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ARCHITECTURAL DESIGN OF THE SCIENCE COMPLEX AT ELIZABETH CITY STATE UNIVERSITY

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This paper gives an overall view of the architectural design process and elements in taking an idea from conception to execution. The project presented is an example for this process. Once the need for a new structure is established, an architect studies the requirements, opinions and limits in creating a structure that people will exist in, move through and use.

Elements in designing a building include factors such as volume and surface, light and form changes of scale and view, movement and stasis. Some of the other factors are functions and physical conditions of construction. Based on experience, intuition and boundaries, an architect will utilize all elements in creating a new building.

In general, the design process begins with studying the spatial needs which develop into an architectural program. A comprehensive and accurate architectural program is essential for having a successful building. The most attractive building which does not meet the functional needs of its users has failed at the primary reason for its existence. To have a good program an architect must have a full understanding of the daily functions that will take place in the building.

The architectural program along with site characteristics are among a few of the important guidelines in studying the form, adjacencies and circulation for the structure itself and also in relation to the adjacent structures. Conceptual studies are part of the schematic design, which is the first milestone in the design process. The other reference points are design development and construction documents. At each milestone is established review and coordination with all the consultants and the user is essential in refining the project. In design development phase conceptual diagrams take shape, architectural, structural, mechanical and electrical systems are developed. The final phase construction documents convey all the information required to construct the building.

The design process and elements described were applied in the following project.

SCIENCE COMPLEX

The Science Complex at Elizabeth City State University in North Carolina was constructed in 1989 and houses the major undergraduate Science curricula at the university. Primarily, the programs include Biology, Geo-Science, Physics, and Chemistry. The entire instructional program includes classrooms, laboratories, support facilities, and faculty and administrative space. In addition, the complex features a Science theatre/planetarium and a lecture hall to be used by the community.

The following is the architectural program as approved by the university planning committee for the science complex:

		No. of Rooms	Capacity (persons)
A.	General Purpose Instructional Fac.		
1.	Lecture Hall	1	180
2.	Science Theatre/Planetarium	1	60
3.	General Purpose Classrooms	3	35
4.	Lecture Classrooms (Tiered)	2	60
5.	Seminar Rooms	4	20
6.	Micro-Computer Laboratory	1	25
7.	Library/Enrichment Center	1	—
B.	Laboratories		
1.	Biology	2	35
2.	Chemistry	2	35
3.	Physics	2	30
4.	Geo-Science	2	30
5.	Research Laboratories	16	8-10
6.	Cartography Room	1	—
7.	Animal Room	1	—
8.	Greenhouse	1	—
9.	Electron Microscope Room	1	—
C.	Support Spaces (Instructional)		
1.	Storage and Preparation Rooms	8	—
2.	Central Supply Rooms	2	—
3.	Balance Room	1	—
4.	Walk-In Freezer (Cold Room)	1	—
5.	X-Ray/Dark Room	1	—
D.	Faculty and Administrative		
1.	Department Chairpersons Office	3	1
2.	Secretary/Department Chairpersons	3	1
3.	Faculty Offices	20	1
4.	Secretarial Pool (Faculty)	1	4
5.	Faculty Lounge	1	—
6.	Conference Room	1	25
E.	Student Facilities		
1.	Student Lounge	1	—
2.	Student Organization Offices	5	—
F.	Unassigned Space Mechanical Space, Circulation, Storage, Restrooms, and Other Miscellaneous Space - Approximately 35% of Net		

The gross area for the building is programmed at 56,413 square feet.

SITE DESCRIPTION

The site, located at the northeastern end of the Elizabeth City State University campus is primarily flat, typical for that region of the state. Very little vegetation existed on the site. Storm drainage, water/sewer utilities, and electrical service were all available to the site from the campus and/or from Elizabeth City.

SITE DEVELOPMENT

The site was developed in order to provide an anchor building to the northeastern end of the campus, where most of the buildings are at least 30 years old or more. The challenge in master planning this site resided in creating a landmark that would symbolize the community of Elizabeth City. Another design criteria was the harmonization of the science complex within the low-key campus atmosphere.

To stay in scale with the existing two and three story buildings, the mass of the new science complex graduates from a one-story structure closest to the existing structures to a four-story building adjacent to Hoffler Street. Figure 1 shows the layout of the site plan.

Because of its location, the site design sought to create a promenade of trees from the existing campus to the science complex plaza area.

This promenade continues through the building, creating a bifocal entrance, with visitors from off-campus having access via the Hoffler Street entrance and students and faculty gaining access from the plaza. Outdoor classrooms, science exhibits, and other university events are scheduled at this plaza. A new parking lot adjacent to the building will provide space for faculty and visitors arriving to use the complex.

DESIGN SOLUTION

The main spine of this complex is an interior pedestrian atrium (Science Boulevard) extending the campus entrance promenade (south) through the building and leading to the community entrance (north). This atrium also connects the four story laboratory classroom building to high-use spaces housing the lecture hall and the science theatre/planetarium. The primary reason for creating the science boulevard was to provide interaction among students from all veins of science, faculty and at times, community.

The four-story graduates from a one-story structure of the southeastern end of the building to a four-story structure adjacent to Hoffler Street (city street). Each successive floor houses a smaller number of functions commensurate and consistent with the program requirements. On the first floor (fig. 2) are housed general purpose classrooms, lecture halls, the science theatre, library and the laboratories for the Biology department. In addition, a connecting structure houses the animal room and greenhouse spaces, which are primarily used by the Life Sciences, and other support spaces.

