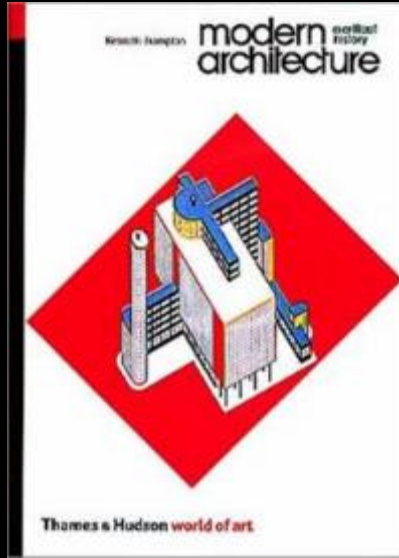


The Architecture of Assembly:

The Advent of Industrialized
Construction Methods and the Impact on
the Design Process



causes of the change in the way of
building things...

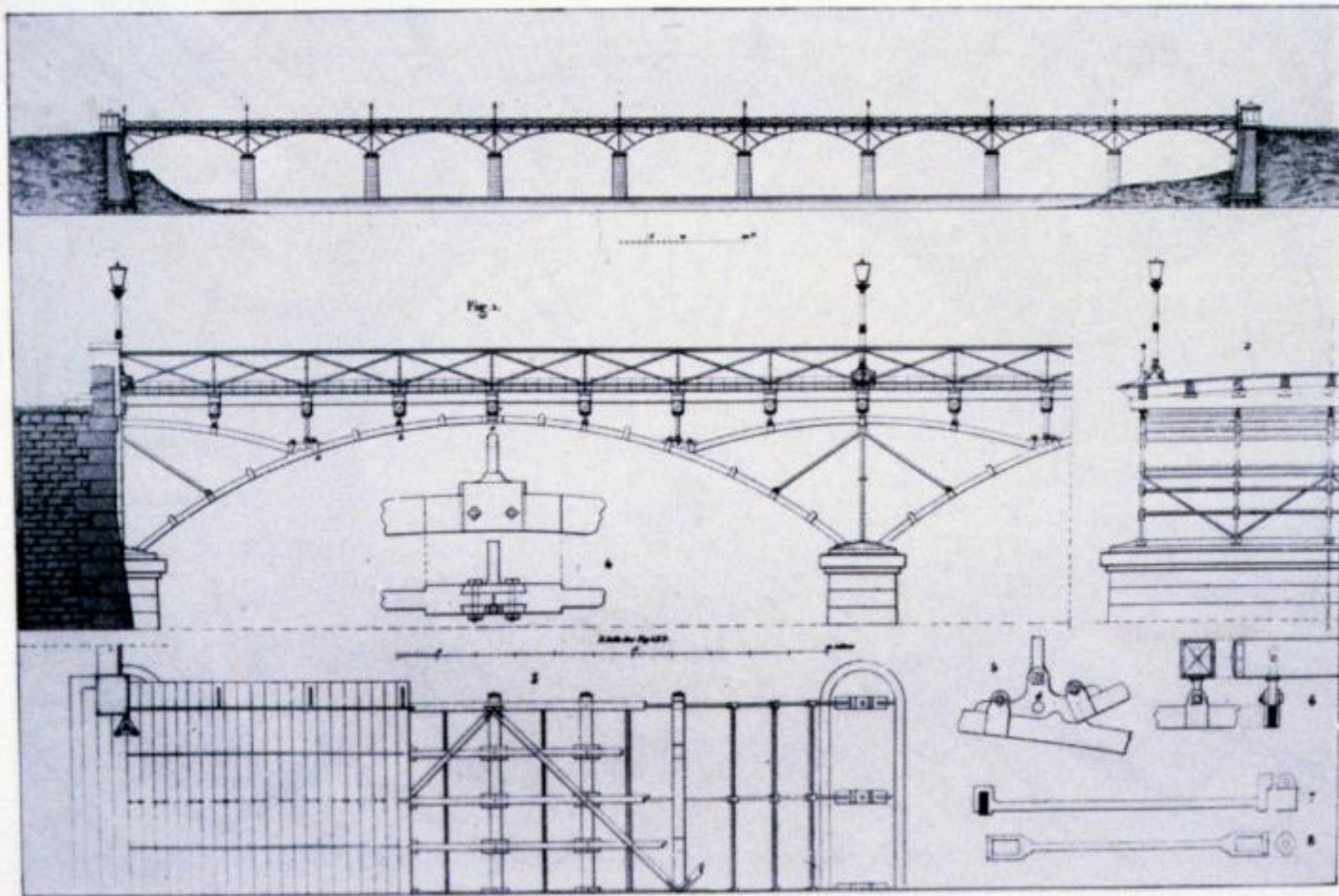
"cultural transformations"
human ability to exercise control over
nature



"territorial transformations"
increase in population and general
urbanization and demand for buildings



“technical transformations”
advances in mathematics, physics and
structural engineering



Pont des Arts
 Louis-Alexandre de
 Cessart and Jacques
 Dillon
 Paris, France
 1804
 original 9 arch bridge
 rebuilt 1984 with 7
 arches





Bourse de Commerce
Paris, France
François-Joseph Belanger
Iron dome 1811

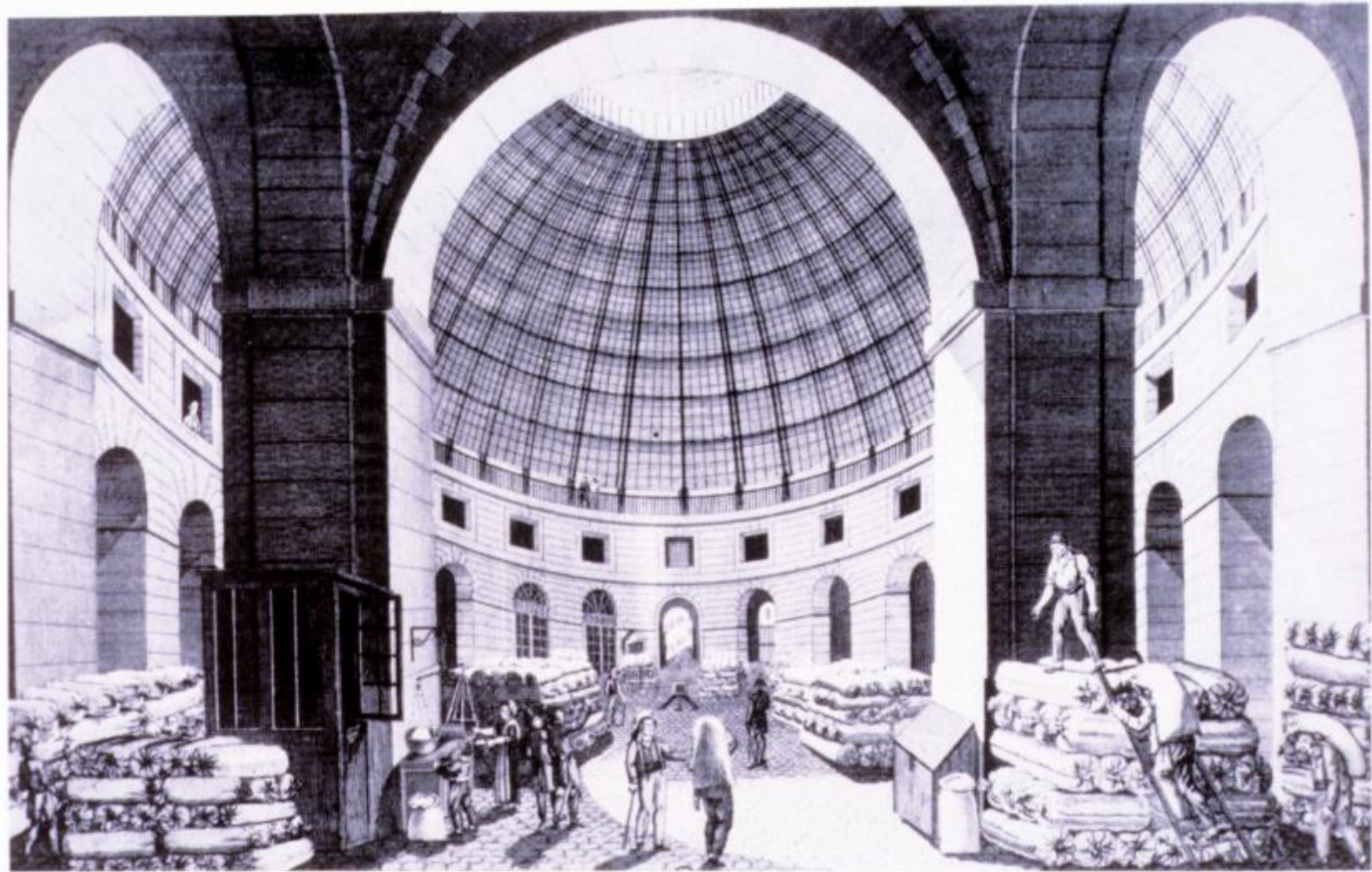




Plate 19. Passage des Princes, Paris, 1860 (Frances H. Steiner)

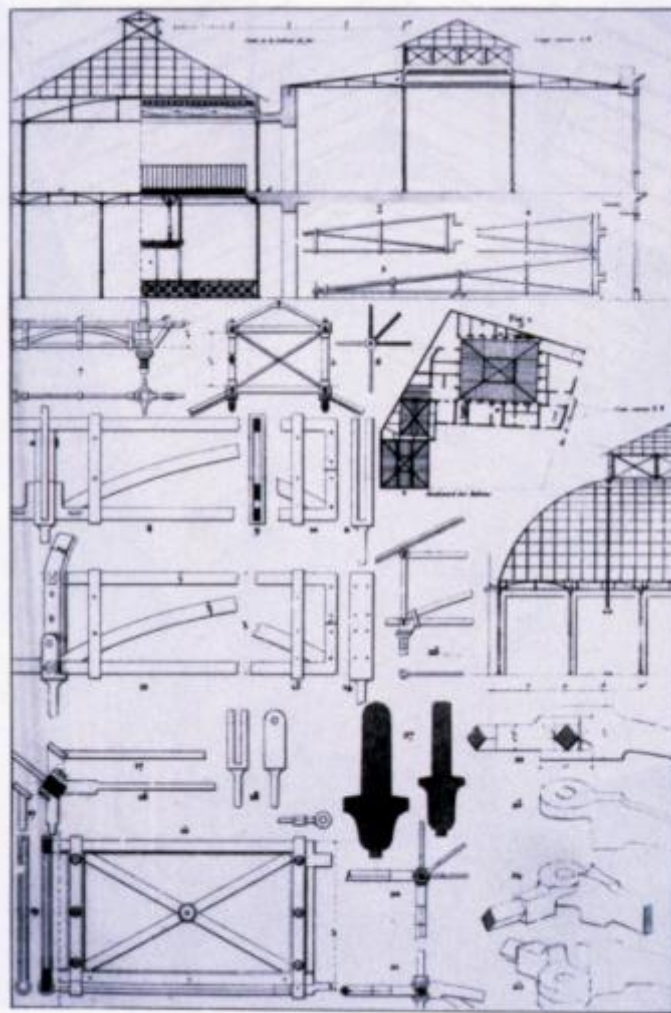


Plate 20. Tavernier. Galerie de Fer, Paris, 1829 (Thiollet, 1832, pl. 26)

P R É C I S
D E S L E Ç O N S
D'ARCHITECTURE

D O N N É E S :

A L'ÉCOLE POLYTECHNIQUE,

PAR J. N. L. DURAND,
ARCHITECTE ET PROFESSEUR D'ARCHITECTURE.

SECOND VOLUME

CONTENANT TRENTEDEUX PLANCHES.

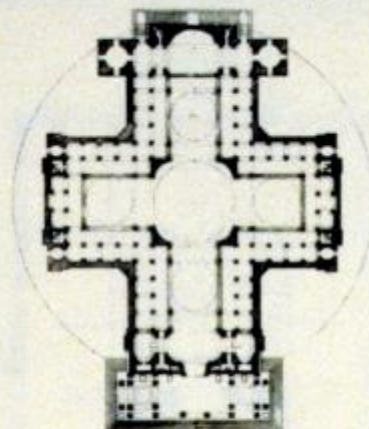
Paris, 40 francs.

A P A R I S,

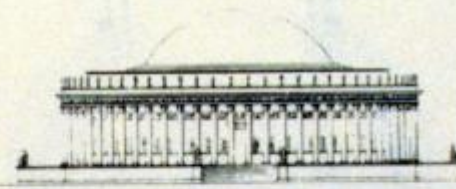
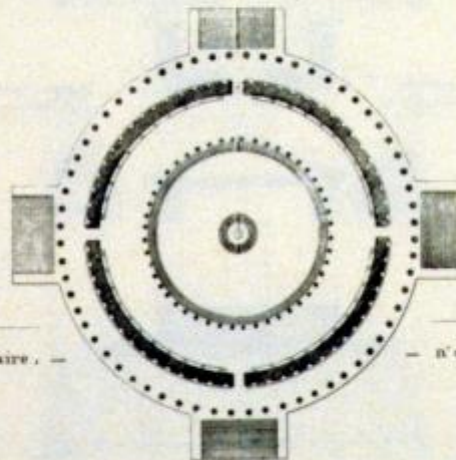
Chez { L'AUTEUR, à l'École polytechnique,
et BERNARD, Libraire de l'École polytechnique,
et de celle des Ponts et Chaussées, quasi des Augustins,
n.º 31, au premier, près la rue Gît-le-Cœur.

—
a. 2. XIII, (1803.)

Jean-Nicolas-Louis Durand
French Architect
1760 - 1834

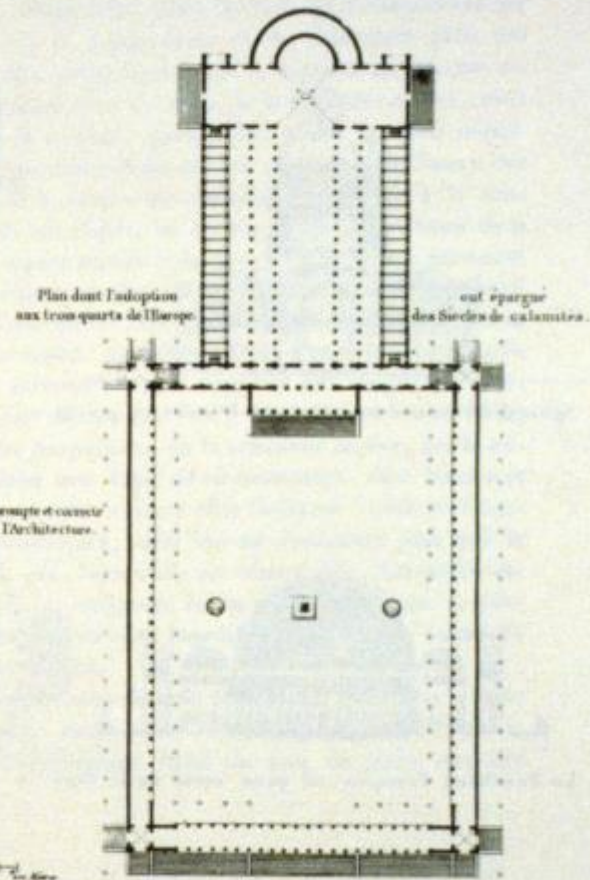
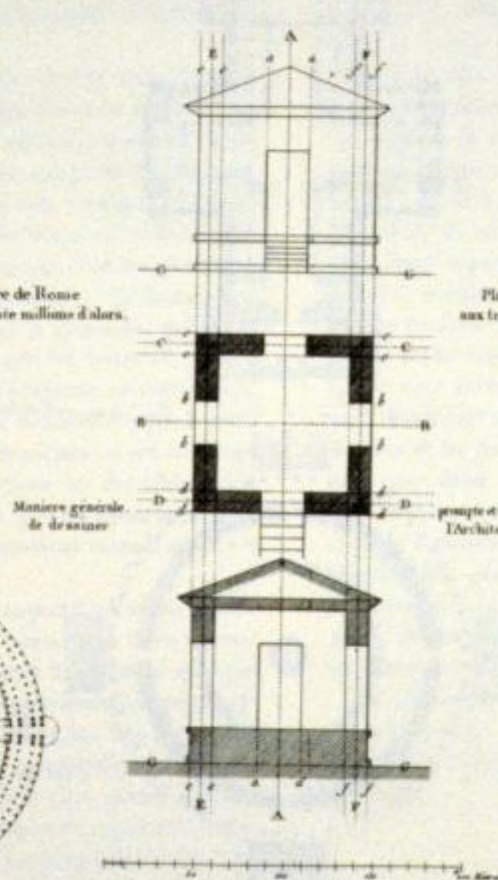
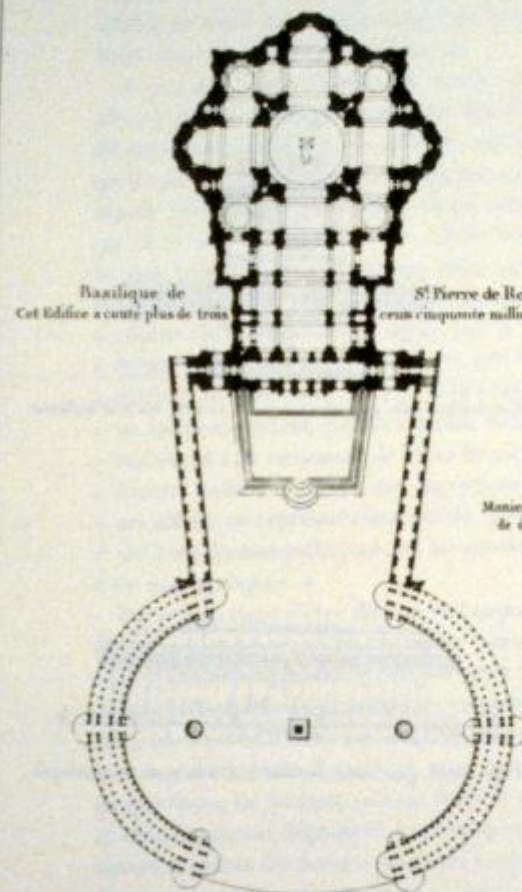


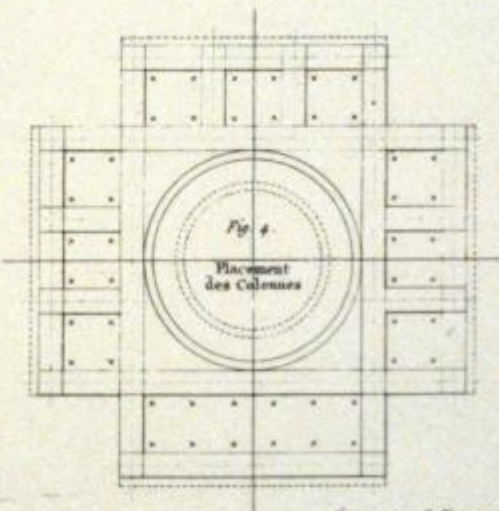
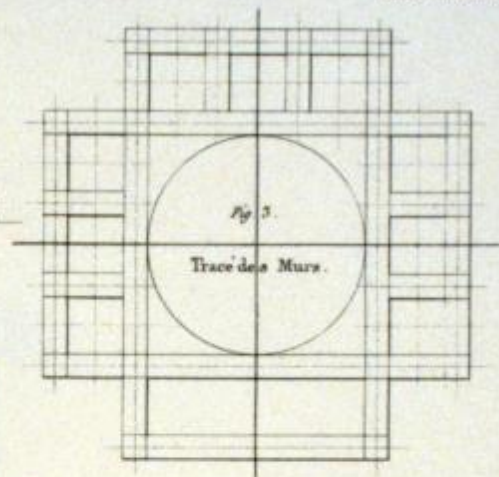
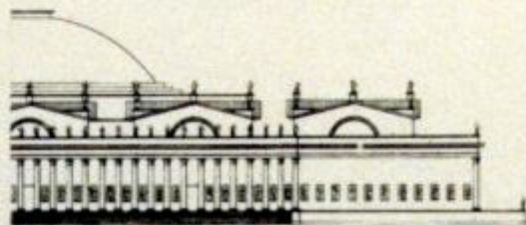
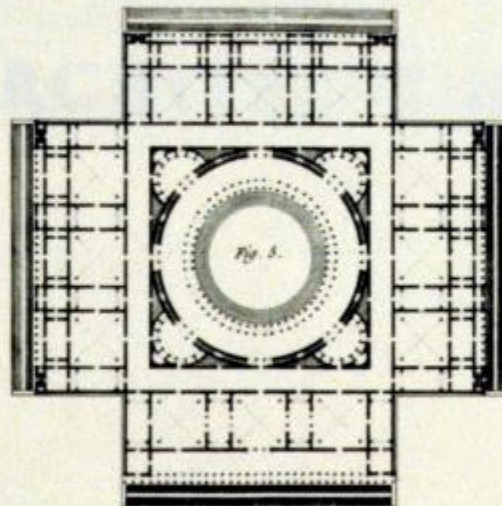
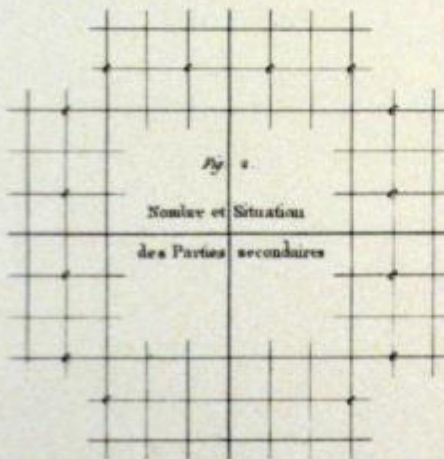
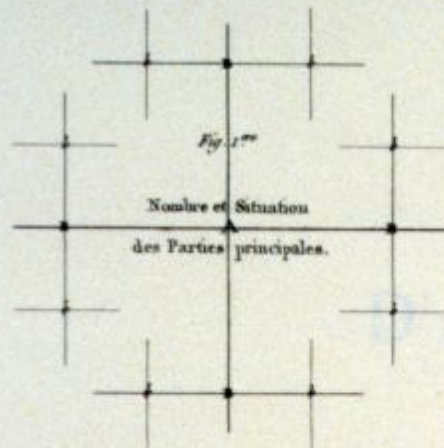
Eglise de S^t Genevieve, ou Panthéon Français, tel qu'il est. — Cet Edifice quoi qu'assez resserré, a coûté dix huit millions.



Le Panthéon Français, tel qu'on auroit dû le faire. —

— n'en eût coûté que neuf, et eût été vaste et magnifique.





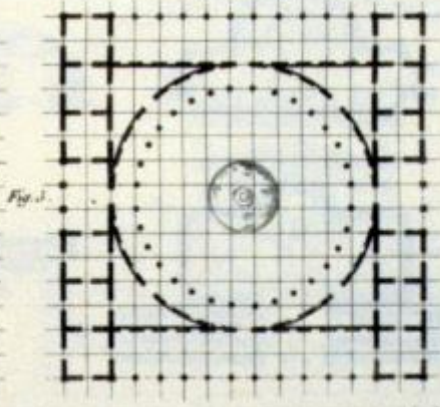
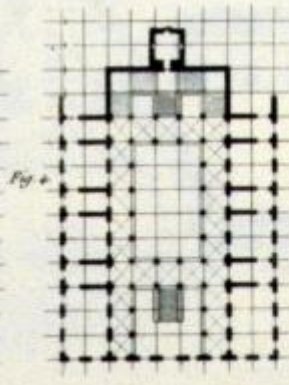
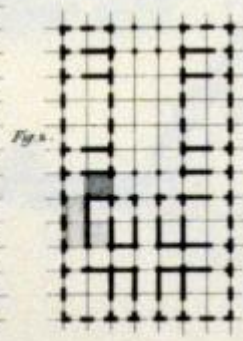
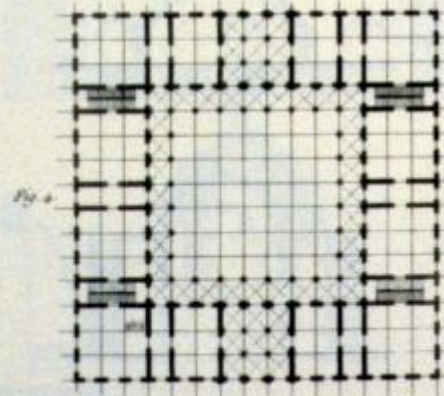
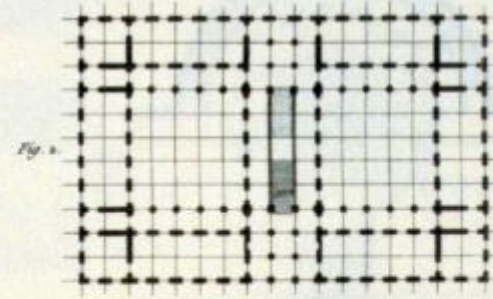
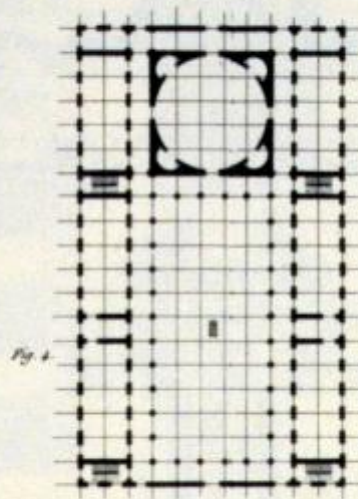
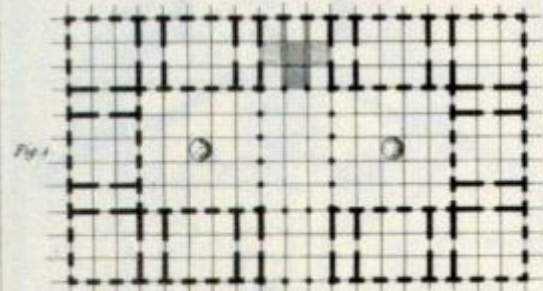
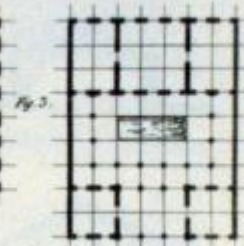
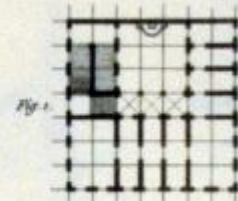
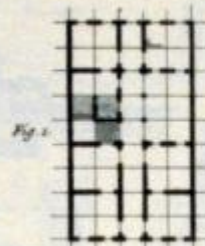


Fig. 1.

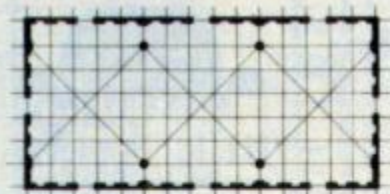


Fig. 2.

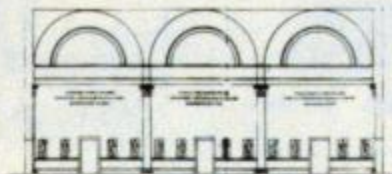


Fig. 3.

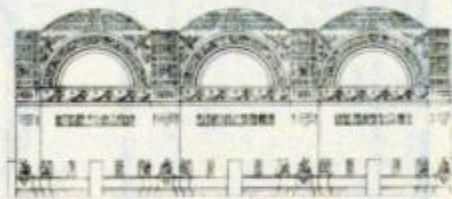
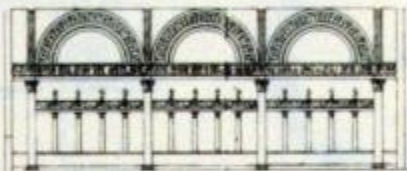
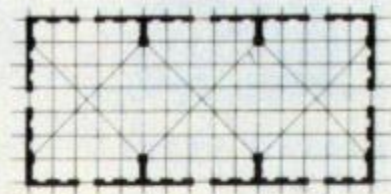
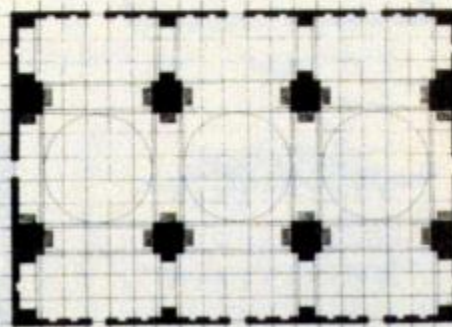
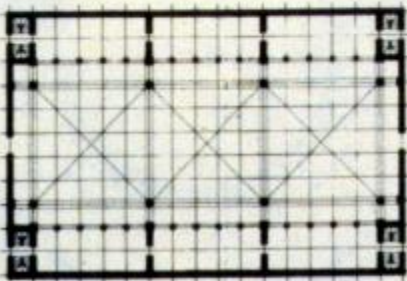
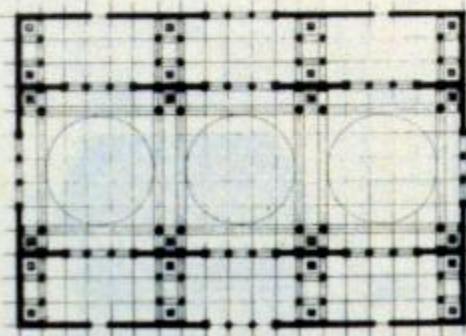


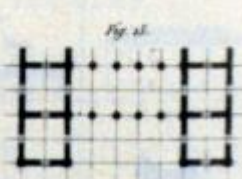
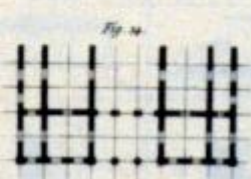
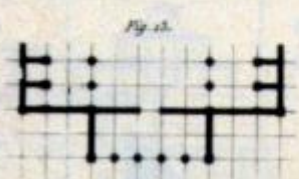
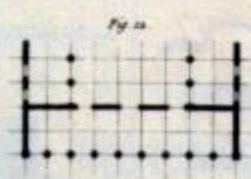
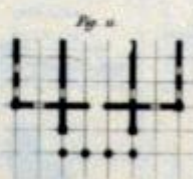
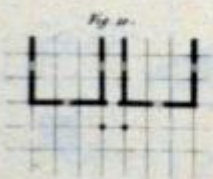
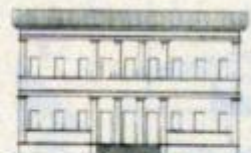
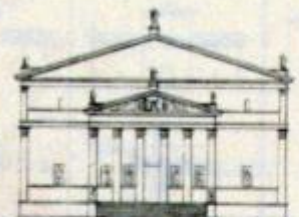
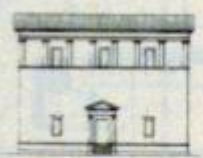
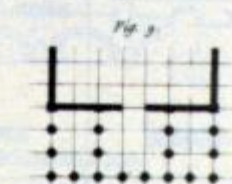
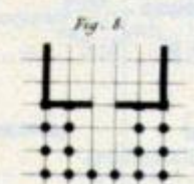
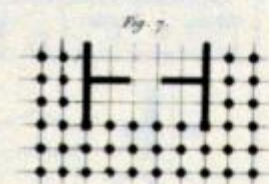
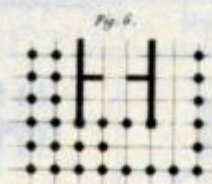
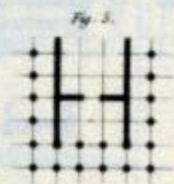
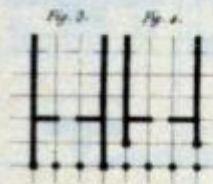
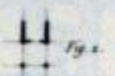
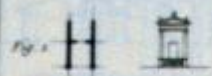
Fig. 4.

Fig. 5.

Fig. 6.



POCHES
ouverts par des entrecolonnements.



COMBINAISONS HORIZONTALES,
de Colonnes, de Pilastres, de Murs, de Portes et de Croisées.

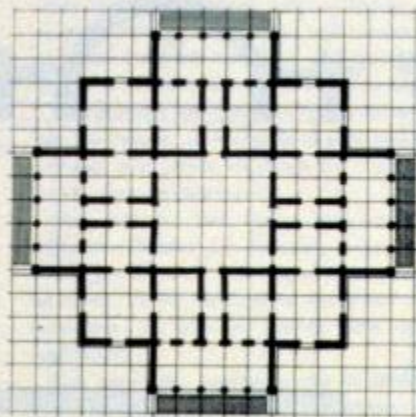


Fig. 1.

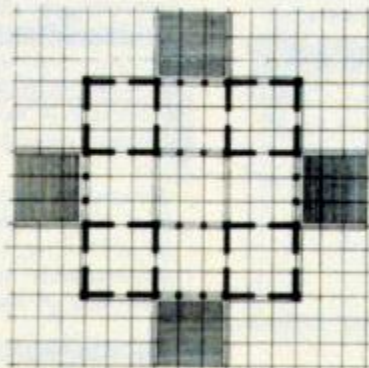


Fig. 2.

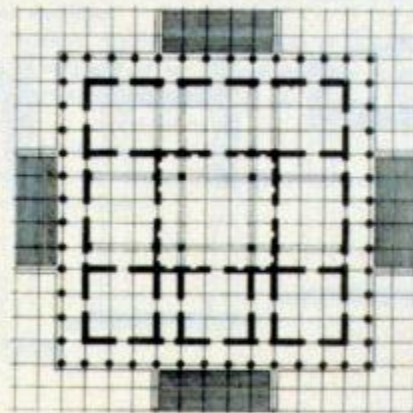
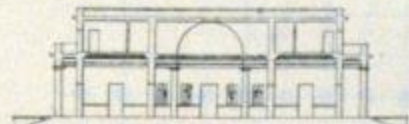
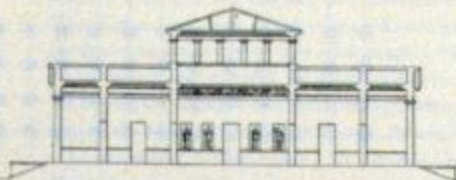


Fig. 3.



ENSEMBLES D'EDIFICES

formés par la combinaison de parties de cinq entrées axes de largeur.



marche à suivre -

+ — +

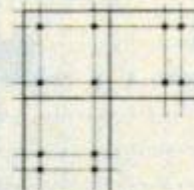
| + |

+ — +

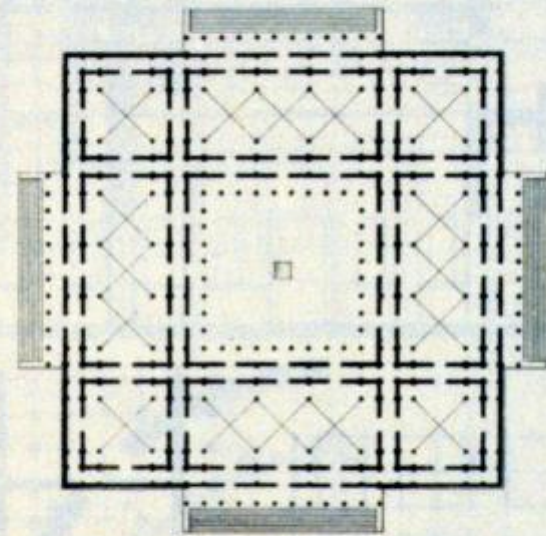
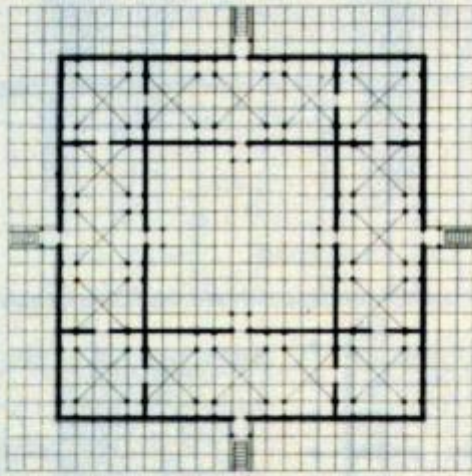
- lorsque l'on compose -

+	—	+
	+	
+	—	+

- ou même -

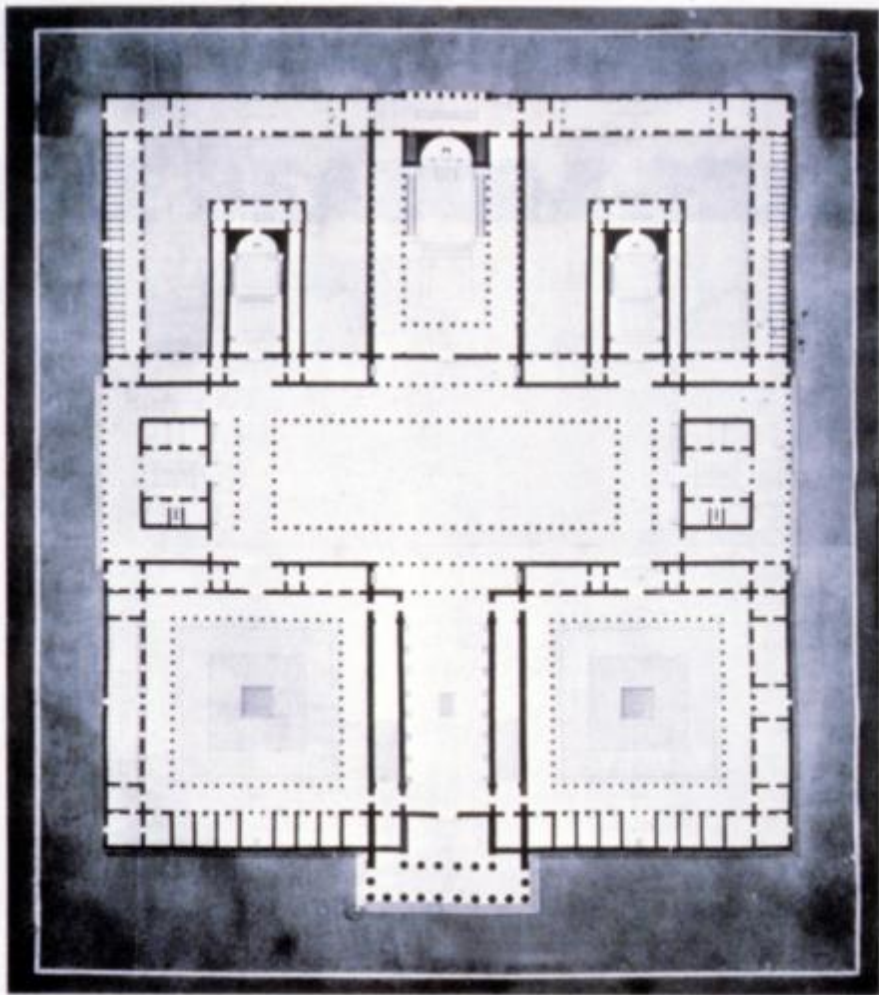


lorsque l'on copie.



Henri Labrouste
Ecole des Beaux Arts
1801 to 1895

Structural Rationalism

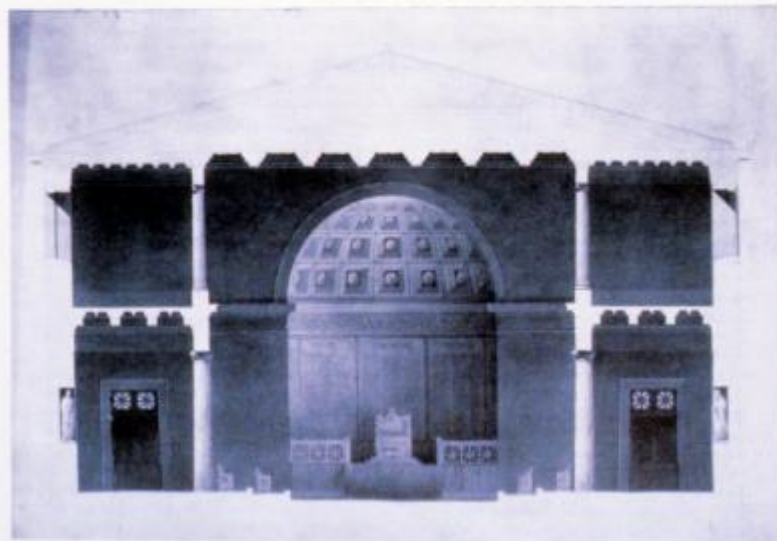


3 Henri Labrouste, plan of the Tribunal de Cassation, 1er Grand Prix, 1824

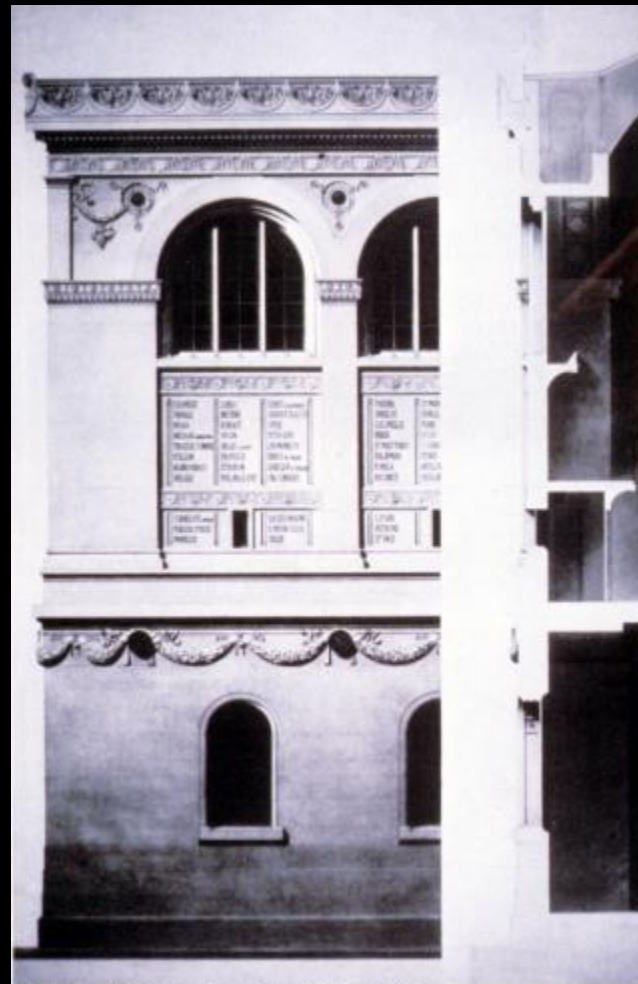
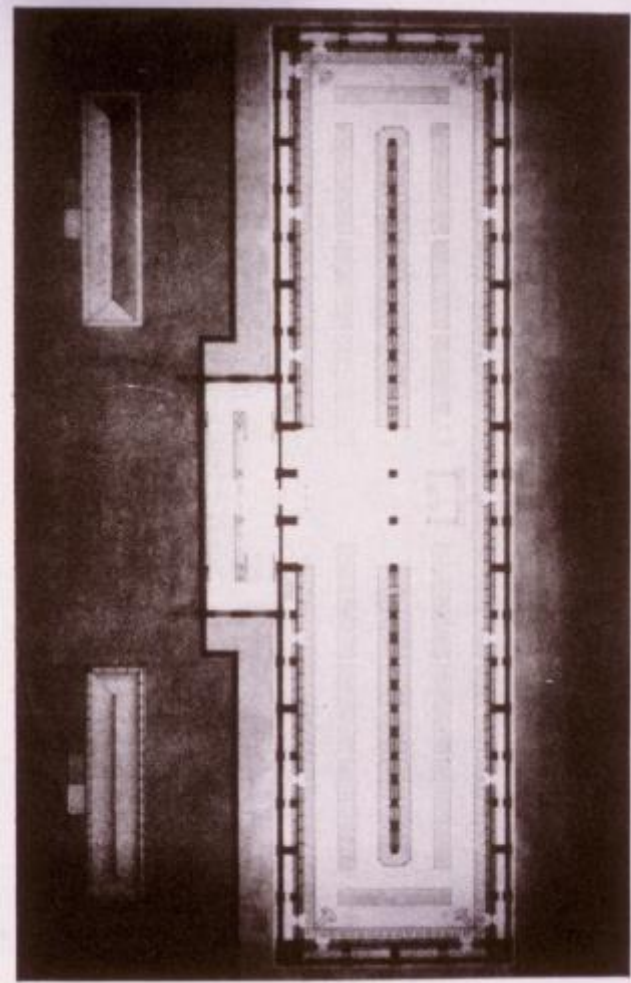
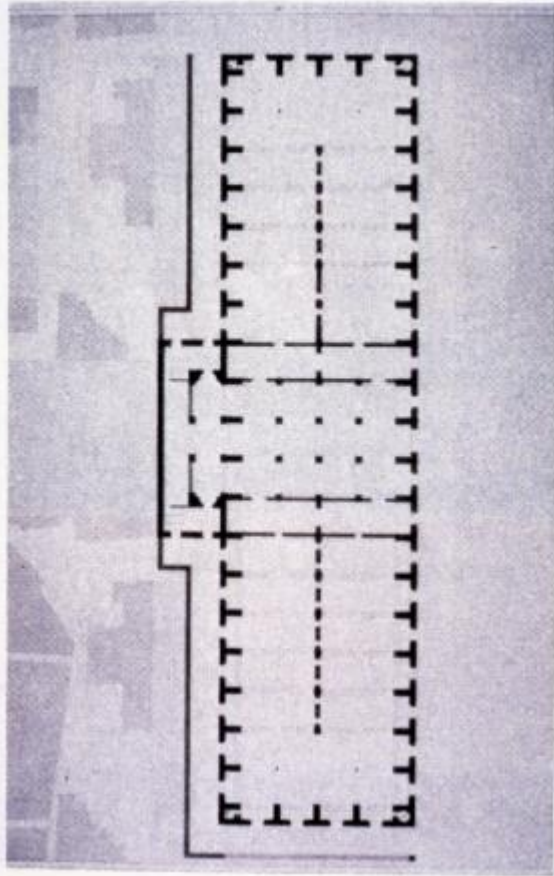
3 Henri Labrouste, plan du Tribunal de Cassation, 1er Grand Prix, 1824.



84, 85 H. Labrouste, Cour de Cassation, 1824: rendered elevation and longitudinal section (above), and rendered cross-section of main courtroom. (Deuxième-Àvis)

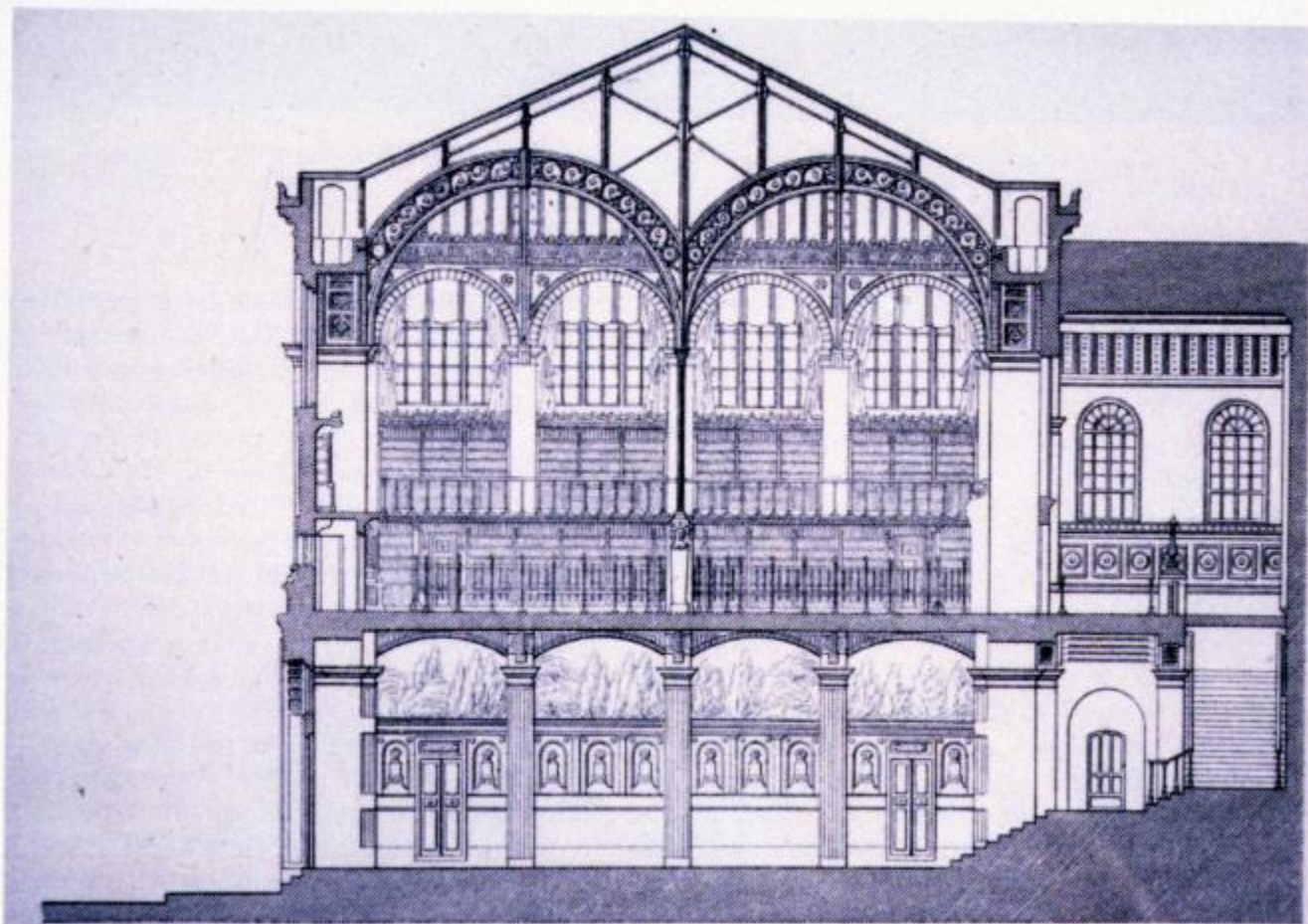


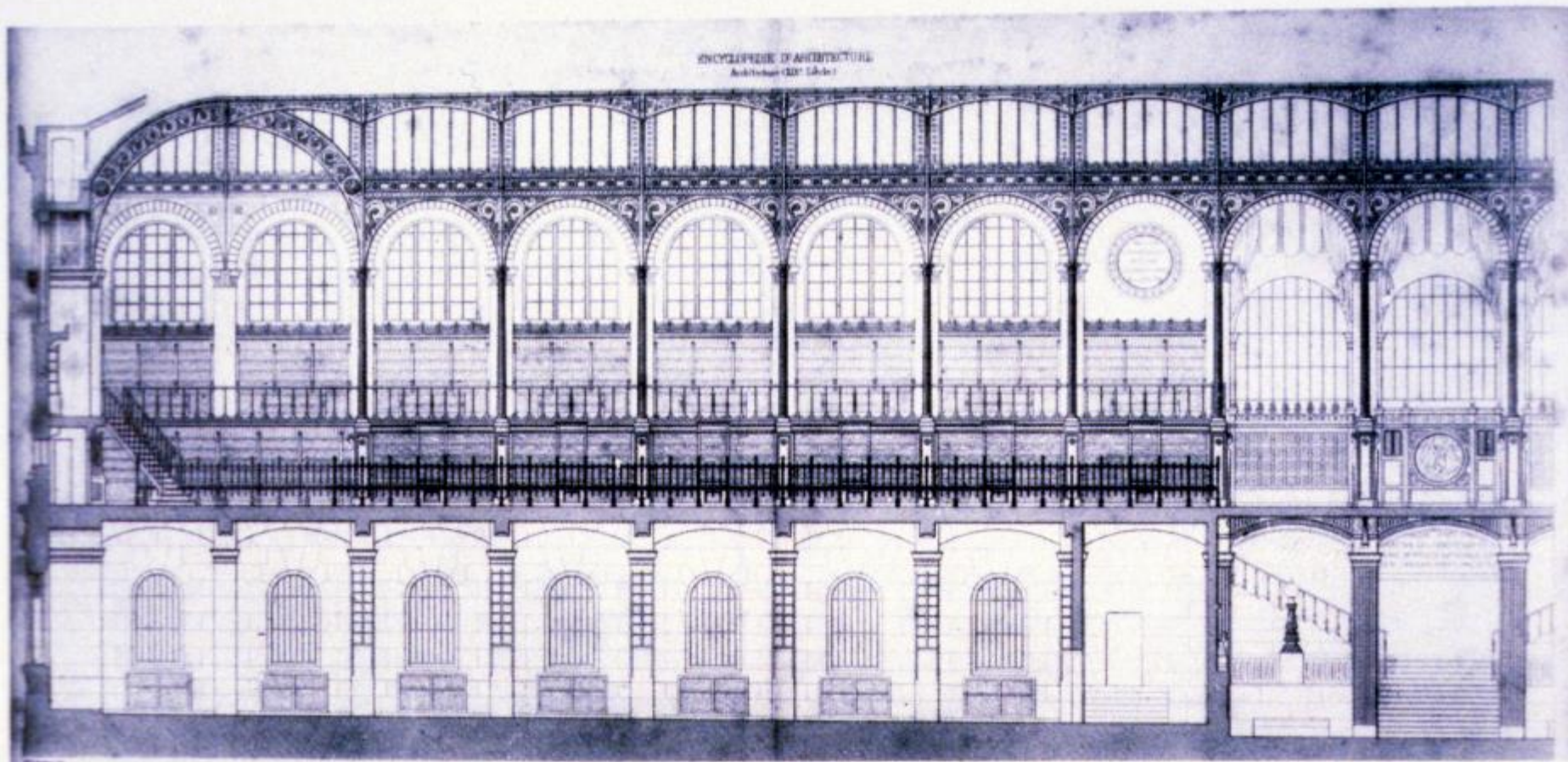
*Henri Labrouste's Bibliothèque Sainte-Geneviève,
Paris, 1838-50*



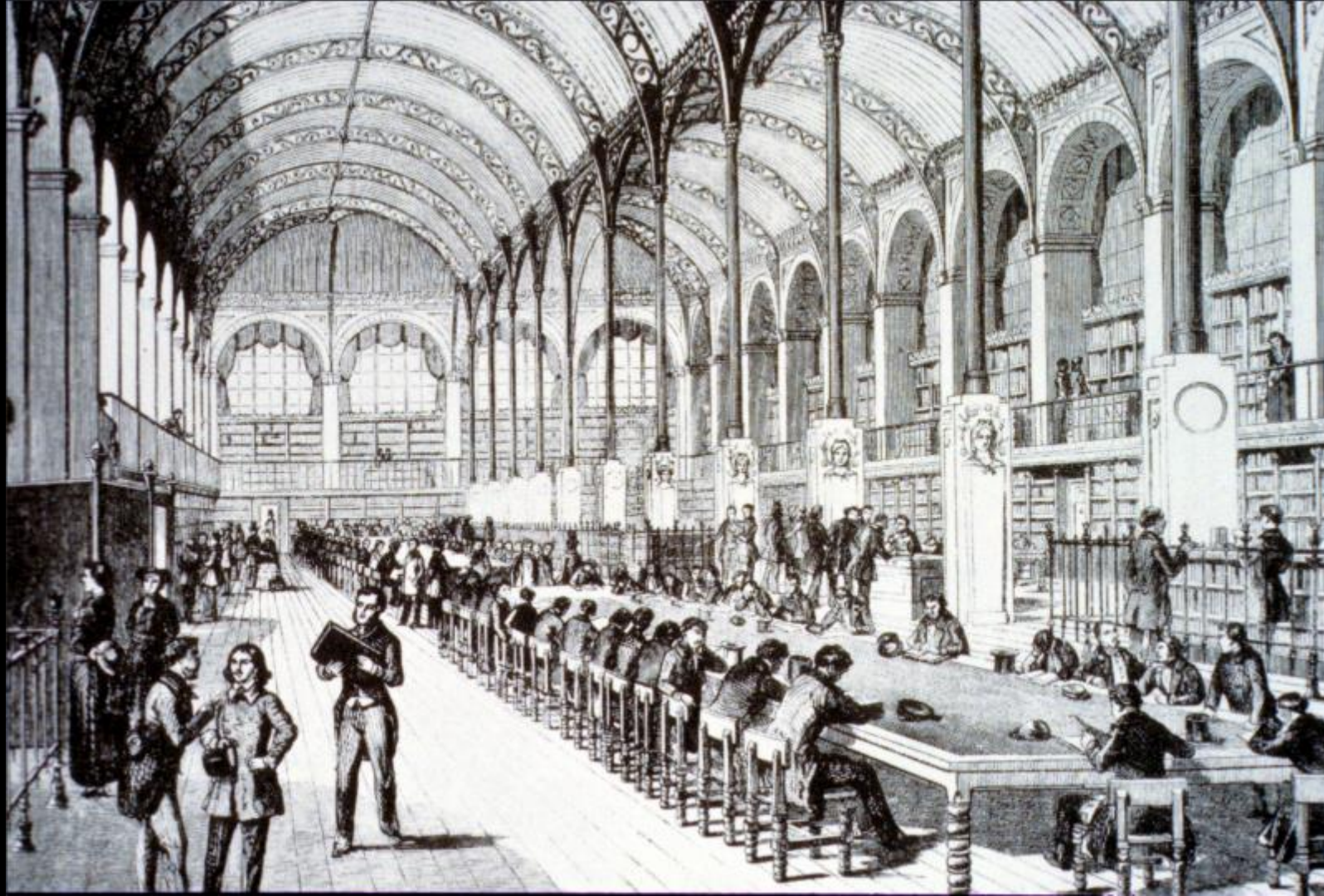
Bibliothèque Sainte-Geneviève d'Henri Labrouste à Paris (1838-50)







143 Bibliothèque Ste-Geneviève: longitudinal section of western half. Engraved after a drawing by Labrouste. (From the *Encyclopédie d'architecture*, V, 1855)





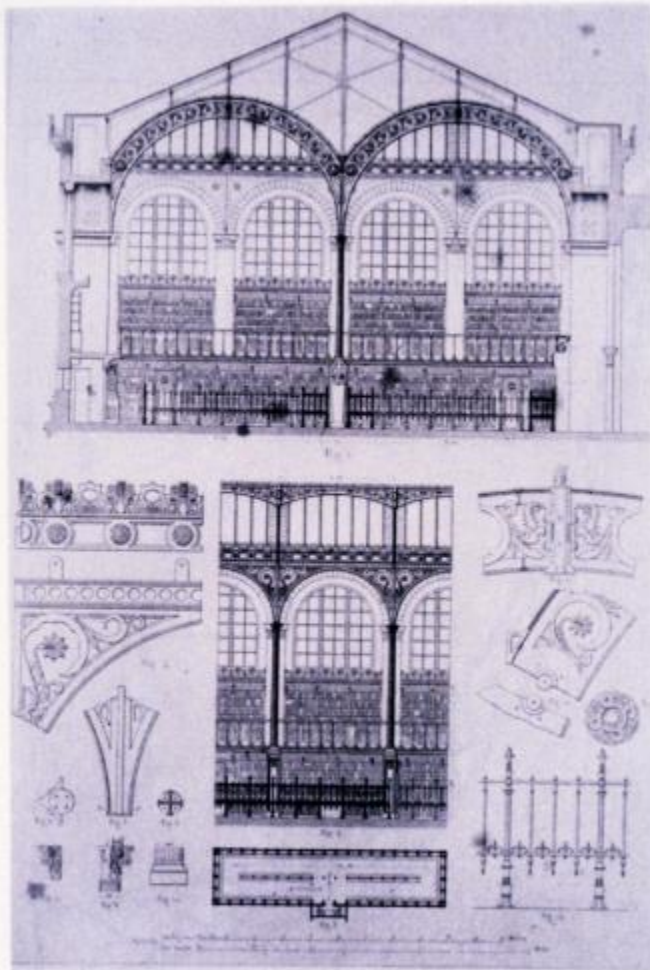
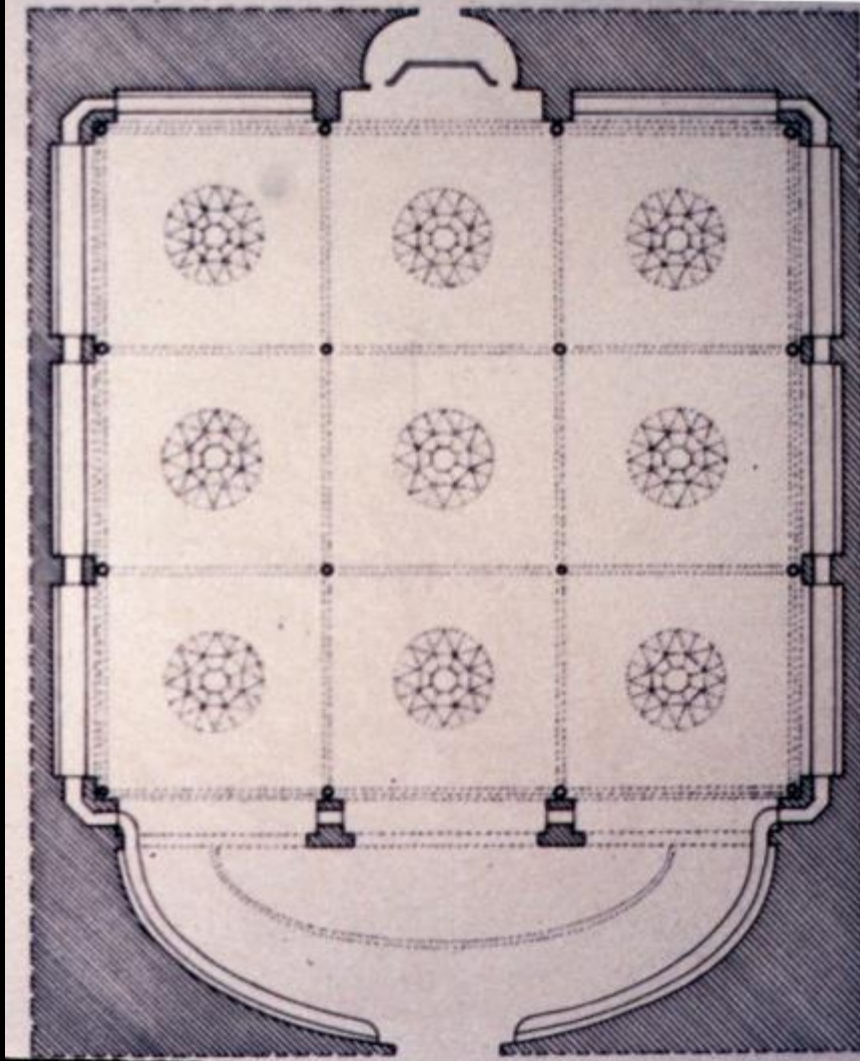
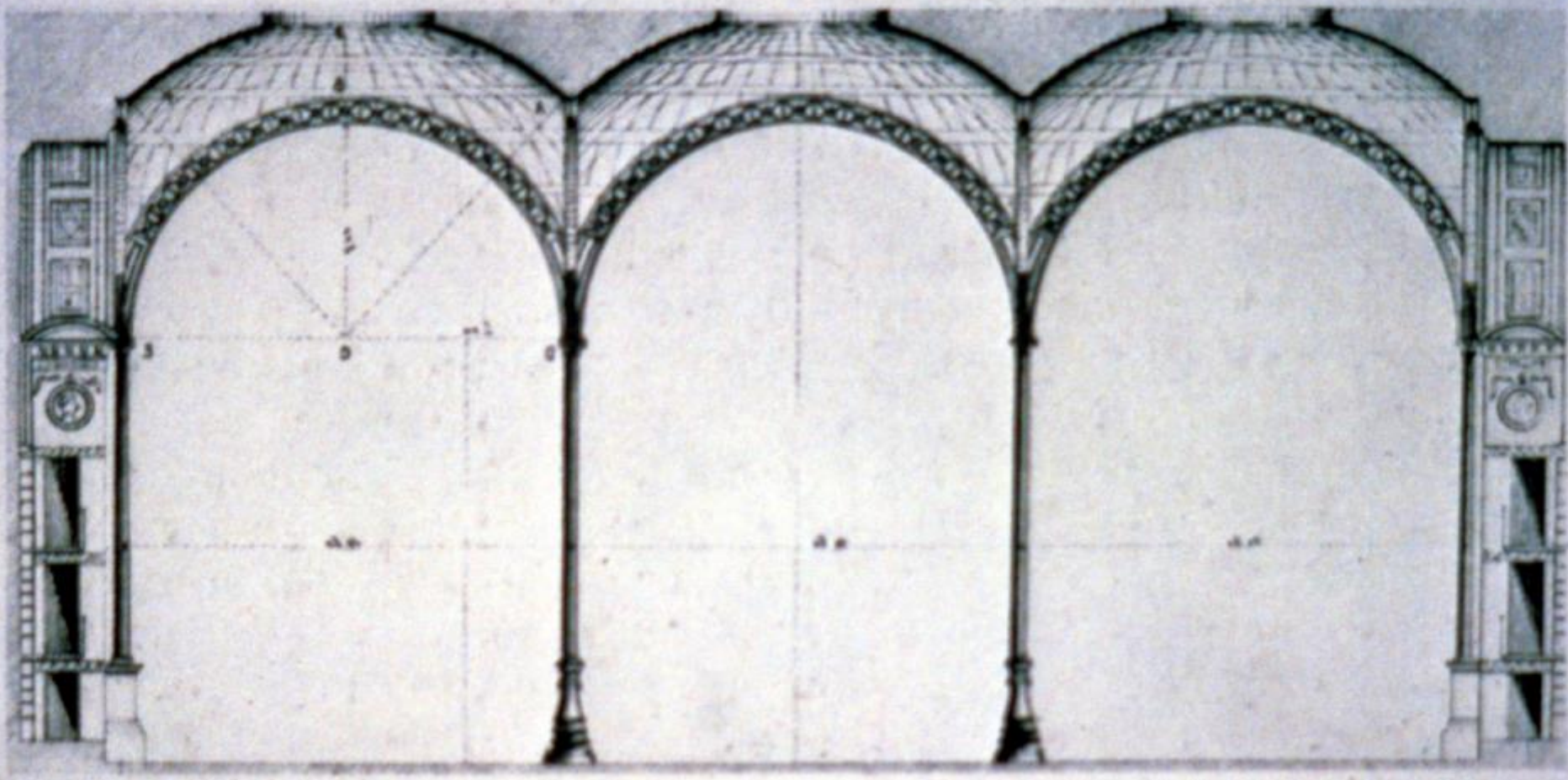


