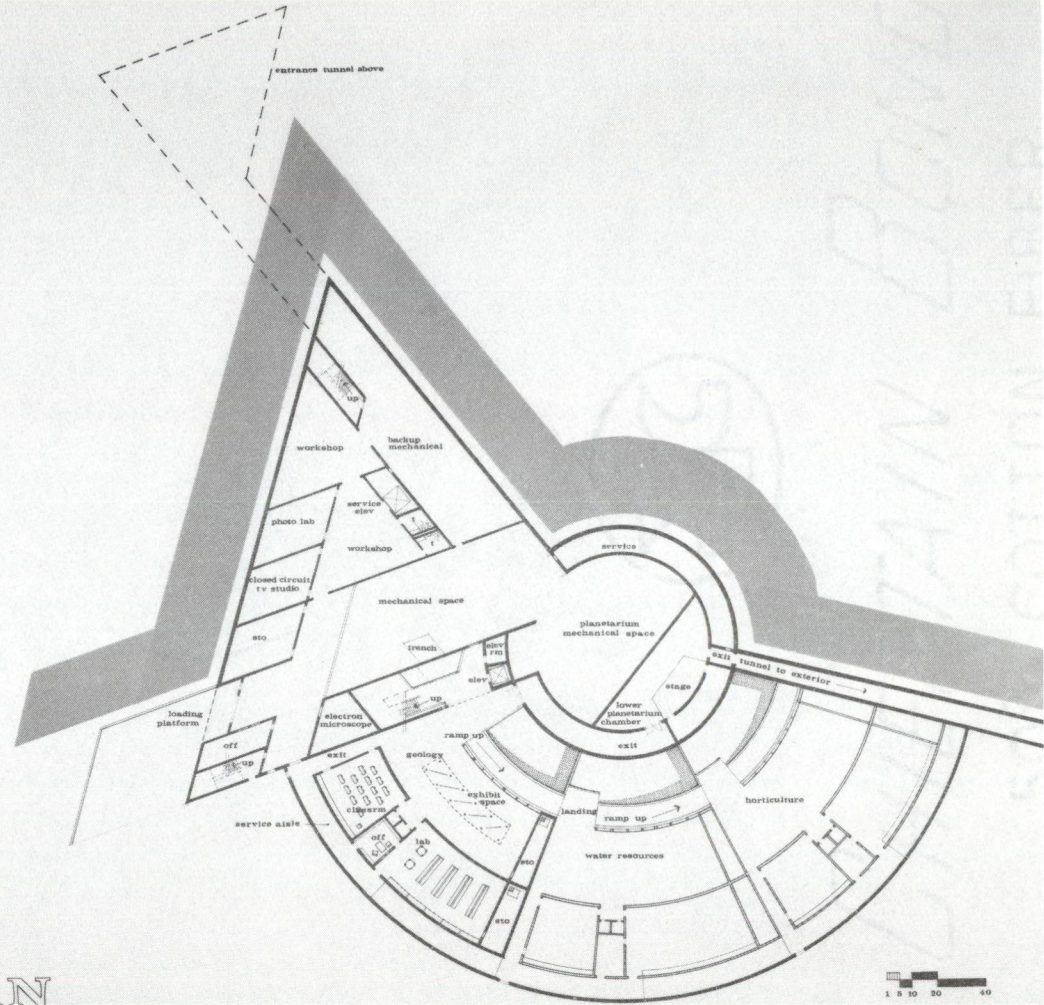


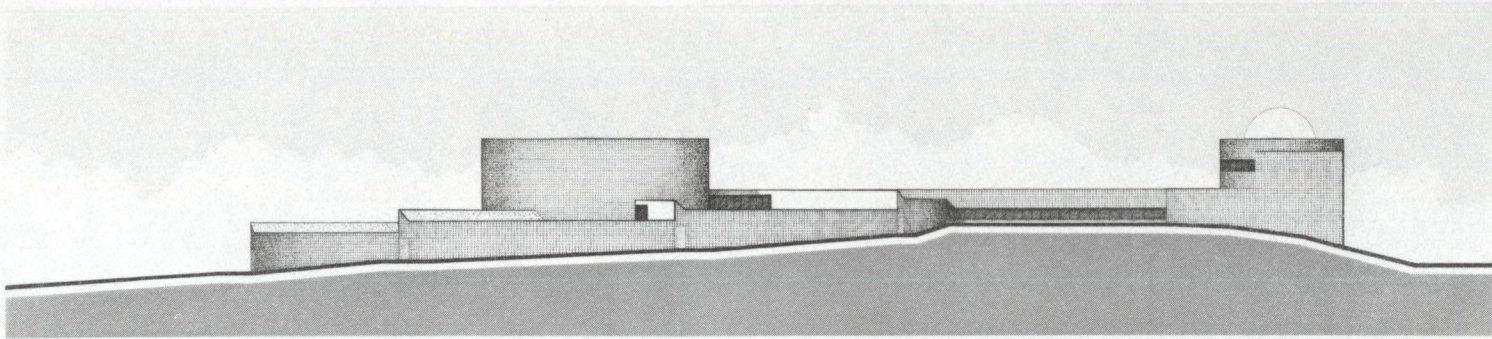


circulation

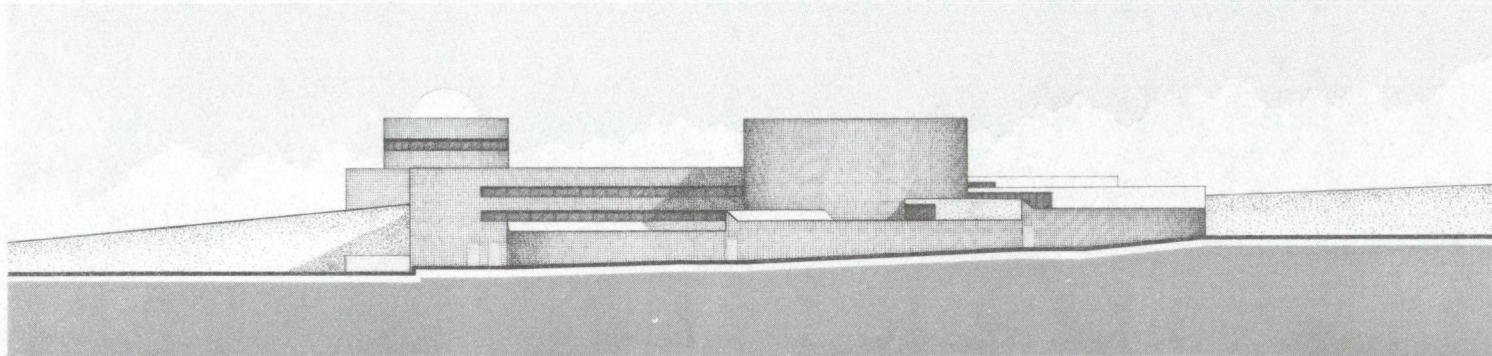
- primary
- secondary
