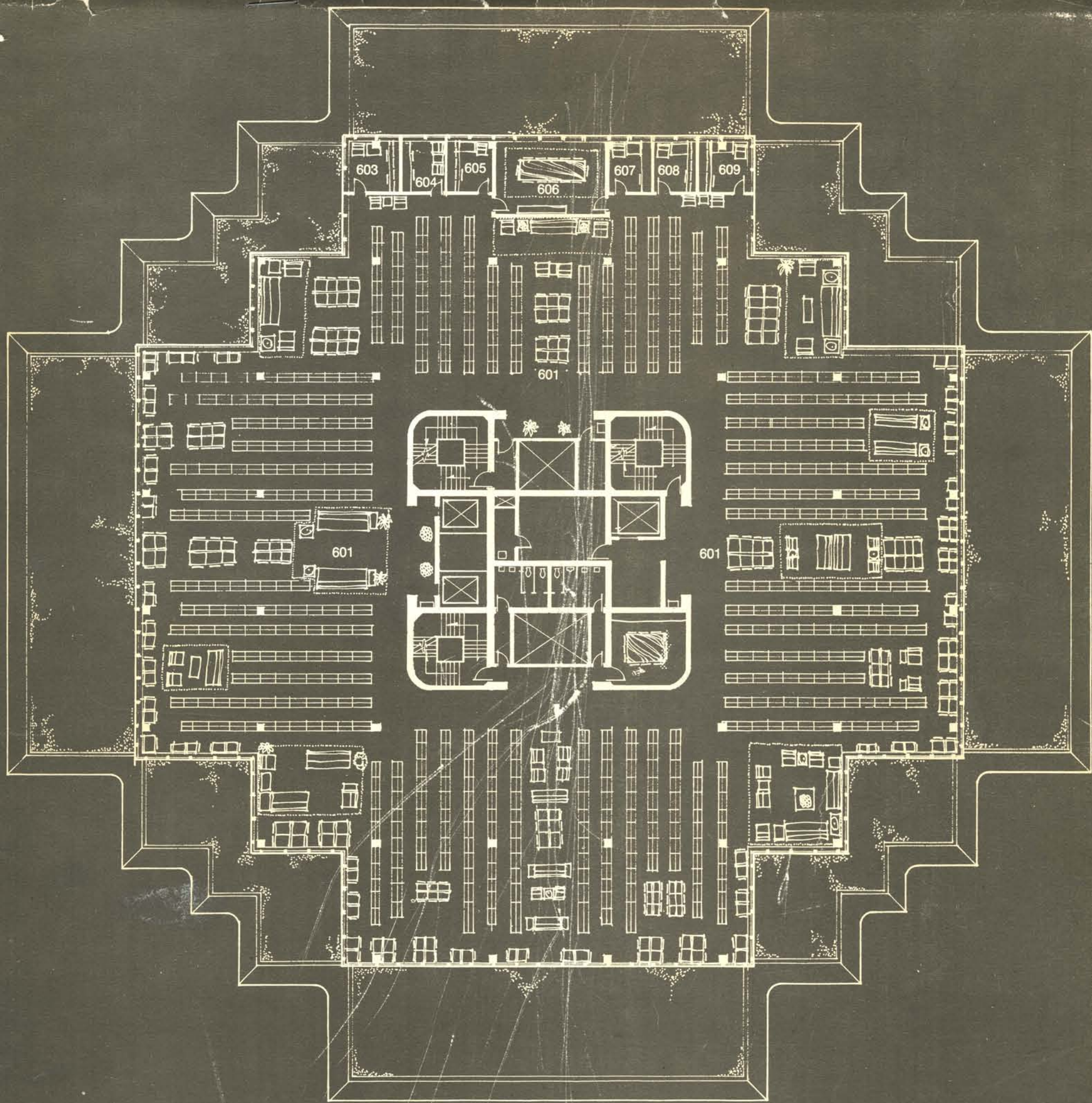

Central Library

University of California at San Diego

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August 1969

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SUMMARY OF CONTENTS

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In June 1965, William L. Pereira & Associates was asked to design the Central University Library, which would be the key building for the entire University of California, San Diego (UCSD).

Site Selection. The architect's relationship with the University of California at San Diego began in 1957 when he was asked by the Regents to find an appropriate site for a new campus in this part of the state. The staff made an exhaustive study, producing some 19 sites which were evaluated in depth. The site recommended by the planners and accepted by the Regents was a picturesque, wooded area near the north San Diego/LaJolla/Torrey Pines coast.

The University Center. The original development plan for the UCSD campus provided for three new clusters of colleges linked by roadways to the existing Scripps Institute of Oceanography, which was considered to be the fourth cluster. The plan grouped the three new clusters about a central area, the University Center, which included the Central Library, Administration, Theatre, Museum and Art Gallery.

In 1965, a university committee was formed to determine a precise program for the University Center and to choose the site for the Central Library. The committee commissioned William L. Pereira & Associates to prepare a master plan for the area. Primary goals for the University Center were that it should serve as the gateway to the campus, link the campus with the surrounding community, and be in close proximity to the clusters of colleges.

The planners recommended that the University Center be moved eastwards and connected to the community by a boulevard. The boulevard, running east and west, would turn south at the University Center, linking it with the commercial areas to the south and east of the campus. The Center itself was now located at the epicenter of the college clusters.

The Revised Long Range Development Plan (LRDP). The LRDP for the campus has been reevaluated and modified. It retains many of the original planning concepts and recommendations, but it compresses the college clusters into smaller units and reduces the distance between them, thereby achieving a closer relationship of functions and providing reserve areas at the perimeter of the campus. It locates the Central Library at the intersection of two main axes.

III. THE LIBRARY COMPLEX

Page 21

The program for development of the University Library (adopted March 29, 1965) envisions a complex of libraries, including:

1. A Biomedical Library.

2. The library already in operation at Scripps Institute of Oceanography.

3. Three cluster libraries, centrally located within the other three clusters of colleges, combining undergraduate and science library facilities.

4. The Central University Library, which will house the largest part of the University's book collections as well as the central administration offices and processing departments of the library system. It will serve graduate students enrolled in nonscience programs and, pending completion of the first Cluster Library, will meet a large part of the requirements of undergraduate students. The present plan calls for completion of the first increment of the Central University Library in 1970 and the first Cluster Library in 1972.

IV. RESEARCH AND ANALYSIS OF EXISTING UNIVERSITY LIBRARIES

Page 25

Basic Needs of a Graduate Library. In general, the graduate library today should provide the reader with: (1) ready access to the stacks, (2) a comfortable reading station, and (3) reasonable privacy.

Today's library places more emphasis on retrieving and transmitting knowledge and information than on storing it away. This leads to the stacks being open and well spaced. The old, high-ceilinged reading room is being replaced with smaller, scattered spaces and individual carrels.

Architectural Types. In studying existing research or graduate libraries, the architect analyzed several basic architectural types: the tower, the cube or box, the central court, subterranean, gateway, and pavilion or compound types.

Functional Types. Graduate libraries were also analyzed on the basis of how the three basic areas (stacks, public and staff) related in organization and function. The various distinctive arrangements were: subterranean (stacks below ground), split collection (stacks above and below public/staff areas), elevated (stacks above public/staff area), and special solutions for unique collections.

Methods of Expansion. In graduate libraries studied by the architect, the most common method of expansion is horizontal. A second method of expansion is vertical, in which a series of buildings share the circulation systems of the staff and public floors below. A third method is by a combination of the first two. The fourth method is by splitting the book collection with the public and staff floors, moving book stacks both above and below the ground.

V. CENTRAL UNIVERSITY LIBRARY

Page 37

The Site. The site for the Central Library was located at the geometric center of the campus at the head of a small canyon. The canyon, planned to be kept as an open reserve, is visually exposed to the Coast Freeway to the northeast, so that even with the ultimate development of the entire campus, the library will remain a visible and symbolic landmark of UCSD.

The Program. The ultimate library program calls for a total of 255,000 assignable square feet. It will accommodate 3,000 readers and house 2,500,000 volumes, principally in the humanities and social sciences.

The first increment will be 110,000 assigned square feet, (157,000 outside gross square feet), and have a total project budget of $5,120,000. It will accommodate 1,250 readers and will house 675,000 volumes. Subsequently, there will be two increments, each of approximately 62,500 square feet.

Development of the Concept. Many schemes for the development of the first increment and its ultimate expansion were developed and evaluated. Four of them afforded a solution to the problem and contributed in one way or another to the ultimate design of the Central University Library. They were the multitower scheme, the subterranean scheme, the gateway scheme, and the compound scheme. While each of these could evolve into a workable and satisfactory library, none provided a single best way of creating a permanent visual symbol in the University Center and a satisfactory system of expansion.

Expansion and the Site. Ultimately, the site itself yielded the answer to the question of expansion. Because of its sloping character, expansion was made feasible by splitting the collection into two parts – above and below the public and staff areas. The first increment would contain about one-third of the ultimate book stacks above the public and staff floors, with the remaining two-thirds below these floors, cascading down the canyon.

The Form of the Stacks. Because it is unusual and can establish a powerful image for the University Center, and because it best satisfies the need for expansion and the highest possible level of library operation, the sphere was chosen as the basic form for the Central University Library.

VI. FIRST INCREMENT

Page 49

Schematic and Preliminary Phase. In the final design, the general collection is housed in a five-level spheroid, schematically circular in plan and elliptical in cross-section. The sphere is raised 30 feet above the plaza by a colonnade of 16 concrete columns. The plaza – the Forum – is a square, 200 feet on each side. Beneath the Forum, which is raised one level above the ground, is the main public floor.

The interior design of the building is aimed at bringing the readers into as close as possible contact with the books themselves. Spaces are defined primarily by furniture and book stacks, with a minimum of permanent partitions, providing maximum flexibility for rearrangement. In carrels and other reading areas along the perimeter of the stacks, and in furniture groupings interspersed throughout the floors, there are accommodations for over 1,250 readers. The sphere provides a single, large circular floor at the center of the form where there is space for a proportionately large number of readers and books. The floors above and below this level become progressively smaller, so that from the center of the third floor, the outer rim of stacks on the other floors are equidistant (with vertical movement by stairs or elevators). Eighty percent of the initial collection can be housed in the three central floors of the stacks, and no book housed in the sphere will be more than 100 yards or two minutes away from the study point.

Refinement of the Building Design. After the approval of the Regents, for economic reasons, the design of the structural system was analyzed and reevaluated. William L. Pereira & Associates began studies to eliminate as much structural steel as possible in order to keep the building within the construction budget. A system of reinforced concrete construction was developed and was subsequently accepted by the Regents.

The Library Levels.

The Lower Level. Staff and public areas constitute the main use of this level of the library, with a significant amount of space dedicated to the main mechanical rooms.

The Main Level. This level of the building is the main entry and control point for the library and houses the main public and staff areas, including the Catalogue, Bibliography, Reference, main circulation desk and Data Processing Center.

The Forum Level. The Forum level is the roof of the floor below, an open plaza that will be used for many different functions and will have movable planters and benches to define large areas for group discussions or intimate areas for solitary reading. Because it is at the heart of the campus, it will become an area where academic and social interface of many forms can occur without disruption of the library function.

The Core. The central core has a similar configuration on all levels and provides the space for vertical runs of utilities, air-conditioning, stairs and elevators.

The First Level of the Stacks. This is initially planned to house the record and tape collection and a portion of the general collection.

Second Level of the Stacks. This is approximately 150 feet across and will house a major portion of the book collection. Carrels and other reader stations will be dispersed throughout the book stacks, with major lounge areas in each of the four corners.

Third Level of the Stacks. This is the largest floor – some 200 feet in diameter. It will house the major part of the general collection and will have the largest number of individual reader stations. Faculty studies and seminar rooms are located on both the north and south sides of this floor.

The Fourth Level of the Stacks. This level is identical in size and shape to the second level; however, it is surrounded by the roof area of the floor below. A portion of this roof will be developed as an outside study area.

The Fifth Level of the Stacks. This level houses the Special Collection and Rare Book Collection and is the only floor that has controlled access.

Mechanical and Electrical Systems. The University Central Plant provides the Central Library, via utility tunnel, with high temperature and chilled water, primary electrical power, telephone lines, program-clock system, fire-alarm system, and multiplexing cable for equipment controls.

Landscape Concepts. The dominant landscape concept is to site the Central Library among the existing eucalyptus trees and maintain the grove-like quality, specifically in the immediate vicinity and hopefully in the projected north–south and westerly mall approaches. The Forum will be enhanced by deck drains which can accommodate large trees in planter boxes. Additional street furniture, benches and sculpture will be added to fulfill its function as a space for meeting and discussion.

Construction at the Building. Ground-breaking ceremonies took place on the site in July 1968, and construction com-

menced soon thereafter. The lower two floors of the building were built first so that the Forum level could be used as a platform for the scaffolding that would hold the form work in place until the building is virtually complete. In the winter of 1969, the scaffolding will be removed and the true impact of this architectural tour de force will emerge. The library should be in operation in the fall of 1970.

Future Expansion. The architect has proposed optional methods of future expansion. One scheme calls for attaching structures to the base of the building and cascading them down the sides of the canyon to the north. These future increments will primarily house more book collections. Their roofs will be treated in total or in part as walking decks, functioning in a manner similar to the Forum.

In a second scheme, the canyon is filled with automobile parking structures, on top of which are placed two immense library floors which connect to the main and lower levels of the first increment.

The final decision as to the method by which the library should expand can be made only after an indepth evaluation of the space requirements of future increments, and an analysis of both the costs involved and the funding available.

VI. APPENDIX

I. ASSIGNMENT

I. ASSIGNMENT

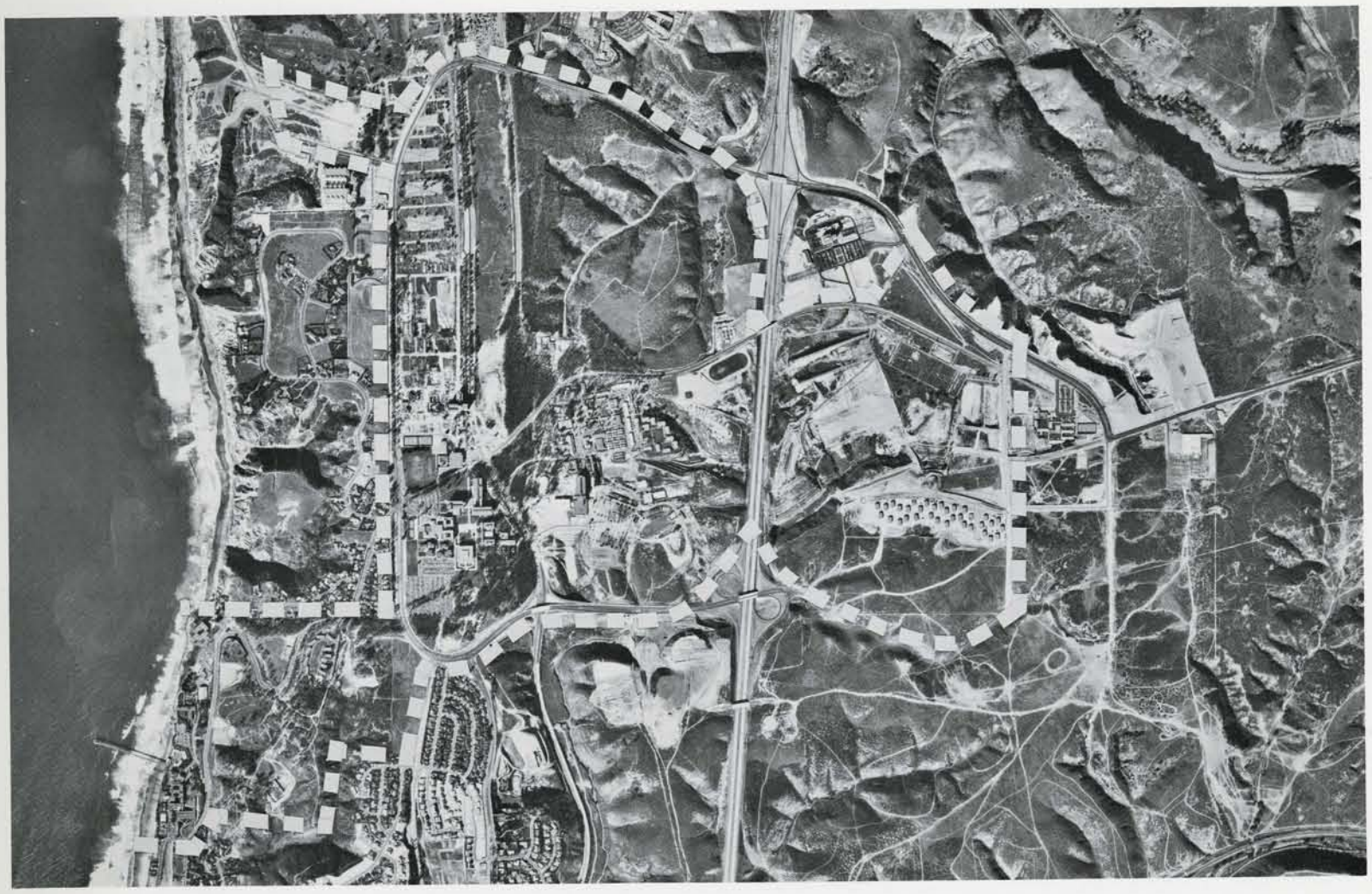
In June of 1965, William L. Pereira & Associates was asked to design the Central University Library, which would be the key building for the entire UCSD campus. It was an opportunity, as Mr. Pereira said, "to make a statement in the structure that would affirm our attachment, our commitment, and our hopes for this university, and our faith in the fulfillment of its mission in this society."

The design of a structure such as this must reach beyond the library's practical capacity as a functional building. It must be able to convey to future generations the idea of the power and permanency of the knowledge contained inside it.

The chronology of the development of the Library follows:

October, 1965	Agreement for services between Owner and Architect.
April, 1966	Review and approval by Regents of preliminary design – steel structural scheme.
November, 1966	Review and approval by Regents of concrete structural scheme.
March, 1967	Begin working drawings and specifications.
August, 1967	50% client review and approval of contract documents.
November, 1967	100% client review and approval of contract documents.
March, 1968	Contract documents issued for bid.
May, 1968	Construction bids opened and awarded.
July, 1968	Construction began.
May, 1970	Estimated date of completion and occupancy.

II. UCSD



High level aerial photo of UCSD – 1969.

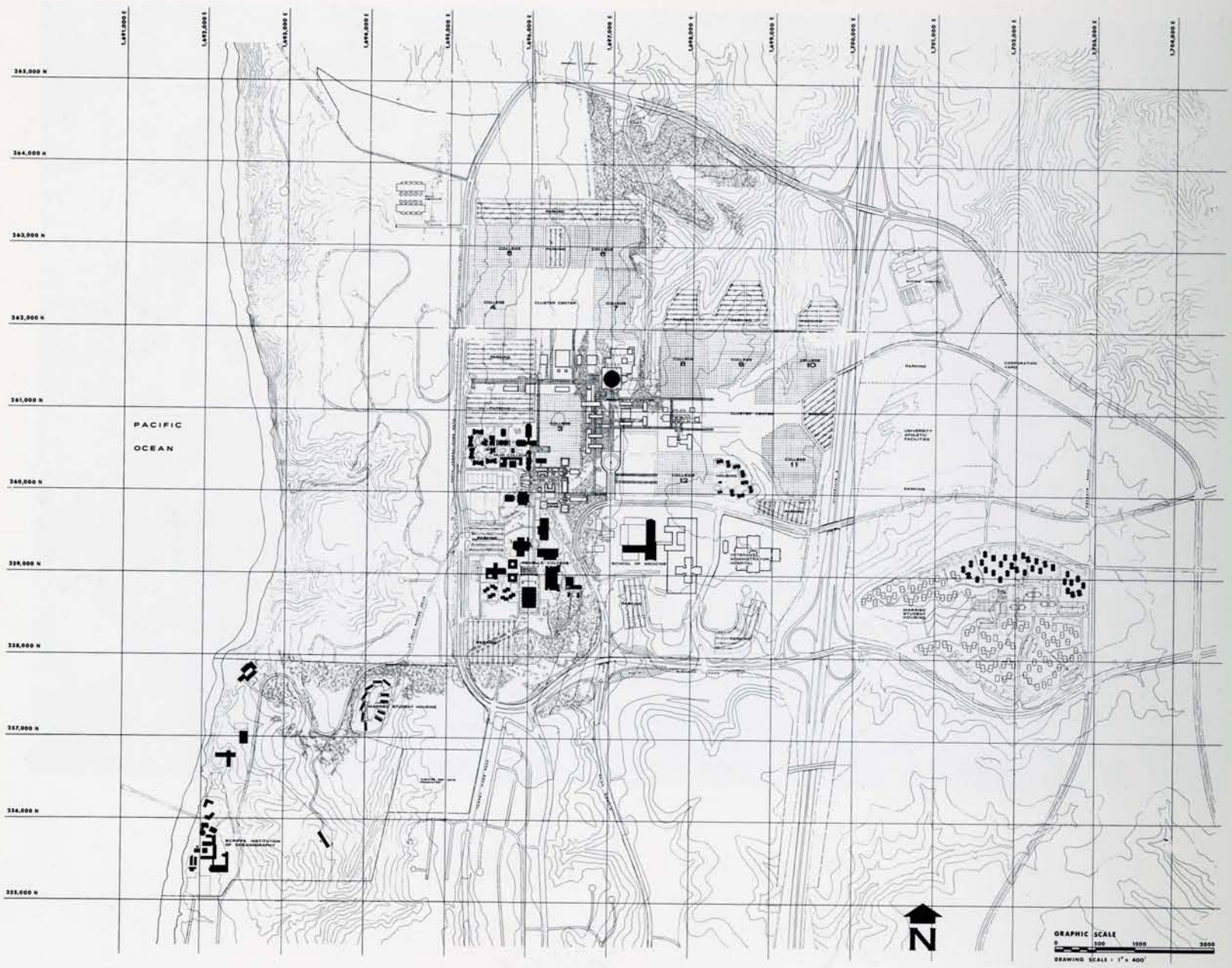
II. UCSD

Site Selection

The Architect's relationship with the University of California at San Diego began in 1957. Asked by the Regents to find an appropriate site for a new campus in this part of the state, the staff made an exhaustive study by land and air, producing some 19 locations of 1,000 acres or more, each of which justified further consideration. These sites were evaluated in depth, using "weighted criteria" method. Among the criteria were two unusual requirements: "a sense of place" and "the spirit and nobility" of the site.

The planners believed that the proper choice of site would contribute most importantly to the quality of the future university. A site was sought and found that had an intangile "sense of place," where the "spirit and nobility" of the environment could not be obscured by the passage of time and would, moreover, be enhanced by the works of man. The planners made their recommendations and the Regents made their decision.

The site chosen for the University of California at San Diego was a picturesque, wooded area near the north San Diego-La Jolla-Torrey Pines coast.



The revised master plan (by A. Quincy Jones, F.A.I.A.) locates the library in the University Center — the heart of the campus.

The University Center

The development plan for the campus of the University of California at San Diego, prepared by Robert Alexander & Associates in 1963, provided for three new clusters of colleges, each cluster consisting of four colleges. These clusters were linked by roadways to the existing Scripps Institute of Oceanography, which was considered to be the fourth academic cluster. The plan grouped the three new clusters about a central university area which included such communal elements as the Central Library, Administration, Theatre, Museum and Art Gallery.

This plan, however, gave a strong visual relationship to the ocean, rather than a functional relationship to the academic clusters or to the community that would surround it in the future.

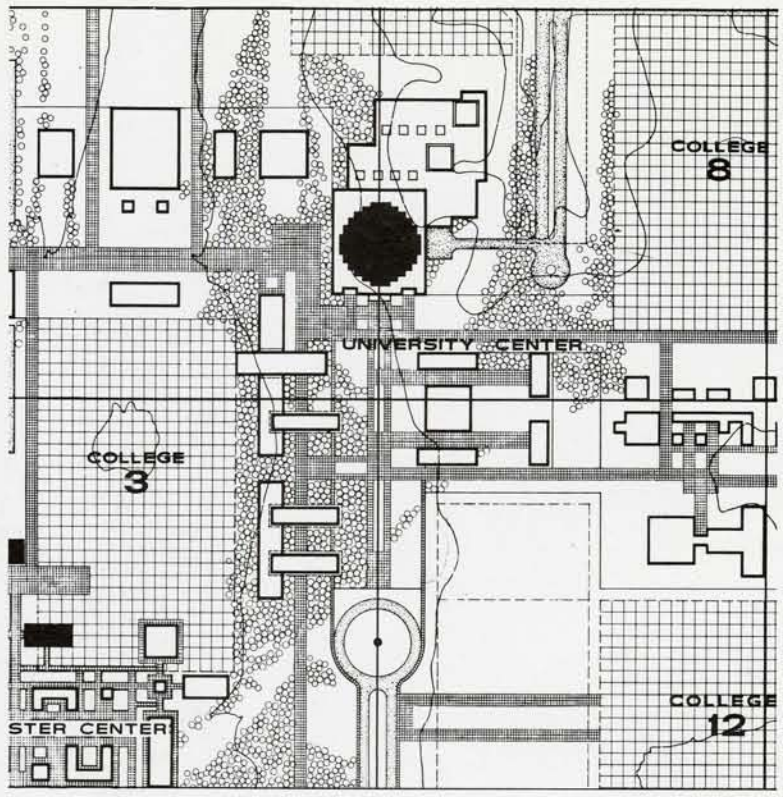
In 1965, a University committee was formed to determine a precise program for this central area, to establish its relationship to needs of the whole central campus, and to immediately choose the site for the Central Library. The committee commissioned William L. Pereira & Associates to prepare a master plan for this area, later and currently referred to as the University Center.

Primary goals of the University Center, as defined in this study, were that it serve as a gateway to the campus, that it link the campus with the surrounding community, and that its academic buildings and functions be in closer proximity to the clusters of colleges.

The program for the University Center consists of over 2,000,000 square feet of academic-public building and would require 8,000 linial feet of street and/or pedestrian mall frontage. This demand for frontage, coupled with the planners' goal of linking the campus with its surrounding community (primarily represented by the lands zoned for commercial use), led the planners to recommend that the University Center be moved east from its original site and connected to the community by a great boulevard. The boulevard, running east and west, would turn south at the gateway of the University Center, linking the Center with the two principal commercial areas, one to the south and one to the east of the campus. The Center itself was now located at the epicenter of the college clusters.

From the east, the main boulevard to the campus, would, in essence, be a parkway, with wide sidewalks, flanked by shops and stores, and would provide a strong link between "town" and "gown." Continuity between the two could be even further emphasized by the use of specially designed street lighting, furniture and landscape elements.

A fifteen minute walk from the center of the town (the major commercial area east of the campus) would provide the pedestrian with fascinating changes of mood, space and tempo. The commercial bustle of the town leading into stimulating intellectual and cultural activity of the campus and then on to the relaxing, contemplative atmosphere of the western campus with its strong relationship to the ocean. The boulevard turns south at a major axis of the University Center. This axis, a formal design feature of the plan, is terminated by the most important building on the campus, the Library. At the depository of mans' knowledge, no other building or function would be more appropriate as the visual center of this campus. From its location within the center came various overriding criteria for the design of the building. Since it would be the first building of the center, and would remain as the focus of the center, it would be not only a strong singular architectural statement but would become a lasting symbolic landmark for the entire campus.



Plan of University Center.

The University Center will have the library as its visual point of reference. (Sketch prepared by A. Quincy Jones, F.A.I.A.).

The Revised Long Range Development Plan

Since the study for the University Center was made by William L. Pereira & Associates, the Long Range Development Plan for the campus has been reevaluated and modified. The revised plan, prepared under the direction of A. Quincy Jones, F.A.I.A., consulting architect to the University of California, San Diego, retained many of the original planning concepts and recommendations. It compressed the college clusters into smaller units and reduced the distance between them, thereby achieving an even closer relationship of functions and providing reserve areas at the perimeter of the campus. It located the Central Library at the intersection of two axes that gave an architectural order to the pedestrian malls and plazas of the University Center.

III. THE LIBRARY COMPLEX

III. THE LIBRARY COMPLEX

The program for development of the University Library on the UCSD campus, adopted March 29, 1965, envisions a complex of libraries serving the needs of both the campus and the community. It included:

a. A Biomedical Library, planned as an integral part of the projected School of Medicine.

b. The library already in operation at the Scripps Institution of Oceanography, one of the four college clusters.

c. Three cluster libraries, each centrally located within each of the other three clusters of colleges projected in the master plan, combining the undergraduate and science library facilities for the campus.

d. The Central University Library (including both the graduate humanities and social science collections), located in a central campus complex.

The Central University Library will house the largest part of the University's book collections as well as the central administration offices and processing departments of the library system. It will serve the graduate students enrolled in non-science programs and pending completion of the first Cluster Library, will meet a large part of the requirements of undergraduate students, particularly those enrolled in the Second College. (After the Cluster Library is available for use in 1972, the Central Library would continue to meet about 30 percent of the undergraduate library requirements.)

At the time of its completion in 1970, the first increment of the Central University Library will be at some distance from the existing colleges. This disadvantage has been given serious consideration, but the pressure of sharply increased enrollment projections and the difficulty of justifying construction of two permanent library buildings at nearly the same time has left no other satisfactory alternative to the present plan for completion of the first increment of the Central University Library in 1970 and the first Cluster Library in 1972.

Construction of the Central University Library under the present plan will also make it possible to provide permanent quarters for the processing departments and the graduate research collections when it becomes advantageous to move them from the limited space available in the temporary facilities. Later construction of the Central University Library almost certainly would have necessitated storing parts of the collection and of cannibalizing reader or stack space in the existing library for staff work areas.

All undergraduates, but particularly those in the Second College, which will be located nearer the central campus, will be expected to make extensive use of the Central University Library during the interval from 1970 to 1972. The small collections started in the temporary facilities for undergraduate use will ultimately become the basis of the first undergraduate collections in the Cluster Library. The cluster library concept, which evolved from earlier planning, has the advantage of paralleling closely the physical organization of the campus itself – clusters of colleges intended to serve as both residential and academic unities. The cluster libraries lend emphasis to this academic plan by preserving the advantages of smaller academic units for the students and thus helping to achieve a greater degree of self-containment for each of the college clusters. The totally centralized undergraduate library, on the other hand, would obscure this plan and tend in some degree to undo the atmosphere created by the college unit. It is certain that students will make readier use of libraries located within their college clusters and adapted to their needs than they would of a library at a greater distance serving the entire UCSD undergraduate population. Also, faculty members in the colleges will be able to work directly with the local library unit, making the library a more integral part of the teaching process.

The cluster library concept offers an additional advantage of combining undergraduate and science collections in a single building. This will result in an economy of operation and staff for both collections. The creation of science research collections near other research and teaching facilities will, furthermore, forestall the demand for departmental collections.

Multiple volumes of basic science, undergraduate humanities and social sciences material, which would be required in a single undergraduate library for the entire campus, will be distributed among the three cluster libraries. The total number of volumes in science research materials is no greater than in earlier plans, while the number of volumes required specifically for undergraduate use is reduced in this plan.

Information retrieval, including connections to national and regional data processing centers, as well as the handling of local tapes or other information storage devices, will become a regular part of research library operations in the near future. An increasing amount of the work of acquisition, cataloging, and circulation will utilize data processing methods and equipment. At UCSD, periodicals and serial records are already being maintained by the computer at the campus computer center, located at Revelle College. It is expected, however, that a centralized computer center, probably located in the University Center, will have to be established for the entire university, and that its facilities will be extended through satellite stations and consoles in the library. Space will have to be provided in the library for these stations and other equipment.

As additional library units are built in the college clusters, the rapid transfer of books from one building to another will be needed. A system of underground conveyors or tubes has been proposed for this purpose. Internal conveyors must also be considered, since, even though graduate students would continue to have stack access, it is likely that at some future time undergraduates will be required to call books from the stacks to the Circulation Desk on the main level.

IV. RESEARCH AND ANALYSIS OF EXISTING LIBRARIES

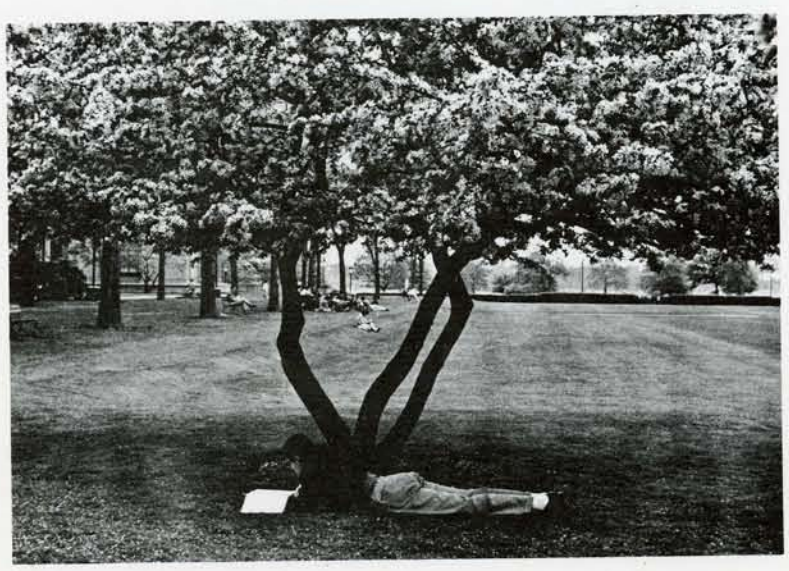
IV. RESEARCH AND ANALYSIS OF EXISTING LIBRARIES

Basic Needs of a Graduate Library

Before schematic designs were begun, the architects studied and reviewed all the background material available, including functional relationship diagrams; flow charts; various methods of storage, retrieval and control. To help the process, criteria were developed by which schematics designs could be evaluated before being pursued.

Any good library plan must provide for efficient operation and must satisfy the needs of the library staff. But the reader's needs are also of paramount importance.

Some of the basic essentials which any good library building must provide for readers are: shelter, light, comfort and privacy. The privacy of not being crowded rather than the privacy of a prison cell.



A book, a comfortable place to read, and reasonable privacy are the essential elements of a good library.

A reader today, however, needs more than these basic essentials and a book. First, he usually needs stacks of books. To find his way through the forest of stacks which make up a modern library, the reader must first consult a catalog, where, if he is lucky, he will stumble upon unexpected entries on the same subject. When the book or books are found, they may be heavy or awkward to handle, so it is desirable for the reader to have, as close as possible to the stacks, a place where he may sit down and read.