Plate 44. Henri Labrouste. Bibliothèque Saint-Geneviève, Paris, 1843-50.
Section, plan and details (Reynaud, 1860-63, Pl. 80)

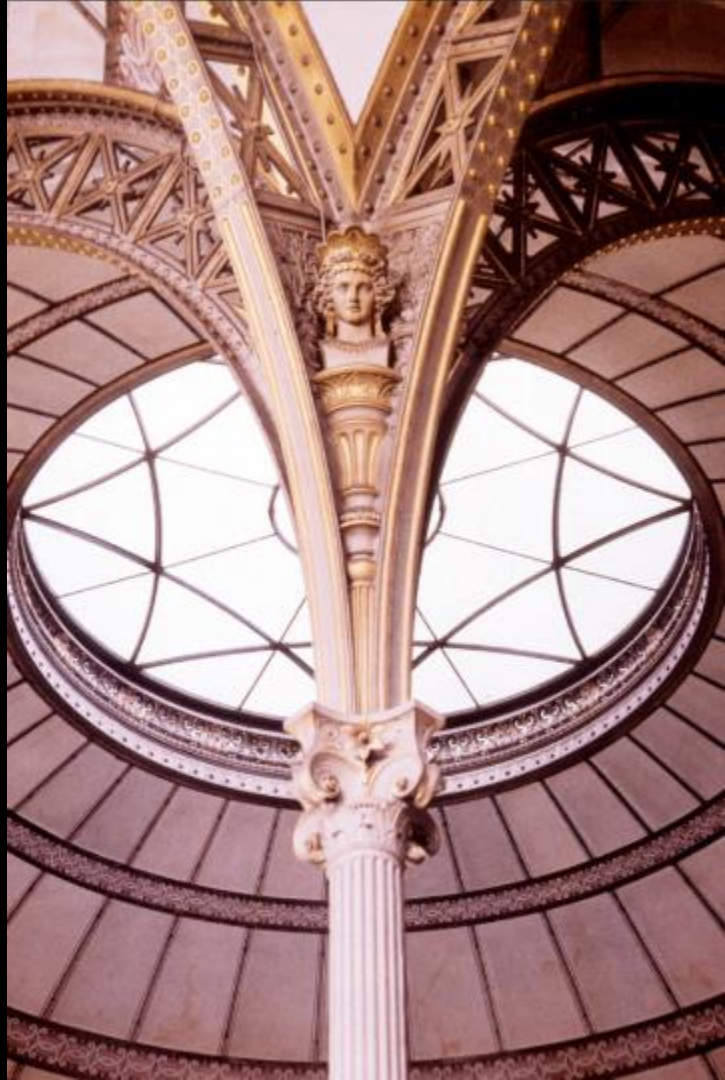


Bibliothèque Nationale de
France
Paris, France
Henri Labrouste
1862 to 1868









The Great Exhibition 1851
Hyde Park, London, England

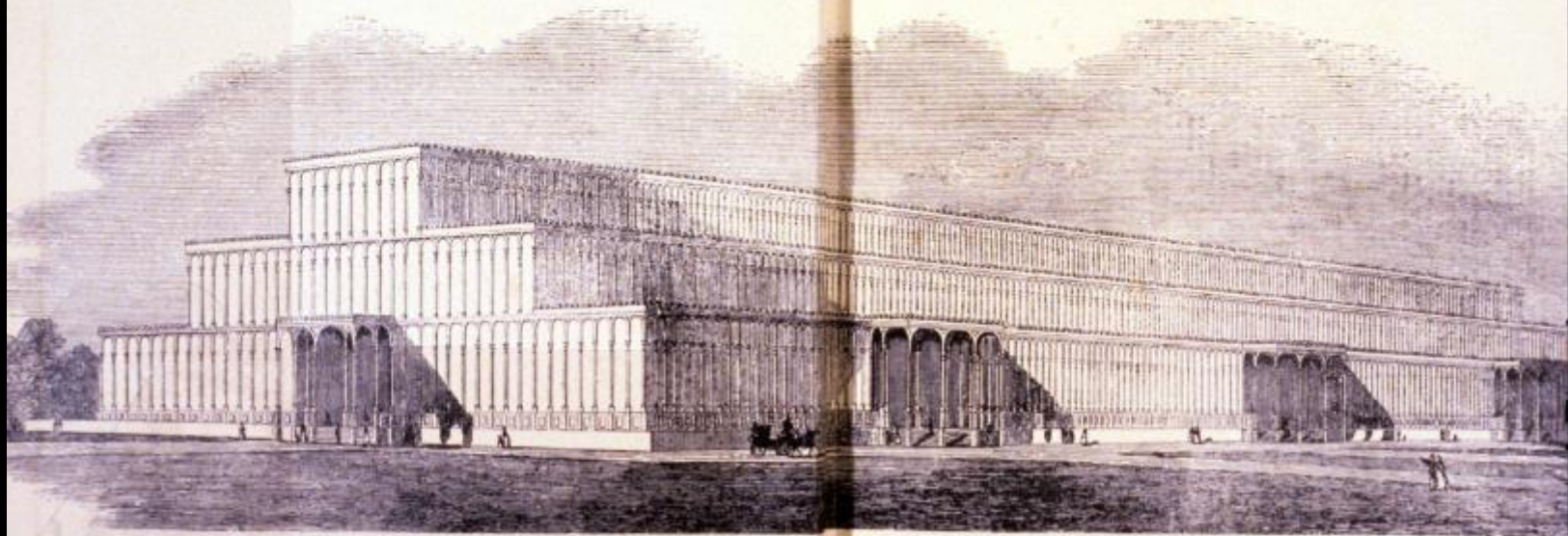
Sir Joseph Paxton



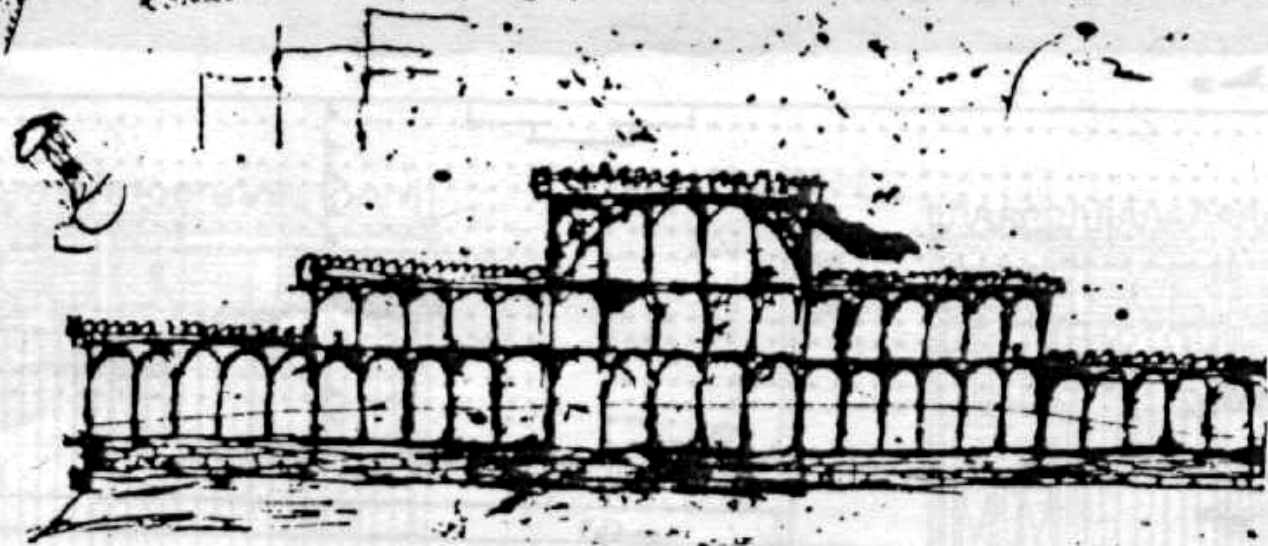
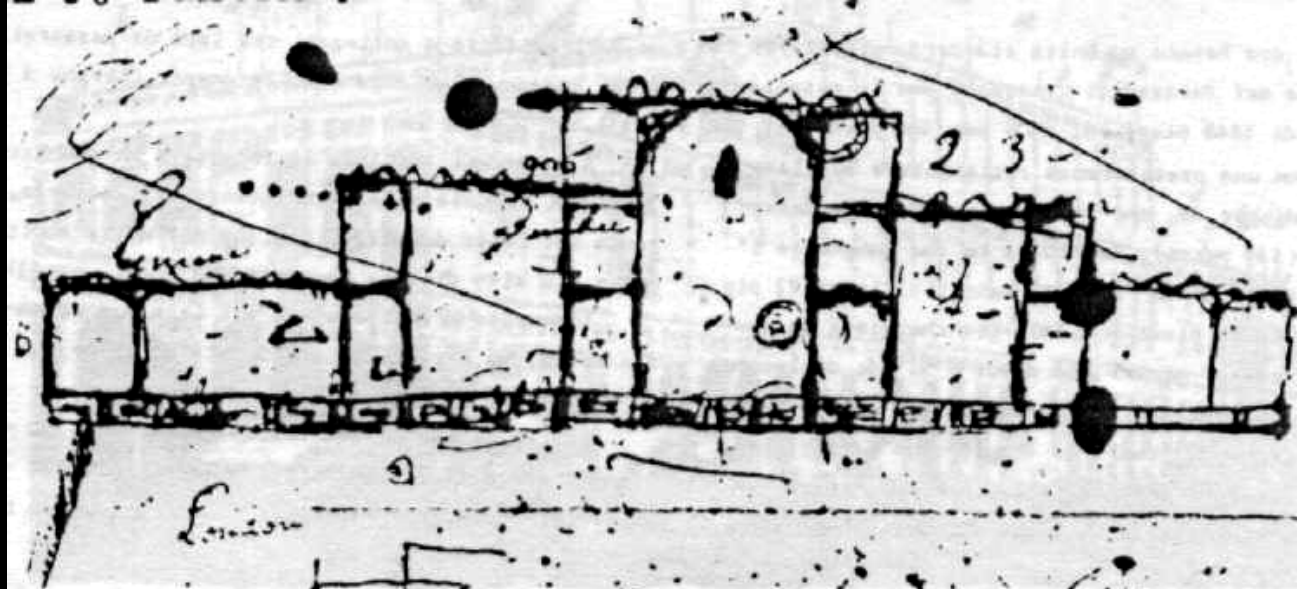
The Great Exhibition 1851
Hyde Park, London, England
Sir Joseph Paxton

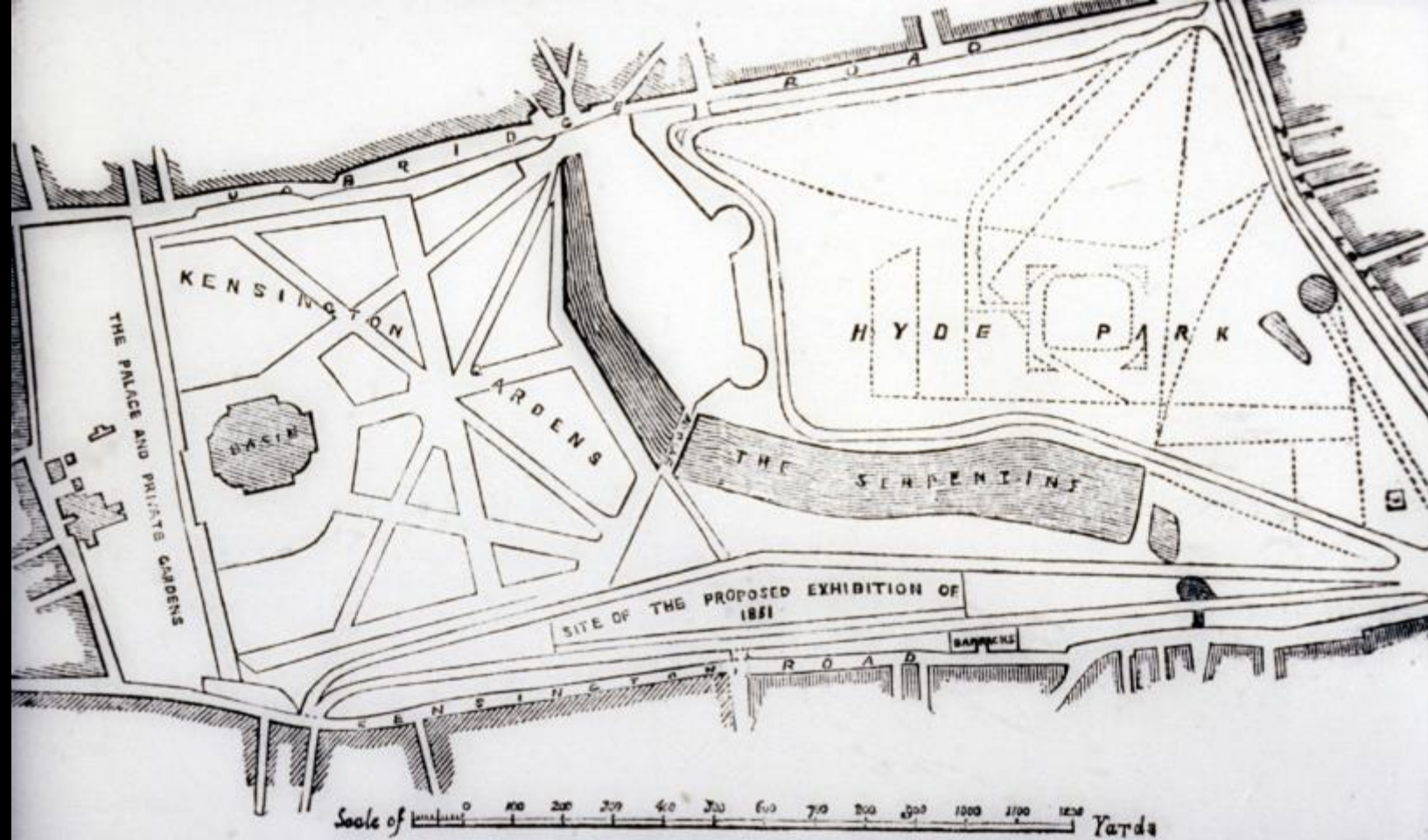


THE OFFICIAL DESIGN.

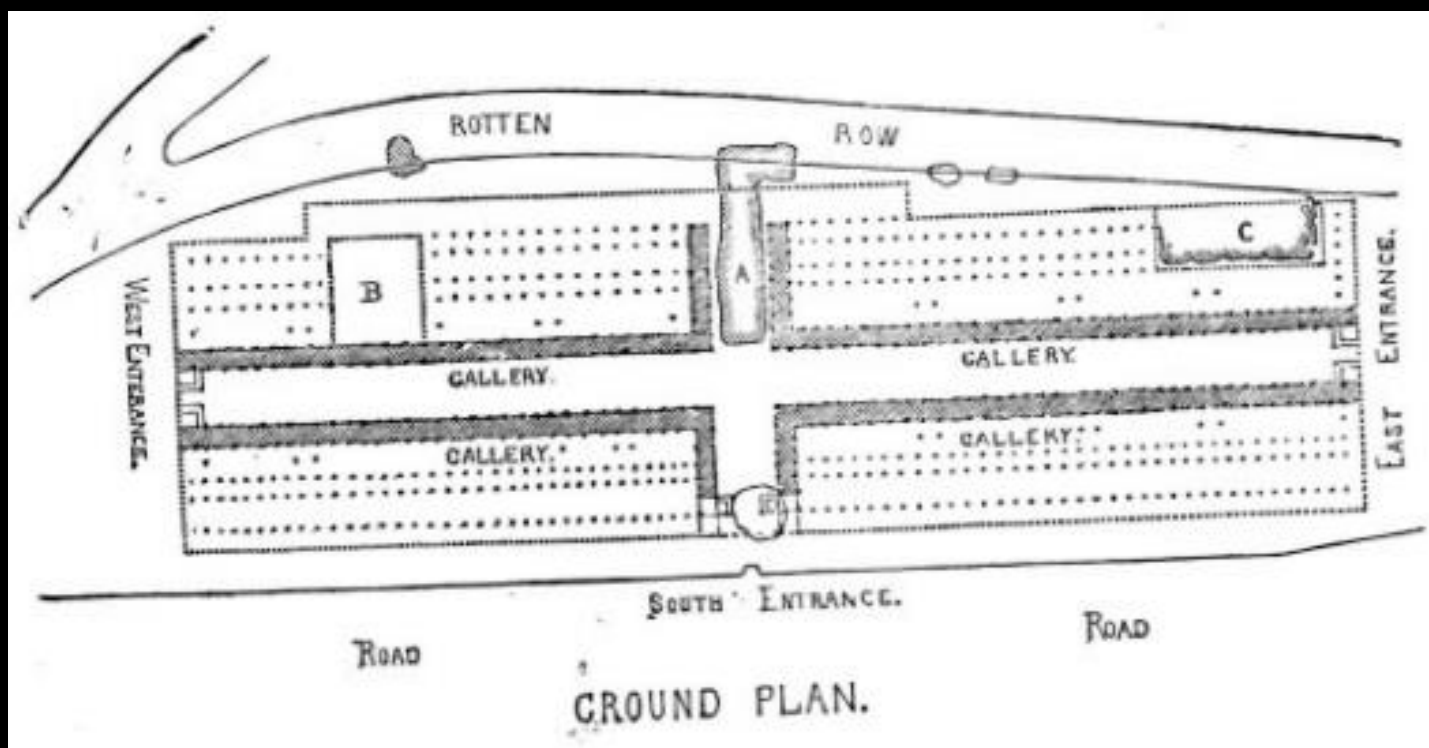


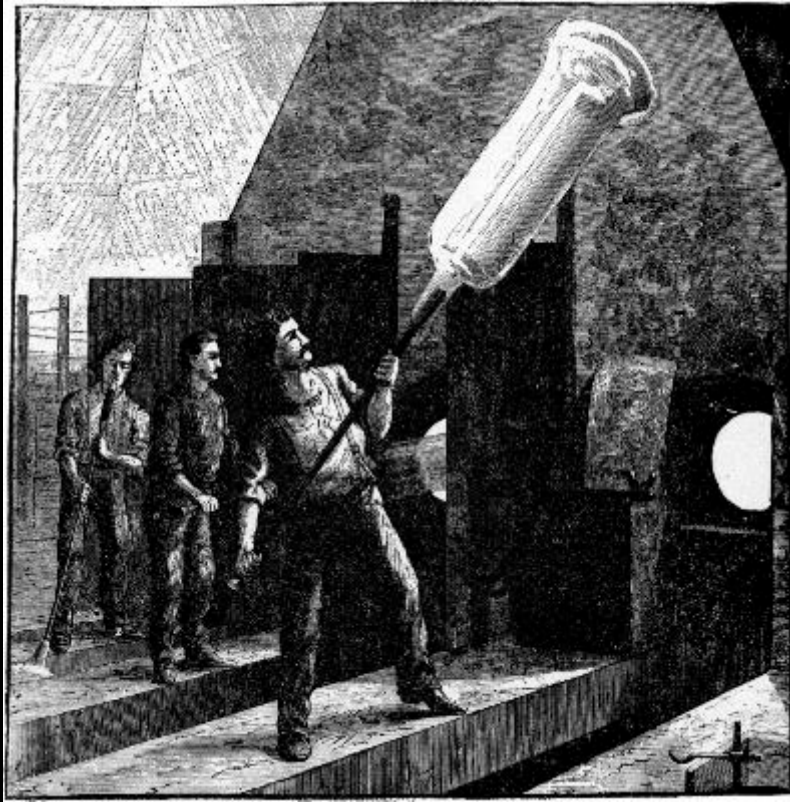
PAXTON'S DESIGN.





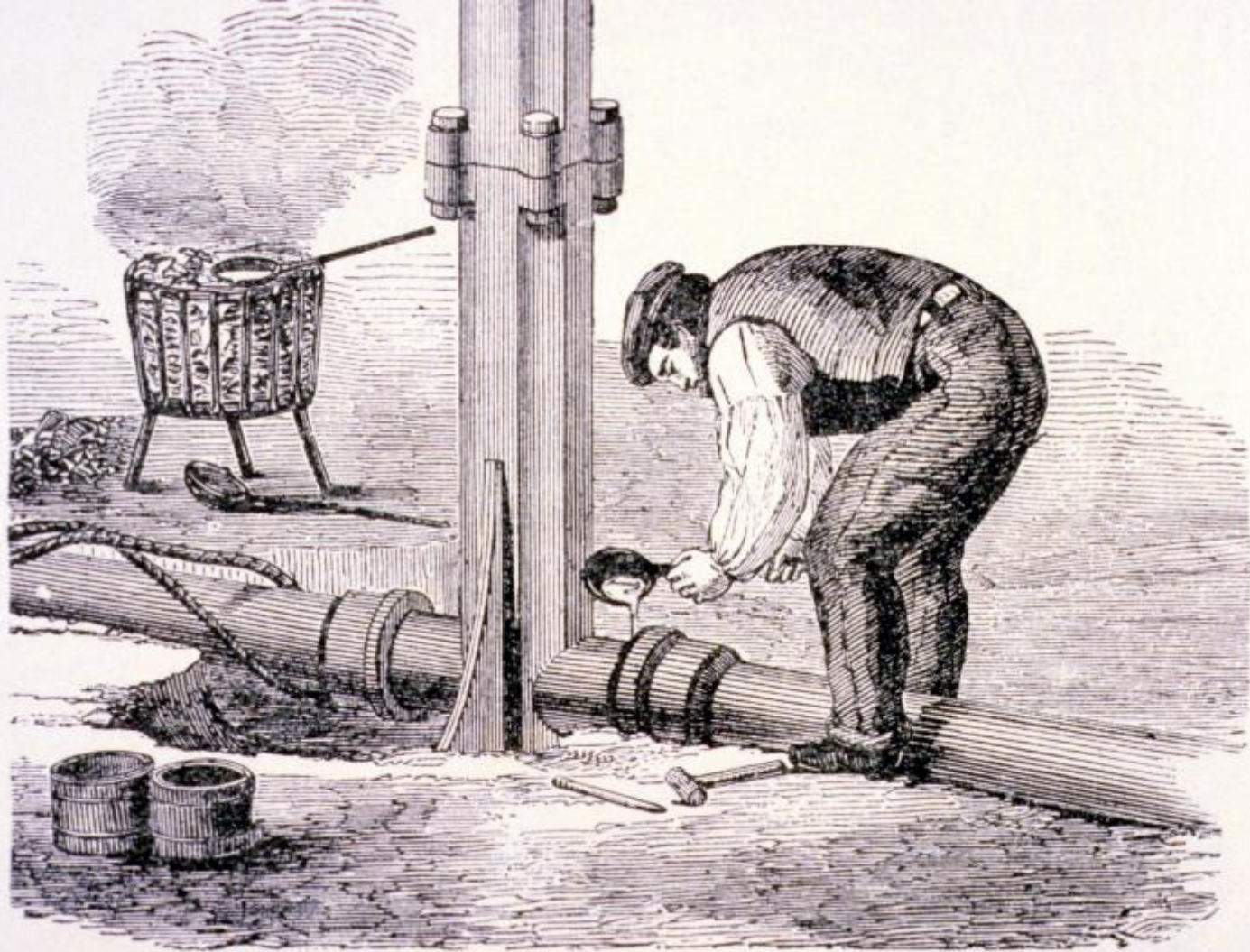
PLAN OF HYDE PARK.

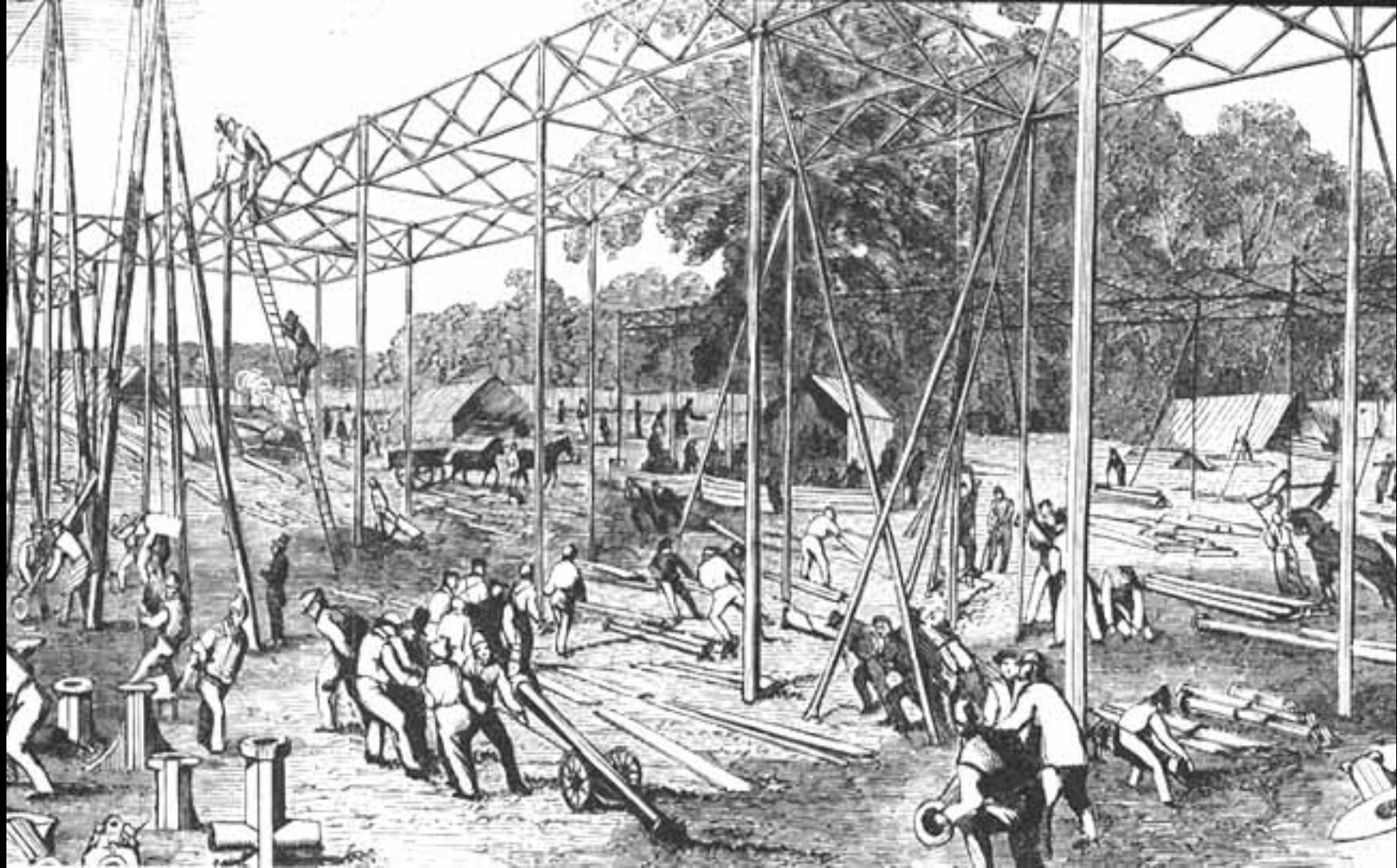


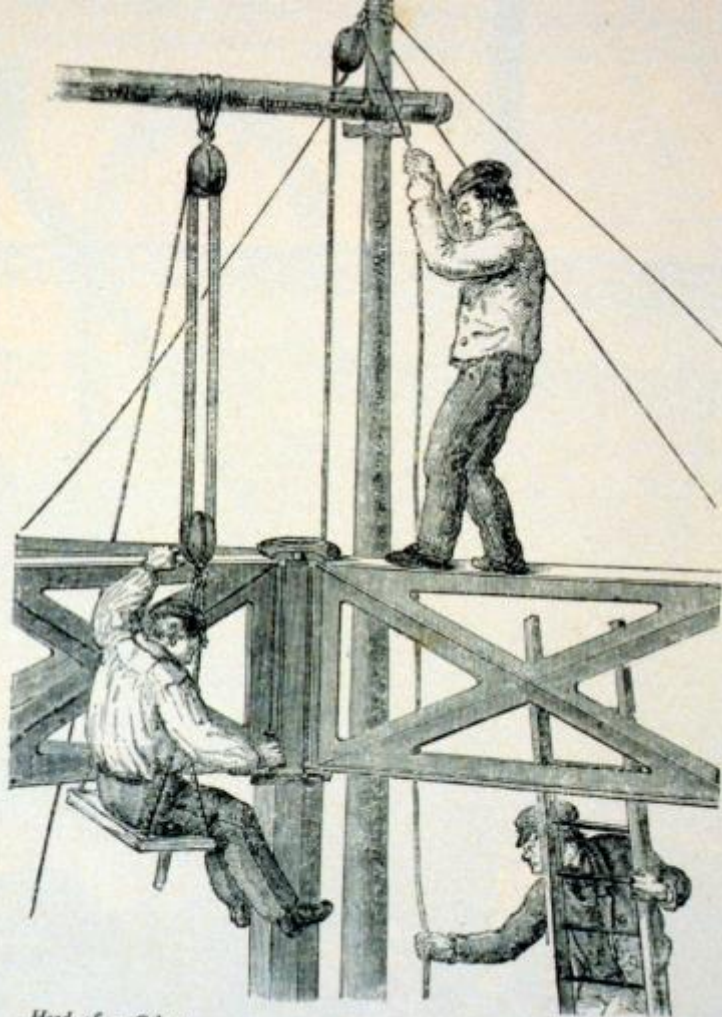


Cylinder glass is made by swinging a long hollow tube of glass in a long pit. It folds out to 30" x 49".

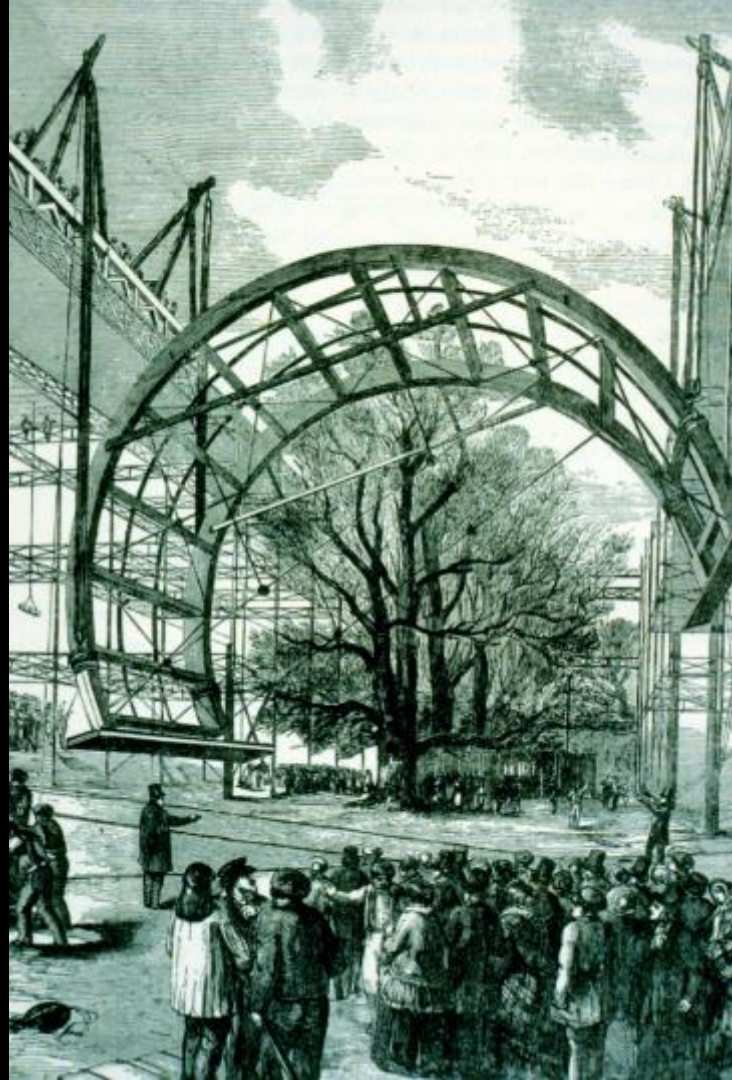
It was cut into 3 panes of 10" x 49" and this formed the basis of the modules for the building – combined with the slope required so that the condensation on the roof glass would not drip, but rather cling to the glass and end up in a condensation gutter at the base of the sloped glass.

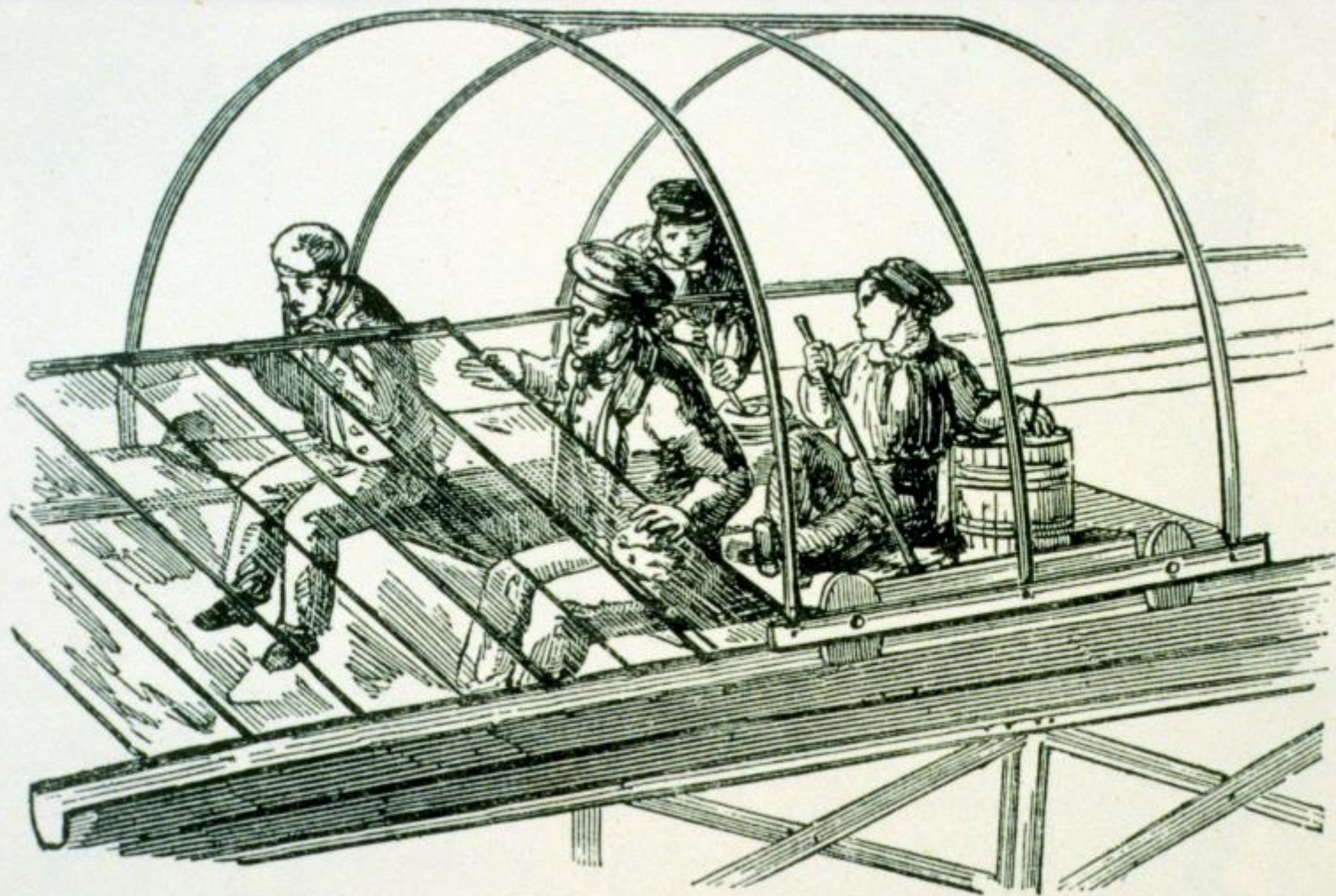




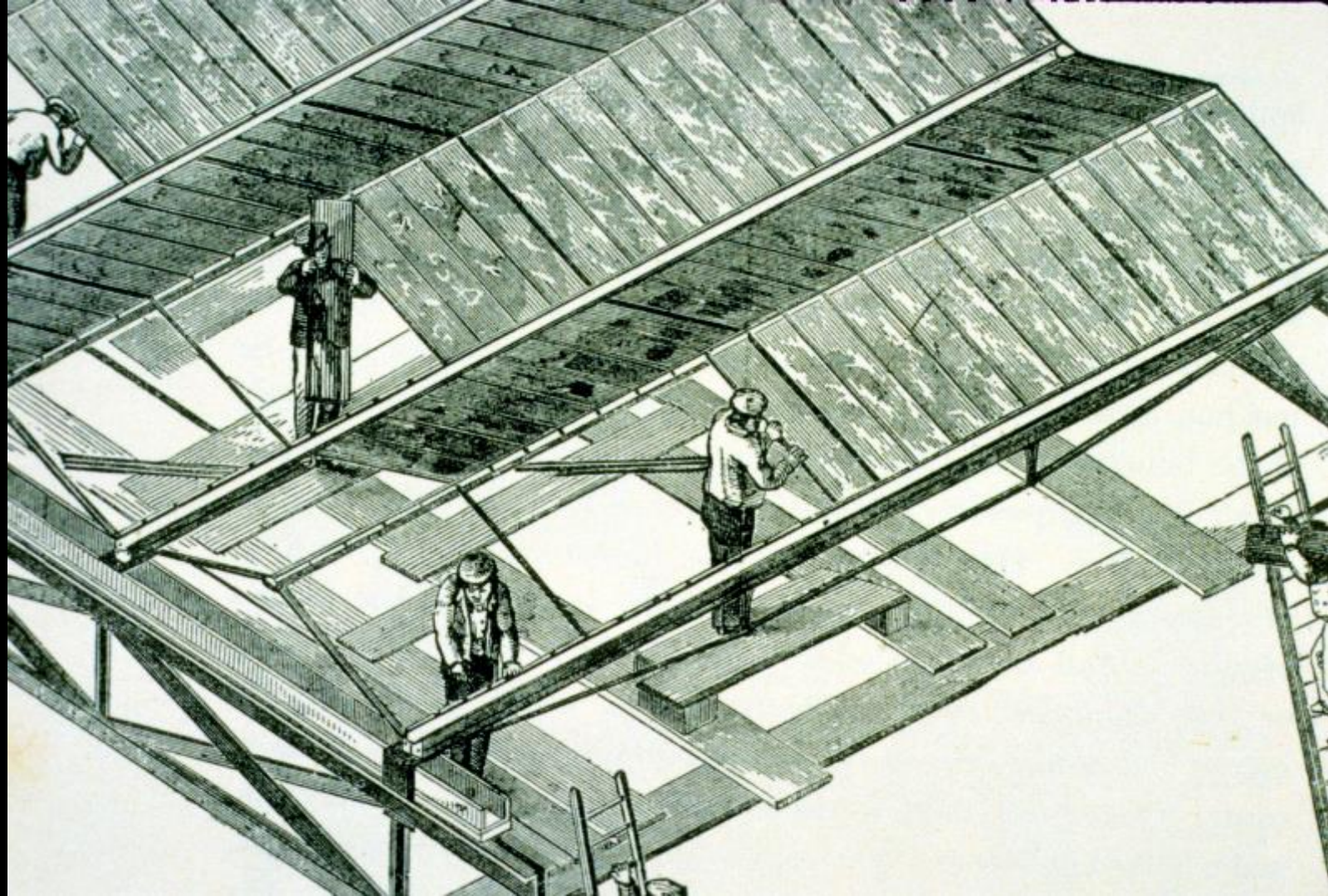


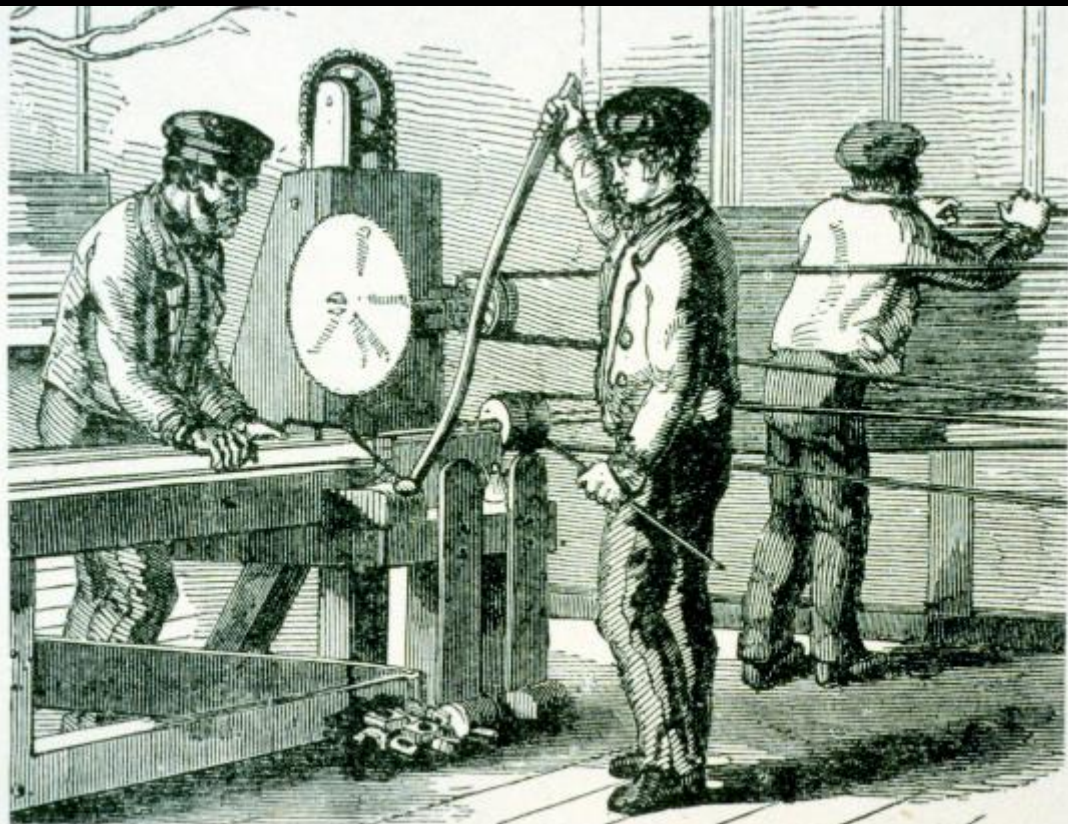
Head of a Column.





Glazing Waggon.





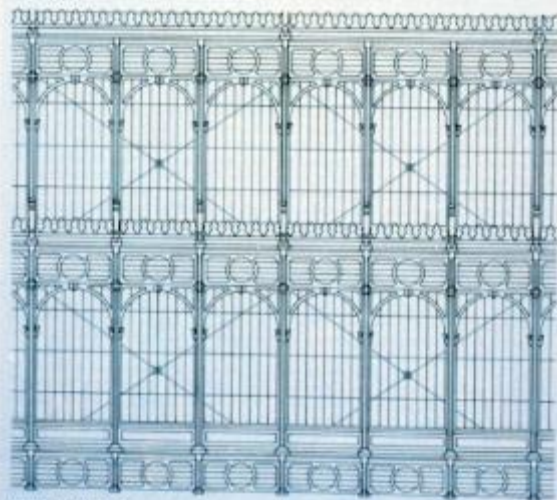
The Sash-bar Finishing Machine.



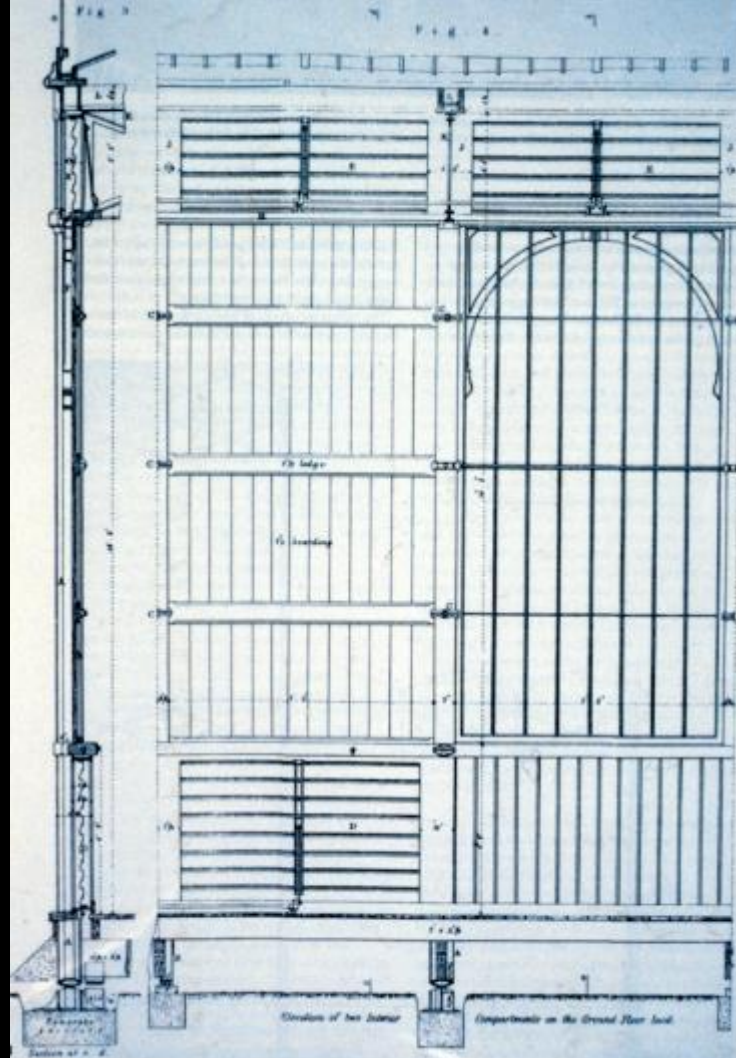
Punching Machine.

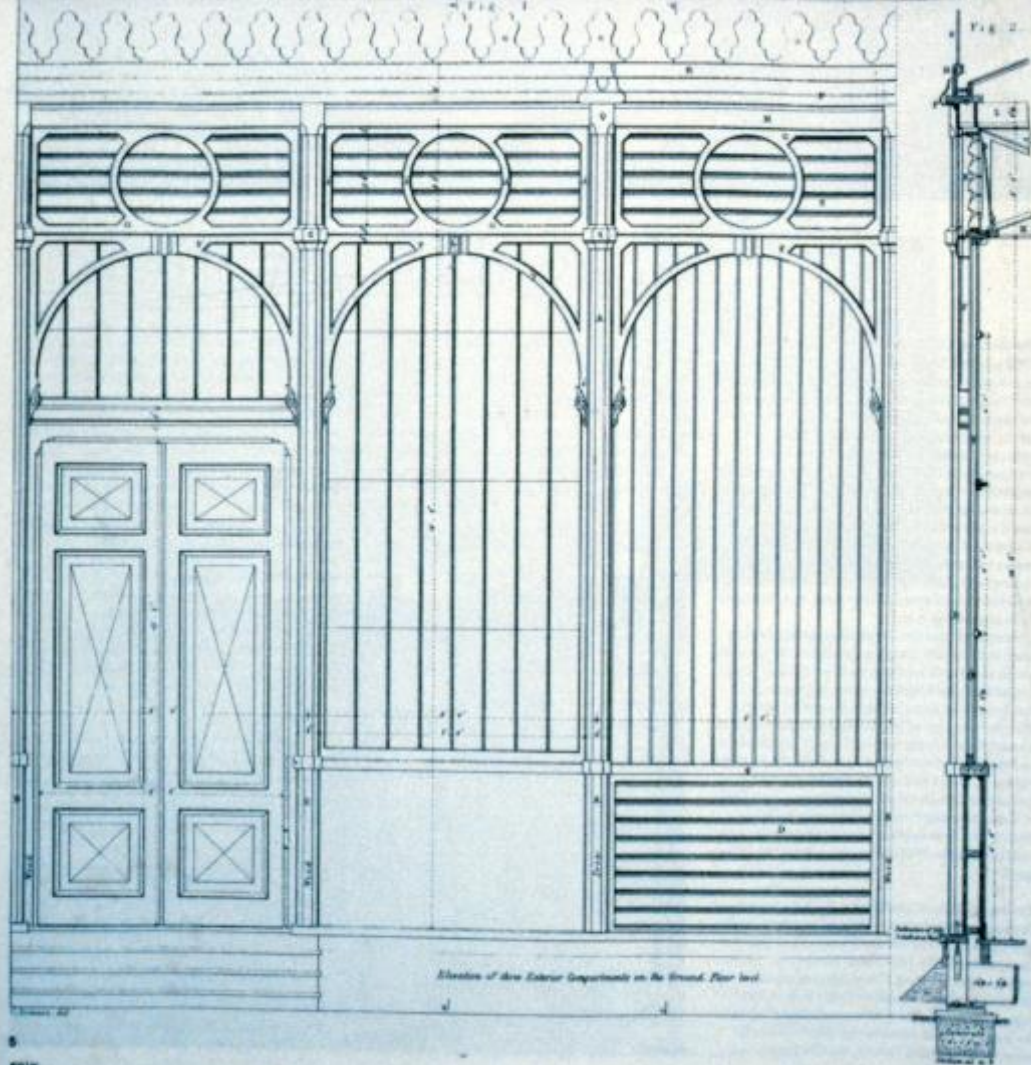


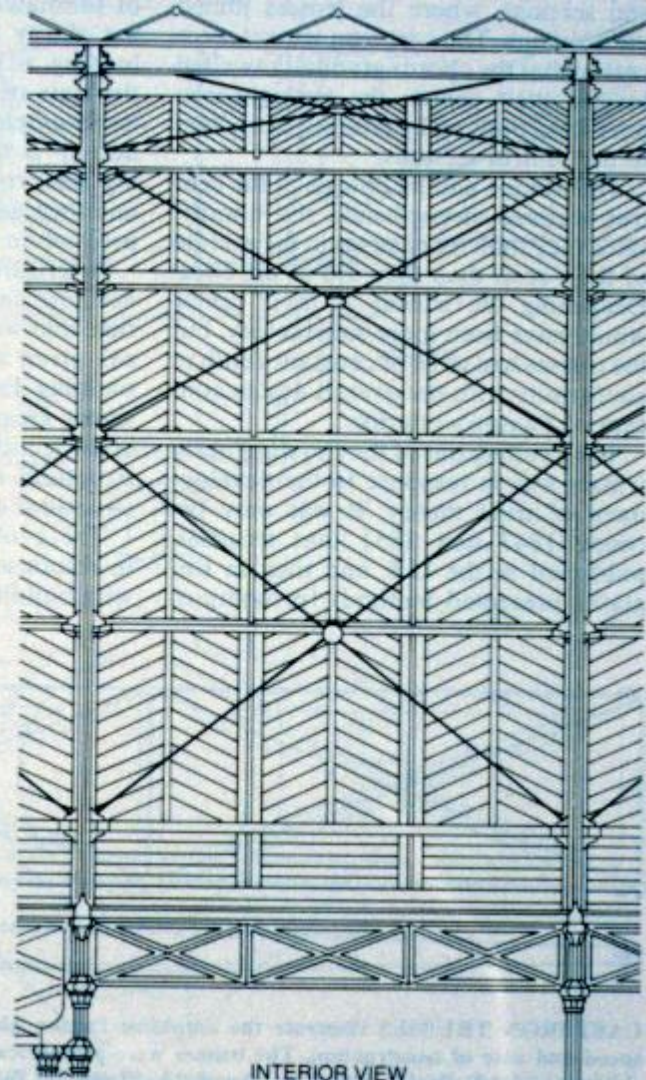
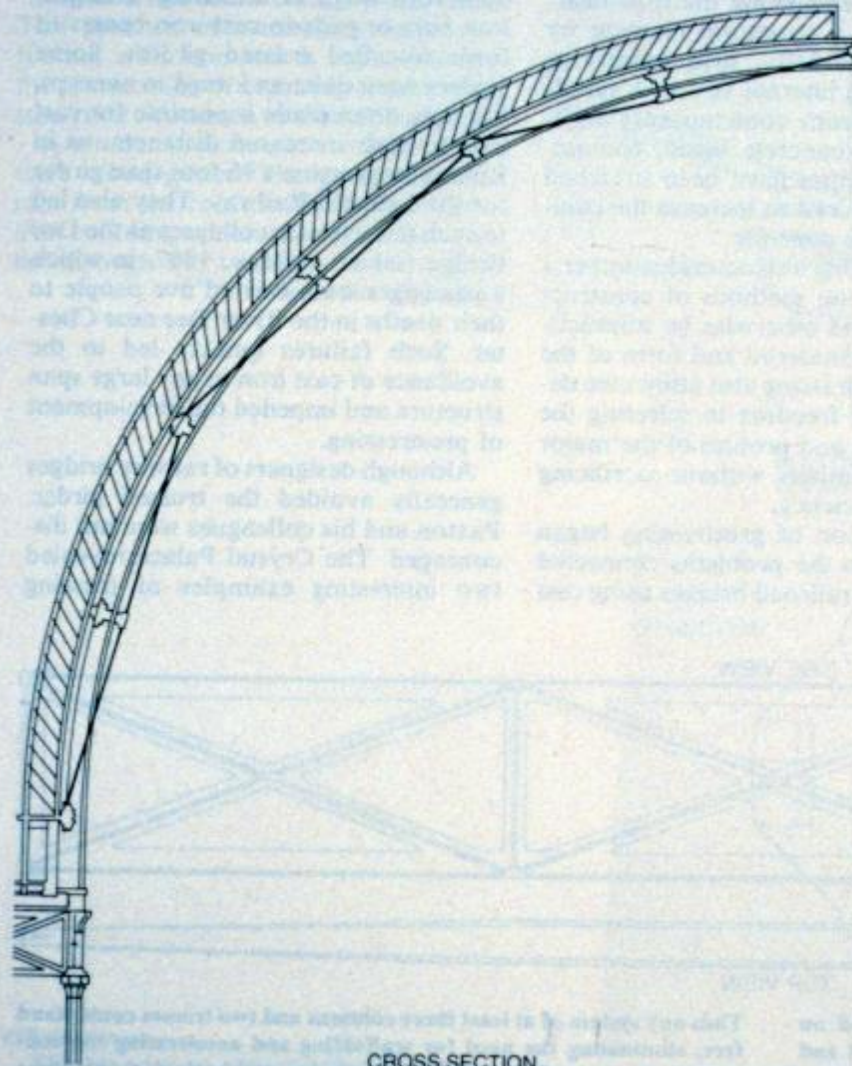
WROUGHT-IRON RODS provided a rigid support for the exterior walls of the Crystal Palace, which had an internal wall to stiffen it. Visible from inside and out (the interior view is shown here), these cross braces added to the building's strikingly contemporary appearance.

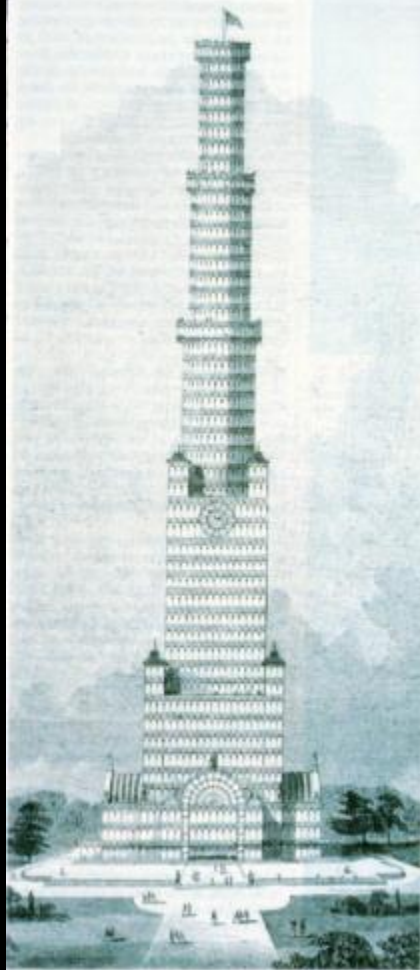


CLUSTAL WALLS





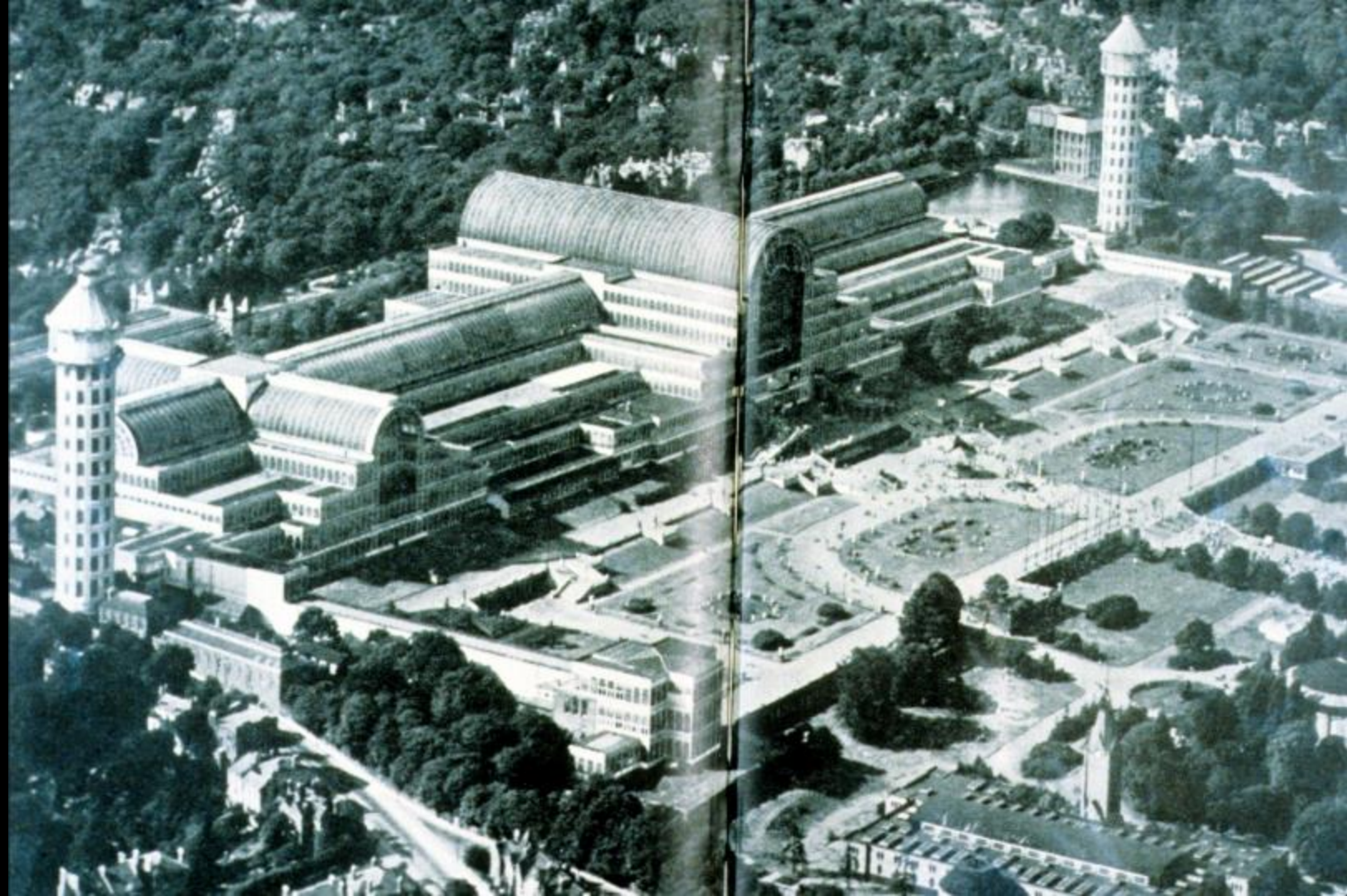




MODULAR CONSTRUCTION of the Crystal Palace prompted a contemporary of Paxton's to suggest that the modular units of the building be rearranged to form a 1,000-foot tower (left). A vertical



Crystal Palace would have been too heavy for its cast-iron columns; now steel beams make such buildings possible. At right is Skidmore, Owings & Merrill's Sears Tower, built out of stacked modular units.

