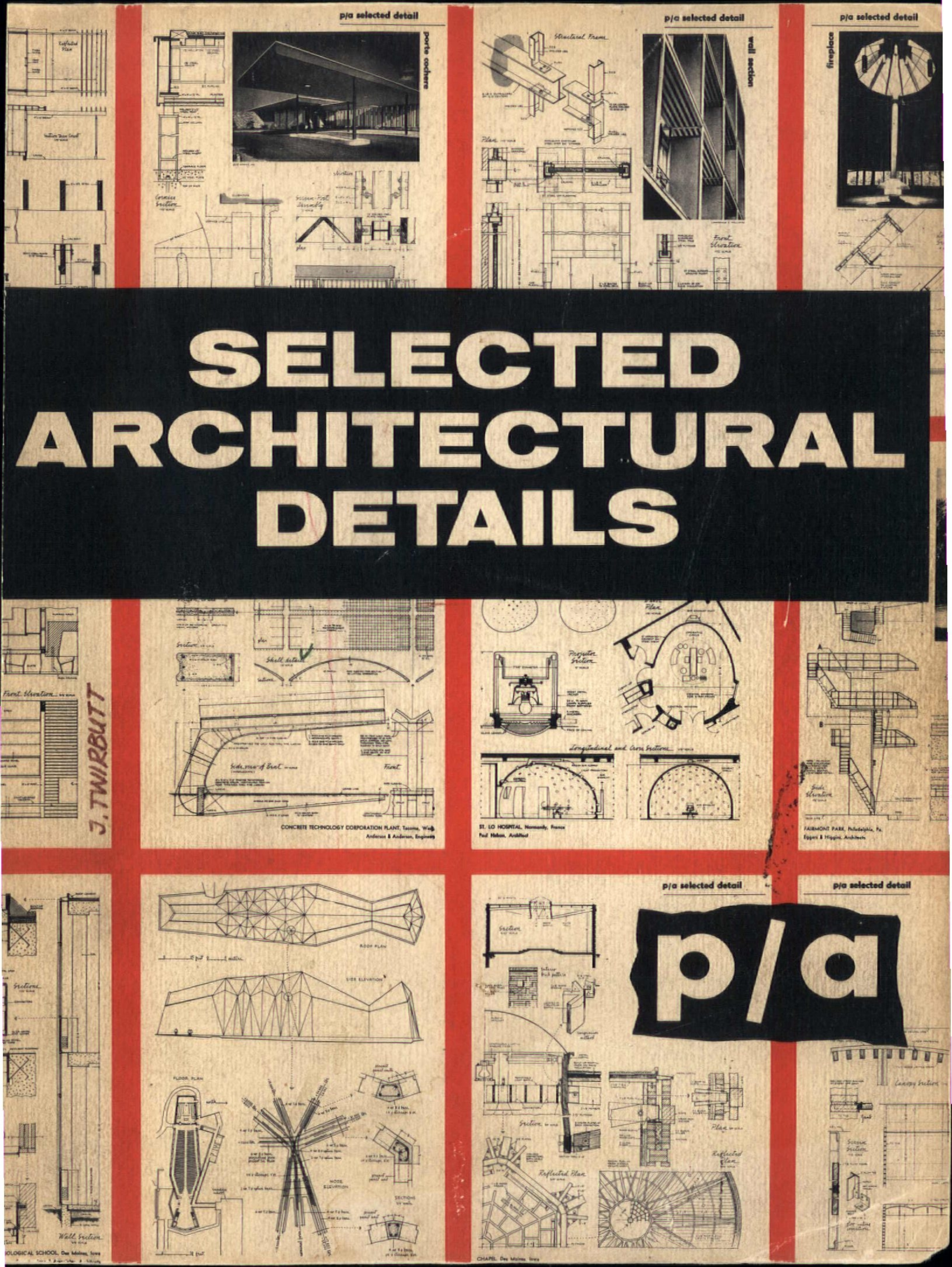
SELECTED ARCHITECTURAL DETAILS



p/a

Selected Architectural Details

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Fr.

SELECTED ARCHITECTURAL DETAILS

for . . .
architects, engineers
designers & draftsmen

1961

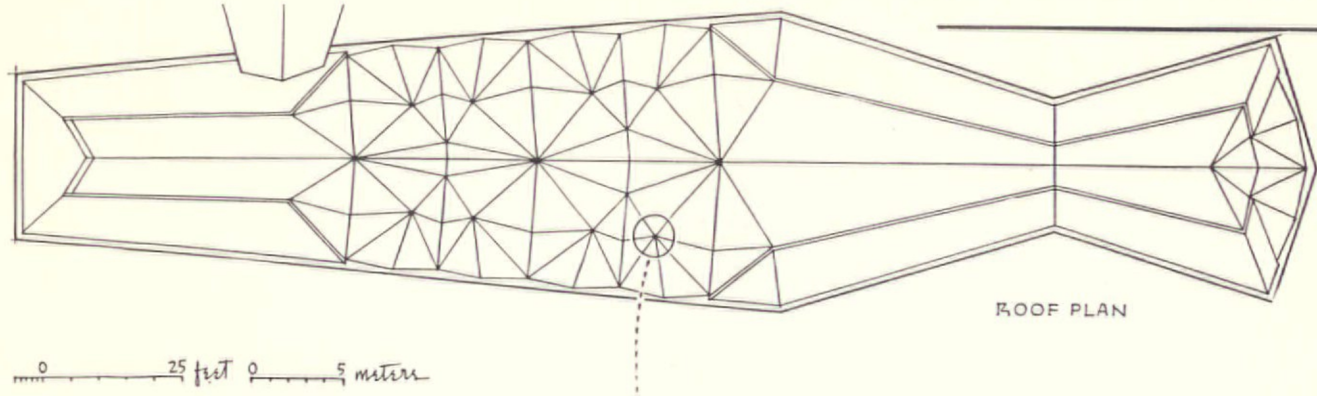
A Reinhold Publication • 430 Park Avenue, New York 22, N. Y.

Section 1 CEILINGS & ROOFS

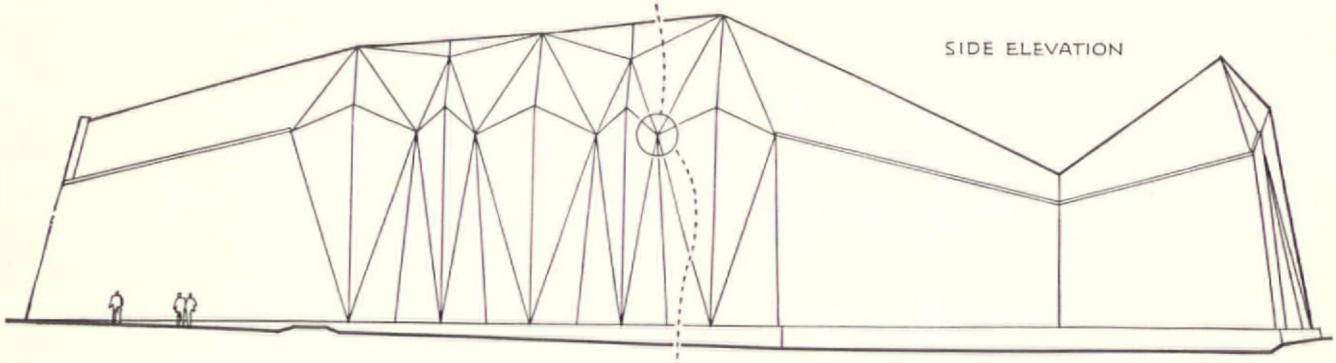
ROOF NODE — CHURCH
ROOF TRUSS — CHAPEL
ROOF FRAME — CLERESTORY — SCHOOL
COPPER-SHEATHED DOMES — AIRPORT
ROOF FRAME — STEEL BENT — SCHOOL
ROOF FRAME — WOOD TRUSS — SCHOOL
ARCH SPAN — SUPERMARKET
HUNG CEILING — MOTEL
LUMINOUS CEILING — CITY HALL

p/a selected detail

church node

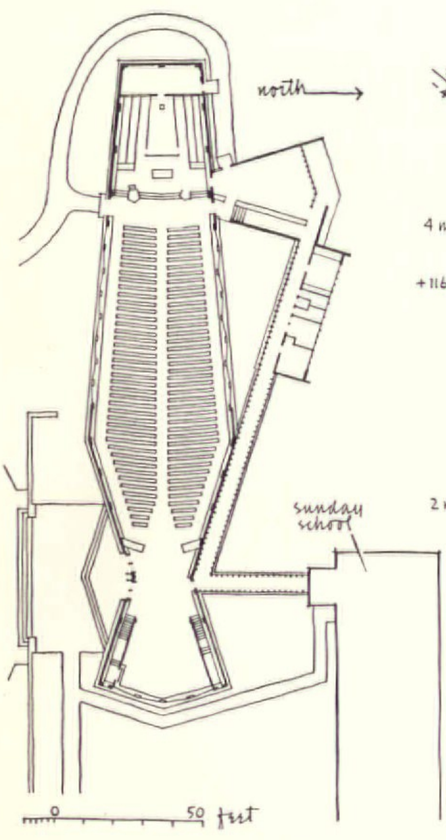


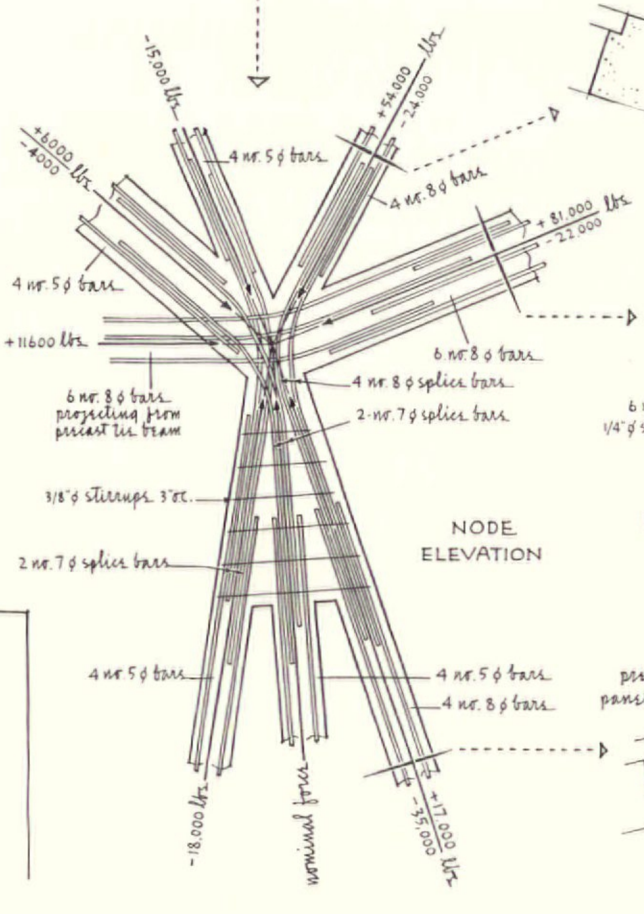
ROOF PLAN



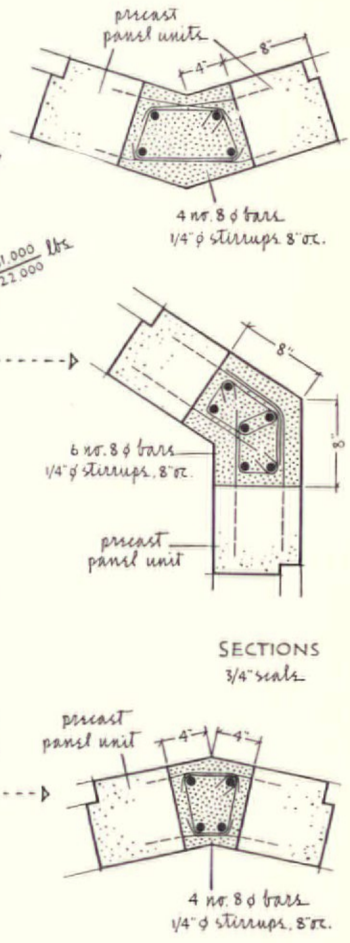
SIDE ELEVATION

FLOOR PLAN





NODE ELEVATION

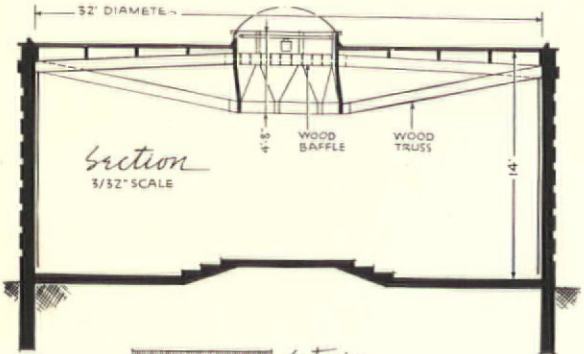


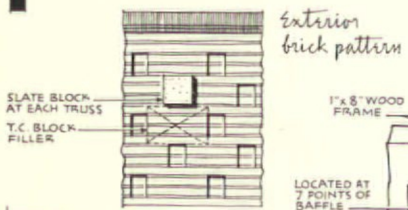
SECTIONS
3/4" scale

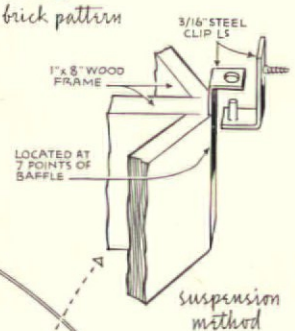
PRESBYTERIAN CHURCH
Stamford, Connecticut

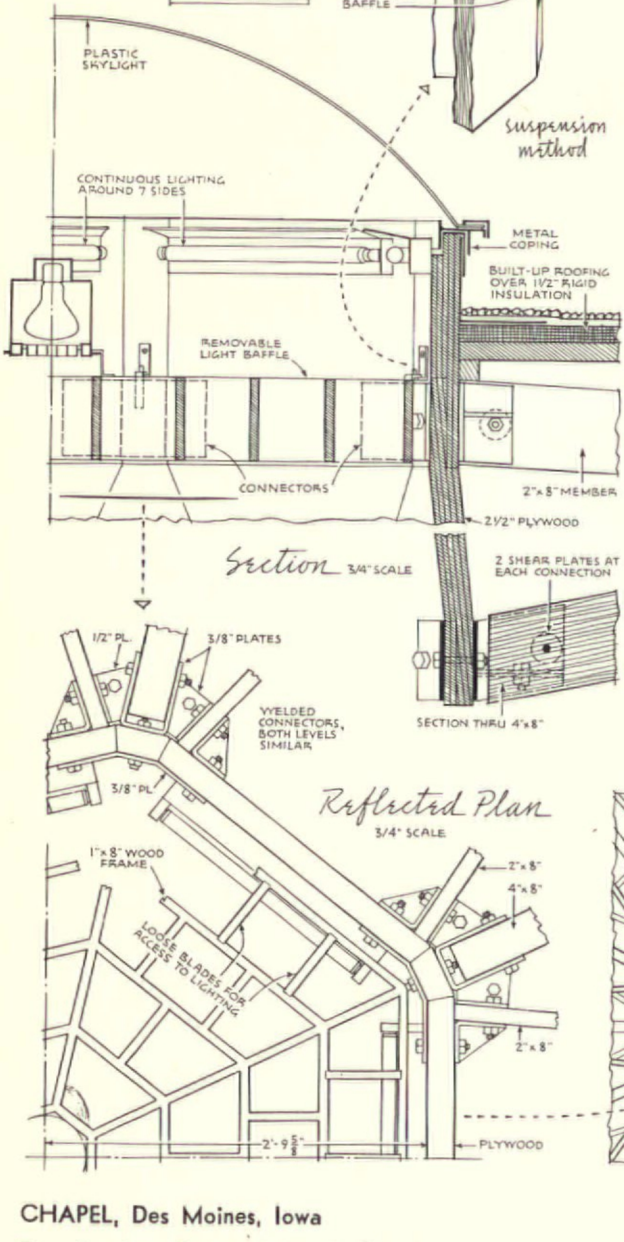
Harrison & Abramovitz, Architects
Sherwood, Mills & Smith, Associated Architects

roof truss

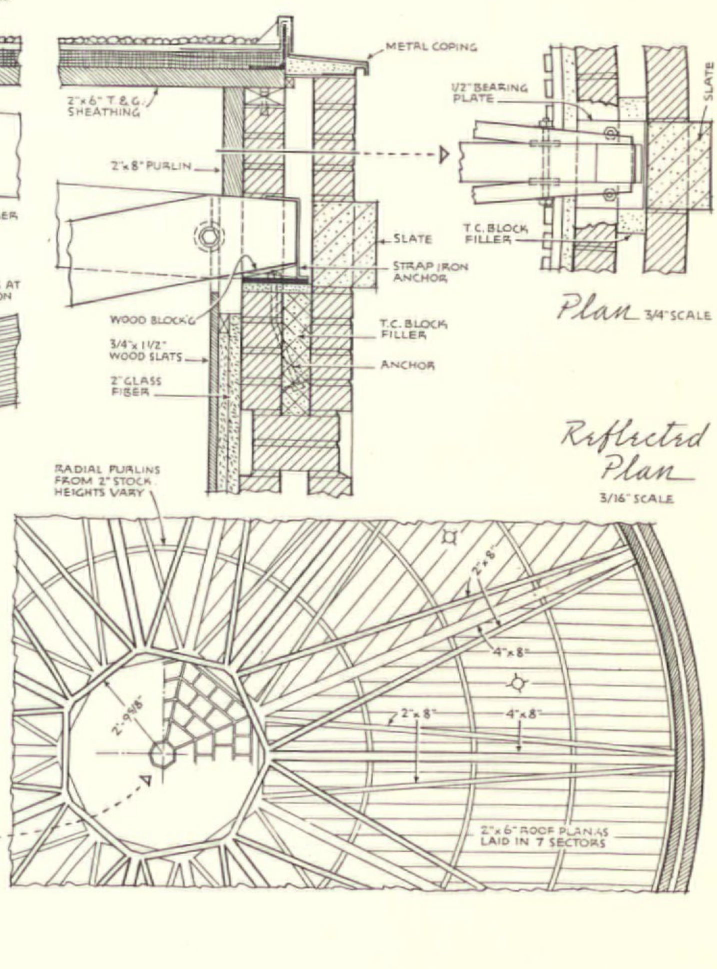








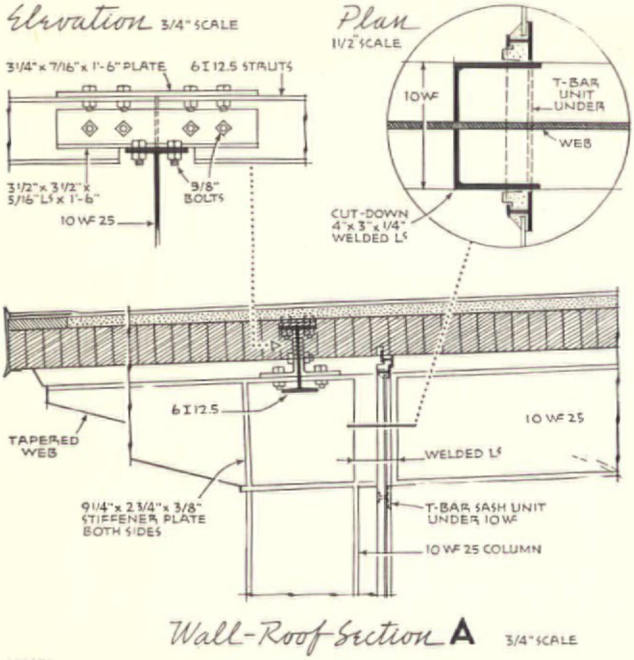
WARREN REYNOLDS, INFINITY INC.

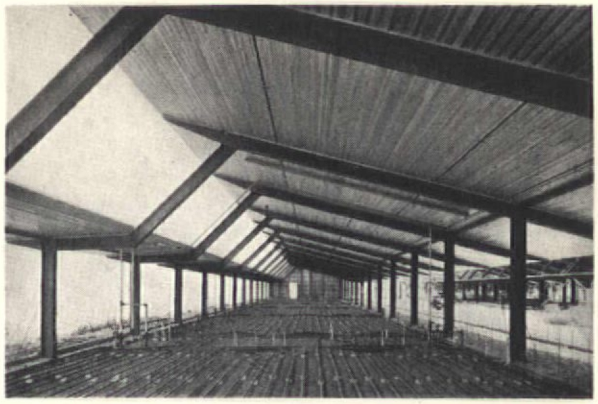


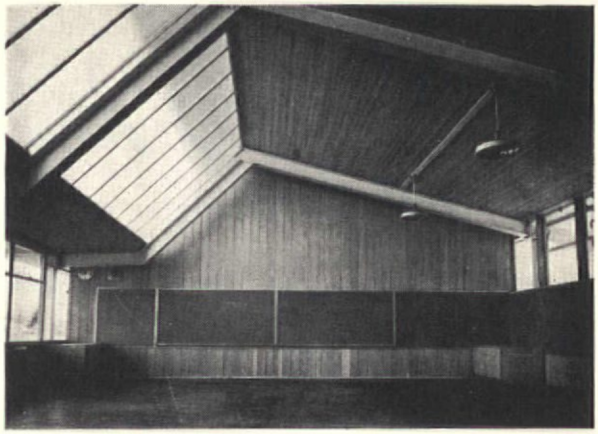
CHAPEL, Des Moines, Iowa

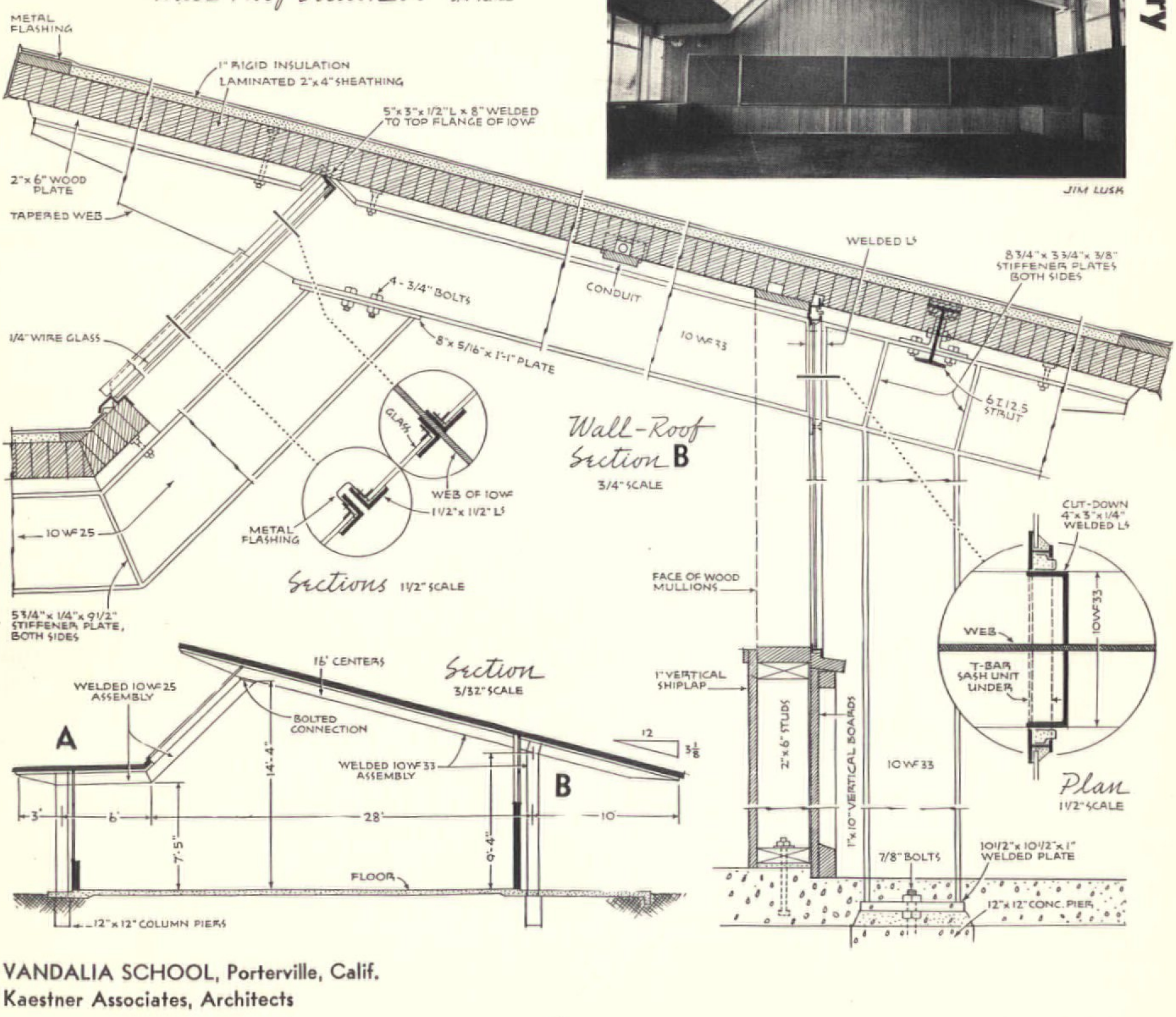
Eero Saarinen & Associates, Architects

roof frame: integrated clerestory



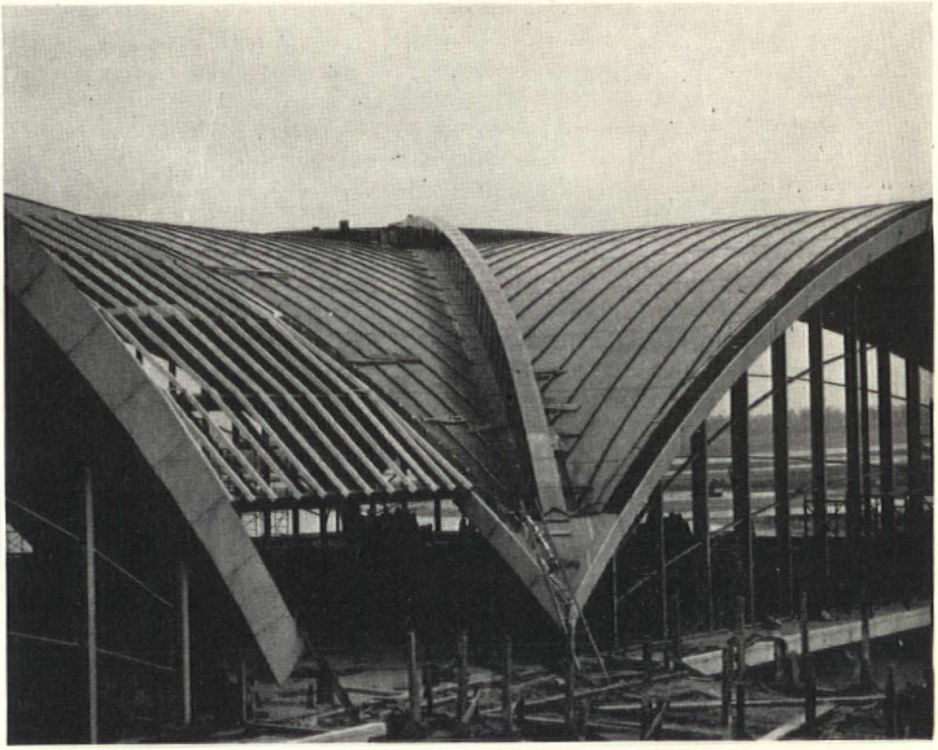






VANDALIA SCHOOL, Porterville, Calif.
Kaestner Associates, Architects

copper-sheathed domes

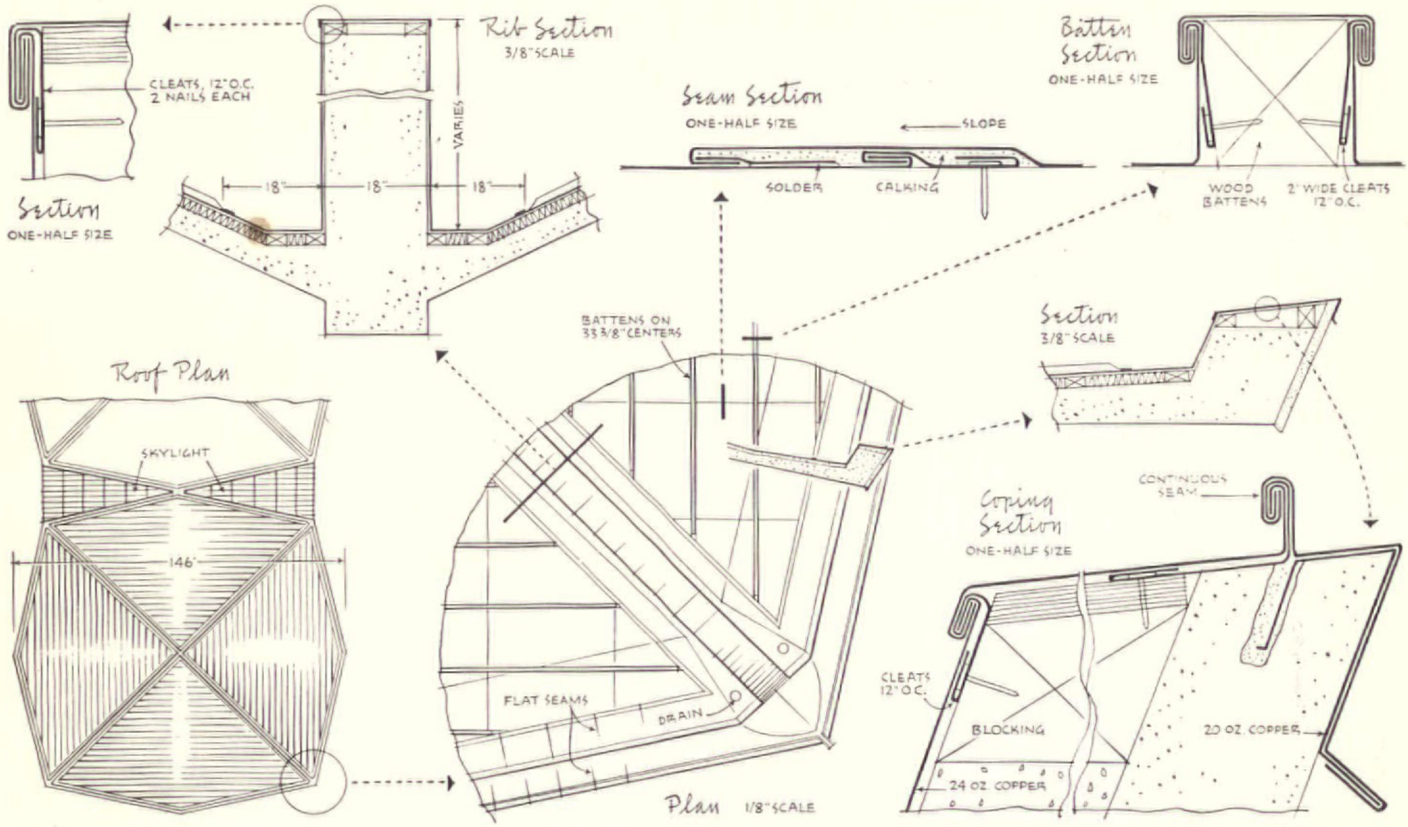


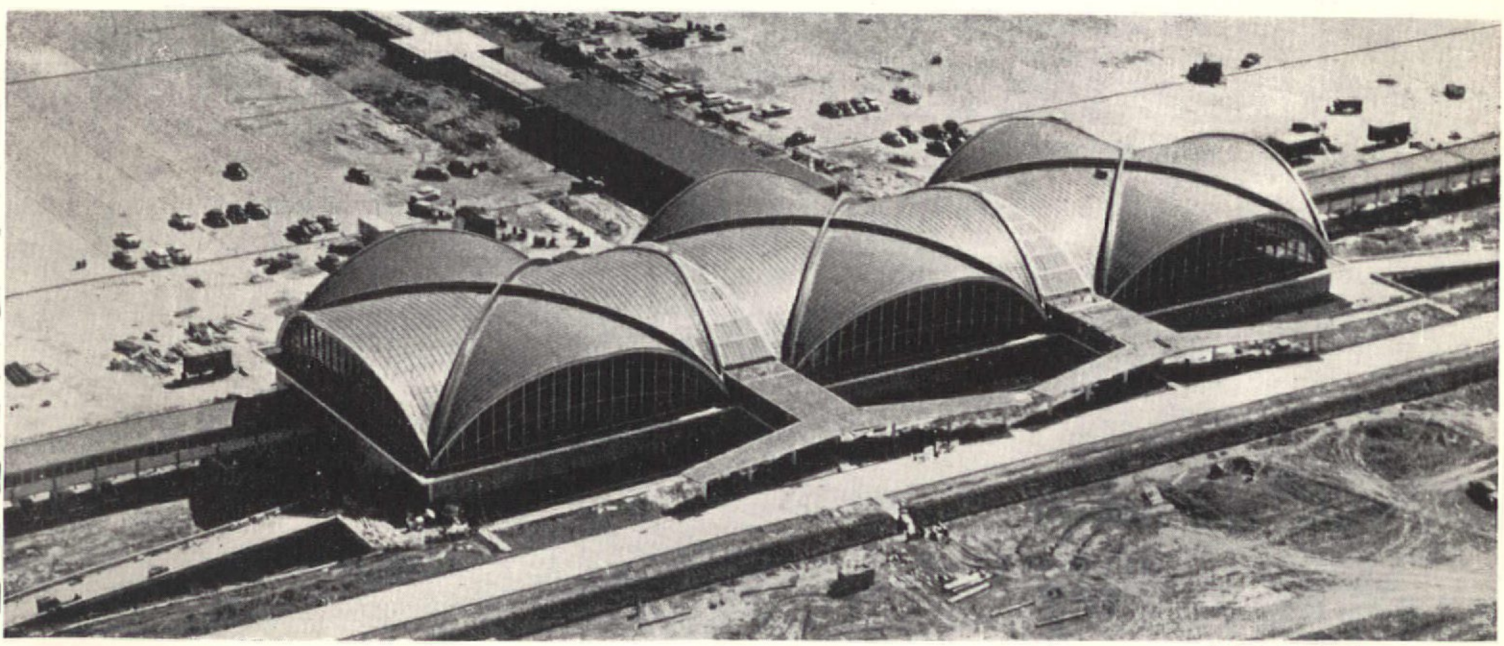
The new Airport Terminal Building at Lambert Field, St. Louis, was dedicated this spring. One of several remarkable uses of material in this unique structure, consisting of three-intersecting barrel-vaulted sections with six intersecting dormer arches, is its copper roofing. According to the Copper and Brass Research Association more than 50,000 sq ft of cold-rolled sheet copper, using batten-and-seam construction, was required to cover the roof. (Sections connecting the three primary units of the roof are glass skylights.) In addition to providing excellent protection against the elements, copper was specified because of the monumental character of the building. In a short time, the entire surface will acquire a blue-green patina and the roofing may actually be expected to outlast the structure that it protects.

The Terminal Building is approximately 415 ft long, 120 ft wide, and has a maximum height of 32 ft. The roof was constructed of thin-shell concrete, over which an insulated plywood deck was applied. Each roof section rests on four pendentives, thus eliminating all interior columns in the main concourse.

Minoru Yamasaki, while a principal of the architectural firm of Hellmuth, Yamasaki & Leinweber, designed the Airport Terminal Building. (He provided the large areas of glass and the vaulted arches to convey the impression of flight.) William C. E. Becker was Structural Engineer; Roberts & Schaeffer acted as Consultants for the concrete shells. Copper roofing was installed by Mound Rose Cornice & Sheet Metal Works.

Detail of pendentive at intersection of two barrel vaults (above). *Section at left was later filled with glass. Sheet-metal workers apply 20-03 cold-rolled sheet copper in batten-seam construction* (right).

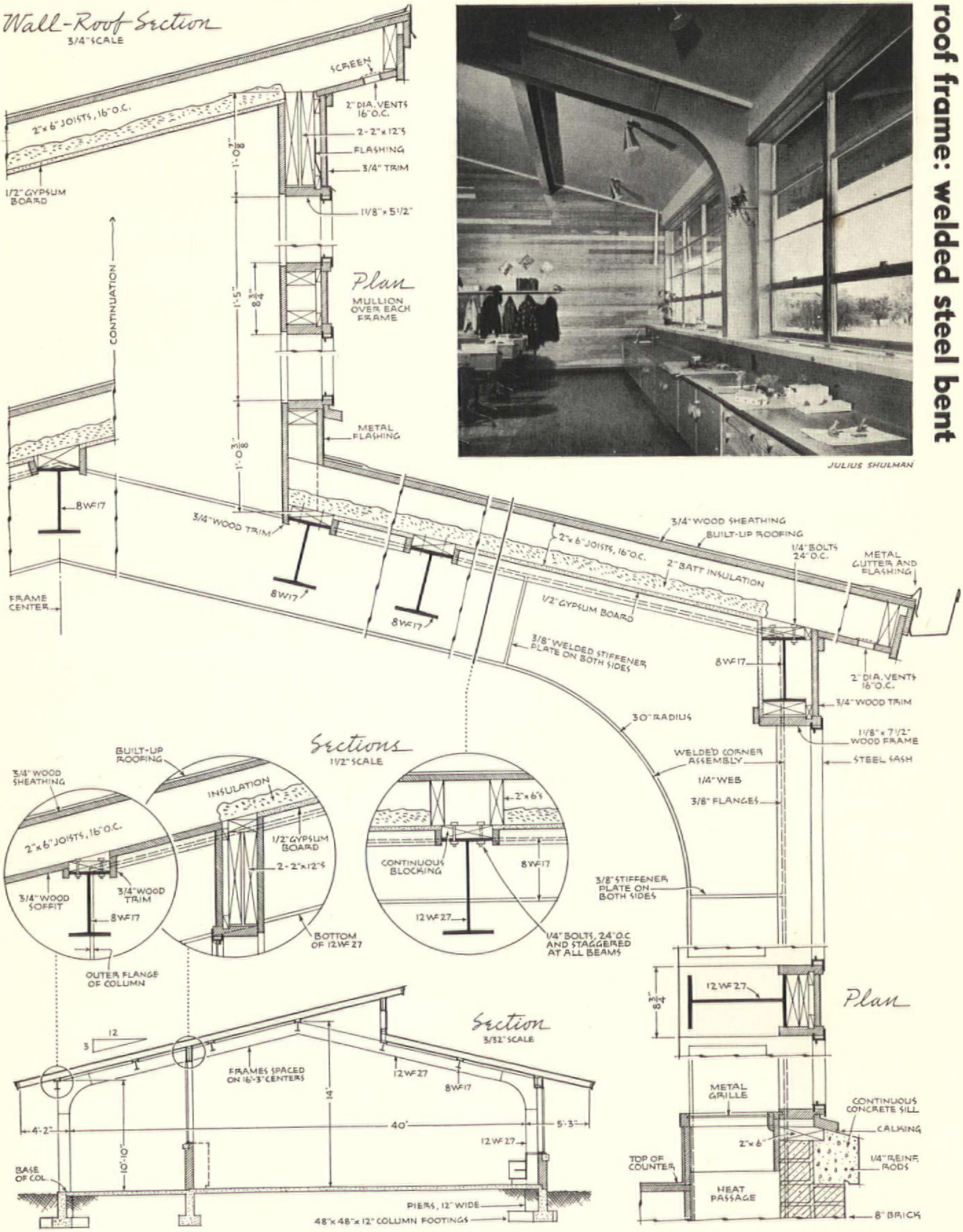




St. Louis Post Dispatch

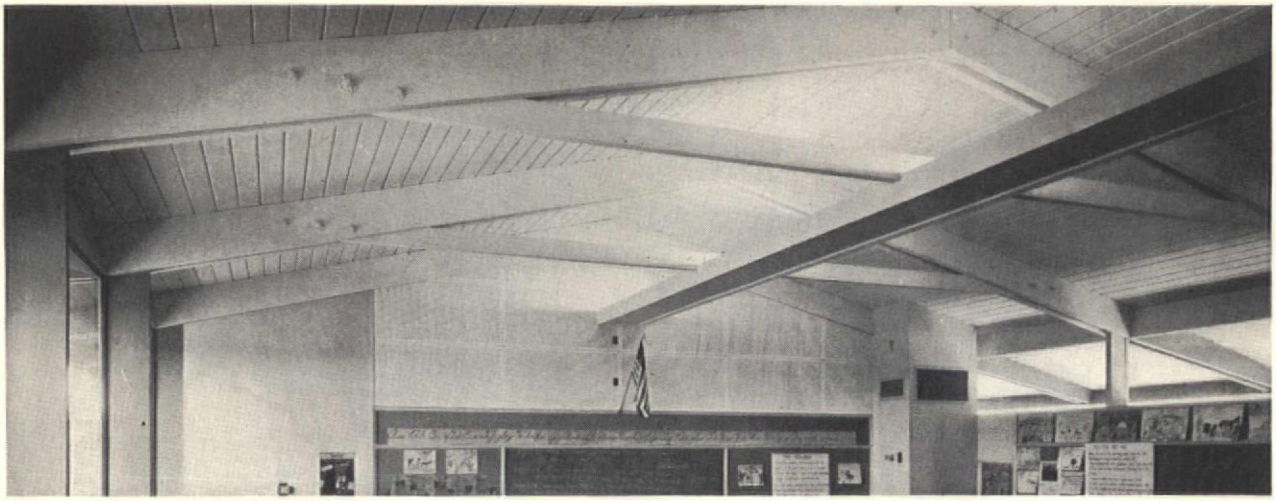
roof frame: welded steel bent

JULIUS SHULMAN

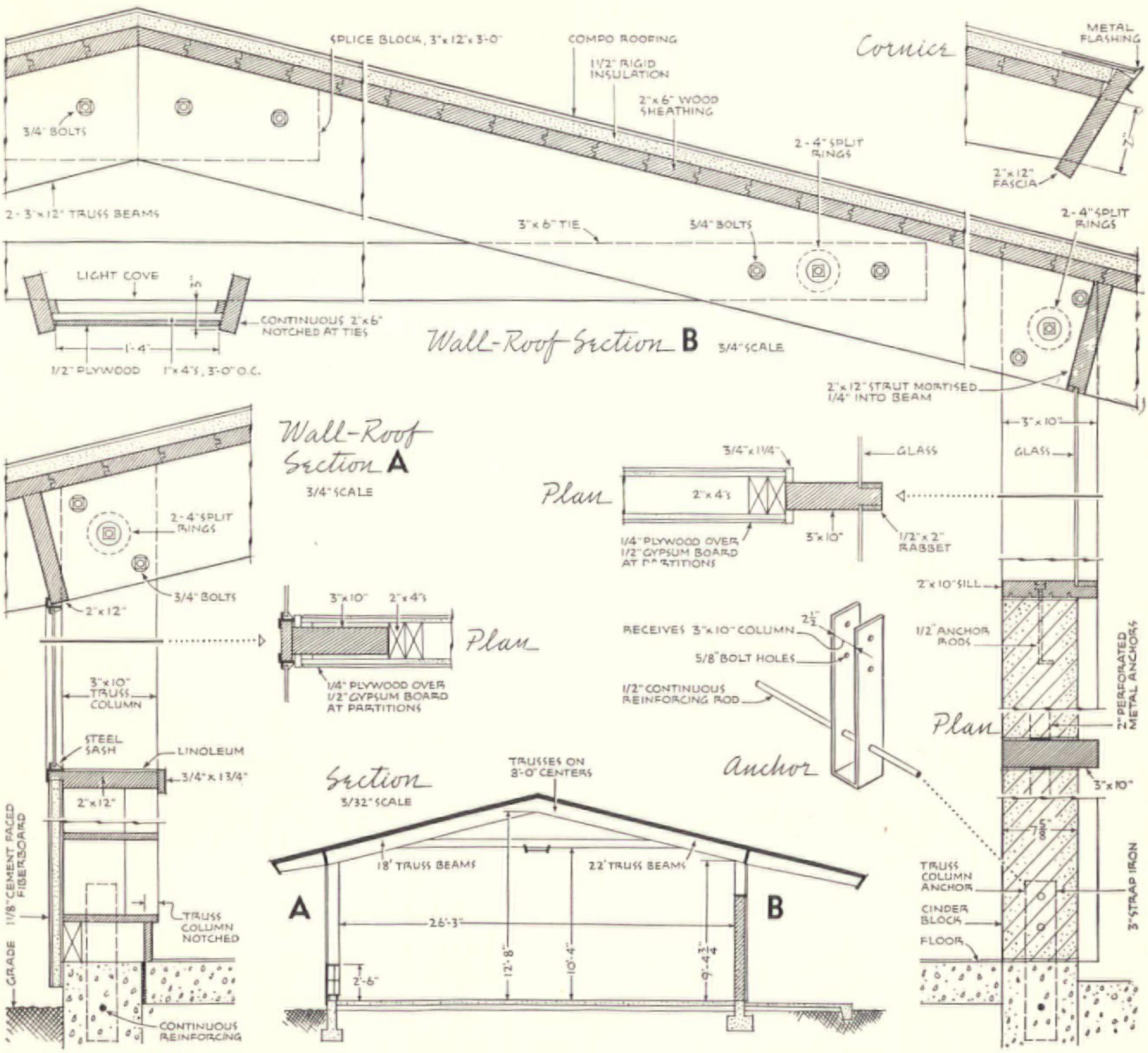


LUTHERAN SCHOOL, Wichita, Kans.
Ramey & Himes, Architects

roof frame: wood truss



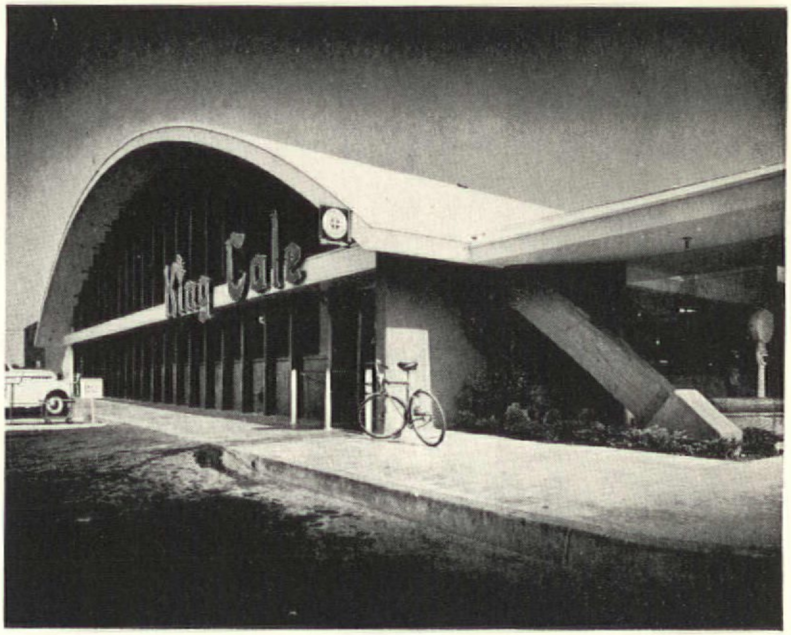
STUART WEINER



HAROLD W. SMITH SCHOOL, Glendale, Ariz.
Guirey & Haver, Architects

p/a selected detail

store: glazed arch span



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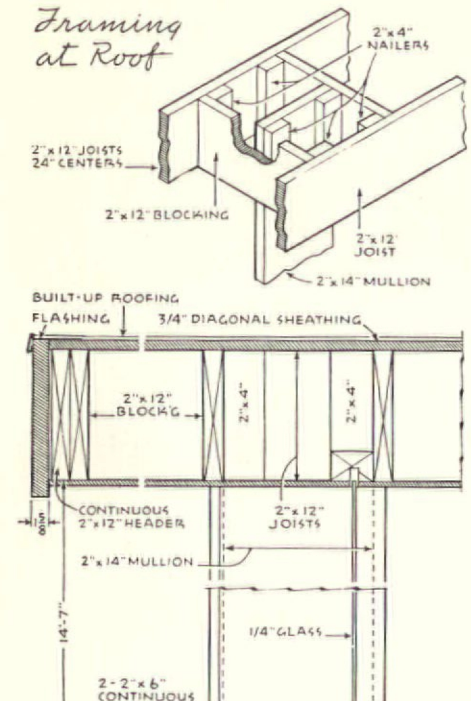
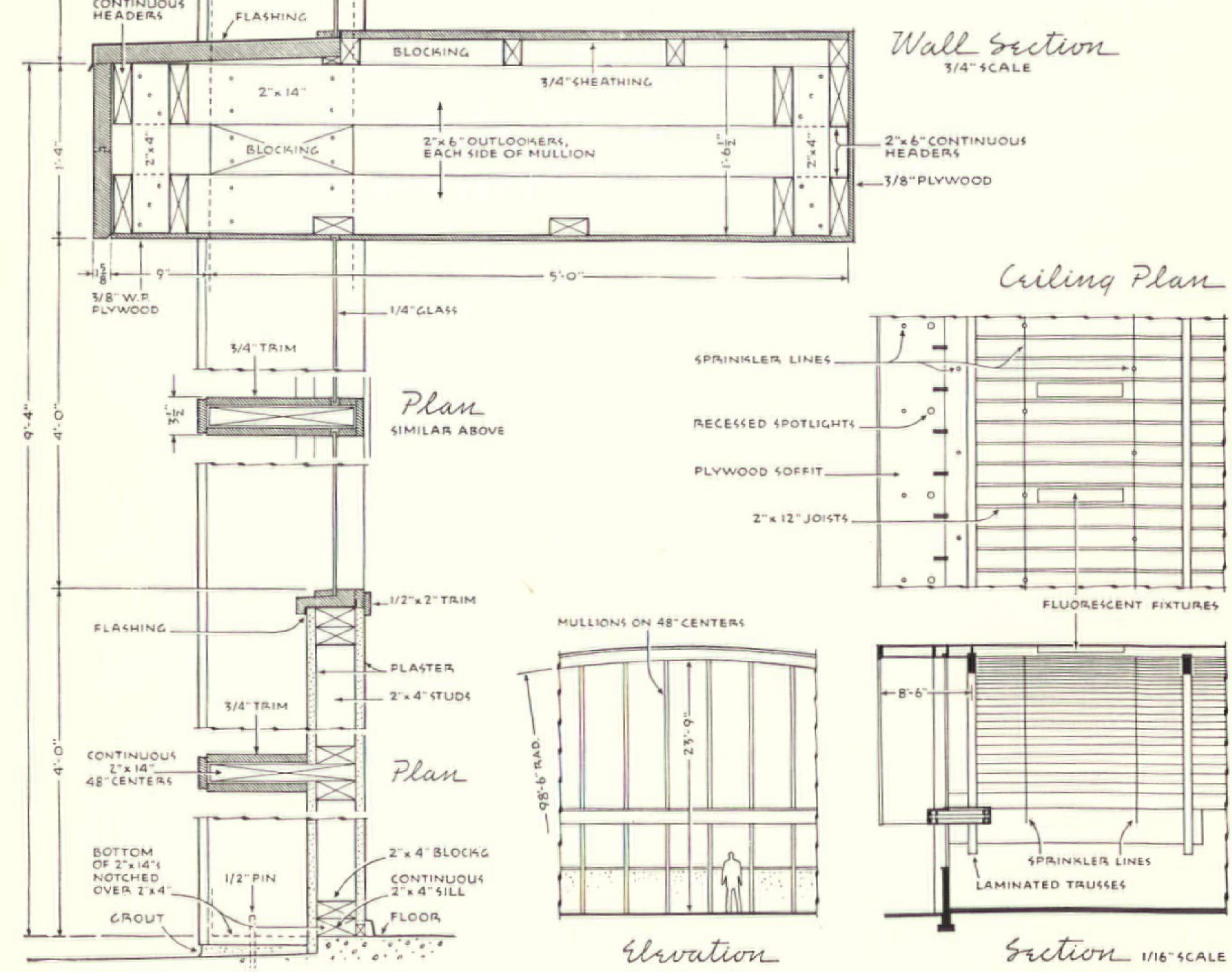


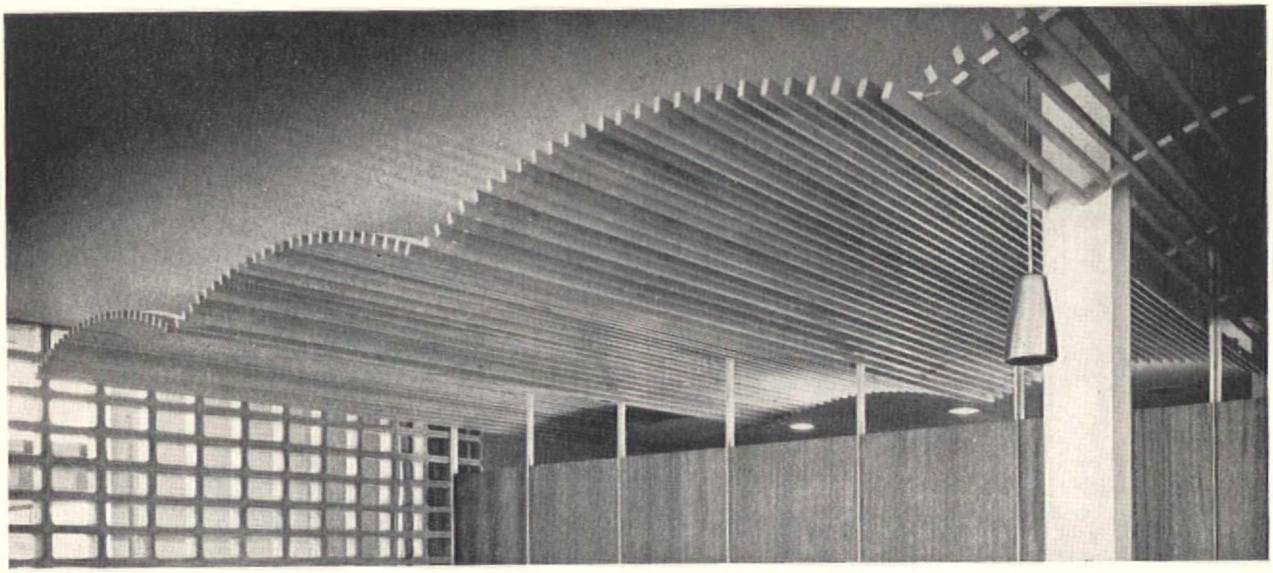


KING COLE SUPERMARKET, Whittier, Calif.

A. Quincy Jones Jr., Architect

p/a selected detail

hung ceiling



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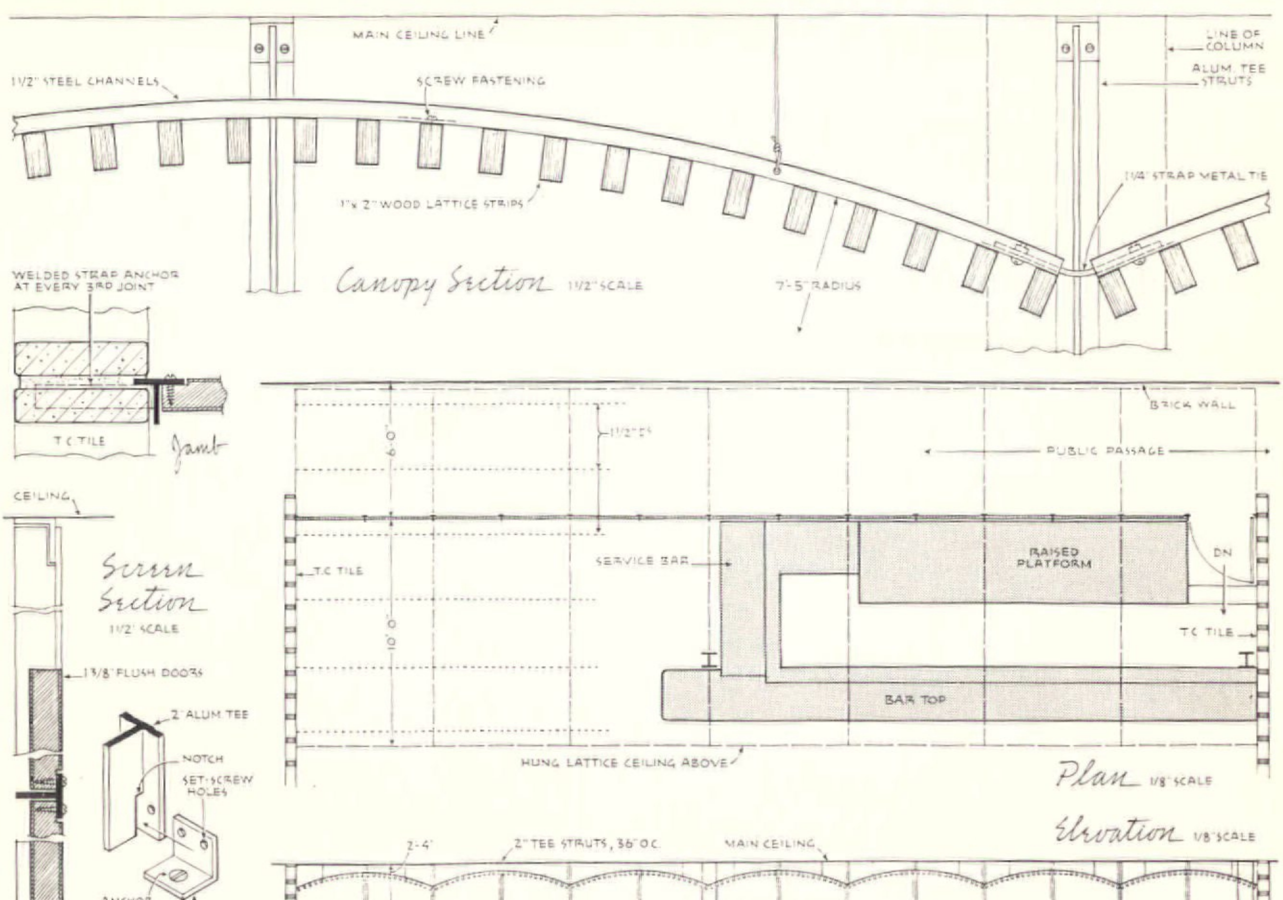
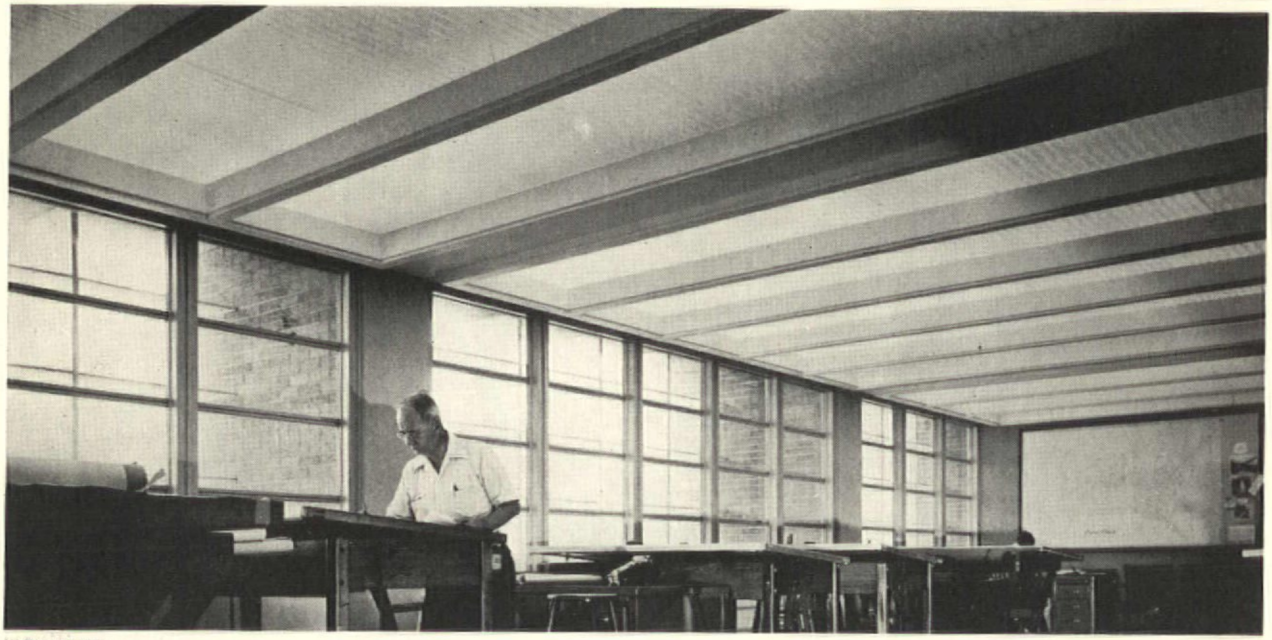
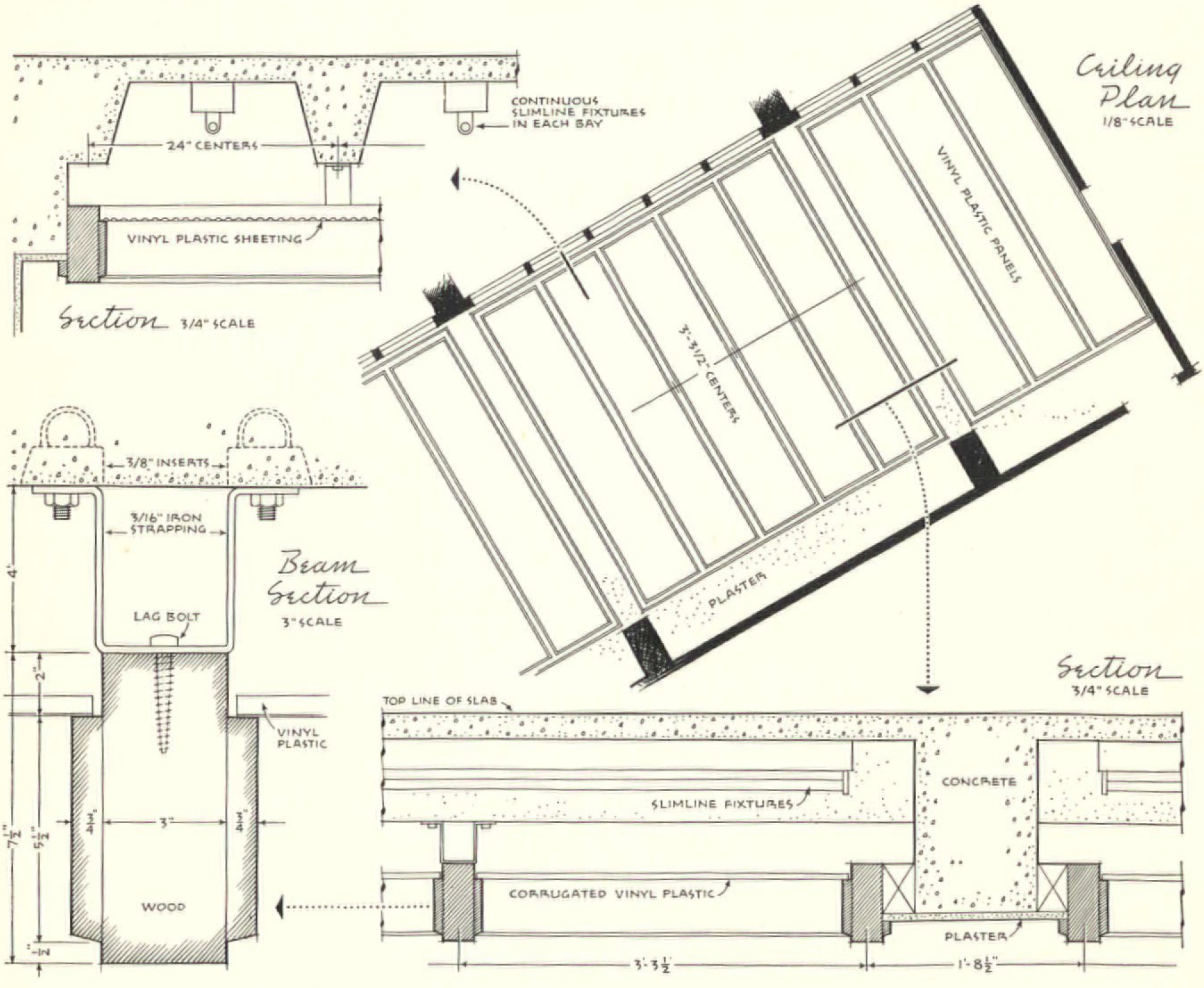


DESERT MOTEL, Tucson, Ariz.
Hausner & Macsai, Architects

city hall: luminous ceiling



ULRIC MEISEL



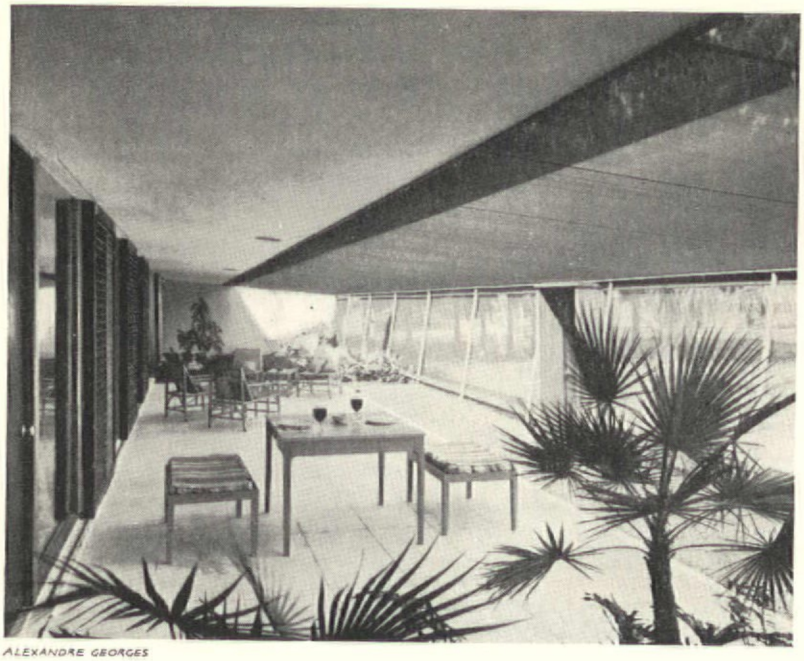
CORPUS CHRISTI CITY HALL, Corpus Christi, Tex.

Richard S. Colley, Architect

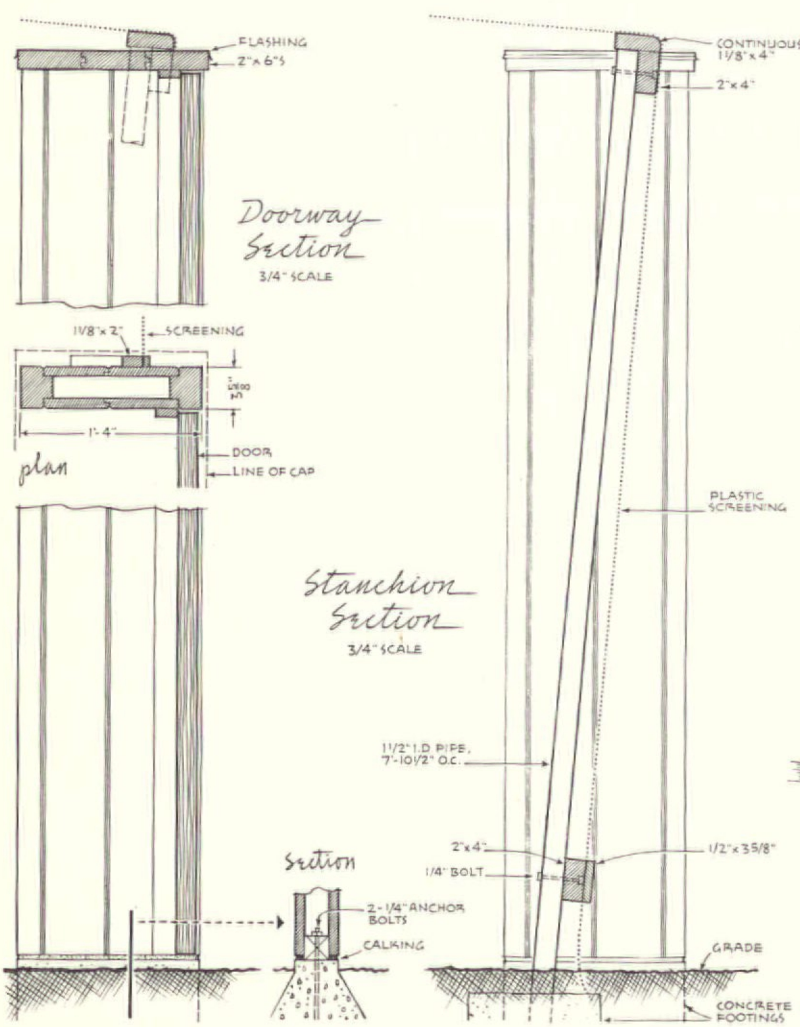
Section 2 COURTS & TERRACES

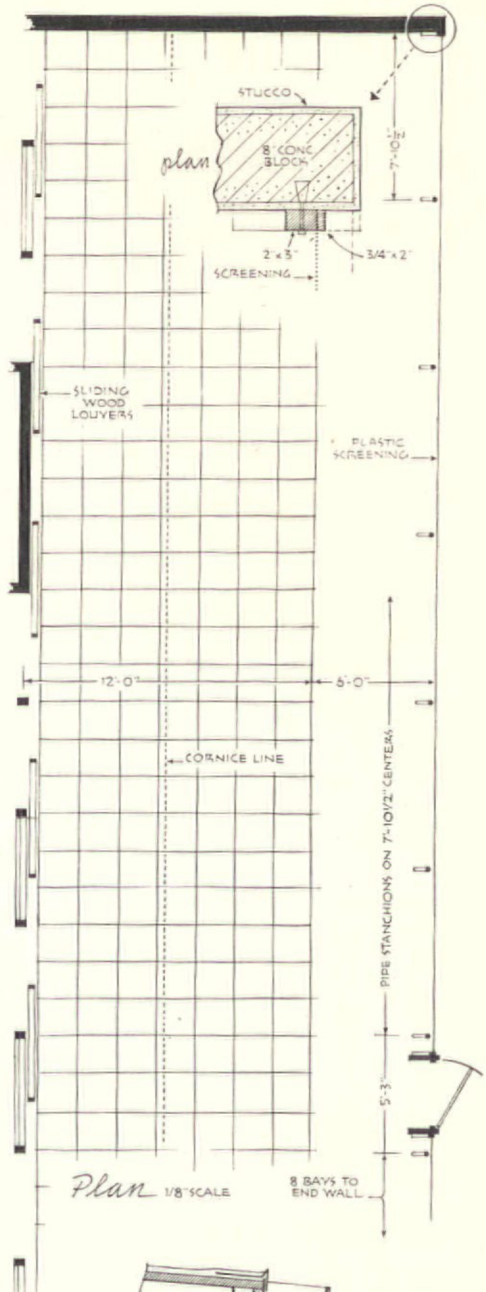
p/a selected detail

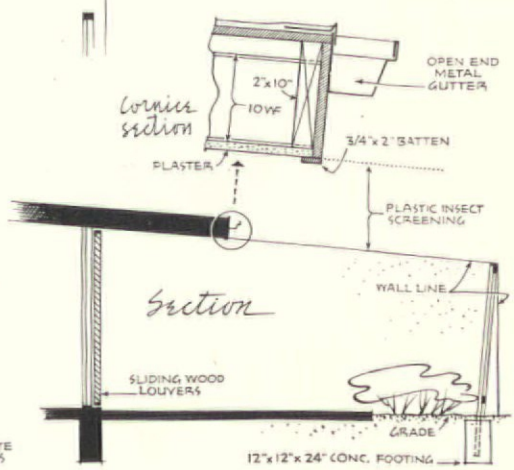
screened terrace



ALEXANDRE GEORGES



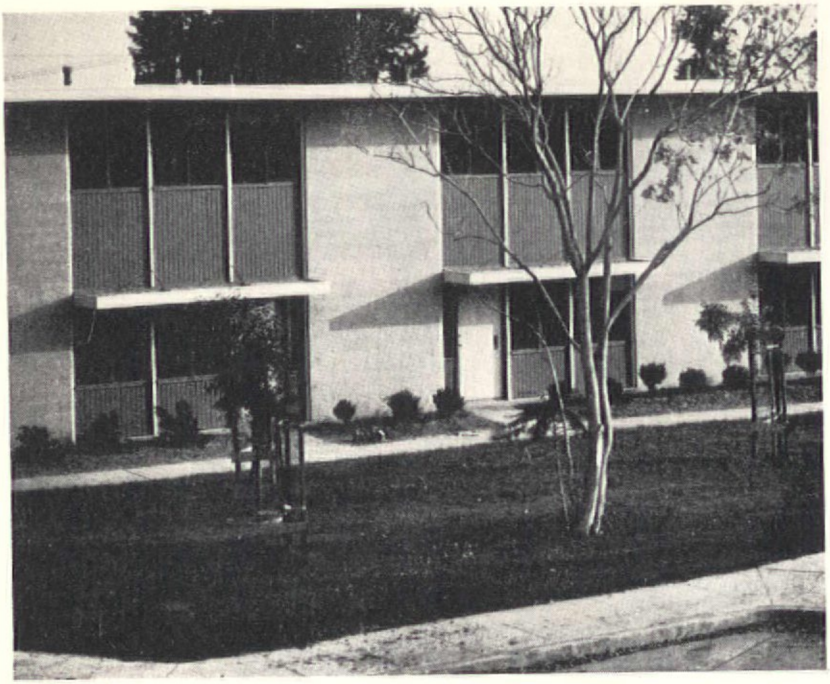




HOUSE, Redington Beach, Fla.
Rufus Nims, Architect

p/a selected detail

entrance facade



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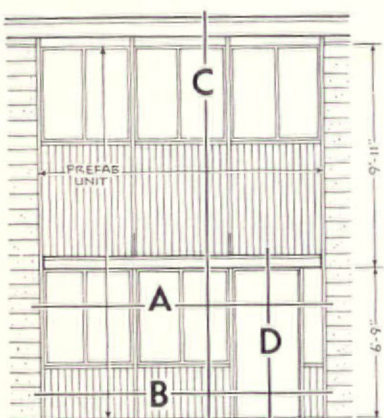
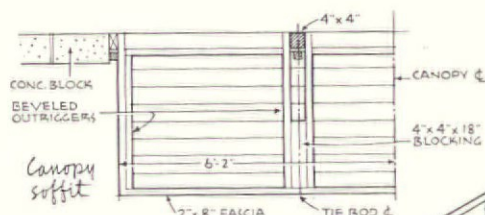
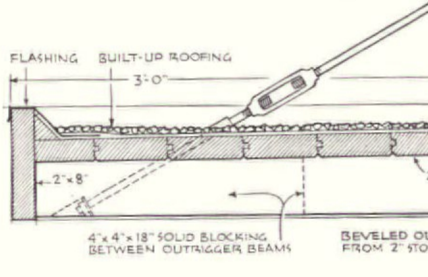
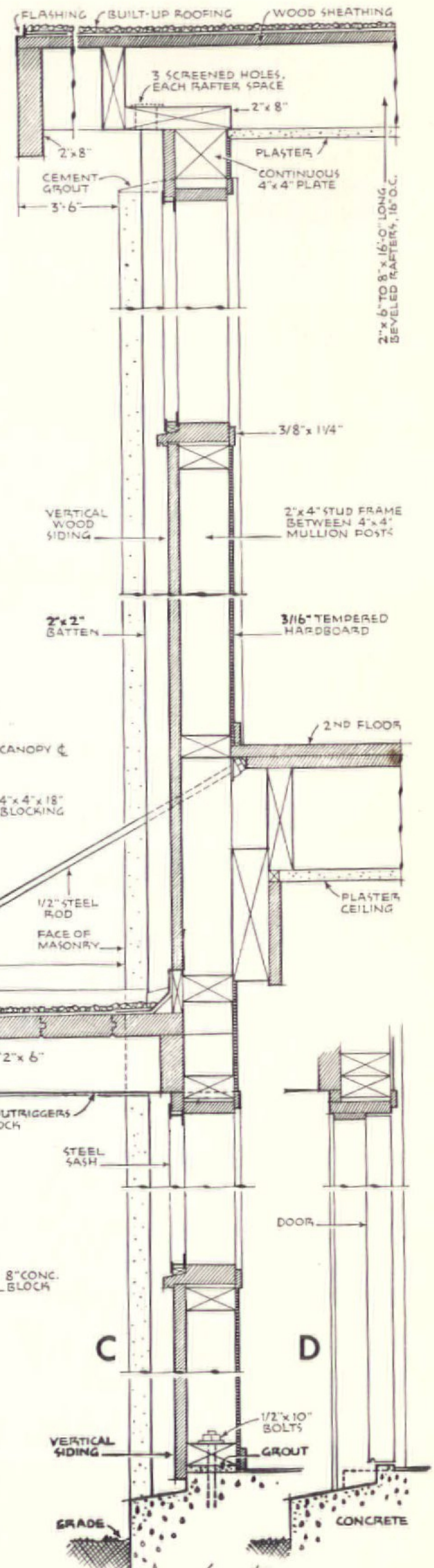


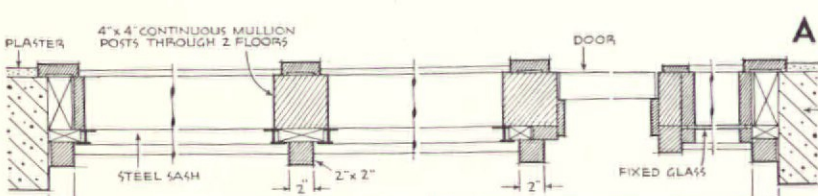
Elevation 1/8" SCALE



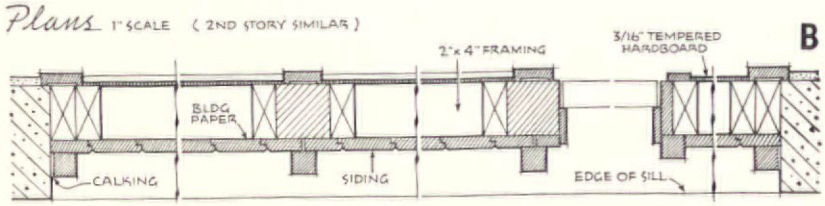




Sections 1" SCALE



Plans 1" SCALE (2ND STORY SIMILAR)

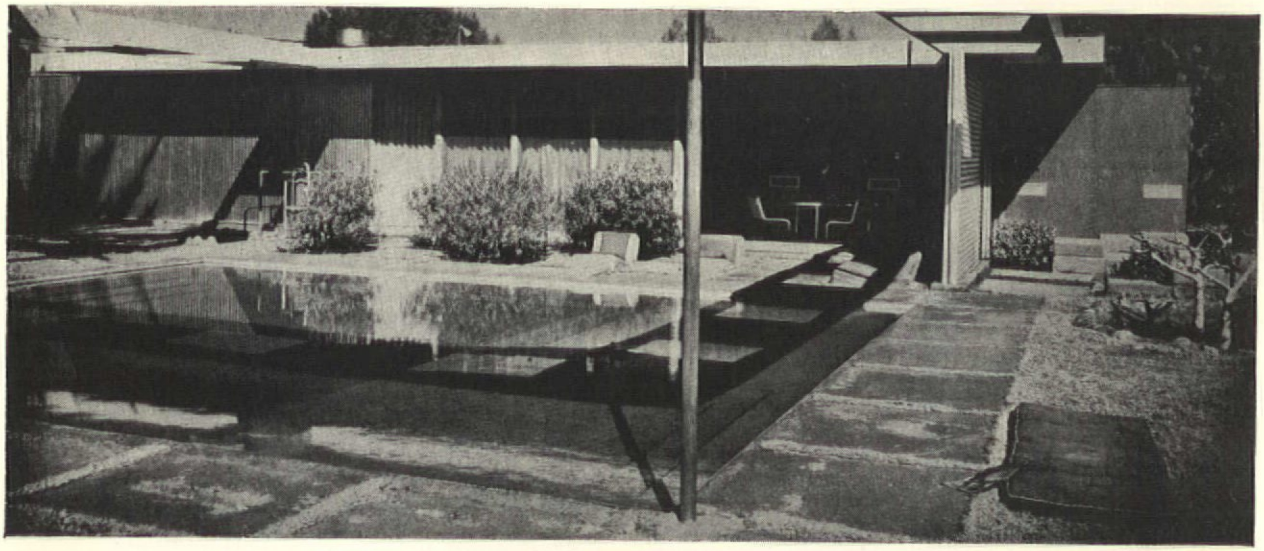


HOUSING PROJECT, Pacoima, Los Angeles, Calif.

