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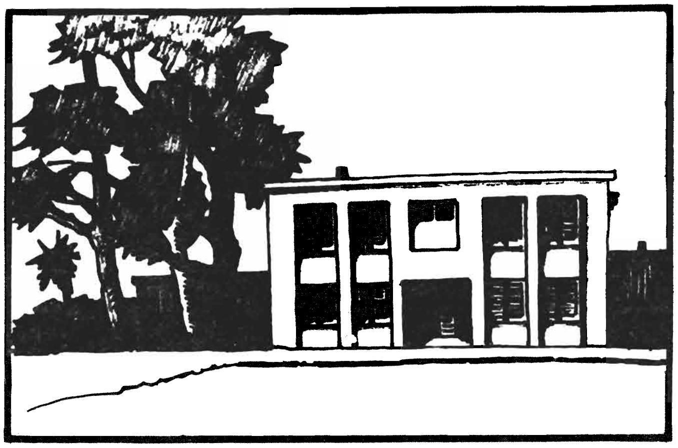

The George H. Scripps Memorial Marine Biological Laboratory
of the Scripps Institution of Oceanography
University of California, San Diego

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Historic Structure Report to the California Office of Historic Preservation

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This report was originally submitted in June 1979 as a manuscript to the California State Office of Historic Preservation.

It was printed in October 1979, with minor changes in the text and with more significant changes on page 39, based on information that was uncovered during the summer of 1979 by volunteers who enthusiastically removed interior modifications of the building that had been made over many years.

Cover drawing by Helen Reynolds

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BRIEF HISTORY OF THE PROPERTY

The George H. Scripps Memorial Marine Biological Laboratory is the original building on the present site of the Scripps Institution of Oceanography (of the University of California, San Diego). Now frequently called "Old Scripps," the two-story reinforced concrete building was erected in 1909-1910, and thus was the first truly permanent structure of any of the shoreside marine biological stations in the western hemisphere.[1] Although unpretentious, it is well suited to its purpose and typifies the direct approach of this renowned institution to the problems of learning about the sea. The building is now but one -- and a small one -- of the institution's many buildings, but a surprisingly large number of the institution's research projects have some relation to it.

The building is also an architectural landmark, as one of the first monolithic concrete buildings designed by, and built under the supervision of, Irving J. Gill. Scripps Laboratory was one of two buildings designed by Gill that were said to have "marked the beginning of his mature style. . . . Both were utilitarian with cost a major consideration. This was Gill's opportunity to experiment in concrete monolithic construction, to strip away ornament and projections and to flatten the roof."[2] The other building (the Holly Sefton Memorial Hospital for Children, in San Diego) has been demolished. In these buildings Gill used the latest techniques in reinforced concrete -- the Kahn method -- and he designed the structure to the same static load-carrying capabilities as are normally specified today.

Scripps Laboratory was built as part of the plan of zoologist William E. Ritter (University of California) to carry out a survey of the marine life of the coast of California. From 1892 to 1903 Ritter and his colleagues and students made piecemeal excursions along the Pacific coast, carrying out biological studies while seeking a suitable site for a permanent summer station. In 1903 an invitation from physician and conchologist Fred Baker moved them to San Diego, where Baker's enthusiasm soon lined up support from San Diego citizens, including newspaper publisher E. W. Scripps and his half-sister (and partner) Ellen Browning Scripps.[3]

In the fall of 1903 the Marine Biological Association of San Diego was formed by about thirty people to support Ritter's survey. The following year Ellen B. Scripps promised an eventual $50,000 to the association for its work and buildings. In 1905 the city of San Diego allowed the association to use land on Alligator Head (now La Jolla Cove Park) for a building. The offer was reversionary. A frame building 24 by 60 feet (designed by the architectural firm of Hebbard and Gill, possibly as a contribution) was constructed there in the spring of 1905, for about $1,000, paid by subscriptions raised chiefly by the La Jolla Improvement Society. That structure was built as a temporary one. Plans were initiated for a permanent laboratory building or even a group of buildings for the eventual marine station. The new buildings were assumed to be for the Alligator Head site, until E. W. Scripps changed the whole plan by urging the acquisition of Pueblo Lot 1298, the present site of the Scripps Institution, from the city of San Diego. This was carried out in 1907. Considerable discussion and planning followed that year and the next, simultaneously with plans for building a ship and negotiations to have the station become a unit of the University of California.

In 1909 the several contracts for the first building were let, and by July, 1910 the building was completed. In 1912 the assets of the Marine Biological Association were transferred to the University of California -- land, building, equipment, and a ship -- and the association was dissolved. In 1914 it rose from its ashes to repeat the ceremony because the University had lost the transfer papers, and it dissolved again. From then the Biological Station was the Scripps Institution for Biological Research, until 1925 when, with a broadening of the laboratory programs, it was renamed Scripps Institution of Oceanography.

As the sole building at the station, the George H. Scripps Laboratory housed everything at first. Director and Mrs. Ritter lived on the second floor of the building for three years, until a home for the director was built nearby. All research projects were housed in Scripps Laboratory. From his second-floor office Ritter planned and led the small institution into more than solely biological studies. The first outside field was physics; he brought physicist George F. McEwen to the station even before the laboratory was built. Other disciplines followed, and by the 1930s the full range of oceanographic disciplines -- biological, physical, chemical, geological -- had been housed in Scripps Laboratory. Until 1950 the director's office was in the room at the southeast corner of the second floor (marked Library on the original plans), and the only classroom was in the southwest corner nearby. One can fairly say that the growth of the Scripps Institution, the origin of its fleet of research ships, the planning of its first major expeditions, and the beginnings of a great many research programs originated in this modest structure.

With the arrival of geologist T. Wayland Vaughan as director in 1924, and the change in name and emphasis of the institution in 1925, the variety of work housed by Scripps Laboratory became both more diverse and more oceanographic. The studies of the genetics of deer-mice carried out for many years by biologist Francis B. Sumner were ended, and he turned to studies of the coloration of fishes; a major portion of the first floor became the "laboratory for the study of fishes" in 1932. Other changes in the building were made to house the extensive collections of marine sediments, corals, and foraminifera that represented the specific interests of Vaughan. More students found their way to the institution, not just for occasional classes in the second-floor classroom but for full-time research leading to a doctoral degree. (The degrees, however, were awarded in those early years first from the Berkeley campus, later from the University of California Los Angeles, and sometimes from other institutions for work actually done at Scripps.)

The third director, Harald U. Sverdrup, soon after his arrival in 1936, began compiling in this building the first comprehensive oceanographic text; The Oceans, by Sverdrup, Martin W. Johnson, and Richard H. Fleming (Prentice-Hall, 1942) was typed by secretary Ruth Ragan in the room adjacent to the director's office. During World War II, Sverdrup and student Walter H. Munk worked in an upstairs office to devise the methods of surf-predicion that were used for troop landings in North Africa and Europe.

Immediately following World War II there was rapid growth in oceanography throughout the nation, both in ocean research and in education. Scripps Institution offered the only advanced-degree program then in oceanography, and the single classroom had a sudden influx of students. The basic courses in oceanography were taught there, seminars were held, and dissertation defenses were held in that room. For many years the scientific staff gathered there weekly, to lunch and to discuss their latest researches, their latest expeditions and their plans for the next one, and to hear visiting scientists.

When the postwar expansion finally resulted in addition of new buildings on the campus, Scripps Laboratory became the domain of marine geologists and marine biologists. API Project 51, a large program directed by Francis P. Shepard, was on the second floor, and biologists occupied the wet laboratories on the first floor. By the 1970s the geologists had also moved out, and the building was back to biology only. Carl L. Hubbs occupied the second floor, and with collaborators and students worked on fishes, marine mammals, and archeology; his extensive personal library of books and reprints occupied the original library room. In 1977, after completion of the Marine Biology Building, the remaining staff moved out, and the building was left empty, for demolishing or restoration.

An incomplete tally of the oceanographers who have been at one time or another located in Scripps Laboratory includes a large number of the leaders in the field. Eleven of them were members of the National Academy of Sciences, an appreciable fraction of the oceanographers in that body, and others have received a wide variety of awards for ocean research and public service. At least eleven oceanographic institution or department leaders were educated here: Roger R. Revelle, who directed Scripps itself; Richard H. Fleming at the University of Washington; Wayne V. Burt, and more recently, G. Ross Heath at Oregon State; Dale F. Leipper at Texas A & M; Donald W. Pritchard at Johns Hopkins; John A. Knauss, at Rhode Island; Warren S. Wooster at University of Miami; Harris B. Stewart, Jr., at the NOAA Miami Laboratory; T. K. Treadwell as Commander of the Naval Oceanographic Office; and Charles Bates as Chief Scientist for the U. S. Coast Guard.

The Scripps Laboratory thus played a major part in the history of oceanography, was the site of major research programs, and was the place where a large percentage of the nation's oceanographers were trained. Given the explosive growth in ocean science, it seems unlikely that any other single building will occupy such a prestigious position again.

PLANNING, DESIGN, AND CONSTRUCTION

Acquiring the Land

William E. Ritter described the acquisition of the present site of Scripps Institution as it took place in 1907:[4]

> VII. THE FINAL LOCATION
>
> To Mr. E. W. Scripps belongs the credit of proposing what at first flush seemed an extravagant if not an altogether impracticable solution of the problem. The city of San Diego is a large landowner, its possessions being a heritage from the Mexican regime before California became a part of the United States.

The land is situated in the extreme northern portion of the city, several of the 'pueblos'' fronting on the ocean. The southernmost of these water-front pueblos is about two miles from the northern confines of the village of La Jolla and another quarter of a mile from the nearest railroad service. Mr. Scripps' plan was to secure this pueblo ''No. 1289,''*consisting of nearly one hundred and seventy acres, as a site for the station. The tract has an ocean front of approximately one-half mile, of which about one-third is available for any buildings, piers, breakwaters and so forth. that the station might need. The remainder of the frontage being a sheer cliff of from fifty to two hundred feet could not be used as a site for station buildings proper, but a considerable area of rocky shore at the foot, including a fine trap-dyke reef, would be a valuable asset as a collecting ground and as a source of rock for building purposes.

In spite of the obvious difficulties that would attach to such a situation because of distance from sources of supply of both domestic and laboratory materials, after much deliberation it was resolved to take the step, provided the land could be secured. The city authorities were found to be well disposed toward the station, as indeed they had been at all times when occasion had arisen to seek aid from them. Willingness was expressed to give the tract to the association could this be done under the law. Since no way of alienating the land was allowed by the city charter other than by selling it at public auction to the highest bidder, such an auction was arranged for by the city council, the understanding being that a bid by the Biological Association at a nominal figure would be acceptable to the city. This course could be legitimately taken because of the right of the municipality to reject all bids. The project having been well discussed before the city council, in the newspapers, and with the dealers in real estate, very generously no bidders other than the association appeared at the auction. Thus this fine tract of land came into possession of the association nominally for $1000, but with the understanding that Miss Scripps would expend $10,000 in building a public roadway through this land and other lands belonging to the city. The deed of trust is without restriction, the city officials placing full confidence in the association for the

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*Should read 1298.

performance of its duties as a trustee of public property. The transaction was closed in August, 1907.

The tract was made accessible during the same summer by the construction of the boulevard which was a part of what later became the main highway between San Diego and Los Angeles. This piece of road, built by Mr. E. W. Scripps mostly at the expense of Miss E. B. Scripps, as above mentioned, was of far greater significance to the station than the mere furnishing of an easy access from the village of La Jolla. Opening up as it did the whole ocean-side area between La Jolla at the south and Del Mar at the north, and passing through the unique and much favored Torrey Pine Grove, it has been a great factor in bringing to public attention the beauty of the region and the natural productiveness and utilizability of the lands. Furthermore, the ascent from sea level to the three hundred-foot elevation of the mesa being through the station's tract, the necessary tortuousness of the road causes it to reach a large portion of the land.

Thus was settled the long and earnestly considered question of just where on the face of the earth the final home of this biological enterprise should be. But the home itself was still far from an accomplished fact, though a long, sure step toward it had been taken some time before when Miss Scripps had notified the board of directors during the fall of 1905 of her decision to place $50,000 at its disposal, chiefly for building purposes, but also for whatever use the best interests of the station might demand. The main building was to be a memorial to a deceased brother, George H. Scripps. Soon after the settlement of the site question, planning for the first permanent building was turned to afresh.

The difficulties in the way of actually looking after the affairs of the station, incident to the fact that none of the scientific staff upon whom fell the chief responsibility could be at La Jolla more than a few weeks or at best months at a time each year, were becoming more and more apparent to all, but to none more than to Miss Scripps and Mr. Scripps. Nothing had so strongly emphasized the need of the constant presence at the scene of operations of a responsible scientific head as the preparations for building. To meet the needs Miss Scripps decided early in 1909 to so endow the station that its affairs could have most of if not the whole time and energy of the scientific director. Accordingly Dr. Ritter took up his residence at La Jolla on June 1, 1909, the arrangement between the Biological Association and the University being that he return to Berkeley each year to give one or more brief, concentrated courses of instruction, the station paying two-thirds and the University one-third of his salary.

A supply of fresh water being an indispensable prerequisite to development of any kind on the new possessions, the city was again appealed to and readily undertook to lay a four-inch pipe from La Jolla to the building site.

Planning the Building

Planning for a building had begun even earlier by the Marine Biological Association. On September 22, 1906 William E. Ritter, Fred Baker and banker Julius Wangenheim were appointed as the building committee. Ellen B. Scripps suggested that not more than one-half of her offered $50,000 be used for "building purposes," so as to leave an adequate amount for a "boat" and equipment.

During the fall of 1906 Ritter, then at the Berkeley campus, worked out a general plan for a two-story laboratory building, after looking over rooms in Berkeley laboratories and even laying out spaces for tables, cases, doors, and sinks. Ritter's letters indicate that he was especially concerned with getting adequate lighting into each room. He also suggested arranging the laboratories in pairs of connecting rooms. His first choice of material was what he called "cement." From a Berkeley architect Ritter obtained a rough estimate of $26,000.[5]

Wangenheim, in San Diego, asked for an estimate from the architect of his own house, Irving Gill; the estimate was $48,000. Ritter and Baker suggested displacing Gill as the final architect, and Baker commented that Gill had once told him that it was not an architect's business to know about cost of buildings.[6] E. W. Scripps was convinced that "whatever plan Gill would give us, we could be sure that it would cost a great deal more than we would want to pay."[7]

Baker got estimates (on not quite the same structure) from a Mr. Stannard and a Mr. Quayle. He also talked with Mr. Cotton from a newly incorporated company, Folsom Brothers, which wanted to draw plans and bid on construction. According to Baker, "Cotton suggested stucco on frame, which I told him I thought would be considered too inflammable and not stable enough, as we hope to be building for a great many years."[8]

Wangenheim was much in favor of retaining Gill, on the basis that Gill had a better sense of line and architectural harmony than anyone else he knew.[9] According to E. W. Scripps, Wangenheim guaranteed to pay himself "every dollar that building according to Gill's plan costs more than the estimates."[10] Gill submitted preliminary plans in October, 1907, for a group of buildings as a complete station.[11] Of these only one was to be built immediately.

At a meeting of the association's board of directors on July 14, 1908, it was considered "the sense of the meeting that a sum not exceeding $20,000 be used for a building and necessary appliances, and that the aforesaid appurtenances should include grading for a building, tanks for use of salt and fresh water, movable furniture (to be built in building), architect's fees, septic tank, and piping from building to water tanks."

From mid-summer of 1908 Charles A. Kofoid, a Berkeley colleague of Ritter's, spent a six-month sabbatical touring biological laboratories in Europe. During this tour he purchased laboratory and shipboard equipment for the La Jolla station, and sent advice on the construction of the laboratory, especially of its aquarium tanks and seawater-piping system. His comments seem to have had little impact on the design, except for the aquaria, which were built according to his suggestions, but they were replaced with more serviceable units in 1932.

One result of Kofoid's study was a 360-page survey volume, published by the U. S. Bureau of Education in 1910.[12] In this he displays the results of his visits to more than 90 such stations from Ireland and Norway to Spain and the Crimea. The major ones whose structures are still in existence are the Marine Biological Association Laboratory in Plymouth (U.K.), the Musée Oceanographique in Monaco, and the Zoological Station at Naples. All of these structures of the late 1800s are magnificent in dimensions and facade compared with Scripps Laboratory, yet none of the stations have grown much beyond their 1910 size and scope. Interestingly, of the entire European list, the only one that has emerged as a leading modern, multidisciplinary oceanographic institution is the Institute of Marine Research in Kiel, which at that time Kofoid characterized as "located in rented quarters ill-adapted to its work." It now has a good modern building, built to replace its older facilities destroyed in World War II.

It may be that these 19th-century forerunners of modern marine science institutions became old too soon in their magnificent quarters and were unable to move, as Scripps and Kiel were, into modern oceanography. In this context then, the Scripps building must be recognized as the oldest in the world, by far, to have provided a home for this development.