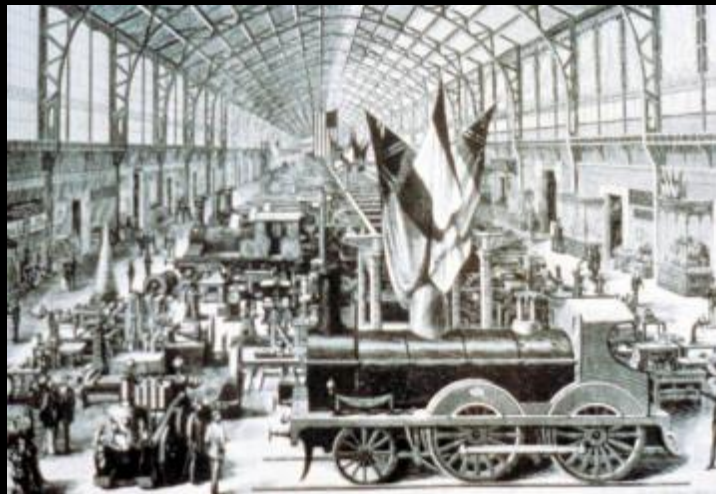




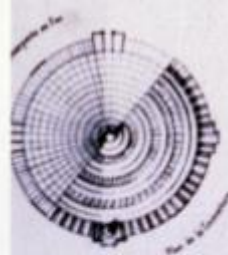








Plan Circulaire



Plan Elliptique

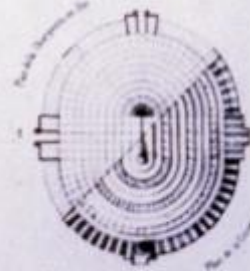
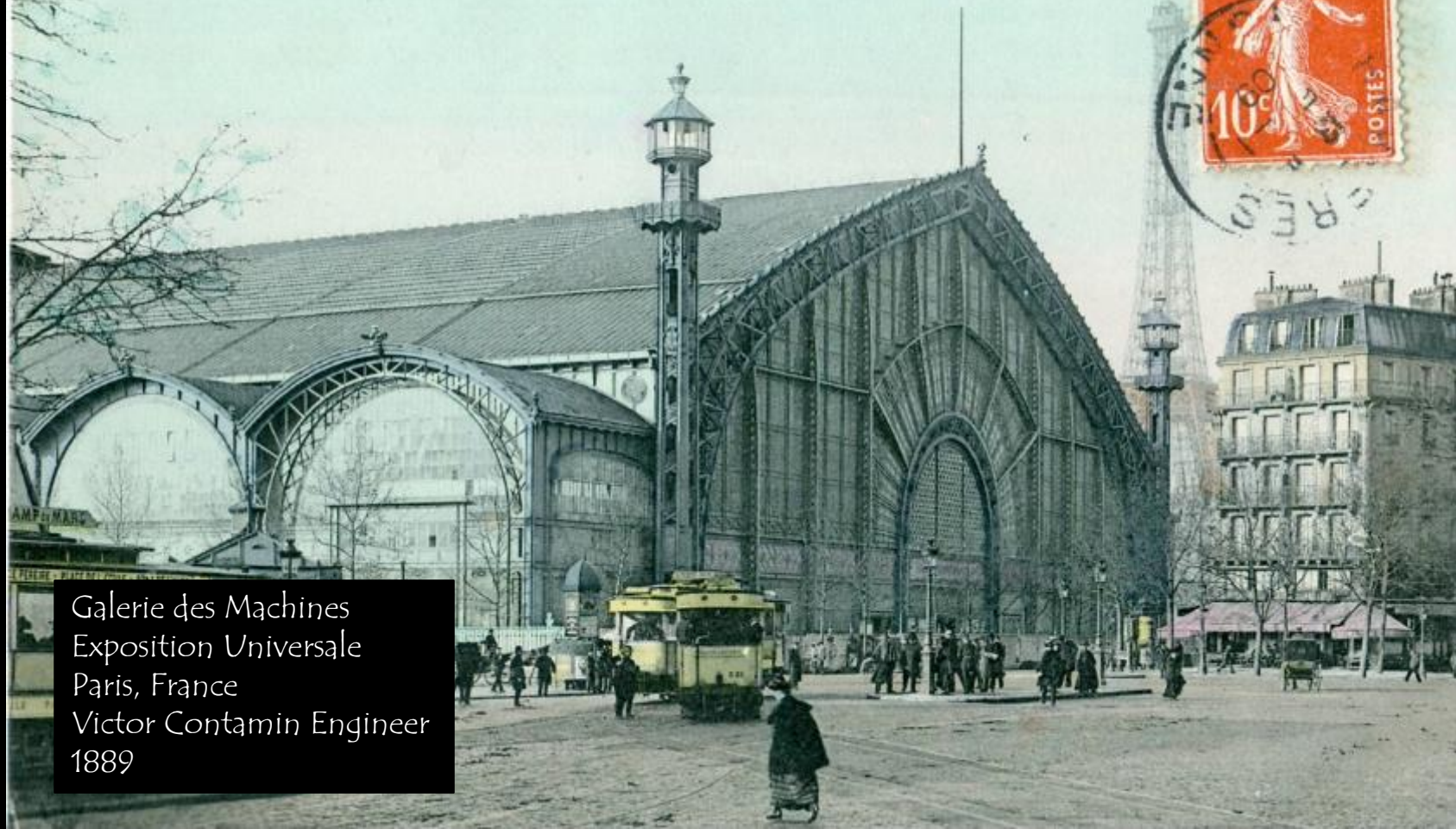


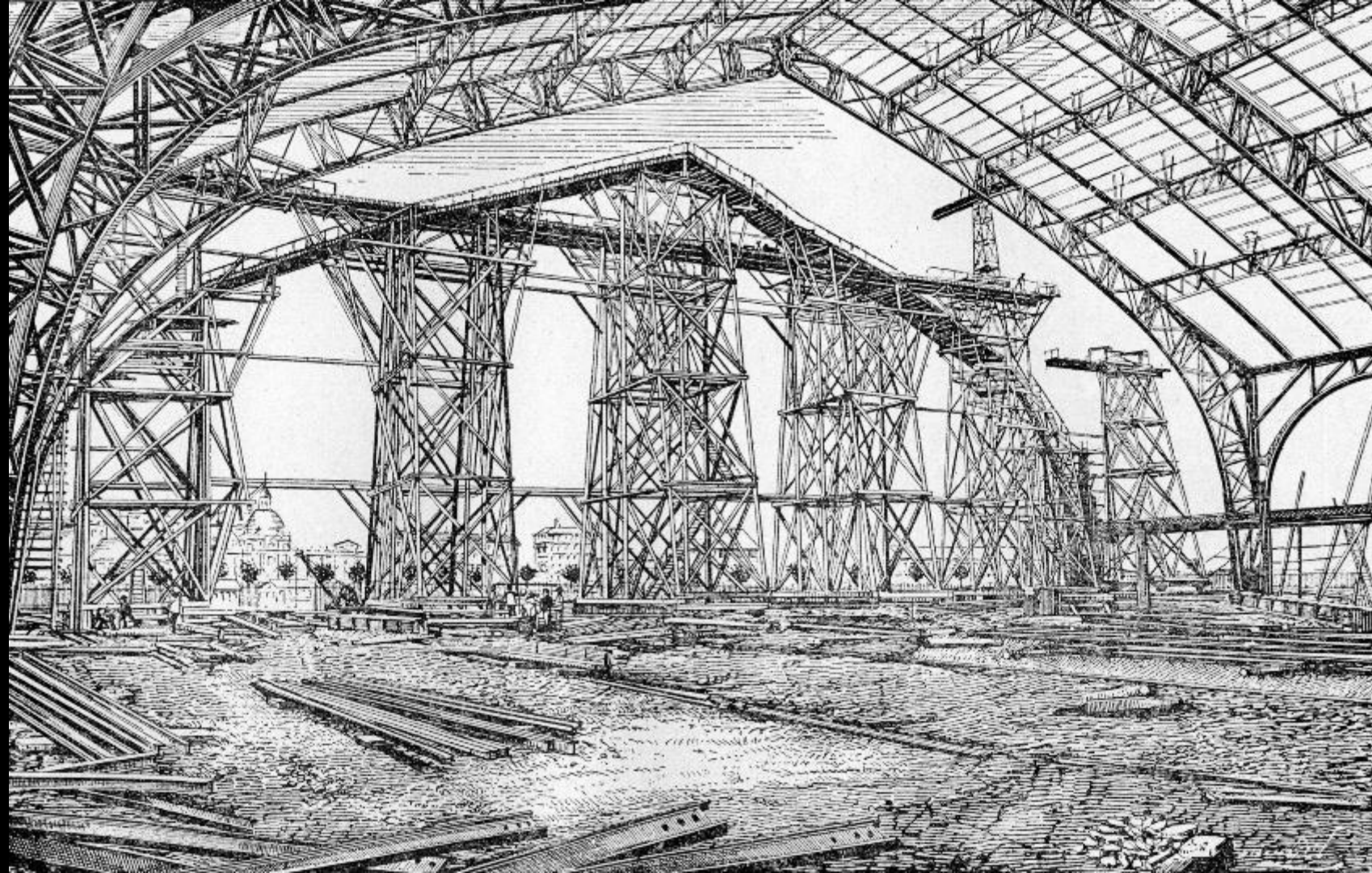
Plate 41. Paul Gricumard. Project for the International Exhibition Building of 1867, published in 1865 (Gricumard, pl. 1)

528. PARIS — Galerie des Machines C. L. C.

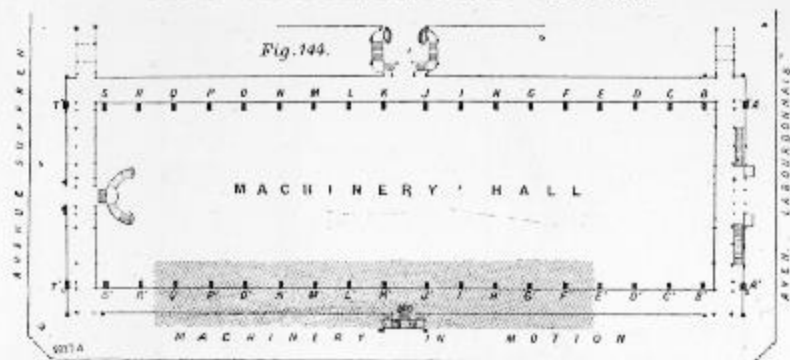


Galerie des Machines
Exposition Universale
Paris, France
Victor Contamin Engineer
1889





THE MACHINERY HALL.



PLAN SHOWING POSITION OF PIERS AND STAIRCASES. (See page 453.)

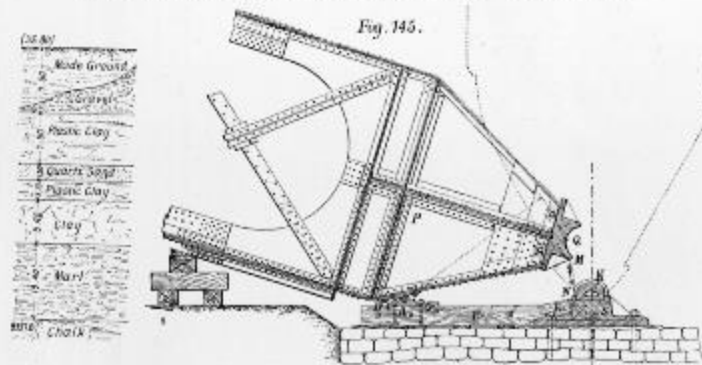
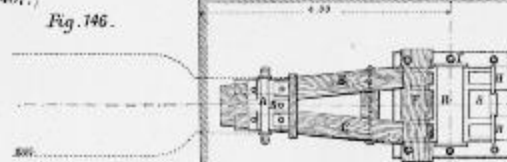


FIG. 147. (See page 457.)



MODE OF ERECTING PRINCIPALS. (See page 458.)

DETAILS OF ROOF OF MACHINERY HALL AND OF SIDE GALLERIES.

(For Description, see page 453.)

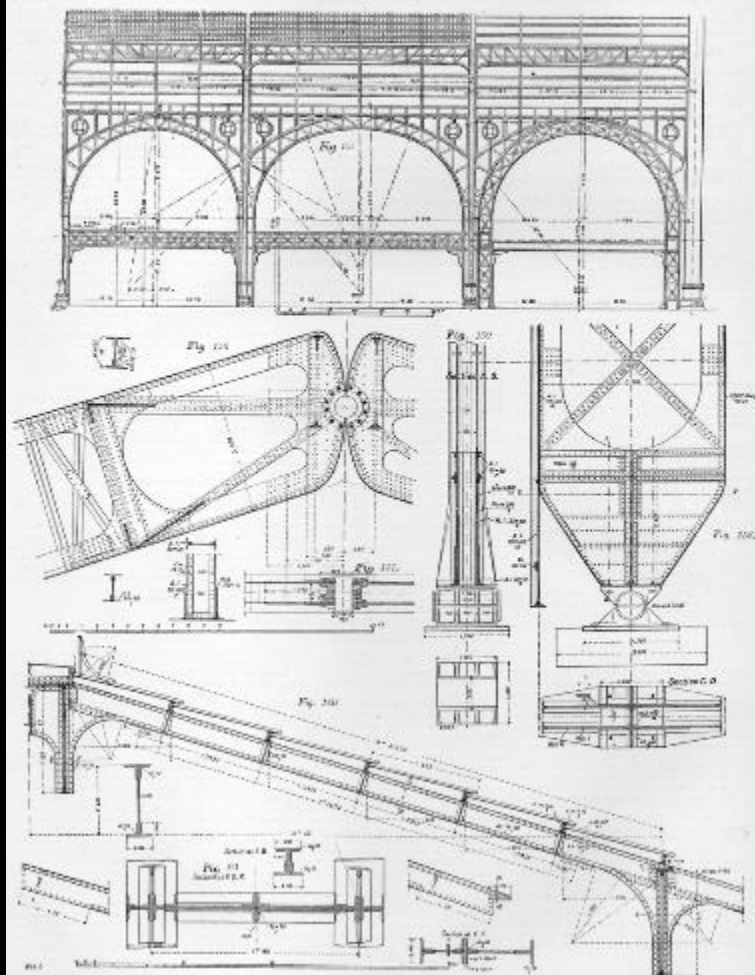
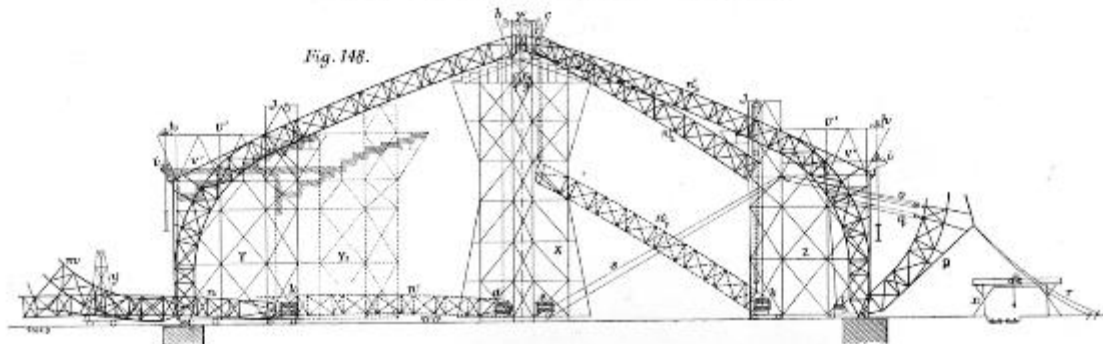
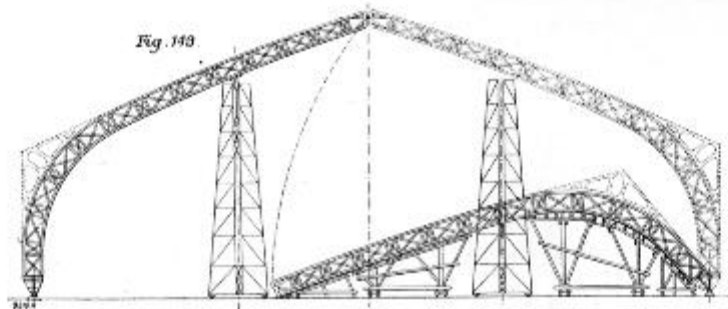


Fig. 148.



MODE OF ERECTING MACHINERY HALL ROOF; THE FIVES LILLE COMPANY. (See page 457.)

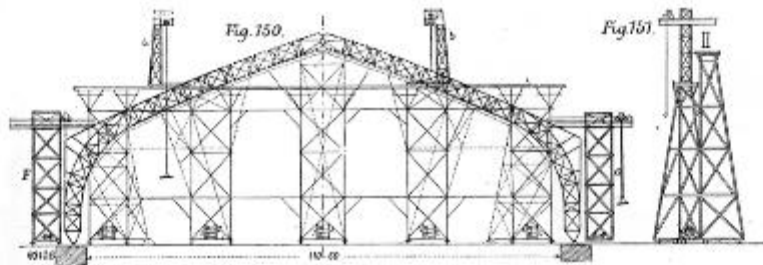
Fig. 149



PROPOSED MODE OF ERECTING MACHINERY HALL ROOF. (See page 457.)

Fig. 150.

Fig. 151.



MODE OF ERECTING MACHINERY HALL ROOF; WM. CAIL ET CIE. (See page 458.)

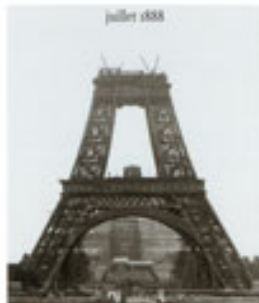


Eiffel Tower
Great Exposition 1889
Paris, France
Gustav Eiffel
324m

mai 1888



juillet 1888



septembre 1888



mai 1889



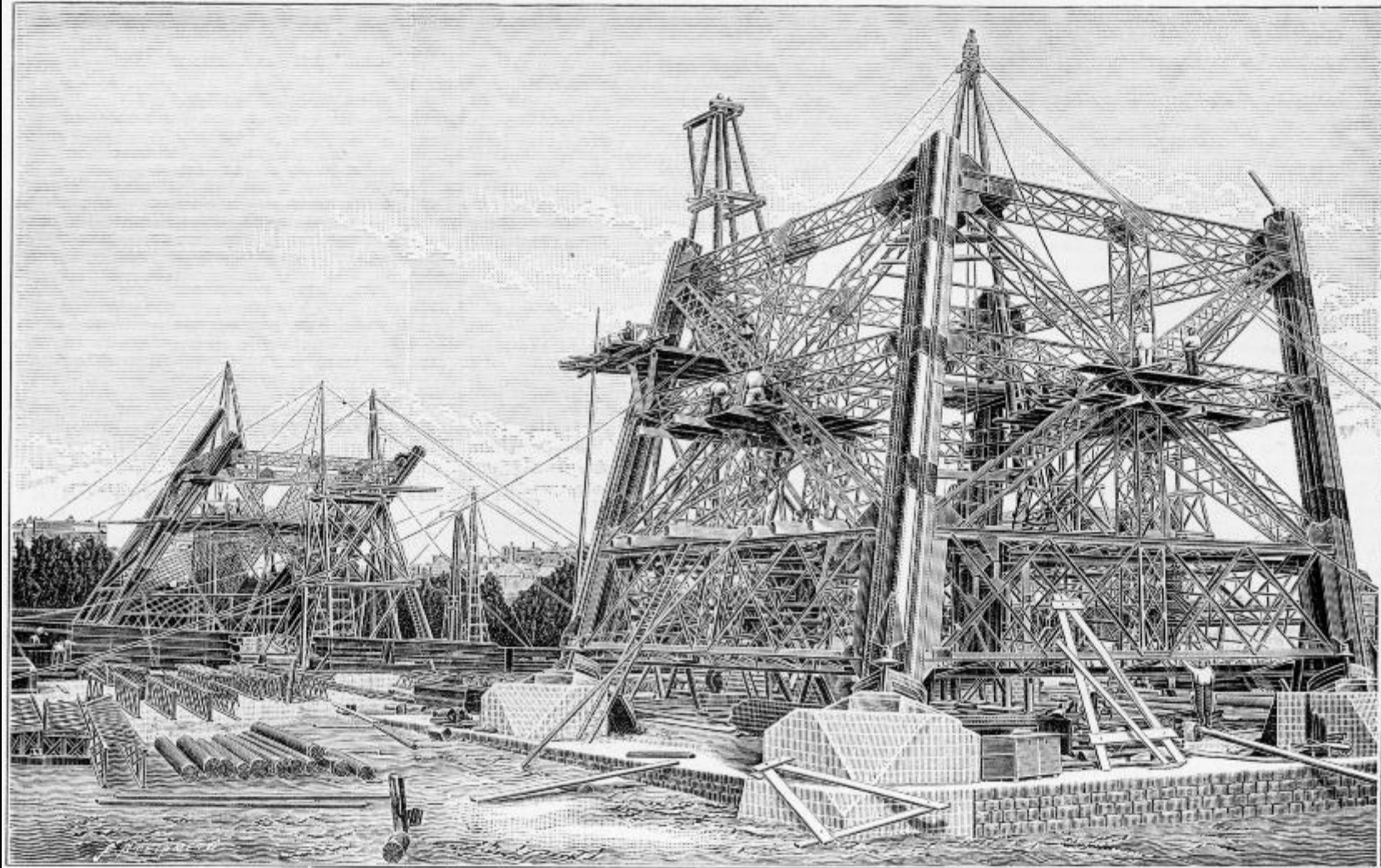
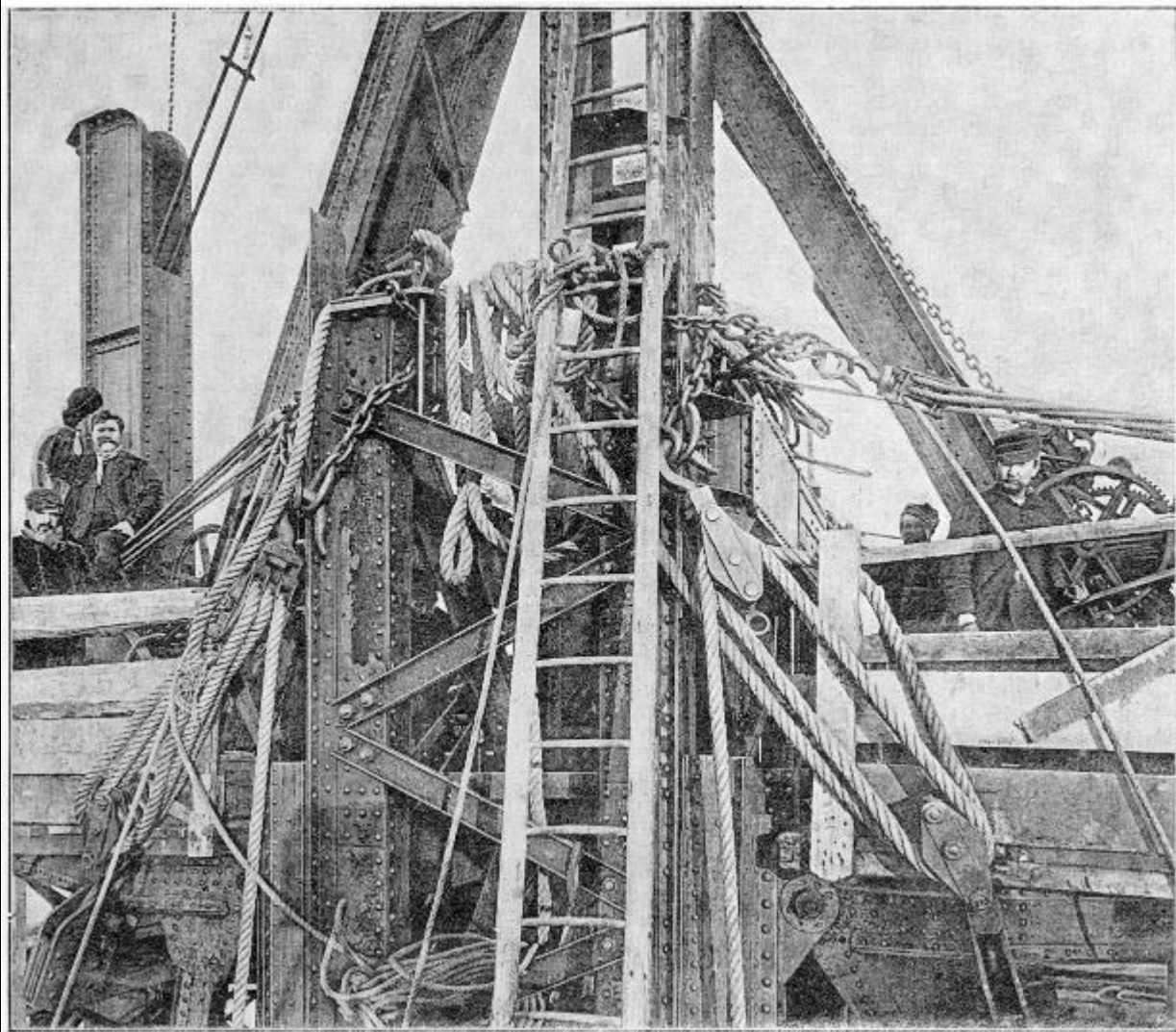
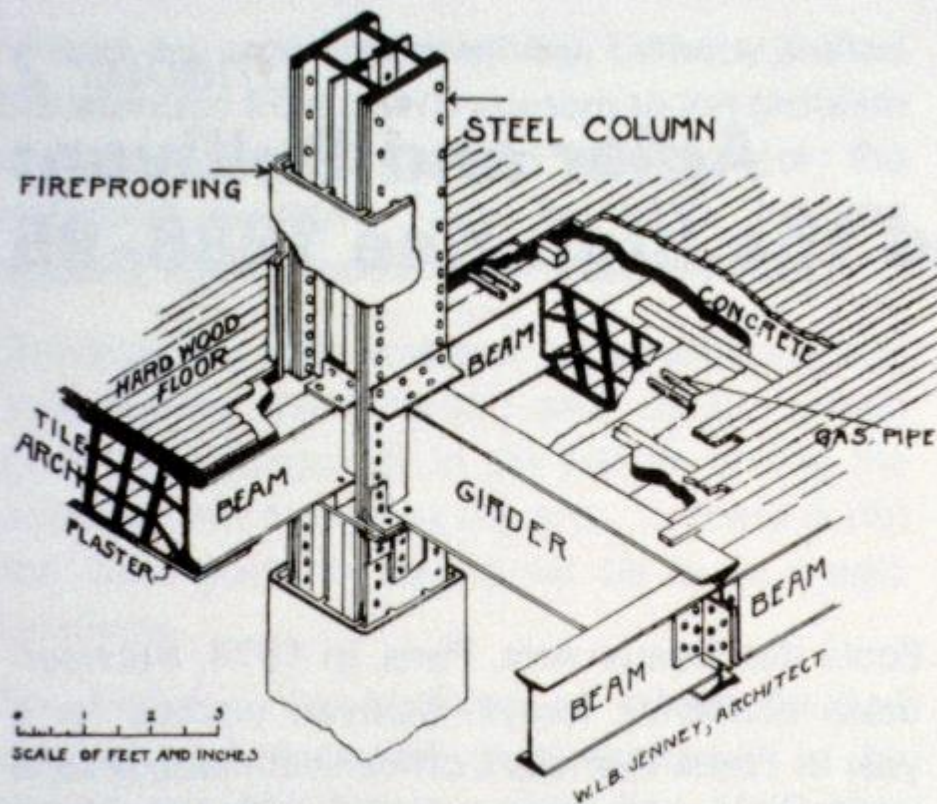
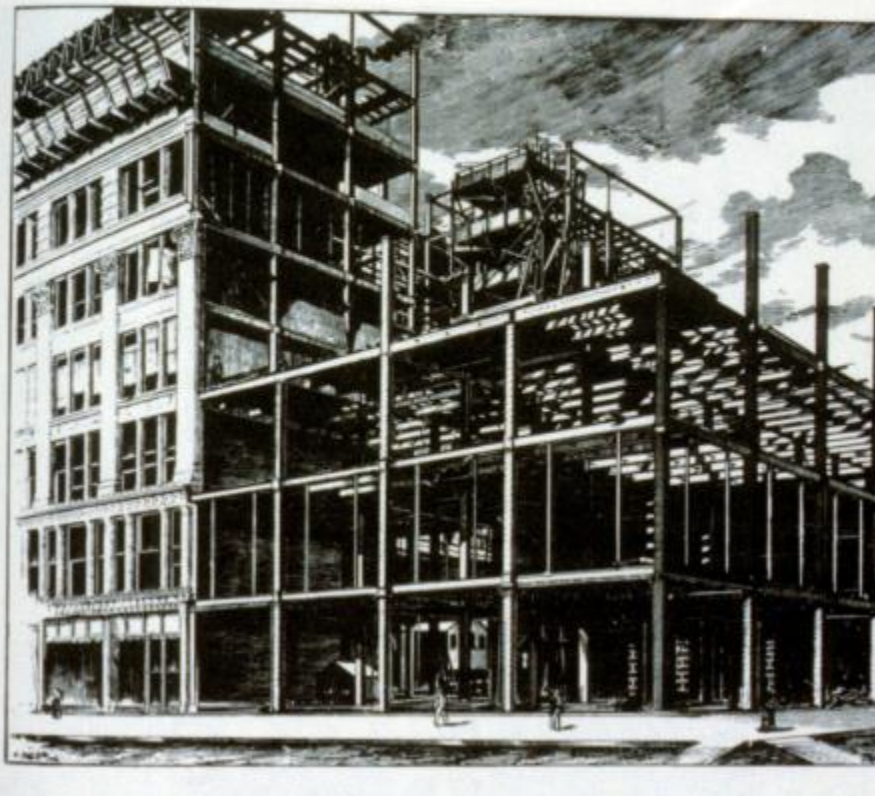


FIG. 37. THE EIFFEL TOWER, COLUMN NO. 4; SEPTEMBER, 1887.





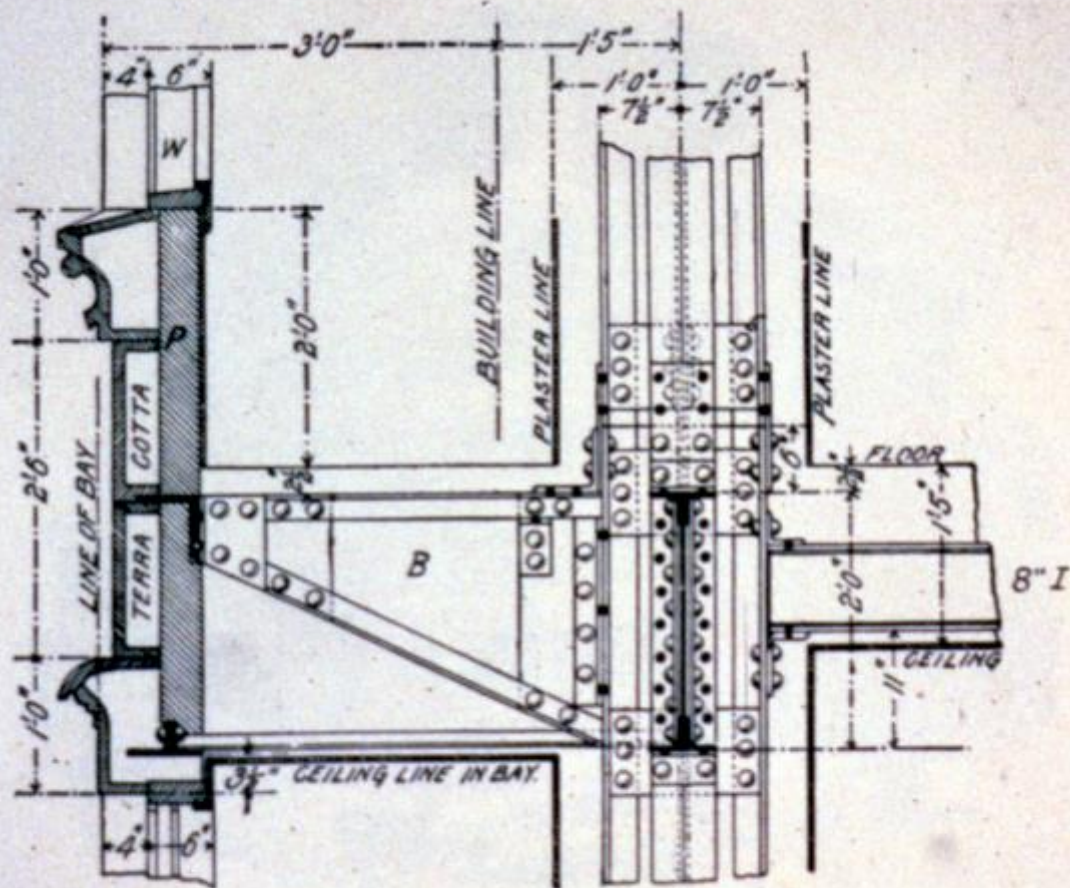
44. Fair (Montgomery Ward) Store, Chicago, Ill., 1890-91. William Le Baron Jenney, architect. Part of the steel and wrought-iron frame during construction.



32 Jenney, Fair Store, Chicago, 1890-91. Detail of fireproof steel-frame construction.



Reliance Building
Chicago, Illinois
Burnham, Root & Atwood
1895
First real curtainwall skyscraper



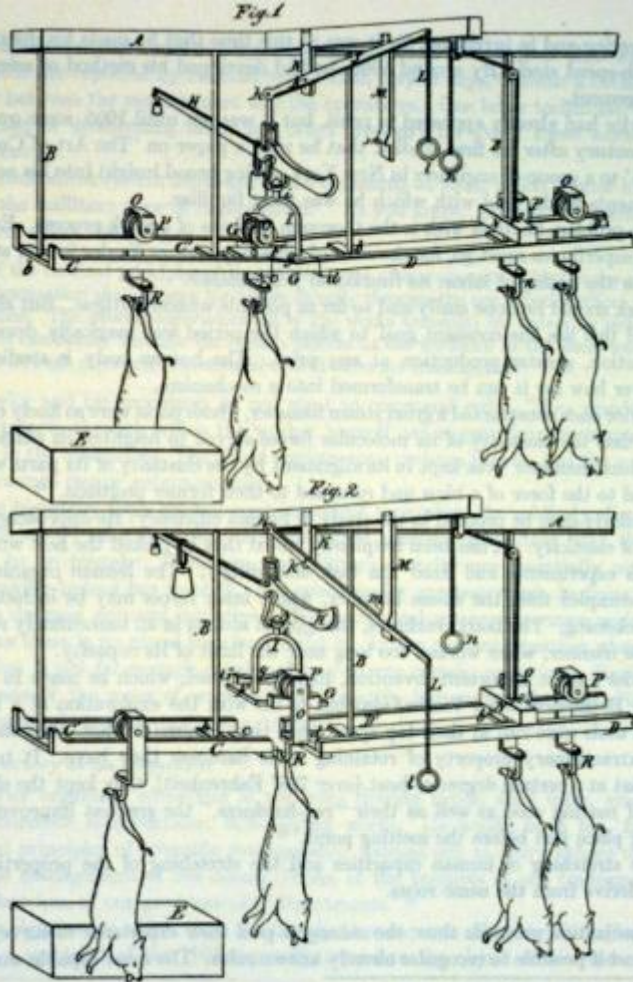
27 Atwood and Burnham, Reliance Building,
Chicago, 1890/94-95. Cross section of window bay.

MECHANIZATION
TAKES
COMMAND

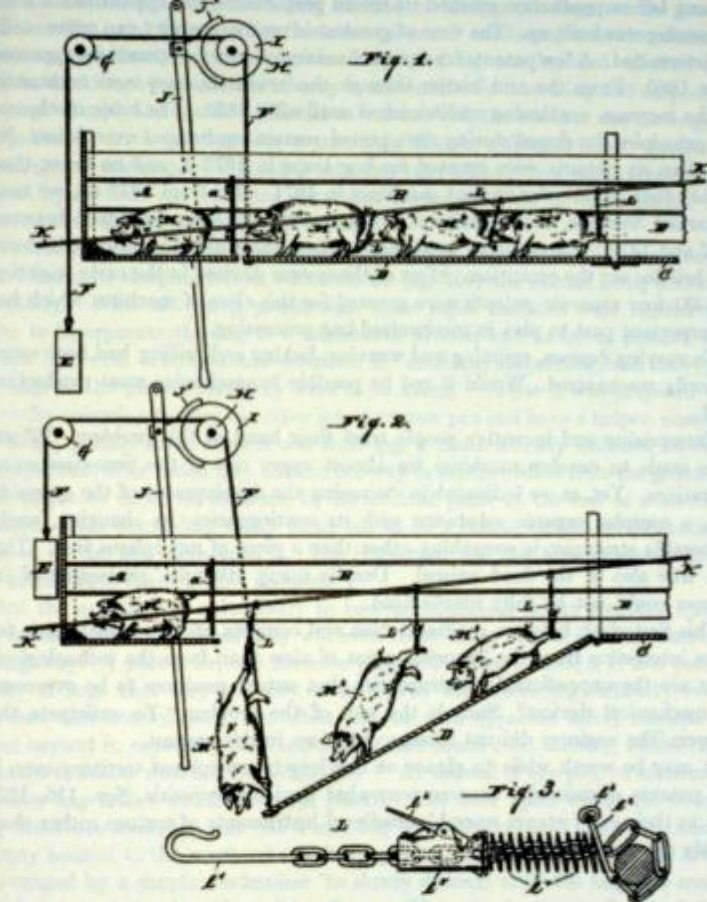
S. GIEDION



The Effects of
Industrialization



50. Automatic Hog-Weighting Apparatus for Use in Packing Houses. Cincinnati, 1869. This device invented by a Cincinnatiian shows that the late 1860's had considerable practice in combining the overhead railway with sections of the assembly line. (U. S. Patent 92,083, 29 June 1869)

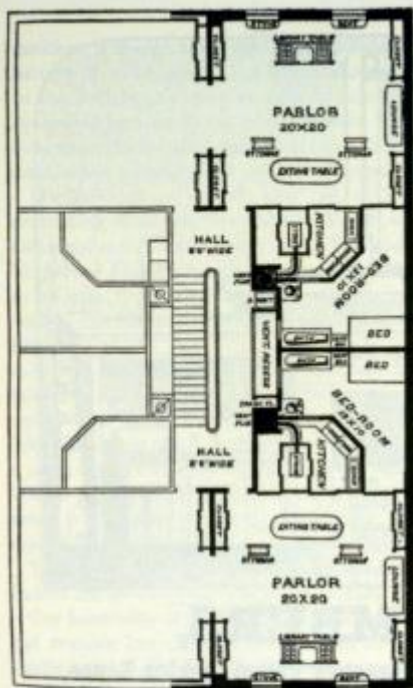


117. Apparatus for Catching and Suspending Hogs, 1882. Here the living animal must be introduced into the 'disassembly' line. From the 1870's on when stunning was found too slow, devices were proposed to hoist the hog to the overhead rail without struggle: 'The hog M acts as a decoy for the others, and much time and labor are thus saved. The brake is manipulated to allow the trap D to slowly descend until the hogs are completely suspended, when they slide off on the bar K to the place where they are to be killed.' (U. S. Patent 252,112, 10 January 1882)

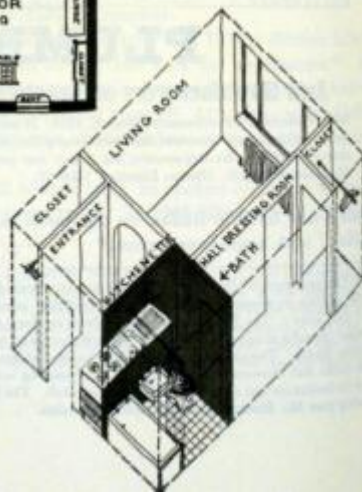
Residential Initiatives



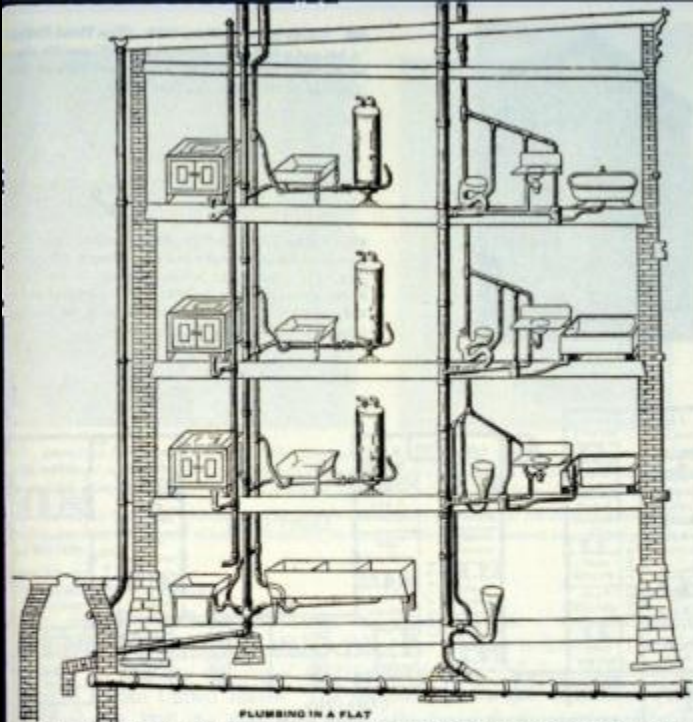
Prince Albert's Model Houses.



489. CATHERINE BEECHER: Plan of a City Flat, with Built-in Bedroom, Kitchenette, and Bath, 1869. Just as Catherine Beecher's kitchen anticipates the present-day kitchen in its arrangement (fig. 334), her layout of a city flat realizes, in primitive form, the unit of bathroom, bedroom, and enclosed kitchenette. (The American Woman's Home, 1869)



490. One-Room Apartment with Kitchenette and Bath Back to Back, 1930's. Left of the entrance, a closet; to its right, an open kitchenette, which a wall separates from the bathroom. This wall carries the fixtures for both. (850 Seventh Avenue, New York. Sketch by Florence Schust)



491. Chicago Apartment-House Plumbing, 1891. The Chicago apartment houses of the 'nineties, which incorporated the most advanced standards, already show the fixtures aligned along one wall, but not in the most compact way. The bathtub is still set against the long wall. Later it will be turned 90°, as will the toilet. (Industrial Chicago, 1891)

Like Pullman's sleeping car *The Pioneer* (1865), this marked an important step toward the democratization of comfort, when a middle-class hotel was built around a standard living unit of bedroom, bath, and closet. In Europe, even today, the combination of a room with private bath borders on luxury. Putting into practice the maxim 'a bath to every bedroom' immediately influenced the whole plan (figs. 492-4), and was as decisive for the hotel as the organization of the bath and kitchen for the plan of the private house. At once the standard American layout had appeared: The bath is a cell and an appendage to the bedroom.

Le Corbusier's 5 points of Architecture

2. Free Facade

non-supporting walls that could be designed as the architect wished

4. Roof Terrace

compensate for the green area consumed by the building and replacing it on the roof

3. Ribbon Window

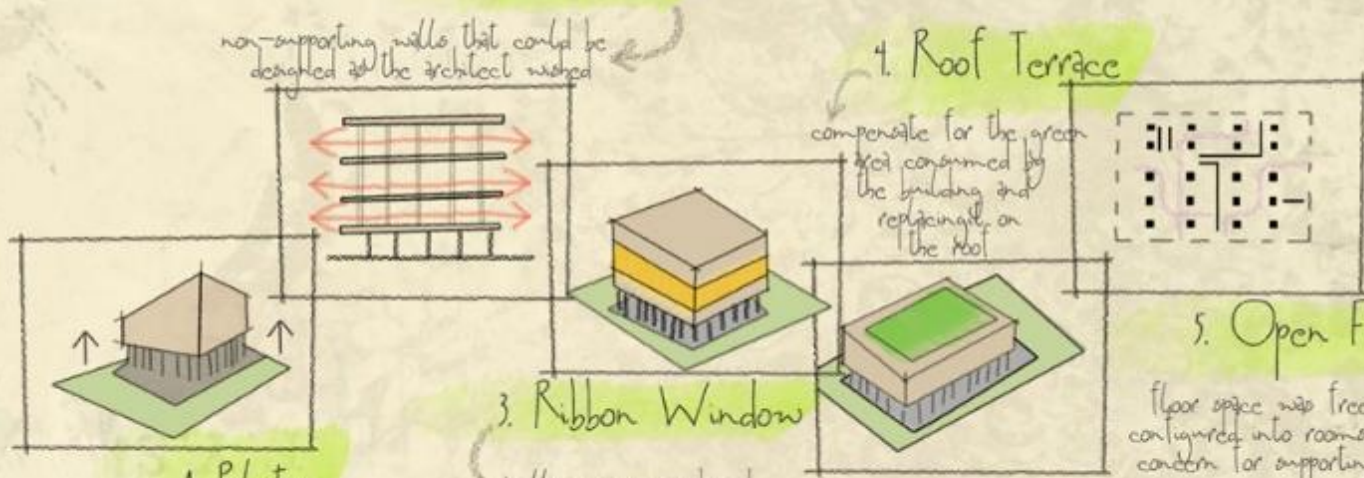
allow unobstructed views of the large surrounding

5. Open Floor Plan

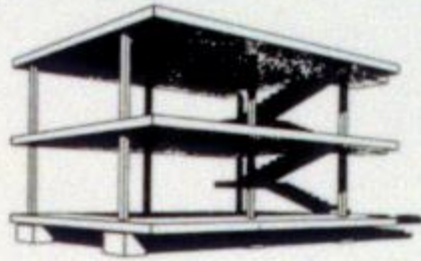
floor space was free to be configured into rooms without concern for supporting walls.

1. Pilotis

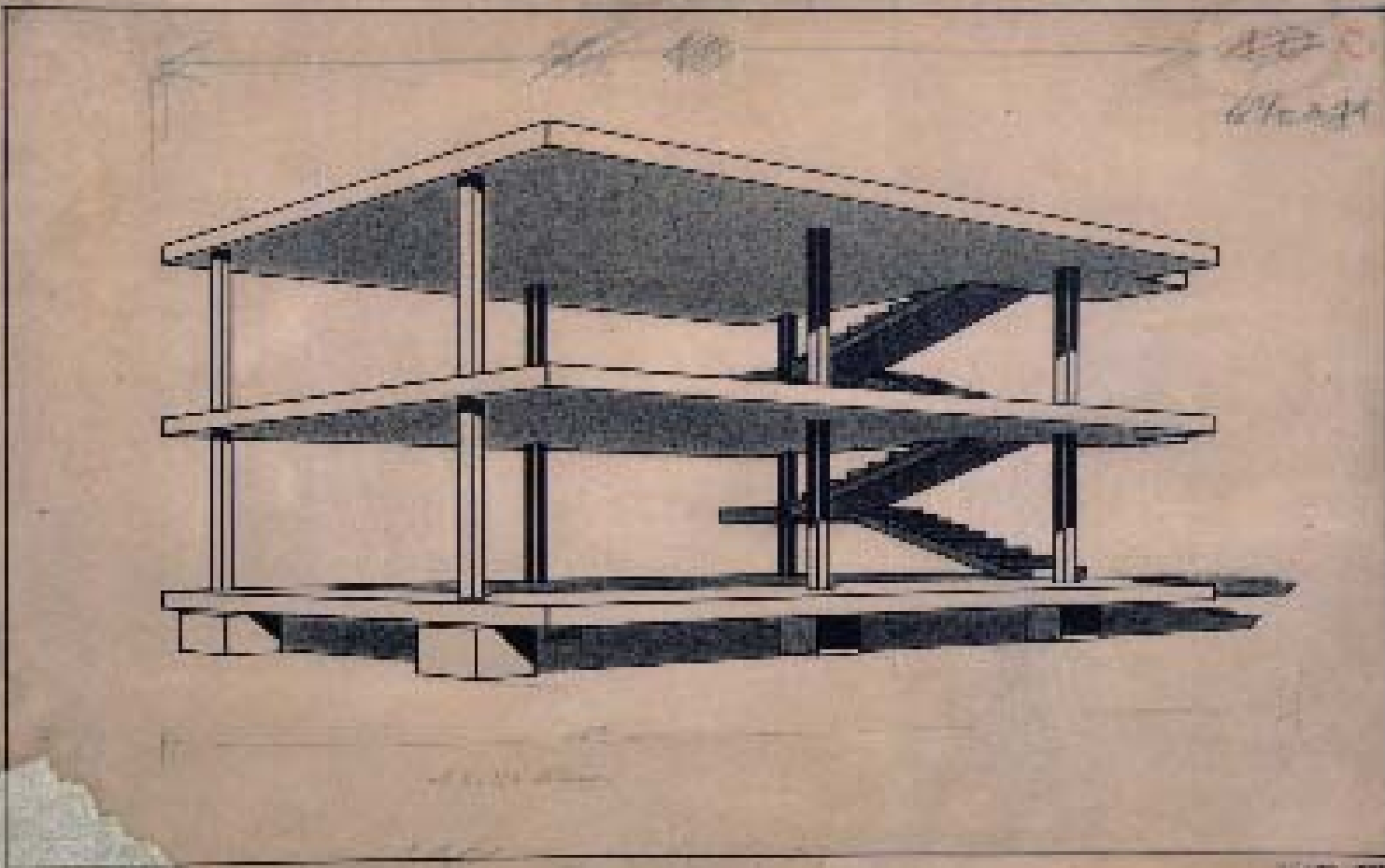
provides structural support



Le Corbusier
Swiss/French Architect
1887 to 1965



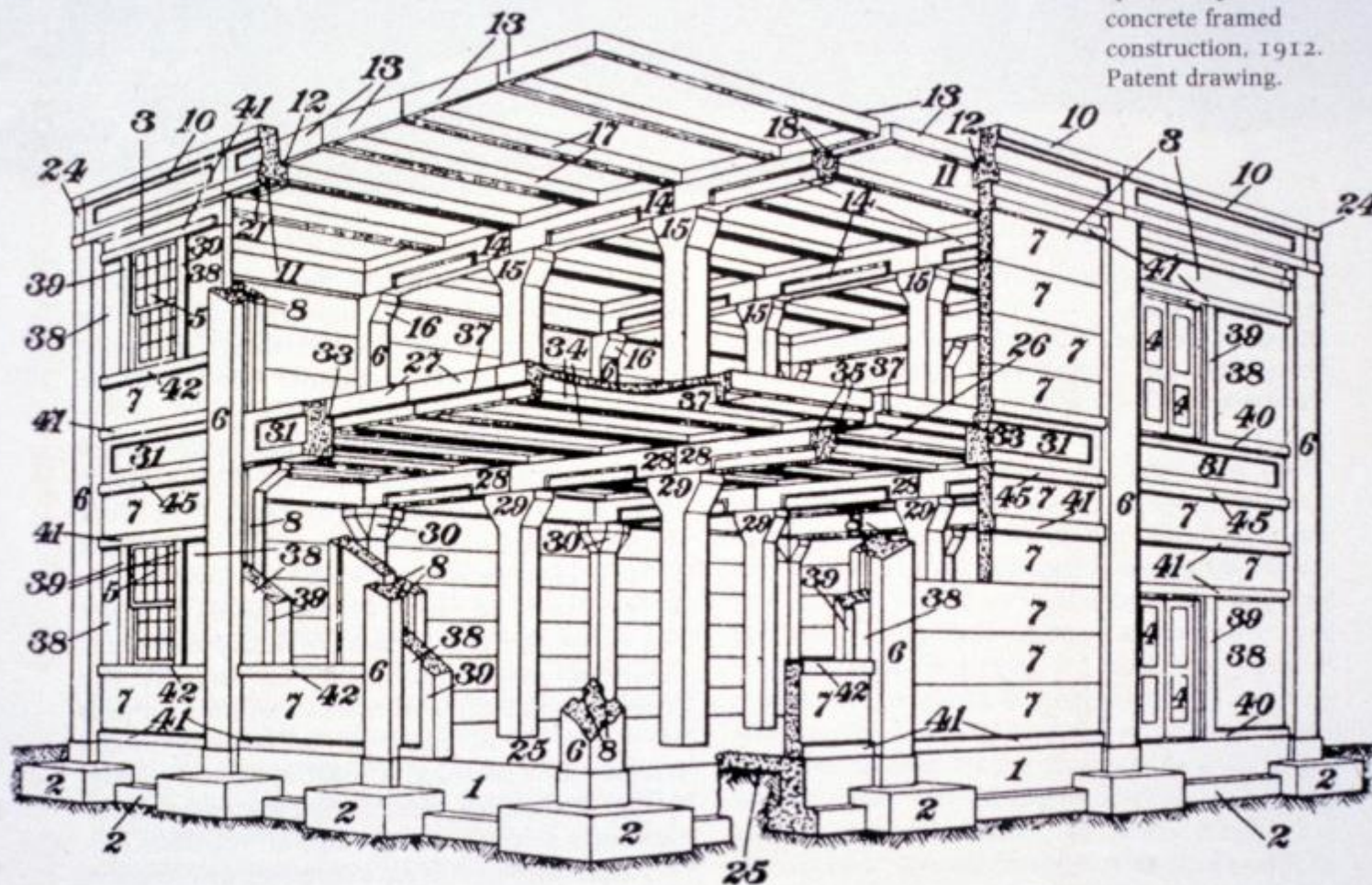
“In the next twenty years, big industry will have co-ordinated its standardized materials . . . technical achievements will have carried . . . methods of rational construction far beyond anything we are acquainted with.”
—Le Corbusier, 1914



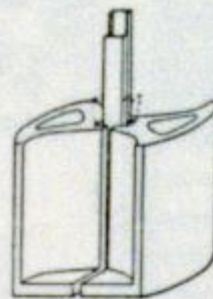
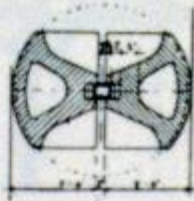
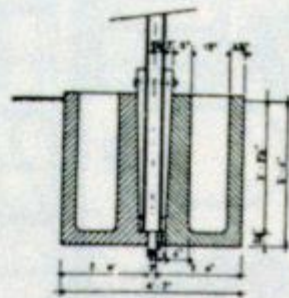
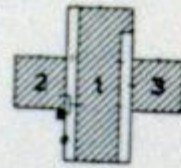
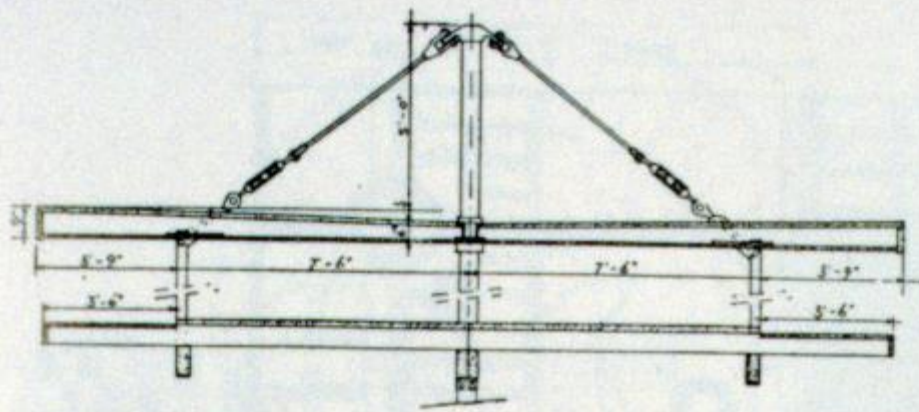
(C) FLC

10209

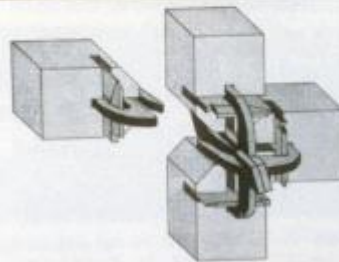
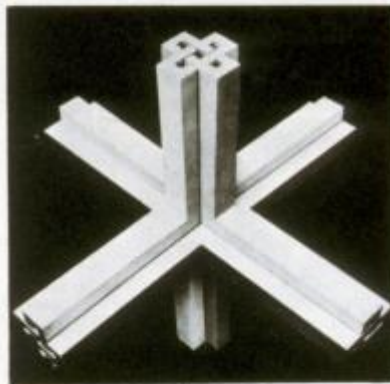
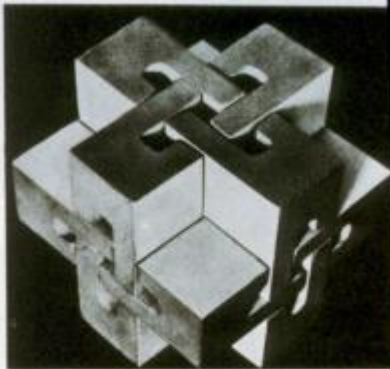
4.10 Conzelman
system of precast-
concrete framed
construction, 1912.
Patent drawing.



The Birth of Modular Design



155 Neutra, One-Plus-Two prefabricated extendable family house, 1926.
Details of structural support and assembly pattern.