Arthur Gallion and Victor Gruen, Associated Architects

SELECTED DETAIL

residence: sliding doors



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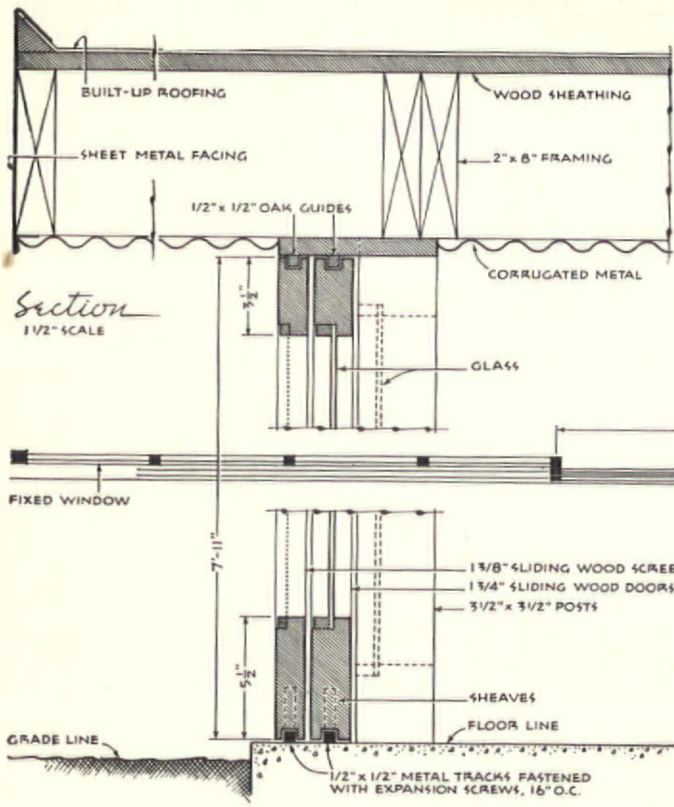
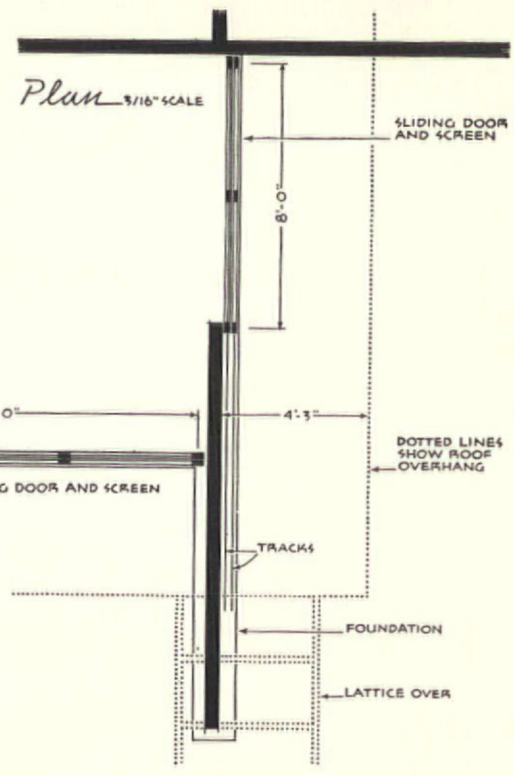
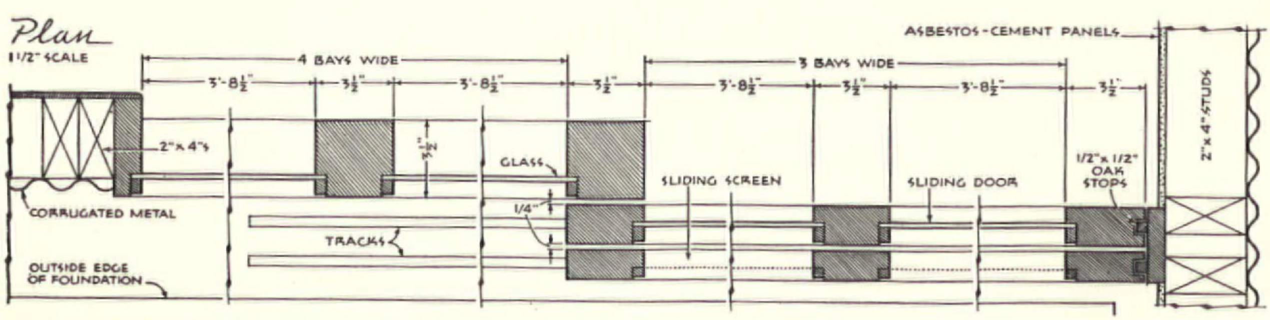






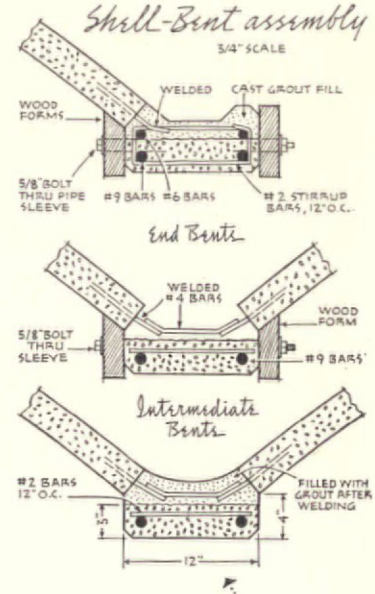
CLARK RESIDENCE, Palm Springs, Calif.

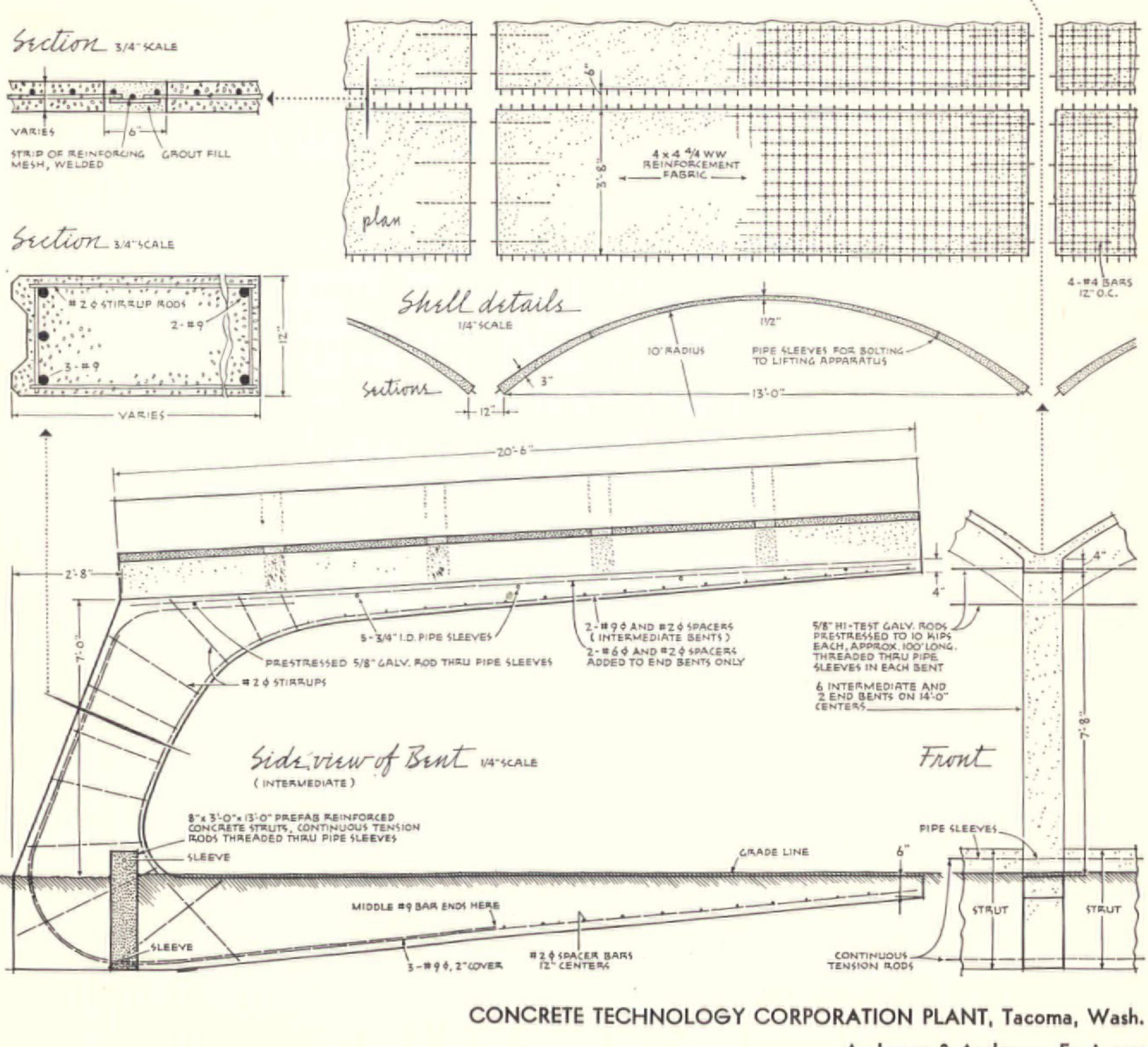
Clark & Frey, Architects

p/a selected detail

carport

DEARBORN-MASSAR



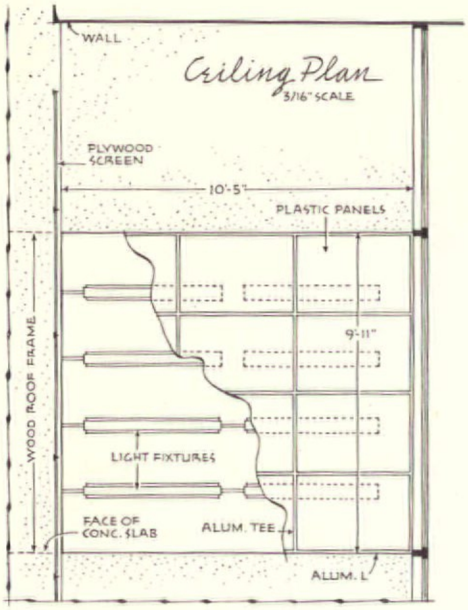


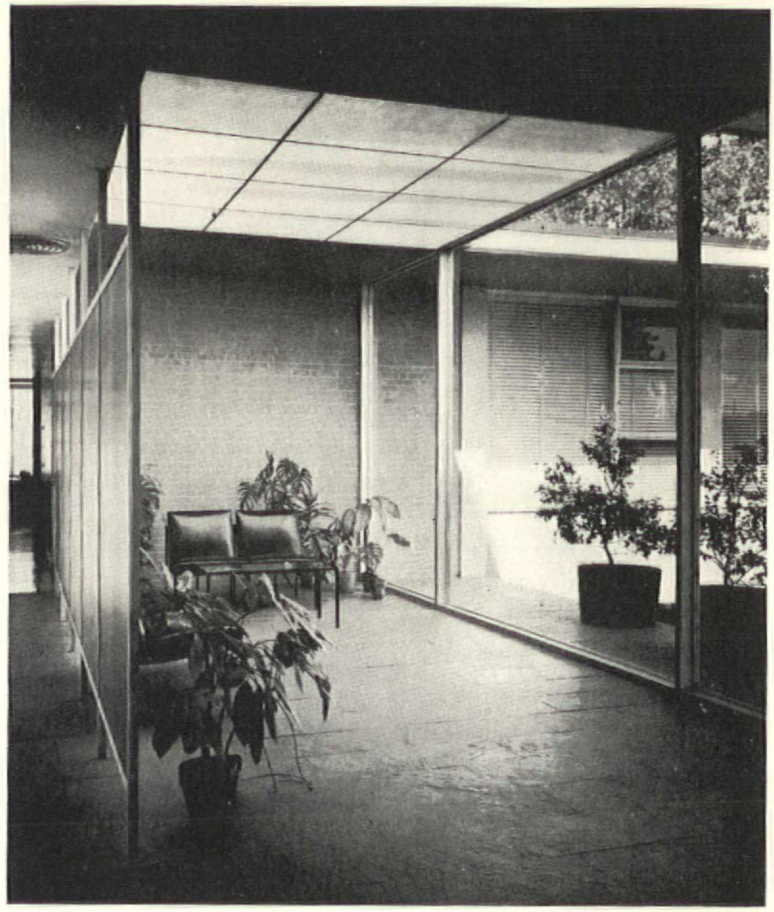
CONCRETE TECHNOLOGY CORPORATION PLANT, Tacoma, Wash.

Anderson & Anderson, Engineers

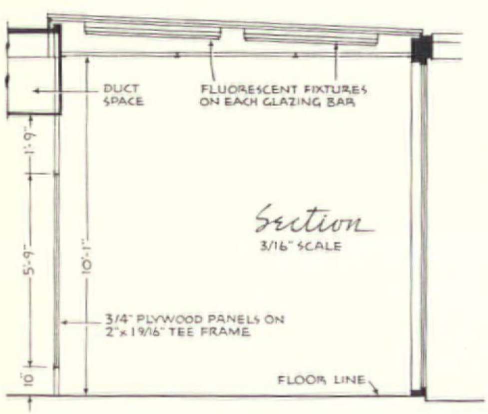
p/a selected detail

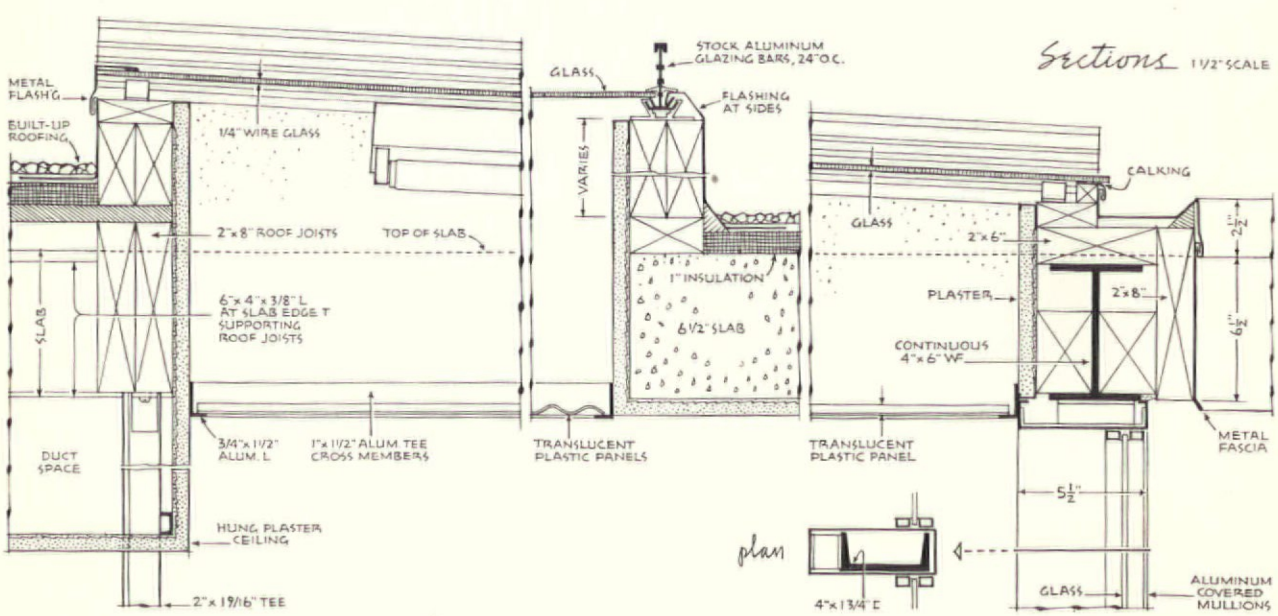
skylight





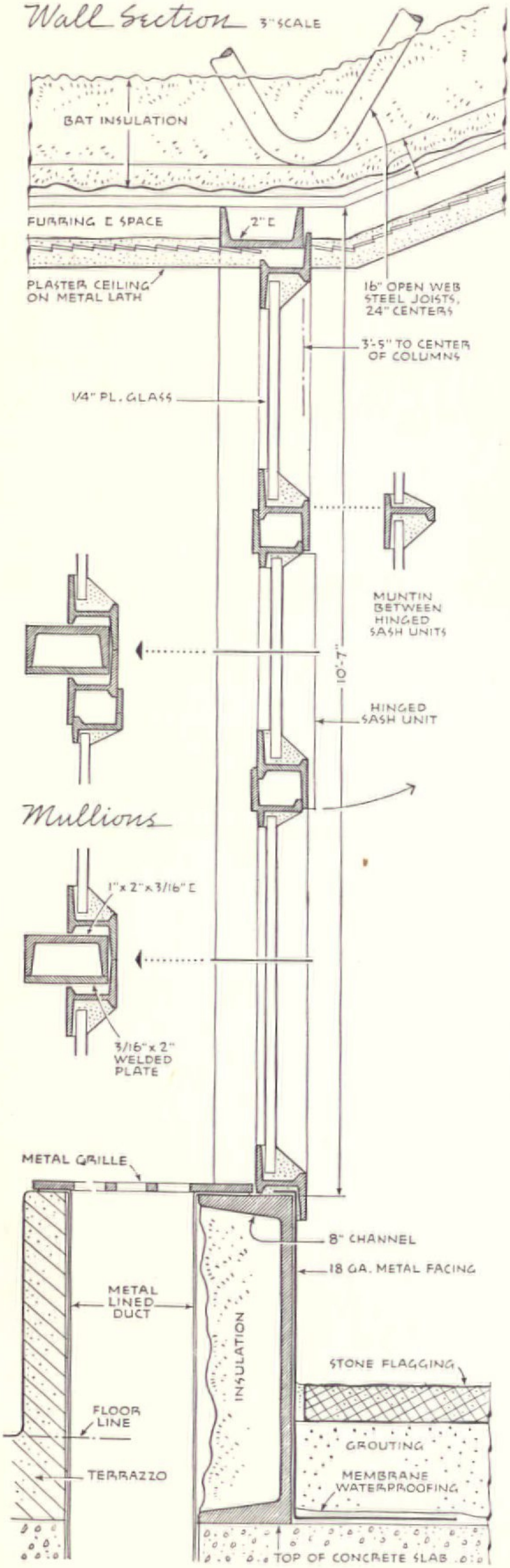
MAC MIZUKI

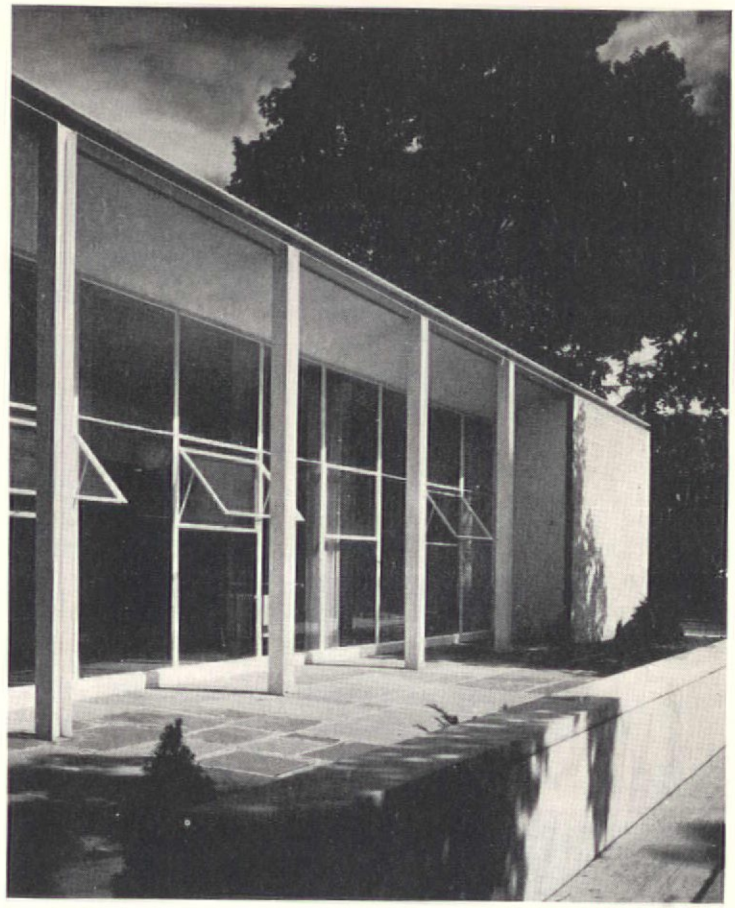




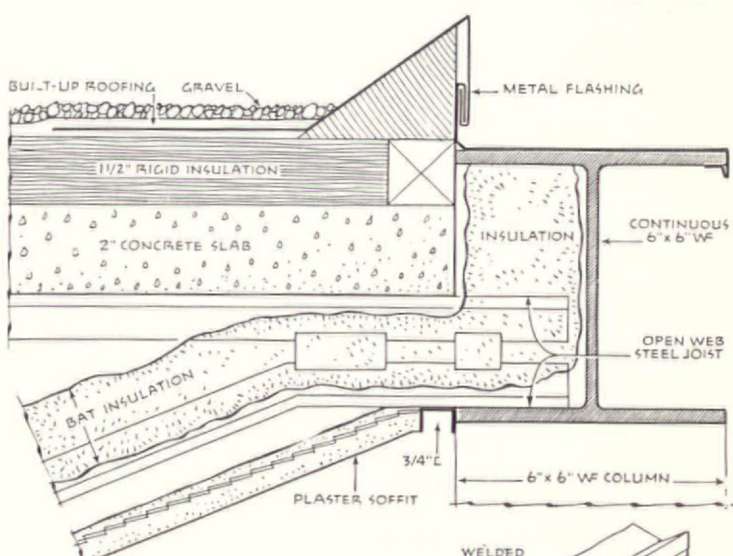
OFFICE/LABORATORY BUILDING, Herculaneum, Mo.
Hellmuth, Yamasaki & Leinweber, Architects

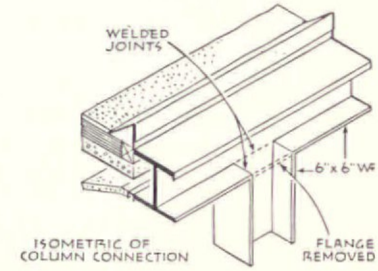
bank: loggia window wall





HEDRICH-BLESSING



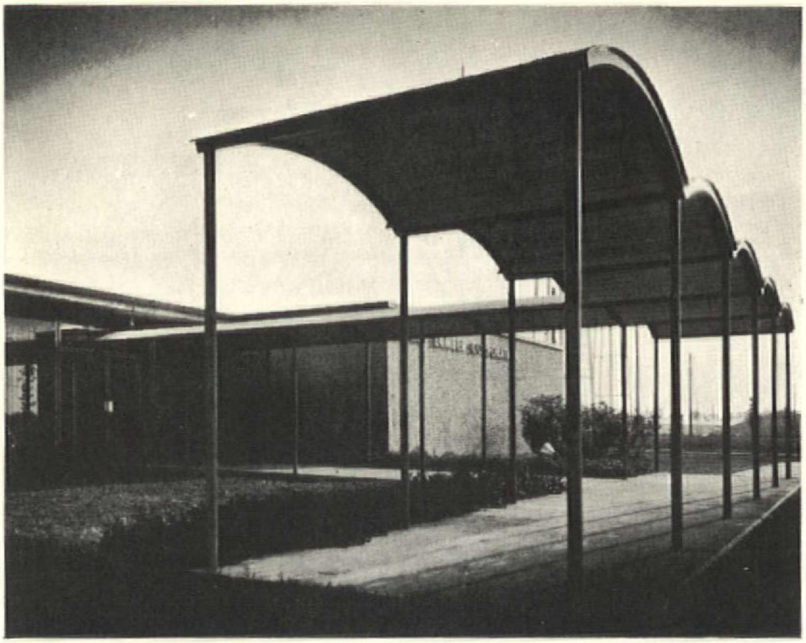


OTTAWA SAVINGS AND LOAN ASSN., Holland, Mich.

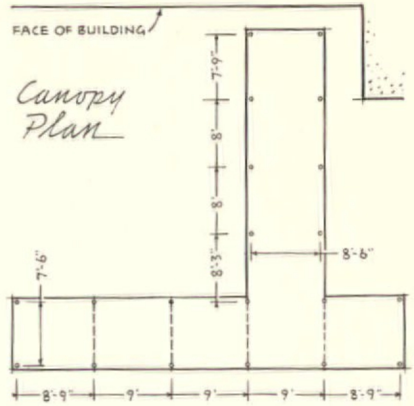
Harry Weese, John Van der Meulen, and Bruce Adams, Architects

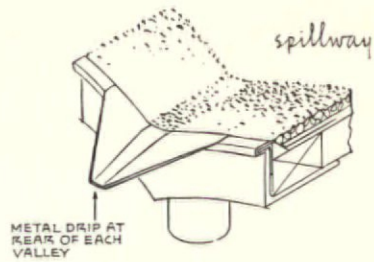
p/a selected detail

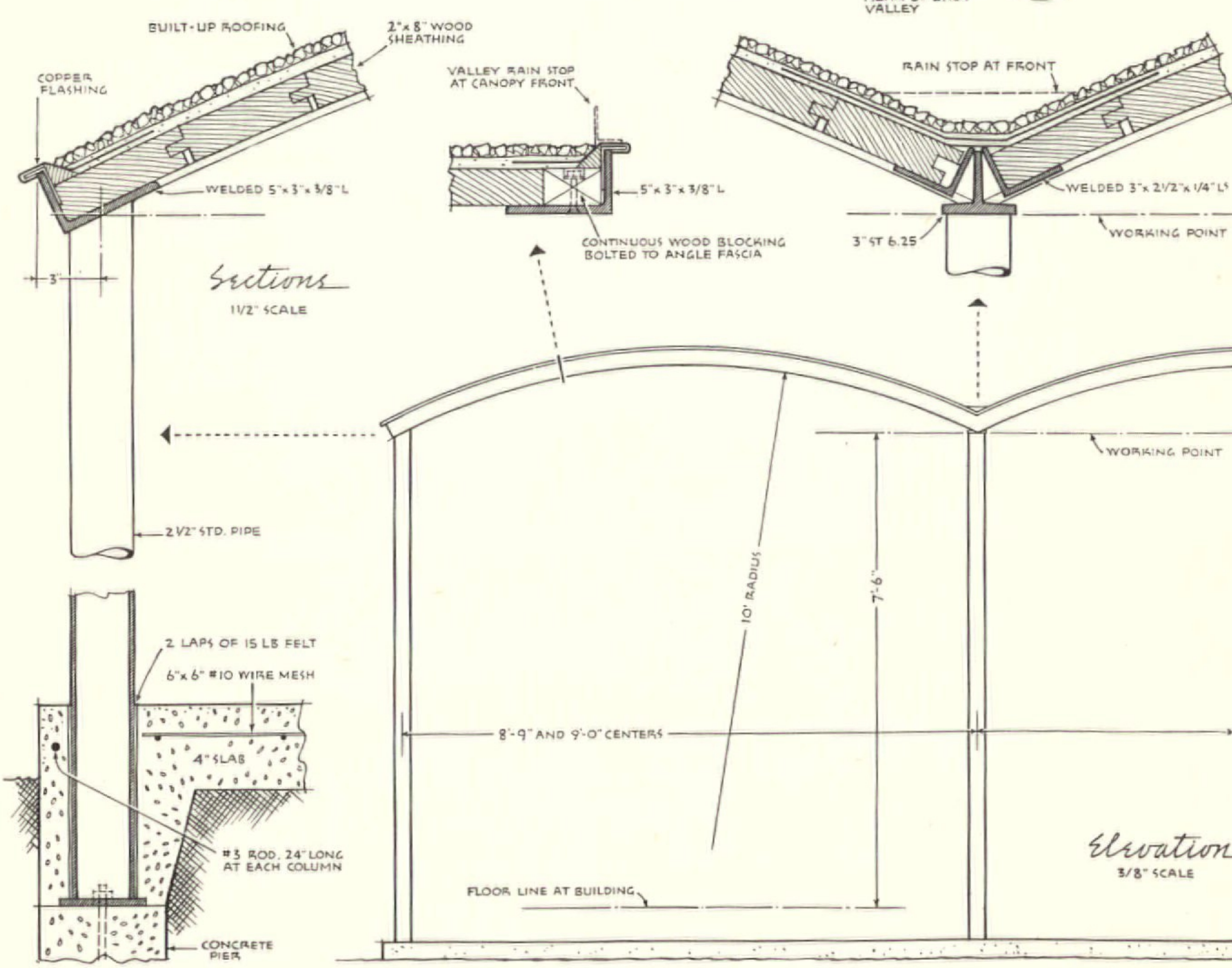
covered walkway



F.W. SEIDERS



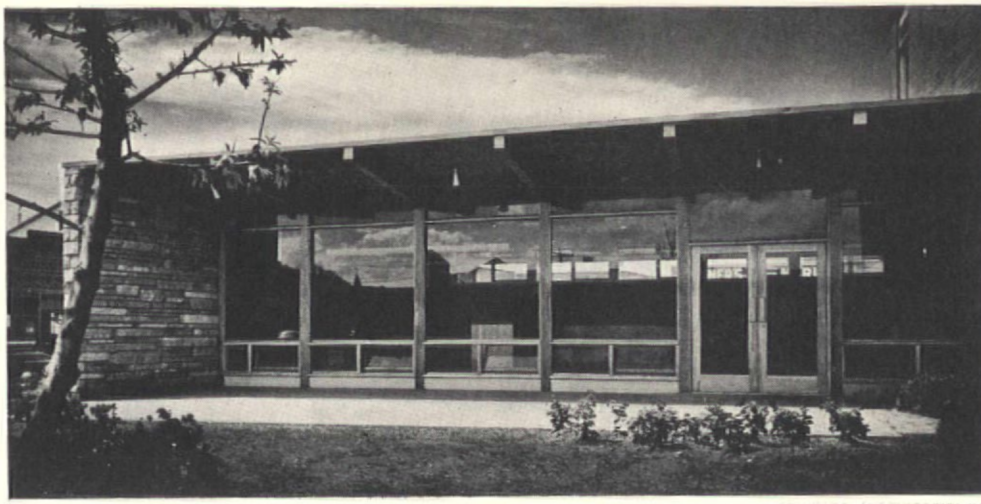




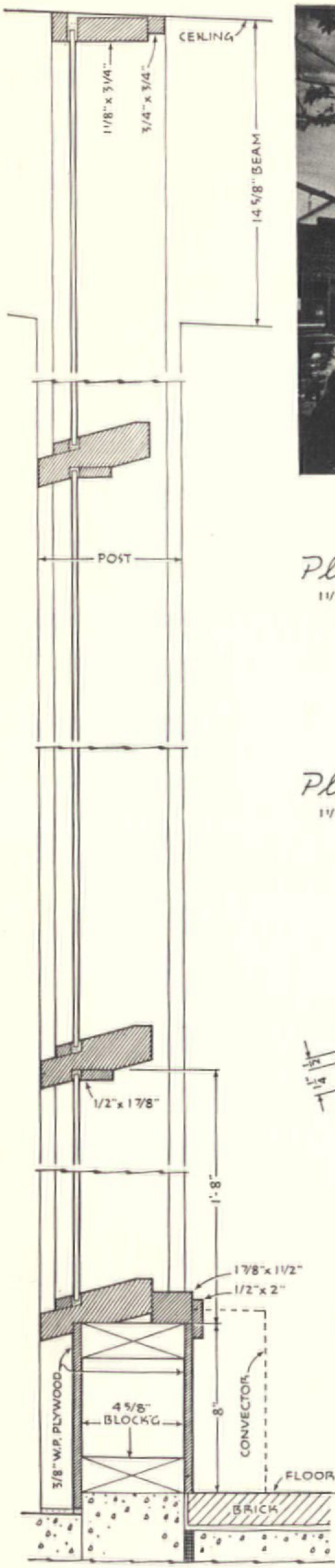
OFFICE BUILDING, Sillsbee, Tex.

George Pierce & Abel B. Pierce, Architects

city hall: window wall



REYNOLDS, PHOTOGRAPHY INC.



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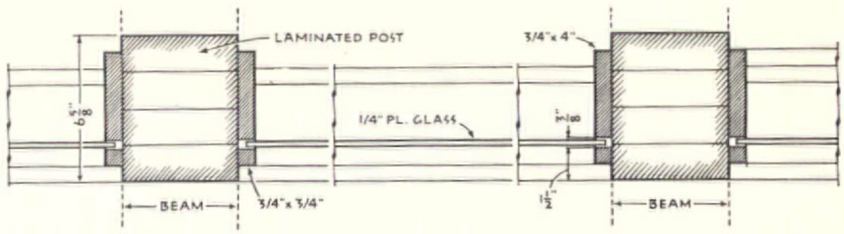
Plan **C** 1 1/2" SCALE



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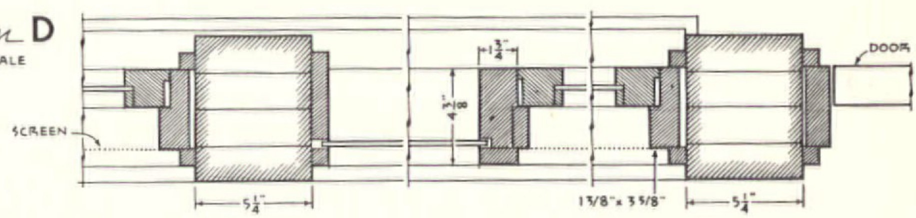

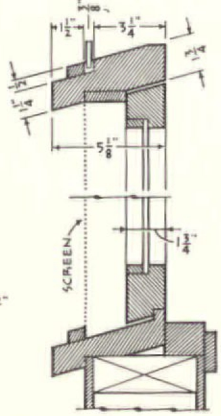

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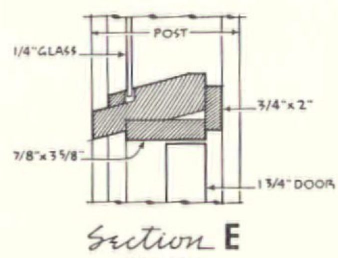
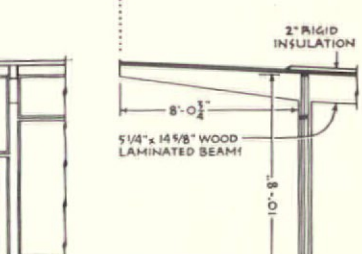
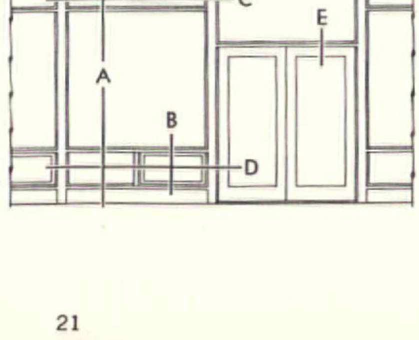


Section **E** 1 1/2" SCALE

Section 1 1/2" SCALE





Elevation 1/8" SCALE

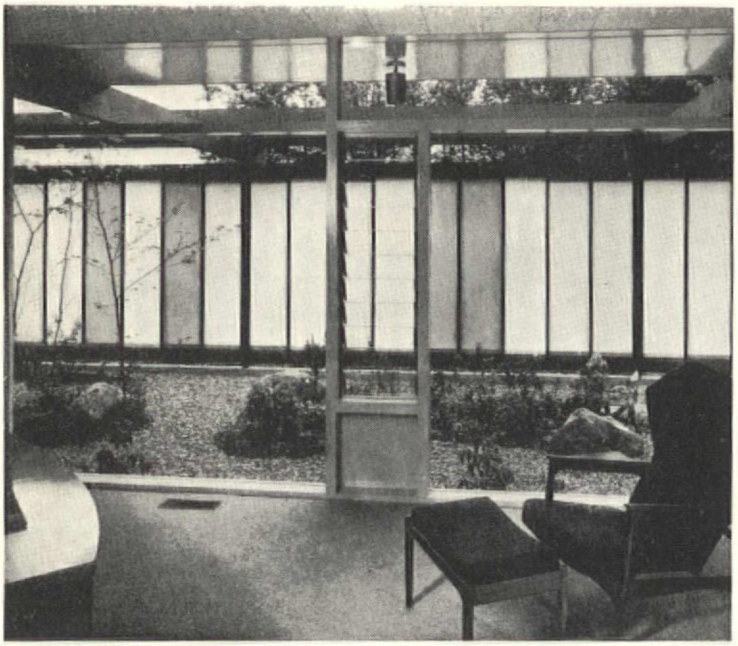
Section 1/8" SCALE

BRIGHTON CITY HALL, Brighton, Colo.

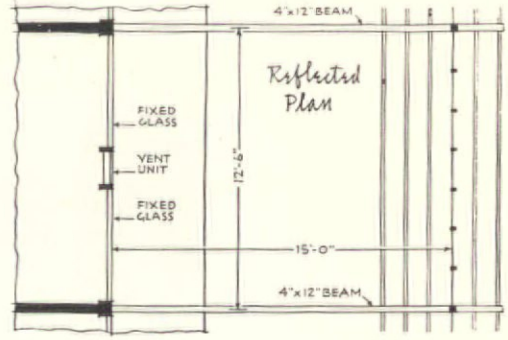
James M. Hunter, Architect

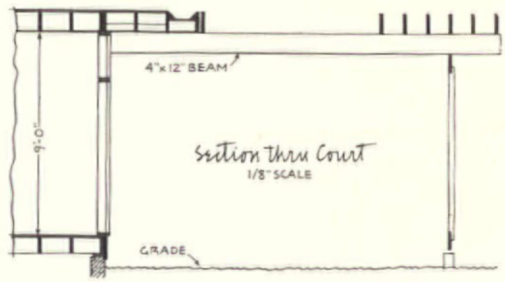
p/a selected detail

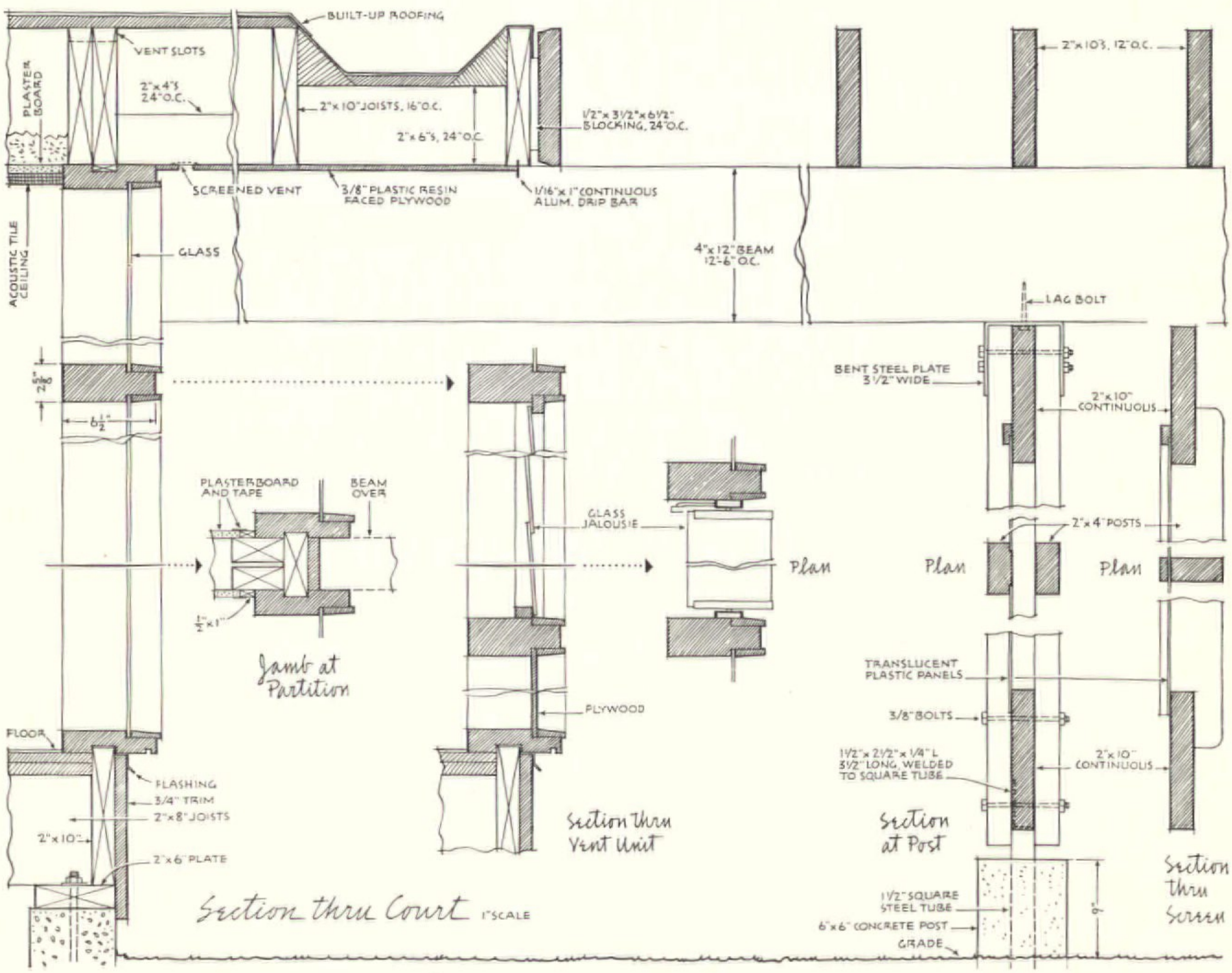
garden court



DEARBORN-MASSAR





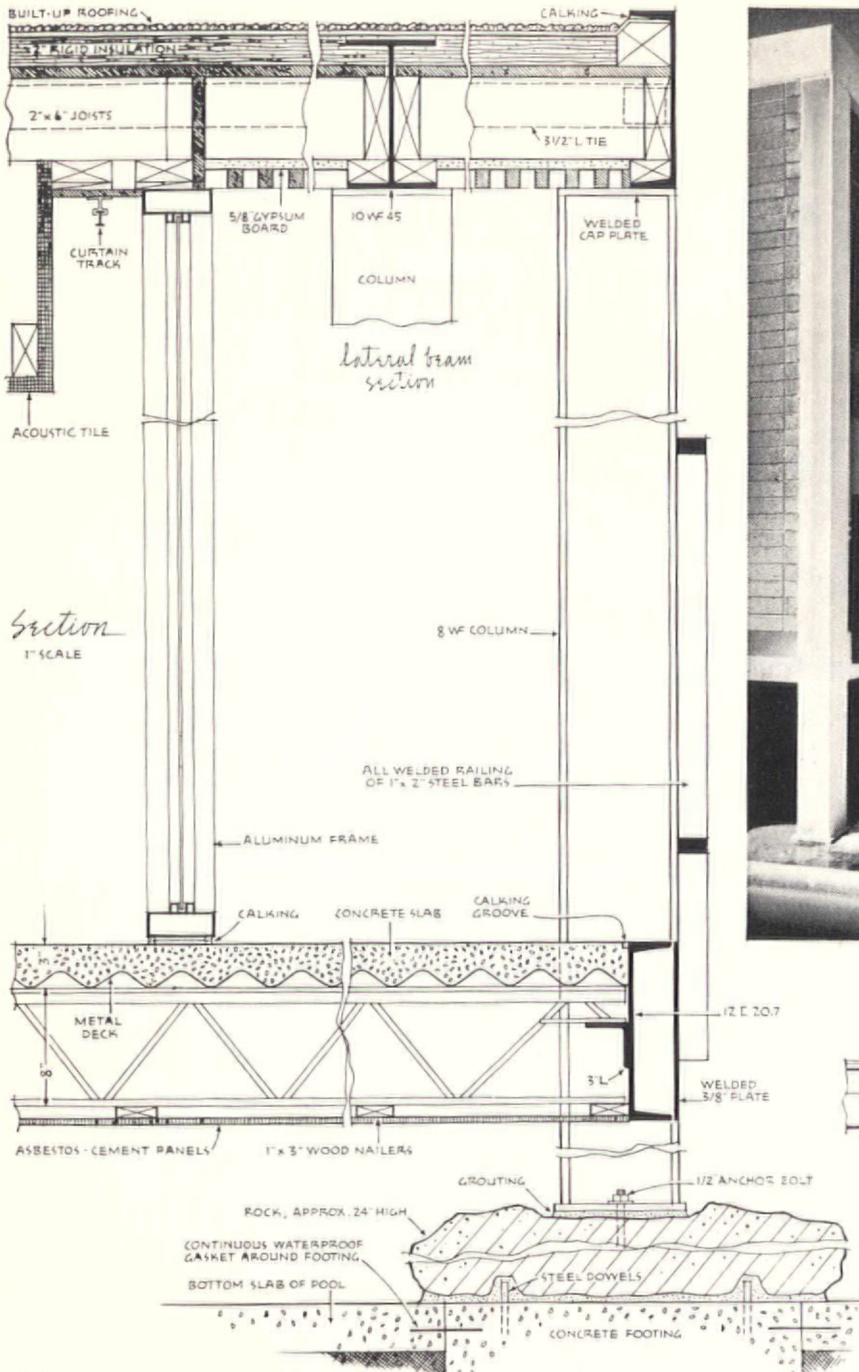


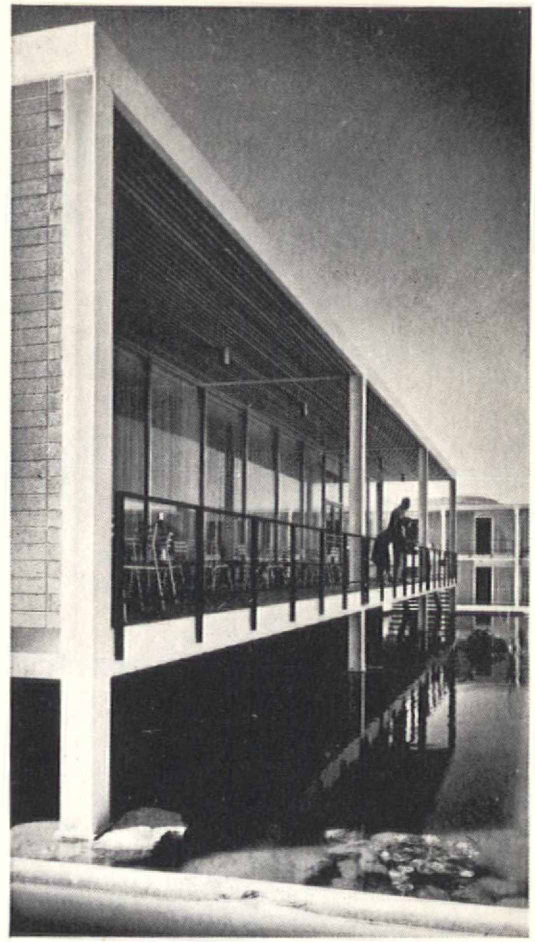
MEDICAL CLINIC, Seattle, Wash.

Paul Hayden Kirk, Architect

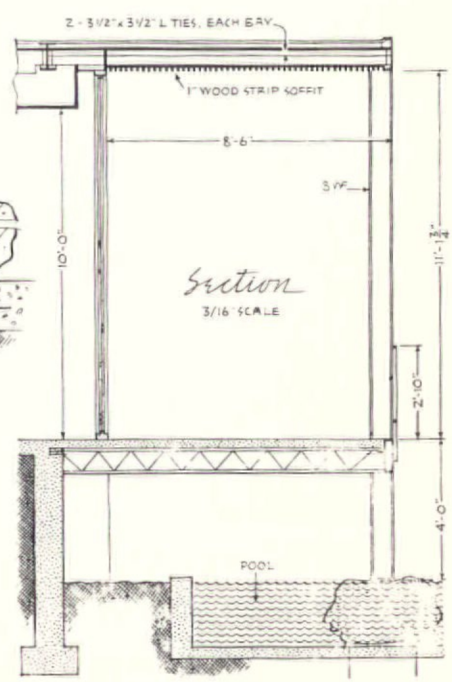
p/a selected detail

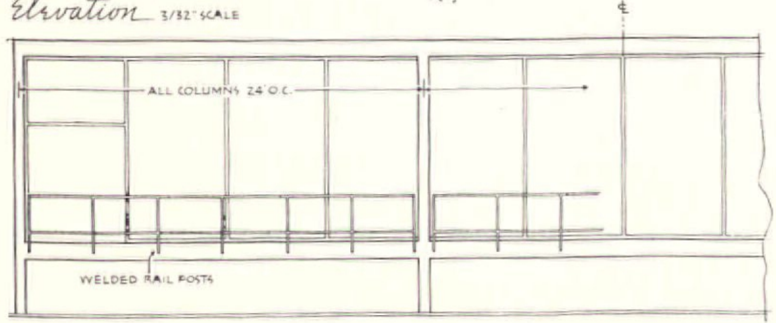
porch





JULIUS SHULMAN



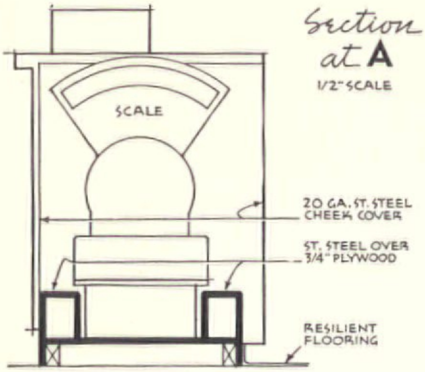


DESERT MOTEL, Tucson, Ariz.

Hausner & Macsai, Architects

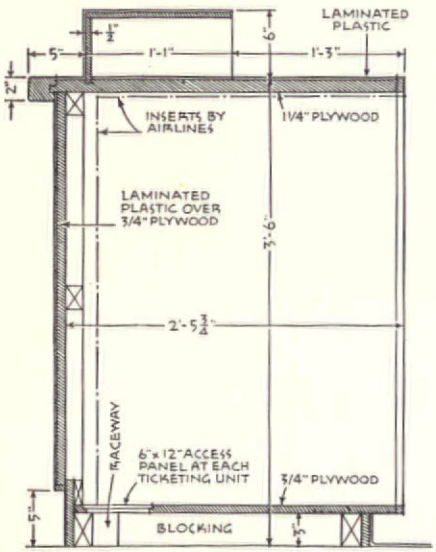
Section 3 DESKS & COUNTERS

TICKET COUNTER — AIRLINE
TELLER'S COUNTER — BANK
TELLER'S COUNTER — BANK
CUSTOMER'S DESK — BANK
CHARGING DESK — LIBRARY

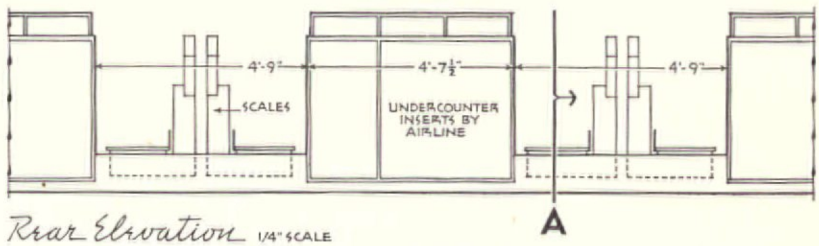


Section at A 1/2" SCALE

ALFRED A. DE LARDI PHOTOS

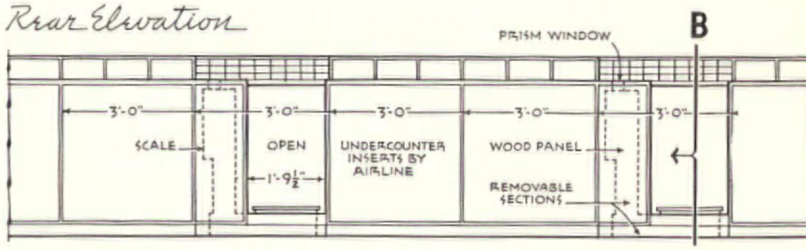


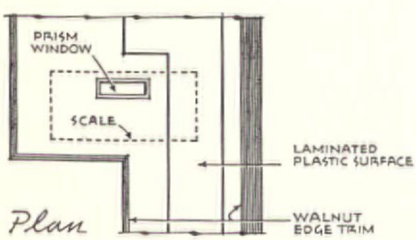
Shell Section 3/4" SCALE



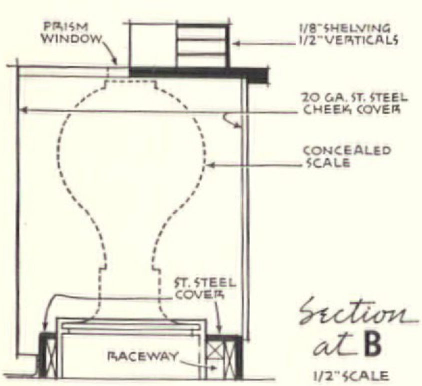
Rear Elevation 1/4" SCALE

Rear Elevation





Plan



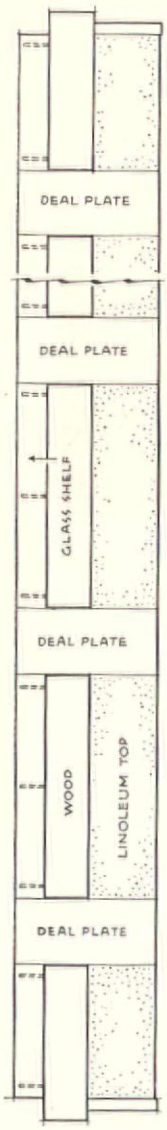
Section at B 1/2" SCALE

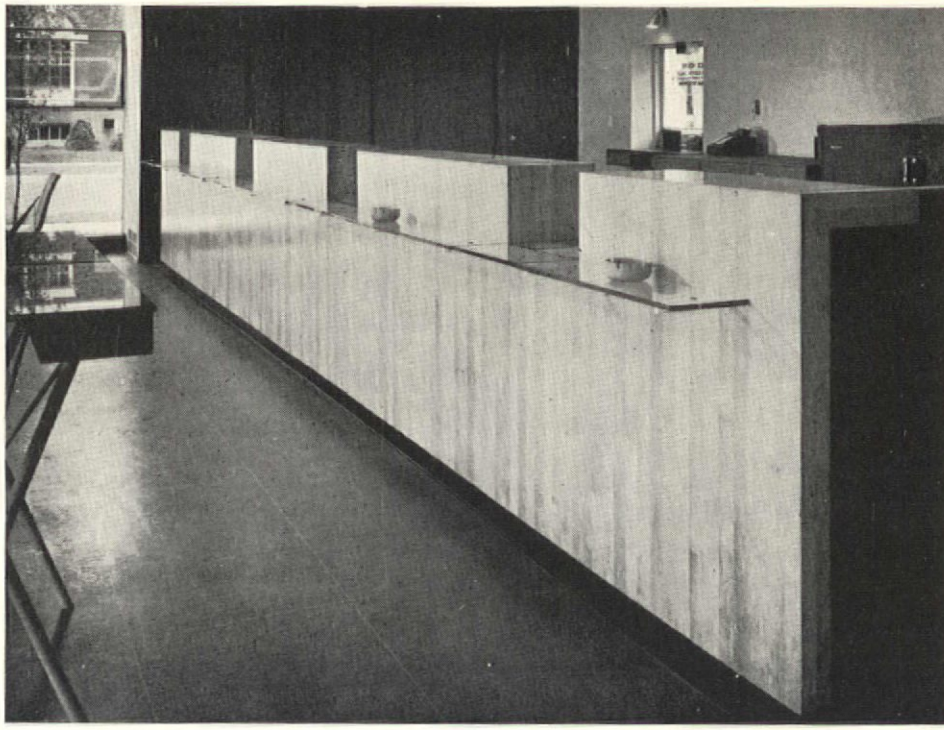
PHILADELPHIA INTERNATIONAL AIRPORT TERMINAL, Philadelphia, Pa.

Carroll, Grisdale & Van Alen, Architects

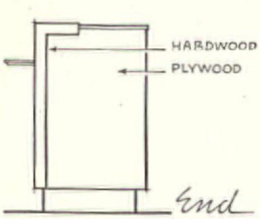
bank: teller's counter

Plan
1/4" SCALE

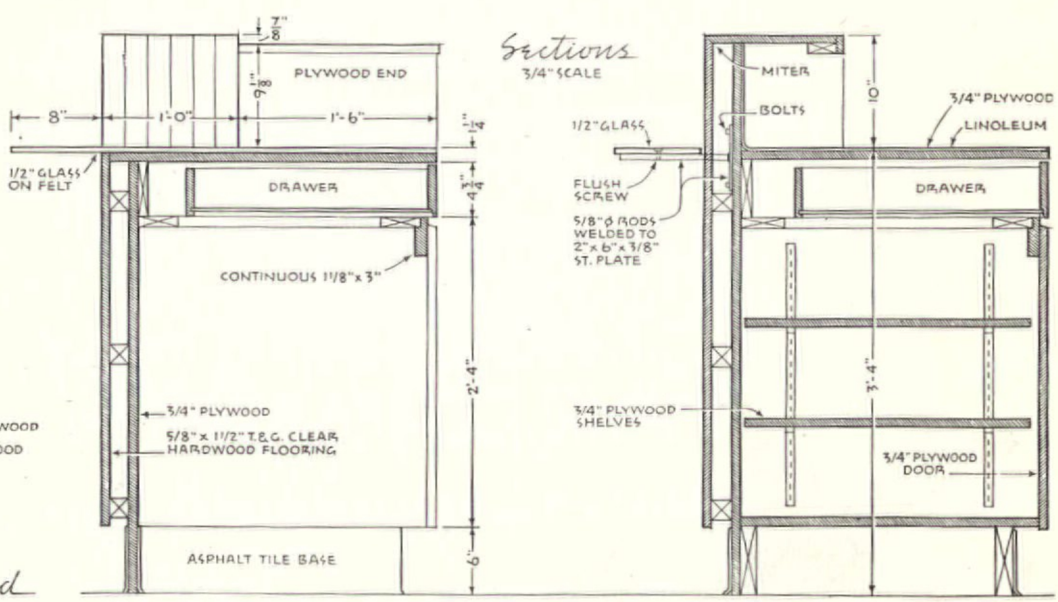




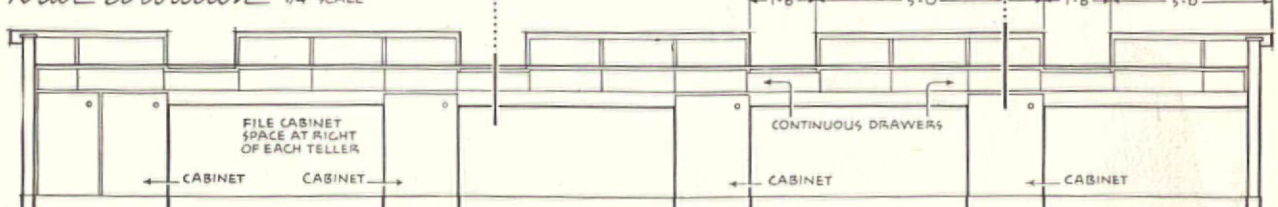
HEDRICH-BLESSING



Sections
3/4" SCALE



Rear Elevation 1/4" SCALE

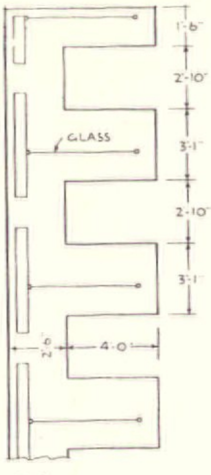


OTTAWA SAVINGS AND LOAN ASSN., Holland, Mich.

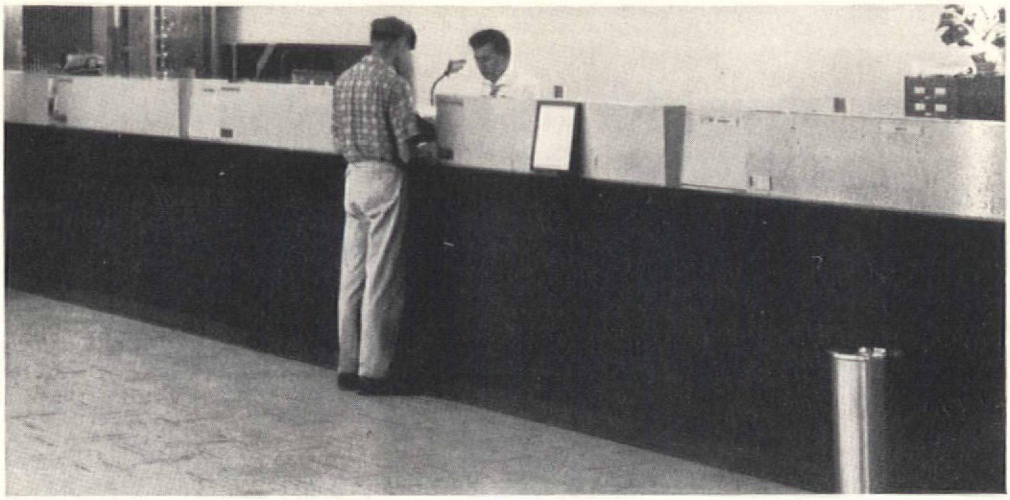
Harry Weese, John Van der Meulen, and Bruce Adams, Architects

p/a selected detail

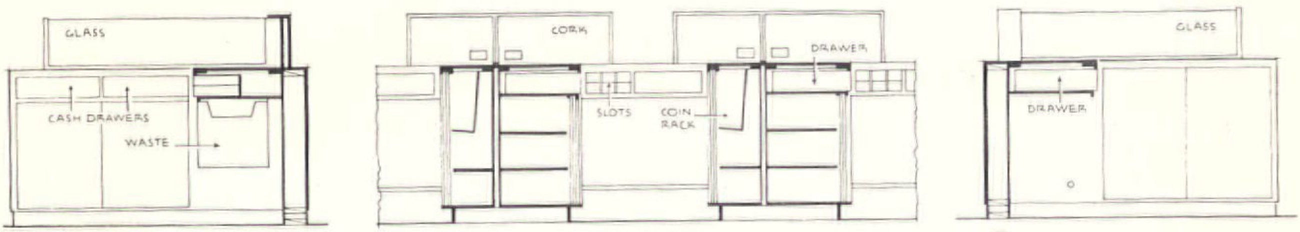
bank counter



Plan 1/8" SCALE

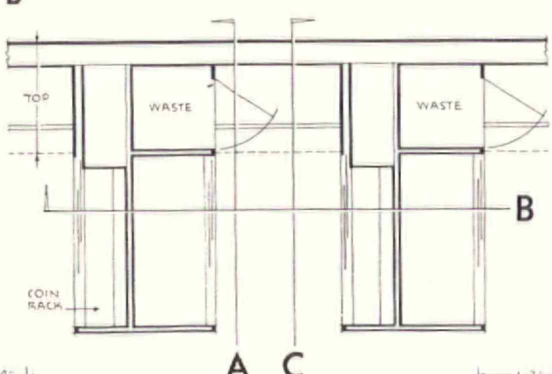


DEARBORN-MASSAR



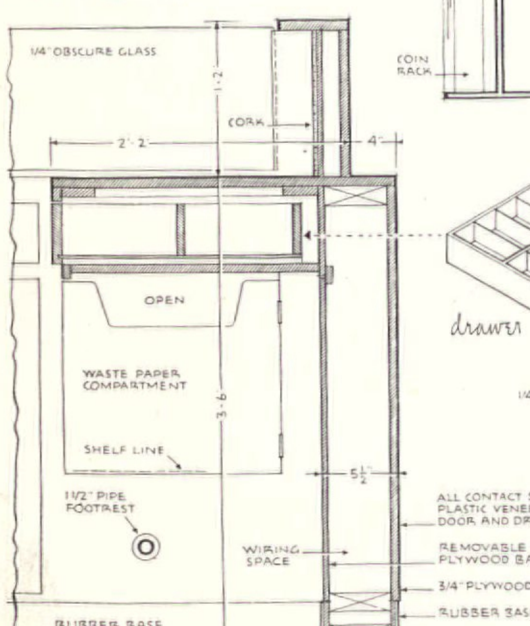
Sections 1/4" SCALE

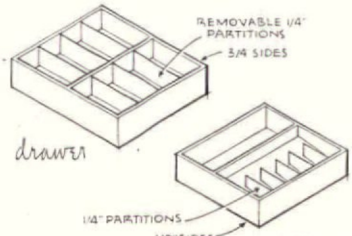
A B C



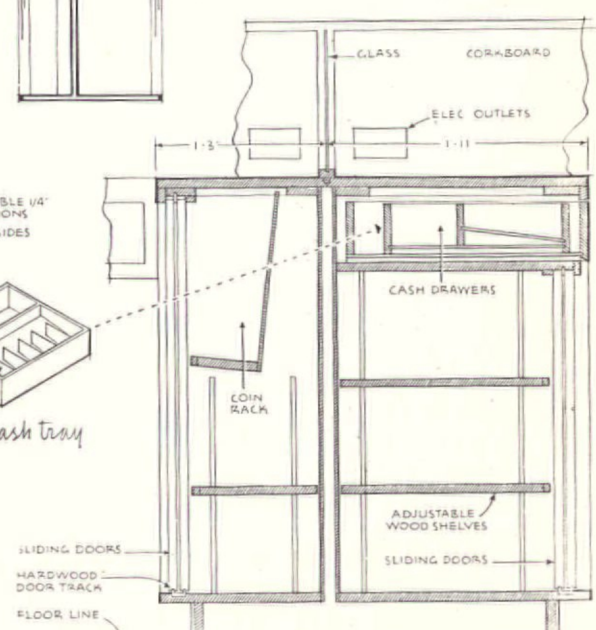
Plan of Undercounter 1/4" SCALE

Section at A 3/4 SCALE





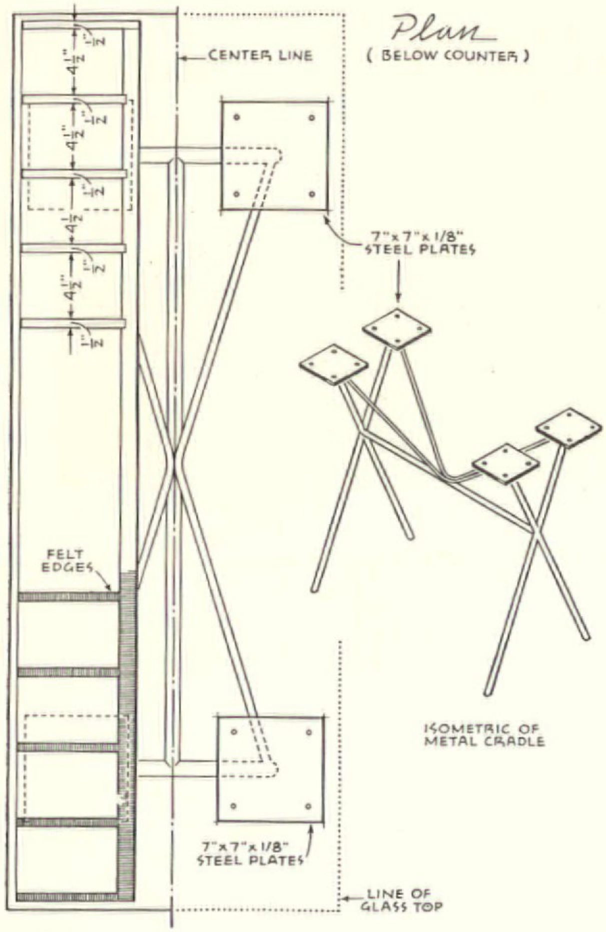
Section at B 3/4 SCALE



INDUSTRIAL BANK, Tacoma, Wash.

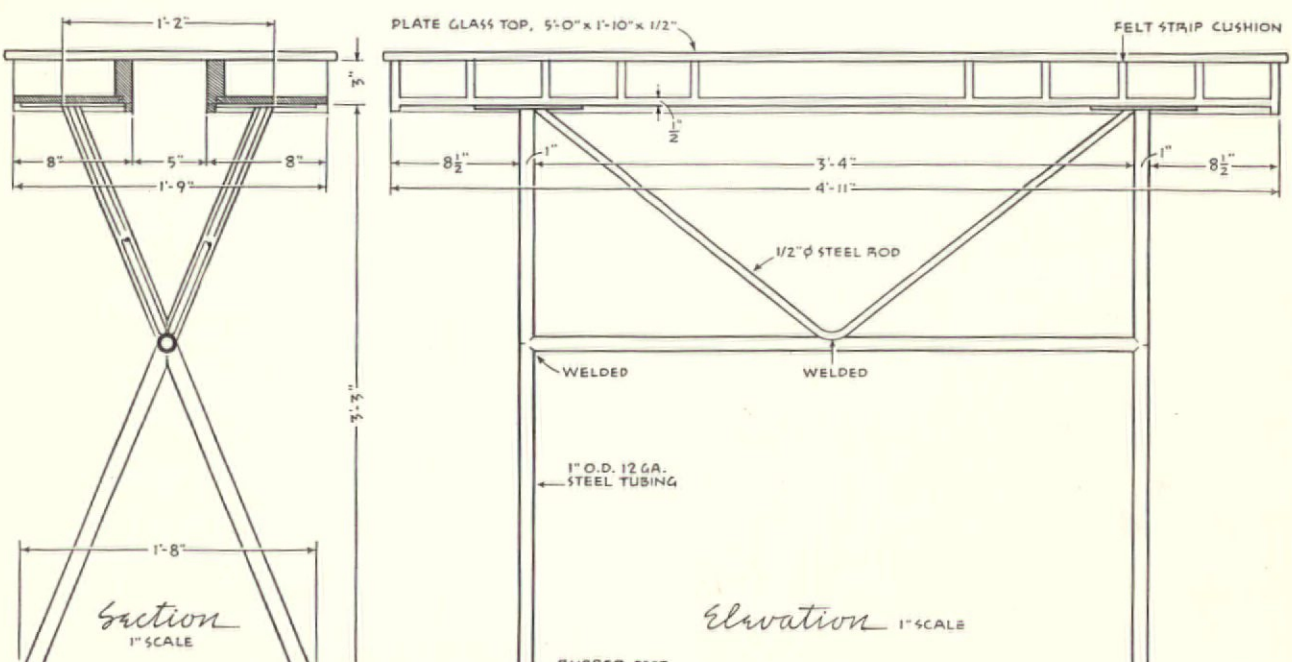
Robert Billsbrough Price, Architect

bank: customers' desk



Plan
(ABOVE COUNTER)

HEDRICH - BLESSING

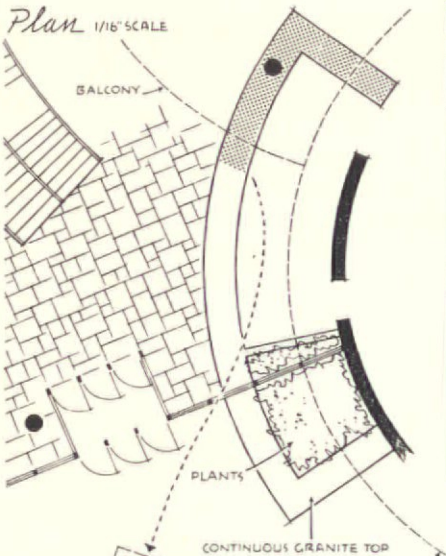


OTTAWA SAVINGS AND LOAN ASSN., Holland, Mich.

Harry Weese, John Van der Meulen, and Bruce Adams, Architects

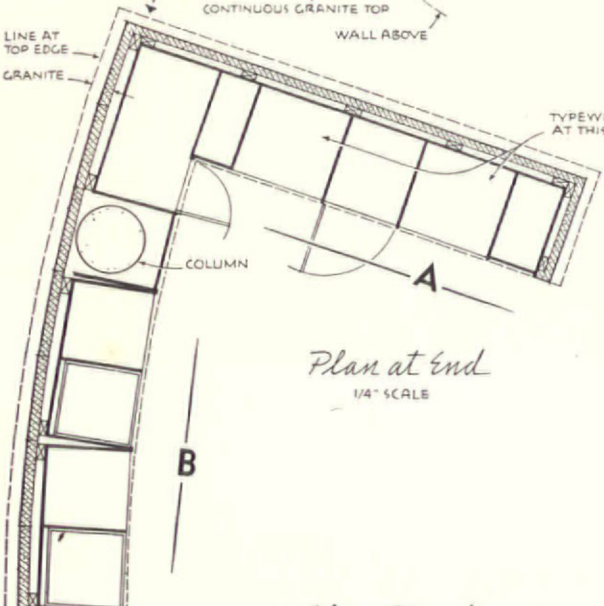
charging desk

Plan 1/16" SCALE

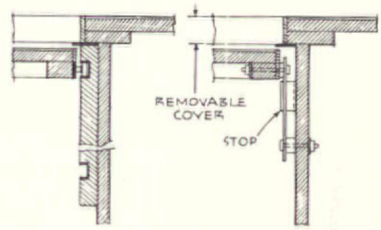


JOSEPH W MOLITOR

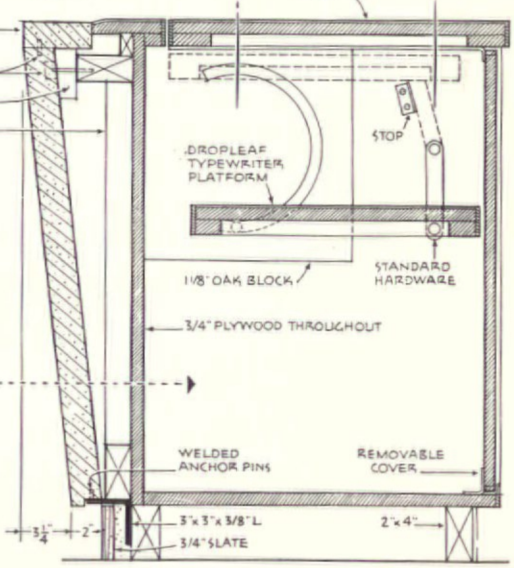
Plan at End 1/4" SCALE



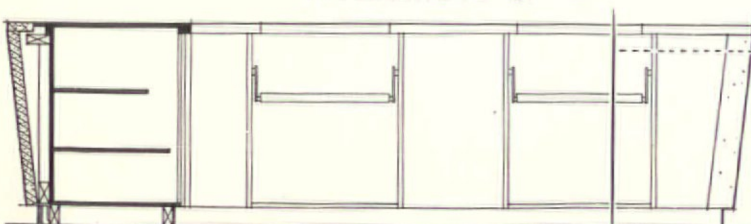
Jambs



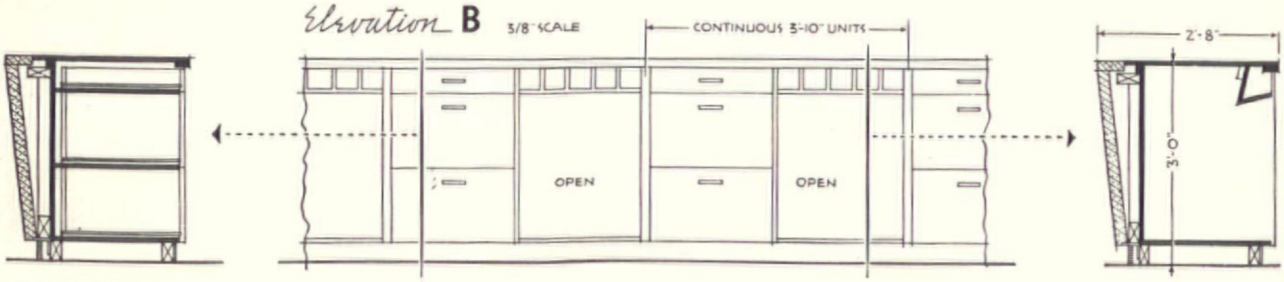
Typical Section 1" SCALE



Elevation A 3/8" SCALE



Elevation B 3/8" SCALE



LIBRARY, Charlotte, N. C.

A. G. Odell, Jr. & Associates, Architects

Section 4 DISPLAY UNITS

DISPLAY WALL — PHOTOGRAPHY SALON

DISPLAY UNIT — NEWS AGENCY

DISPLAY CASES — SILVER SHOP

DISPLAY CASES — MUSEUM

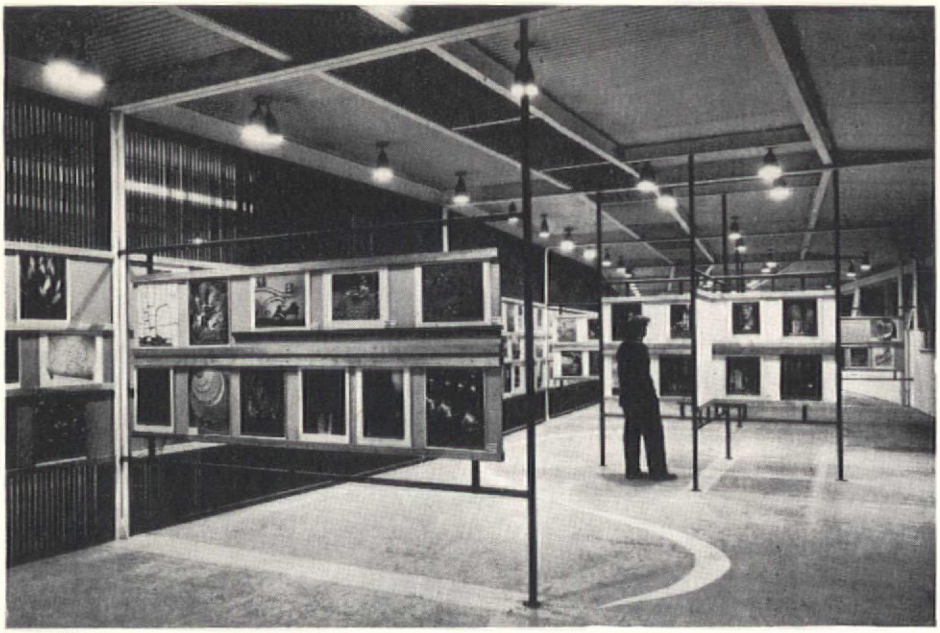
DISPLAY CASES — DEPARTMENT STORE

DISPLAY CASES — DEPARTMENT STORE

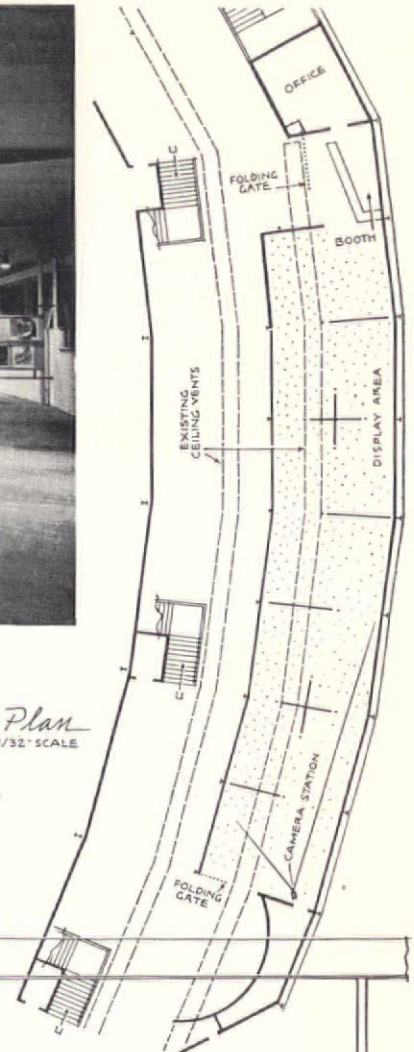
DISPLAY SIGNS — OUTDOOR

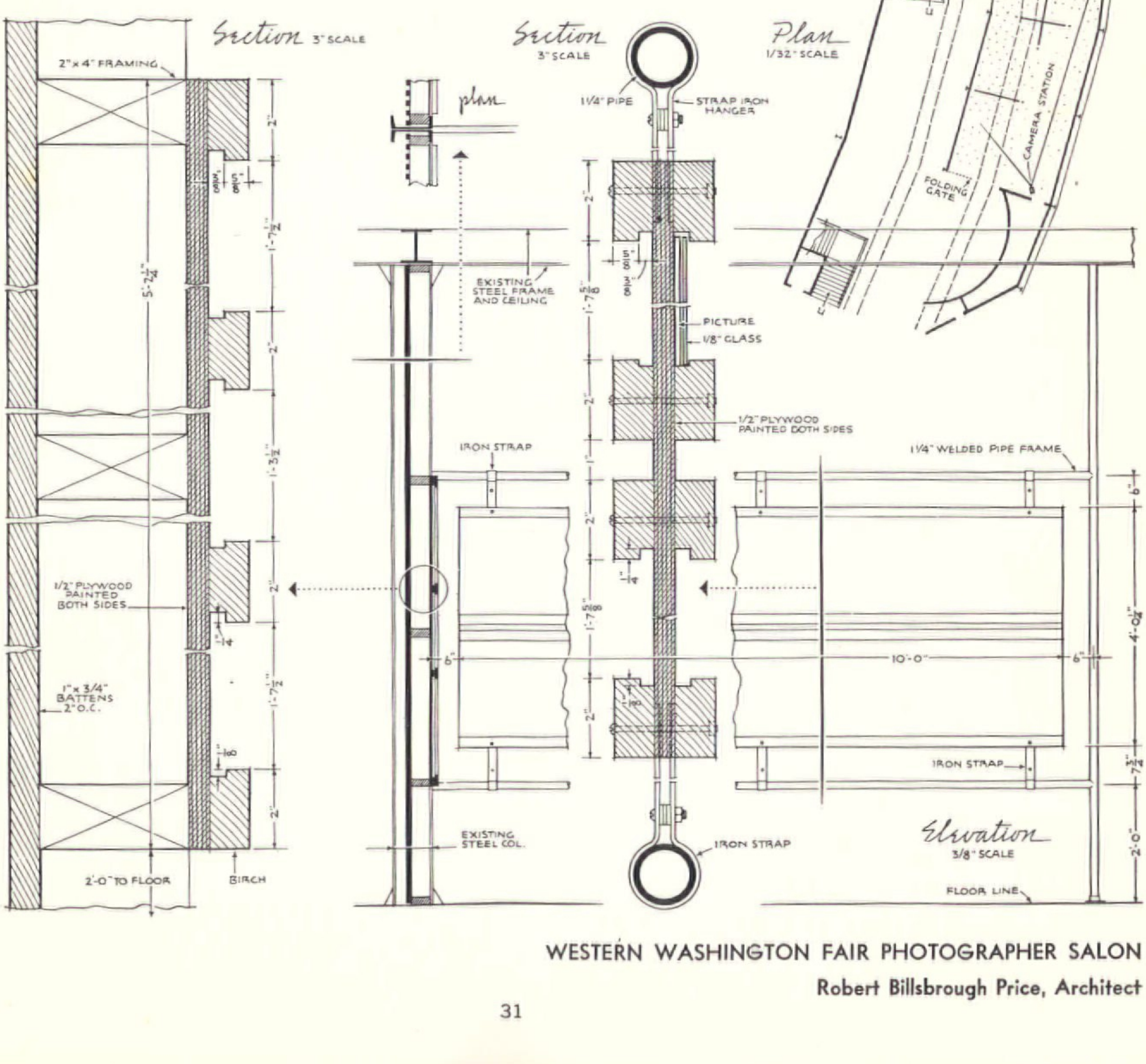
p/a selected detail

display wall



DEARBORN-MASSAR

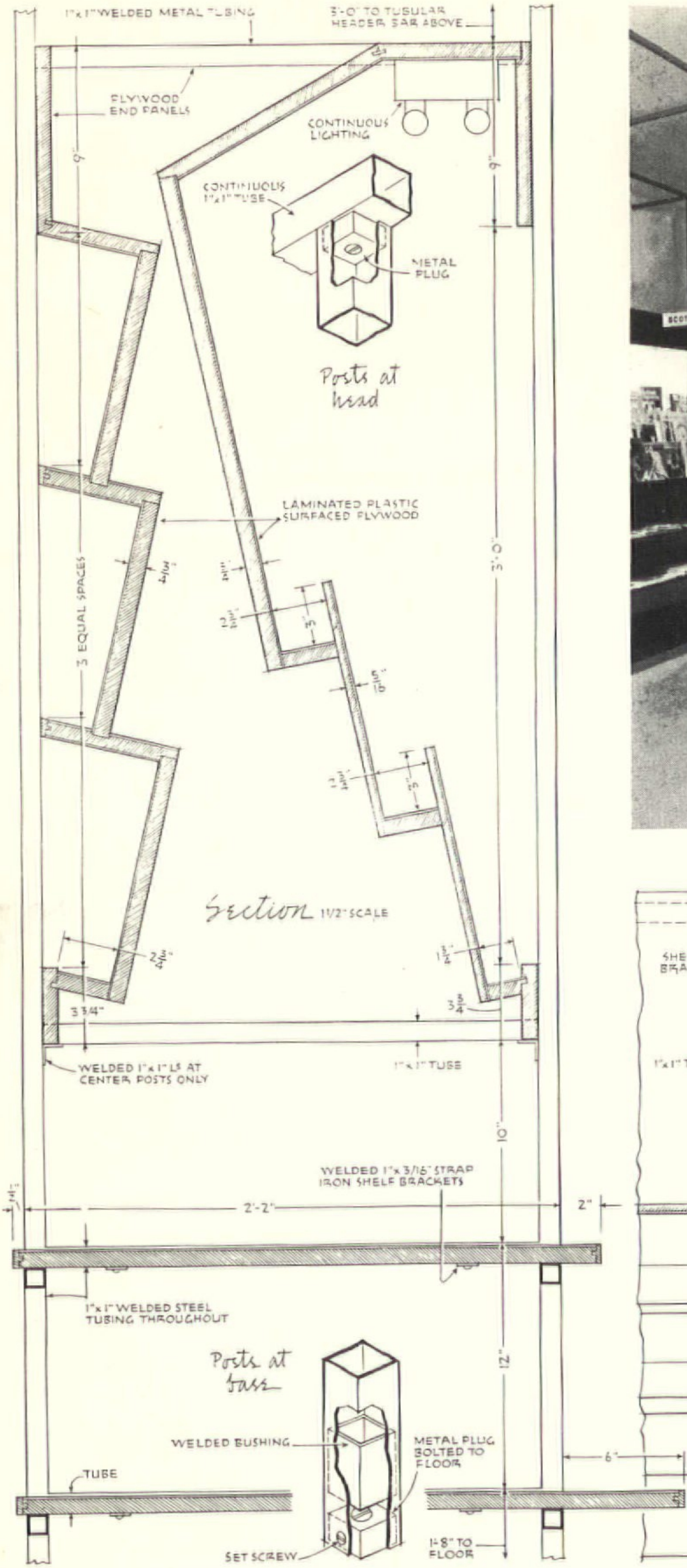




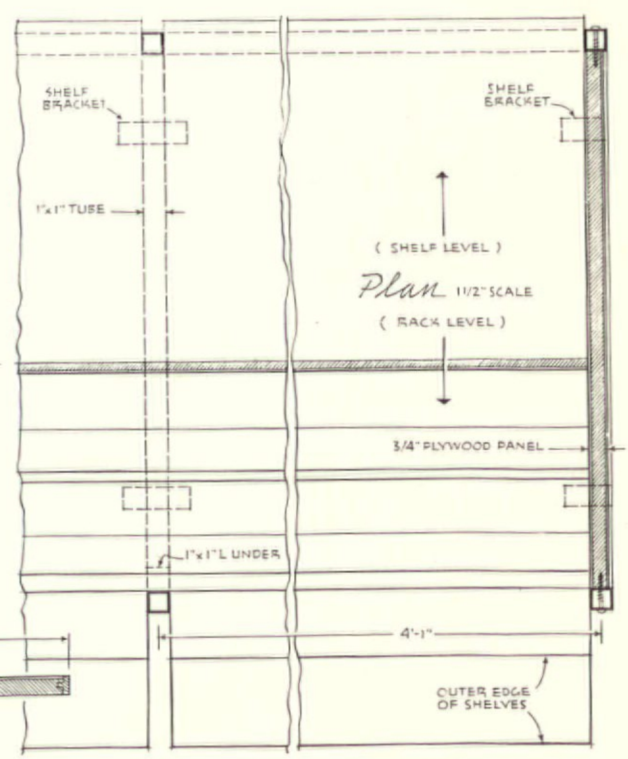
WESTERN WASHINGTON FAIR PHOTOGRAPHER SALON

Robert Billsbrough Price, Architect

display unit



BEN SCHNALL

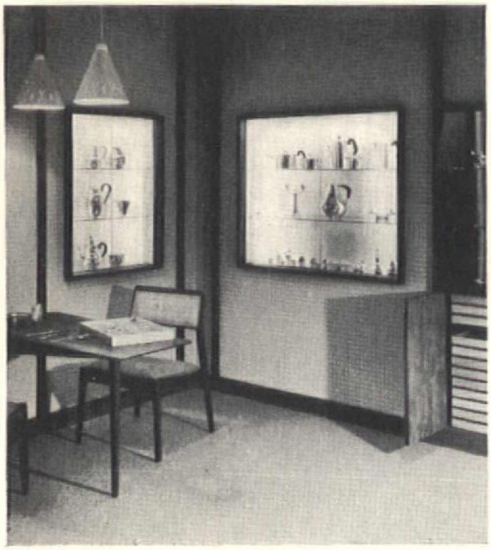


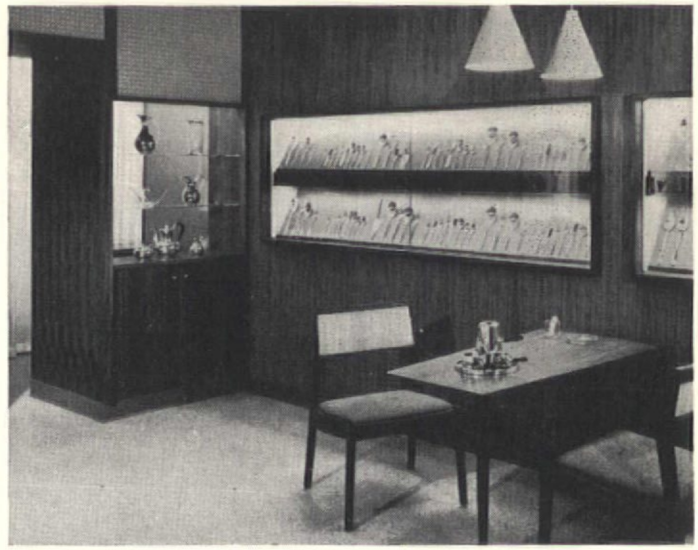
NEWS AGENCY, New York, N. Y.