The Architect

Irving Gill may well have been the right man chosen for the wrong reason. Since an extensive biography of him is available[13] and shorter accounts have appeared recently in several places, we shall not go into detail here. He was the son of a builder, born in 1870 in Syracuse, New York. At age 20, he managed to get on the staff of the famous Louis Sullivan in Chicago as a draftsman, a customary method of receiving architectural training at the time. He worked for Sullivan at the same time as Adolf Loos and Frank Lloyd Wright, and they were apparently good friends; Wright's son later worked as a draftsman in Gill's office in San Diego in a continuation of the same tradition. After two years in Sullivan's office, Gill moved to San Diego (then a town of less than 25,000 people, and in the after-effects of a collapsing real-estate boom), and set up an office for the practice of architecture. He was not a devotee of any "school" of architecture -- in fact, it was said that he didn't know one school from another -- and he had a great deal of interest in experimenting with new methods of construction. His first commissions in San Diego were, however, for relatively conventional buildings. Due at least in part to his engaging personality, he received commissions for a number of homes of wealthy members of the San Diego business community, among whom were Julius Wangenheim and Ellen B. Scripps.

During the period of design of Scripps Laboratory, Gill was obviously intrigued by the properties and artistic possibilities of un-ornamented concrete construction. In 1907 he designed the Laughlin house in Los Angeles of concrete and hollow tile and in 1908 several other concrete structures. The matter of material had been debated extensively among the Scripps building committee and others before an architect was chosen; "alabastrene" (concrete) blocks, wood with stucco, brick, and concrete were all considered. Ritter in most matters had the last word. But in this case, while rejecting wood because of fire hazard, and while expressing a preference for "cement," he did not take a strong stand; at one stage he said that he did not care whether the building was brick or "cement"; whichever was cheaper would do.[14] In other aspects of the building it is less easy to determine whether the architect or the customer set the style. In architectural articles it is noted that the George H. Scripps Laboratory marks a change in Gill's style toward a simplicity of design, stripping away all unnecessary external ornament, creating a building "plain as a boulder." It may be that Ritter's desire for a functional building at minimum cost, and E. W. Scripps's steady emphasis on the need for economy (in everything except his own living style) had a strong influence on the young architect, which carried far beyond the building immediately at hand.

The influence of Ritter on the "light and airy design" is more obvious. Ritter was unwavering in his insistence upon natural lighting and on scientific convenience. The external windows are large and the working laboratories are on the north side of the building because Ritter wanted good north light for microscope work. The internal windows from the laboratories to the corridor were placed there as a matter of scientific convenience, so that the aquaria could be lighted from all sides if desired. The skylights, surprisingly, do not appear at all in the drawings for the building that are in the collection of Gill's plans at the University of California, Santa Barbara; yet when the first estimates on construction cost caused concern that the building could not be built within the budget (Wangenheim's assurance apparently not being taken into account), Ritter suggested that he could do without electricity rather than omit the skylights.[15] The architectural arrangement of the building thus seems to be the result of an interplay between Ritter, a user who knew what he wanted, and Gill, an architect for whom innovation was a pleasure.

The strictly structural side of the design -- the use of the Kahn system of reinforced concrete -- is probably pure Gill. Despite the lessons of the 1906 San Francisco earthquake, there is no mention of the need for reinforcement in any correspondence between members of the building committee. Perhaps that was thought to be purely the architect's concern, or perhaps earthquakes were not considered a San Diego problem. At any rate, for reasons that we do not know now, the drawings prepared by Gill call out Kahn System reinforcing throughout the building, and the sheets that show the reinforcing are countersigned by J. B. Harris, Civil Engineer, on behalf of the Kahn System of Reinforced Concrete.

The Engineer

One important figure in the history of the Scripps Laboratory, Julius Kahn, probably never saw the building. If Gill had chosen to build a concrete laboratory using the customary methods of the day, it probably would have been (as declared in the Blaylock earthquake-hazard report[16]) a poor earthquake risk. Somehow the choice was made to use the "Kahn Method" of reinforced concrete construction, a technique now almost forgotten but which gave this building a high degree of strength against shear forces.

Julius Kahn (1874-1942), civil engineer, manufacturer, and inventor, was born in Germany and raised in Detroit, Michigan; he received his education at the University of Michigan, from which he received a B.S. in Civil Engineering and the degree of Civil Engineer.[17] After several years of work as an engineer for others, he returned to Detroit in 1901 and went into partnership with his older brother Albert Kahn, architect and one of the founders of modern architecture, who specialized in industrial buildings. The firm pioneered in reinforced-concrete design, and Julius Kahn quickly realized the deficiencies of the reinforcement systems then in use: failure of reinforced concrete by slippage of the steel in the concrete, by separation of the reinforced portion from the unreinforced concrete of the main portion of the beam, and by fracture of the beams in shear due to diagonal tension. He designed a new type of reinforcing bar -- the Kahn Trussed Bar, which had shear members rigidly attached to the main reinforcing bar -- which Albert Kahn tried out in the Agricultural Building of the University of Michigan, at Ann Arbor [sic]. [17]

Julius and Albert Kahn, and a few friends, incorporated the Trussed Concrete Steel Company in 1903, to produce and market the new construction method, with Julius Kahn as president and general manager. Other innovative steel reinforcement items followed the trussed rods in quick succession; according to Irwin, 37 patents, most of them basic, were issued to Julius Kahn between 1904 and 1914. Kahn and his firm did not content themselves with supplying materials for use in whatever design a local architect might choose and whatever installation method a contractor might use. Instead, they developed a complete construction method, carried out training programs for structural engineers, and issued booklets giving standards, calculation methods, specifications, and instructions for foremen.[18]

The Kahn method became widely used within a short time following the company's establishment in 1903. Lewis Estes cites the use of the Kahn system in two buildings in the San Francisco area that had been built prior to the 1906 earthquake and did not collapse; he also cites buildings and bridges built prior to 1911 in Jamaica, Italy, Japan, and the Philippines.[19] The rapid spread of a new construction system and material is unusual today, primarily because of the detailed specifications of many building codes and government standards, and resistance by construction trades. The Kahn system did meet some union opposition: brick walls were used by the architect "under protest" for the Bekins warehouse in San Francisco, as a concession to the bricklayers' union. In general, however, the acceptance of the concrete method was rapid. The provision of standards and instructions by the manufacturer relieved the architect of a great deal of work and responsibility.

One may wonder why a system of construction that became internationally used so rapidly has been all but forgotten. Reinforced concrete is an almost indispensable base for much modern architecture, yet the Encyclopedia of Modern Architecture, while mentioning Albert Kahn several times, discusses the esthetics of reinforced concrete construction at length and never mentions Julius Kahn, who made it possible and who held the patents! The Kahn system may have gone out of favor because of the relatively complex job of manufacturing the special shapes of his reinforcing bars, in comparison with the relatively simple ribbed bar now in common use. Improvements in welding technology may also have made it simpler to fabricate special reinforcing shapes on the job than to transport bulky special reinforcements long distances from the factory. It now seems that the system is generally forgotten except by restoration architects and engineers.

The Kahn system of reinforcement uses as its primary strength members Kahn Trussed Bars, which have a rectangular cross-section of the main bar, with flanges on two diagonally opposed corners. The flanges are sheared so that they can be bent upward, remaining attached to the main rod over a short interval (figure 1). In the plans of Scripps Laboratory such bars two inches by 3/4 inch were called for in the beams and in the window lintels, and 1½ inch by ½ inch bars in the balcony, stairway, and the second floor. For the columns 3/4-inch "cup bars" were called for, wrapped in a 12-inch spiral with "no. 3 wire." The drawings showing the reinforcement of the interior walls have not been found. Test holes disclosed the presence of "rib metal," which is essentially a heavy-gauge expanded-steel lath in a rectangular pattern.

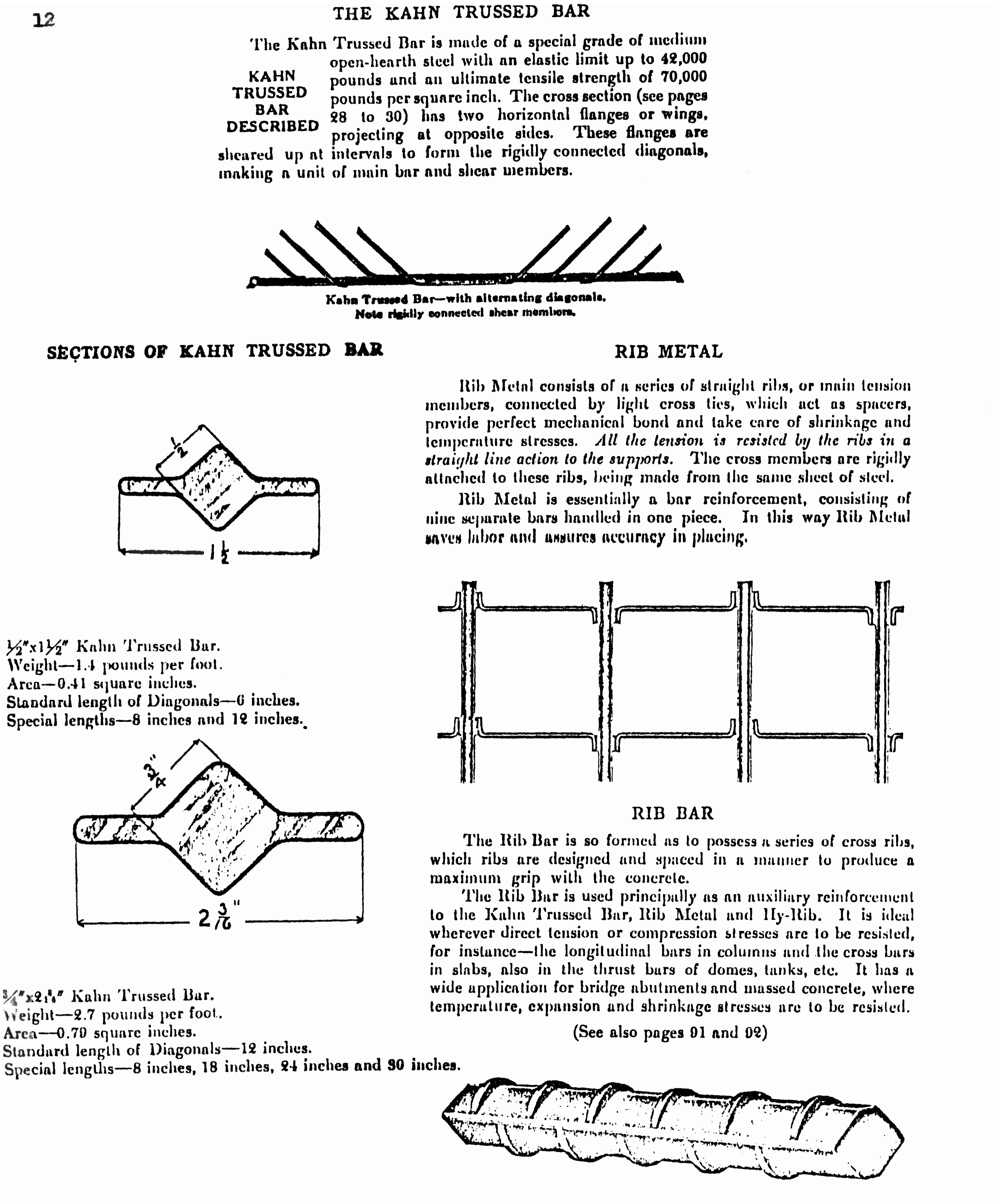
Recent pachometer tests indicate that wherever it could be checked the reinforcement was placed as specified.[20] The only unusual circumstance in construction seems to have been in the mode of building the internal walls. Gill designed thin interior walls, in this as in others of his buildings. The walls are only 2.75 inches thick, but are made of cast reinforced concrete. According to John Kariotis (personal communication), who did the final engineering analysis of building strength, the normal mode of fabrication of the walls would have been to erect the rib metal and then trowel a cement plaster onto it to reach the desired thickness. In this case, it is apparent that a concrete containing aggregate was poured between forms within this narrow spacing. This may have been responsible for some of the later corrosion damage to the building, since separation of the aggregate and formation of voids at the bottom of the forms permitted the entrance of water into the walls. Spilling of seawater onto the floors from the aquaria probably aggravated the situation.

The steel-frame windows were probably also made by Trussed Concrete Steel Company. Kahn was also an inventor of steel-window systems, and the ones that were first installed in Scripps Laboratory resemble the ones commonly used in factories at the beginning of this century.

Construction History

Final drawings (see Appendix) and specifications for Scripps Laboratory were finished in September, 1908. Curiously, the specifications state that the building was for the University of California, even though the land was owned by, and the contracts for construction signed on behalf of, the Marine Biological Association of San Diego.

Gill provided a highly detailed set of specifications, particularly in his requirements for the concrete work, ones that read strangely now. For example, salt-water sand from La Jolla Cove, to be "free from foreign substances and thoroughly dried," was designated in mixing the concrete. Gravel was to be clean beach pebbles. Gill even specified that "only laborers of intelligence and ability to understand the directions given them are to be employed to mix and place materials in the [concrete] mixer."[21]



THE KAHN TRUSSED BAR

KAHN TRUSSED BAR DESCRIBED

The Kahn Trussed Bar is made of a special grade of medium open-hearth steel with an elastic limit up to 42,000 pounds and an ultimate tensile strength of 70,000 pounds per square inch. The cross section (see pages 28 to 30) has two horizontal flanges or wings, projecting at opposite sides. These flanges are sheared up at intervals to form the rigidly connected diagonals, making a unit of main bar and shear members.

Kahn Trussed Bar—with alternating diagonals. Note rigidly connected shear members.

SECTIONS OF KAHN TRUSSED BAR

½"x1½" Kahn Trussed Bar.
Weight—1.4 pounds per foot.
Area—0.41 square inches.
Standard length of Diagonals—6 inches.
Special lengths—8 inches and 12 inches.

¾"x2 3/16" Kahn Trussed Bar.
Weight—2.7 pounds per foot.
Area—0.70 square inches.
Standard length of Diagonals—12 inches.
Special lengths—8 inches, 18 inches, 24 inches and 30 inches.

RIB METAL

Rib Metal consists of a series of straight ribs, or main tension members, connected by light cross ties, which act as spacers, provide perfect mechanical bond and take care of shrinkage and temperature stresses. *All the tension is resisted by the ribs in a straight line action to the supports.* The cross members are rigidly attached to these ribs, being made from the same sheet of steel.

Rib Metal is essentially a bar reinforcement, consisting of nine separate bars handled in one piece. In this way Rib Metal saves labor and assures accuracy in placing.

RIB BAR

The Rib Bar is so formed as to possess a series of cross ribs, which ribs are designed and spaced in a manner to produce a maximum grip with the concrete.

The Rib Bar is used principally as an auxiliary reinforcement to the Kahn Trussed Bar, Rib Metal and Hy-Rib. It is ideal wherever direct tension or compression stresses are to be resisted, for instance—the longitudinal bars in columns and the cross bars in slabs, also in the thrust bars of domes, tanks, etc. It has a wide application for bridge abutments and massed concrete, where temperature, expansion and shrinkage stresses are to be resisted.

(See also pages 91 and 92)

Figure I. Kahn reinforcement, of types used in Scripps Laboratory, as illustrated in Kahn System Handbook.

To the surprise of the building committee, the lowest bid on the concrete work -- the major structural work -- was only $6400, less by half than the next bid. At that price the total building cost as planned would be only $13,000. All of the concern about leaving features out was dropped, and a few more items were added to the plans.

The entire construction project was handled most informally by today's standards. Gill was retained as construction supervisor, but the contracts were awarded individually to each firm, not to a prime contractor with subcontractors. Several companies in San Diego and La Jolla were included. Perl Acton was awarded the largest contract on March 24, 1909; that firm was to perform "all the excavating, concrete work and carpenter work of said building (including all filling, steel, terra cotta, forms, lumber, millwork, interior finish, glazing, rough and finishing hardware . . .)."[22] As separate contracts, Acton also laid the main water line, the gutters and the drainpipes, installed the skylights, did the sheetmetal work, and put in the septic tank. Hazard, Gould & Company put on the composition roofing. Rohde Brothers Plumbing provided and installed all interior plumbing and the gas lines. The firm of Ayres & Steventon did the electrical work. Brelin & Walker did the lathing and plastering and provided the aquaria. Jones & Butler did the painting.

Construction began in May of 1909. While Gill was the official supervisor, Mrs. Ritter said that she was the actual one:

> An overseer of the work was necessary as the architect's visits, owing to the great distance [14 miles from San Diego], were infrequent. . . . It fell to my lot to be this overseer or go-between architect, contractor and owners. I had had no experience in building aside from watching the erection of our home in Berkeley, but I had a keen and accurate eye and could read the specifications intelligently and listen to directions from both the architect and scientific director. Hours each day were spent on the job. [23]

The building was completed by July, 1910, well after the six months originally estimated for construction. Its cost, including laboratory fittings, was $15,818.09.[24] As that was well within the allowance, a sea-water storage tank on a tower and a small wooden storehouse were also built at the same time.