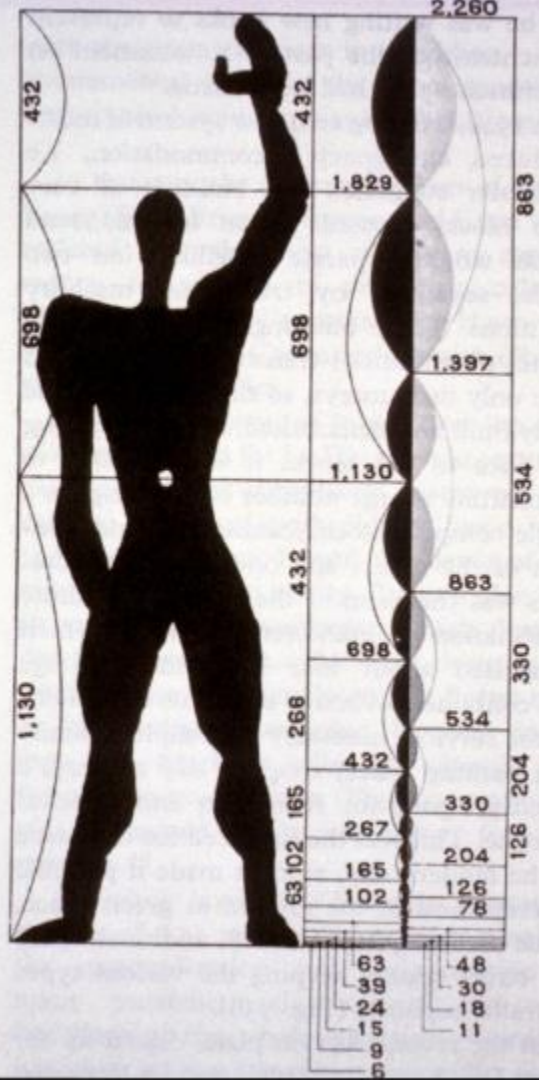
819-822 Details of the packaged house system worked on by Gropius and Wachsmann in 1942 for the General Panel Corp. (from K.W. The Turning-point of Building)

Le Corbusier

LE CORBUSIER

LE MODULOR

THE MODULOR



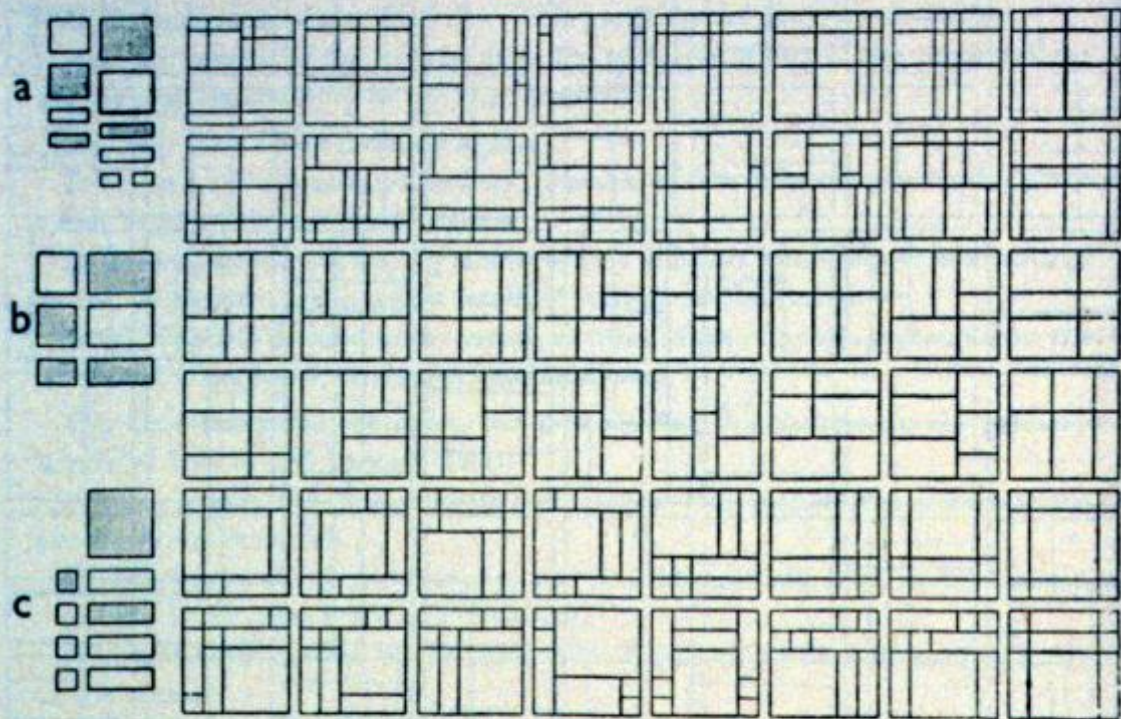
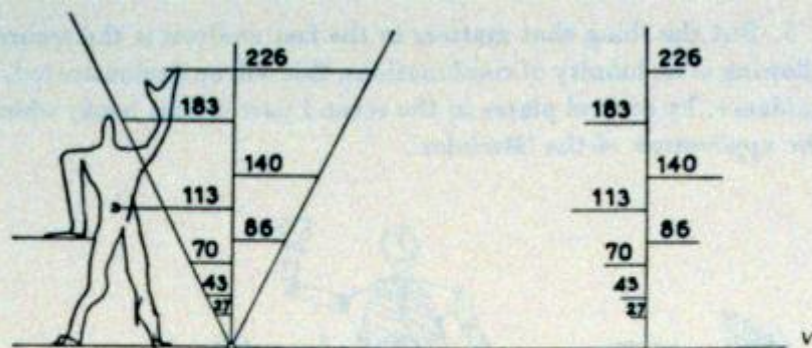


FIG. 40

FIG. 25



They may be drawn as follows:

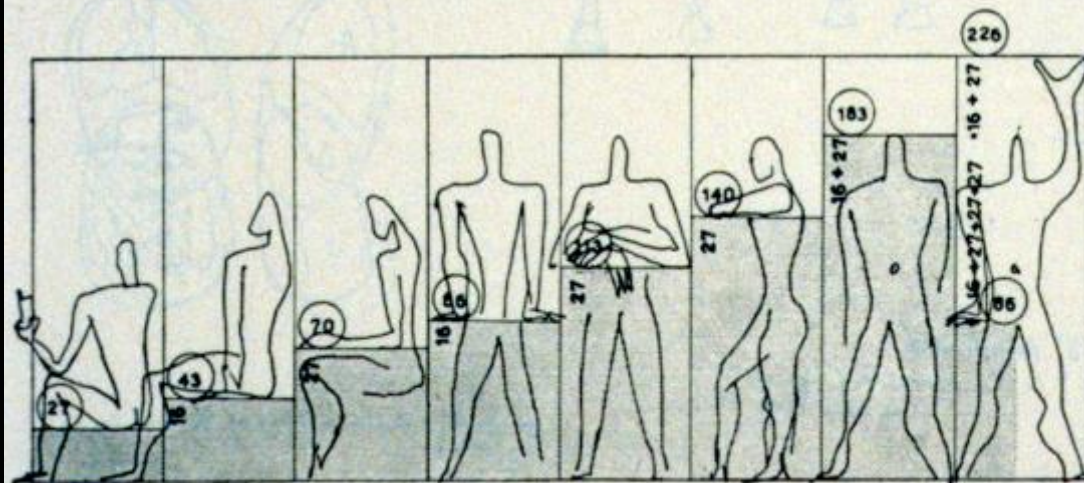


FIG. 26

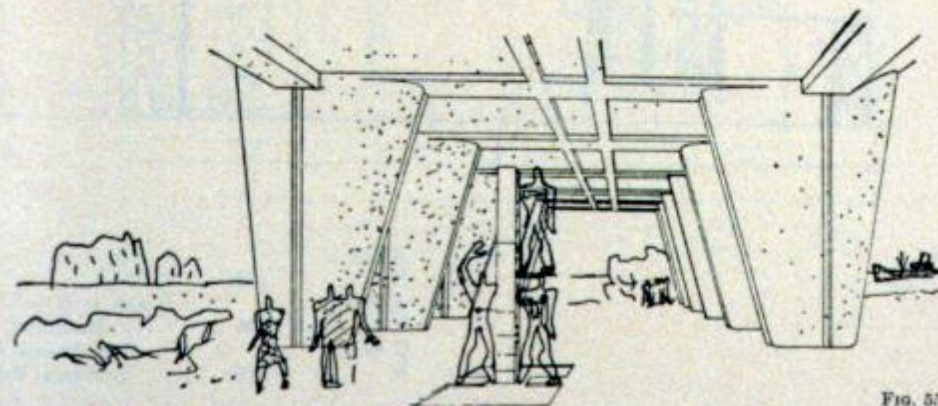
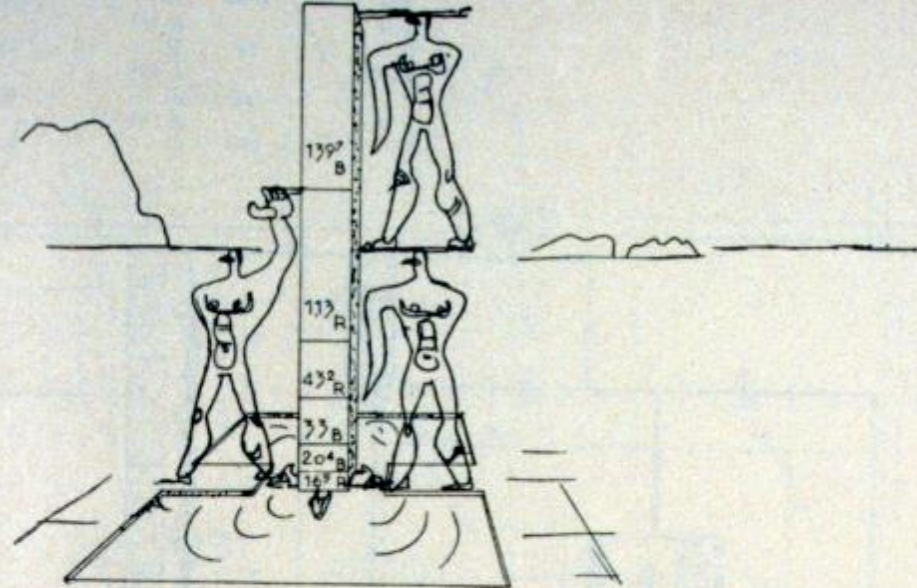
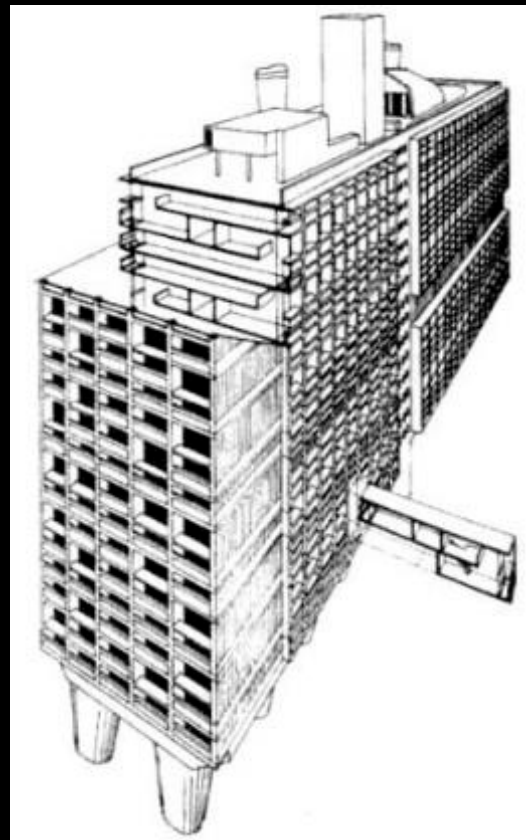
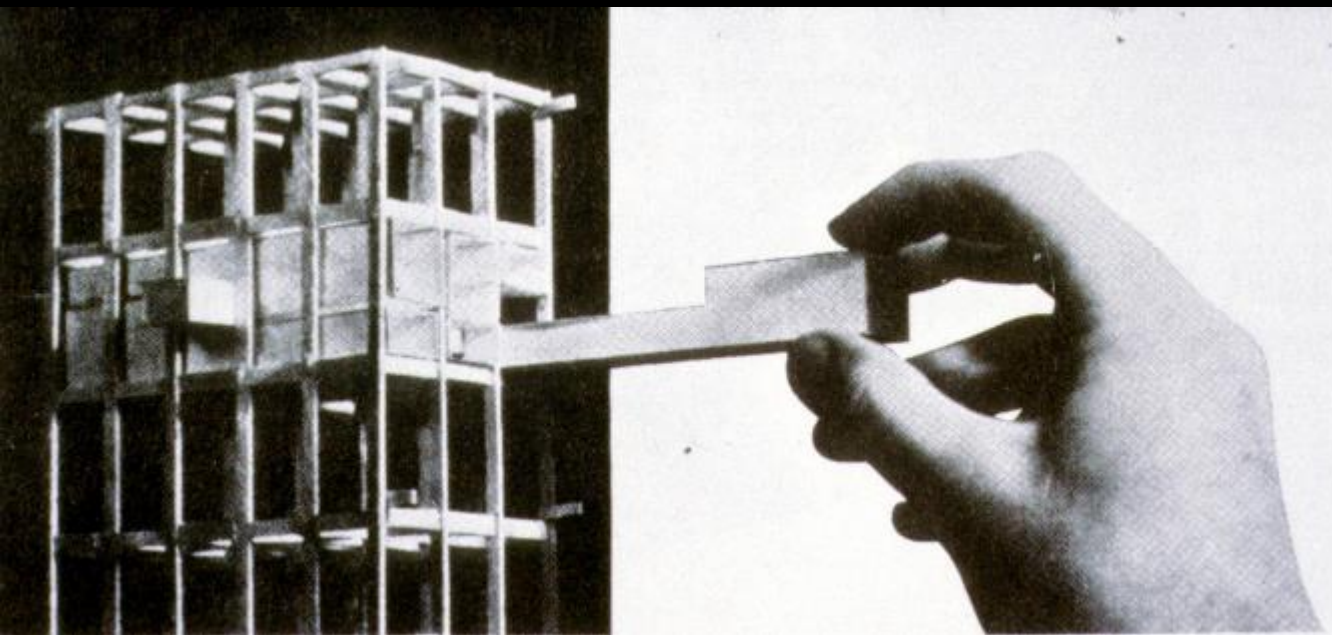


FIG. 55



Unité d'habitation
Marseille, France
1947 to 1952
Le Corbusier





Series		
	Red	Blue
A	65 ³	
B	165 ³	
C		20 ³
D		33
E	43	
F		53
G	70	
H		86
I	113	
J		226
K	296	
L		336
M	419 = L + F	

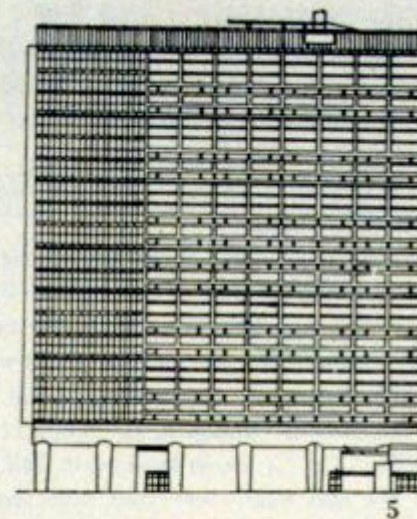
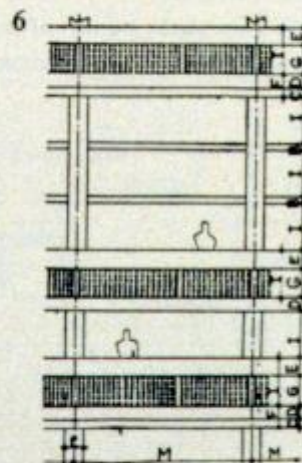
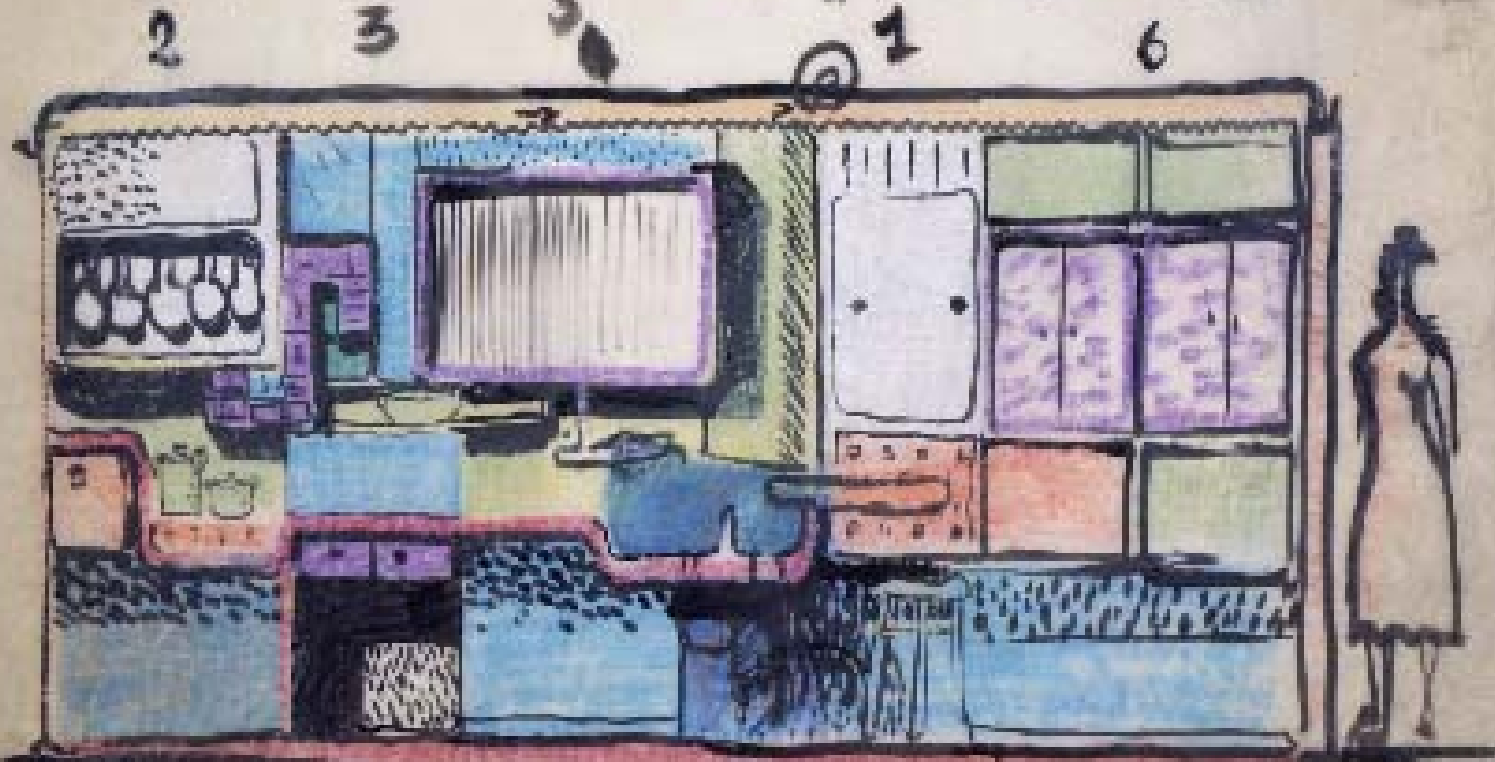
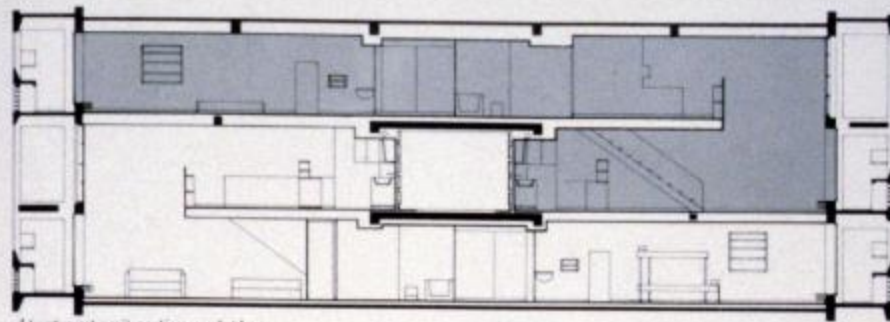


FIG. 50

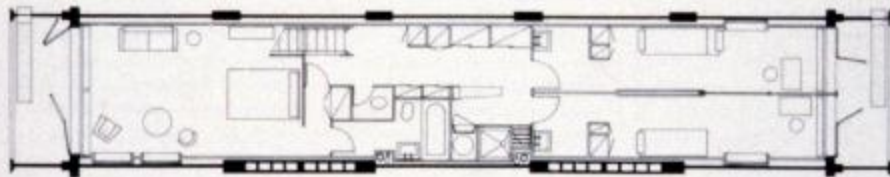
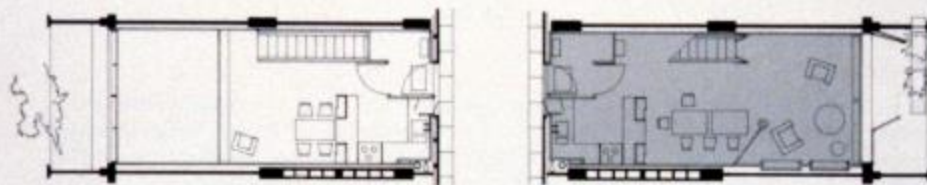
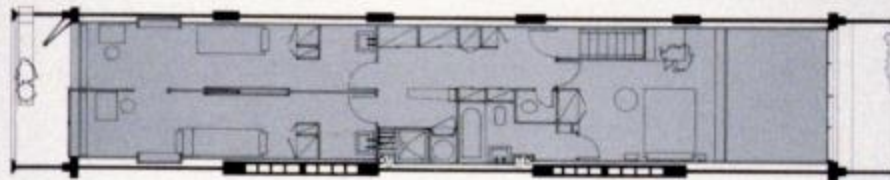
Development. Cuisine



* LA CUISINE (cuisine) placards et rangement (1 table de préparation - Réfrigérateur - Freezer) Placards 6 porte



Apartment unit section and plans.

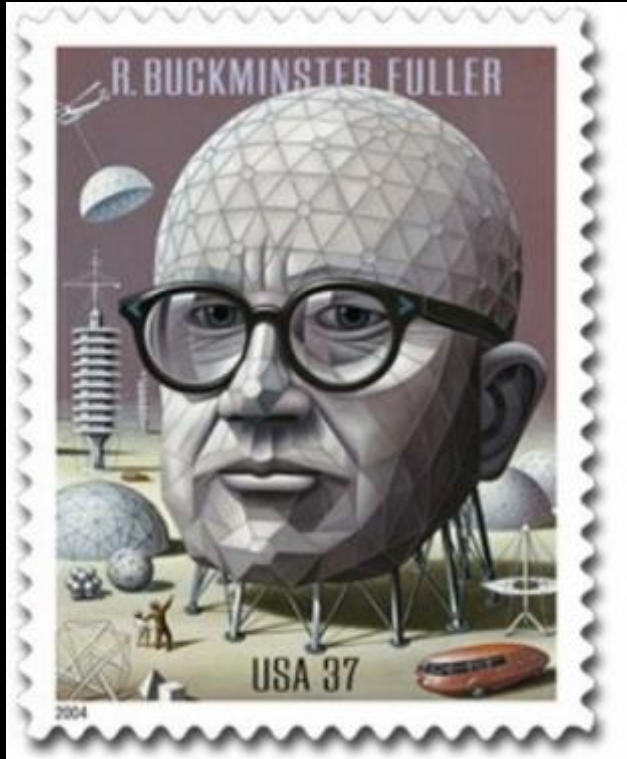




3

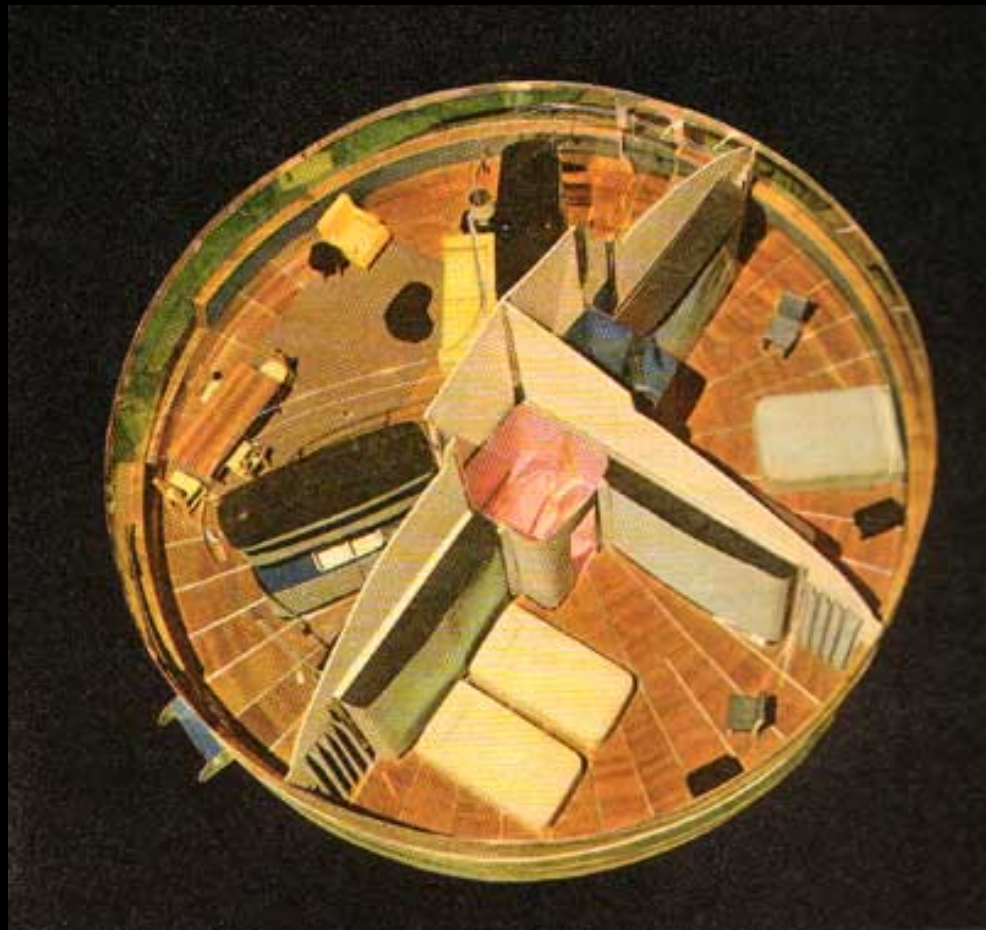
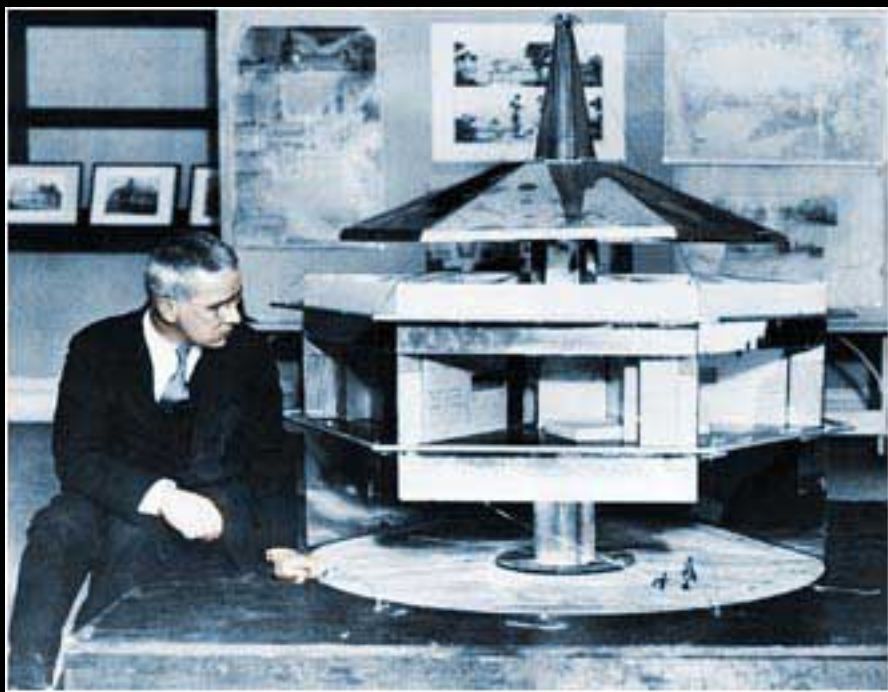
2

1



Buckminster Fuller
American Architect
1895 to 1983

Buckminster Fuller's dymaxion principles
signified "dynamism plus efficiency"





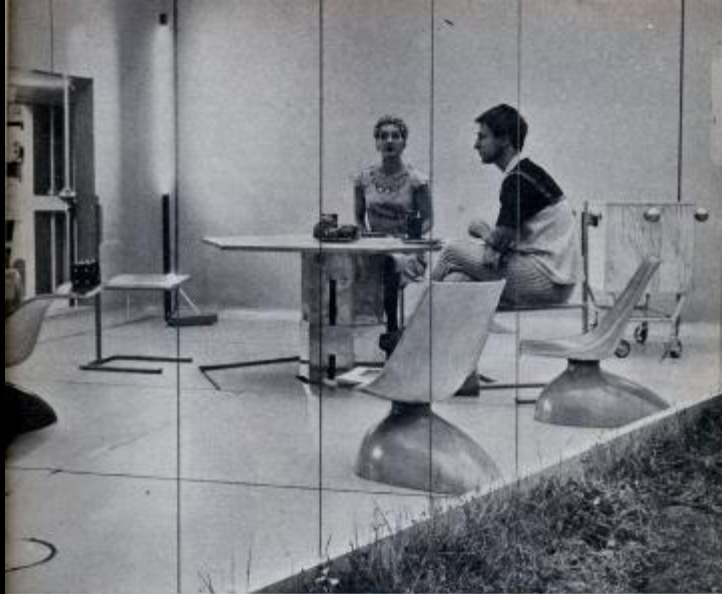






BY
H. Philip Churchill
ATTORNEY





Main room of 1980 home adjoins central garden. The dining table can sink into floor.

1956 – Peter and Alison Smithson's
"house of the future"



Short-wave transmitter with push buttons
controls radio-phonograph-color TV set.

This is a House?

British architects have designed this Home Of The Future to prove that living will be much easier in the brave new world of tomorrow.

STAR of the London Daily Mail Ideal Home Exhibition of 1956 was this eye-opening Home Of The Future designed by architects Alison and Peter Smithson. It is a one-bedroom town house that contains a garden within it. The shell is moulded of plastic-impregnated plaster and the roof is covered with aluminum foil to reflect the sun's









The Jetsons
1963



"custom" vs "off-the-shelf"
repeated elements

LIFE IN A CHINESE KITE

Standard industrial products assembled in a spacious wonderland



Design by Eames about flexibility of frame, every area of rectangular blocks of pattern

The sparkling construction shown on these pages happens to be the place where one of America's foremost young designers and his wife are living the close of their lives. More important, it is also one of the most advanced house structures built in this country to date.

So far as Charles Eames is concerned, there is no reason why a house should not be:

- ▷ Spacious—space being the greatest luxury there is;
- ▷ A sophisticated industrial product;
- ▷ And as light and airy as a suspension bridge—as skeletal as an airplane fuselage.

Having got this straight in his own mind, Eames asked himself these questions: How cheap is space? How industrial is our building industry? How light is steel?

LOCATION: Santa Monica, Calif.
CHARLES EAMES, Designer
SYMPORE, CARL SALZMAN, INC., General Contractor

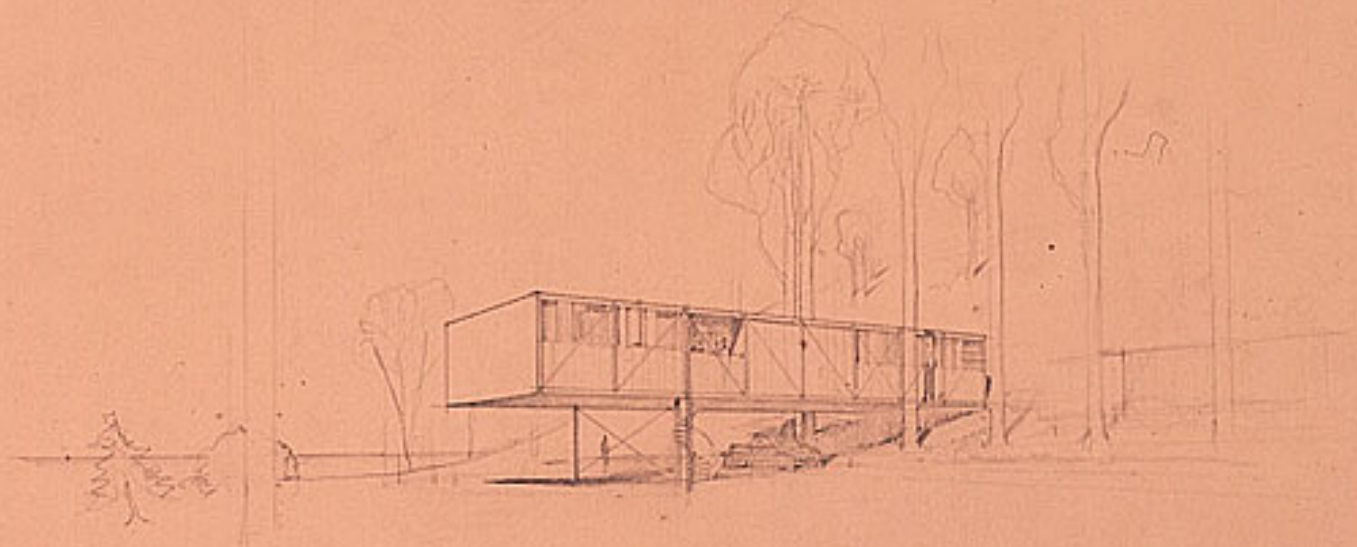


Twenty living room suspended from steel wire. Eames-designed suspended ceiling is capable of opening, lowering and, standing up, redefining interior space.

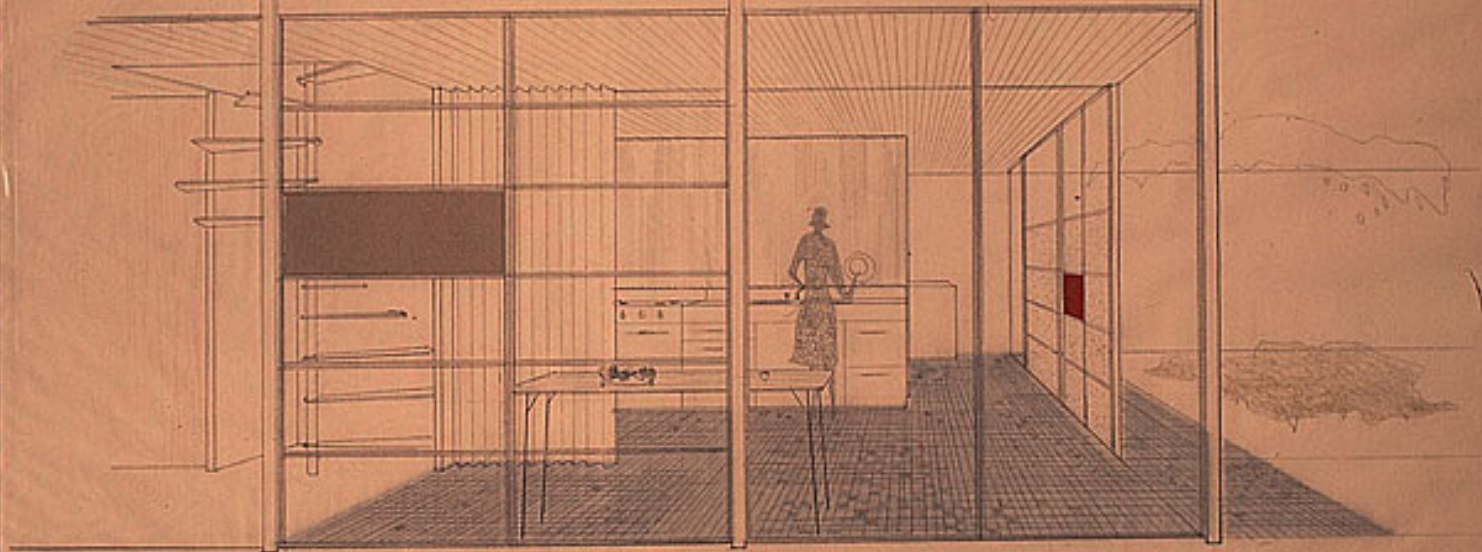
Porch is made from steel and is built on a concrete foundation. It is built on a concrete foundation. It is built on a concrete foundation.

*Designed and built for the Case Study House program of the University of California, Berkeley.

Case Study House No. 8 Pallisades, California Charles and Ray Eames 1949



Bottom Page 9



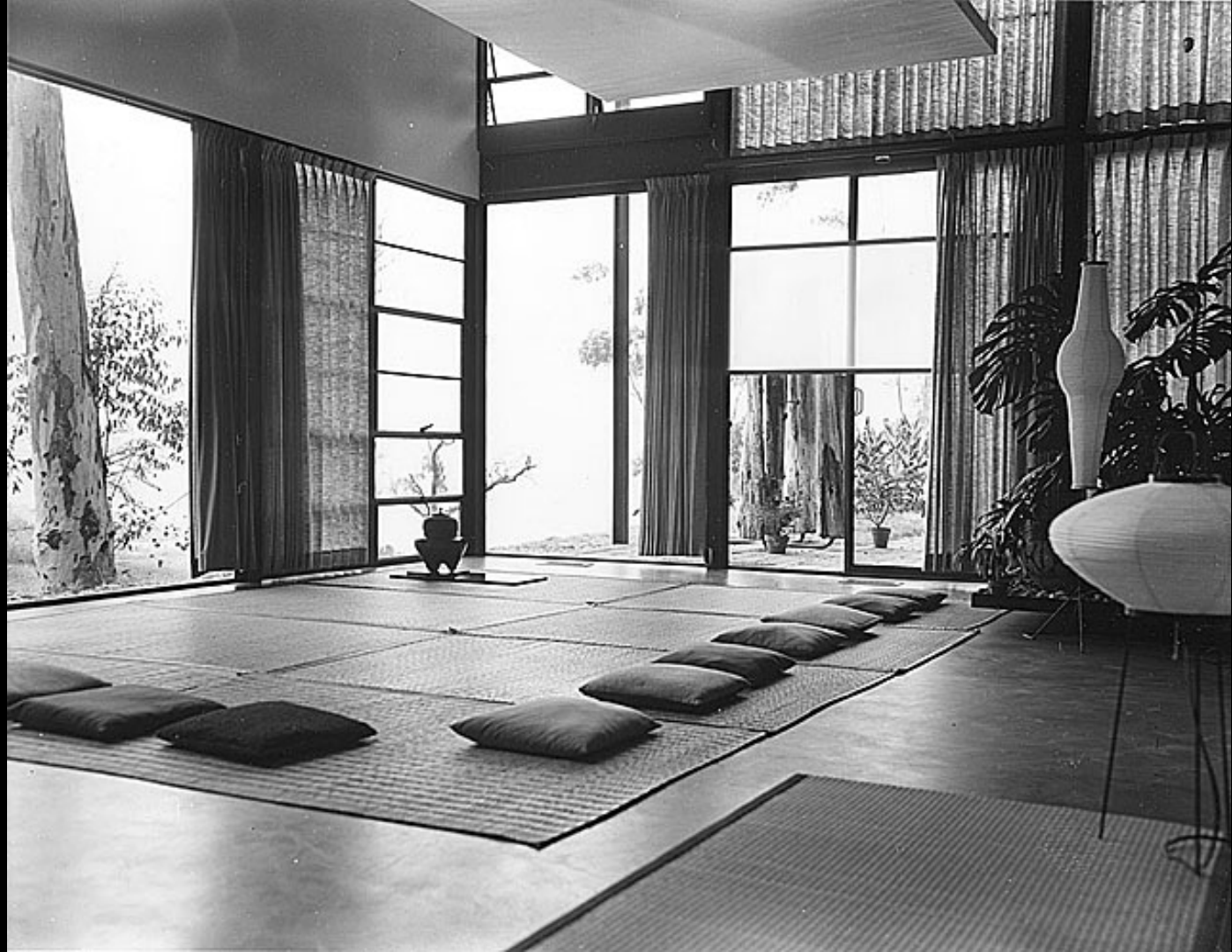
KITCHEN-DINING AREA OF CASE STUDY HOUSE NO. 8
2 3/16" UNGLAZED CERAMIC TILE EXTENDS FROM
DINING AREA INTO KITCHEN AND TO UTILITY AREA
EXTEND.







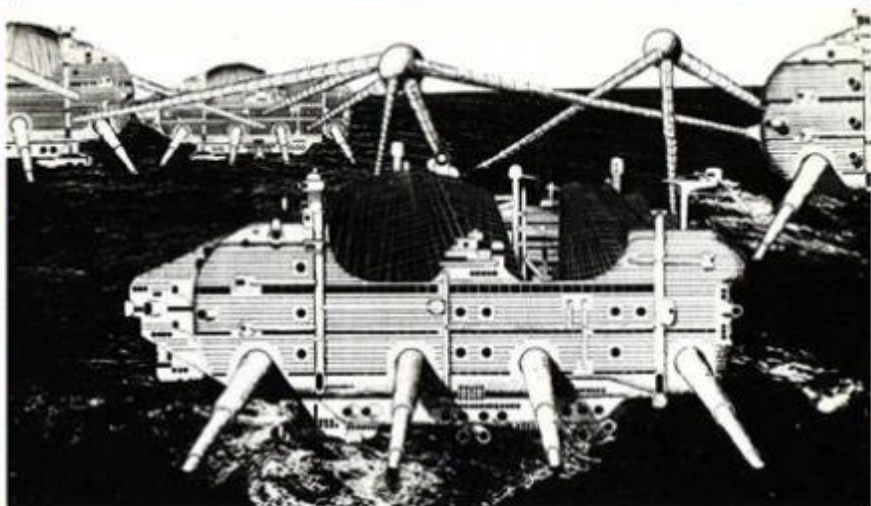
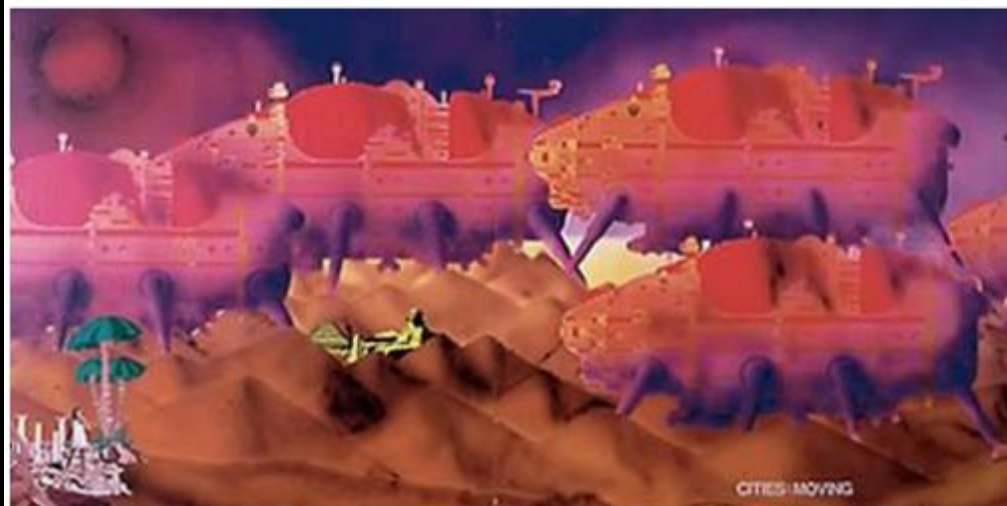
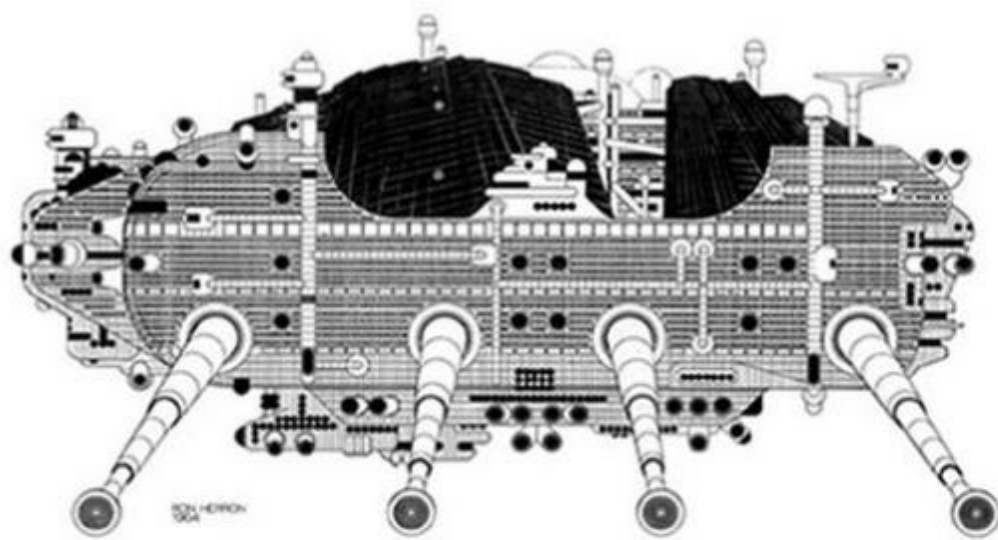








Archigram
Avant-garde British Design Group
1960s





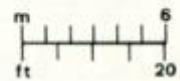
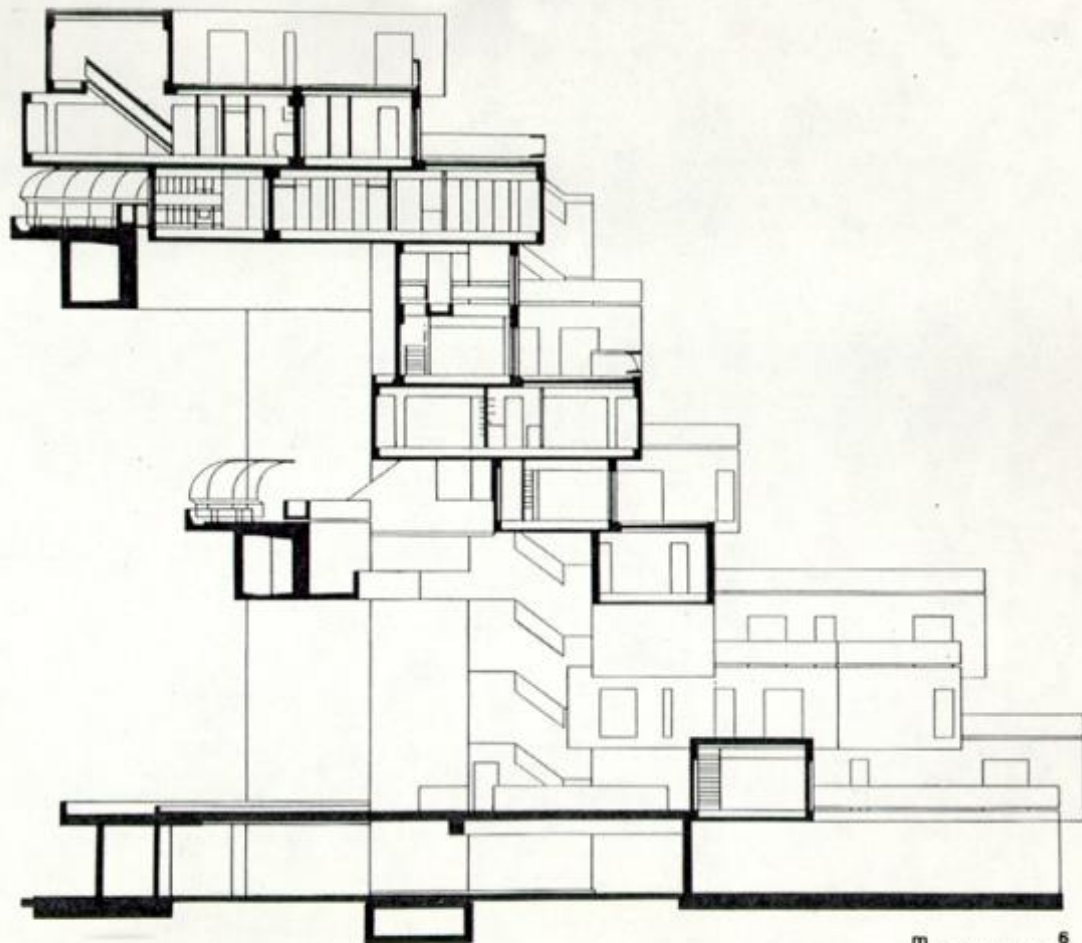
EACH WALKING UNIT HOUSES NOT ONLY A KEY
ELEMENT OF THE CAPITAL , BUT ALSO A LARGE
POPULATION OF WORLD TRAVELLER-WORKERS.

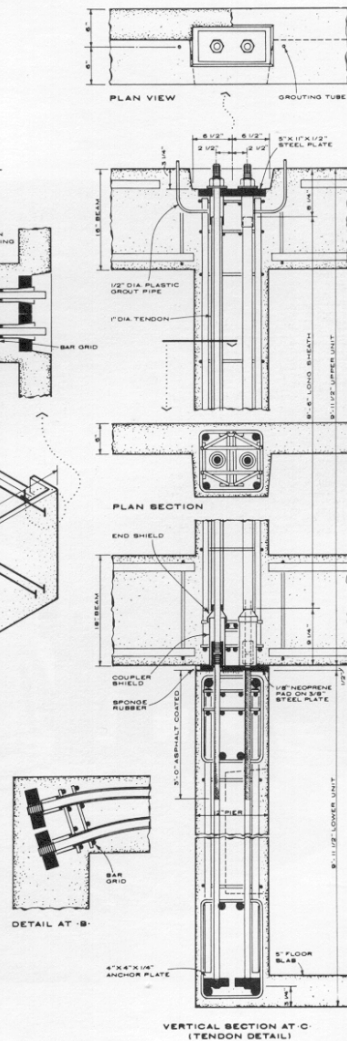
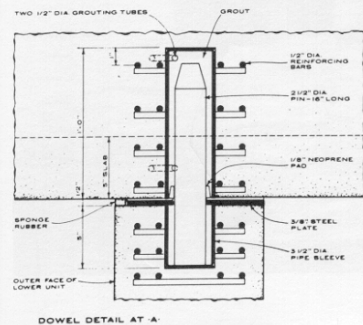
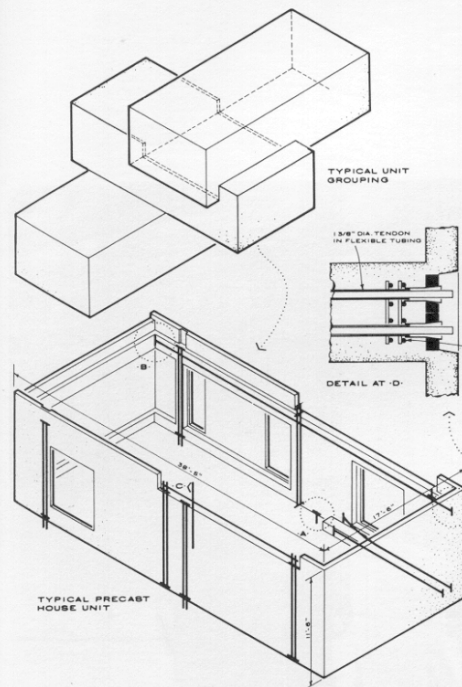
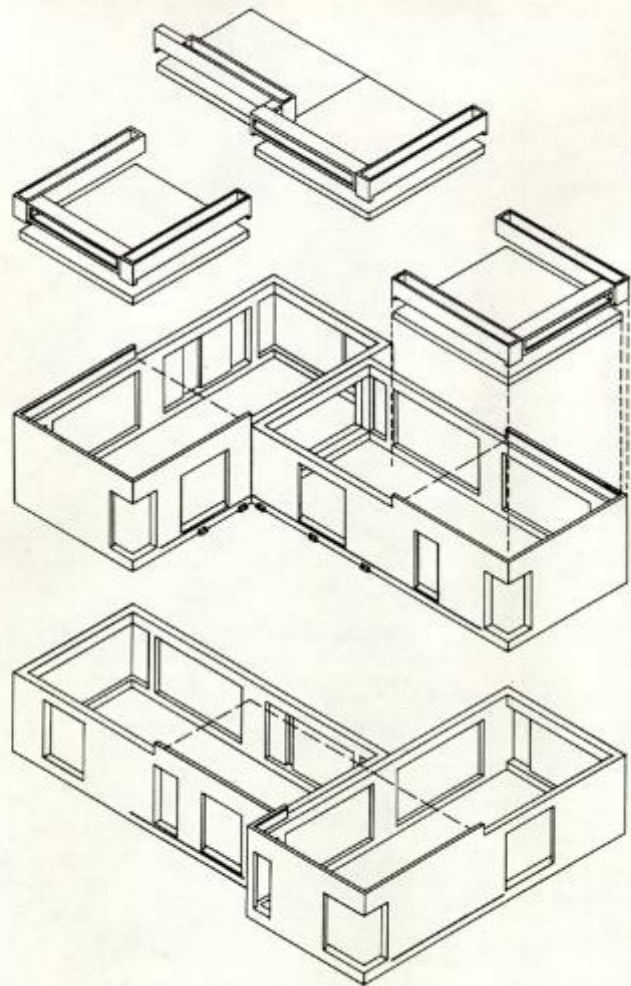
A WALKING CITY

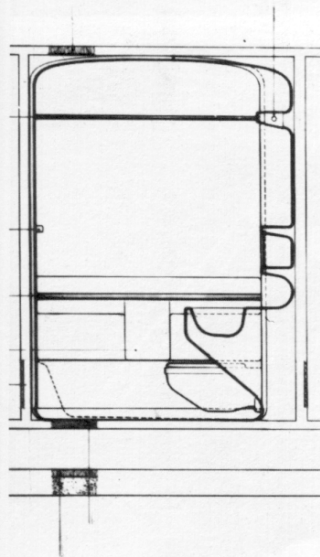
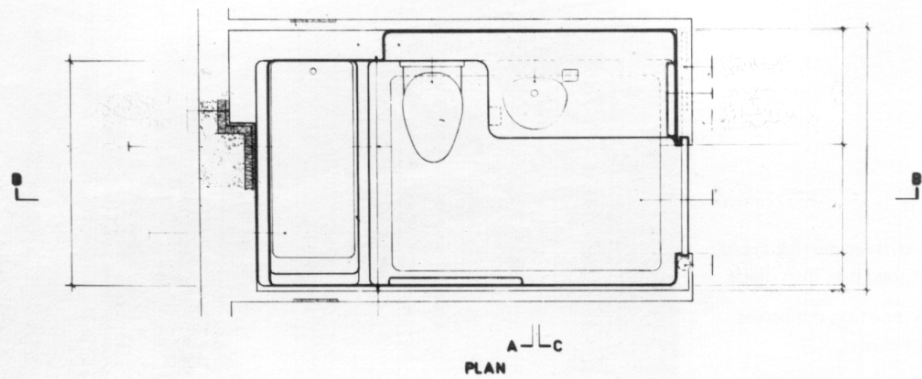


Habitat '67
Montreal Expo Residences
Moshe Safdie Architect
1967

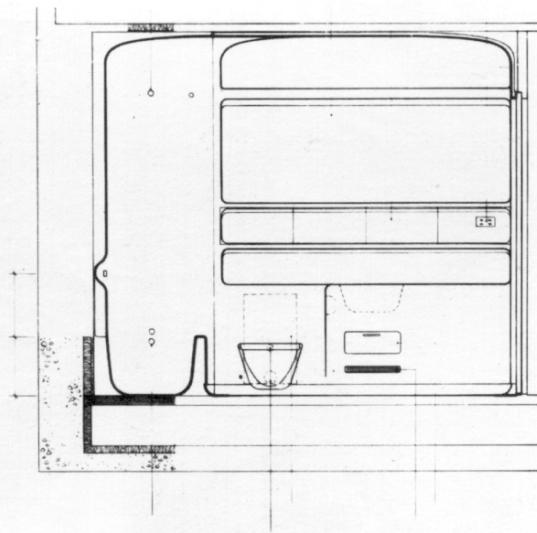




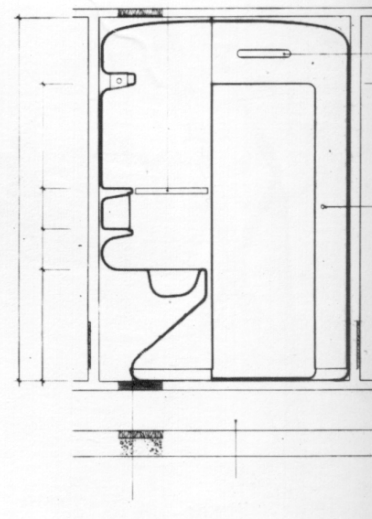




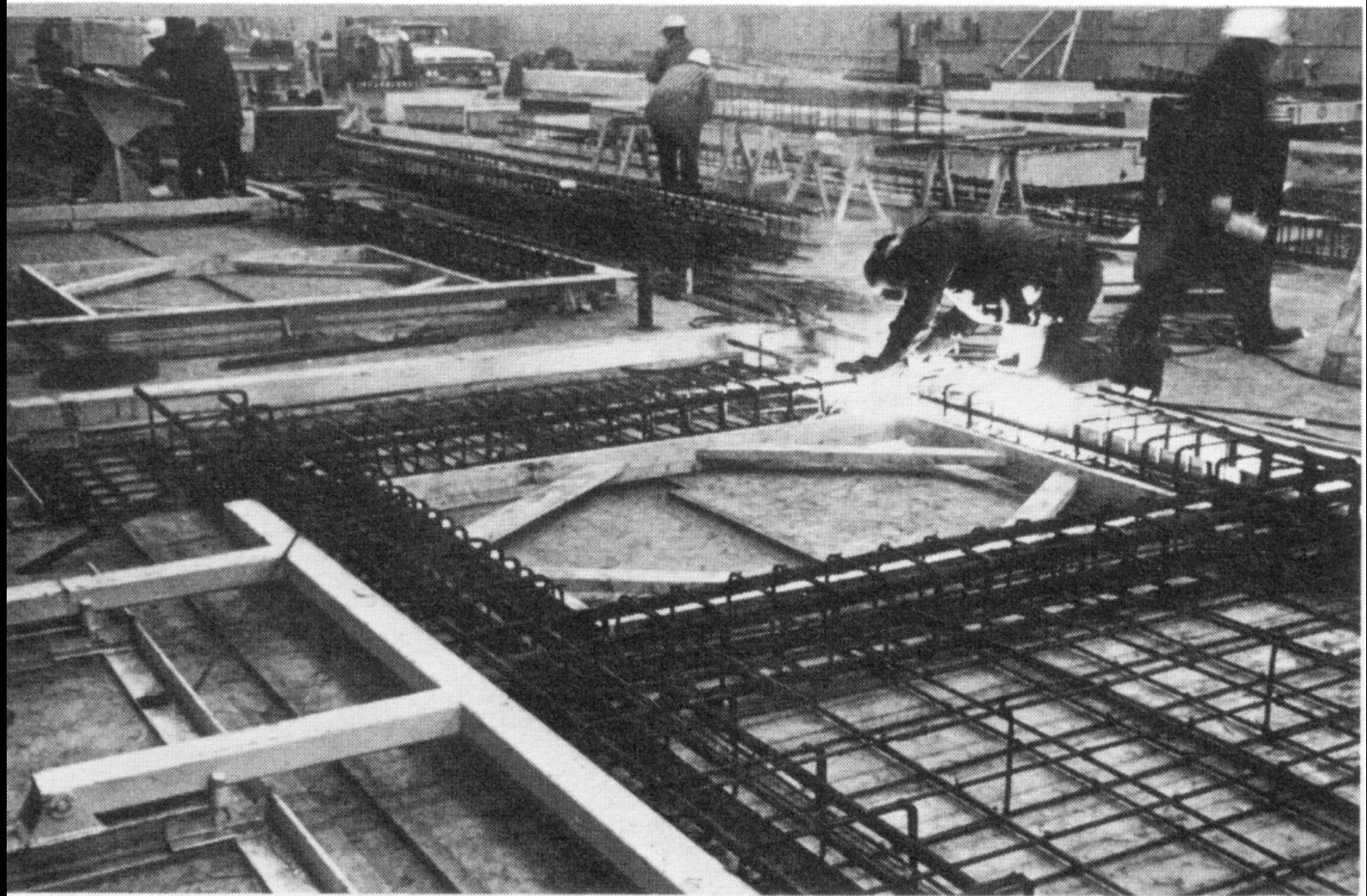
SECTION A-A
COUPE

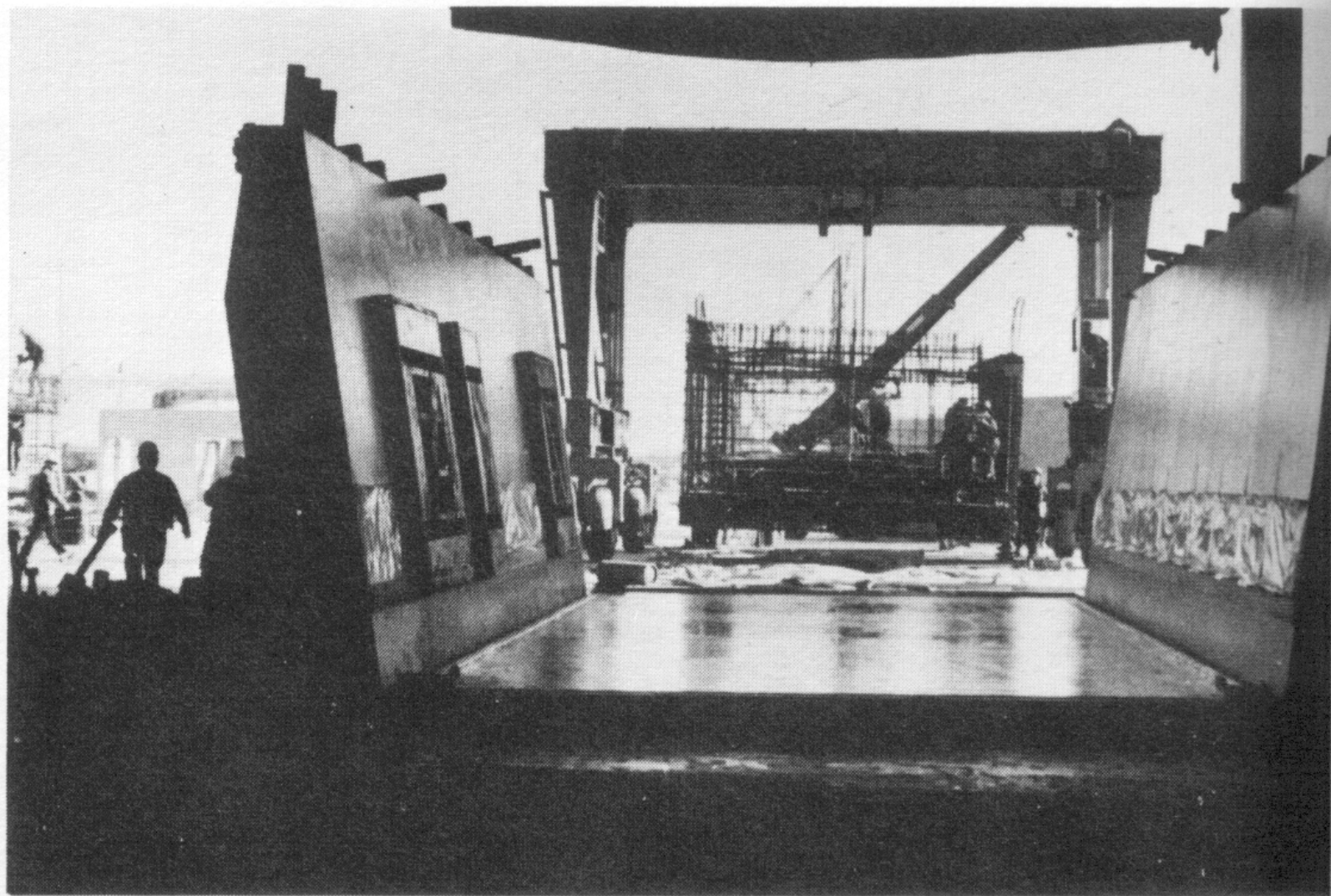


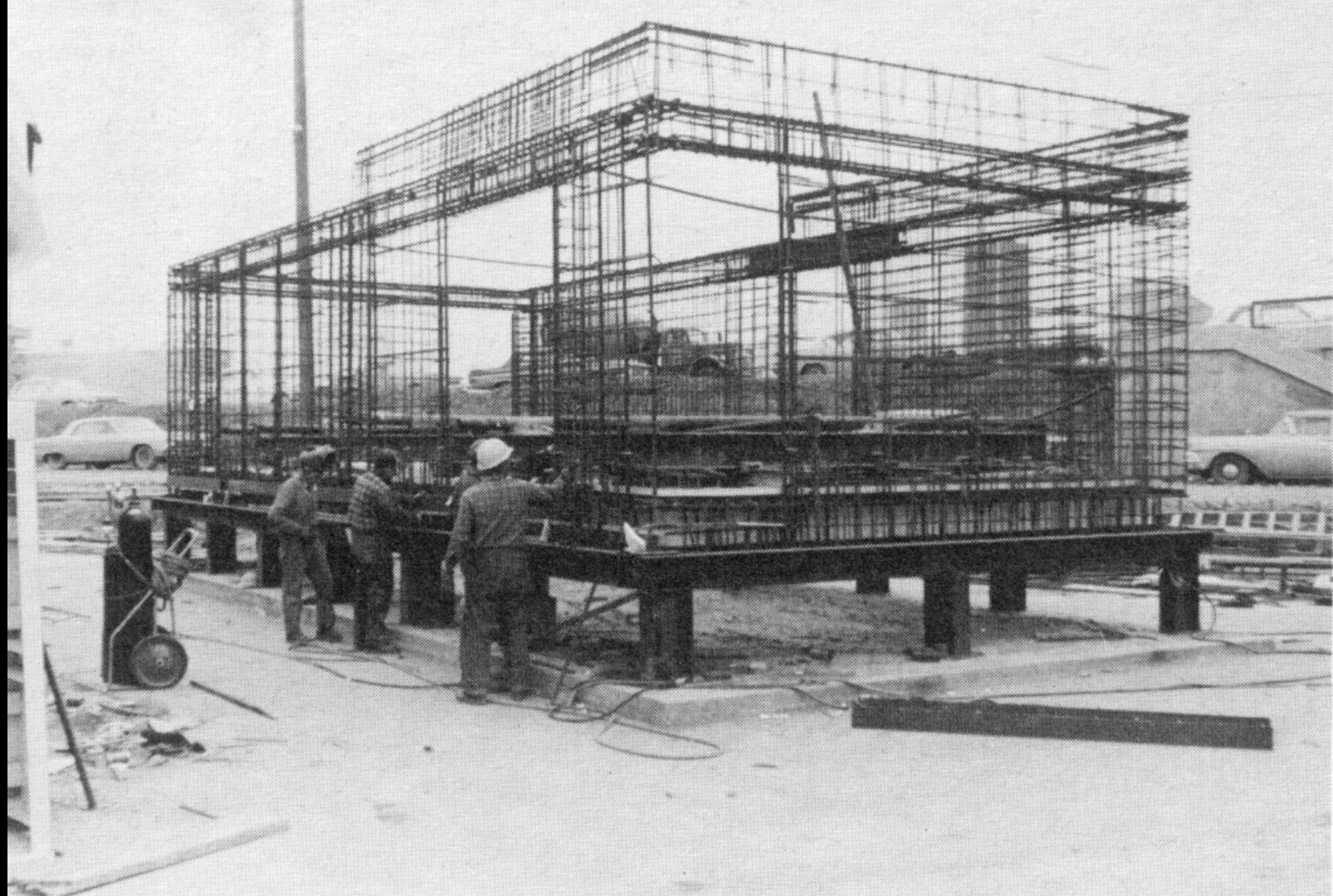
SECTION B-B
COUPE



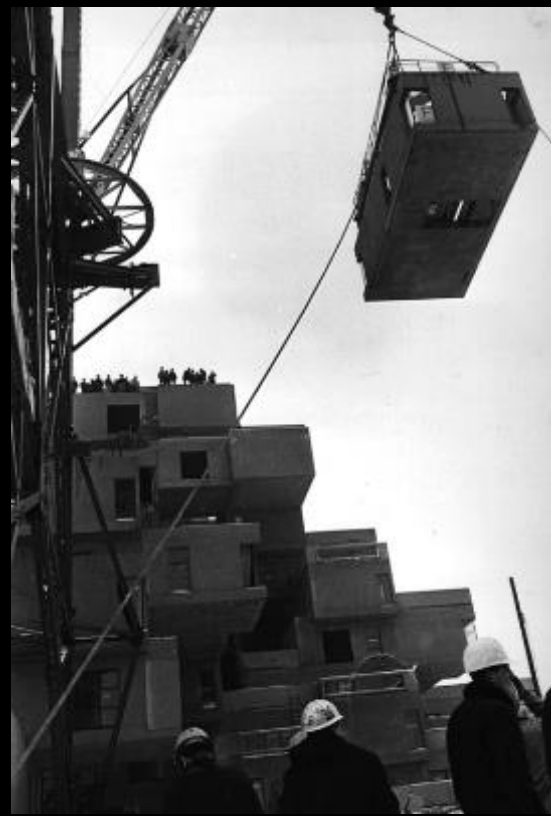
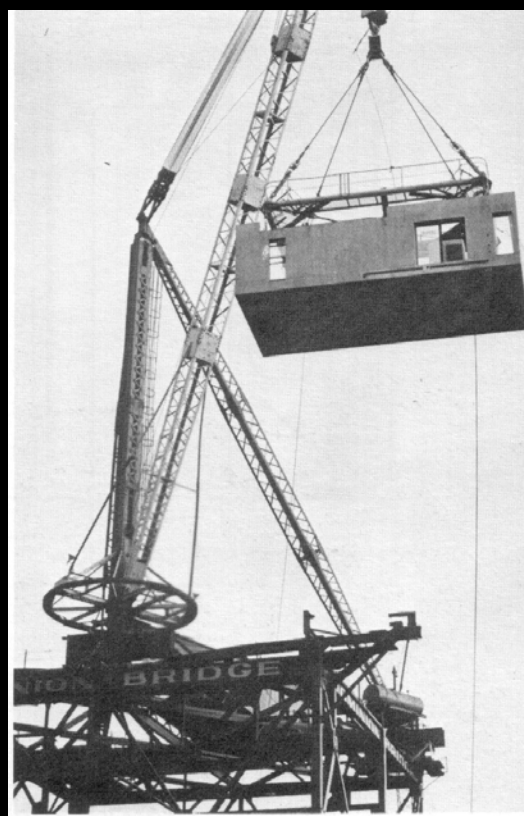
SECTION C-C
COUPE