Hansen & Thuesen Inc., Designers

p/a selected detail

display cases





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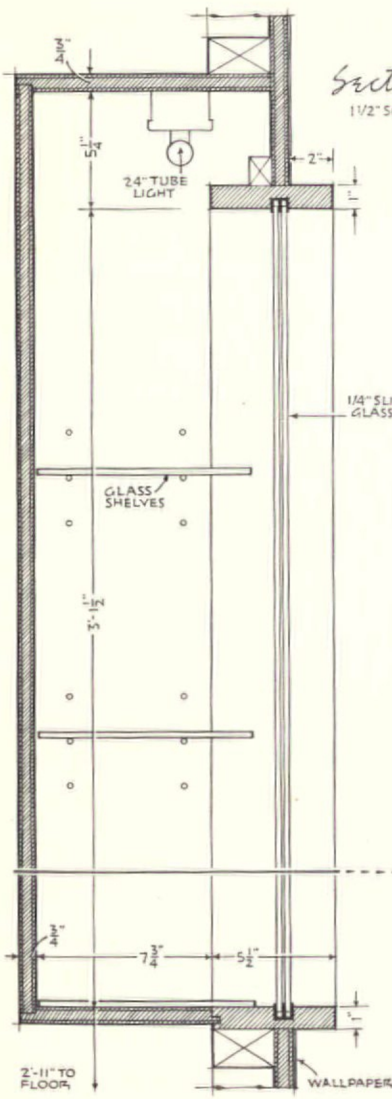
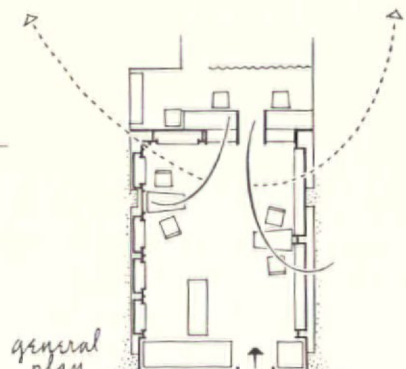
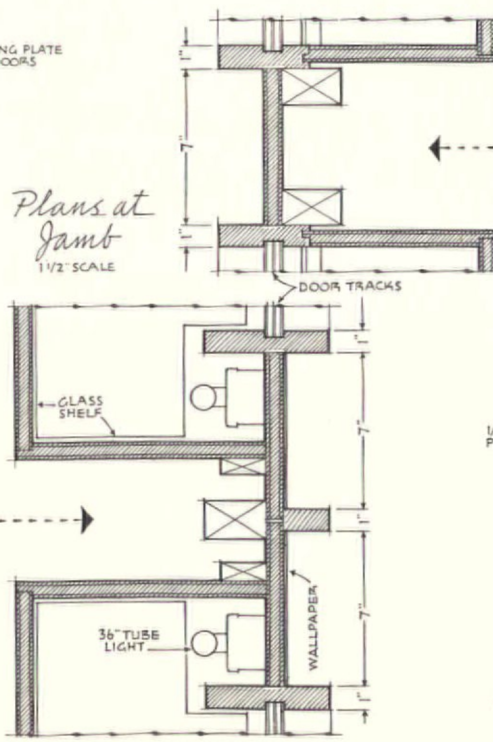
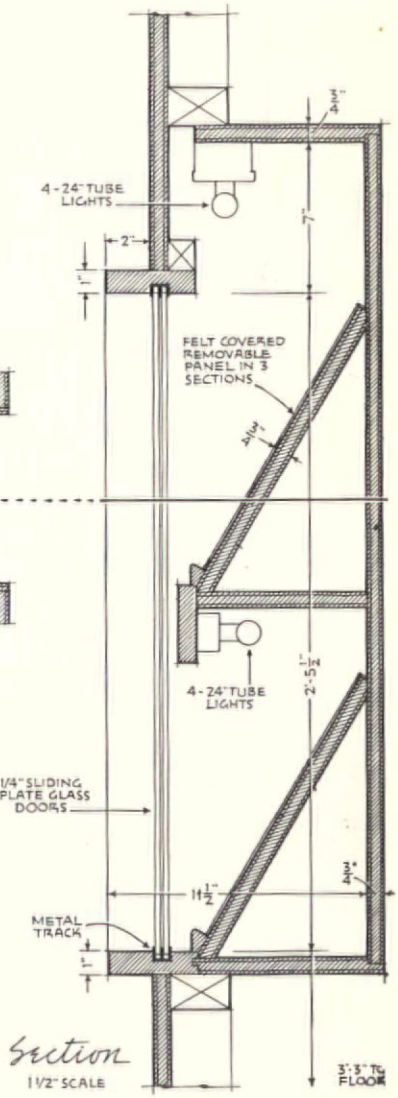


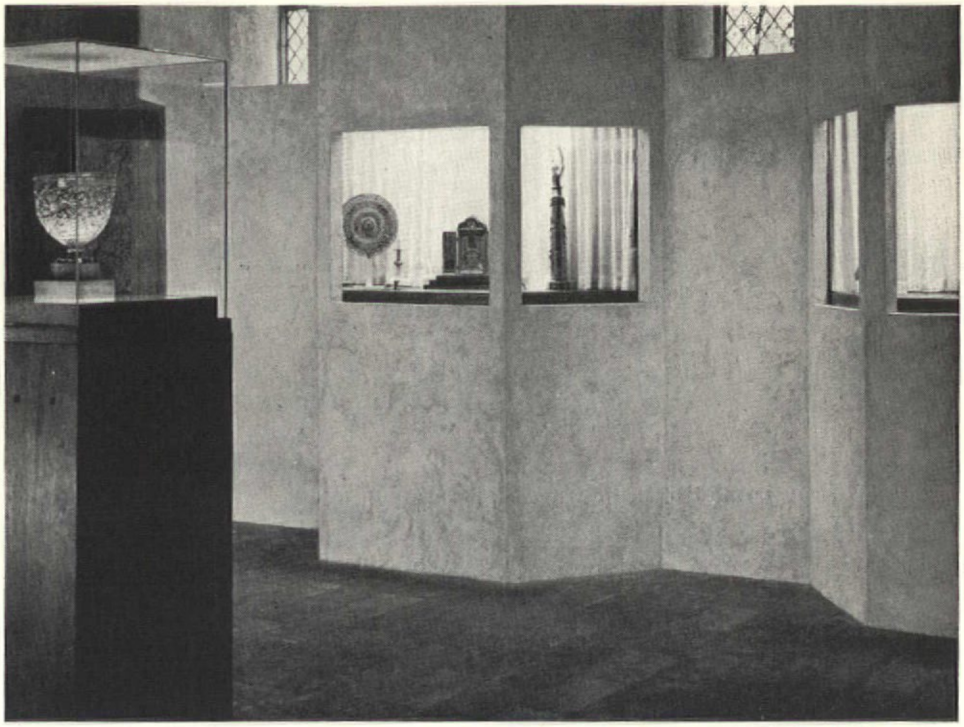


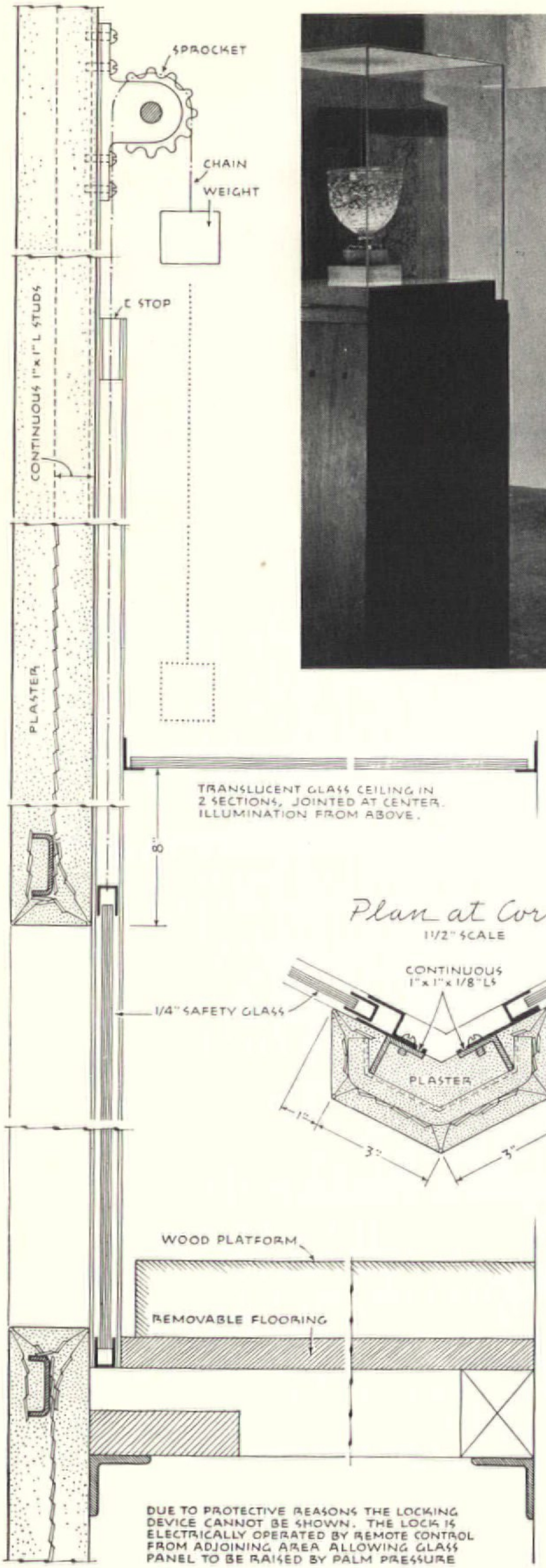




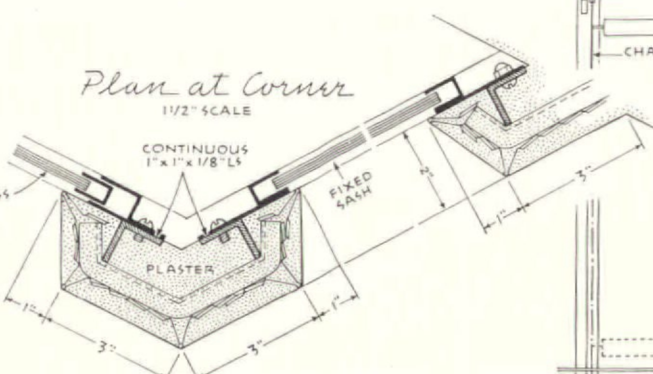
SILVER SHOP, New York, N. Y.
Hansen & Thuesen, Inc., Designers

museum: display case

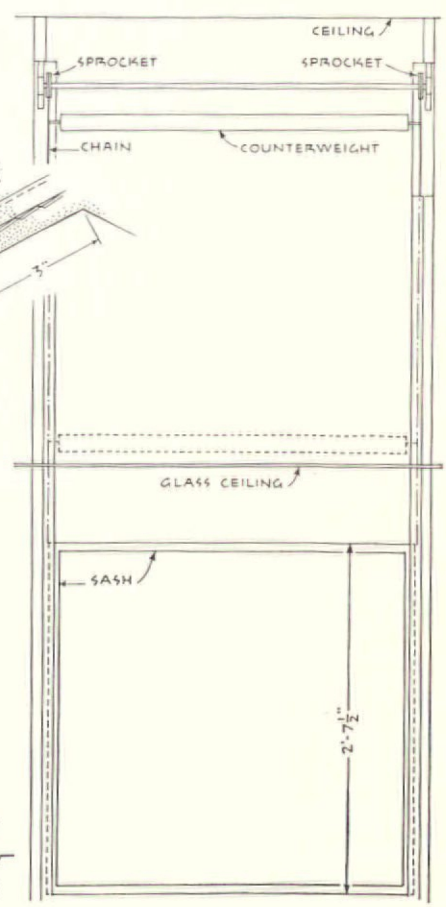

COURTESY OF THE METROPOLITAN MUSEUM OF ART



Section
1/2" SCALE



Plan at Corner
1/2" SCALE

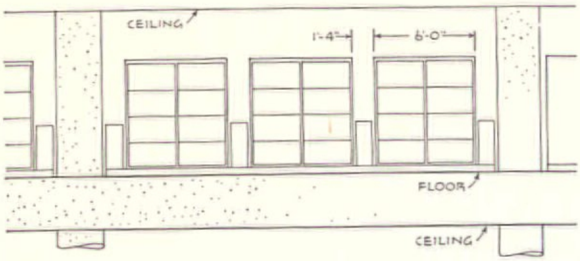


Sliding Window
(FROM REAR)

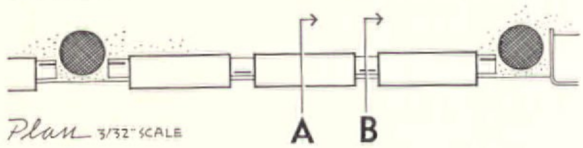
THE CLOISTERS, New York, N. Y.

James J. Rorimer, Case Designer

display case



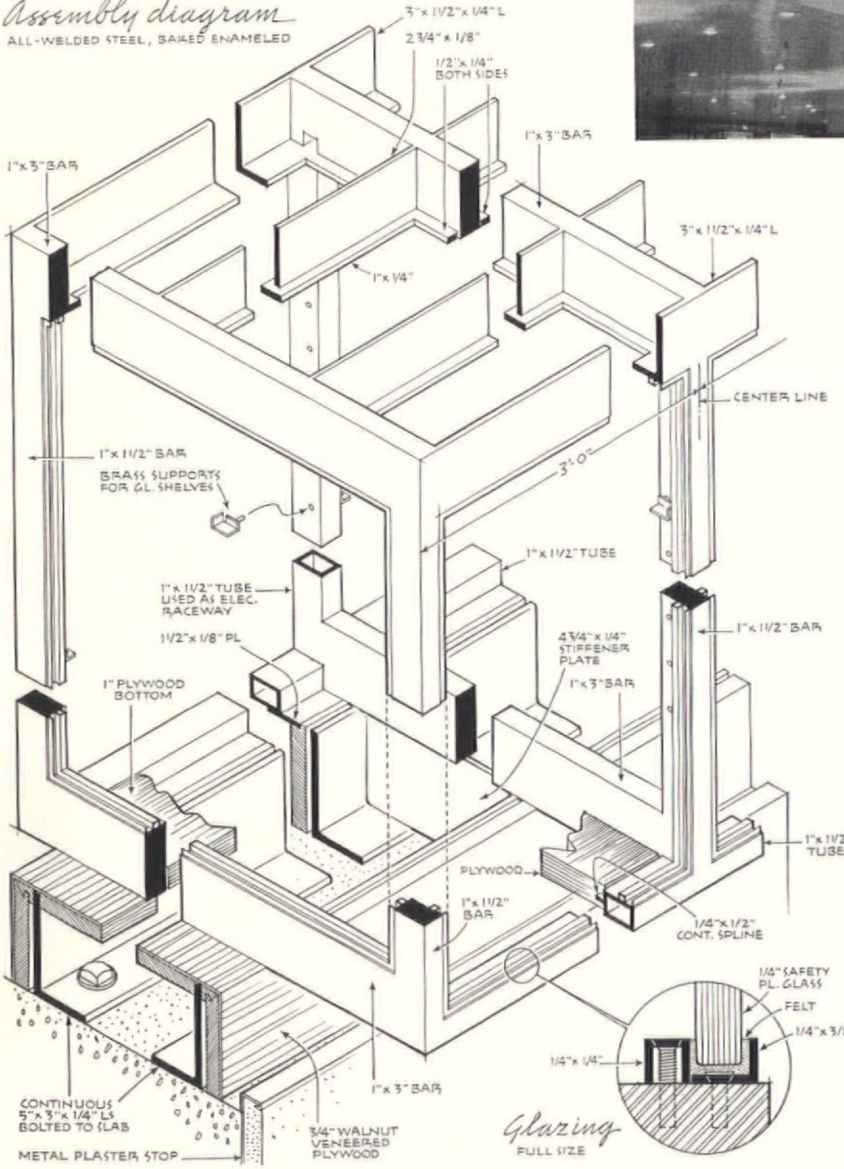
Elevation

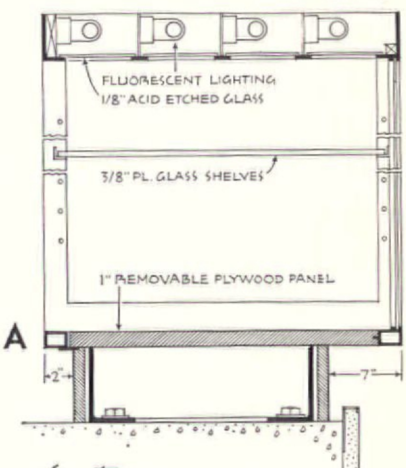


Plan 3/32" SCALE

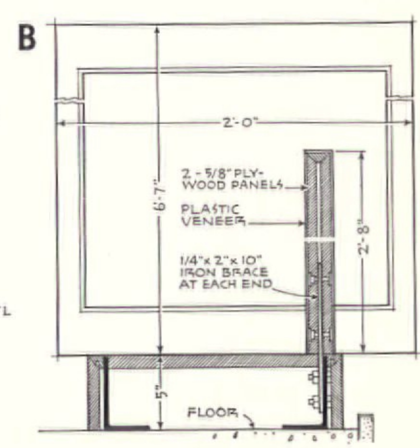
WARREN REYNOLDS

Assembly diagram
ALL-WELDED STEEL, BAKED ENAMELED

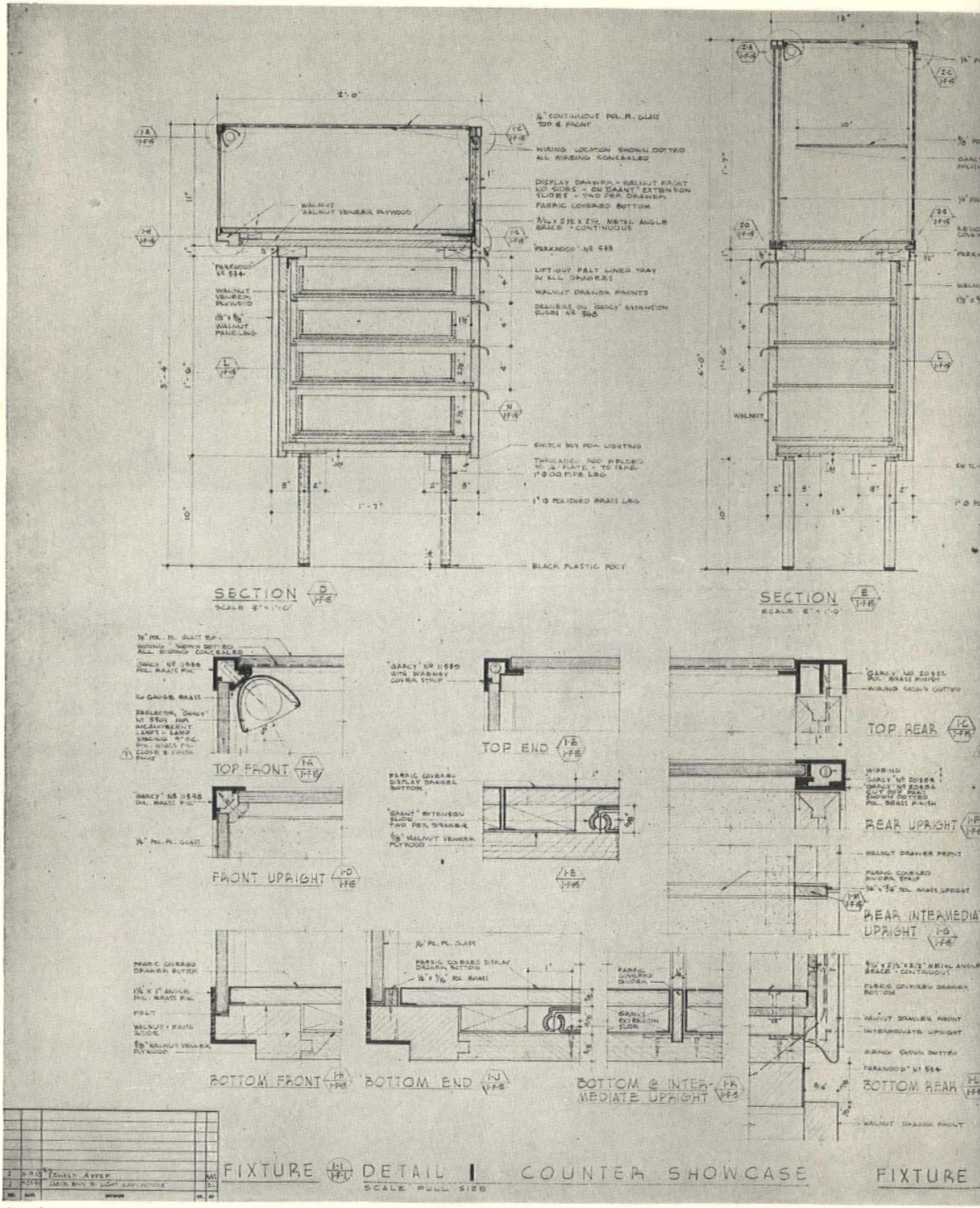




Sections 1" SCALE

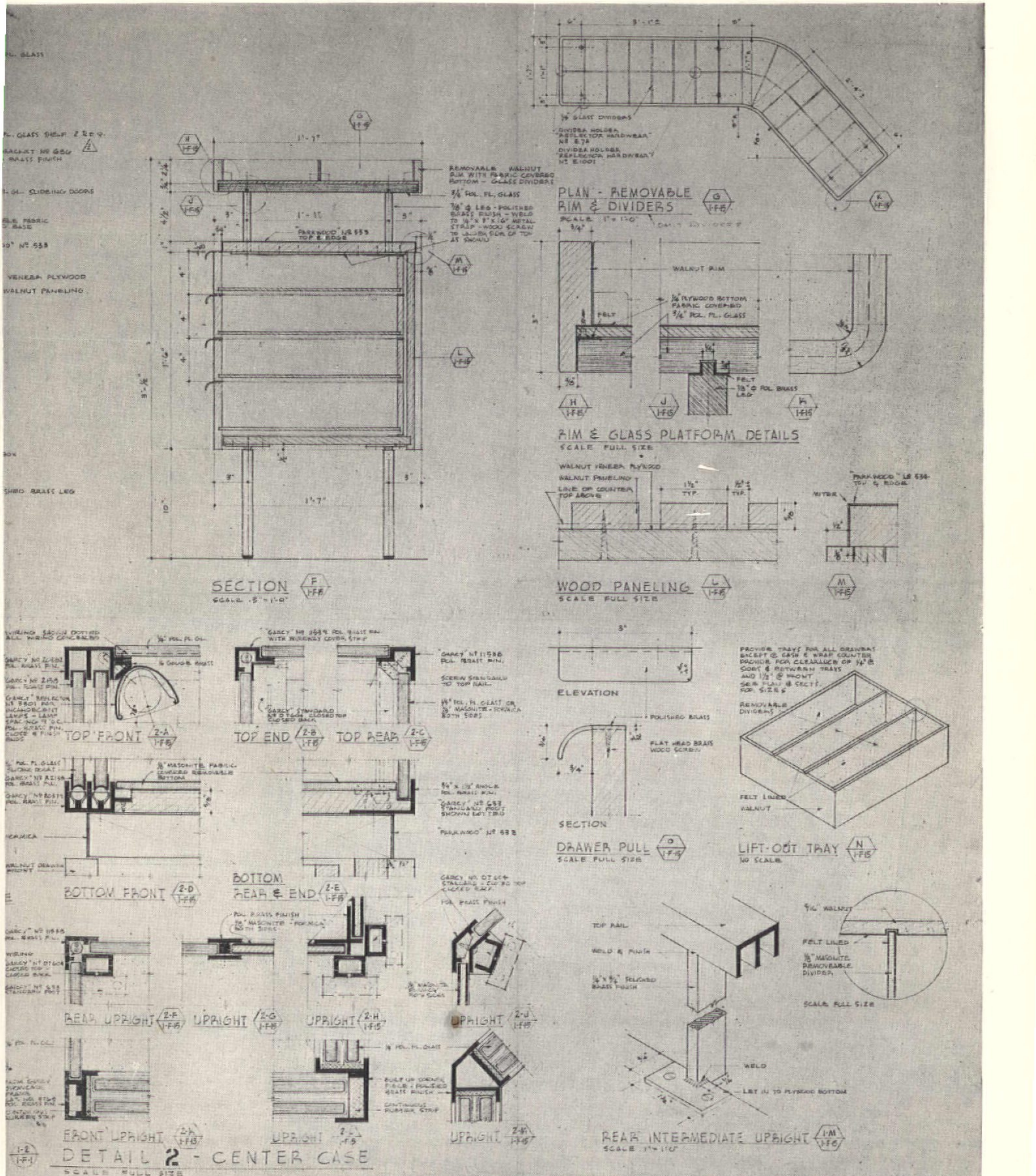


DEPARTMENT STORE, Rochester, Minn.
Victor Gruen, Architect
Rudolf L. Baumfeld, Associate-in-Charge
Larson & McLaren, Associated Architects



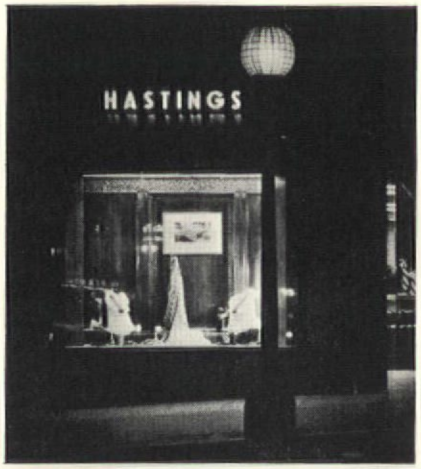
display cases: Department Store, Rochester Minn.

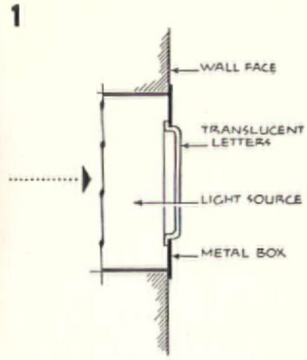
Victor Gruen, architect



Rudolf L. Baumfeld, associate-in-charge; Larson & McLaren, associated architects

1





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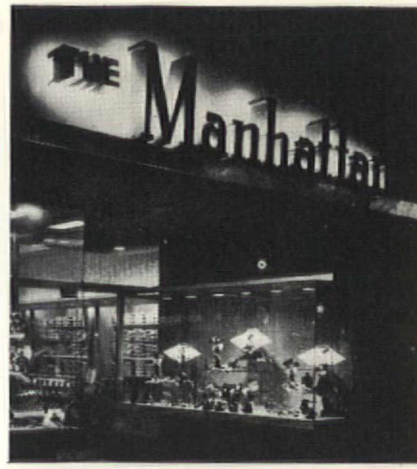

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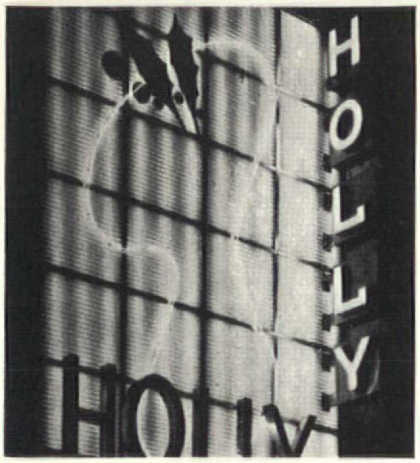
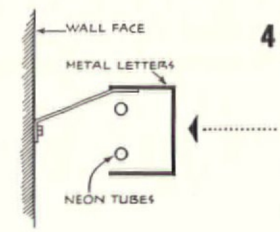
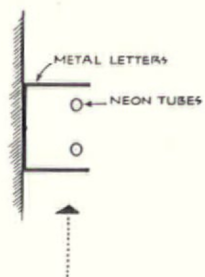


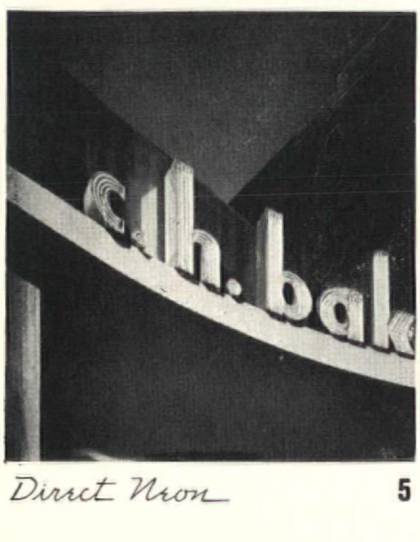


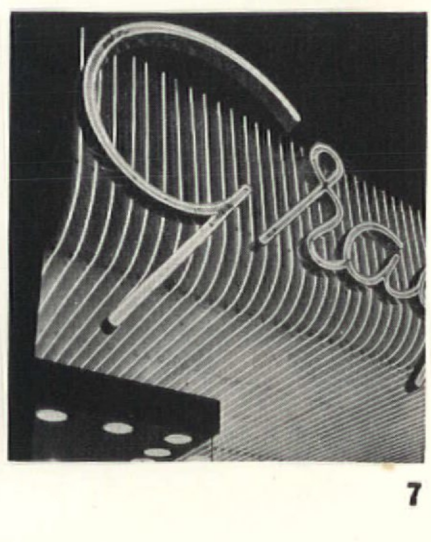
4

Translucent

Indirect Neon







Direct Neon

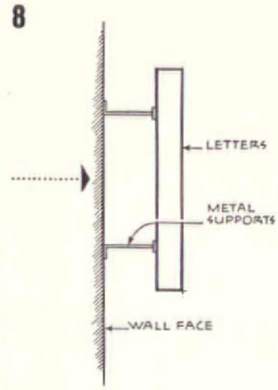
5

6

7

1 Hastings Men's Store, San Francisco, California: Gruen & Krummeck, architects. Philip Fein Photo. **2** Holly Women's Store, Baton Rouge, Louisiana: Morris Lapidus, architect. Rohm & Haas Photo. **3** Manhattan Men's Store, New York City: Morris Lapidus, architect. Gottscho-Schleisner Photo. **4** Joseph Magnin Store, Sacramento, California: Gruen & Krummeck, architects. Roger Sturtevant Photo. **5** C. H. Baker Shoe Store, San Francisco, California: Gruen & Krummeck, architects. Roger Sturtevant Photo. **6** Stan Hall Men's Store, Los Angeles, California: Gruen & Krummeck, architects. Garber-Sturges Photo. **7** Gray Sons Women's Store, Hollywood, California: Gruen & Krummeck, architects. Harry H. Baskerville, Jr. Photo.

8



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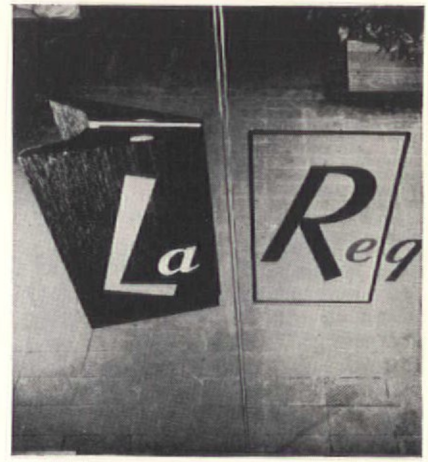

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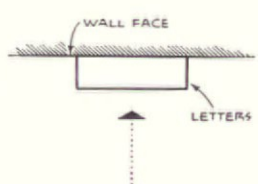
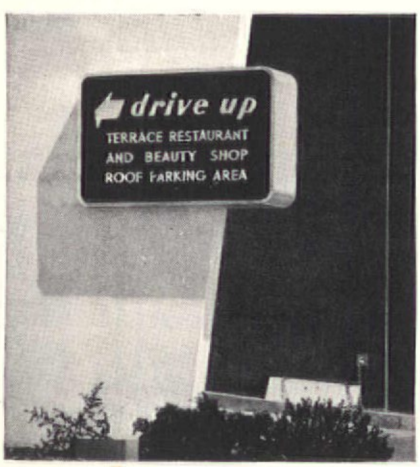
Projected Block



11

Brush Stroke



Applied Block

12

13

14

8 Grayson's Children's Store, Los Angeles, California: Gruen & Krummeck, architects. Harry H. Baskerville, Jr. Photo. **9** John Forsythe Men's Store, New York City: Morris Lapidus, architect. Gottscho-Schleisner Photo. **10** La Regina Women's Store, New York City: Joseph & Vladeck, architects, Ben Schnall Photo. **11** C. H. Baker Shoe Store, San Francisco, California: Gruen & Krummeck, architects. Roger Sturtevant Photo. **12, 13, 14** Milliron's Department Store, Los Angeles, California: Gruen & Krummeck, architects. Julius Shulman Photo.

Section 5 FIREPLACES

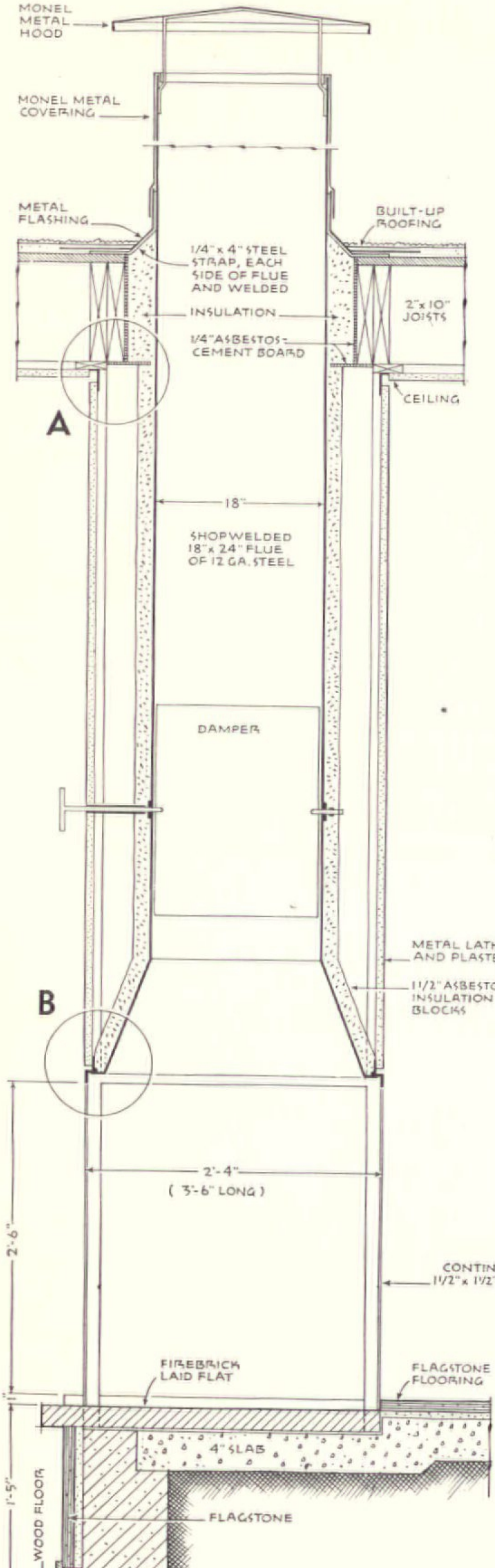
HOUSE

COMMUNITY CENTER

SCOUT LODGE

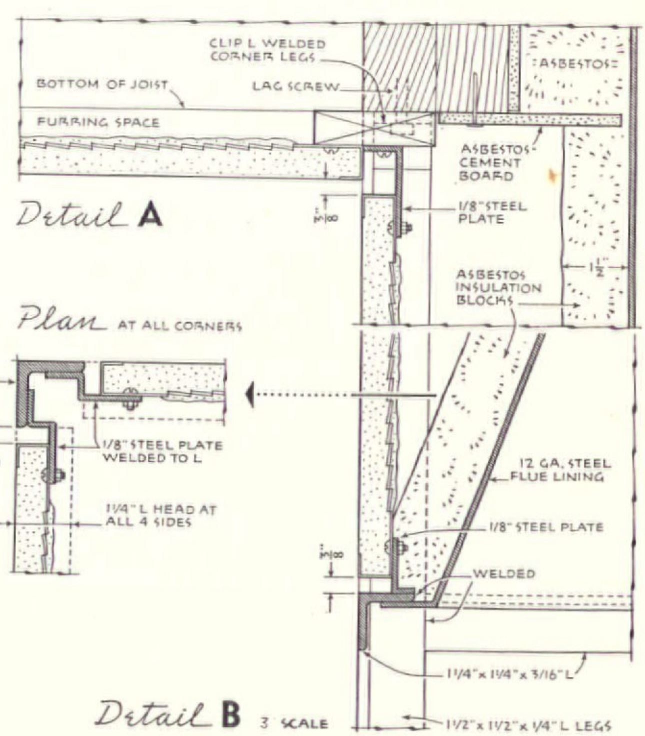
GIRLS' CAMP

house: fireplace



Section 3/4" SCALE

LIONEL FREEDMAN



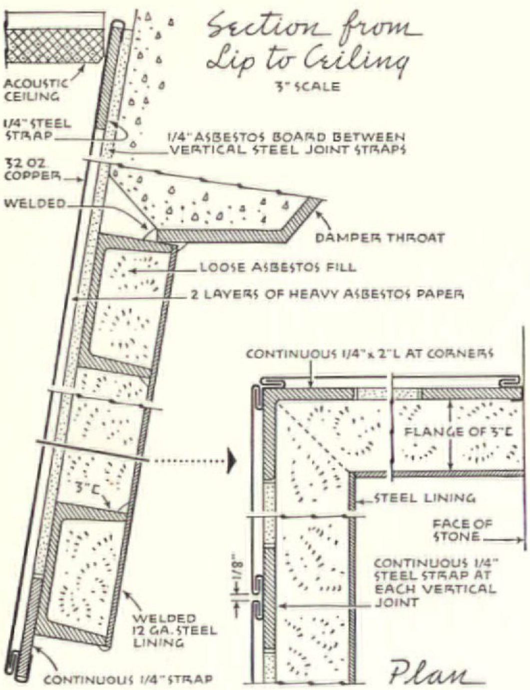
Detail **A**

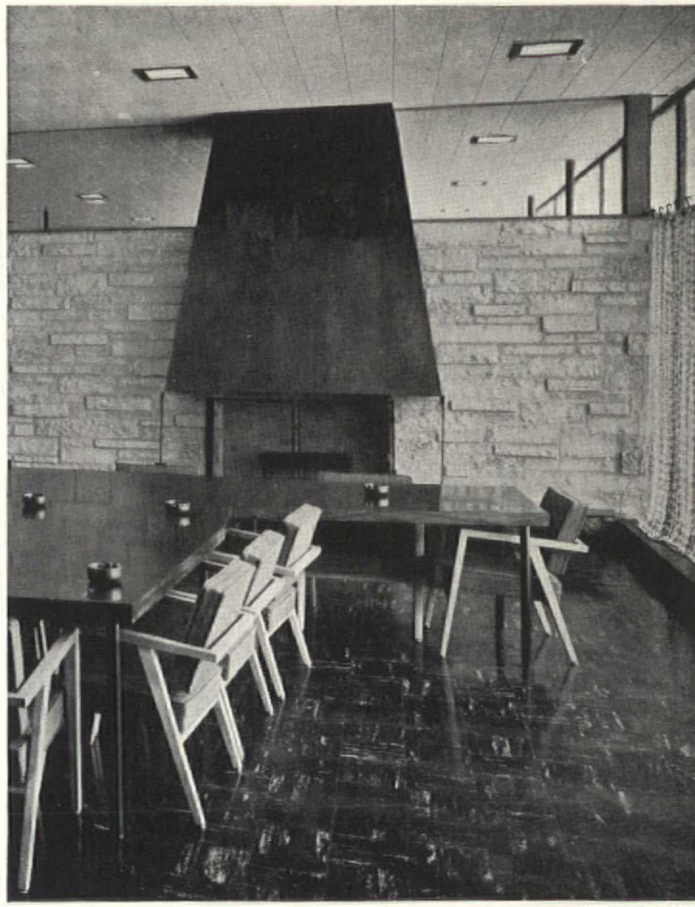
Plan AT ALL CORNERS

Detail **B** 3" SCALE

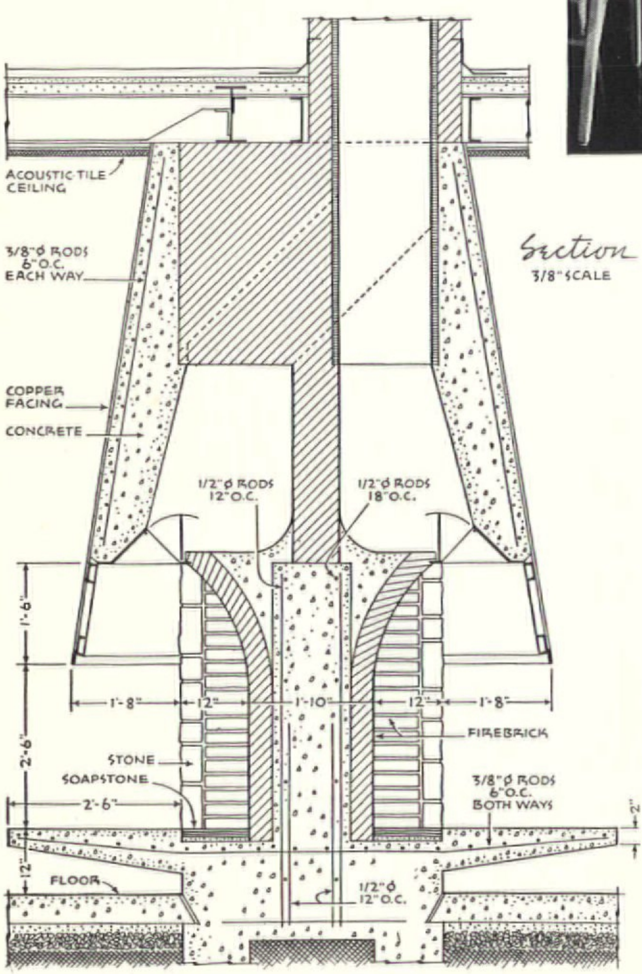
GOLDSTEIN HOUSE, Bloomfield Township, Mich.
Leinweber, Yamasaki & Hellmuth, Architects

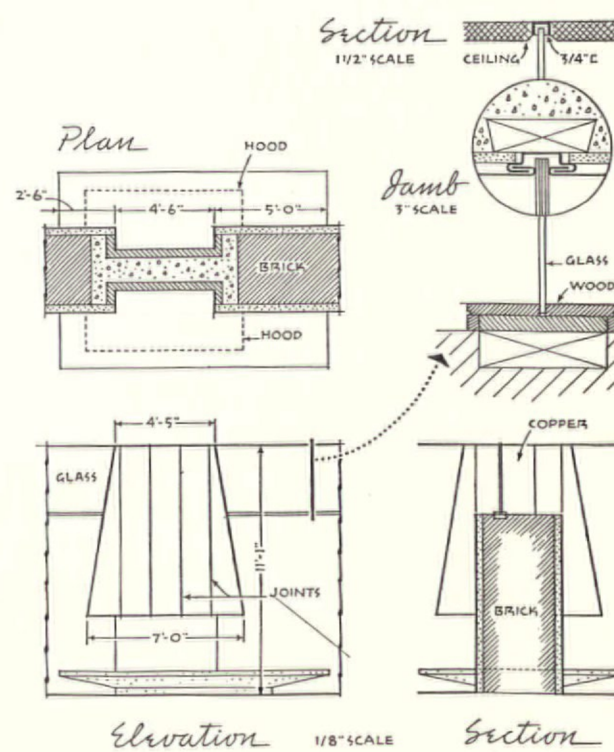
recreational building: fireplace





HEDRICH - BLESSING





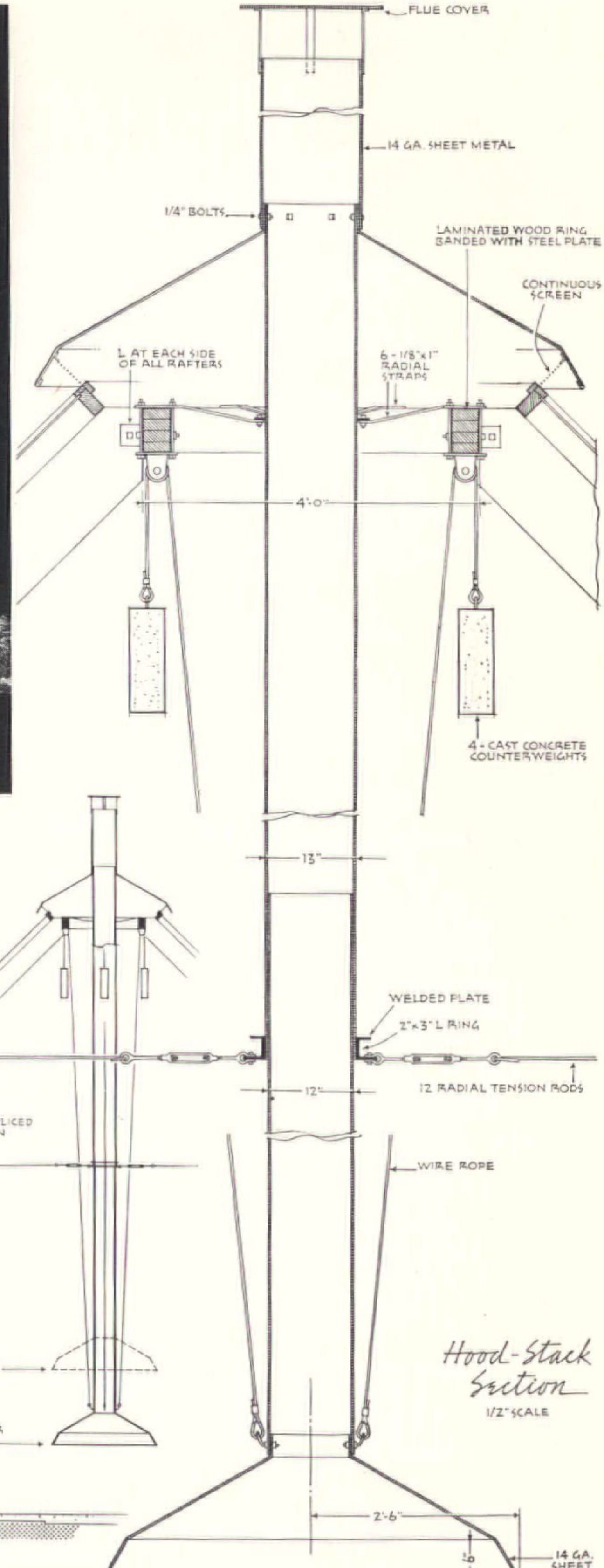
BEDFORD PARK COMMUNITY CENTER, Bedford Park, Ill.

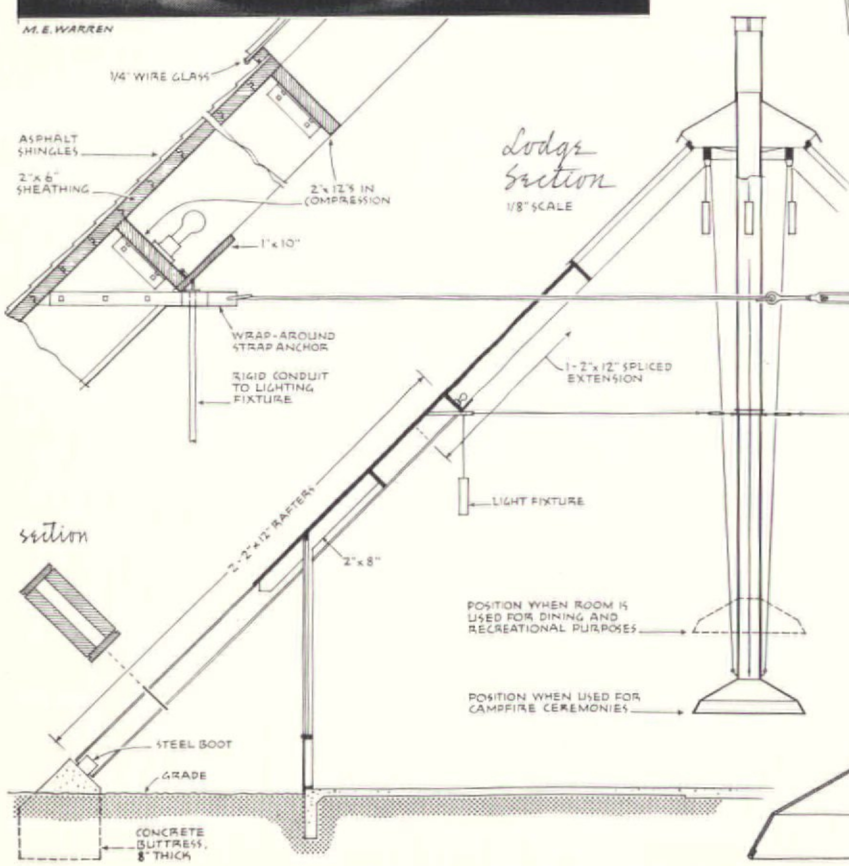
Perkins & Will, Architects-Engineers

p/a selected detail

fireplace

M. E. WARREN



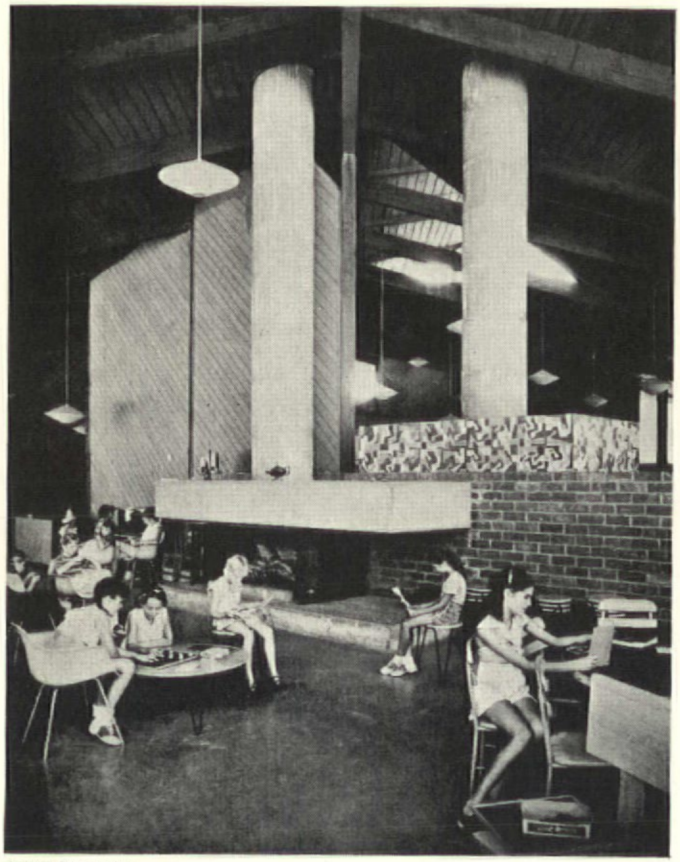


GIRL SCOUT LODGE, Annapolis, Md.

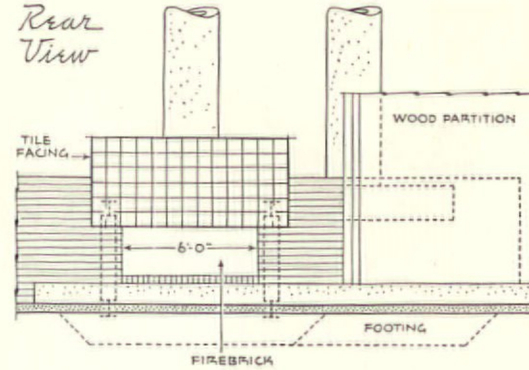
Rogers, Taliaferro & Lamb, Architects

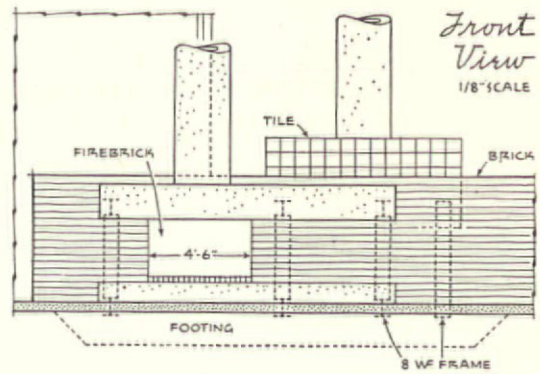
p/a selected detail

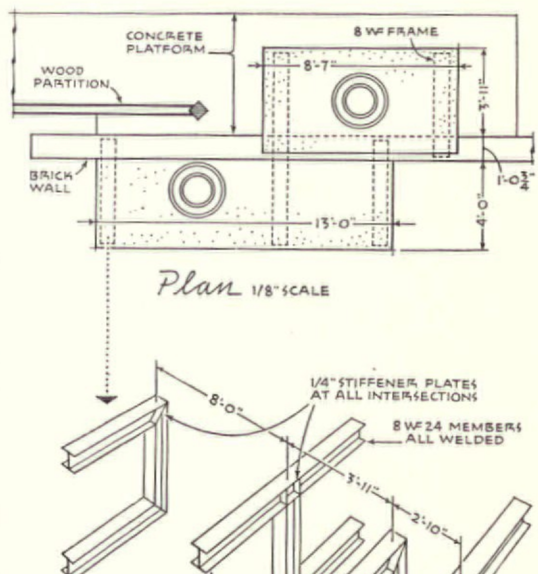
recreational building: fireplace

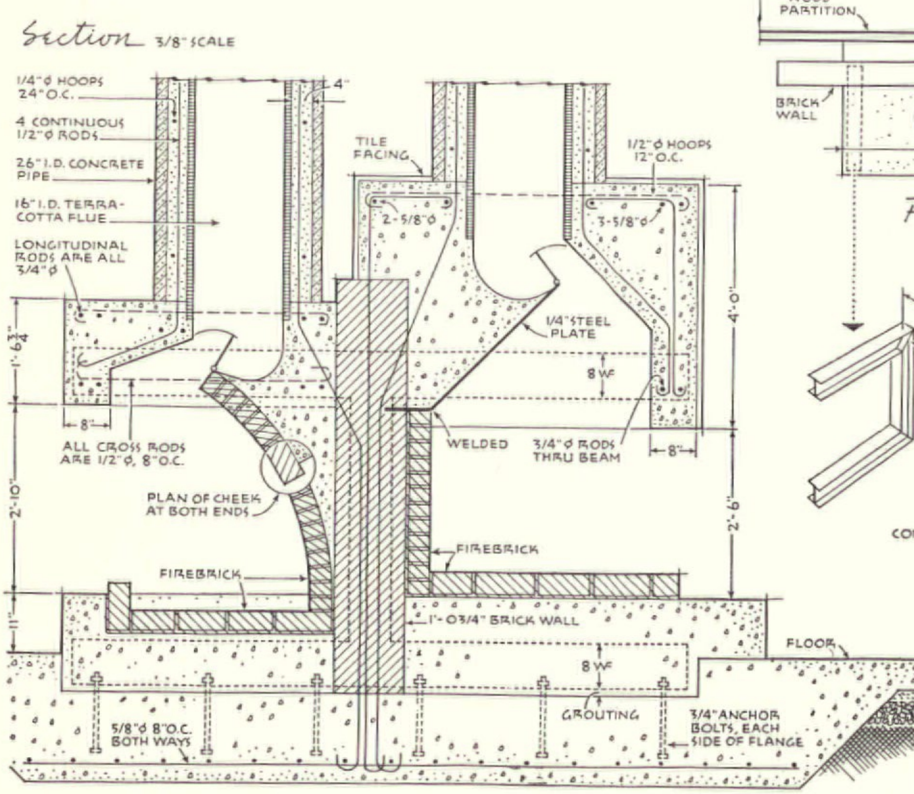


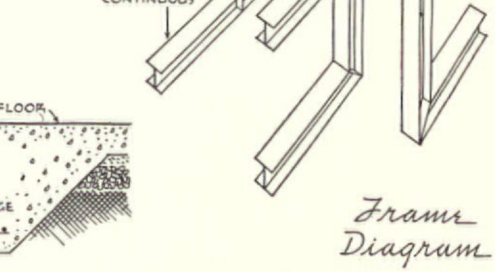
JULIUS SHULMAN











GIRLS' CAMP, Los Angeles, Calif.

Smith, Jones, and Contini, Architects-Engineers-Site Planners

Section 6 SOLAR CONTROL DEVICES

WALL OVERHANG — ELEMENTARY SCHOOL

WALKWAY SUNSHADE — ELEMENTARY SCHOOL

WINDOW SHADE — HIGH SCHOOL

EXTERIOR SUNSHADE — ARCHITECTURAL SCHOOL

SUN HOOD — BUSINESS SCHOOL

WINDOW LOUVER GRID — HOSPITAL

ENTRANCE CANOPY — DEPARTMENT STORE

SUN SHADE — OFFICE BUILDING

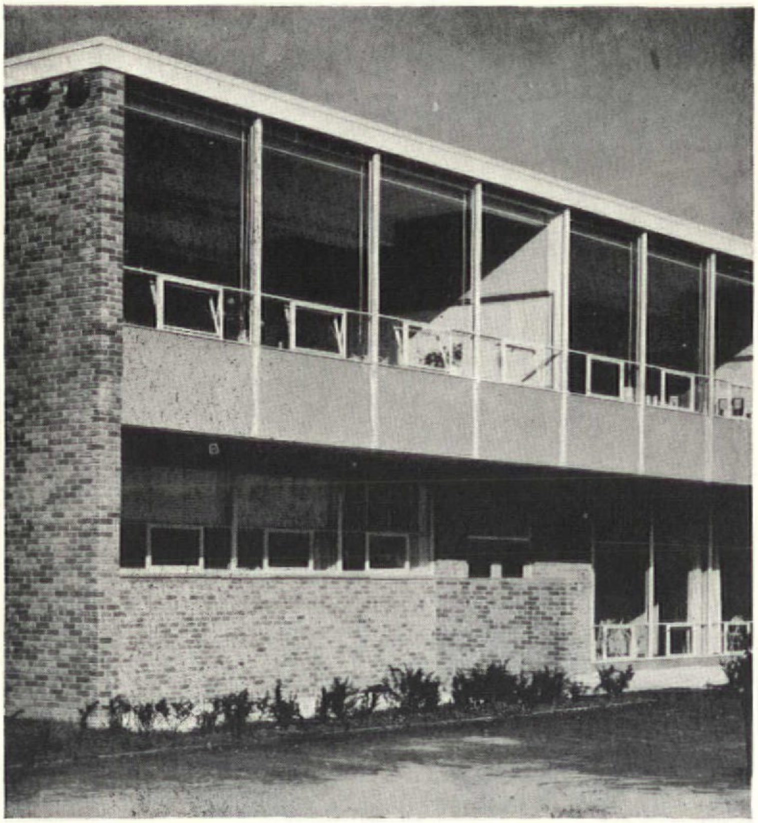
WINDOW LOUVER GRID — OFFICE BUILDING

SOLAR SCREEN — OFFICE BUILDING

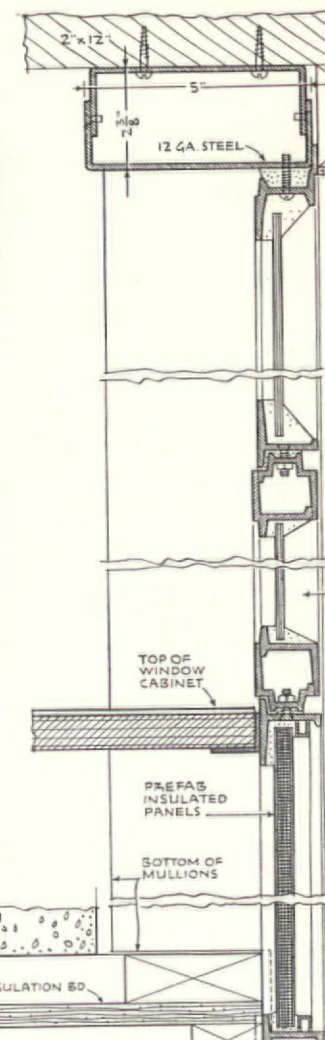
PORTE COCHERE — COUNTRY CLUB

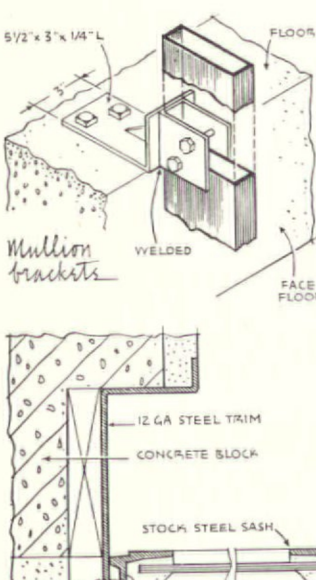
p/a selected detail

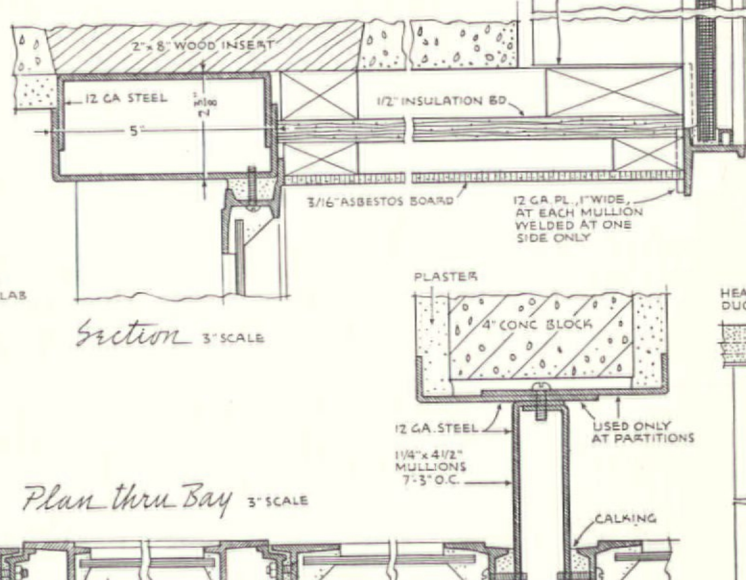
wall section

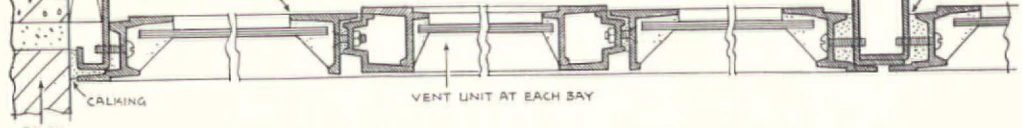


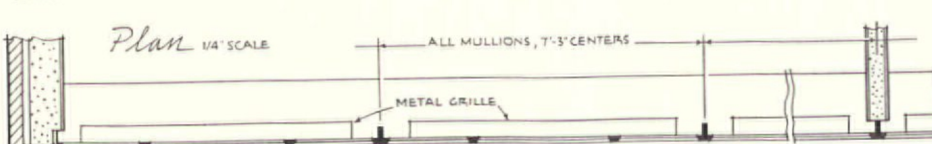
JOSEPH W. MOLITOR

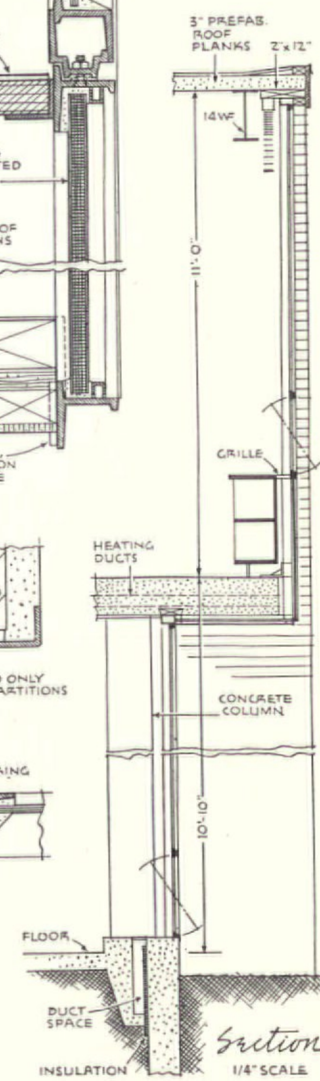






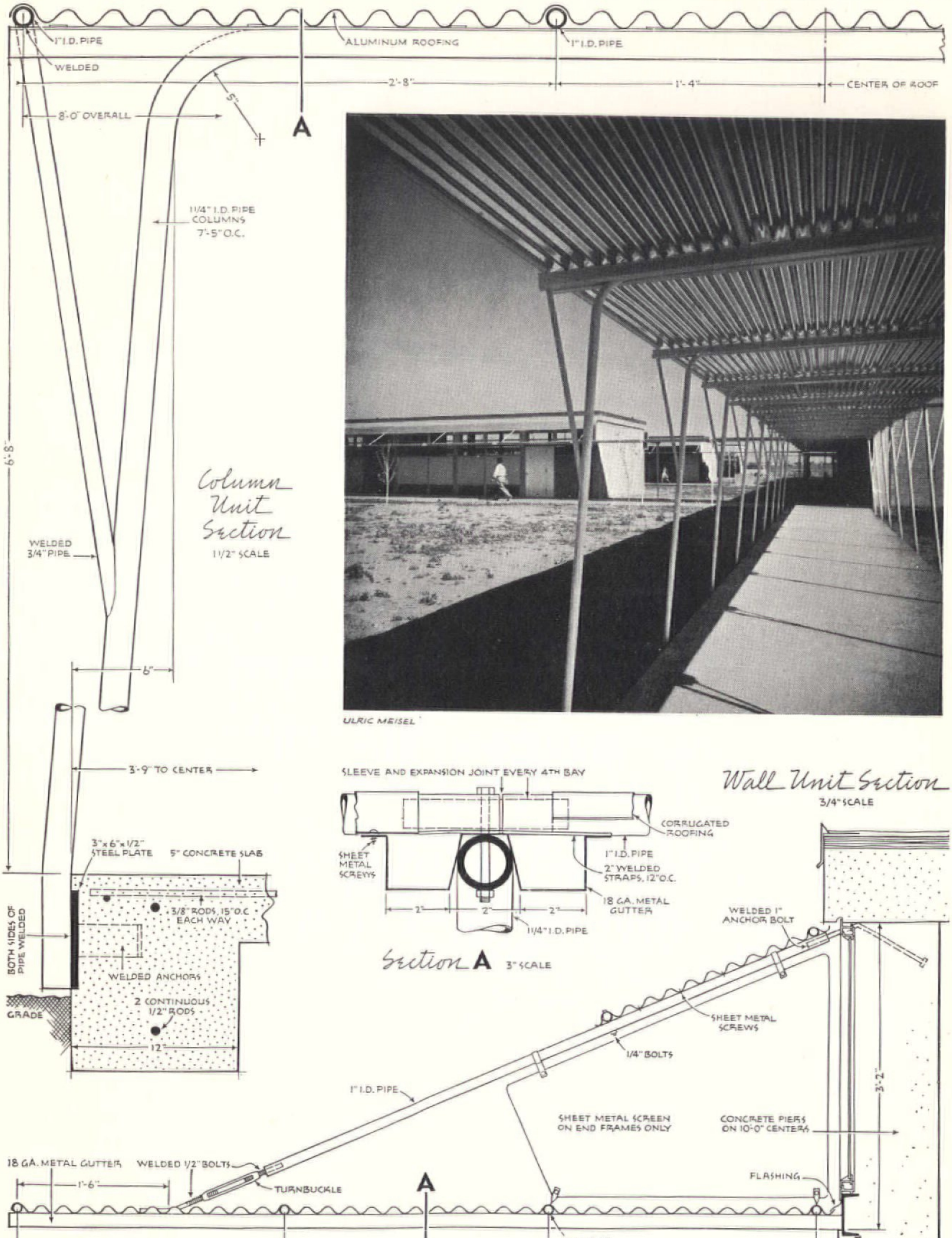






ELEMENTARY SCHOOL, Sharon, Conn.
Sherwood, Mill & Smith, Architects

covered walkways, sun shades

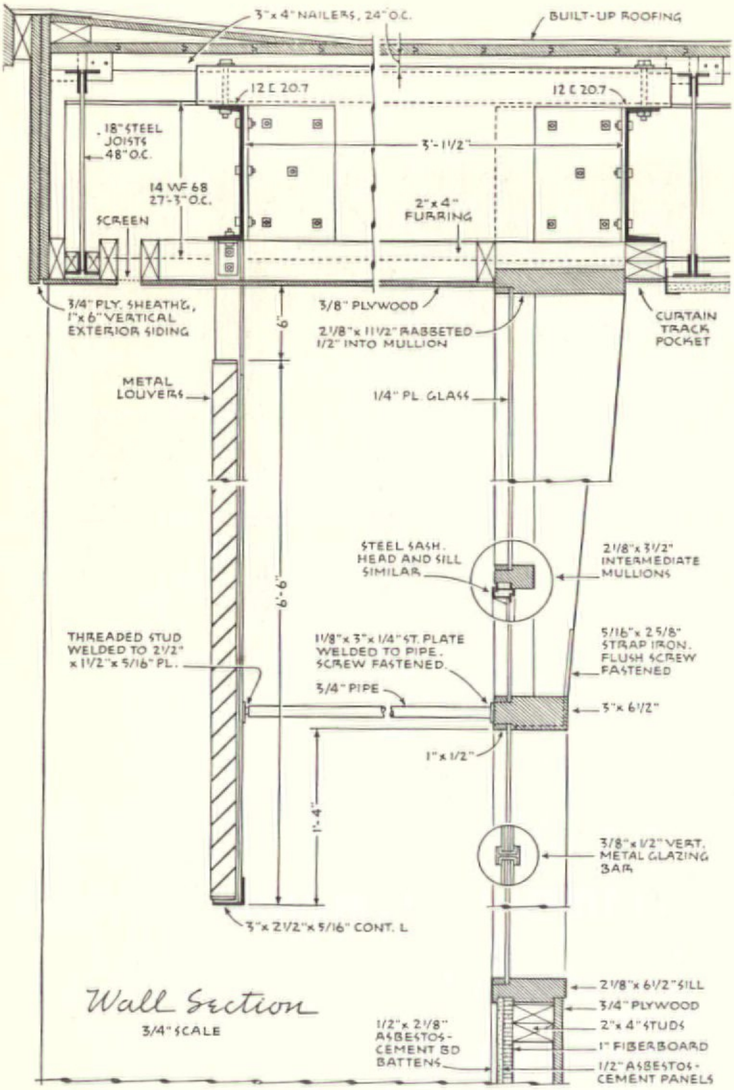


ULRIC MEISEL

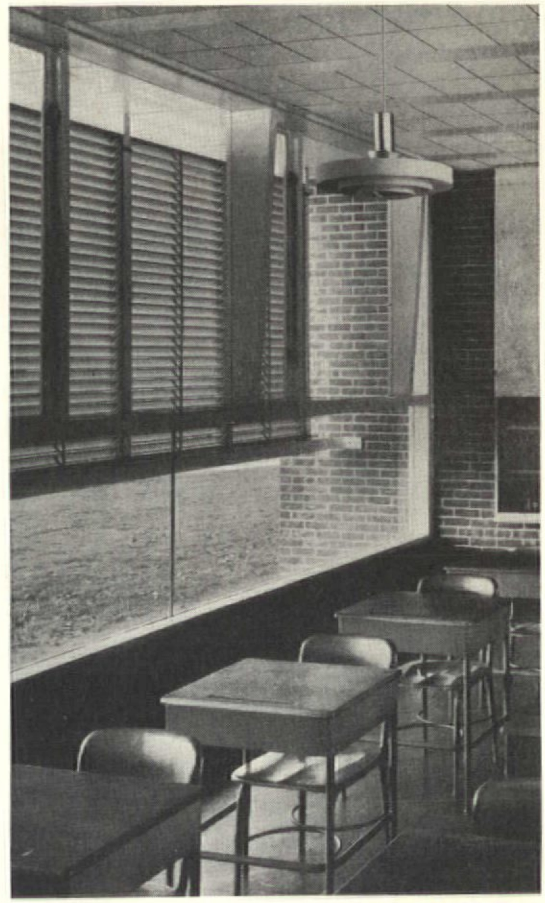
ELEMENTARY SCHOOL, Harlingen, Tex.
Cocke, Bowman & York, Architects

p/a selected detail

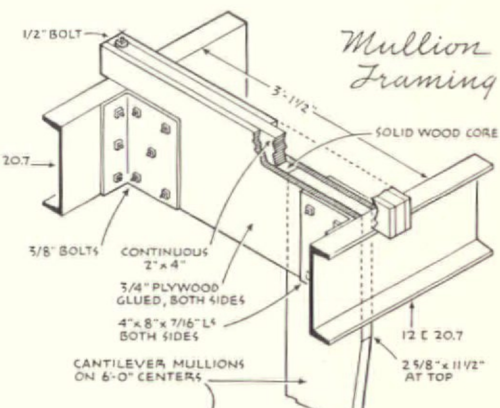
school: classroom window



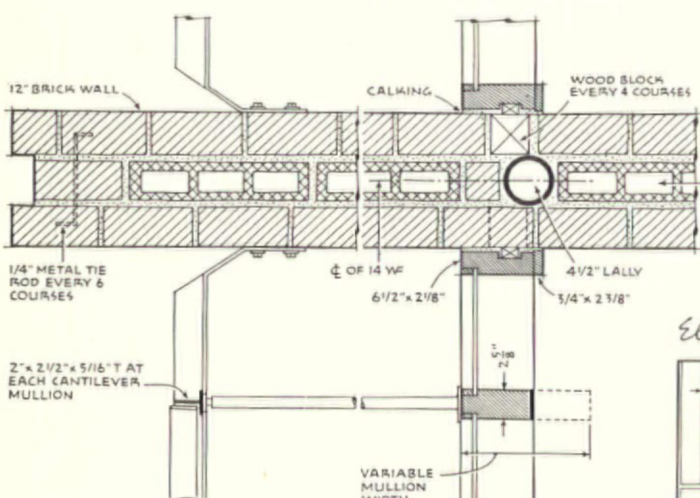
Wall Section
3/4" SCALE



LIONEL FREEDMAN

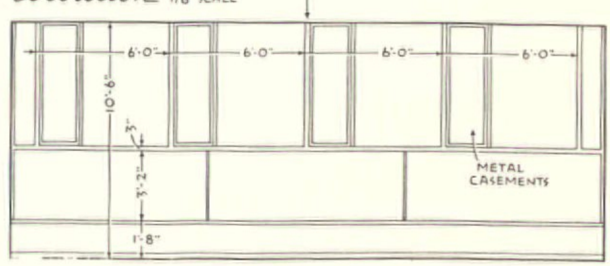


Mullion Framing



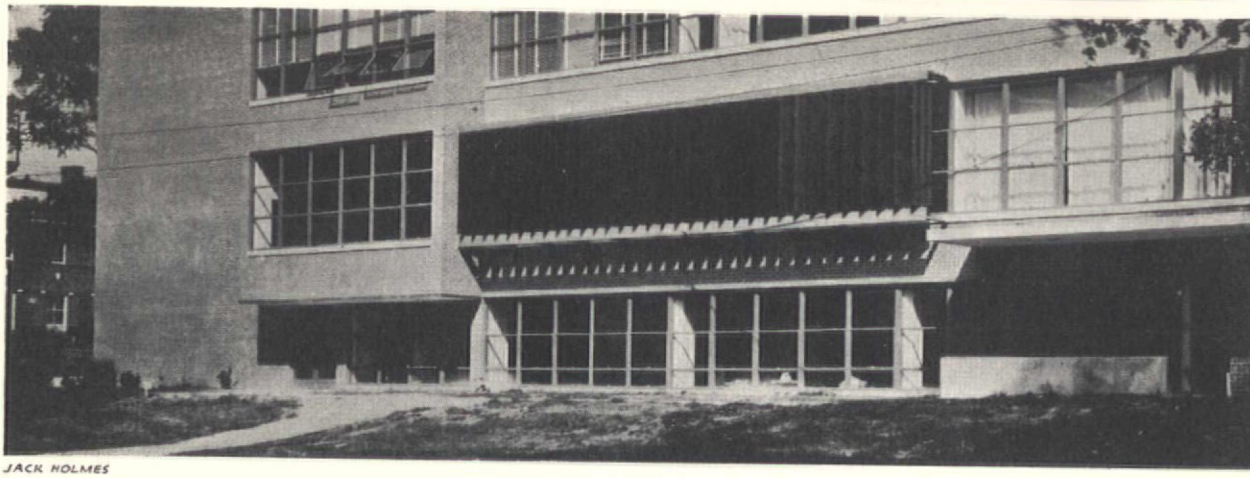
Plan
3/4" SCALE

Elevation 1/8" SCALE

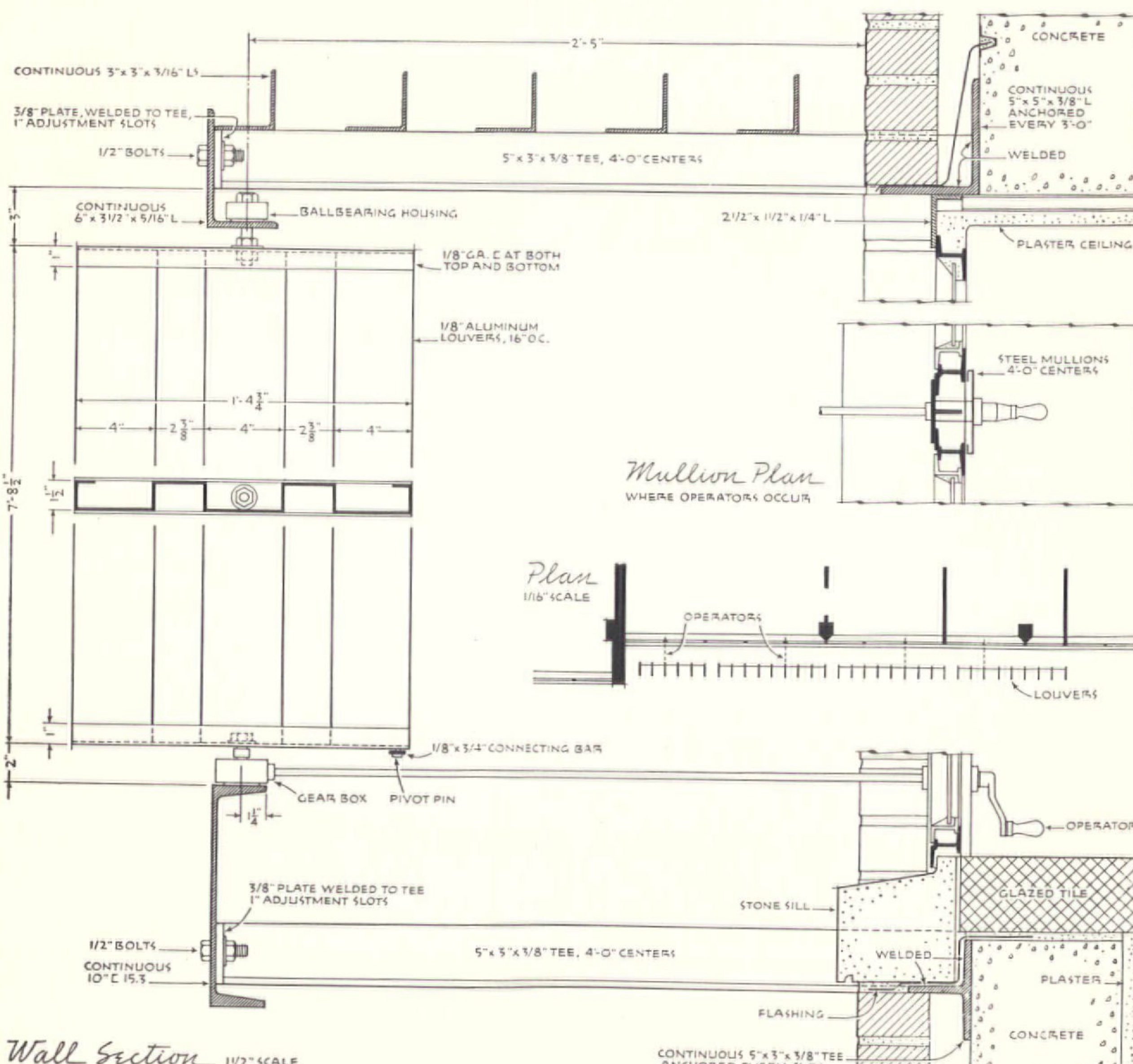


DARIEN JUNIOR HIGH SCHOOL, Darien, Conn.
Ketchum, Giná & Sharp, Architects

school: exterior sunshade



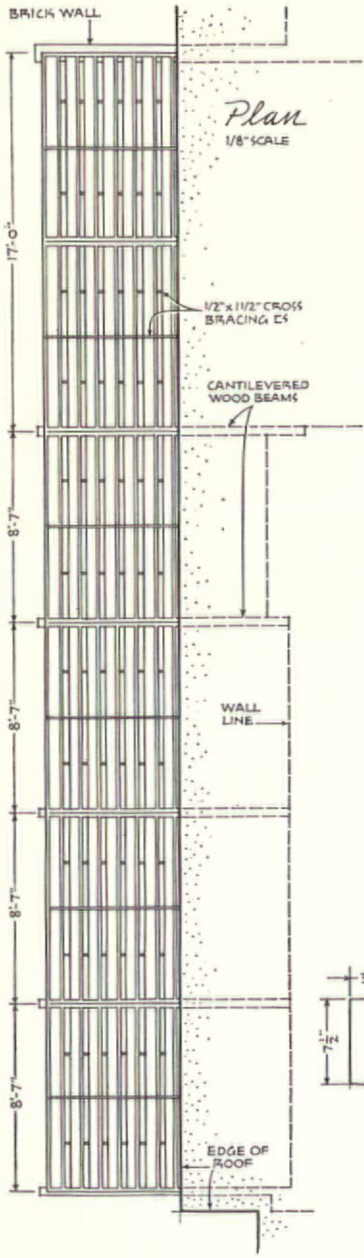
JACK HOLMES

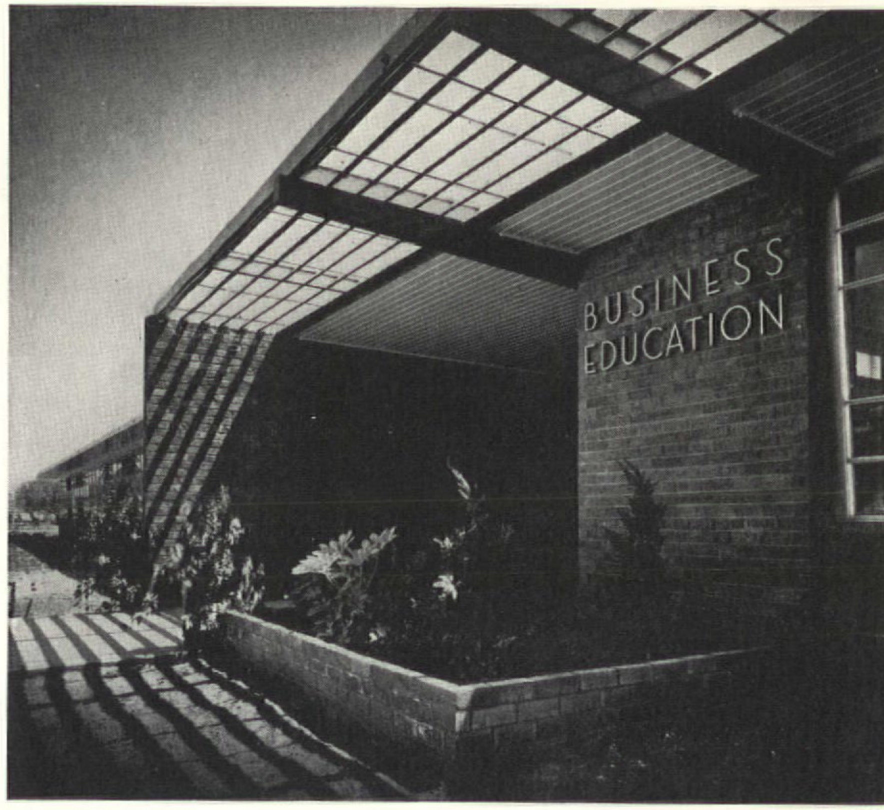


SCHOOL OF ARCHITECTURE AND THE ARTS, ALABAMA POLYTECHNIC INSTITUTE, Auburn, Ala.
Pearson, Tittle & Narrows, Architects

p/a selected detail

sun hood





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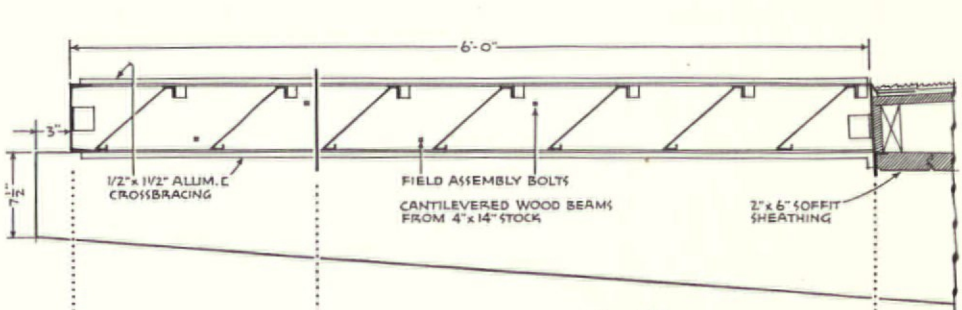
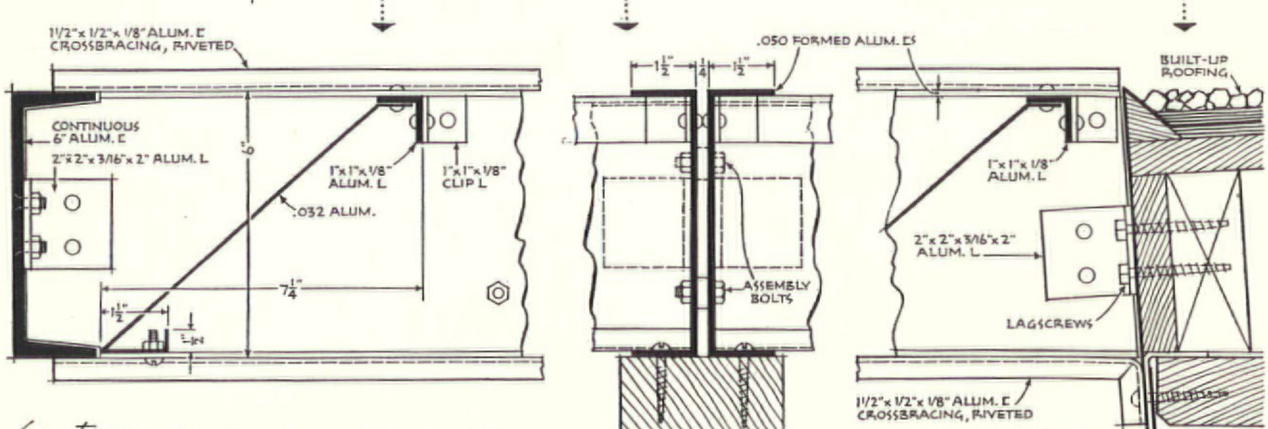