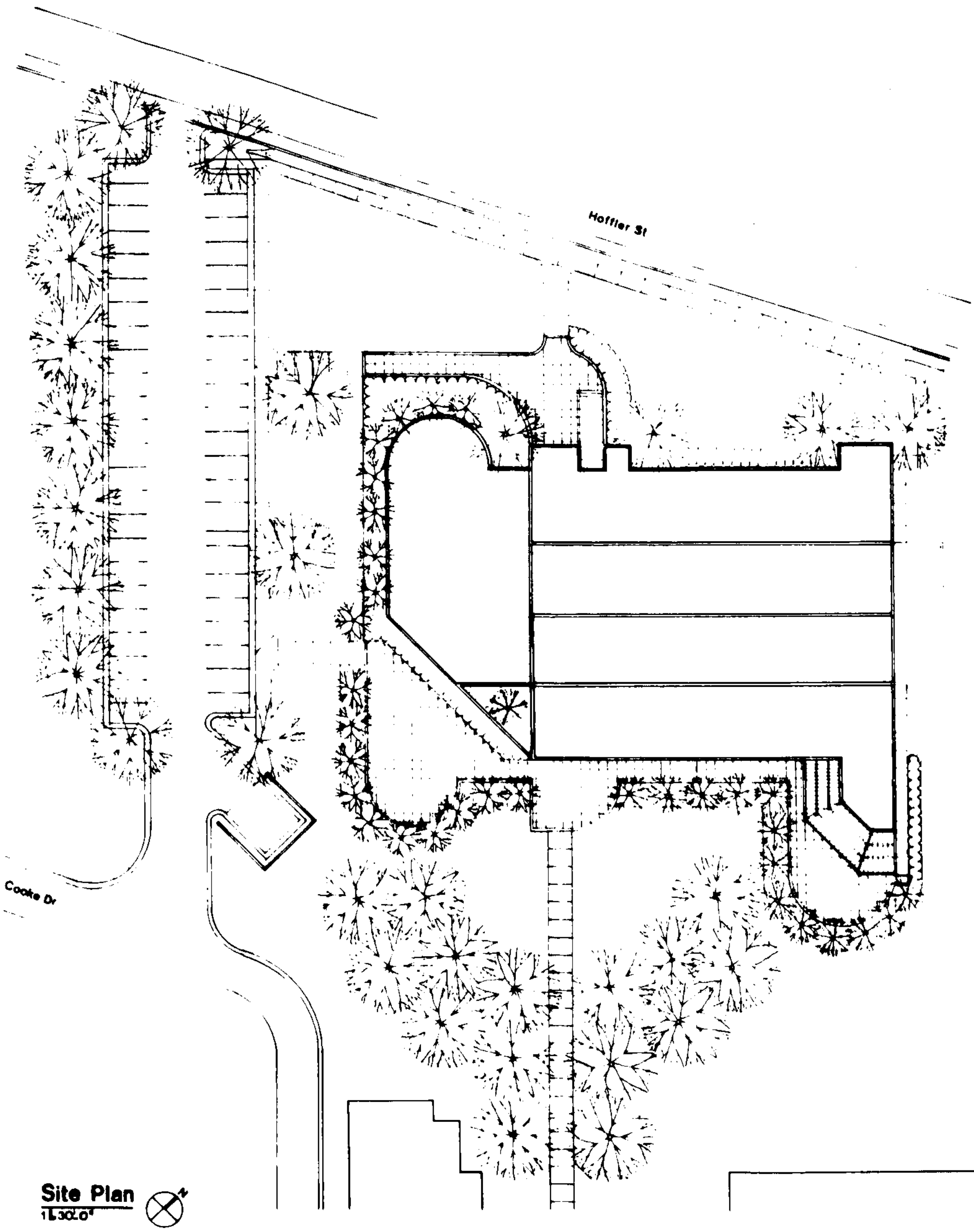

Figure 1. Site plan.

The second floor (fig. 3) houses physics and chemistry facilities, student offices, and other support spaces. The third floor, (fig. 4) the Geo-Sciences with its corresponding support area, in addition to administrative offices for department chairman. The fourth floor (fig. 5) is primarily faculty offices. The central circulation system is a large atrium corridor connecting all floors by an open stairway system (fig. 6). The form of this building followed the functional requirements. Figures 7 and 8 show model studies and elevations for this building.

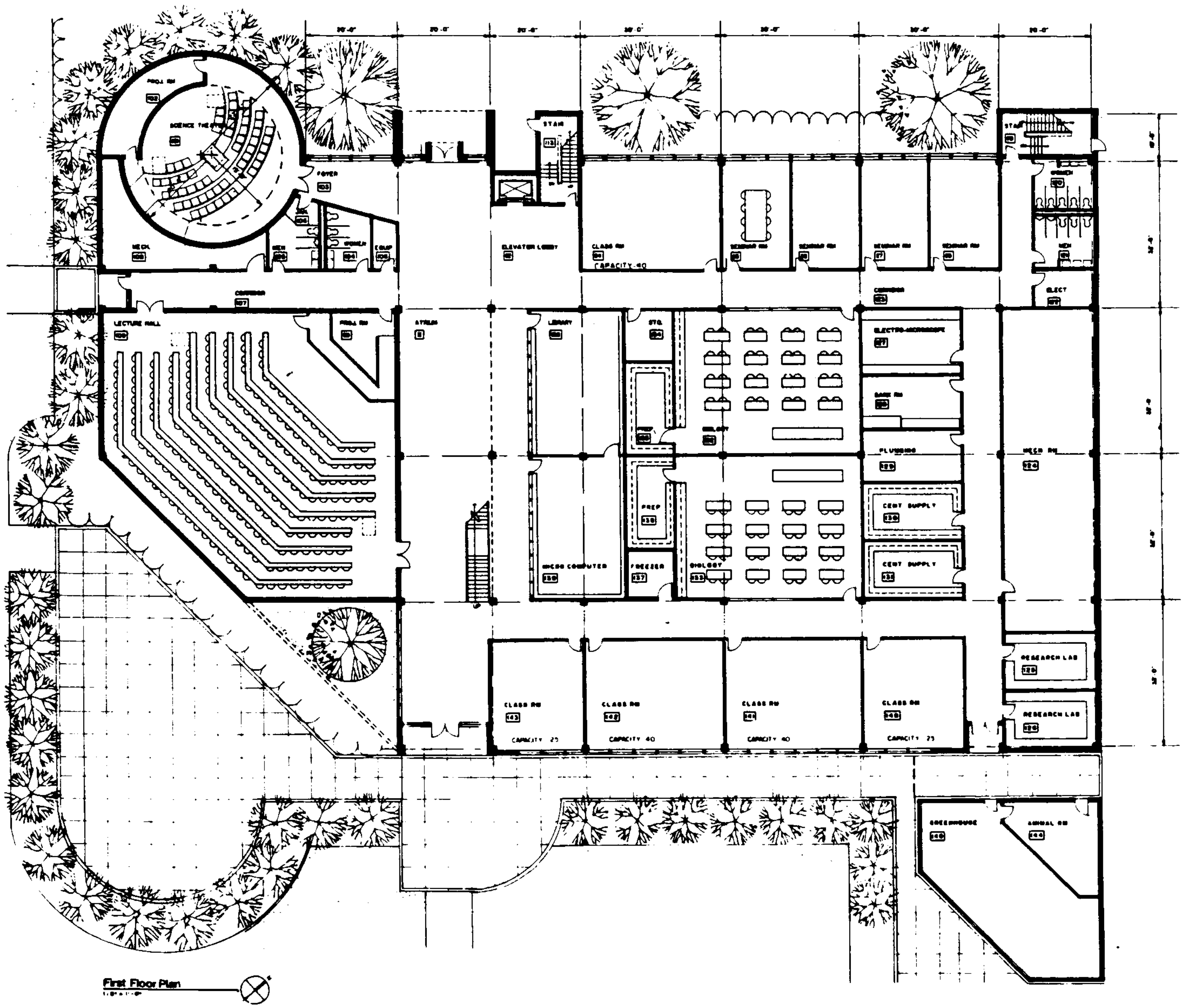

Figure 2. First floor plan (design).