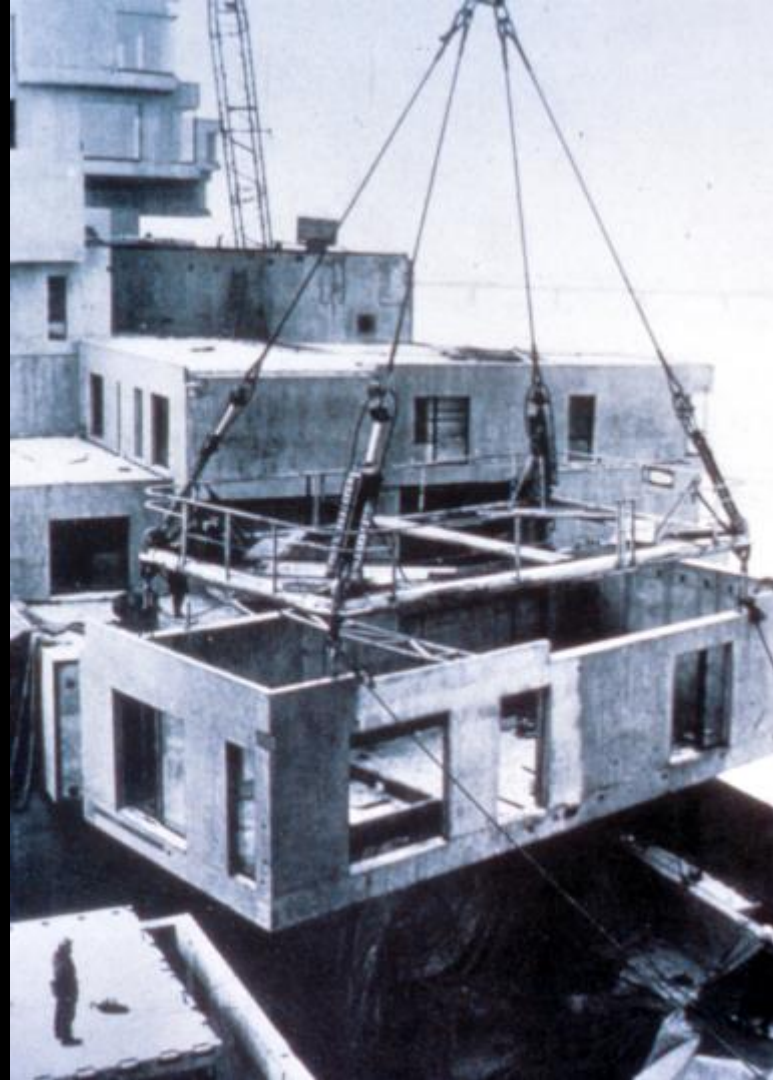






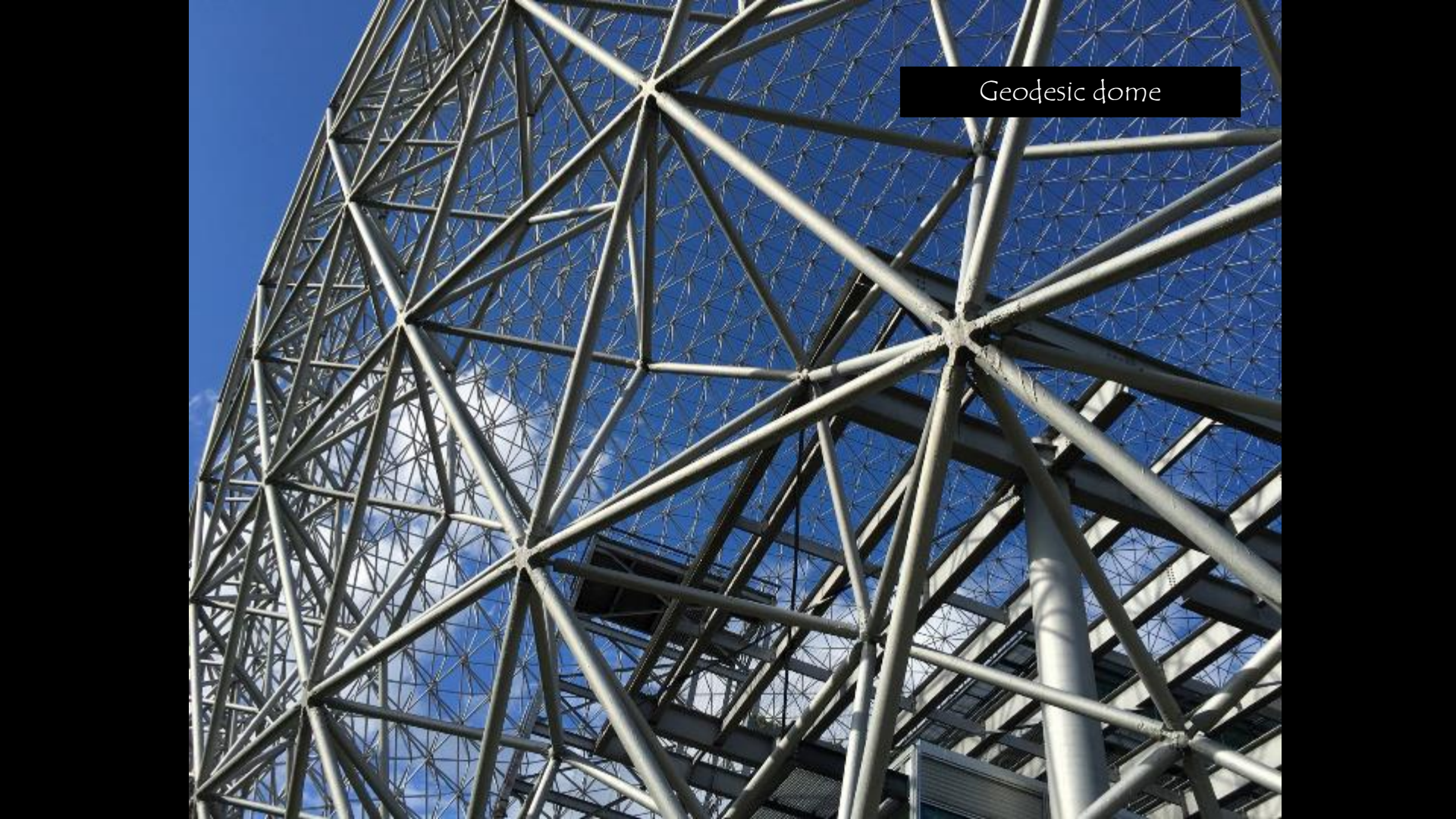






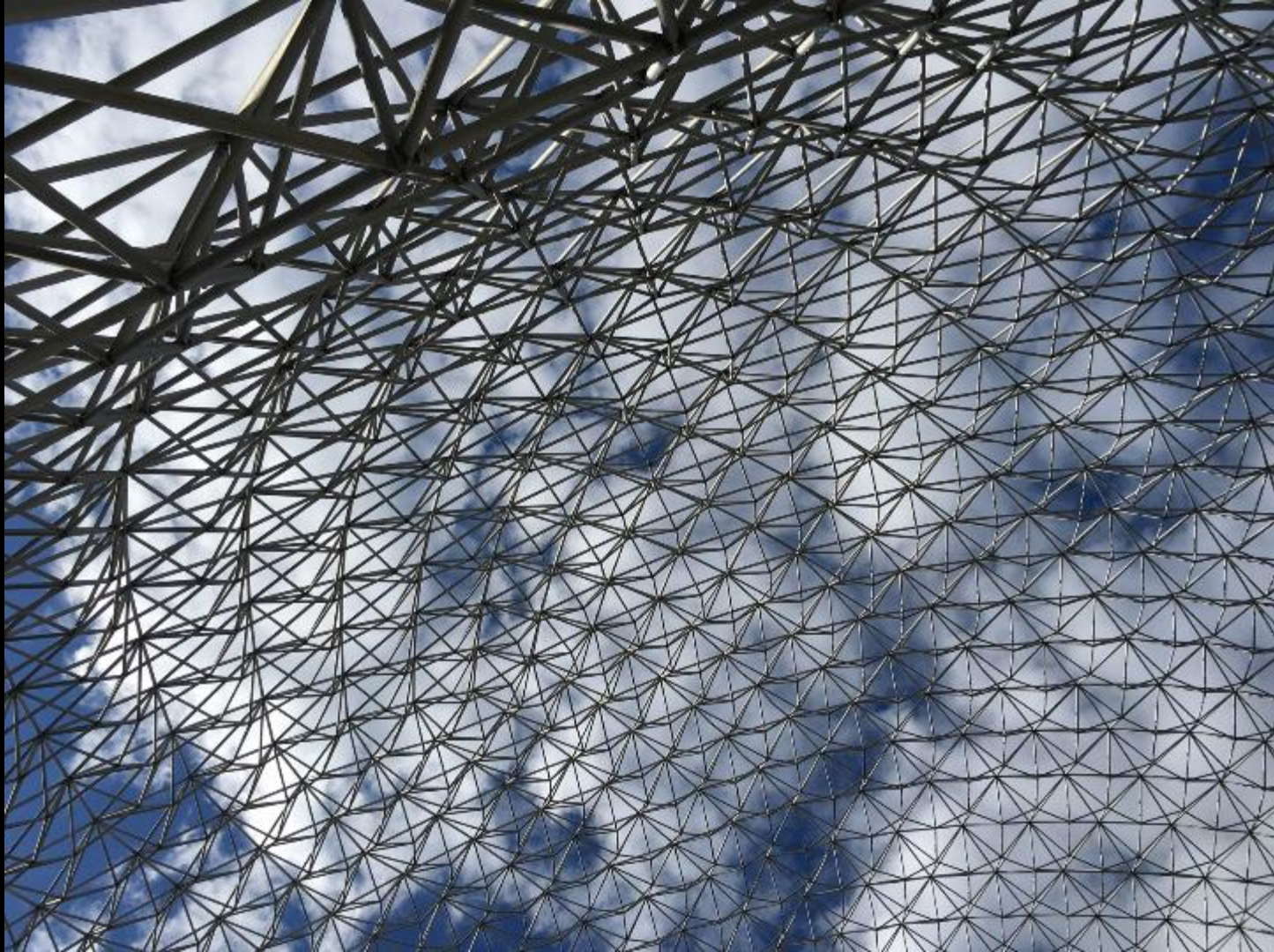


American Pavilion
Expo 1967
Montreal, Quebec
Buckminster Fuller

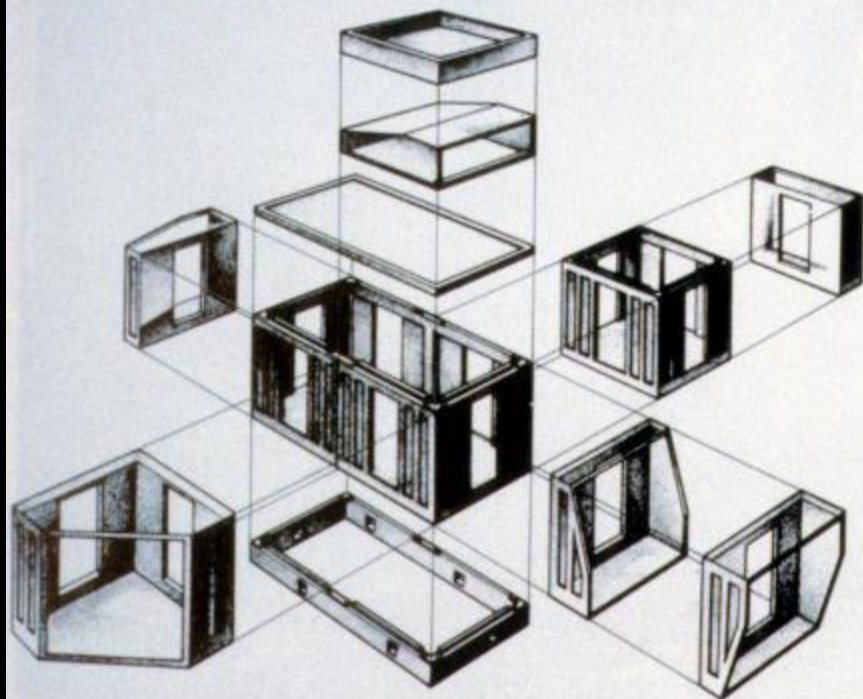


Geodesic dome



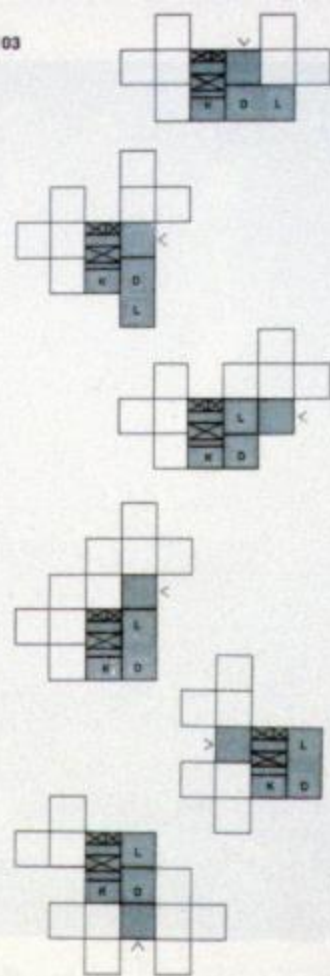


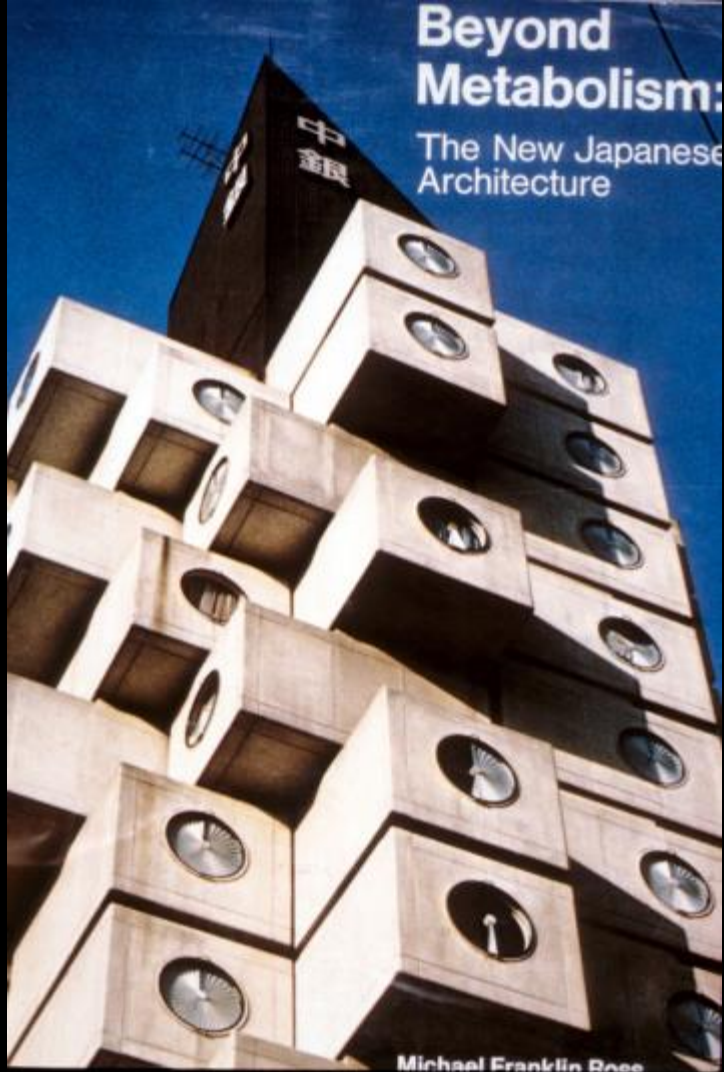
Economy is achieved through
repetition of the elements and mass
production



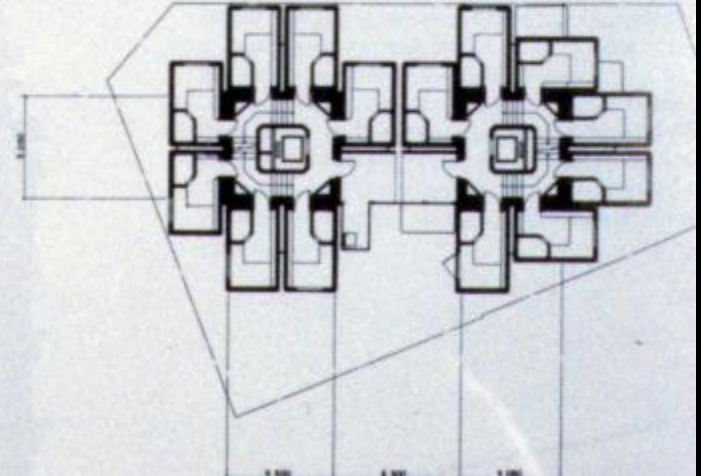
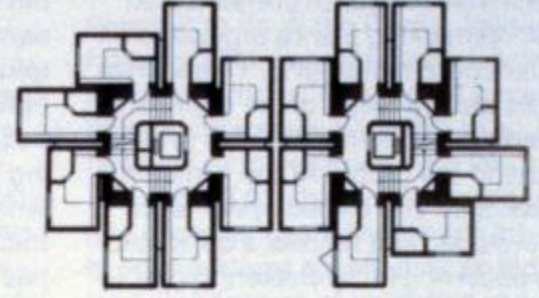
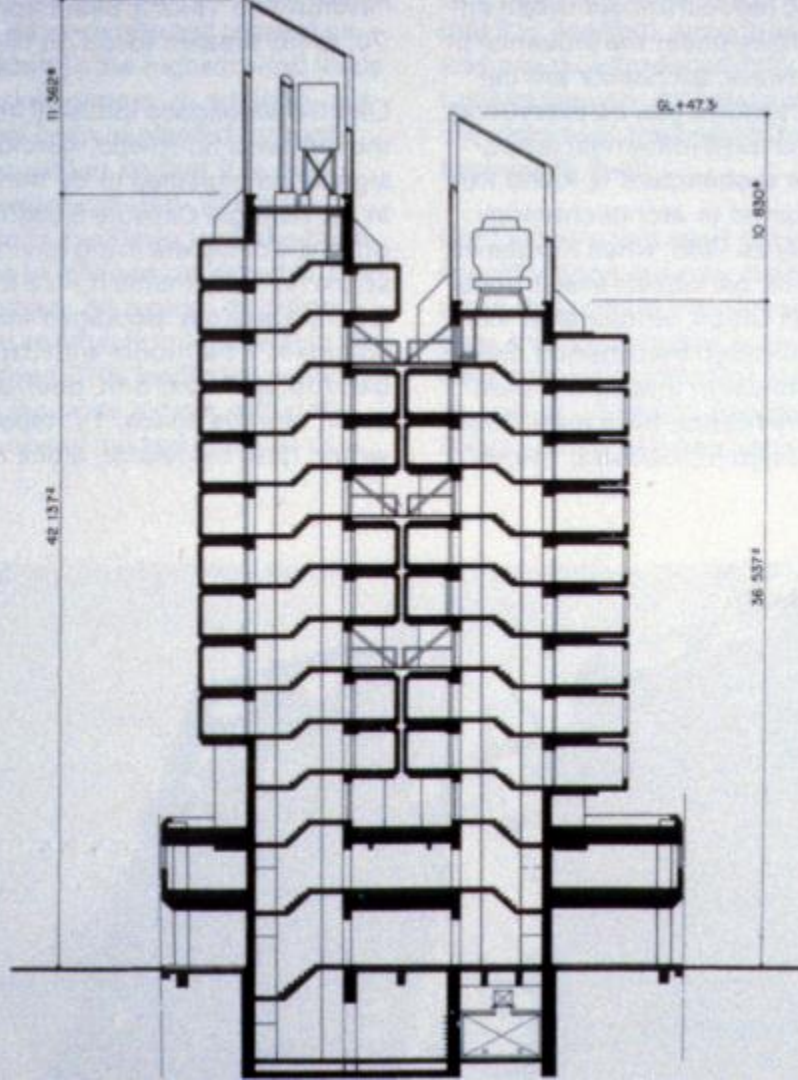
102, 103.

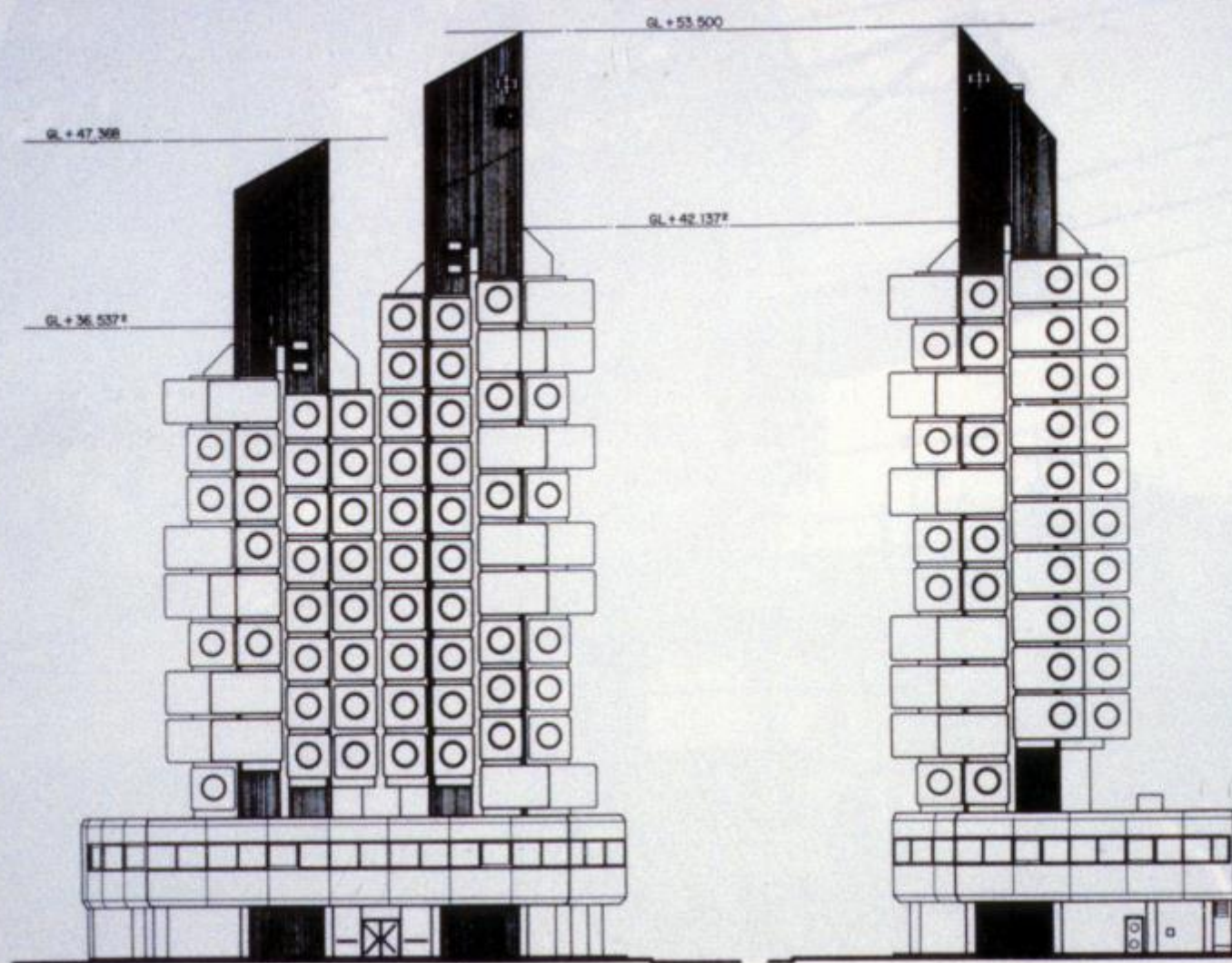
Taisei Overseas System, Design Prototype, Kisho Kurokawa, 1971: This closed system of prefabricated concrete elements fits together like the traditional Japanese puzzle. A variety of floor-plan clusters are available.

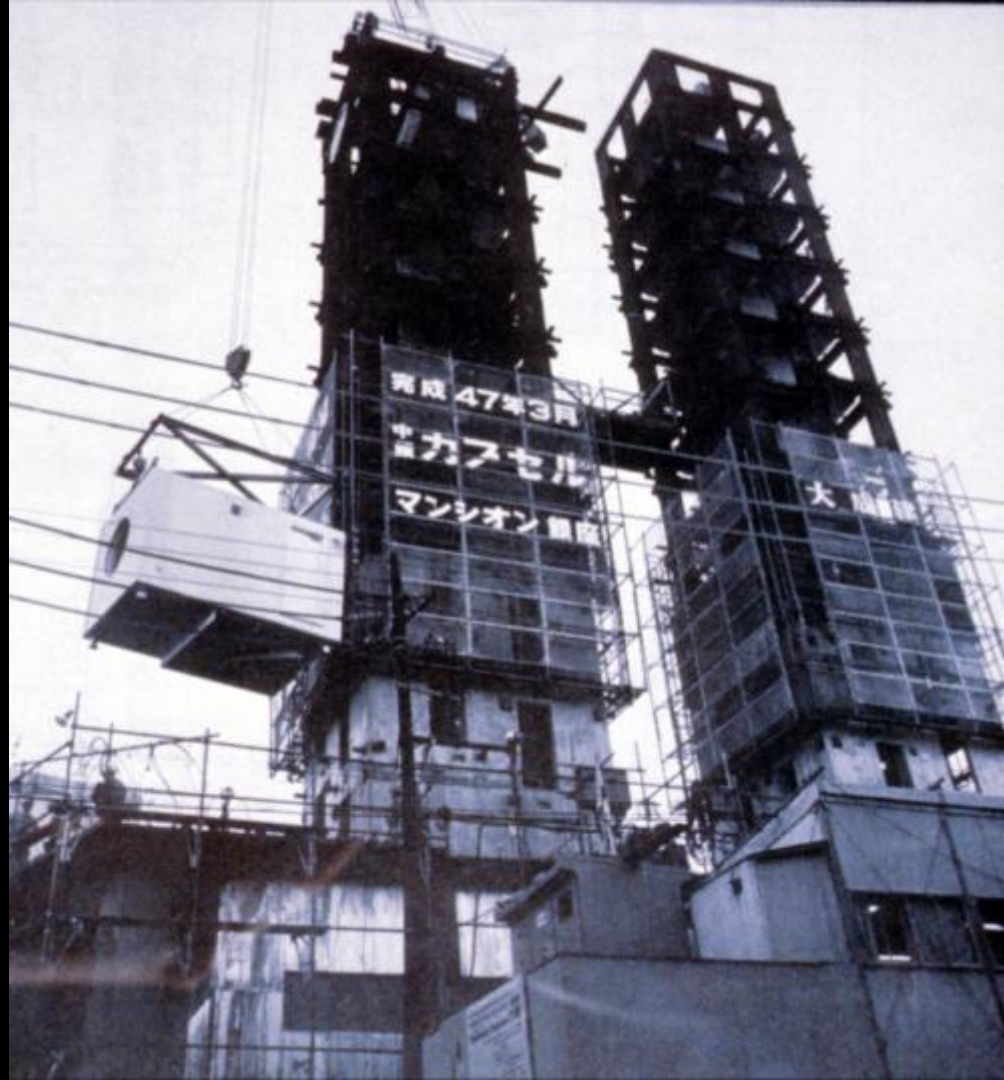


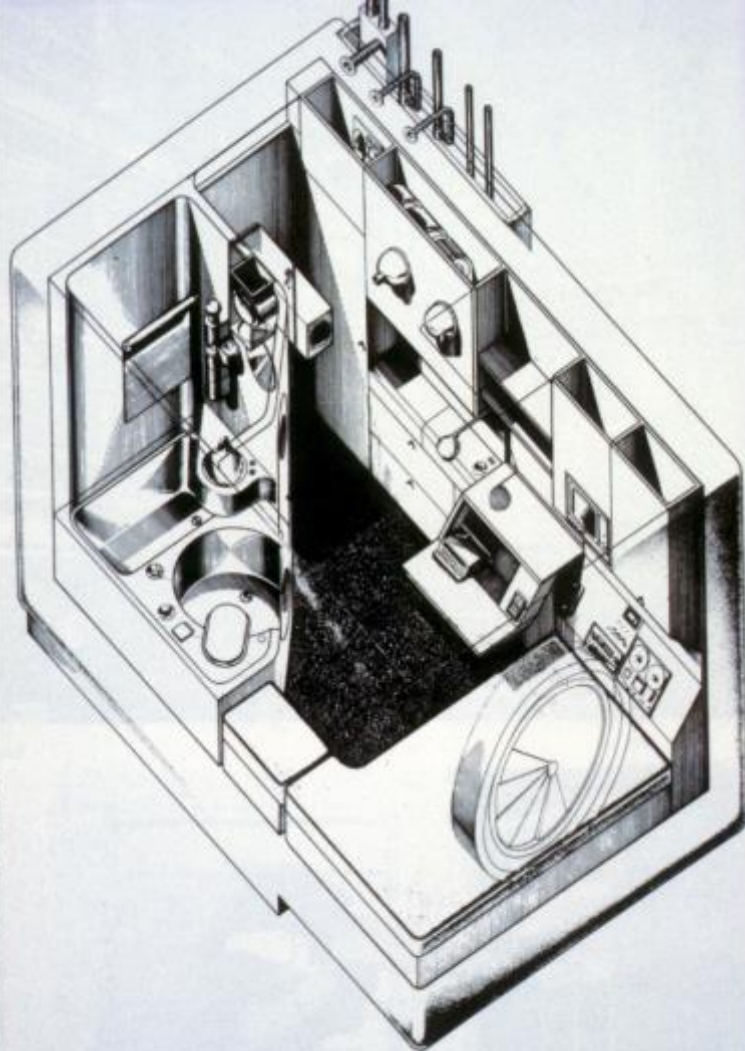


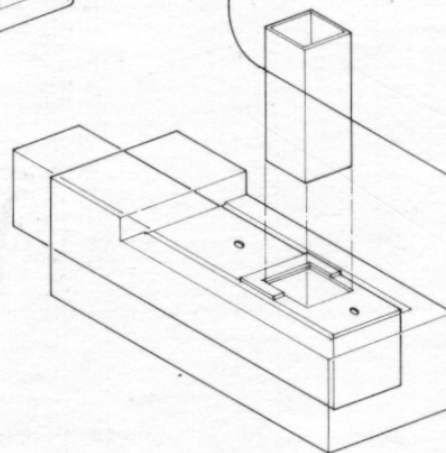
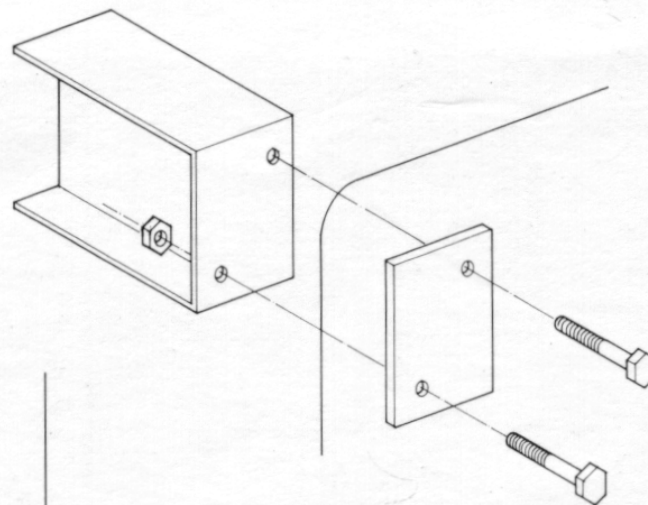
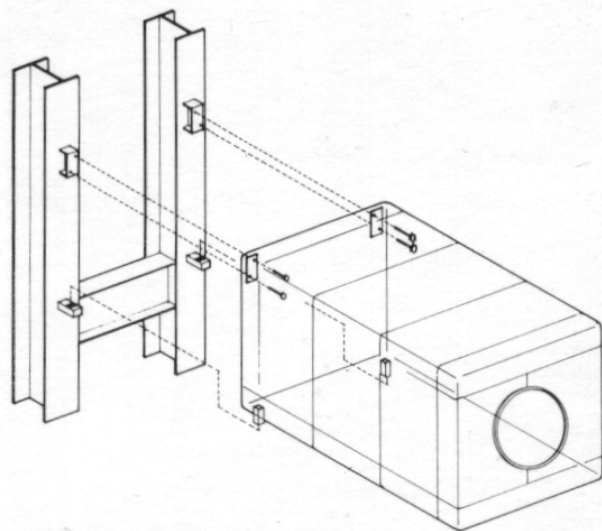
Nakagin Capsule Tower
Tokyo, Japan
Kisho Kurokawa
1972



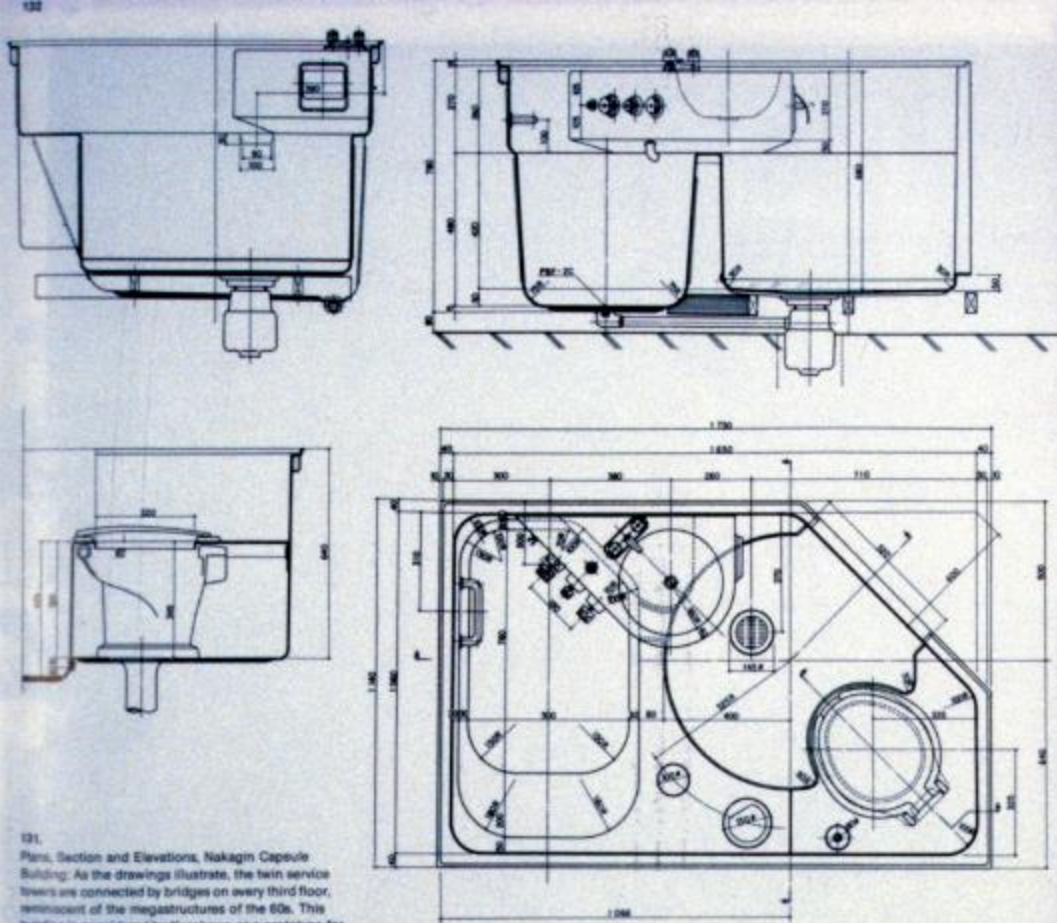






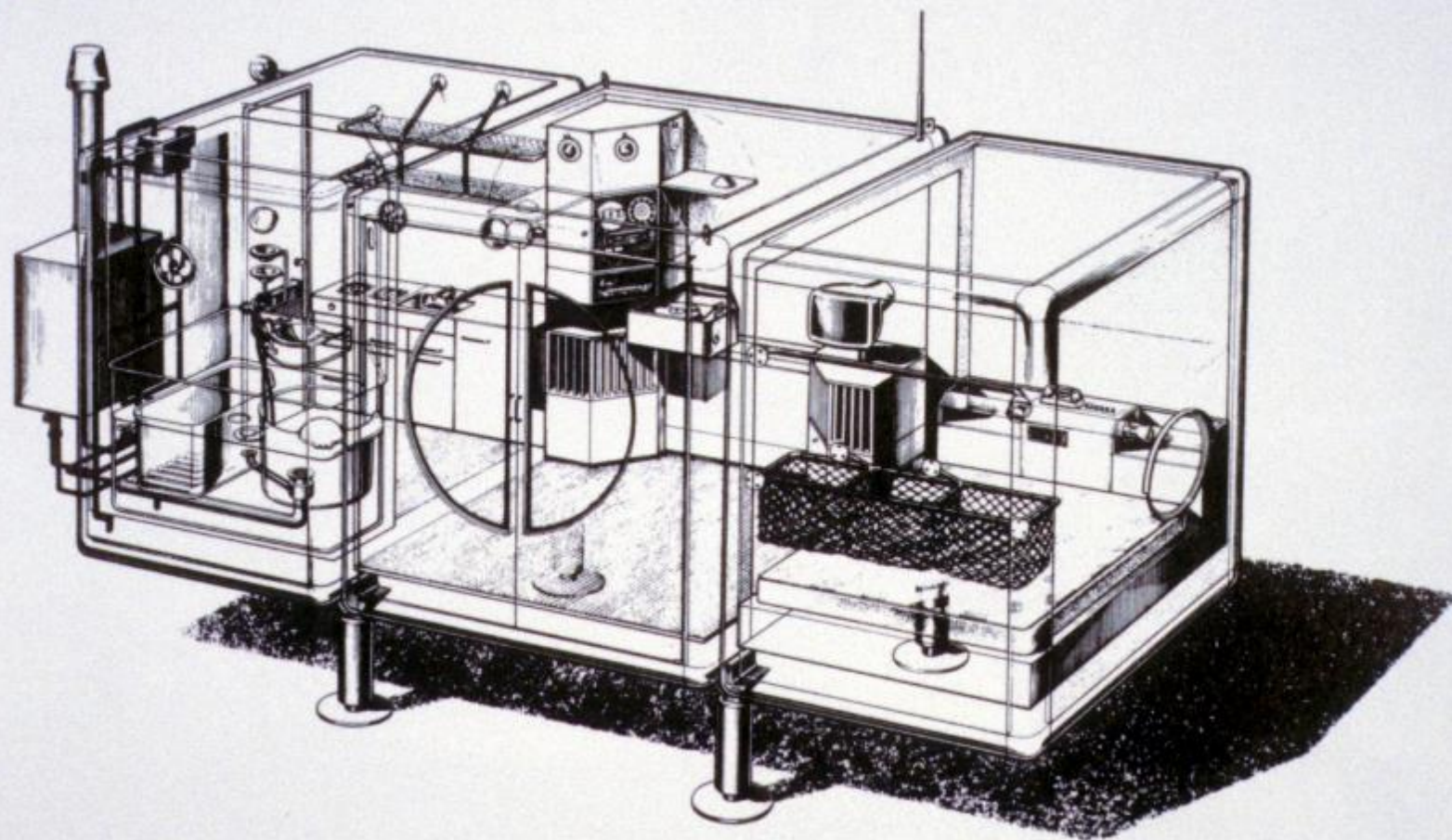


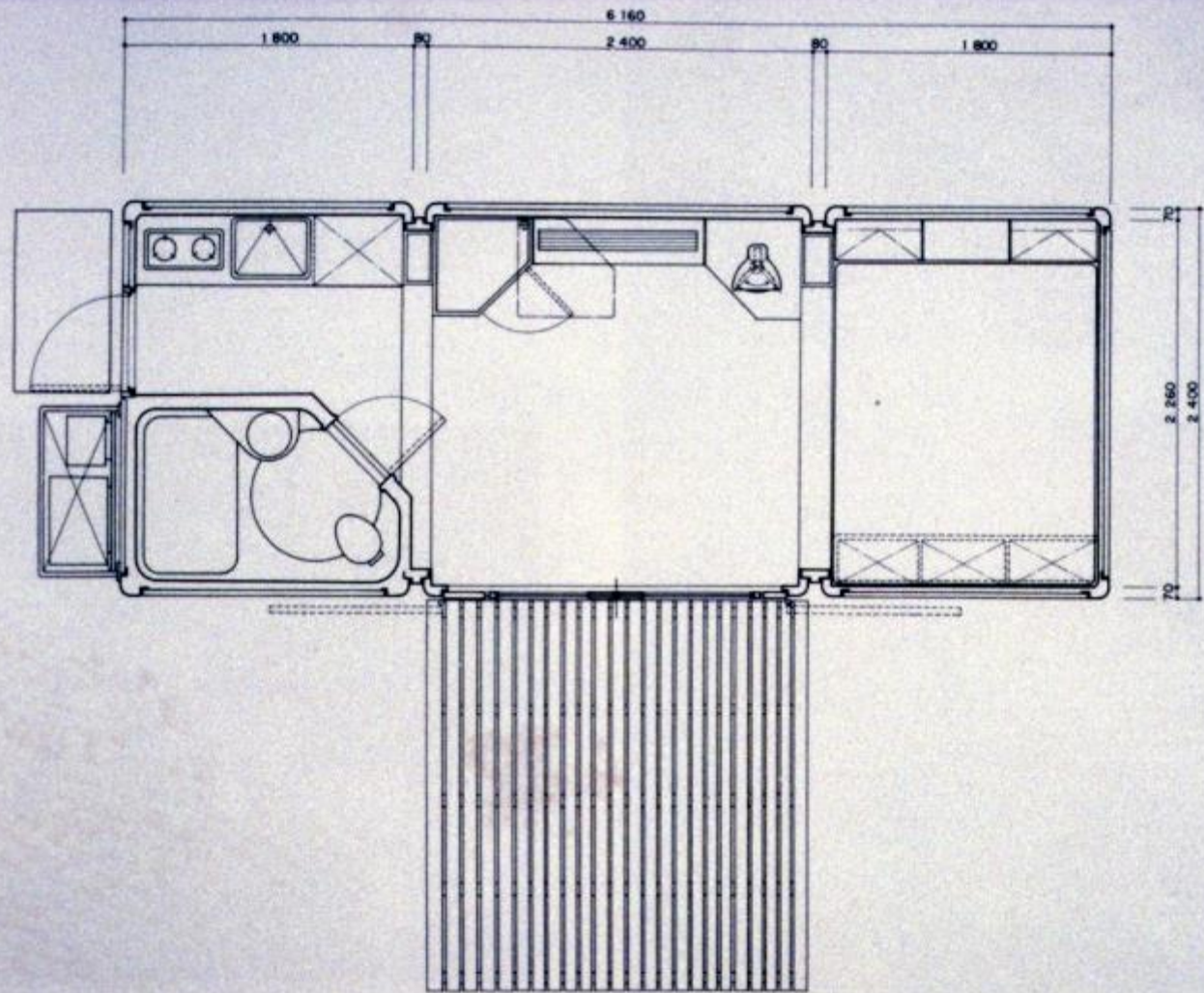
Detail of system of joining capsule to shaft



131. Plans, Section and Elevations, Nakagin Capsule Building. As the drawings illustrate, the twin service towers are connected by bridges on every third floor, reminiscent of the megastructures of the 60s. This building is considered by Kurokawa as a prototype for a larger urban community.

132. Bathroom, Nakagin Capsule: Evolved from the toilet capsules that Kurokawa created for the Celestial Theme Pavilion at Expo '70, this piece of industrial design is in itself a modern-day Japanese puzzle, integrating all sanitary functions into 21 sq ft (2m²).









タワーヒル

線グループ 2F



SERVICE STAND









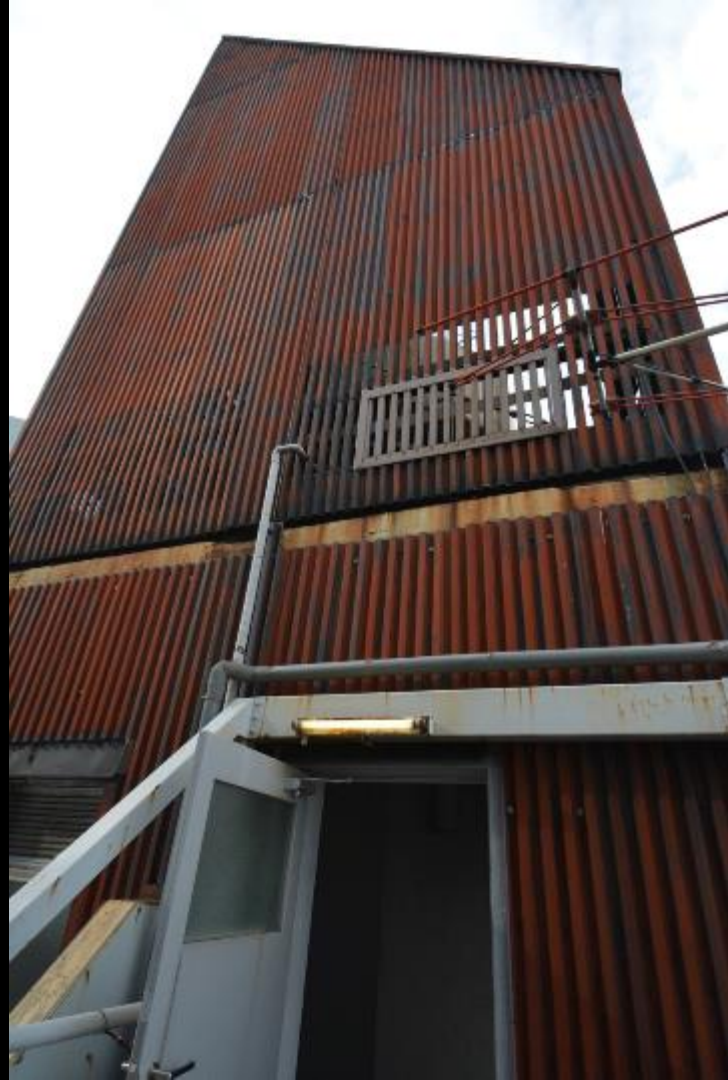


























nakagin
capsule towers

PROJECT INFO
Location: Tokyo, Japan
Client: Nakagin Associates
Architect: Nakagin Associates
Year: 1984-1985
Type: Residential
Units: 1,000
Area: 10,000 sqm
Height: 100m
Materials: Steel, Concrete, Glass
Furniture: Custom-made
Lighting: Custom-made
Sound: Custom-made
Security: Custom-made
Maintenance: Custom-made
Management: Custom-made
Construction: Custom-made
Occupancy: Custom-made
Future: Custom-made

DESIGN CONCEPT
The Nakagin Capsule Towers are a prime example of Japanese modular architecture. The towers consist of a central concrete core with steel-framed capsules attached. Each capsule is a self-contained living unit with its own kitchen, bathroom, and sleeping quarters. The design allows for easy expansion and contraction of the building as needed.

ARCHITECTURAL FEATURES
The towers feature a unique modular design with a central concrete core and steel-framed capsules. Each capsule is a self-contained living unit with its own kitchen, bathroom, and sleeping quarters. The design allows for easy expansion and contraction of the building as needed.

INTERIOR DESIGN
The interior of each capsule is designed to be functional and efficient. It includes a kitchen, bathroom, and sleeping quarters. The design is minimalist and modern, reflecting the Japanese aesthetic.

EXTERIOR DESIGN
The exterior of the towers is made of steel and concrete. The capsules are attached to the central core in a modular fashion, creating a unique architectural form.

CONSTRUCTION
The towers were constructed using a modular system. The central core was built first, and then the capsules were attached. This allowed for easy expansion and contraction of the building as needed.

MAINTENANCE
The towers are maintained by Nakagin Associates. They provide a range of services including cleaning, repairs, and management.

MANAGEMENT
The towers are managed by Nakagin Associates. They provide a range of services including cleaning, repairs, and management.

CONCLUSION
The Nakagin Capsule Towers are a prime example of Japanese modular architecture. They provide a unique and efficient living environment that can be easily expanded and contracted as needed.



WELL I

PLEASE TIGHTEN THE FAUCET. IT LEAKS.

WE LOVE YOU. THANK YOU FOR EVERYTHING.

GRACIAS!!!

ENJOY 東京!!!

TIPS: Valencia 20th - Spain

There's a public bath (Sento) nearby.

IF YOU NEED ANYTHING, CALL

MASATO RAE: 080 9575 5192

Do not use!

THANK YOU VERY MUCH

PLEASE TIGHTEN THE FAUCET. IT LEAKS.

WE LOVE YOU. THANK YOU FOR EVERYTHING.

GRACIAS!!!

ENJOY 東京!!!

TIPS: Valencia 20th - Spain

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IF YOU NEED ANYTHING, CALL

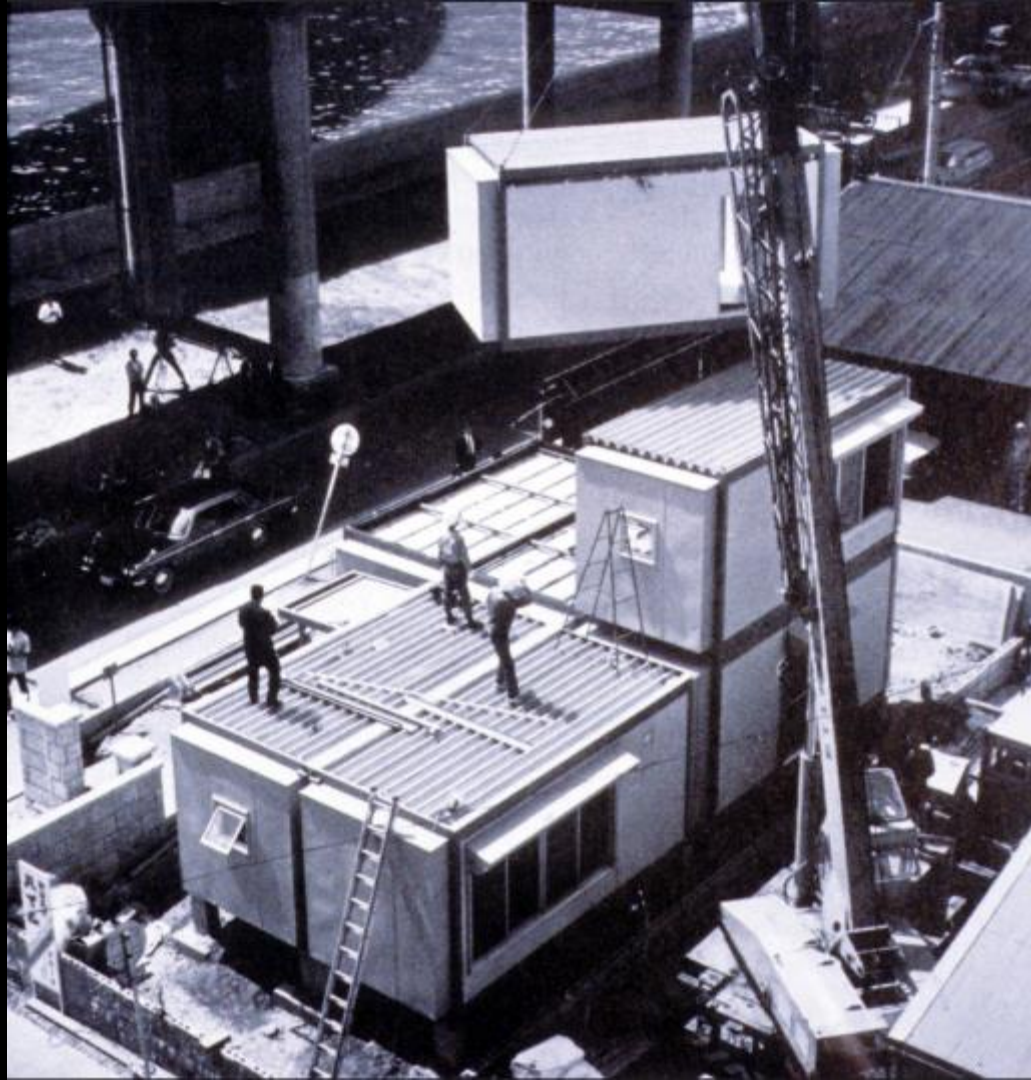
MASATO RAE: 080 9575 5192



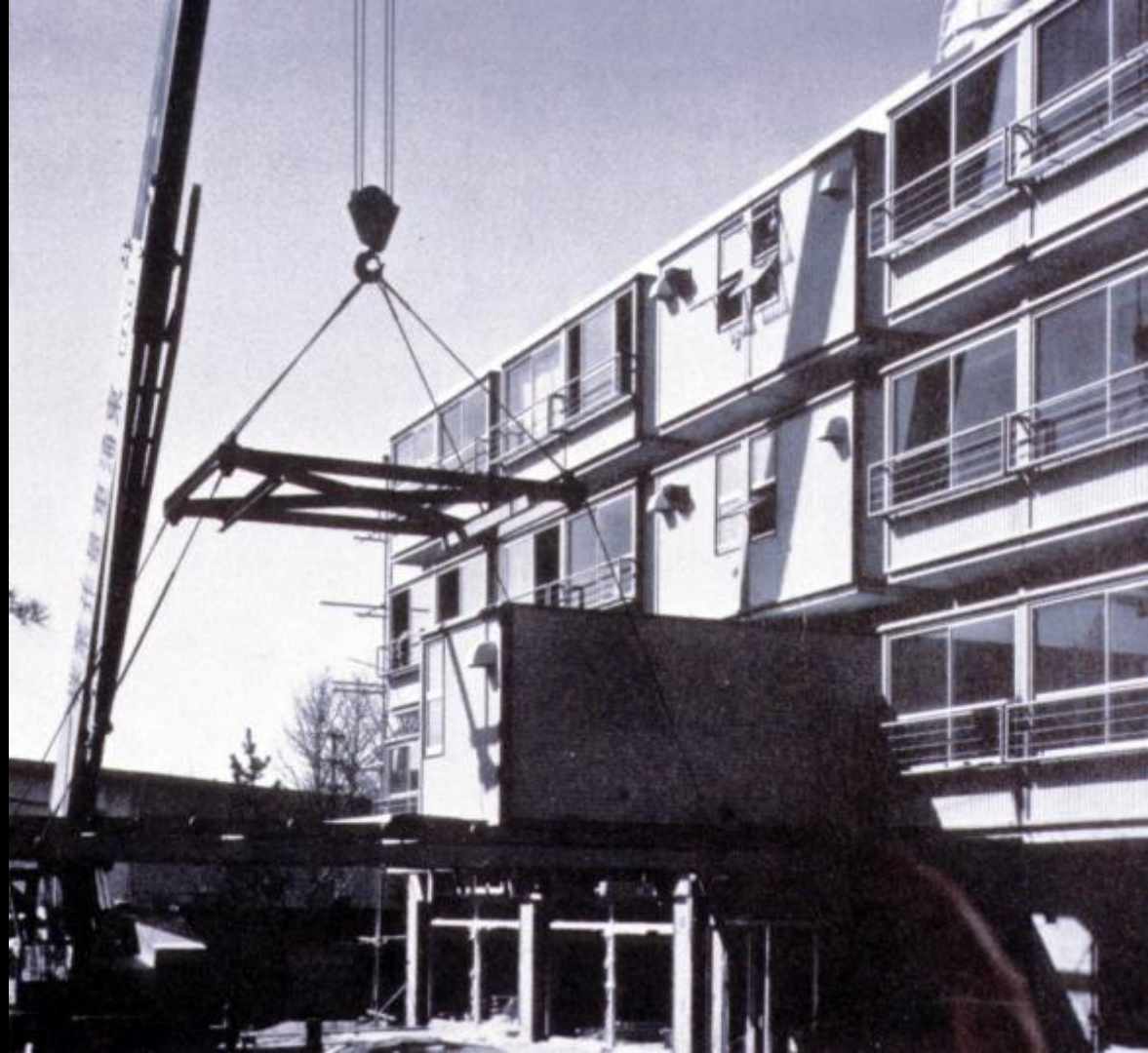














816, 817 Two types of American prefabricated houses: the 'colonial cottage' produced by the American Houses Inc. at \$7,500 and the 'Catalina' house produced by the U.S. Steel Houses Inc. at \$11,500



Very good—14 hours flat—but they're all upside down!



845 (above, left) New York, One of the façades of the U.N. building

846 (below, left) Cartoon from the Architectural Record, April 1955

847 (right) Pittsburgh, A.L.C.O.A. building (Harrison and Abramowitz, 1952)





The High Tech Movement



HIGH-TECH?

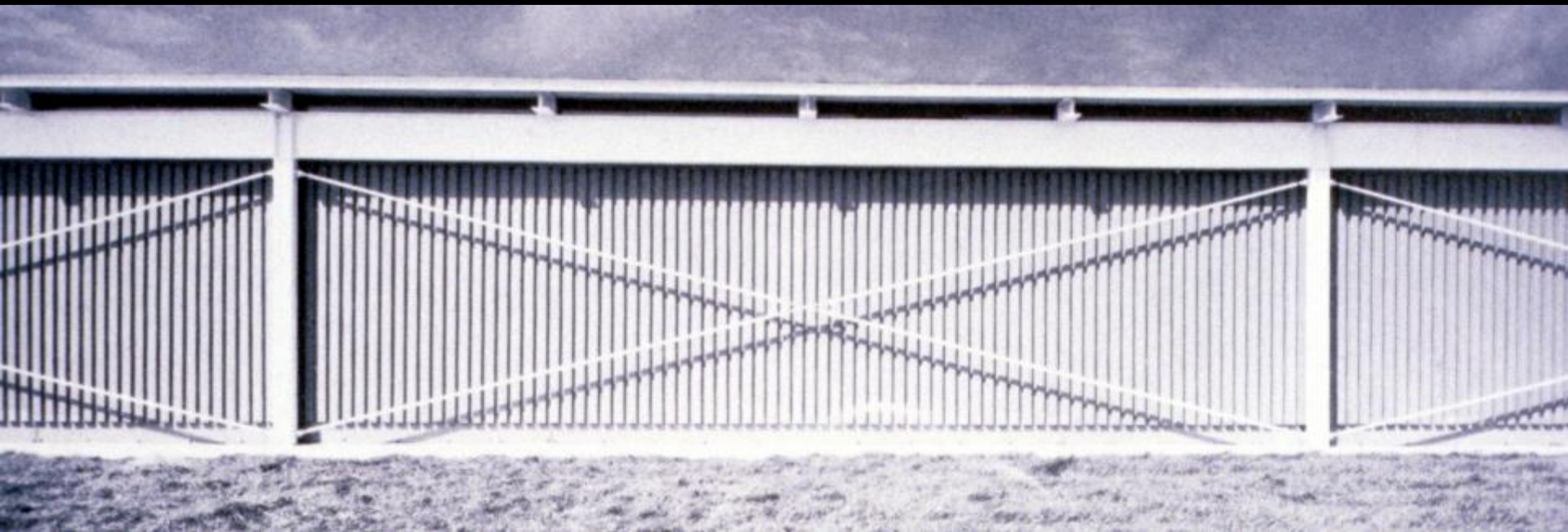
TECH-BLINDS!

TECHNICAL BLINDS LTD.
Innovators of solar shading systems
Woodburn Town, High Wycombe, Bucks. 1062851 2431

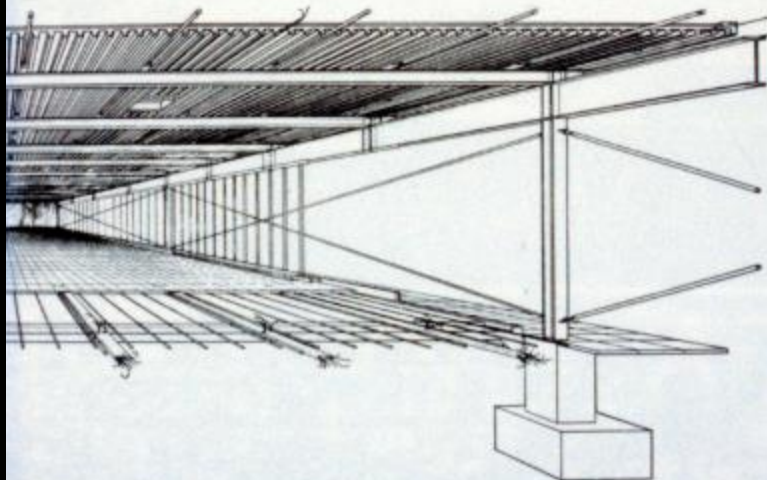
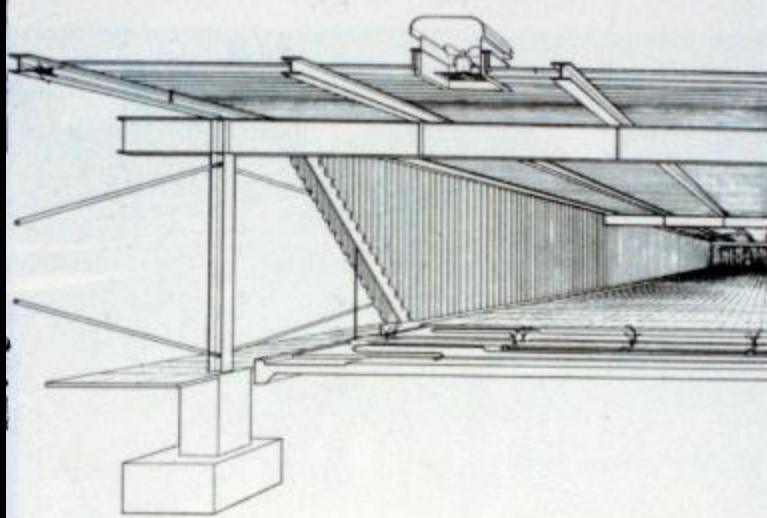
A photograph of the Renault Centre in Swindon, showing its large glass facade and prominent yellow structural frame. The building is a modern, multi-story structure with a large, curved glass facade. A prominent yellow structural frame, consisting of a central vertical column and several horizontal and diagonal beams, is visible in the foreground. The frame is made of a perforated metal material. The building is set against a blue sky with some clouds.