Section 3/4" SCALE



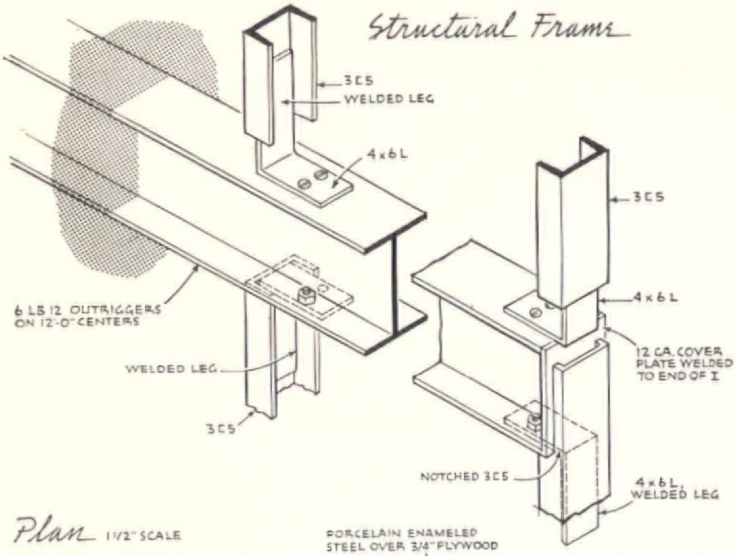
Sections 3" SCALE

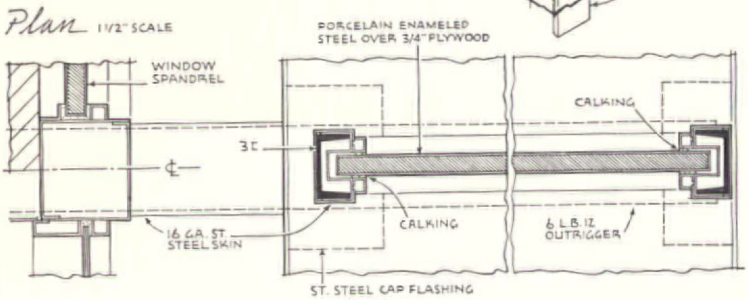
4"x 14" WOOD BEAM

BUSINESS EDUCATION BUILDING, Costa Mesa, Calif.
Richard J. Neutra & Robert E. Alexander, Architects

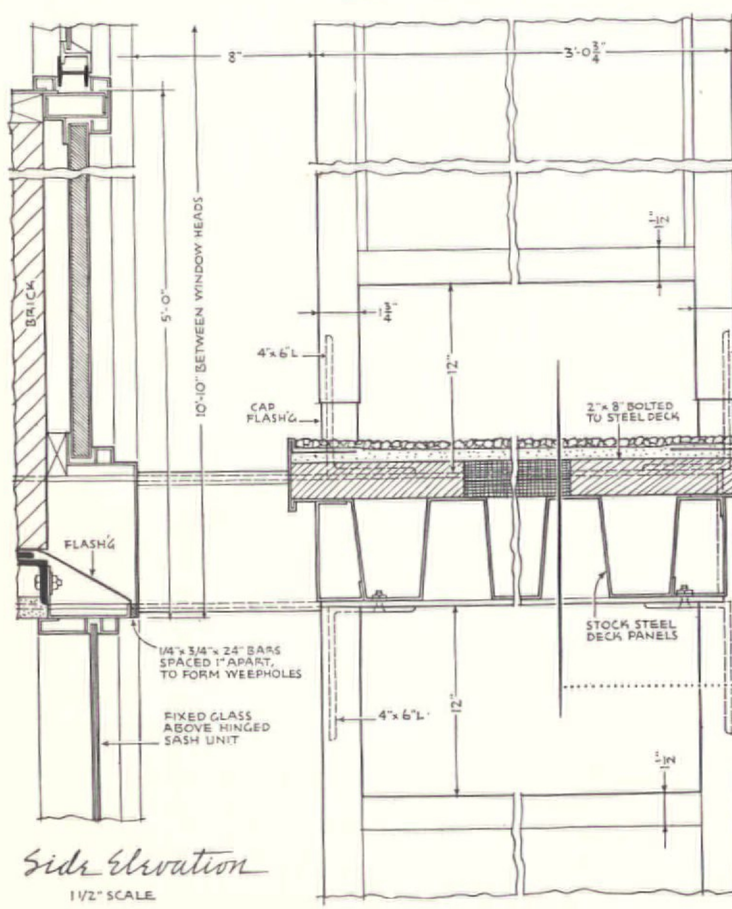
p/a selected detail

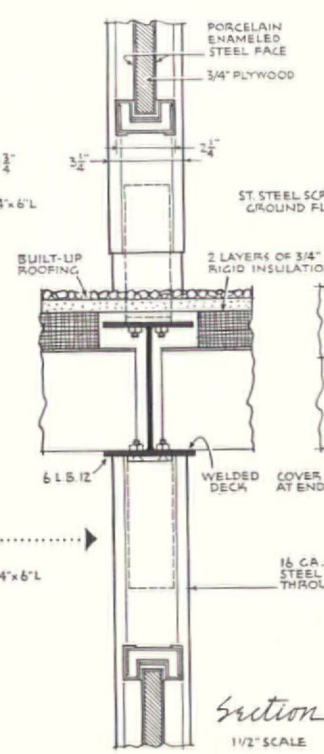
wall section

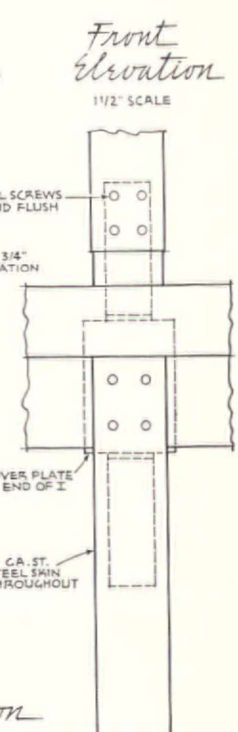




LAWRENCE S. WILLIAMS



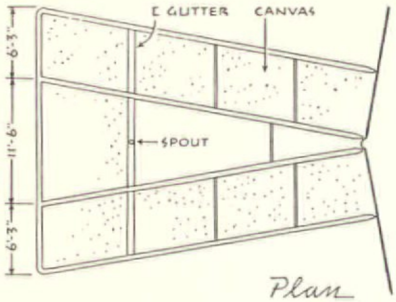


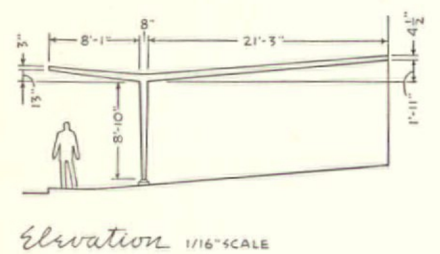


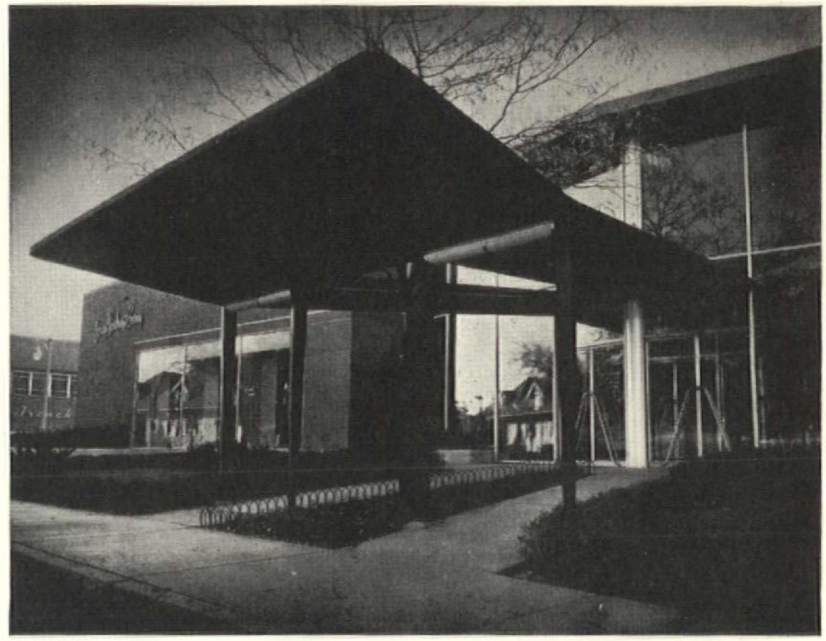
HOSPITAL, Pottstown, Pa.
Vincent G. Kling, Architect

p/a selected detail

store: entrance canopy







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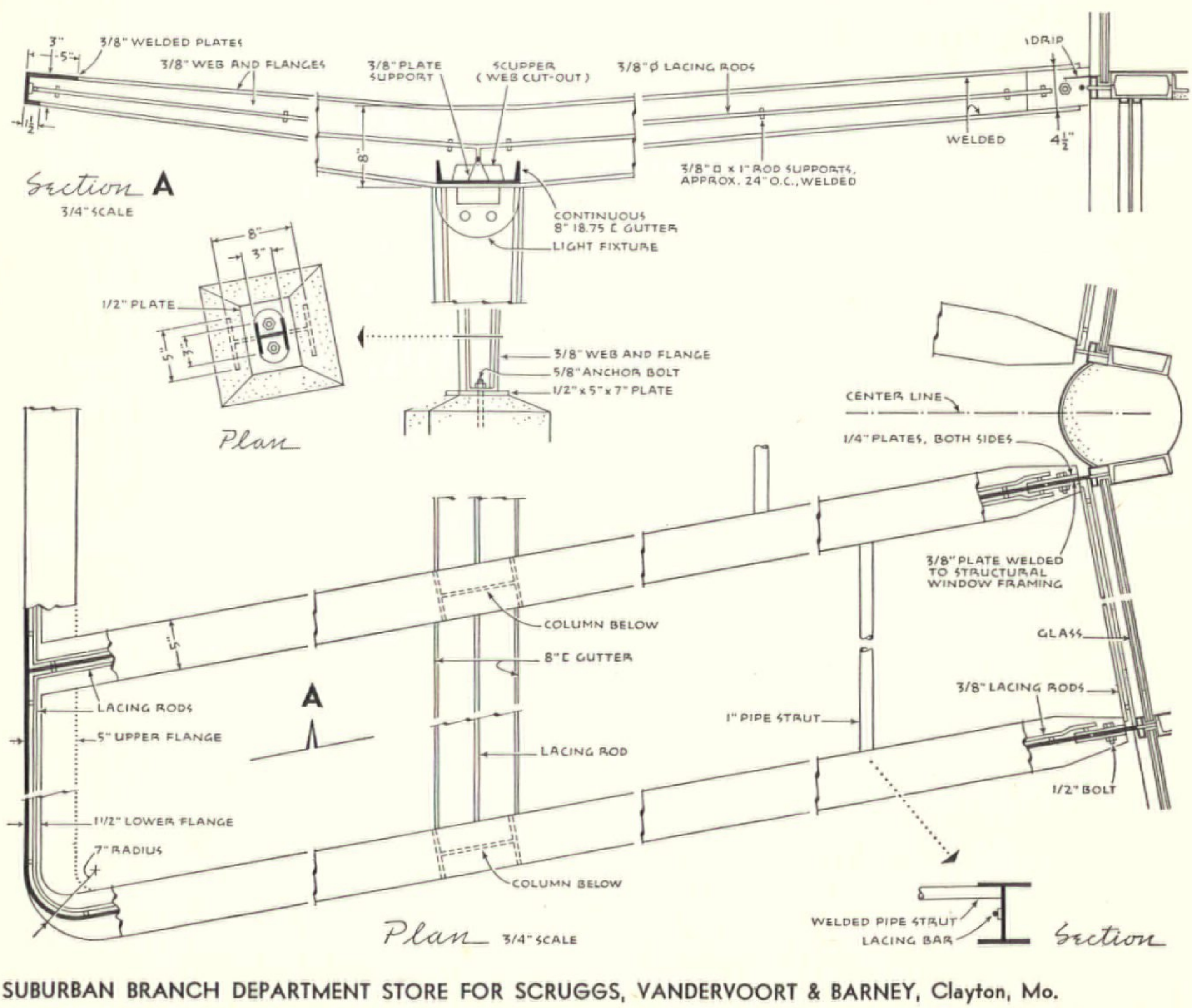
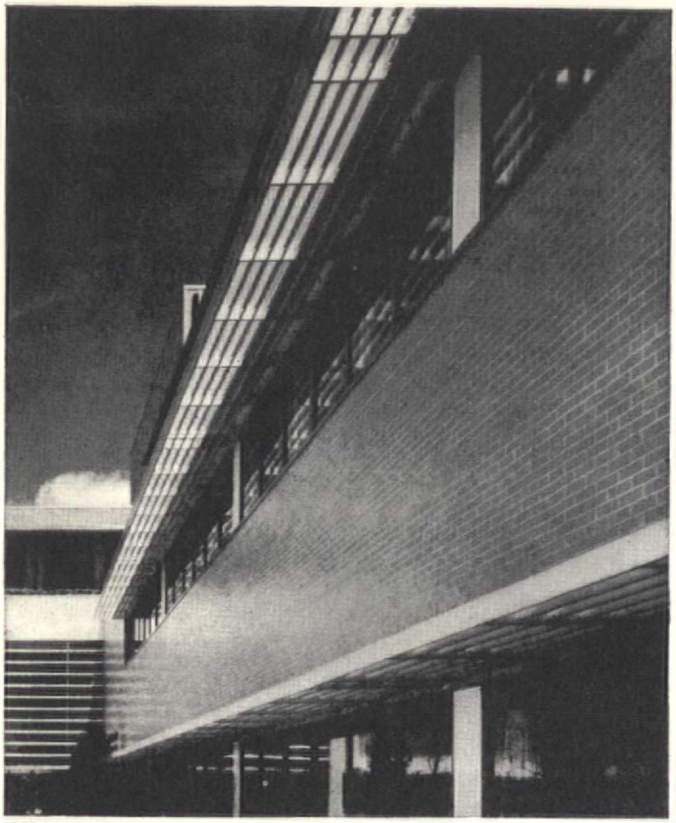


SUBURBAN BRANCH DEPARTMENT STORE FOR SCRUGGS, VANDERVOORT & BARNEY, Clayton, Mo.

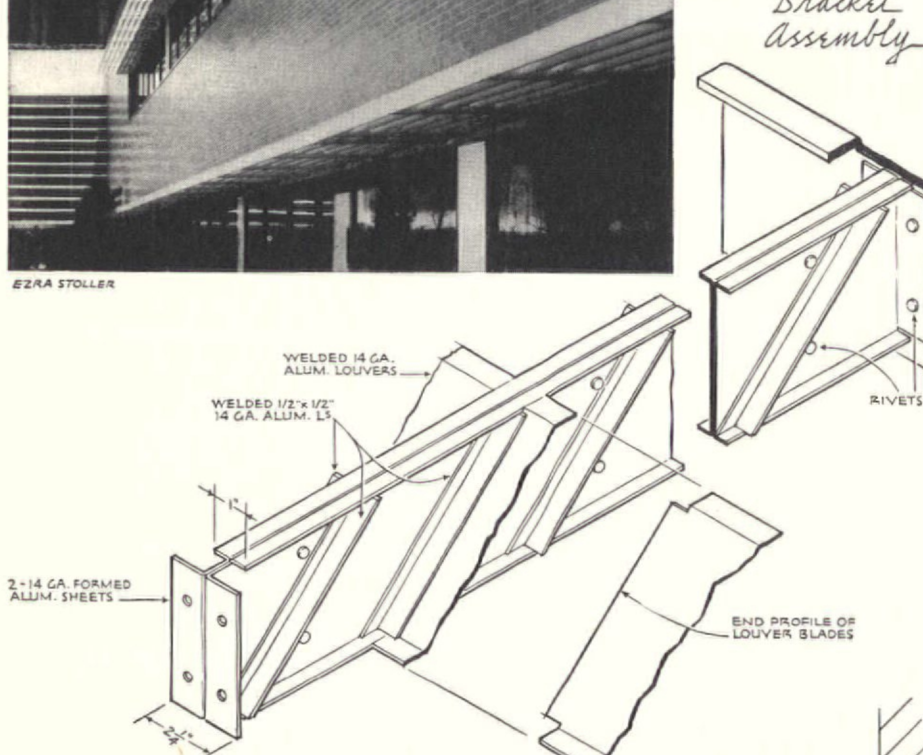
Harris Armstrong, Architect

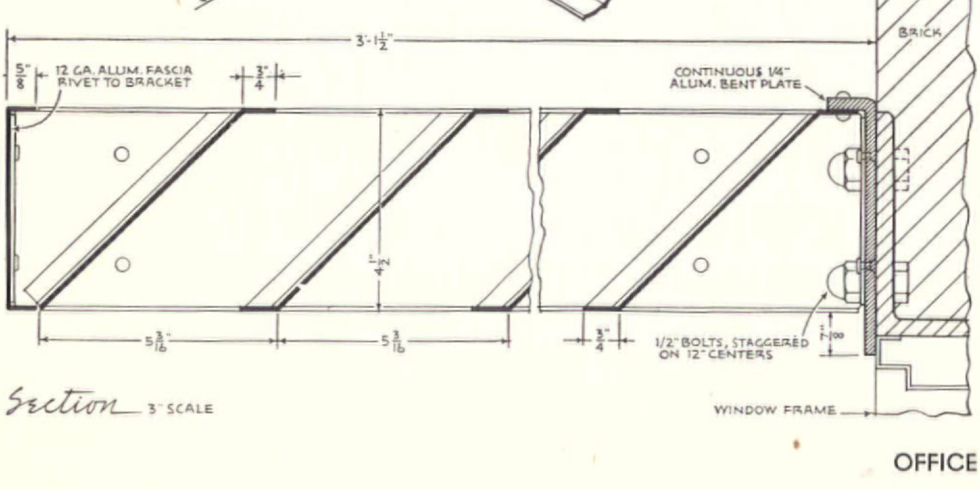
p/a selected detail

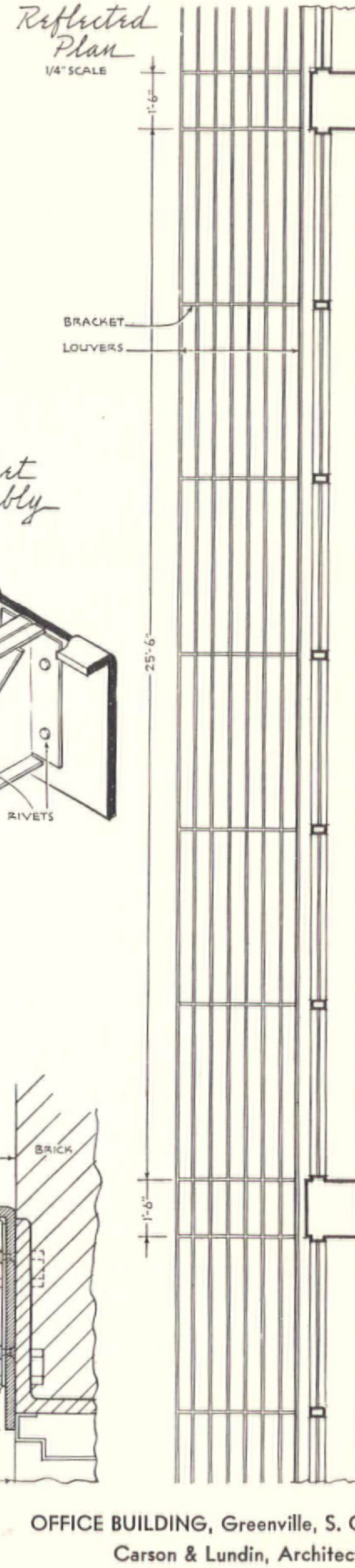
sun shade



EZRA STOLLER



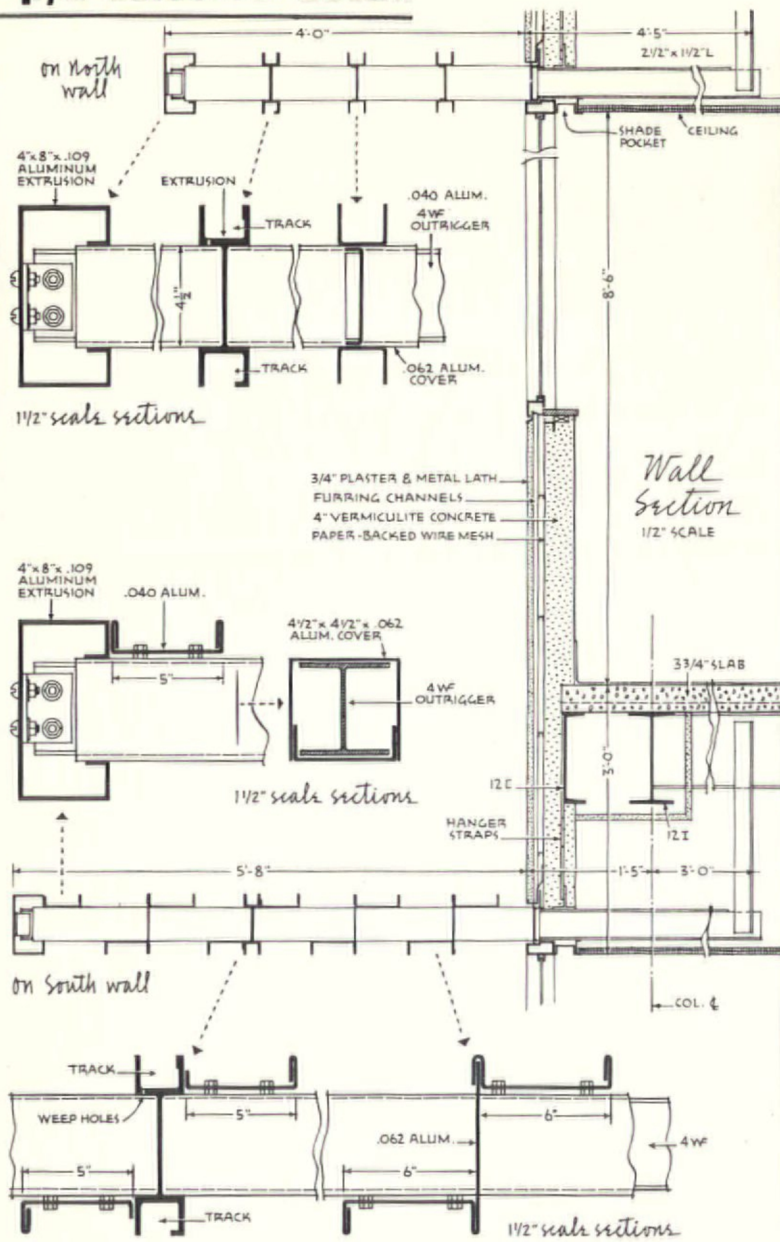


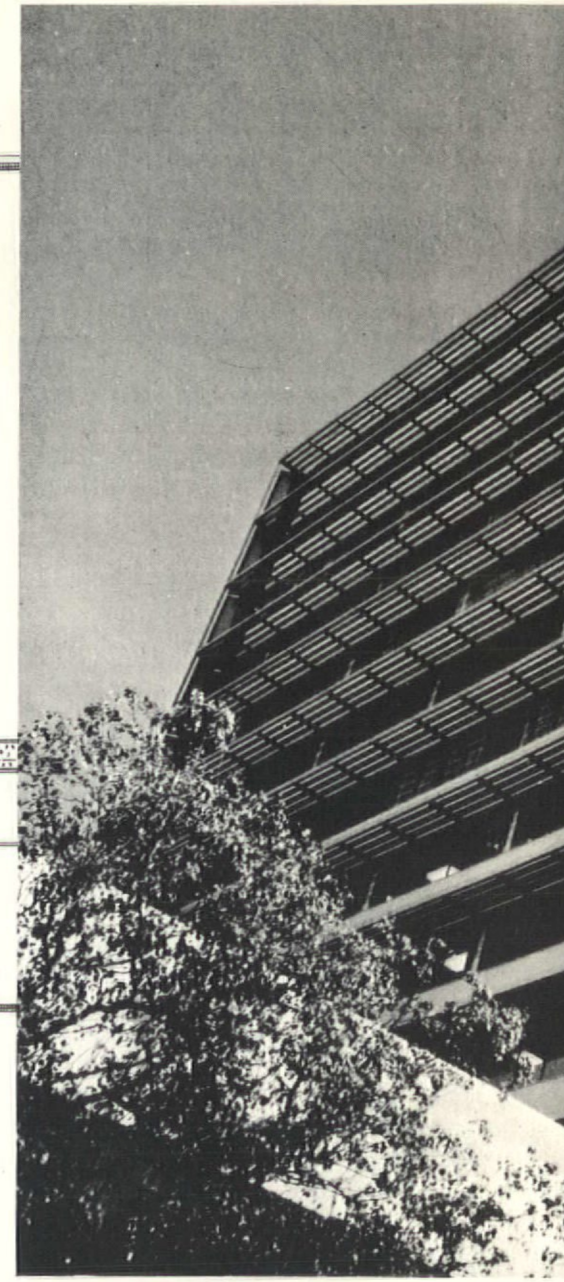


OFFICE BUILDING, Greenville, S. C.
Carson & Lundin, Architects

p/a selected detail

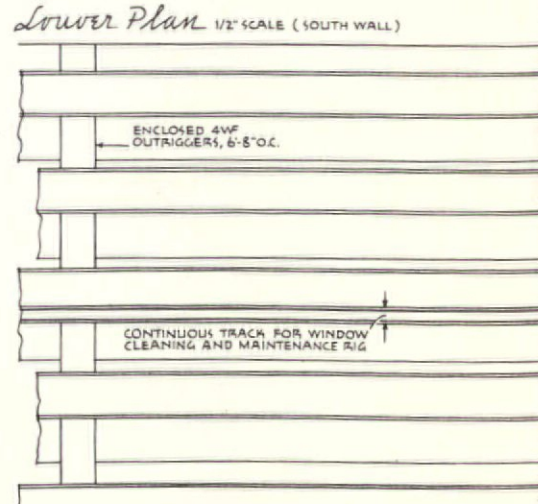
sun-control devices





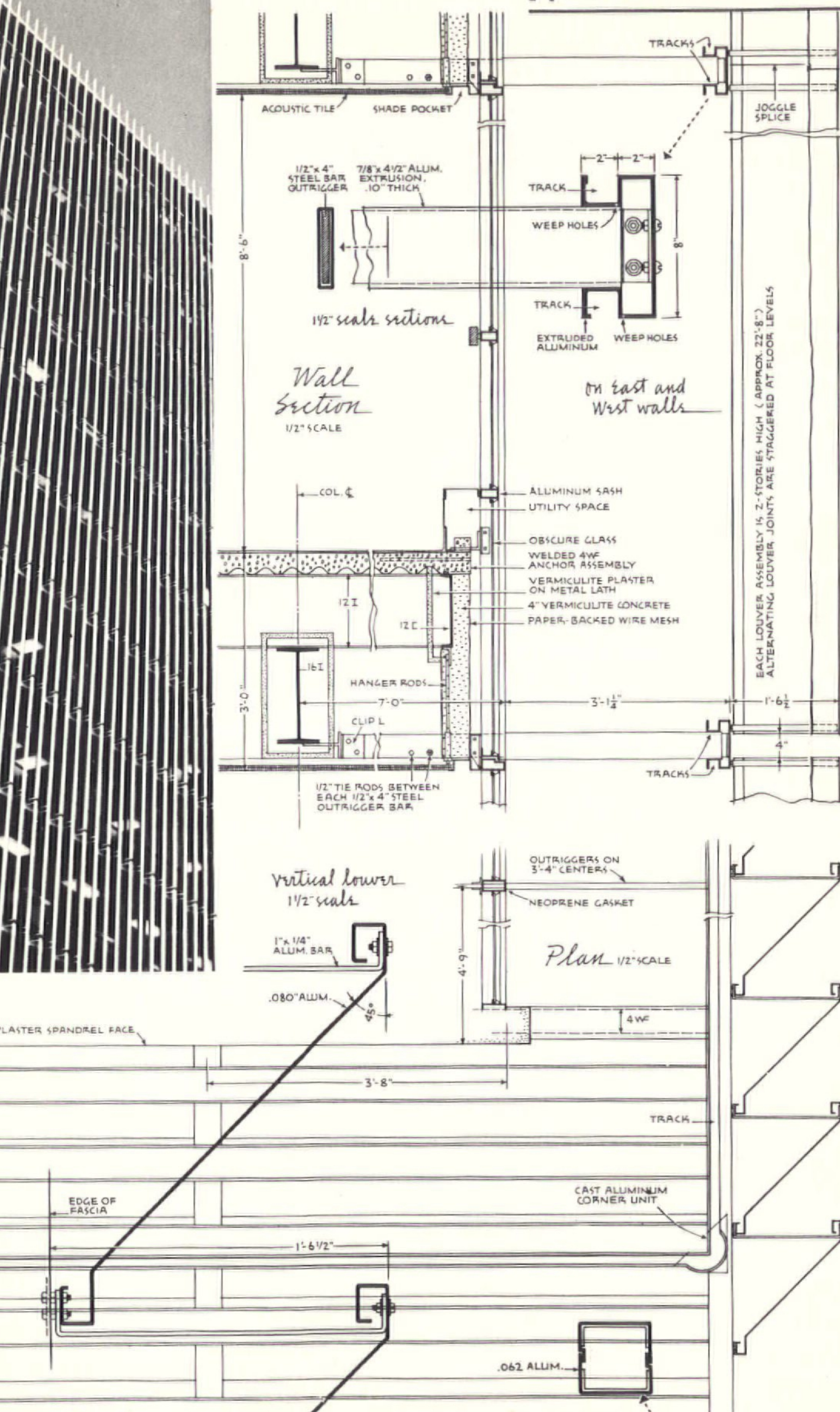
GORDON SOMMERS

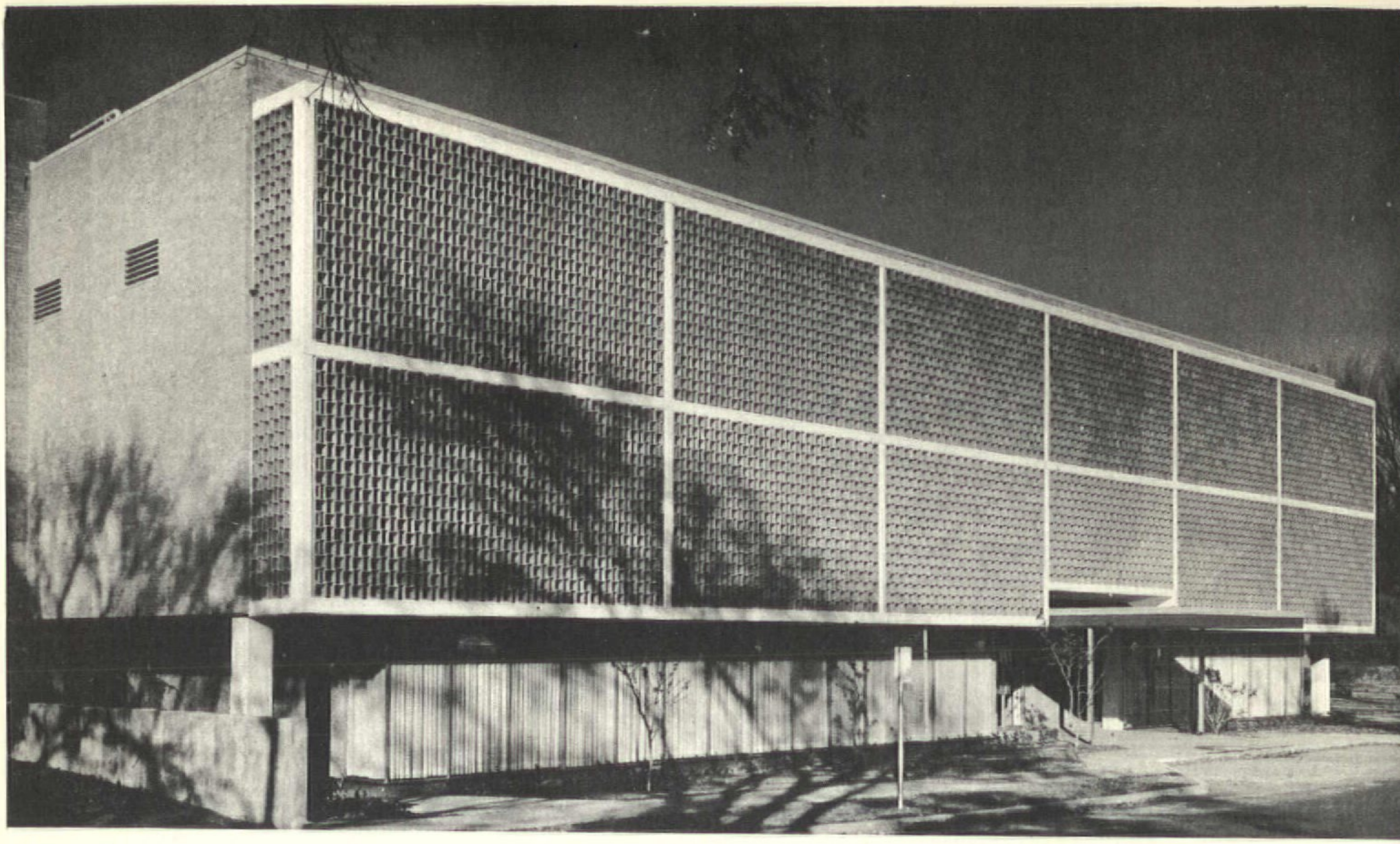
Louver Plan 1/2" SCALE (SOUTH WALL)



p/a selected detail

sun-control devices

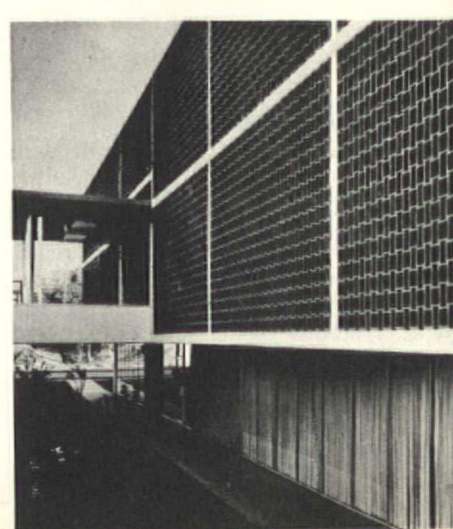


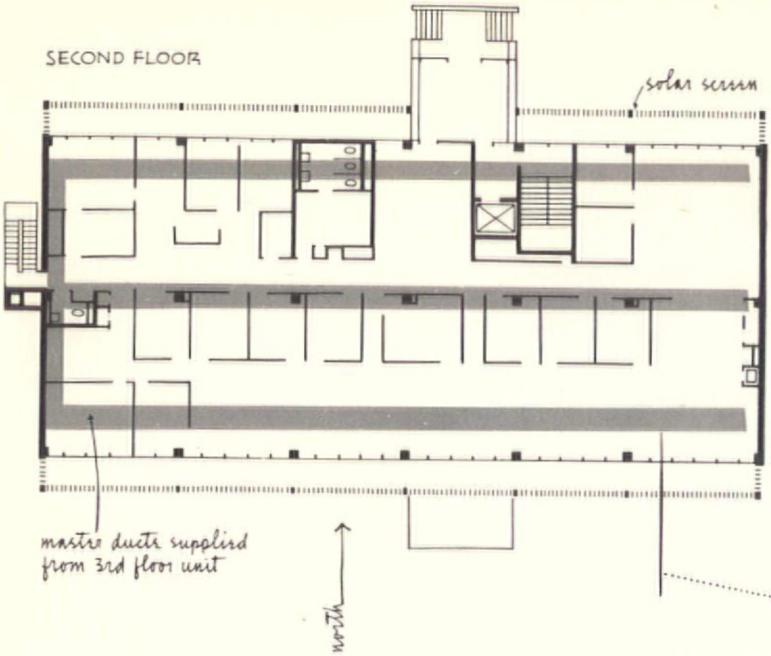


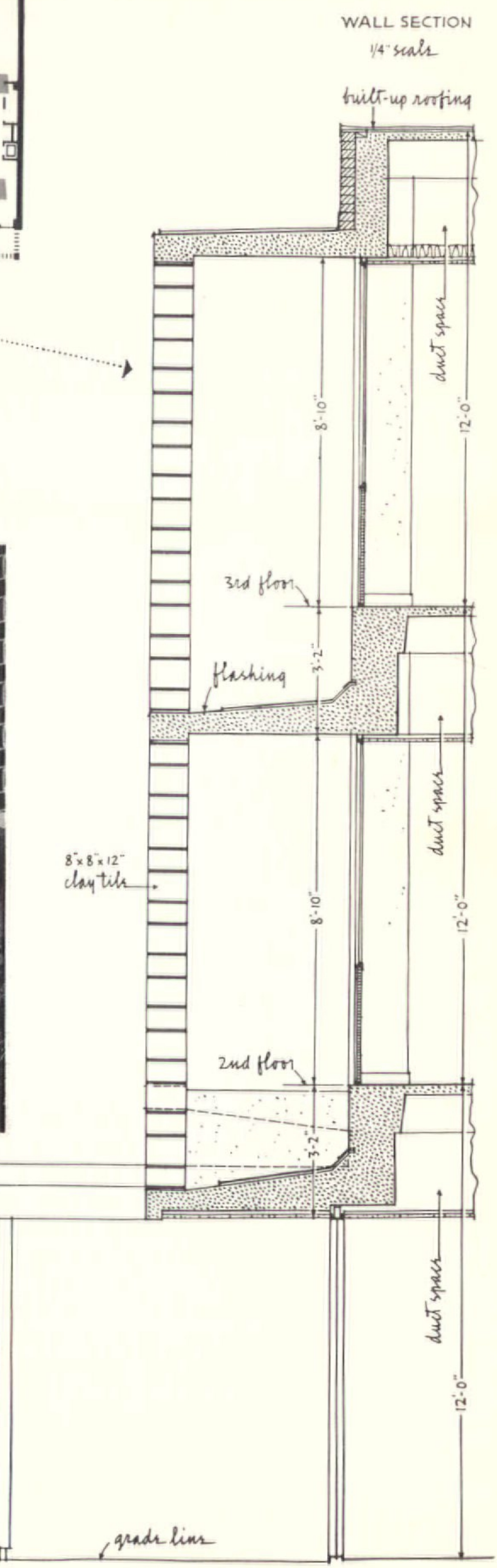
Building with Rental Areas: Oklahoma City, Oklahoma

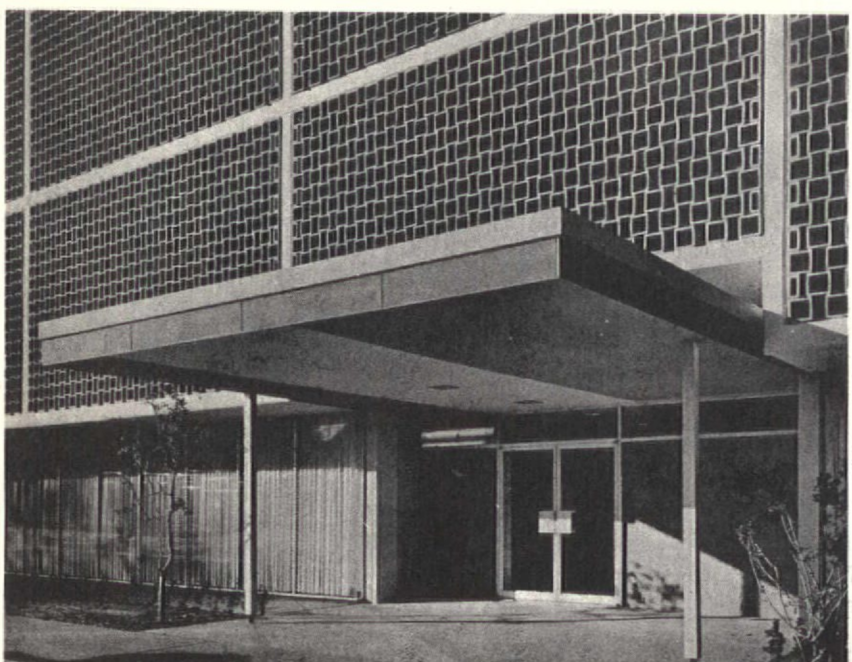
Among salient points of this office building for a mortgage banking firm and its tenants are: (1) two of the three floors are at ground level—one approached from street (*above* and *acrosspage*), the other via bridge from the parking lot at a higher elevation (*right*); (2) the building, bordering a busy highway on the outskirts of Oklahoma City has been placed at right angles to the road for reduction of traffic noises, desirable north and south exposures, advantageous placement of parking lot, and most dramatic aspect of building from passing cars; (3) economy, structural simplicity, and plan flexibility have been achieved by a reinforced-concrete frame, equal bay spacing, and an off-center corridor; (4) tile screens were designed to cut glare, eliminate the need for expensive window-wall materials, blinds, and drapes, and, most important, to keep direct sunlight off glass and thereby reduce cooling load.

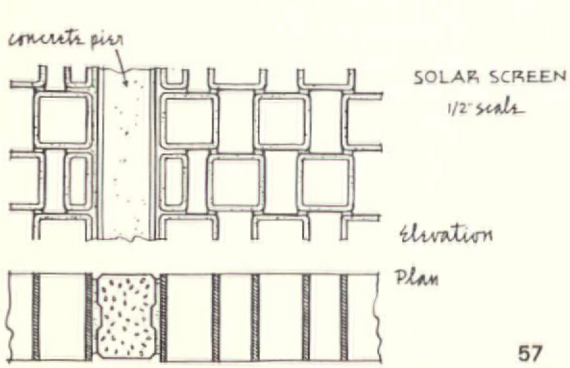
Air conditioning is accomplished by two packaged units—one located in the basement, the other installed on the third floor. "Each unit," report the architects, "contains two compressors which are controlled in steps by the temperature-control system. The heating unit utilizes the package-unit fans, but each unit has three hot-water heating coils in the three-zone supply ducts. The zones are: north, south, and interior; ceiling outlets supplied from a master ductwork system were located according to the tenants' requirements. The heating coils are served from a hot-water boiler and controlled with modulating valves. The outside-air and return-air dampers are controlled to maintain a 60 F mixed-air temperature." Had the solar screen been omitted, it would have been necessary to supply four additional tons of air conditioning per floor. Caudill, Rowlett & Scott were Architects; James M. Samis, Mechanical-Electrical Engineer; James G. McDonald, Structural Engineer; Grant C. Carpenter Construction Company, General Contractor.



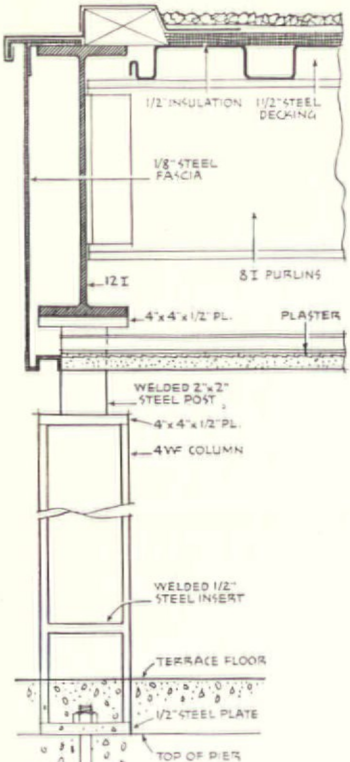

SECOND FLOOR
solar screen
master ducts supplied from 3rd floor unit
north


WALL SECTION
1/4" scale
built-up roofing
duct space
8'-10"
12'-0"
3rd floor
3'-2"
flashing
duct space
8"x8"x12" clay tile
8'-10"
12'-0"
2nd floor
3'-2"
duct space
12'-0"
grade line

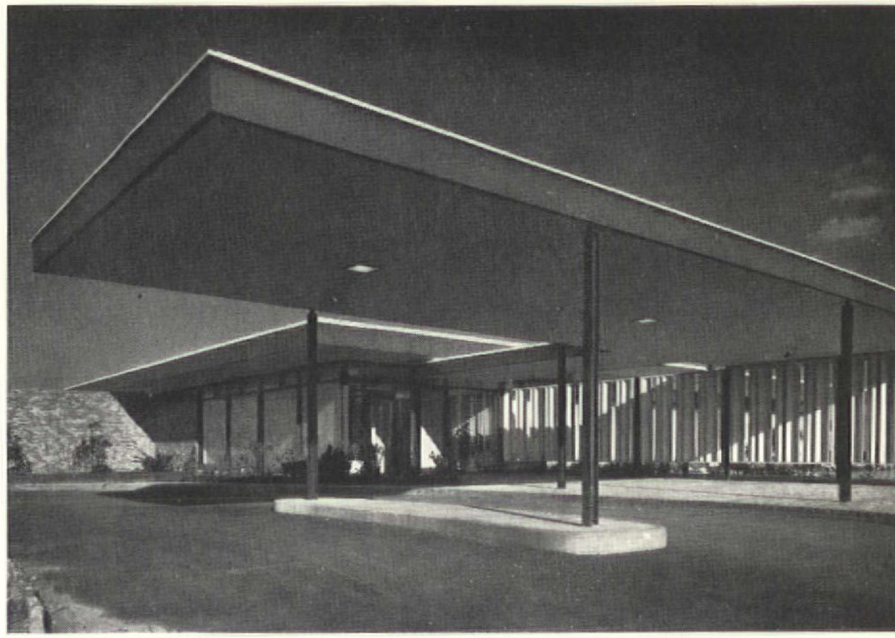



concrete pier
SOLAR SCREEN
1/2" scale
Elevation
Plan

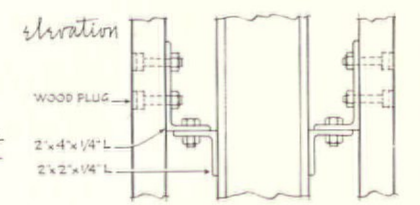
porte cochere



Cornice Section
1/2" SCALE

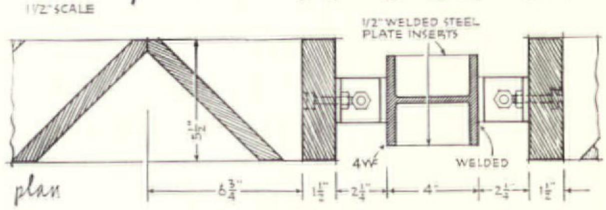


BOB HAWKS, INC.

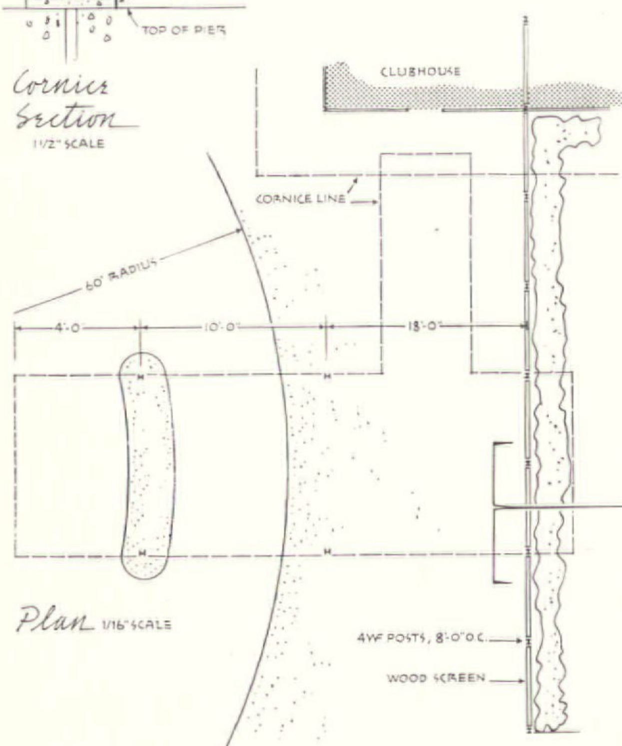


elevation

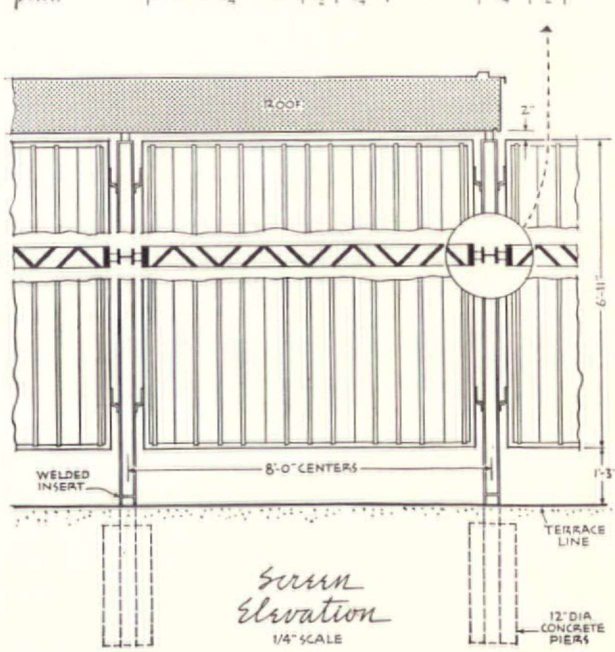
Screen-Post Assembly
1/2" SCALE



plan

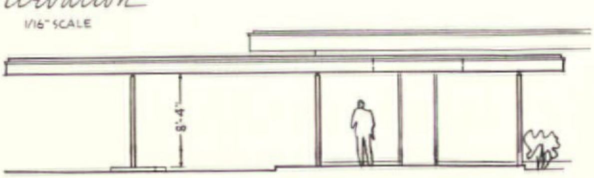


Plan 1/16" SCALE



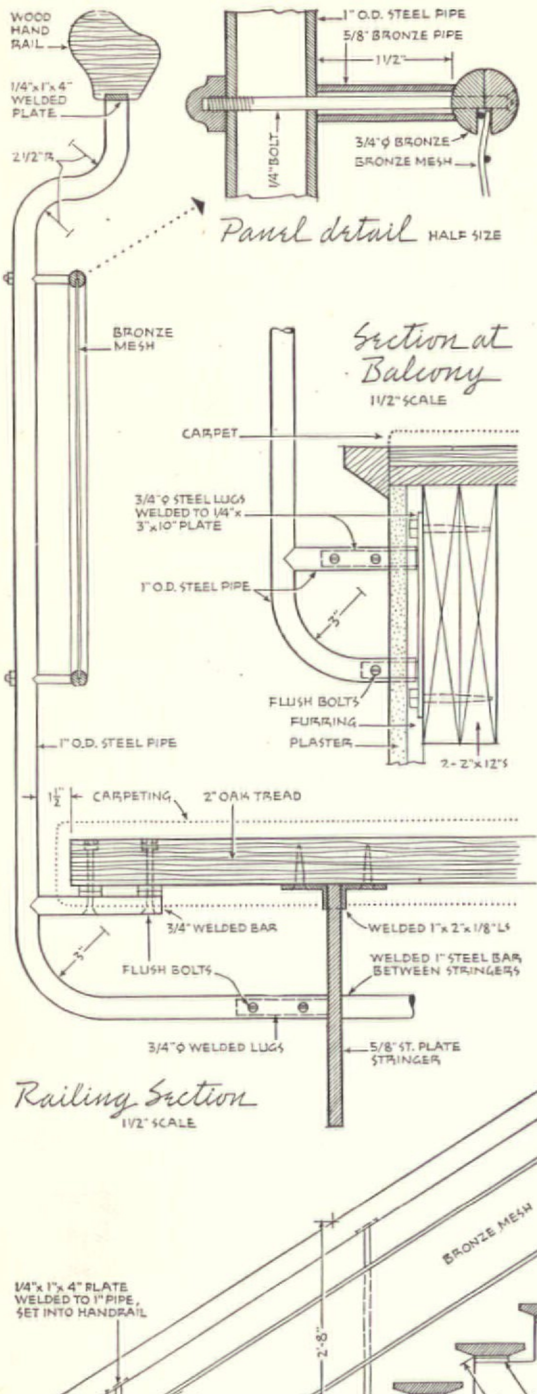
Screen Elevation
1/4" SCALE

End Elevation
1/16" SCALE

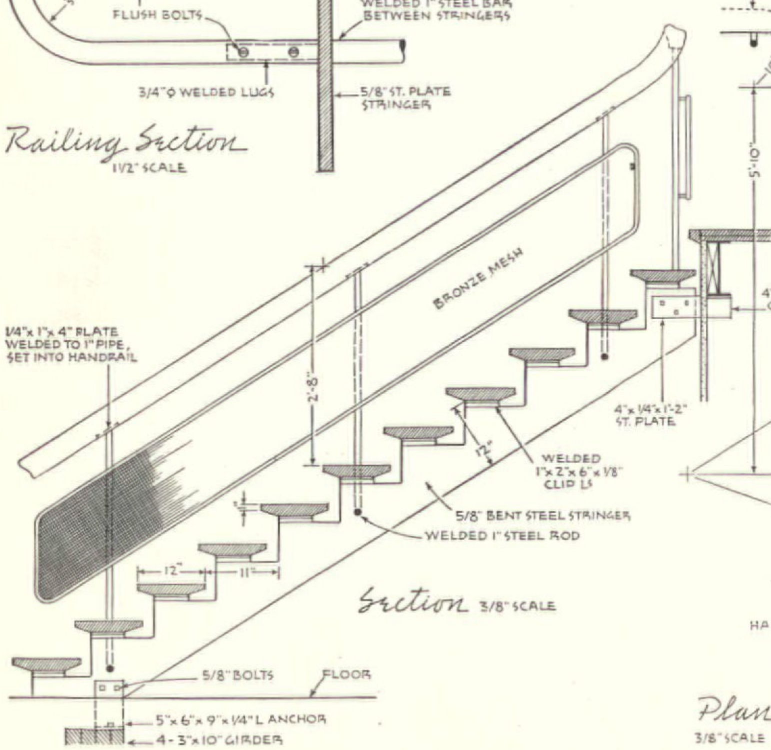


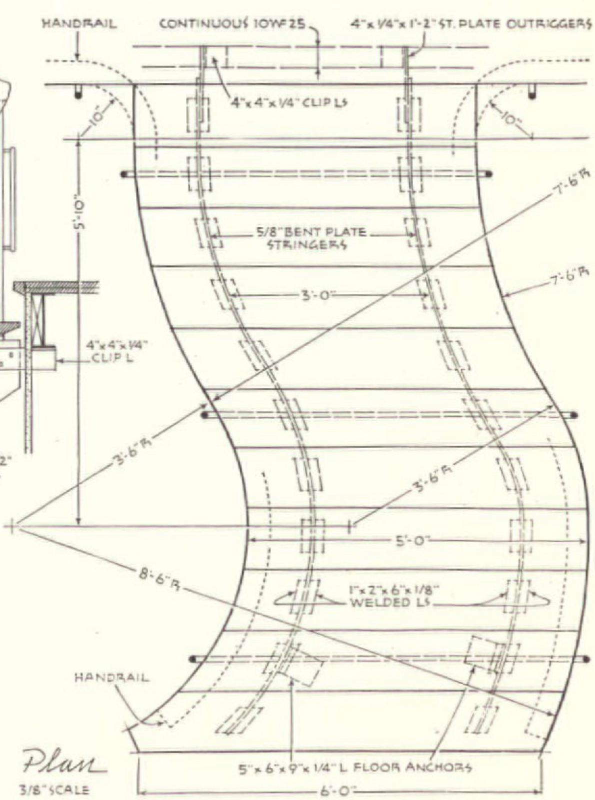
COUNTRY CLUB, Tulsa, Okla.
Donald H. Honn, Architect

Section 7 STAIRS & RAILINGS



EZRA STOLLER

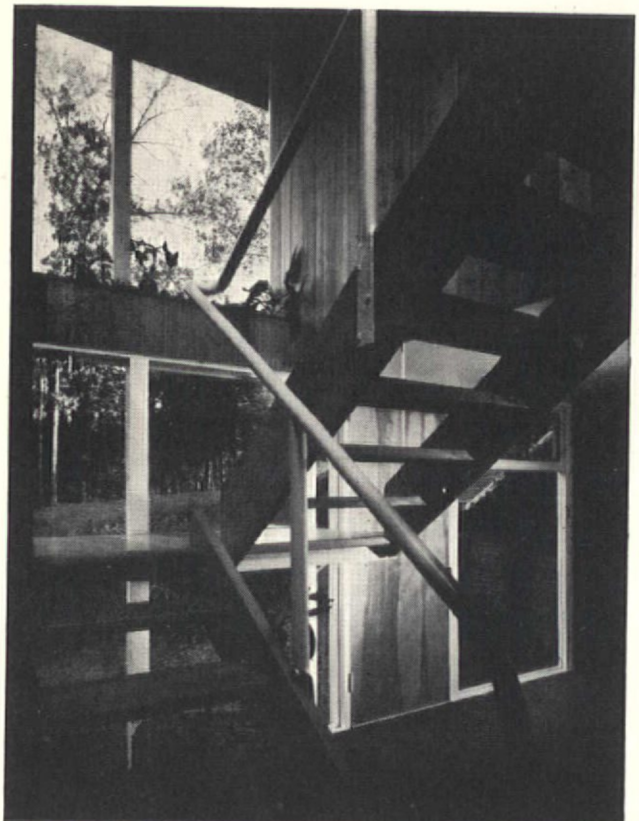




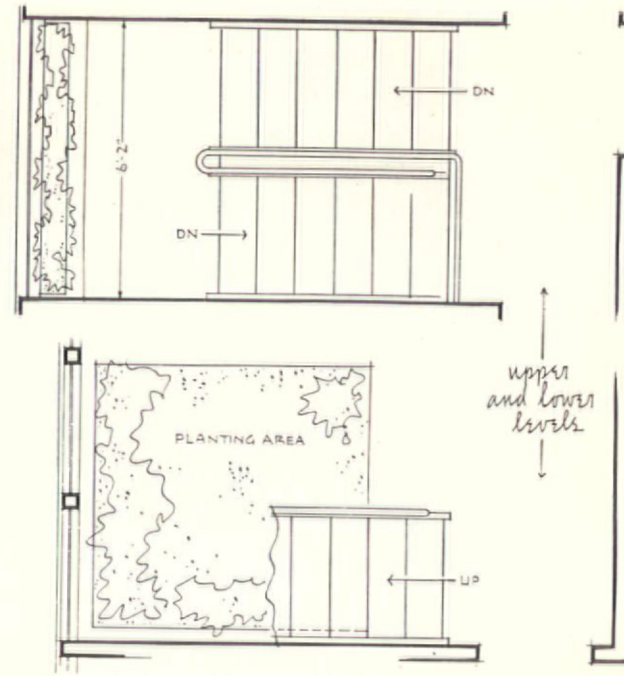
HOUSE, Long Island, N. Y.

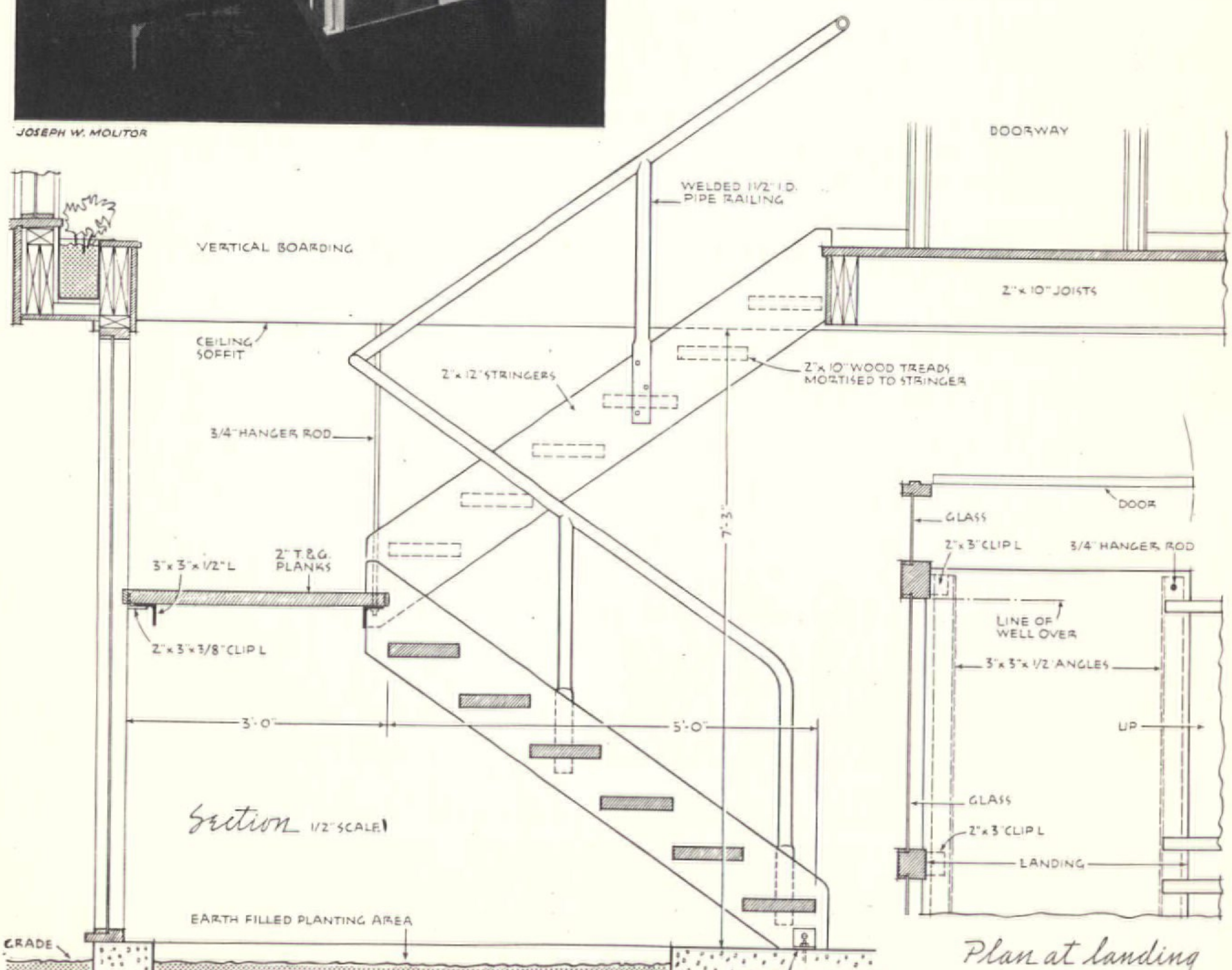
Katz-Waisman-Blumenkranz-Stein-Weber: Architects Associated

stairway



JOSEPH W. MOLITOR





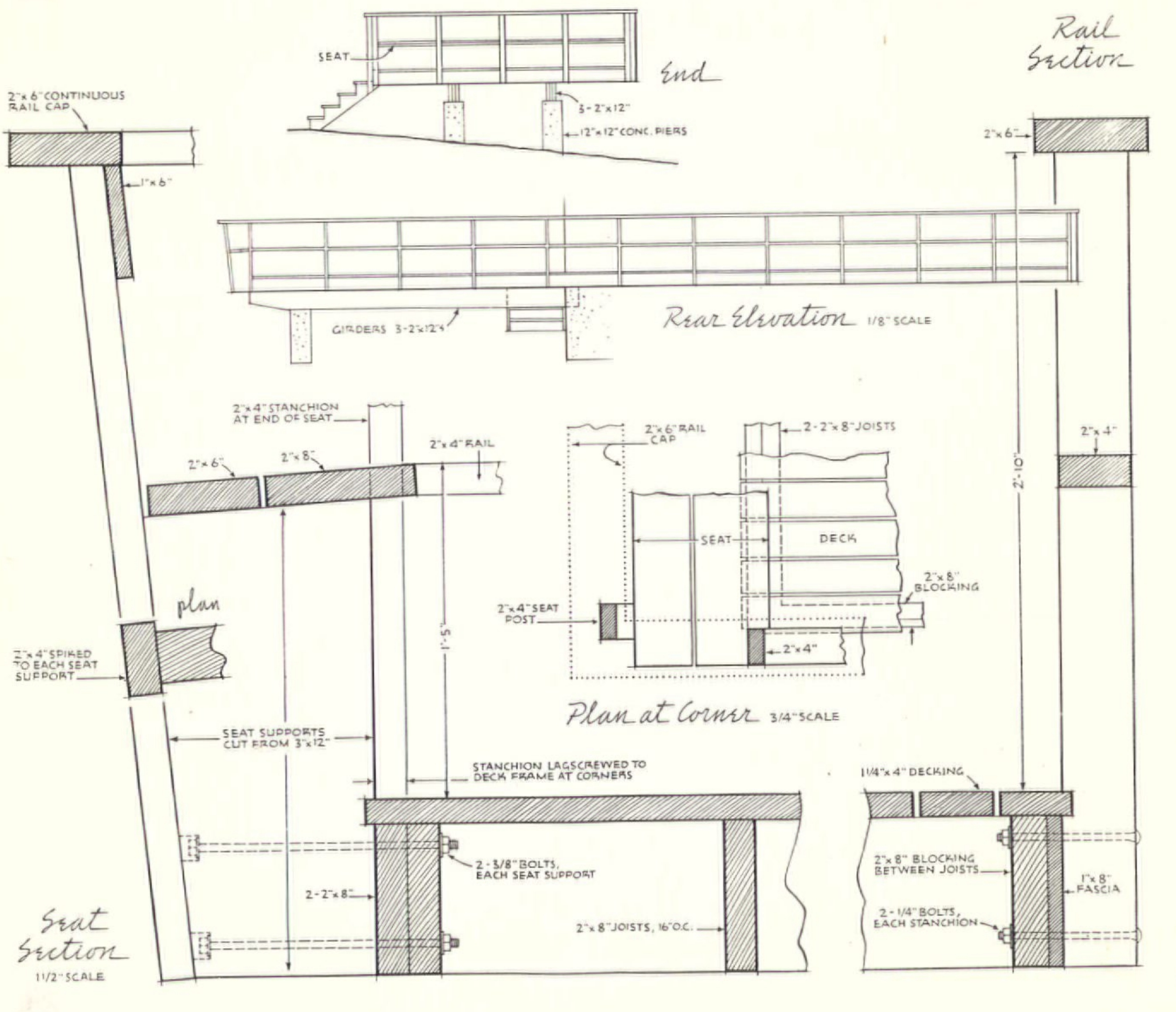
HOUSE, Charlotte, N. C.

A. G. Odell, Jr. & Associates, Architects

p/a selected detail

deck railing

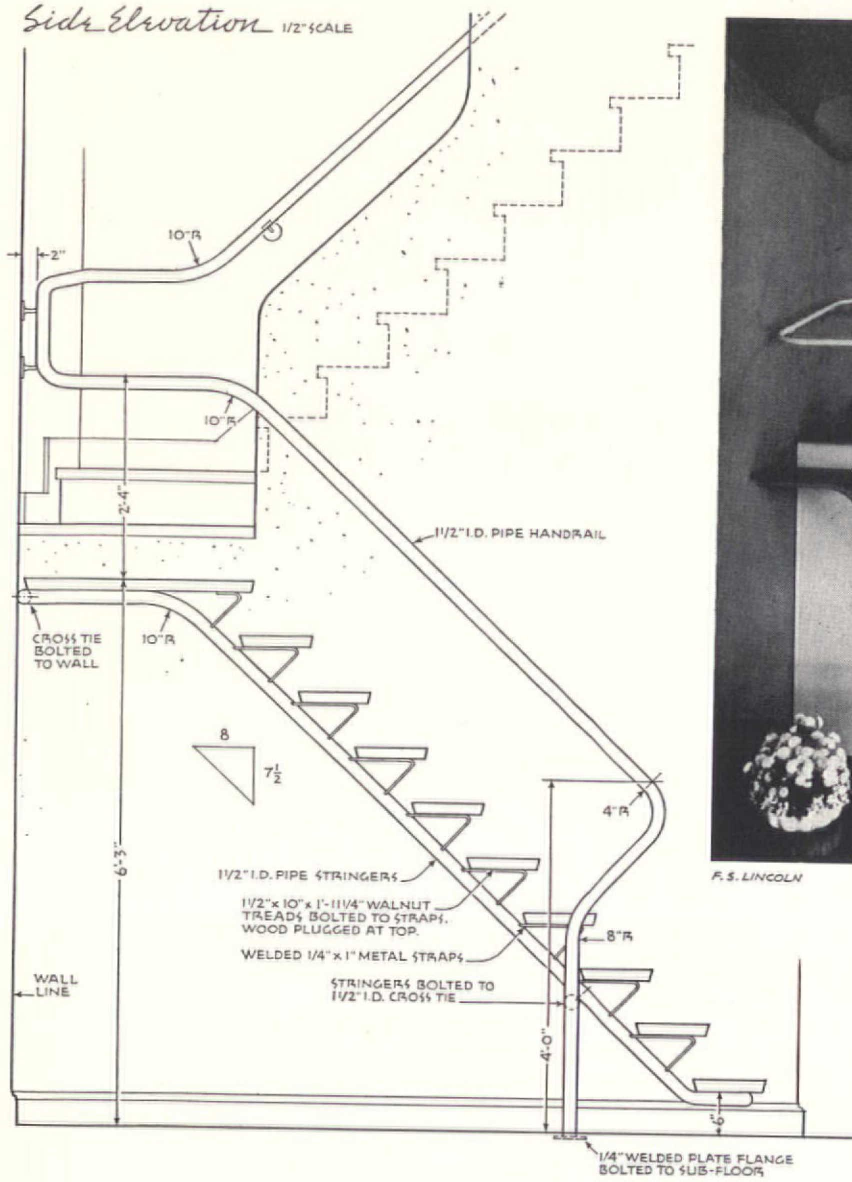
LOUIS REENS

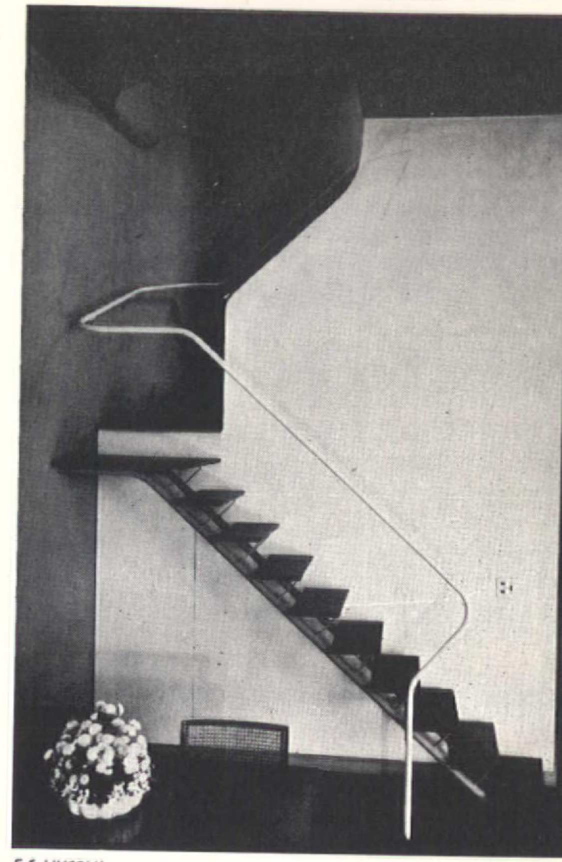


HOUSE, Weston, Conn.