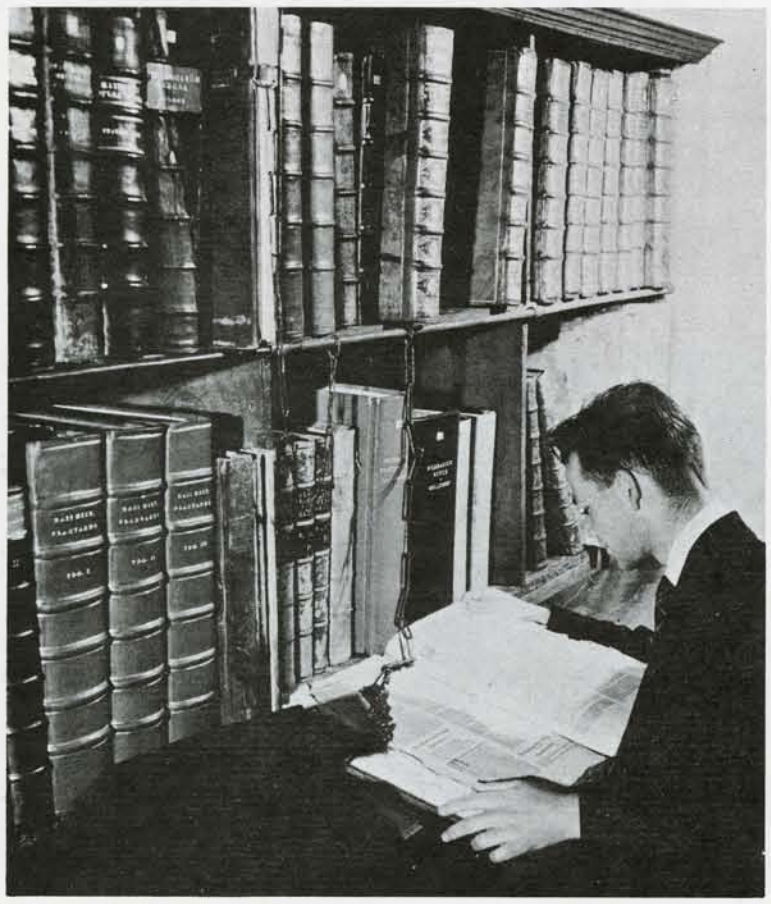
The work place may be a desk or an armchair, or one of many different types of carrels. Whatever it is, the modern reader does not want a large formal reading room with flat tables. This means that library buildings should be capable of accommodating as many readers as possible in individual study carrels. Seventy or eighty percent of library users prefer carrels, which offer at least visual privacy.

The carrell approach is especially appropriate for this Central Library, with its preponderence of faculty and graduate students. An undergraduate library has different needs: large areas of reading space and a relatively limited number of books and other library materials. As a graduate library, with research its principal function, this one requires smaller reading areas and an unlimited collection of library material. In general, faculty members will spend long hours in the library and they must be able to leave their work and find it undisturbed when they come back to it. Graduate students are especially eager to move ahead with their work with a minimum of interruptions. Their daily work schedules may be irregular and, since they probably use more volumes, they need more space for study than most undergraduates.

There are also the outsiders who, in a large urban center like San Diego, may make up as much as a third of the researchers in the library. They, too, are likely to want privacy and a working situation where they are undisturbed and conveniently near the area in which the material on their subject is kept. In general, then, the graduate library today should provide the reader with: 1. access to the stacks, 2. a comfortable reading station; and 3. reasonable privacy.

These things sound simple and obvious today, but they were not always provided. Older libraries were often more like warehouses, primarily concerned with the storage of books. Stacks were designed to exclude readers; lighting and heating were often inadequate; and seating was in large groups around huge flat tables.

Today's library is a more active part of the teaching machinery. There is more emphasis on retrieving and transmitting knowledge and information than on storing it away. This leads to the stacks being open and well spaced. Students are encouraged to browse. The old, high-ceilinged reading room is being replaced with smaller, scattered alcoves and spaces. There is more free-flowing space and a mixture of reading and stack space.



Chained books—a Medieval approach to the library function.

There were other important criteria to be met. The building should provide attractive and diversified types of interior space and be capable of expanding without disrupting the library operations. The building must relate to its site. It must be beautiful as well as functional. It should express the idea that the library is one of the most significant elements of the campus.

During the schematic phase of the project, the architects studied existing research or graduate libraries, concentrating especially on architectural functions and expansion.

Architectural Types

The Tower. The tower, is of course, a striking and significant architectural form, and its use for a library has many advantages. In addition to its visual contribution to the over-all campus scene, a tower library usually features relatively small floors, useful for housing collections of special subjects. The smaller spaces also avoid the bowling-alley effect which occurs in some of the huge lines of stacks in other libraries. Since vertical transport by elevator is inevitable, towers can help cut down the need for extended horizontal movement. And, if natural light is desirable, the tower provides an abundance of exterior wall surface for windows. The tower form is not without disadvantages, however. Unless it is on a commanding site, it has to be extremely tall to be significant. The small floors can severely limit both the arrangement and the use of the collection. The spread of the collection over many floors, even though serviced by elevators inevitably creates a circulation problem. One overriding consideration is the fact that a tower is not readily expandable.

Towers are apparently an acceptable symbol of a university library and have been used with varying degrees of success at Yale, Texas, Cambridge (England) and Notre Dame.

The Notre Dame Memorial Library Building, for example, has two floors of one acre each which house the college library, on top of which is an eleven-story, nearly-windowless tower which is the research library. Each of the tower floors is 18,000 square feet.

The Cube or Box. Many librarians agree that the tower form is not desirable unless the floors themselves are large. Hence, most present libraries are in the form of a cube. From a design standpoint, this library shape can be extremely simple and elegant. Furthermore, because the cube can provide large unobstructed floors, the collection can be efficiently organized into large blocks or sections. The existence of fewer floors means easier access to the books, without depending on mechanical vertical circulation. On the negative side, however, certain elements must be acknowledged.

To begin with, the cube does not, by its geometry alone, establish a significant architectural form, and this is a particularly important consideration when the library is planned to be one of the principal buildings of a campus. Also, the floors may be too large for comfort, and may require excessive horizontal movement on the part of readers. Finally, expansion is difficult. Examples of this type of library include the Yale Rare Books Library and the University of Pittsburgh Library.

Central Court. A modification of the cube style is the "central court", an example of which is the Countway Library of Medicine at Harvard.

This scheme turns inward to a multi-storied, sky-lit court with stairs and elevators at each of the four corners of the court perimeter. The book stacks are in the center of each floor. The quiet alcoves for reading and conversation are on the periphery, at the greatest distance from the corridors, with the book stacks as a sound buffer.

This arrangement protects the books from the sun's heat and glare. For operational purposes, it is almost as efficient as the box.

The central court design has the same drawbacks as the box, however. It cannot expand gracefully, and is not in itself an especially interesting or significant form. Its principal drawback is that horizontal circulation is severely impeded, by the existence of the court.

Subterranean Libraries. Sometimes, in order to use a special site to relate to associated buildings which are on a smaller scale, some floors of a library are put underground.

This is the case at the Lamont Library at Harvard and the Olin Library at Washington University. In both these libraries there are subterranean stacks and reading space, the former has one of its five stories below ground and the latter has two out of five similarly constructed. This form of building does not provide for expansion except vertically, and it deliberately understates the importance of the library in relation to the other buildings of the campus.

The Gateway. This is another form, besides the tower, in which a library can become the focal element of a campus. At Clark University in Worcester, Massachusetts, the library, located on a hill in the center of the campus, is raised up on piers and forms a gateway between the academic and the residential complexes.

The space beneath the building acts as a general meeting place and is the symbolic center of the campus.

Pavilions or Compound. An unusual solution has been tried at Northwestern University, where, by developing the new research library as separate though interconnected pavilions, it was found that the huge volumes of space required could be broken down in scale, resulting in a better architectural relationship to the existing campus structures and a more efficient relationship between the individual users and the library's specialized functions. At this library, expansion is simplified by the provision of three units or increments, each of which will ultimately house material on different subjects: one for the social sciences, one for the humanities and one for history. The interiors of the three circular pavilions offer great variety of space and privacy for individual study.

Disadvantages of this approach include increased building costs, increased library personnel to administer and oversee the dispersed stacks, and inconvenient relationships between various portions of the collection.

Functional Types

By analyzing the relationships between the three basic areas (stacks, public and staff) in existing libraries, four functional types of libraries were established. (Usually the stack area is many times the combined area of the public and staff areas, and this ratio tends to increase as libraries operate under an increasingly open-stack situation where the reading space is provided within the stacks themselves.)

The first functional type of library is the Subterranean, where the stacks are placed below ground. This type of library is built when there is a height restriction imposed by the campus and only the public and staff floors have natural light and views. From the standpoint of scale, significant architectural form is extremely difficult to achieve, because of the limited area involved above the ground. However, cost savings are made possible by the lack of fenestration and the insulation value of the surrounding earth. Usually, this type of library is used when the books are "paged" (a staff member gets the book as requested) and the amenities of light and view are not required in the stacks.

The second functional type of library is the Split Collection, or separated stacks. In this commonly used type, stacks that are usually open to the public are placed above the public and staff areas, and those that are closed are placed below, for control reasons. This type of library has "dead storage" in its basement, with the material that is most used located in the areas above the ground. In many cases, the basement is built as a safety valve for a rapidly expanding collection. Libraries of this type usually take the architectural form of a box or cube, and the treatment of the facade becomes the primary architectural feature.

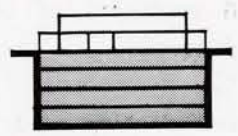
A third functional type, most used in an open-stack situation, is the Elevated type. Here the book stacks are placed above the public-staff floor and the height of the building is limited only by the size of the program and the site area. This type of library can take the architectural form of a tower or can be reduced to a box or cube. In essence, the stacks are provided with excellent natural light and view, but the associated problems of fenestration costs and heat loss are encountered.

A fourth library type, Special, was established for buildings that did not fall into any of the foregoing types. This category included libraries that were designed for a special purpose, or which contained a special rather than a general collection, and required special servicing. Typical of the Special library type is the Yale Rare Books Library, where books are housed in a glass envelope to control humidity and temperature, while other parts of the collection are housed in vaults, for security reasons. Harvard's Countway Library of Medicine is also in this Special category, because it locates its most-used periodicals away from the remainder of the collection.

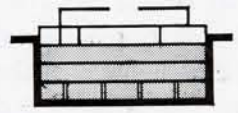
FUNCTIONAL TYPES OF LIBRARIES BY LOCATION OF THE STACKS

SUBTERRANEAN

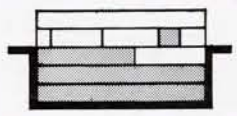
JOHN HOPKINS
1,000,000 Volumes



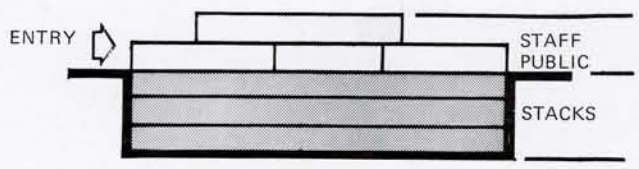
NATIONAL LIBRARY OF MEDICINE
1,162,000 Volumes
230,000 Square Feet



QUEENS BOUROUGH PUBLIC
860,000 Volumes
194,000 Square Feet

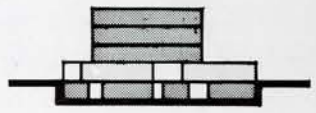


- No good natural light to stacks.
- Major architectural element is small volume of space above grade.
- Expansion at sides of stacks in basements.
- Functions separated horizontally.
- Staff and public areas have natural light and view.

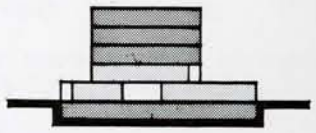


SEPARATED

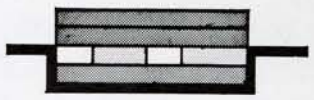
UNIVERSITY OF DELAWARE
1,050,000 Volumes
156,000 Square Feet



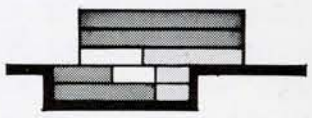
CORNELL
2,000,000 Volumes
240,000 Square Feet



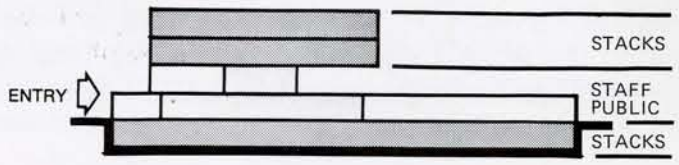
OREGON STATE
127,000 Square Feet



WASHINGTON UNIVERSITY
1,000,000 Volumes

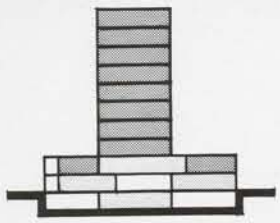


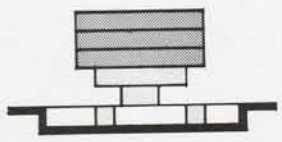
- Expansion into basement or addition of more floors.
- Split stacks.
- Exterior facades become major architectural element.
- Volume of space enclosed is horizontal in nature.
- Circulation – horizontal and vertical.
- Functions separated horizontally.



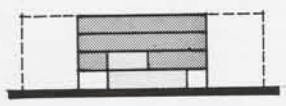
ELEVATED

NOTRE DAME
1,750,000 Volumes

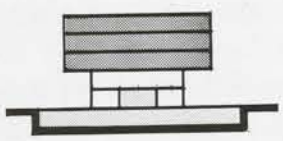




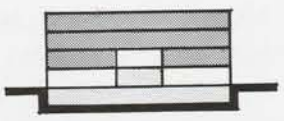
UNIVERSITY OF ALBERTA
1,200,000 Volumes
184,000 Square Feet



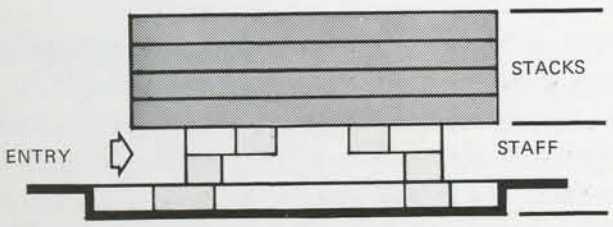
NORTHWESTERN
1,200,000 Volumes



UNIVERSITY OF PITTSBURGH
1,500,000 Volumes
225,000 Square Feet

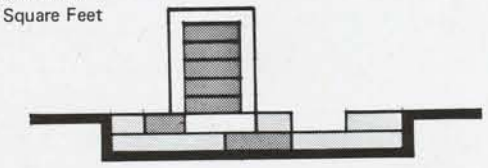


- Good light to stacks.
- Expansion at side or in another structure.
- High cost of fenestration.
- Major volume of interior space possible.
- Major volume of space enclosed and massive vertical element developed.
- Circulation — vertical.
- Functions separated vertically.

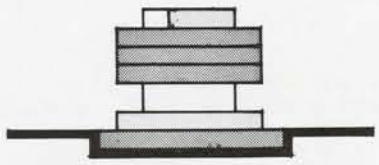


SPECIAL

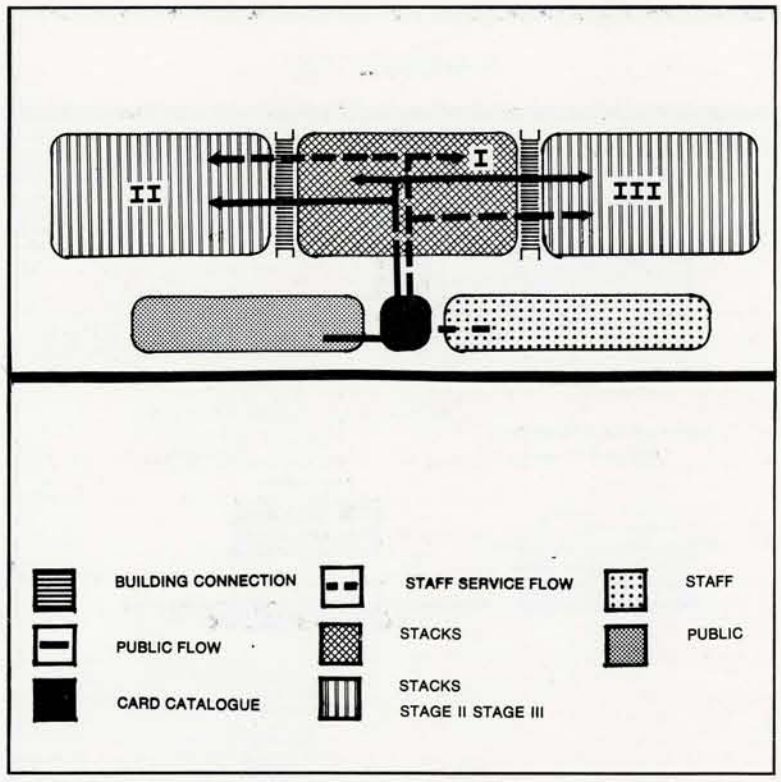
YALE (rare books)
800,000 Volumes
88,300 Square Feet



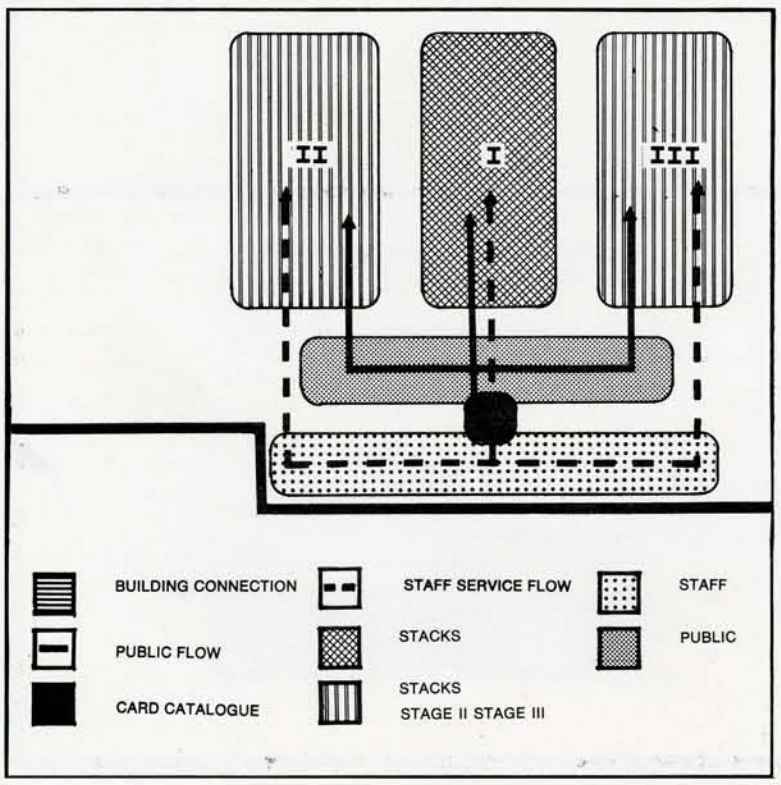
HARVARD'S COUNTWAY
1,000,000 Volumes



- Design developed by requirements of the highly specialized collections housed.



Schematic section of horizontal expansion.



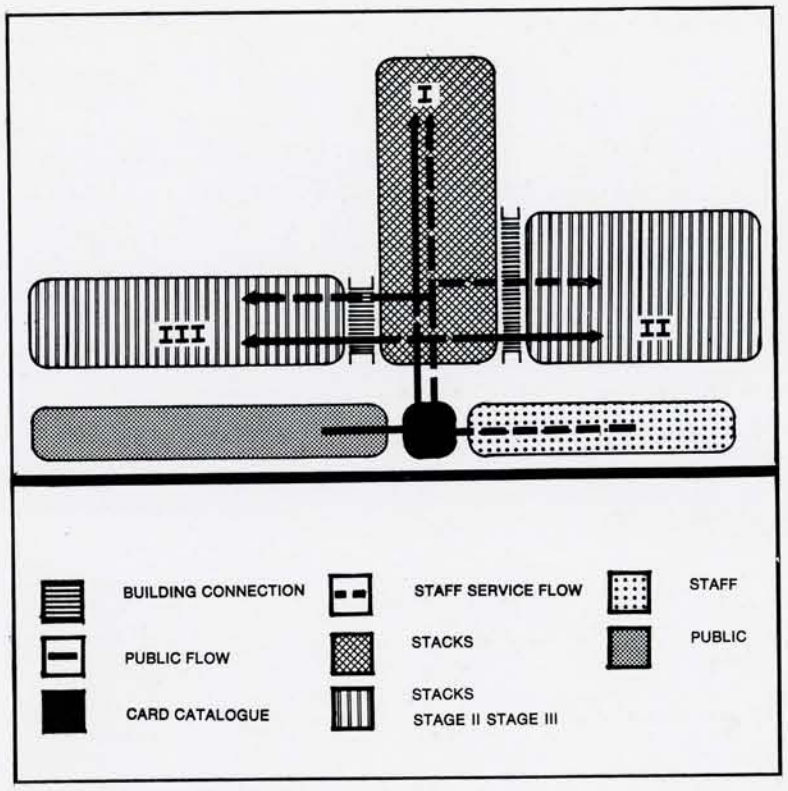
Schematic section of vertical expansion.

Methods of Expansion

Many large buildings are constructed in phases or increments, each of which must work functionally within a framework established in the initial planning of the first increment. In the case of libraries which were studied by the architect, the patterns in which they expanded, or were intended to expand, fell into four basic categories, with most of the new space being dedicated to book stacks rather than public or staff areas.

The most common method of expansion is horizontal, by merely adding continuous space to the initial building. This type of expansion has been used in many libraries and usually affords a good functional relationship in all phases. It does not, however, allow any single increment to remain as an architectural statement and, since each increment might be of a dissimiliar design, a visual competition is set up between the various increments.

A second method of expansion is vertical, in which a series of buildings share the circulation systems of the staff and public floors below, yet are not connected at the upper levels. The disadvantage of this scheme is that people must return to the main level of the library in order to reach another portion of the building or book stack. This scheme also provides for a multiplicity of vertical circulation systems, a factor that will increase costs, both initial and operational.



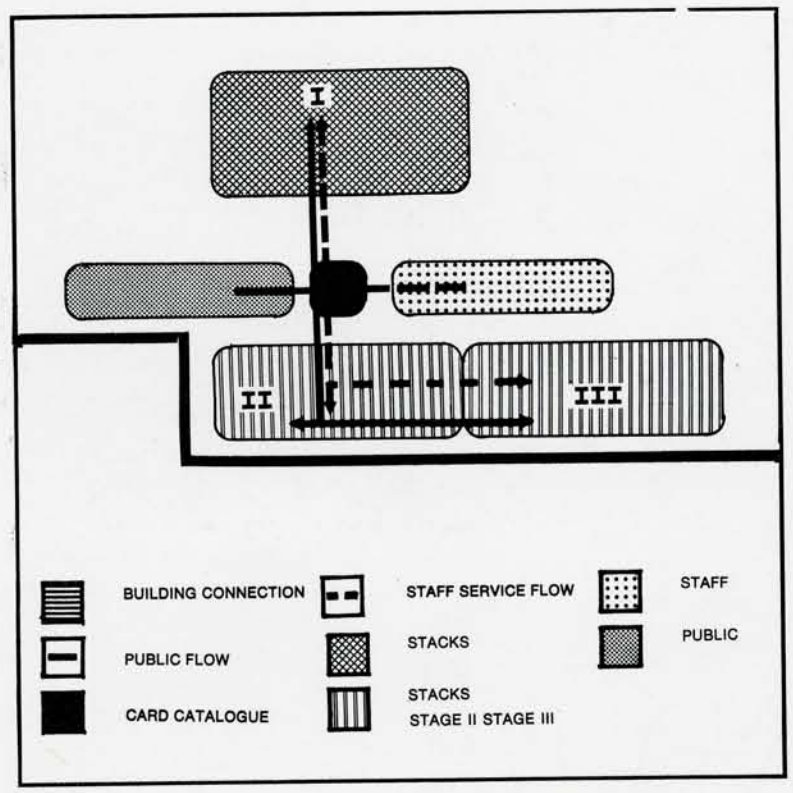
Schematic section of vertical and horizontal expansion.

A third method of expansion is by a combination of the first two – future increments added vertically as well as horizontally. This kind of expansion is usually the result of unanticipated expansion and is typical of most libraries today. Some of the book stacks are continuous to the original increment, while other areas are completely isolated, except for connections at public or staff levels. Unless the ultimate design can be planned in the first increment, and if this planned incremention is not enforced throughout the subsequent construction, the resultant building will be chaotic in appearance and its function would be inefficient.

The fourth method of expansion is splitting the book collection with the public and staff floors, having book stacks both above and below the ground. One good feature of this method is that it allows for the incorporation of a single vertical circulation element that ties the total system together.

Another positive element is that the staff and public areas are near the center of the total library building.

One negative aspect, however, is that the subterranean book stacks have no exposure to the outside unless special conditions exist on the site. Generally, when this condition exists, the first increment of book stacks must be below the public and staff areas, thereby not providing a strong architectural form above the ground.



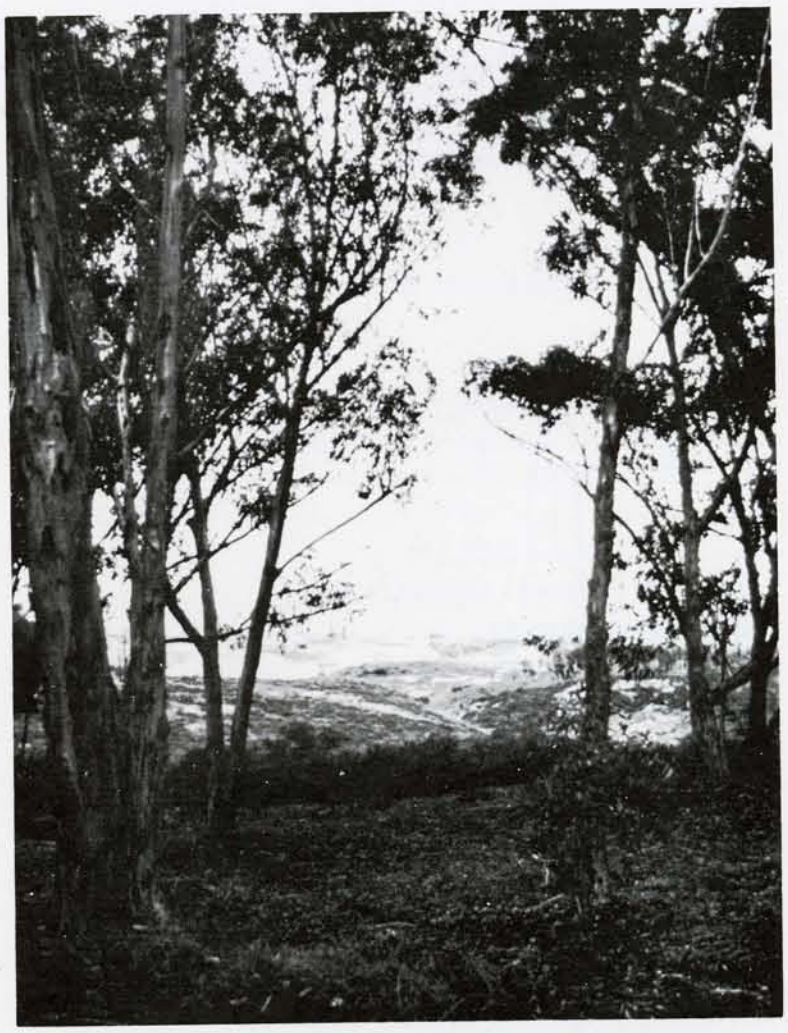
Schematic section of split expansion.

V. CENTRAL UNIVERSITY LIBRARY

The Site

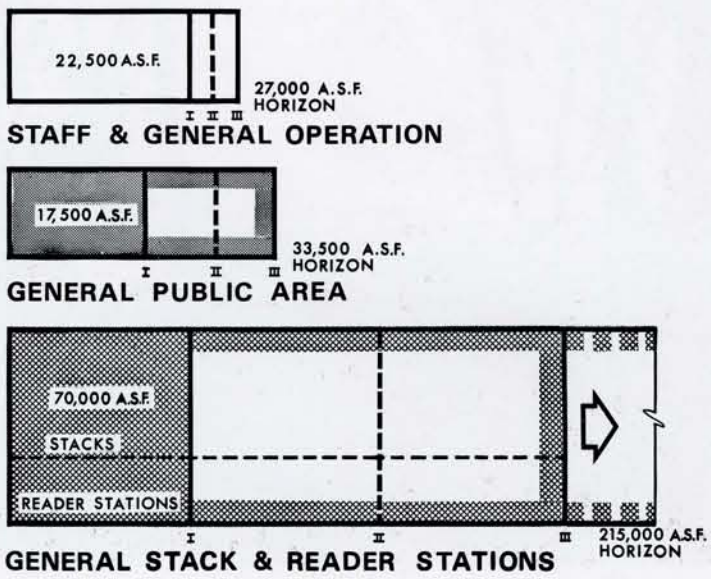
The site for the Central Library was located at the geometric center of the campus at the crest of a small canyon. The canyon, planned to be kept as an open reserve, is visually exposed to the Pacific Coast Freeway to the northeast, so that even with the ultimate development of the entire campus, the library will remain a visible and symbolic landmark of UCSD.

This sloping site is densely covered with eucalyptus trees on its southern portion, while the northern portion contains only low evergreen chaparral. The preservation of these trees became another primary design criteria as the architect began the design of the building.



The site for the library.

SUMMARY OF PROPOSED SPACES									
Department and Type of Space*	Each Space			Assignable Square Feet			Preliminary Plans		
	Space No.	No. of Sta.	No. of Ident. Spaces	Each Space	Total Ident. Spaces	Total Type of Spaces	No. of Spaces	Total ASF	(+) or (−) ASF
1	2	3	4	5	6	7	8	9	10
Circulation & Reserve	1	7	1	2,000	2,000	2,000			
Xerography	2		1	150	150	150			
Ill. Office	3	3	1	600	600	600			
Card Catalog	4		1	1,800	1,800	1,800			
Reference Desk	5	3	1	900	900	900			
Librarian's Office	6	1	1	300	300	300			
Administration Offices	7–8	1	1	300	300	300			
Reception–Administrative Staff	9	3	1	450	450	450			
Librarian's Conference	10		1	323	323	323			
Supplies Room	11		1	200	200	200			
Library Photo Service	12		1	400	400	400			
Reference Offices	13	9	1	1,350	1,350	1,350			
Acquisitions Area	14	22	1	3,300	3,300	3,300			
Serials Area	15	20	1	3,000	3,000	3,000			
Receiving & Docks	16	1	1	700	700	700			
Catalog Area	17	31	1	4,700	4,700	4,700			
Departmental Offices	18–21	1	4	150	600	600			
Public Services Office	22	1	1	150	150	150			
Staff Conference Room	23		1	800	800	800			
Special Collections	24	6	1	2,000	2,000	2,000			
Special Collections Offices	25	2	1	350	350	350			
Documents Collection & Readers	26	8	1	2,000	2,000	2,000			
Documents Work Room & Office for 625,000 volumes	27	3	1	450	450	450			
Stacks & Readers	28	1108	1	74,575	74,575	74,575			
Faculty Studies	29–49	1	20	100	2,000	2,000			
Seminar Rooms	49–50	14	2	336	672	672			
Seminar Rooms	50–51	20	2	390	780	780			
Typing Stations	52–72	20	1	25	500	500			
Sound Stations	73–83	10	1	25	250	250			
Microprint Room & Microprint storage)	84	10	1	300	300	300			
Data Processing	85			500	500	500			
Maps & Non-Book Collection, Archives	86			3,000	3,000	3,000			
Bibliography Room	87		1	600	600	600			
TOTAL						110,000			



Graph of first, second, and third increments of the library program.

The Program

The ultimate library program calls for a total of 255,000 assignable square feet. It will accommodate 3,000 readers and house 2,500,000 volumes, principally in the humanities and social sciences. The First Increment will be 110,000 assigned square feet, with 157,000 outside gross square feet. Subsequently there will be two increments, each of approximately 70,000 assignable square feet or 100,000 outside gross square feet.

Because only one-third of the ultimate library was to be constructed in the initial phase of construction, and because this initial phase must create the initial and ultimate architectural character and visual focus of the University Center, an unusual problem confronted the architect. The initial phase had to be strong enough architecturally to establish a focus, yet not dominate the urban cityscape that would ultimately develop in the Center. Moreover, the expansion of this first increment would have to meet all the functional requirements of a library, yet not detract from or conflict with the architectural identity of the first increment. This indeed, was a major consideration, since little more than a third of the ultimate building would be constructed initially.

Since the building would be enlarged by at least two additional units of about the same size as the first unit, and since its collections and staff will not be fixed at any specific size, it was designed to be capable of considerable expansion with horizontal or vertical increments, or possibly both. The interior design of the building was made as flexible as possible, to provide for changes in the layout of services as they become necessary.

The First Increment of the Central University Library will house the activities and services required from 1970 to 1975 (at which time the Second Increment of the building is planned for completion). Space allocations for the First Increment are:

1,250 Reader Stations:	31,250 square feet
110 Staff Stations:	16,500 square feet
675,000 Volumes (max. capacity)	50,625 square feet
Miscellaneous Space:	11,625 square feet
Total Space	110,000 square feet

Seating in the Central University Library is based on a ratio of 1:4 for undergraduate students and 1:3 for graduate students. The additional space required for graduate seating must be charged against space allocated to the academic departments of the University in the non-scientific disciplines. The faculty studies provided in the Library are included in the space calculated on a 1:3 ratio for graduate students.

The miscellaneous space provides for facilities such as card catalogs, non-book materials, unbound serials, maps, and public service desks. The plan provides for shelving the entire collection of 675,000 volumes in open stacks. Based on .1 square foot per volume and 30 square feet per reader station standards, 105,000 square feet would be justified for this project. Necessary features of the First Increment for the Central University Library were, breifly described, as follows:

a. A single entrance/exit for general public use, with at least five checkout control stations planned as an extension of the Circulation Services Desk. The entrance/exit is so located that it would be capable of continued convenient use after the construction of the second and third increments of the building. These increments should be related to this entrance in such a way that it will not be necessary to provide additional public entrance/exit facilities.

b. Staff entrances combined with the receiving entrance and loading docks.

c. Service elevator, opening from within the circulation services area, giving controlled access to all other levels in the building. It is preferable that the elevator not be keyed. Elevator access and page stations on other levels within a single enclosure are combined with terminals to the future book conveyor.

d. Public elevators, since the building has more than two levels above ground. The location of both stairways and elevators for public use are such that access to them can be controlled if it ever becomes desirable to limit the use of upper or lower levels to graduate students only.

e. Circulation Desk area, combining the reserve book stack for approximately 5,000 volumes and the Reserve Book Issue Desk. This should be near the entrance/exit, as indicated above.

f. Exhibit and waiting area, adjacent to the entrance and the Circulation Services Desk.

g. Current Periodical display area or room, with display shelving.

h. Reference Services Desk, with an adjoining area for closed reference materials and reference shelving for 20,000 volumes.

i. Space for a conveyor terminal in the circulation services area. The conveyor will connect to other buildings.

j. Open stacks for 625,000 volumes, distributed evenly through the reading areas, with reader stations.

k. Four hundred open carrels, intermingled with the book stacks.

l. Lounge areas to seat about 162 persons. One lounge area located near the entrance in the waiting/exhibit area; another in the periodicals area or room; the rest distributed equally throughout the library.

m. Open seating for about 350 persons at tables accommodating four or six persons each.

n. Four seminar rooms with wall shelving, to accommodate 14 to 20 persons each.

o. Twenty faculty studies, completely soundproofed and enclosed.

p. Typing facilities for 20 persons. These are carrels without doors, completely soundproofed on three sides, furnished with carrel tables with all extensions.

q. Sound facilities for 10 persons. These are enclosed on three sides with soundproofing and will have turntables and/or tape desks and/or direct wiring to a central tape bank.

r. A Special Collections Room with office and work room, including shelving for about 10,000 volumes.

s. A documents collection area or room with closed-stock area and work room. Shelving for 10,000 bound and unbound documents, totaling about 70 double-face sections of 90" shelving.

t. A Microfilm Reading Room seating about 10 persons, with a storage area.

u. Work areas and offices for the technical processes staff: receiving and loading docks, Acquisitions Department, Serials Department and the Catalog Department. Total staff in these areas equals 77 FTE.

v. Administrative offices, including an office for the University Librarian, two additional offices, reception area, and space for 3.5 FTE staff members.

w. Reference offices accommodating about 10 FTE and located adjacent to the Reference Services Desk. A separate office for the Head of Public Services is also included near this area.

x. A Bibliography Room with shelving for 5,000 volumes, equally accessible to the Catalog and Acquisitions staff and to the public, is located near the card catalogs.