Renault Centre, Swindon.

Architects: Foster Associates.



Reliance Controls
Swindon, UK
Team 4 (Wendy and Norman Foster +
Richard and Sue Rogers)
1967



2 Team 4, Reliance Controls Factory, Swindon, 1966

Characterized by components that
express their forces

–

Tension vs. Compression

–

Skinny vs. Fat



Pompidou Centre
Paris, France
Piano and Rogers
1977









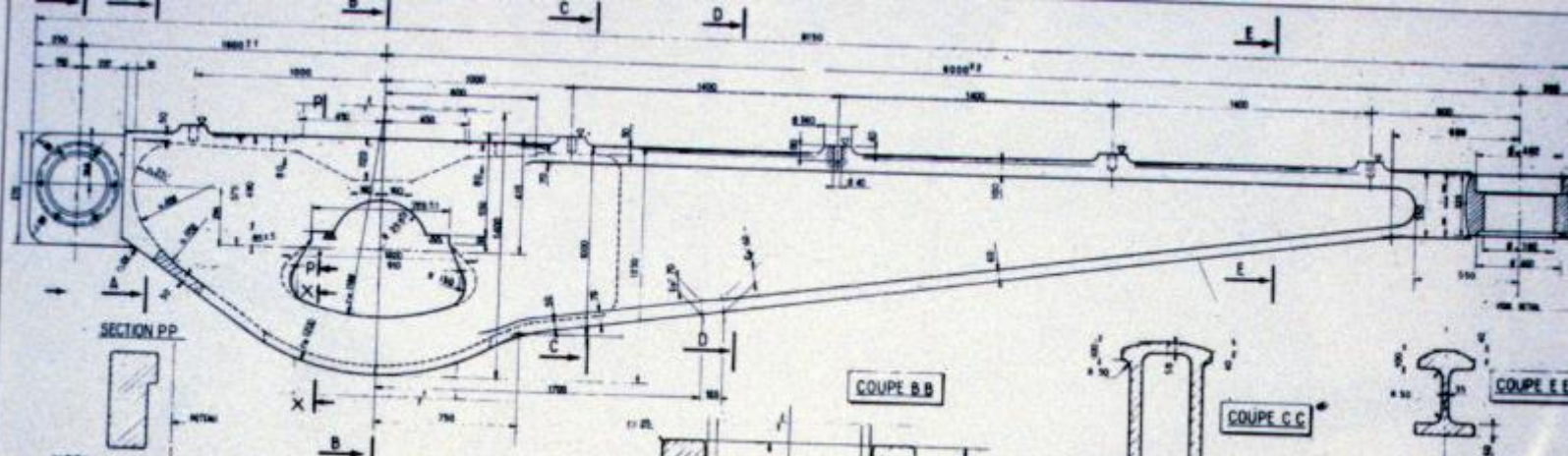












SECTION PP

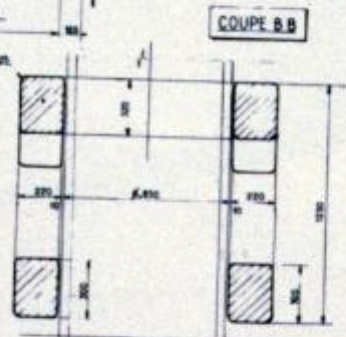


NOTA

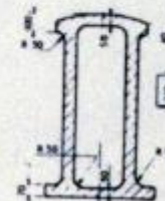
MATIERE
 AFTER MOULÉ SUIVANT CAHIER DES CHARGES
 LIMITE DE RUPTURE MIN. 33.5N/MM²
 LIMITE ELASTIQUE MIN. 34.5N/MM²
 TOLERANCES
 SAUF INDICATION CONTRAIRE POUR
 LES DIMENSIONS LES TOLERANCES
 SERONT CONFORMES AUX NORMES
 NF A3300 CLASSE A
 LA TOLERANCE DE RECTITUDE DE L'AXE (DISTANCE A-A)
 SERA DE 1.5MM
 REFERENCES PLANS N° 14, 20, 22
 TYPE A 75
 TYPE B 75

NOTA (suite)

INDICATIONS D'USURE CONFORMES
 A LA NORME NF 2 04 01
 APRES MISE EN PLACE DES APPUIS
 LES ESPACES LIBRES SERONT REMPLIS
 DE COUPEL SPÉCIFIQUE
 COUL APPROXIMATIVEMENT 1.50 TONNES
 Contre les Ponts de la B
 Technique de la Route de la B



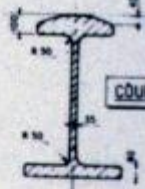
COUPE B.B



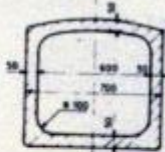
COUPE C.C



COUPE E.E

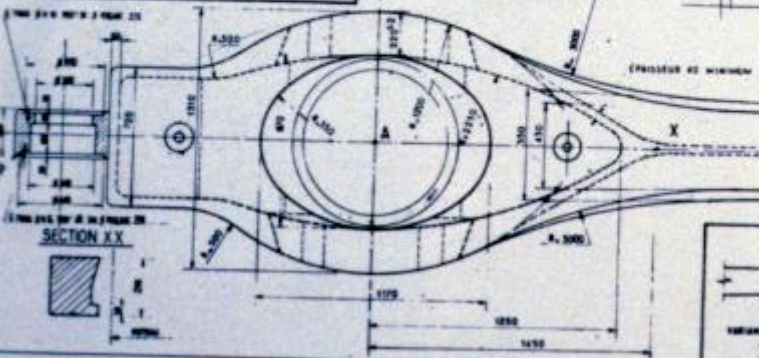


COUPE D.D

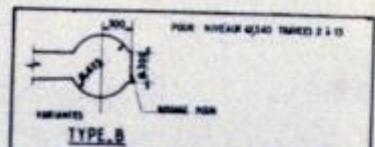


COUPE A.A

GERBERETTE TYPE A

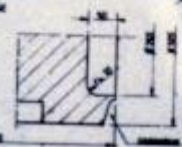


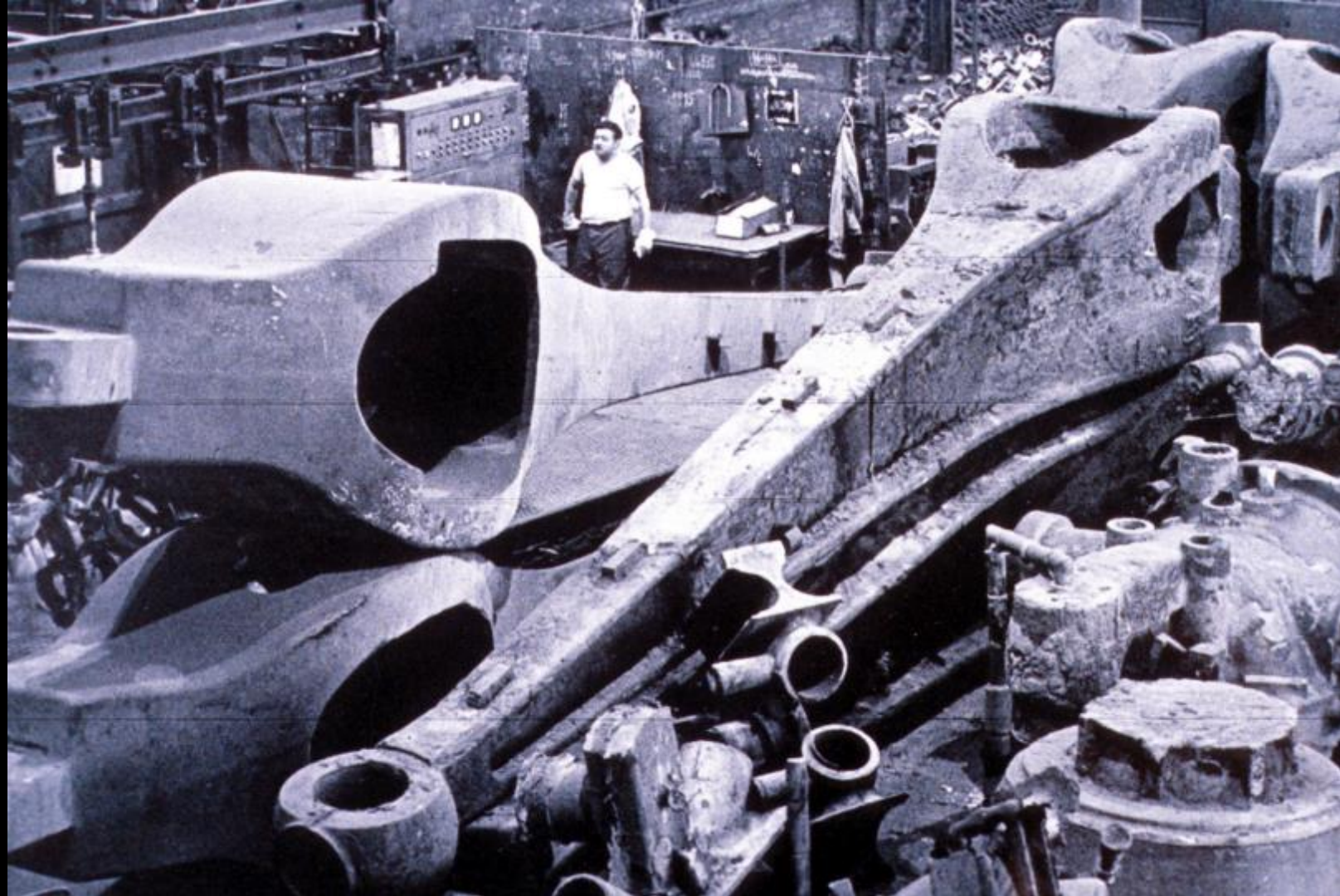
SECTION XX



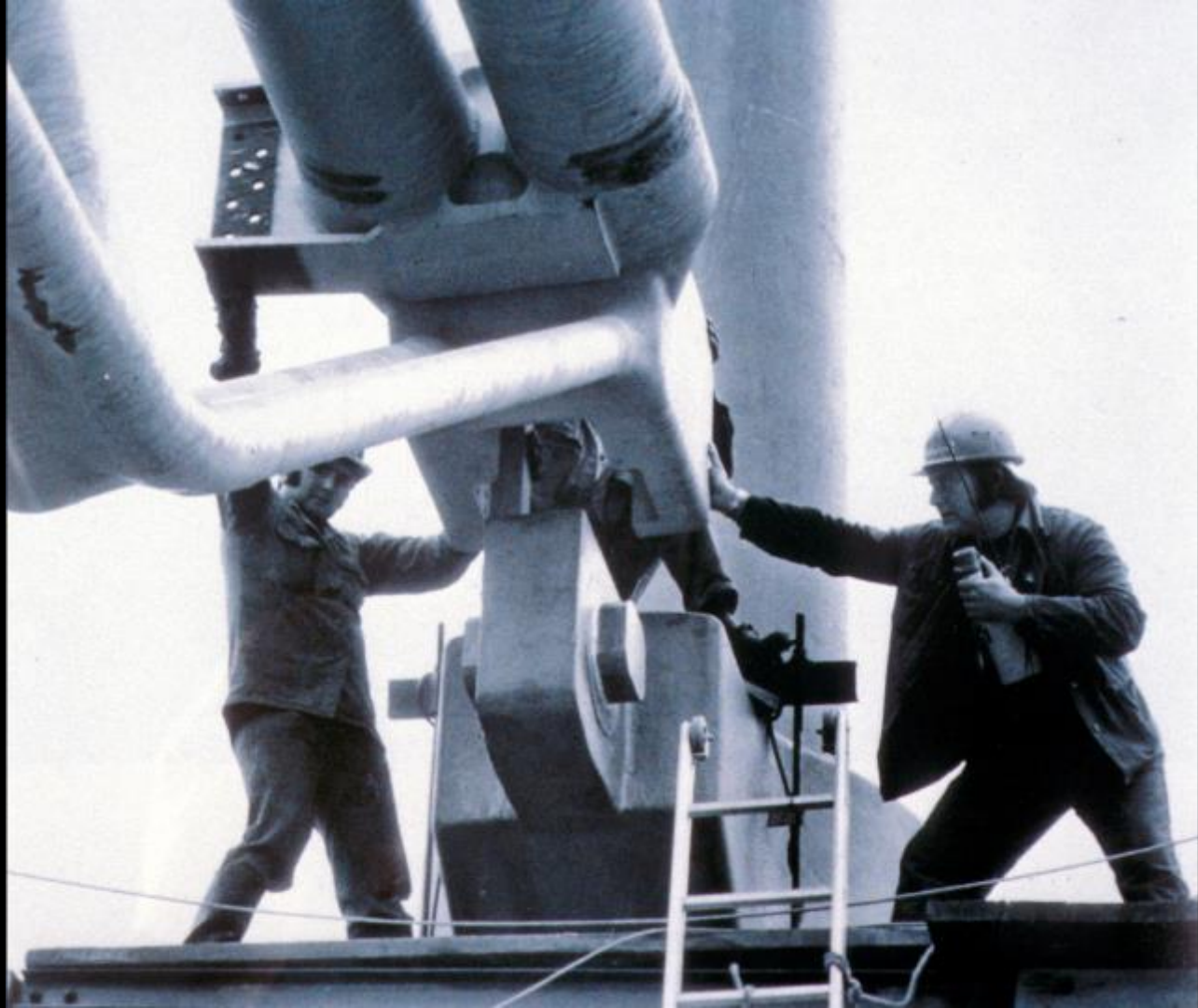
TYPE B

DETAIL DU BORDAGE
 AUX NIVEAUX 48.540
 48.540
 47.540











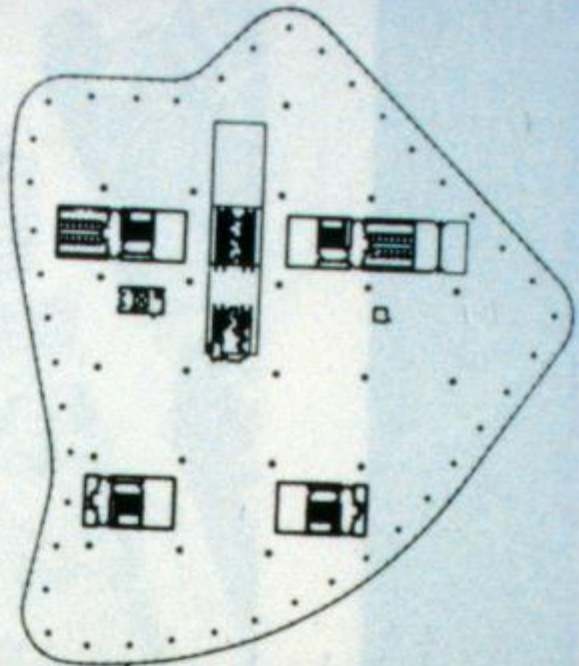
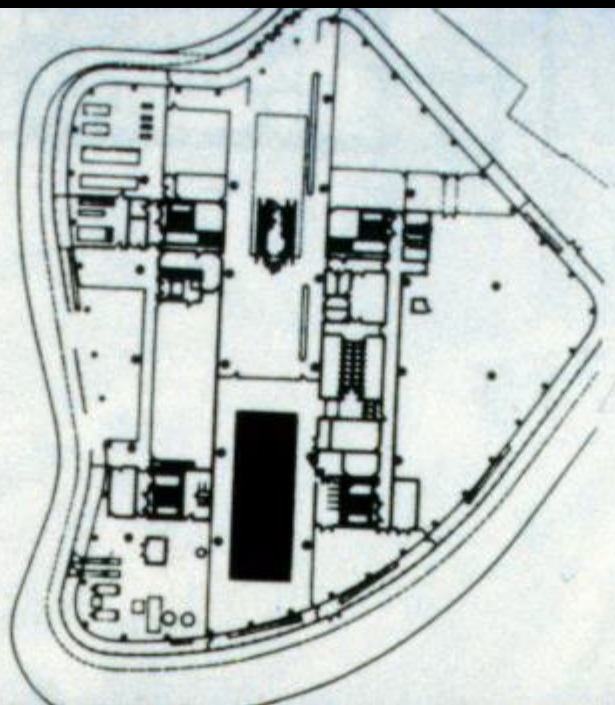
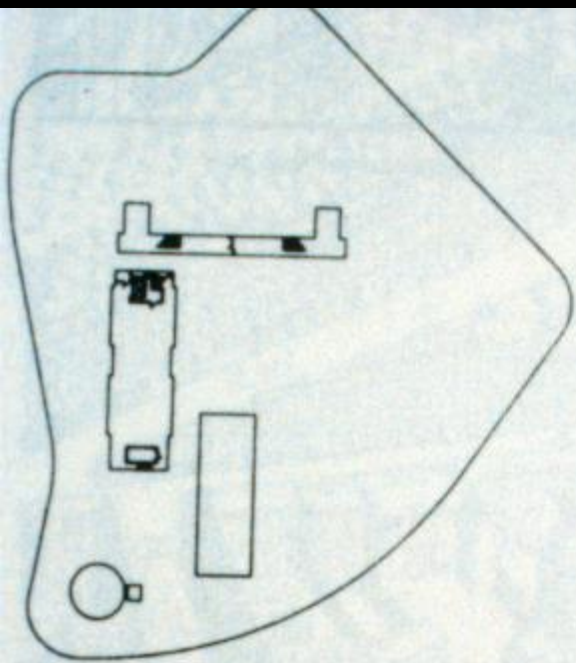




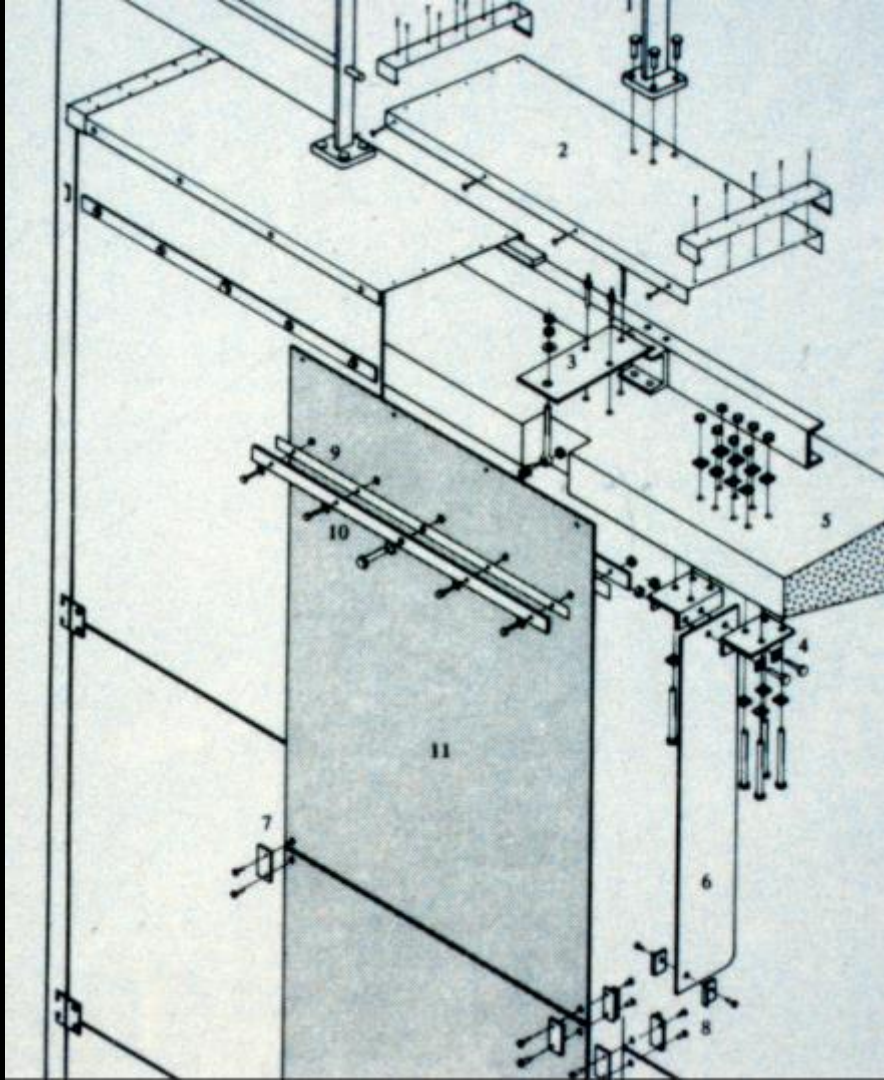
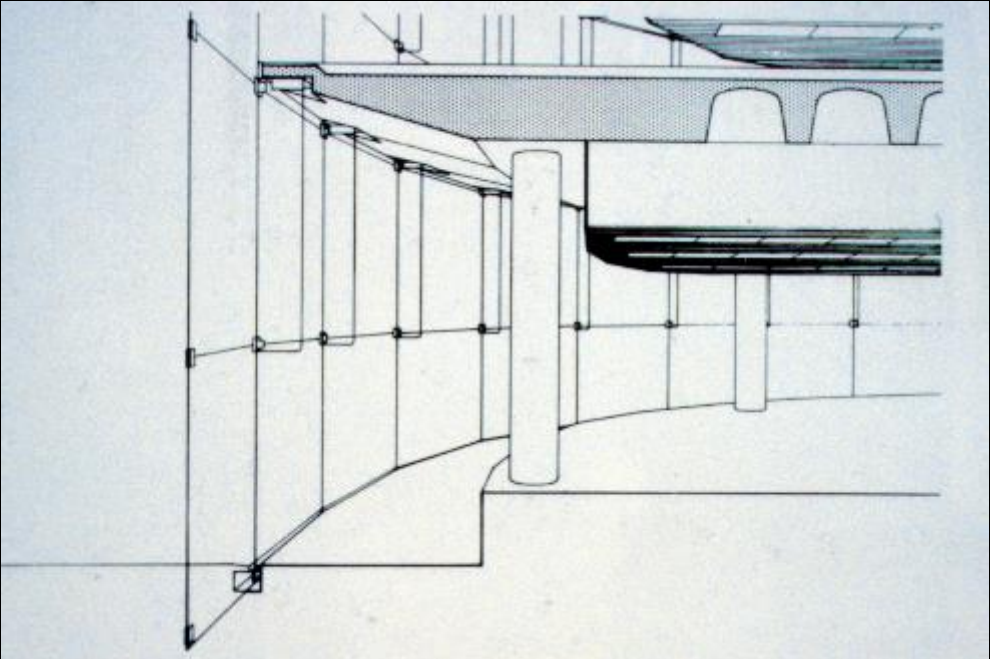
Willis Building (Willis Faber Dumas)
Ipswich, England
Norman Foster and Michael Hopkins
1975









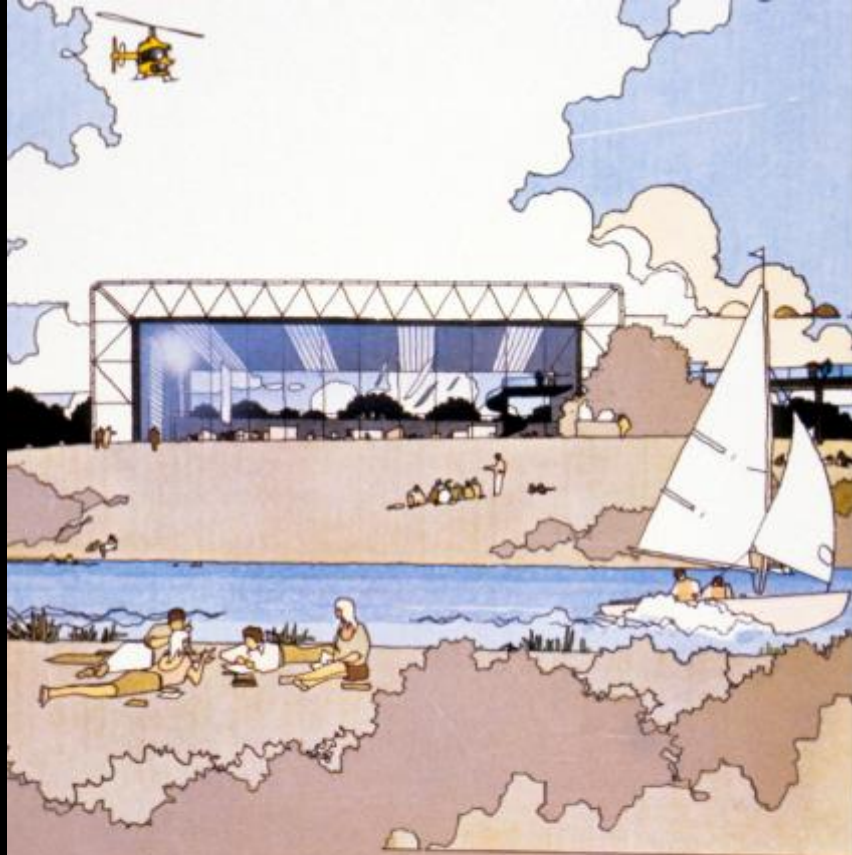






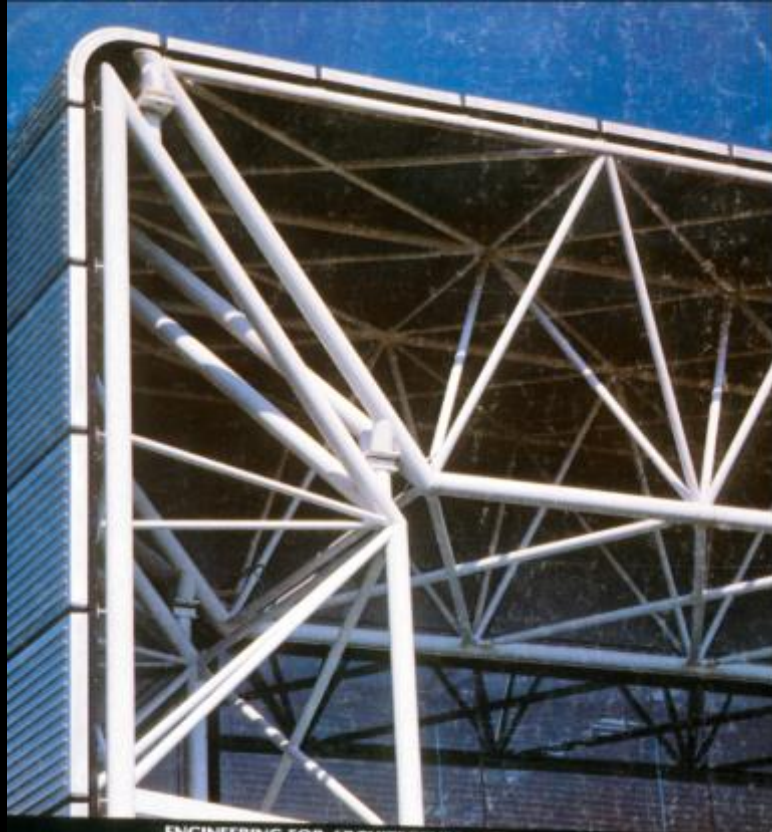


Sainsbury Centre for the Arts
England
Foster and Partners
1977



FOSTER ASSOCIATES'

SAINSBURY CENTRE



ENGINEERING FOR ARCHITECTURE 1979

ARCHITECTURAL RECORD

MID-AUGUST 1979

A MCGRAW-HILL PUBLICATION \$5.50 PER COPY

THE BUILDING AS SERVICING MECHANISM TECHNOLOGY



Internally the services are disguised and the servicing

Given the progressive highly serviced and technologically 'sterile' that has tended to be associated with Foster Associates' buildings in the past, the Sainsbury Centre can either be seen as a special case (as a university arts building) or alternatively making a change in emphasis of Foster's use of advanced technology. The diagrammatic concept shows around a concrete to exploit the 2.1m deep, spectacular, free-spanning structural system eventually chosen, as a consistent service zone around the entire envelope of the building (since the original proposal to expose the structure externally was dropped).

This zone - that on one side with the glazed, solid (concrete) or louvre cladding system, and on the other, internally, with adjustable perforated aluminium louvers - is able to dynamically manage the environmental conditions within the building, by filtering or generating light, introducing and extracting air, and alternatively buffering or absorbing sound. It houses service rooms at ground level and provides outside access across the roof to the lighting system and roof ponds. Rather than the commonplace of decentralised servicing of White Palace, which is displayed as part of the building yet justified by its efficiency, the servicing of the Sainsbury Centre, encompassed in a similar manner, is deliberately low key - optimised by the controlled mirrored service ducts in the external elevation, internally the service entrances are similarly disguised as part of the overall consistent louvre interval detail. As Foster notes, the servicing is sensed rather than visible - magically responding to the changing light levels.¹⁸

The concept of the building as machine has recently fascinated architects in the 20th century. The Centre's visible response to the changing external environment brings the building close to re-asserting the Constructivist ideal of an objective architecture of technical function; leaving a sinking, if pragmatic, similarity to Nikolai Noy's vision of a 'light architecture'.¹⁹

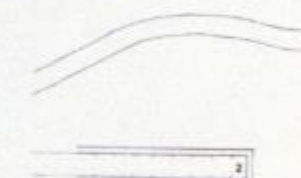
Foster's container for culture conditions its internal environmental discourse, as a 'sensitively controlled box' - its cultural and security system revealed into perforated walls. This stress on security, it could be argued, has had a not insignificant influence both on the siting and organisation of the building (the security system extends into the university grounds). The 'living' area for the collection sits atop a concrete retained, elevated basement, whose presence speaks of the immense difficulty of the collection. Foster, talking of his visit to Louisiana museum outside Copenhagen (with the Sainsbury while researching the project), was impressed by the 'social ingredient' of the place: 'everybody was there, everybody was enjoying it, the kids were there, the old age pensioners were there. It was a great flat place - what was also very exciting were the displays, which were not over-protected, were really exposed...'.²⁰ While enjoying the relaxed atmosphere, he deplores the lack of attention to servicing and security:

their negative facilities - it was almost nuts, you really felt that with a screw driver you could have opened the whole place up and taken whatever was in storage away... If they had a Japanese exhibition which was due to come that week, and they were in a terrible state, they were going to have a container truck outside in the street and they were wondering how to get security between the street and this particular display how in such a way they can move these precious objects from the container into the building itself.²¹

The Sainsbury Centre solves the dilemma by hiding underground its service entrance for receiving

Key to plan and sections:

- 1 Access road
- 2 Ramp
- 3 Louver bay
- 4 High level walkway
- 5 Tank
- 6 Entrance
- 7 Special exhibition area
- 8 Terrace
- 9 Coffee area
- 10 'Living area'
- 11 Study reserve
- 12 School of Fine Art
- 13 Kitchen
- 14 Restaurant
- 15 Service entrance study room
- 16 Study area
- 17 WC's
- 18 Plant
- 19 Storage
- 20 Workshop
- 21 Roof access space



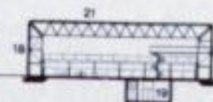
Dimensions

External length	121.4m
Internal length	122.4m
External width	35.6m
Internal width	29.5m
External height	18.2m
Internal height	7.3m

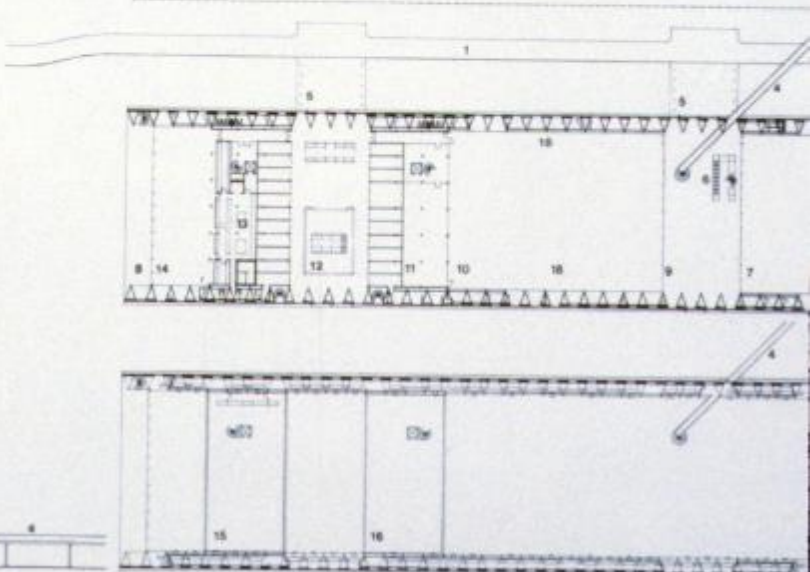
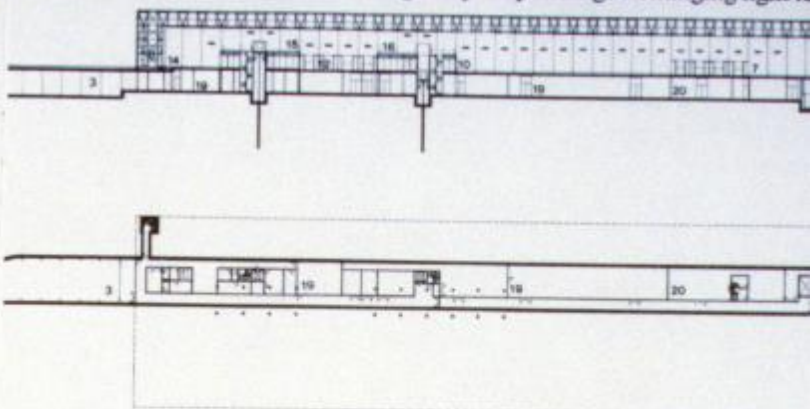
Ground floor area	3550.0m ²
Mezzanine floor area	835.0m ²
Basement floor area	1064.0m ²
Service zone area	735.0m ²

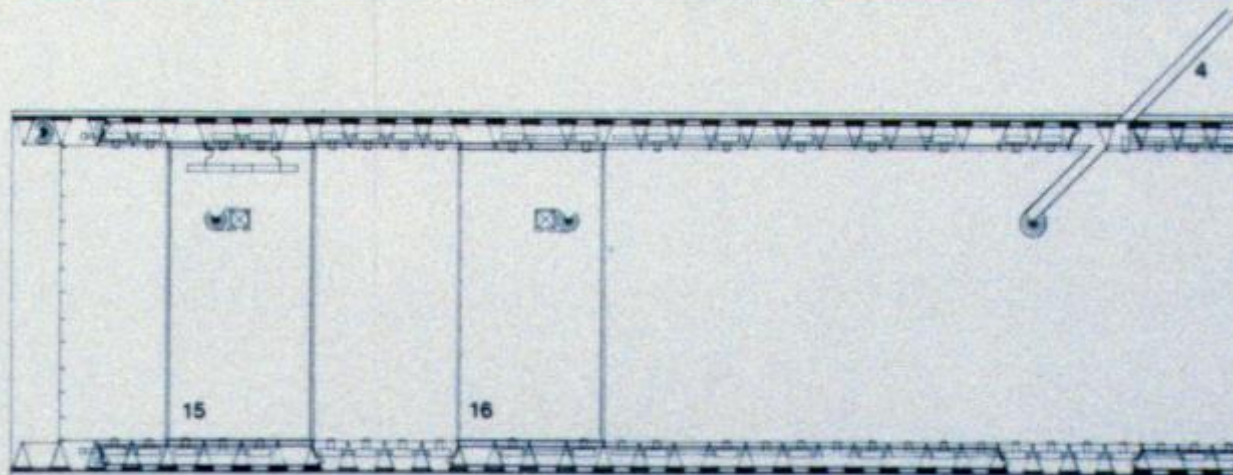
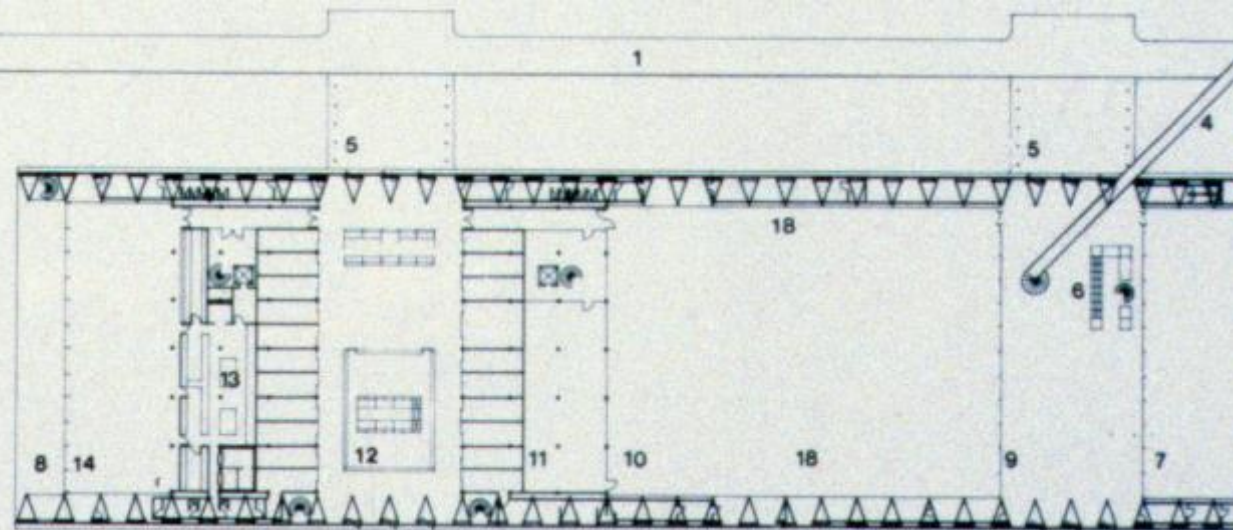
Total area

6186.0m²



ing is sensed rather than visible - magically responding to changing light levels.





strained by an insistence on discreetly hidden services in the spirit of a liv-

loading, exhibitions and deliveries. From the roof a spiral staircase is cut into the ground away from the building, and ramped down

hancement. Lined with propion loading systems does have many of the characteristics of propionisation – indeed with 13 million Btu it is not entirely a trivial component – but back up against a half-level loading dock only in front of the service doors. Behind the basement corridor, capable of being 17 feet long, is a half-level loading dock. If half was along its length, provides access to the main level of the building. The main level is a work of art, to a hydraulic lift at the end of the building (concealed as part of the building's structure).

... The Museum is linked to the world as shown by transparent lifts and linked outdoors. However it functions quite

As a security device ensuring the safe of valuable works or art - it is not intended for long-term storage, as the items not in the main exhibition area are kept an-

for academic purposes in the adjacent study
 building is only somewhat aware, perhaps,
 that the security cameras in the 'living
 room' show that the domestic interior of this space

agility, vibrant physical organization and security that are built into the building, more mundane level the main working building is the restaurant kitchen located

N.C. is the one major urban space (and concept at the moment) with a view of building. Efficiently serviced in terms of its somewhat restricted and intermittent is also concerned with the condition

It also compared with the operations as provided on the staff of Faber. Apparently constrained by an insistence on better servicing.

... of a large room, surrounded by a climate-controlled vault for works of art, air-conditioned, and relies on the oil engineering of the ventilation system.

the engineering in the ventilation system, the thermal climate of East Anglia, and the unique, reflective and highly insulated building envelope.

of delivery and security, covered by all diametrically opposing (and spying on) environments, the latter appear as an (and environmental modification) of

It was found that the growth of the algae was significantly higher in the closed system than in the open system. The results of the experiment are shown in Table 1.

It is open to modification and change: the flexible cladding system, but

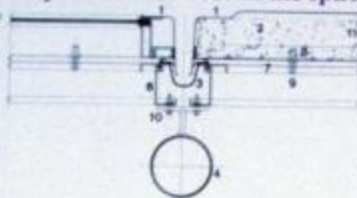
22

6 Plant
7 All services: plant,
darkroom, WC's, stairs
8 Solar controlled blinds

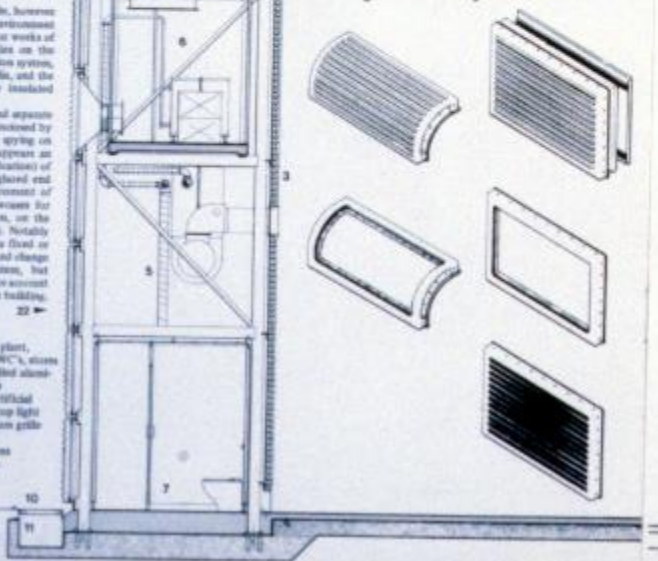
9 Combined artificial and natural top light	10 Cast aluminum grille
---	-------------------------

	11. <i>Game</i>
<i>display</i>	12. <i>Display names</i>
<i>active name</i>	13. <i>Display name</i>

Typical cladding panel lay:



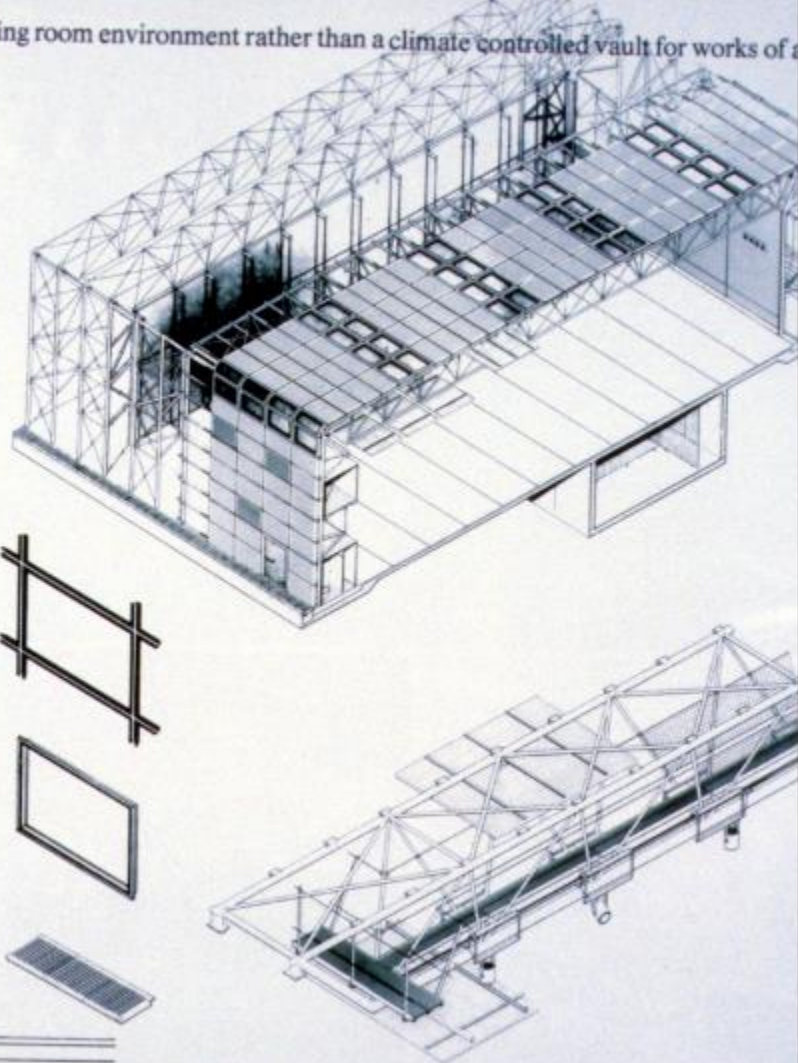
A detailed technical drawing of a roof truss system. The drawing shows a cross-section of the roof structure. Key components are numbered: 1. The main horizontal beam (chord); 2. The top horizontal beam (chord); 3. The bottom horizontal beam (chord); 4. The vertical support (post); 5. The diagonal bracing; 6. The horizontal bracing; 7. The roof slope; 8. The roof pitch. The drawing includes various structural details such as joints, bolts, and fasteners, and is labeled with dimensions and material specifications.

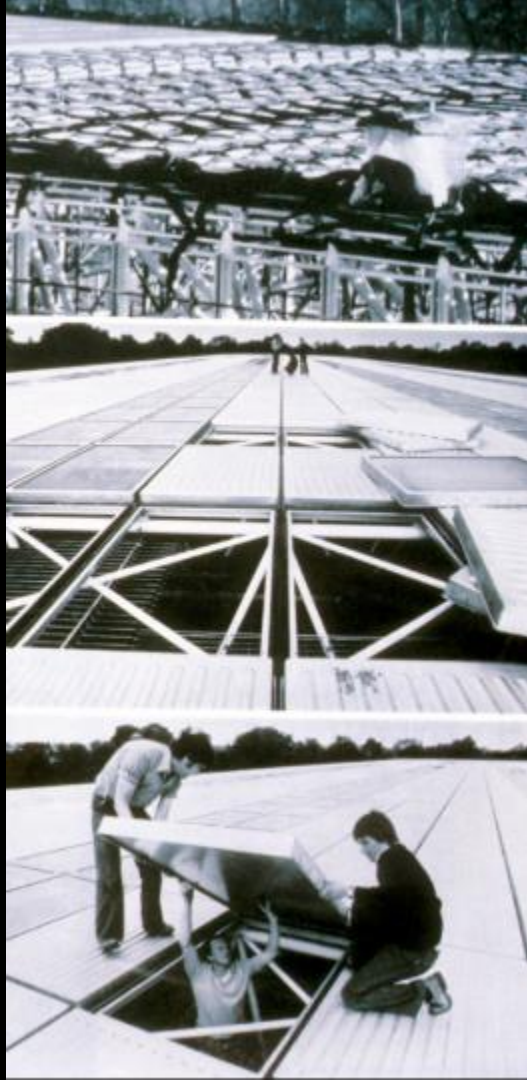


- 6 Plant
- 7 All services: plant, darkness, WC's, stairs
- 8 Solar controlled aluminium louvers
- 9 Combined artificial and natural top light
- 10 Cast aluminium grille
- 11 Gutter
- 12 Display screens
- 13 Display cases

11) Aluminium channel stiffener

ing room environment rather than a climate controlled vault for works of art





















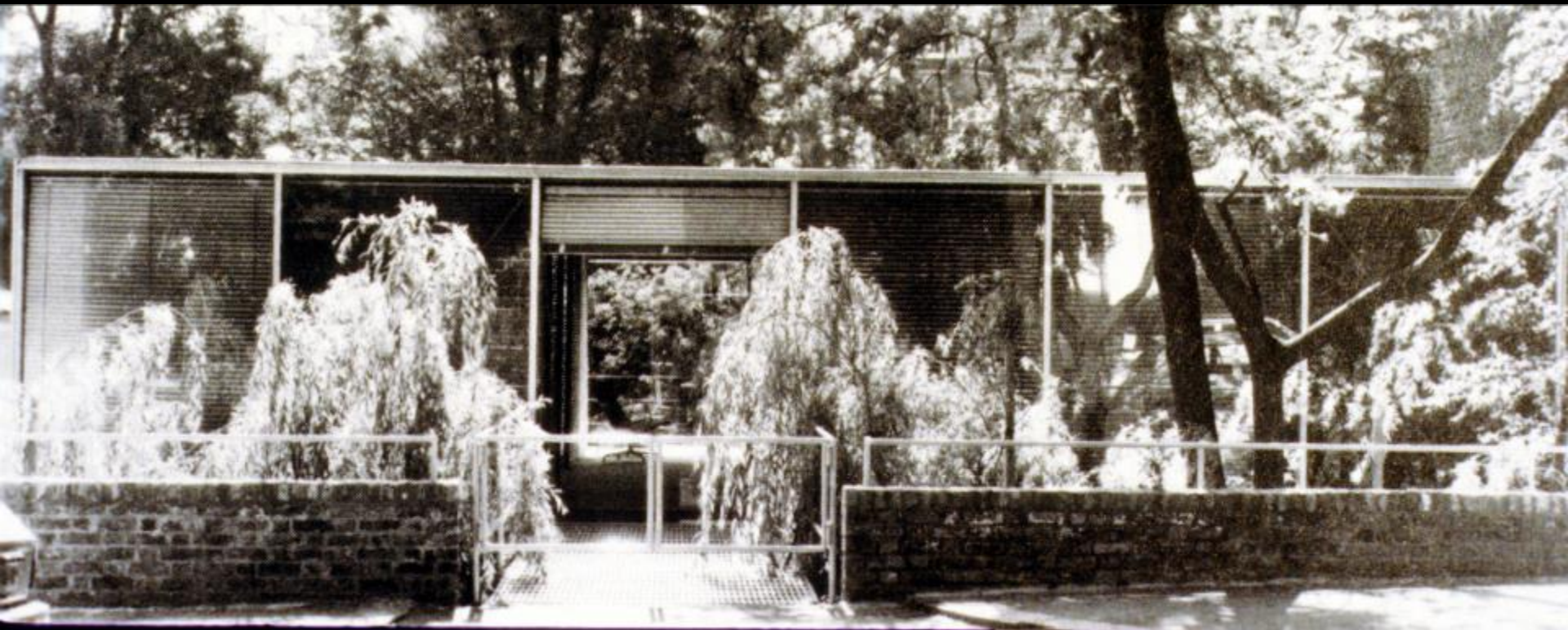






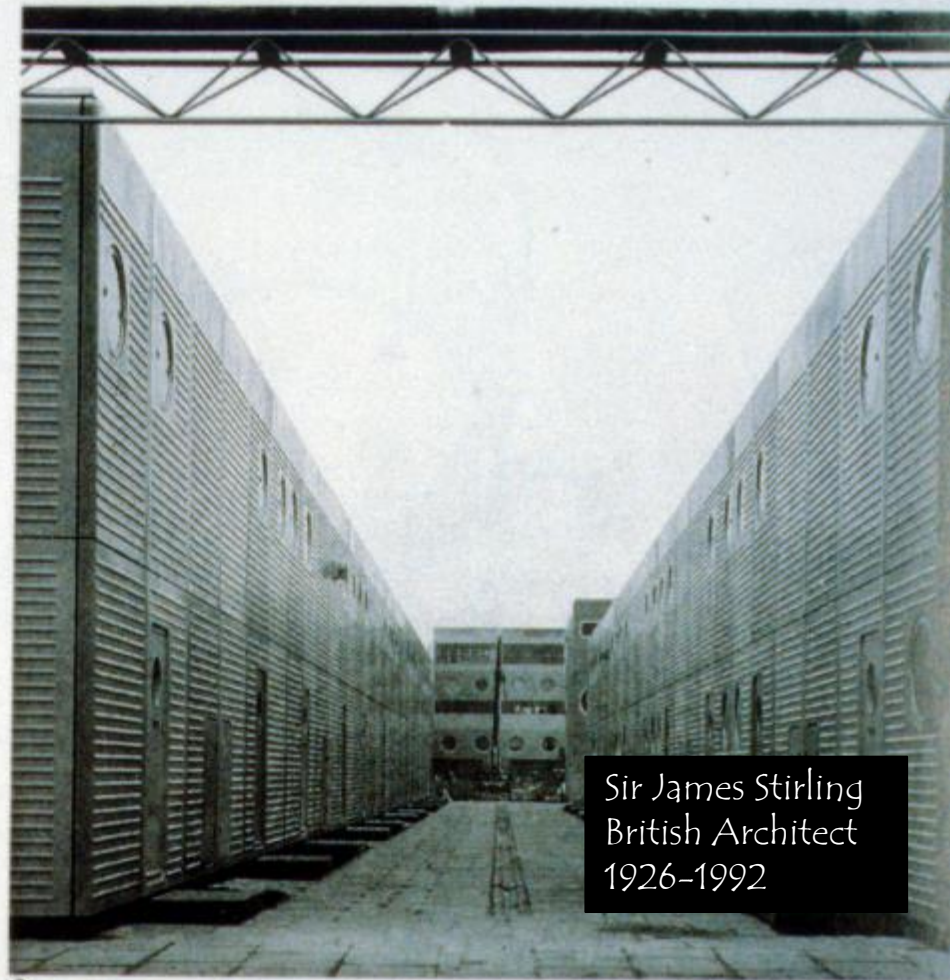
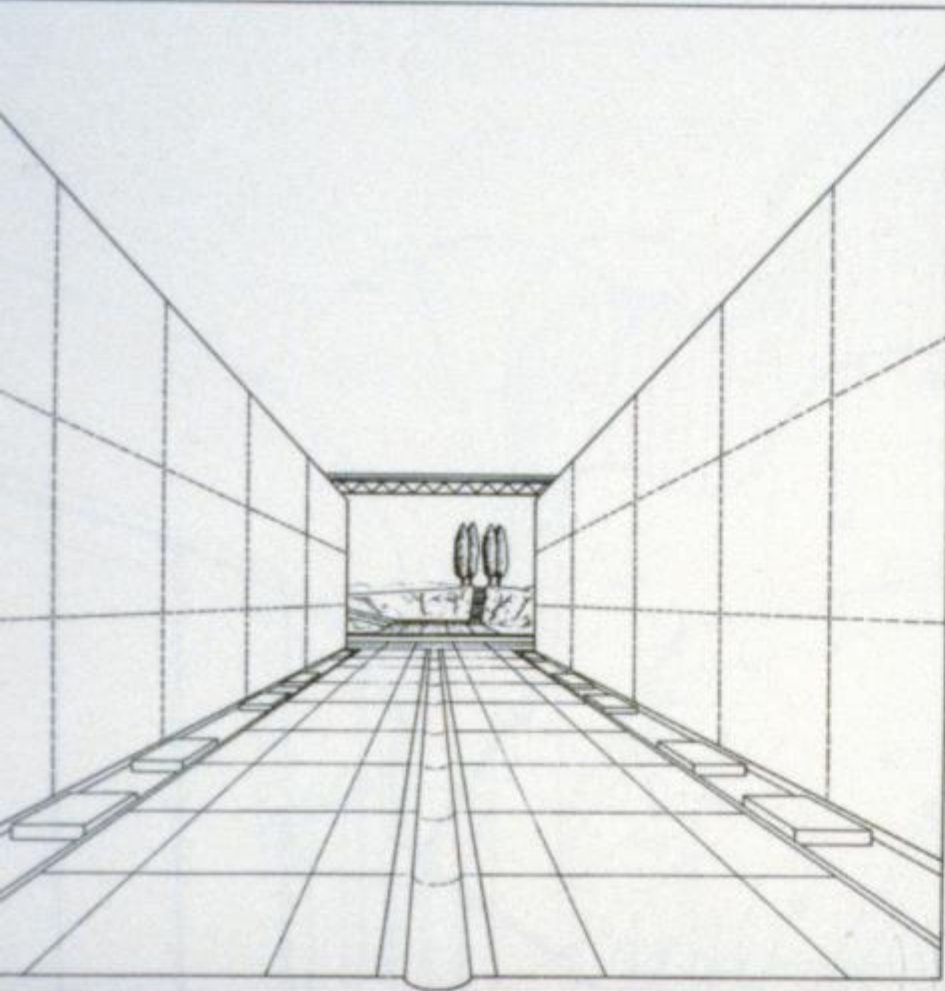
High Tech design approaches vary based on the choice to create custom components or use standard off-the-shelf materials

The historian Reyner Banham referred to these early buildings as "serviced sheds" as they exposed the structure and also all of the mechanical systems.