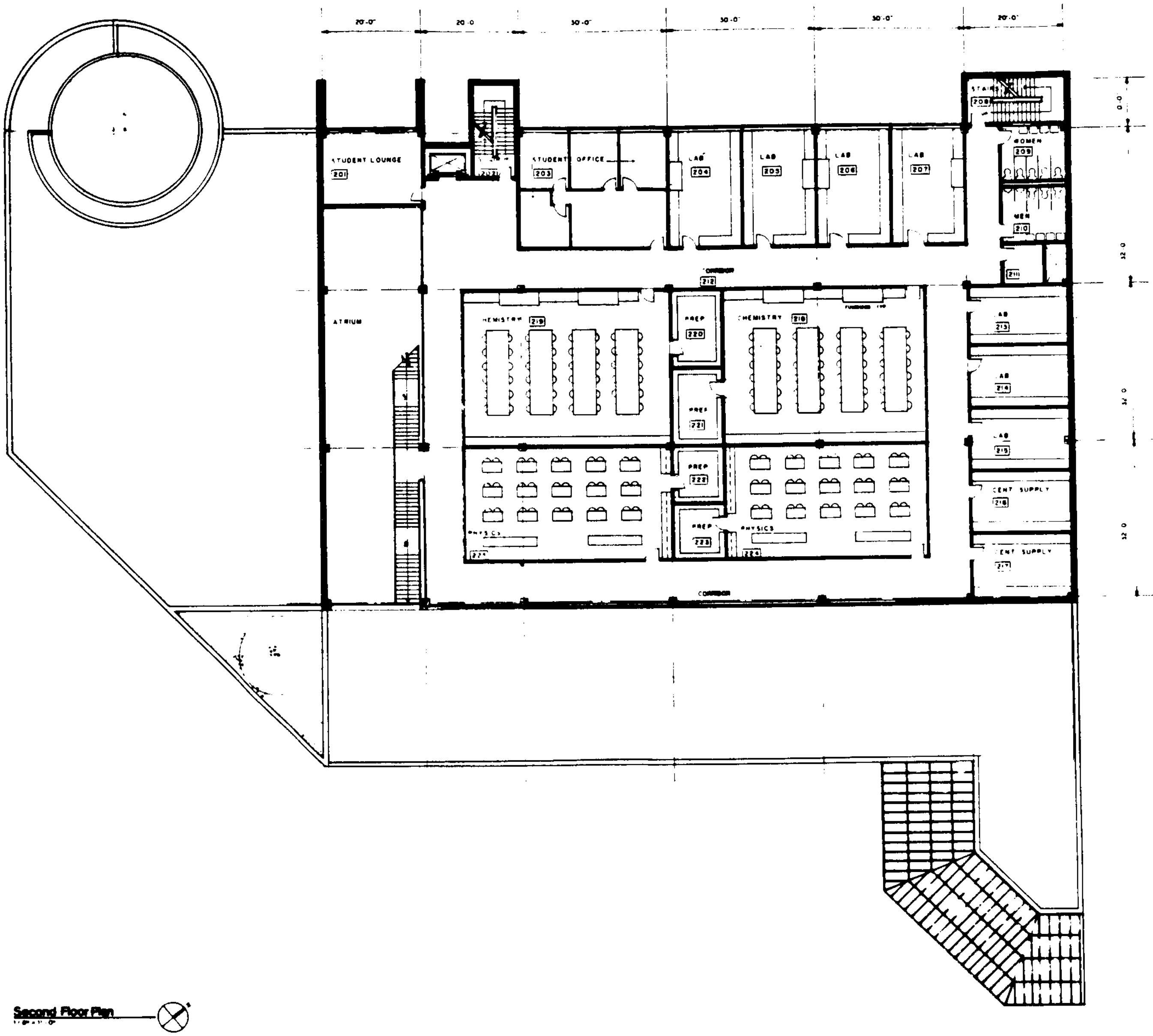

Figure 3. Second floor plan.

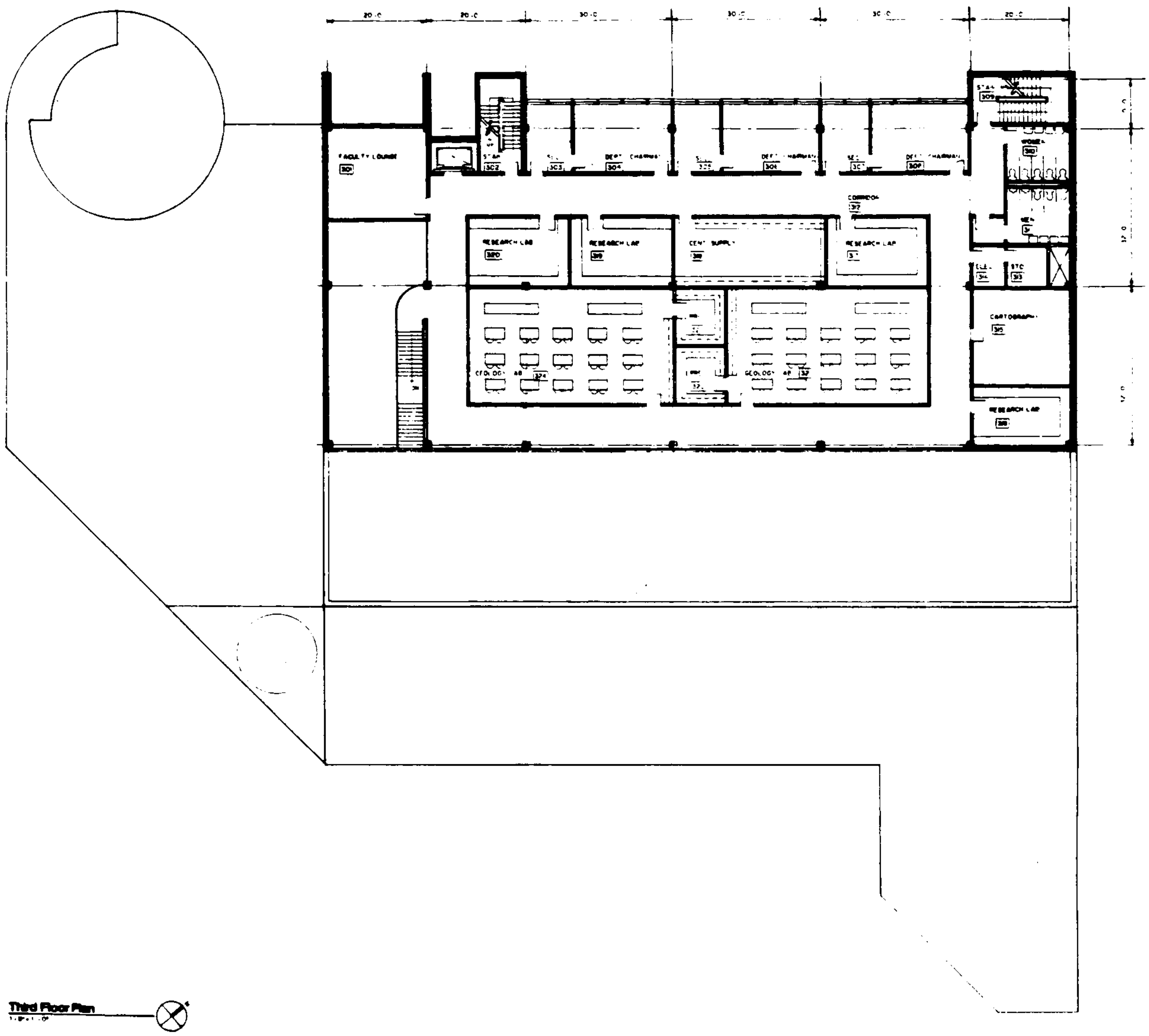

Figure 4. Third floor plan.