The Budget

THE BUDGET

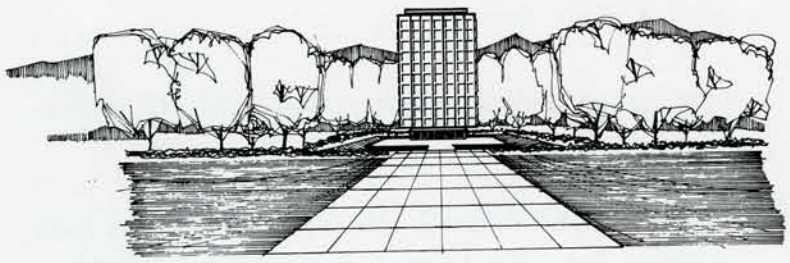
Funding Schedule	1965–66	1966–67	1967–68	1968–69
$5,120,000	Parking $67,000	Working Drawings $141,000	Construction $4,197,000	Equipment $715,000

Estimate of Cost

0. Site Clearance	$ 15,000
1. Construction*	3,532,000
2. Utilities	130,000
4. Site Development	125,000
5. Fees	208,000
6. Supervision, Inspection, Surveys, Tests, 7. Plans, Specifications	135,000
8. Special (Book Moving)	50,000
Subtotal	4,195,000
9 Contingency (± 5%)	210,000
TOTAL BUILDING PROJECT**	4,405,000
3. Groups 2 & 3 Equipment (includes bookstacks)	715,000
TOTAL PROJECT	$5,120,000

Project Data	Area Totals	Ratio	Construction* Unit Cost	Total Building** Project Unit Cost
Outside Gross Square Feet (ogsf)	157,000	1	22.50	28.06
Assignable Square Feet (asf)	110,000	.70	32.11	40.05

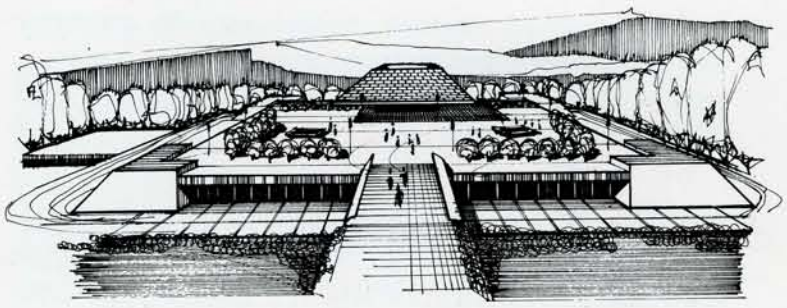
The budget established by the University of California.



The multi-tower scheme.

Development of the Concept

The schematic phase of all architectural projects involves the creation of concepts that could satisfy the requirements of the program, of the client and of the architect himself. These concepts are then applied to the criteria to test their validity. In the case of this project, many schemes for the development of the first increment and its expansion into an ultimate configuration were developed and evaluated. As a result, four schemes emerged, each of which afforded a solution to the problem and contributed in one way or another to the ultimate design of the Central University Library.

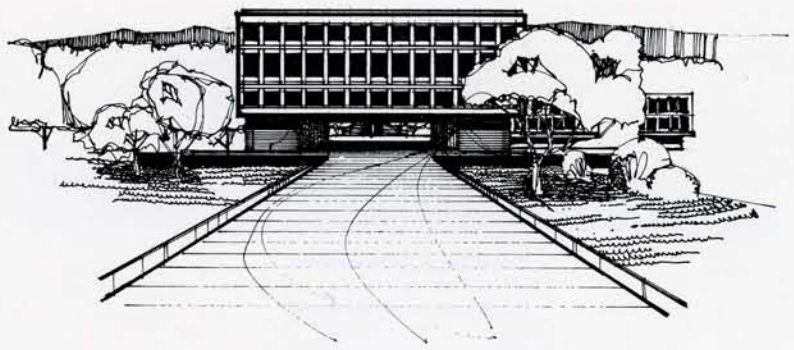


The subterranean scheme.

Multi-Tower Scheme. This scheme established a single tower as the first increment. Expansion would be by the addition of future towers. However, this provided poor intra-stack connections. Also, because of the limited first increment program, a true tower shape could not be produced without reducing the floors in size thereby reducing the efficiency of the building.

The Subterranean Scheme. This scheme employed a walking deck on top of the stacks, which were located in a series of basements. A dramatic entry to the library was created, but extensive horizontal circulation patterns were required and the reduced scale of the exposed elements of the building did not proclaim the library as the heart of the University Center.

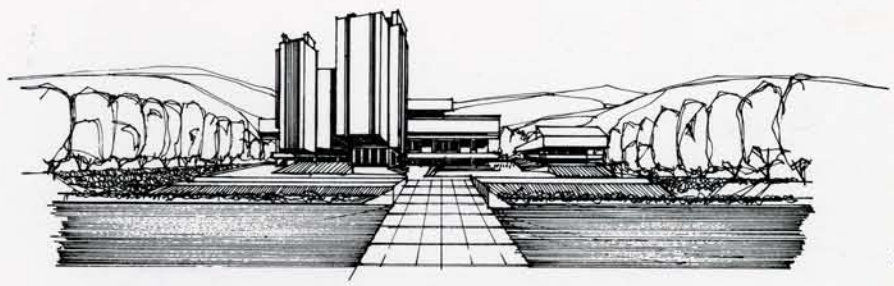
Gateway Scheme. This scheme proposed a first increment building with the stacks elevated above the public entry level. In subsequent additions to the library, the stacks would create a courtyard and the building itself would be connected to the already existing staff areas. This scheme established a significant design statement and a point of reference for the campus, but the circulation within the building was poor.



The gateway scheme.

Compound Scheme. This scheme provided for a series of buildings within a parklike area. Like the Gateway scheme, it was successful in establishing a "sense of place", however, it had a poor circulation pattern due to the dispersion of its elements.

While each of these schemes could evolve into a workable and satisfactory library, none of them establishes a single best way of creating a permanent visual datum in the University Center and a satisfactory system of expansion.

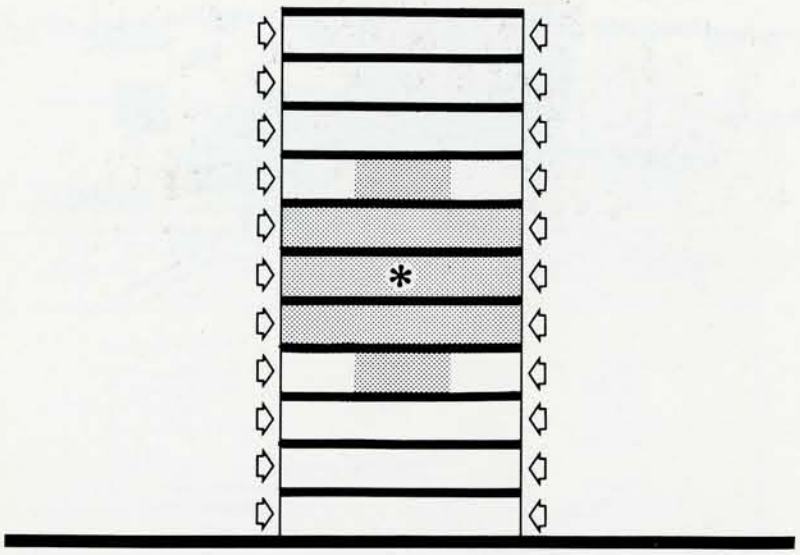


The compound scheme.

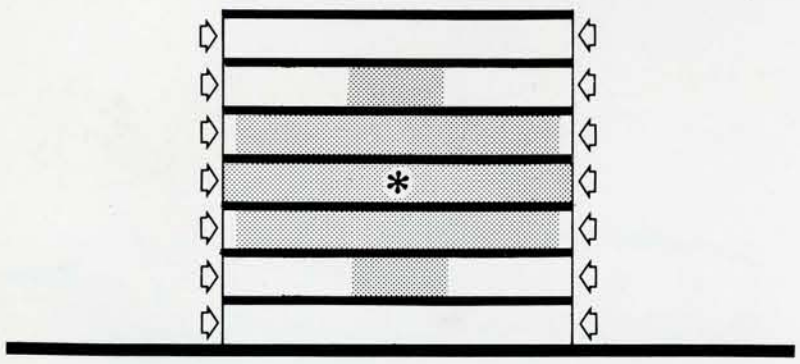
The Shape of the Stacks

The shape or form of the structure that would house the bookstacks in the first increment was determined by two major factors – the results of several studies of how people use and move within different shaped buildings and the desire to establish a strong image for the University Center.

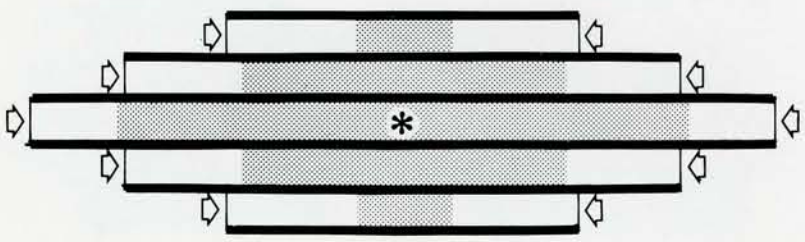
The tower shape for housing an open book collection has the advantage of a high window-to-floor ratio, that is, views and natural light can occur with greater frequency in a tower shape because there is more exterior surface. And the tower itself is a distinctive architectural shape because of its height and relative scale to the human being. The tower, however, does not satisfy many of the requirements of libraries. Its usually smaller floors severely limit the organizational collection, it requires a large staff to control it, and the problems of vertical circulation can become monumental and costly. Indeed, at any given time period a person is restricted to a relatively small area of the total building because of the time required to move vertically by stair or elevator.



The Tower Shape — Gray shading indicates area accessible in a given time from a single point.



The Cube Shape — Gray shading indicates area accessible in a given time from a single point.



The Ellipse or Sphere Shape — Gray shading indicates area accessible in a given time from a single point.

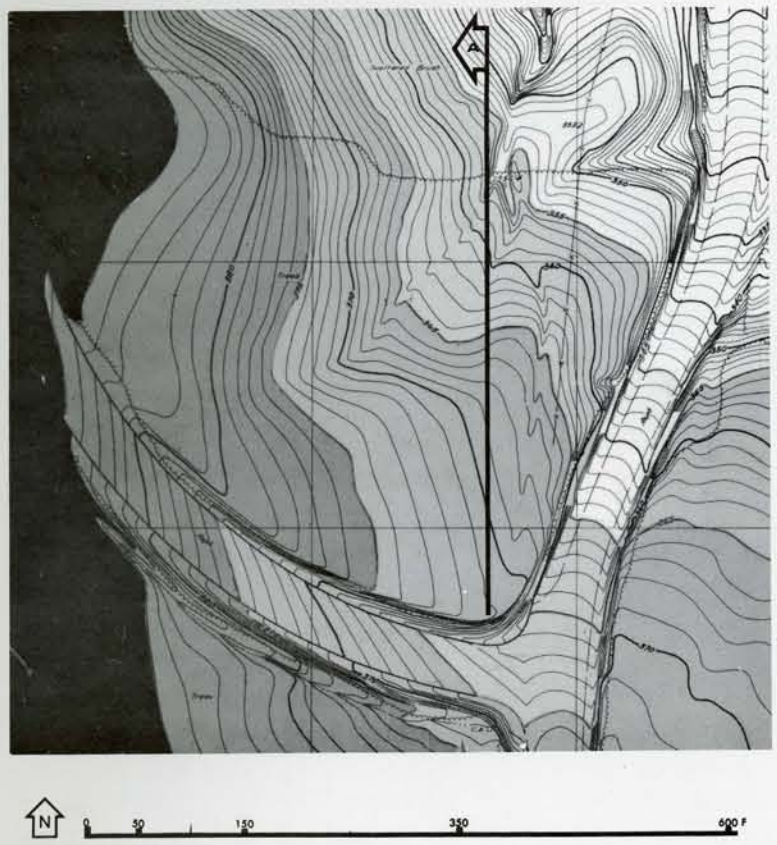
By flattening the tower, a cube or box is formed. This shape has been accepted most frequently by librarians because the problems of vertical circulation are minimized, control of the stacks can be effected by a minimal number of staff members, and the larger floor areas allow for ease of organization of the collection. By reducing the vertical size of the building, the architectural form has less impact, and because of the deeper floors, the window to floor ratio is reduced. Should the box contain many floors, there would arise the associated problems of vertical circulation in a tower. Because the box form library has larger floor areas than the tower shape, people circulating within it would, within any given period of time, have access to more area.

Indeed, given the pattern of area accessible in any given time in a multistory building, and assuming that a person decides to move unobstructedly and horizontally in any direction, then the best shape for a building housing a book collection is an ellipse in section or a flattened sphere.

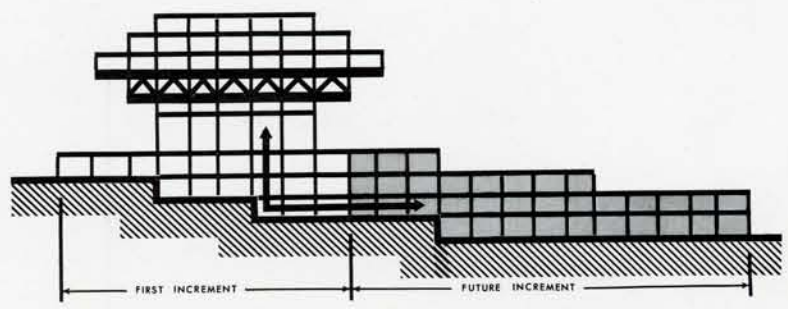
Certainly the sphere is believed to be the most functional and desirable shape for housing a book collection of the type which will be contained in the Central University Library. It allows optimum access to the book collection from a central point, with each floor above and below the middle floor reduced in size to compensate for the time it takes to move vertically, by stairs or elevator. Also, as a result of the basic geometry, the center floors are the largest and they can therefore house the largest proportion of the books and the greatest number of readers. The ratio of window surface to floor area is good on the largest floor and excellent on the floors above and below it. The spherical form allows for a high degree of flexibility in the organization of the collection and does not rely on elevators for circulation within the book stacks.

Beyond the functional advantages, the spherical form is unusual and could establish a more powerful and unusual image for the University Center than could either the tower or cube. It is a strong architectural form which, from either an exterior or an interior viewpoint can potentially evoke a rich aesthetic experience.

For all these reasons, and because it best satisfied the need to establish a visual reference for the University Center, the need for expansion of different parts of the program at varying rates and times, and the architects' desire to provide for the highest possible level of library operation, the sphere was chosen as the basic form for the Central University Library.



Topography of the site and a section through the site.

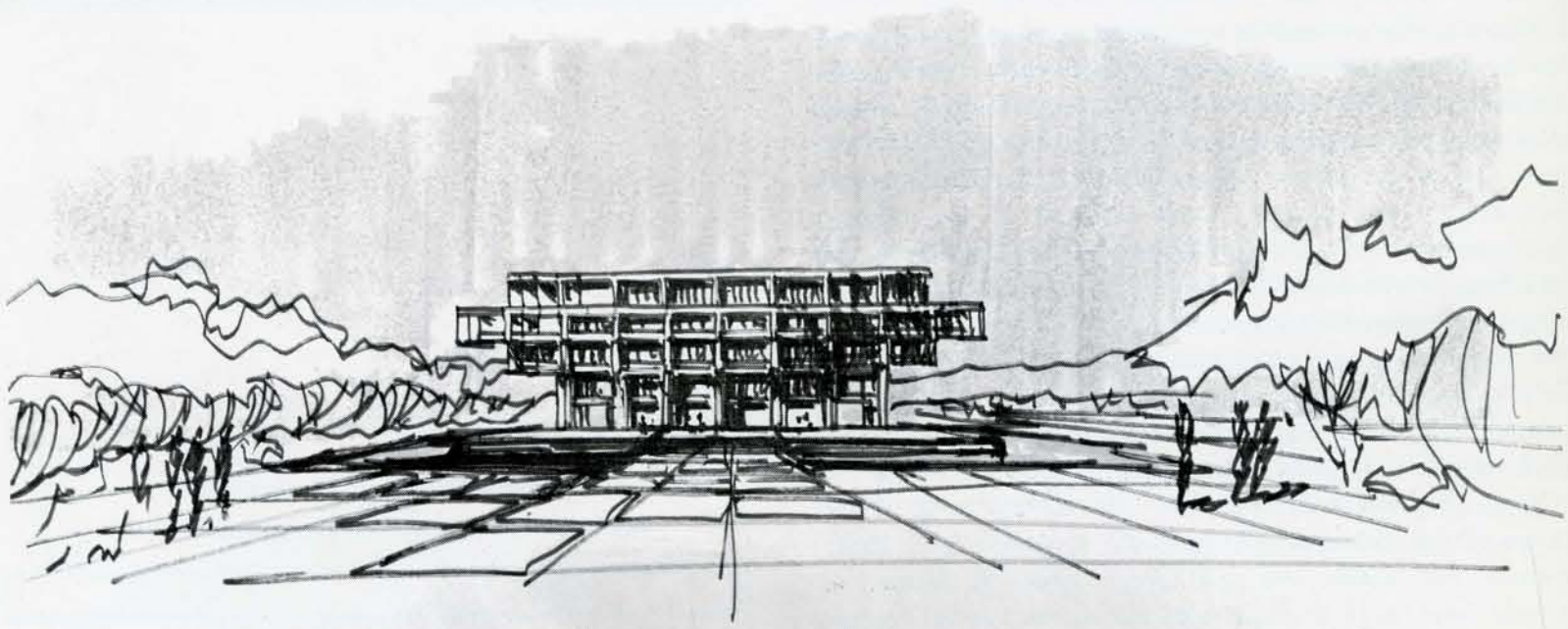


Schematic section of the all-steel structural scheme showing first and future increments.

Expansion and the Site

Ultimately, the site and its topography yielded the answer to the question of how the library was to expand and located the functional parts. Because of its sloping character, expansion was made feasible by splitting the collection into two parts, above and below the public and staff areas. The first increment would contain about one-third of the ultimate book stacks above the public and staff floors, with the remaining two-thirds below these floors, cascading down the canyon. By cascading down the canyon, rather than burying the future book stacks in a man-made hole, the amenities of natural light and view were retained around most of the perimeter. Some of the negative aspects of the subterranean book stacks were thus overcome. Further, by locating the vertical circulation element near the center, most of the floors of the ultimate building could be served by a single system. The public and staff areas would be located at ground level, both of them adjacent to the central vertical circulation system. Above these floors would be located the first increment of book stacks.

Early design studies indicated that a low building would not satisfy the need for scale in the University Center.



The building raised above the ground.

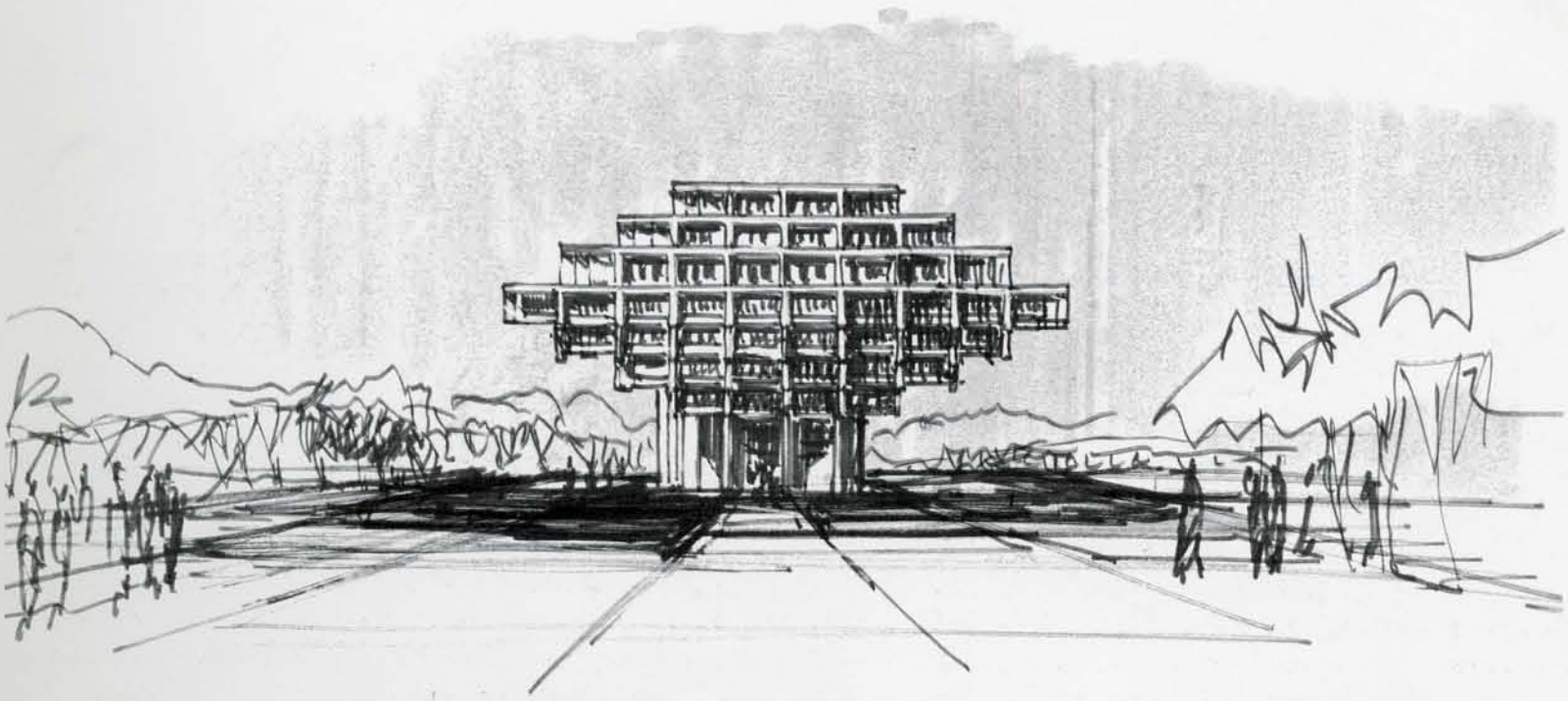
The Forum

Traditionally, libraries have been designed as memorials, with formable walls and a great sense of containment. Activities not associated with the library function, even though a part of the academic environment, were barred from this fortress-like edifice. In this library, however, because it is at the cross roads of the cluster colleges that constitute UCSD, the epicenter of academic activity, space must be provided for large numbers of people walking and congregating. And yet this must not adversely affect the proper operations and use of the library.

This kind of space was created by elevating the sphere, which houses the general collection, above the roof of the ground floor. This roof area, paved, becomes a plaza – The Forum – with access from the surrounding malls and walkways. With landscaping added – benches, potted plants, etc. – this plaza becomes an attractive area for discussions, displays, reading or contemplation.

By elevating the spheroid above the lower floor and supporting it on columns, the base of the entire building became visually open and the columns somewhat reflected the pattern of the trees on the site. This additional height also reinforced the architectural image created by the rich and unusual shape and helped establish the scale necessary for a significant architectural statement.

By fulfilling certain criteria, this library design seems well suited to the special functions which it is to serve and to the site which has been assigned to it. And it is, to the best architects and planners, an entirely original design. In



Elevating the building established the library as the visual point of reference for the campus.

Original design for the library.

In October of 1965, the library, in its schematic form, was presented to the Library Planning Committee, the library staff and the staff of the Architects and Engineers, where it was subsequently accepted with great enthusiasm. Typical was an article by Donald C. Davidson, University Librarian at the University of California at Santa Barbara, which was published in the campus news letter:

"If I Bowdlerize adjectives to describe the proposed new library at San Diego I presume that golldarndest would describe the building that Pereira came up with to satisfy the programmed requirements. (If it is accepted – and this was only the first presentation of a schematic approach to the building – it will be the library of the century.) As current chairman of the California Librarian Association buildings committee and as incoming chairman of the American Librarian Association counterpart committee, all I can do is hope it is accepted. It won't be far enough along for the California Librarian Association in December but it could prove to be important for the American Librarian Association Buildings Institute in mid-1967. It needs a full presentation, for it does reconcile program with a totally original aesthetic concept. Obviously architects recently have been worried about stodginess of libraries, and have done violence to library needs in some of California's efforts to overcome this stodginess. Pereira has dramatically done the aesthetic task within the scope of library needs. I wish I could talk with my hands on paper to describe the 'sculptural, tour de force' building being considered at San Diego."

VI. FIRST INCREMENT

Steel Scheme — Model of the library as viewed from the park of the University Center.

VI. FIRST INCREMENT

Schematic and Preliminary Phase

In the final design, the general collection is housed in a five-level spheroid, schematically circular in plan and elliptical in cross-section. The sphere is raised thirty feet above the plaza by a colonnade of 16 concrete columns. The plaza – the Forum – is a square, 200 feet on each side. Beneath the Forum, which is raised one/half level above the existing level of the ground, is the main public floor, containing most of the staff and public areas and those library services most frequently used: reference rooms, card catalogs, periodicals, circulation, etc. Entry to the sphere is made at this floor, by elevators contained in a core which passes through the open Forum. Below this main level is a basement or lower level about half the size of the main level above. It housed public and staff areas as well as the main mechanical room for air conditioning. From the staff areas of these two floors will come service and maintenance not only for the graduate collection housed in this building but all the book collections housed in the satellite cluster libraries that will make up the UCSD library system.

AREA ANALYSIS			
Summary By Floors			
Floors	Assignable Area		Gross Area
	Program	Designed	
Lower	8,370	8,446	18,320
Main	28,380	28,577	44,002
Forum	–	–	2,378
First Floor	*(73,250)	7,396	11,191
Second Floor	*	15,915	19,710
Third Floor	*	25,706	29,561
Fourth Floor	*	15,915	19,710
Fifth Floor	*	7,837	11,191
TOTALS	110,000	109,792	156,063

Percentage net design area to gross: 70%

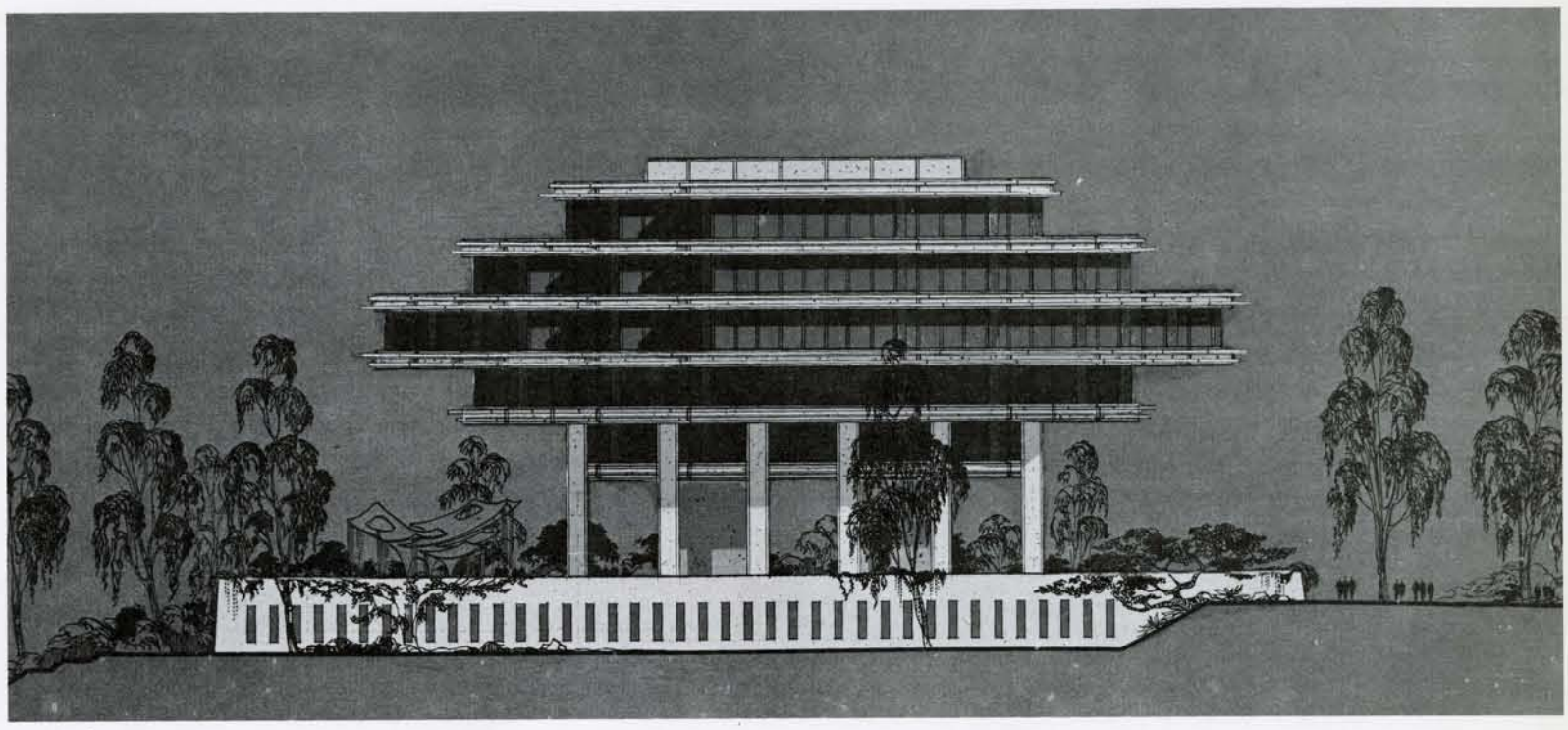
* General collection, reading stations, faculty studies, seminar rooms, and special collections divided among first, second, third, fourth and fifth levels.

Summary of General Stacks by Levels			
Levels	General Stacks	Studies	Seminar
First	7,171	–	225
Second	15,690	–	225
Third	23,996	924	636
Fourth	14,909	462	544
Fifth	5,946	154	225
TOTALS	67,712	1,540	1,855

In many libraries, the collection is isolated from the reader and books are requested or paged. This library, being principally a graduate library, will have an open collection, i.e., the reader may enter the collection itself and find his own book. Further, the traditional reading room for the collection will be omitted, with seats for the readers being located within the stacks themselves. Because of this fundamental organization of the library, the stacks have been designed to be inviting to the reader, providing an environment conducive to study, reading and working with the books.

The interior design of the building is aimed at bringing the readers into as close as possible contact with the books themselves. Spaces are defined primarily by furniture and book stacks, with a minimum of permanent partitions, thus providing maximum flexibility for interior rearrangement in the future. Besides the carrels and other reading areas along the perimeter of the stacks, there are furniture groupings interspersed throughout the floors, more than enough accommodations for the over 1,250 readers anticipated and planned for in the program.

The sphere provides a single, large circular floor at the center of the form (third floor of the stacks) where there is space for a proportionately larger number of readers and books. This increases the probability of most readers being near the center of the collection. The floors above and below this level become progressively smaller, the result being that from the center of the Third Floor the outer rim of stacks on the other floors are equidistant (with vertical movement by stairs or elevators). As this concept was adjusted into a programmed space, it was found that 80% of the initial collection could be housed in the three central floors of the stacks. No book housed in the sphere will be more than one hundred yards or about two minutes away from the study point.



West elevation of the all-steel structural scheme.

Initially, because of the long cantilever employed in the design, a steel frame was thought to be the most economical and feasible method of construction. This system employed four huge steel trusses, a full story in height that were concealed in the second floor of the spheroid, and created a platform for a standard structural framing on the third, fourth and fifth levels of the spheroid. The undersurface of the sphere and the fascials were designed to be constructed in plaster and concrete. Most of the structural system was based on a simple square module of 22'-6"; and the only significant destinction was the steel truss that created the cantilevers of the sphere.

This schematic concept, and the project budget, were taken to the Regents of the University in April of 1966 and received their unanimous approval.

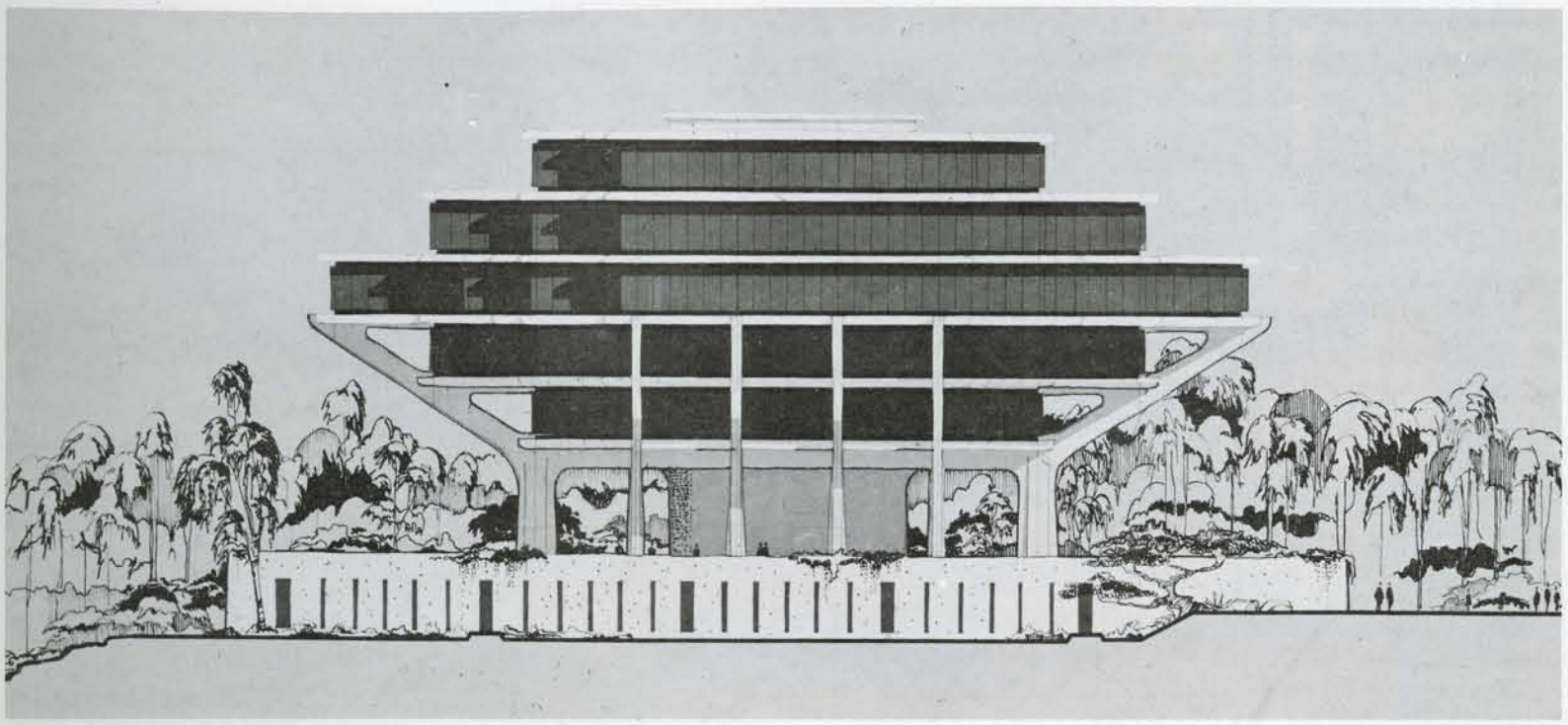
Refinement of the Building Design

After the approval of the Regents, the design of the structural system was analyzed and reevaluated. At that time, with major commitments in national defense, prices per ton of steel and the costs of fabricating and erecting the type of truss system proposed were increasing at an alarming rate. Evaluating this trend, and noting that the costs related to reinforced concrete were not increasing nearly so fast, William L. Pereira & Associates began studies to eliminate as much structural steel as possible in order to keep the building within the agreed-upon construction budget which had been presented to and accepted by the Regents.