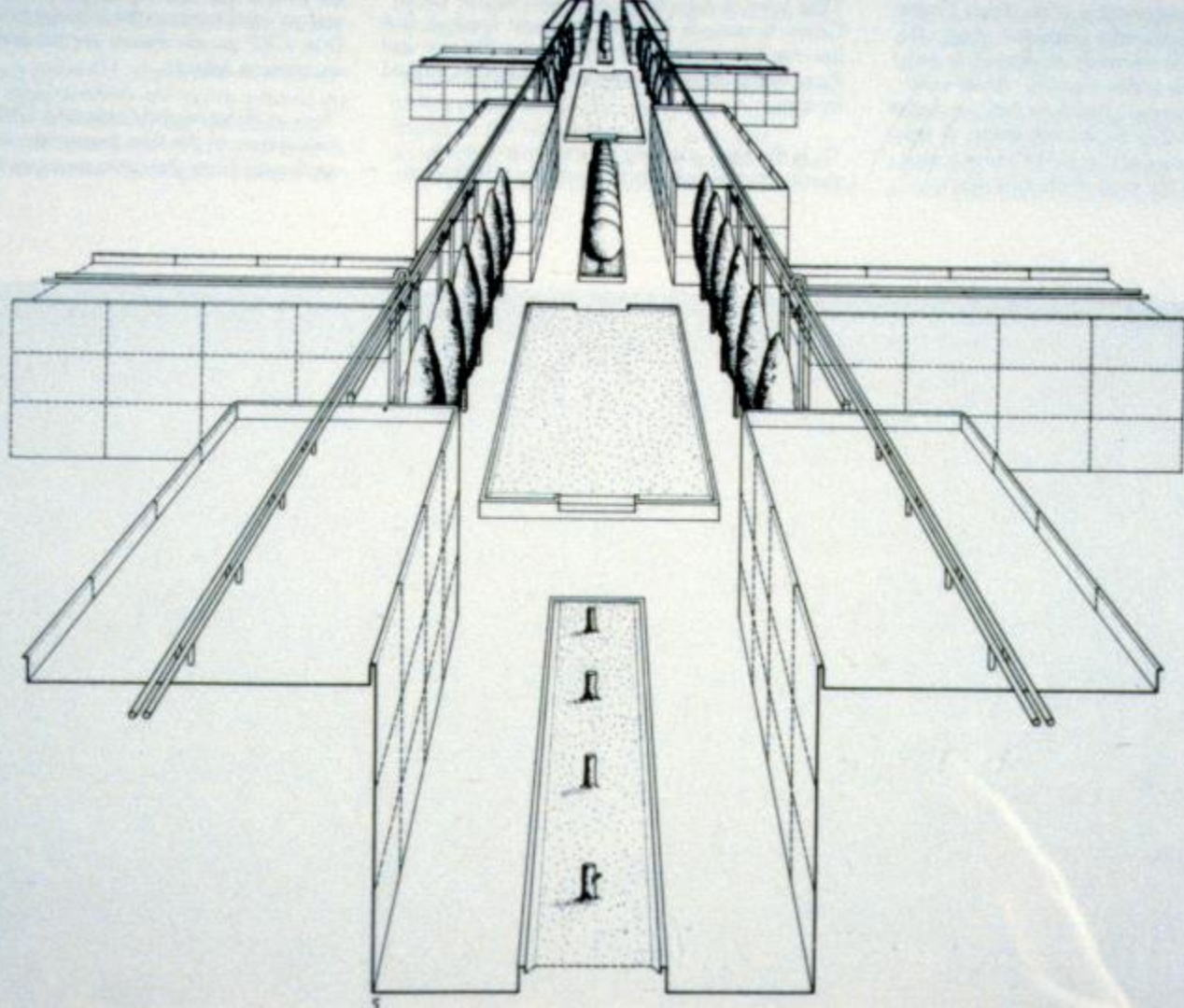


Residence
Michael Hopkins
1976





Sir James Stirling
British Architect
1926-1992

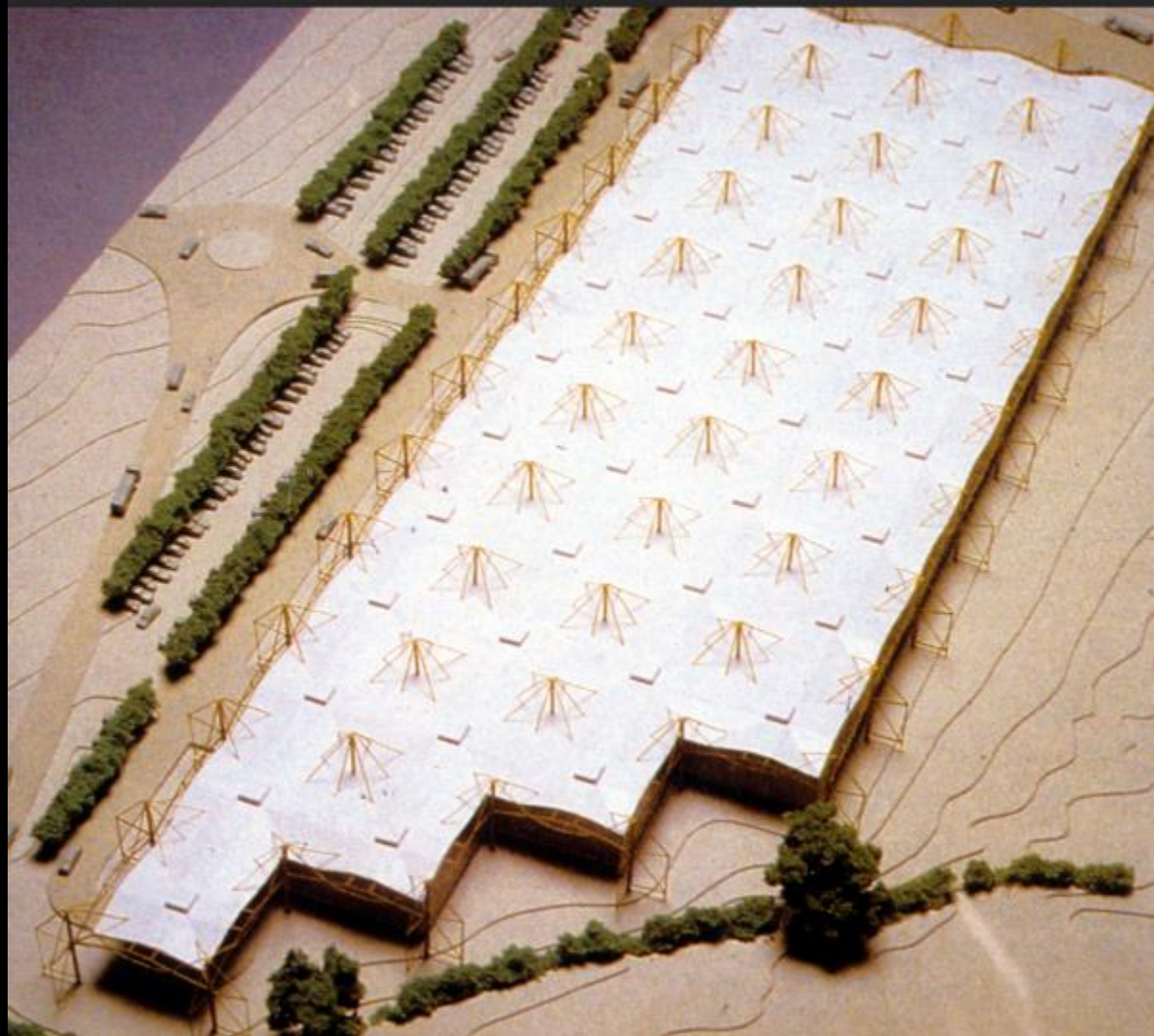


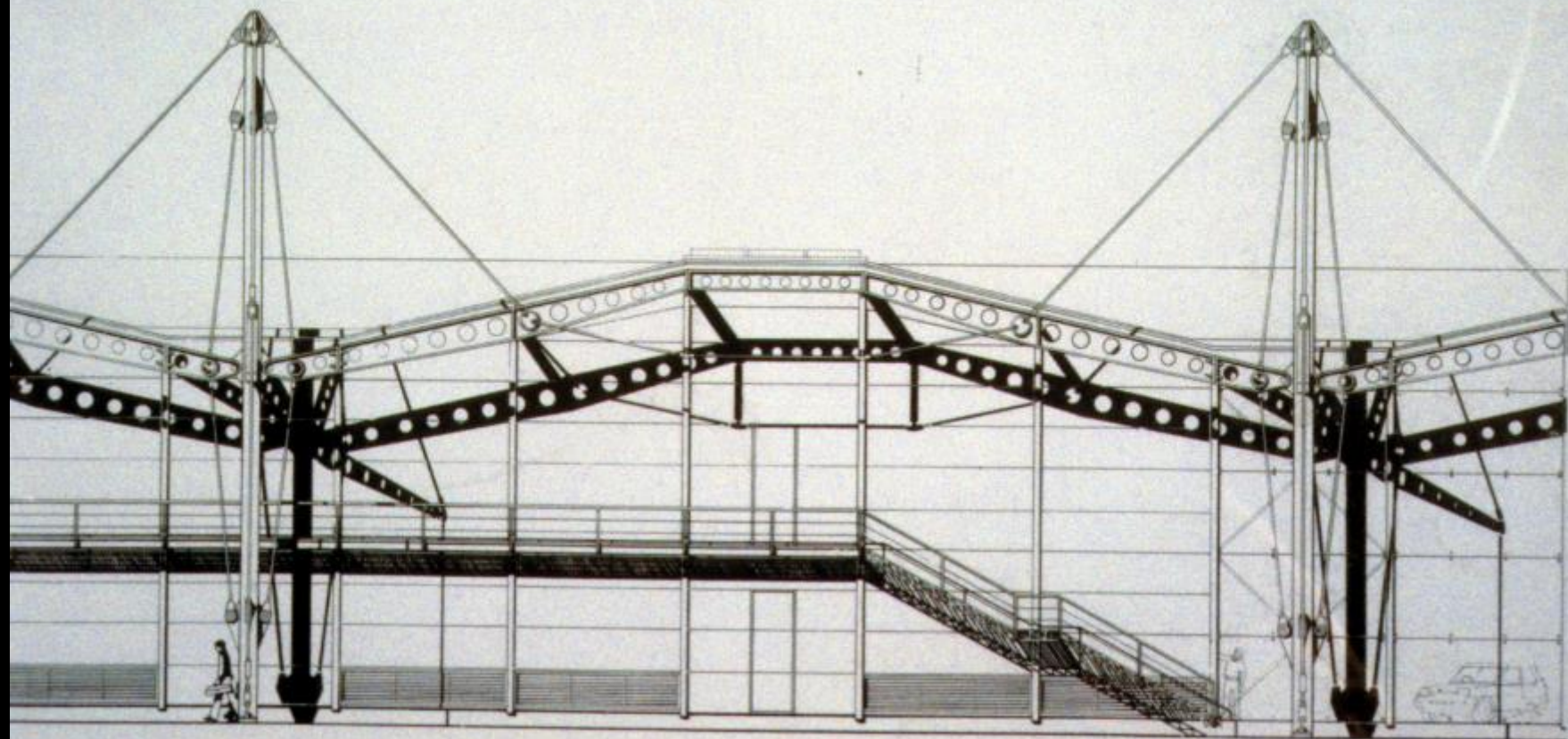


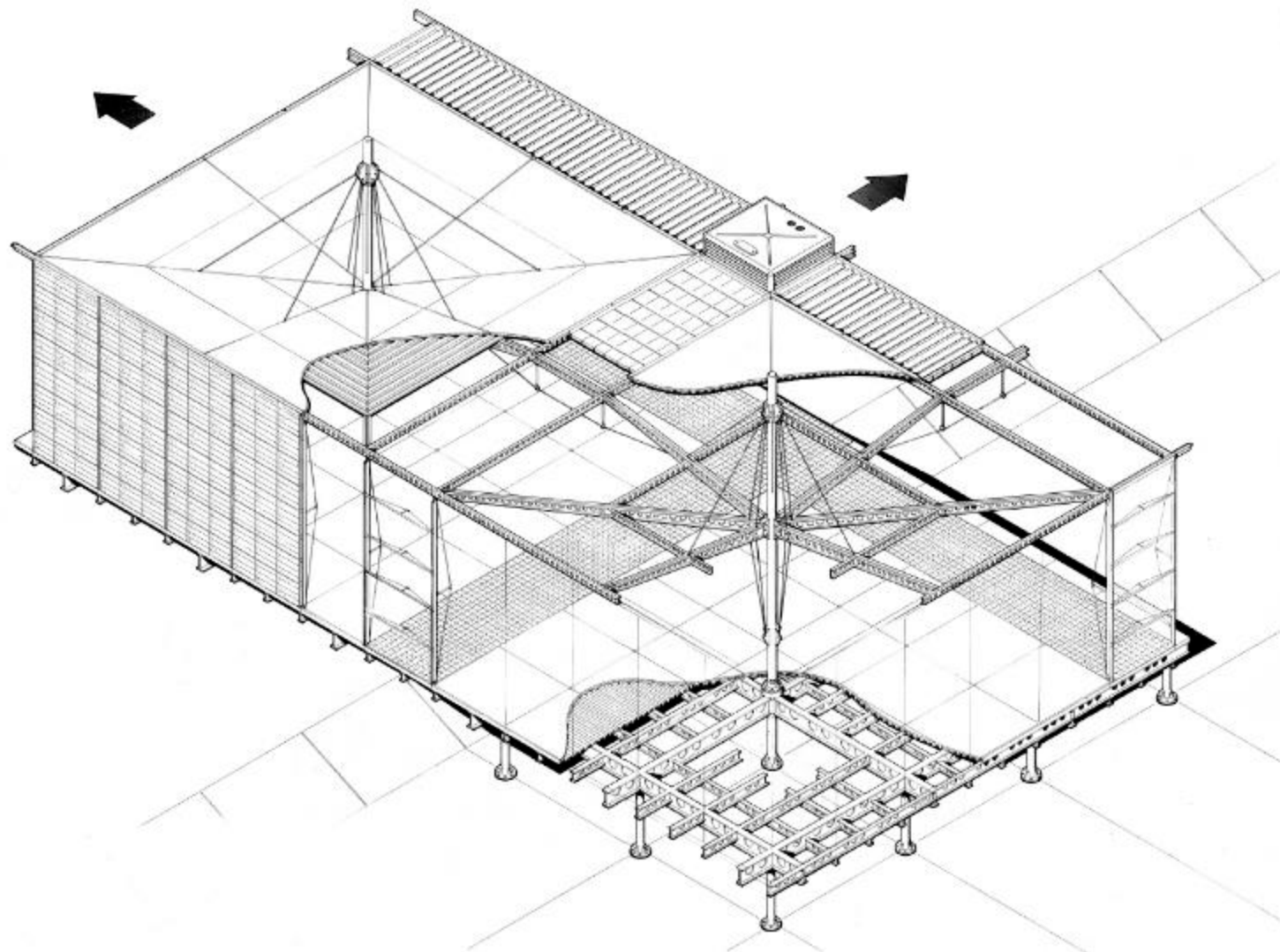


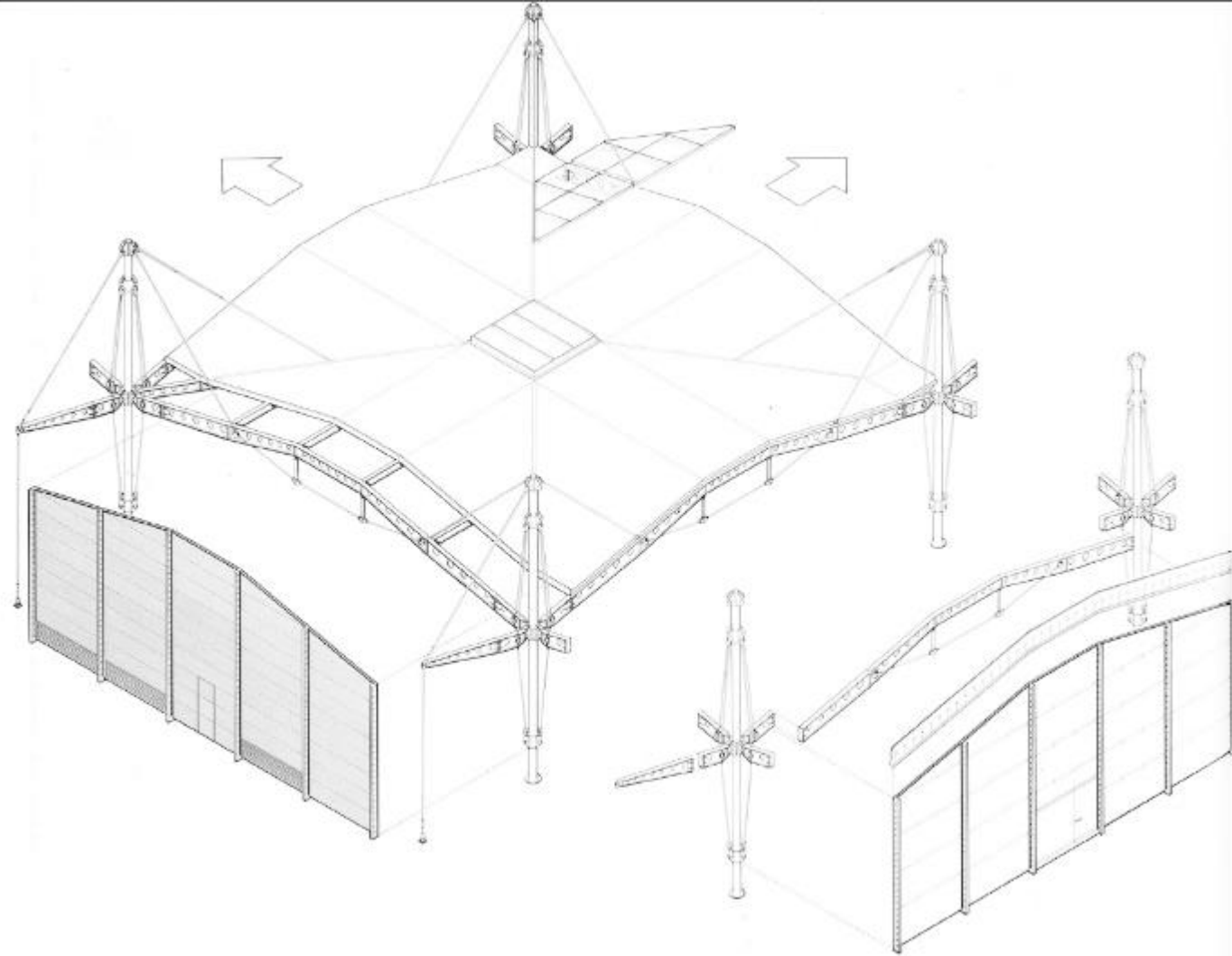


Renault Centre
Swindon, UK
Foster Associates
1982





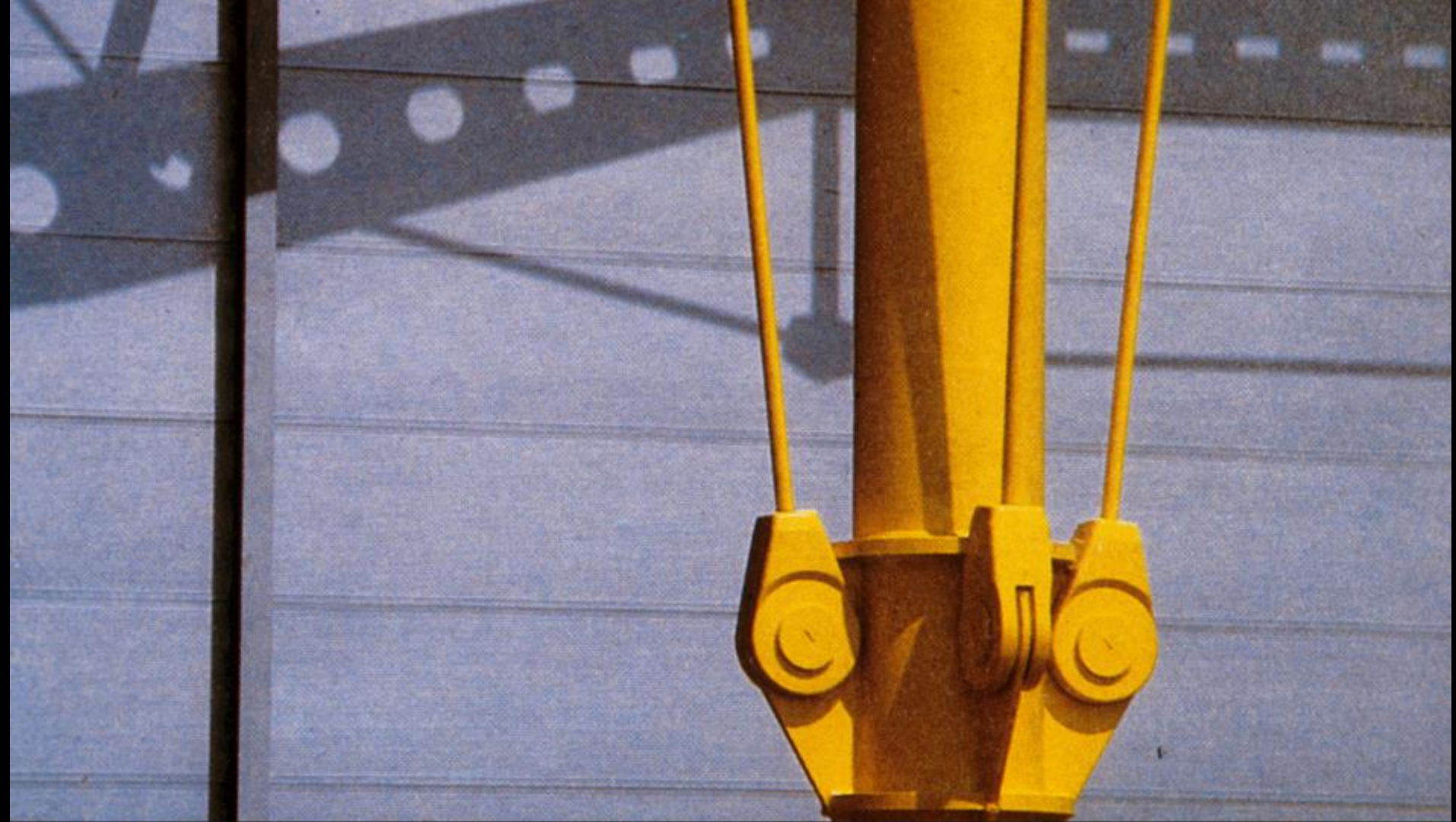












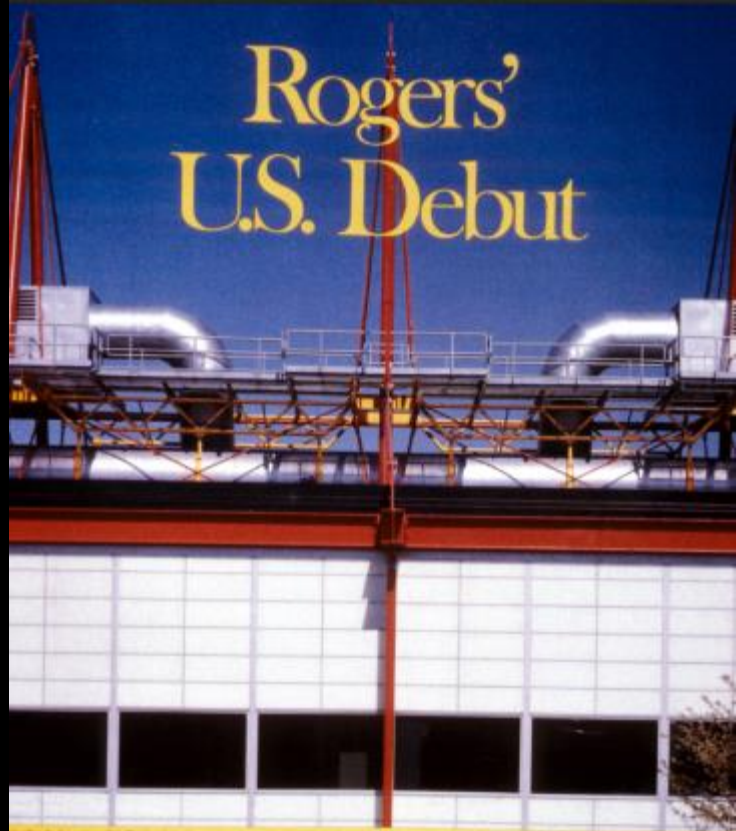
Progressive Architecture

AUGUST 1985



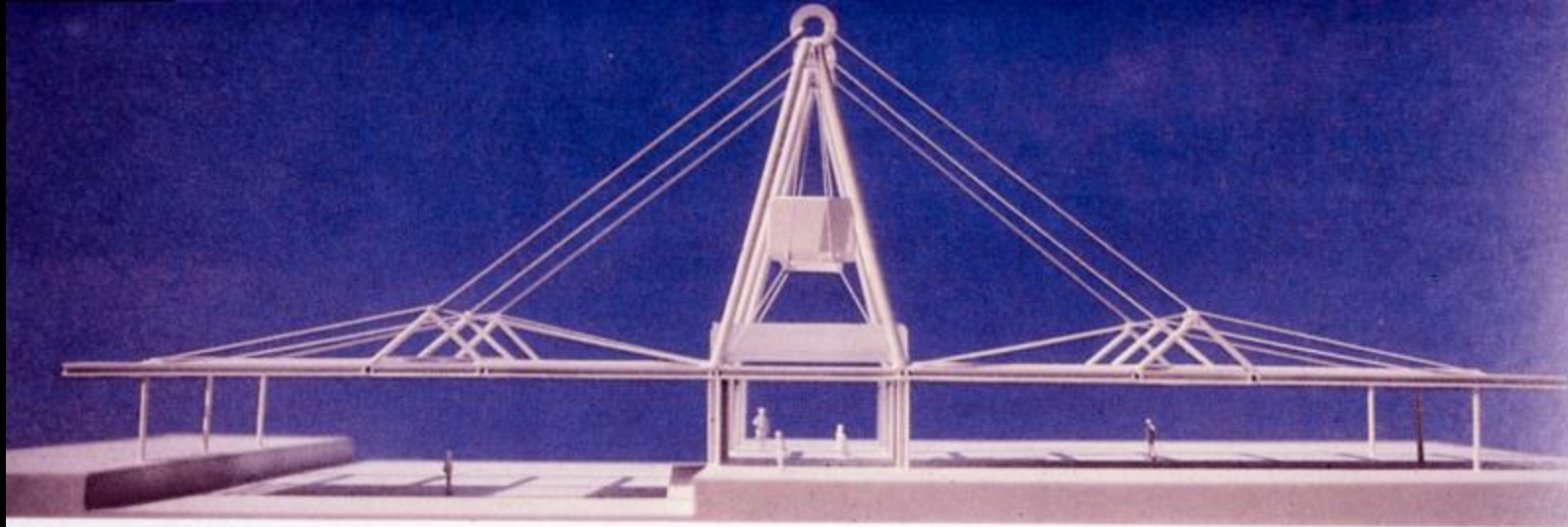
PA Technology
Hightstown, NJ
Richard Rogers
1985

Rogers' U.S. Debut

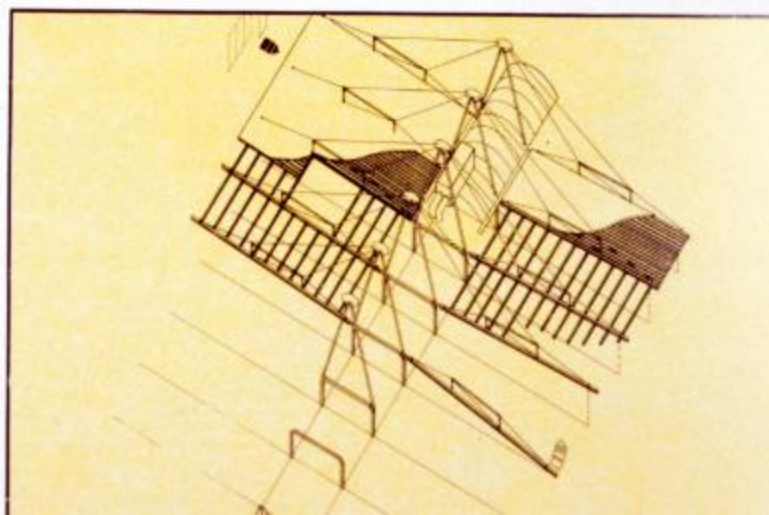


Industrial elevation, PA Technology Center.

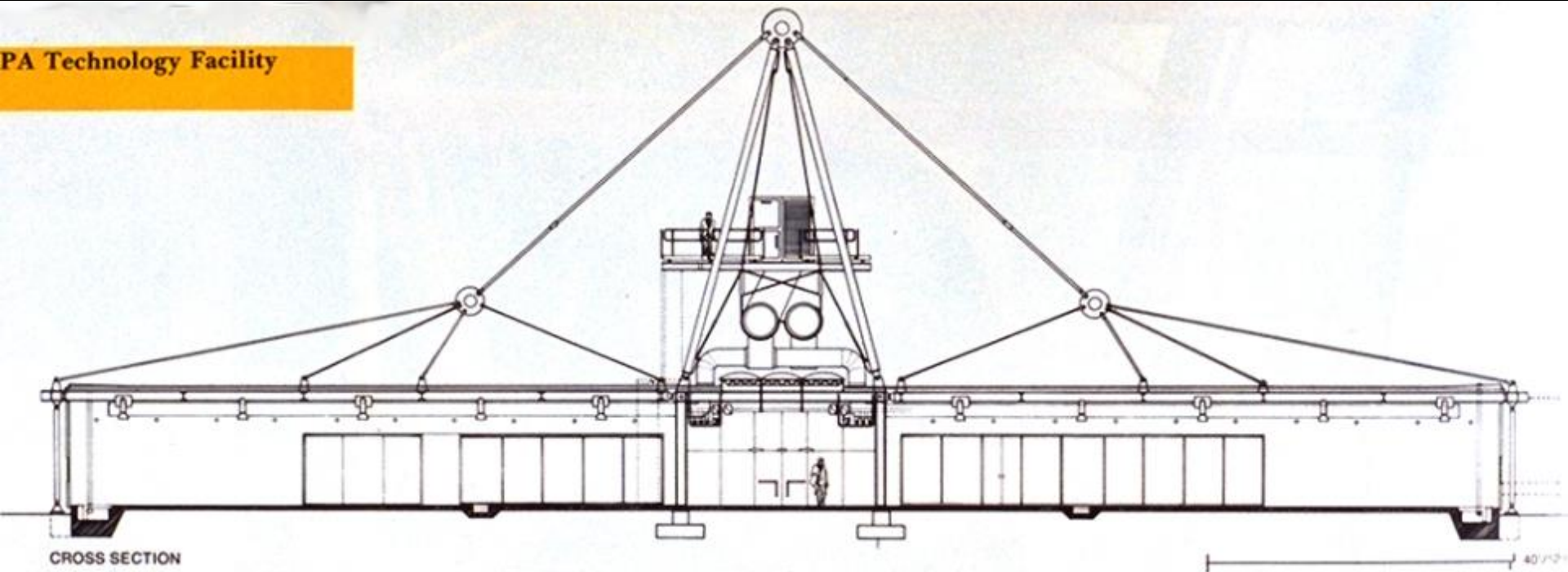
The PA Technology Facility in Hightstown, N.J. is the first work in the U.S. by British architect Richard Rogers, with Kelbaugh & Lee of Princeton, N.J.

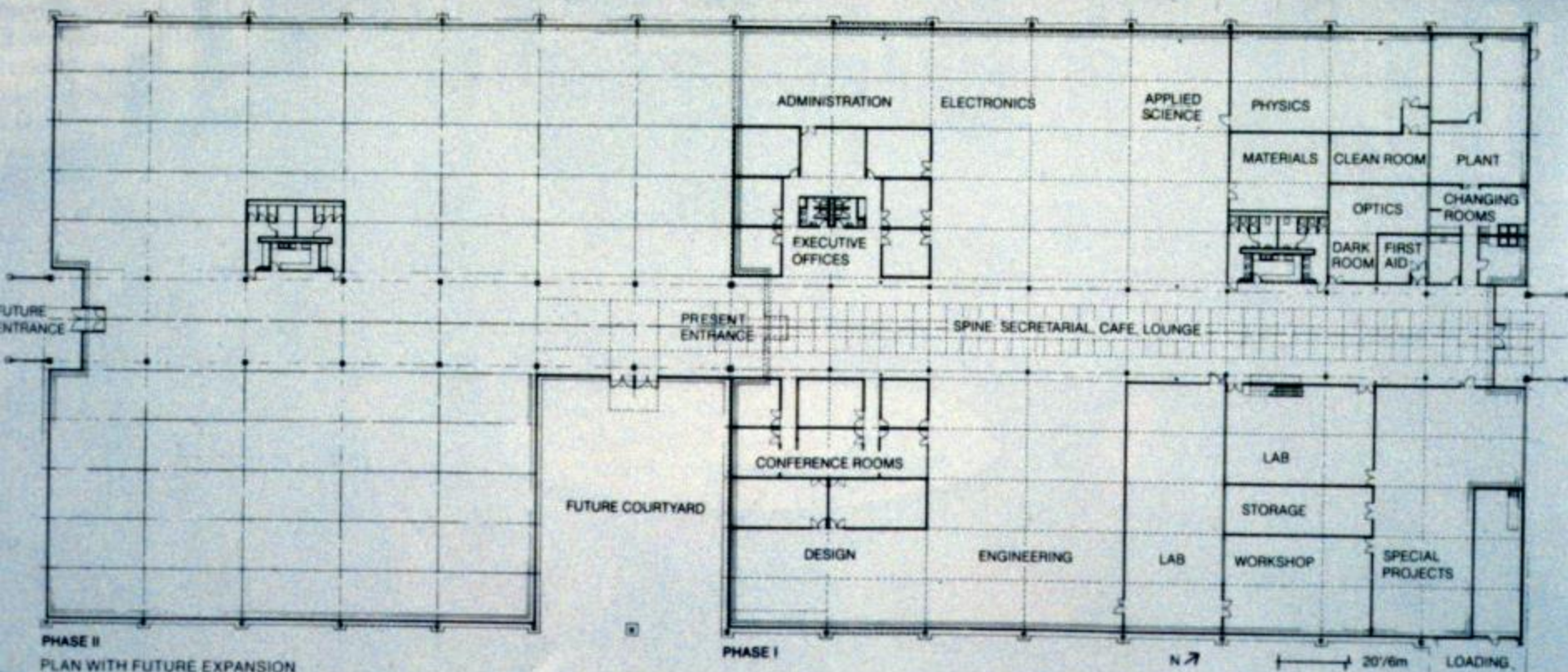


Model of structure



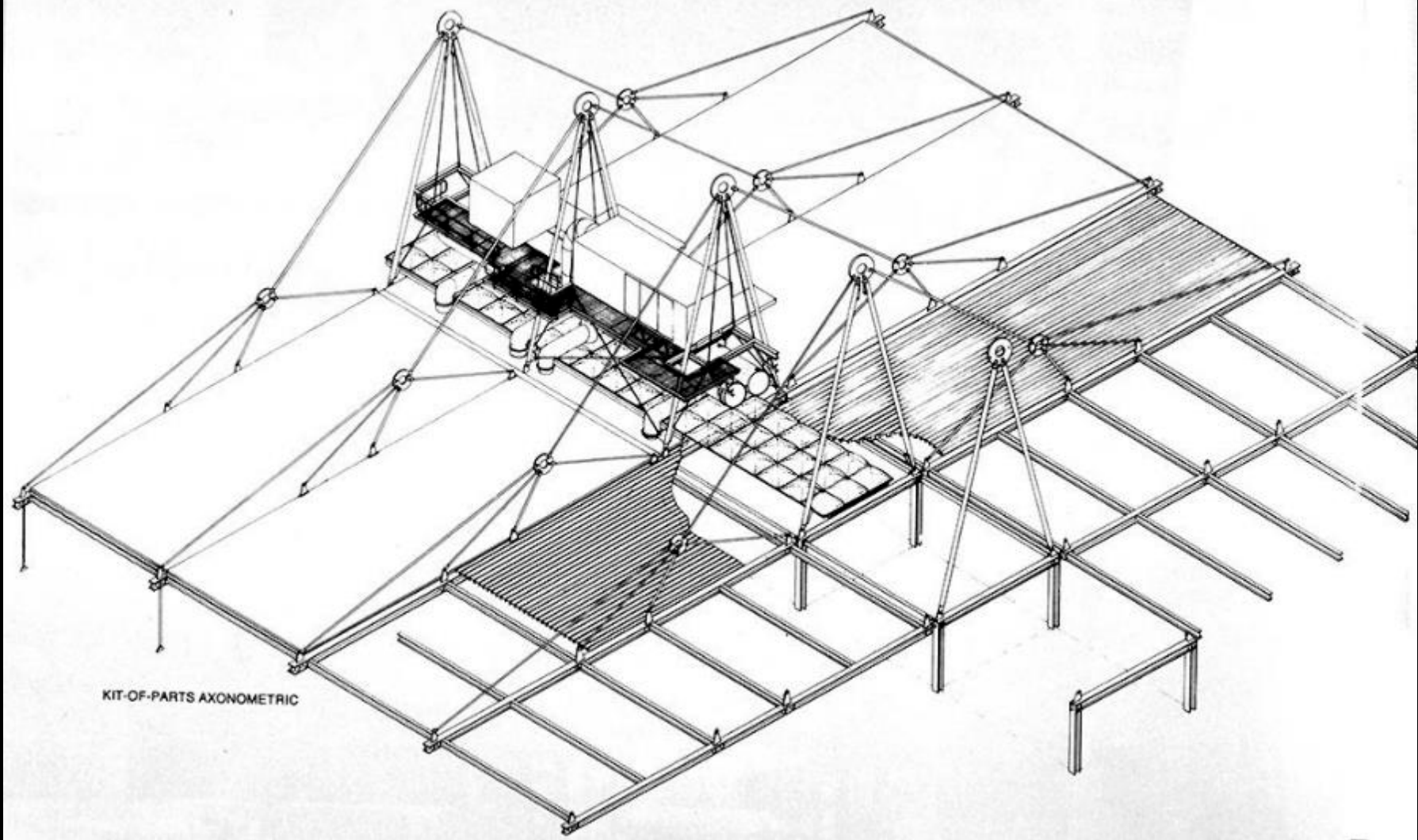
PA Technology Facility





PHASE II
PLAN WITH FUTURE EXPANSION

PHASE I



KIT-OF-PARTS AXONOMETRIC

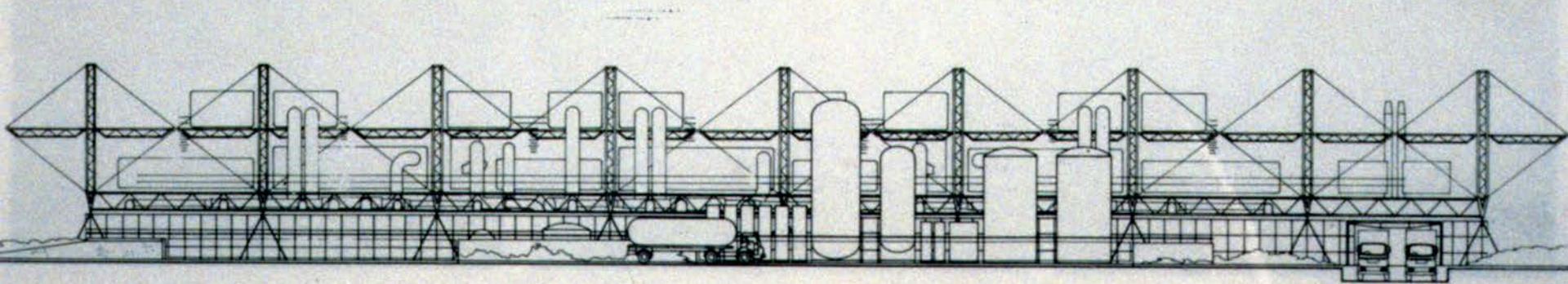
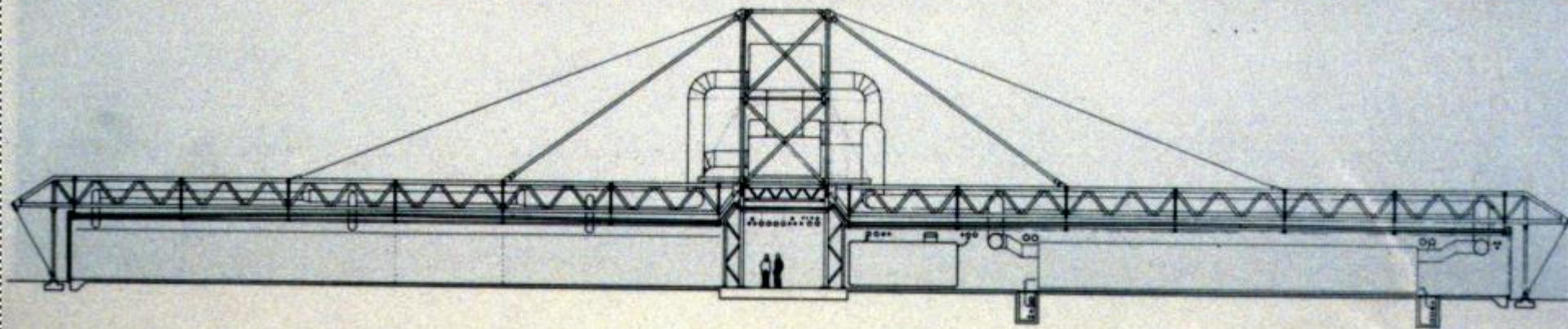


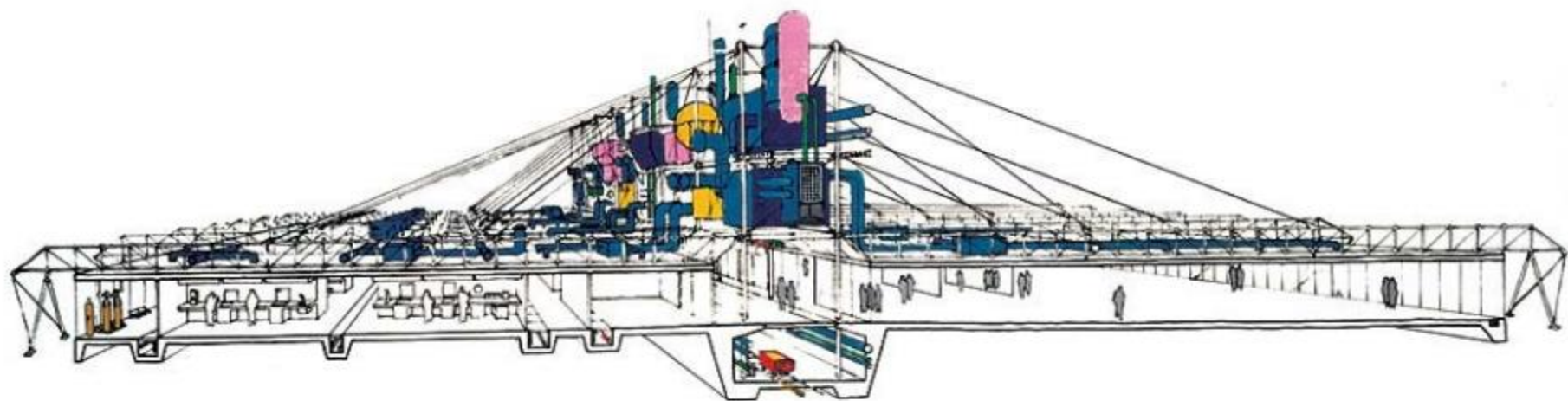


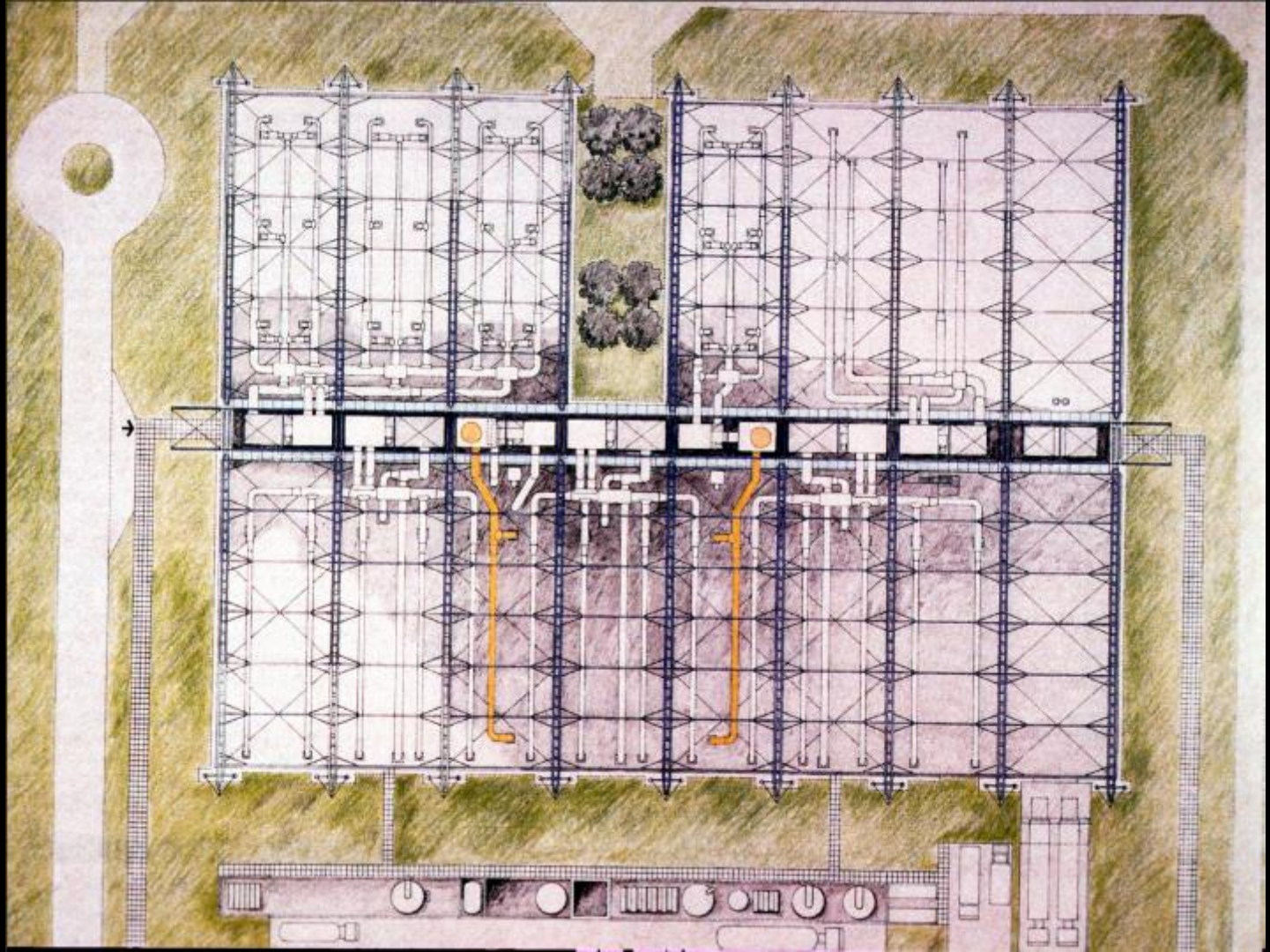


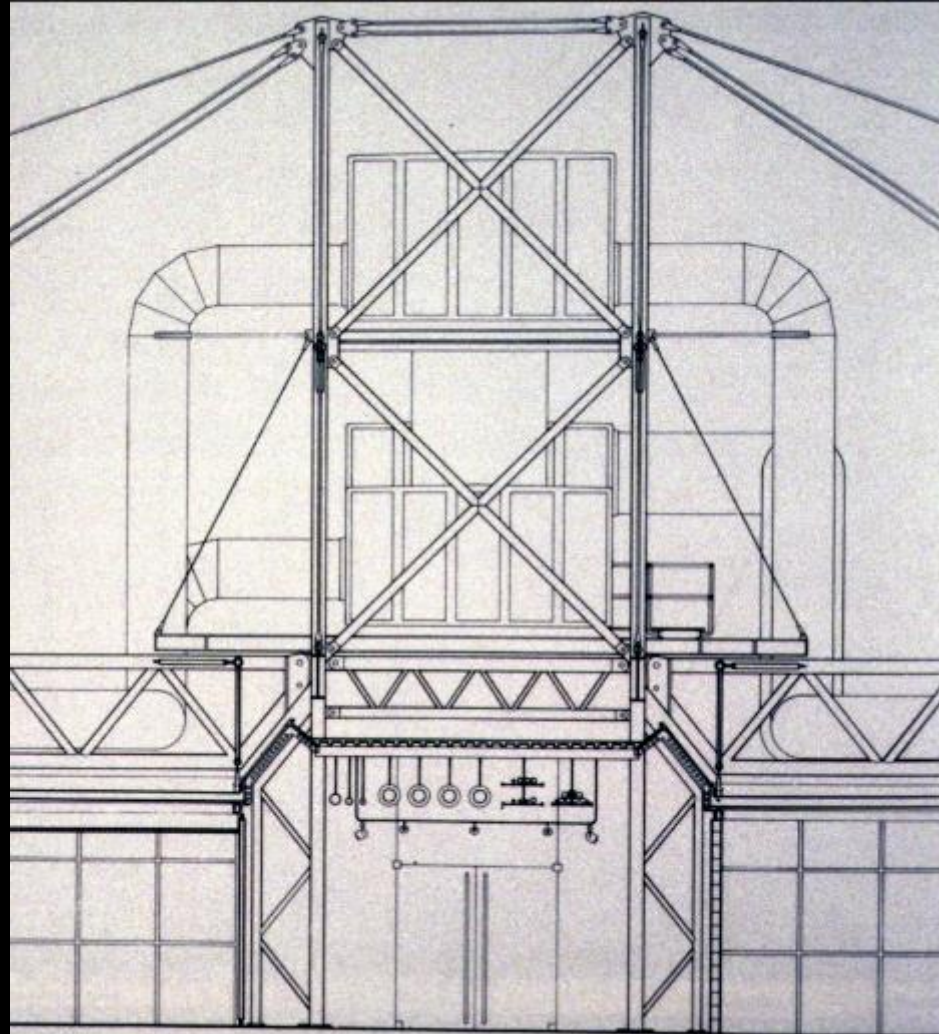


Inmos Technology
Newport, Wales
Richard Rogers
1982

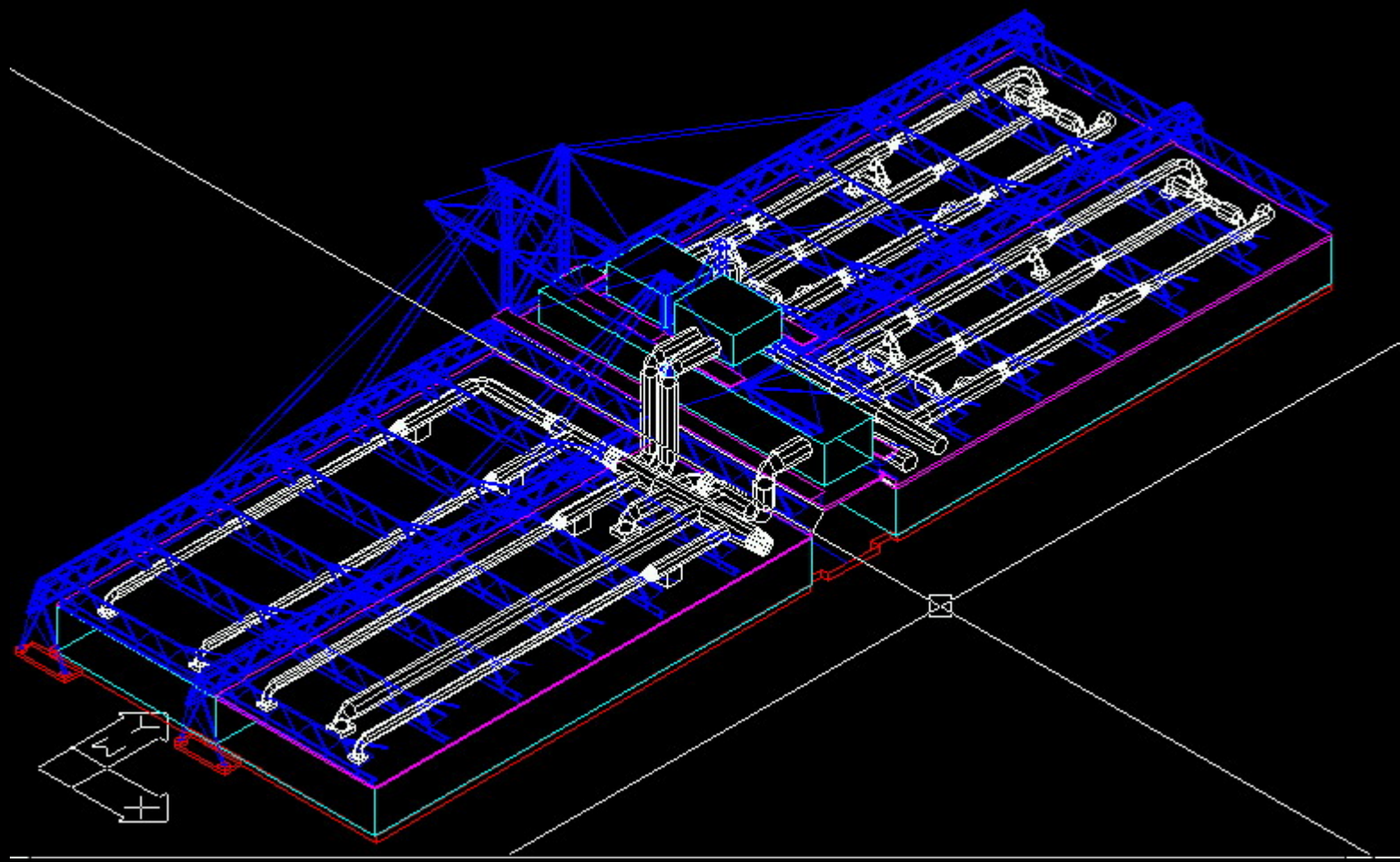


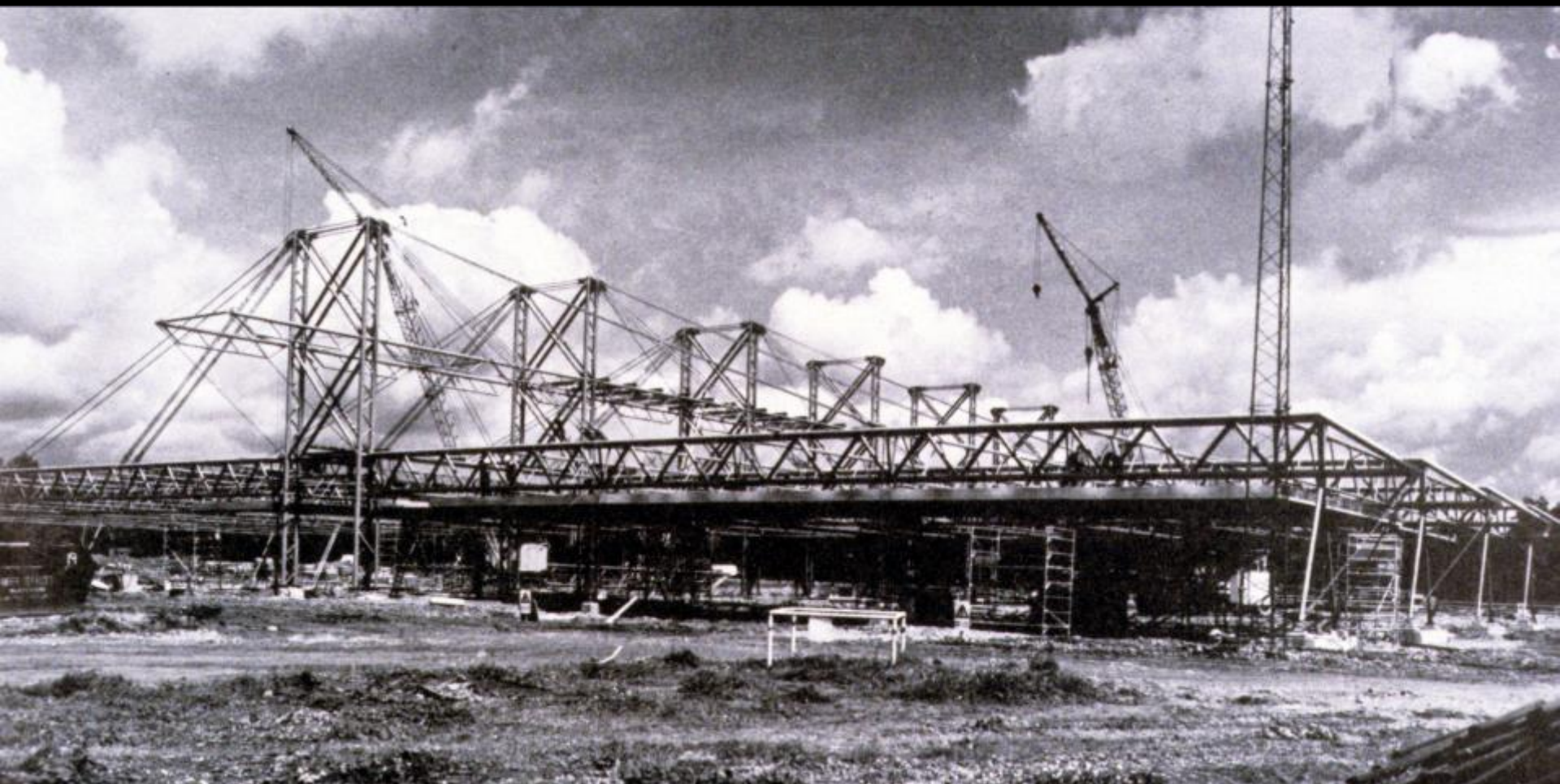






Detail of elevation



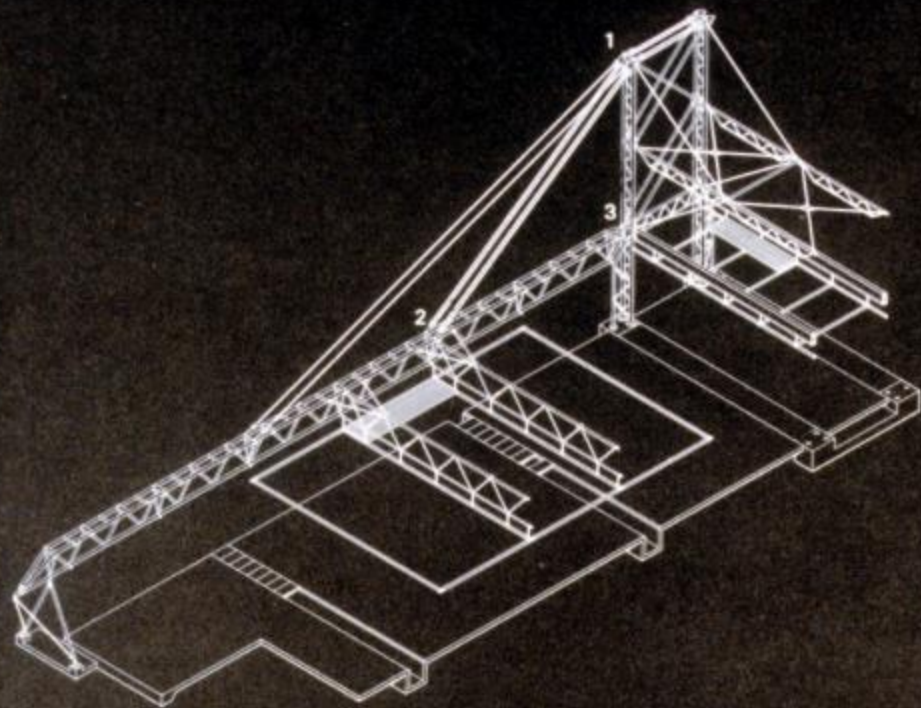




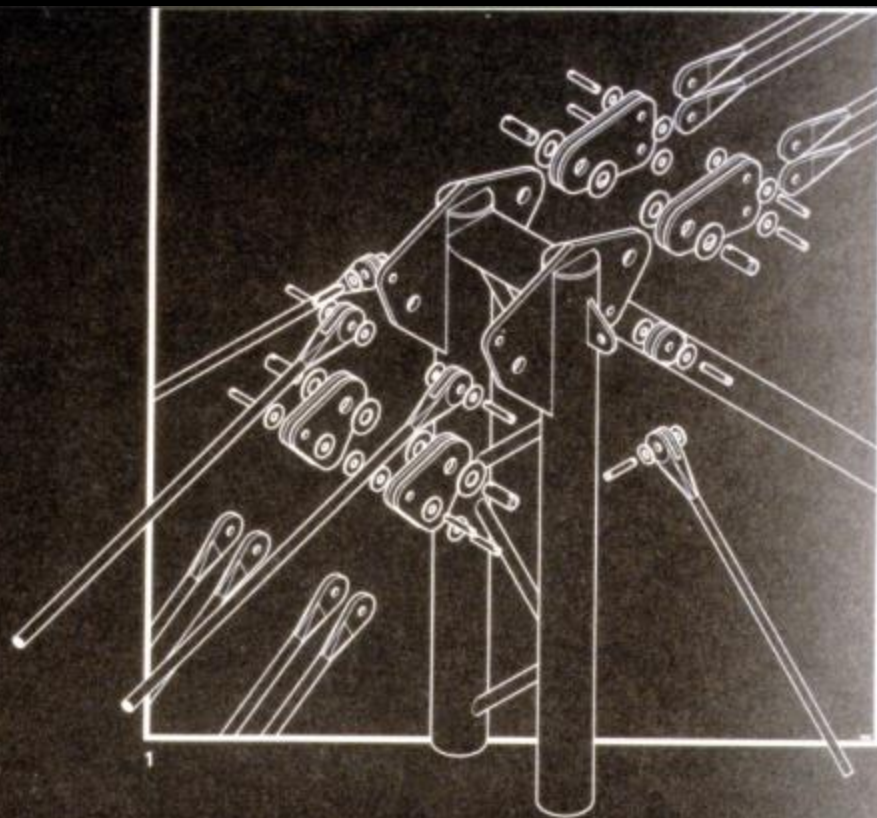
CONSTRUCTION SEQUENCE

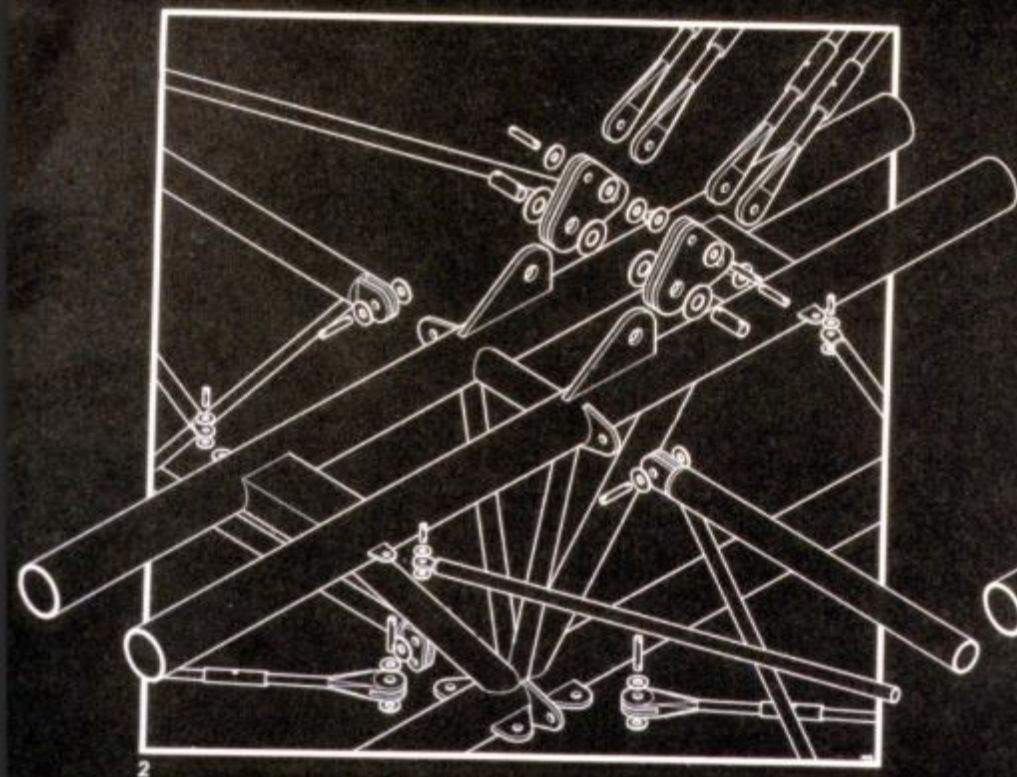




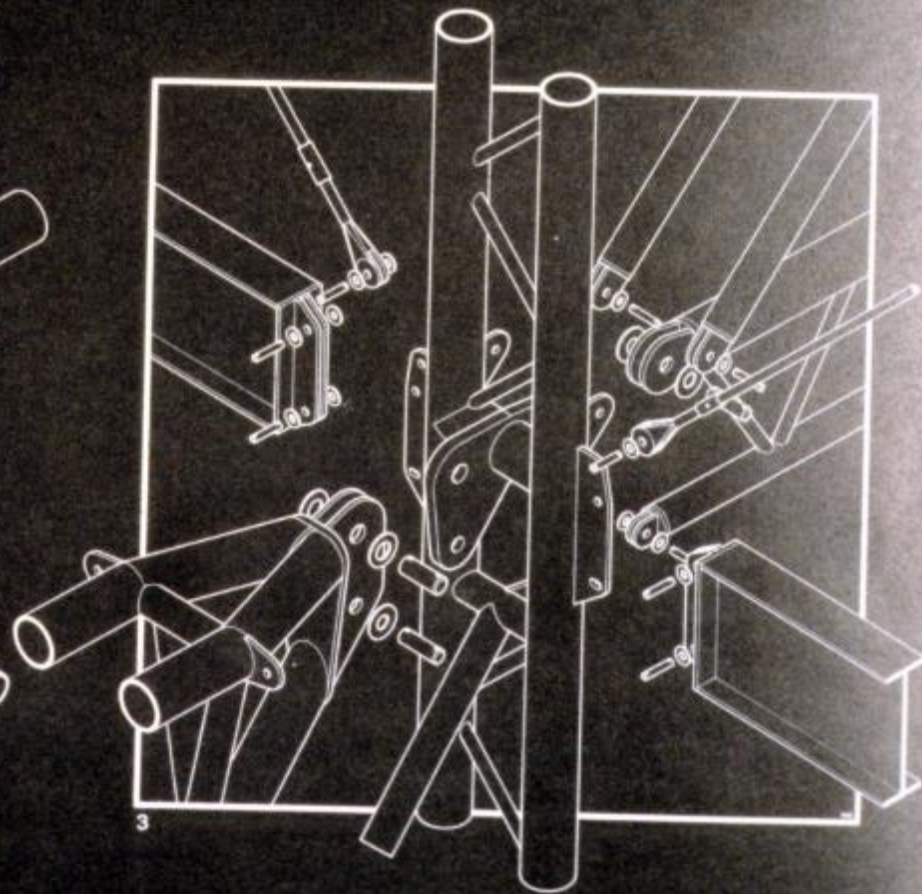


Structural axonometric with junction details

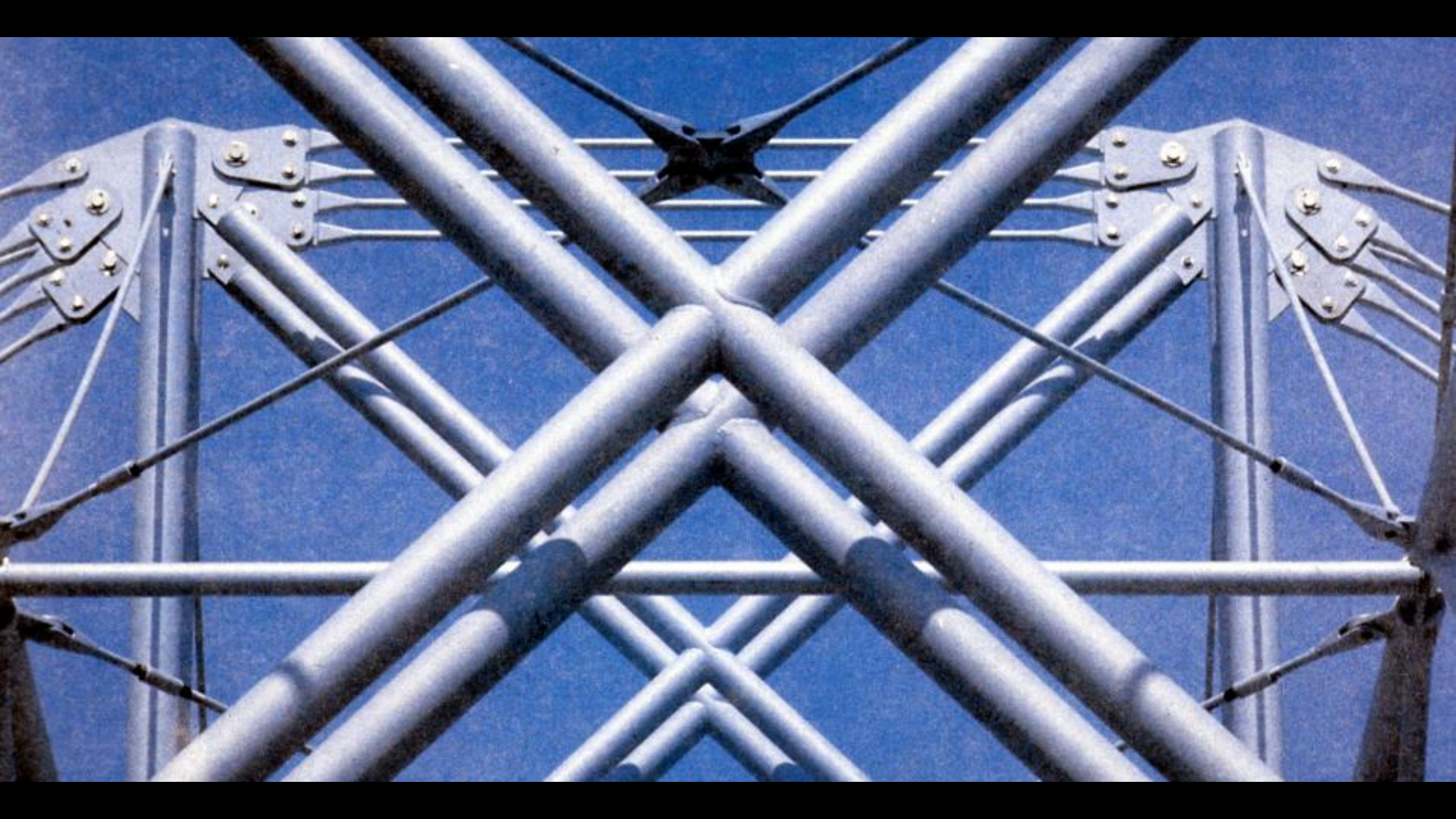




2



3







Oxford Ice Rink
Oxford, England
Grimshaw Architects
1984

















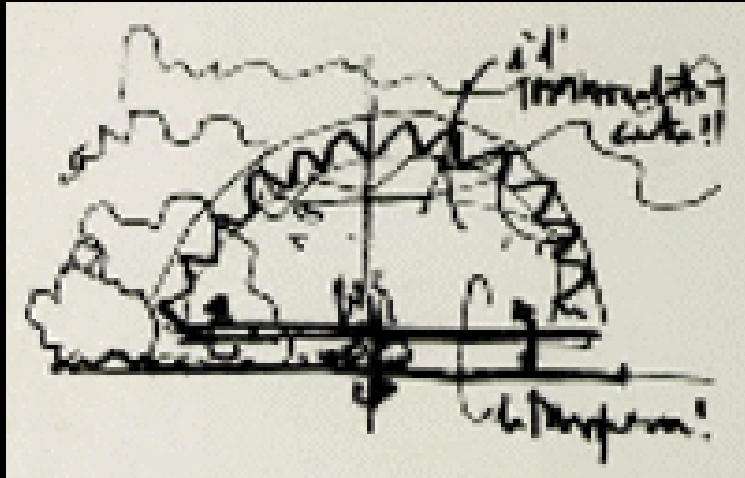






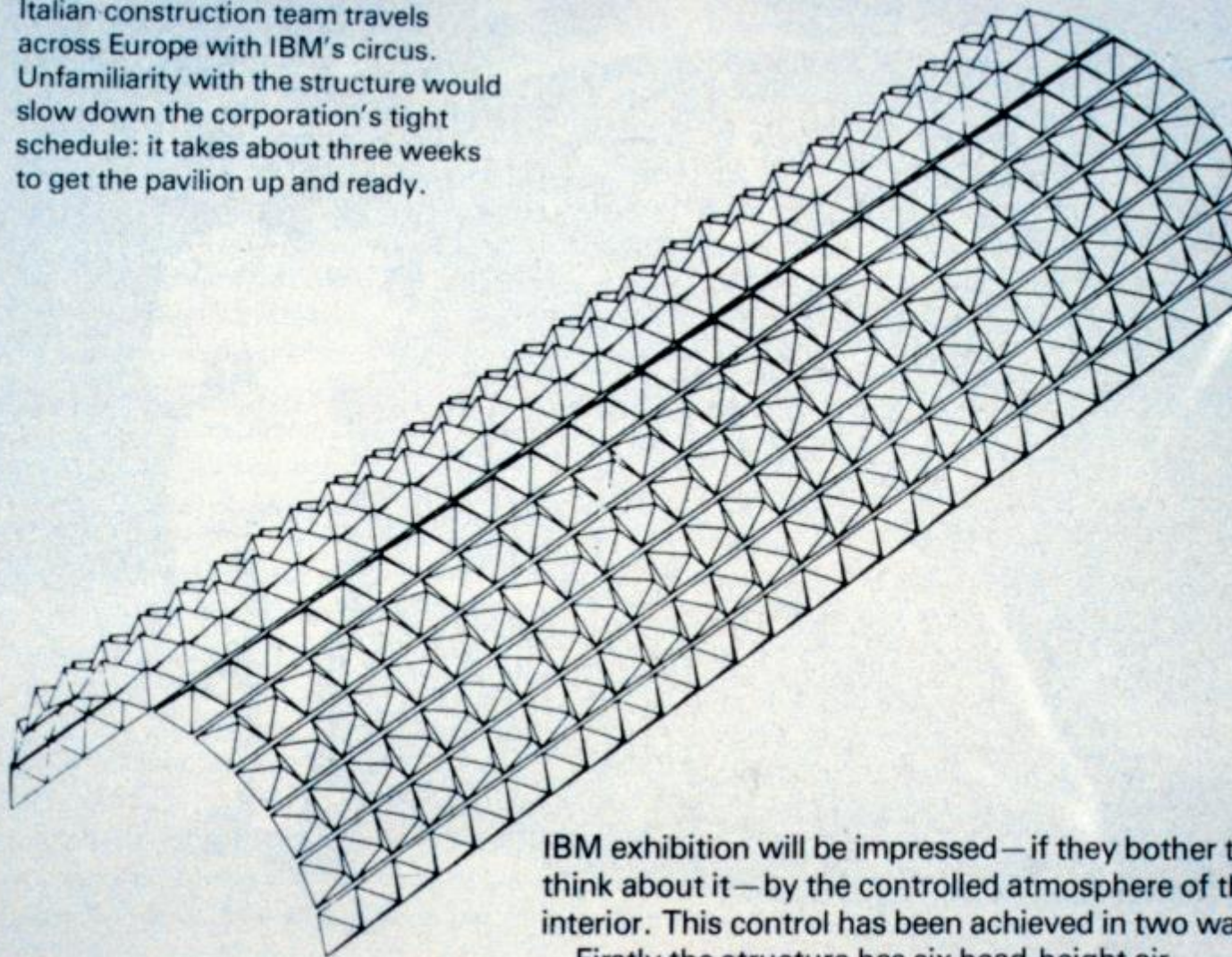






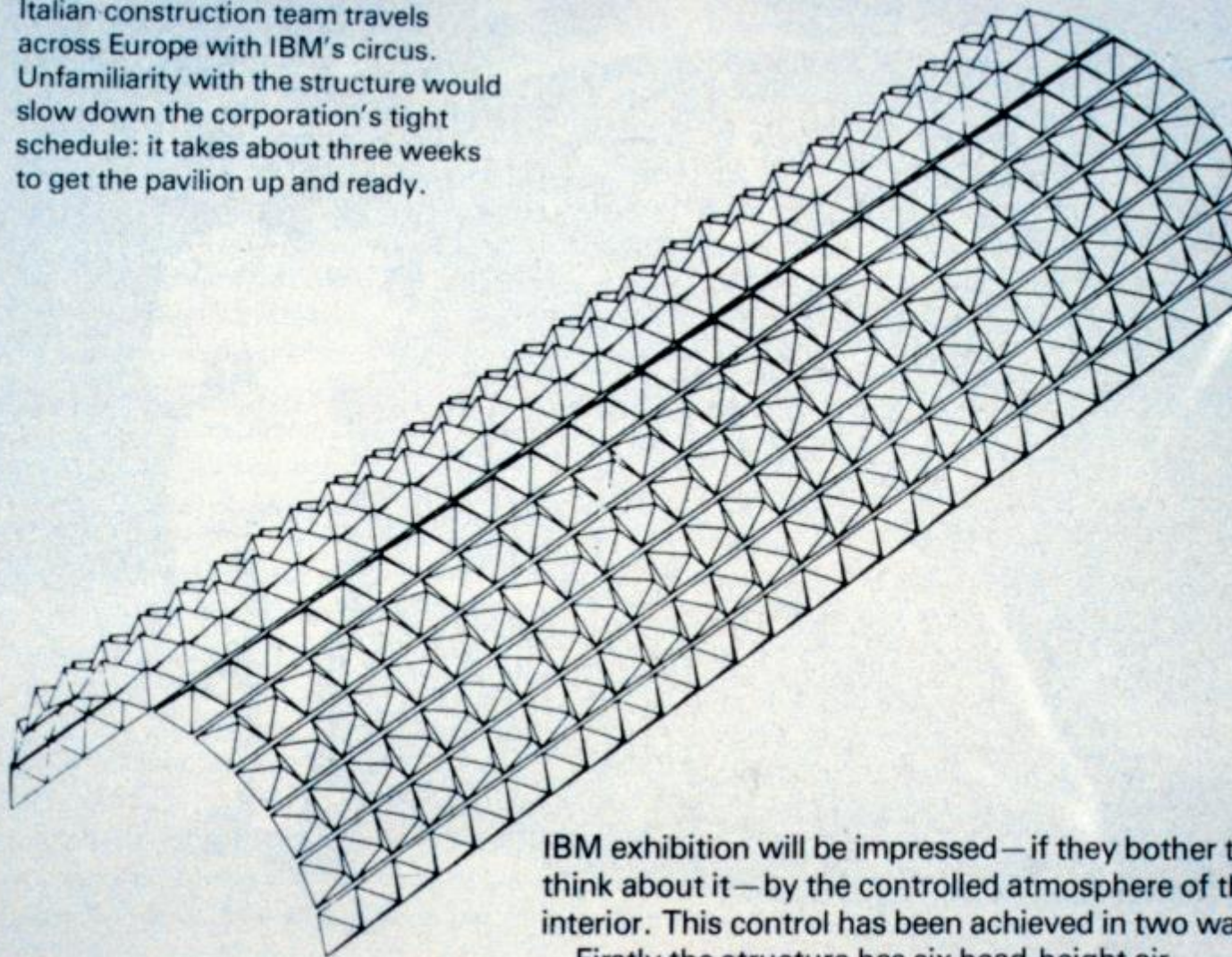
IBM Traveling Pavilion
All over Europe
Renzo Piano
1982-1986

Italian construction team travels across Europe with IBM's circus. Unfamiliarity with the structure would slow down the corporation's tight schedule: it takes about three weeks to get the pavilion up and ready.