As noted earlier, Ellen B. Scripps had specified that the building be known as the George H. Scripps Laboratory, in memory of her deceased older brother.[25] A plaque with that name was installed during construction (it is located at the foot of the stairway by the east entrance) with the date 1909, as the building was supposed to have been completed during that year.

Mrs. Ritter noted that as the laboratory had been "built for the future," the scientific work at the beginning could all be housed on the first floor. So the Ritters moved into the second floor in July, 1910, and invited into their quarters two young women who were carrying out researches at the station. Mrs. Ritter "was faced with the problem of converting a future lecture-hall, six laboratories, a library and apparatus-room into a residence with all of its requirements."

To carry this out, the lecture-hall became one huge living-room; in addition:

> Four laboratories were converted into bedrooms, one into a kitchen and the sixth end-room into a dining room. The future library became Mr. Ritter's library and study, and the apparatus room was transmuted into bathroom and laundry. The building was piped with gas and water, but the heating apparatus even for bath and laundry had to be invented. So spacious a residence was never mine, before nor after [continued Mrs. Ritter]. Everyone who entered that huge living-room exclaimed over it. It was arranged as three units -- living-room, sitting-room and library. The partitions were not evident, but the effect was.
>
> A large skylight in the roof which caused a disastrous glare, I covered with brown canvas, giving a soft mellow glow in the room.[26]

The history of the station and layout of the building at this time, with photographs and diagrams, and with a description of the scientific equipment, were detailed in 1912 by Director Ritter.[27] The description of the building from that report follows verbatim.

> The first permanent building, known as the George H. Scripps Memorial Building (pl. 18, fig. 1),* situated sixty feet from the edge of a fifteen-foot sea-cliff, is a plain rectangular two-story structure of reinforced concrete, 26 feet high, 75 feet long and 50 feet wide. Its long axis is perpendicular to the water front and runs east and west. The flat, parapeted roof carries two large iron-framed skylights, one over the corridor, the other over the museum and lecture room. The only other buildings so far erected are a tank-house located about twenty-five feet north of the northwest corner of the laboratory, and a small frame building (20 by 30 feet) which serves in part as a store-room for miscellaneous bulky material, and in part for housing an automobile.
>
> On the ground floor of the laboratory** is a corridor 12 feet wide running from the east to the west entrance. Along the north side of this corridor are six rooms (12 by 17 feet each) for investigators. These rooms occupy the entire length of the building. South of the corridor is an aquarium room (17 by 37 feet) occupying the southwest corner; a dark-room (8 by 8 feet) which opens from the east end of the aquarium room; a shop (12 by 8 feet) also opening from the east end of the aquarium room as well as from the corridor and men's toilet; a store-room for reagents and glassware (15 by 16 feet); the janitor's room (9 by 10 feet) occupying the southeast corner, and between this and the east entrance a lavatory for women. Ten feet west of the east entrance concrete stairs ascend from the lower corridor to the second floor leading directly into another corridor (12 by 37 feet), along the north side of which are three*** investigators' rooms exactly similar to those of the ground floor. At the west end of this corridor is a museum and lecture room (32 by 37 feet), along the north side of which are three more investigators' rooms. South of the corridor and occupying the southeast corner

*Fig. 2 **Fig. 3 ***Fig. 4

Figure 2. Exterior view of George H. Scripps Memorial Laboratory, about 1911 (from Ritter, 1912).

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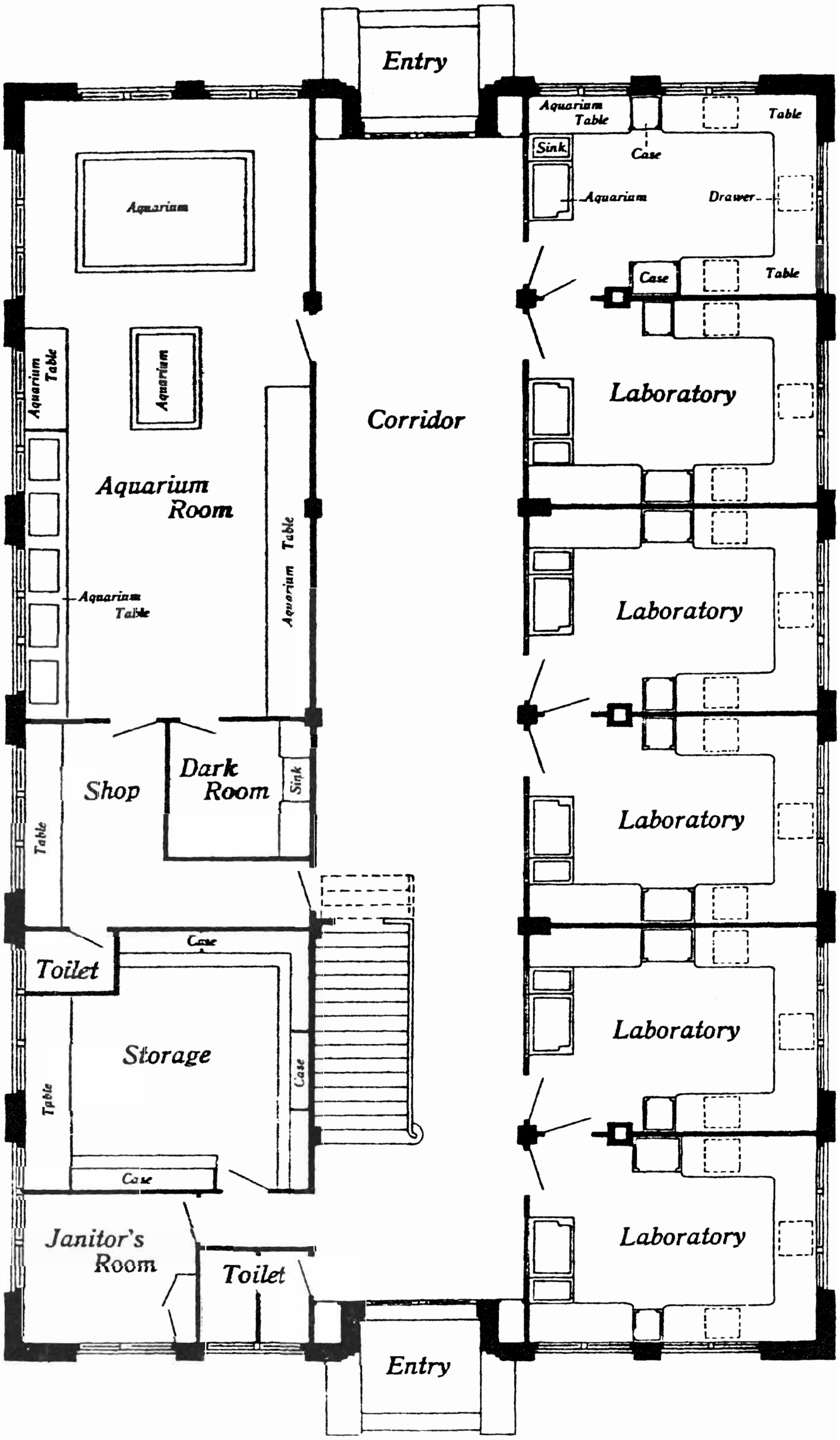

Fig. 2. Ground floor plan of Laboratory.

Figure 3. From Ritter (1912).

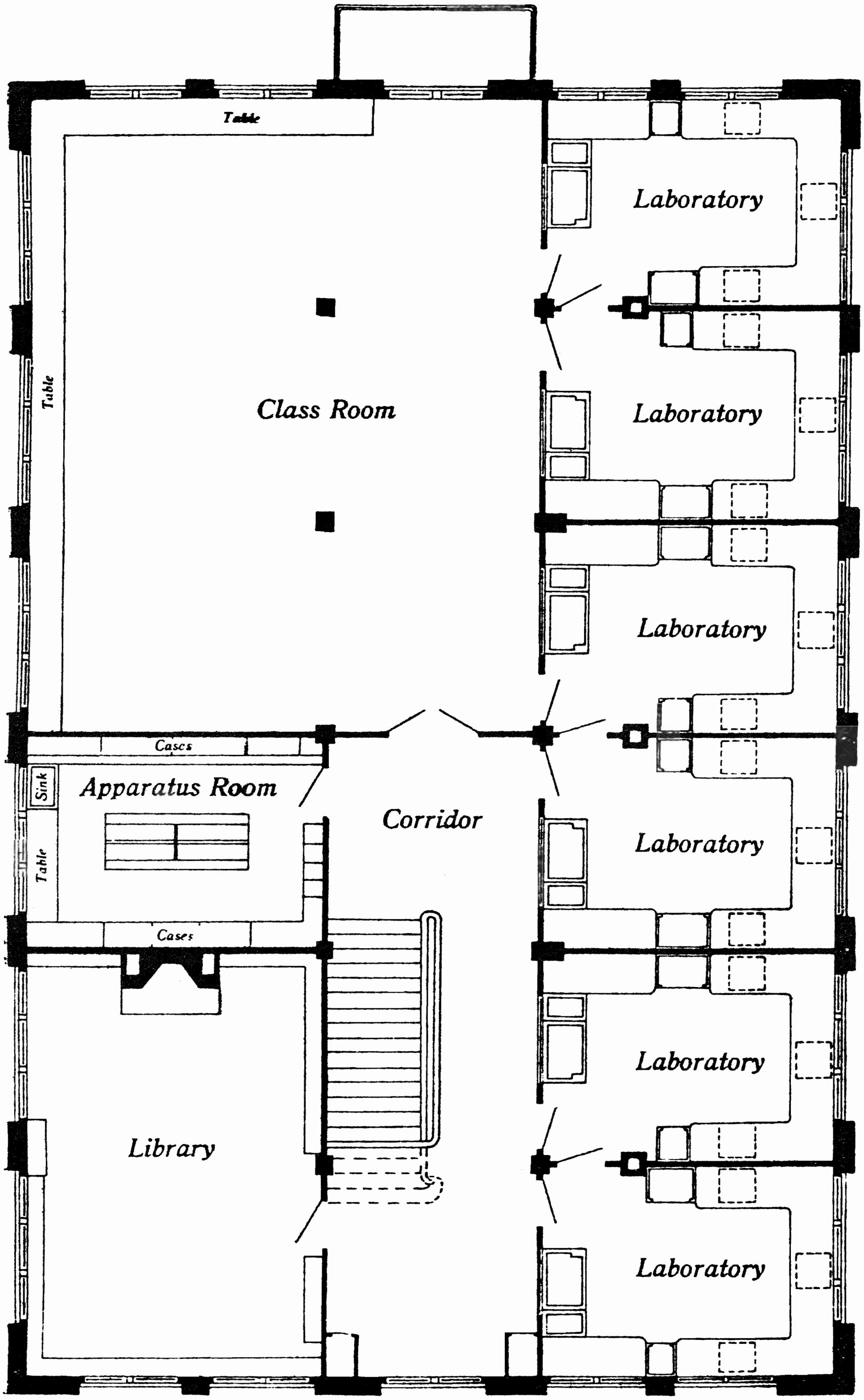

Fig. 3. Second floor plan.

Figure 4. From Ritter (1912).

of the building is the library (17 by 25 feet); while adjacent to it and opening from the corridor at the head of the stairs is an apparatus and glassware room (12 by 17 feet).

The furniture of the investigators' rooms is simple. It includes a U-shaped table running across the north and half way down the east and west walls, two and a half feet wide and provided in the middle with a chest of five drawers, and with one drawer on each wing. On the east and west walls are a set of book shelves, a large specimen case, a cloak locker, and a "wood stone" table 2 feet 2 inches by 6 feet 3 inches adjacent to a sink, and a two-story aquarium on the south side. These rooms, in common with the rest of the building, are supplied with gas, fresh water, and electric lights. At present they are heated with stoves, although provision is made for gas grates. While thus simply equipped these rooms were planned to yield the greatest convenience and satisfaction as scientific workshops. The common difficulty in controlling, for microscopic purposes, the extreme variations in light intensity is overcome by the very simple device of admitting only north light to the microscope's reflector through three large windows (2 feet 6 inches by 5 feet 8 inches each). Again the usual awkward and troublesome manner of filing and caring for one's working collections is, we believe, satisfactorily overcome by the construction and arrangement of the specimen cases. Similarly the salt-water aquarium is constructed and arranged to allow ease of observation and experimentation as well as illumination from all sides.

The specimen case, constructed of well-seasoned Oregon pine, is 7 feet 3 inches high, 3 feet wide, and 2 feet deep. The insides of its lateral walls are provided with cleats and upon these cleats moveable shelves 1 inch thick are placed, the distance from one shelf to the next varying according to convenience. Upon each shelf rest two trays 15 by 21 inches, in which the bottles of specimens are kept. This arrangement is advantageous from two points of view, (1) bottles of any size may be filed by merely readjusting the distance to the shelf above, and (2) in having two trays instead of one on each shelf, thereby making them lighter and easier to handle. The case is rendered dust proof by a glazed hinged door, which is locked by two circular window catches, one a third the distance from the top and the other a third the distance from the bottom of the door.

The aquarium (pl. 21, fig. 4),* after plans by Professor Kofoid, in each investigator's room consists of two stories. The upper one is rectangular, with inside measurements of 37 inches in length by 17 in width and 13 in depth, and is elevated so that its base is 4 feet 9 inches above the floor. Its walls consist of half-inch plate glass 10 inches high and 35 and 14 inches wide at the sides and ends respectively, which glass is supported in a reinforced concrete frame 2.5 inches thick. The lower aquarium, rectangular in shape and constructed entirely of reinforced concrete 2.5 inches thick, is of the same length and depth as the other aquarium, but about nine inches wider. A wooden shelf resting upon concrete cleats is located intermediate between the two aquaria and the salt-water system is so arranged that small moveable aquaria may be operated thereon. At the front base of the upper aquarium is another smaller shelf, supported upon iron cleats, which may be used for glassware or experimental apparatus whenever desired. It is noteworthy that the plate glass of the upper aquarium is set directly into the concrete walls, thereby eliminating all metal rods and bolts. Another important feature is that the upper aquarium backs against frosted glass windows, thus making it possible to illuminate the aquarium from any desired direction. The salt-water supply pipes are of soft lead with vulcanite cut-offs and delivery cocks. Every main angle is provided with a clean-out plug. The waste aquarium water is carried away by a system of open drains in the cement floor.

The method of circulation within the aquarium is based upon the siphon principle, as follows (pl. 21, fig. 4): From a $1\frac{3}{8}$-inch soft lead supply pipe (*s*) the water enters through a vulcanite stopcock into the aquarium inlet (*i*), which is merely a channel $\frac{7}{8}$ inch in diameter, in the concrete wall. As the water fills the aquarium it also ascends the outlet (*o*), which like the inlet is a $\frac{7}{8}$-inch channel in the concrete wall, until it reaches an overflow level (*l*) about three inches below the aquarium top. This brings the siphon into action, and the water passing through

*Not included here.

the descending end of the siphon (*d*), also a channel in the concrete, enters the lower aquarium. As the lower aquarium fills, the water after passing through a screen fitting in the slots (*sl.*) ascends an outlet (*e*) similar to that in the upper aquarium. After reaching an overflow level about two inches below the top of the lower aquarium, the water flows downward through the descending stem of the siphon (*f*) into the floor gutter (*g*). This gutter is 3¼ inches wide and, beginning in the most easterly investigators' room, runs in a straight line through the other five rooms, and conducts the water down a gentle slope through an exit at the west end of the building into the ocean. The gutter is installed only on the ground floor, the plan for the second story not being completed as yet. This scheme of circulation very simply and effectively solves many difficulties. The water enters and leaves at the base of each aquarium; the pipes when clogged can be readily cleaned through their orifices (*m*). Overflow is not likely to occur except in case of stoppage of outlets and absence of the investigator from the room. Even if, in an extreme case, water should overflow onto the floor, no damage would be done, for the cement floor is constructed like the deck of a ship, so as to slope toward the gutter. With this system a constant level of water is maintained in the aquaria in such manner as to afford adequate circulation and simplicity in cleaning.

The excellently lighted aquarium room is supplied with two floor tanks used as aquaria for large animals. Each may be partitioned into two, in which case the water enters one compartment by flowing over the partition from the other. The smaller tank is 5 feet 2 inches long, 3 feet 4 inches wide, and 5 feet deep. The larger is 9 feet 3 inches long, 6 feet wide, and 5 feet deep. The bottom in both is 16 inches below the floo and both are concrete, with walls 4½ inches thick. In addition to these floor tanks the aquarium room is provided with four tables for serial aquaria. Each table is supplied with five or more rectangular aquaria 31 inches long and 21 inches wide, arranged in succession according to height, the highest being 15 inches, the next adjacent being 2 inches lower, and so on. They are made of half-inch plate glass supported by galvanized iron frames, and rest upon either concrete or soft lead bases. Each aquarium is provided with an inlet pipe and bottom outlet. Each may therefore be used as a unit, or by plugging the outlet and siphoning from one aquarium to the next, serial circulation may be maintained. The outlet in either unit or serial arrangement leads into a concrete floor tank beneath the table. This tank extends the entire length of the table, but is constructed so that it may be partitioned into five compartments in which serial circulation may be maintained by allowing the water to flow from one compartment over the partition into the next. The final outlet is similar to that in the investigators' rooms, the water flowing by siphons into gutters and thence out of the building.