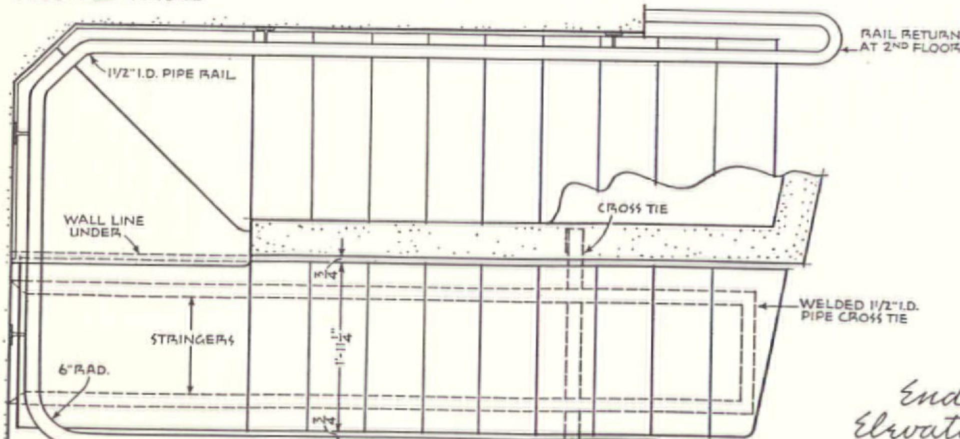
Huson Jackson, Architect

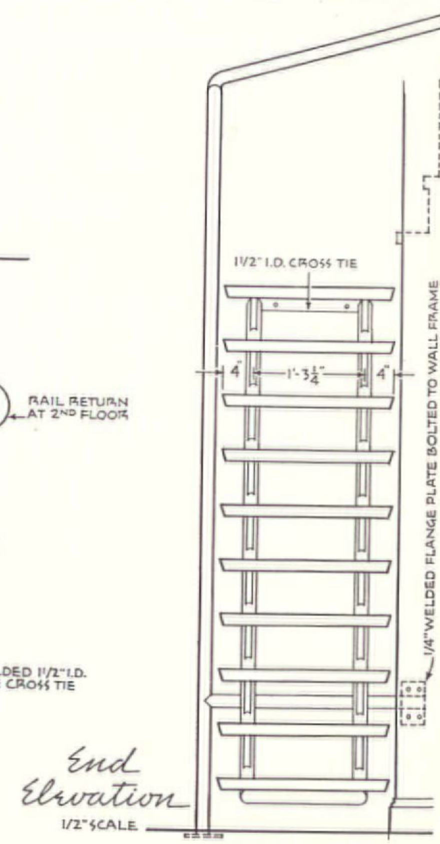
Side Elevation 1/2" SCALE




F. S. LINCOLN

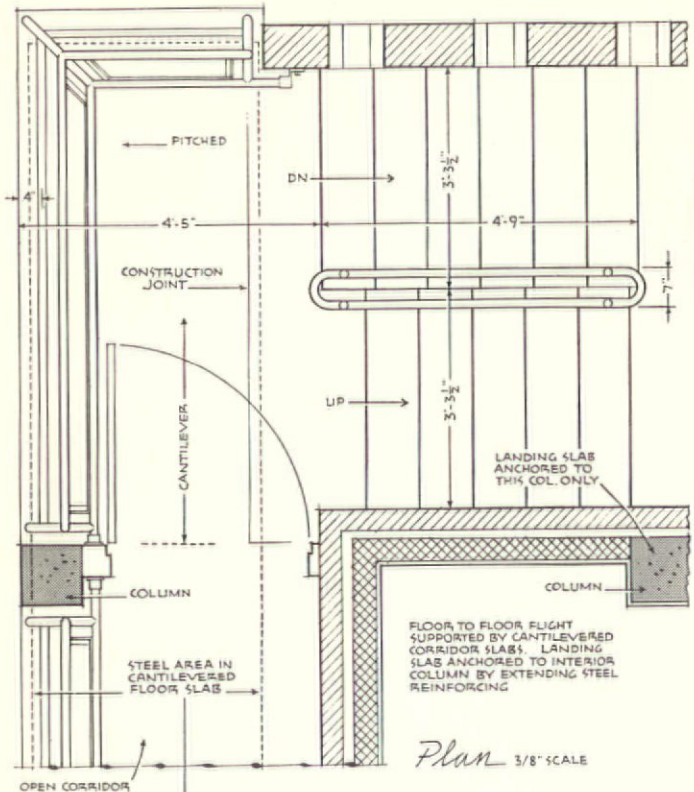
Plan 1/2" SCALE

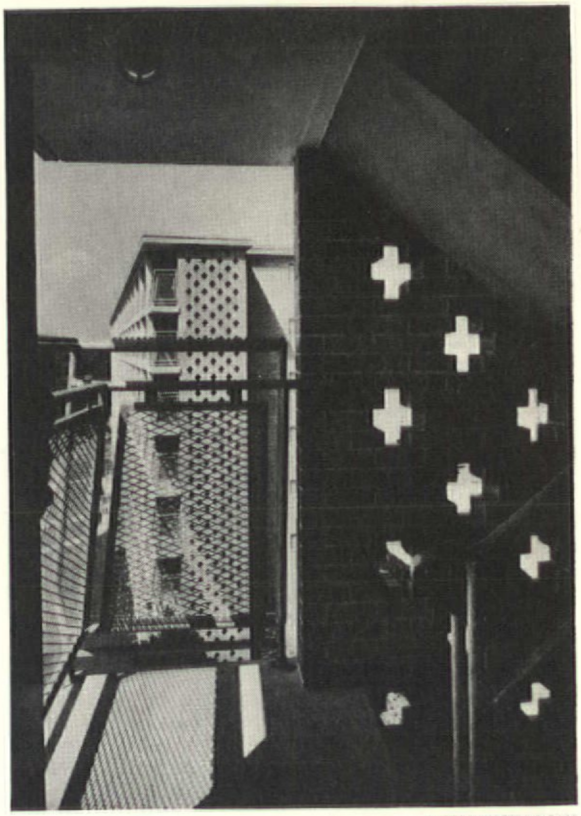




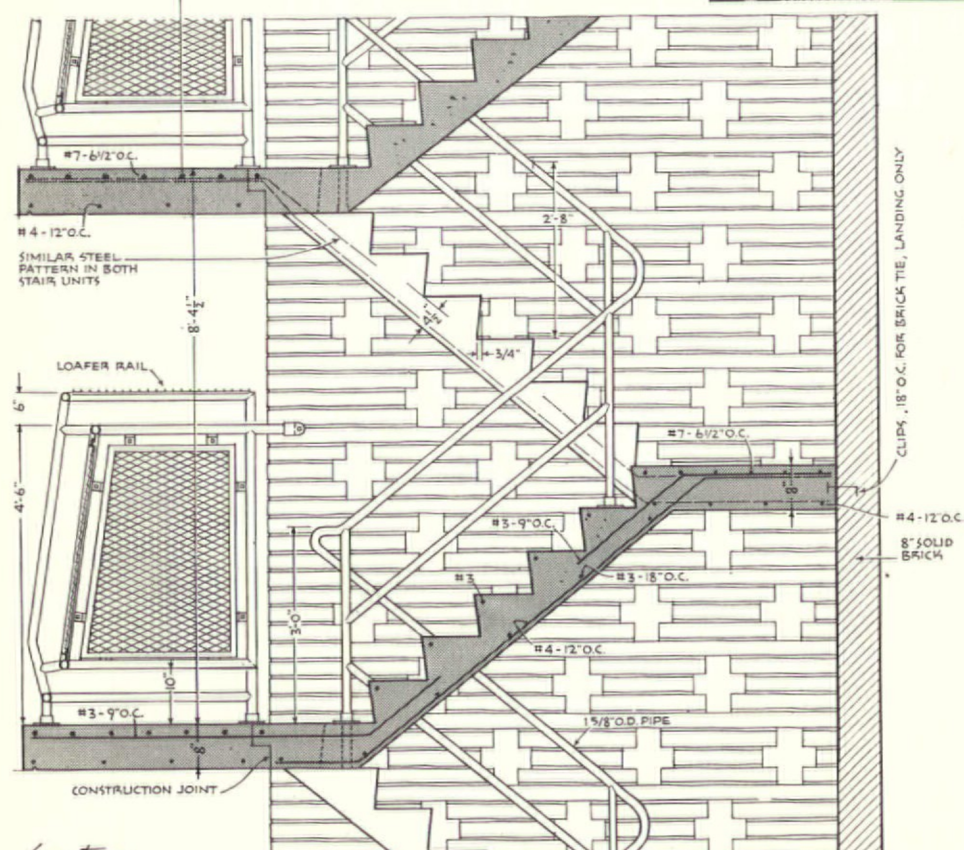
APARTMENT, New York, N. Y.
Joseph Aronson, Designer

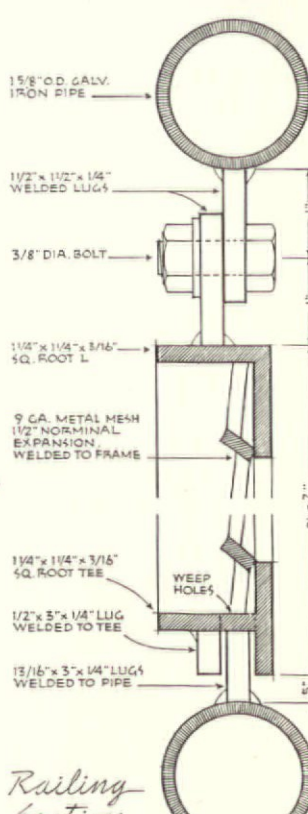
stair enclosure





GOTTSCHO-SCHLEISNER

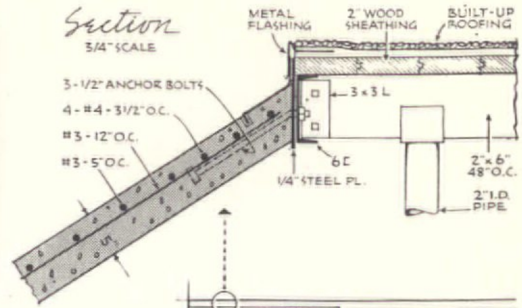


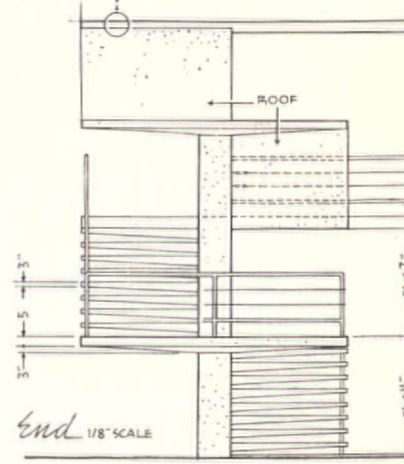


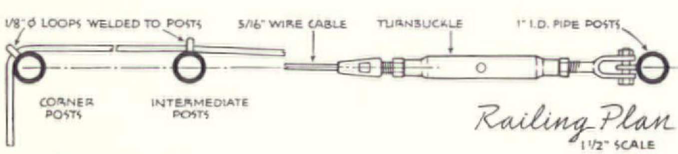
PUBLIC HOUSING, Stamford, Conn.
William F. R. Ballard, Architect

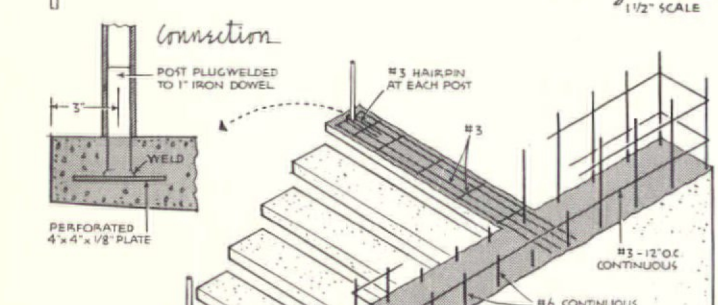
outside stair

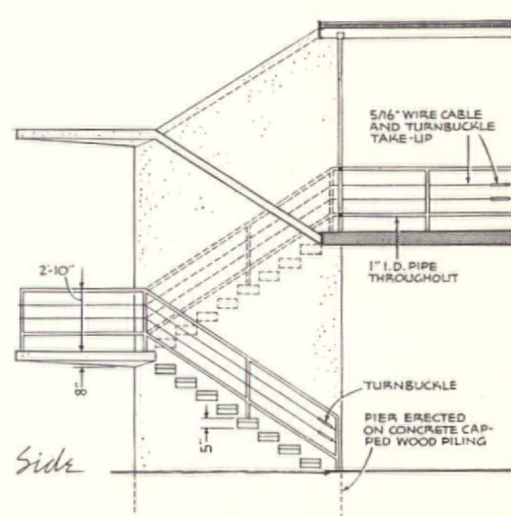
FRANK LOTZ MILLER

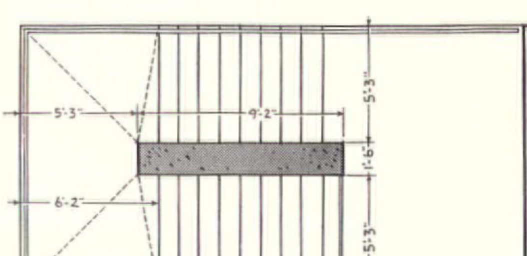










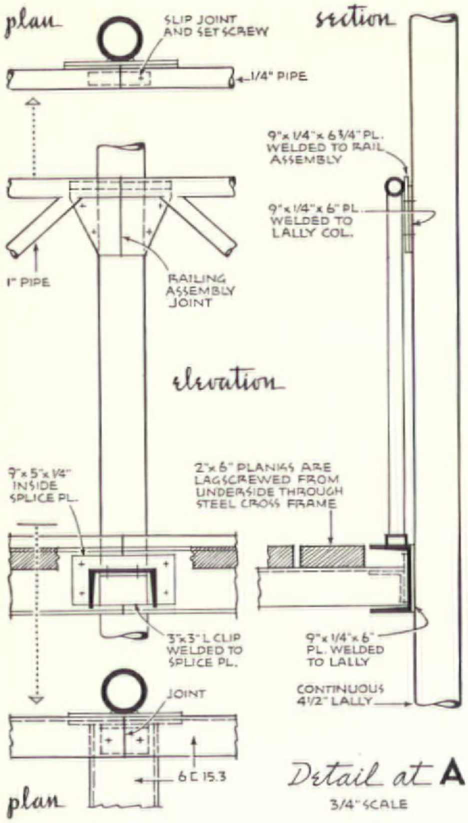


ELEMENTARY SCHOOL, New Orleans, La.

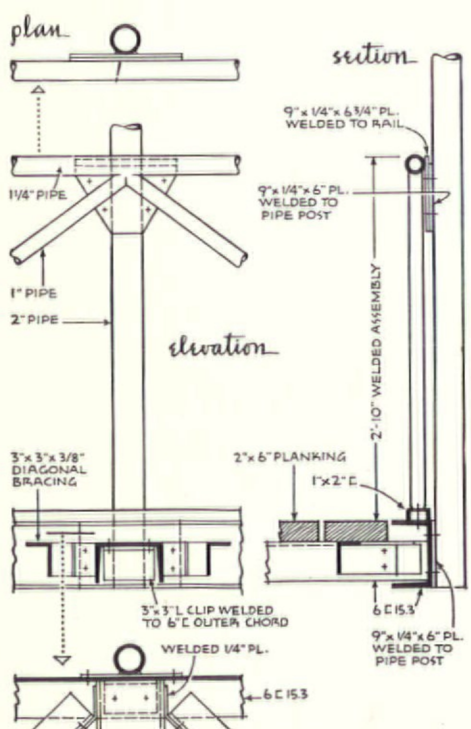
Sid Rosenthal, Architect; Charles R. Colbert, Associate Architect

p/a selected detail

pedestrian bridge

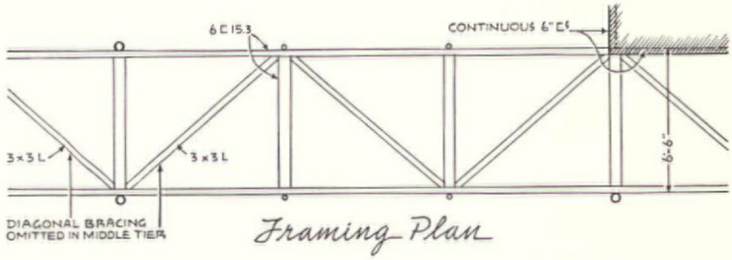


Detail at A
3/4" SCALE

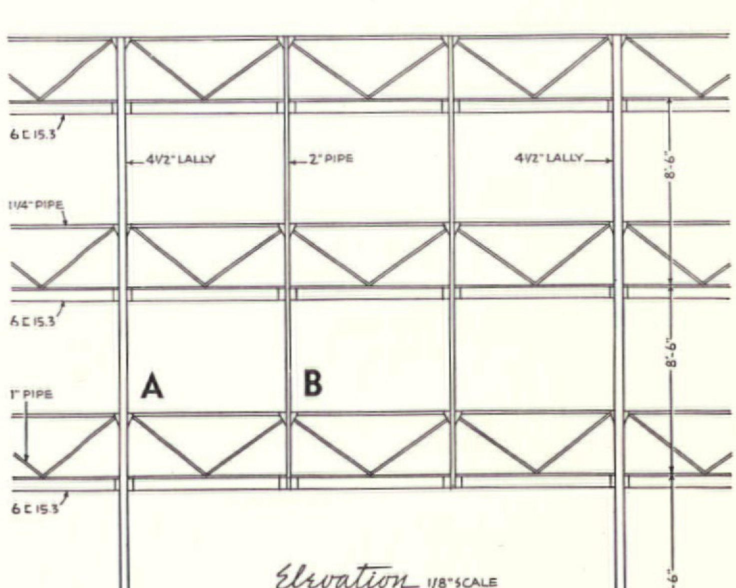


Detail at B
3/4" SCALE

WARREN REYNOLDS



Framing Plan

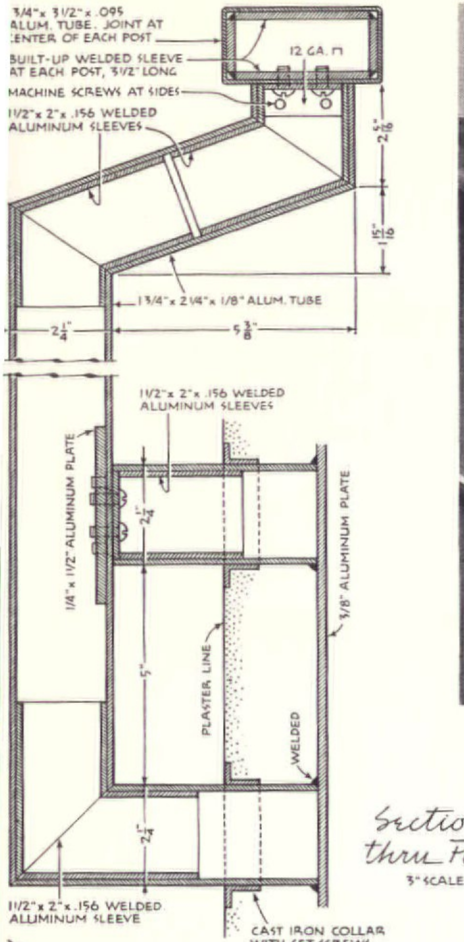


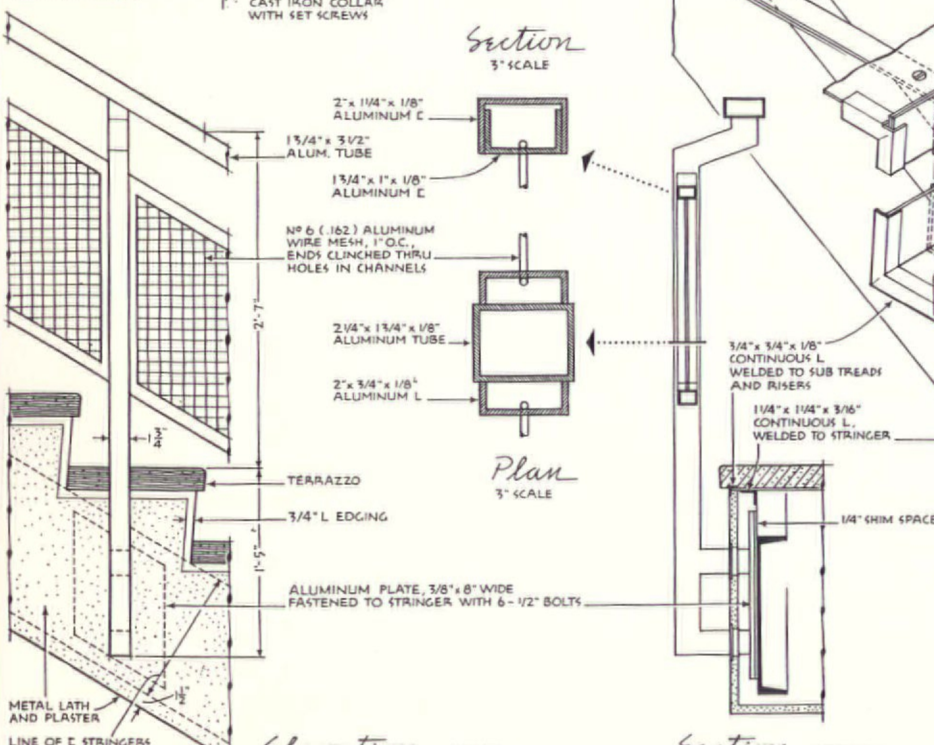
Elevation 1/8" SCALE

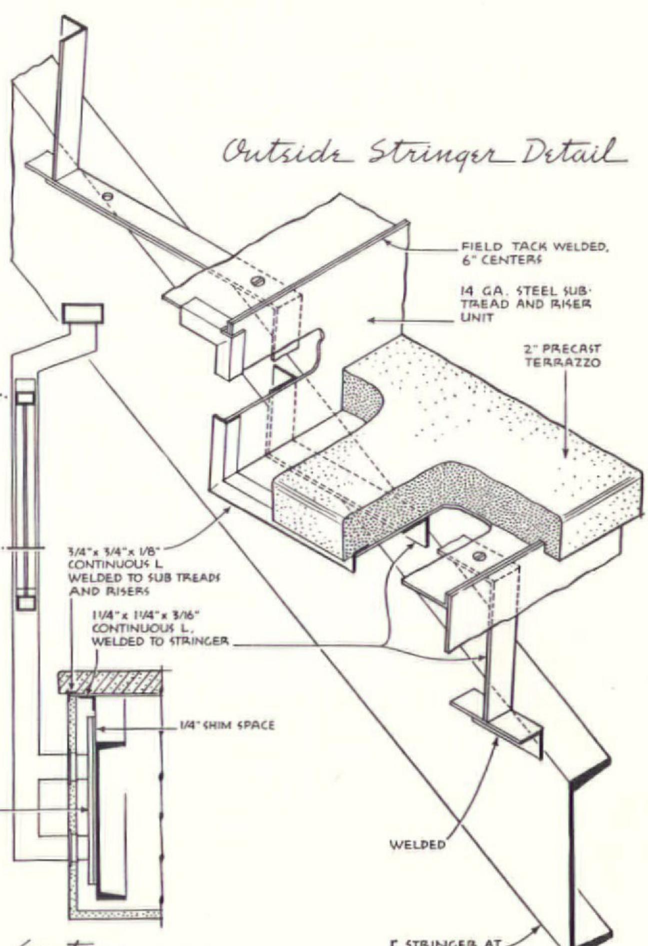
DRAKE UNIVERSITY, Des Moines, Iowa
Eero Saarinen & Associates, Architects

SELECTED DETAIL

p/a library: stair railing





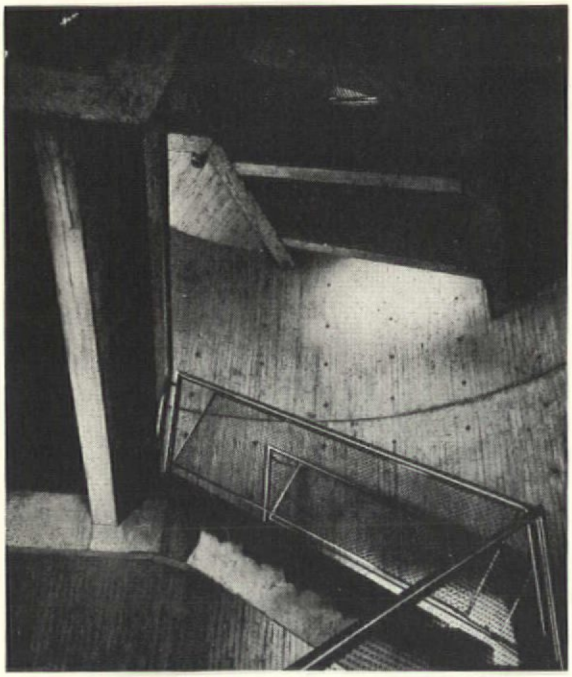


BRADLEY UNIVERSITY LIBRARY, Peoria, Ill.

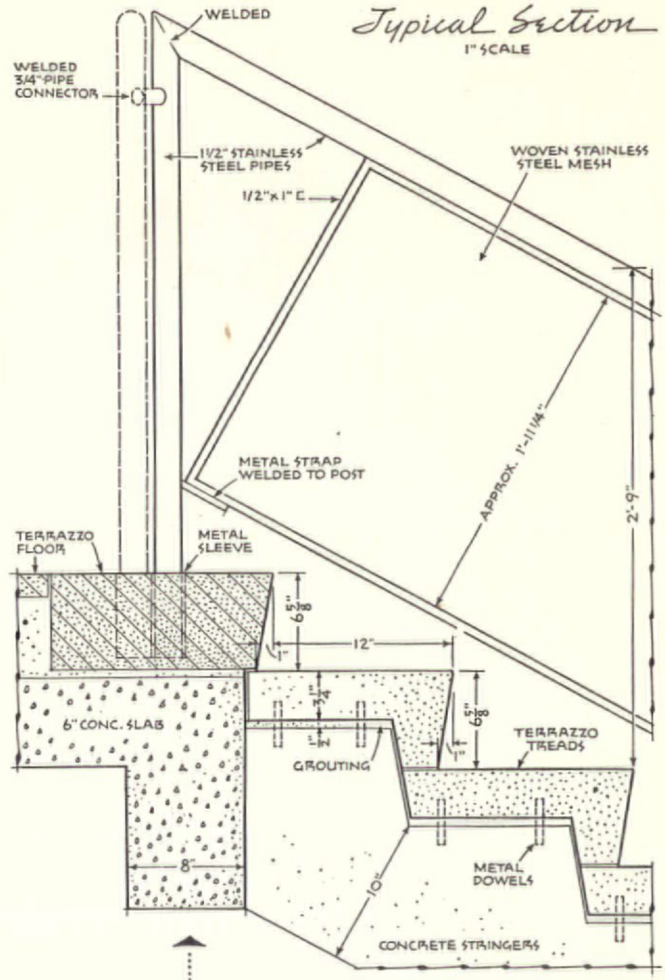
Emerson, Gregg & Briggs, Architects

p/a selected detail

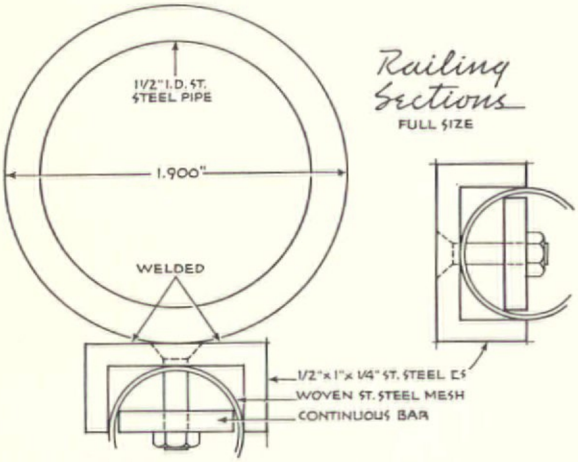
stairway



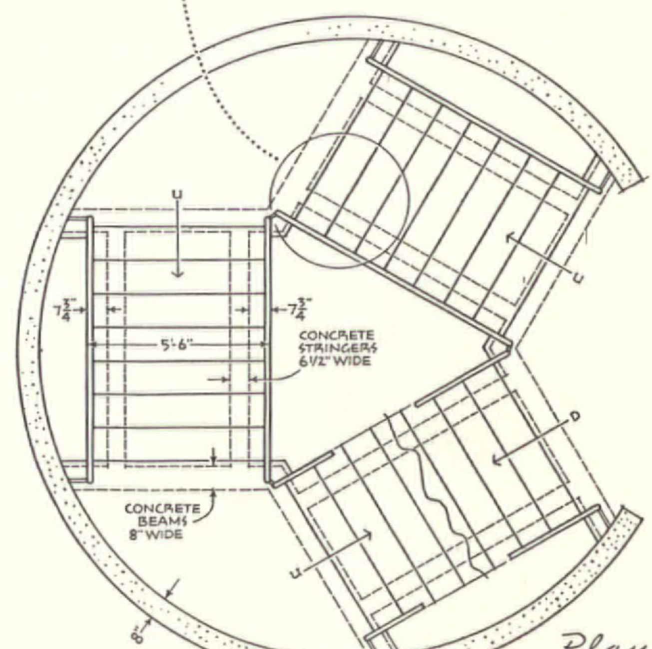
LIONEL FREEDMAN PHOTOS



Typical Section
1" SCALE



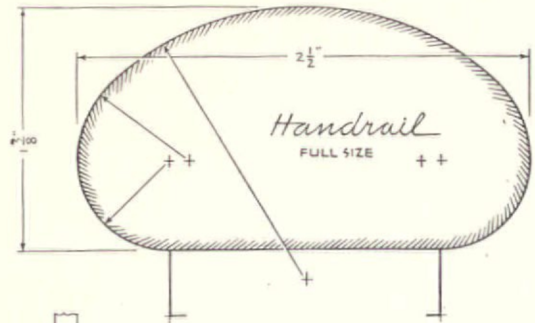
Railing Sections
FULL SIZE

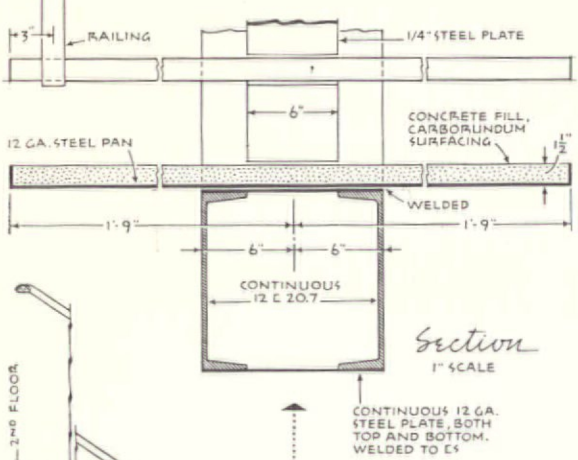


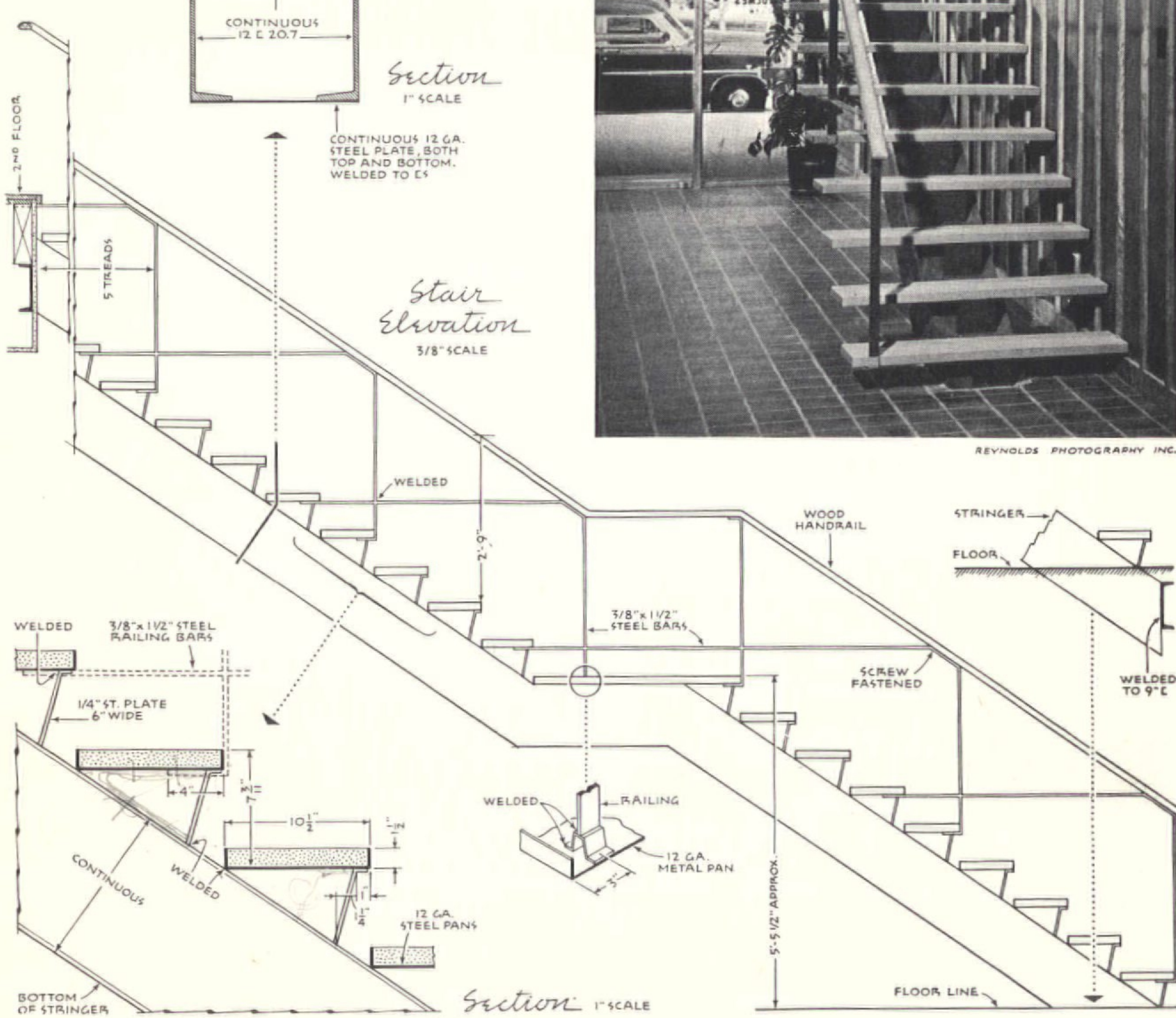
Plan
3/16" SCALE

ART GALLERY AND DESIGN CENTER, New Haven, Conn.
Douglas Orr-Louis I. Kahn, Associated Architects

bank: stairs





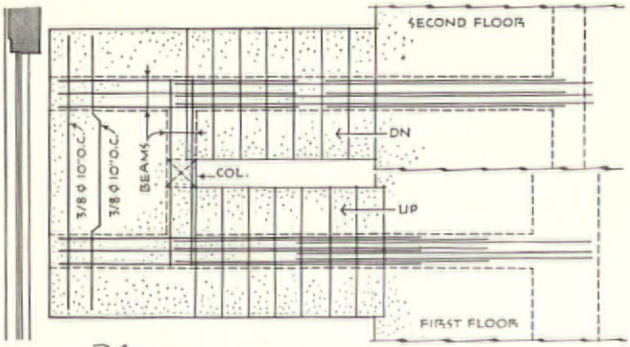


REYNOLDS PHOTOGRAPHY INC.

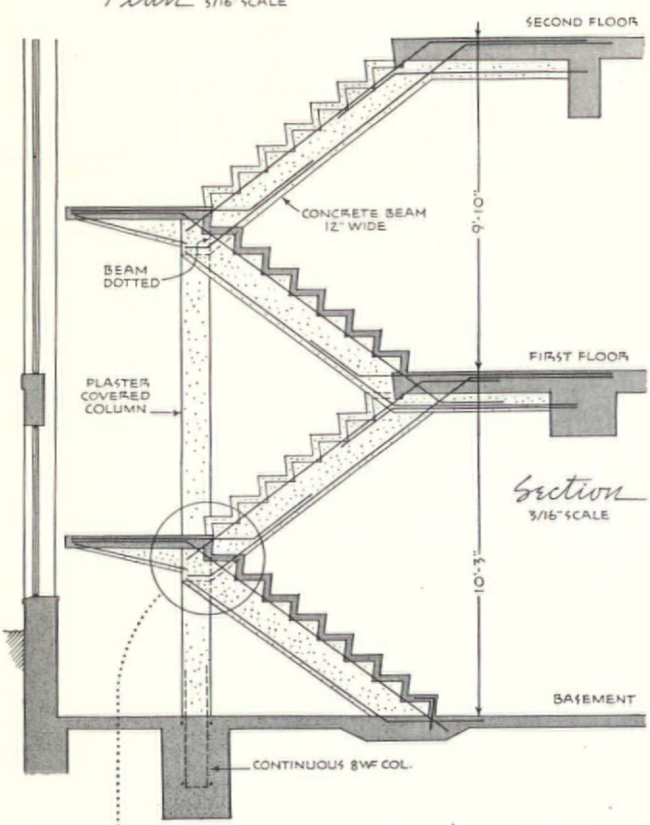
BOULDER INDUSTRIAL BANK, Boulder, Colo.

James M. Hunter, Architect

clinic: stairs

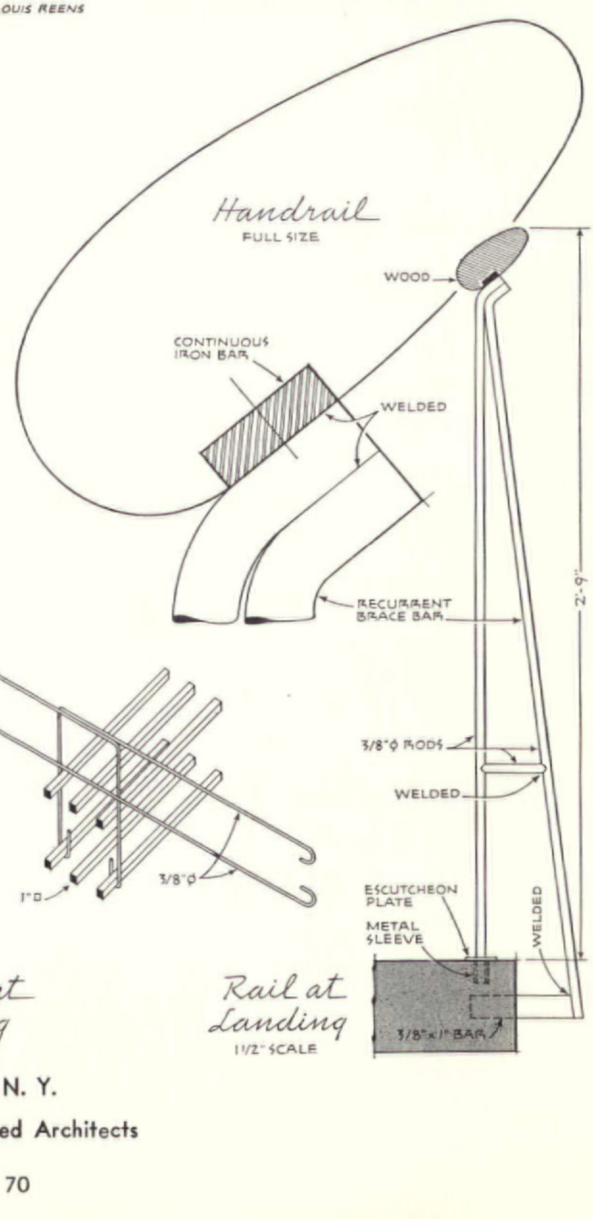


Plan 3/16" SCALE



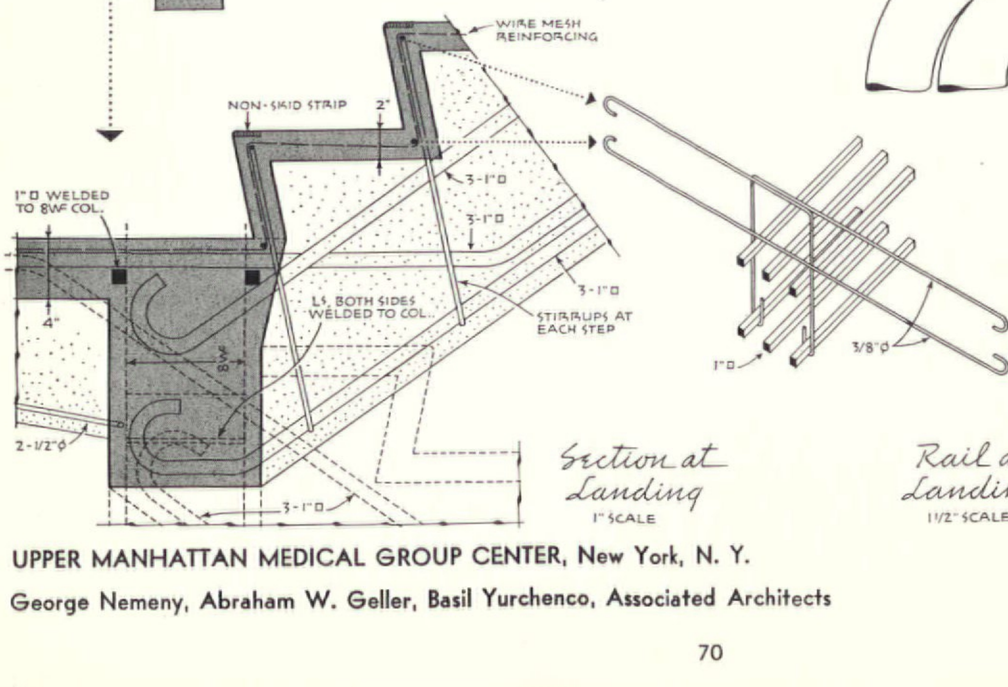
Section 3/16" SCALE

LOUIS REENS



Handrail FULL SIZE

Rail at Landing 1 1/2" SCALE



Section at Landing 1" SCALE

UPPER MANHATTAN MEDICAL GROUP CENTER, New York, N. Y.

George Nemeny, Abraham W. Geller, Basil Yurchenco, Associated Architects

Section 8 STORAGE UNITS

CORRIDOR STORAGE WALL — ELEMENTARY SCHOOL

CLASSROOM STORAGE WALL — HIGH SCHOOL

PUPIL BUNKS — KINDERGARTEN

STORAGE WALL — EXECUTIVE OFFICE

STORAGE WALL — HOUSE

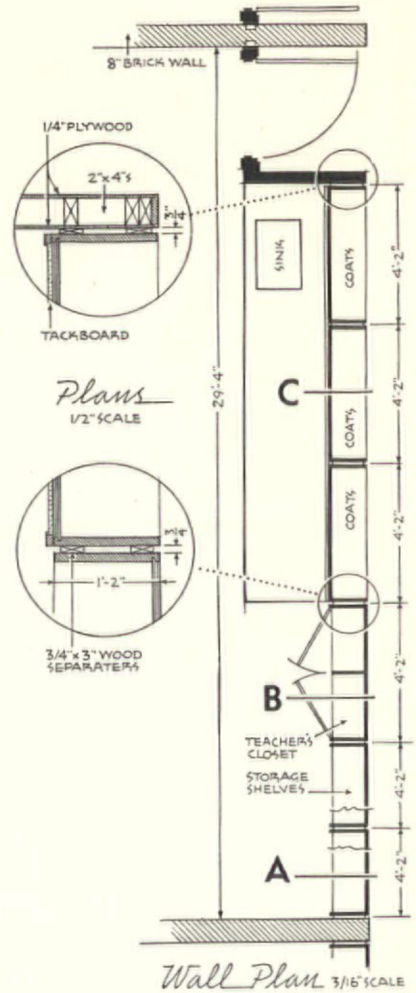
STORAGE UNITS — HOUSE

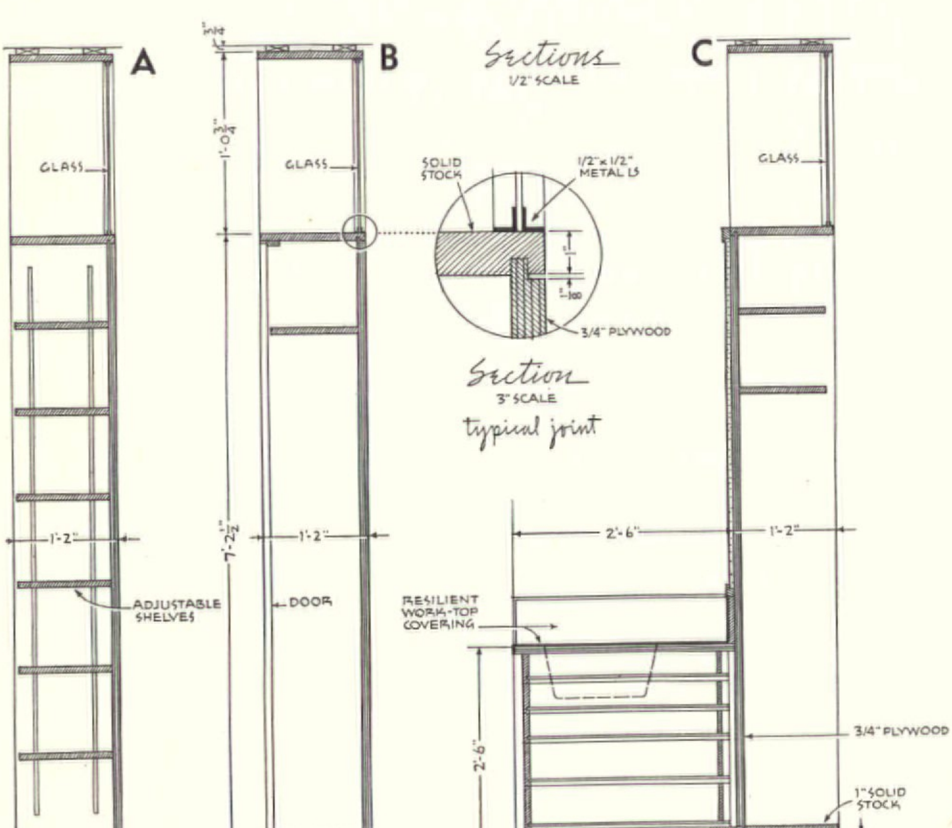
SEWING CABINET — HOUSE

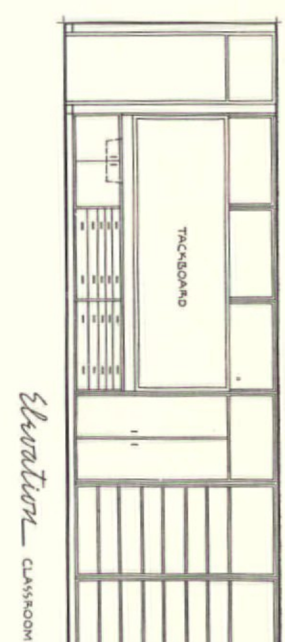
BATHROOM CABINET — HOUSE

corridor storage wall

GOTTSCHO-SCHLEISNER

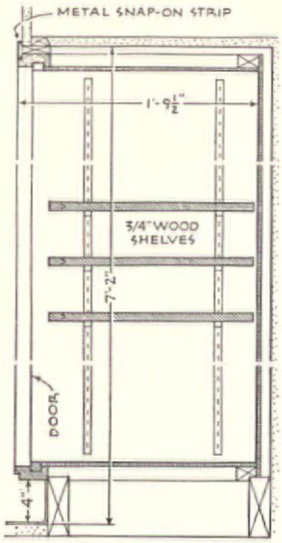




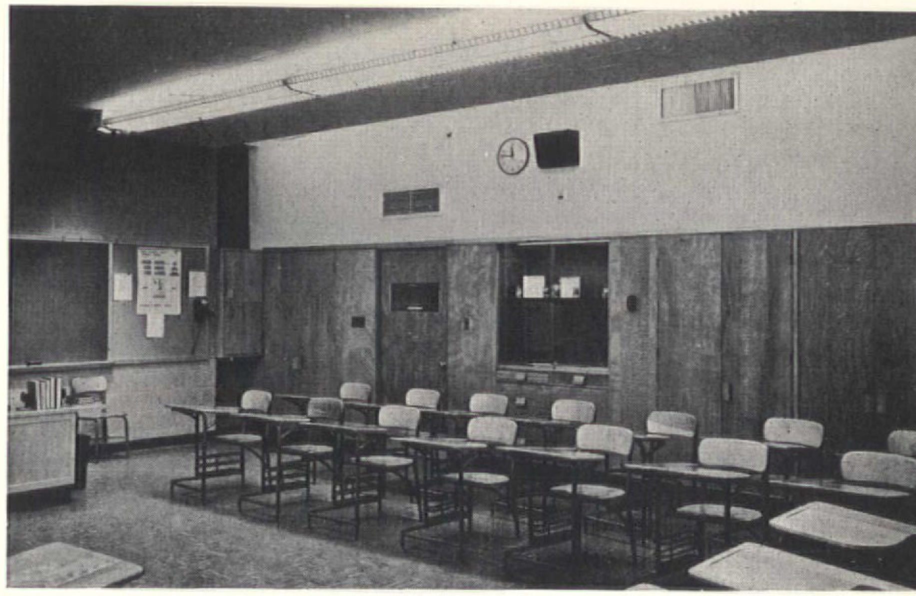


ELEMENTARY SCHOOL, Schenectady, N. Y.
Skidmore, Owings & Merrill, Architects

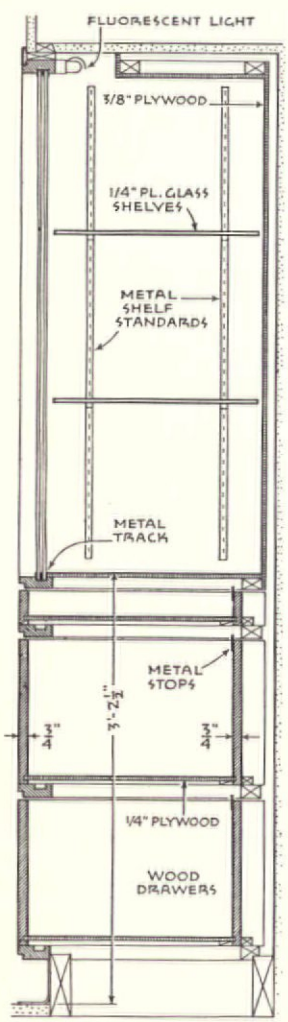
school: classroom storage wall



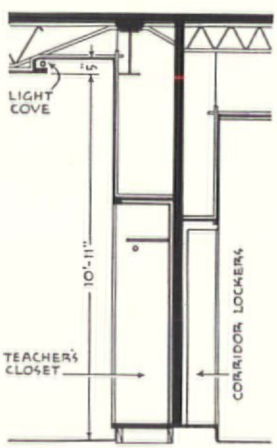
Section C 3/4" SCALE



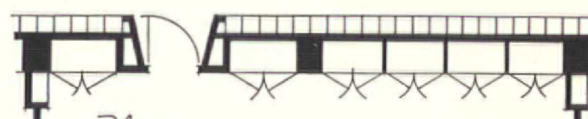
RICHARD SHIRK



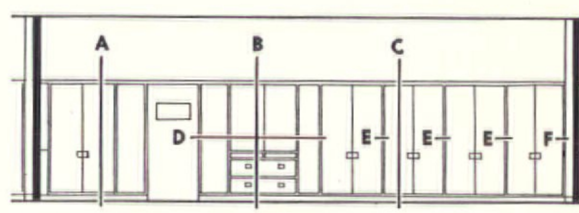
Section B 3/4" SCALE



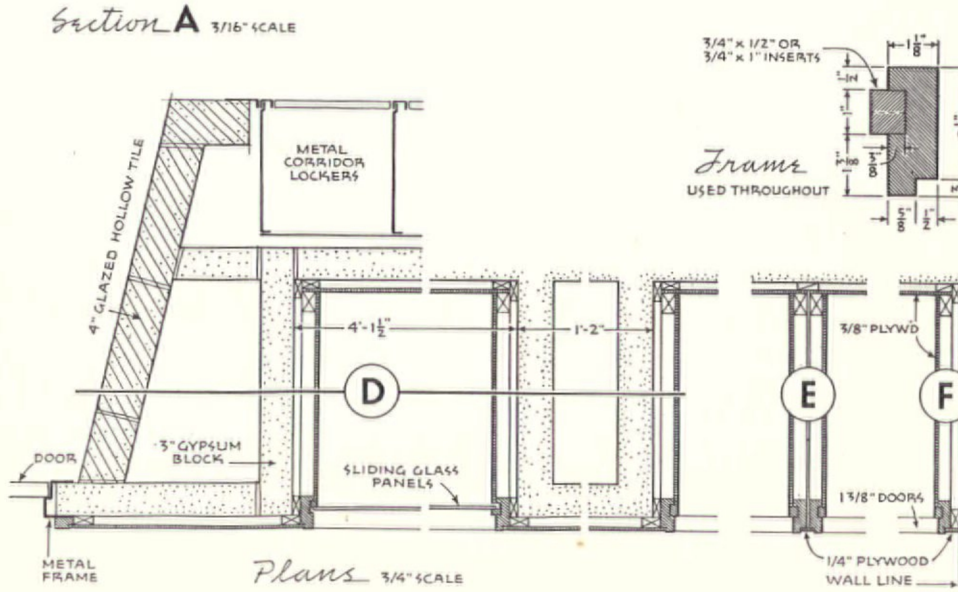
Section A 3/16" SCALE



Plan



Elevation 3/32" SCALE

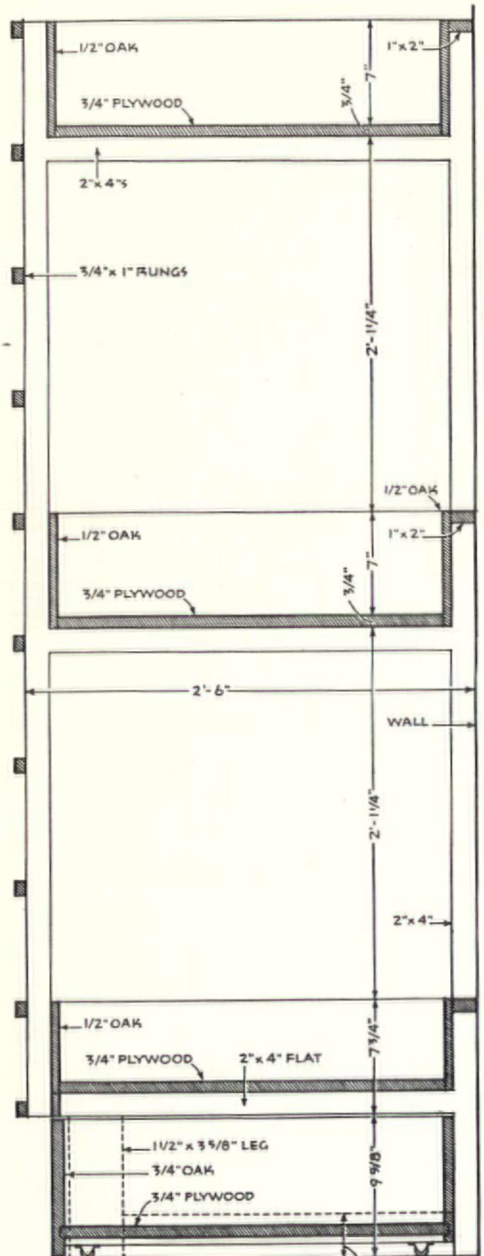


Plans 3/4" SCALE

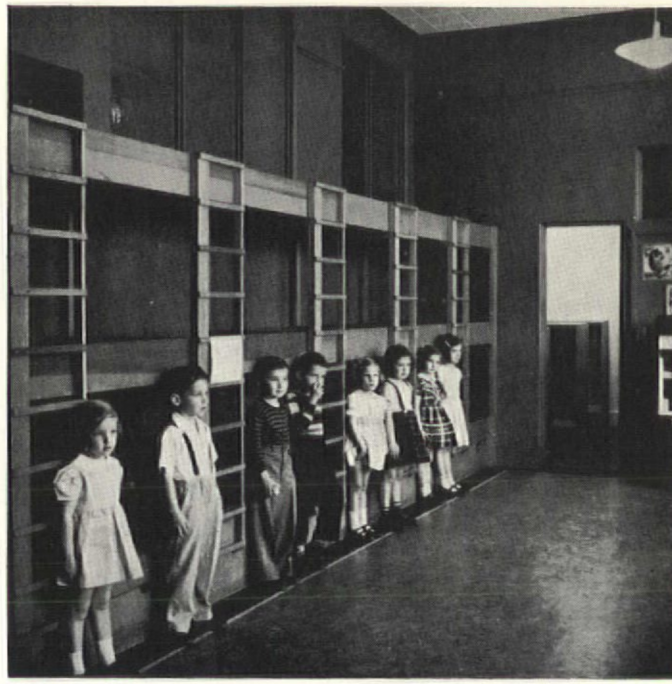
BIRMINGHAM HIGH SCHOOL, Birmingham, Mich.

Swanson Associates, Architects

kindergarten: bunks

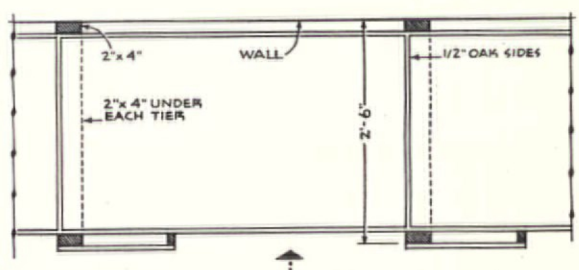


Section 1" SCALE

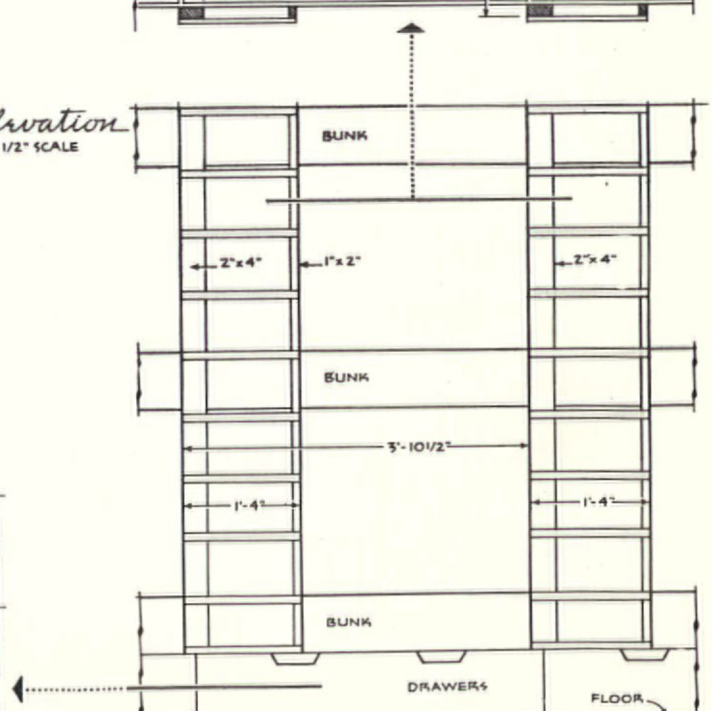


SUZANNE SZASZ

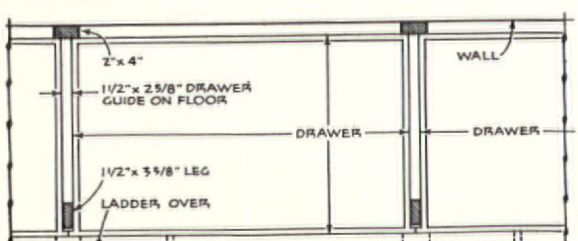
Plan 1/2" SCALE



Elevation 1/2" SCALE



Plan 1/2" SCALE

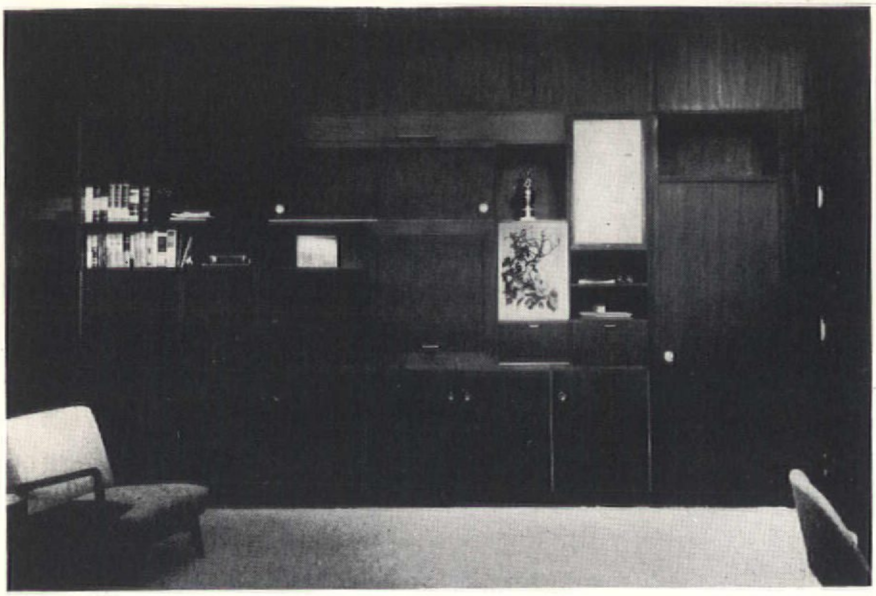


MILTON SCHOOL, Rye, N.Y.

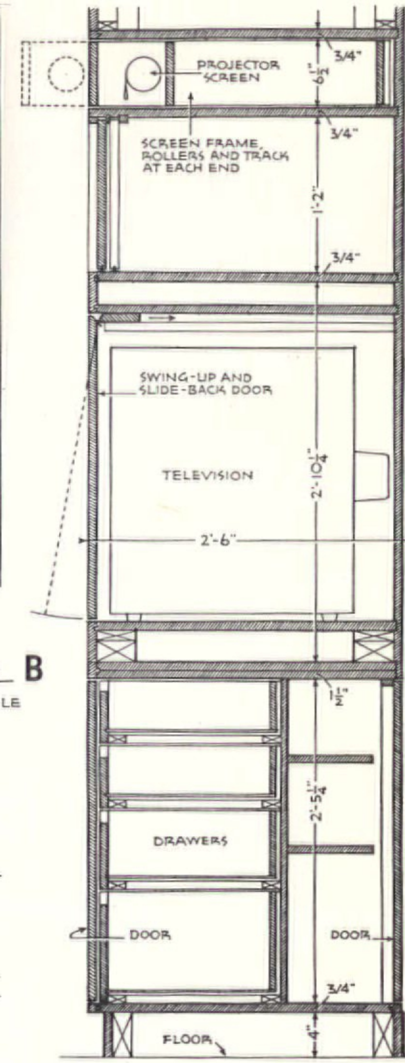
Caleb Hornbostel, Architect

p/a selected detail

storage wall



MARTIN LINSEY

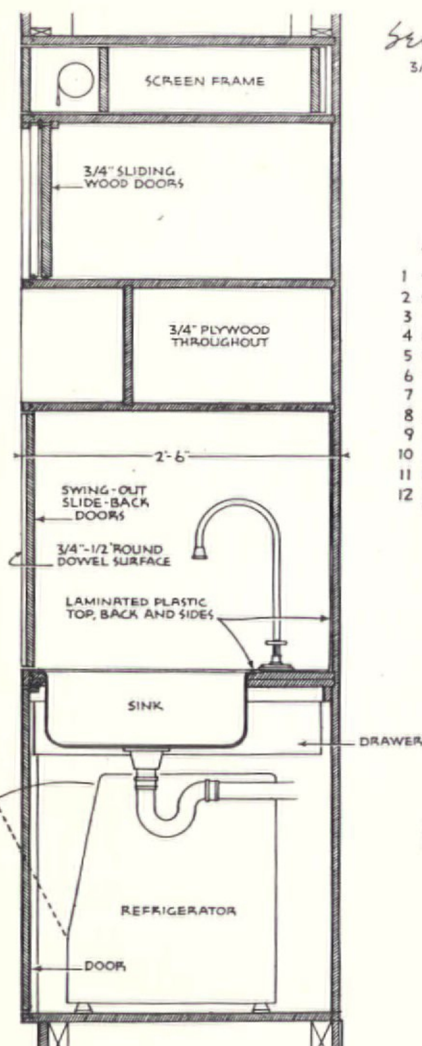


Section **A**

3/4" SCALE

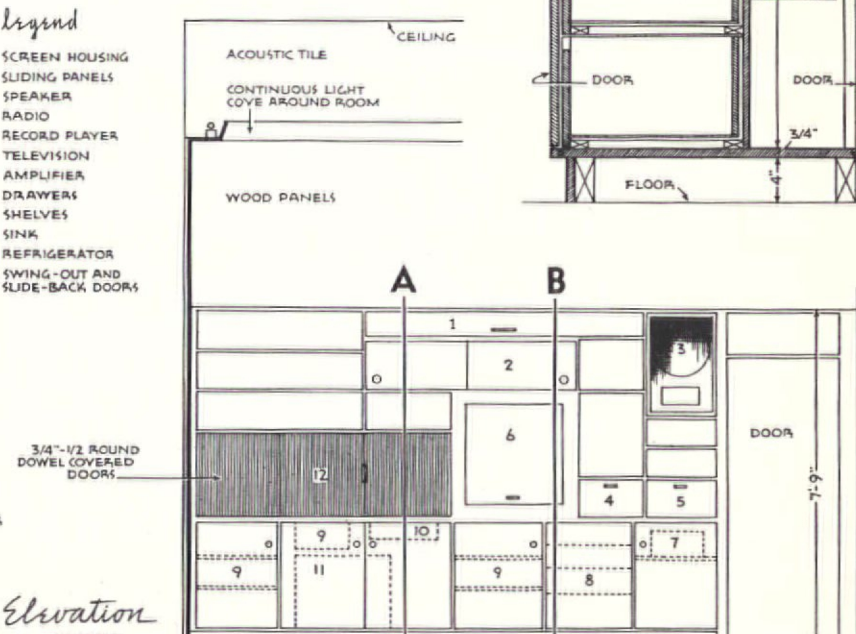
Section **B**

3/4" SCALE



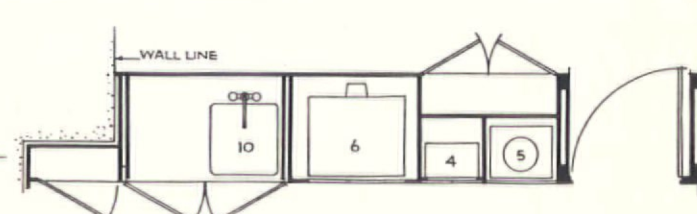
Legend

1 SCREEN HOUSING
2 SLIDING PANELS
3 SPEAKER
4 RADIO
5 RECORD PLAYER
6 TELEVISION
7 AMPLIFIER
8 DRAWERS
9 SHELVES
10 SINK
11 REFRIGERATOR
12 SWING-OUT AND SLIDE-BACK DOORS



Elevation

1/4" SCALE



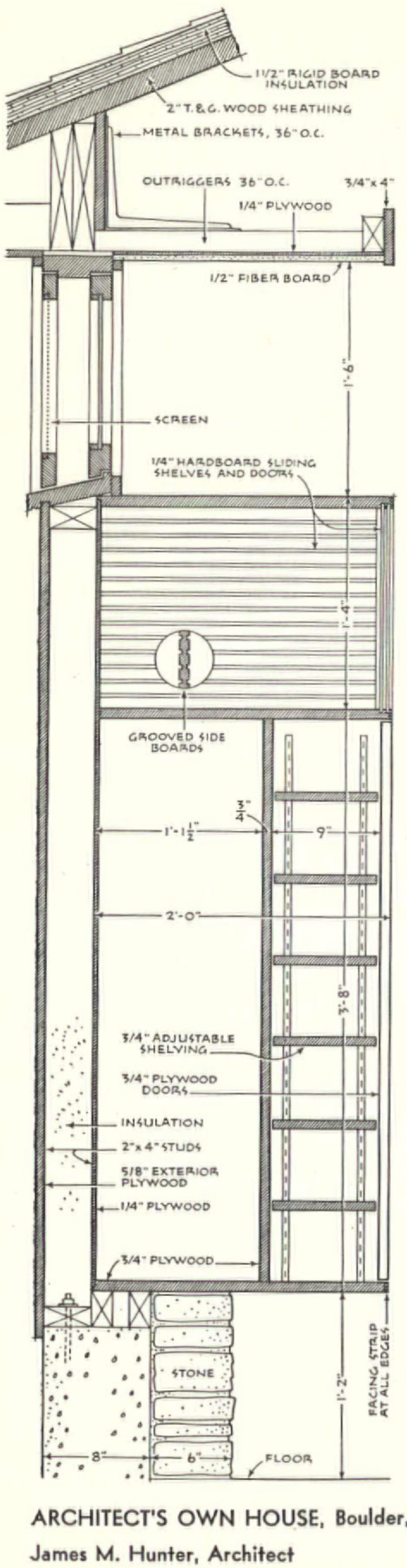
Plan

1/4" SCALE

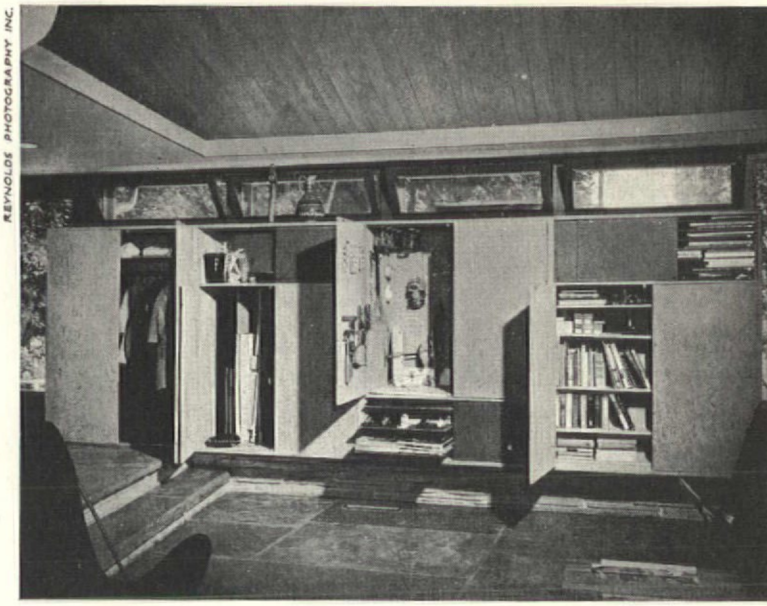
EXECUTIVE OFFICE, Cleveland, Ohio
George Rider Company, Architects
Leon Gordon Miller, Interior Designer

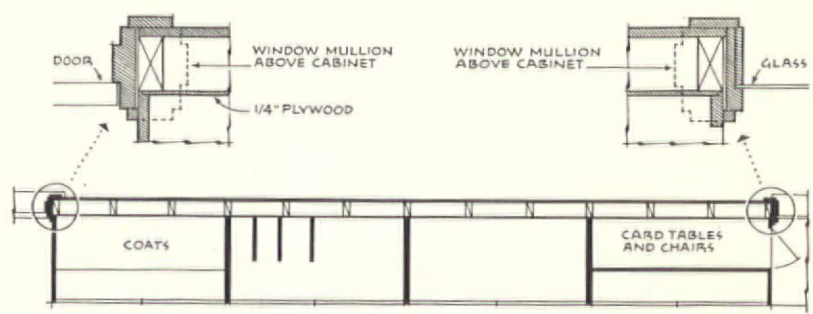
house: storage wall

Section at A 1" SCALE



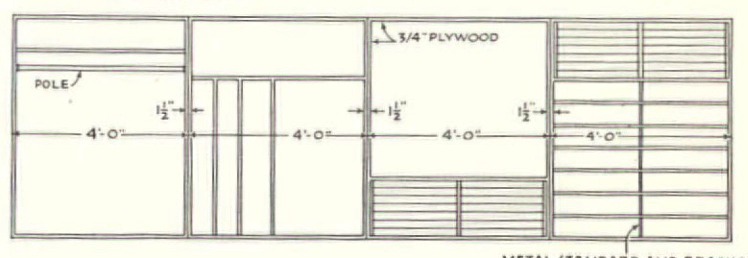
REYNOLDS PHOTOGRAPHY INC.

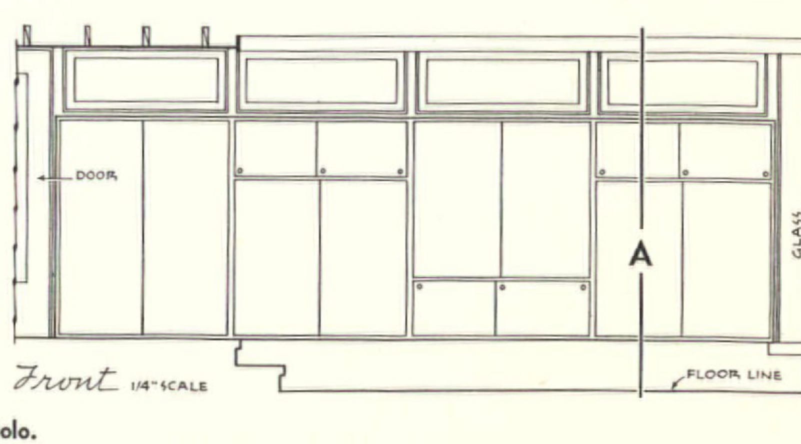




Plan 1/4" SCALE

Doors removed



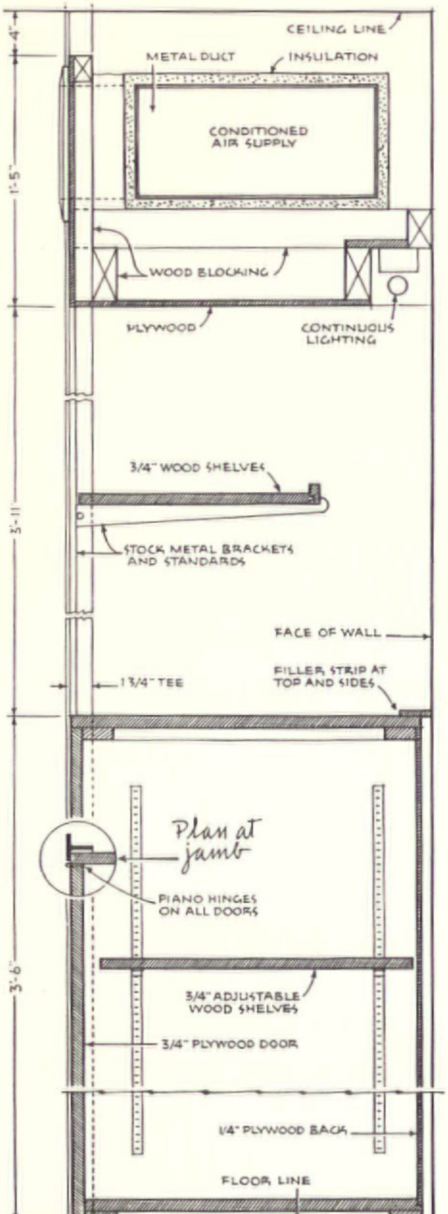


Front 1/4" SCALE

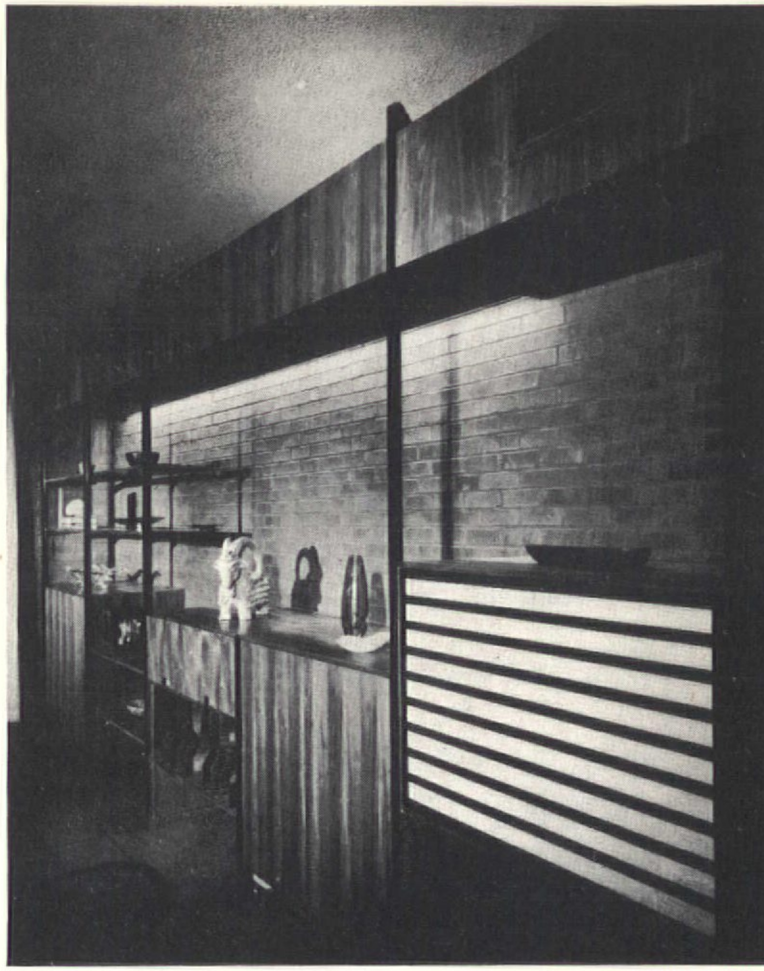
ARCHITECT'S OWN HOUSE, Boulder, Colo.

James M. Hunter, Architect

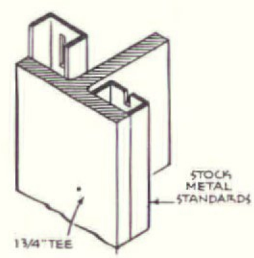
storage unit



Section at A 1" scale

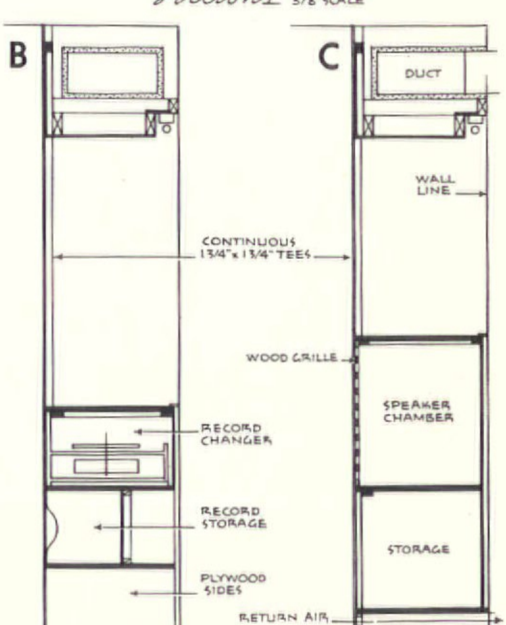


ULRIC MEISEL

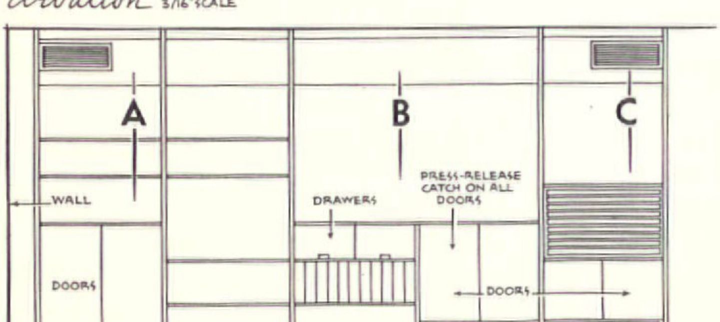


Bracket Support

Sections 3/8" scale



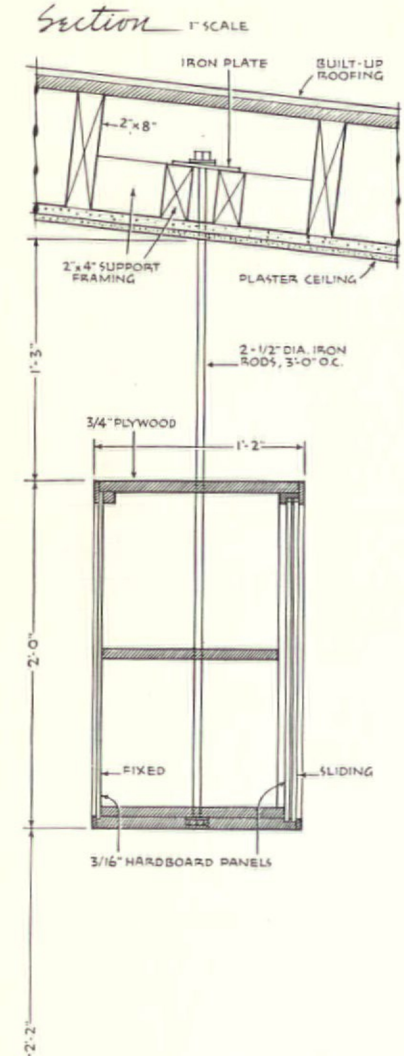
Elevation 3/16" scale



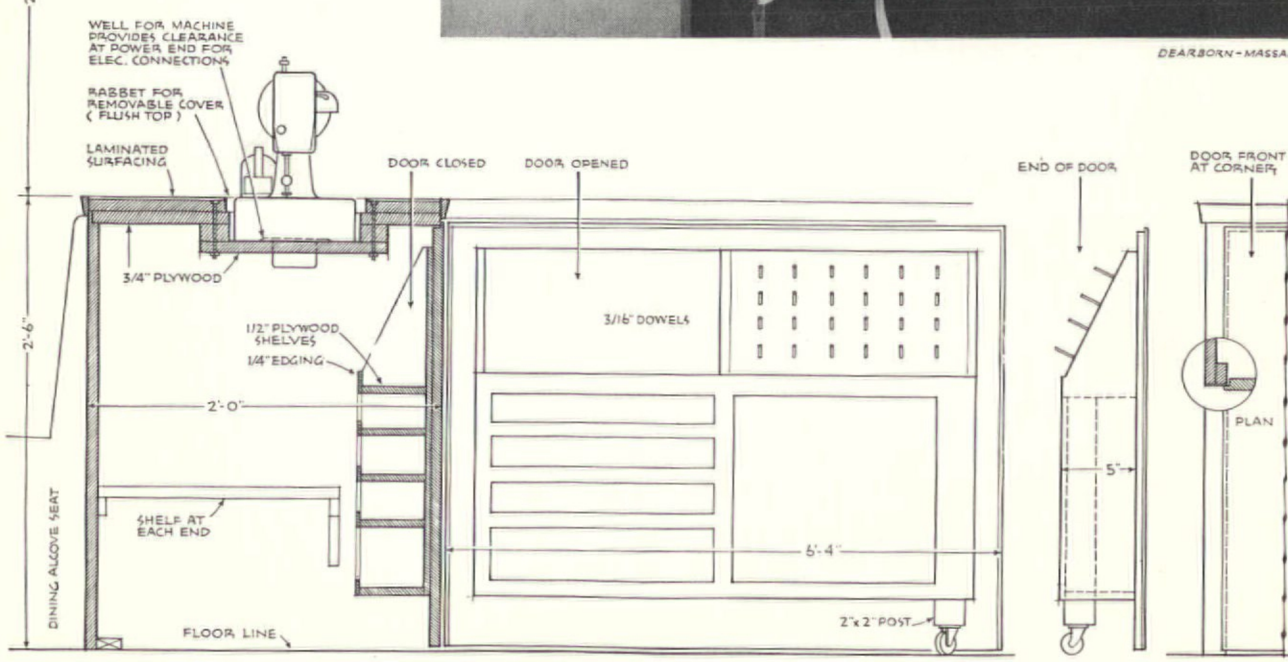
HOUSE, Dallas, Tex.