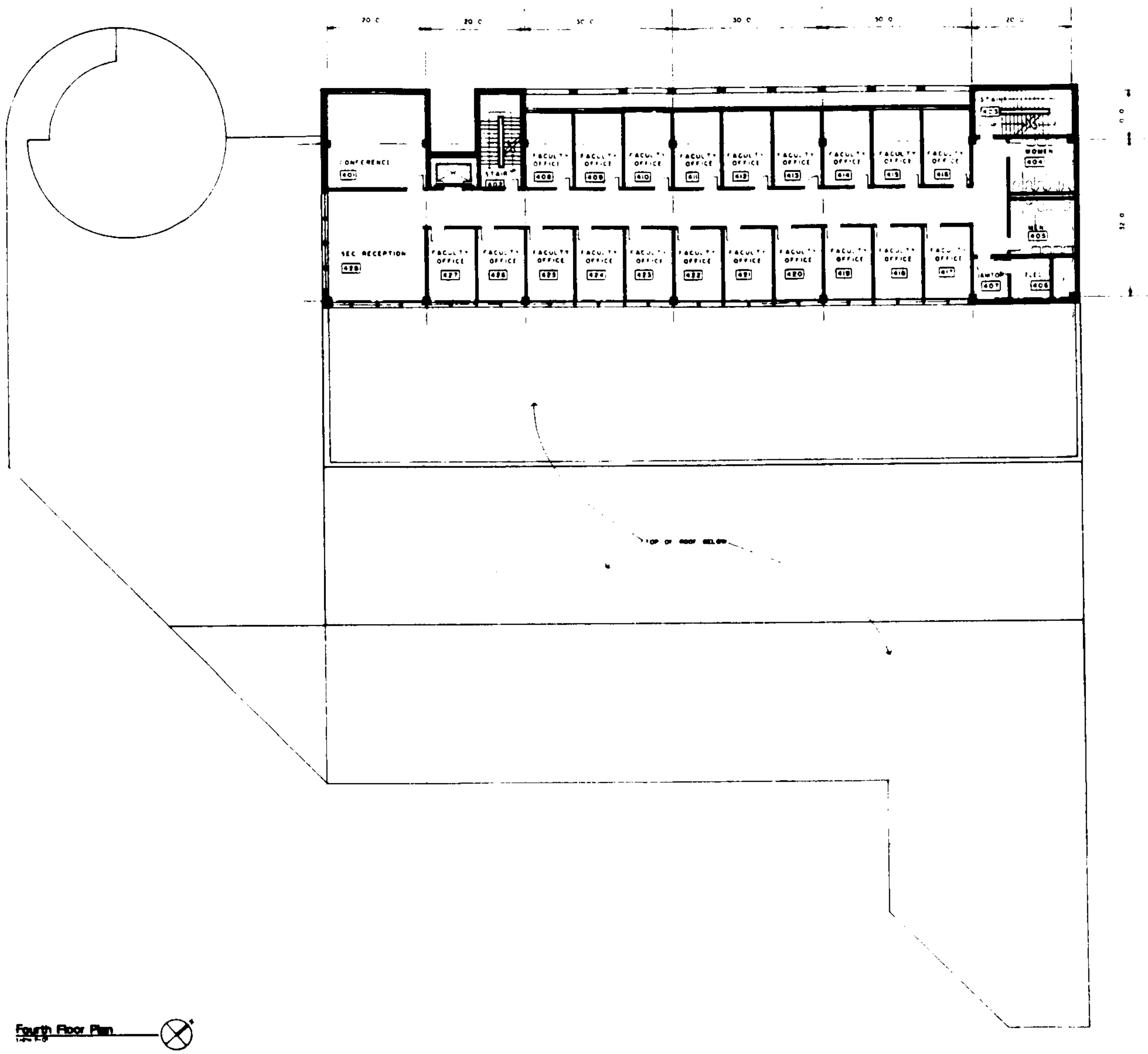

Figure 5. Fourth floor plan.

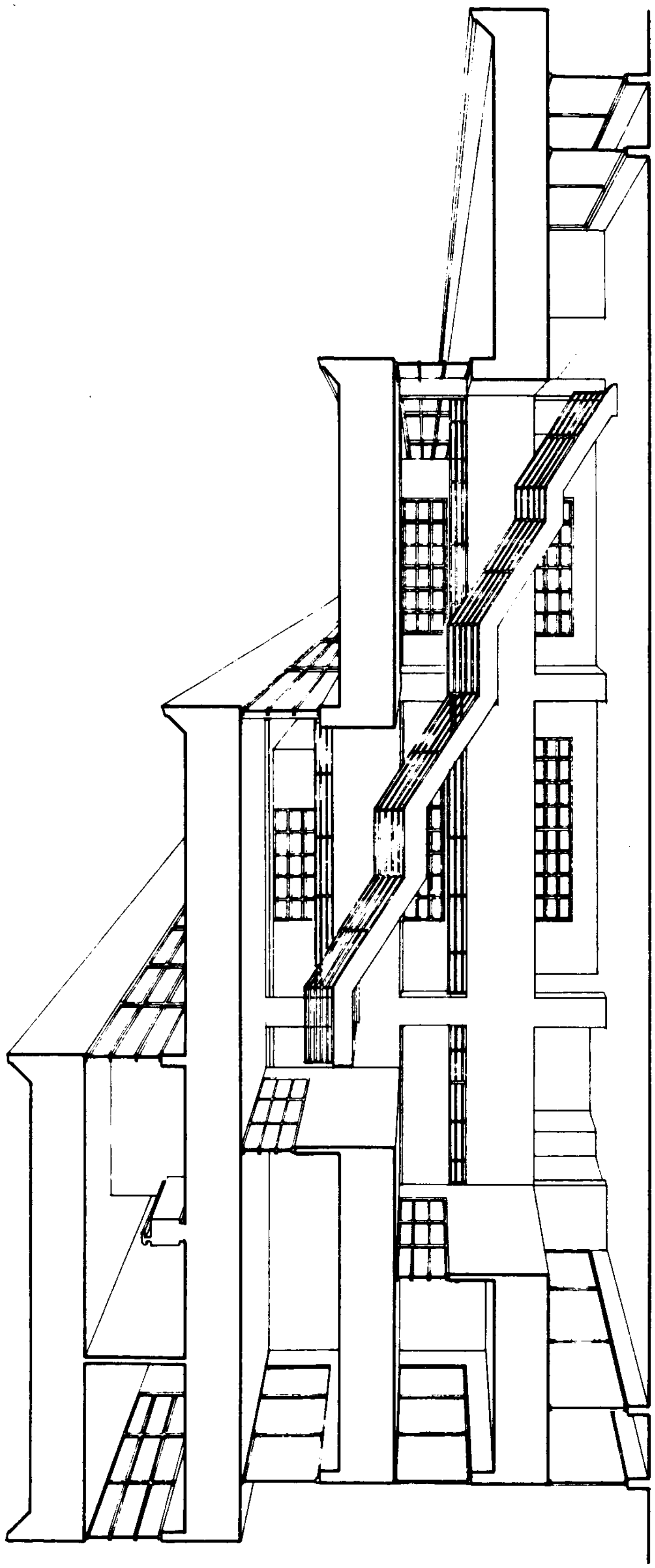

Figure 6. Sectional perspective through the atrium.

