Reassembling the Rolling Bridge

An Art Gallery at Fort Point Channel, Boston

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Submitted to the Department of Architecture on May 10, 1996 in partial fulfillment of the requirements for the degree of Master of Architecture.

Abstract

Spanning the Fort Point Channel for nearly a century, Boston's Rolling Bridge is a familiar landmark to many railway commuters and residents of the city. Its robust steel assembly, characterized by three anthropomorphic forms, demonstrates the principles of late nineteenth-century bridge design. As a symbol of the industrial age, it is also the last surviving drawbridge of its kind in the city. Unfortunately, this bridge will be demolished as part of the ongoing Central Artery / Third Harbor Tunnel project. Despite numerous efforts to salvage the structure for the arts community in the district, its re-utilization remains doubtful. The bridge's demolition exposes a prevalent problem in the post-industrial city: the annihilation of industrial artifacts by new infrastructural demands. Can one create a new future for an abandoned artifact such as the Rolling Bridge?

This thesis suggests that the artifact evolves to dynamically engage its surrounding environment. It proposes that the **bridge** be dismantled and its parts reassembled into a **building**. By transplanting the new structure onto an adjacent site, a tension is created between the disappearance of the "ancestor" and the appearance of its "descendant". Recast as an art gallery for the Fort Point Arts Community, the transformed structure will present another chapter of the bridge's history.

In re-utilizing the bridge components, the thesis will accomplish two tasks: one, preserve the memory of the original structure; and two, redefine the role of this artifact within the city. The mission is to provoke new ways of thinking about industrial relics by using the bridge as an instigator.

Thesis Supervisor: Wellington Reiter
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I would like to thank

Wellington Reiter for channeling my thoughts,

Ellen Dunham-Jones for broadening them and

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Michael Tyrrell provided valuable material and guidance throughout the design process. I am also grateful to **Paul Donelly**, who injected optimism to sustain my momentum.

Rich Stump, **Chris Nutter**,

Ernesto Rodriguez, **BK Yeh**,

Charlotte Williams, **Katie Archard** and **Kyrre Culver** -

lifted my spirits when times were difficult.

Finally, this book is dedicated to my **parents**,

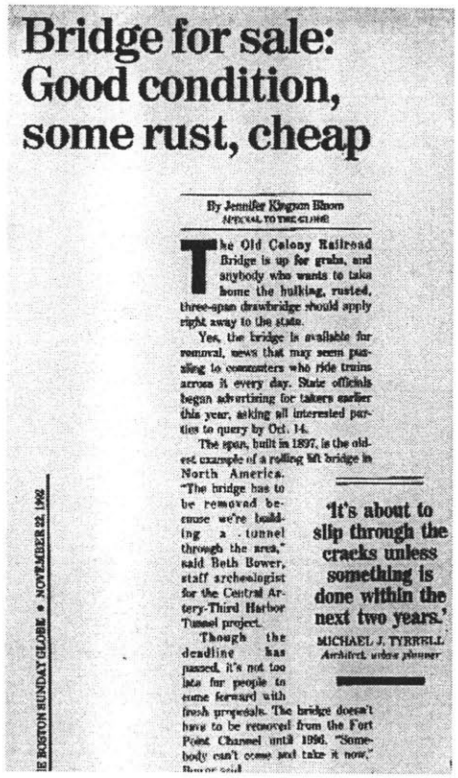
three brothers and four sisters

- **Alan, Francis, Colin, Alicia, Catherine, Debbie and Yoko**.

Their jubilation upon my acceptance into

MIT's graduate program

is remembered.



THE BOSTON SUNDAY GLOBE • NOVEMBER 22, 1992

Bridge for sale: Good condition, some rust, cheap

By Jennifer Kingson Bloom
SPECIAL TO THE GLOBE

The Old Colony Railroad Bridge is up for grabs, and anybody who wants to take home the hulking, rusted, three-span drawbridge should apply right away to the state.

Yes, the bridge is available for removal, news that may seem puzzling to commuters who ride trains across it every day. State officials began advertising for takers earlier this year, asking all interested parties to query by Oct. 14.

The span, built in 1897, is the oldest example of a rolling lift bridge in North America.

"The bridge has to be removed because we're building a tunnel through the area," said Beth Bower, staff archeologist for the Central Artery-Third Harbor Tunnel project.