Enslie Oglesby, Jr., Architect

sewing cabinet



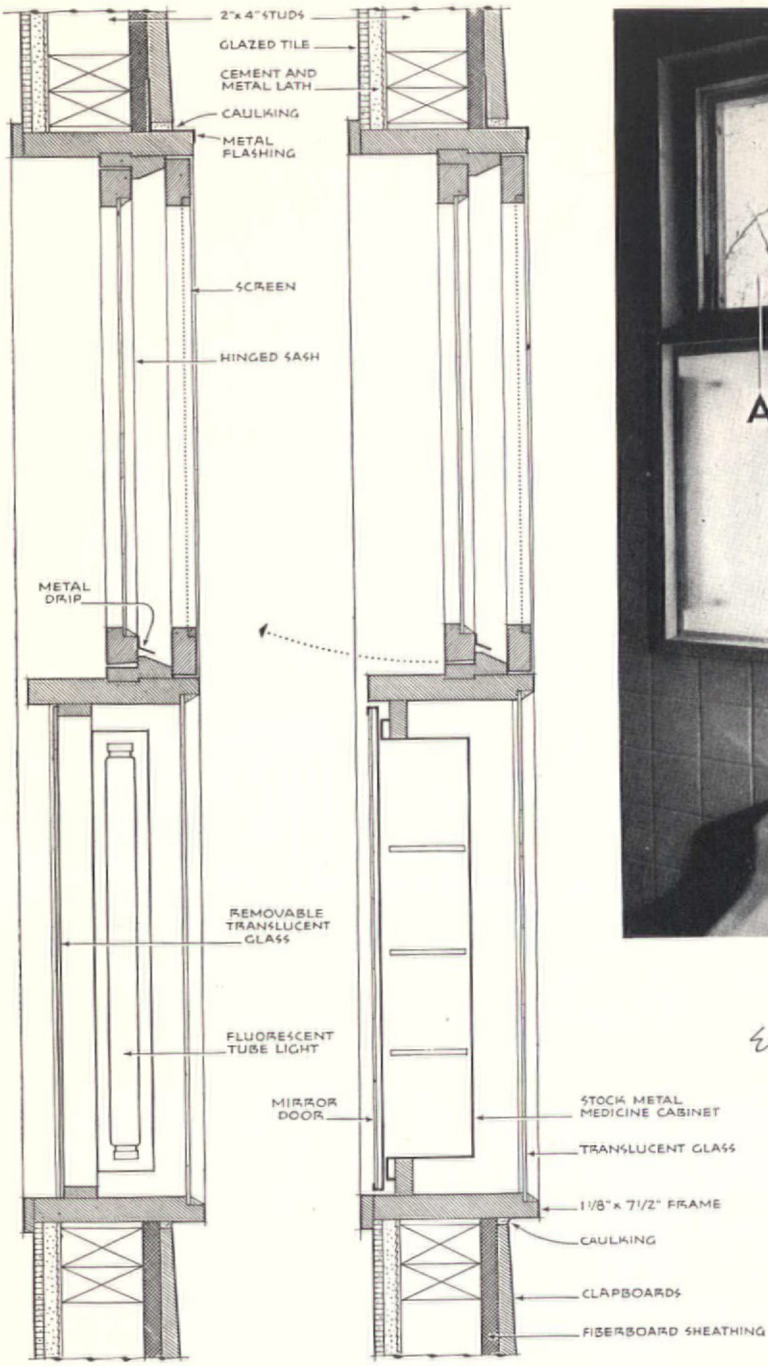
DEARBORN-MASSAR



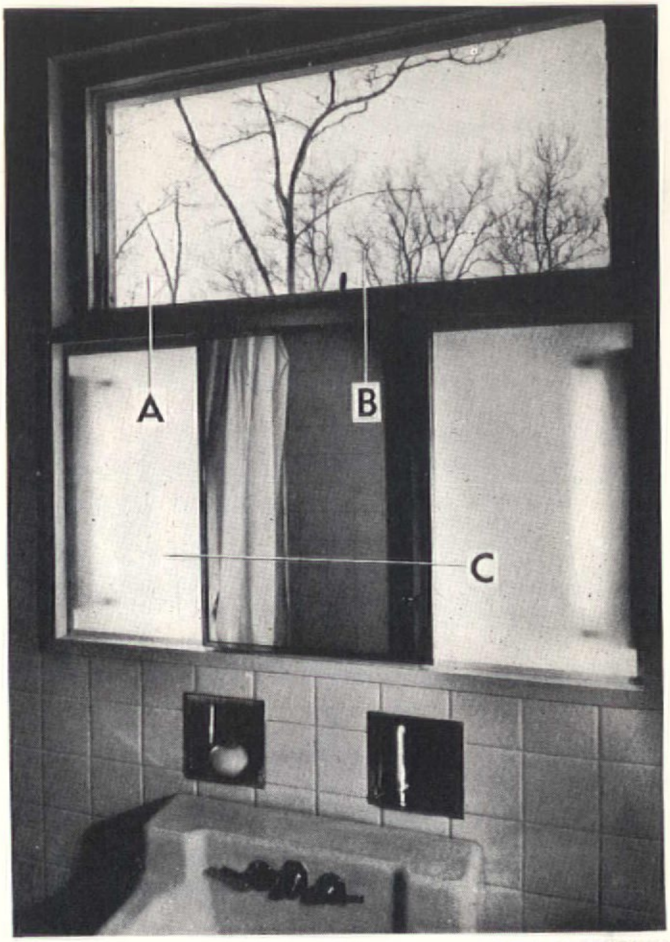
HOUSE, Tacoma, Wash.

Robert Billsbrough Price, Architect

house: medicine cabinet window unit

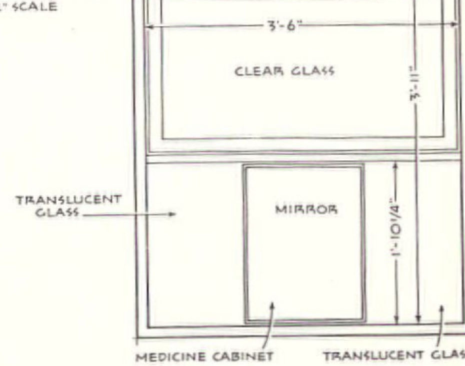


Section A 1 1/2" SCALE Section B

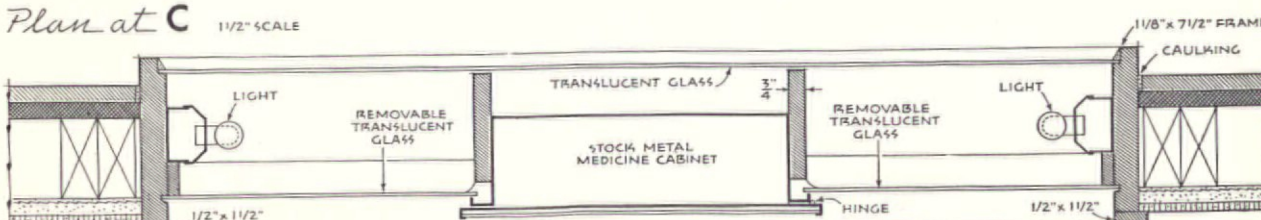


GOTTSCHO-SCHLEISNER

Elevation
1/2" SCALE



Plan at C 1 1/2" SCALE

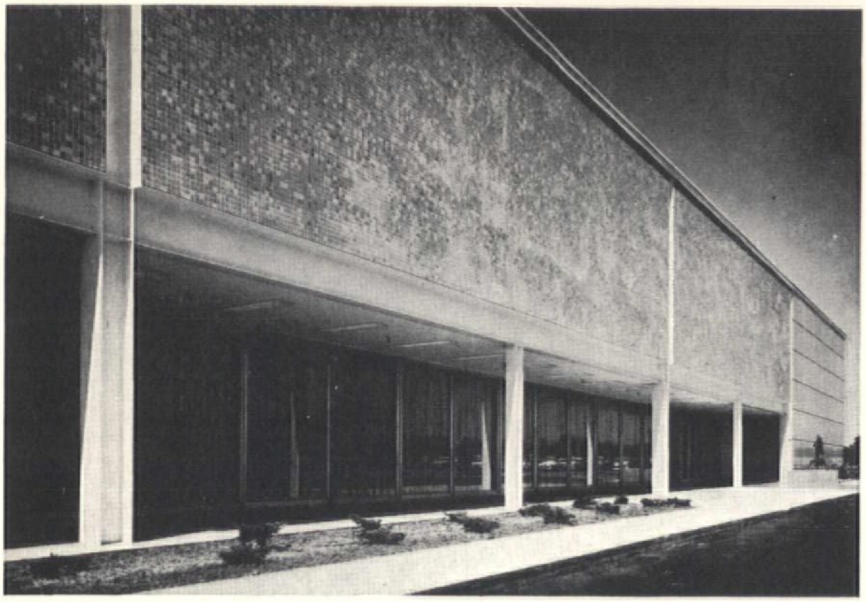


WILLIAM ZENG RESIDENCE, Massapequa, N. Y.
Caleb Hornbostel and J. P. Trouchaud, Architects

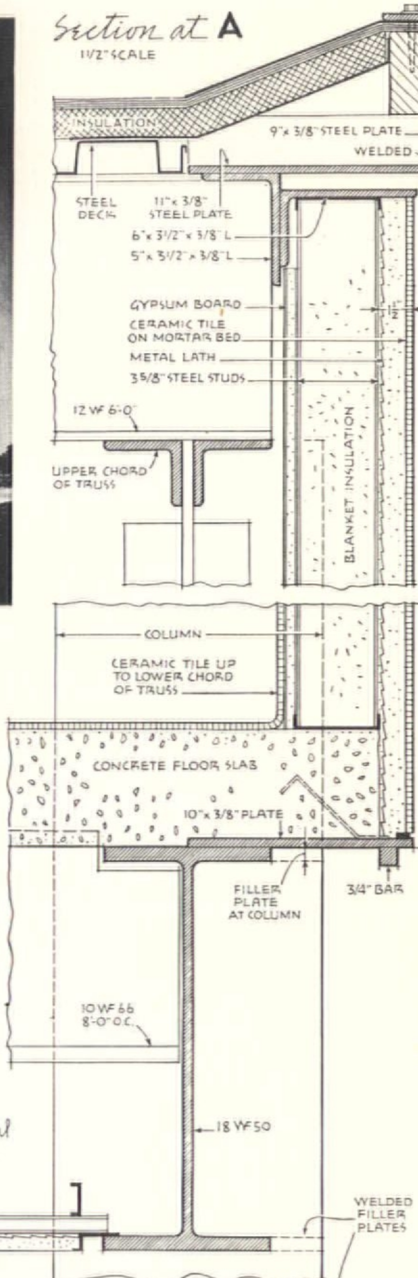
Section 9 WALL SECTIONS

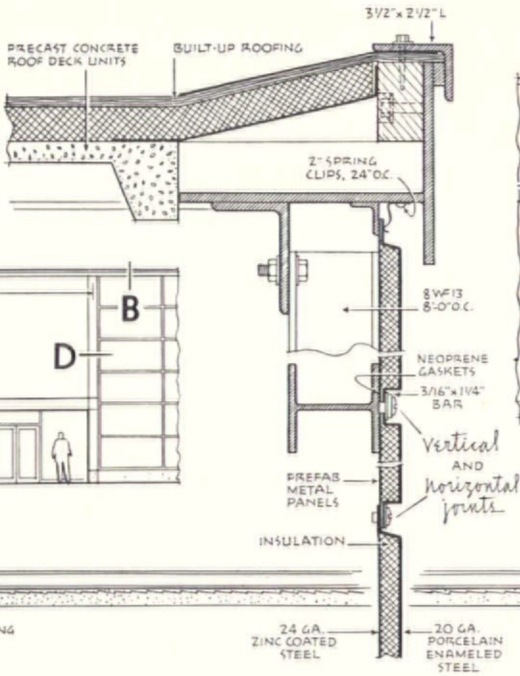
p/a selected detail

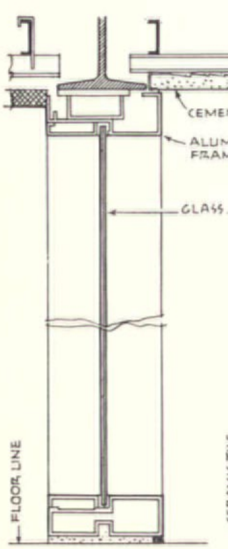
wall section

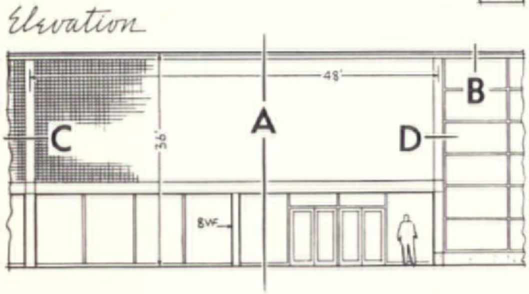


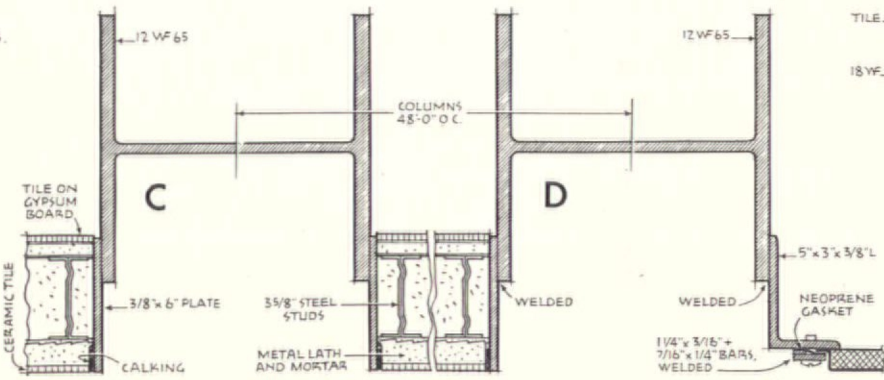
MORLEY BAER

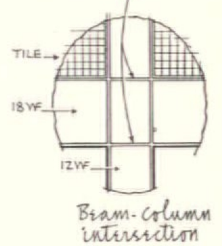










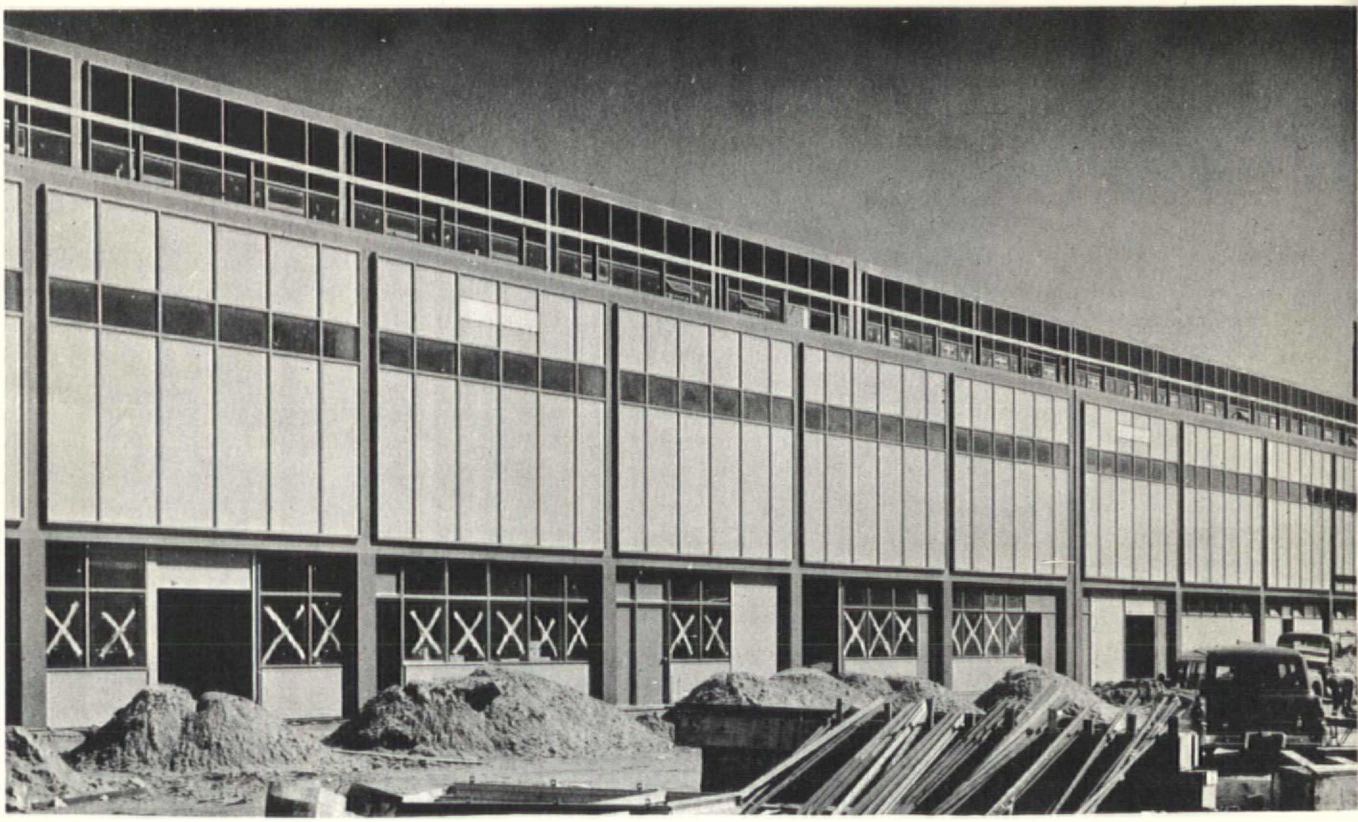


PAPER MILL, Fullerton, Calif.

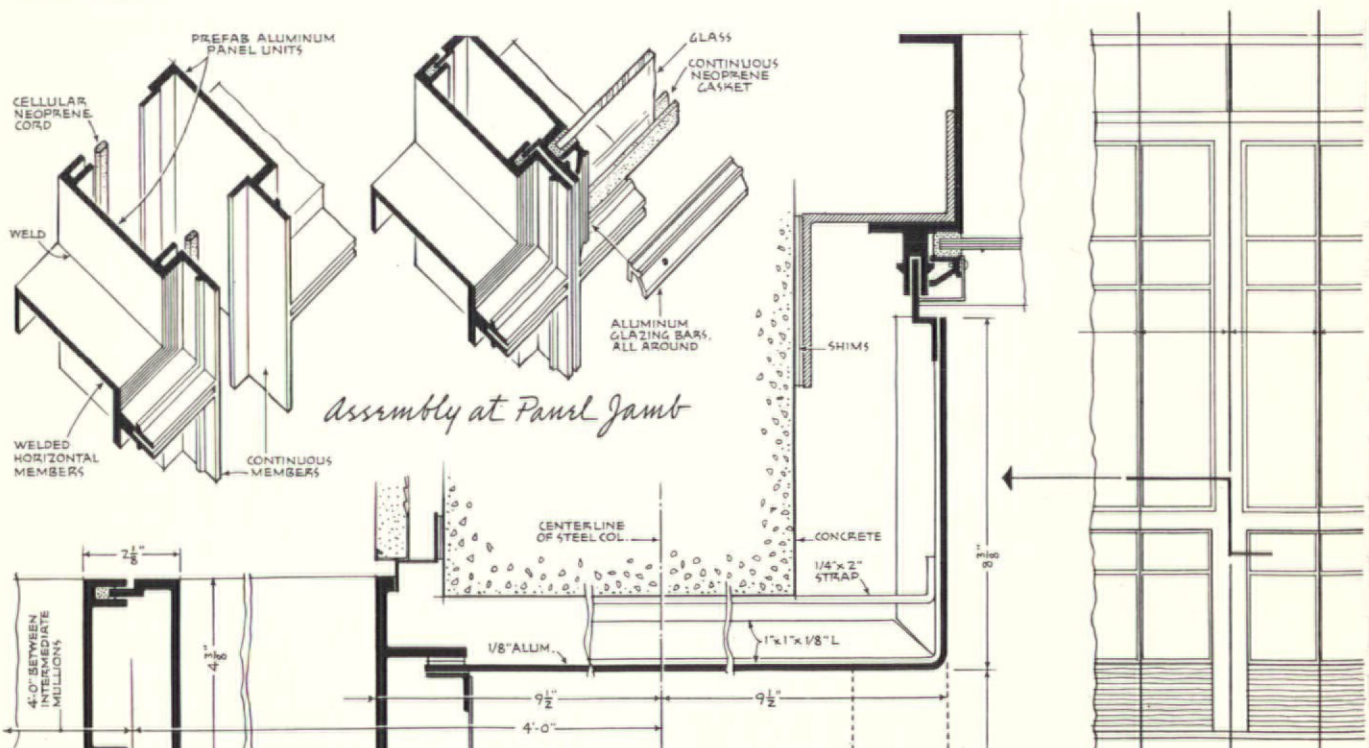
Kimberly-Clark Staff and Skidmore, Owings & Merrill, Architects-Engineers

p/a selected detail

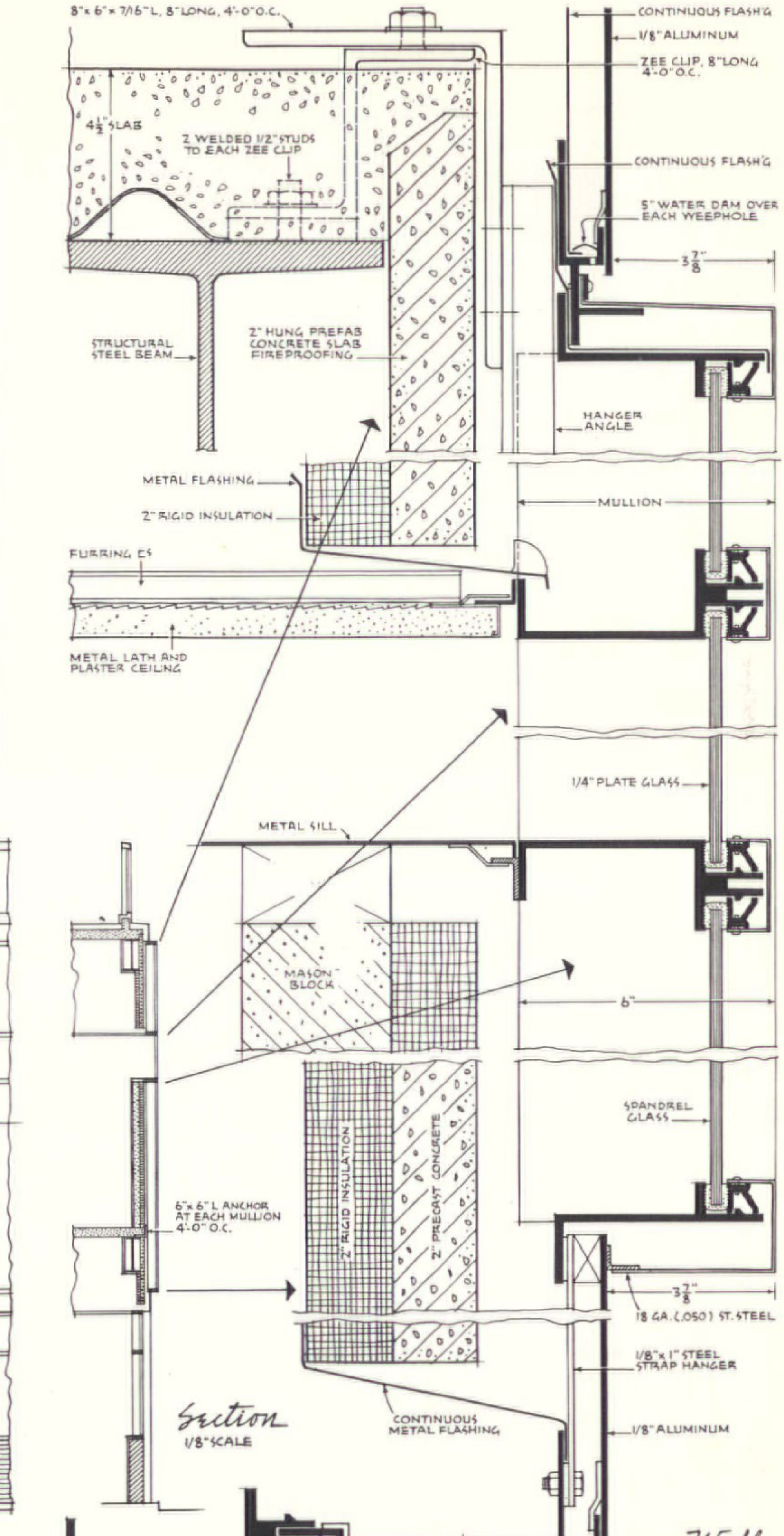
wall section

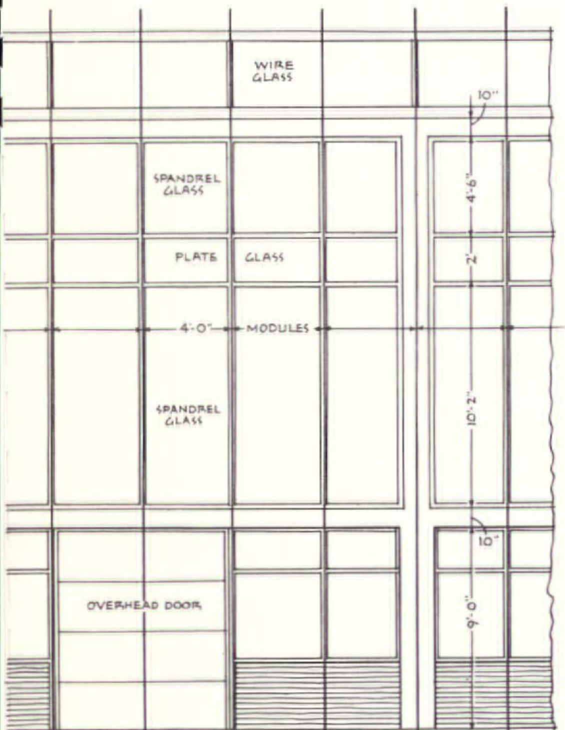


GOTTSCHO - SCHLEISNER



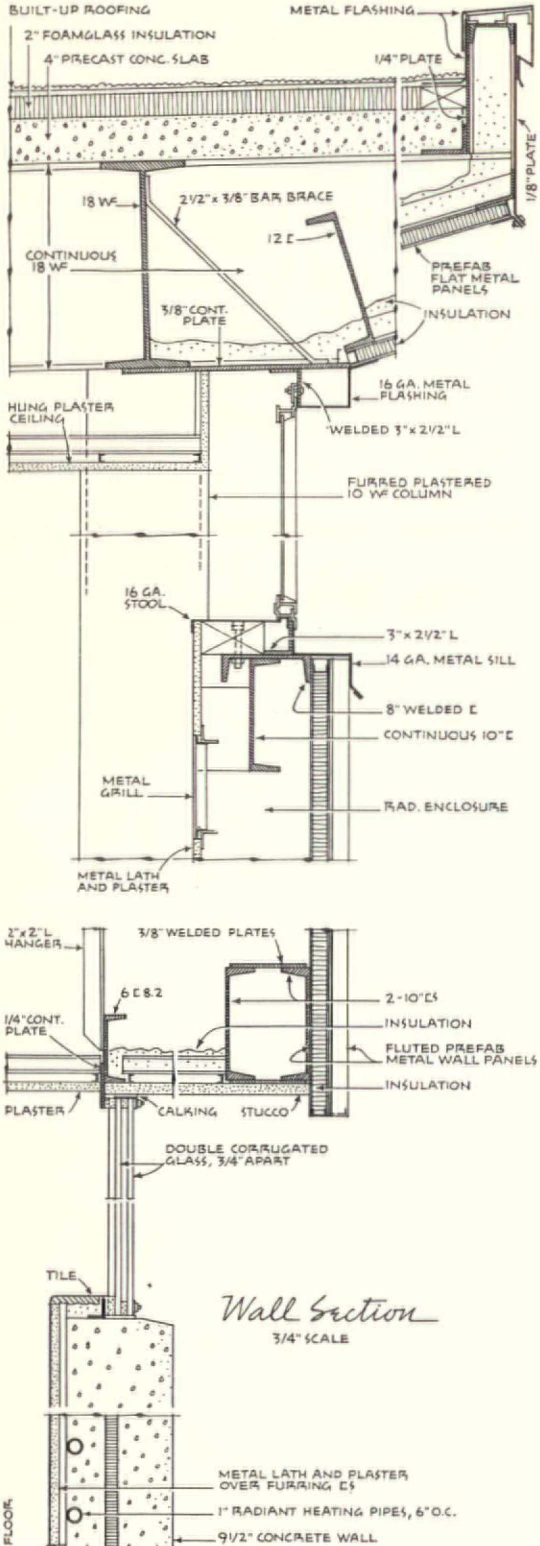
INTERNATIONAL AIRLINE WING BUILDINGS, New York International Airport



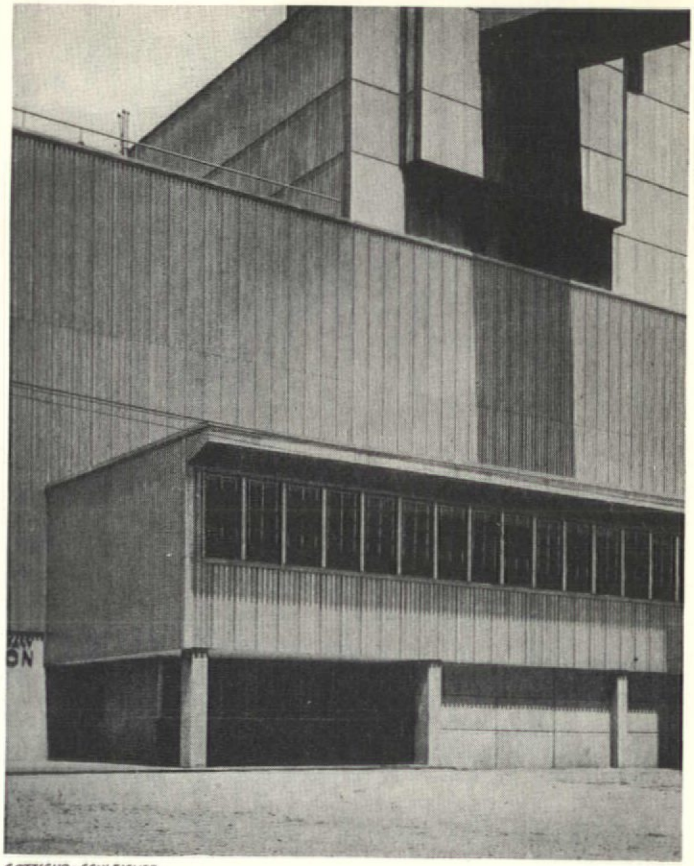


Typical Bay Elevation 1/8" SCALE

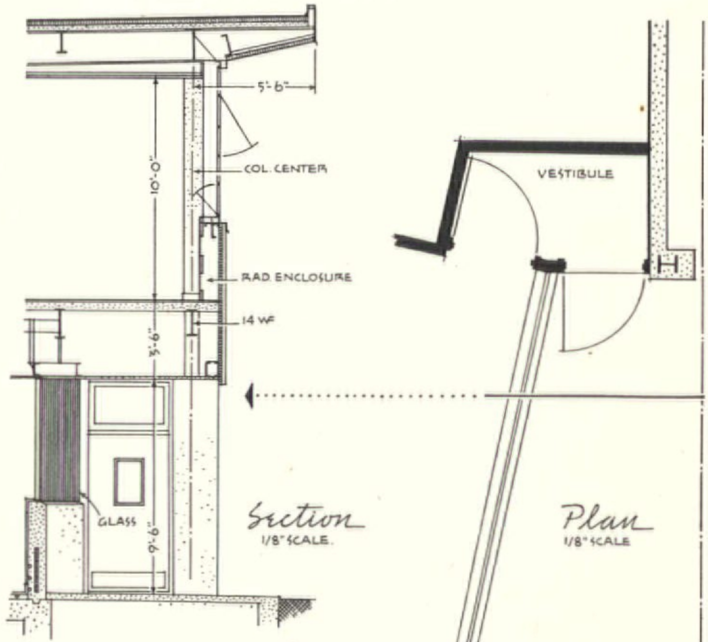
Skidmore, Owings & Merrill, Architects



Wall Section
3/4" SCALE



GOTTSCHO-SCHLEISNER



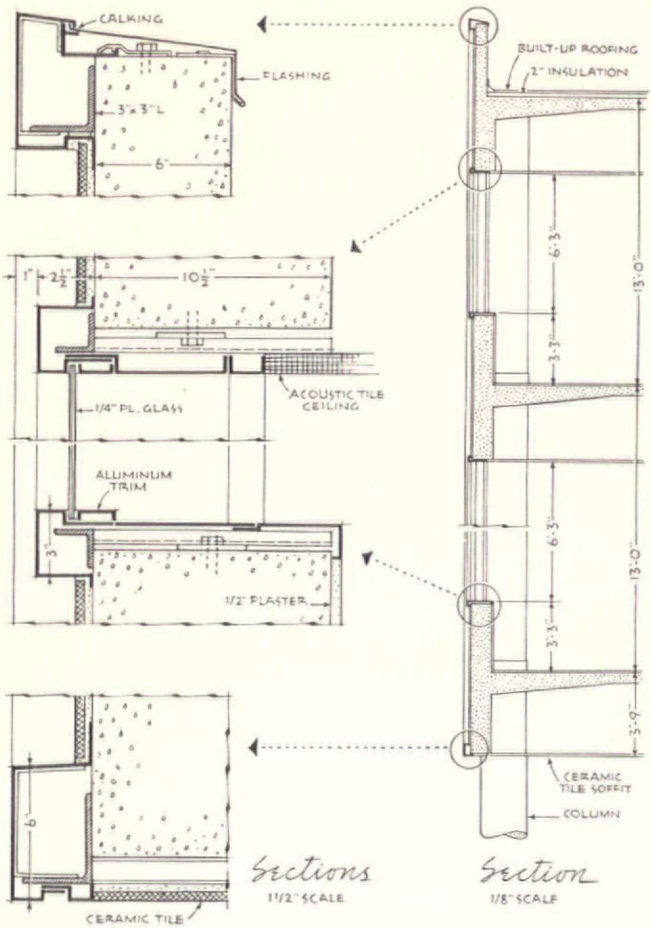
Section
1/8" SCALE

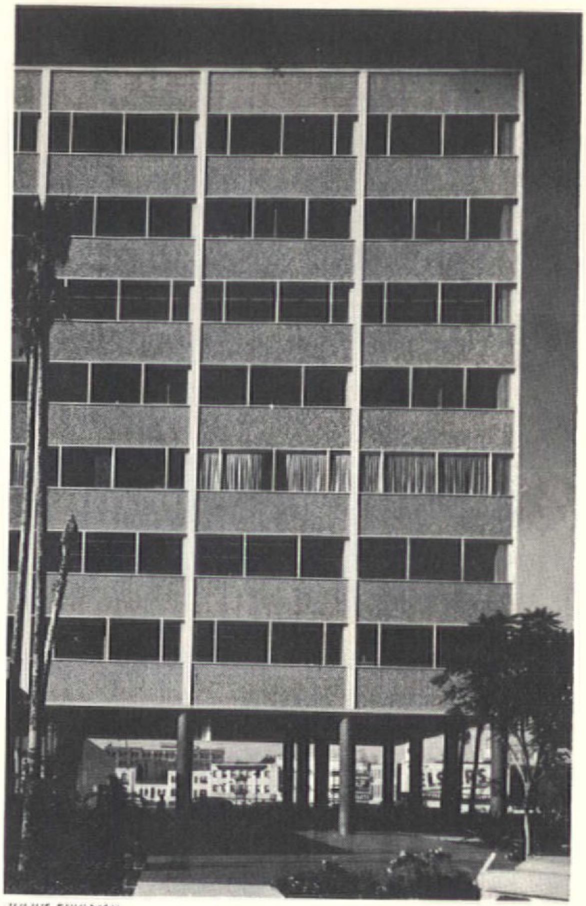
Plan
1/8" SCALE

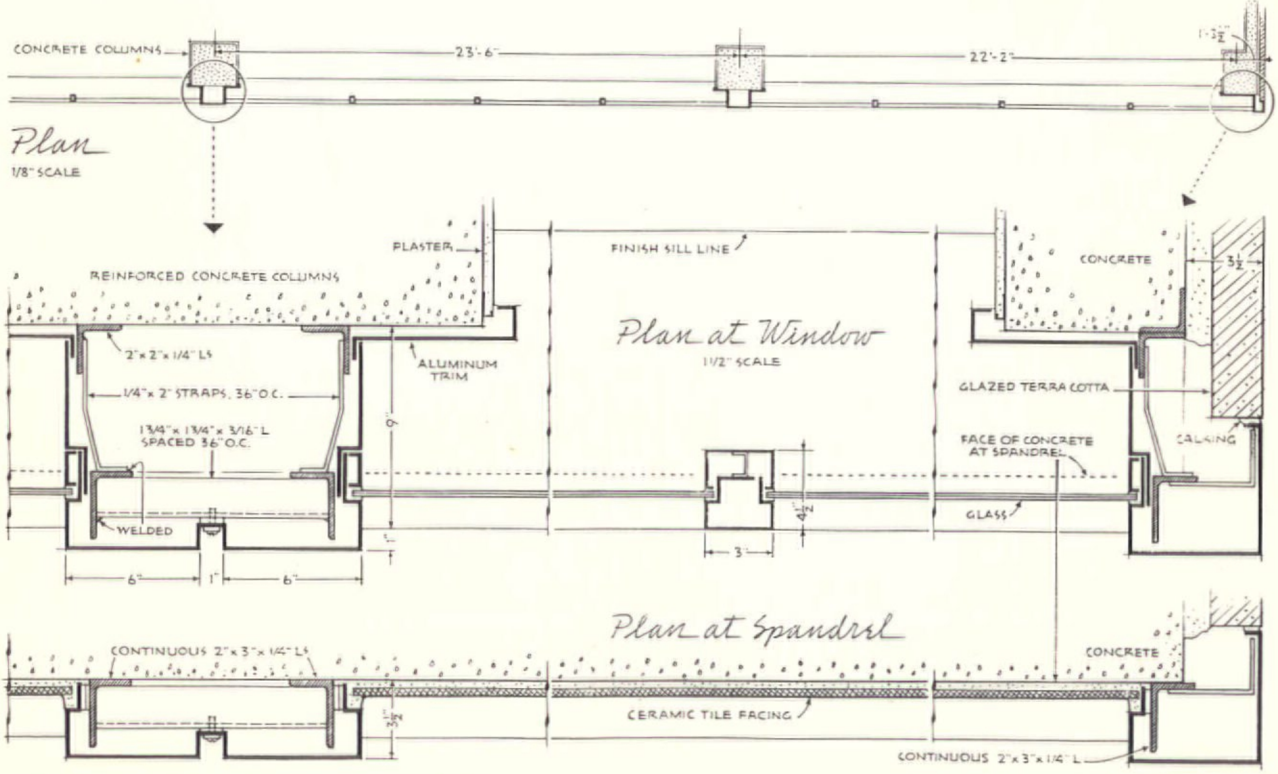
STEAM-ELECTRIC STATION, Kansas City, Mo.

Ebasco Services Inc., Design and Construction

wall section




JULIUS SHULMAN

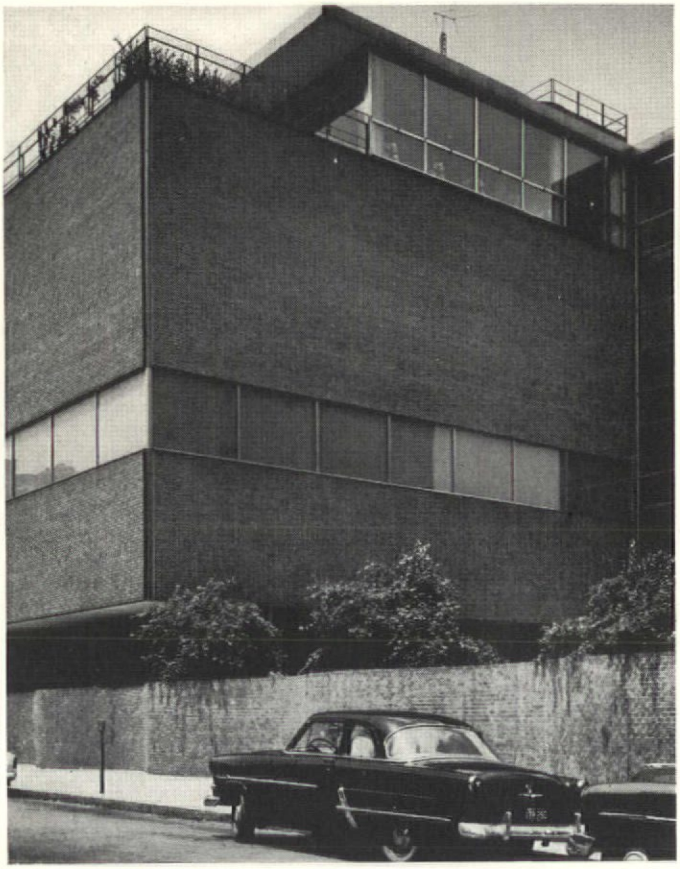


POLICE HEADQUARTERS, Los Angeles, Calif.

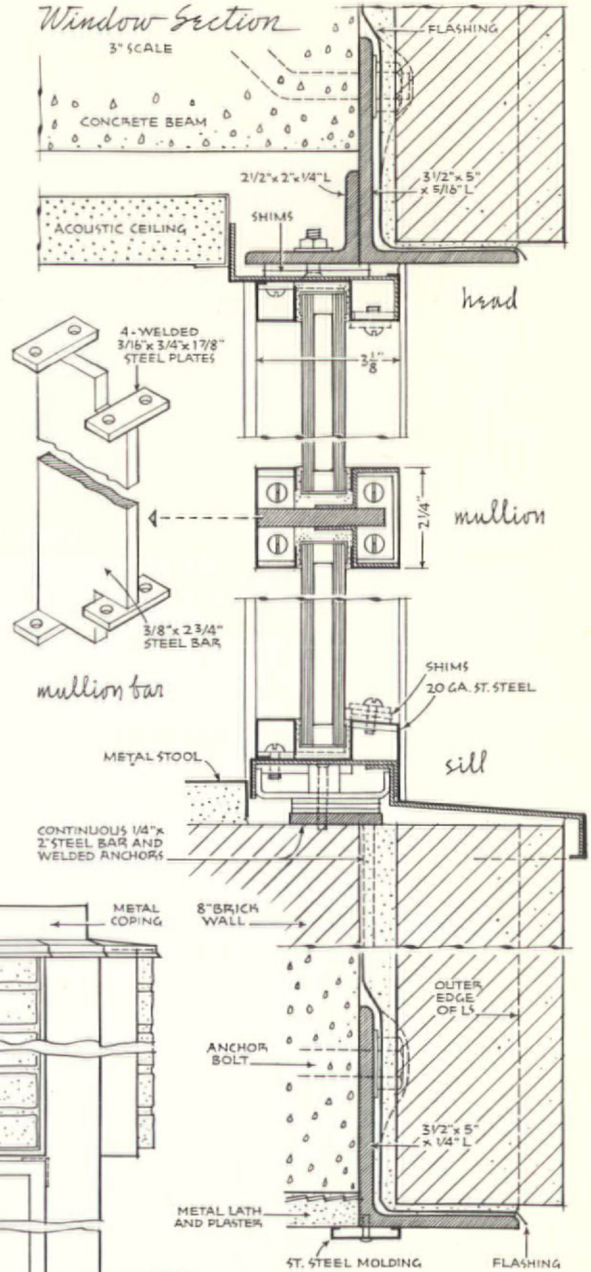
Welton Becket & Associates and J. E. Stanton, Associated Architects

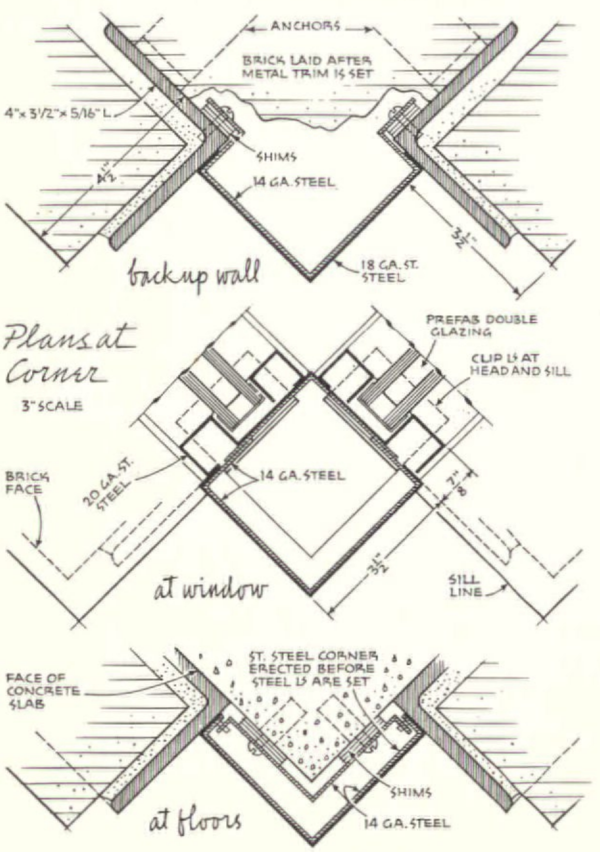
p/a selected detail

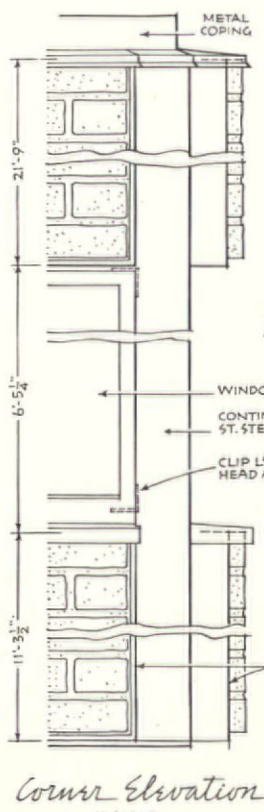
wall section

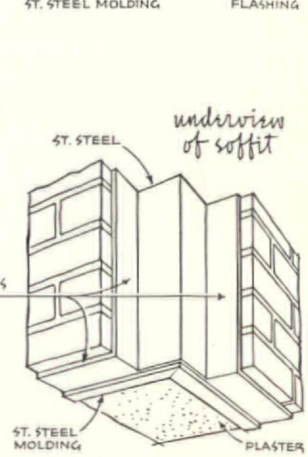


BILL ENGDAHL, HEDRICH-BLESSING







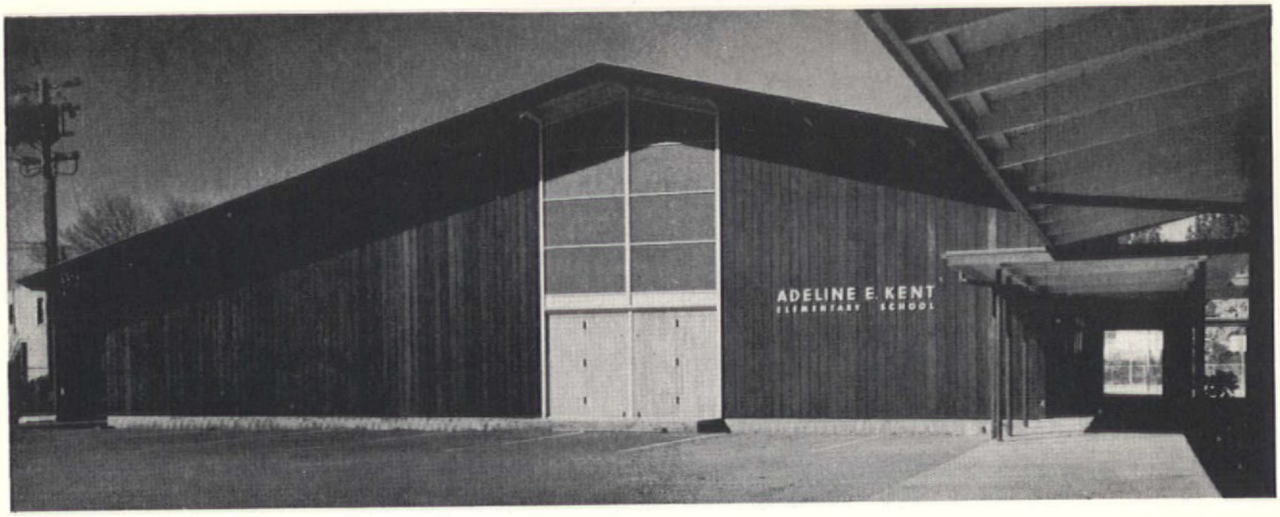


PUBLIC LIBRARY, Cincinnati, Ohio

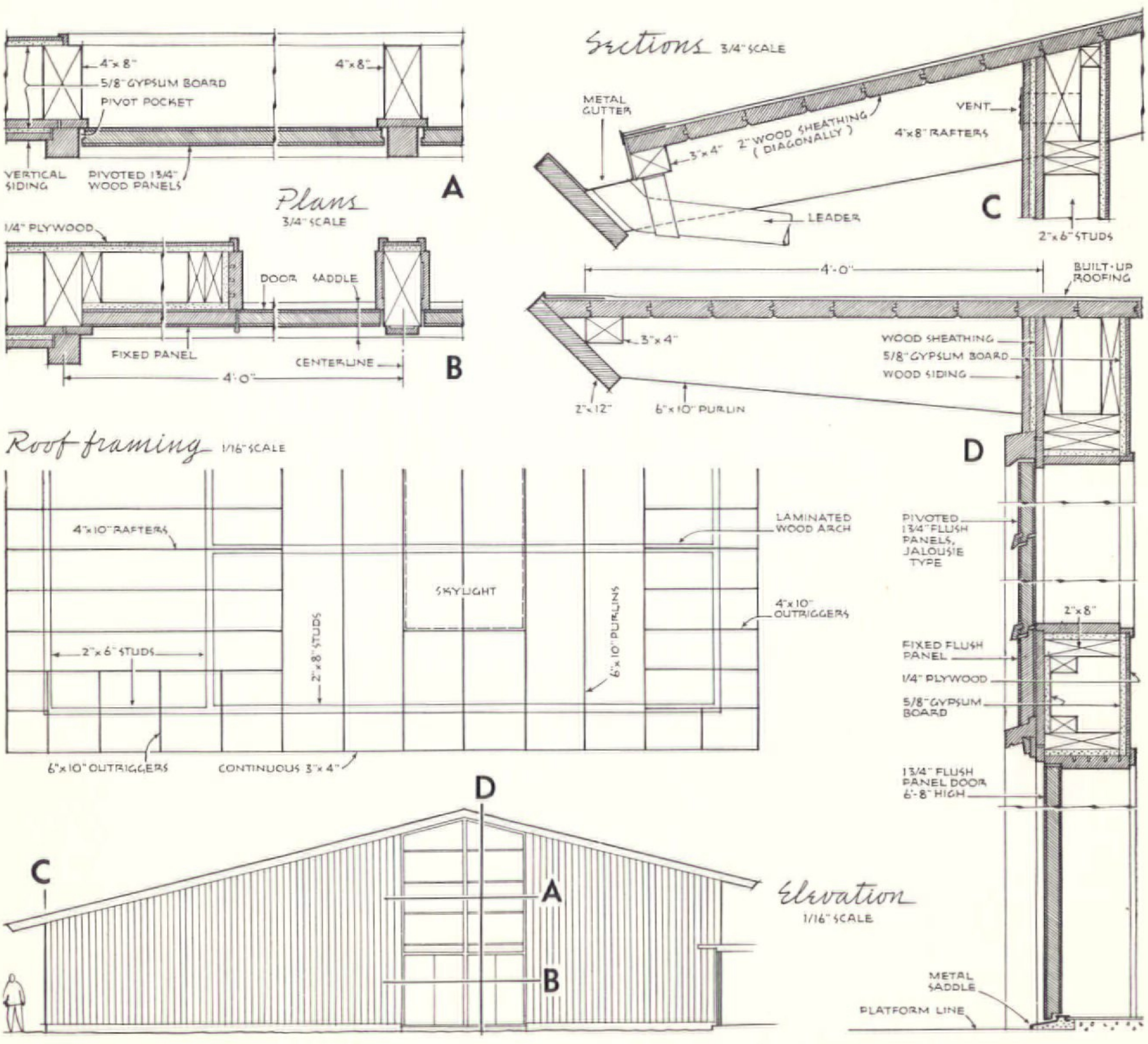
Woodie Garber & Associates, Architects

p/a selected detail

wall section

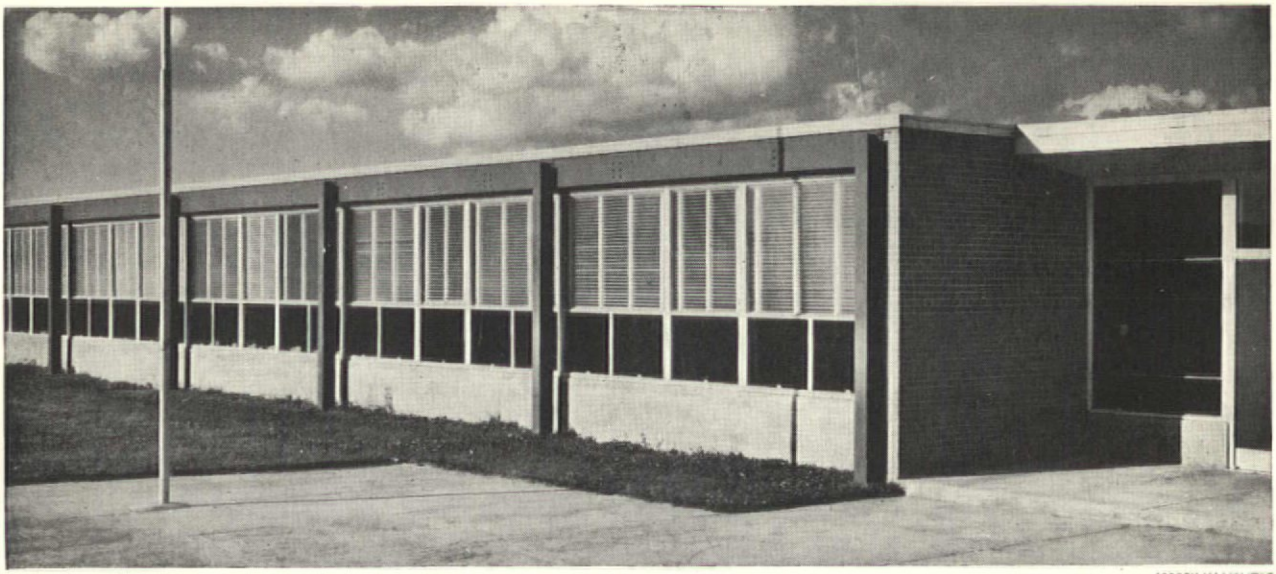


PHIL PALMER

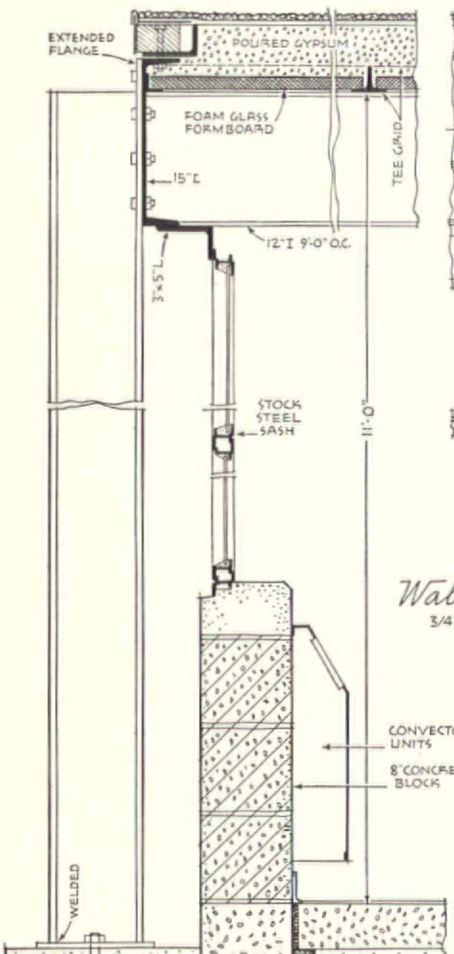


ELEMENTARY SCHOOL, Kentfield, Marin County, Calif.

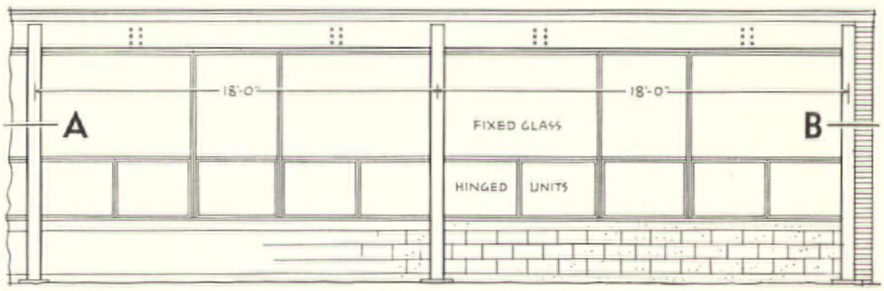
Corlett & Spackman, Architects



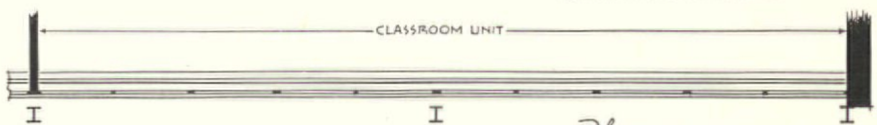
JOSEPH W. MOLITOR



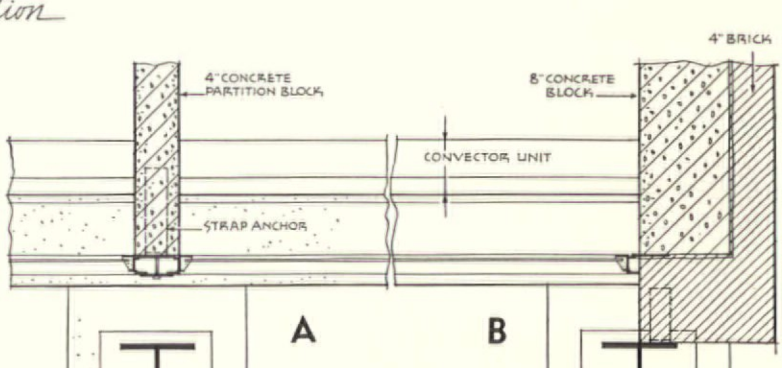
Wall Section 3/4" SCALE



Elevation 1/8" SCALE



Plan 1/8" SCALE



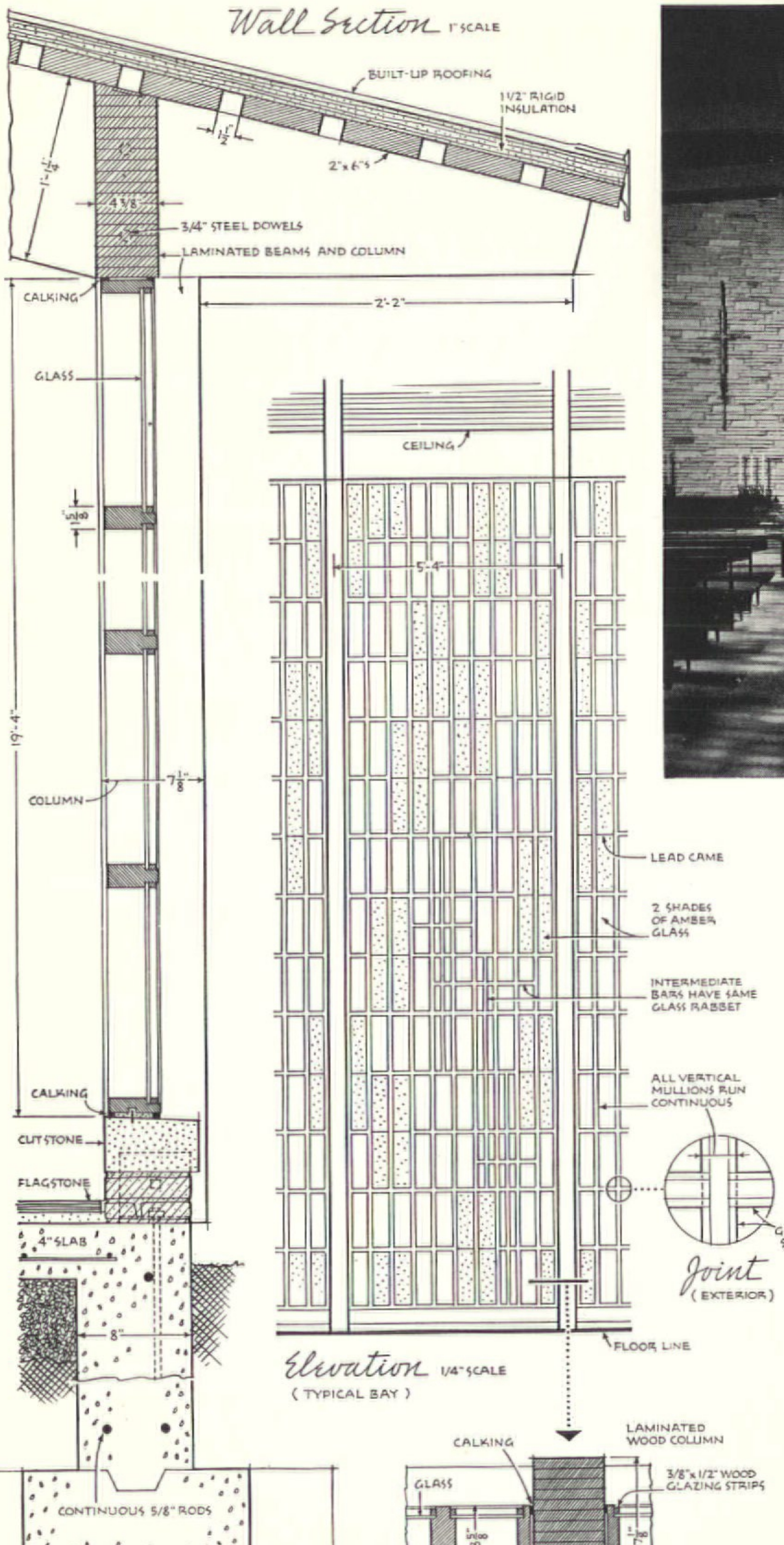
Plans 3/4" SCALE

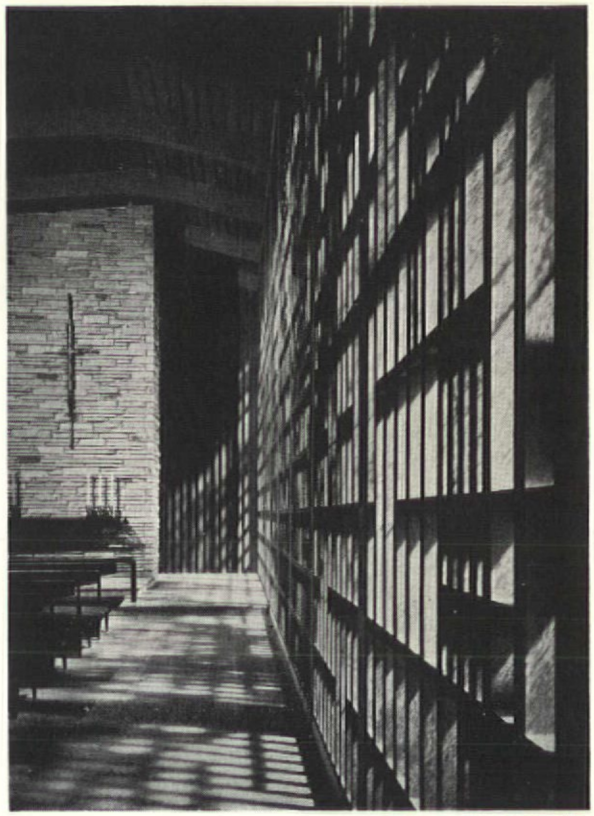
ELEMENTARY SCHOOL, Madeira, Ohio

A. M. Kinney Inc.—Charles Burchard

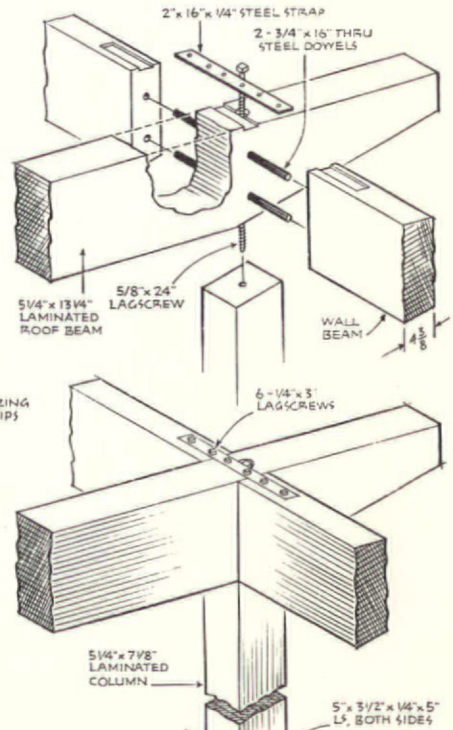
Section 10 WINDOW WALLS

glazed wall





REYNOLDS, PHOTOGRAPHY INC.

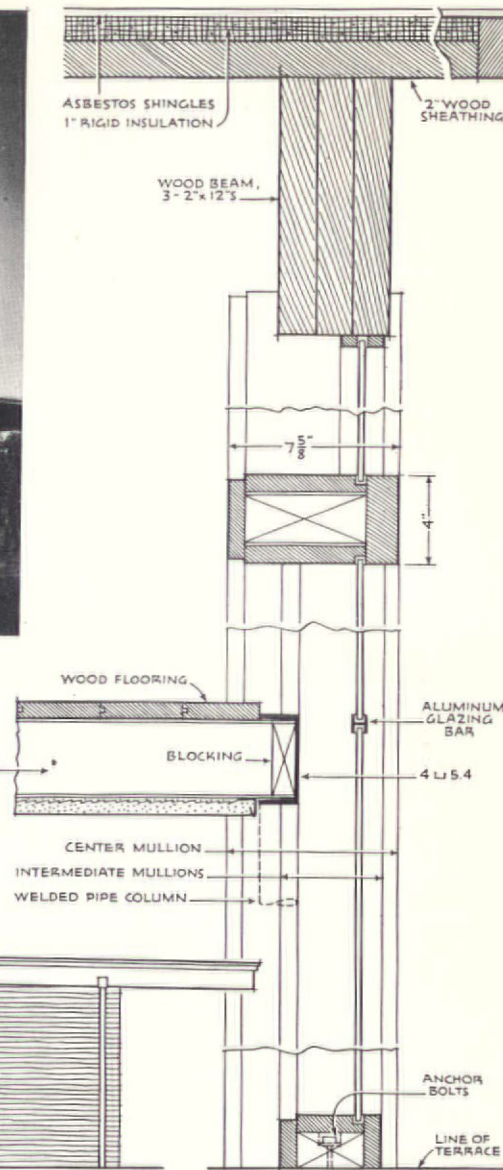


CHAPEL, Fort Collins, Colo.
James M. Hunter, Architect

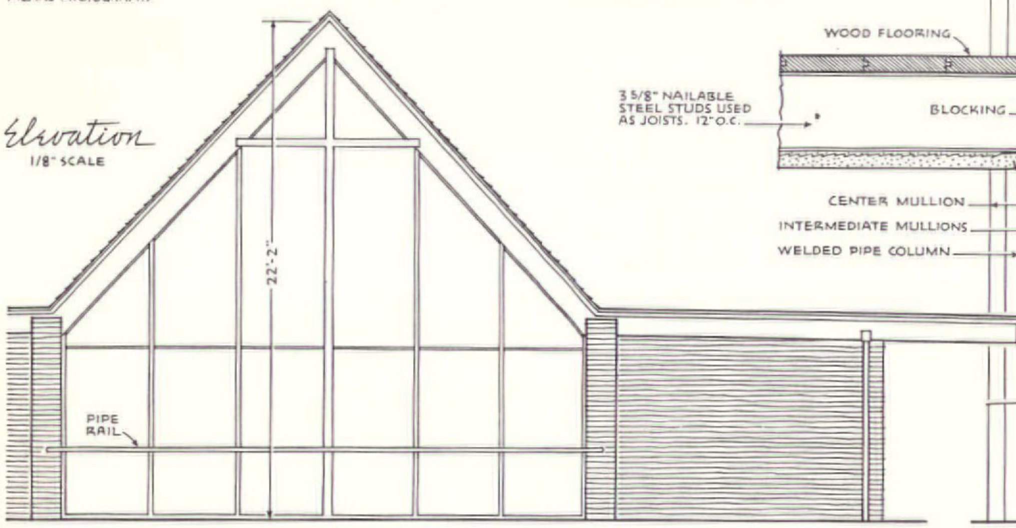
p/a selected detail

gabled window

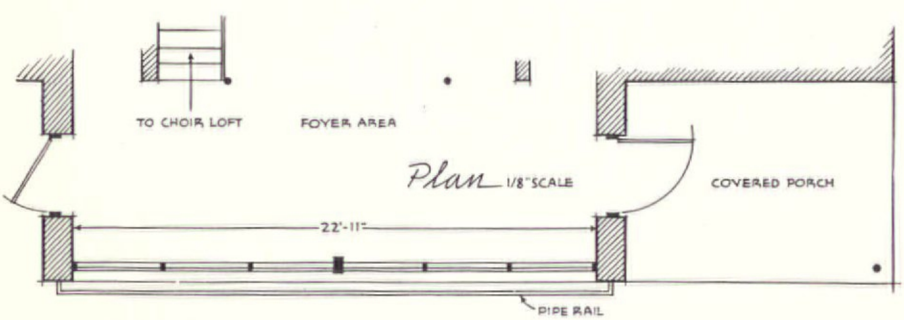
MEARS PHOTOGRAPHY



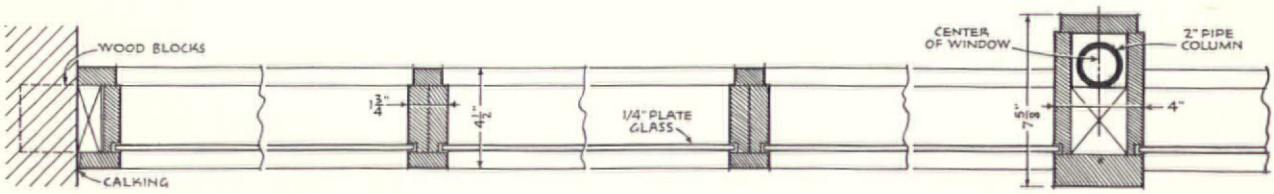
Section 1 1/2" SCALE



Elevation 1/8" SCALE



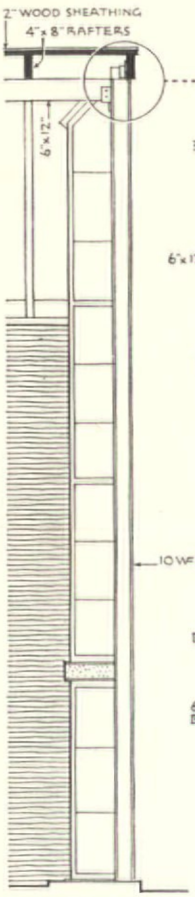
Plan 1/8" SCALE



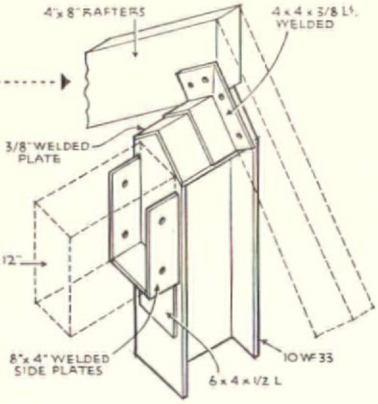
Plan 1 1/2" SCALE

CHURCH, San Antonio, Tex.
Milton A. Ryan, Architect

gabled window

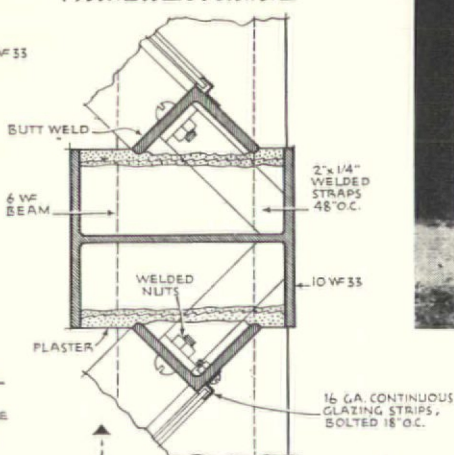


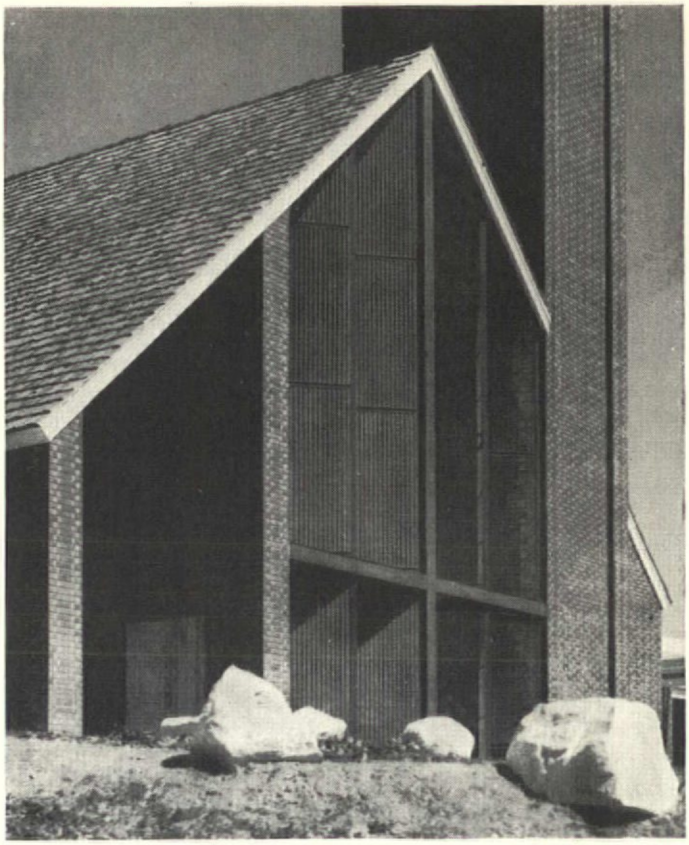
Section 1/8" SCALE
(AT CENTER COLUMN)



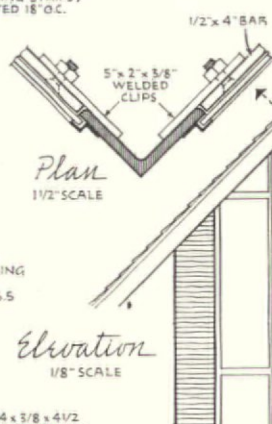
Detail at Ridge

Plan at Column

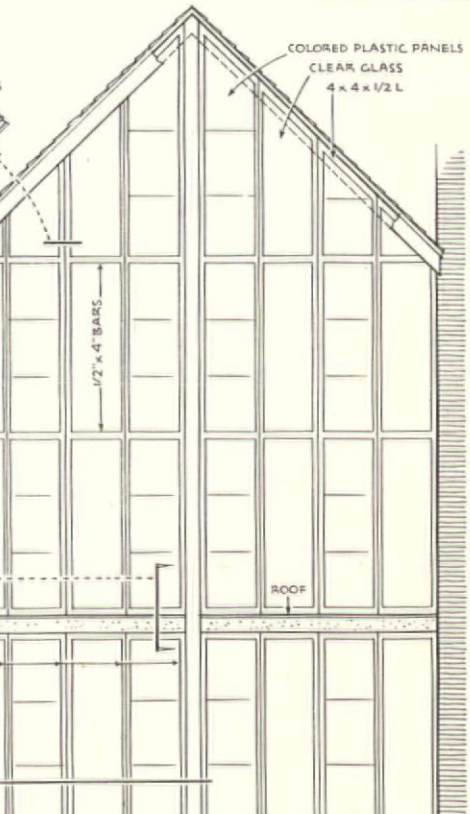




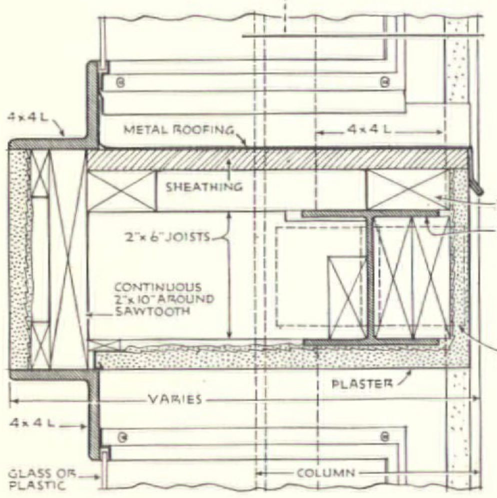
DOUGLAS M SIMMONDS



Plan
1 1/2" SCALE

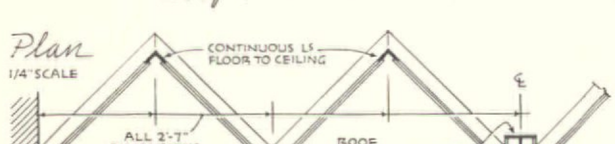


Elevation
1/8" SCALE



Roof Section 1 1/2" SCALE

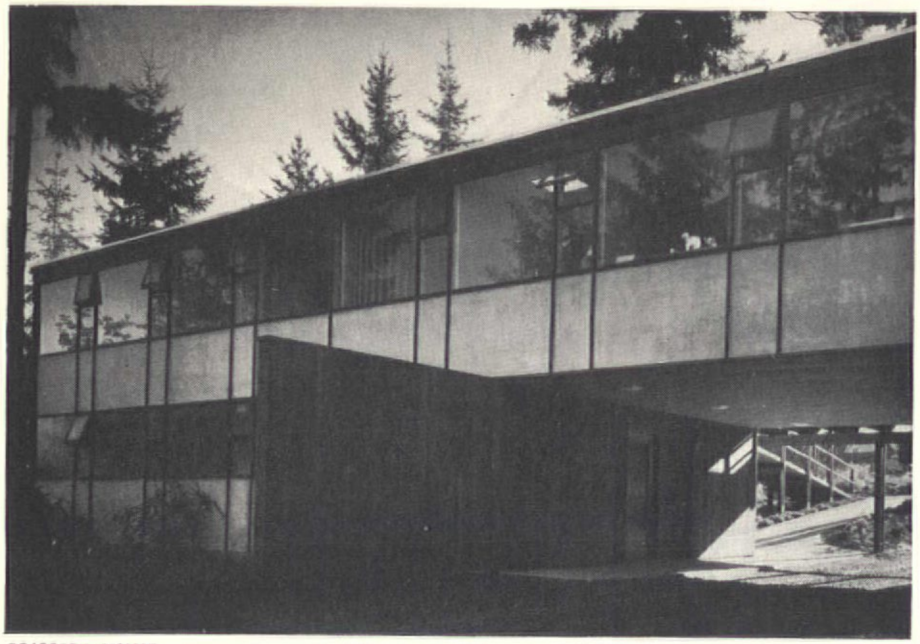
Plan
1/4" SCALE



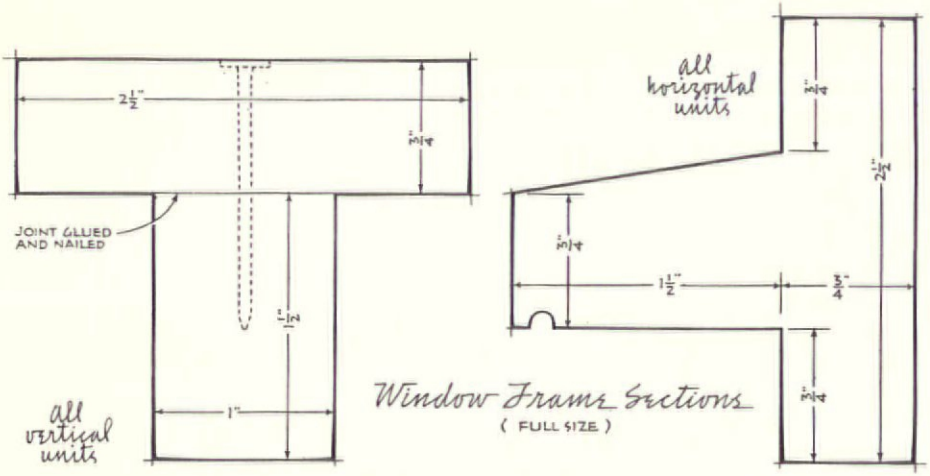
CHURCH, San Pedro, Calif.
Carleton Monroe Winslow, Architect

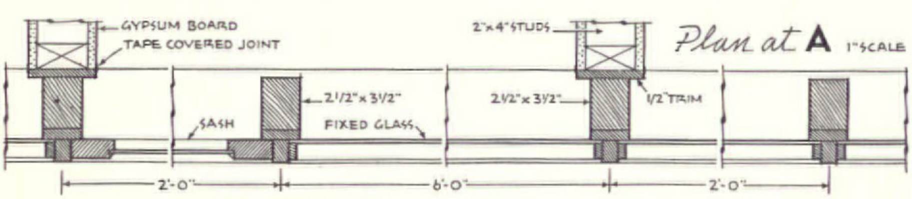
p/a selected detail

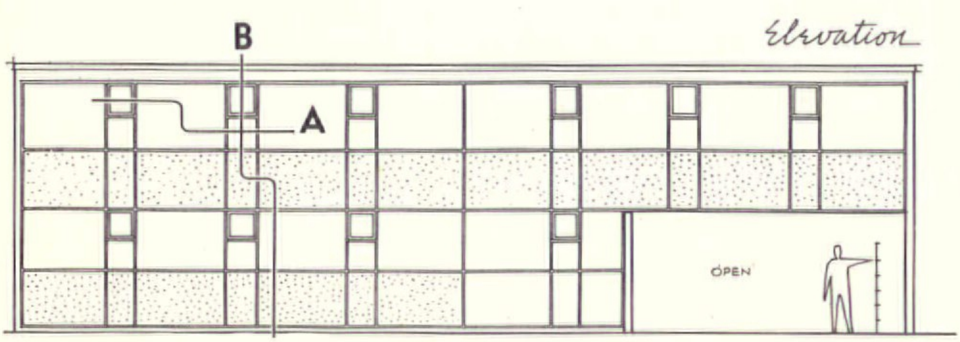
wall section

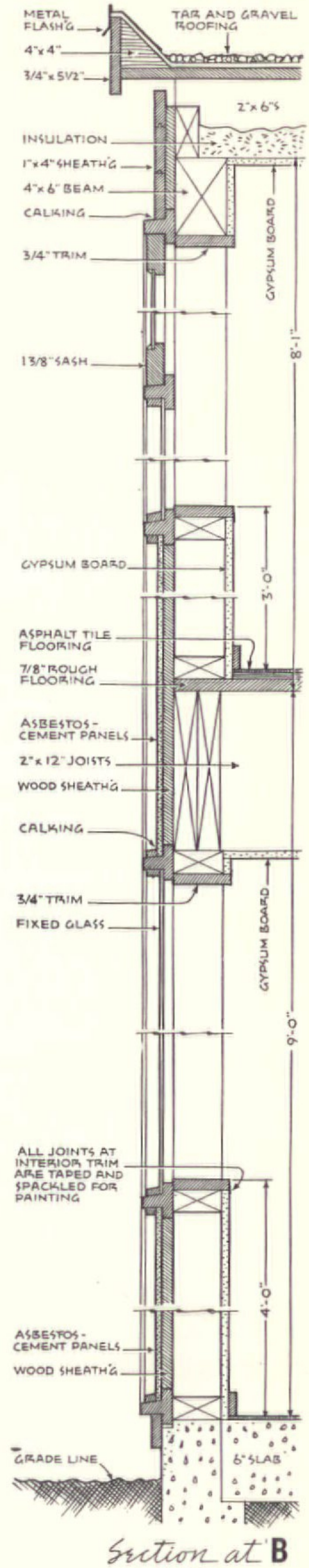


DEARBORN - MASSAR



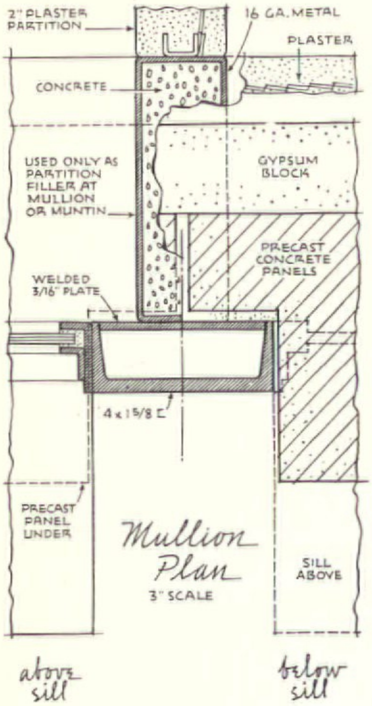


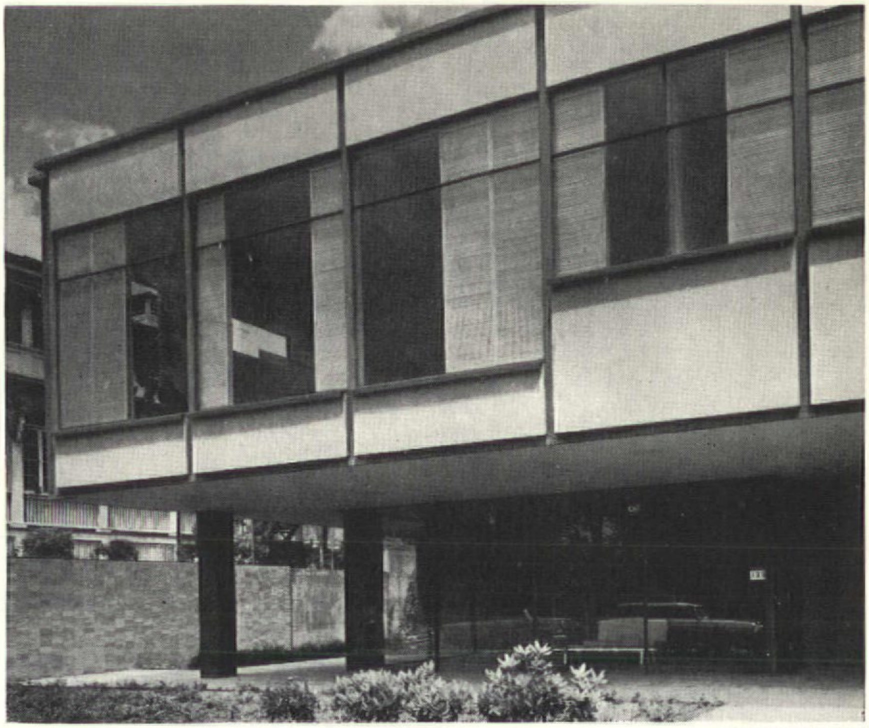




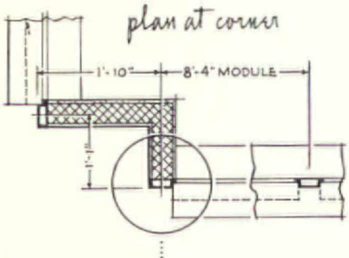
HEALTH CLINIC, Seattle, Wash.