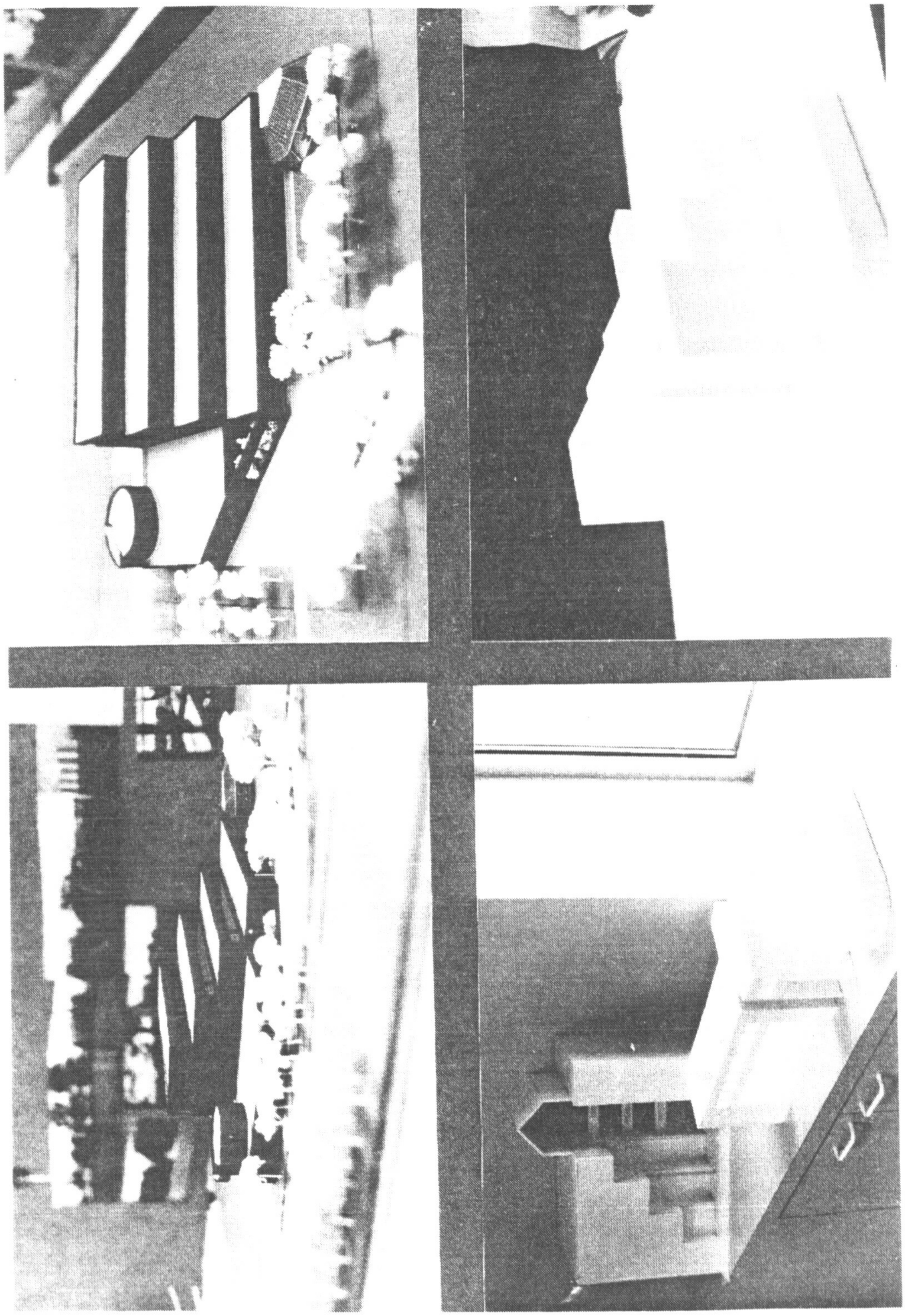

Figure 7. Model studies.

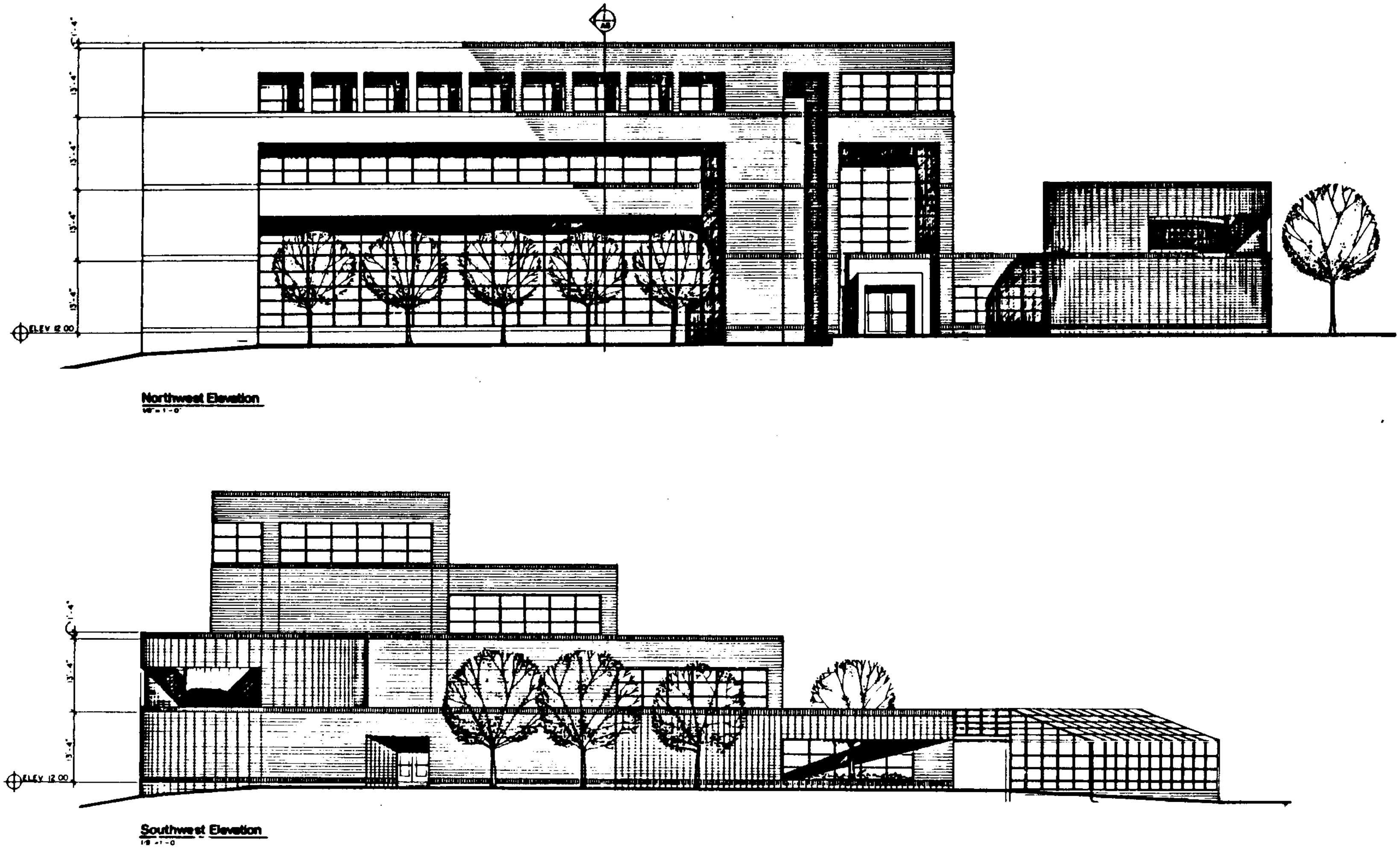

Figure 8. Elevations.

ARCHITECTURAL MATERIALS

The exterior walls are composed of 4-inch face brick (the common material for this region), 1-inch air space, 1-inch rigid insulation, and batt insulation between studs, 6-inch metal stud and gypsum board finish. All labs will have epoxy painted gypsum board. Figure 9 shows the wall section cut through the north wall.

Materials used in the building will consist of the following:

Exterior glazing consists of 1-inch tinted insulated glass and spandrel glass in aluminum frames, with fixed and operable units for ventilation and emergency egress.

Interior partitions are painted gypsum board on metal studs. Interior partitions are detailed to meet the required fire protection requirements. Doors are stave-core wood units in hollow metal frames. Exterior doors are aluminum framed with tempered glazing.

Ceilings in most areas are acoustical tile ceilings. As an alternate, the 30' 0" diameter projection dome over the Science Theatre is fuse bonded vinyl on aluminum. The dome surface is 23% perforated for acoustical purposes. The Lecture Hall has reflective panels to direct sound evenly throughout the space.

Single-ply roofing over rigid insulation is used on most roof areas. The Greenhouse is specially skylighted to meet the requirements of that space. All roofing assemblies are designed to meet a "U" value of 0.10.

Finish flooring in most areas is vinyl composition tile, with the exception of sheet rubber on all lab areas and ceramic tile floors in the toilets. The Lecture hall, Planetarium, all offices, conference room, and student and faculty lounge areas are carpeted.