> 'It's about to slip through the cracks unless something is done within the next two years.'
> MICHAEL J. TYRRELL
> *Architect, urban planner*

Though the deadline has passed, it's not too late for people to come forward with fresh proposals. The bridge doesn't have to be removed from the Fort Point Channel until 1996. "Somebody can't come and take it now," [illegible]

fig. 1 Article taken from The Boston Sunday Globe, Nov 22, 1992

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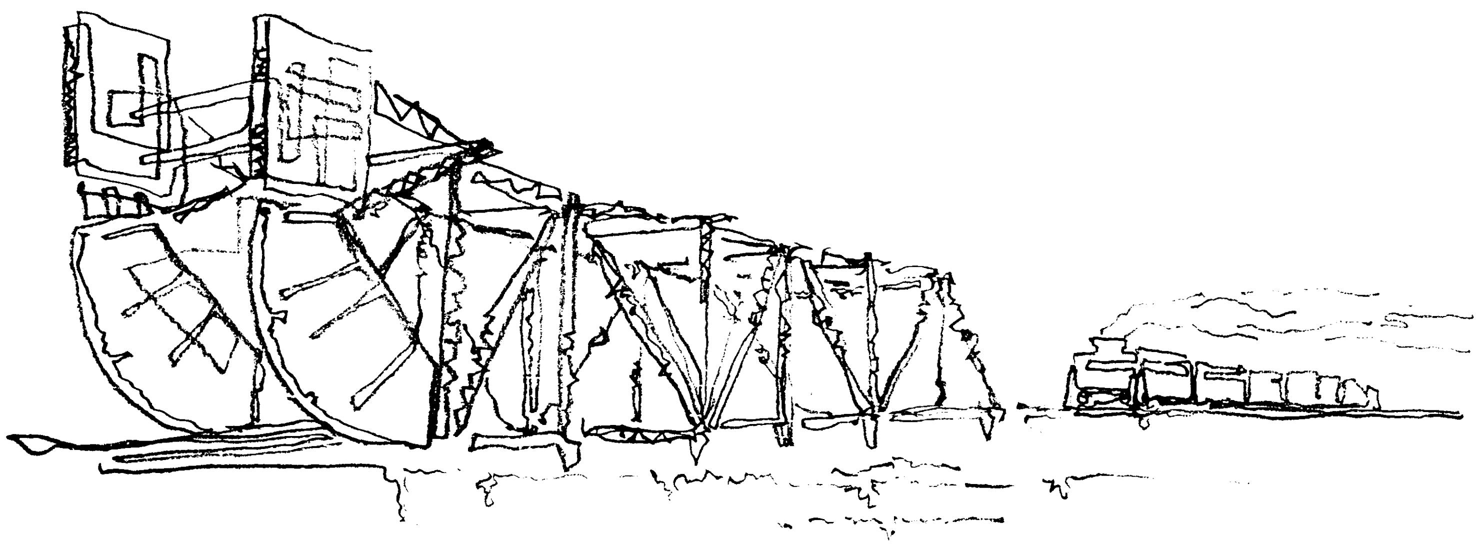


Introduction

Given the unique thesis investigation - design of architecture from pre-existing components - this book presents the bridge's transformation as a series of connected events. The four major episodes - **Bridge, Dismantlement, Reassembly and Building** - illustrate the gradual obsolescence of the artifact and its re-emergence into a new structure. Each episode begins and ends with a scenario. Photographs, sketches and drawings are thus assembled sequentially.

The first episode outlines predominant issues regarding the artifact. Controversies over its demolition/ preservation explain why this thesis was potentially challenging. Background information of the site reveals the industrial nature of its setting, upon which a proposal for its relocation is suggested.

Episode two conveys the dismantling of the steel structure. Physical and structural characteristics of its components are examined and documented. From here, a series of schematic models and sketches will illustrate the initial design repertoire.

Having discovered after the earlier attempts that the structural principle of the bridge can be translated into a building vocabulary, I proposed a strategic method of assembly. The third episode depicts this systematic dismemberment and transplantation of the components.

Upon arriving at this junction, episode four illustrates the relationships that the building established with the bridge and the industrial landscape. It potrays both formally and spatially, how the evolved structure finally reclaimed the status of the archaeological relic in the site.