The remaining rooms need scarcely more than a passing word. The dark-room is supplied with sink, running fresh water, electric lights, and the usual equipment pertaining thereto, the walls and ceiling being black. The reagent and glassware rooms afford ample space for storage. They are equipped with numerous lockers, some with glass and some with wooden doors so arranged as to yield the most space compatible with convenience. The museum-lecture room is not yet equipped, and the library room* is used as such only temporarily until more adequate quarters may be obtained. It is provided with adjustable wall shelves utilizing all the space not taken up by windows, the door and a fireplace.

The tank for the salt-water supply to the laboratory aquaria is a cylindrical structure of concrete reinforced by the so-called "high-rib" steel framework of the Kahn system. It is 16 feet high and 16 feet in diameter, and has a capacity of 20,000 gallons. It is partitioned into halves, either one of which may be used independently of the other. In addition to the usual outlet pipe the tank is provided with another to permit drainage and cleaning. The tank is supported by an octagonal, two-story reinforced concrete building 24 feet high, intended to house the pumping plant when installed.

Great difficulty was experienced in making the tank watertight. The contract was let on the assumption that the concrete walls would be strictly impervious. Whether from faulty design,

*Fig. 5

Figure 5. View of one corner of the library, about 1912 (from Ritter, 1912).

construction, or material is uncertain, but the tank leaked badly at first and no way was found of remedying the trouble except by resort to asphaltum for an inside dressing. This was applied by the membrane method, i.e., by alternating layers of asphaltum and burlap. Leakage was entirely stopped in this way. Whether sea-water in contact with these substances will become noxious to the sensitive organisms of the plankton remains to be determined, but there are good grounds for hoping it will not.*

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*The tank, in fact, served adequately for twenty years.

CHANGES AFTER CONSTRUCTION

When the Ritters moved into the two-story wood-frame Director's House, completed on the campus in December, 1913, the second floor of Scripps Laboratory became available for scientific use. It is not now clear whether six more of Kofoid's "two-story aquaria," as described in Ritter's 1912 report, were then installed in the laboratory rooms on the second floor; probably they were not, in view of the unsolved drain problem and the fact that there is now no trace of the necessary gutter in the floor of the upper laboratory rooms.

When the second major building of the campus, the Library-Museum, was built in 1916, the central second-floor window at the east end of Scripps Laboratory was removed, and a bridge was built there to connect the two buildings. For some years the only telephone at the station was in the director's office in Scripps Laboratory, and people in the Library-Museum were summoned to it via that route, inevitably dubbed "the bridge of sighs." The bridge was removed in 1949;[28] the Library-Museum was razed in 1977, and its former location was landscaped.

After the construction of the bridge, no major changes in Scripps Laboratory were documented until 1927, when Director Vaughan wrote:

> I have started to have what was the old aquarium room in the southwest part of the main laboratory building divided so as to make three rooms and to have the lecture room at the southwest corner on the second floor divided into two rooms. This will result in an actual gain of four laboratory rooms.[29]

In 1932 more extensive remodeling took place. Blueprints were prepared by the Department of Buildings and Grounds at the University of California, Los Angeles campus, following sketches made by Francis B. Sumner for a "Laboratory for the Study of Fishes" (figure 6). Sumner was changing his field of work, and a major portion of Scripps Laboratory was assigned to him that year, after the completion of the third major building, Ritter Hall (which was designed by Irving Gill's nephew Louis Gill). A special appropriation of the State Legislature had been obtained to cover the extensive remodelling costs.

Some of the 1932 remodelling was well planned. Much of it, however, was unimaginative and displayed a profound lack of appreciation of the structural and architectural merits of the building. Air circulation and lighting were blocked, and the ground floor was cut up into a maze of dark cubicles. Some of the new walls, as in Ritter Hall, consisted of brittle terra-cotta blocks, which are especially hazardous in earthquakes.

Of the two walls that had been installed to divide the old aquarium room in 1927, the western one was removed in 1932 and the eastern replaced by a wall of terra-cotta blocks. Gutters were cut in the floor on the west and south walls of the aquarium room, for seawater overflow, and new aquarium tanks were installed. The western portion of the main corridor on the first floor provided two additional rooms; one was gained by walling off the western 12 feet by a glass-windowed partition (and sealing the door to the west end of the aquarium room and the door and corridor windows into the northwest laboratory office); another was obtained by

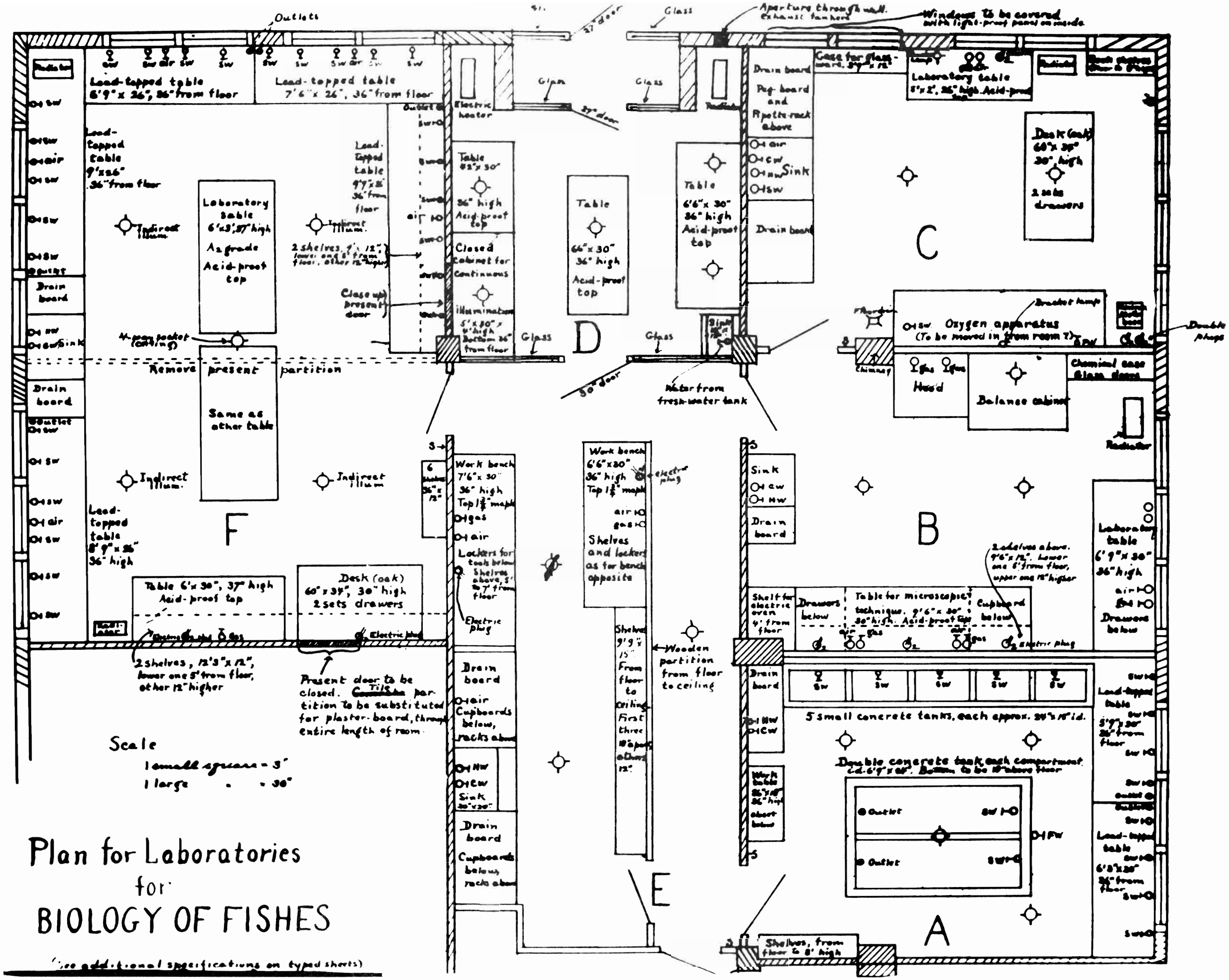

Figure 6. Plans by Francis B. Sumner for changes to be made in 1932.

building a terra-cotta wall two-thirds of the way across the corridor at the midpoint of the building and then carrying a stud-and-wallboard partition down the hallway and around to the aquarium-room entrance, leaving a narrow passage. The darkroom was removed completely; it and the shop became a laboratory room. The men's room was removed from its original location, and a new small one built out of a portion of the janitor's room at the east end of the building. The door connecting rooms 107 and 109 (now 18 and 19) was walled up, and room 107 converted into an additional aquarium room, with new gutters cut into the concrete floor on the **west and north sides. Similar gutters were cut into the concrete floor on the south, west, and part of the north side of the main aquarium room. New concrete floors were poured in both aquarium rooms, over the old.**

The partitions that had been installed in 1927 to divide the classroom on the second floor were removed, and the room was divided lengthwise; although the plans called for a terra-cotta tile partition, the actual construction was mostly studs and plasterboard. This wall cut down the ventilation severely in the remaining classroom. A ventilator installed on the roof over the classroom at some now-forgotten time was not effective. The area separated off from the classroom was divided by partitions into two rooms; one of these, a storeroom, blocked access to the balcony.

Steam radiators were installed throughout the building in 1932, to replace the stove heating. Steam was obtained from the heating plant in the basement of just-completed Ritter Hall, and the pipes were carried through a concrete trench beneath the roadway. (This was replaced in 1945 by an iron pipe.) The pipes (steam, return condensate, and hot water) emerge in an open pit that was cut in the floor of the northeast first-floor office. Internal plumbing and electrical systems were revised extensively, and fluorescent lights were installed. There is extensive correspondence about new laboratory and office furniture, but no complete lists have been found. It is certain that most of the sinks and "sink tables" in the laboratories were replaced, and the locations specified for many of the sinks indicate that not all of the original "two-story" aquaria in the first-floor laboratories were still in place. Because the walls are solid reinforced concrete, it was not possible to hide the new plumbing and electrical conduits; this was apparently the beginning of what became a maze of exposed piping on the overhead and conduits along the walls of the building. At some now-unknown time, new sewer lines were installed. The troughs in the floor for aquarium overflow that Ritter described in 1912 must have been removed in the 1932 remodelling; the concrete floors of the laboratories on the north side of the first floor show a patched section for a trench running the full length of the building where the trough must have been. The seawater supply system for the entire station was overhauled at this time. A 30,000-gallon underground storage tank was installed east of the director's house, and in December, 1932 the storage tank on a tower that Ritter had found so troublesome at first was taken down (with a charge of dynamite that is said to have blown out windows on the north side of Scripps Laboratory).

Remodelling of the building and the addition of new furniture eliminated the original U-shaped tables in the individual laboratories. Parts of some of them may still be present, cut into an L-shape, with one arm removed to allow installation of a radiator in each office.

The fireplace was repaired in what had originally been designated as the library but which had much earlier become the director's office. Also in 1932, a number of storage cases were obtained for "the large collections of marine bottom sediments, corals, and foraminifera at the Institution,"[30] collections that represented the specific interests of Director Vaughan.

The steel-framed casement windows were completely replaced with pairs of box frames and double-hung wood sash. The original windows had six panes per unit (three wide, two high) while the replacements had two panes in each of the pairs. This change created a problem at the wall between the southeast laboratory and the janitor's room where the wall had lined up with the divider one-third of the way along the window. Instead of using a narrower window, a short section of wall was removed, and a slanting wall section was installed to bring it to the division between the two windows of the pair. Five of the salvaged windows were sold to aquarium curator Percy S. Barnhart for one dollar each (after approval had been obtained from university authorities in Berkeley).

The record of changes within Scripps Laboratory is not well documented after 1932, since most subsequent changes were accomplished by service personnel of the institution; details of such changes are not in the archives. Some time between 1932 and 1949 a layer of magnesite covered with asphalt tiles was placed on the second floor, which covered the glass sidewalk lights. Plywood was installed over all of the corridor windows. Another terra-cotta block partition was built in the back corridor of the first floor, which created another room. This cubicle was completely lined with copper screening for an X-ray room. A wall and door were built across the first-floor corridor at the back edge of the stairway. Cabinets were built in front of the entrance to the westernmost hallway room on the first floor, which covered the glass-window partition (without removing it). Carl L. Hubbs joined the Scripps Institution faculty in 1944, and was assigned the first floor of Scripps Laboratory for some years and later almost the entire second floor. For his needs for storage of many specimens and a large personal library, cabinets and shelving were constructed at various times.

After the removal of the "bridge of sighs" to the library in 1949, a ladies' room was built into the east end of the second-floor hallway, and the door to the bridge was walled up except for a small high window. A water heater was installed adjacent, and piping was carried down through the dumbwaiter shaft. The men's room on the first floor was enlarged, taking over the original janitor's room (the south window of which was closed up) and part of the previous ladies' room. The small remainder of the latter became a janitor's closet. The fireplace in the library, and the wall that created a small storeroom by the balcony, were also apparently removed at about this time. At a later date, a new darkroom was created by subdividing room 12 (the former east end of the aquarium room), and a great deal of additional plumbing and wiring was installed in the first-floor laboratories. Some time after 1949 an extensive forced-air ventilation system was installed. Air was drawn in through the upper half of the window of the janitor's closet (originally the ladies' room) adjacent to the street, carried through large ducts in the hallway just above head height, and distributed through a maze of ductwork to all of the laboratory offices, the aquarium room, and the hallway cubicles on the first floor. An exhaust system carried air out of these rooms, through a pipe out of a first-floor laboratory window, up the side of the building to a blower on the roof.

In 1959, a one-story U-shaped frame building was built seaward of the Scripps Laboratory, half-enclosing it and adjoining it so closely that the western door of the original building could open directly into a hallway of the new structure. The new building, called the General Services Building on the plans, was promptly called "New Scripps," and the original one naturally became "Old Scripps." The original second-floor French doors and balcony of the original building were removed and the doorway was converted into a window; a set of French doors was placed where a window had previously been in the northwest corner of the classroom. A wooden staircase was built for a second exit, with a walkway across the roof of New Scripps and down to the ground.

This, then, was the condition of the building in the spring of 1977, when, soon after the completion of the Marine Biology Building, the occupants of Scripps Laboratory began moving out. Several doorways were damaged in the course of moving large equipment items, and all of the better movable furniture was transferred to the new building. For some years no significant maintenance work had been done on Scripps Building. The roof leaked in several places, resulting in damage to plaster, paint, and flooring; seawater leakage from aquaria on the first floor had resulted not only in plaster damage but some obvious corrosion of reinforcing rods and spalling of concrete. Test cores had been taken through several of the columns, leaving unfilled holes to the outside. Birds nested in the unused forced-air ventilation system on the first floor.

In July, 1977, a group of volunteers set out to clean up the building, in order to show off its best points. Besides removing the abandoned debris, they set out to expose the best original features of the building, sometimes by removing ill-considered later additions. The long-unused forced-air ducting was removed from the first-floor corridor. All of the partitions across that corridor were removed, except the one at the westernmost end. The long-forgotten sidewalk lights were rediscovered by Sarah W. Spiess, so the volunteers chipped away the asphalt tile and magnesite fill above them and cleaned off the paint below. Most of the plywood covers were removed from the corridor windows on both floors, the internal partition around the darkroom that had been built into the room at the east end of the original aquarium room was removed, and the wall at the east end of room 203 was demolished. A number of other later partitions remained to be removed before restoration work could begin; these were scheduled to be removed in the summer of 1979.

THE CONDITION OF THE BUILDING IN JUNE, 1979

The George H. Scripps Laboratory stands on a beach terrace, at the foot of a steep hill leading up to a higher mesa. When the land was first acquired, it was covered with grass and low shrubs, with occasional cacti and succulents -- essentially the same landscape now seen along parts of the northern coast of Baja California. On the hill slopes behind the station, probably during the 1920s F. B. Sumner planted aloes, which bear brilliant red flowers in the spring. Otherwise, the hill slope remains little changed. In the flat area around Scripps Laboratory, however, and on up the road, a large busy institution has been built, which dwarfs the original building among larger structures.

To the west of Scripps Laboratory, between it and the ocean (and coming halfway forward on the north and south sides) is "New Scripps," a one-story wooden structure sheathed in rough pine boards. North of both buildings is a lunch stand and a lawn area with tables where many of the staff eat lunch. The original station road, a narrow asphalt street now named Discovery Way, passes east of the laboratory, separated from it by a narrow concrete sidewalk. Across the road is a landscaped patio, the site of the former library building (demolished in 1977). Ritter Hall, a three-story building of an indeterminate style with an overhanging false roof of heavy Spanish tile, lies to the northeast; attached to it and forming a large F-shaped structure surrounding the patio are the two additions to Ritter Hall, three stories with basement, the larger one sheathed in blue mosaic tile. Immediately south of Scripps Laboratory are four large (but young) Torrey pine trees, and south of them a rose garden and lawn. Immediately west of the entire building complex is a sloping bank, leading down to a seawall, a sandy beach, and the Pacific Ocean.