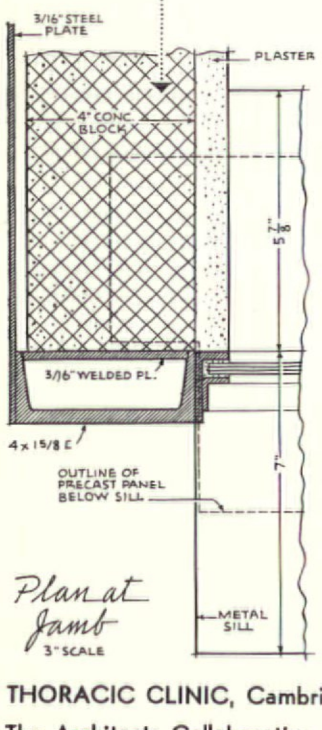
Paul Hayden Kirk, Architect

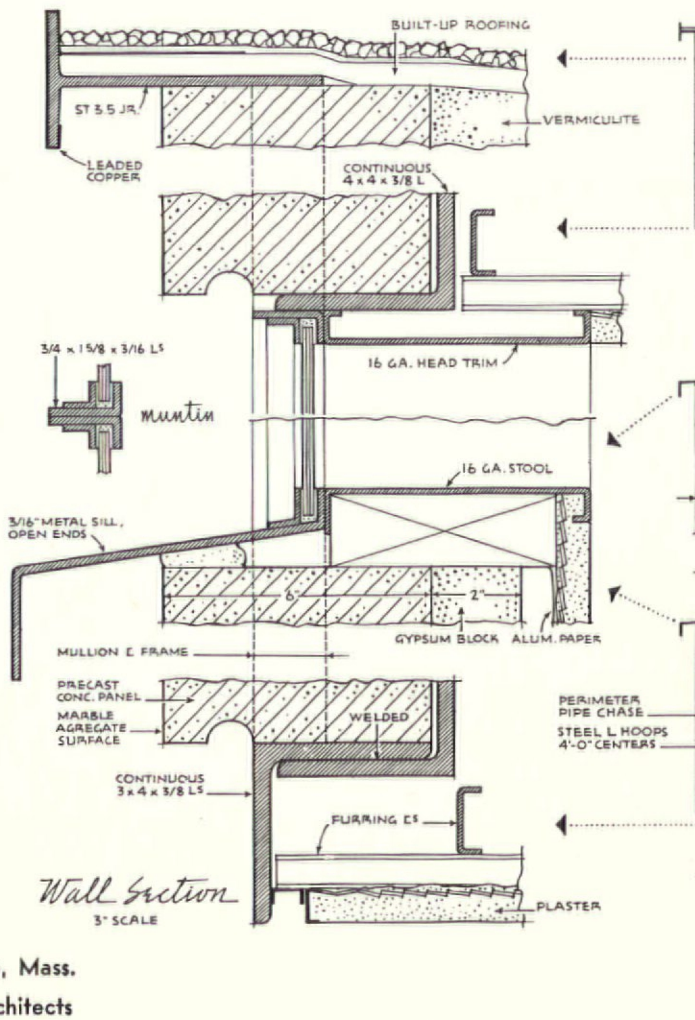


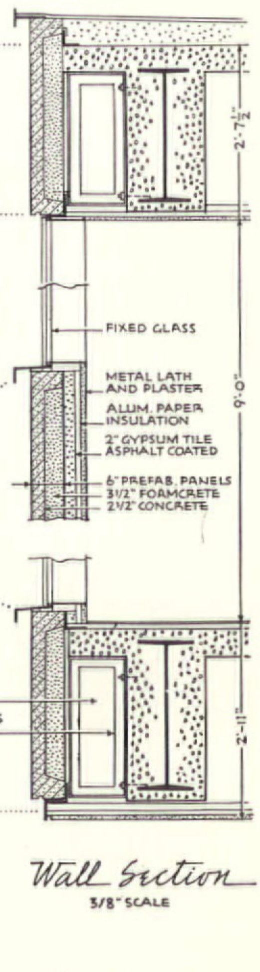


JOSEPH W. MOLITOR



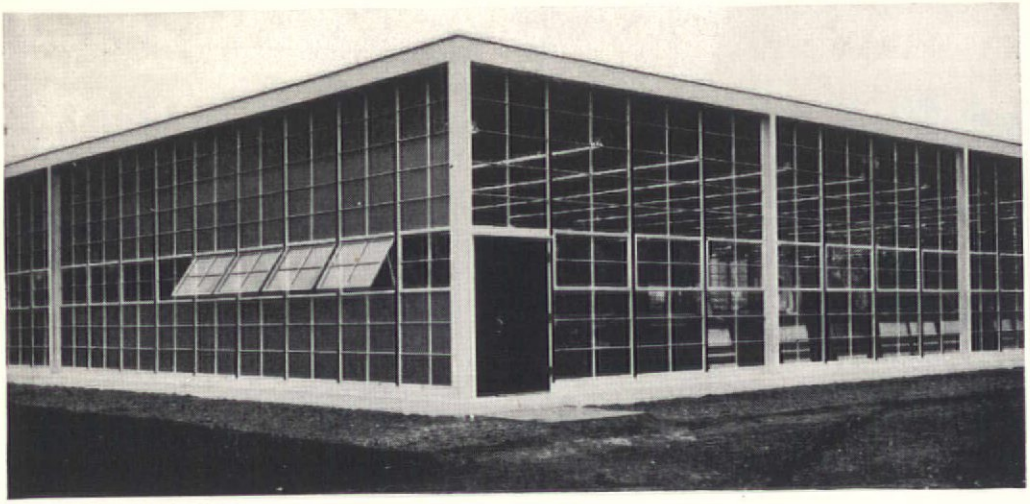




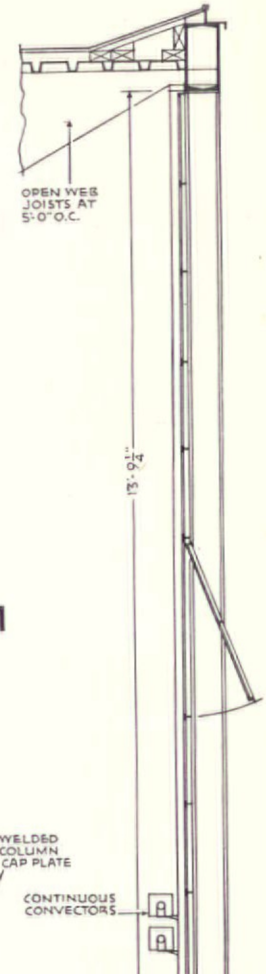


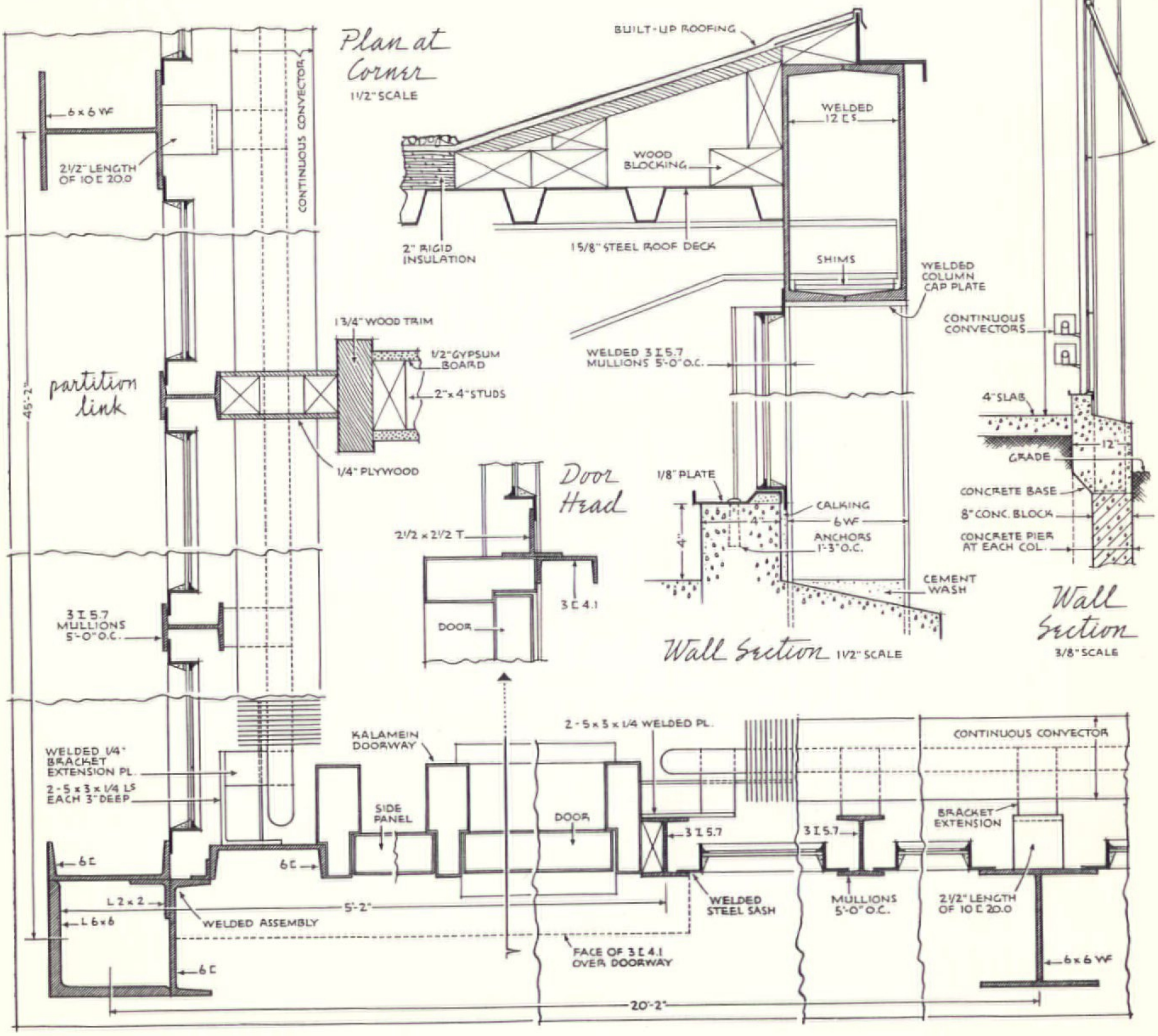
THORACIC CLINIC, Cambridge, Mass.

The Architects Collaborative, Architects



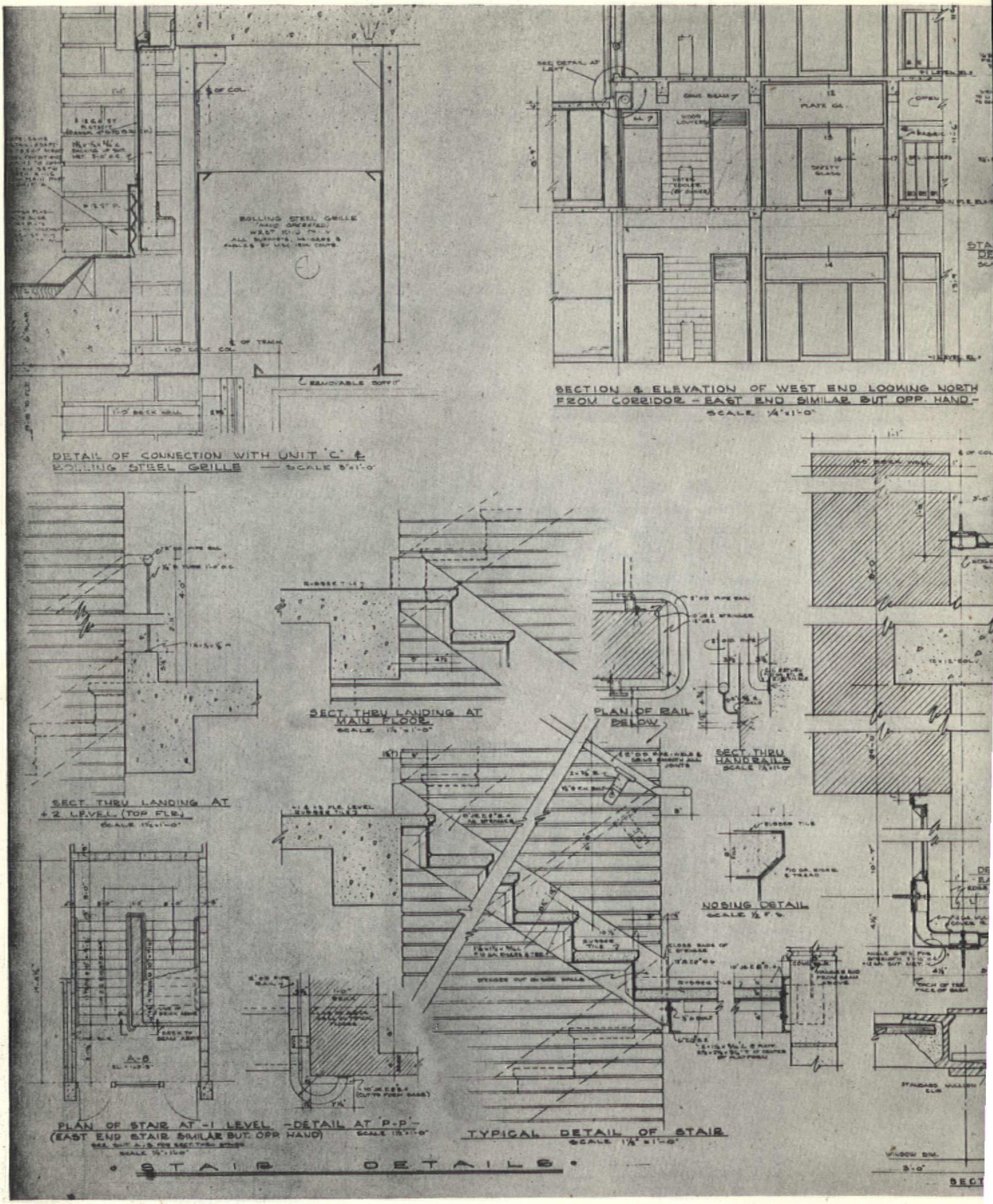
HUGH ROBERTSON A.R.P.S - PANDA



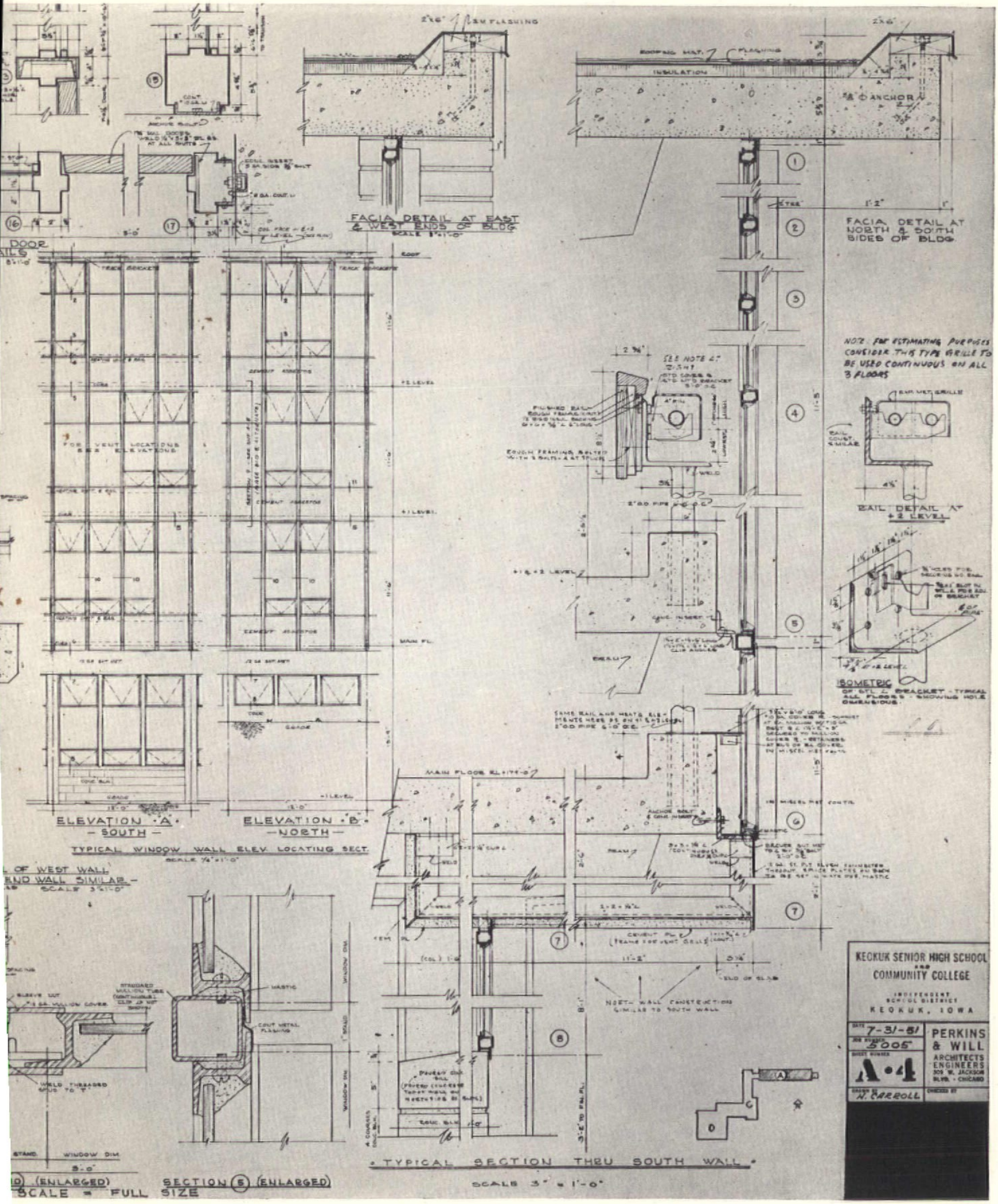


ARCHITECTS' OFFICE BUILDING, Toronto, Canada

John B. Parkin & Associates, Architects-Engineers

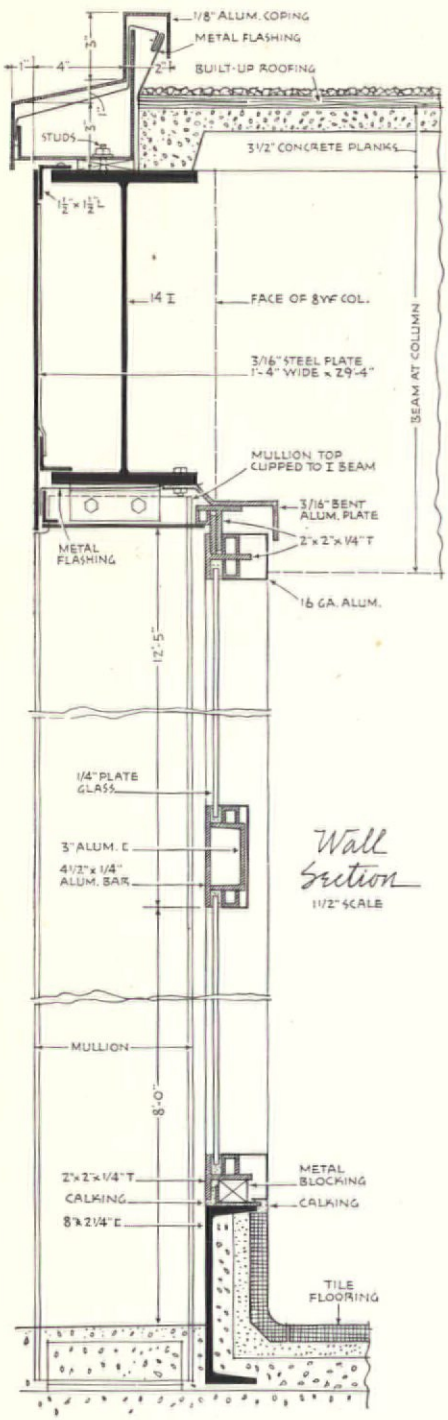


corridor window wall: High School-Community College, Keokuk, Iowa


FACIA DETAIL AT EAST & WEST ENDS OF BLDG.
FACIA DETAIL AT NORTH & SOUTH SIDES OF BLDG.
NOTE: FOR ESTIMATING PURPOSES CONSIDER THIS TYPE GRILLE TO BE USED CONTINUOUS ON ALL 3 FLOORS
RAIL DETAIL AT +2 LEVEL
ISOMETRIC OF STL. L BRACKET - TYPICAL ALL FLOORS - SHOWING HOLE DIMENSIONS.
ELEVATION ·A· - SOUTH -
ELEVATION ·B· - NORTH -
TYPICAL WINDOW WALL ELEV. LOCATING SECT.
NORTH WALL CONSTRUCTION SIMILAR TO SOUTH WALL
TYPICAL SECTION THRU SOUTH WALL
SCALE 3" = 1'-0"
SECTION (5) (ENLARGED)
SCALE = FULL SIZE
KEOKUK SENIOR HIGH SCHOOL AND COMMUNITY COLLEGE
INDEPENDENT SCHOOL DISTRICT
KEOKUK, IOWA
7-31-51
5005
A·4
PERKINS & WILL
ARCHITECTS ENGINEERS
309 W. JACKSON BLVD. - CHICAGO
H. CARROLL

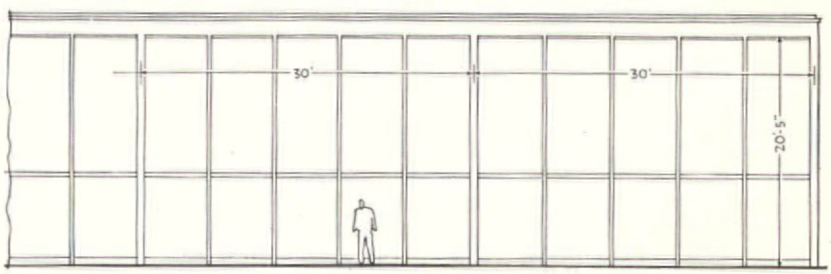
p/a selected detail

window wall

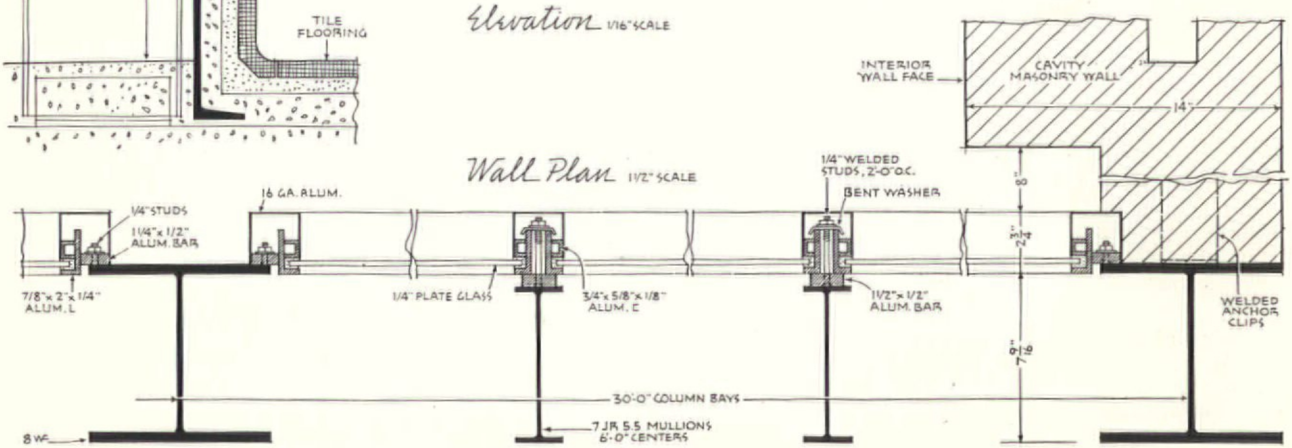


Wall Section 1 1/2" SCALE

GOTTSCHO-SCHLEISNER



Elevation 1/16" SCALE

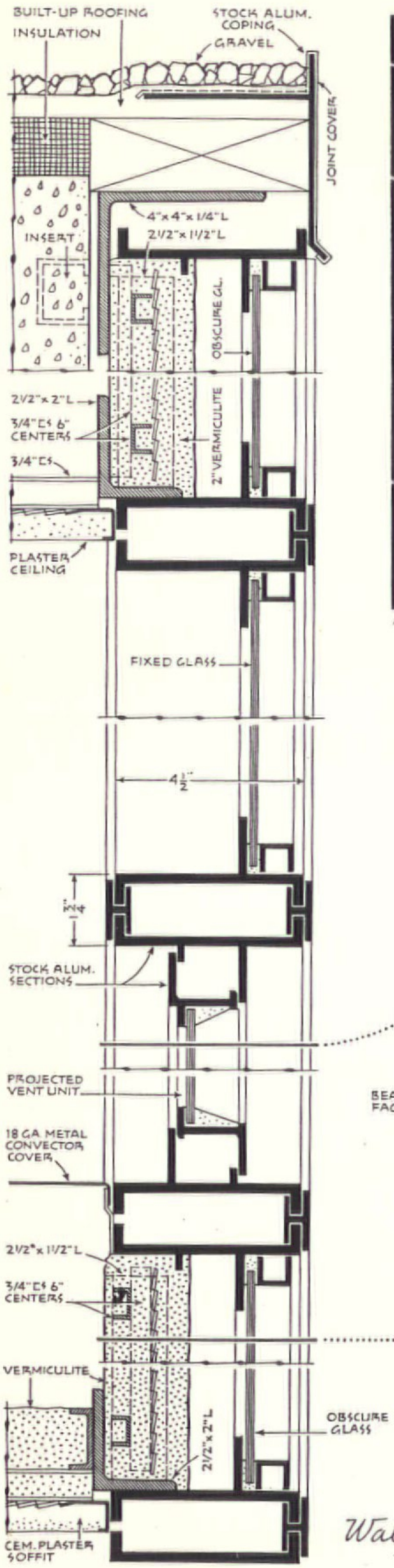


Wall Plan 1 1/2" SCALE

CENTRAL HEATING AND REFRIGERATION PLANT, New York International Airport, N. Y.

Skidmore, Owings & Merrill, Architects

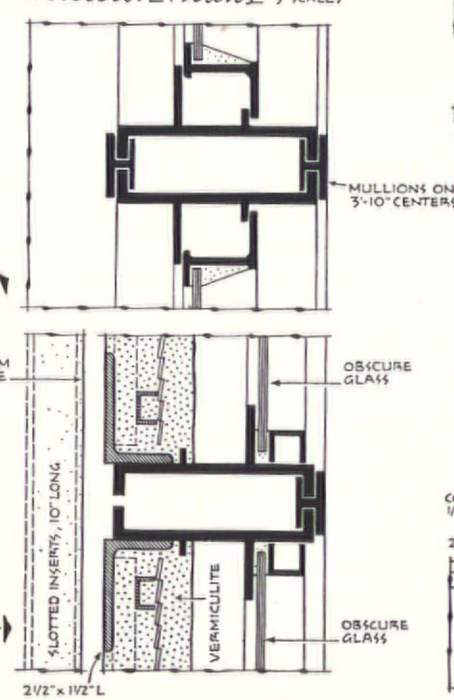
window wall

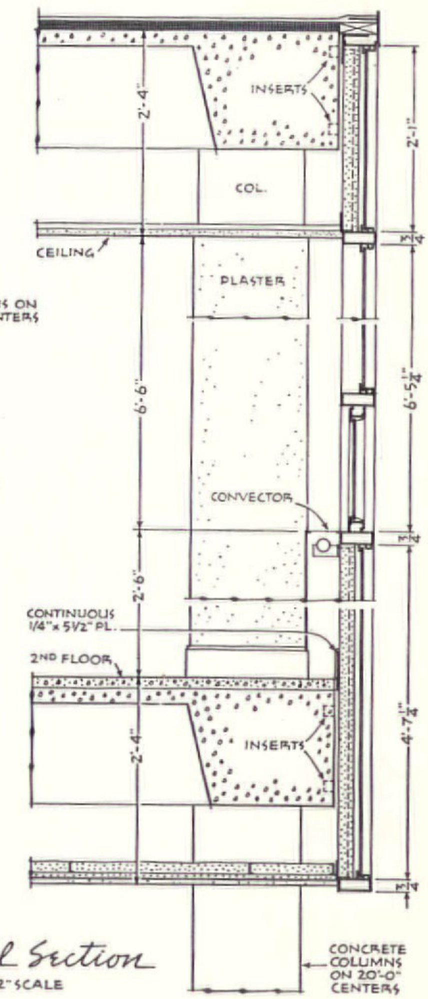


Wall Section
3" SCALE

RICHARD SHIRK

Mullion Plans 3" SCALES

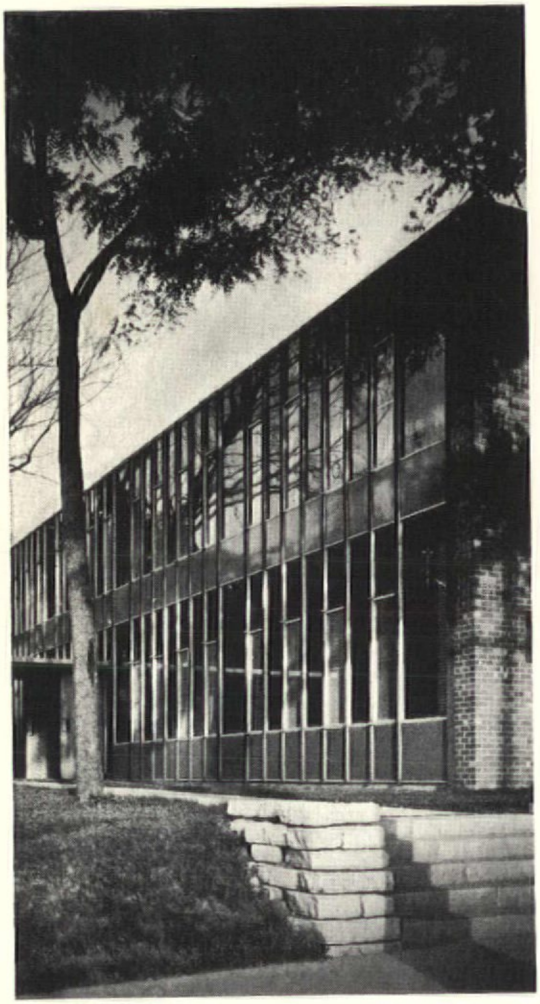




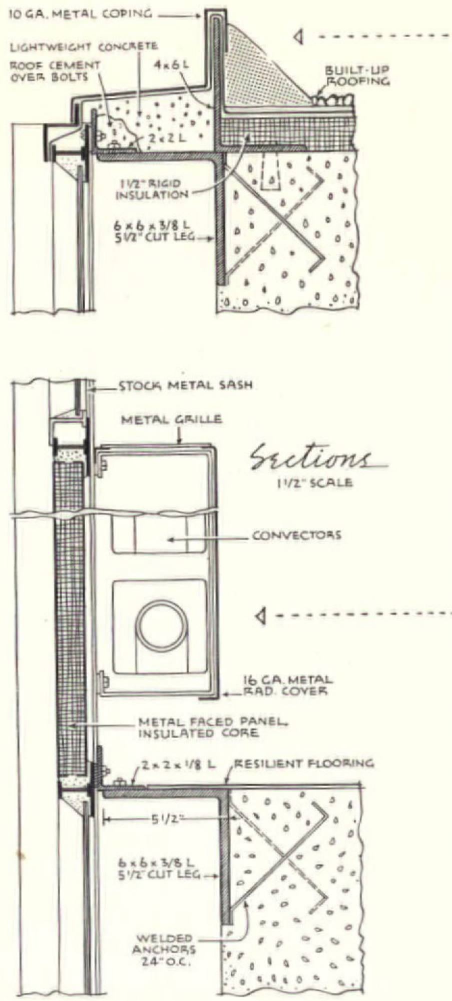
Wall Section
1/2" SCALE

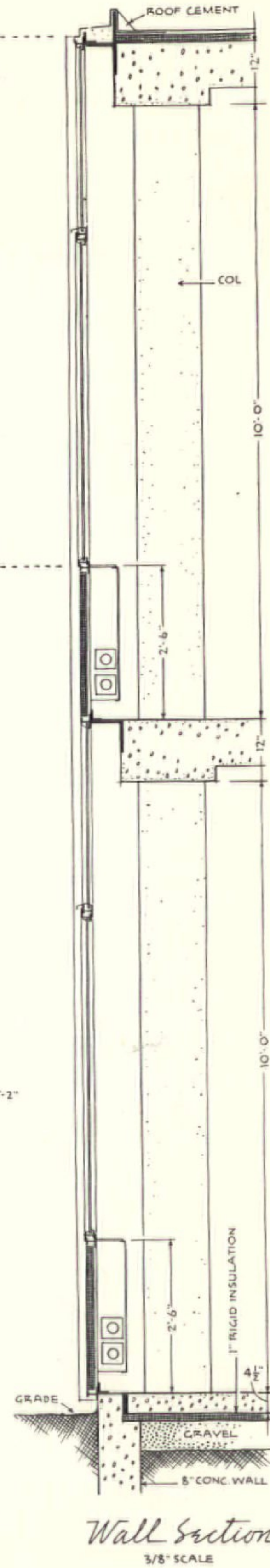
EDUCATIONAL AND SOCIAL CENTER, Detroit, Mich.
O'Dell, Hewlett & Luckenbach, Architects

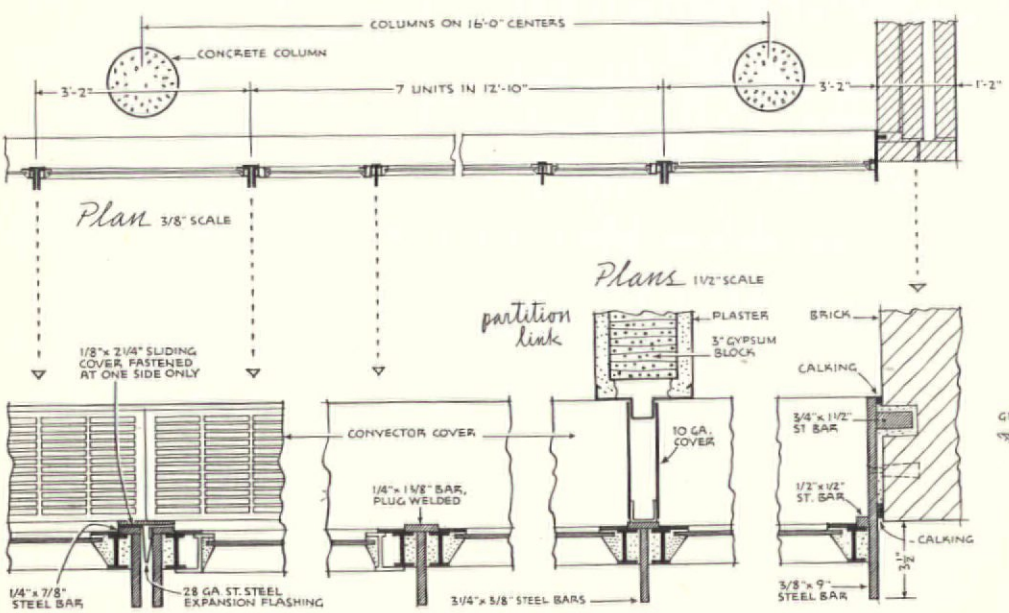
wall section



WARREN REYNOLDS, INFINITY INC.



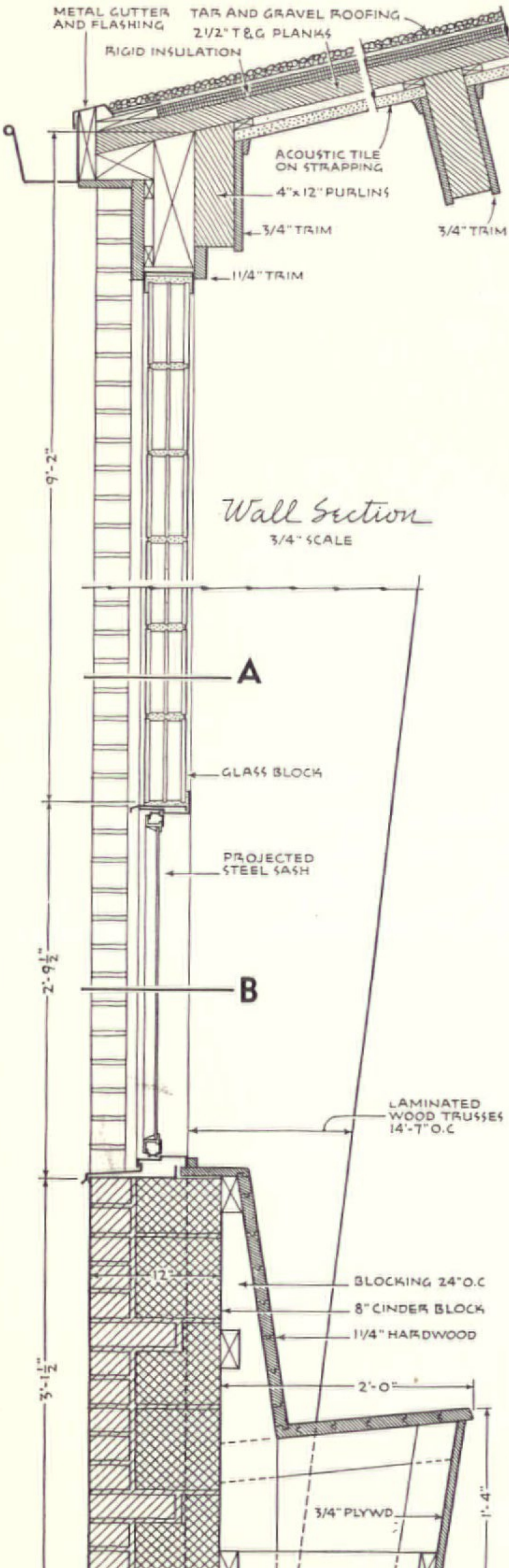




THEOLOGICAL SCHOOL, Des Moines, Iowa

Eero Saarinen & Associates, Architects

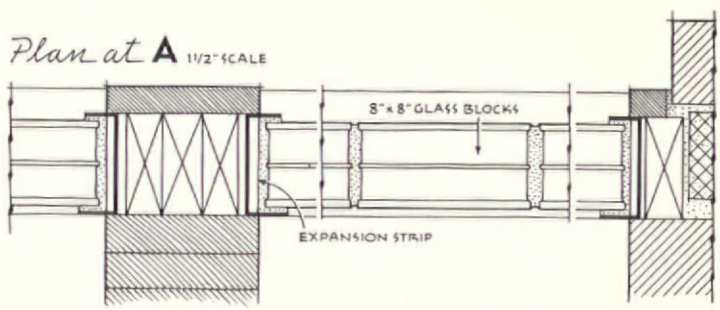
school: window seat



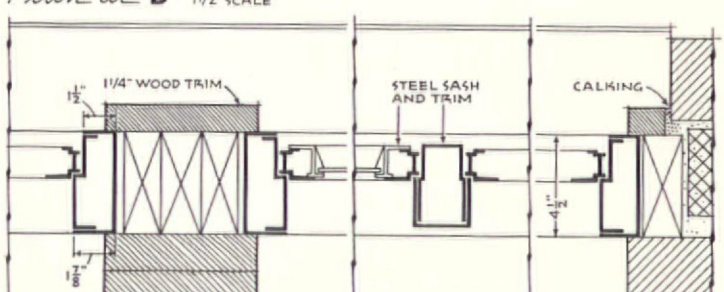
Wall Section
3/4" SCALE

RICHARD GARRISON

Plan at A 1 1/2" SCALE

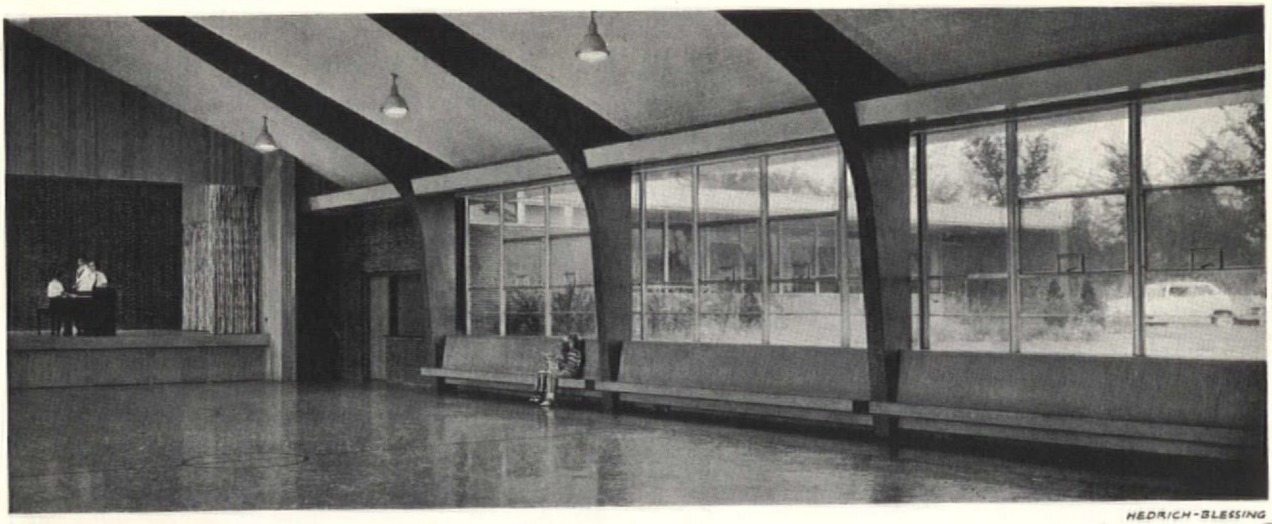


Plan at B 1 1/2" SCALE

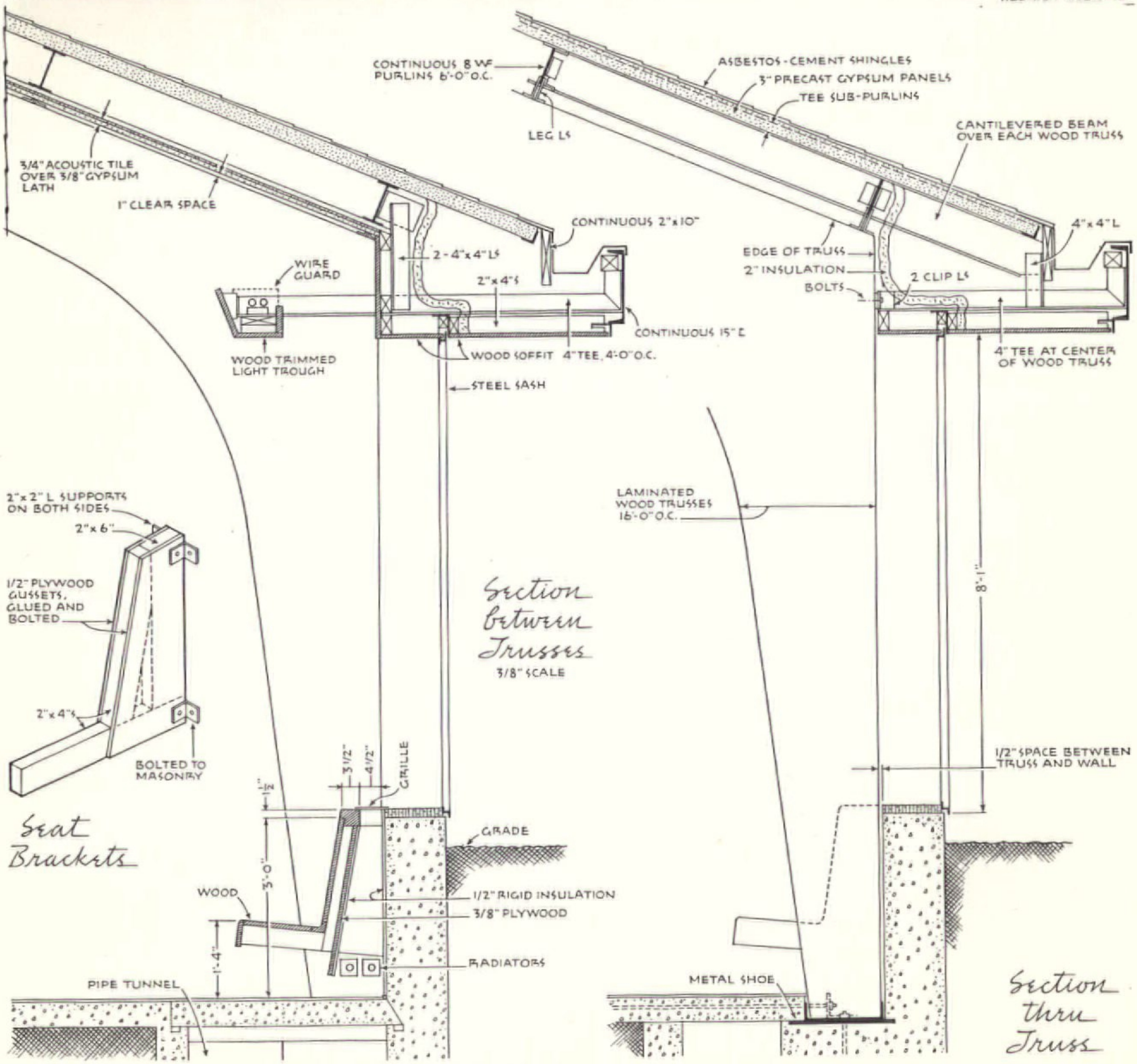


BROAD MEADOW SCHOOL, Needham, Mass.
Hugh Stubbins Associates, Architects

community building: window seat



HEDRICH-BLESSING

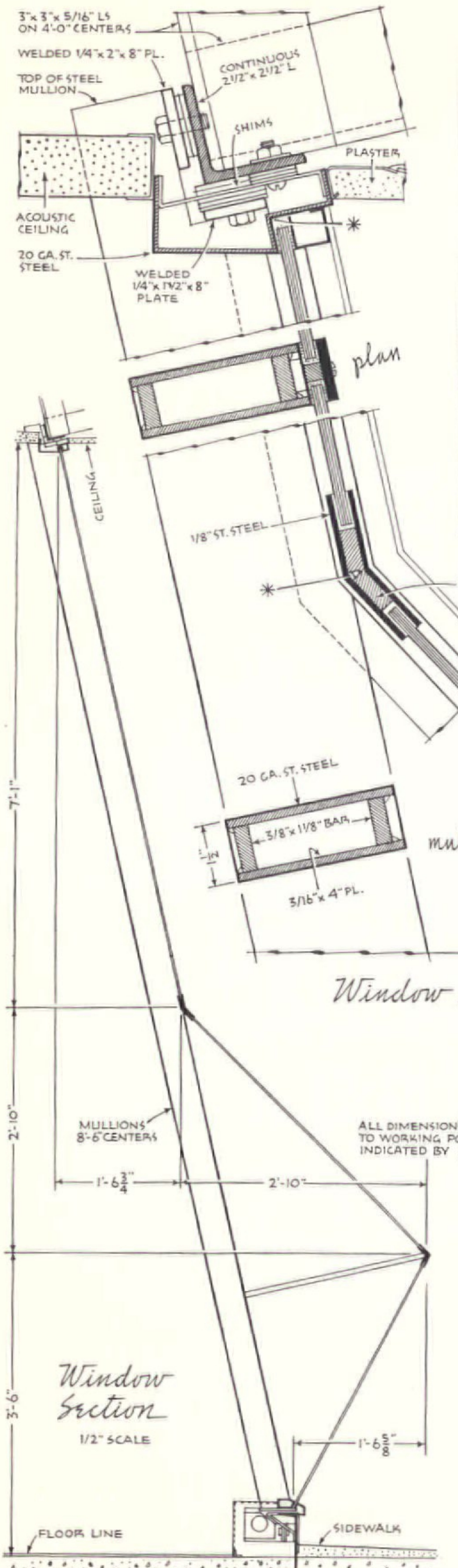


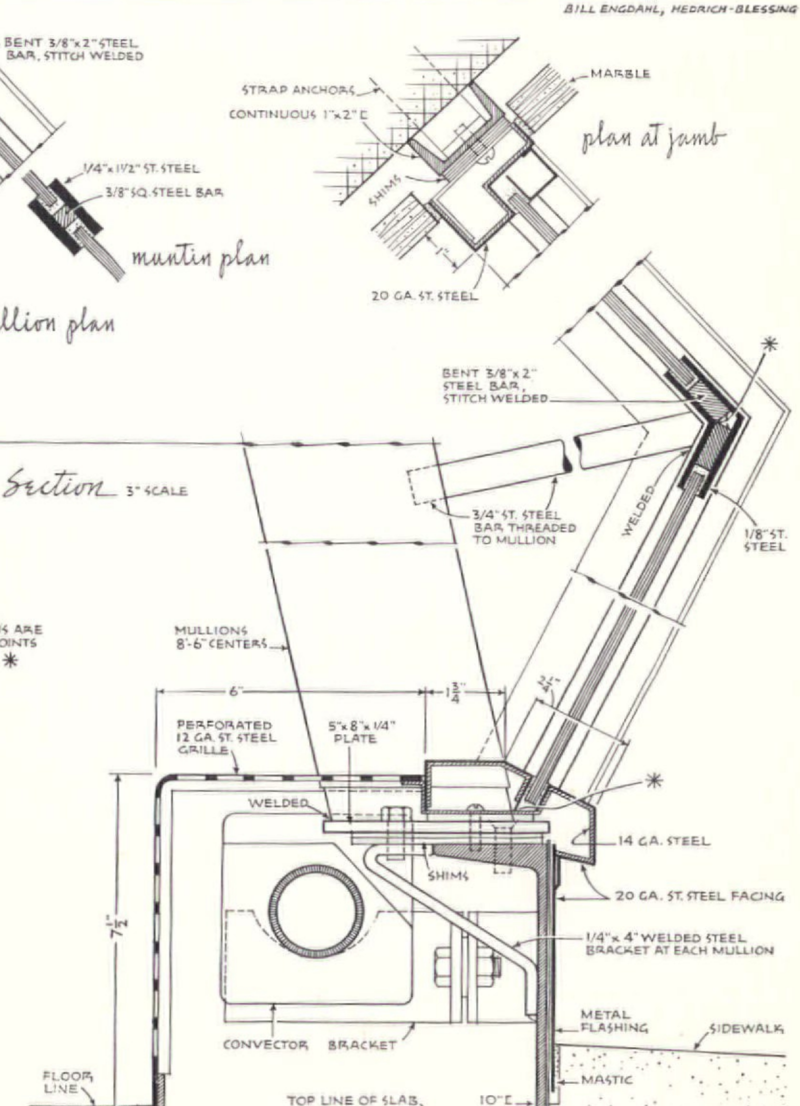
BEDFORD PARK COMMUNITY CENTER, Bedford Park, Ill.
Perkins & Will, Architects-Engineers

p/a selected detail

sloping window wall

BILL ENGDAHL, HEDRICH-BLESSING



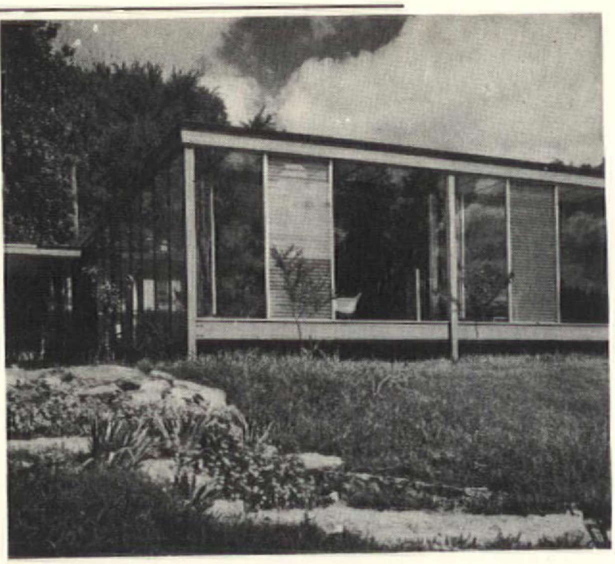


PUBLIC LIBRARY, Cincinnati, Ohio

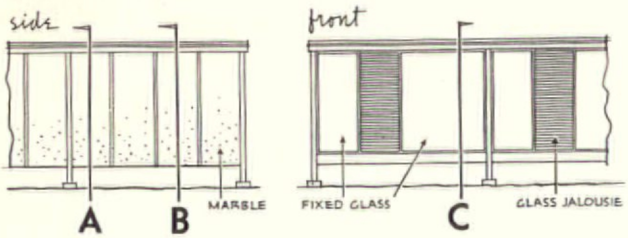
Woodie Garber & Associates, Architects

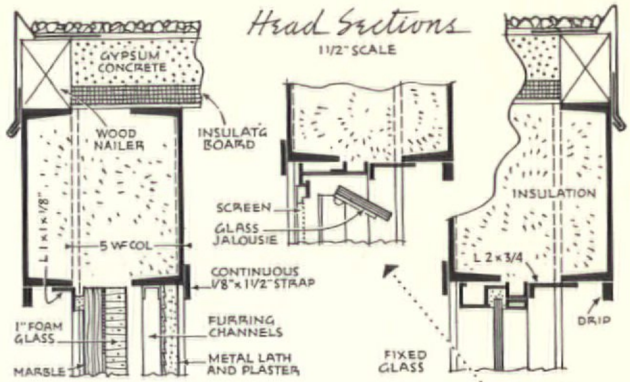
p/a selected detail

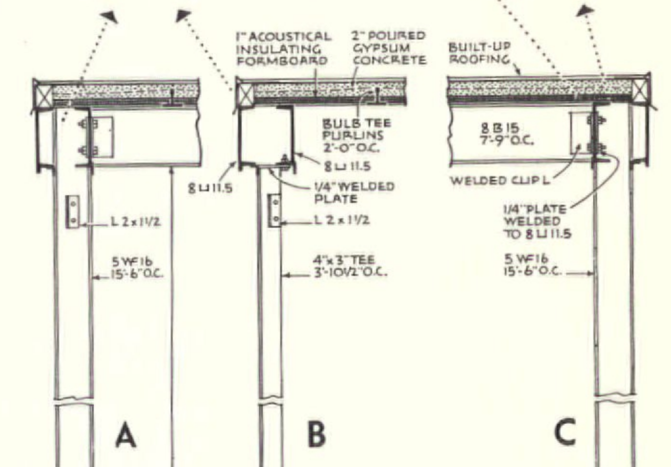
window wall

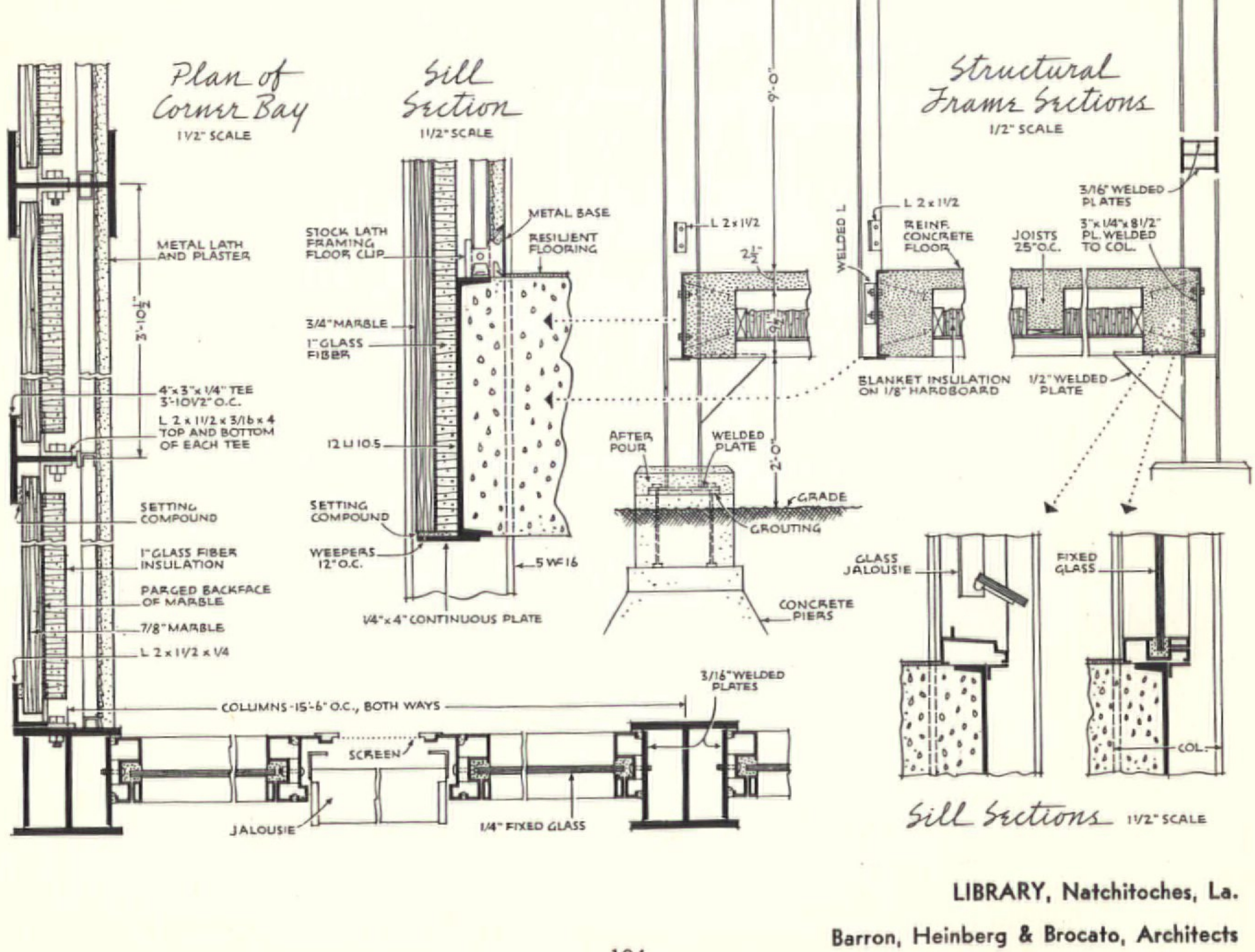


FRANK LOTZ MILLER





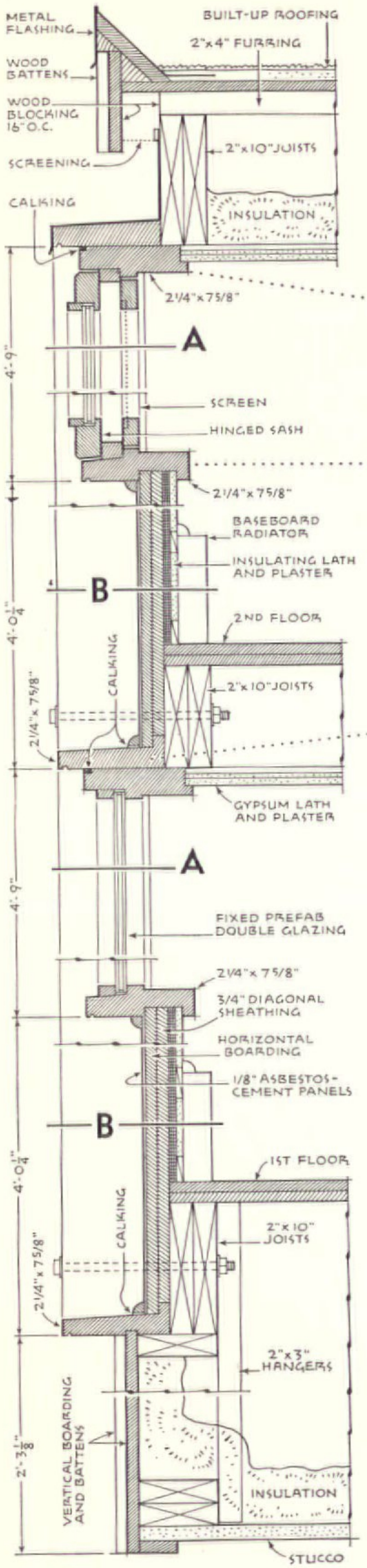




LIBRARY, Natchitoches, La.

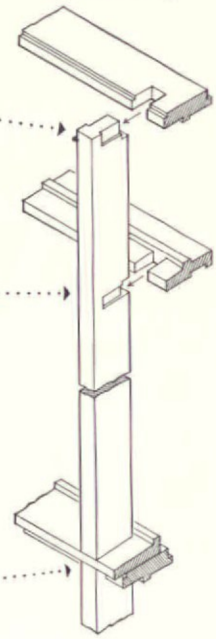
Barron, Heinberg & Brocato, Architects

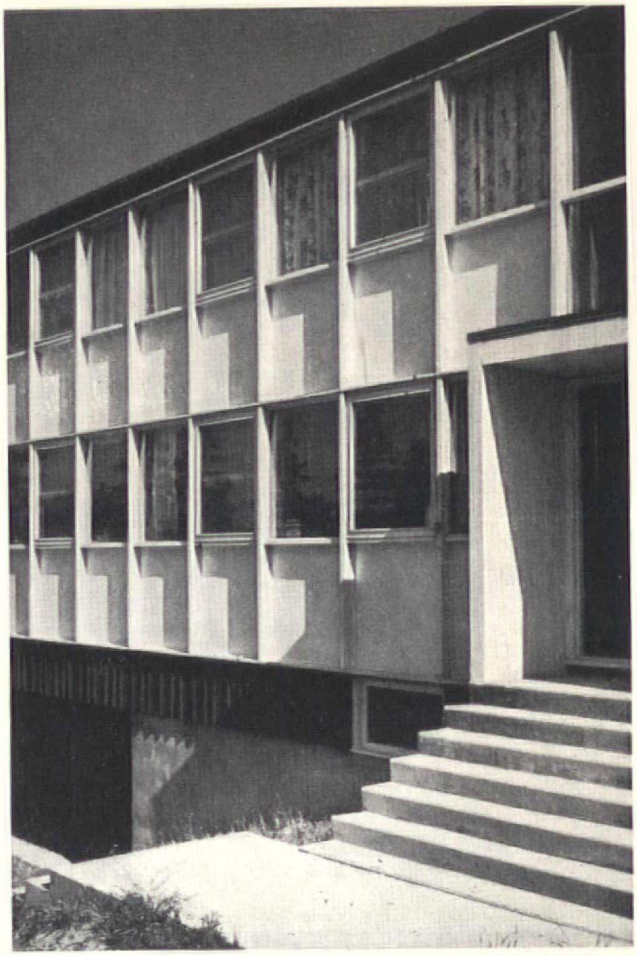
apartment: window wall



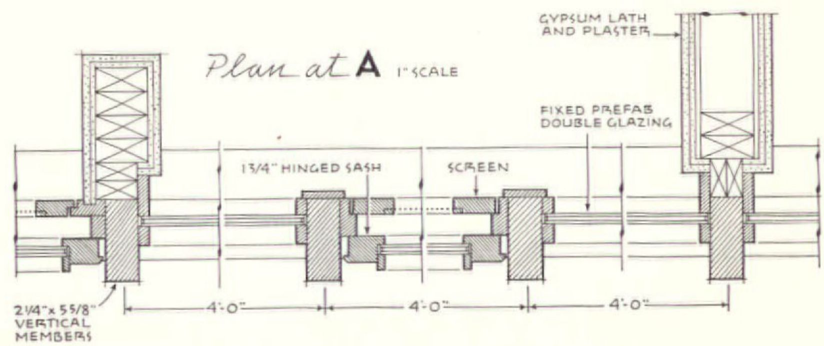
Wall Section 1" SCALE

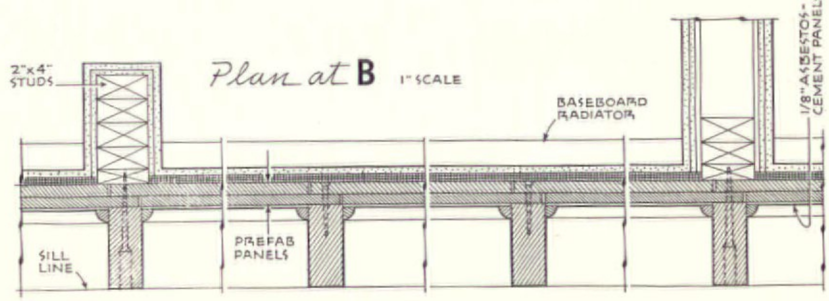
Frame Assembly





RICHARD GARRISON



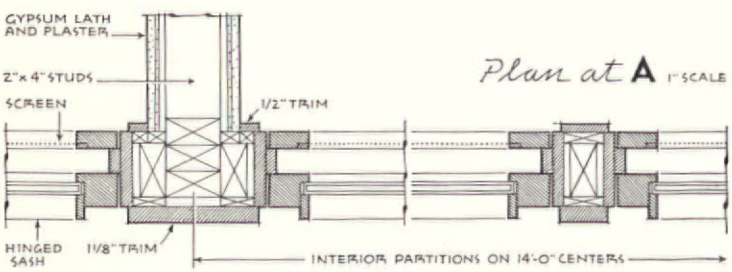


CRESTWOOD APARTMENTS, Rutland, Vt.
Whittier & Goodrich, Architects

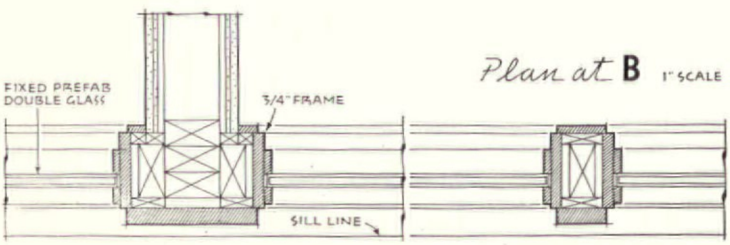
p/a selected detail

apartment: window wall

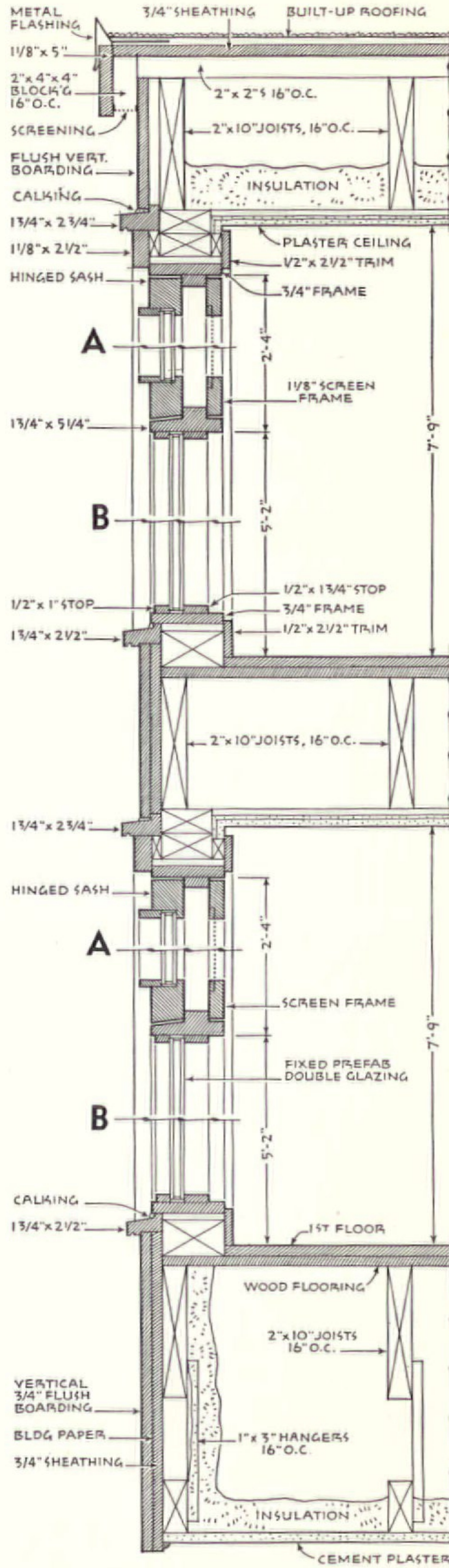
RICHARD GARRISON



Plan at **A** 1" SCALE



Plan at **B** 1" SCALE



Wall Section 1" SCALE

CAPITAL APARTMENTS, Montpelier, Vt.
Whittier & Goodrich, Architects

Section 11 DETAILING FOR MODULAR MEASURE

William Demarest

MODULAR MEASURE

the working tool for modular assembly

No conscious move toward assembly of modular parts has been so persistent or so fruitful as Modular Measure. As Committee A62 of American Standards Association, its proponents have long had professional and industrial support. Now the movement is co-ordinated (and incorporated) under the new Modular Building Standards Association, with active sponsorship of AIA, Producers Council, Associated General Contractors, National Association of Home Builders, as well as individual members. Administratively heading much of the work in recent years has been William Demarest, author of the following article. *Modular Assembly* cannot be fully successful with a vaguely but not-quite modular approach to manufacture or to drafting methods. There must be a discipline; there must be an accepted lowest-common-denominator module as well as the large structural module within which parts fit; and there must be a drafting-designing-detailing method. These are the elementary needs: with use of the techniques of Modular Measure they can become the tool.

Former Modular Co-ordinator of The American Institute of Architects, Washington, D. C.; Demarest has recently become the plastics-in-building consultant for Manufacturing Chemists' Association, Inc., also of Washington.

Ackad

With the blessing of AIA and the help of many building materials manufacturers, Modular Measure was launched more than a decade ago. Traditional modes of dimensioning in construction were irrational and haphazard. By now, the new system is widely acknowledged to be the only practical means available for bringing order into building dimensions and product sizes.

In this light, it is puzzling to observe that (1) a heavy preponderance of architects who have used Modular Measure are highly enthusiastic about its advantages, and yet (2) the total number of architectural offices that have adopted the new method is very small. Furthermore, a great many students emerging today from schools of architecture to start work in architects' drafting rooms, are quite ignorant of the way a Modular working-drawing is dimensioned and why.

The following report on Modular Measure is an attempt to gage the present performance of this method of dimensioning, from the architect's viewpoint. It may incidentally shed some light upon the reasons for the hesitancy about the new system, shown to date by architects and architectural educators.

The word "new" can be used only relatively when speaking of Modular Measure. Proposals for something of the sort date back to the 1920's. It was in 1936 that Albert F. Bemis, a public-spirited industrialist, published his proposal for a "cubical modular method" as a means of reducing housing costs. This laid down the principles of Modular Measure which, after being developed a little more fully by an industrywide study group under American Standards Association, was promulgated late in 1945.

Establishing four inches as the basic module for construction, Modular Measure provides a simple means of correlating the. dimensions of buildings with stock sizes of the materials going into them. Buildings are laid out in 4-in. multiples and material units are sized to fit together in repeating joint-to-joint dimensions likewise divisible by 4 in. These two aspects of the single idea are essential to the practical application of the method; they must be kept in mind, too, whenever discussing it.

Subsequent promotion of Modular Measure under AIA auspices necessarily placed most emphasis upon the building-layout side: the Modular working-drawings and details. Modular-size materials were already beginning to appear, but the necessary modular drawings were not. Either aspect, of course, influences the other. It is reasonable to surmise that, if substantially all working drawings were Modular, most material sizes would be Modular—and vice versa. This situation is often assumed to explain entirely the reluctance of the profession to adopt Modular Measure—architects, it is said, are merely awaiting a wide selection of Modular materials.

Strictly speaking, Modular working drawings are only these that indicate a certain aid to dimensioning: the three dimensional Modular reference grid, the spacings of which are, of course, always 4 in. This grid is the link between the sizes of the parts and the layout of the whole. Nonetheless, upon noting how very few architectural offices report themselves to be using Modular Measure, one wonders whether there may not be a great many architects who unknowingly almost do employ this principle. Inefficiently perhaps, and without the grid (and without a name to describe what they are doing), they are adjusting building-layout dimensions to accommodate stock unit sizes. These days, indeed, a great many of the most-used sizes are modular, even when not advertised as such. The list of components which follows is necessarily incomplete, since it would be too tedious to name all product types, some units of which might be made to go together in increments that are 4-in. multiples—if the detailer is sufficiently adept at making them work out that way. With more truly Modular building materials coming into the market all the time, architects may already be more nearly Modular than they think!

available components for Modular-Measure dimensions*

Masonry

Brick	Structural Clay Products Institute 1520 18th Street, N. W. Washington, D. C.
Concrete Block	National Concrete Masonry Association 38 South Dearborn Street Chicago, Ill.
Tile	Structural Clay Products Institute 1520 18th Street, N. W. Washington, D. C.
Natural Stone	Indiana Limestone Institute P. O. Box 471 Bedford, Ind. The Marble Institute of America 32 South Fifth Avenue Mount Vernon, N. Y. Building Stone Institute 2115 Martindale Avenue Indianapolis, Ind.

Glass Block

Vents

Screens

Windows

Aluminum	Aluminum Window Manufacturers Association 45 North Station Plaza Great Neck, N. Y.
Steel	Metal Window Institute Cheltenham, Pa.
Wood	National Woodwork Manufacturers Association, Inc. 332 South Michigan Avenue Chicago 4, Ill.

Doors

Steel	Steel Door Institute 2130 Keith Building Cleveland 15, Ohio
Wood	National Woodwork Manufacturers Association, Inc. 332 South Michigan Avenue Chicago 4, Ill.

Ceiling Components

Acoustical Tile	Acoustical Materials Association 335 East 45th Street New York, N. Y.

Troffers

Diffusers

Package Assemblies

Curtain-Wall Panels

Metal Partitions

Wood-Frame Construction (Based on 16" o.c. stud spacing)

Wallboard, plywood, siding, roofing, etc. including interior and exterior finishes in 16", 32", 24", and 48" widths	Douglas Fir Plywood Association 1119 A. Street Tacoma 2, Wash. Hardboard Association 205 West Wacker Drive Chicago 6, Ill. Asbestos-Cement Products Association 509 Madison Avenue New York 22, N. Y. Gypsum Association 20 North Wacker Drive Chicago 6, Ill.
Metal lath	Metal Lath Manufacturers Association Engineers Building Cleveland 14, Ohio
Insulation	National Mineral Wool Association 2906 Americas Building Rockefeller Center New York 20, N. Y. Insulation Board Institute 111 West Washington Street Chicago 2, Ill.
Combined furnace, hot-water heater, central air-conditioning	
Warm-air heating ducts	
Prefab, folding, attic stairs	

Flue Lining

Clay	Clay Flue Lining Institute 161 Ash Street Akron, Ohio

Fire-Extinguisher Cabinets

Plumbing Fixtures — Plumbing Fixture Manufacturers Association
1145 Nineteenth Street, N. W.
Washington 6, D. C.

Drinking Fountains

Shower Stalls, stamped

Kitchen Cabinets — Steel Kitchen Cabinet Manufacturers Association
Engineers Building
Cleveland 14, Ohio

Major Appliances

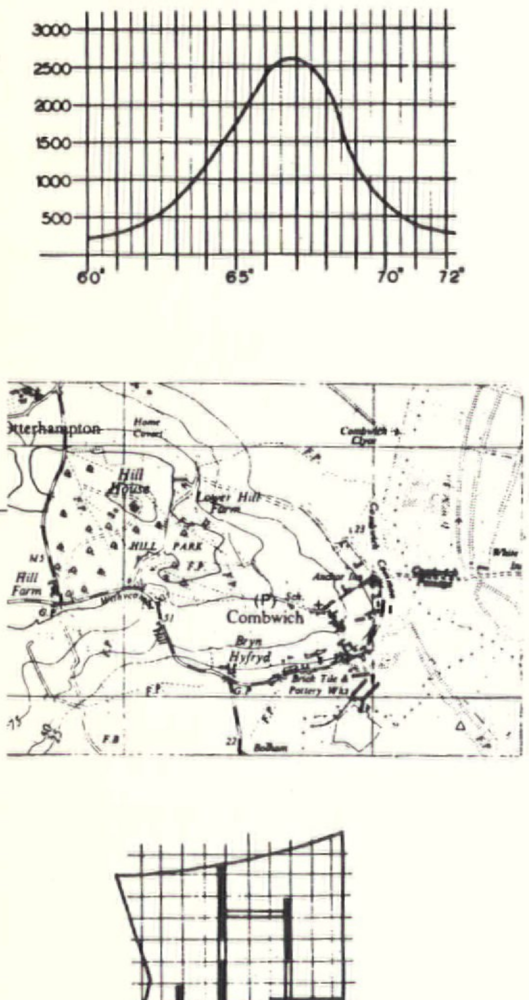
Electric	National Electrical Manufacturers Association 155 East 44th Street New York, N. Y.
Gas	Gas Appliance Manufacturers Association 60 East 42nd Street New York 17, N. Y.

Air-Conditioning and Refrigeration Equipment

Air-Conditioning and Refrigeration Institute
1346 Connecticut Avenue, N. W.
Washington 6, D. C.

*No complete list of available components for Modular-Measure dimensioning exists and similarly, no complete tabulation of manufacturers of these components has been compiled. Presented above are many component-types that are known to be produced on the 4-in.-module principle. Where they exist, associations and institutions—which have indicated a willingness to furnish architects and engineers with names of their members offering products for Modular dimensioning—are named. A tabulation of individual manufacturers of Modular-Measure components was not attempted, since it would inevitably be incomplete and might give a disproportionate picture.

Modular Measure: reasons for co-ordinated dimensioning



In the communication of information, we are accustomed to and readily understand the reference grid: used as a graph (top), *on a map* (center), *or in building* (bottom).

Our building industry is often likened to that of agriculture—the only basic U. S. industry larger than building, according to most people's figures. By their very natures, the two have much in common. Each is vast in size, supplying a fundamental need of the population. Although giant corporations are operating profitably in each field, both include a vast number of small entrepreneurs, to be found in most localities across the land.

As in agriculture, tradition and conservatism have loomed large in the building industry. In the former, during recent years, the consumer has benefited increasingly from the analysis and reorganization of the processes of farming, food storage, and transportation — processing and marketing in the light of current technology. Such progress has been slower to appear in construction; however, since World War II, improved techniques have been accepted more readily than in the past. Now, a more or less concerted effort is being made to analyze the building process in its entirety, with the thought that it should be organized to make the most of present and impending technological advances.

A basic trend, common to other important American industries, is now beginning to appear in building construction. "Industrialization" is perhaps the most apt of several terms used to describe it. Its philosophy was recently summed up by a building researcher this way: "Industrialization requires that the product be made and stocked without knowledge of just who will buy it and just where it will be used." The "industrialization" of building tends to encompass a growing range of materials; it is aided and abetted by a strong trend in present-day design—"component" assembly *(page 148)*.

standardization

Any "ideal" of an all-bolted, all-gasketed assembly serves only to represent the theory of the component method. Few, if any, of its advocates hope to see it practiced to such an extent in the immediate future. At the same time, it is a fact that the building process is undergoing industrialization and that the unpopularity of the component approach to design is a major factor favoring this development. It can be noted that completed buildings which have carried the concept furthest are very often costly "showpiece" designs, employing specially fabricated components. The missing element in such cases—and the link needed for industrialization of the whole procedure—is mostly dimensional standardization.