These studies produced a building that was framed in concrete up to the second level of the spheroid, where again the huge truss produced the cantilevering platform. This scheme, while it came within the budget, still had some negative aspects, the most important of which was the dependence on the steel truss. This truss also constituted an interior planning problem on the second level since it could be penetrated with access opening for people and utilities only at certain points. This severely limited the flexibility of planning furniture, book cases and other uses on this level. Another inherent problem in a hybrid structural system such as this, the combination of reinforced concrete and structural steel, is the technique of connecting or detailing the two systems together. The steel trusses, with their enormous stresses, would require huge and costly connectors at the points of intersection and transfer of stress to the reinforced concrete. For these reasons, a third and final structural scheme was developed, using only reinforced concrete.

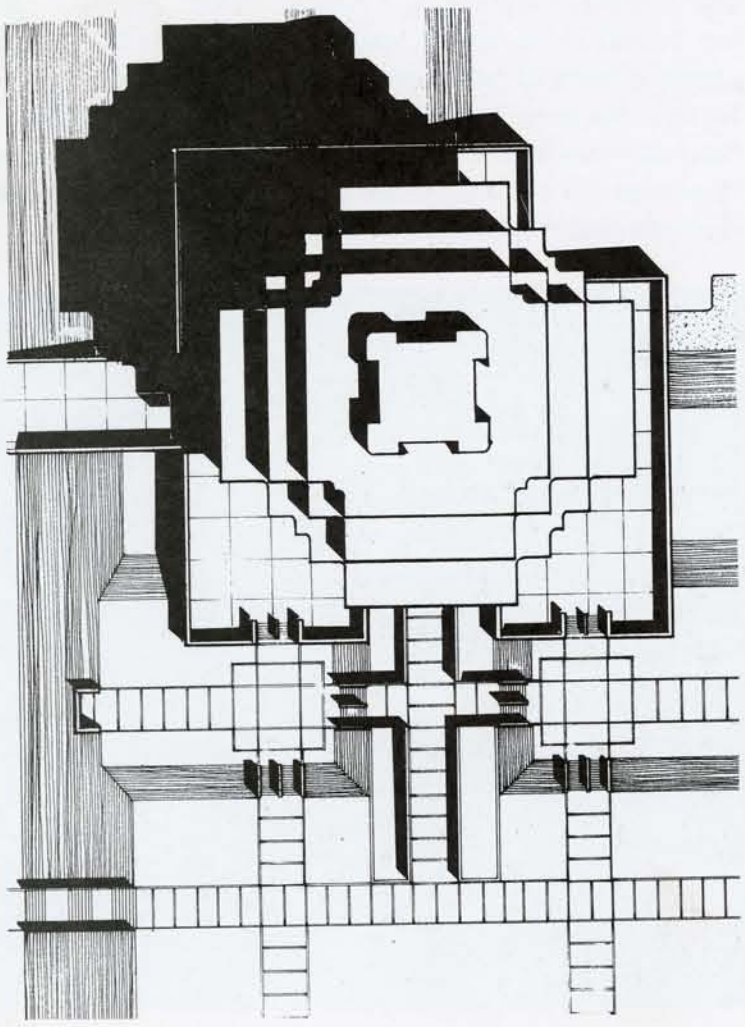
This scheme is very simple in concept; it moves the cantilevering action of the steel truss from the inside of the building to the exterior in the form of sixteen diagonal concrete members that tie each of the three lower floors of the sphere together. These diagonal members continue down to intersect with the colonnade, thereby creating sixteen reinforced concrete bents. With this system, the second level was freed of the planning limitations imposed by the truss and the total structural system was changed from a hybrid to a homogeneous system of reinforced concrete.

The all-concrete system also provides for a new dimension and vocabulary in design. Concrete, unlike structural steel, can be left in its natural state and is fire proof. It has the plastic quality of being able to take almost any shape and texture, the only limitation being the texture and design of the form in which it is cast. This characteristic of concrete eliminates the costs of fireproofing the structural steel and applying plaster to achieve architectural details.



West elevation of the all-concrete structural scheme.

Concrete Scheme — Model of the library as viewed from the park of the University Center.

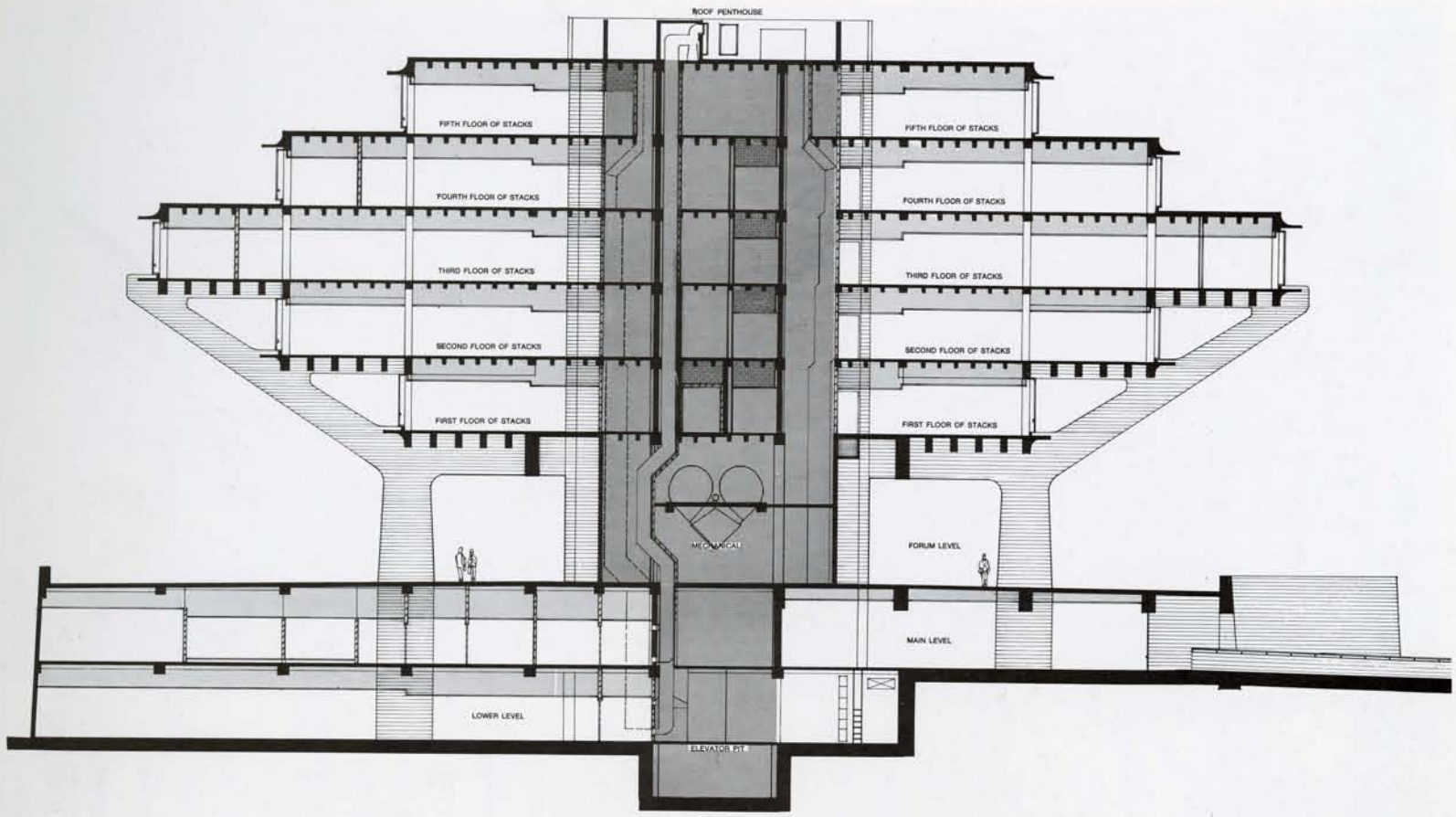


Site plan of first increment.

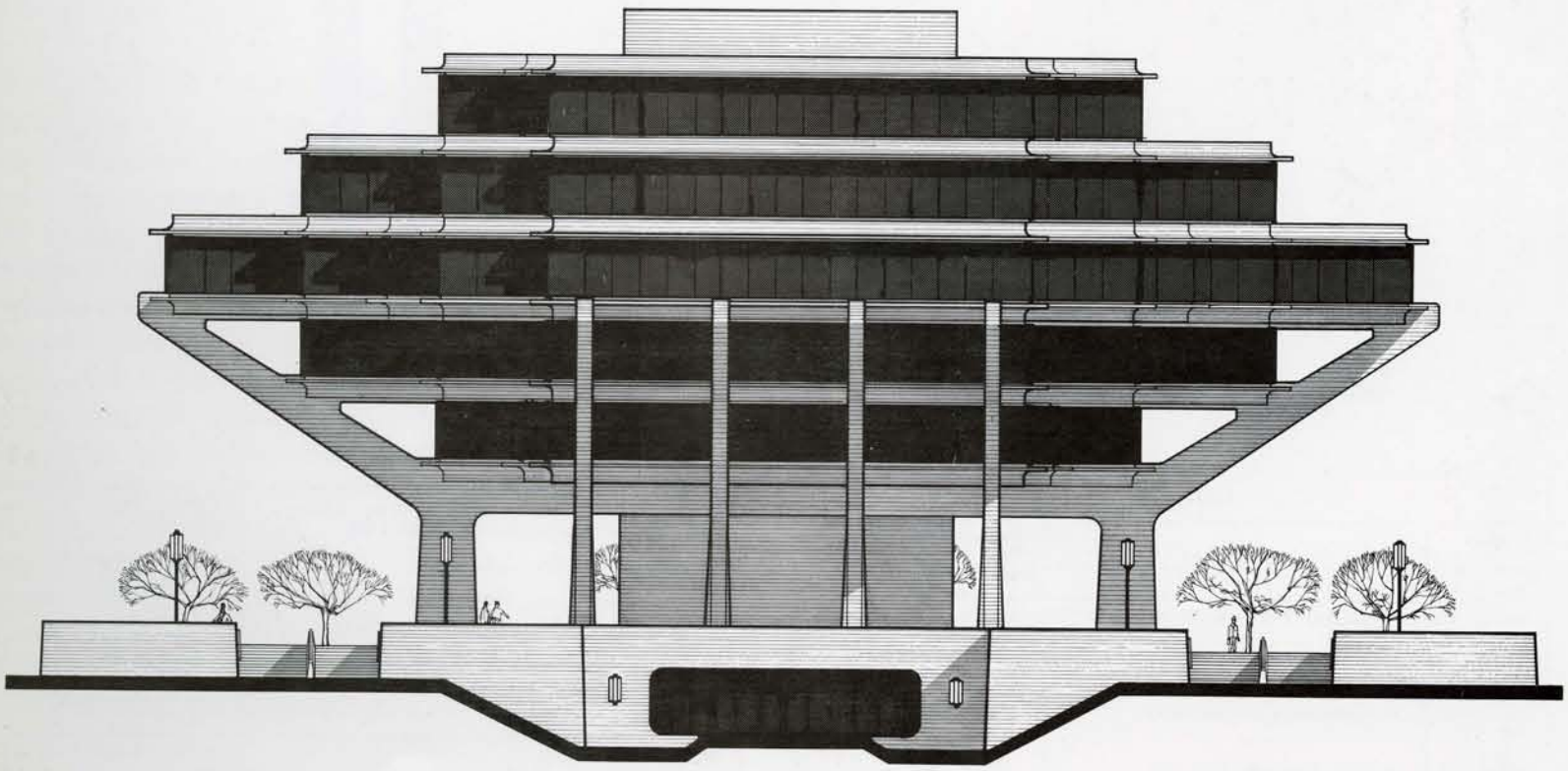
The final structure of the building incorporated a poured-in-place concrete frame based on a square module of 22'-6" on all floors, which provides optimum flexibility in the arrangement of book stacks. The sixteen concrete bents start at the massive foundations, several feet below the basement, and extend through the lower two levels of the building to embrace or cradle the spheroid some thirty feet above the Forum. The texture of the bents and the exterior walls will be rough, with a horizontal pattern derived from the arrangement of the form boards. The exterior floor framing of the sphere is exposed, expressing a rich coffered texture on the underside of the sphere. The rustication created by the use of rough form boards in both the interior and exterior will be counter-pointed by the use of glass and metals.

This structural system, more than the earlier systems explored, supplements the unique architectural form of the building and helps create a dramatic sculptural focus for the University Center. Also, from a functional standpoint, it better meets the present and future demands of a great graduate research library.

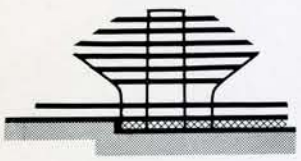
Because this modification altered the appearance of the building, it was again reviewed by the Regents, in November of 1966, and was approved. From this point, the library went into working drawings, a phase in which little change in concept or design occurred.



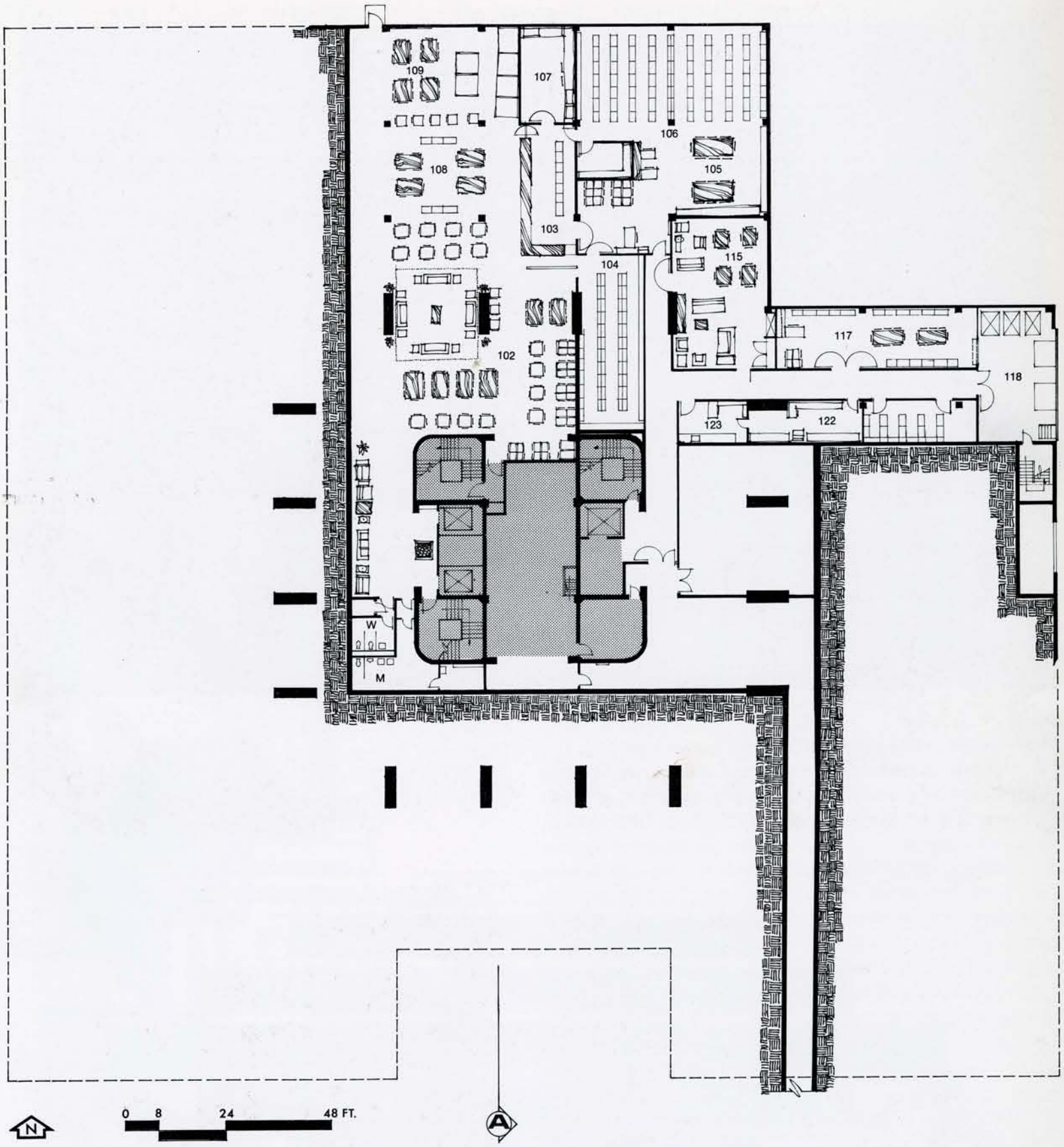
Building Section A of the first increment.



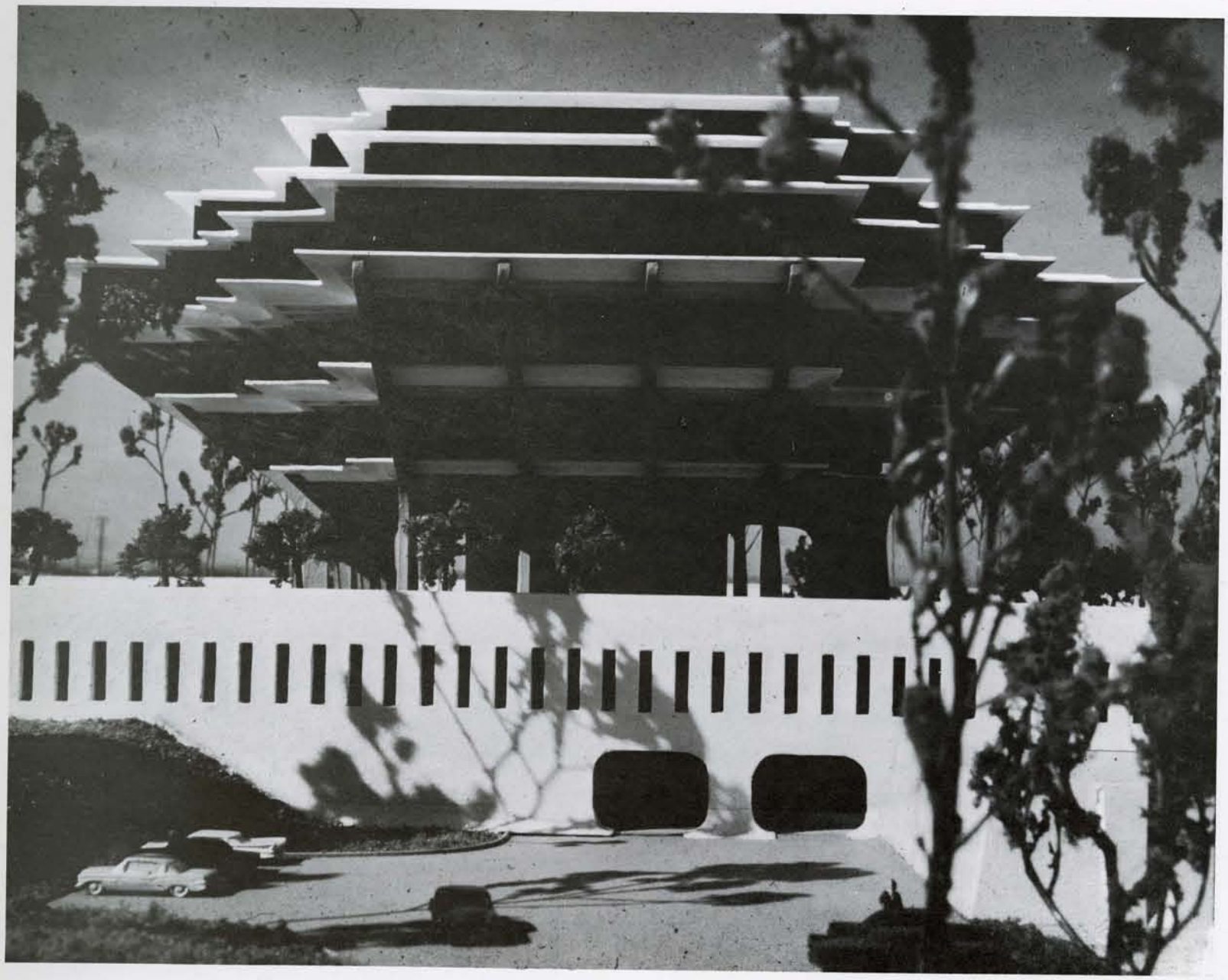
South elevation of the first increment.



Lower level of the first increment.



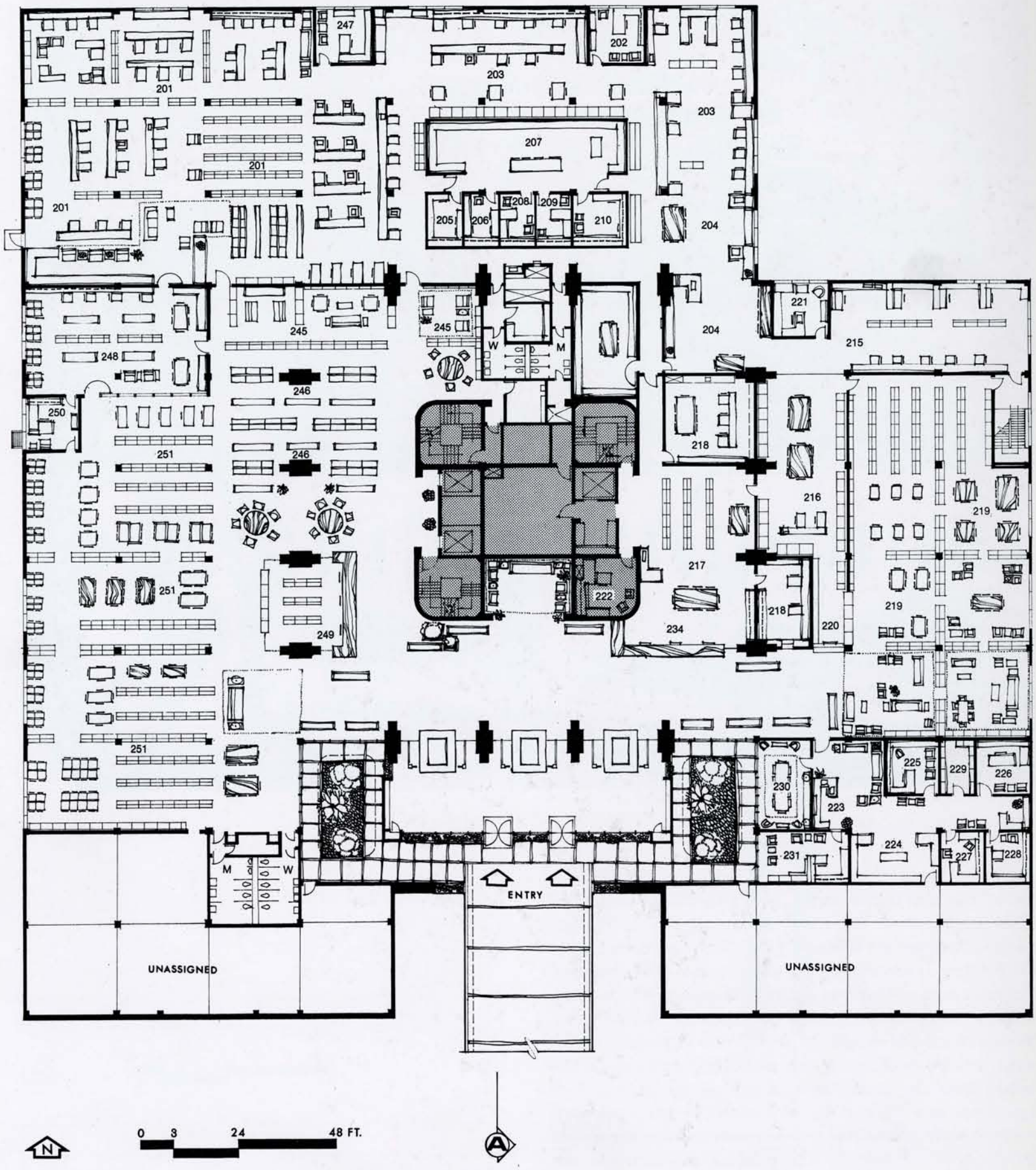
LOWER LEVEL					
Space		Description	Assignable Area		Gross Area
Room No.	Ref. No.		Program	Design	
102	04	Reserve Book Reading Room	2,000	1,736	
103 104	05	Reserve Book Issue Desk, Stacks and Work Area	700	836	
105 106	34	Documents Work Area and Stacks	1,875	1,992	
107	36	Microfilm Storage and Work Area	400	222	
108 109	33 35	Documents Reading and Reference Room — Maps and Microfilm Reading Area	1,325	1,535	
115	45	Staff Conference Room	850	874	
117 118	01	Receiving and Mail Room — Loading Dock	700	747	
122	02	Library Photographic Service Work Room and Duplicating Work Area	520	504	
123	03	Dark Room			
TOTAL SQUARE FEET			8,370	8,446	18,320

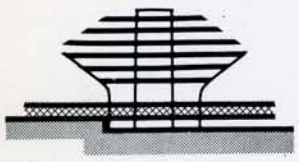


Photograph of model from the east showing loading docks.

The Library Levels

The Lower Level. Staff and public areas constitute the main use of this level of the library, with a significant amount of space dedicated to the main mechanical rooms. Thermal energy and power are housed in an underground tunnel, enter the building at this level on the southern face of the building. The staff areas on this level are for both general service of the building (receiving, photography, dark room, and staff conference room) and specialized service of the collection (document, reserve book, maps and microfilm work areas). The public areas are housed in a continuous space, with each functional area defined by furniture. The north and east exterior walls of the level will be removed when the second increment is constructed. The future expansions will be a continuation of this floor and the above mentioned departments will expand outward to the north and east. Public access to this level will be by the two passenger elevators or stair cases in the west side of the core, while staff will have exclusive use of the service elevator and stairs on the east side of the core.





Main level of the first increment.

The Main Level. This level of the building is the main entry and control point for the library and houses the main public and staff areas. There is a notch on the northeast side which will be filled in by expansion in the near future, as will the two unassigned spaces that flank the entry walk on the south.

At the main entrance the public passes through control desks and into the main gallery, a corridor 150 feet in length and 20 feet in width. This corridor links the basic public spaces together and will be used for displays and informal seating areas, one of which is in the core itself. Two small, interior gardens open to the sky, illuminating the gallery and providing an interesting juxtaposition of space and light.

The gallery terminates on the west in the Reference area. This area, like others, is basically open, its spatial organization determined by book cases and furniture. It is controlled by the Reference Service Center, an area enclosed by a free standing desk and book cases.

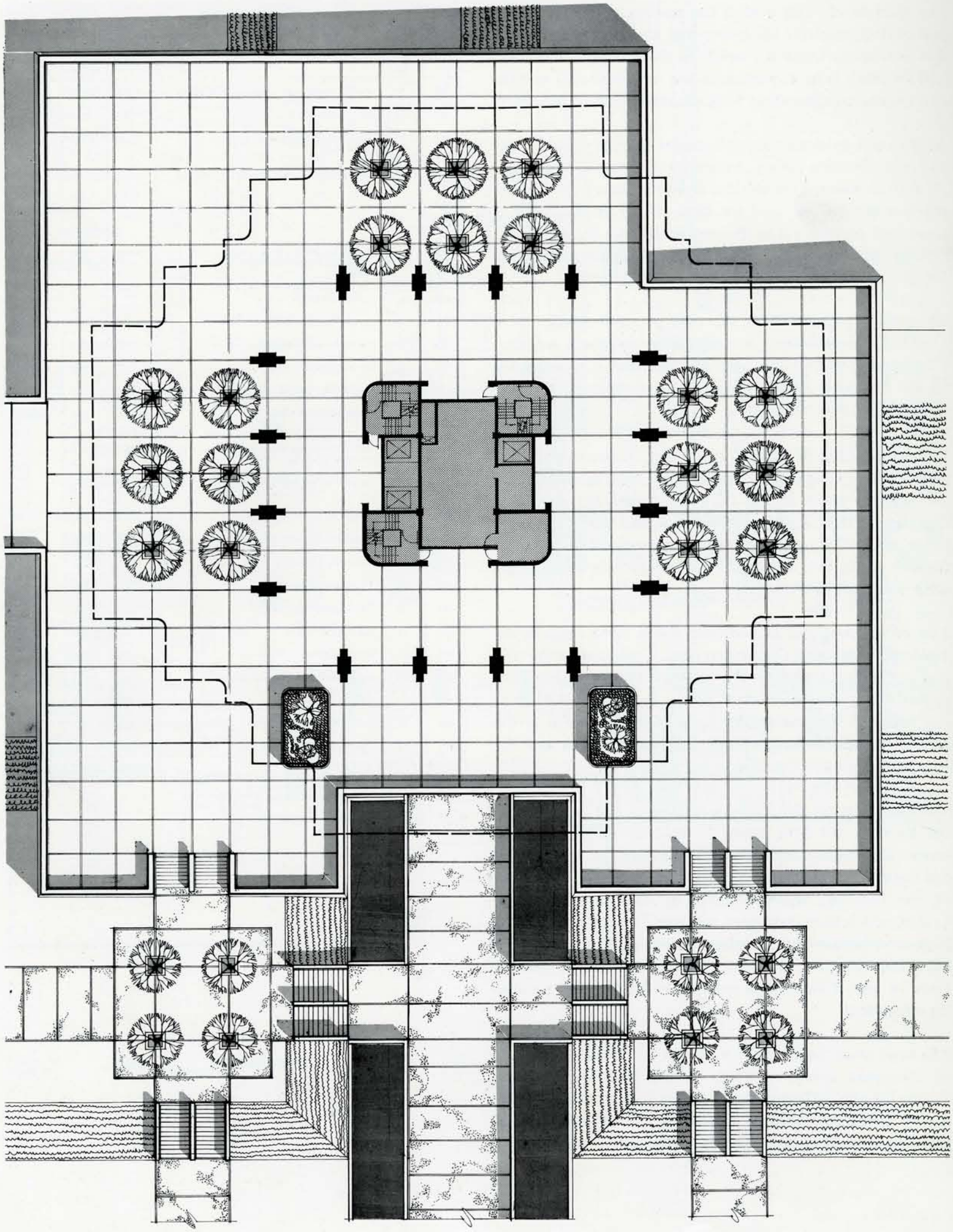
Directly adjacent to the Reference area, to the north, is the main Card Catalogue and Bibliography area, surrounded by the primary users of the Card Catalogue, the Reference department, the Catalogue department, and the public circulation areas. The Card Catalogue is immediately adjacent to the two public stair and elevators which provide access to the other floors of the library.

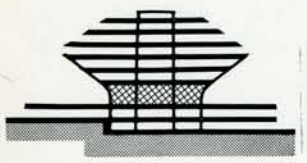
East of the core, and immediately visible upon entry to the building, is the main Circulation desk. Traditionally the control and information point for libraries, the Circulation desk in this library is supplemented by the three control desks at the entrance. The eastern terminus of the gallery is in the Serials (magazines and periodicals) reading room and the General Administration offices.

The staff areas on this level are located on the north side of the building and have access to both the staff stairs and service elevators. The major staff users are the Acquisitions and Cataloging departments, which run the entire north wall of the building, separated only by the Data Processing Center, which they both need and use. The Data Center is a large room with a bank of offices for key-punching, programming and directors. The center is provided with an elevated floor for ease of installation and maintenance of data processing equipment.

The basic visual impact of this floor is the central core, made of rusticated concrete, which should become the visual datum for the juxtaposition of spaces that surround it. The spaces themselves will be created by the arrangement of furniture, bookcases and movable display panels and cases.

MAIN LEVEL					
Space		Description	Assignable Area		Gross Area
Room No.	Ref. No.		Program	Design	
201	22	Catalog Department – General Work Area	5,900	6,159	
202	21	Acquisitions – Librarian's Office	150	169	
203 204	20	Acquisitions Department Work Area	4,250	4,266	
205 206 207 208 209 210	24 25	Data Processes Center Offices "	1,380	1,336	
215 216	17 18	Serials Department Work Area Preparation Area	2,700	2,668	
217 218	07	Circulation Department Work Area Circulation Office	1,390	1,140	
219	15	Serials Reading and Display Area	3,050	3,039	
220	16	Serials Service Desk	300	240	
221	19	Serials Librarian's Office	150	169	
222	08	Circulation Librarian's Office	150	225	
223 224	27	Administrative Offices	340	338	
225 226	26	Administrative Assistant's Office & Assistant Librarians' Offices	500	569	
227 228	30	General Administrative Office " " "	280	220	
229	31	Supply Room	130	110	
230	32	Librarian's Conference Room	300	345	
231	29	University Librarian's Office	250	286	
234	06	Circulation Service Desk	210	373	
245	10	Bibliography Room or Area	600	600	
246	09	Public Catalog Area	1,200	1,200	
247	23	Catalog Librarian's Office	150	169	
248	13	Reference Department and Work Area	1,150	1,042	
249	12	Reference Service Desk	300	300	
250	14	Reference Librarian's Office	150	169	
251	11	Reference Collection and Reading Area	3,400	3,445	
TOTAL SQUARE FEET			28,380	28,577	44,002





Forum level of the first increment.