Miscellaneous fixed equipment will include the following:

1. Science Theatre/Planetarium: Fixed seating; desk and special projection equipment.
2. Lecture Hall: Fixed desks and seating, chalkboard and projection screen.
3. Seminar and Classrooms: Chalkboard and tackboards.
4. Library: Library shelving, casework.
5. Labs: Most labs include a fixed experiment station.
6. Support Areas: Storage and shelving, casework, and lockers.

STRUCTURAL SYSTEM

The structural system for the four-story science complex is structural steel frame. The roof structural system is 1 1/2-inch-metal roof deck supported by H-series steel joist framed into wide flange section steel beams. The floor structural system is 2 inch composite metal floor deck with a 3 1/4-inch light weight concrete topping. Steel beams and steel girders provide support to the composite metal deck floor system.

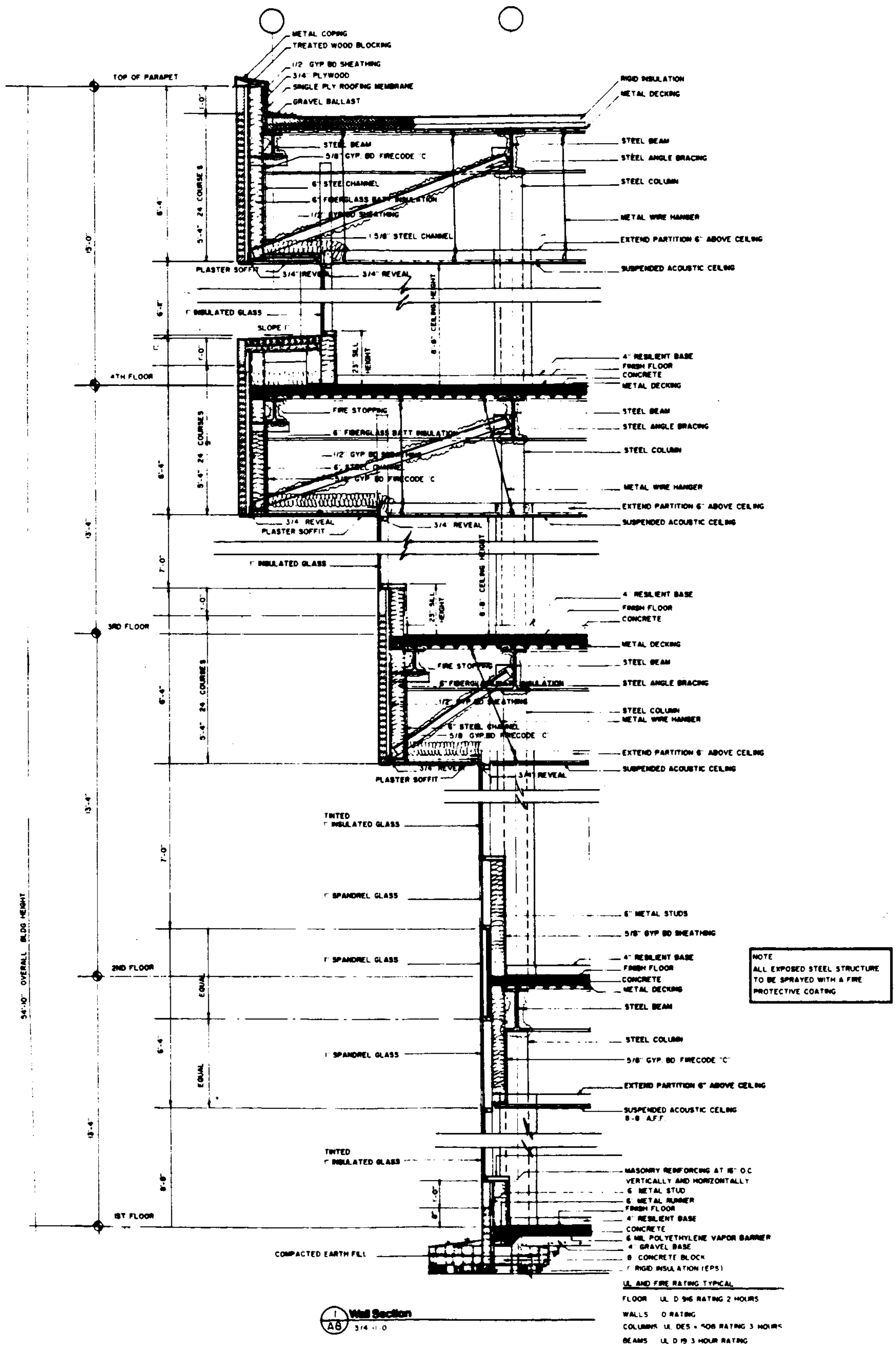

Figure 9. Wall section.

The foundation system is prestressed concrete piling driven into the dense to very dense sand.

MECHANICAL SYSTEM

Based on the data provided by a life cycle cost analysis of six mechanical system alternatives, the following was selected. The cooling system consists of two reciprocating water cooled chillers. Heat is provided by a fuel oil fired boiler. Exhaust systems: All laboratory spaces are furnished with laboratory hood and exhaust system. The laboratories are also capable of being 100% exhausted for odor and fume control.

The entire plumbing system was designed in accordance with all local, state and national plumbing codes.

FIRE PROTECTION

An automatic sprinkler system was required throughout this building.

ELECTRICAL SYSTEM

Electrical systems included the following:

1. A complete system of power distribution equipment and wiring, power connections to equipment, etc. Electrical service to the building is from a utility company padmounted transformer.
2. A complete lighting system, primarily utilizing fluorescent fixtures for interior spaces and high pressure sodium fixtures for exterior areas.
3. A system of raceways, outlets, and equipment space to accommodate the installation of telephone and other communications equipment.
4. A complete fire alarm system.

All systems—architectural, structural, mechanical and electrical—were selected in the design development phase. In the construction document phase all the details were established for conveying the information to all the prime contractors figures 10 through 12 show some examples of the construction documents. Figure 13 presents the final image of the new Science Complex for the Elizabeth City University at Elizabeth City, North Carolina.