- staff

LOWER FLOOR PLAN



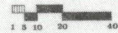


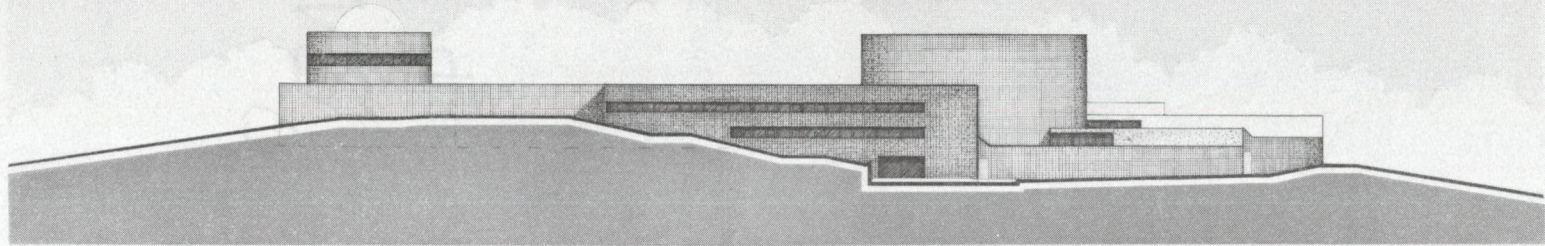
east



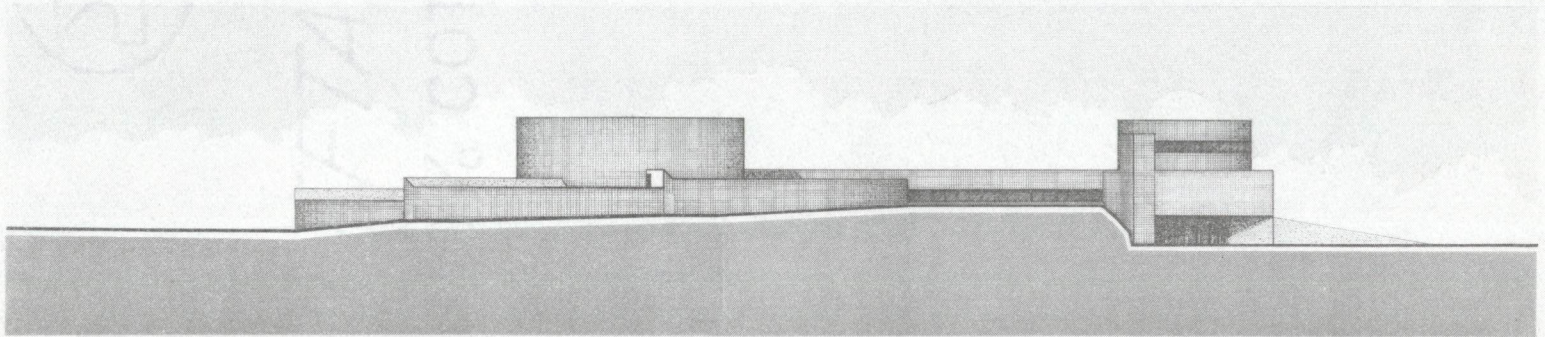