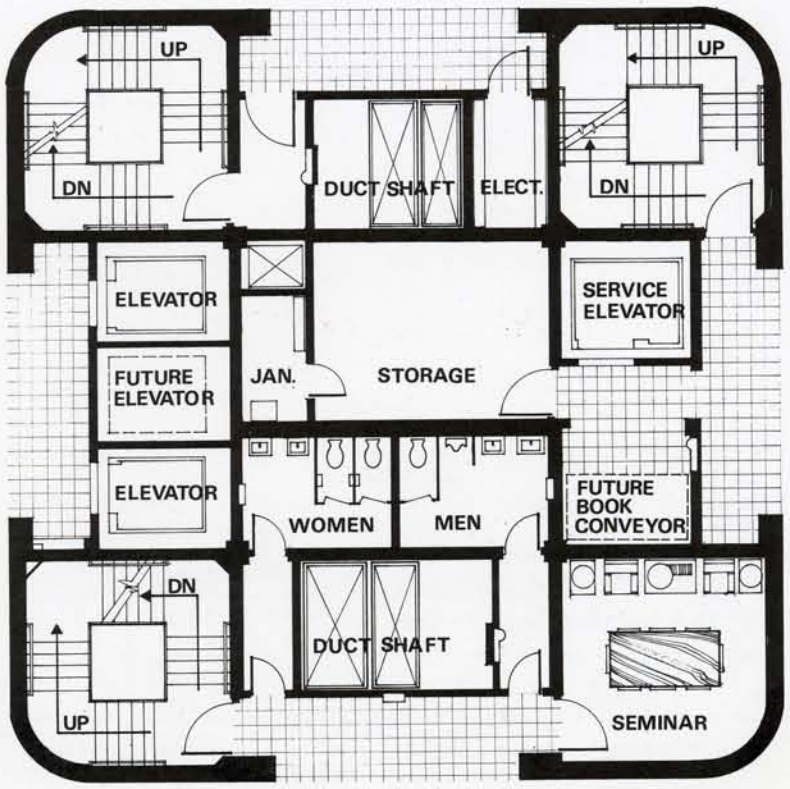
The Forum Level. The Forum Level has already been mentioned in an earlier section. It is the roof of the main level and the center of the building, which is itself at the intersection of the two primary pedestrian circulation axes of the University Center. Initially access to this level is by two sets of stairs on the south with provisions for a future bridge on the west. While fire exit doors from the library open onto this open plaza, no access to the library will occur. The only enclosed area on this level is the core, some thirty feet in height, that houses the elevators, the stairs and the air-conditioning equipment for the stacks above.

The Forum will be used for many different functions and will have movable planters and benched to define large areas for group discussions or intimate areas for solitary reading. The spatial experience of the Forum will be exciting, with the sixteen great concrete bents reaching upward to support the spheroid and to act as a canopy for the plaza itself. From within the colonnade, near the core, the spatial experience will be confining or contained, while from outside the colonnade, an expansive quality of the space will be experienced.

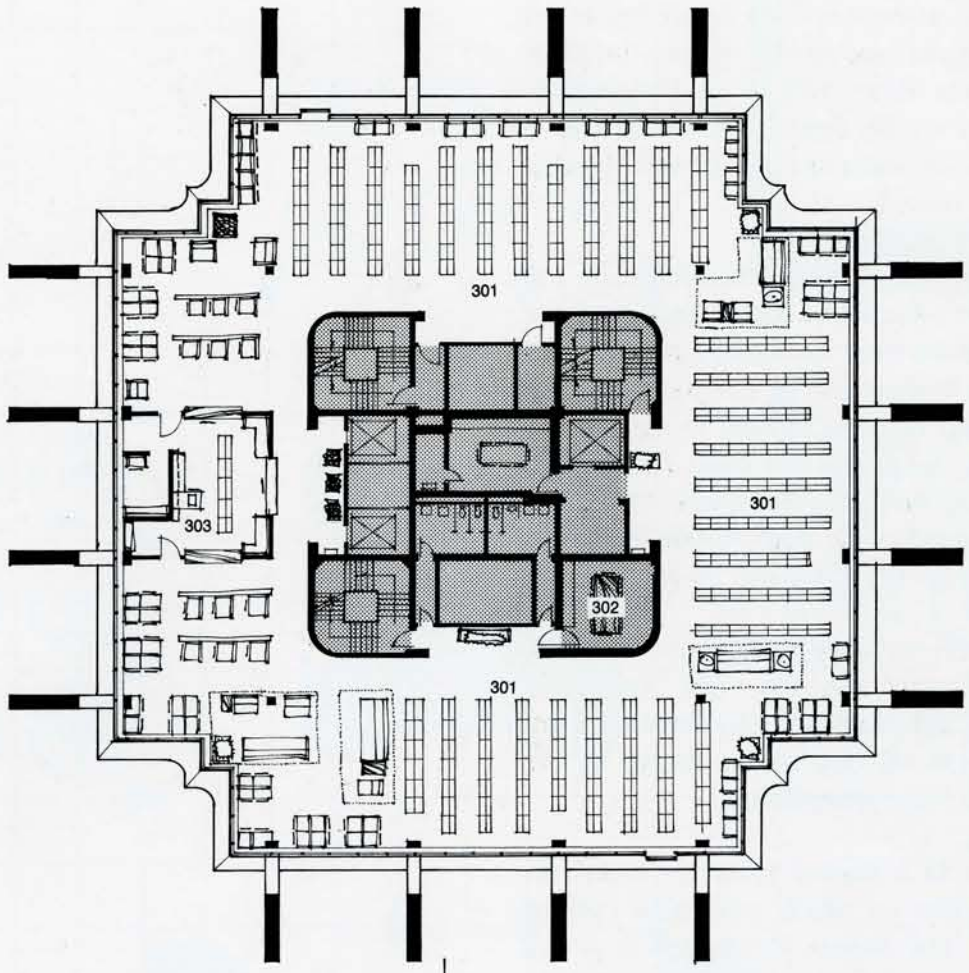
The Forum will be illuminated at night by lamps on standards and by indirect lighting of the core. Light from inside the building itself will spill out through the windows to illuminate the exposed portions of the sphere above, so the canopy effect will occur in the evenings also.

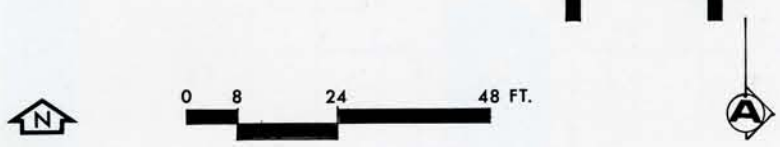
The Forum will also act as a display space for sculpture, traveling displays and kiosks on which notices of campus activities can be posted. The Forum, because it is at the epicenter of the campus, will indeed become an area where academic and social interface of many forms can occur without disruption of the library function itself.

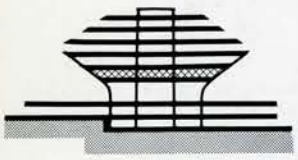
The Core. At the heart of the building is the central core. This element has a similar configuration on all levels of the library and provides the space for vertical runs of utilities, air-conditioning, stairs and elevators. Stairs occur in three corners of the core, the fourth corner housing a variety of functions depending upon which floor the core is intersecting. The west wall contains the public elevators, two of which will be installed in the first increment, with space allocated to the installation of a third in the future. The opposite side of the core houses the service elevator and space for a future book conveyor. The center of the core is dedicated to toilets and a storage room, while the areas on the north and south of the core are for air-conditioning ducts. The core will be constructed of poured-in-place concrete in highly rusticated forms. This element of the building also provides most of the lateral stability for the structure during earthquakes or high winds.



The Core — typical plan in the sphere.





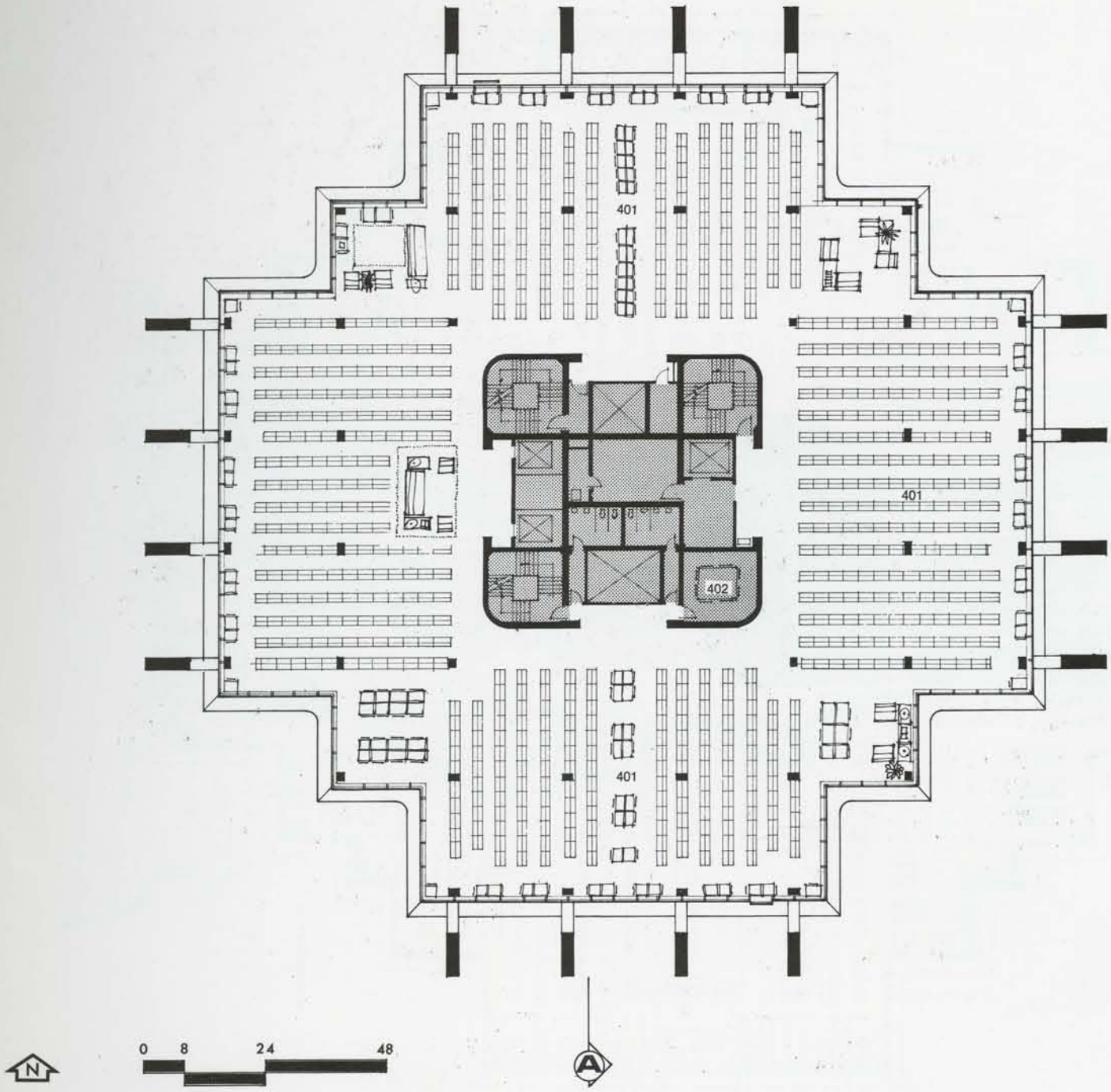


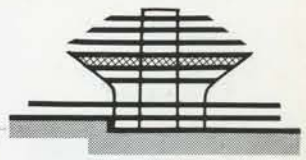
First level of the stacks.

FIRST LEVEL					
Space		Description	Assignable Area		Gross Area
Room No.	Ref. No.		Program	Design	
301	44	General Collection Stacks & Reading Areas		6,665	
302	40	Seminar Room		225	
303		Control		506	
TOTAL SQUARE FEET				7,396	11,191

The First Level of the Stacks. The first level of the stacks is initially planned to house the record and tape collections and a portion of the general book collection. Tapes will be checked out from the control center, immediately in front of the public elevators, and then taken to a listening carrel, at either the right or left of the control center. The carrels themselves will be connected to the control center so that many different stations can be using the same audio material.

Sun control for this level is provided by the forty-foot overhang of the two floors above. The concrete fascia below the continuous glass-window wall is designed to be used for washing the outsides of the windows. Beyond the glass line, the sixteen concrete bents are visible as they continue up the structure.



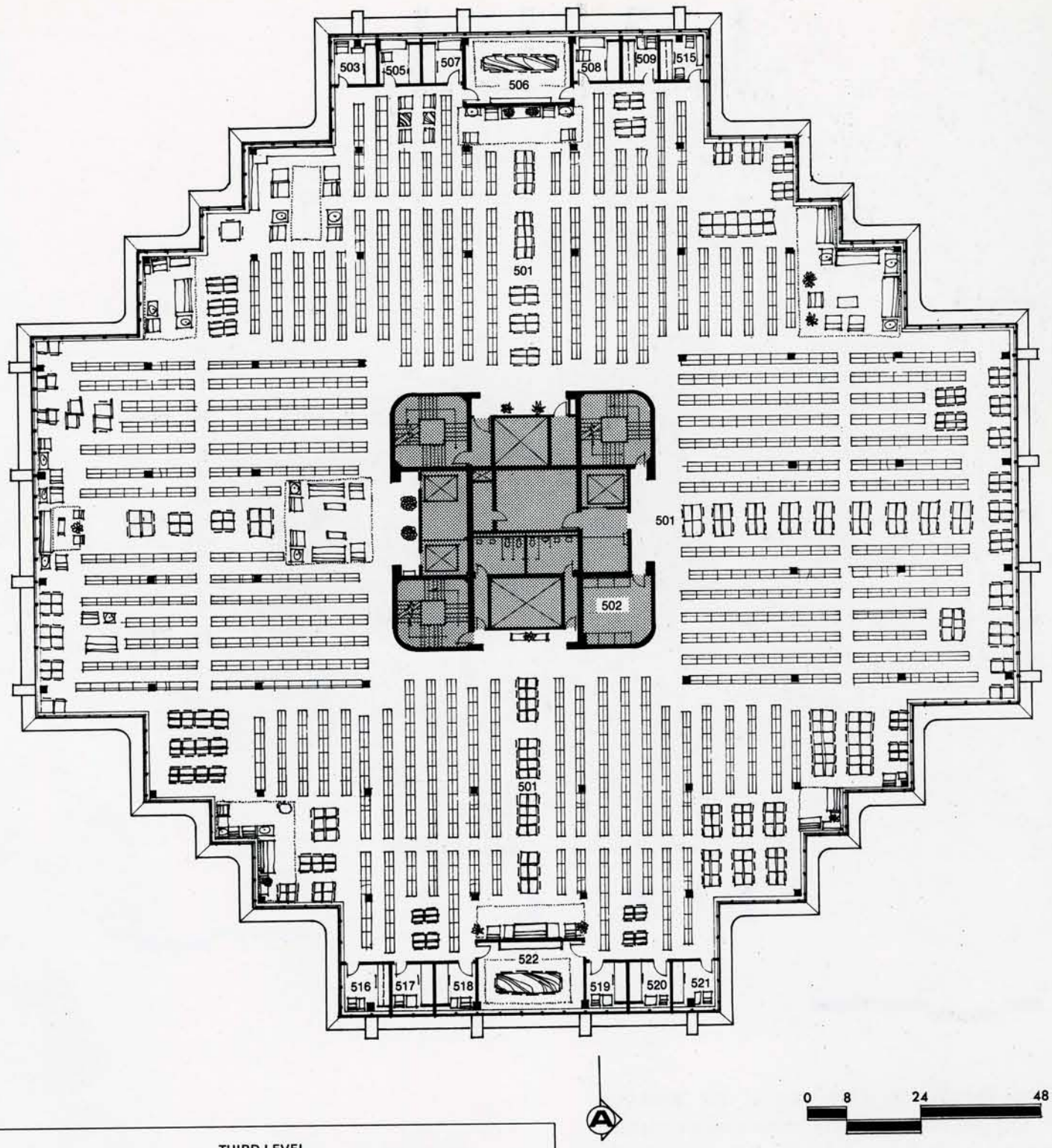


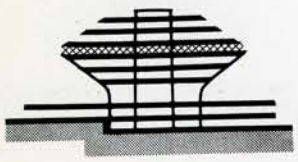
Second level of the stacks.

Second Level of the Stacks. This level of the stacks is approximately 150 feet across and will house a major portion of the book collection. Carrels and other reader stations will be dispersed throughout the book stacks, with major lounge areas in each of the four corners of this level. People seated in these areas will have a spectacular view of the eucalyptus grove outside and will be protected from the sun by the twenty feet overhang of the floor above.

The book stacks are planned so that they may be removed and relocated to any part of the library. The stacks will radiate out from the core on all levels of the sphere because the light fixtures must run perpendicular to the stack to achieve an efficient level of illumination. The light fixtures, recessed in a suspended ceiling, are arranged in continuous rings around the core. A seminar room is located in the core for student and/or faculty use.

SECOND LEVEL					
Space		Description	Assignable Area		Gross Area
Room No.	Ref. No.		Program	Design	
401	44	General Collection Stacks & Reading Areas		15,690	
402	40	Seminar Rooms		225	
TOTAL SQUARE FEET				15,915	19,710

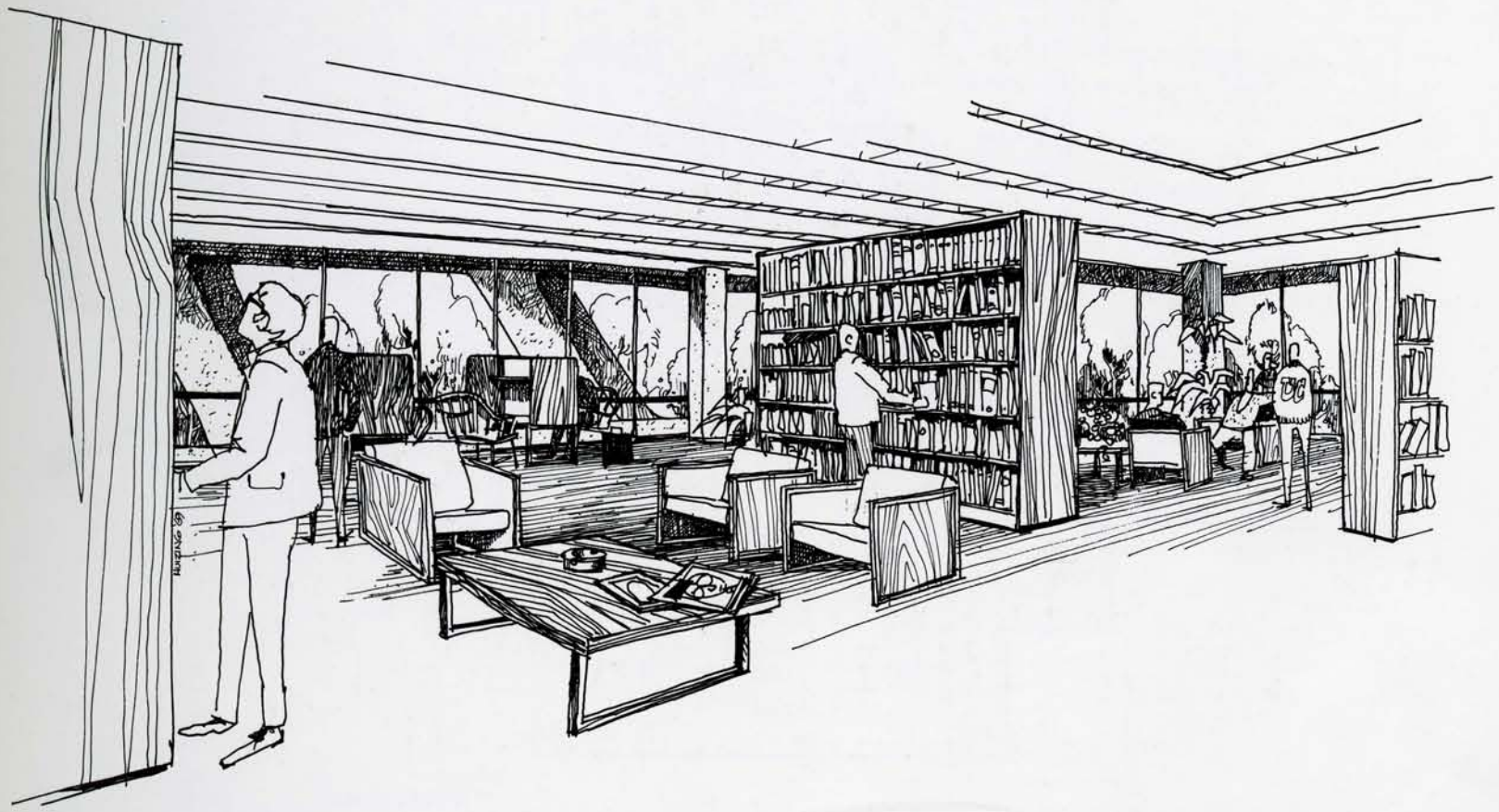




Third level of the stacks.

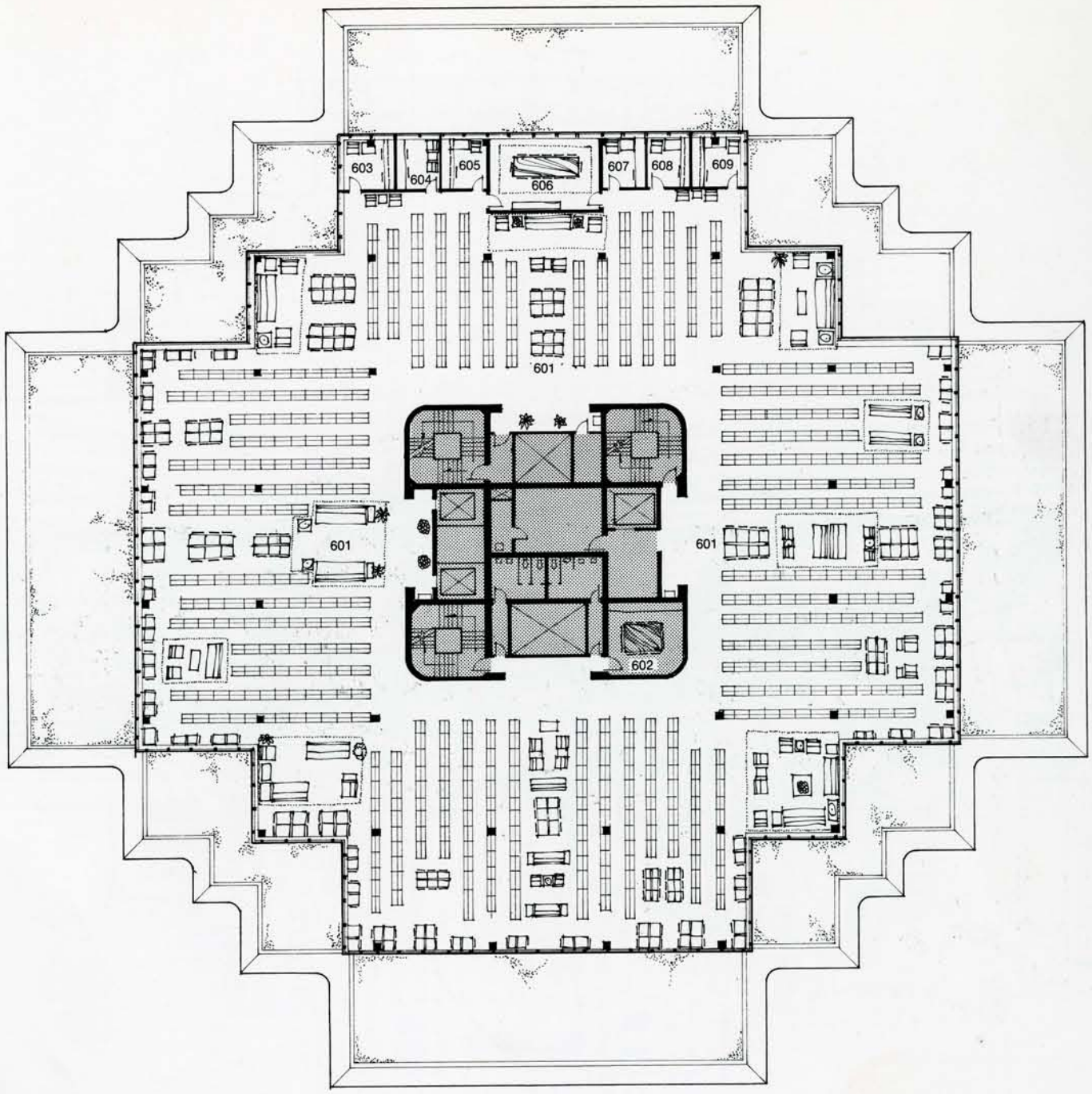
THIRD LEVEL					
Space		Description	Assignable Area		Gross Area
Room No.	Ref. No.		Program	Design	
501	44	General Collection Stacks & Reading Areas		23,996	
502	37	Typing Stations	150	150	
503 505 507 508 509 515 516 517 518 519 520 521	39	Faculty Studies (12@ 77 sq. ft.)	840	924	
506 522	40	Seminar Rooms		636	
TOTAL SQUARE FEET				25,706	29,561

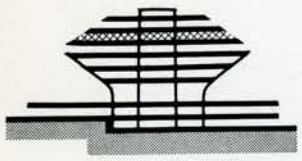
Third Level of the Stacks. The third level of the library is the largest floor, some 200 feet in diameter. It will house the major part of the general collection of books and will have the largest number of individual reader stations. The stacks will radiate out from the center of the floor in an irregular fashion, creating niches of privacy for reading and study. The generally fan-like arrangement will also serve to frame the distant views beyond the windows.



Sketch of reading area and book stacks.

On both the north and south sides of this floor, faculty studies and seminar rooms are located. These were located on these sides of the building so as to minimize the need for the sun control. The faculty studies are not designed as offices for a single faculty member, but rather as retreats to be assigned probably on an annual basis to people working extensively with the collection. The seminar rooms are designed so that they can be simply divided in two, used for group discussions, or used to house special collections of books or specific portions of the collection in constant use by researchers. The core at this level contains six typing stations in a sound proof room.

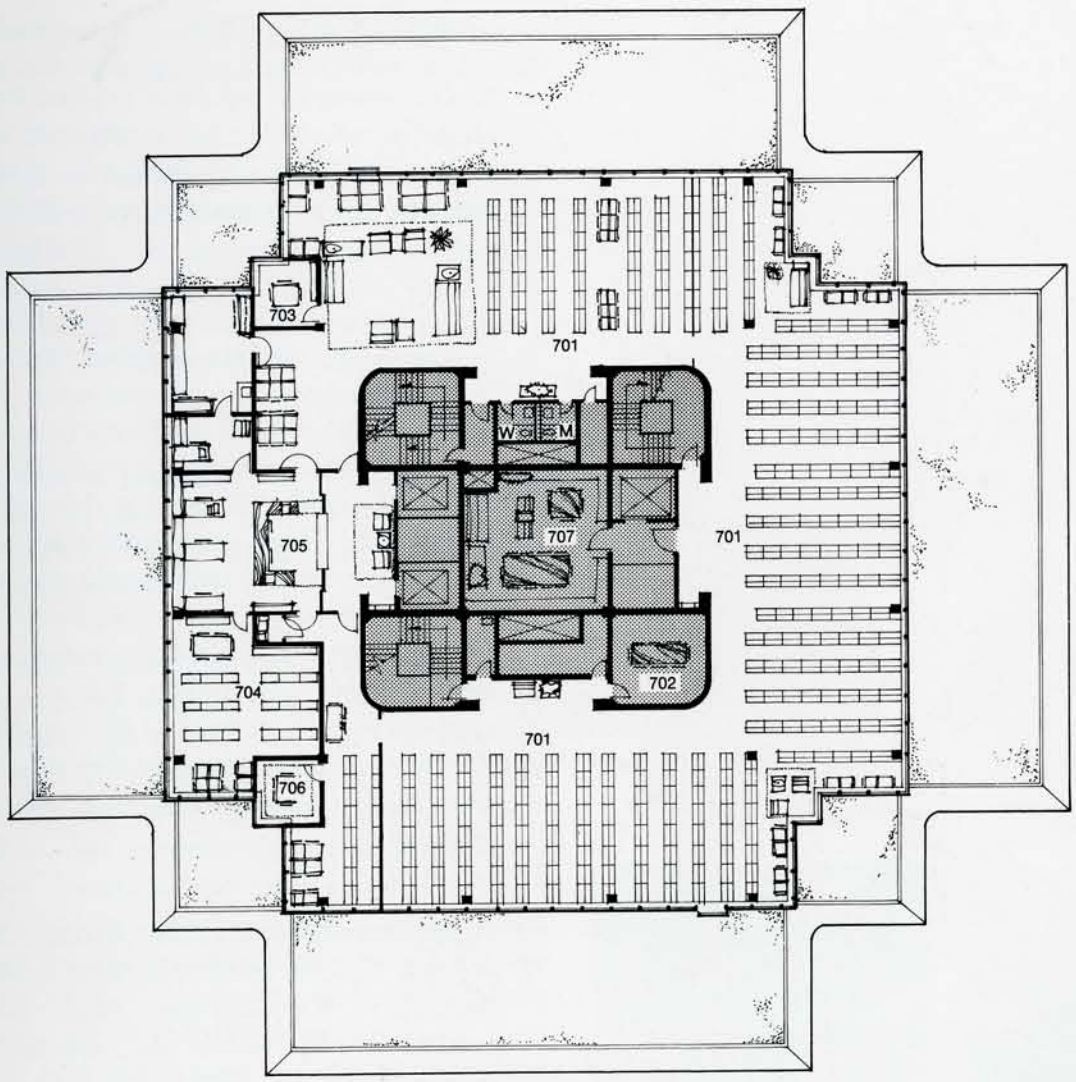




Fourth level of the stacks.

FOURTH LEVEL					
Space		Description	Assignable Area		Gross Area
Room No.	Ref. No.		Program	Design	
601	44	General Collection Stacks & Reading Area		14,909	
602	40	Seminar		225	
603 604 605 607 608 609	39	Faculty Studies (6 @ 77 sq. ft.)	420	462	
606	40	Seminar		319	
TOTAL SQUARE FEET				15,915	19,710

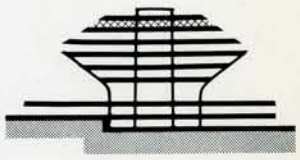
The Fourth Level of the Stacks. This level of the stacks is identical in size and shape to the second level, however, it is surrounded by the roof area of the floor below. A portion of this roof will be developed as an outside study area. These areas are defined by planters, benches and redwood duckboard which serves as a walking surface. The study areas will be modular in construction and movable, so that the areas can be enlarged or removed as requirements change. These areas will be located outside faculty studies, seminar rooms and areas where the general readers could have access.



The Fifth Level of the Stacks. The top level of the sphere houses the Special Collection and Rare Book Collection and is the only floor that has controlled access. The smaller floor size at the top level complements the specialness of the collections. There is a greater feeling of intimacy, security, protection.

The special collection includes books that form a collection of their own, by subject or by donation to the library, and books that tend to be vandalized or mutilated (atlas, photographic essays) or stolen (erotica). The special collection department contains a work area, reading room, highly controlled stacks, a display room for one special donated collection, and an office for the department head. A faculty study and seminar room will also be included on this level, and the deck surrounding the level will include outside study areas.

In the future, with more donations of book collections, this floor could conceivably be developed into a series of individual rooms, each well furnished and detailed, and each housing a separate book collection.



Fifth level of the stacks.

FIFTH LEVEL					
Space		Description	Assignable Area		Gross Area
Room No.	Ref. No.		Program	Design	
701	44	General Collection Stacks & Reading Area		5,956	
702	40	Seminar Room		225	
703	39	Faculty Study	70	77	
704	41 42	Special Collection Reading Room, Stack Area & Office			
705	43		1,500	1,512	
706	39	Faculty Study	70	77	
707				472	
TOTAL SQUARE FEET				8,309	11,191

Mechanical System

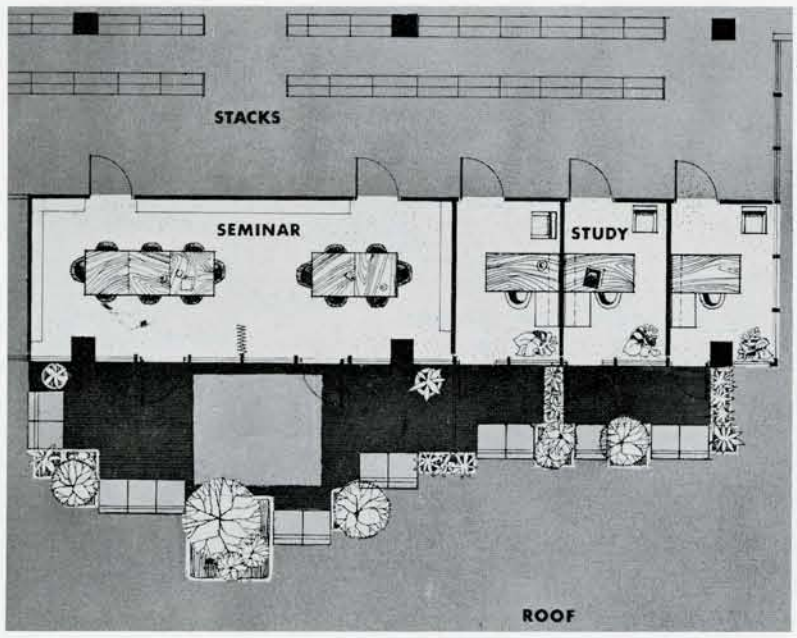
The University Central Plant provides the Central Library, via utility tunnel, with high temperature and chilled water, primary electrical power, telephone lines, program clock system, fire alarm system, and the multiplexing cable for equipment controls.

Air conditioning is provided by a low-velocity double-duct system supplied by three central fan-and-coil units. The first level equipment serves the two lower levels and the two fan units at the third level serve a portion of the second floor and the tower. Distribution is symmetrical about the east–west center line of the tower with identical supply ducts and accompanying return air plenums rising at the north and south side of the core and each serving one half of each of the five tower floors in a symmetrical "tree-like" pattern. Areas are supplied with conditioned air through double deflection-type directional air-flow ceiling diffusers with concealed lever-operated volume dampers. In the tower air is returned through slots at the perimeter and, at the central core, into the ceiling plenum. First and second level return air is through the ceiling grilles.

Temperature-control zoning is determined by the building exposure and the interior partition arrangement. Each zone is controlled by pneumatic room thermostats operating pneumavalves at warm and cold air ducts with constant volume control.

Sensors monitoring high temperature and chilled water, room temperature and electric motor control are extended by multiplexing to the central control computer system at the Central Plant.

Present air handling equipment is sized to supply a future nine-modular addition at the northeast corner of the first two levels, which, when completed, will complete the square base at the Forum level.



Typical exterior study area to be located on the fourth and fifth levels of the stacks.