The exterior of Scripps Laboratory (figures 7-8) is much as it appeared after the 1932 remodelling, changed from its original appearance only by the change in window style. The dividers between lights of the original steel-frame windows tended to disappear from sight; in the wood-framed windows they are apparent. The windows are in pairs throughout the building (except at the southeast corner of the first floor on the south wall, where one is missing). Windows are of only two sizes: pairs of wide windows between columns on the north and south walls, and pairs of narrow windows on the east and west walls. Six window lights have been removed and replaced by air intakes and exhausts; two large vent pipes rise along the north wall. The exterior is painted uniformly with a buff paint, including all window frames, trim, and doors. Originally, at the completion of construction, it was plain concrete, with varnished woodwork on the doors.

The roof has four chimneys: the three that serve the laboratory offices on the north side, and a later addition at the center of the south side. The original chimney from the library room is gone. The skylights are still present, but the frames are badly corroded and may need replacement. The wire glass of the skylights is mixed: most is of the familiar hexagonal pattern; a few lights of the west skylight have a diamond pattern. Each skylight has a ventilator (passive) at its peak; they still operate. Two mechanical ventilator fans are mounted on the roof; one over the old classroom is rusted away, the other, which serves

Figure 7. East view of Scripps Laboratory in 1977.

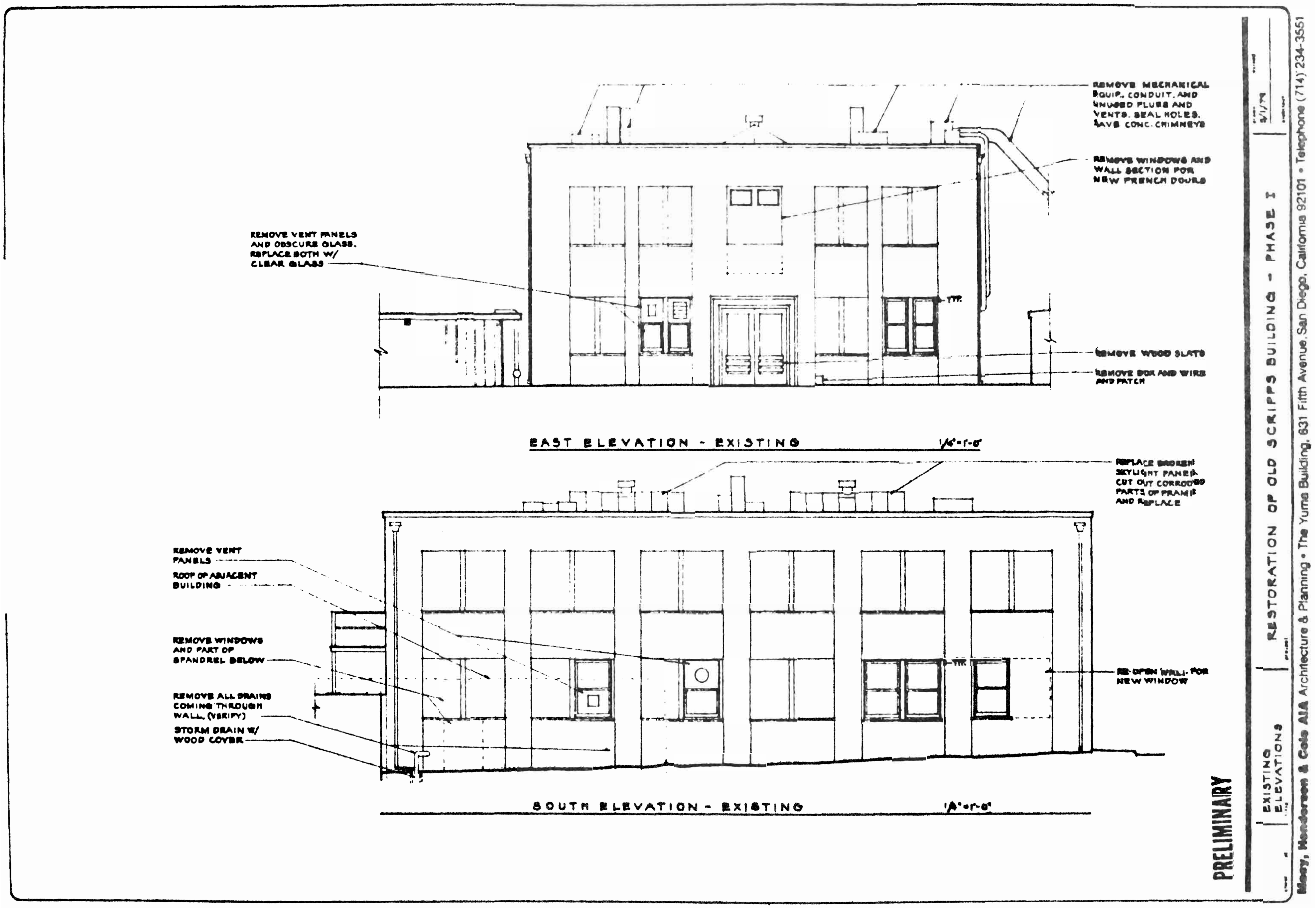

Figure 8. East and south elevations of Scripps Laboratory in May, 1979.

the lunch stand, still works. Despite Gill's statement that buildings should be plain as a boulder,[31] ornamented only by lichens and the delicate tracery of vines, there are none of either now, although there was a large vine in the 1920s on the northeast corner.

On the interior, a few features are best described for the building as a whole, noting only exceptions. The flooring in all of the rooms on the first floor, except the northeast laboratory office, is bare concrete. In that laboratory, and in all rooms except the library on the second floor, the floor covering is asphalt tile. Ceilings are uniformly bare concrete, except for the front entryway (figure 9) and the classroom, which have acoustical tile. Nearly all of the internal doors are of dark varnished wood, with a single large inset panel. The exceptions (two slab doors, two five-panel doors, and one two-panel door) are all later additions. The six-light windows between the corridors and the laboratories on the north side are present in all but one case; the window of the northwest laboratory on the first floor has been removed. Most of the corridor windows have clear glass (much of it covered with paint); a few lights are frosted. Lights in the exterior windows are obscure glass in the restrooms, wire glass in the aquarium room, elsewhere clear. Each room on the north side of the first floor, except room 18 (see figures 10 and 11 for present room numbers), and all rooms on the second floor, except the ladies' room, have a radiator, and the classroom has three. The electrical wiring for all outlet plugs is surface-mounted conduit; the wiring to the light switches and the ceiling outlets is concealed in the structure, through the original conduit. All lights in the building, except spotlights in the classroom and one fixture in room 11A under the stairs, are fluorescent; conduit is surface-mounted on the ceilings and fed from the original ceiling outlets.

The glass sidewalk lights in the ceiling of the first-floor corridor have been uncovered above and the paint scraped off below; all but two are intact, and they do provide light into the corridor. They extend from the stairway back to the end of the present hallway, by the door to room 17.

The degree of deterioration of the reinforcing rod and concrete is not fully known. In some locations, spalling of concrete is obvious, and reinforcing rods are rusted to powder; in other areas tested by coring or chipping the reinforcement is uncorroded. In general, the areas of most obvious damage are at the foot of columns and the base of some interior walls, where seawater overflow from aquaria has entered the concrete. It was suggested by John Kariotis (personal communication) that this damage may have been caused by segregation of the concrete, with voids formed between aggregate at the bottom of the forms, which permitted entrance of the seawater. The most obvious area of spalling and corrosion is in the south side of the large column that forms the frame of the west exterior door. This apparently continues down into the adjacent wall that forms the west wall of the old aquarium room (room 13). Another obvious area of spalling is on the east exterior wall, at the base of the column nearest the seawater-intake pipe (by room 21). Additional areas of spalling and corrosion can be noted at the base of the column at the junction of rooms 20 and 21 with the corridor, and at the lintel above the north windows of rooms 204 and 205. Serious deterioration of the plaster is apparent in the walls of rooms 13 and 18, both of which were used for aquaria for many years.

Figure 9. East corridor of Scripps Laboratory just before the scientific staff moved out in June, 1977.

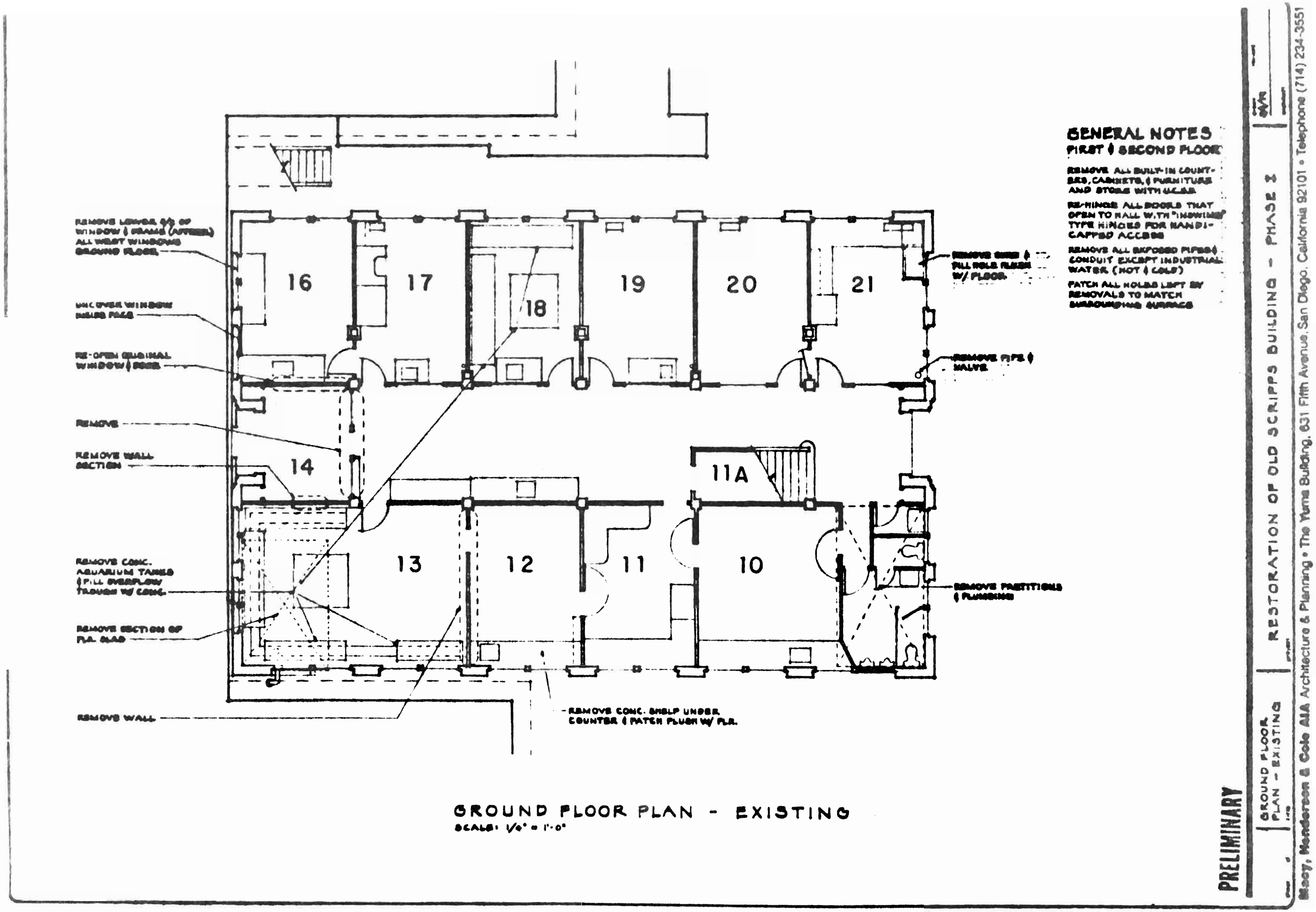

Figure 10. Ground floor plan in May, 1979, with current room numbers.

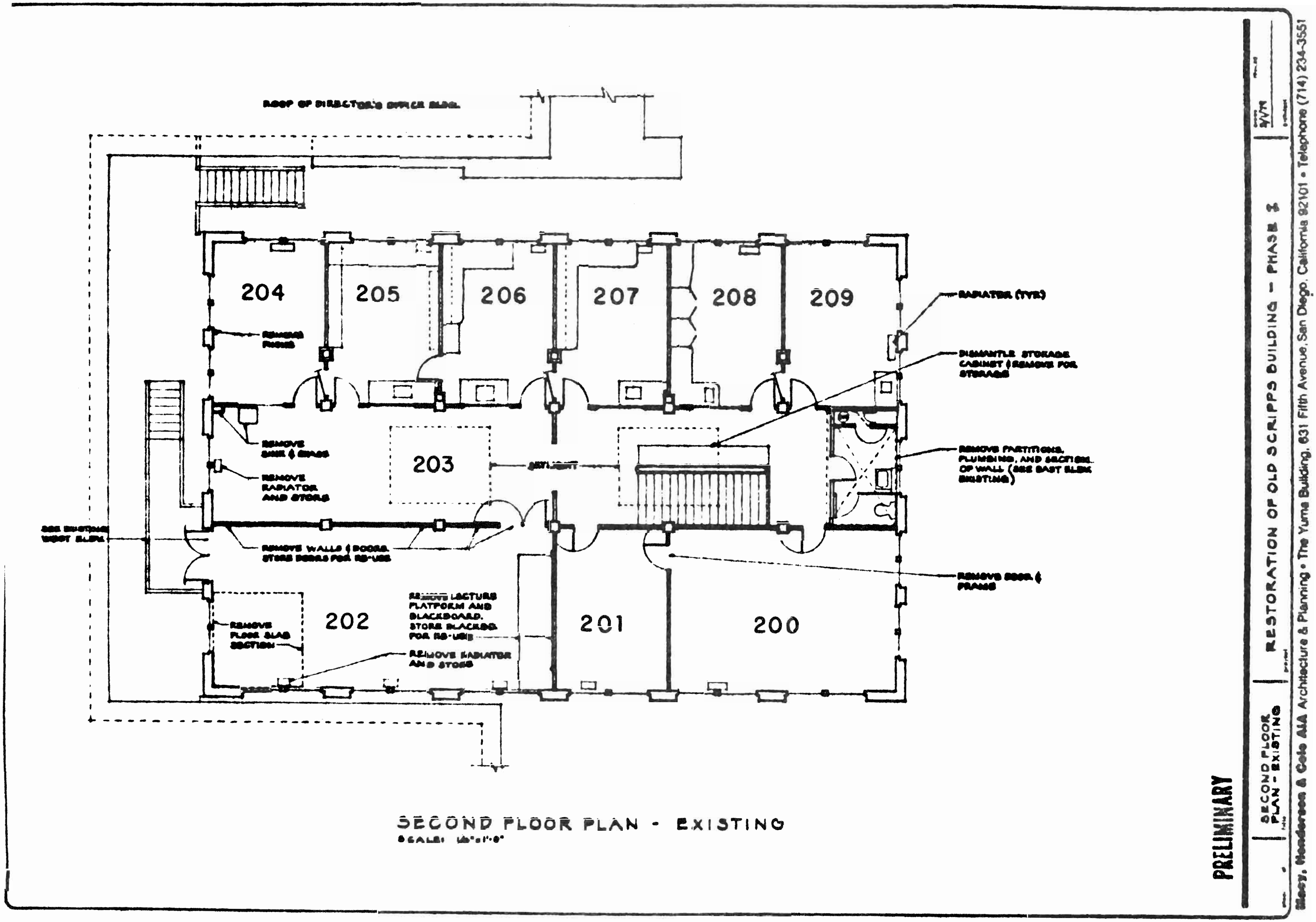

Figure 11. Second floor plan in May, 1979, with current room numbers.

The parapet is badly cracked and vent pipes within it are corroded. Roof leaks in recent years have been serious and have caused damage to ceiling plaster, wall plaster, and floor tiles in rooms 200, 206, and 208.

The first floor, as described by Ritter in 1912, had six laboratories on the north side of the main corridor; on the south side, starting from the east end were a toilet and a janitor's room, then a store room, then a machine shop surrounding a darkroom, and at the southwest corner an aquarium room that occupied three bays. Starting now at the left as one enters the east door, there is the dumbwaiter (now a pipeway but still with a door), a small janitor's closet (unnumbered) that was the original ladies' room, and a men's room that occupies all of the original janitor's room. The window that was on the south side of the original janitor's room has been removed. An air intake for the defunct forced-air system occupies the upper half of the window in the present janitor's closet.