The considerations here are quite obvious, since they have to do only with the fitting together of building components. The basic point (and perhaps the one most difficult of solution) is that each type of joint detail must be pretty much standardized as to size and shape. There is considerable latitude in the stringency of this requirement, but it seems to have become progressively more precise and limited with the advance from masonry (mortar joints) to inflexible metal-to-metal points of some complexity. This trend need not persist as a necessary concomitant of industrialization; the advent of all-glued structures, for instance, might reverse it and permit somewhat greater latitude in joint standardization. There are countless possible variations in the ways a component must fit other component parts of the building (including duplicates of itself). Fitting together thus, without need for "specials," demands both that the joints themselves be standardized and that the over-all, joint-to-joint dimensions of components likewise be brought under control. This is merely a matter of size and fit; beyond this limited scope, it has no design significance. What happens between joints (edges, surfaces, and ends) of a component may be far more important; yet, from the viewpoint of routine assembly, is not significant.

assembly on a grid-pattern

The typical rectangularity of most buildings suggests the basis upon which the layout of components may be co-ordinated. A flat-roofed, boxlike building made entirely of component panels, for instance, could readily be laid out by following a rectalinear grid, in three dimensions, spaced according to the "repeat"—or module—by which the panel unit is assembled with its identical neighbors. This panel module would not necessarily equal the outside dimension of a unit; it would be governed by the assembled panel *and* joint. Just like the length of a wave-cycle, the module would be the dimension from a certain point (say, mid-joint) to the next identical point, repeated (mid-joint again). An interesting report on the actual development of such grid systems for the Hertfordshire (England) prefab school-building program was recently published.[1]

A modular grid of this sort provides a simple and practical method for co-ordinating the layout of a building with the size of the component. It is very commonly used by architects these days, but generally running in one dimension only. The best example of this is the horizontal dimensioning of ribbon windows that run across at least one entire façade, thus permitting no "take-up" at either end. The designer must employ a module, the dimension of which probably does not equal the width of the individual window unit. Further, for steel-framed office buildings, the architect correlates the different horizontal modules of fenestration, of office width, and of structural bays.

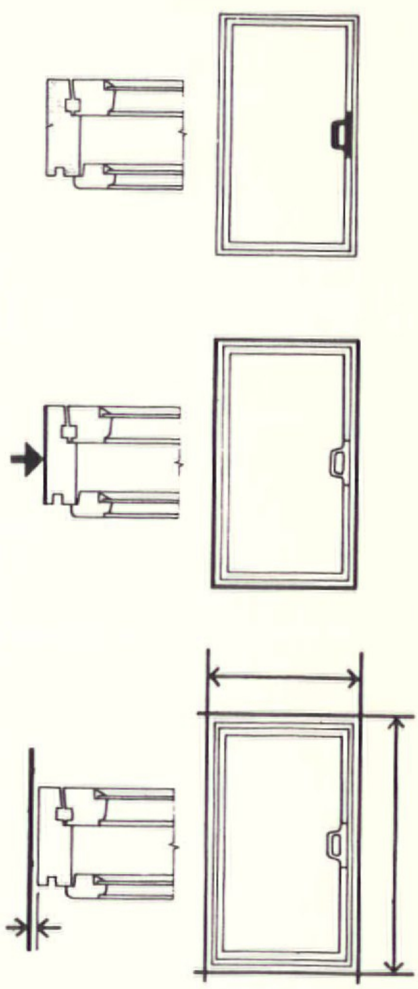
This is sufficient for isolated dimensional co-ordination, where the sizes of components can be adjusted to suit the module selected. Such freedom is likely to be achieved, however, only by specially ordering the desired sizes. Whether it now costs more than using stock sizes (for larger structures), the "special order" obviously conflicts head-on with the smooth quantity-production and distribution of standard items. It blocks reductions offered by industrialization.

Therefore, the assembly-grid principle has been carried one step further. A universal Modular grid has been established for the U. S. building industry, in an attempt to provide a common basis for correlating stock sizes of all building materials and equipment. This grid employs a 4-in. module in each of its three dimensions. It is expected that this relatively small module will function as a "least-common denominator" for substantially all stock units of whatever magnitude. Their nominal (or "grid," or "modular") sizes need only be some multiple of the basic 4 in. in order for them to fit readily into the assembly grid. Into the building, that is, without need for further fabrication or on-site alteration.

This dimensional system, of course, is Modular Measure. Its Modular grid has further usefulness to the draftsman and contractor in terms of simplified and more orderly dimensioning. Trouble making fractional dimensions can be kept to a minimum under Modular Measure. Furthermore, those remaining are pulled out of controlling dimension-strings and isolated, since the only cumulative units of measurement are the 4-in. modules.

For these and related reasons, the system is already being used to advantage by a number of architects without awaiting the availability of a wide array of stock building components in modular sizes. The real significance of Modular Measure, however, lies in the fact that dimensional co-ordination in the building is an absolute necessity, if the trend to industrialization is to prevail. Just as industrialization appears to offer the only avenue to reduced building costs, so does Modular Measure offer the only practical approach to co-ordinated sizes and dimensions.

[1] *"Flexibility Through Standardization,"* July 1957 P/A.



A modular component **(top)** ***has two attributes: its profile is designed to be co-ordinated with other modular components*** **(center);** ***its dimensions are derived from its modular dimensions*** **(bottom).**

Sketches from Modular Co-ordination in Building, *Project 174, European Productivity Agency of the Organization for European Economic Co-operation, August 1956.*

Modular Measure: dimensioning drawings

Modular Measure facilitates orderly systematic dimensioning of working drawings by introducing an "egg-crate" of reference planes throughout the entire space that the building will occupy. The egg-crate consists of series of parallel planes, each using a *4-in.* spacing, since that is the basic module. On paper, these appear as lines making a grid of 4-in. squares—the gridlines.

Preliminary sketches are affected by Modular Measure in only one way. If design modules are used in laying out the building, they should be multiples of 4"—such as 16", 40", 7'-8", etc. Any 4" multiple whatsoever will do, the idea being simply to make it easier for the draftsman, later on, to convert preliminaries into scale-drawings dimensioned in multiples of the basic 4-in. module.

Draftsmen must form the habit of beginning details with the gridlines and must set them down first in starting a detail-drawing of any kind. This has to be an inviolate rule for any drafting team that intends to produce Modular drawings. There are no exceptions: even hasty freehand sketches of only part of a detail, jotted down during discussion or study of a problem, must all start with an indication of the 4-in. Modular grid. (An underlay showing the grid will not do, although it can be useful as a guide for drawing in the gridlines.) If a detail is going to be worked up on the final sheet, it is helpful for the draftsman to rule the gridlines in ink or on the back of the tracing paper. Thus, they cannot be erased as changes are made; it is essential that they appear on the blueprints. When dimensioning a Modular detail, the draftsman locates the surfaces of parts, centerlines, etc., by dimensions to the gridlines shown, not to points elsewhere in the building. (Because of the 4-in. grid, a Modular detail should require fewer small, fractional dimensions than a detail drawn the old way.)

Most "modular" drafting rooms set a dividing line at the scale of ¾" = 1'-0". Smaller scales are considered too fine to actually show the 4-in. grid; *all* drawings at larger scales must show it. Small-scale layout drawings – plans, sections, and elevations—give nominal, or "grid," dimensions wherever feasible. The draftsman must understand that the grid is still there, even though it cannot be indicated when the building is drawn at such scales. Insofar as possible, these drawings show nominal surfaces: nominal walls and partitions, nominal finished-floor, etc. This will mean that, for the most part, lines indicating such surfaces will coincide with (invisible) grid lines. Thus, the distance between the arrow at one end of a dimension-line and the arrow at the other end will be some multiple of 4 in. This rule should not be interpreted to mean that such things as nominal 6-in. stud-partitions and nominal 10-in. cavity-walls must be increased arbitrarily to 8 in. and 12 in. The nominal dimensions should be used as originally intended. And, although nominal finished-floors must be located on gridlines, floor *thicknesses* need not be 4-in. multiples. Modular Measure introduces no requirements as to ceiling heights. On small-scale plans for houses of conventional wood-frame construction, a single arrow is commonly used to indicate the actual face of a line of wall-studs or partition-studs, coinciding with a gridline.

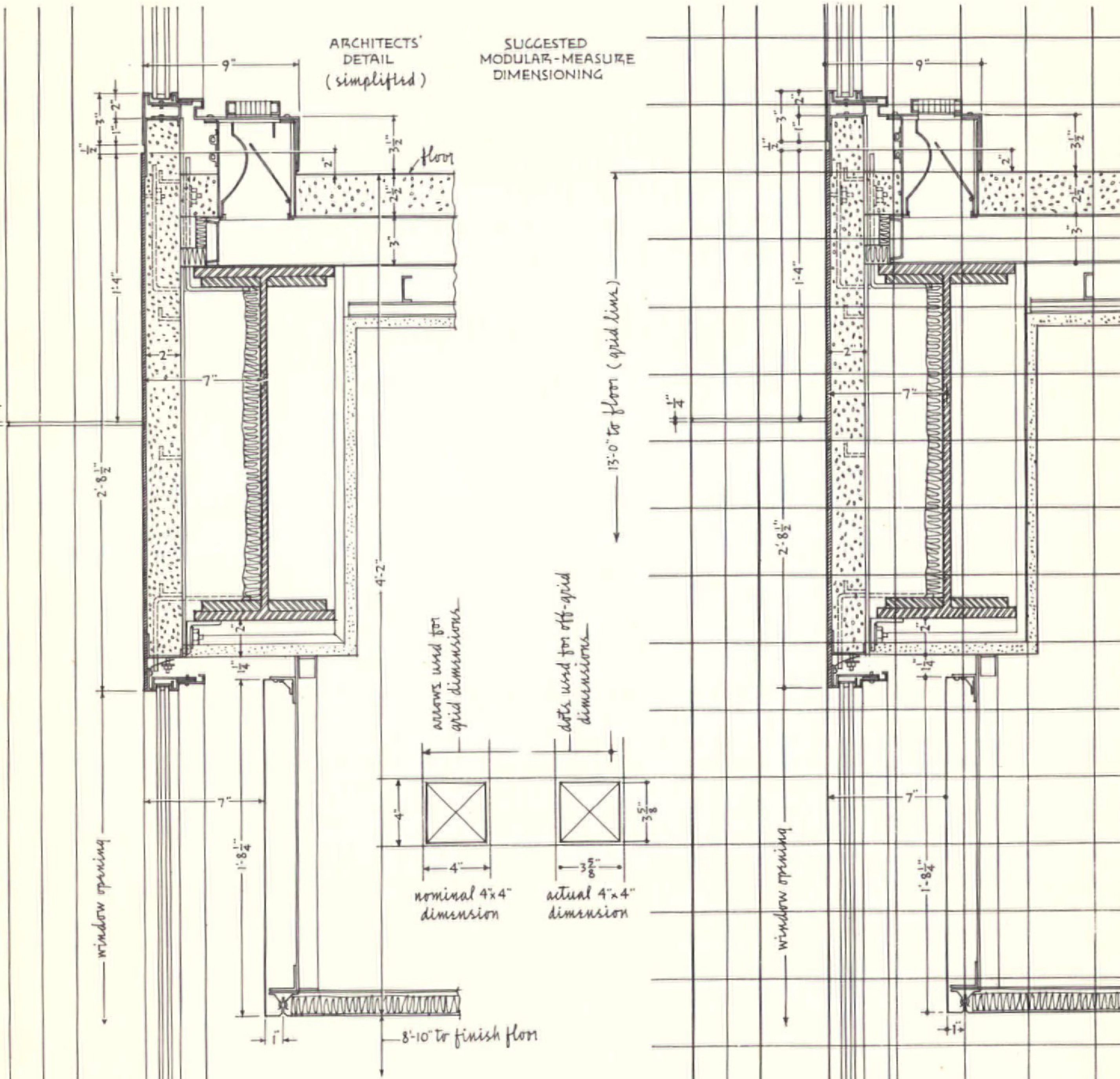
Dots and arrows at the ends of dimension-lines have a specific significance on modular drawings. This arises from the fact that the 4-in. Modular grid cannot be indicated on small-scale plans, sections, and elevations. In referring back and forth between these layout drawings and (larger-scale) detail drawings, it is necessary to know exactly where any particular detail fits into the building as a whole. The Modular grid makes this clearly apparent, even when the same detail occurs at several different locations. This is possible simply because the grids on the various detail-drawings actually represent small portions of the three-dimensional, over-all building grid. Almost all the lines to which dimensions are taken on the small-scale layout drawings will coincide with lines of the building grid. In other words, they will be gridlines; it is therefore important that they be identified as such. Hence, the rule that, on all Modular drawings, a dimension taken to a gridline is indicated by an *arrow*; but where a dimension-line terminates off the grid, a *dot* must be used instead (*illustrated acrosspage*).

For example, when the nominal jamb of a window is located on a small-scale plan by a dimension-arrow, it is evident that this dimension is to a gridline. On the window detail, that gridline is seen as part of the regular 4-in. Modular grid which always appears on large-scale drawings. Recognizing the same gridline apearing on both the plan and the detail, the construction man readily understands just where the designer intended that jamb to be located. Whether at large scale or small, whether the grid is drawn in or not, the draftsman uses an arrow when dimensioning to a gridline; when dimensioning to a point off the grid, he uses a dot.

Vertical dimensions are co-ordinated in modular drafting by setting nominal finished-floors coincident with horizontal gridlines. Actual finished floors are generally located ⅛" below a gridline, with one exception. In wood-frame construction, the top of the sub-floor (or of slab-on-ground) coincides with a gridline.

Many architects report, after they have started to dimension working drawings and details by Modular Measure, that this system encourages two things: drafting short-cuts, helping produce drawings, and clarity of presentation – which not only is helpful to those in the drafting room but also assists the contractor and his men to get the job built in strict accordance with the architect's intentions. A significant comment is often heard: "*The gridlines make everything fit.*" In essence, once the draftsman has formed the habit of thinking primarily in terms of the aforementioned "3-D" egg-crate, instead of "1-D" dimension-lines, he has mastered the principle of Modular Measure. He is then well on the road toward more orderly, more accurate drafting.

Details of typical spandrel in Inland Steel Building, Chicago. Architects: Skidmore, Owings & Merrill. Detail (left) *shows standard method of dimensioning as indicated on the architects' drawings. Detail* (right), *however, suggests how drawings might have been executed—if Modular-Measure dimensioning had been chosen. (Dimensions developed by author.) Additional discussion and photos of the Inland Steel Building are presented* (page 158).



Modular Measure: present performance

Modular Measure has been touted widely in the architectural world. AIA has co-operated in staging seminars, publishing booklets, etc.—all intended to interest the architect in the new mode of dimensioning and to explain how it accomplishes benefits for him and his client. Many AIA members have heard Modular Measure's claims of performance forcefully expounded by one of its most notable practitioners—C. E. Silling of C. E. Silling & Associates, Charleston, West Virginia, a Fellow and past Director of the Institute. He has preached the Modular "gospel" at countless architects' meetings and has intrigued his audiences by reports of large "profits" open to the practitioner through the efficiency and economy of Modular Measure. Drawing upon the experience of his own small, but highly productive, office, Cy Silling has made Modular Measure sound mighty attractive—spectacularly helpful to most phases of an architectural practice.

Skeptics have wondered why it should seem that most of the enthusiasm in support of Modular Measure's claims should emanate from just a handful of people—Silling and a few others who, like him, became excited about the method through use of it. Actual practitioners of Modular Measure were rare, not long ago; it was thought, however, that this should no longer be true, following the profession's decade-long exposure to the idea. Accordingly, 131 architectural offices of diverse geographical location were written, and invited to comment—if they had had actual experience with Modular Measure—up eight claims (stated below) made by the proponents of the system. It was emphasized that "Modular Measure" meant preparation of working drawings according to the drafting practices prescribed by AIA—using 4 in. as the basic unit in dimensioning; indicating this on detail-drawings by actually showing the 4-in. grid in which the building is placed; using an arrow when dimensioning to a gridline, otherwise a dot to locate any surface not coincident with the grid.

Twenty-six firms responded that they had followed Modular Measure, thus defined; each commented on at least a few of the claims in question and how they had been borne out in actual practice. Some claims, such as the reduction of draftsmen's errors, were widely endorsed; others were sharply challenged. A small minority reported that they had undertaken the adoption of Modular Measure; yet, for a variety of reasons, had thought it an unprofitable change and had abandoned the attempt.

Certain points were made, again and again, by those who had used the system: The co-operation of one's structural engineers is critically important; modular exterior-door sizes are badly needed; Modular Measure must not be permitted to dictate design decisions. It also became clear that the schools have failed, so far, to familiarize future draftsmen and architects with the new dimensional procedure. The continuing lack of modular sizes of building materials was, of course, frequently decried.

These are the eight Modular claims, one by one, along with some of the comments received on each:

fewer drafting errors

The great preponderance of architects who commented stated definitely that dimensional errors on working drawings were reduced by Modular Measure. This was generally attributed to the simpler and more obvious indication of dimensions than was possible when dimensioning in the traditional manner. Some felt that this one immediate benefit furnishes ample justification for taking up Modular dimensioning.

fosters clearer detailing

Insofar as it can be compressed into a few words, the argument of Modular enthusiasts that the method can clarify detail-drawings arises from its use of a three-dimensional system of co-ordinates. This appears on large-scale drawings as a grid, forming 4-in. squares. The draftsman, it is said, is forced to "think through" a detail with care, since he must locate key points properly within the omnipresent Modular grid by reference dimensions to grid lines.

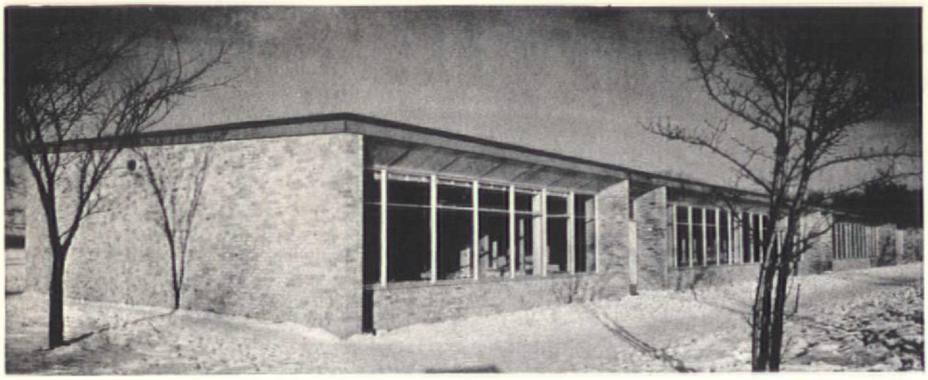
By and large, actual experience would appear to substantiate this claim. Detailing is an important aspect of design and is at the very heart of the drafting operation; different architects will view it in different lights. The comments received varied accordingly, but almost all who liked Modular Measure liked its influence upon large-scale details. Exceptions were those who said they found the modular grid inapplicable to some types of details. Another interesting, and also negative, fact emerged: No one complained of the bother of indicating the grid on his large-scale drawings, in the first place.

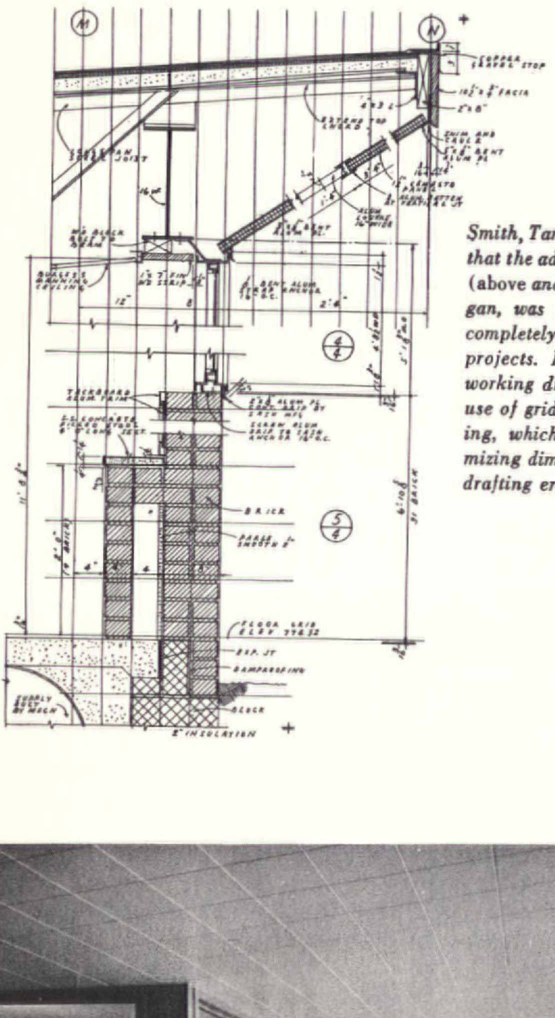
drafting costs reduced by faster production of working drawings

Efficient drafting-room production can result only from good organization and training; improved dimensioning practices can never be more than a contributory factor. This probably explains why some firms with Modular-Measure experience consider the method ineffective in cutting costs, in the face of the majority which feels that it undoubtedly does speed production and thereby reduces the expense of producing a set of drawings. Most comments were unqualified: "Definitely lower drafting costs"; "speedier production and lower costs always"; etc. Some did not have cost records complete enough to substantiate savings; others, new to Modular Measure, were confident of realizing economies, but did not feel that they were yet being achieved.

Any change in a going operation must be thought of as an investment, since a dip in efficiency is inevitable. Until architectural schools make a practice of familiarizing all students with Modular Measure,[2] the conversion of each office will call for a period of training (which is most practical to spread out, crew by crew). Losses caused by such inefficiency represent an investment that the architect hopes to recoup as his drafting force begins to work more smoothly and rapidly

[2] *A significant comment was received from one large architectural and engineering firm which has been using Modular Measure for some years: "We know that some draftsmen have come to work for us just because they want to learn Modular Measure. Our Chief Draftsman reports they lose no time learning the system and, with very little instruction, they are practically educated within a week or two."*





Smith, Tarapata, MacMahon, Inc., report that the addition to the Pembroke School (above *and* below), *Birmingham, Michigan, was one of their most successful completely integrated Modular-Measure projects. Regarding the production of working drawings, they found "that the use of gridlines required less dimensioning, which naturally resulted in minimizing dimensional error as well as line-drafting error."* Lens-Art Photos

by Modular Measure. This was not emphasized in the comments received, but other sources have confirmed that apprehensions as to the actual efficacy of Modular Measure have been a major factor in delaying adoption by individual firms. The greatest lesson to be learned from the respondents is that each office must assure acceptance by all those employes affected and must plan adequate indoctrination of those who are to put the new procedures into practice.

useful in co-ordinating unit sizes of materials

Dissatisfaction with spotty availability of Modular-size building materials was expressed in the architects' comments. Manufacturers' difficulties in developing Modular-unit sizes were not appreciated. Reports on material sizes echoed others' comments with regard to drafting and detailing (above) to the effect that Modular-size exterior doors cannot now be found, are urgently needed.

makes possible tighter cost-estimates

This claim was not substantiated by response received. Such matters are hard to gage in any case and the lack of comment would imply that architects using Modular Measure are as yet unconvinced on this score. However, in addition to the few responding affirmatively, a few others predicted that this will be the case, some day. Negatively, none seemed to think the new mode of dimensioning causes less-accurate estimates.

quicker layout of the job at the site

Modular Measure makes possible radical simplification of dimensions at the foundation level. Except in rare instances, fractions of inches can be avoided completely: often, all layout dimensions can be multiples of the 4-in. module. This provided basis for the claim that the new method speeds job layout. Modular architects' experience seems to be mixed. Although layout can be greatly benefited by Modular drawings, this will depend on the familiarity of superintendent, foremen, etc., with the principles involved.

reduces masonry costs while improving quality

The masonry interests, who were the first to push the Modular-Measure idea, should be pleased by the preponderantly favorable comments received on this question. Architects further pointed out that nothing is gained unless Modular-size units are available competitively and unless the masons are acquainted with the system. Some appeared to doubt whether a mason of lesser skill could, through Modular Measure, produce work of quality equal to nonmodular masonry laid up by a superior journeyman without the benefit of modular dimensioning.

requires no compromises as to freedom of architectural design

It was to be expected generally that architects using Modular Measure would be convinced that this mode of dimensioning presents no conflict with their basic function as designers, and this proved to be the case. Conversely, one firm has declined to adopt the system as yet, partly because of a feeling that it can handicap design. An important comment received from several was to the effect that, if design considerations are more important, there will be times when the Modular method will have to be ignored. (Nonrectangular elements of a Modular building, for instance, would have to be dimensioned pretty much as for a nonmodular job. A few reference dimensions will suffice to locate them relative to the building grid.)

Furthermore, some architects pointed out that, if the "component-assembly" approach to design is being followed, Modular is a positive aid to good design.

Modular-drafting practice will undoubtedly evolve as more and more offices adopt this method. At present, a number of questions remain unanswered. One office queried: "When typical details are employed, should arrows, dots, or some other indication be used? Not all typical details are located within the grid set-up in the same position. Perhaps a simple note added to the standard instruction decal[3] could indicate the use of an arrow for all typical details, regardless of location." Another pointed out: We have a problem in dimensioning to odd (Modular-standard) brick courses, as we have not adopted dimensioning in *thirds* of inches and *sixteenths* do not total up to three courses in 8 in. We have thus found that the 4-in. basic unit is a fallacy for (Modular-standard) brick-faced buildings. The actual unit is 8 in., to keep brick coursing similar in equal stories. This means that story heights can vary only in 8-in. increments and, in many cases, this is impractical." Quite a number of offices have developed reference systems, based upon the 4-in. Modular grid, to cope with such problems of vertical co-ordination as the one just indicated, also to identify controlling elevations and to make it easier to find elements in plan.

[3]*Instruction decals for working drawings are available from AIA Headquarters, Washington, D. C.*

The general conclusion that may be derived from the reports received is that claims of Modular Measure's benefits are largely true, but cannot be guaranteed in every case. It is a tool for achieving order, specifically in dimensioning, in the production phase of architecture. Dimensions and size considerations pervade this phase and efficiency can only be achieved through a multiplicity of improvements. Modular Measure can help in many ways, but is still probably performing almost at its worst—because of widespread unfamiliarity with (and occasional opposition to) the system and because of the dearth of Modular-co-ordinated materials with which to execute the Modular drawings. That this "worst" is found well worthwhile by a number of practitioners justifies faith in the new method. Specific comments, from individual architectural firms, on the preceding eight claims are presented (*page 266*).

One firm—Aeck Associates, Atlanta, Ga.—was good enough to set down a full report on its recent adoption of Modular Measure. The following was prepared by F. J. Bull (then of the Aeck firm, now partner in Office of Frank J. Bull, Architect, & John N. Kenney, also of Atlanta):

case-history: converting to Modular

"In the beginning, there was the promise of Modular Co-ordination. The beginning, I believe, was in 1952 at a meeting of Georgia Chapter, AIA. A well-known architect, the prophet of Modular profits, along with Bill Demarest, gave an illustrated lecture on the benefits to be gained from the use of Modular dimensioning.

"We had always been impressed with the need for efficiency in producing complete and accurate drawings. Here was a method that met the specs! The only action taken, however, was to set up a file entitled, 'Modular Co-ordination.'

"The 1954 winter meeting of North Carolina Chapter, AIA, was a conference on 'Simplified Drafting Procedures.' In this we took part and told of our office practices, but there were the same two men as before extolling the virtues of Modular Measure. We began to think more seriously about it.

"At the time, we were doing a good volume of school work. We discovered that all of the materials were Modular! There were jumbo brick and concrete block; standard-size steel, projected windows; and 4-in. steel columns and beams in 8-ft bays. Everything was Modular except the architects and the drawings. Although they may not have been real, there seemed to be many reasons for keeping the *status quo*. Most of these buildings were in rural locations and built with local labor which would not be familiar with the system. Budgets were very low and bids had been coming in right. Perhaps Modular would cause a cost increase that we could not stand. Then, too, there was the inherent fear of the unknown. We stayed with the old system of dimensioning.

"We had, however, become convinced that we should try the new means of dimensioning and we told ourselves that we were only waiting for the 'right building.' By definition, we meant a project with a good budget figure, a project not too large, one rather simple to do. It would come along at just the time 'when things get back to normal in the office.' Our apprehension revolved around time schedules, remarks of other architects who claimed some bad experience with Modular, and the position held by the joint AIA-AGC Committee, which was to hold the entire subject of Modular Measure in abeyance until there was a general acceptance throughout the industry.

"A year and a half later we thought we saw the proper opportunity to use Modular. It was a small professional office building for seven doctors.

"Financial arrangements and budgeting were meticulous and endless. The clients employed a firm of CPA's to work out all angles and aspects of their proposed investment. Of course, the heart of this work was the estimate of the building cost. In panic, I guess, we sent a letter to all bidders, enclosing reprints from the January 1955 *Constructor*, official publication of the AGC. This reprint had lavish praise of the advantages of the Modular method.

"It was only several days later that we received a letter from a general contractor who was bidding. He had never heard of the Modular system before and had settled down to the usual two weeks of 'take-off.' After exactly three days he had finished all quantity take-offs and had subs all lined up. He stated that it was the easiest take-off and the most accurate that had ever come through his office. On bid day, the contractor who had written the letter was low bidder with a proposal 3/10 of 1% less than the budget. The spread of bids from low to high was $4\frac{1}{2}$%. It was not all silver lining, however, for the doctors then agreed to disagree—and the building has never been built.

"Change-over from standard dimensioning to Modular dimensioning appears as formidable as establishing a new practice. There are many factors involved, many unknowns. Others have done it with success; and finally we decided that we could do the same. In considering the problems, take them one by one, as they come up in a normal project: design, detailing working drawings, engineering supervision, and shop drawings.

design

"From the standpoint of design, the common misconception is that Modular Measure is bringing automation to architecture. Nothing could be further from truth. The design process is unchanged and Modular will not relieve the designer of responsibility for what he does, whether good or bad. It is perhaps most important for the designer to understand the uses and limitations of Modular in order to overcome any fear of it.

"A disciplined design establishes a design module which is related to the structural bay. All that Modular asks is that this be related to the 4-in. detail module to achieve the best results in the use of materials. From there, design freedom is unchanged. Our experience is that design suffers less during detailing and results can be better, because now the designer and the detailer will be thinking along the same lines and using dimensions which spring from the same basis.

modus operandi

"A keen interest in developing and polishing our methods of presenting complete and accurate information on our drawings has resulted in a *modus operandi* which may be peculiar to this office. We call it the Tee-Up and, since I shall refer to it again, a short explanation is required. The Tee-Up has developed not only in the interest of efficiency, but also as a matter of flexibility in the use of a small drafting force to produce a moderate volume of work.

"The Tee-Up begins with well worked out preliminary design drawings. During the first phase of working drawings, only one or two men are assigned to the job. They work up freehand details completely and accurately for the entire project. Next the working-drawing sheets are laid out at quarter-size and each drawing is assigned a position on a sheet and given a reference number. When drafting begins, any number of men can be used, as each sheet is complete and cross referenced. A sort of bulldozing occurs, with a full crew drafting the fruits of the Tee-Up; and the drawings are completed in a rather short time, ready for checking. Meanwhile, the next job is being Teed-Up. With this method of operation, the insertion of Modular Measure affected only two men in the first few weeks of the first job. They were the only ones in the office who understood the "square bubble." The working familiarity gained by these two men during the Tee-Up process made it quite simple to explain the system to the rest of the men in the office.

detailing working drawings

"It is a fact that the key man in the whole process is the one who sets up the governing wall sections and details and so establishes location of the building within the grid. If this is done with understanding, the solution to many problems becomes almost automatic. It seems certain that our Tee-Up process was a fortunate complement to the use of Modular Measure.

"As the final drawings progressed, the draftsmen quickly learned the basic elements of this system by drawing from the freehand details. The chief difficulty experienced at the outset was in terminology. There appear to be Modular, nominal, and actual dimensions—a module, a grid, a reference dimension. Even conversation is nerve racking and there is much wasted motion in distinguishing the nominal from the actual and in mis-using the words 'grid' and 'reference.' It is only through experience that this confusion is eliminated.

"One of the aids to Modular Measure that we use is the grid or cross-section paper for the detail sheets. The grid is printed on the paper in light blue that does not print, unless it is picked up with a pencil line. The grid may cause some confusion in locating a drawing on the paper, but becoming accustomed to it speeds up drafting, as it partially eliminates the need for scaling every dimension. The tendency is to draw in too many grids and to give unnecessary dimensions in tying things down to the numerous reference points that are available. Here, again, it is experience that counts, as it is with any system for dimensioning. Prior to Modular, it had been our custom to do most detailing at $1\frac{1}{2}$-in. scale. With Modular we find it is faster to draw and reference at 3-in. scale.

"The importance of the arrow-and-dot convention and its usefulness was to be profoundly impressed on the draftsmen. Invariably there is confusion in expecting a direct relation between dots, arrows, actual and nominal dimensions when, in fact, there is no direct or implied connection between any of the terms. The convention, however, makes it very simple to scan a drawing and locate the controlling grid lines. Then, knowing the standard clearances or reference dimensions of the various materials, one can read a plan and translate it into details in a way that is quite similar to reading a foreign language and thinking in English.

"Although there are several drafting aids specifically made for Modular Measure, the only one we have used in addition to the grid paper is the standard 'Stanpat Appliqué' which gives the explanation of Modular Measure. This is located at the top-right corner of the cover sheet for the information of the contractor.

"Masonry scales become an unnecessary item of the past. It is simple and fast to think in terms of 4 in.—and three courses equal 8 in. A rule of thumb we have used is 'Even eight, odd four; opposite plus 1⅝ in.' This is a statement, in essence, of the fact that 8 in. is divisible into even feet, even feet plus 8 in., and odd feet plus 4 in.; and when three courses equal 8 in., coursing falls on the opposite conditions plus 1⅝ in. That is, for example, 6'-4" + 1⅝" or 6'-5⅝", and so on.

engineering

"Professional consulting engineers help us on all of our work. The electrical and mechanical engineers have not been greatly concerned with our use of Modular, except in localized and specialized conditions. In these fields, the effects and advantages appear during construction. Modular Measure is of great importance in structural engineering, however, because of dimensioning. Beginning with the top of the footing and location of walls and column faces on footings, the use of arrows, dots, and reference dimensions is as important in the structural drawings as in the architectural. The peculiarities involved are basic and simple. Required tolerances and connections with other materials are usually handled with standard reference dimensions. Engineering design, of course, is based on actual sizes, and this can become a point of acute consternation on the part of the structural engineer. With the standard ½" reference dimension, a nominal 12"x12" concrete column is actually 11"x11". The dimensions for reinforcing steel are not affected, in general, and are all actual dimensions. So here is a combination of facts that makes it paramount to have accurate detailing on the drawings and thorough understanding on the job. Admittedly, it is a little different from wood construction where 2"x12" is also a nominal size.

"With the complications attached to architectural details, the 3-in. scale is justified. Often structural details can be shown at much smaller scale, ⅜ in. or ¾ in. The necessary grid lines and reference dimensions can be exaggerated out of scale for clarity. Requirements are simple and generally need only one or two grids to explain a structural detail. The engineer, however, must have thorough understanding of the system in order to read the architectural drawings correctly and to make proper use of the dot-and-arrow convention.

"The engineer questions the advantages of Modular in his practice, stating that it complicates the scheduling of beam and column sizes and reinforcing, and increases drafting and checking time due to the required additional details to explain references to grid lines. With added details there is also the chance of additional error. Another difficulty which will be explained below concerns shop drawings which are not submitted with Modular dimensioning.

supervision

"The last phase of a project over which we have complete control is supervision. Customarily, all of our work is supervised by one full-time field supervisor. To be completely candid, we dealt rather lightly with this particular phase until it cost us some job mistakes. It is now evident to us that the usage in the drafting room affords tremendous opportunities to learn the applications of Modular Measure which are not available to the man in the field. Time is required for experience to breed confidence, but with the supervisor this is a disadvantage. A further complication is the transition period with both dimension systems under construction. For us, this period is still in progress. In the drafting room, the experience of seeing mistakes made and corrected, and the opportunity to adapt basic principles to new and varying conditions, is like learning a foreign language by living with it. A detailed explanation to field supervisor is not equal to this experience. Therefore some bridging method must be used. To achieve this we have had office personnel visit the job site with the supervisor to explain the system with particular application to the job at hand.

"Our first job to be completed under Modular Measure was the Headland High School in East Point, Georgia, an Atlanta neighbor *(acrosspage)*. Upon award of the contract, we were delighted to hear the contractor state that he had a working knowledge of Modular Measure from previous experience. Our happiness was short-lived, however, when we discovered his experience had been with that worst-of-all modular fault—a job that is Modular on the outside and actual on the inside. The contractor and his superintendent were invited to the office for a period of instruction. It apparently had truly little effect in building the confidence of the superintendent, who claimed that the new system could not be trusted with the men under him. Innovations required in job layout seemed to be insurmountable obstacles.

"The construction moved along smoothly, however, and we soon began to keep a diary of comments by the superintendent as he discovered what he called 'lucky breaks.' One of his luckiest days was when he discovered that the masonry coursed both directions around openings with no cutting and, furthermore, coursed from slab to slab with no odd joints. He was truly excited when he discovered that he could start a mason almost anywhere on a wall—as many masons as he pleased—and the work would course out. On one occasion, the plumber was locating sleeves on the concrete forms with reference to grid lines, which he picked up from the ⅛-in. plans, with the help of the arrow-and-dot convention. Completely unnerved, the superintendent proceeded to check the plumber's work by adding up long strings of actual and fractional dimensions, only to find the sleeves properly spotted. After this, when an electrician located panel boxes without using fractional dimensions, the superintendent just stood to one side with arms folded and a scowl on his face.

"With respect to job lay-out, it became obvious that architectural details assume far more importance with Modular Measure than otherwise. The carpentry foreman stayed in trouble until he learned to consult the details for the key reference dimensions. It appeared that he was accustomed to working without the help of details at all.

"We have had our greatest difficulty with shop drawings. As yet we have not included a specification requirement that shop drawings must be submitted on

Modular Measure. Because the manufacturers of building materials have been the chief sponsors of Modular, this should not be necessary. There appears, however, to be a great need for education of the manufacturers' representatives. During development of the working drawings the representative of a large manufacturer of windows, whose catalog features the grid and Modular dimensioning, was much relieved to learn at last exactly what the red lines on the catalog details were for. With good humor we took this occasion to give another short course in Modular Measure.

"When construction began on the High School we urged the contractor to require shop drawings to be Modular for his own benefit. Reasons stated were for simplification of the work for everybody and because the materials used were Modular in size. There was a prompt refusal of this suggestion by the manufacturers themselves, who claimed their shop workers were not familiar with the system and they feared many errors in fabrication. Furthermore, their drafting departments were not familiar with it and they felt there was not enough volume at the present time in Modular Measure to warrant any changeover. Inasmuch as the responsibility for co-ordination of dimensions of all materials and equipment rests with the contractor, we have felt that the urgency of requiring Modular shop drawings also rests with the contractor. During construction, who could reap more gain?

conclusions

"The approach we have developed toward Modular Measure is that it is a tool to be used, just as a compass is a tool. The more we use it, the more skilful we become. Standard details in catalogs and reference books are things we study, but do not copy. The complexity of a detail depends on design requirements, and so our details may bear no resemblance to the standards; but the principles are the same and the advantages are still there. Drafting costs appear to be improved due to accuracy and the ease with which drawings can be checked.

"The effect of Modular on the cost of construction is something on which we have no evidence in either direction. The buildings appear to cost neither more nor less, whether we use Modular or not. However, reports from other parts of the country, where its use is more common, indicate a price advantage for Modular. This could be an important factor in determining whether to use the system, and it is conceivable that some day clients will demand it. When that happens, we will be there.

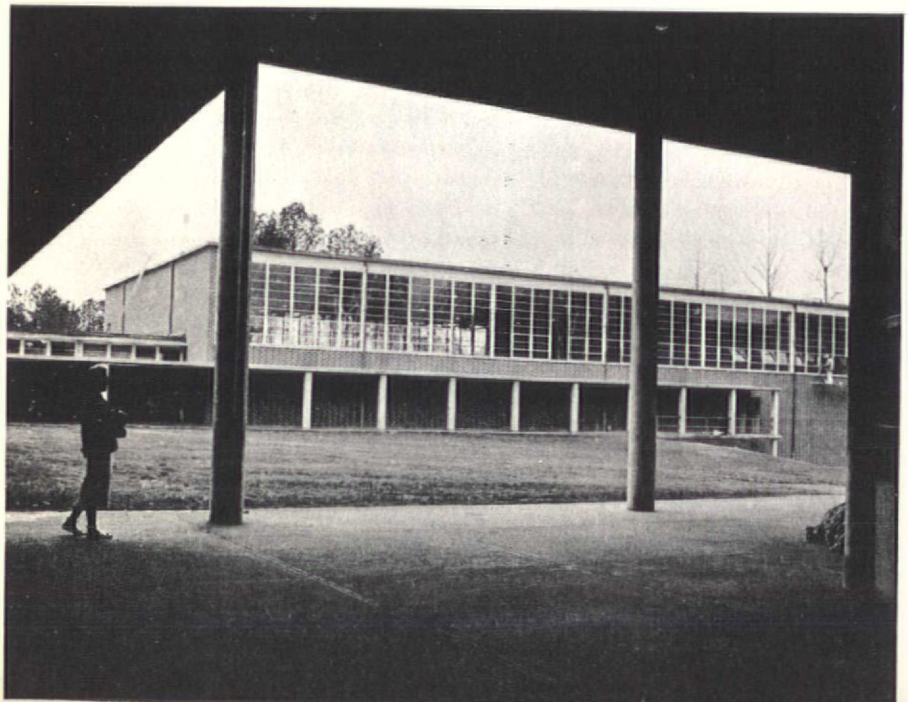
"The importance of the degree of acceptance of Modular must not be underestimated.

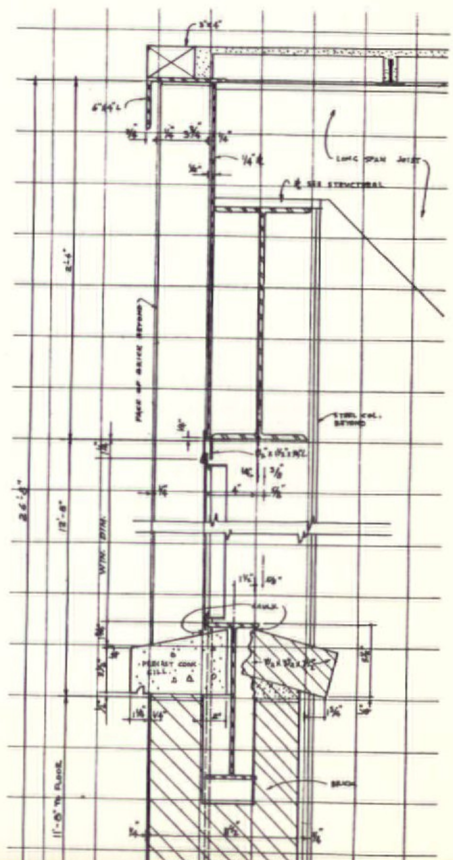
"Contractors in our area are either noncommittal or opposed. Quite apart from the lack of volume of Modular, which causes unfamiliarity, there is a certain amount of closed-mind attitude. This may be due to lack of information, erroneous information, or a terrifying experience with the half-Modular job. Many architects also appear to be misinformed or not informed at all. Often one who is outspoken against the system has tried a timid approach, an attempt to change over bit by bit. The resulting confusion is enough to make anyone vow to leave the stuff alone. For success with it, it is necessary to be completely Modular throughout the drawings.

"Since the continued use and development of the entire idea is dependent upon acceptance by owners, contractors, architects, and manufacturers, it would appear that there is still a great amount of work to be done along the lines of informative promotion. Either this or the dire necessity to use all means to restrain building costs, I believe, would cause rapid and complete acceptance.

"As a former air-line pilot, I cannot help comparing the rapid change and giant strides in air transportation and its traffic-control methods with the ponderous inertia that must be overcome in order to move the building industry step by step. Is it really inertia—or only complacency?"

Headland High School, East Point, Ga. Architects: Aeck Associates. This Modular-Measure brick school was built and furnished for $11 per sq ft.
Photo: Floyd Jillson





Modular Measure: its role in architectural education

As observed in the foregoing, Modular-trained draftsmen are very scarce. The proposal has often been made, since the earliest days of the effort to bring Modular Measure into general use, that it should be taught by all schools of architecture. It is argued that students, not wedded to traditional practices, would readily appreciate the worth of the new system. With the passage of "x" number of years, these same students would become dominant in the profession and Modular Measure would thereby be universally employed. That premise seems logical and, if it had been put into effect in 1945 when the system was first presented to the building industry, it might already be starting to take effect on a large scale. One question, though: How to convince the schools themselves that they should include this strange, new procedure in their courses on materials, construction, and drafting?

No survey has been taken, but it is probable that only about half a dozen of our architectural schools regularly train students in Modular Measure, in the sense of augmenting instruction in the method by actually requiring a certain number of Modular working drawings and details. Possibly another two-dozen schools indoctrinate students in the principles involved, without introducing them to specific Modular materials or instructing them as to the preparation of Modular drawings.

In past years, one likely deterrent among architectural educators has been some doubt as to the ultimate acceptance of Modular Measure by the building industry. A consideration that should encourage its inclusion in architectural curricula is that it offers a useful tool to help bridge the gap between pure design and the practical, "nuts-and-bolts" construction of an architectural design; as opposite sides of the same coin, either suffers if isolated from the other. Harold D. Hauf, Dean of Rensselaer Polytechnic Institute's School of Architecture, has expressed it thus: "We have no course in modular drafting, nor do we expect to have, since we feel that the concepts of modular planning and co-ordinating dimensioning for details should be instilled in each student as a part of his general thinking. We weave both concepts, and some details, of modular drafting into our first-year course in architectural drawing. This work is carried further in our second-year course in building materials and construction. Although mindful of the difference between Modular Measure and modular planning in general, we nevertheless attempt to unify the two ideas and show that Modular Measure (based on the 4-in. Module) is a logical sequence to modular planning. We find that the 4-in. Module for detailing does not become such a revolutionary idea to students who already know about modular planning. If one accepts the larger planning-module, particularly for items such as curtain-wall construction, it becomes very logical indeed to take advantage of the same concept in detailing the units."

The following report was contributed by Assoc. Prof. Melvin W. Isenberg of the Department of Architecture. The Pennsylvania State University, where preparation of modular drawings has been a regularly required part of each student's training for a number of years.

case history: teaching Modular

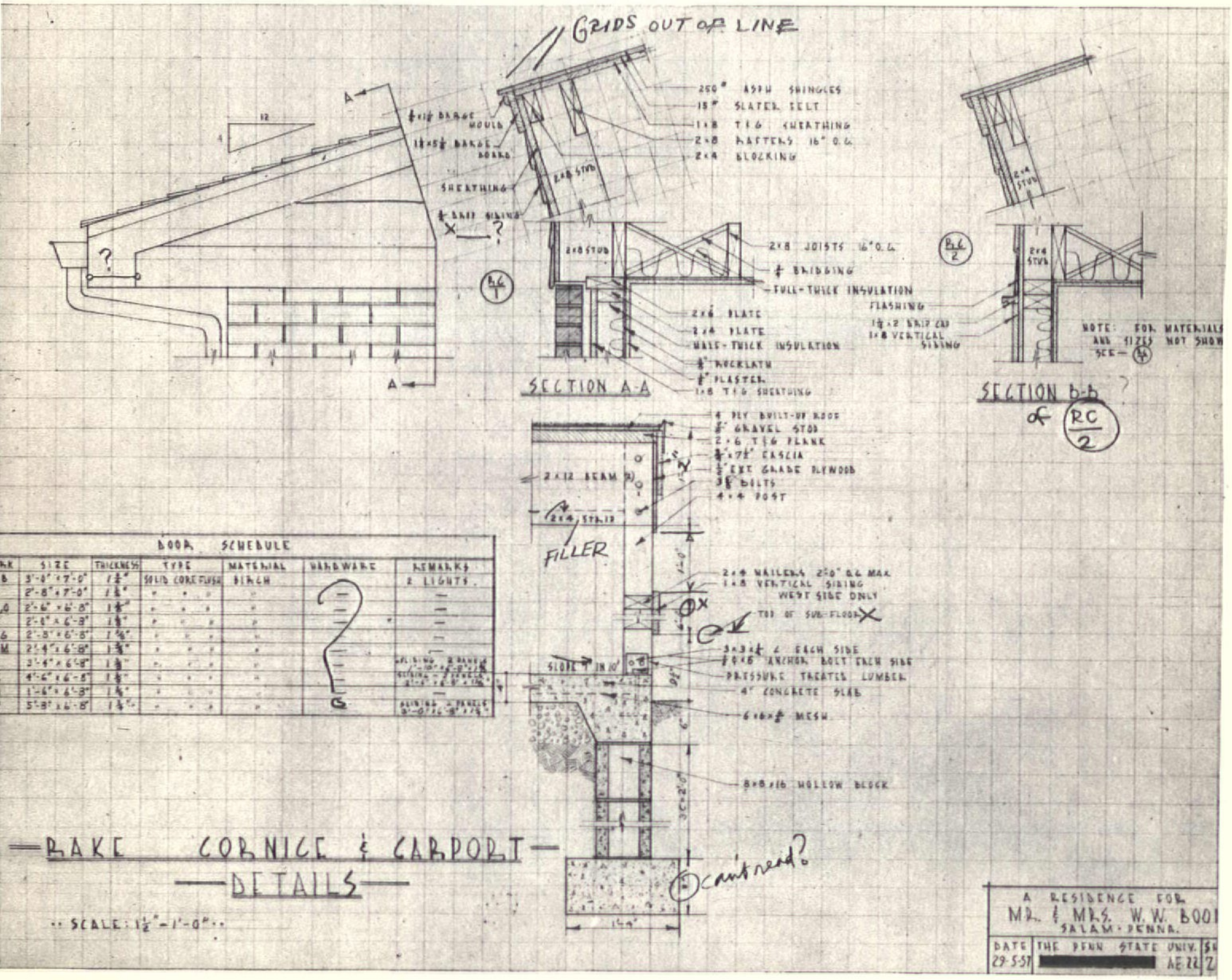
"Every student in Department of Architecture at The Pennsylvania State University is made familiar with Modular Measure, its history, reasons for its existence, and its use in practice. This has been going on continuously for the past six years, ever since we became aware of the great need for introducing the system into our educational institutions in order to expand the use of Modular Measure in actual practice. Since the manufacturer will normally produce to satisfy a demand, and the contractor will build according to plan, it must be the architect to whom we turn for the spark which will expand the use of the system. We utilize this conviction by instilling in the minds of our future architects and engineers a clear and unmistakable picture of the real advantages of Modular Measure, so that they can introduce it into offices when the opportunity arises.

"I should like to describe how a typical student is instructed in the preparation of architectural working drawings. He normally has had no previous experience in an office or on a construction job. Therefore we must start from the beginning. First, he schedules a course in materials and methods of architectural construction during his third semester. This course consists of approximately 25 clock hours of lecture-discussion, a small part of which is devoted to the philosophy of Modular Measure so far as it relates to the manufacture of the product, and to the assembly of the materials. Modular is compared with nonmodular by illustration and examination of actual products. The student is usually convinced of the need for an expansion of the system as the advantage of truly Modular materials become apparent.

"It has been found that the alert student must be 'sold' on the idea of Modular Measure. We use an assortment of devices to help convince him, among which devices are excerpts from such publications as *Grid Lines*, specimens of Modular working drawings, manufacturers' catalogs, slides by member-companies of the Producers' Council, and other illustrative material. We have prepared a number of 35-mm slides which are used to good advantage in this "selling" task. The student is thoroughly impressed when he sees what can be done in the drafting room: a clear and legible floor plan of a large and complicated building drawn at 1/16-in. scale.

"It is in the Working-Drawings course of his fourth semester that our student first puts to use the principles of Modular Measure. A small residence is usually selected for the problem, and preliminary drawings are worked out prior to the start of the course. The preliminary sheet is examined carefully and over-all dimensions are accepted or changed where necessary to accommodate Modular materials. It is highly improbable that such a house would ever be built, for the greatest possible variety is incorporated into the structure in order to give the student the maximum possible experience in the limited time available. We try to use some frame walls, some solid-, cavity-, or veneer-masonry walls, a stair, a fireplace, and at least three different kinds of windows in each house. No major changes are permitted during the progress of the course, but the student is permitted and even encouraged to change the house in minor respects. This is the manner in which he may exercise originality without deviating too far from the general problems considered in group discussion.

"For the first third of the course, the student develops his details on what we



call 'work-sheets.' Periodic tests are given to drive home construction principles and to uncover weaknesses in the teaching procedure.

"After the student has become familiar with the process of making the drawings, usually a third of the way through the course, he is encouraged to work directly on his final drawings without going through the 'work-sheet' stage. These drawings, too, are submitted for checking and then returned to the student for correction *(example on preceding page)*.

"The final set of drawings, consisting of seven to nine 18" x 24" sheets, is submitted at the end of the semester and examined in detail. Corrections are again noted and the papers are returned to the student. Slower students must find some extra time outside of scheduled class periods to complete the minimum requirements. Faster students are encouraged to prepare details, such as kitchen-cabinet layouts, not required of all. It has been our experience that superior work from the students has been a satisfying result of this method of teaching.

"In succeeding semesters, the student is not compelled to use Modular Measure in any of his submitted work. There is an occasional design problem where he applies a larger planning module, a multiple of 4 in. He may, and frequently does, voluntarily use Modular Measure in details accompanying design problems. Very often, the Fifth-Year-Thesis problem is executed on a Modular basis, again without any compulsion, but because of a conviction that superior details will result. We have no statistics at present to determine what happens after the students graduate and start working in offices. It is still too early to arrive at any valid conclusions concerning the effectiveness of our program, but we sincerely hope that our graduates continue to be enthusiastic proponents of Modular Measure.

"My experience in teaching Modular Measure at Penn State has convinced me of a number of things which I can summarize as follows:

"1. *It is primarily a selling job* and, in order to sell the student, the instructor must first convince himself that Modular Measure is well worth the effort.

"2. *Modular dimensioning will take no more time initially* than the more conventional approach and will actually require less time later on, or will permit greater coverage in the same time.

"3. *There is the potential danger of the student becoming a slave to the method,* but if he is constantly reminded that deviation from Modular dimensioning is not only permitted but desirable at times, this danger need not become an actuality.

"4. *The student will develop a clearer understanding of details* and be better equipped to create original details by this method.

"5. *Drafting is generally improved,* principally in line contrast.

"6. *Accuracy is improved many-fold* with far fewer errors in dimensioning.

"7. *The instructor's task in checking drawings is made much easier.*

"8. Lastly, and perhaps most significant of all, the *teaching of Modular Measure in the curricula of the architectural schools will probably do more than any other single thing toward expanding the use of the system.*"

Modular Measure: future prospects

The entire foregoing discussion revolves about the question: "Is Modular Measure worthwhile, either for the building industry at large or for the individual architectural practitioner, or both?" Its aims, of course, are wholly admirable: reduced building costs, better-integrated design, speedier production, fewer mistakes in dimensioning. But, admittedly, present performance does not attain these desirable goals. Each must judge for himself, weighing ultimate advantages against present obstacles. For architects, the immediate benefits are beginning to become apparent; yet, not all architects become convinced at the initial attempt to use the system. Some commentators say that Modular Measure is inevitable, in view of the present industrialization of building. It is hoped that this report will assist the interested observer of "modular" progress in forming his own judgment as to the real promise of the new method, from his own viewpoint.

The prospects for acceptance of Modular Measure throughout U. S. building improve constantly as, one by one, steps are taken in that direction. The trade press is continually reporting such developments as sponsorship of the modular effort by the general contractors group (the AGC), adoption of the system for certain large Corps of Engineers construction programs, the requirement of Modular dimensioning in a couple of revised Federal housing titles, the advent of new types of building components in Modular sizes. Cumulatively, these steps become significant.

I, for one, am convinced that—barring the sudden development of a different, and patently better, mode of orderly dimensioning—Modular Measure will gain acceptance at an increasing rate. Constantly used by many people, it will surely be refined and revised, until it may some day evolve into a system far removed from that presently practiced. Our measuring tapes, for instance, may come to be marked—after the first foot—simply in increments of the 4-in. module. Jigs for panels, etc., may be made adjustable on a similar basis.

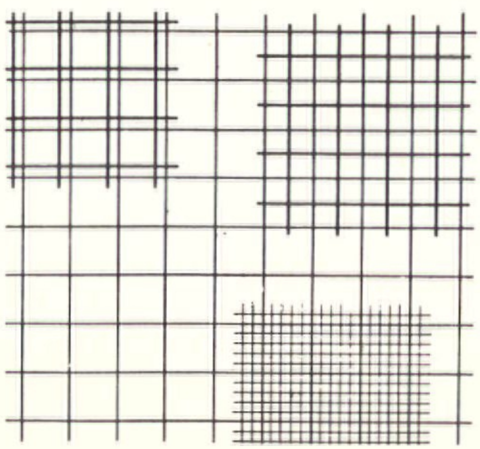
This conviction springs less from noting the publicly announced developments implying a trend toward industry adoption of the system than from observing that a heavy percentage of *practitioners* already find it worthwhile. Despite present difficulties, architects, contractors, and the materials manufacturers who follow Modular Measure like it and want to continue using it.

"When?," not "whether?," becomes the question. The factors hindering acceptance of the system have been mentioned above. In contrast to such negative considerations, there are, in my belief, two most promising directions for "priority" efforts in the over-all Modular-Measure program. One is the development of a much wider variety of Modular-size building units. It is true that the manufacturers launched the program to begin with, but they have necessarily been neglected while an all-out campaign was being waged to convince architects that they should give Modular dimensioning a try. Now, with the architects becoming enthusiastic, it is vital that work be resumed with manufacturing groups (under the auspices of American Standards Association, whose Committee A62 is the official arbiter of Modular procedures and sizes). There are indications that many such groups are eager to work out Modular sizes for their products, when the "A62" program is reactivated.

Just such activity is now in the making, with the appointment of the vigorous "Mr. Modular Prophet" Silling as Chairman of the ASA committee A62 and the recent creation of the Modular Building Standards Association, which Silling heads as president. Let us hope that, in as short a time as a couple of years, Modular building units will begin to appear in quantity and diversity.

The other opportunity for most effective effort in facilitating the conversion to Modular lies with the schools. Most already advocate employment of planning modules in design; as has been indicated, Modular Measure is closely related. Indoctrinating all student-architects in Modular dimensioning would not be of immediate significance, but its long-term effect would be assured. Architectural educators have an obligation, not only to practicing professionals, but also to the students themselves, to familiarize these architects-to-be with modular principles and applications. Their awareness of this, I am informed, is growing; it is to be hoped that soon, all schools will teach Modular Measure.

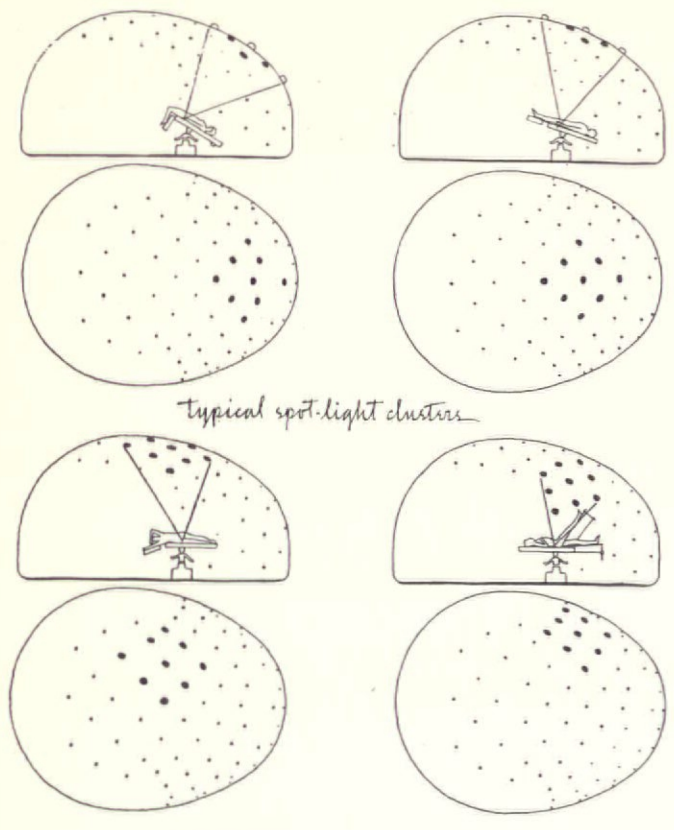
The idea proposed by Bemis in the 1930's, the logic of which was widely endorsed in the 40's, is known throughout the industry to have proved itself in actual practice, albeit on a limited basis. Much still remains to be done, but the principle today is practically assured of universal acceptance. I am now confident that its aims will be achieved because the industry has, by and large, become persuaded that – as Modular Pioneer Bemis wrote in 1936 – "Not only for the manufacturer, the industrialist and the engineer, but for the architect as well, does the 'cubical modular method' offer a solution, a resource, and a tool."

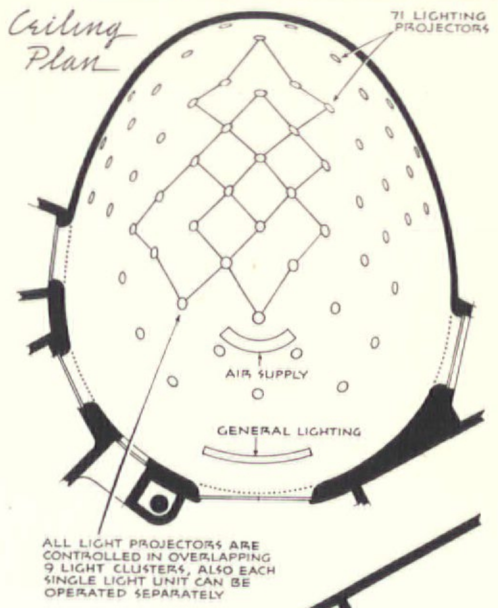


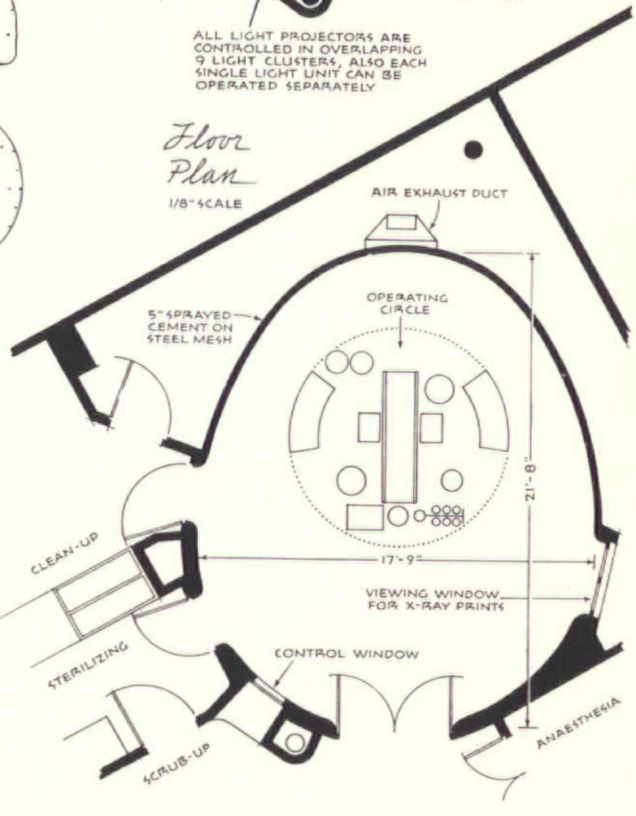
Section 12 MISCELLANEOUS DETAILS

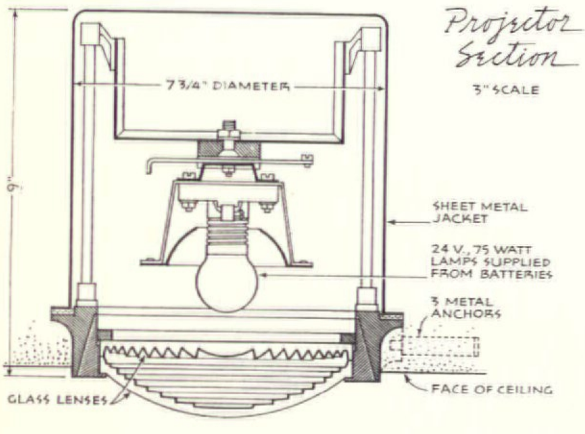
p/a selected detail

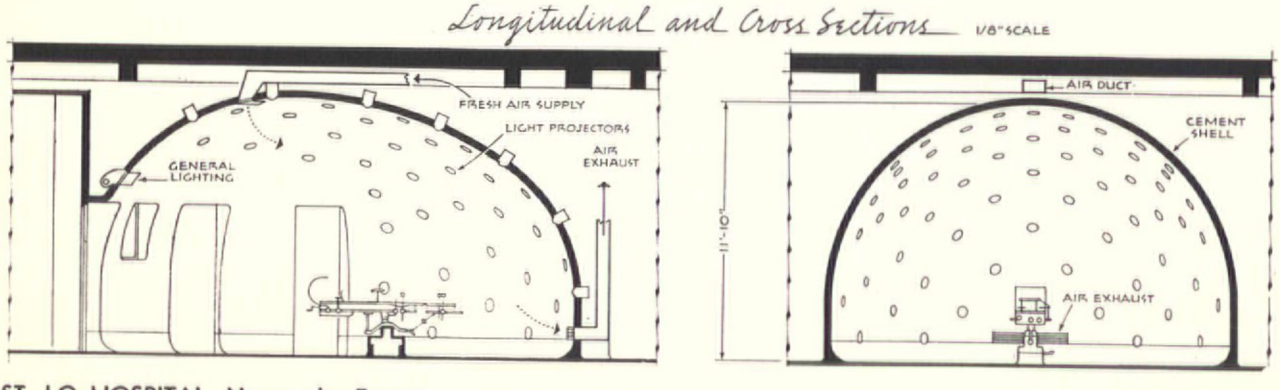
operating room





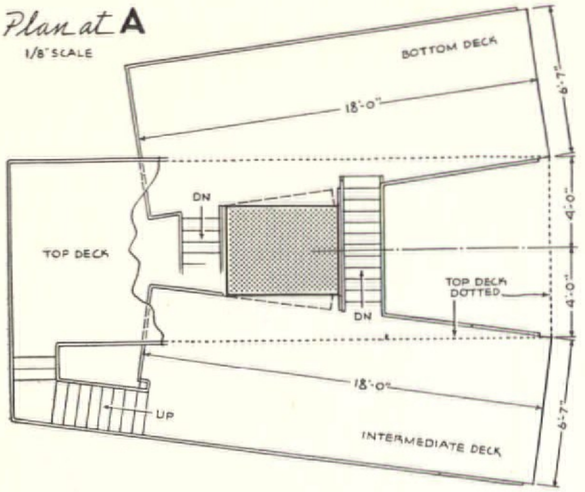


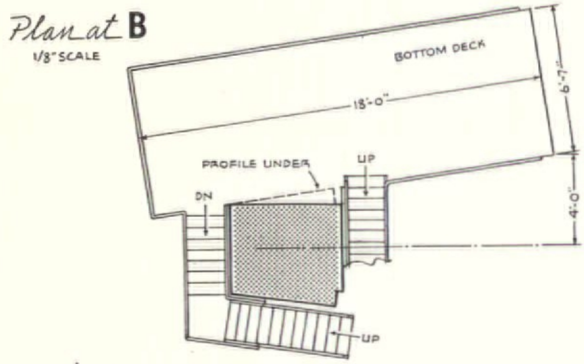




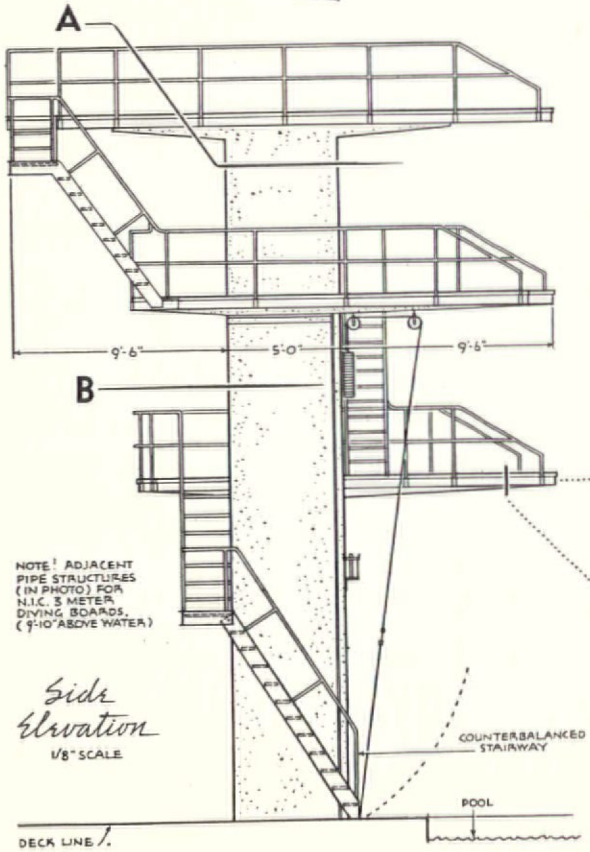
ST. LO HOSPITAL, Normandy, France

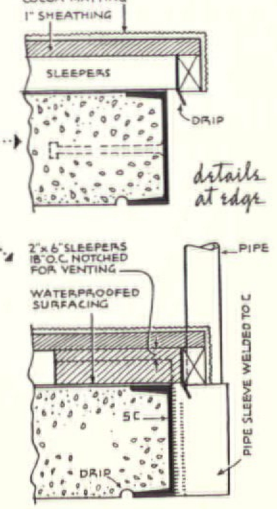
Paul Nelson, Architect

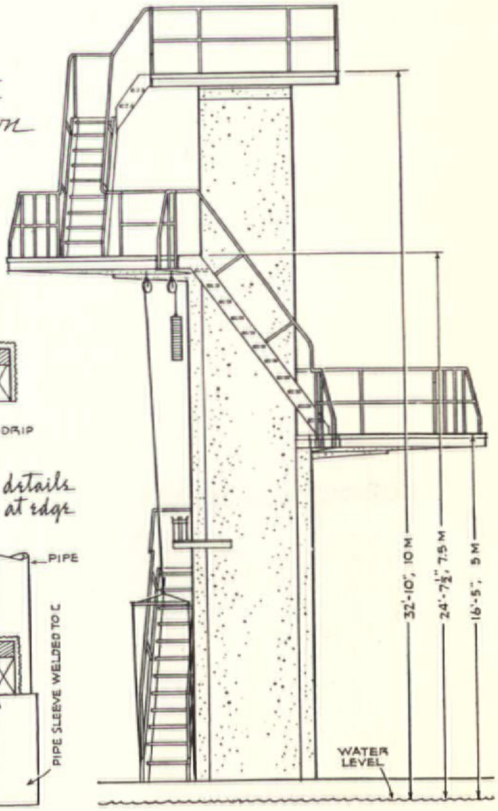




LAWRENCE S. WILLIAMS





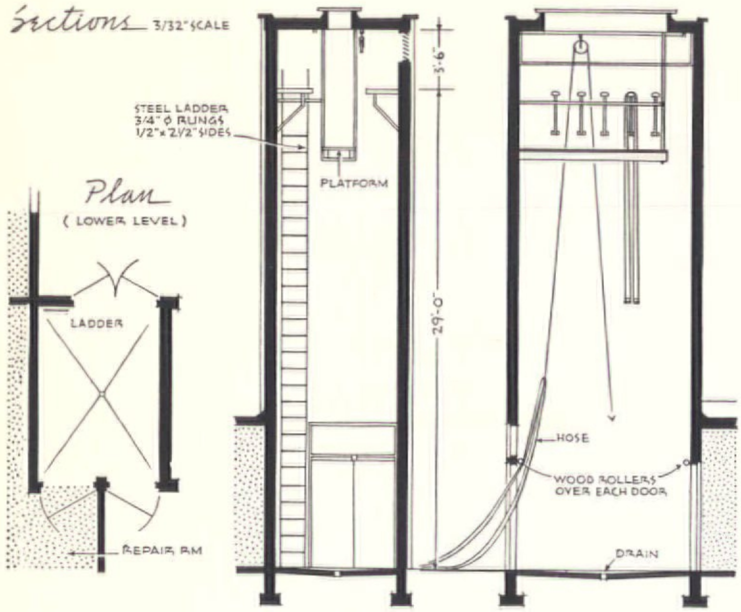


FAIRMONT PARK, Philadelphia, Pa.

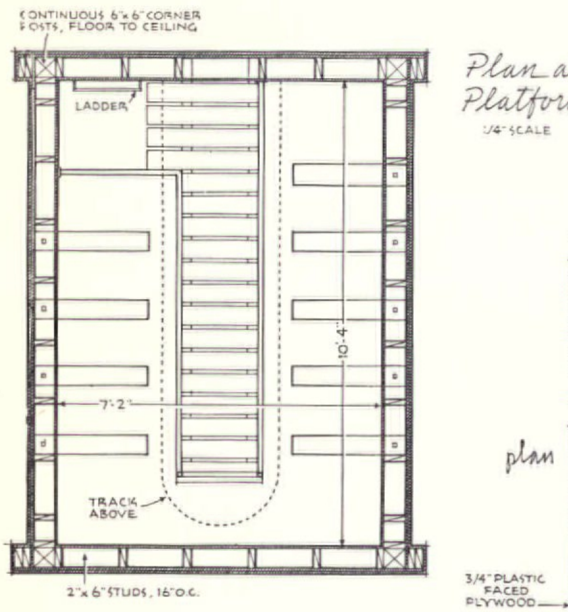
Eggers & Higgins, Architects

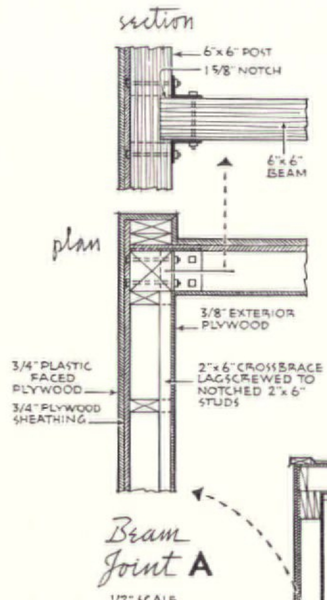
p/a selected detail

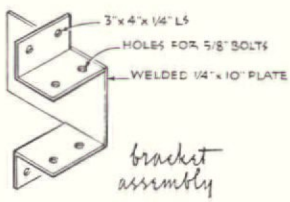
hose tower

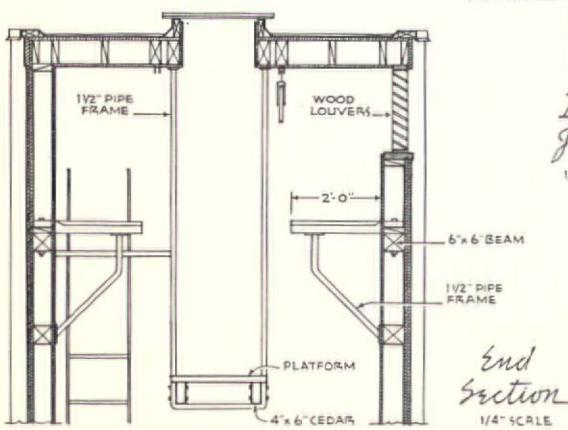


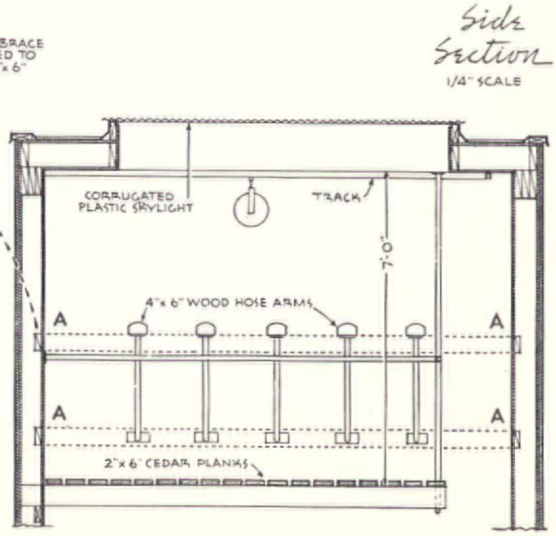
DEARBORN-MASSAR





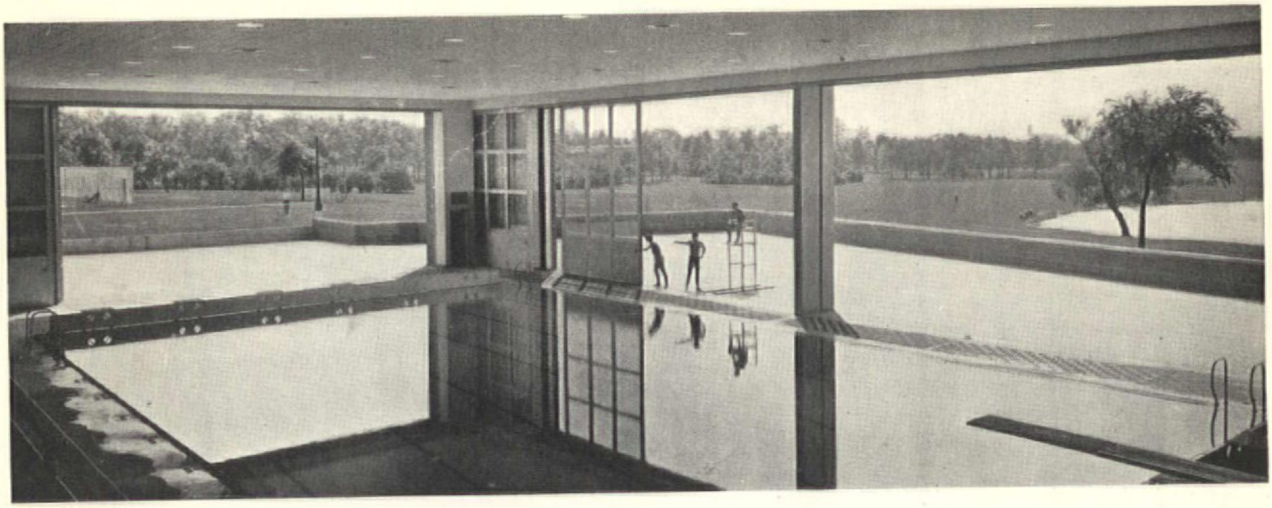




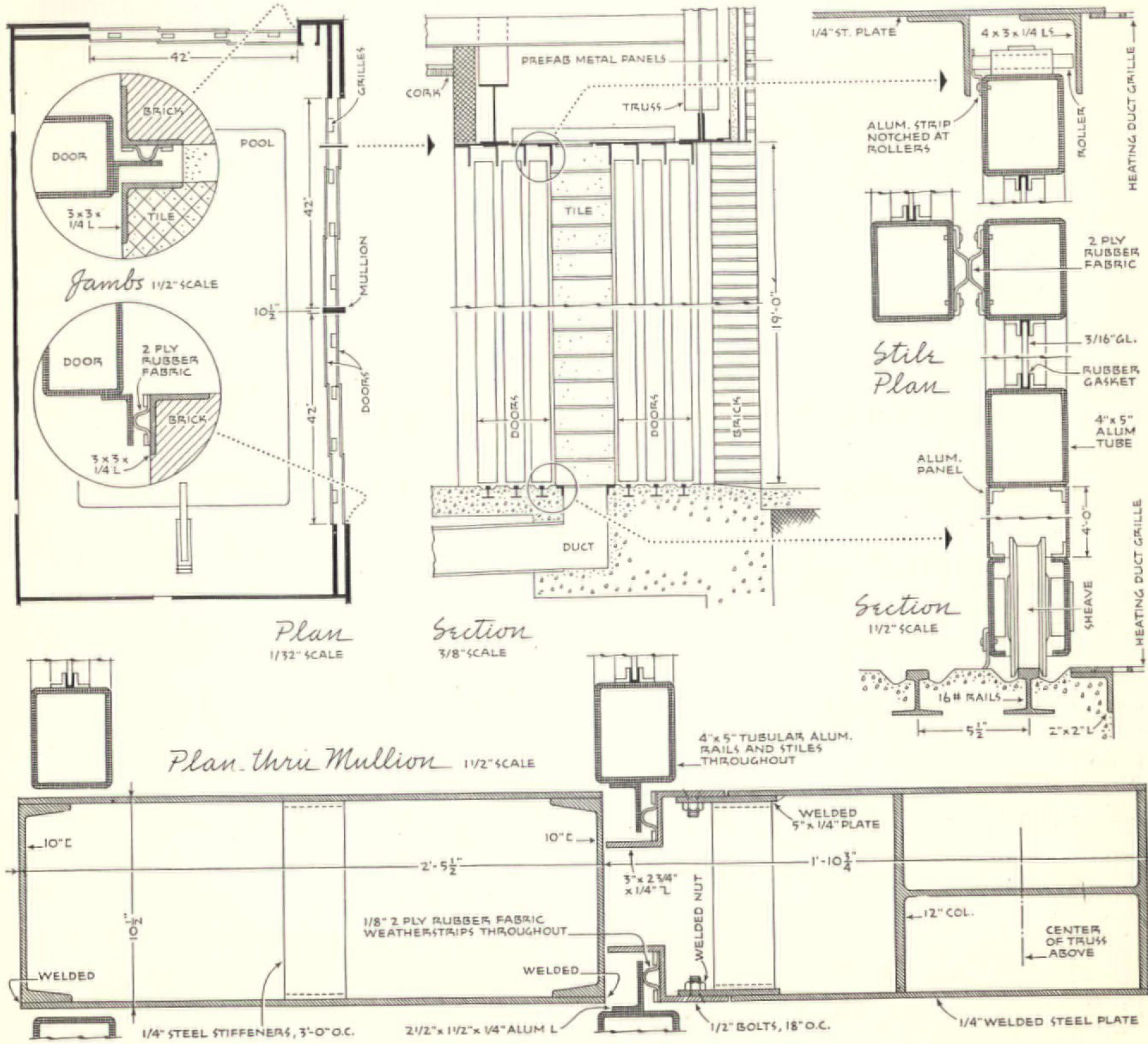


FIRE STATION, Tacoma, Wash.
Robert Billsbrough Price, Architect

recreational building: sliding doors



LENS ART STUDIO



GEORGE S. PATTON MEMORIAL SWIMMING POOL, Detroit, Mich.

Giffels & Vallet, Inc., L. Rossetti, Associated Engineers-Architects

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