Electrical System

The primary electrical service is distributed on the top of the utility tunnel. It consists of dual electrical services at 12,000 volt, three-phase terminated in a primary selector switch, and then transformed by unit substations to either 277/480 volt, 4 wire for lighting and 480 volt, 3 wire for power. Dry type transformers are employed to derive 120/490 volt power for convenience outlets, incandescent lighting and other miscellaneous requirements. Unit substations and dry transformer are located in the first level.

An emergency generator is located on the first level, and provides power to exit lighting, fire alarm system, and other essential loads.

A door alarm system is provided for control and security. The master control board is located at the central circulation desk on the second level. The system controls all exterior doors, and admittance to the special collections, located on the eighth level. When these areas are personally supervised the sound portion of the alarm can be turned off at the master control.

The fire alarm system is connected to the central control point in the main power plant and includes heat and smoke detectors. Conduits are provided throughout the building for future closed-circuit television.

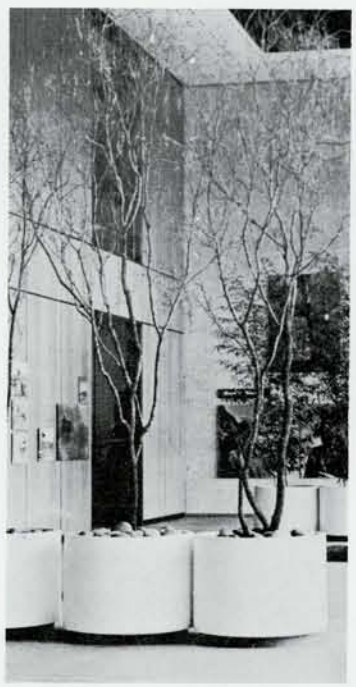
Lighting is designed for maximum flexibility and allowing stacks to be placed in either direction. Light levels of 70fc are maintained in the stack area to allow interspersion of carrels and reading areas without supplemented light. Stack lighting on levels four through eight is on the stack module of 4'-6" centers in concentric rows perpendicular to the stacks. Open-reflector single-tube fluorescent fixtures are used to provide even light distribution and reduce fixture brightness and glare. Lights on the first and second levels are two-tube open-reflector fluorescent on 7'-6" centers. Lighting levels for the staff and public areas are 50fc. Exterior lighting at the third level is provided by post top fixtures and on the fourth and fifth levels by incandescent lighting around the core.

Landscape Concept

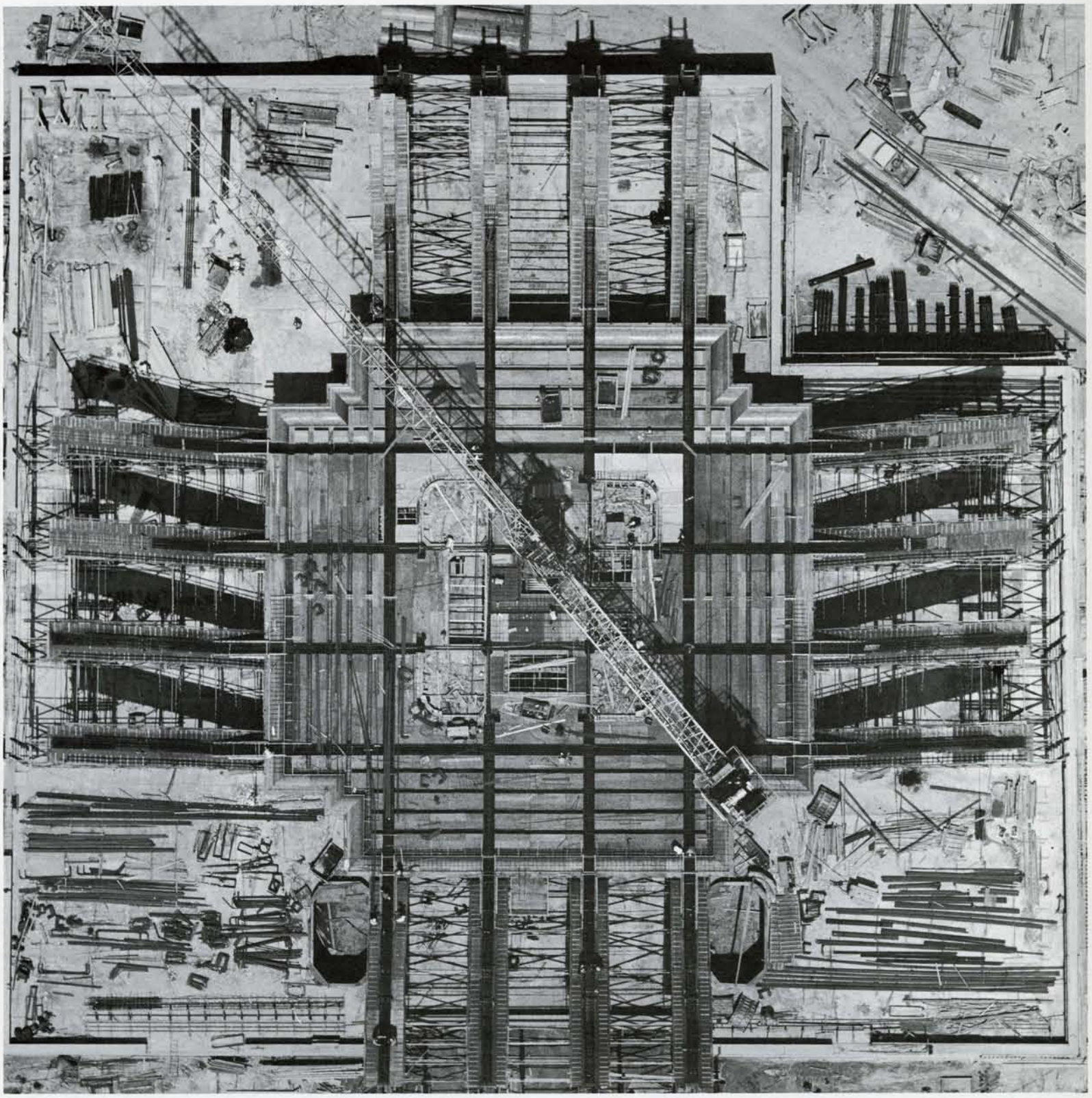
The dominant landscape concept was to site the Central Library in among the existing eucalyptus trees and maintain the grove-like quality, specifically in the immediate vicinity and hopefully in the projected north-south and westerly mall approaches.

Several schemes were developed during the design phases to suggest this concept, but final landscaping has been deferred until a master plan for the malls and University Center is adopted by the University.

For the Forum level, public space has been enhanced by deck drains for large trees in planter boxes. Additional street furniture, benches, and sculpture will be added to fulfill its function as a space for meeting and discussion.



Modular and moveable planters to be used in the exterior study areas and on the Forum.

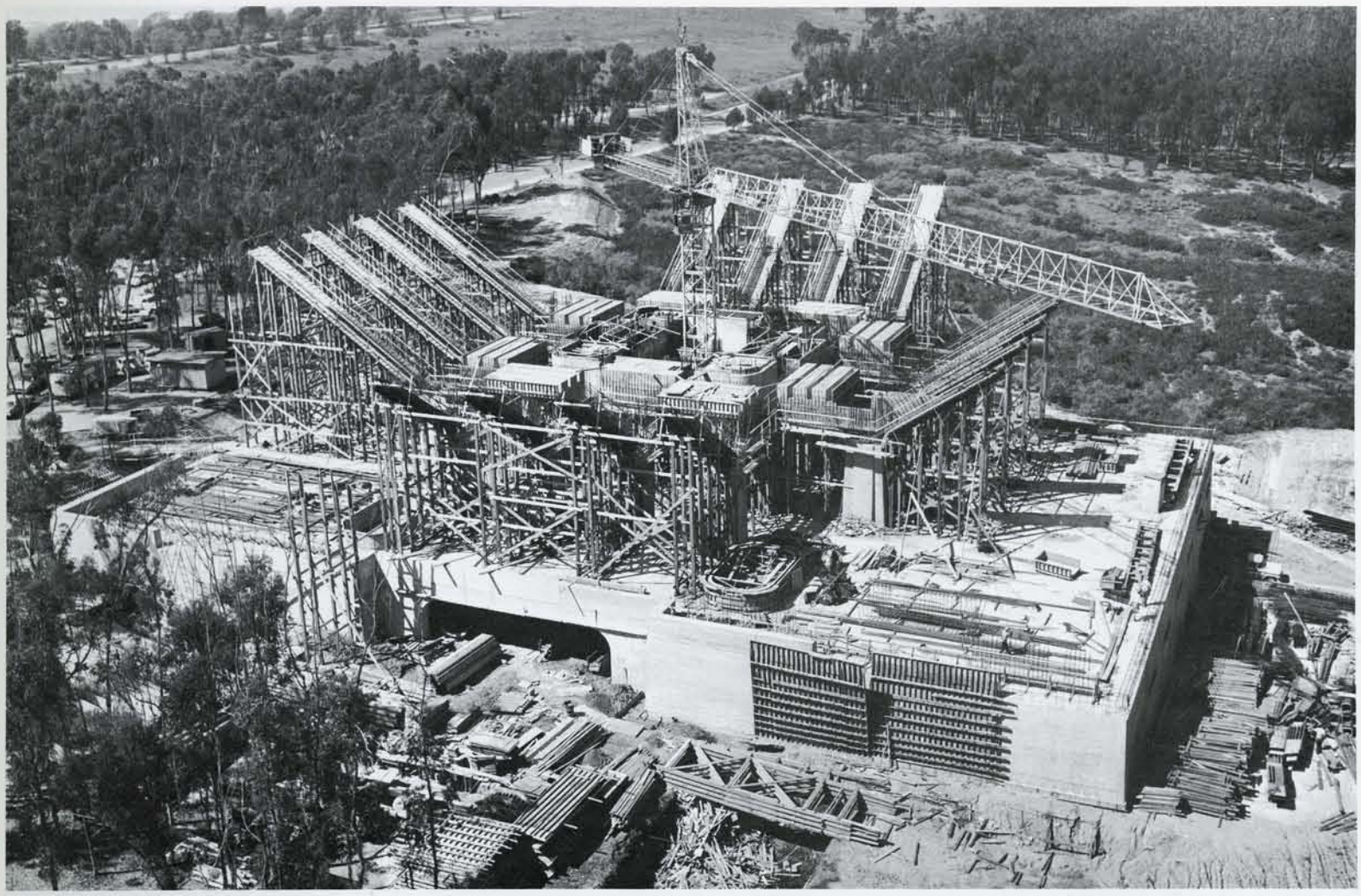


Aerial photograph directly above the library's center during construction.

The Construction of the Building

Preconstruction Phase. After the completion of working drawings and specifications and after the client's approval of both those and the estimated cost of construction, the problem of actually getting the building constructed was confronted.

Although this building was basically a simple concrete frame with no involved or complicated finishes, and although it had been designed with a method of construction in mind, it did have an unusual shape, and the architect was very concerned



Oblique aerial photograph from the southeast.

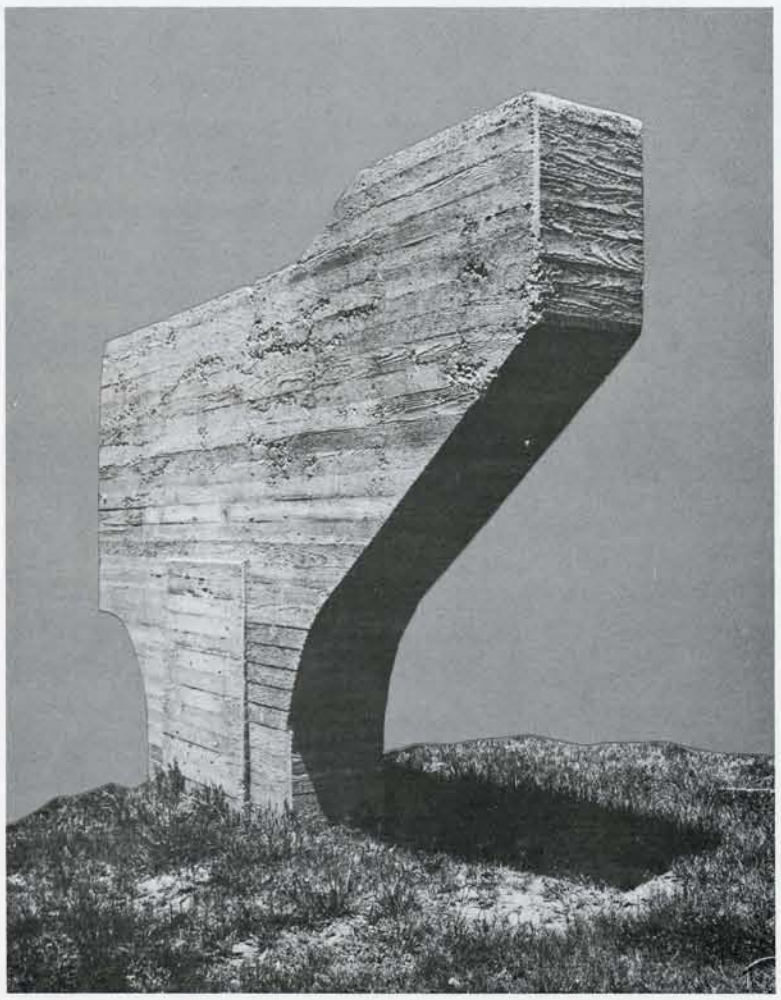
that the contractors might not submit bids or would attach a premium to his cost estimate. A series of preconstruction conferences were held, therefore, and all the bidding contractors were invited.

The building was discussed in great detail and the method of construction was explored. It was explained for example, how the building was designed to have the center of the core left open during construction to provide space for the construction crane. In this way, a single crane could reach any part of the project from that one point.

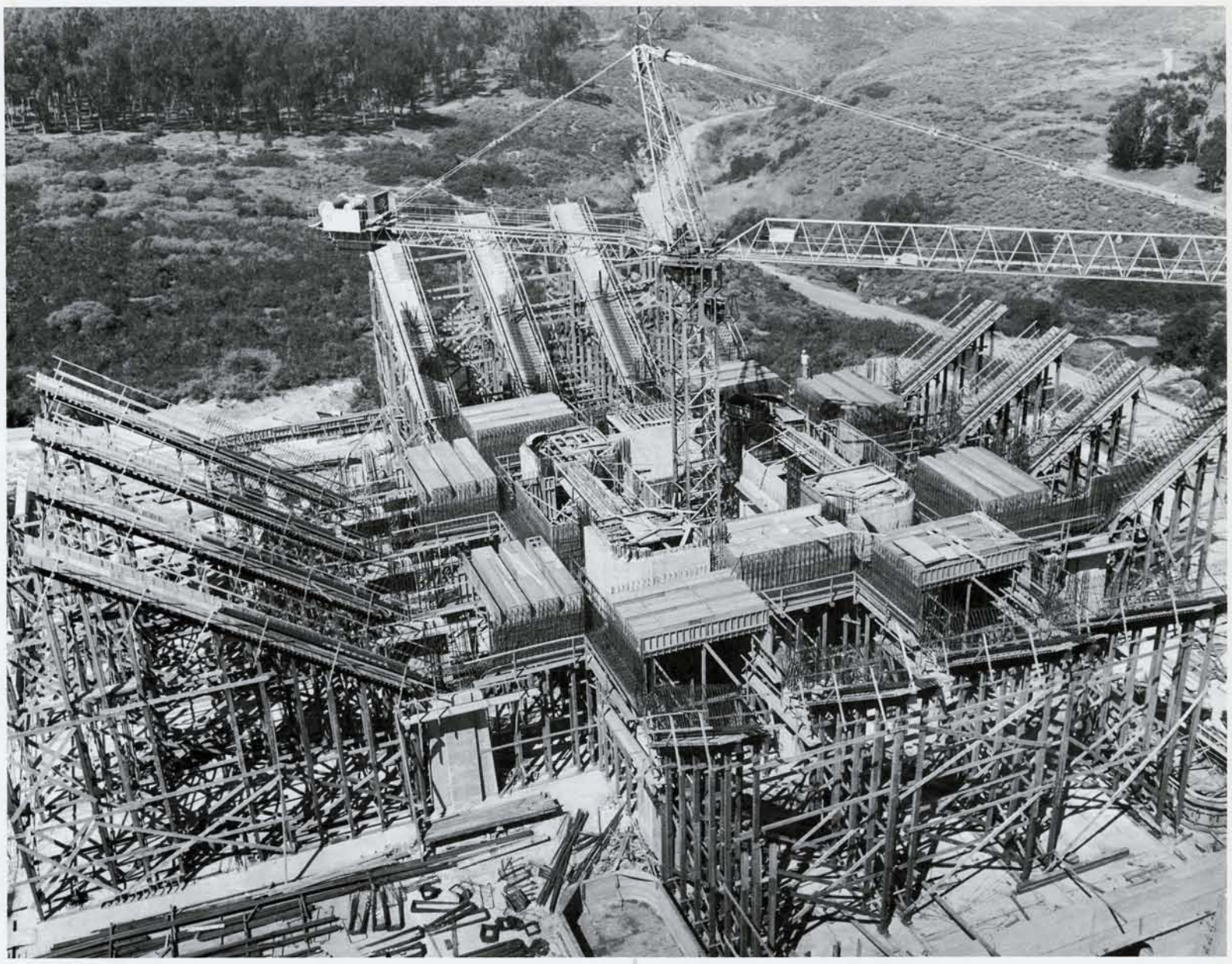
Further, the Architect built a half-scale model of a portion of the concrete bents in order to demonstrate the method of forming the quality of concrete desired by and acceptable to both the owner and the Architect.

With this additional information, which is not normally given, the contractors were better informed and could make more accurate estimates. As a result, in May of 1968, bids were approved and the project was awarded to a contractor whose bid was within 1% under the architect's estimated cost of construction.

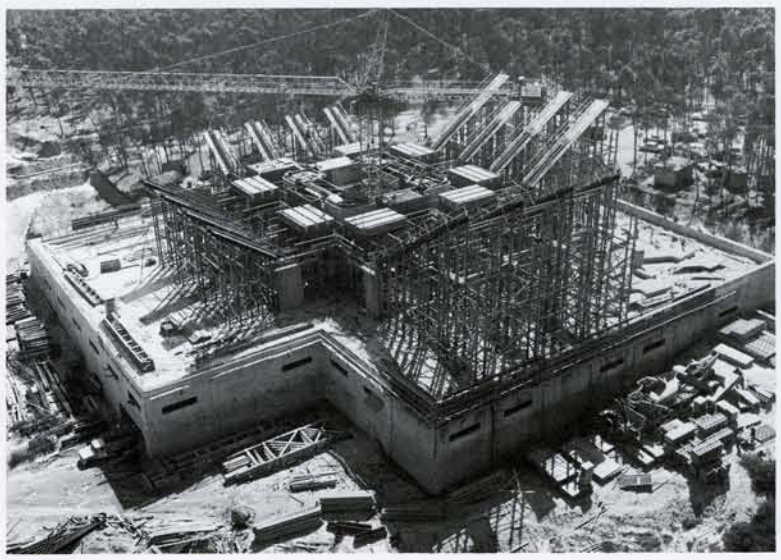
Construction Phase. Ground breaking ceremonies took place on the site in July of 1968, and construction commenced soon thereafter.



Test model of concrete bent.



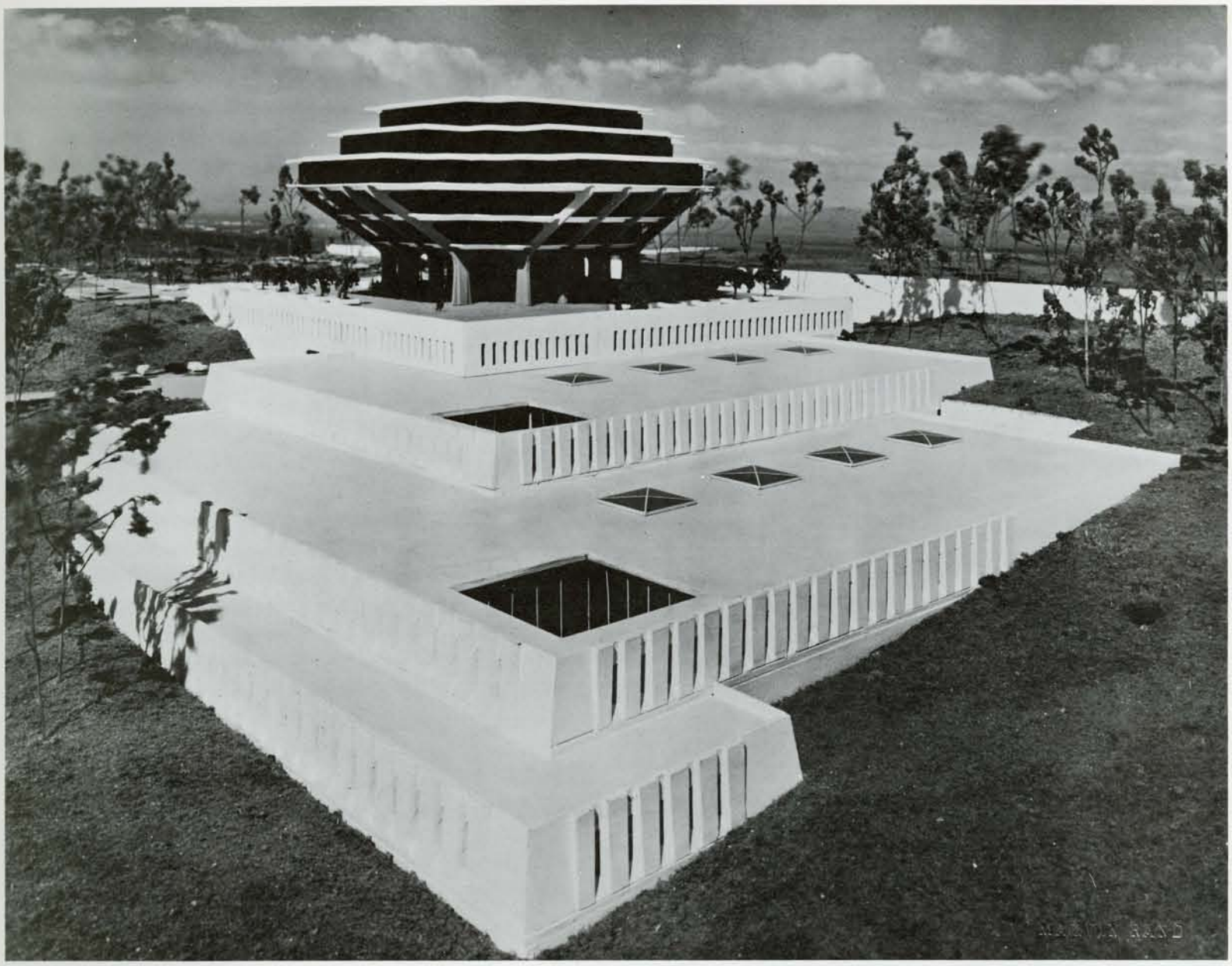
Detailed aerial indicating schoring and form work.



Aerial photograph from the northeast indicating massive scaffolding.

The lower two floors of the building were built first, so that the Forum level could be used as a platform for the scaffolding that would hold the form work in place. This scaffolding would remain in place until the top floor was installed. This was necessary because the post tensioning of the lower floors of the sphere could not be correctly executed until the floors above were in place and exerting their ultimate weight.

This mass of scaffolding will act as a cocoon for the building until it is virtually complete. Only then, in the winter of 1969, will the scaffolding be removed and the true impact of this architectural tour de force emerge and be totally comprehended. Final finishes and interiors will be the last phase of construction. The library should be in operation in the fall of 1970.

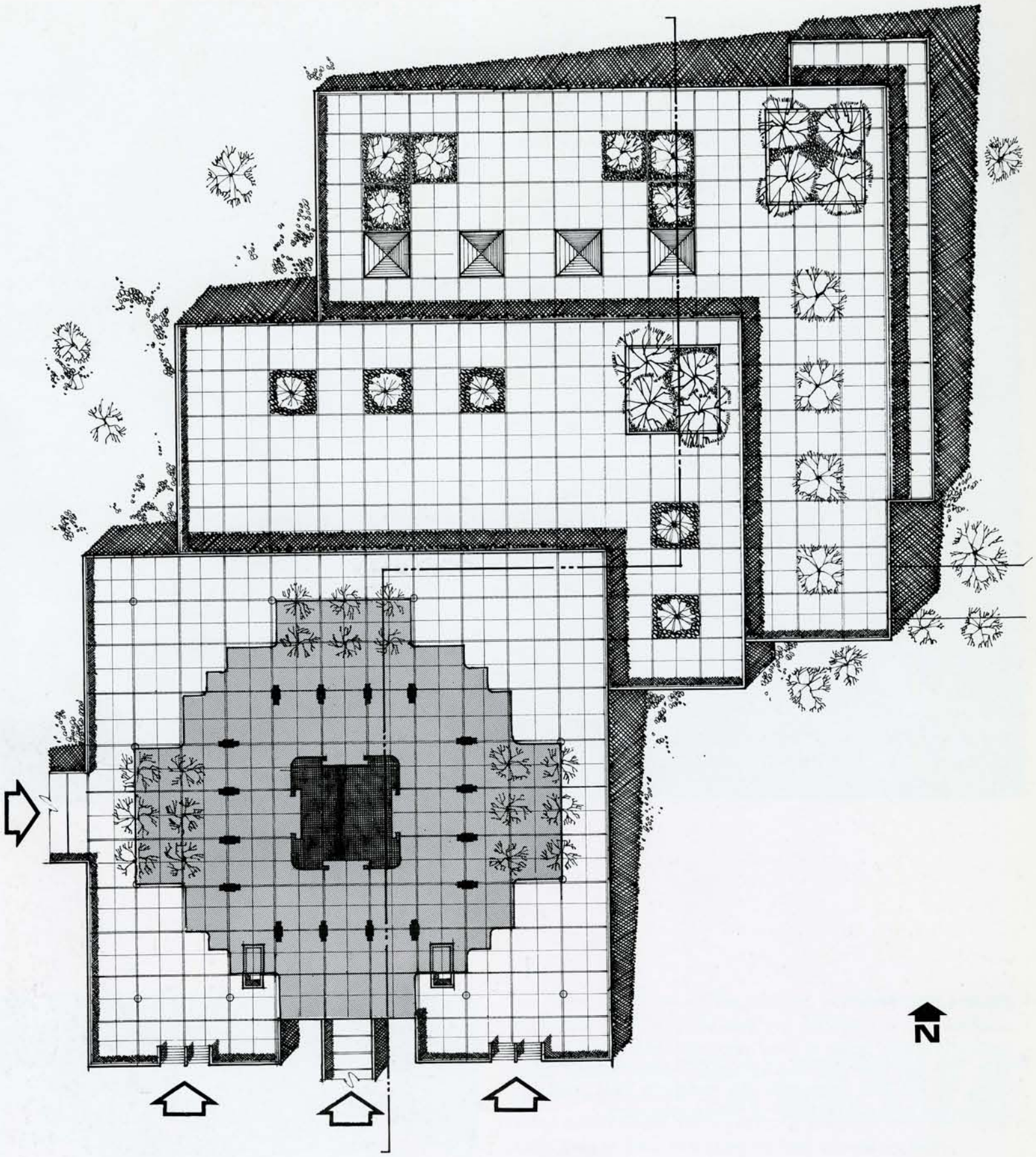


Model of the library showing Scheme A expansion, with future buildings cascading down the hillside.

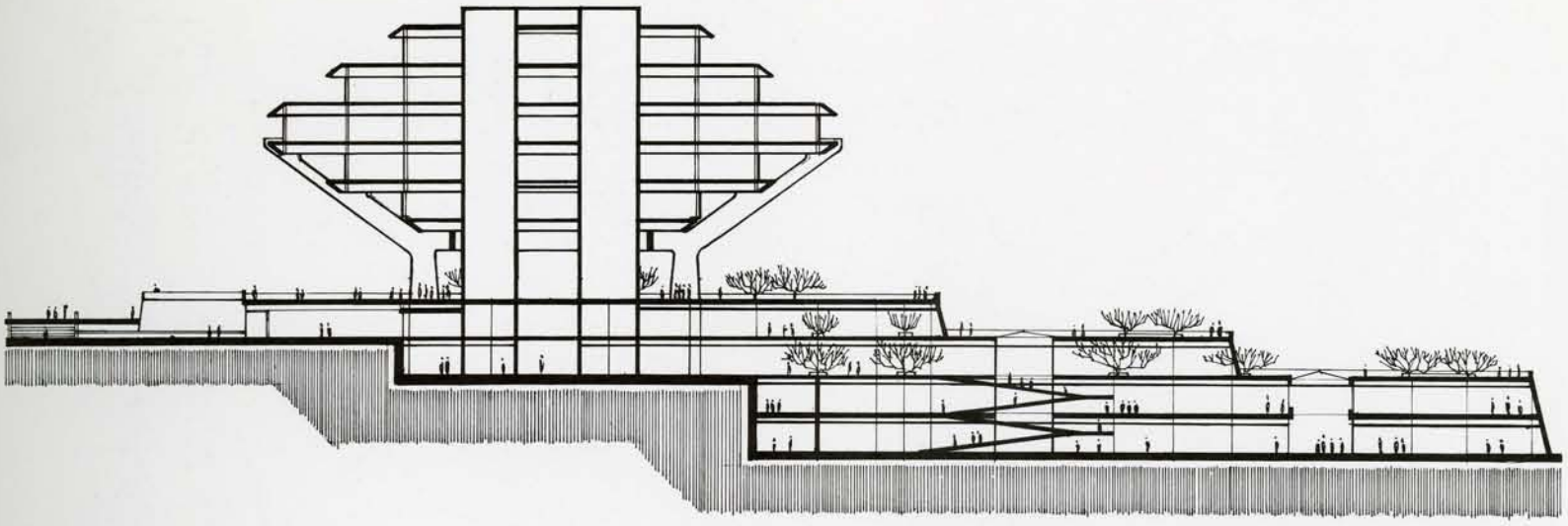
Future Expansion

Along with the development of the design and construction scheme for the first increment, the architects have studied and proposed optional methods of future expansion.

One scheme calls for attaching structures to the base of the building and cascading them down the sides of the canyon to the north. These future increments of construction will primarily house more book collections; little space will be devoted to staff or public areas. These cascading units will, however, house only small portions of the collection; the largest and most used, the humanities portion, will ultimately be housed in the spheroid.



Site Plan — Expansion Scheme
A.



Section — Expansion Scheme A.

Because these floors will be large, approximately 250 feet square, light wells will be incorporated to introduce light and provide outside reading areas. Skylights can be used in other areas, possibly over multi-story openings which would interrupt the vast floor of these future units. Changes in level, varying ceiling heights and other architectural treatment can be employed to overcome the monotony of these large floors.

It is anticipated that the roofs of these future increments will be treated in total or in part as walking decks, functioning in a manner similar to the Forum of the first increment. Indeed, these decks will be large enough to connect with the colleges of the second and third clusters.

In a second scheme the canyon is filled with automobile parking structures, on top of which are placed two immense library floors which are level and connect to the main and lower levels of the First Increment. This scheme provides the library staff with a high degree of flexibility in the internal organization of the collection and an efficient circulation schematic. There are problems, however, for one thing, parking structures are not funded from the same sources as general building budgets. Secondly, without careful study of scale and detail, the immensity of each floor could be staggering and over powering.

Phasing in two future increments will allow the development of separate buildings with shared light wells and connected to each other by bridges. The light wells and skylights would introduce natural light into these additions and ventilation for the garages below. The roofs would be treated as walking decks, with displays, planters and seating areas. The final decision as to the method by which the library should expand can only be made after an in-depth evaluation of the space requirements of the future increments, and an analysis of both the costs involved and the funding available.