Room 10, the original storeroom, is not on the standard 12-by-16-foot module; its eastern wall is two feet east of the line of the structural columns, and therefore does not tie in as a shear member; it was thus originally. That wall has been altered at the south end, where a short diagonal section was put in to allow the use of a window of the same size as the others in the building when the three-part steel windows were replaced by pairs of wooden ones in 1932. The room has a long built-in laboratory bench, with inset sink and with drawers below, along the south wall. Room 10 is entered by the stub hallway from the east. The original door to the west from the men's room has been closed up, and another door cut through the center of the wall to room 11.

Room 11, the original darkroom and shop, is fitted out as a laboratory, with an L-shaped bench, with drawers and cabinets below, along the south wall and half of the east wall. A fume hood on top of the bench on the east side has a pipe outlet that leads around two sides of the room close to the ceiling, and disappears through the ceiling at the northwest corner into the chimney of the apparatus room above. The room is entered through three doors: from room 10, room 12, and the corridor. The second door in the west wall, which originally served the darkroom, has been closed up.

Room 11A is the space beneath the staircase; it has been variously used as a darkroom and as a storeroom.

Room 12 is the eastern one-third of the original aquarium room. It has raised concrete ledges (4 inches high, 30 inches deep) along the north and south walls. Where the recent darkroom partition has been removed, the terra-cotta tile that fills the gaps between the ceiling beams is partly exposed. Color-coded pipes (seawater, hot and cold freshwater, distilled water, gas, and air) lead across the ceiling north to south, at the west side of the room, and then run behind tables along the south wall. The western wall of the room is of terra-cotta tile, plastered.

Room 13, the western two-thirds of the original aquarium room, has five large concrete aquarium tanks. Four of these, each divided transversely into two sections, line the south, the west, and part of the north wall. The fifth, divided into four sections, is centrally located in the west half of the room. Gutters in the concrete floor lead along the walls to a drain in the southwest corner. Plaster on the lower part of the walls behind the aquaria is peeling badly.

Room 14 is the western section of the original corridor. It is separated from the corridor by a wooden partition containing glass windows; a cabinet is in front of one of the windows. The original west doorway is open, facing a blank wall of New Scripps Building.

What was most recently known as room 15 no longer exists; originally part of the corridor, it had later been enclosed and was removed in 1978.

Room 16 is the laboratory office at the northwest corner of the first floor. The original door and window to the corridor are gone, and the room is entered from room 17, adjacent to the east. The windows at the west side of room 16 have been painted over, and the lower halves covered with plywood; the second window from the south has been completely removed and the opening filled. In this room, as in the others in line with it on the north side of the first floor, there is an east-west run of color-coded pipes suspended from the ceiling. In the floor repairs to the concrete are visible, where the original drain gutter was replaced by a buried sewer line. A window air conditioner is on one window on the north side. There are outlets for three ceiling fixtures.

Room 17 is similar to 16; it has a built-in fume hood, of commercial construction, with exhaust leading into the old chimney. A drain pipe leads down the wall in the southeast corner; a wooden bench with ceramic sink is inside the corridor window.

Room 18 is an aquarium room. A large concrete aquarium tank, divided crosswise into two sections, is along the west wall, and a similar one is along the north wall. A longitudinally divided tank occupies the center of the room. Overflow gutters have been cut into the floor along the north and west wall, leading to a drain in the northeast corner. A table with cut-out for a stainless-steel sink stands under the corridor window. The door into room 19 has been removed and the opening closed up. Exhaust ducts lead through the room from elsewhere in the building, and exit through the window.

Rooms 19 and 20 are in all respects similar to room 17, except that they have no fume hoods. Room 21, the northeast corner laboratory office, has windows on the east side as well as the north. A fume hood connects to the chimney. A large pipe and valve protrude from the floor in the southeast corner. A pit about two feet deep, with a plywood lid, is located in the northeast corner of the room, and from it extend steam and condensate pipes from the boiler in Ritter Hall basement; they lead across the ceiling to serve the rest of the building. The broken exposed edge of the floor slab in the sides of the pit shows the use of rounded cobbles in the concrete. Built-in furnishings include (clockwise, from the chimney) the fume hood (wooden, with a vertical sliding-glass front panel, single cold-water faucet, drain, two gas outlets, electric outlet) and an L-shaped counter on the west and north walls (Formica-covered wood, supported by a cupboard on the west side and a chest of drawers on the north side). A sink has been removed from above the valve in the floor.

On the second floor, the main corridor has had the eastern end cut off to become the ladies' room. The obscure-glass window of this is small and high. Through the ladies' room one gains access to a shaft to the roof, covered by a wooden lid, apparently original. A set of wooden cabinets has been built along the corridor against the side of the stairwell.

Room 200 is the original library, later the director's office, 16 by 24 feet. It has a linoleum floor. Walls and ceiling are painted light yellow. The original lighting consisted of five fixtures hung from the ceiling; in recent years there were 12 fluorescent fixtures wired into the five outlets, controlled from a switch by the corridor door. There is considerable water damage to the ceiling and floor from roof leaks at the former site of the fireplace. A pipeway leads up the southeast corner.

Room 201, the former apparatus room, has a door through from room 200, by the north wall. A stub chimney starts two feet below the ceiling up through the roof. A hole has been knocked in the north wall, beside the doorway to the corridor, and ribbed reinforcement exposed. A core hole has been drilled through the column in the southeast corner of the room, exposing concrete with crushed aggregate. A pipeway leads up the northwest corner. The ceiling and walls are painted cream over light yellow.

Room 202 was for many years the classroom, filled with rows of chairs. It is currently without furniture except a blackboard and a dais at the east end of the room. The ceiling is covered with acoustical tile; fluorescent lights are suspended over the main portion of the room, and there is a row of spotlights forward of the blackboard. The double doors entering the room are the original single-panel wooden doors, altered by installation of a set of louvers in the lower half of the panel. During testing work, a 45-inch north-south slot was cut in the floor of the room, near the west end; fortunately it was between the beams, and in the location currently chosen for an exit stair. Windows have Venetian blinds, in tracks to make them light-tight. One window has serious deterioration of the sash. A pair of French doors leads from the northwest corner of the room to a wooden staircase outside. A blower assembly is mounted above the door; another is above a hole in the center of the classroom ceiling. The plasterboard wall on the north side of the room is covered by a large (sectional) chart of the world, dating from the 1950s.

Room 203, the other half of the original classroom, has been opened out to full length recently by the removal of the partition that was formerly just west of the door to room 206. It has a skylight above (with a crumbling green canvas shade that can be pulled across horizontally), and sidewalk lights in a portion of the floor. A lavatory sink is in the northwest corner.

Rooms 204, 205, and 206 open directly from 203. The doorway to room 205, which had been covered with plywood, has been uncovered; the door is missing. A doorway has been cut through from 205 to 206; it has a two-panel door of slightly later style than the original ones. Room 204 is empty, except for a telephone and a radiator. Room 205 has a wooden sink, with drainboard, cabinets, and shelving. Room 206 is outfitted as an office, but also has a lead-lined sink and drainboard. An L-shaped bench, similar to that in room 21, has a cabinet and a five-drawer storage unit below. The ceiling shows water damage from a roof leak.

Room 207 has a sink unit with plastic sink and wooden drainboard, an L-shaped laboratory bench (with three cabinets below the west arm and a five-drawer unit below the north arm), and shelving. There is a vent pipe up the southeast corner of the room. Some water damage to the ceiling and a wall has been caused by a roof leak. Room 208 has a sink unit, similar to that in 207, a short laboratory bench with a five-drawer storage unit below, and three tall specimen cabinets. Room 209 has a similar sink unit in the southeast corner, a rock-storage cabinet (of golden oak, similar to ones that were original equipment in Ritter Hall in 1931), and an old-fashioned blackboard mounted over the corridor windows. The windows are exposed and intact (but painted) on the inside and are covered with plywood on the corridor side.

Subsequent to the writing of the preceding, additional work was done in the summer of 1979 to prepare for restoration. Walls later than the original construction were removed, closed doorways were reopened, surface-mounted pipes and conduit were removed, and built-in furniture was removed for disposal or storage depending on condition and age.

While clearing the building, some new facts were discovered. Walls thought to have been added in the 1931 remodelling were of three different types, probably built at different times. A wood-stud wall covered with perforated plasterboard lath and plaster was found at the south side of the men's room (old janitor's room), concealing pipes. The western two-thirds of the wall between rooms 202 and 203 was of similar construction. The eastern one-third of this wall, as well as the lower half of the wall between the corridor and room 14 and the fillings of closed doors and one internal window, were of mortar on metal lath, tenuously connected to the adjacent walls by sections of reinforcing rod inserted into shallow sockets. The wall between rooms 12 and 13, like the wall of the X-ray room, was of terra cotta tile, fastened to the remainder of the building by faith, gravity, and a single bolt into the ceiling beam.

The pipeways between rooms on the north side of the building (in the alternate walls that did not have original connecting doors) were of unusual construction, which did not match the original plans. On the first floor there was a gap between the north-south wall and the corridor column; the pipes were within the gap, and covered over with a lath and plaster wall. On the second floor, directly above, the pipes were embedded in solid concrete.

During removal of the built-in cabinets, tentative identification was made of segments that were probably part of the original outfitting of the building. These included five-drawer units under some laboratory benches that match Ritter's original description; two units of this type in second-floor laboratories had unpainted wall behind them and unfinished concrete floor beneath. All of these units were constructed of 3¼-inch tongue-and-groove pine. Tall cabinets of similar material in room 208 are also probably the original specimen cases. The fume hood in room 21 appears to have been modified from one of the specimen cases, and portions of the same material have been built into other units throughout the building.

GEORGE H. SCRIPPS LABORATORY -- AS ART

We have discussed the importance of Scripps Laboratory in the history of oceanography, and have referred to its importance in the history of architecture. Some of those who are asked to help save and restore it ask: Is it beautiful? The answer is, of course, in the eye of the beholder.

Irving Gill, the architect, was one of the pioneers of modern architecture. Few of his works prior to Scripps Laboratory, however, show indications of such a style. He had designed luxury homes for the well-to-do of San Diego and their friends in the east. Only when planning for Scripps Laboratory began did he show any indications of the simple style for which he became famous (and which probably destroyed his career). Stripping away external ornamentation, building a structure for utility, ease of maintenance, and minimal cost, he developed a style which, while briefly accepted locally, soon lost favor among those who had been his best customers.

Scripps Laboratory stands, therefore, as one of the earliest examples of the ornament-free style of modern architecture, where "form follows function," and little is included that is not necessary for the practical goals of the building. Even the balcony on the west side was utilitarian: oceanographers are addicted to looking out to sea. To those San Diegans who admire the ornate Spanish Colonial buildings of Balboa Park, designed by Bertram Goodhue, Scripps Laboratory appears excessively plain. It is beautiful only if one likes simple form, appropriately scaled.

The construction style -- reinforced concrete, in which all parts of the building help carry the load -- was an advantage in some ways, a drawback in others. The use of reinforced concrete in the interior walls was the only feature that in the end prevented demolition as an earthquake hazard; without this strengthening against shear, the building would have been too weak. On the other hand, this stiff design, which made the building so inflexible against physical vibrations, also made it inflexible for changes in use. The generous size of the offices and laboratories, and the interconnections called for by Ritter, helped compensate for this inflexibility. The use of large windows, glass floor-lights, skylights, and corridor windows makes the building highly energy-efficient in a climate where heating and air-conditioning are not major problems and where most office buildings require large amounts of energy for lighting in the daytime.

One can say, then, that Scripps Laboratory suited its purpose admirably: it provided spacious working quarters in which to do work that required good light, and it provided a close relationship with the world outside. It can still serve for such work. It is, therefore, what Ritter and E. W. Scripps wanted it to be: a tool, for performing scientific research. That it was anything more than that, a structure of pleasing proportions and a landmark in architecture, is a credit to Irving Gill. It is an engineering success in the most general sense of the term: a tool that serves its function in the best way possible at the least cost. Like all good tools where form follows function, it is pleasing to the eye.

Acknowledgments

Most of the material in this report has been derived from plans, specifications, and correspondence in the archives of Scripps Institution of Oceanography and from examination of Scripps Laboratory itself. We thank Prof. Boris Bresler for his careful analysis of the building structure and of the Kahn method of reinforcement, and for permission to quote from his engineering report on the building. We also thank Mr. John Kariotis and Mr. John Henderson for their reports on the building and their recommendations on its strengthening and restoration. Republic Steel Company provided information on the life and work of Julius Kahn. Sarah W. Spiess provided sources on Irving Gill and other background material. Bruce Kamerling, San Diego historian, led us to the original plans of Scripps Laboratory, which were kindly provided to us by the Art Department of the University of California, Santa Barbara. Without those plans, which gave us awareness of the building construction, Scripps Laboratory would probably be rubble now.

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[10] E. W. Scripps outgoing correspondence, November 9, 1908.

[11] Ritter outgoing correspondence, October 27, 1907. Unfortunately, these plans cannot be found in the SIO archives or in the collection of Gill's works at the Art Department of the University of California, Santa Barbara. Correspondence between various members of the association through 1907 can be confusing in relation to Scripps Laboratory, because "the building" may be either the one on Alligator Head or the plans for a large permanent building or group of buildings there or at the eventual site; several different locations were under consideration. The best sequence is found in the minutes of the board of directors of the association, which are in the SIO archives.

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Appendix

The following analysis of the problems and possibilities of the restoration of George H. Scripps Memorial Biological Laboratory is extracted from a report prepared by John Henderson, A.I.A., and John Kariotis, structural engineer, under a contract between the University of California and the firm of Macy, Henderson, and Cole. Schematic plans prepared by them are included as figures following the text.

ARCHITECTURAL BASIS OF DESIGN

The objectives of this project are:

- to make the building structurally safe
- to restore significant historic elements
- to make the space fully functional for contemporary use

The work will be done in two phases.

Phase I

- structural and architectural demolition
- new stairs and ramp
- interior and exterior concrete patching, block infill and structural additions to existing walls
- new roofing, flashing, counter flashing, skylight repair, roof insulation, roof drainage, downspouts and reworking of snack bar vent
- new doors and rework of old doors
- repair and refinish windows and glass block
- all exterior painting
- rough-in for office sinks, new waste pipe and connection
- new electrical panel, smoke detectors, fire alarm, telephone backboard

Phase II

- new concrete balcony
- coffee bar
- new deck
- rehanging doors for handicapped
- french doors east and west elevations
- lobby doors in Administration Building
- interior painting and refinishing
- cleaning and painting floor
- new toilets and partitions in Administration Building
- room numbers, chalkboards, etc.
- restoration of library and laboratory
- restoration of exterior windows (metal)
- new office sinks and water heater
- reactivate steam radiator system and connect to Old Ritter boilers

- new light fixtures, switches, plug strip and wireway
- chair lift added to rear stair
- new Scripps Mall sitework

SITE FEATURES

Old Scripps is located a few hundred feet from the Pacific Oean on the campus of Scripps Institute of Oceanography, north of La Jolla, California. It was the only building for miles when it was built in 1910 to house the Institute. Today it is surrounded by other buildings.

The Administration Building which wraps around the west half of Old Scripps make complete exterior restoration of the building impossible since some of the original windows are blocked, and the view from others is cut off. Obscure glass will be used to readmit light through windows that have been coverèd. In other locations obscure glass will screen negative views. The east doors open on a landscaped patio area and this relationship will be emphasized by the addition of a balcony identical to the original one which was on the west elevation.

Existing drainage patterns will be retained around Old Scripps. New paving in Phase II will slope away from the building to new drains on the east side of the paving.

A new mall will be provided in Phase II to give the building an open space which it had originally. The landscaped mall will tie into the patio area, provide a north-south emergency vehicle path and provide unity to the surrounding area.

DESIGN FUNCTION

The original plan of the building is easily adaptable to the new required uses. The laboratories on the north side of both floors will be utilized for individual offices.

Several first floor rooms on the south side will be combined to form a Seminar Room and a General Purpose Room. A coffee bar and sink will be provided in the hall.

Because of the second floor library's historic significance and because the original drawings and photographs are available, it has been chosen for full restoration, open to the public. A fireplace and shelving to match the original library's will also be provided. Because of its proximity to the stair and the restored library, the adjacent room will house a restored laboratory, also open to the public. Removal of modern partitions at the southwest section of the second floor permit the original large space to be used as an office pool. French doors at the west wall lead to a wood deck which takes advantage of the ocean view and breeze. At the opposite end of the building, french doors lead to the "restored" balcony overlooking the main entrance and the landscaped public open space.

The walkway "skylights" which originally provided natural light to the first floor hall will also be restored to provide their original function.

DEMOLITION

Since the building has been in continuous use since it was constructed and has undergone numerous remodelings, considerable demolition work will be necessary to clean up the interior to their original character. All of the laboratories will be gutted for new office spaces. All partitions, plumbing, mechanical (except radiators), flooring or doors not on Gill's original plans will be removed. A few original interior walls and doors will be removed to allow for a new staircase, a larger classroom and other plan considerations for contemporary usage without sacrificing the historical integrity of the building.