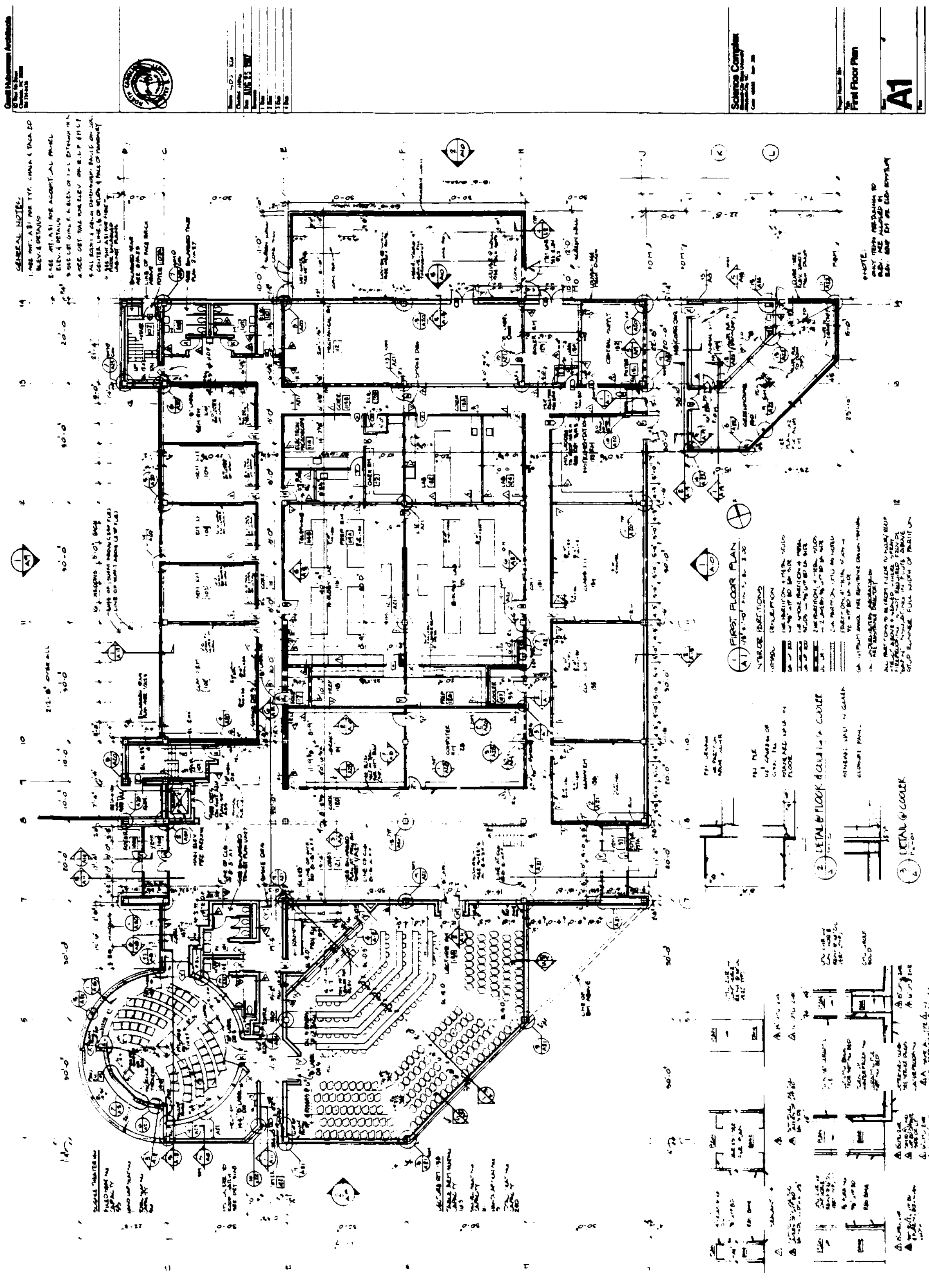

Figure 10. First floor plan (construction document).

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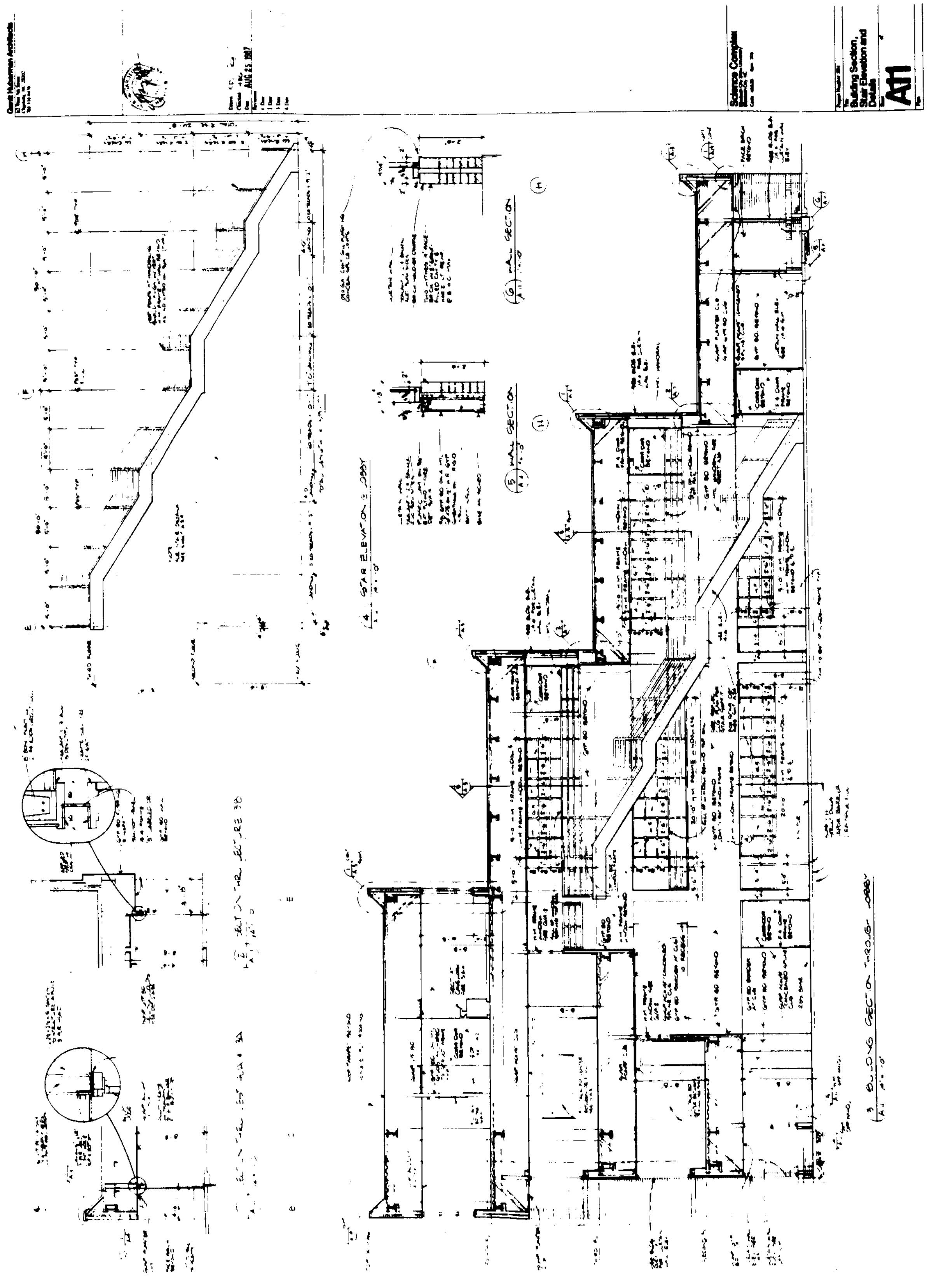

Figure 11. Section (construction document).