south

ELEVATIONS



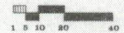


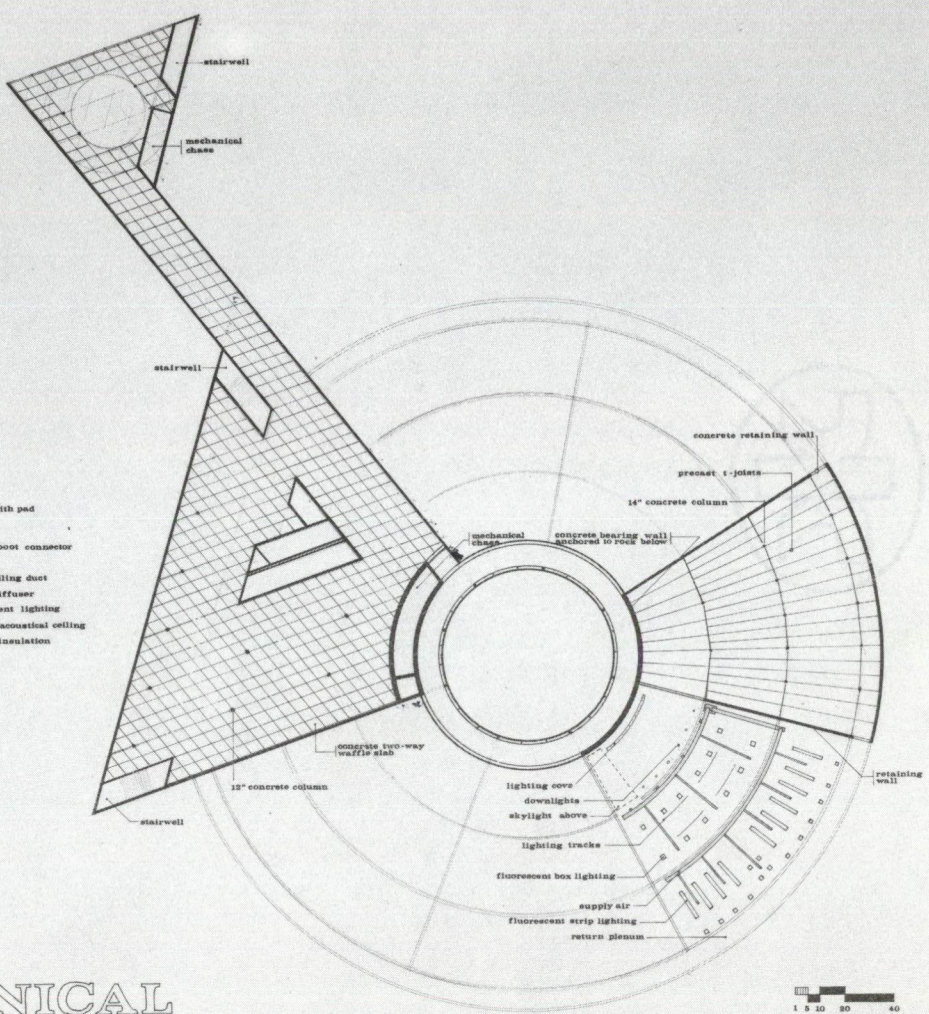
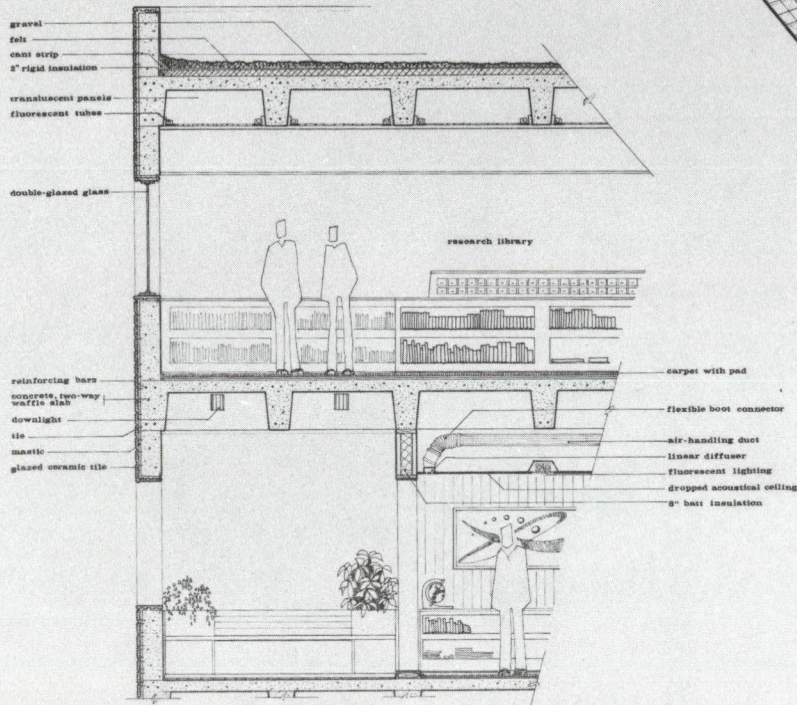
west