FIRE SAFETY

A new stair, required as a second fire exit from the second floor, will be connected to the lobby of the Administration Building at the first floor by a ramp and short connecting structure. This connection will also provide access to existing toilets (meeting handicap requirements) in the Administration Building. The existing inadequate toilet facilities in Old Scripps will be removed. The connecting passage will be protected with a fire door. Fire safety also requires that existing west window openings (below the Administration Building roof) on the first floor be protected with 6" concrete block. See electrical and mechanical sections for additional fire safety features.

WEATHER PROTECTION

Much of the existing deterioration of the building can be traced to faulty roofing and roof drainage. The existing roofing will be removed and replaced with a 4 ply built-up roof on 1½" urethane foam insulation. All downspouts will also be reworked and replaced. The existing somewhat deteriorated concrete parapet will be covered with a metal parapet cap and existing plumbing vents will be removed and plugged to provide a weather tight condition.

Both roof skylights will have all corroded components and broken glass replaced. Care will be taken to maintain their historic character, since they are an important feature of the building.

All exterior windows will be repaired, cleaned, reprimed and repainted. In Phase II, they will be replaced with new metal windows matching the original window configuration. The entire exterior plastered surface will be repainted.

STRUCTURAL BASIS OF DESIGN

Vertical Loads:

Analysis of the vertical load carrying system of the structure was based on the assumption that all members would behave within their elastic limits. All vertical loading was based on in-place dead loads plus applicable floor or roof live loads. Live loads were reduced when tributary areas contributing to the loading pattern were large enough to warrant use of load reduction factors, based on UBC guidelines.

During the analysis of all roof and floor members, the following assumptions were made as a basis for determining the elastic deformation of the system:

> All roof, floor joists, and exterior walls were assumed to be a continuous system. Exterior supporting walls were assumed to be a member composed of both the supporting pier and spandrel.
>
> All loads for the roof and second floor girder system were derived from the results of the moment distribution for the applicable joist systems. Both girder and interior column systems were assumed to be continuous and with uncracked sections.

As a result of these assumptions, moment distribution produced maximum moments and shears for all members. These loads were then compared to maximum ultimate member capacities (based on the quantity of Kahn reinforcement per a report prepared by Boris Bresler, September 1978). As a result of this comparative analysis, all members were found to perform within their elastic limits.

Seismic Analysis:

Determination of horizontal base shear was accomplished by use of ground motion from USGS open file documents and standard analysis as outlined in Chapter 23 of the UBC. This double analysis was done to develop a comparison between stresses, in the lateral resistive system, from both base shears. Loads calculated by the UBC base shear were modified per "ultimate" load factors as stated in Chapter 26 of the UBC, while loads calculated from the USGS ground motion were unfactored.

The referenced USGS document indicates a design rock acceleration of 0.10 g for the site when mean attenuation values are used. If mean plus one standard deviation is used for attenuation, the design rock acceleration is nearly 0.20 g. This rock acceleration is assumed equal to the firm ground motion. Base shear for a stiff structure is reasonably equivalent to the mass of the structure multiplied by the ground motion expressed as a percent of gravity acceleration. Standard analysis by Chapter 23 of the UBC for a Zone III location yielded an equivalent base shear coefficient of 0.14.

Distribution of lateral base shears was accomplished by analysis of total full height wall rigidities in lieu of individual pier deformations. This was done to more accurately model full height interior wall systems that, based on an individual pier analysis, would not have exhibited large flexural deformations. Both the roof and second floor diaphragms were assumed to act in rotation and translation. The effects of additional wall loads due to torsional effects of the diaphragm were not considered due to the near symmetrical shape of the structure. The total base shear was distributed to individual wall systems by classical methods based on linear deformations.

After each individual wall system was assigned its proportional distributed load, random checks were made of various pier and spandrel sections for analysis of internal stress levels. All interior wall sections were analyzed for pure shear and flexural stresses. Exterior pier and spandrel stresses were determined from uncracked sections and cracked sections working in combination with the existing Kahn reinforcement system. Factored and unfactored stress levels, resulting from UBC and alternate base shears respectively, were then compared to allowable stresses as determined by Chapter 26 of the UBC. A maximum compressive and yielding stress of 2000 psi and 36000 psi were used, respectively, for concrete and steel.

Results of this analysis have shown that all stress levels within the lateral load resistive system of the structure are within allowable limits when determined by the previously mentioned analysis methods. The exterior wall system is stable even when considering that total pier overturning moments are resisted by cracked spandrel sections. Reinforcement yield stresses, within these sections, were never reached.

Conclusions:
Based on the results of the vertical load analysis, all vertical load carrying members were found to be of adequate structural capacity to support all applicable live and dead loads. There exist numerous areas of deteriorated reinforcement and spalled concrete. These areas should be reconstructed to assure that the structural integrity of the system is restored to its original condition.

The seismic analysis performed comply with the stated intent of the University of California Seismic Safety Policy. Conflicts within that policy have been resolved by assuming that the acceptable level of earthquake safety is based on the sole consideration of protection of life and prevention of personal injury.

We do not equate this stated policy with complete compliance with the seismic provisions of Title 24. That document was developed by the Seismology Committee of the Structural Engineers of California and has the criteria "resist major earthquakes, of the intensity of severity of the strongest experienced in California, without collapse but with some structural as well as non-structural damage". Further it is expected "that damage is limited to repairable damage". This damage limitation inherently provides a very low risk to life-safety.

The Seismic Safety Policy also states that a site intensity of Mercalli IX be considered as a standard seismic design event. This assumes that seismic risk zoning used for both

Title 24 and other sources such as the USGS document is not applicable. We have utilized seismic zoning considerations for the comparative analysis. It is our opinion that consideration of life safety must be equitable for all geographic areas of the State of California and seismic zoning is essential to establish a uniform risk.

The present lateral load resistive system, when analyzed with all walls uncracked and deforming within their elastic limits, could be considered to perform with a good seismic rating. As previously mentioned, analysis of exterior pier and cracked spandrels have shown that ample reinforcement exists in these members to maintain their structural integrity. However, at interior walls, unreinforced cracked spandrels would cause a modification to the total rigidity of the structure, creating a redistribution of loads that should, in our opinion, be avoided.

One of the most economical ways of developing a stronger wall element would be to increase the thickness of all interior lateral load resistive walls to a minimum structural section of 4" thickness.

HEATING SYSTEM - BASIS OF DESIGN

Design Criteria:

1. Reuse existing steam radiators
2. Avoid using ducted system
3. No cooling required

System Selection:

The existing radiators could be supplemented with new radiators of similar configuration in the rooms that do not now have radiators. The heating media could either be steam or high-temperature water. Steam is available from two boilers in Old Ritter Hall. These boilers have the capacity to supply the Old Scripps Laboratory. Steam could also be generated from a new boiler system installed in the Old Scripps Laboratory. High-Temperature water is available from the building that surrounds the Old Scripps Laboratory on the west side.

It is recommended that a steam system be used with the steam obtained from the boilers in Old Ritter Hall. To activate this system, new steam supply and condensate return lines must be installed in the ground between the Old Scripps Laboratory and the Ritter Hall boilers. The existing steam mains within Old Scripps Laboratory can be activated and new piping added for the new radiator locations.

Existing steam and condensate piping originates at the east end of the building and circulates towards the west. If a new steam plant were used it would have to be located on the east end of the building in order to make use of the existing piping. The use of space at the entrance and the cost of a new plant and its accessory fuel supply and flue minimizes its attractiveness. The cost for the new plant in the east end of the building is estimated at about $5,000 and would require approximately eleven-hundred cubic feet of space.

The hot water system available in the adjoining building operates between 125°F and 165°F, depending upon the season. The existing radiators would have reduced efficiency at this temperature of water input. The cost, however, is probably comparable to the cost attributed to supplying steam lines from Ritter Hall.

Reusing the existing radiators and supplying steam from Ritter Hall is felt to meet the design criteria with the most efficiency and least life cycle cost.

PLUMBING SYSTEM - BASIS OF DESIGN

The existing restrooms within Scripps Laboratory will be removed. The restrooms within the adjacent wing on the south side will be utilized by the tenants of the Old Scripps Laboratory. Cost for the addition of two toilets within that Laboratory have been included as an alternate cost within the cost estimate. The only additional plumbing will be: (1) Roughing-in of the existing industrial water lines for twelve (12) future handwash sinks, six on the 1st floor and six on the 2nd floor. The cost for the sinks themselves are included as an alternate cost on the cost estimate.
(2) Hot water for the industrial water line will be generated by an electric hot water heater either underneath one of the handwash sinks or in the stairwell. (3) A double bowl kitchen type sink will be added for coffee mess use. Hot water for the sink will be generated by an instant hot water dispenser attached to the sink. Hot water is generated by a 1250-watt heater attached below the deck of the sink. The dispenser has a 60 cup capacity.

FIRE PROTECTION

The exterior walls and openings will be protected from fire by extending an automatic sprinkler system from the adjacent building.

ELECTRICAL - BASIS OF DESIGN

1. Electrical Service
   A. Electrical power shall be from an existing electrical vault located adjacent to the project structure.
   B. The serving voltage shall be 120/208 volts single or three phase as required for equipment.

2. Lighting
   A. All building light fixtures shall be made to maintain or re-establish the effect of the original fixtures with the new design.
   B. All building fixtures shall have an incandescent light source.
   C. Switching of light fixtures in so far as possible shall be maintained from the same locations as the original structure.

3. Conduit System

   The existing conduit system that is concealed in the poured concrete structure shall be reused. All other surface conduit shall be removed under the demolition section.

4. Surface Wireway

   Distribution of receptacle power and telephone cabling shall be run via a double compartmented duct system. This raceway will be run surface mounted at the ceiling between spaces and at the baseboard within designated offices and work areas.

5. Power Equipment

   A single 225A circuit breaker panel to be located in an equipment closet at the west end of the lower level will distribute all required power.

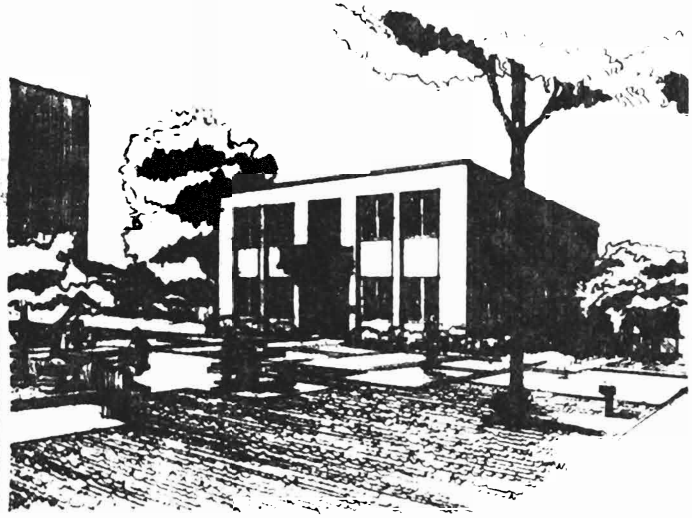
6. Telephone Equipment

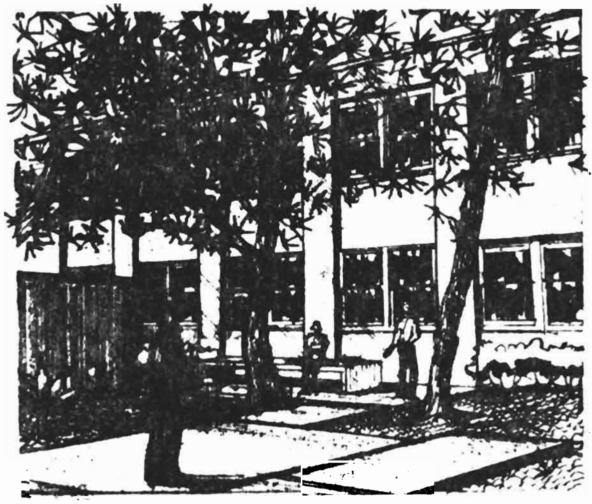
   A telephone terminal backboard will be furnished in the lower level equipment closet for all telephone stations terminations.

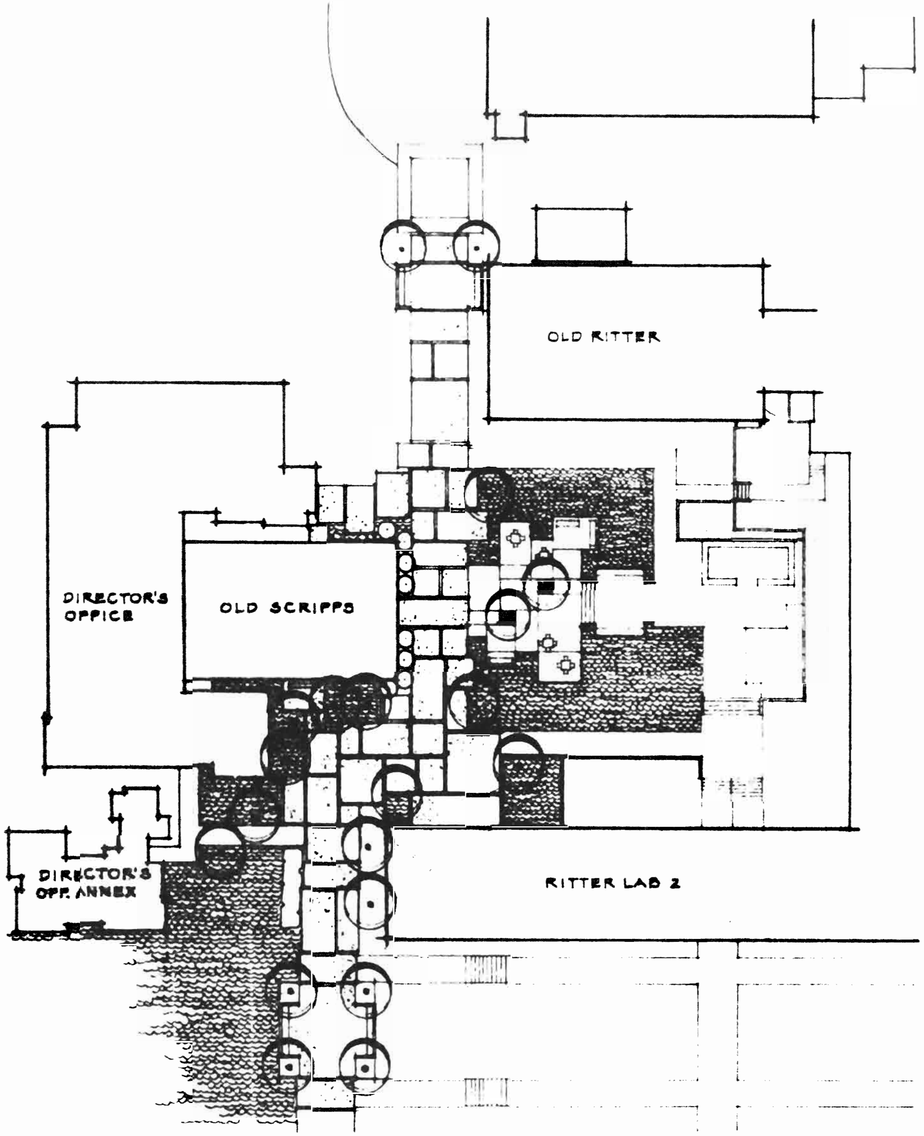
7. Fire Alarm
   - A. Smoke detector devices will be provided in all corridors and large room areas.
   - B. Additional manual fire alarm pull stations and alarm bells shall be provided at the upper and lower levels of the new stairway.
   - C. The new fire alarm devices shall be tied into the existing annunciator fire alarm system located in the adjacent building to the north.

8. Mechanical Equipment

   All new mechanical and plumbing equipment shall be connected as required for operation.