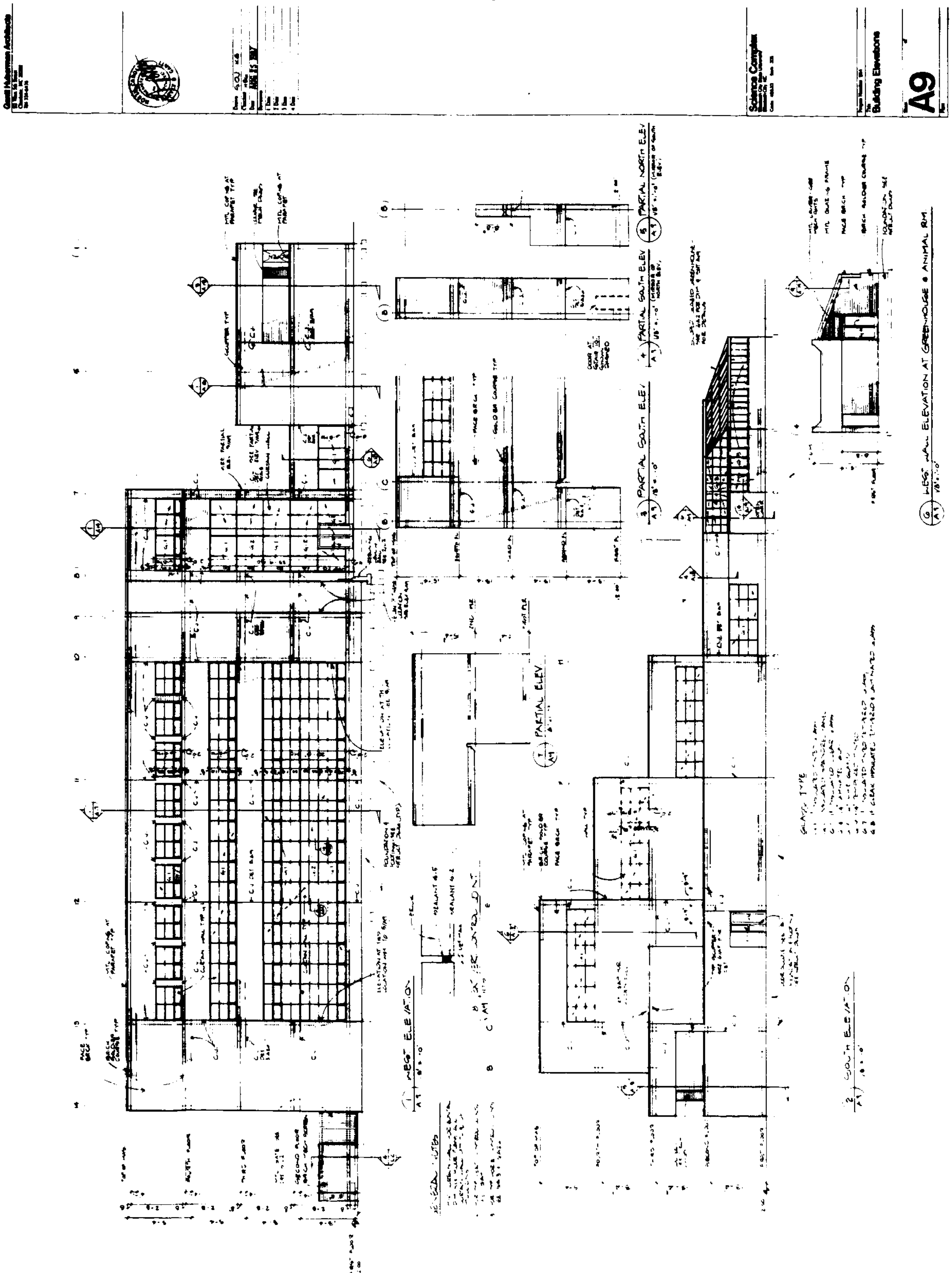

Figure 12. Elevation (construction document).

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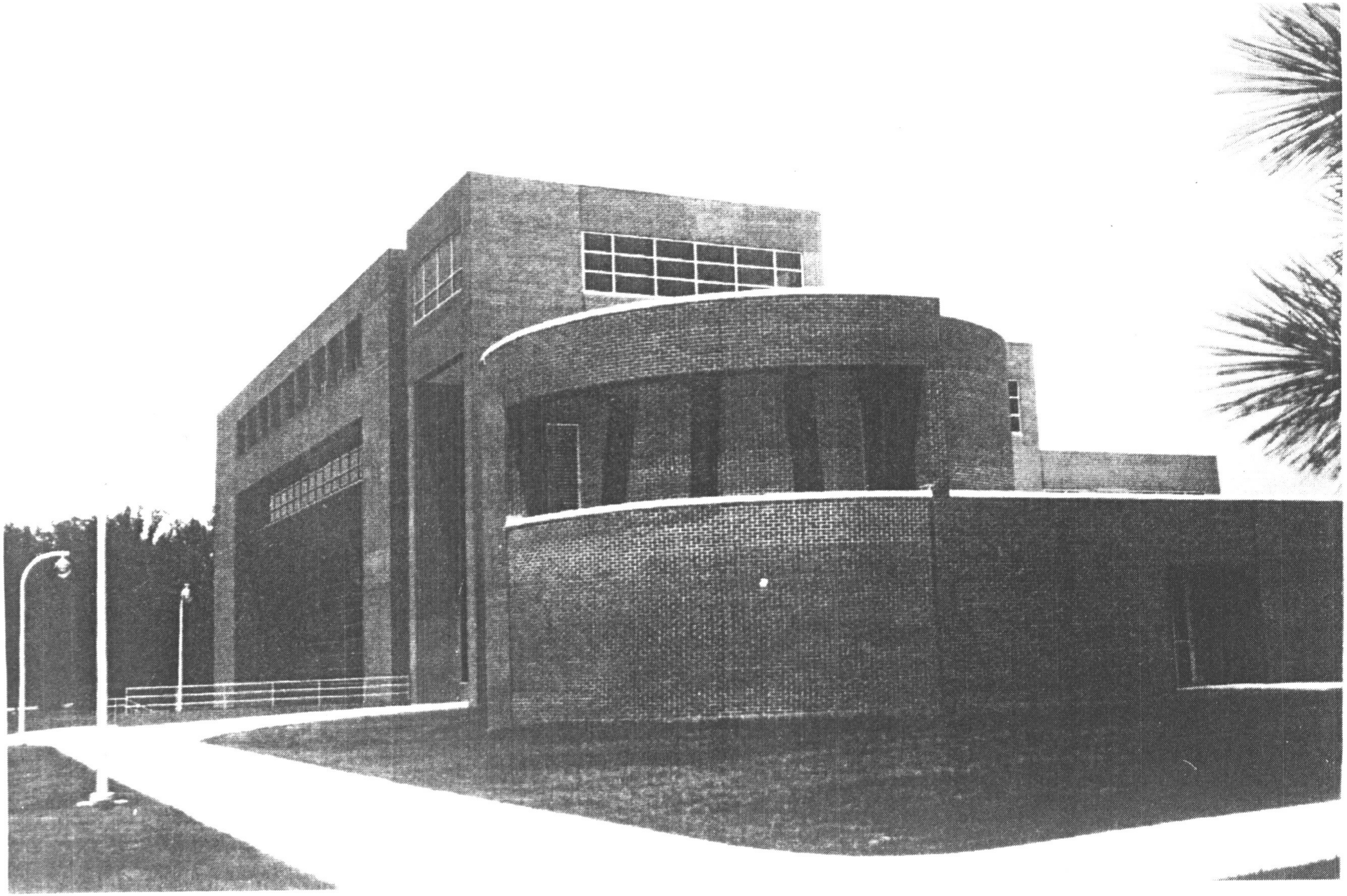

Figure 13. The Science Complex.

BIOGRAPHY

Soheila Jahromi:

I was born in 1955 in Tehran, Iran. After finishing high school, I came to the United States to attend Clemson University in Clemson, South Carolina. At Clemson I studied architecture and worked for Overstreet Architectural Co. In 1982 I completed my studies at Clemson receiving a Masters degree in Architecture. From 1982 to 1985 I worked for Overstreet Architectural and also was involved as a volunteer with "Habitat for Humanity," an organization providing architectural and construction labor services.

In 1985 I moved to Charlotte, North Carolina to work at the Architectural office of Harvey Gantt (Mayor of Charlotte, North Carolina). The project presented in my technical paper was my assignment at Gantt Huberman Architects. While in Charlotte I served on the committee board for "The Guild of Charlotte Artist." I was married in 1985 and my son was born in 1987. In 1988 we moved to the Bay Area. I am currently employed with Bentley Engineering working as a contract employee for Ames Facilities Engineering Branch. I am also a volunteer member of Disaster Assistance Response Team (DART).