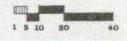
north

ELEVATIONS





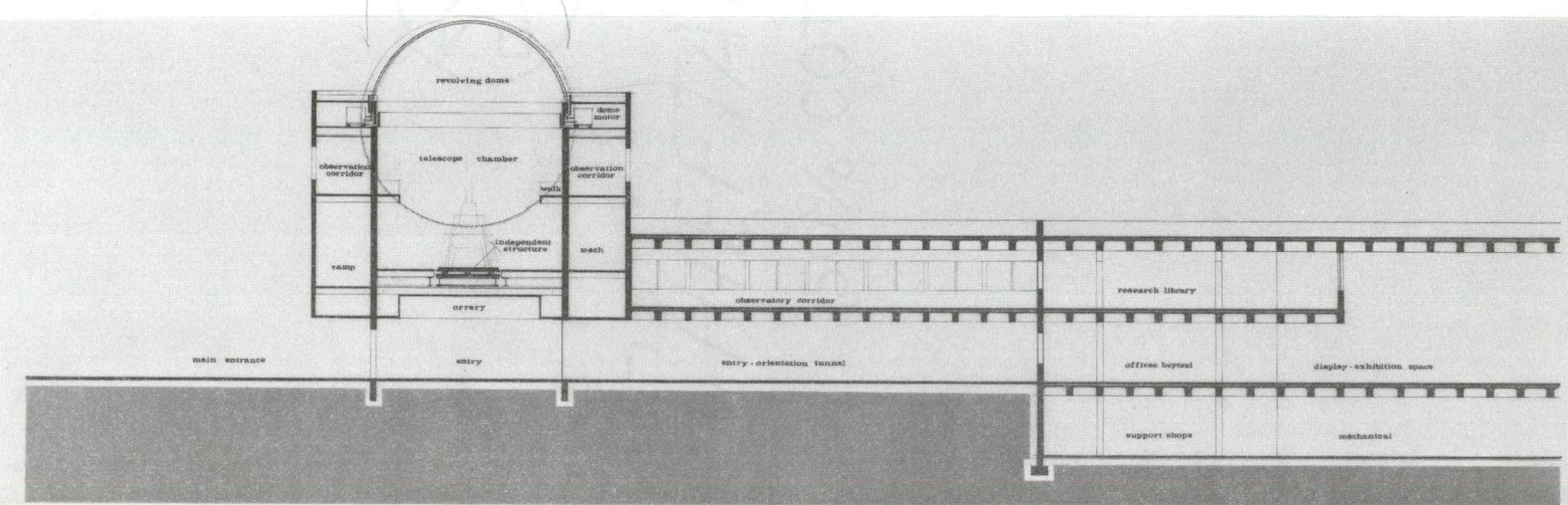
STRUCTURAL - MECHANICAL



DRAWING NO. 10000

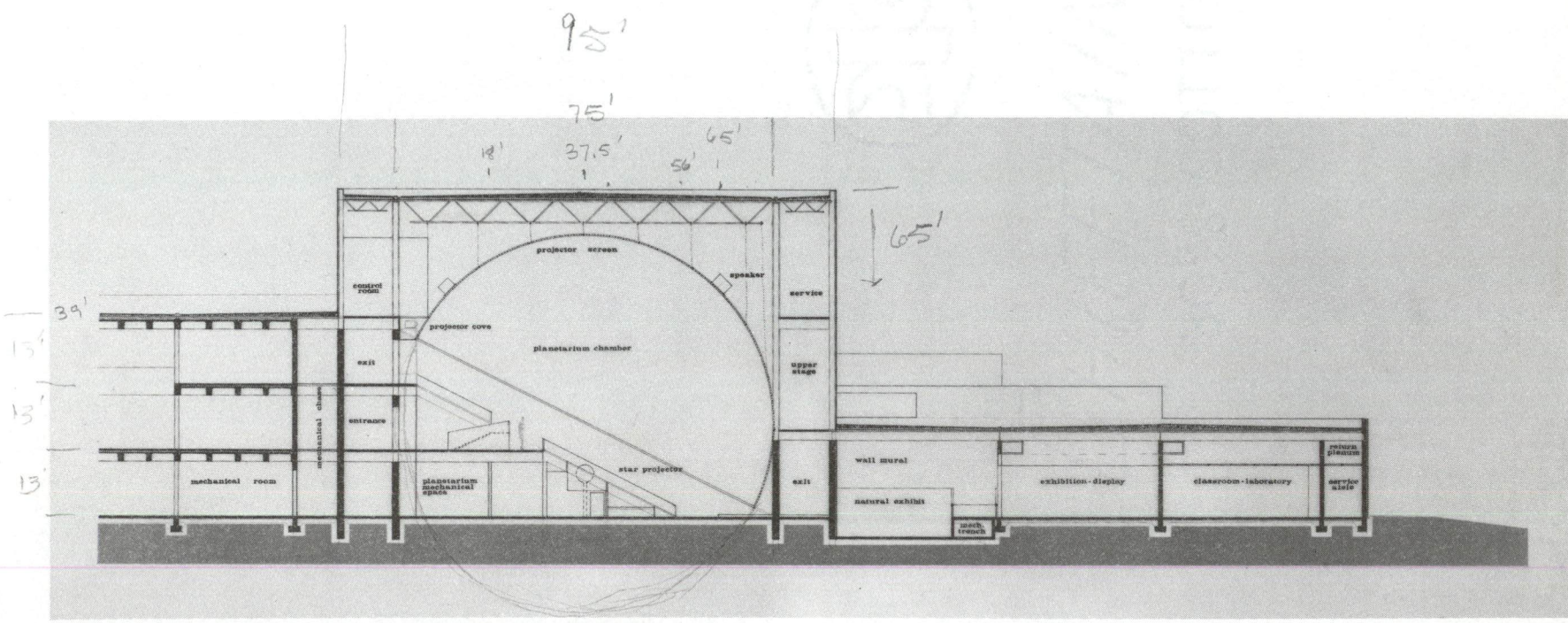
UNIVERSITY OF
BOSTON
BOSTON FINER

35'