PRELIMINARY

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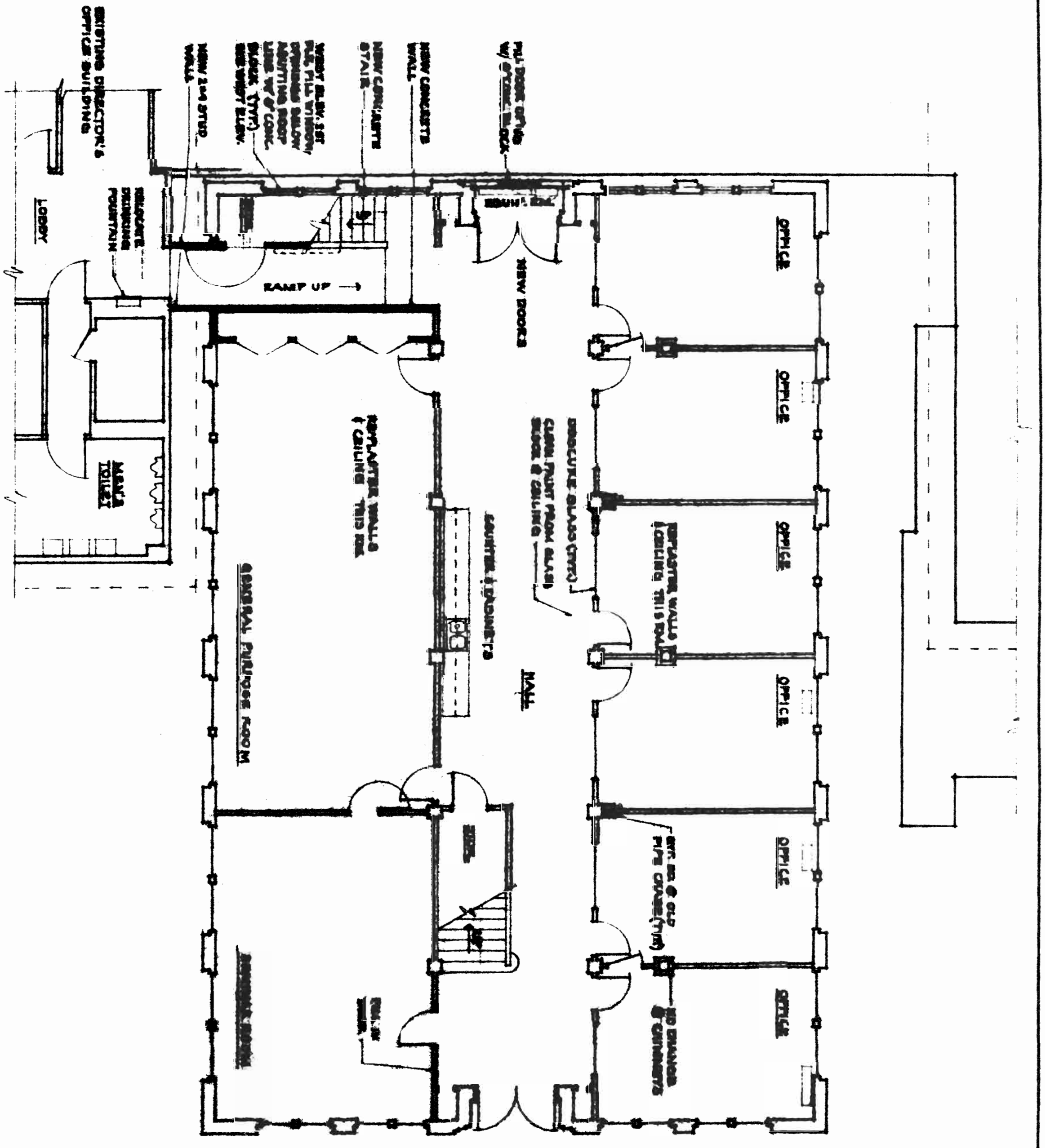

GROUND FLOOR PLAN - NEW

SCALE: 1/4" = 1'-0"

GENERAL NOTES
FIRST & SECOND FLOORS

NEW WALLS SHOWN SHADED

PAINT WALLS & CEILING

STRIP & REFINISH ALL EXISTING DOORS

CLEAN, REPAIR, REPRIME & REPAINT ALL EXISTING WINDOWS. SUPPLY OBSCURE GLASS AS NOTED.

PRELIMINARY

sheet of	title	project	drawn
	GROUND FLOOR PLAN NEW	RESTORATION OF OLD SCRIPPS BUILDING - PHASE I	EVR

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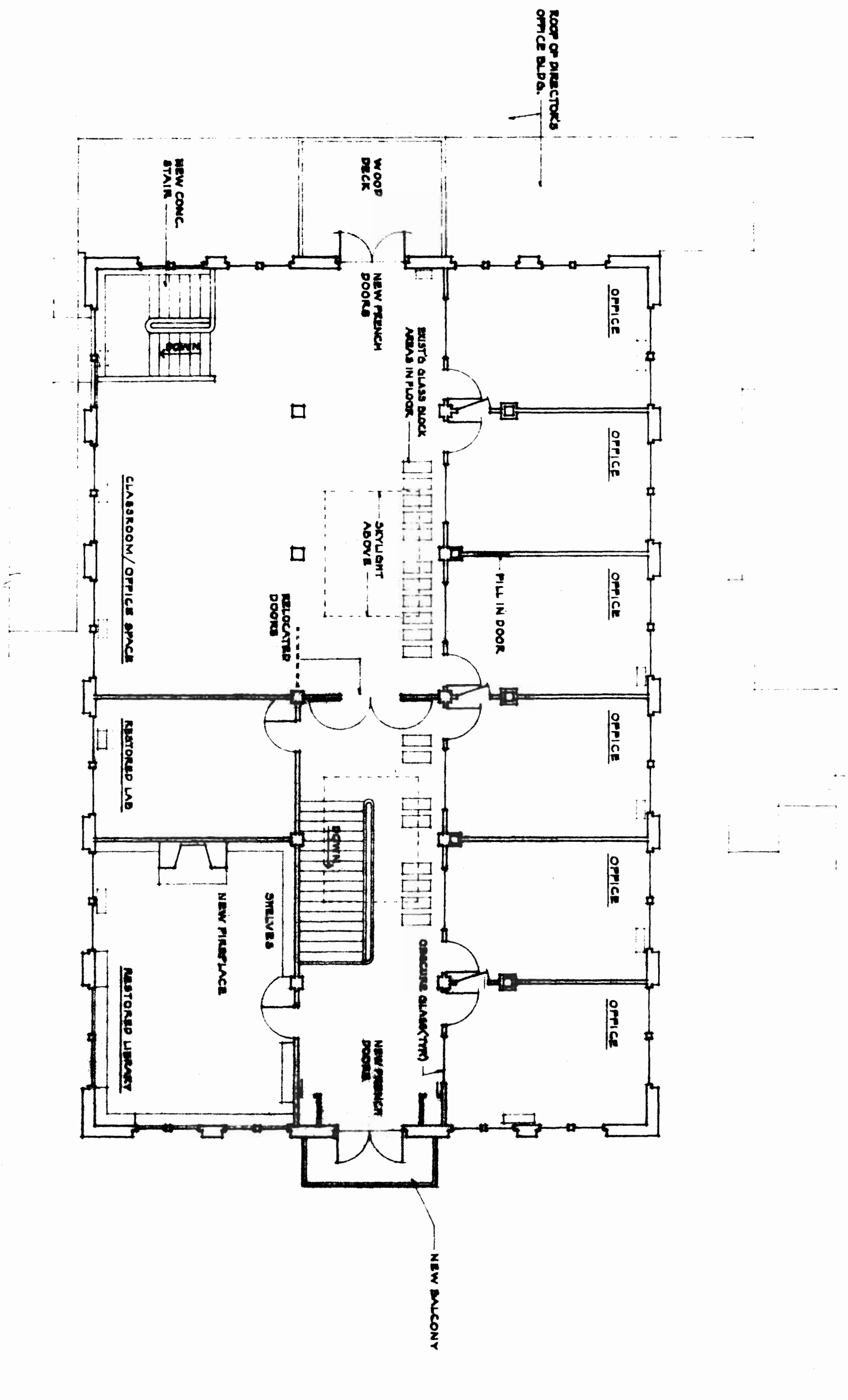

SECOND FLOOR PLAN - NEW

SCALE: 1/4" = 1'-0"

PRELIMINARY

sheet of	title	project	drawn revised
	SECOND FLOOR PLAN - NEW	RESTORATION OF OLD SCRIPPS BUILDING - PHASE I	5/1/79
			architect

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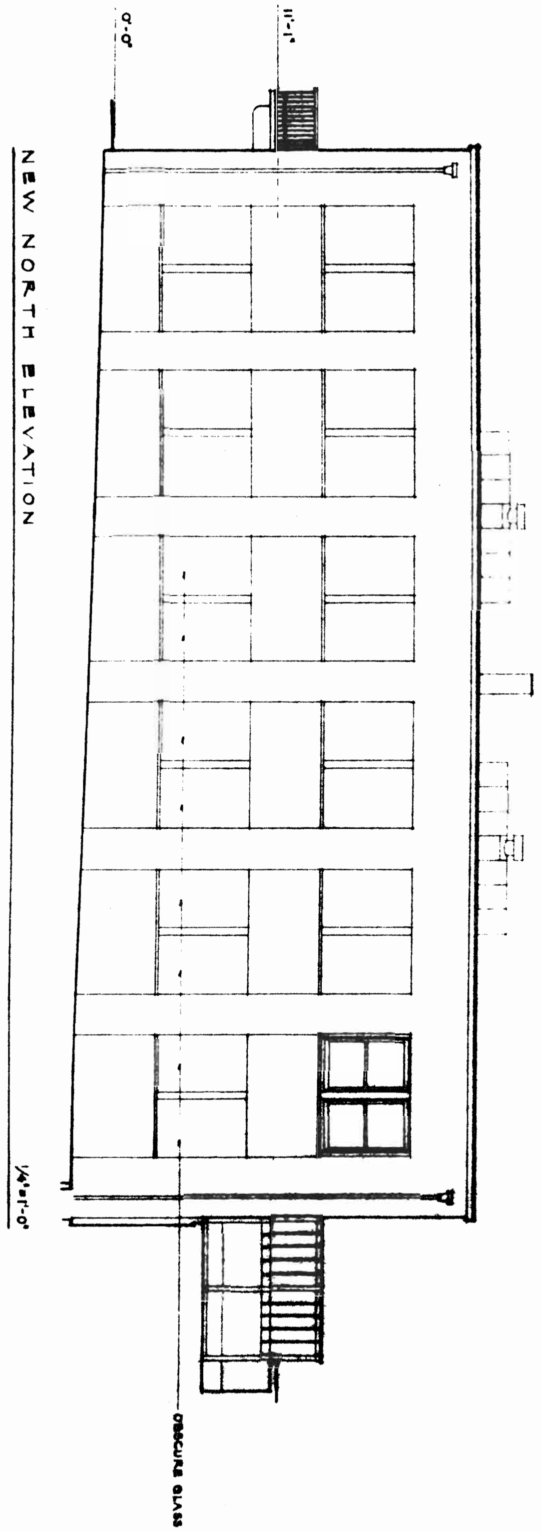

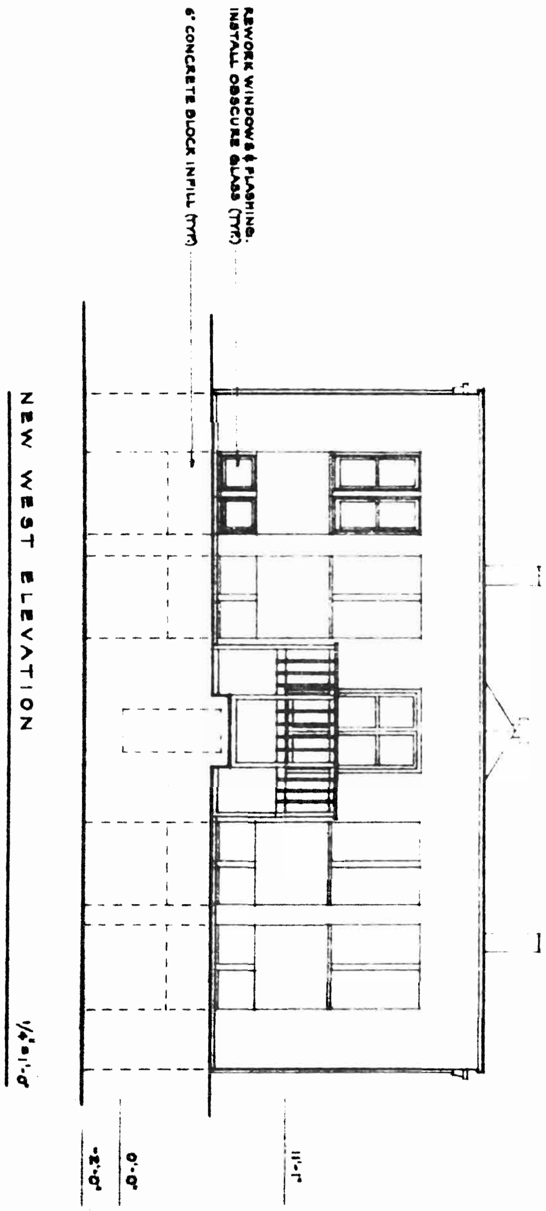

SEE SOUTH & EAST ELEVATIONS FOR ADDITIONAL NOTES

PRELIMINARY

sheet of	title	project
	NEW WEST & NORTH ELEVATIONS	RESTORATION OF OLD SCRIPPS BUILDING - PHASE I

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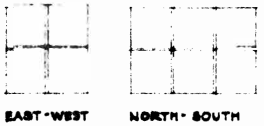
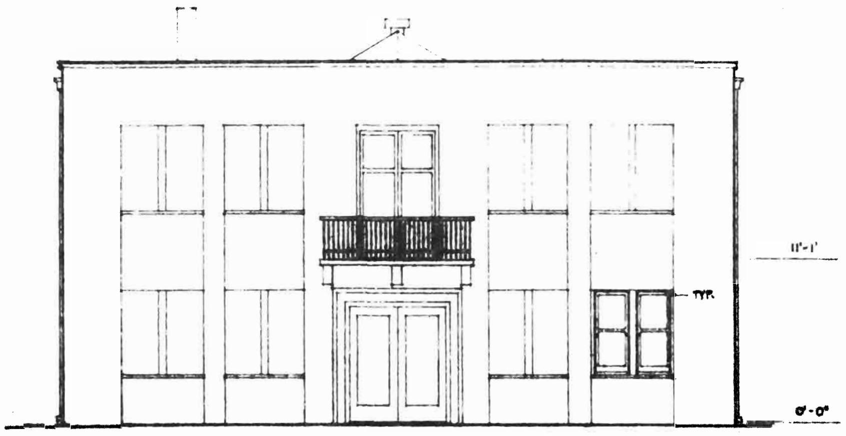
BID ALTERNATE 'A'

REPLACE ALL WOOD WINDOWS W/ STEEL 'AWNING' TYPE WINDOWS





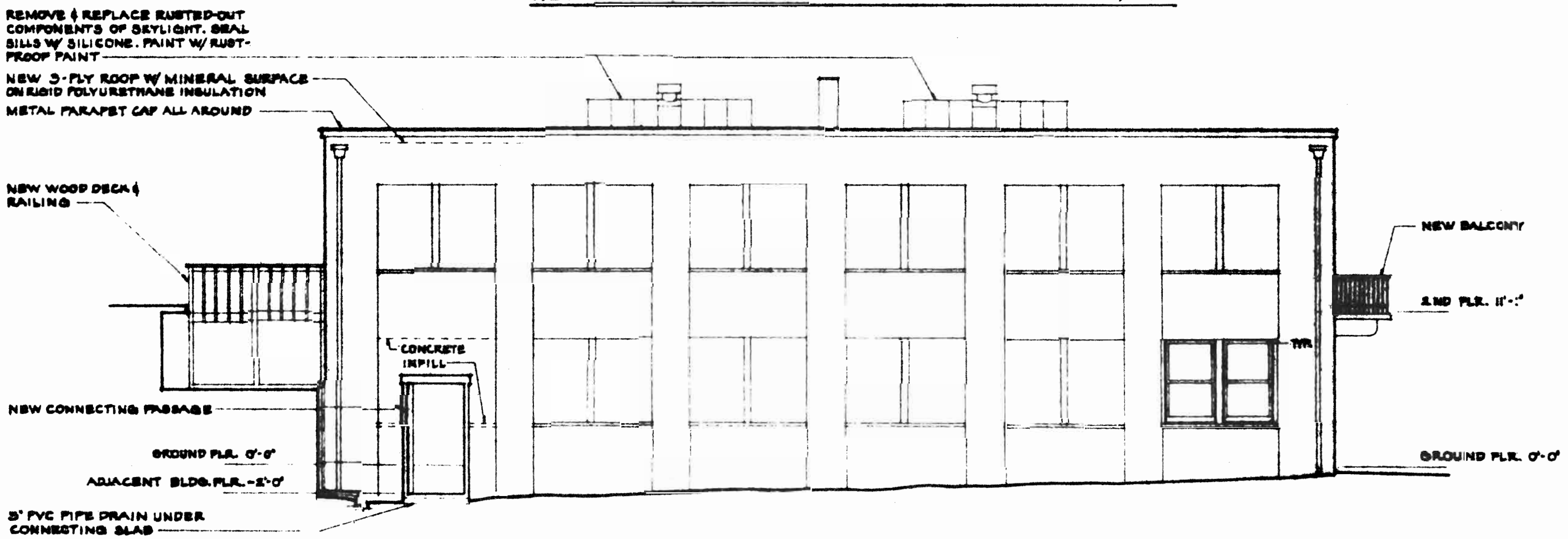
NEW EAST ELEVATION 1/4"=1'-0"

EXTERIOR NOTES

REMOVE EXISTING COATING

CHEMICALLY TREAT SURFACE & CRACKS TO ARREST DETERIORATION OF CONCRETE

APPLY NEW COVER COAT



NEW SOUTH ELEVATION 1/4"=1'-0"

PRELIMINARY

sheet of

title NEW EAST & SOUTH ELEVATIONS

project RESTORATION OF OLD SCRIPPS BUILDING – PHASE I

drawn 8/1/79 revised

approved

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