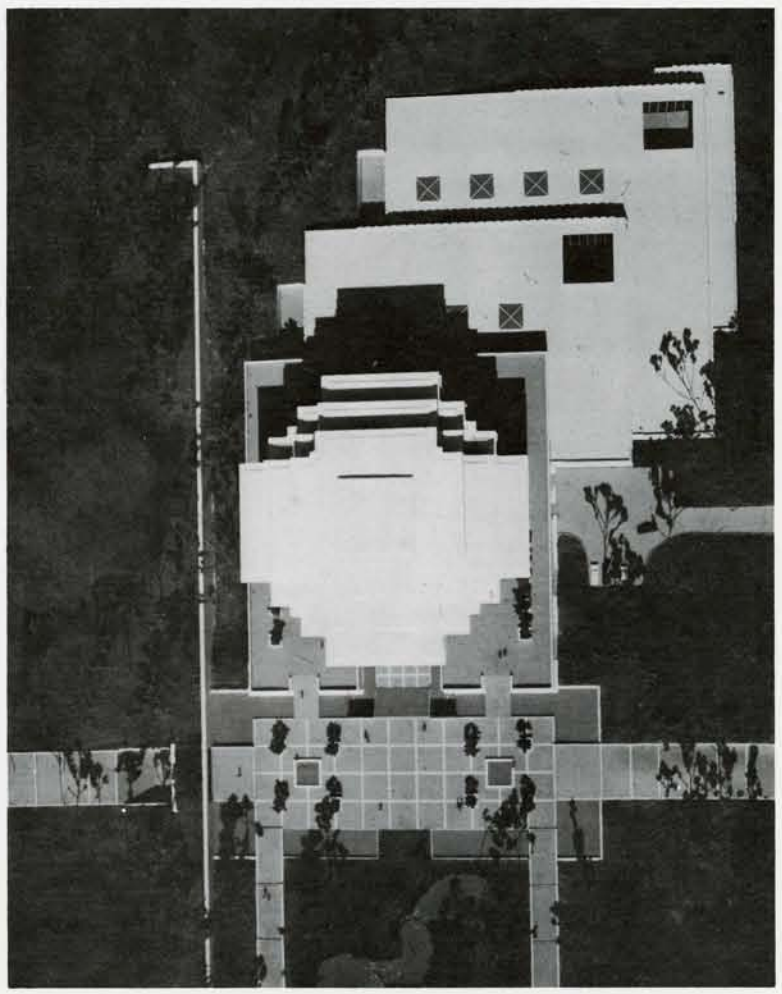
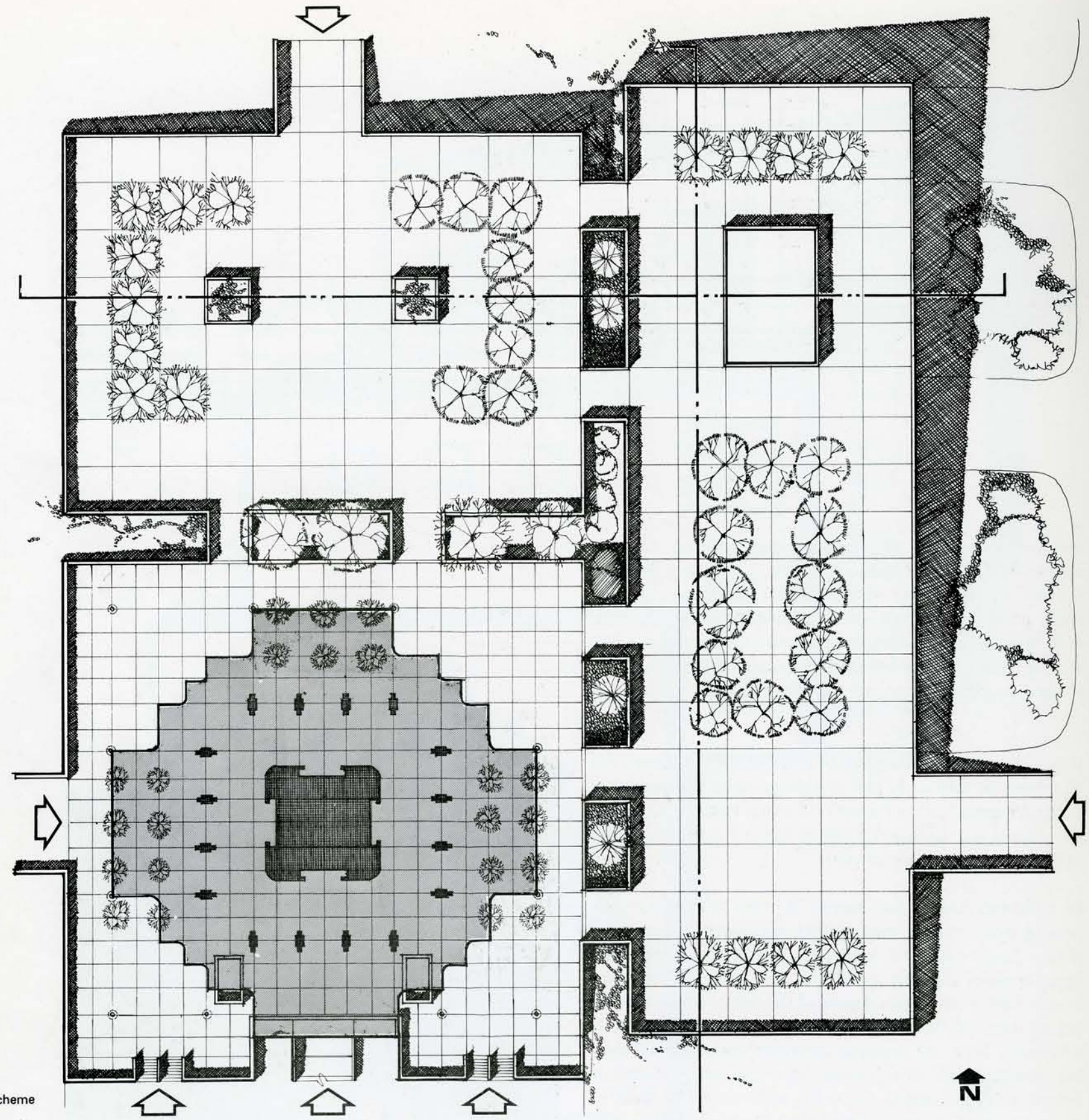
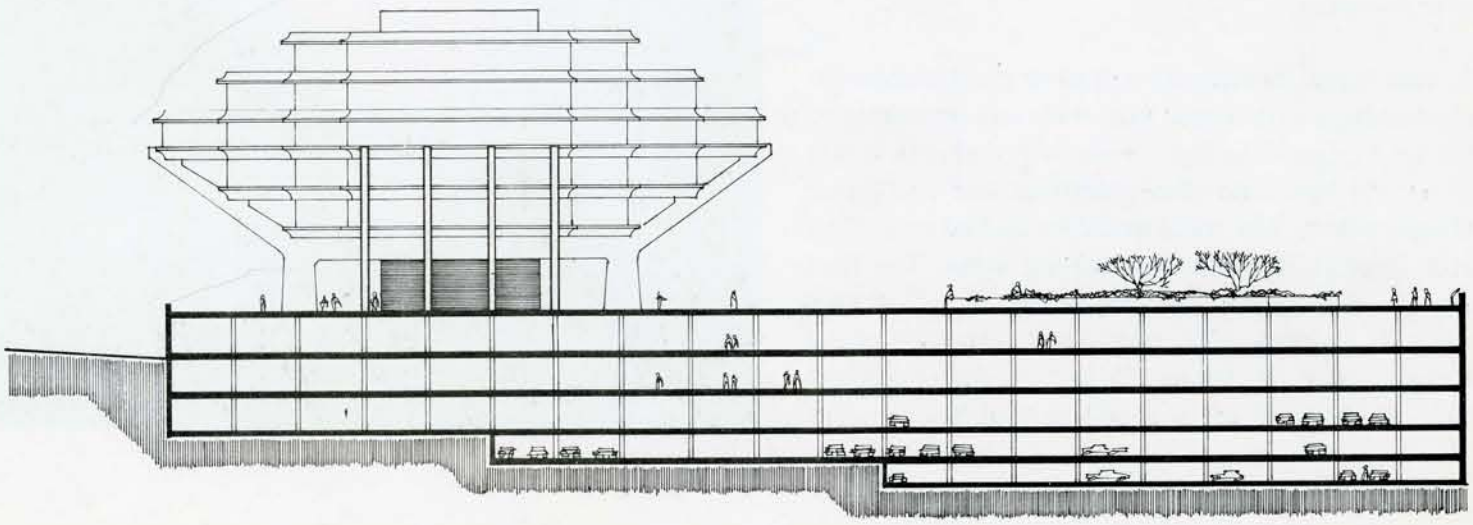


Photo of model showing cascading future expansion.



Site Plan — Expansion Scheme B.



Section — Expansion Scheme B, provides two immense library floors above parking structures.

VII. APPENDIX

VII. APPENDIX

A. A Historian's Viewpoint On University Libraries

by Dr. Galbraith, Chancellor of
University of California, San Diego

My interest in libraries derives from two perspectives – as a professional historian and more recently as a University administrator. As a historian I have been nourished by great research libraries, and as an administrator I am confronted with the problem of developing such a library on the San Diego campus of the University of California. I think it can be assumed that my comments are not unbiased, but I hope that they will not be discounted for their lack of objectivity.

During the last century, indeed during the last generation, there has been a dramatic change in the attitude of university boards of trustees, of legislators, and of the general public toward university libraries. One hundred years ago President Everett of Harvard made an eloquent appeal to the governing board for support for the college library. He said:

> "Another very important object of expenditure is the library. I would call it the most important, if I knew degrees in these matters, all of first-rate interest and necessity. Our library, it is true, is large; at least it seems so in this country. It exceeds fifty-three thousand volumes, which is one-tenth part of the estimated size of the library of the British Museum, – one-twentieth part of the reported size of the Royal Library at Paris. Still it may be asked, are not fifty-three thousand books enough? Can any mortal man read fifty-three thousand volumes? To which I readily reply, no one can read a tenth of a fiftieth part of that number of books, to any advantage; at least if they are of the size of many of the mighty folios that adorn our shelves. But a public library is not for the use of any one man, or any one class or set of men, having the same tastes, objects, and range of study. It is for our numerous body of instructors in their several departments; for four or five hundred students, graduates, and undergraduates; for a long list of other persons, having, by the standing laws, the right of borrowing books from the library; and it is for the public at large; for no individual having occasion to consult it, for any serious purpose, literary or scientific, is ever refused.
>
> "Now, sir, for new books in all the departments of art, literature, and science, we have barely eight hundred dollars a year, – a sum inadequate to the purchase of the new works of value which annually appear in any one department. What is the consequence? It is twofold; – first, all who have studies which must be pursued, are obliged to have private libraries of their own, a steady drain on small incomes; and secondly, they are obliged to endure at every turn the mortification and disadvantage of remaining in ignorance of the present condition of the sciences, or to take it at second hands from the reviews. There can be no cheerful progress, no first-rate scholarships, under such circumstances."

The Board considered Everett's plea, and concluded that it could not endorse such extravagance. No one could possibly read the 53,000 volumes already in the library; why buy more?

During the next seventy-five years there was a considerable change in outlook. President Edmund P. James of the University of Illinois had this to say in 1920:

> ". . . the University of Illinois Library is most inadequate for the purposes which a university library ought to serve. No man in our faculty can today carry on a scientific investigation in any line without running up very soon against an absolutely impenetrable stone wall, because he has not access to the entire experience of the race and he is therefore groping blindly in whatever he is attempting to do; duplicating work which other men have done; attempting to do things which other men have demonstrated to be impossible; experimenting without the advantage of the experience of the men who have gone before him.

"The people of this State, whether for weal or woe, located the University of Illinois in a village 125 miles from any important collection of books. Speaking generally, therefore, the library which is to quicken and stimulate and fructify scholarship and investigation at the University of Illinois must be a library located upon the campus of the University.

"We need, therefore, a much larger collection of books, other things being equal, than does the University of Chicago, or Harvard, or Yale, or Columbia, or Pennsylvania, all of which institutions are located within easy reach of collections which in the aggregate are two or three or four times their own collections.

"The following list gives the number of volumes in twelve libraries of the universities of this country:

Name	Number of volumes in library	Number of volumes in other available libraries in the neighborhood
1 Harvard	882,104	1,830,000
2 Yale	600,000	109,000
3 Columbia	450,000	3,230,000
4 Cornell	395,209	30,000
5 Wisconsin	384,000	82,000
6 Chicago	357,411	1,393,000
7 Pennsylvania	334,400	1,359,000
8 Princeton	372,300	5,000
9 Michigan	270,998	8,000
10 California	210,000	37,000
11 Brown	191,000	338,000
12 Illinois	188,000	34,000

"Harvard University has access to additional collections amounting to more than two millions of volumes. The New York collections of four millions of volumes are accessible to Yale within a two hours' ride. Pennsylvania has, of course, Johns Hopkins and Washington on one side, Princeton and New York on the other, within easy reach: while Princeton has Philadelphia on one hand and New York on the other.

"It will be seen that the collections of the University of Illinois are very far inferior to those of Harvard and Yale and Columbia and Chicago, although all these institutions are located in the midst of a very hotbed, so to speak, of other library collections. It will also be seen that the University of Illinois is inferior in actual number of books, to Cornell and Michigan and Wisconsin, though Michigan does not have an agricultural school in connection with it, and therefore does not need the great segment of a university library represented by the agricultural literature of the world.

"It is plain that the University of Illinois cannot hope to take its place among the great institutions of the world as a real center of learning and investigation until it has much larger library facilities."

Today, when great university libraries range from two million to seven million volumes, President James' ambitions in quantitative terms are obviously of a bygone era, but his stress on the central importance of the library is as timely today as when he stated it. As a chancellor of a new university "125 miles away from any important collection of books," I consider his comments to be particularly germane. San Diego, a metropolitan area of over one million people, with several colleges and many research-oriented industries, has no research library nearer than Los Angeles. Various palliatives have been proposed for this condition. We have a campus bus service which enables a scholar to get to UCLA in two and a half hours, leaving at 8 a.m., and returning him in another two and a half hours (God and traffic willing) in the afternoon. I have no desire to discontinue the bus service, but it can hardly be suggested that it is a substitute for a research library on the San Diego campus. The same comment can be made about interlibrary loans which are a supplement, not a substitute, for a great library in the area.

It is not my intention to advertise the peculiar needs of my own library – at least beyond the proportion of time usually allotted to commercials.

In many ways the problems faced by the San Diego campus of the University of California are problems faced in the United States and in other parts of the world in developing new universities, and my remarks should be interpreted in this perspective rather than as special pleading.

A new university is a costly undertaking. Even in the wealthy State of California the development of three new University campuses and several new State colleges has imposed a severe burden on the taxpayers, and there have been suggestions during the past few months that it was a mistake to create so many expensive new centers at one time. I do not believe that it was a mistake, but I do agree that higher education requires substantial financial commitments, and that the taxpayers have a right to ask whether their money is being spent wisely.

Why should there be a great research library at San Diego as well as at Berkeley and Los Angeles? Obviously there must be limits to the expectations of scholars as to the immediate availability of works which they require in their research.

The Harvard Library or the Library of Congress cannot be duplicated in other centers throughout the country, and even these great depositories cannot provide copies of all printed works. Furthermore, manuscript works are unique. The conclusion that some have reached from these facts is that the

accumulation of books in so many places is contrary to reason and that instead of spending millions of dollars on book acquisition, universities should be supporting developments in technology which would make such acquisitions unnecessary and do away with the necessity of building and maintaining huge libraries. Some have suggested that while books may not be obsolescent, librarians are, and they should rapidly be replaced by a new breed of technicians who will utilize modern technology to make information readily available to the user. They suggest that the present effort to add volumes to university libraries makes as much sense as the urge to be number 1 in the football polls. University presidents, most of whom don't *read* books, buy books for prestige reasons. Feeding this egomania are dusty pedants and librarians whose vested interests naturally are in the acquisition of more and more books and more and more staff to service them. This combination of ambitious administrators, reactionary professors, and scheming librarians perpetuates an era which should be dying, the age of *librarius giganticus.* Allied with these reactionaries is a book-publishing business which stands to lose if the present pattern of book acquisition is replaced by a new technology. They are like the nineteenth century Luddites who destroyed machinery because it produced technological unemployment. But they will in time be swept away, just as were the Babylonian clay tablet makers, the scroll-writers, and other obsolete purveyors of information. The final conclusion reached by some is that we are in the midst of a revolution in communication, and nothing can prevent its transforming our system of information storage and retrieval, which is after all what libraries are.

In the 1940's, Fremont Rider published a book, *The Scholar and the Future of the Research Library,* which predicted as grim a future for libraries as Malthus did for people unless they changed their characteristics in a revolutionary way. He pointed out that major university libraries had been doubling in size every sixteen years, and that if this rate continued, the Yale library in the year 2040 would have approximately 200,000,000 volumes, which would require over 6,000 miles of shelves. Its card catalog would have about three-quarters of a million drawers, which would occupy not less than eight acres of space. New books would be arriving at the rate of 12,000,000 volumes per year, and cataloging them would require a staff of over 6,000. Mr. Rider at that time was advocating the use of microcards, and since his day miniaturization has gone far beyond the technology of the 1940's.

Since Rider's dire prophecies, his theme has been played quite frequently. It is sung by people who are deeply involved in computer technology, which has already produced amazing developments in information sciences, scientists who utilize this new technology in their own research and believe that there is no reason it cannot also be applied to research in the humanities, and budgeteers who are appalled by the expenditures for libraries and see in technology a way of escape from steadily-mounting library appropriations. These groups have one attribute in common – they have not done research in the humanities and they usually do not understand the nature of that research. In their ignorance they arrive at excessively optimistic conclusions about what technology can do in its present form for scholars in disciplines alien to their own. With few exceptions, practicing scholars in the humanities, and particularly historians, do not share the view that libraries are on the eve of extinction.

Historians frequently speak in terms of ages and eras, even though in fact history does not usually move by fits and starts. The world did not go to bed on the evening of December 31, 1499, in the Middle Ages, and wake up in modern times, but it is certainly obvious that European society in 1600 was very different from that of 1400. With no more distortion, one can speak of eras of human learning. In the first era, the written word had little to do with intellectual development. What man learned was passed on to his fellows primarily through example or by oral communication. Some societies in Africa and elsewhere until our own day have depended upon oral tradition rather than written records to preserve the knowledge of their past. Then in China and in the eastern Mediterranean, particularly in the Greek city states, civilization moved to a second stage. The Greek intelligentsia of the so-called Golden Age asked themselves sophisticated questions and provided sophisticated answers on the nature of man and his environment. The thoughts of Aristotle, Plato, and others were recorded for others to read. But the primary focus of intellectual activity was the great teacher in discourse with his students in the Grove of Academe. This tradition continued with the medieval universities, where students migrated from place to place to learn from scholars in various places. There were libraries of sorts, but the student-teacher relationship remained fundamental.

We have since moved to a third era where the accumulation of knowledge has led to the development of great libraries. Professors, graduate students, and undergraduates require access to bibliographical collections which could not have been dreamed of in the previous age. The requirements of university libraries one hundred years ago were very small indeed as compared with those of the present. I have noted that the Harvard library of the mid-nineteenth century had 53,000 volumes and that the British Museum had only half a million; not much more than the present holdings of San Diego. Scholarship in that day bore little relationship to that of the twentieth century. Within the last two generations, research in the sciences and in the humanities has accelerated at an awesome rate. It may be an exaggeration to speak of a "knowledge explosion" but whatever the metaphor, research has produced vast resources, and scholars must have access to these resources.

This places a heavy burden upon society to maintain old libraries and to create new libraries adequate for scholarly research. The magnitude of the cost creates pressures to go

back and be peripatetic again, as were the scholars of the previous era, to depend more on buses and planes to take scholars to other libraries, and to lean more on interlibrary loans, or to wait for the fourth era which will use the capabilities of modern technology to store and distribute knowledge to the scholar, wherever he may be. As of today, there is no solution to this strain – we cannot go back to a previous era; the next remains many years away.

Administrators, librarians, and scholars have no alternative but to go on living in the present bibliographical era until a way is found to develop a seat of learning which can be, so to speak, more peripatetic bibliographically than technology yet permits it to be.

This puts a heavy responsibility on the library profession. Librarians must not only help to build centers of learning strong enough to support scholarship in our present era, but must also prepare themselves for the next era before we jump into it.

It may be that in forty years, or even in twenty, technology will have developed to the point where knowledge can be placed in memory storage units and the scholar can sit at his console and tap extensive data banks of information. Some day even the resources of the Library of Congress, the British Museum, and the Bibliothèque Nationale may be easily available to the scholar. The sooner that day comes the better. But a library cannot be developed in 1967 on the basis of what is conceivable generations hence; its users need to use it now; and they cannot be asked to defer their demands until technology provides for them. The counsel of "wait just a little while longer for electronic devices" is somewhat akin to the people of the nineteenth century being told, a generation before the electric light, to dispense with candles since Tom Edison was on the way. Libraries may or may not get their equivalent of Tom Edison; when he arrives the characteristics of libraries will change accordingly. Until then they will have to depend on books, and librarians to service them.

When I moved from UCLA to San Diego three years ago, I observed in a very personal way the significance of a great library. I was at that time still actively engaged in research in the field of British Empire history. At UCLA I could walk across the courtyard to a library which contained the standard works in that field. At San Diego I was 125 miles away from such a library. I could order books on interlibrary loan or I could take the bus to UCLA. Neither was a satisfactory substitute; my research activity suffered. A scholar in history must be able to browse. He does not necessarily know in advance where the information may be found which is relevant to his investigations. A great deal of insight and knowledge is acquired by what may appear to an outsider to be aimless wandering through the stacks. Interlibrary loans are, of course, indispensable aids to research, but they are not and are not intended to be substitutes for direct access to basic research collections.

When I announced my ambition to build at San Diego a third great research library in the University of California system, I was expressing the conviction that there is no substitute present, or prospective, for such a library. I was told that California could not afford a third major University library and that if I would just be patient, technology would provide the means by which such a library would be made unnecessary. The time span involved before such a development would take place was variously estimated – from ten to fifty years. As a student of British Empire history I found something vaguely familiar in such counsel. When Indian and African nationalists used to approach their British rulers with demands for greater freedom they were told that they must be patient – they were not yet ready for the responsibilities of independence, and progress must be gradual. San Diego has a kind of dependence on UCLA. We respect and admire our big brother to the north but the prospect of satellite status in libraries, even for ten or twenty years, is not one which we view with equanimity. It is simply a fact that outstanding scholars in the humanities will not come to a university without a great library any more than outstanding scientists will come to a university without laboratories.

It may be said here that the implication of my remarks is that every research-oriented university should have a library comparable to that of Harvard. That is not my view. Nor do I believe that every university should have a Brookhaven National Laboratory, a Lawrence Radiation Laboratory, or a 200-Bev accelerator. There are certain prerequisites for research in various fields, and those universities are outstanding which attract men and women of brilliance and provide them with the facilities which nourish their scholarship and research. Not every university can attract such scholars, even when they provide the resources; they certainly will not do so unless such resources are available.

There are today 573 universities in the United States offering doctoral programs in the humanities. This is far more than the number which possess strong research libraries. Even if funds were available to raise libraries in all these institutions to a level adequate for research, it would be impossible to do so. There are not enough books in the world to provide for such a development, and the competition for available collections has already raised prices to heights which a generation ago would have been regarded as fantastic. What, then, do I recommend? In the first place, I believe there should be more active regional cooperation among research libraries in their acquisition policies. This cooperation should take two forms; in the rationalization of effort in the purchase of relatively rare materials and in the creation of storage libraries which would be equally accessible to all of the member institutions. It makes no sense to me for libraries in the same metropolitan area to compete with each other as if the others did not exist. I do not think every research library must develop an outstanding collection of works in Sanskrit or that each should

strive for completeness on British colonial policy in the nineteenth century, to cite my own field of specialization. That statement, which I expect will not be uniformly endorsed, I would follow with another proposition: that universities do not have the obligation to offer the doctorate in every field of specialization in every discipline. We do not need dozens of doctoral programs in Near Eastern history, African history, Persian literature.

In general I am an enthusiastic advocate of decentralization of authority in the University of California. I applaud the transfer of authority to the local campuses. But I believe that nationalism can be carried too far, and I do not think that it should be the inherent right of every campus to develop doctoral programs without regard to the availability of such programs on other campuses of the University. Here it seems to me there should be some rationalization of effort. Furthermore, I do not believe that librarians of the various campuses of the University should carry on their acquisitions programs as if they were alone in the world. It seems to me in the public interest, and in the interest of higher education, that they should consult with each other, particularly in the purchase of exotic materials.

Further, I believe that there ought to be developed more centers with similar purposes to that of the Center for Research Libraries. Indeed, I can foresee great advantages in a national center with regional or metropolitan subcenters which can provide quickly on call relatively little used materials. Such centers would be in no sense substitutes for research libraries on the spot but rather a valuable supplement which would reduce the expense for participating institutions in the acquisition and storage of the materials which they would house.

I should like to make one further observation. I have noticed recently various efforts to quantify the needs of a research library. Some of these formulae are produced by librarians, others by bureaucrats. But most of them which I have seen contain the fundamental heresy of relating the size of collections to numbers of students, undergraduate and graduate. The number of undergraduate students has no relationship to the size of a research collection. The requirements of undergraduate instruction involve relatively small collections with an adequate number of duplicates for multiple use. Master's students require more, and Ph.D. candidates, many more. But a university needs a great library primarily to meet the needs of its faculty, and a distinguished faculty will not be attracted or will not stay unless the library provides for its research needs. Of course, no single library will ever provide adequately for such needs, but there is a certain level of frustration beyond which faculty members will not be prepared to go. A great research library, then, does not follow the creation of a great university. It precedes such creation and it grows with the needs of the faculty which it attracts.

I have spoken of the need for great research libraries but have not indicated how I propose to find the resources necessary to finance them. It is an interesting point that this question does not come up with laboratories for science, engineering, and medicine. Somehow society finds the means to finance them because it finds what they produce useful and good. But society is not convinced equally of the value of research in the humanities. Many might agree with Disraeli's observation that "nine-tenths of existing books are nonsense, and the clever books are the refutation of that nonsense," or Voltaire's remark that "it is far better to be silent than merely to increase the quantity of bad books." All of our lives would be simplified if we had an absolute standard with which to judge nonsense and to differentiate the good from the bad and an all-wise arbiter who could make such a decision. But, fortunately, we, at least in the free world, do not live in such an environment. We shall continue to accumulate books, magazines, and other documents of varying degrees of merit, and it will be the duty of research libraries to preserve them and to make them available to scholars with a minimum of delay. As an administrator, I give my sympathy to the librarian who must wrestle with these problems, as a scholar, I shall pound on the librarian's desk and demand better service.

B. Outline Specifications

Division 1 – General Requirements

Section 1A. Specifications cover the furnishing of all labor, materials, equipment and transportation required for complete structure, including Group I Furniture, Equipment and Service Road. Utility lines to be extended five feet beyond building line and connected to existing services, unless specified otherwise.

Section 1B. This increment to be an eight-story, reinforced concrete structure. Exterior walls to first tower level to be concrete, textured finish.

Division 2 – Site Work

Section 2A, Site Clearing. Removal of all trees within building area. Preserve and protect trees indicated to remain.

Section 2B, Excavation, Backfill and Finish Grading. Cut and fill areas as indicated on plan. All fill to be structural, compacted to a minimum 90% density AASHO standards. Fill material not required for immediate building area to be placed as directed for future expansion.

Finish grade around building to be accurate to .1' and hold 6" below finish landscape grade for topsoil.

Section 2C, Storm Drain System.

1. Pick up downspout piping at 5' from building line, combine with surface drains and connect to existing storm drain at easterly side of site in Sorrento Road alignment.
2. Piping and fittings: Extra heavy weight cast iron soil pipe, bell and spigot type.

Section 2D, Service Area.

1. Service road and yard to be 2" asphalt topping over 4" crusher run base.
2. 2 x 4 redwood headers firmly secured at edge of paving.

Division 3 – Building

Section 3A, Structure.

1. Spread footings of reinforced concrete. Assumed soil pressure 6000 p. s. f. based on nearby structures.
2. Floor system through third level to be standard concrete pan-joists or reinforced concrete slabs on grade as detailed.
3. Floor system above third level to be reinforced concrete slab and beam system where exposed and concrete pan-joist where concealed by ceiling.
4. Main columns and exposed bents to be 3000 p. s. i. reinforced concrete with exposed rough form board finish.
5. Typical structural frame to be 3000 p. s. i. reinforced concrete, stone aggregate formed with rough form board finish at exposed areas and plywood forming at concealed areas.
6. Exterior walls to first tower level to be reinforced concrete, poured-in-place panels.
7. Stair and elevator tower walls to be reinforced concrete, stone aggregate, formed with rough form boards, natural finish.
8. Stairs – steel stringers with cement filled steel pans, non-slip nosing, painted steel tube handrails.

Section 3B, Moisture Protection.

1. Membrane under interior slabs on grade and Forum level walking surface.
2. Exterior face of walls below grade to be waterproofed.

Section 3C, Roofing.

1. Twenty-year bond composition roof.

Section 3D, Window Wall. (Includes exterior doors in tower).

1. 16 gauge formed steel shape, bonderized with epoxy paint finish. Exterior glazed.
2. Glass – ¼" clear.

Section 3E, Doors and Frames.

Exterior – 1¾" solid core, unselect hardware for paint finish, 16 gauge steel frame.

Section 3F, Interior Partitions.

1. Sound Rated – Single 24 gauge steel studs with double layer ½" gypsum board on each side. Where ceiling occurs, use foil in attic space for sound baffle.

Section 3G, Ceramic Tile.

1. Floor – thin set, 1" x 1" unglazed tile at toilet rooms only.
2. Walls in toilet rooms 4¼" x 4¼" glazed tile.

Section 3H, Ceilings.

1. 12" x 46" acoustic tile, mineral fiber, with exposed grid in first and second level.
2. Waterproof gypsum drywall in toilets and janitor closets.

Section 3I, Resilient Floor.

1. 9" x 1/8" vinyl asbestos.

Section 3J, Cabinets and Counters.

1. Stain grade veneer – "custom" grade with edge banded doors.
2. Plastic laminate tops – 1/16" x 3/4" plywood. Self-edged, plain color, stabilizing sheet backup.

Section 3K, Finish Hardware.

1. Heavy duty cylindrical lock sets US26D.
2. Surface mounted closers.
3. Surface mounted panic hardware.

Section 3L, Toilet and Shower Partitions.

1. Ceiling hung, baked enamel.

Section 3M, Painting.

1. Interior – 3-coat satin finish.
2. Exterior – slab fascias only – textured coatings "Tex-Cote".

Section 3N, Elevators.

1. Two passenger elevators, 3000-pound capacity. 350 f. p. m., geared. Center-opening doors. Underslung with operating machinery at tower level. Seven level service. Standard cab.
2. One freight elevator, 4000-pound capacity, 250 f. p. m., geared, underslung. 4' x 7' two-speed door, seven level service.

Division 4 – Air Conditioning

Section 4A. System shall consist of three central fan and coil rooms. Frist level equipment to service two lower floors, third level located equipment to service tower with vertical warm and cold air ducts in central core.

Section 4B. Warm and cold air horizontal branch ducts at each floor connected to main air zones. Number and location of main air zones to be determined by building exposure and interior partition arrangement.

Section 4C. Temperature control for each zone to be pneumatic room thermostat operating pneumavalves at warm and cold ducts with constant volume control.

Section 4D, Air Filters. Dry type, similar to Continental "Conomatic" with "Dycon" media.

Section 4E, Dampers. Dampers shall be provided at all locations necessary to balance air quantities. Damper operations shall be locking quadrant type.

Fire dampers shall bear U. L. Label installed as required by State Fire Marshall.

Section 4F, Heating and Cooling Coils. Coils shall be extended surface type with copper tubing and copper or aluminum fins for hot and chilled water service.

Section 4G, Sheet Metal Work. Ductwork and plenum chambers shall be first quality galvanized steel. Gauges and installation shall be in accordance with latest ASHRAE Guide.

Section 4H, Insulation. Warm and cold air duct mains shall be wrapped with fiberglass blanket. Longitudinal seams and transverse joints of all supply ducts shall be taped with 4" strips of 6-ounce canvas held in place with Arabol Adhesive.

Section 4I, Fans. Fans shall meet AMCA standards as to construction and CFM ratings. Fans shall be equipped with flexible connections when connected to duct or plenums and equipped with drive guards.

Vee belt drives shall be rated at not less than 150% of motor rating.

Section 4J, Grilles and Diffusers. Supply air grilles shall be double deflection type directional air flow, each equipped with key or concealed level operated volume dampers. Return air and exhaust grilles shall have horizontal or vertical fixed blades as required and key or concealed lever operated volume dampers.

Section 4K, Monitoring. Sensors monitoring chilled and high temperature water along with room temperature and electric motor control will be extended by multiplexing from the Library to the computer-operated data acquisition system located in the Boiler Room.

Division 5 – Electrical Work

Section 5A, Design Criteria. All work will be specified to be installed in accordance with the latest issue of the "Design and Procedure Guide" as prepared by the Office of Architects & Engineers.

Section 5B, Work Included. The Contractor will provide all materials and equipment and perform all operations required for the complete systems described below including:

1. Termination of the below-listed systems in a new manhole south of the new building. These systems will be fed from the main campus in a tunnel distribution system to be developed outside this contract:

a. 12KV power.
b. Fire alarm.
c. Program clock.
d. Telephone.
e. Television.

2. The following complete and operative systems:

a. Distribution system including substations, panelboards, primary and secondary feeders, transformers, etc.
b. Lighting including lamps.
c. Branch circuit wiring including electrical work for mechanical systems.
d. Door alarm system.
e. Emergency power system.
f. Fire alarm system including heat and smoke detectors.
g. Program clock system.

3. A system of empty conduits will be provided for the following systems.
a. Telephone.
b. Television.

Section 5C, Materials. All materials will be new and will be furnished in accordance with A.I.E.E., N.E.M.A. and Underwriters' Laboratories Standards.

Section 5D, Workmanship. All work will be installed in a neat and orderly workmanlike manner by personnel qualified to do electrical work.

Section 5E, Dry Type Transformers. Transformers will be air-cooled Class "H" with a sound rating not to exceed N.E.M.A. Standards.

Section 5F, Circuit Breakers. Circuit breakers in power panelboards will be AB de-ion type. Lighting panel circuit breakers will be quick lag type. All circuit breakers will be selected for prevailing fault current conditions. Current limiting fuses will be used where required.

Section 5G, Wiring. All wiring will be in conduit and will be installed concealed from view where possible. Rigid conduit will be used underground and in damp locations. Electric metallic tubing may be used in other locations, concealed from view.

Section 5H, Distribution Scheme. Dual electrical services at 12,000 volt, three-phase will be terminated in a primary selector switch and then transformed by unit substations to either 277/480 volt, 4 wire for lighting and 480 volt, 3 wire for power. Dry type transformers will be employed to derive 120/208 volt power for convenience outlets, incandescent lighting and other miscellaneous requirements. Unit substations will be located in the basement. Dry type transformers will be located in the basement.

The emergency generator will be installed in the Penthouse and will provide power to egress lighting, fire alarm system and other essential loads.

Section 5I, Unit Substations. Substations will consist of primary fused air switches, non-flammable liquid-filled transformers. Substations will be completely assembled units as manufactured by General Electric, Westinghouse or Allis-Chalmers.

Division 6 – Plumbing

Section 6A, Fixtures. American Standard, Crane or Kohler.

Section 6B, Piping.

1. Domestic hot and cold water, Type "L" hard drawn copper.

2. Sanitary piping: Outside Building, mechanical joint v.c.p.
Inside Building, service weight cast iron.

Section 6C, Drains: Roof and Floor. Smith, Josam, Zurn.