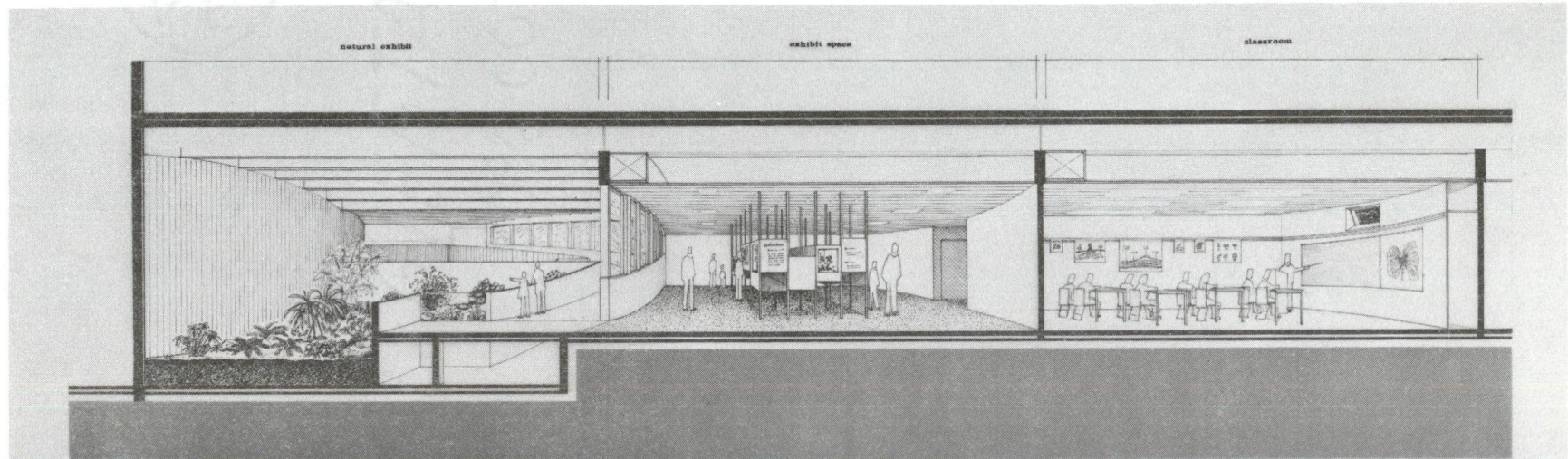


LONGITUDINAL SECTION A-A

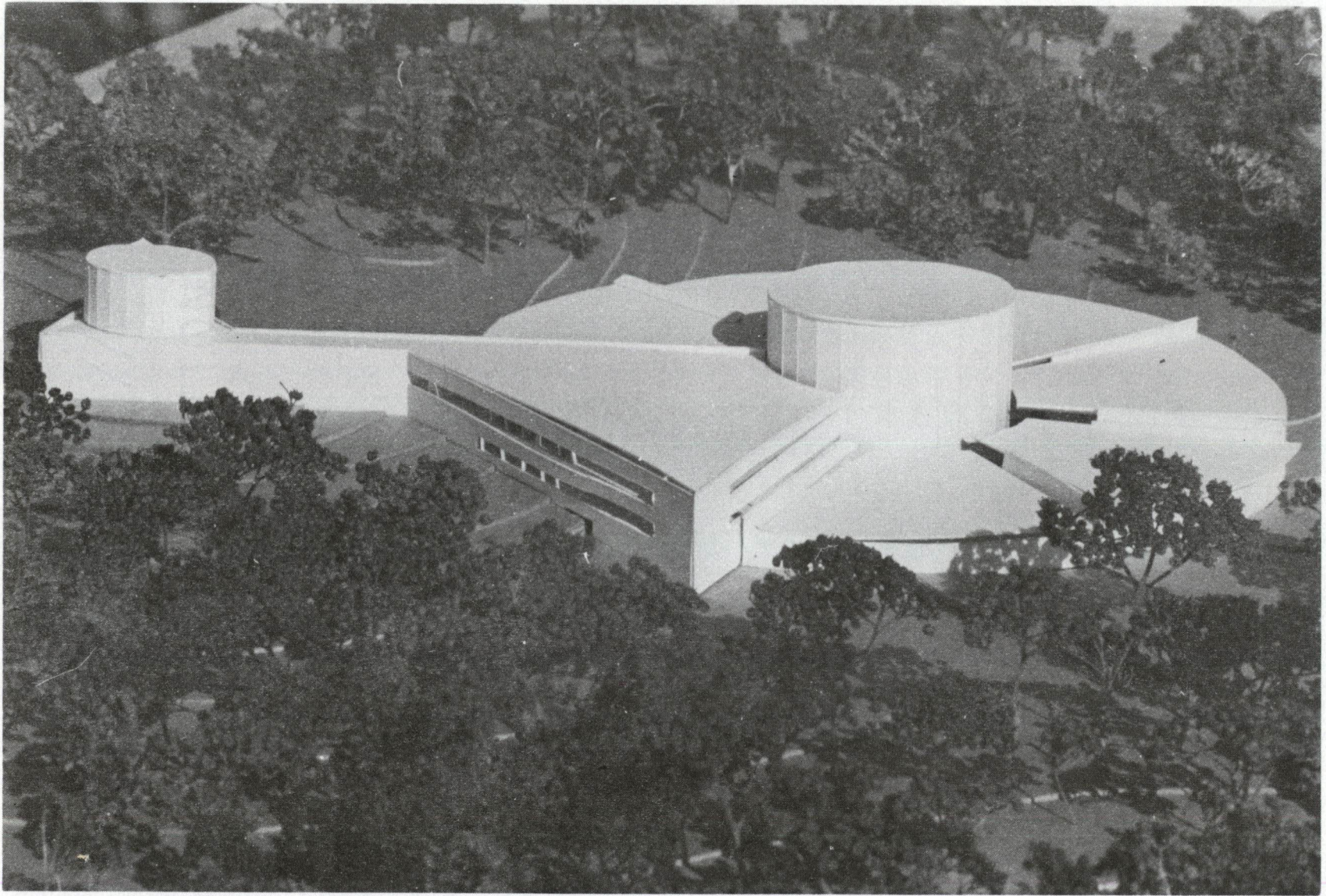