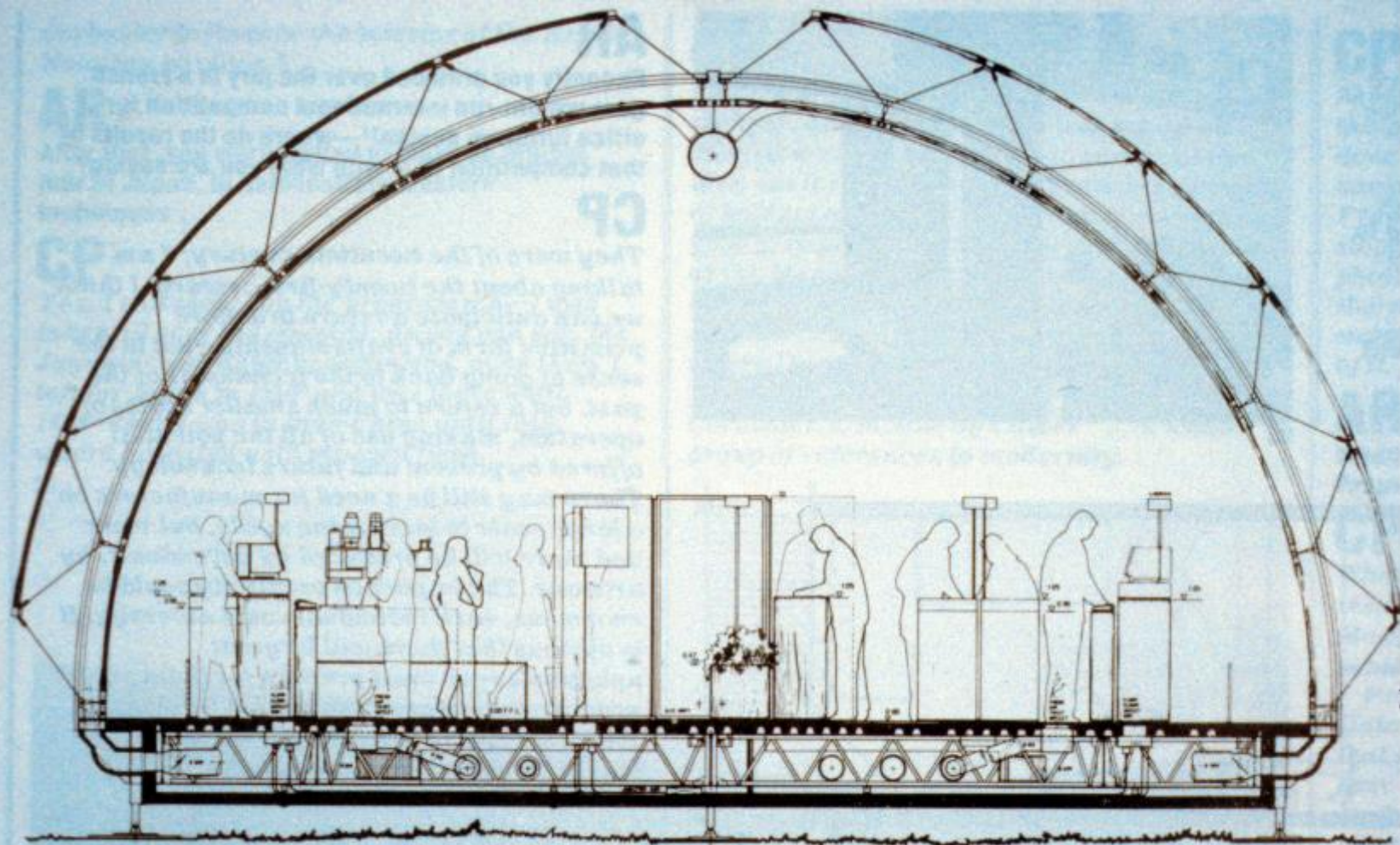
IBM exhibition will be impressed — if they bother to think about it — by the controlled atmosphere of the interior. This control has been achieved in two ways. Firstly the structure has six head-height air-

Italian construction team travels across Europe with IBM's circus. Unfamiliarity with the structure would slow down the corporation's tight schedule: it takes about three weeks to get the pavilion up and ready.

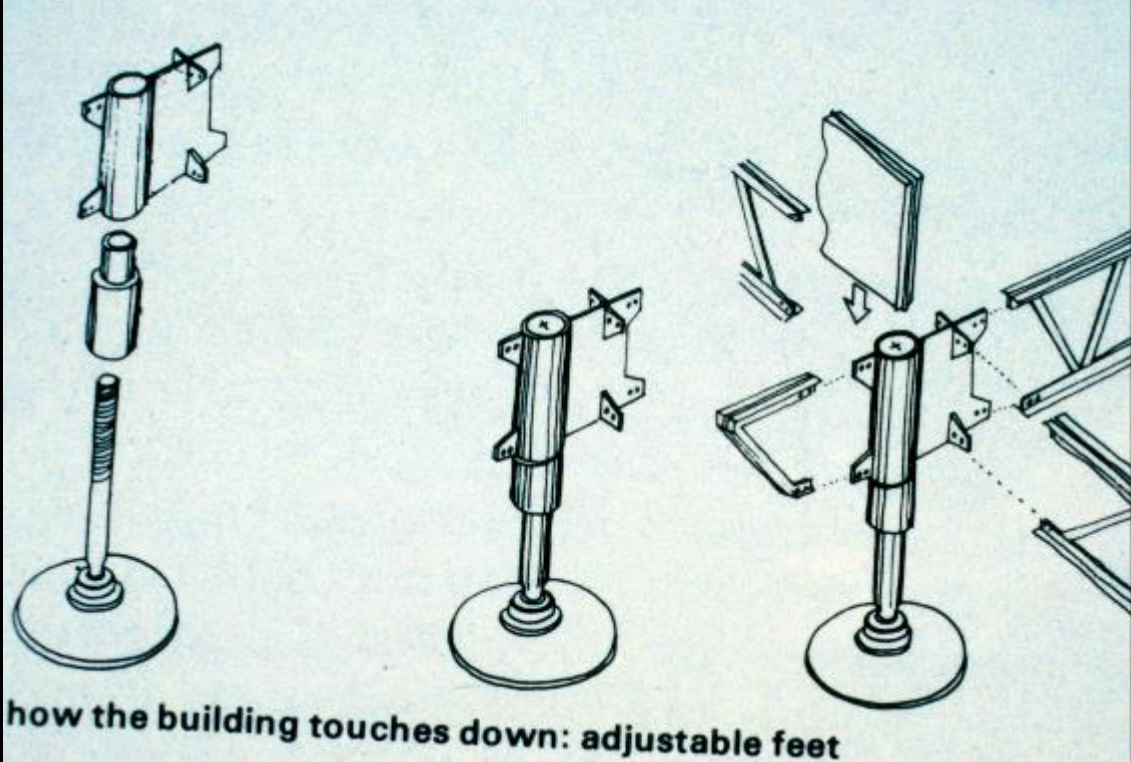
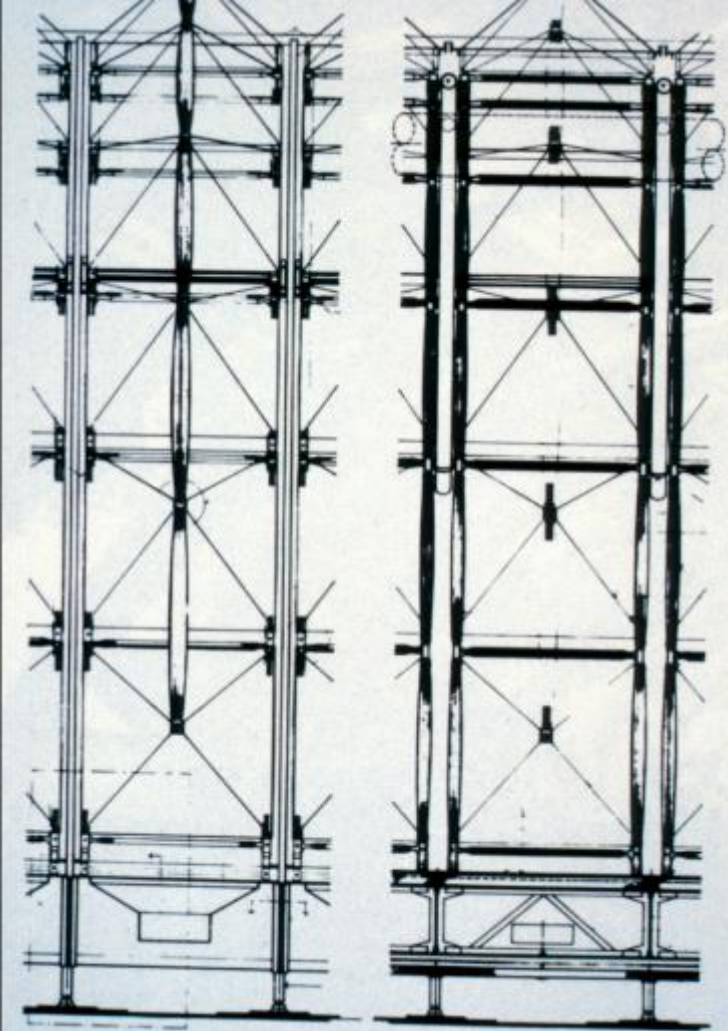


IBM exhibition will be impressed — if they bother to think about it — by the controlled atmosphere of the interior. This control has been achieved in two ways.

Firstly the structure has six head-height air-



section showing structural and air-conditioning systems



how the building touches down: adjustable feet







IKOY Architects
Founded 1968

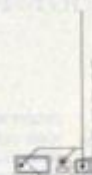
Was interested in "systems buildings"
A combination of custom components
and off-the-shelf

Ron Keenberg, one of the principles,
taught at UWSA in the late 1980s

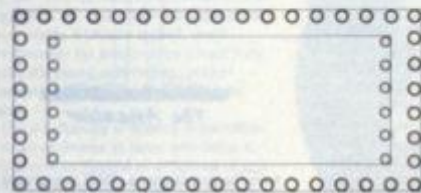
ARCHITECTURAL
TECHNOLOGY
 FALL 1984 THE AMERICAN INSTITUTE OF ARCHITECTS



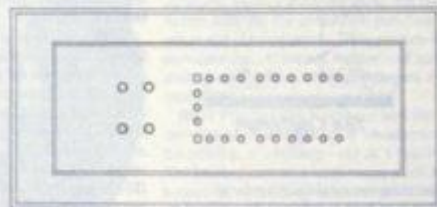
IKOY's INDUSTRIALIZED BUILDINGS



Plumbing



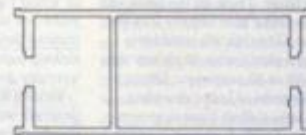
Structural



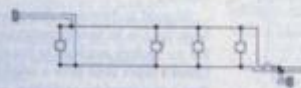
Fitments



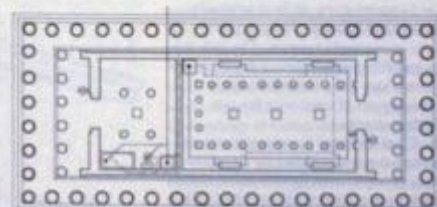
Mechanical



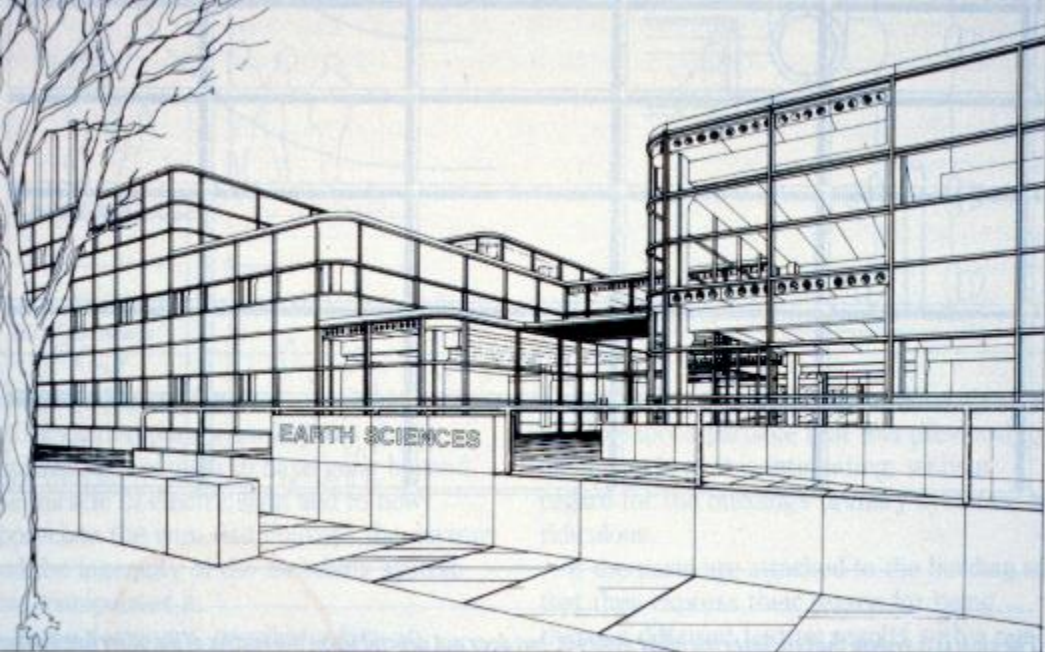
Enclosure



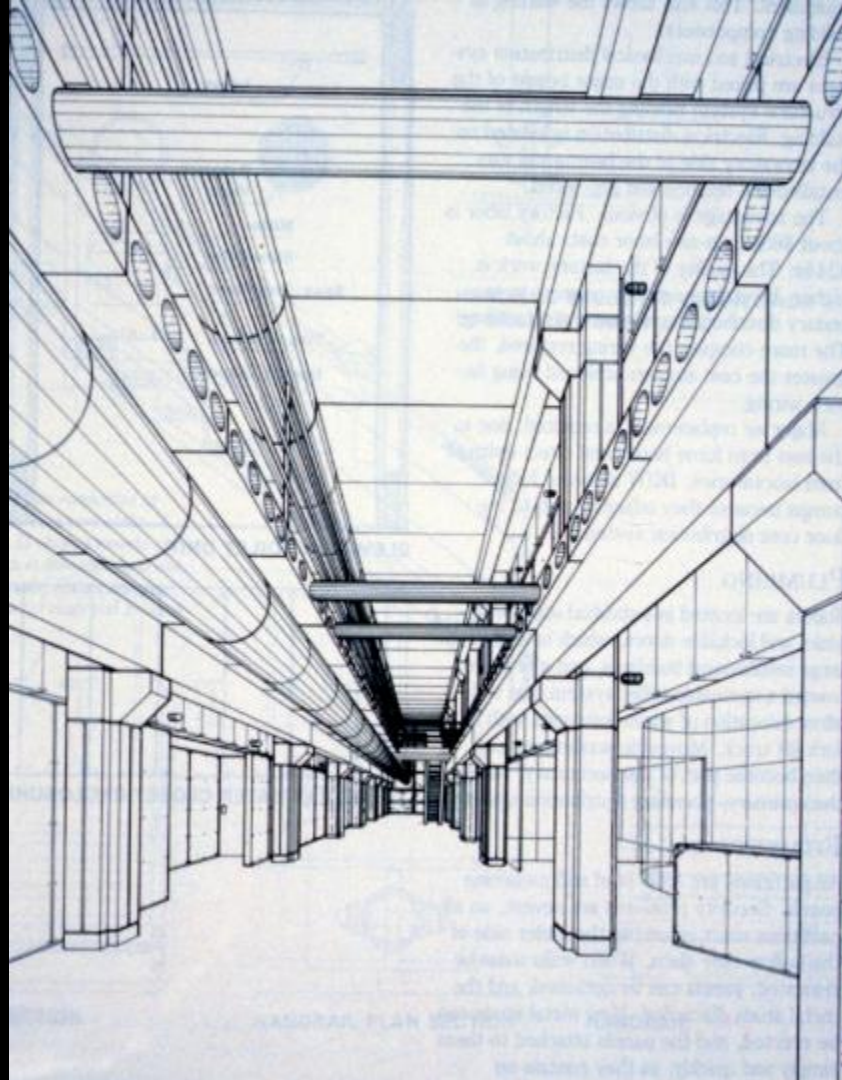
Electrical



Parthenon, Acropolis, Athens 448-432 B.C. Plan



IKOY Architects





























Intumescent fire
protective coating



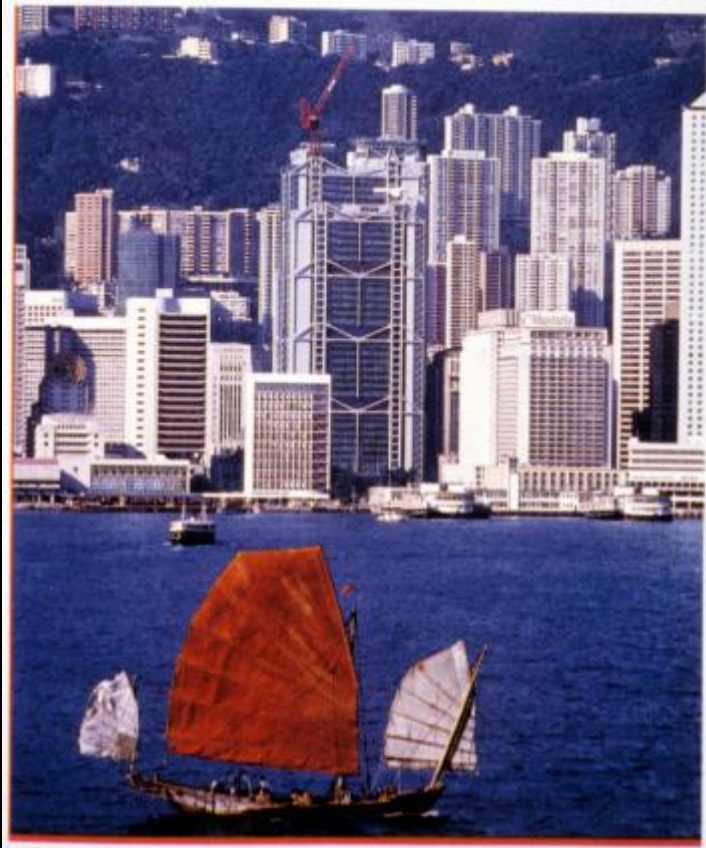






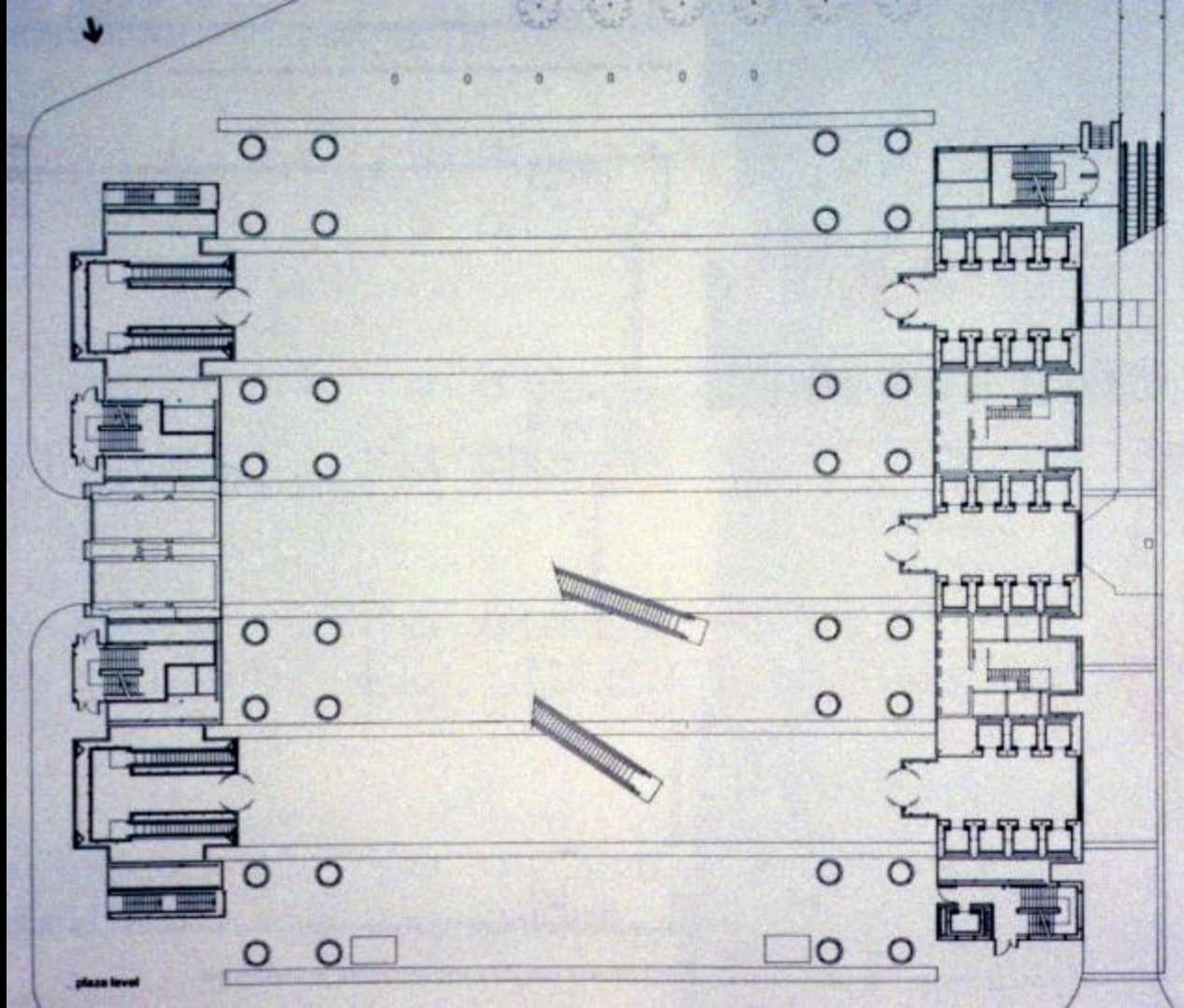
The Hong Kong
and Shanghai Bank
Hong Kong
Foster + Partners
1985

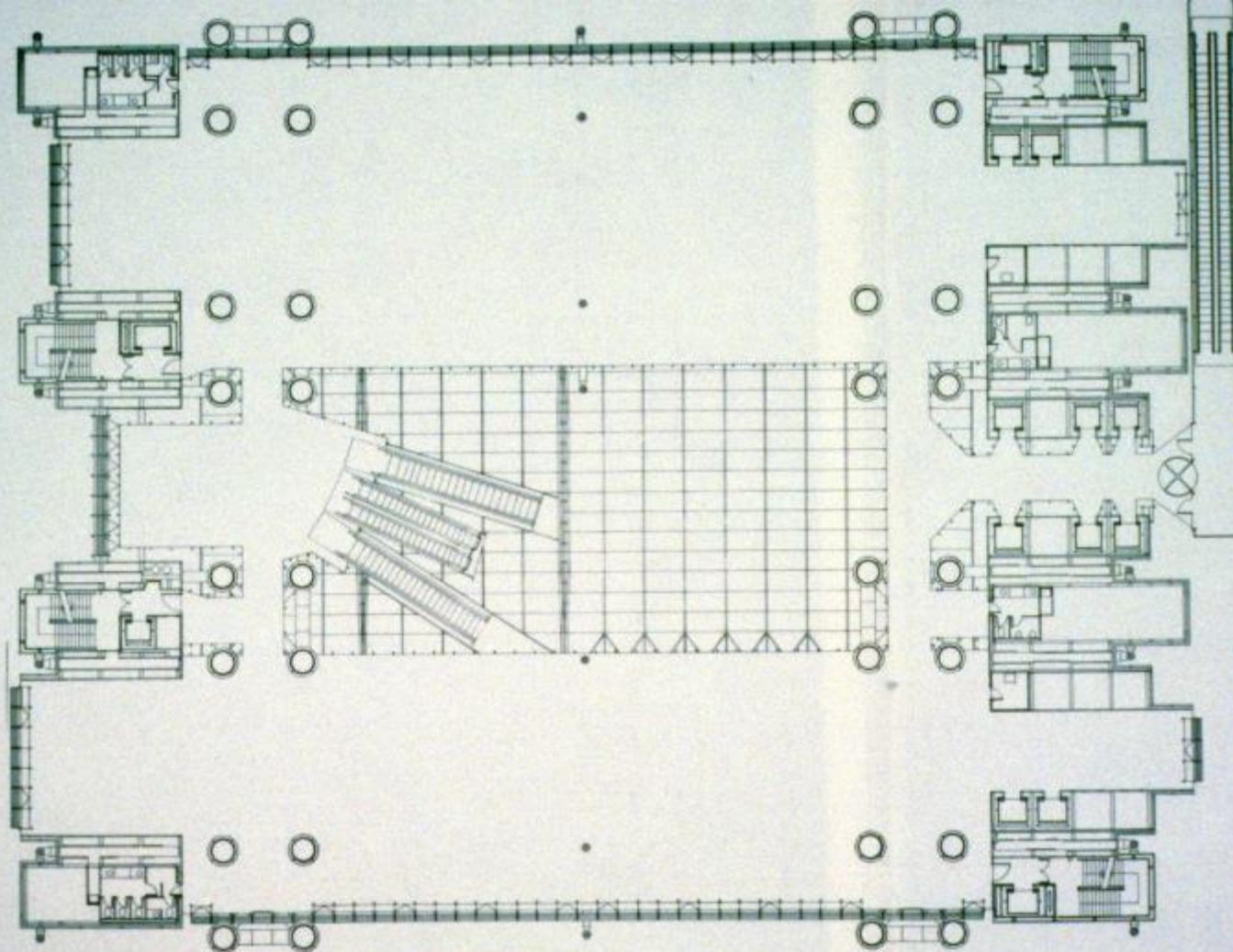
滙豐銀行



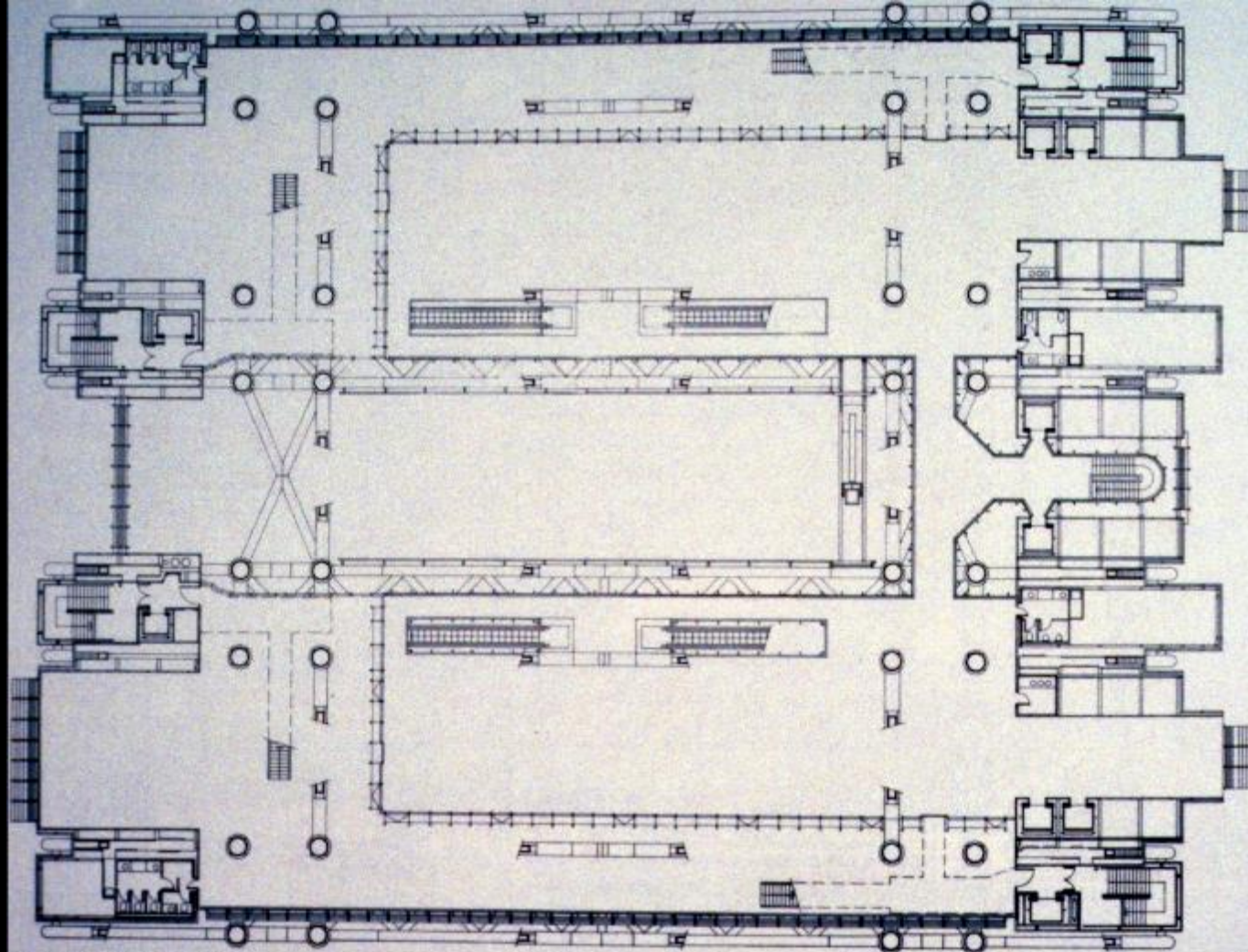




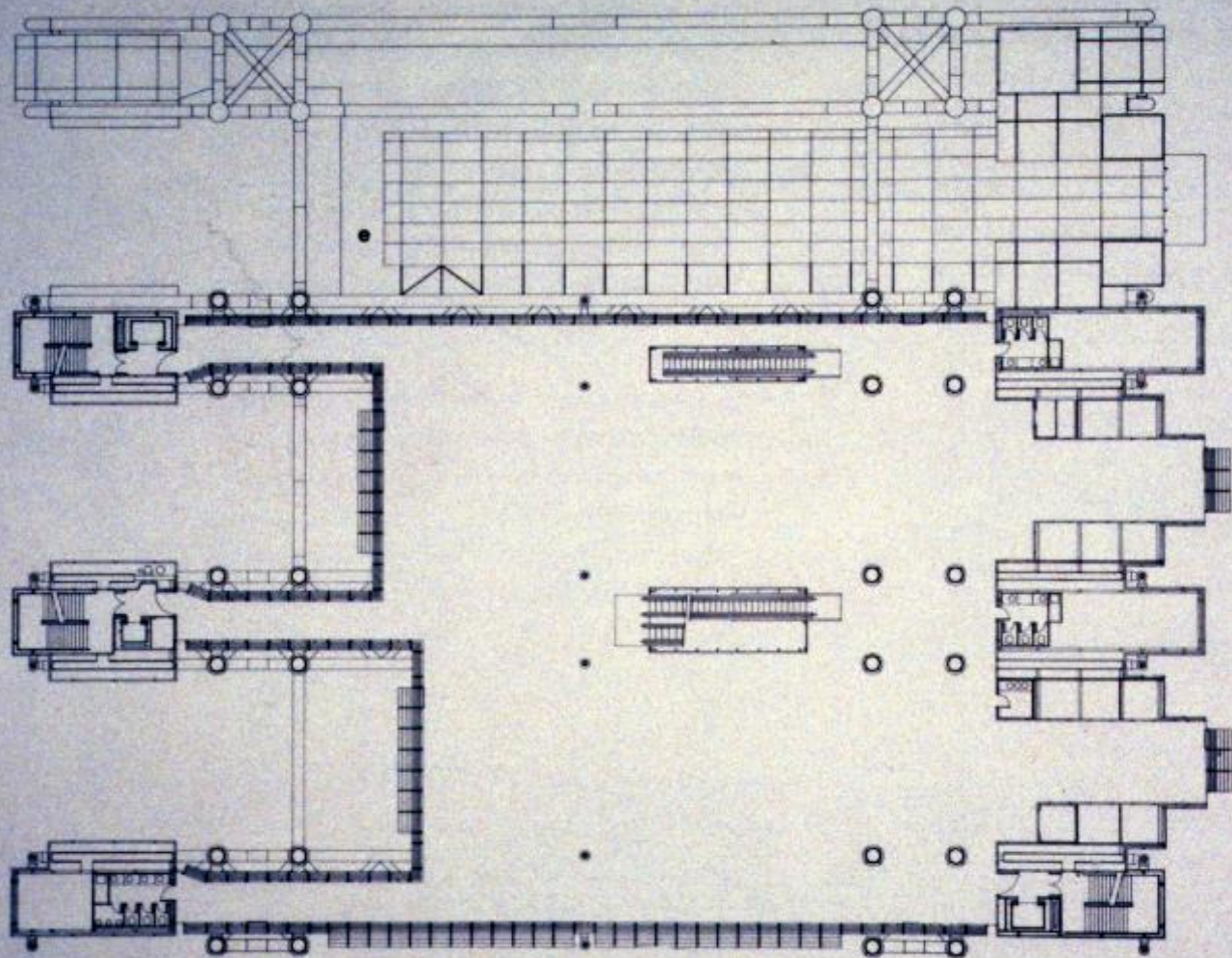




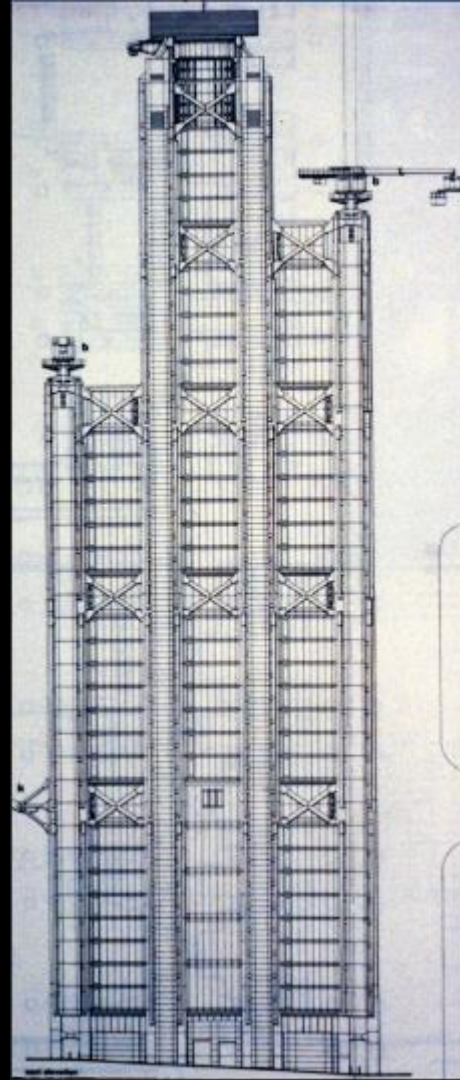
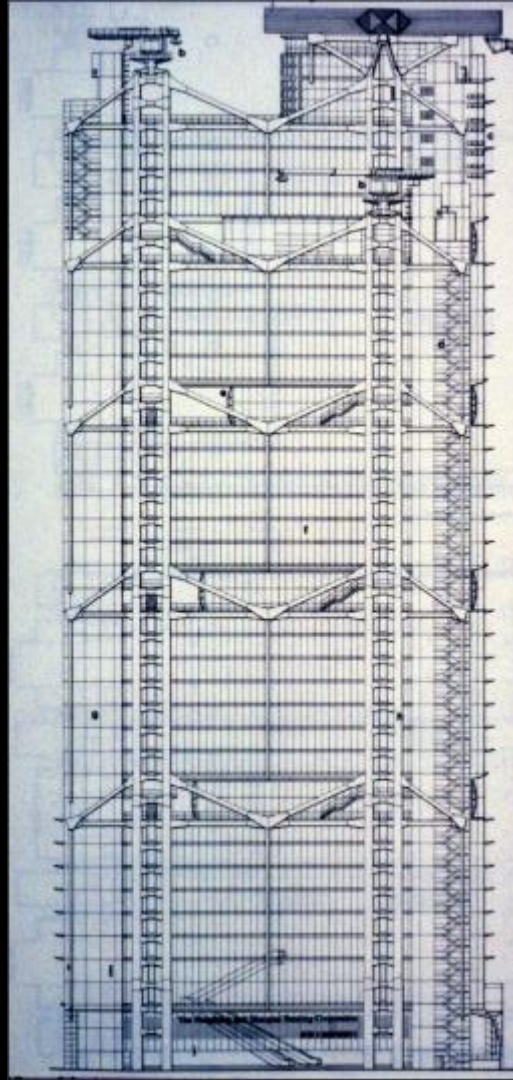
level 3: first level of banking hall at which public arrives on escalators from plaza

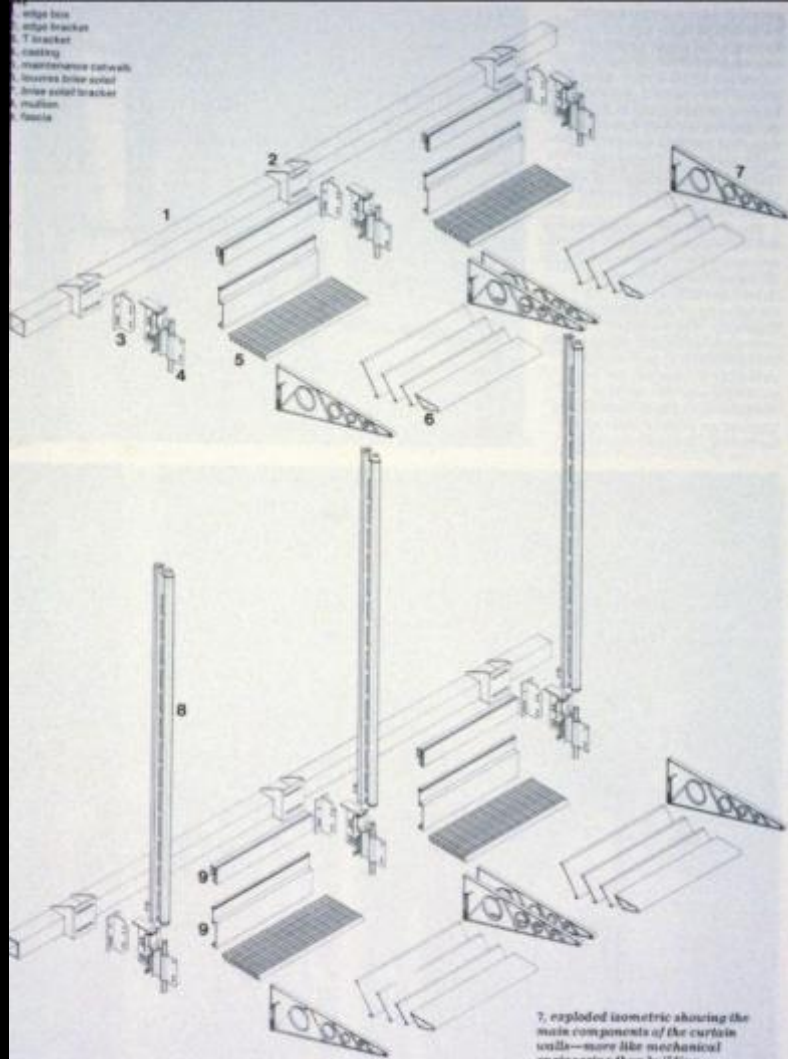


level 11: double height at top of atrium

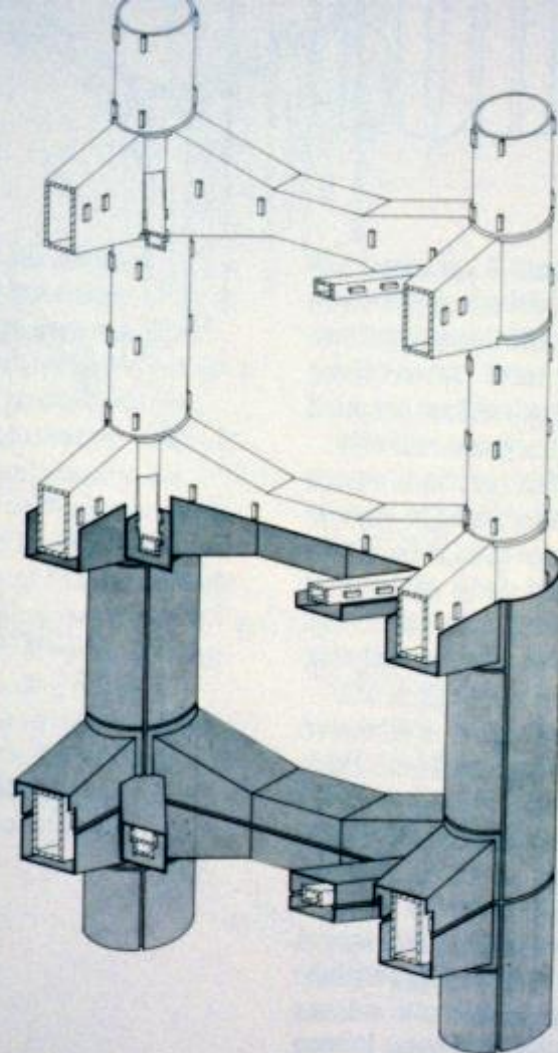


level 30: bulk of building is eroded by light angle requirements





7. exploded isometric showing the
 main components of the curtain
 wall—more like mechanical
 engineering than building.



1

1, isometric section showing the floors cut back between masts on the east side of the building.

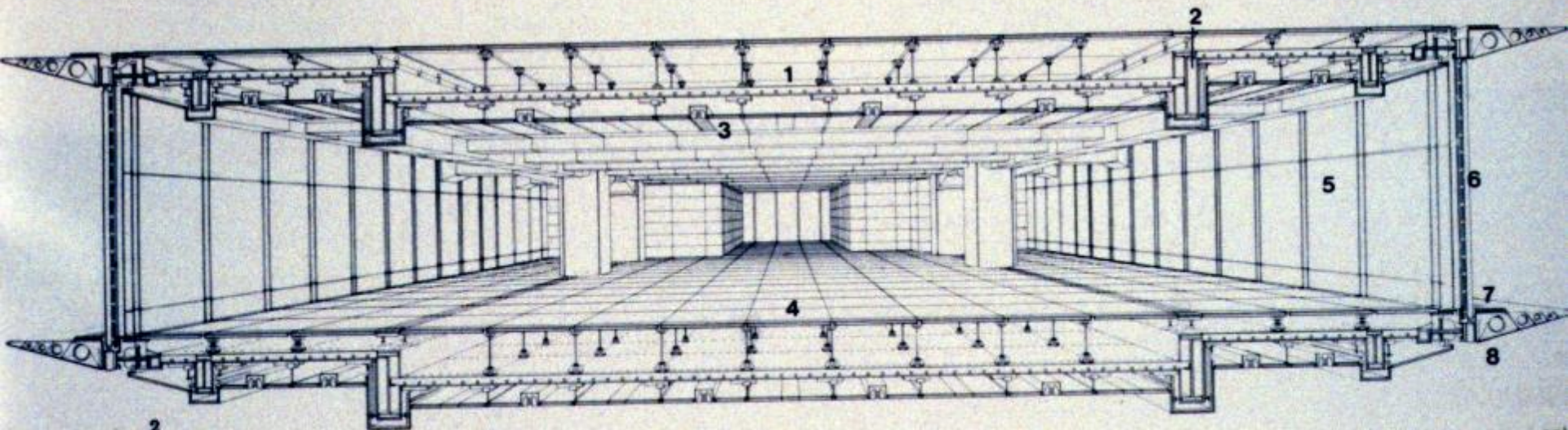
key

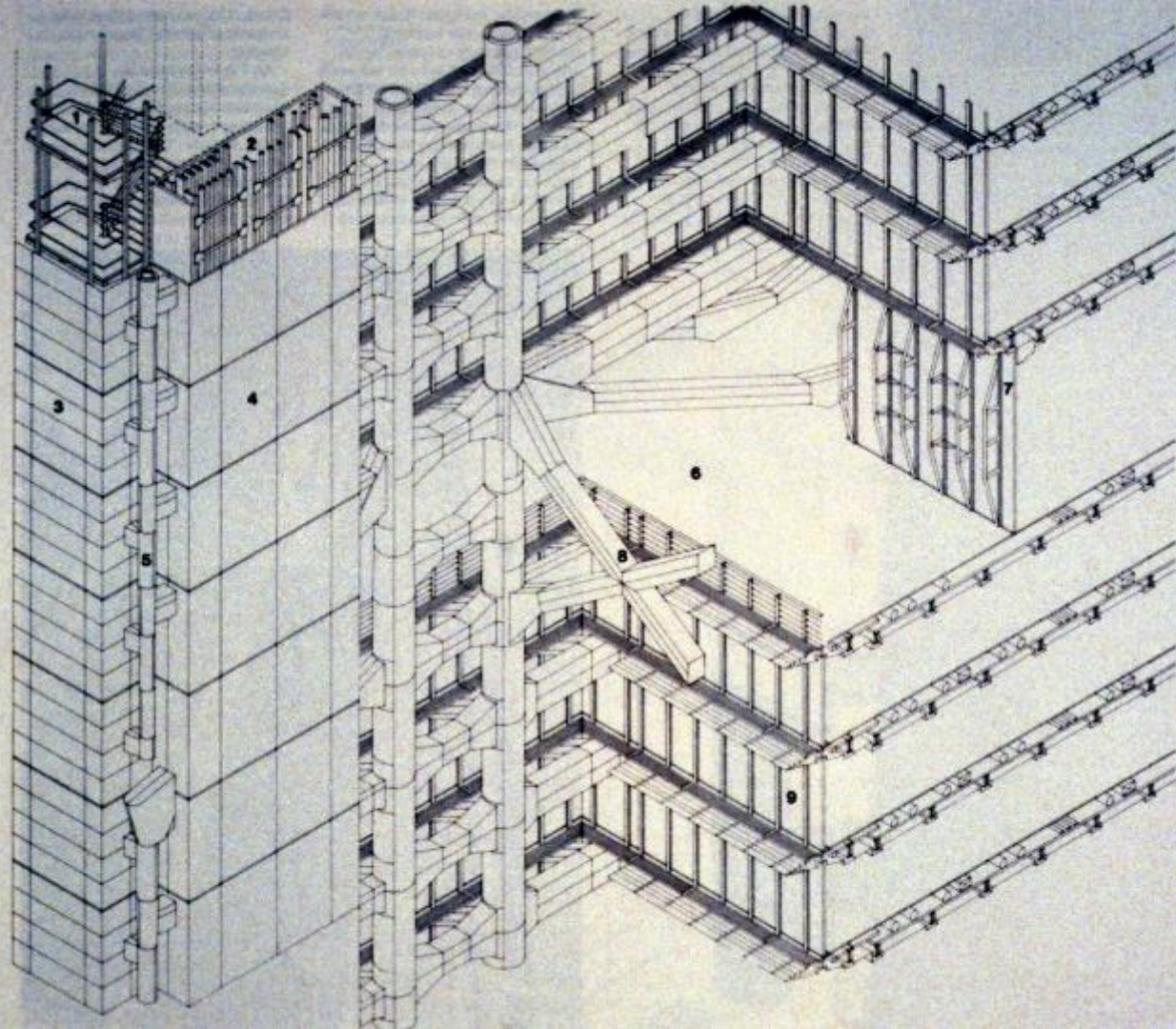
- | | |
|--------------------|-------------------------|
| 1, stairs | 5, outer hanger |
| 2, risers | 6, terrace |
| 3, glass grid wall | 7, trussed mullion |
| 4, panel wall | 8, n/s cross bracing |
| | 9, typical curtain wall |

2, section through a one-bay wide floor.

key

- | | |
|-------------------------|-------------------------|
| 1, 100 mm concrete slab | 5, back-up wall |
| 2, primary beam | 6, typical curtain wall |
| 3, lighting | 7, catwalk |
| 4, raised floor | 8, brise soleil |

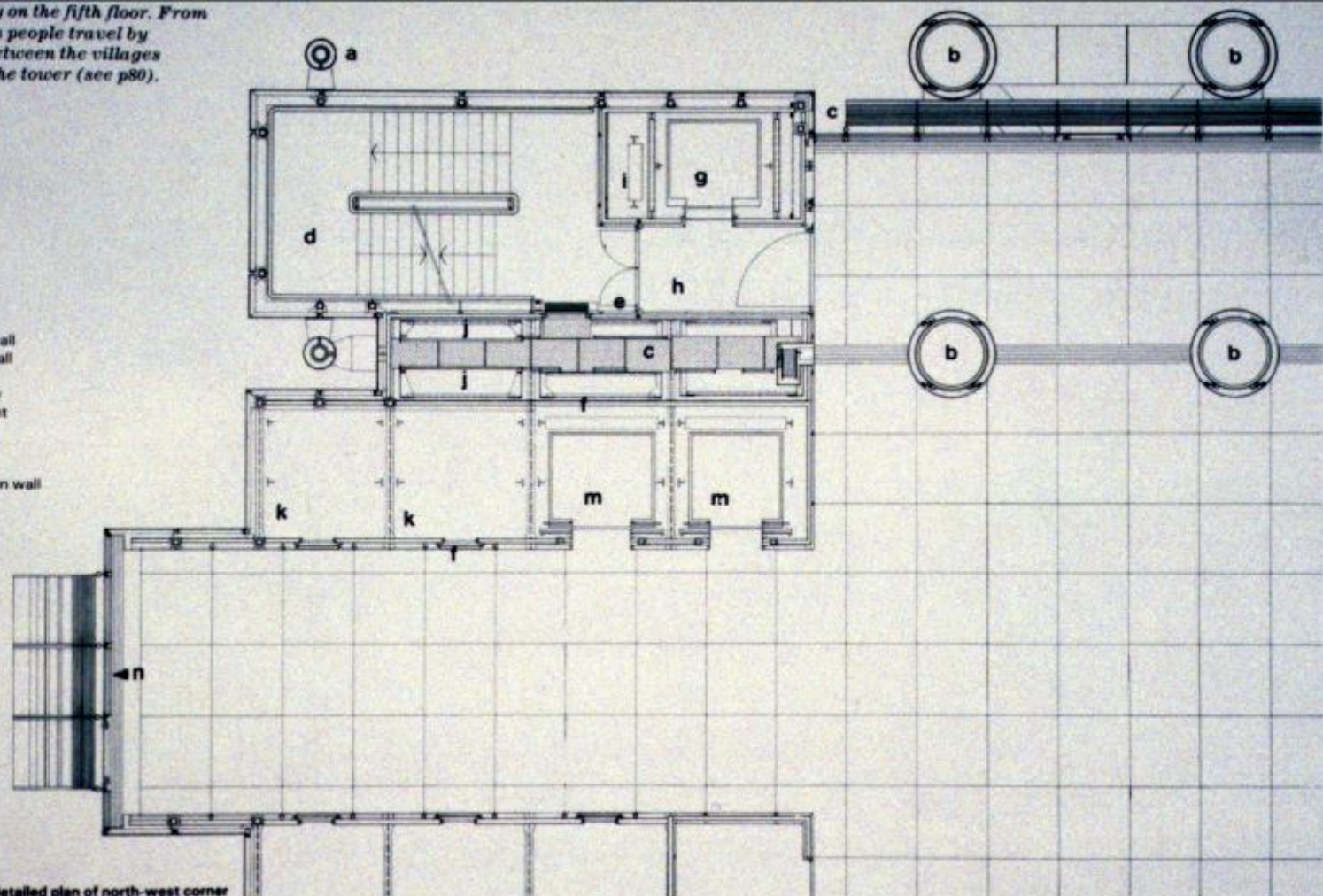




20, lift lobby on the fifth floor. From such lobbies people travel by escalator between the villages stacked in the tower (see p80).

key

- a, hanger
- b, tubular mast
- c, catwalk
- d, stairs
- e, 1-hour fire wall
- f, 2-hour fire wall
- g, goods lift
- h, escape lobby
- i, counterweight
- j, riser
- k, lift shaft
- m, lift
- n, typical curtain wall



detailed plan of north-west corner

























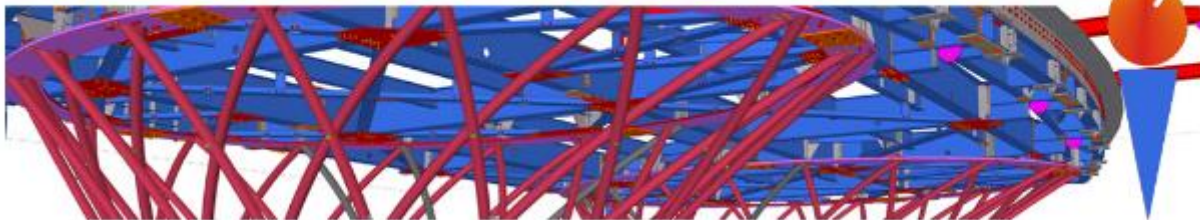
To be continued....

If you take Arch 570: Architectural Steel Design as an elective later on!

<http://tboake.com/SSEF1/index.shtml>

Fun is in the Details: Innovation in Steel Connections

[CISC](#) [Home](#) [Basic Connections](#) [Steel Framing](#) [AESS](#) [Innovative Connections](#) [Historic Projects](#) [Contemporary Projects](#) [Finishes](#)



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[Using the 3D PDFs](#)
[About the Authors](#)
[References and Links](#)
[Site Index](#)
[Legal Disclaimer](#)

Fun is in the Details: Innovation in Steel Connections

A Curriculum Materials Project

Welcome to "Fun is in the Details: Innovation in Steel Connections"! This curriculum materials project has been funded by the **Steel Structures Education Foundation** the former educational arm of the **Canadian Institute of Steel Construction (CISC)**.

The web site is structured into **SEVEN** primary sections on **CONNECTION DESIGN** that will take you through the understanding and development of steel connections. Navigation is accessible at the top of each page, with subheadings for each section available in the left sidebar or through the pull down menu at the top.



This web based project is designed to increase the understanding of connection design in steel structures to better assist students of architecture and engineering in creating more convincing and compelling structures. The project looks at how to take basic methods of creating connections and transform them into innovative connections, using similar principles. Although Standard Structural Steel connections will be included, the emphasis will be on an exploration of Architecturally Exposed Structural Steel (AESS). The project will reference the new CISC AESS documents, in particular the "Category Matrix" and "CISC Guide for Specifying Architecturally Exposed Structural Steel".

Please check out my [Facebook page for AESS](#) . Many more projects there!