C. Cost Estimates

ESTIMATED STRUCTURE CONSTRUCTION COST 100% Complete Drawings March 7, 1968	
General Construction	$3,070,586
Plumbing	60,000
Air Conditioning	320,000
Electrical	513,101
Subtotal	3,963,687
General Contractor's Overhead/Profit, Bond @ 9%	356,731
TOTAL	$4,320,418

Alt. No. 1	Delete 8,000 sq. ft. of area at second and third levels	$ 80,000
Alt. No. 2	Delete 60 db rooms at fourth level	3,000
Alt. No. 3	Change standard bracket shelves to fold-a-shelf. Delete metal end panels.	21,800
Alt. No. 4	Delete 30 starter units and 180 double face units	14,500
Alt. No. 5	Change luminous ceiling to ½" x ½" acrylic diffusers.	13,500
Alt. No. 6	Delete "Columbia" fixture and supply standard fixture with acrylic diffuser.	22,000
Alt. No. 7	Delete vinyl asbestos tile in general stacking areas at fifth, sixth and seventh levels.	12,000
Alt. No. 8	Provide 4'–0" high ceramic tile wainscot in lieu of full height ceramic tile.	4,800
	Subtotal	176,000
	General Contractor's Overhead/Profit, Bond = 9%	15,896
	TOTAL	$192,496

DETAILED COST ESTIMATE
GENERAL CONSTRUCTION
March 18, 1968

Category	Quantity	Unit Cost	Total
Clear Site			
Remove AC	11,900 s.f.	.05	595
Remove trees – eucalyptus	250 each	25.00	6,250
Salvage value	–	–	–
Clear and grub	5 acres	250.00	1,250
			8,095
Rough Grading			
Recompact original ground	120,000 s.f.	.01	1,200
Cut and fill on site	15,064 c.y.	.40	6,026
Cut and leave for backfill	893 c.y.	.40	358
Haul earth from owner's stockpile and fill on site	15,500 c.y.	.65	10,075
Backfill walls	893 c.y.	4.00	3,572
Blade Site	150,000 s.f.	.0075	1,125
Engineering	LS	–	1,000
			23,356
Finish Grading			
Skip and truck	2 days	160.00	320
Labor	6 man days	40.00	240
			560
Site Drainage			
6" Concrete pipe	212'	4.00	848
8" Concrete pipe	230'	4.50	1,035
10" Concrete pipe	130'	5.50	715
12" Concrete pipe	230'	7.00	1,610
15" Concrete pipe	110'	8.50	935
Catch basins	7 each	130.00	910
AC ditch	700'	2.25	1,575
Temporary AC	12,180 s.f.	.11	1,340
18" CMP	LS	–	700
Rip-rap outlets	LS	–	400
			10,068
Landscaping			NIC
Concrete			
Slab on grade, interior	806 c.y.	37.00	29,822
Slab on grade, exterior	97 c.y.	37.00	3,589
Topping	630 c.y.	45.00	18,350
Footing frames	1,590 c.y.	20.00	31,800
Footings, other	226 c.y.	35.00	7,910
Wall basement	804 c.y.	75.00	60,300
Walls above basement	1,656 c.y.	90.00	149,040
Walls, precast tiltup (8" thick)	614 c.y.	60.00	36,840
Beams	2,519 c.y.	85.00	214,115
Spandrels	1,520 c.y.	95.00	144,400
Corner spandrels	119 c.y.	100.00	11,900
Columns	358 c.y.	85.00	30,430
Frames	2,436 c.y.	110.00	267,960
Suspended slabs, pan joists, girders	4,951 c.y.	65.00	321,815
Bridge	105 c.y.	80.00	8,400
30" Concrete air duct	110'	28.00	3,080
Rockfill	825 c.y.	6.00	4,950
Visqueen	59,000 s.f.	.03	1,770
Fill in stair pans	4,186 s.f.	.50	2,093
Concrete curbs at window wall	4,500'	1.50	6,750
Emergency bases	500 s.f.	1.00	500
Hammerhead crane for structural use	LS	–	35,000
Miscellaneous scaffold allowance	LS	–	10,000
Saw cuts	400'	.30	120
Expansion joints	3,295'	1.00	3,295
Wall and floor samples	LS	–	350
Patch beam at prestressed rods	32 each	100.00	3,200
Concrete encasement of H & O ducts	12 c.y.	18.00	216
Concrete topping – Rooms 404 & 407	349 s.f.	1.00	349
Locker base	24 s.f.	3.00	72
			1,418,446
Reinforcing			
Bars in concrete	3,812,000 lbs.	.12	457,440
Mesh, slabs on grade and topping	121,000 s.f.	.04	4,840
			462.280
Prestressing	113,400 lbs.	.60	68,040
Rough Carpentry			
Blocking	LS	–	2,000
Carpentry iron	LS	–	500
Backboards	320 s.f.	.50	160
Duckboards	248 s.f.	1.85	459
Guard rail	30'	1.00	30
			3,149
Structural Steel & Miscellaneous Iron			
Steel stairs	589R	37.00	21,793
Ships ladder	1 each	350.00	350
Handrail	721'	3.00	2,163
Stair rail	856'	8.00	6,848
Hand rail	302'	4.00	1,208
Elev. pit screens	520 s.f.	3.00	1,560
Rail	1,212'	4.00	4,848
Catwalk	3 each	175.00	525
S. M. part. at mechanical room	H&V Contractor	–	–
Ladders	3 each	50.00	150
Elevator beams	3,177 lbs.	.50	1,589
Outside air frame and grating	10 s.f.	5.00	50
¾ Bars at frame and grating	LS	–	35
Railing at turnstiles	65'	8.00	520
Embedded iron	16,436 lbs.	.50	8,218
Miscellaneous iron	7,000 lbs.	.50	3,500
Mesh gates	3 each	90.00	270
Window head frame	3,236'	7.50	24,270
			77,897
Roofing and Waterproofing			
Composition roofing	30,658 s.f.	.23	7,051
Five-course flashing	1,700'	.50	850
Tex-Cote	22,098 s.f.	.40	8,839
Waterproof walls	14,209 s.f.	.35	4,974
Waterproof slab	48,926 s.f.	.15	7,338
Concrete base	2,153'	1.25	2,692
Waterproof slab under CT laticrete	1,580 s.f.	.42	664
			32,408
Sheet Metal			
Gravel strip	186'	2.00	372
Cap and base flashing	34'	2.25	77
Skylights	61 s.f.	6.00	366
Louvers	200 s.f.	6.00	1,200
S. S. sinks and splashes	3 each	300.00	900
Contingency	LS	–	1,000
Fume hood and splash	LS	–	350
			4,265

Category	Quantity	Unit Cost	Total
Insulation			
Wall insulation – Fourth floor	840 s.f.	1.00	840
Ceiling insulation – Fourth floor	349 s.f.	.15	53
Felt strip – ½ x 6-3/8	105′	.70	74
Felt strip – 1 x 4	116′	.70	82
Batts in walls	2,000 s.f.	.10	200
Fiberglass batts	144 s.f.	1.00	144
Window wall head insulation	3,236′	.10	324
			1,717
Drywall			
Metal studs	61,232 s.f.	.37	22,656
One 3/8 and one 1/2 GB walls	65,590 s.f.	.31	20,333
Two 1/2 GB walls	16,594 s.f.	.32	5,310
Two 1/2 GB walls, water repellant	1,454 s.f.	.44	640
Two 1/2 GB walls, water repellant at C.T.	5,528 s.f.	.44	2,433
Lead sound barrier	33,250 s.f.	.14	4,655
Three 1/2 GB walls	840 s.f.	.45	378
HC 1-5/8 GB	1,151 s.f.	.60	691
HC 1-5/8 GB, water repellant	1,918 s.f.	.66	1,266
HC 2-5/8 GB	127 s.f.	.75	96
HC 3-1/2 GB, Fourth Floor	349 s.f.	1.10	384
			58,842
Finish Carpentry & Millwork			
Wood doors S. C.	192 each	60.00	11,520
Bench	7′	3.00	21
Open lockers	24′	50.00	1,200
Circulation counter	241′	60.00	14,460
Entry counter	60′	60.00	3,600
Single shelf	213′	2.00	426
Lower cabinets	47′	35.00	1,645
Shelving 7′ high	771	15.00	1,155
Shelving and pole	14′	2.25	32
Install owner-furnished kit unit	–	–	By Plumber
Typing counter	20	20.00	400
Wood gates	7 each	25.00	175
H. W. partition	240 s.f.	4.00	960
			35,594
Metal Doors & Frames			
Frames	182 each	35.00	6,370
Frames with side light	24 each	45.00	1,080
Frames with rounded corners	1	60.00	60
Doors	15 each	100.00	1,500
Doors – rounded corners	1	180.00	180
Doors – 62 db. sound insulation	2 each	1,000.00	2,000
Inter. window frames	40 each	45.00	1,800
			12,990
Finish Hardware			
Wood and metal doors	214 each	66.00	14,124
Cabinet hardware	LS	–	566
Panic hardware	6	100.00	600
			15,290
Metal Roll-up Doors	64 s.f.	8.00	512
Folding Door	42 s.f.	3.00	126
Metal Windows			
Steel	915 s.f.	7.00	6,405
Window Walls & Glass			
Window wall framing	29,725 s.f.	3.00	89,175
Steel doors	4 each	225.00	900
Steel sliding doors, exterior	15 each	200.00	3,000
Steel sliding doors, interior	176 s.f.	5.00	880
¼ Plate	29,725 s.f.	2.00	59,450
¼ Tempered	914 s.f.	3.25	2,971
¼ Plate	637 s.f.	2.00	1,274
Window wall rail	3,200′	1.25	4,000
			161,650
Caulking	5,000′	1.50	7,500
Acoustic Tile			
Exp. grid 12″ x 46″ x ¾″	47,717 s.f.	.70	33,402
Exp. grid 12″ x 78″ x ¾″	86,303 s.f.	.70	60,412
¾ Mineral tile – Rooms 404 & 407	349 s.f.	.65	227
Vert. furring, 5/8 G.B.	3,344 s.f.	.65	2,174
			96,215
Resilient Floor			
Vinyl asbestos	143,539 s.f.	.35	50,239
Vinyl base 4″	12,686′	.32	4,060
			54,299
Ceramic Tile			
Floor thin set	1,580 s.f.	1.70	2,686
Base thin set	690′	1.25	863
Walls thin set	5,528 s.f.	1.90	10,504
			14,053
Metal Toilet Partitions			
Compartments with doors	31 each	80.00	2,480
Screens	7 each	45.00	315
			2,795

Category	Quantity	Unit Cost	Total
Toilet Accessories			
T. P. disposal	31 each	10.00	310
P. T. disposal	18 each	100.00	1,800
Soap disposal	37 each	15.00	555
Multipurpose units	2 each	80.00	160
Sanitary napkin disposal	20 each	28.00	560
Shelves	10 each	10.00	100
Mirrors with shelf	245 s.f.	8.00	1,960
Grab bars	4 each	25.00	100
			6,465
Loading Dock Bumpers	14′	8.00	112
Dock Levellers	2 each	700.00	1,400
Vinyl Wall Covering	2,308 s.f.	.50	1,154
Weatherstripping	16 each	20.00	320
Elevators			
Passenger, 3000 lb., 300 FPM, 7 stops	2 each	52,000.00	104,000
Freight, 4000 lb., 250 FPM, 7 stops	1 each	32,000.00	32,000
			136,000
Door Signs	150 each	5.00	750
Louver Drapes	31,680 s.f.	.50	15,840
Turnstiles	12 each	216.33	2,600
Shower Door	1 each	85.00	85
Entrance Mats	2 each	192.00	384
Book Depository	2 each	250.00	500
Library Shelving	LS	–	207,709
Paint			
Doors and frames	214 each	15.00	3,210
Steel window walls incl. doors	29,725 s.f.	.20	5,945
Steel sliding doors at inter.	176 s.f.	.20	36
Inter. drywall	91,018 s.f.	.13	11,833
Inter. concrete	80,000 s.f.	.15	12,000
Miscellaneous iron and S. M.	LS	–	3,000
Cabinets	533′	1.25	667
H. W. partitions	240 s.f.	.60	144
Inter. window frames	40 each	10.00	400
Wood gates	7 each	12.00	84
Metal roll-up door	64 s.f.	.40	26
Folding doors	2 each	20.00	40
Metal windows	915 s.f.	.20	183
Mechanical	LS	–	1,000
Wash glass	63,000 s.f.	.08	5,040
			43,608
General Conditions			
Supervisor	18 mo.	1,300.00	23,400
Asst. Supervisor	12 mo.	1,100.00	13,200
Office Manager	18 mo.	800.00	14,400
Job Engineer	6 mo.	850.00	5,100
Payroll taxes & insurance on above salaries	$56,000	.15	8,415
C.P.M.	LS	–	1,500
Offices and sheds	LS	–	800
Building layout crew	2 days	200.00	400
Power	LS	–	1,040
Water	LS	–	400
Telephone	18 mo.	150.00	2,700
Temporary sanitation	LS	–	1,500
Barricades	1,600′	.60	960
Fire protection	LS	–	600
Fire insurance	$3,500,000	.0012x2	8,400
Job sign (2 each)	LS	–	250
Safety lines at building exter.	3,621′	.35	1,268
Tests	–	–	By Owner
Fire protection	LS	–	1,000
Temporary ladders and protection	LS	–	500
Single well material tower	154′	30.00	4,620
Hoist	8 mo.	200.00	1,600
Cables	LS	–	500
Operator	8 mo.	1,000.00	8,000
Personnel elevator	Not required	–	–
Connections material tower to floors	7 each	150.00	1,050
Gates for tower	8 each	75.00	600
Cleanup	176,658 s.f.	.05	8,833
Trash service	18 mo.	100.00	1,800
Truck rental	12 mo.	175.00	2,100
Pickup rental	18 mo.	125.00	2,250
Small tools	LS	–	1,500
Mix designs and testing	LS	–	500
			119,186

CONSULTING FOUNDATION ENGINEERS 711 NORTH ALVARADO STREET □ LOS ANGELES, CALIFORNIA 90026 □ TELEPHONE 386-3920

LEROY CRANDALL
AND ASSOCIATES

May 3, 1967

University of California at San Diego
Office of Architects and Engineers
P. O. Box 109
La Jolla, California 92037

P.O. No. 7S 69826-0
(Our Job No. A-66345)

Attention: Mr. Robert Thorburn
Project Architect

Gentlemen:

Our "Report of Foundation Investigation, Proposed Central Library, San Diego Campus, San Diego, California, for the University of California" is herewith submitted.

The scope of the investigation was planned in collaboration with William L. Pereira & Associates. We were advised of the structural features of the proposed building by Brandow & Johnston Associates, Structural Engineers.

The site is covered by a shallow thickness of overburden soils which in turn are underlain by firm sandstone and siltstone. To provide uniformly good support, we recommend that foundations for the proposed building be established in the sandstone or siltstone. Conventional spread footings may be used in the planned cut area where the sandstone or siltstone will be exposed; deep spread footings or drilled-and-belled caissons may be used in the portion of the building area where fill is to be placed. Recommendations for foundation and basement wall design, for grading, and for floor slab support are presented in the report.

Respectfully submitted,

LeROY CRANDALL AND ASSOCIATES

by LeRoy Crandall
LeRoy Crandall

JK-PM:lb
(4 copies submitted)

cc: (3) William L. Pereira & Associates
Attn: Mr. James Manning
(1) Brandow & Johnston Associates

SCOPE

This report presents the results of a foundation investigation of the site of the subject building. The locations of the proposed building and our exploration borings are shown on Plate 1, Plot Plan.

We previously made a preliminary study of the foundation conditions of the overall site of the San Diego Campus and submitted the results in our report dated October 1, 1962 (our Job No. 62415). We have also performed investigations for the nearby School of Medicine (our Job No. 64801) and for other projects on the Campus.

The present investigation was authorized to determine the characteristics of the soils beneath the subject building site and to provide recommendations for foundation design, subterranean construction, site grading, and floor slab support. The results of the field explorations and laboratory tests, which together with the previous data form the basis of our recommendations, are presented in the attached Appendix.

STRUCTURAL CONSIDERATIONS

The proposed Central Library, which is shown in plan on Plate 1, will consist of a nine-story tower with one-story construction around the tower. There will be a partial basement or lower level beneath the majority of the tower and beneath part of the one-story portion. The building will be of reinforced concrete construction. Exterior column loads in the tower will range from 2,400 to 2,475 kips; interior column loads will range from 700 to 800 kips. Column loads in the non-tower area will range from 150 to 200 kips.

The first floor of the building will be established at Elevation 372.5. Based on the existing topography, excavation up to 10 feet deep and

compacted fill up to 12 feet in thickness will be required beneath the first floor. The basement or lower floor, which will be at the level of the exterior grade to the north of the building, will be established at Elevation 359; this will require excavation up to 11 feet deep and compacted fill up to 3 feet in thickness. A cut slope some 10 feet high is planned some 15 to 20 feet to the west of the building.

SITE CONDITIONS

The site is located within an undeveloped area of the Campus; contours describing the existing topography are shown on Plate 1. At the time of our explorations, there were numerous eucalyptus trees and shrubbery on the property. The removal of the existing trees will result in the disturbance of the upper soils.

As disclosed by the exploration borings, the site is underlain by silty sand overburden soils to depths of one to two feet, underlain by sandstone and siltstone to the depth explored. The overburden soils are moderately firm. The sandstone and siltstone deposits which occur below the shallow overburden soils are firm to very firm. Although of Pleistocene and Eocene age, the deposits have not been distinguished on the logs as to geologic age. A gad (chopping tool) was used to penetrate hard, highly cemented layers within the sandstone and siltstone in most of the borings. Water was not encountered within the 50-foot maximum depth of exploration.

In addition to logging the soils and obtaining undisturbed samples, our field engineer entered four of the borings to observe the sandstone and siltstone deposits in place and to measure the strike and dip of the beds. Generally, the bedded deposits dip downward to the southwest at angles of 5 to 16 degrees below the horizontal. The measurements are indicated on the boring logs in the attached Appendix. Although not considered

significant, fractures and other signs of minor shearing or faulting were observed in some of the borings.

Based on the geologic mapping done during our preliminary study of the San Diego Campus (our Job No. 62415), a concealed fault traverses the building area. The approximate location of this fault, which is indicated on Plate 1, was estimated on the basis of visual observations made at some distance from the building area. The fault occurs within the underlying older Eocene deposits which are covered by more recent Pleistocene deposits in the building area. Accordingly, the fault is not exposed at the site and would be considered ancient since the faulting occurred prior to the Pleistocene epoch.

RECOMMENDATIONS

GENERAL

The planned grading of the site will result in the exposure of the firm sandstone and siltstone over a large portion of the proposed building area. To provide uniform support, we recommend that the building be supported entirely in the sandstone and siltstone utilizing spread-type foundations. Conventional spread footings may be used where the sandstone or siltstone is exposed or is close to final grade. In the planned fill area, either deep spread footings or drilled-and-belled caissons may be used.

As previously mentioned, a concealed fault traverses the site at the estimated location shown on the Plot Plan. The fault is ancient and inactive, and it is extremely unlikely that any ground movements will ever occur along the fault line. Accordingly, we do not anticipate any adverse seismic effects from this source. The only possible problem is that some fault gouge may occur in foundation excavations with the resulting necessity for deepening some of the foundations to reach firm undisturbed material.

FOUNDATIONS

Bearing Value

Conventional spread footings and drilled-and-belled caissons should be carried at least one foot into firm sandstone or siltstone and at least three feet below the existing grade. Exterior footings should extend at least four feet below the adjacent final grade; interior footings may be established at a depth of two feet below the adjacent floor level. Drilled-and-belled caissons should be carried to a sufficient depth to allow proper construction of the caisson bells. Spread footings in the non-basement areas should be located below a plane drawn at 1:1 upward through the bottom of the adjacent basement excavation. Conventional spread footings and drilled-and-belled caissons carried into firm undisturbed sandstone or siltstone and to the appropriate minimum depth with respect to final grade or floor level may be designed to impose a dead plus live load pressure of 10,000 pounds per square foot. A one-third increase may be used when considering wind or seismic loads. Where caissons are used, the weight of the concrete within the caissons may be neglected when computing the imposed downward foundation loads.

Settlement

Settlement analyses have been performed for the range of column loads anticipated. Based on our analyses, the maximum ultimate settlement of the nine-story tower, supported on spread footings as recommended, will be on the order of one-half to three-fourths inch. The maximum differential settlement between any two adjacent columns within the tower will be less than one-fourth inch. The maximum ultimate settlement of the non-tower portion of the building will be about one-fourth inch. To minimize the effect

of differential settlement between the tower and non-tower, the structural portion of the tower should be completed prior to construction of the remainder of the building, or at least prior to making rigid connections between the tower and the adjacent non-tower structure.

Inspection

To confirm the presence of the firm sandstone or siltstone at design elevations and to assure satisfactory support, footing excavations and caisson excavations should be inspected and approved by personnel of our firm. Footings should be deepened if necessary to extend through overburden soils and any fault gouge material that would not provide adequate support. The excavations must be hand-cleaned of loosened soils. The use of at least 24-inch-diameter caisson shafts is recommended to allow personnel to enter the caisson excavations. To assure the safety of personnel within the caisson excavations for hand-cleaning and inspection, temporary casing must be installed.

The sandstone and siltstone are very hard in some locations, and jack-hammers will be required to excavate any hard layers which occur within foundations. Hard layers may occur within drilled-and-belled caissons as well as within shallow spread footings, requiring the use of equipment such as jack-hammers. The foundation excavations should be left slightly uneven if necessary, rather than filling in over-excavated areas with loose soils. It would be desirable to pour spread footings neat against the undisturbed sandstone or siltstone. If backfill is required, it should be compacted to at least 90% of the maximum density obtainable by the ASTM Designation D1557-64T method of compaction modified to use three layers.

Lateral Loads

The passive resistance of the soils and soil friction may be used for resisting lateral loads. A coefficient of friction of 0.5 may be used between footings or the floor slabs and the supporting materials. The passive resistance of the sandstone or siltstone against spread footings and grade beams may be assumed to be equal to the pressure developed by a fluid with a density of 400 pounds per cubic foot. The passive resistance of the natural overburden soils or properly compacted fill may be assumed to be equal to the pressure developed by a fluid with a density of 300 pounds per cubic foot. The lateral resistance of caissons may be computed using any acceptable pole formula. When using the pole formula, the allowable lateral resistance of the compacted fill or natural soils may be assumed to be equal to the pressure developed by a fluid with a density of 600 pounds per cubic foot. A one-third increase in the passive values may be used for wind or seismic loads.

The caissons, friction, and passive pressure may be used in combination, without reduction, for determining the total resistance to lateral loads. If the lateral loads on the structure can be resisted by the combination of these three elements, foundation tie-beams between caissons will not be necessary for seismic stability.

GRADING

Excavation

The underlying sandstone and siltstone are firm to very firm and contain hard cemented layers; penetration of these hard cemented layers required the use of a gad while drilling the exploration borings with bucket-type equipment. It is anticipated that heavy rippers will be

required for excavation of the sandstone and siltstone; however, blasting should not be required.

Where the necessary space is available, temporary unsurcharged embankments may be sloped back without shoring. Unsurcharged excavations may be cut at ½:1 (horizontal to vertical). No critically adverse conditions are anticipated due to bedding of the siltstone and sandstone; however, all embankments should be inspected during excavation by personnel of our firm so that the slopes may be modified if conditions differ from those revealed by the borings and if necessary for safety.

The planned cut slope located west of the proposed building area may be constructed at a slope of 1½:1 (horizontal to vertical) as planned. Drainage of the area above the slope should be carefully planned to prevent water from running over the top of the slope. The slope should be planted as soon as possible to minimize erosion.

Compacted Fill

Prior to placing compacted fill, any soils loosened by removal of the existing trees or otherwise disturbed should be excavated. Next, the exposed soils (except the sandstone or siltstone) should be scarified to a depth of six inches, brought to optimum moisture content, and rolled with heavy compaction equipment. The upper six inches of natural soils should be compacted to at least 90% of the maximum density obtainable by the ASTM Designation D1557-64T method of compaction modified to use three layers instead of five. All required fill should be placed in loose lifts not more than eight inches in thickness, brought to optimum moisture content, and compacted to at least 90%.

Compacted fill slopes (fill compacted to at least 90%) may be constructed at 1½:1 (horizontal to vertical). All compacted fill placed on

BORING 1

DATE DRILLED: April 7, 1967
EQUIPMENT USED: 18"-Diameter Bucket

ELEVATION 361.0*

Elevation (ft)	Depth (ft)	Moisture (% of dry wt)	Dry Density (lbs./cu. ft.)	Sample	Description
360		7.7	117	SM	SILTY SAND - fine, rootlets, brown
					SANDSTONE - greyish-brown
		6.3	113		(GAD USED FROM 1' TO 2')
		6.3	120		Light greyish- and yellowish-brown
350	10	8.1	119		
		9.5	104		(GAD USED FROM 13' TO 14')
		28.9	89		SILTSTONE - greyish-brown
					Layer of SANDSTONE - light greyish-brown
		19.1	106		(GAD USED FROM 16' TO 19')
340	20	(202°-10°) 7.5 (220°-8°)	109		SANDSTONE - light brown
					Light grey and yellowish-brown
		18.0	104		SILTSTONE - light grey and greyish-brown
330	30				(GAD USED FROM 29' TO 32')
		10.3	102		SANDSTONE - light greyish-brown
		5.6	100		
320	40				
		4.6	103		Lenses of Siltstone
					CONGLOMERATE - light brown
	50				

NOTE: Water not encountered. No caving or raveling.

*Elevations refer to datum of reference drawing; see Plate 1 for location of bench mark.

Soils classified in accordance with the Unified Soil Classification System.

(202°-10°) — DIRECTION OF DIP (AZIMUTH); ANGLE OF DIP BELOW HORIZONTAL

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

BORING 2

DATE DRILLED: April 5, 1967
EQUIPMENT USED: 18"-Diameter Bucket

ELEVATION 382.5

Elevation (ft)	Depth (ft)	Moisture (% of dry wt)	Dry Density (lbs./cu. ft.)	Sample	Description
380		16.0	106	SM	SILTY SAND - fine, rootlets, brown
					SILTSTONE - brown
		19.8	105		Brownish-grey
		8.1	94		SANDSTONE - light brown
	10	7.6	106		Greyish-brown and yellowish-brown
370		5.5	106		Slight cementation
		4.1	98		
	20	1.7	97		
360		1.1	101		
	30	6.3	103		

NOTE: Water not encountered. No caving or raveling.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

BORING 3

DATE DRILLED: April 6, 1967
EQUIPMENT USED: 18"-Diameter Bucket

ELEVATION 355.6

Elevation (ft)	Depth (ft)	Moisture (% of dry wt)	Dry Density (lbs./cu. ft.)	Sample	Description
		4.4	106	SM	SILTY SAND - fine, rootlets, brown
					SANDSTONE - greyish-brown and yellowish-brown
350		8.1 (261°-14°)	110		
		9.2	106		
		17.2	97		
	10	12.6 (226°-16°)	110		Layer of SILTSTONE - light brownish-grey
340		7.8 (205°-11°)	102		
		18.0 (188°-9°)	110		Layer of SILTSTONE - lenses of Sandstone, light greyish-brown
	20				(GAD USED FROM 20' TO 21')
330		18.6	85		
		6.8	100		Light greyish-brown
	30				
320		8.0	97		
		5.0	95		Mottled greyish and reddish-brown
	40				
310		4.7	105		(GAD USED FROM 46' TO 47')
	50	13.8	98		Lenses of Siltstone - greyish-brown

NOTE: Water not encountered. No caving or raveling.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

BORING 4

DATE DRILLED: April 6 & 7, 1967
EQUIPMENT USED: 18"-Diameter Bucket

ELEVATION 368.0

Elevation (ft)	Depth (ft)	Moisture (% of dry wt)	Dry Density (lbs./cu. ft.)	Sample	Description
		8.8	105	SM	SILTY SAND - fine, rootlets, brown
					SANDSTONE - greyish-brown
		7.3	102		
360		7.1	100		
	10	5.3	112		
		8.0 (189°-8°)	112		Light grey and greyish-brown
		9.0	107		
350		9.8	98		
	20	16.4 (220°-8°)	110		SILTSTONE - mottled grey and light brown
					(GAD USED FROM 20' TO 23')
		18.6 (140°-7°)	107		Light greyish-brown
					(GAD USED FROM 25' TO 28')
340					Layer of SANDSTONE
	30	28.8	97		
					(GAD USED FROM 31' TO 33')
		10.5	105		SANDSTONE - light grey and brown
330					
	40	5.7	105		
		6.1	102		
320					Dark grey and brown
	50	4.5	108		

NOTE: Water not encountered. No caving or raveling.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

BORING 5

DATE DRILLED: April 6, 1967
EQUIPMENT USED: 18"-Diameter Bucket

ELEVATION 379.9

Elevation (ft.)	Depth (ft.)	Moisture (% of dry wt.)	Dry Density (lbs./cu. ft.)	Sample	Description
				SM	SILTY SAND - fine, brown
		12.6	114		SANDSTONE - greyish-brown
		7.5	101		
		5.7	103		
370	10	3.7	95		Light grey
		3.0	92		Slight cementation, rootlets
		2.4	99		
		1.6	104		
360	20	(250°- 24°)			
		1.1	96		
		(248°- 9°)			
		5.1	97		Light yellowish-brown
350	30				
		12.6	101		Layer of SILTSTONE - grey Greyish-brown and yellowish-brown
		5.2	101		
340	40				
		11.1	109		
		10.0	98		Light reddish-brown
330	50				

NOTE: Water not encountered. No caving or raveling.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

BORING 6

DATE DRILLED: April 6, 1967
EQUIPMENT USED: 18"-Diameter Bucket

ELEVATION 367.0

Elevation (ft.)	Depth (ft.)	Moisture (% of dry wt.)	Dry Density (lbs./cu. ft.)	Sample	Description
		1.3	104	SM	SILTY SAND - fine, rootlets, brown
		9.2	122		SILTSTONE - mottled greyish-brown
		15.3	98		
360		10.6	109		
	10	5.8	103		SANDSTONE - light greyish-brown
		6.1	104		
350					
	20	10.0	112		Layer of SILTSTONE - brownish-grey (GAD USED FROM 20' TO 21')
		11.8	103		
340					(GAD USED FROM 27' TO 29')
	30	15.9	93		Light grey

NOTE: Water not encountered. No caving or raveling.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. of fines)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

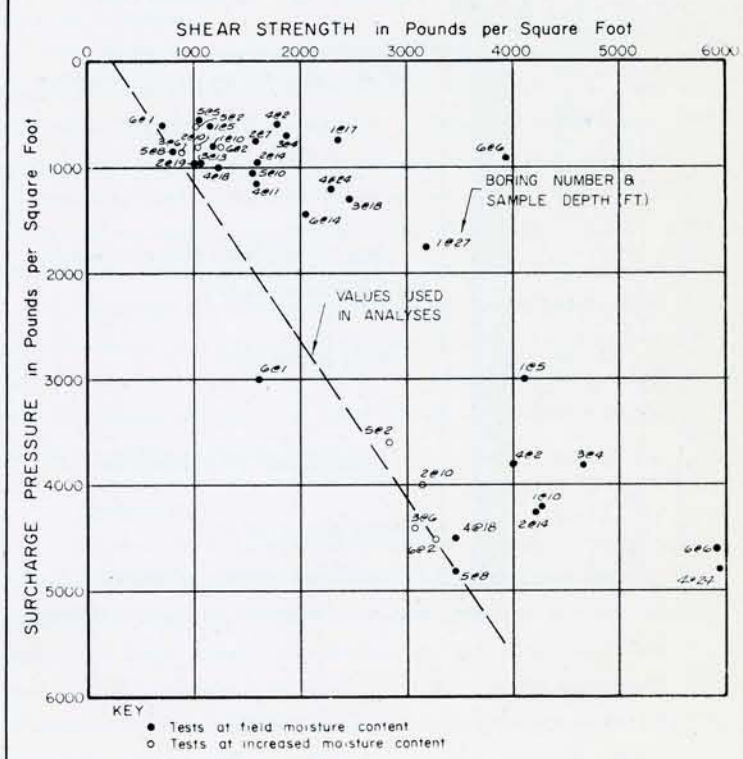
SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

NO. 200 NO. 40 NO. 10 NO. 4 3/4 in. 3 in. (12 in.)
U. S. STANDARD SIEVE SIZE

UNIFIED SOIL CLASSIFICATION SYSTEM

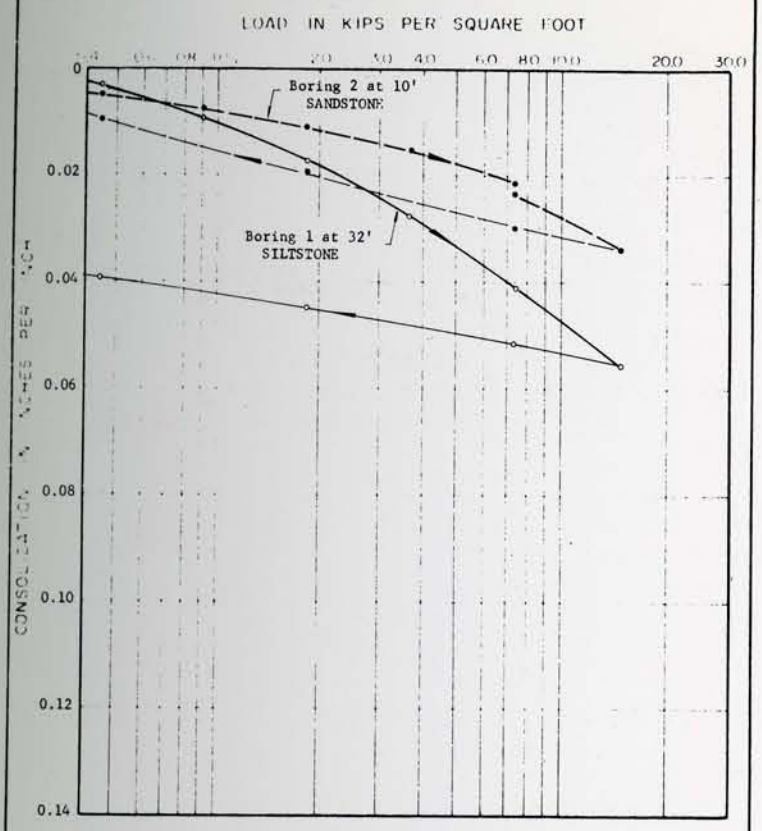
Reference:
The Unified Soil Classification System, Corps of Engineers, U. S. Army Technical Memorandum No. 3-357, Vol. 1, March, 1953. (Revised April, 1960)

LEROY CRANDALL & ASSOCIATES



DIRECT SHEAR TEST DATA

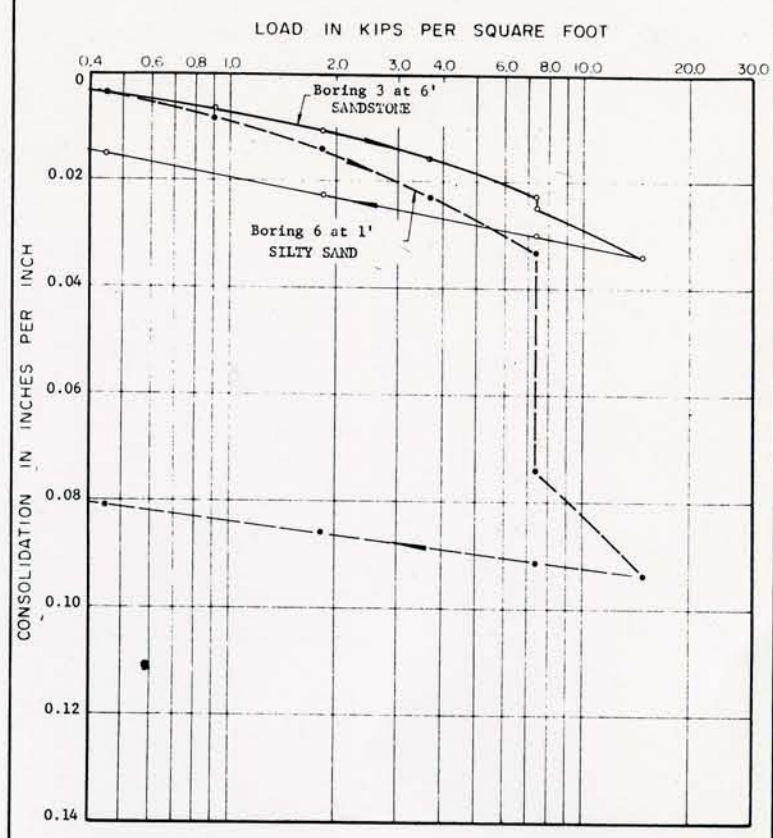
LEROY CRANDALL & ASSOCIATES



NOTE: Water added to sample from Boring 2 after consolidation under a load of 7.2 kips per square foot. The other sample tested at field moisture content.

CONSOLIDATION TEST DATA

LEROY CRANDALL & ASSOCIATES



NOTE: Water added to samples after consolidation under a load of 7.2 kips per square foot.

CONSOLIDATION TEST DATA

LEROY CRANDALL & ASSOCIATES

BORING NUMBER AND SAMPLE DEPTH:	2 at 1'	6 at 2'
SOIL TYPE:	SILTSTONE	SILTSTONE
CONFINING PRESSURE: (Lbs./Sq.Ft.)	200	200
EXPANSION FROM FIELD TO SATURATED MOISTURE CONTENT: (%)	0.7	7.0
SHRINKAGE FROM FIELD TO AIR-DRIED MOISTURE CONTENT: (%)	0.8	3.2
TOTAL VOLUME CHANGE: (%)	1.5	10.2

EXPANSION TEST DATA

LEROY CRANDALL & ASSOCIATES