PLAN ROOM
STAIRWELL

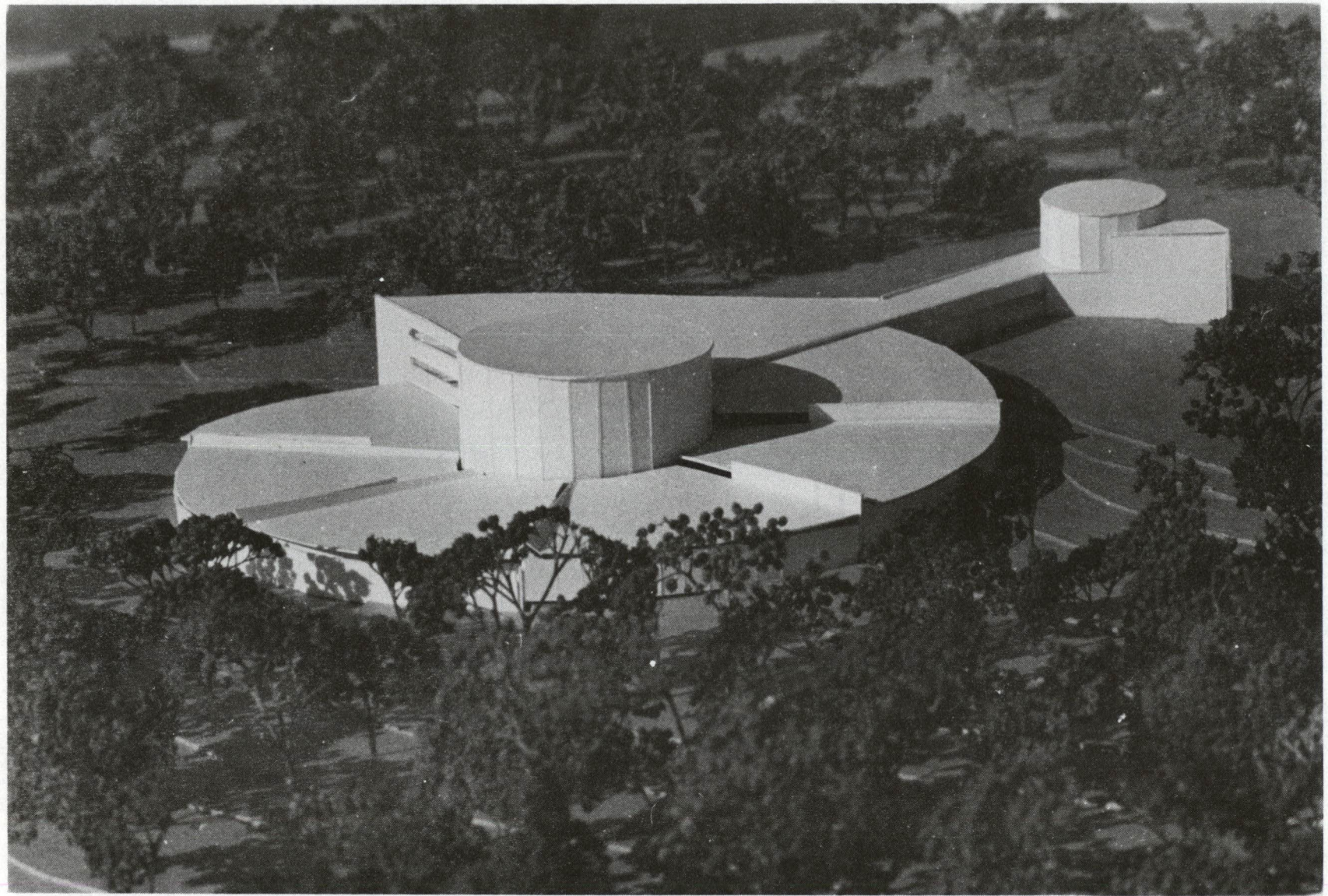


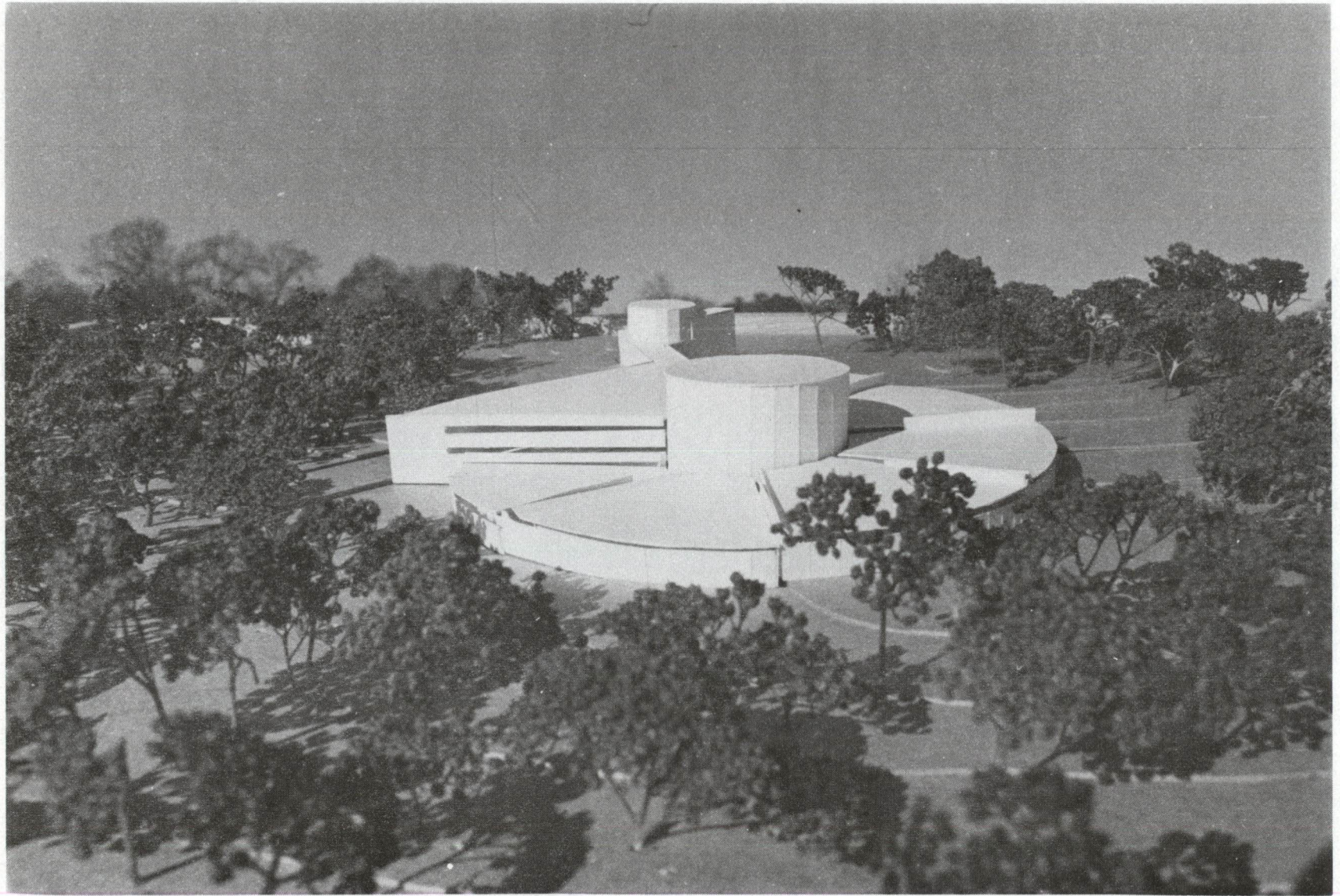
SECTIONAL PERSPECTIVE



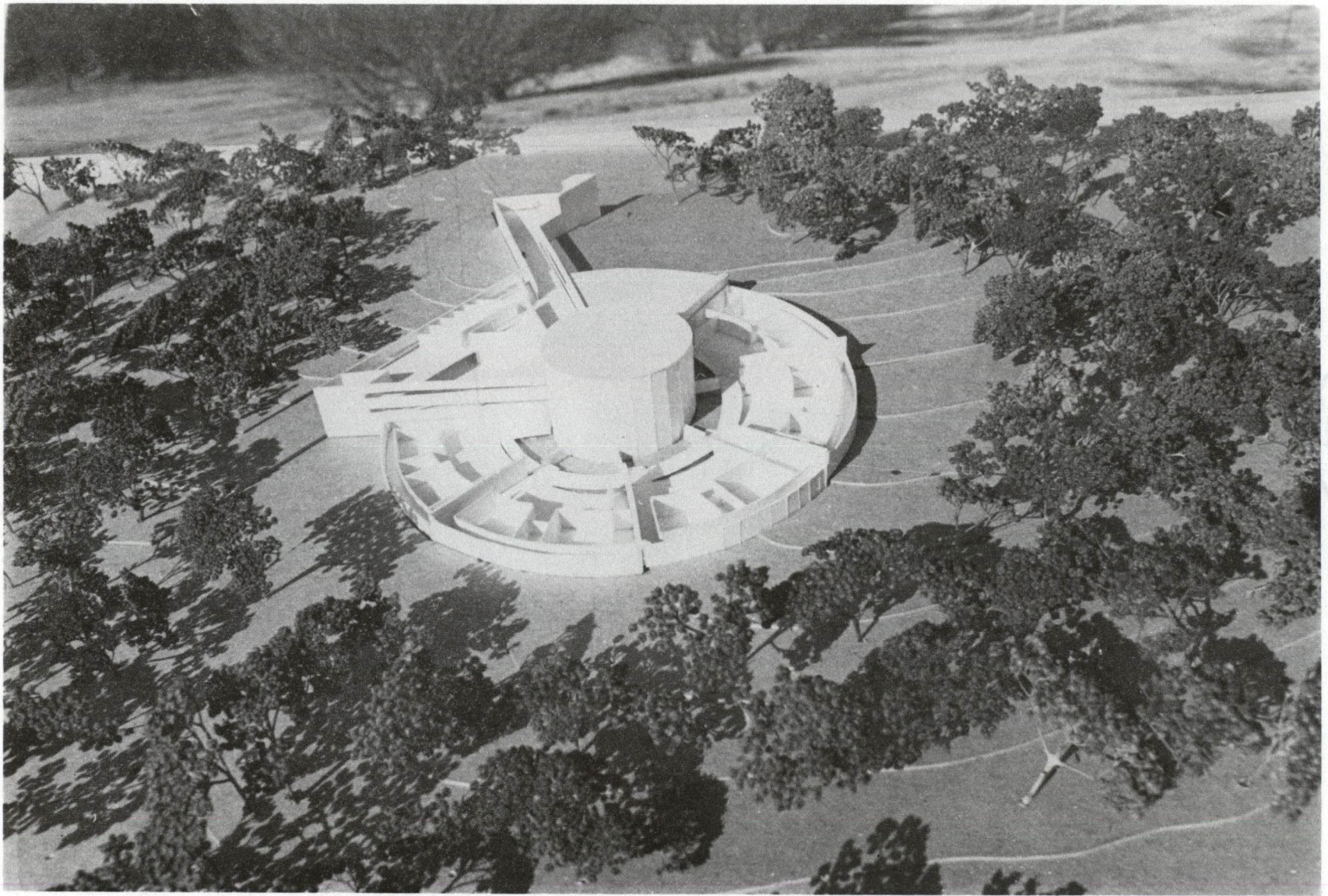
SECTIONAL PERSPECTIVE



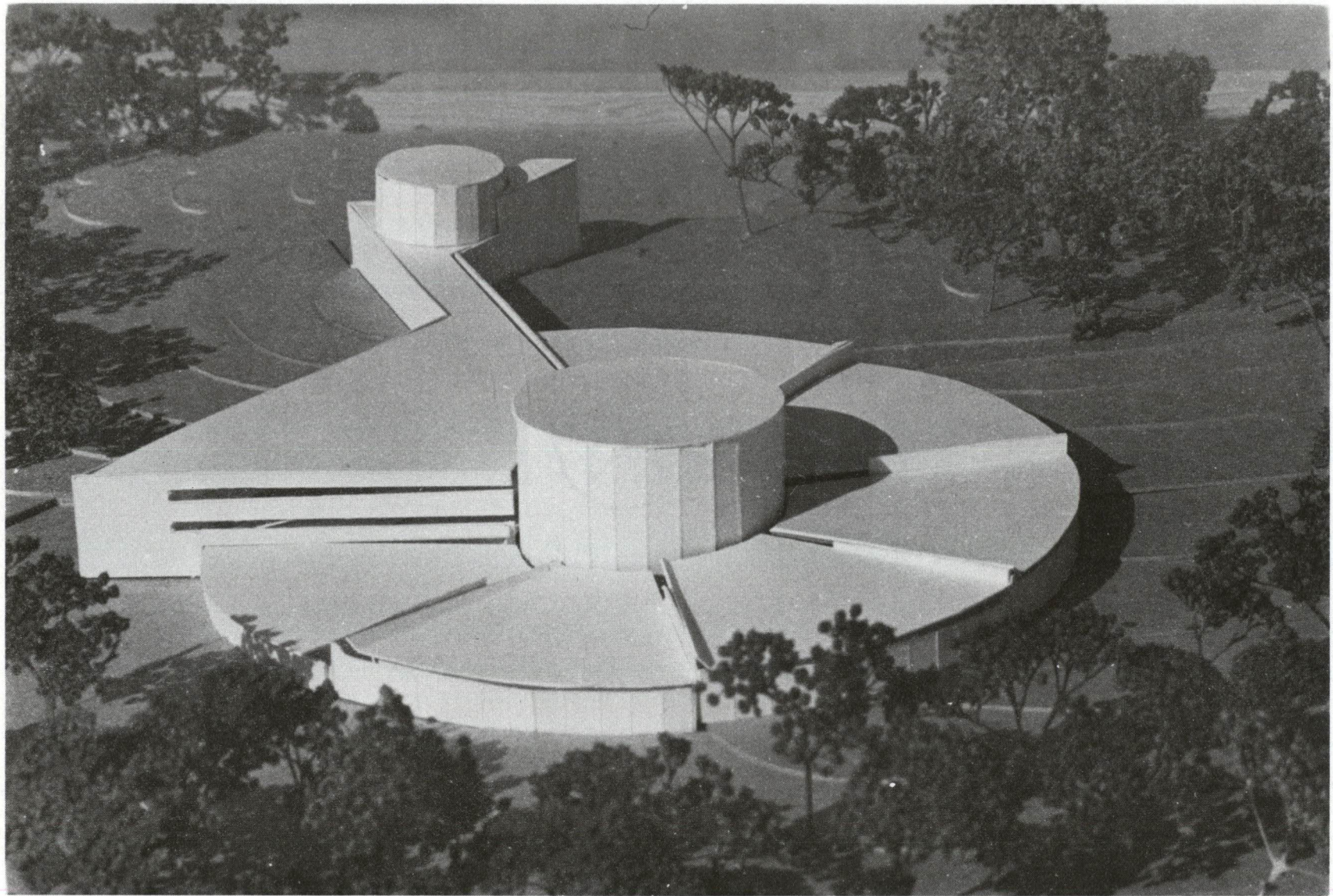




BRISTOL BROAD



BRISTOL BROAD



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