"The bridge has to be removed because we're building a tunnel through the area..... The span doesn't meet modern requirements for a railroad bridge."[1]

Beth Bower
Staff Archaeologist
Central Artery Project

"Maybe we won't dismantle it. Maybe we'll put it on a ship and ship it whole. Shipping guys can do that." [2]

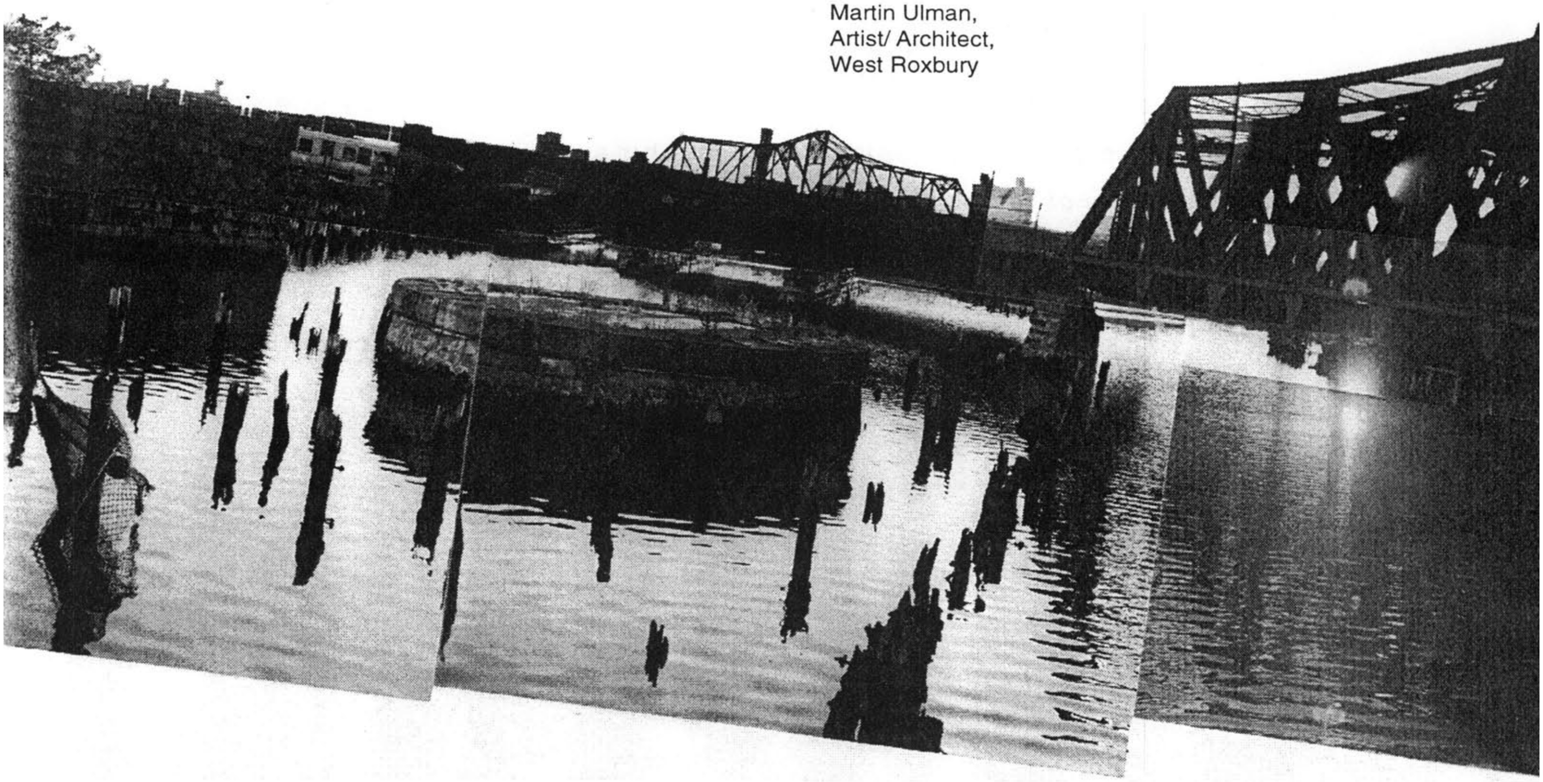
Jerry Williams, President
Integrated Waste Inc.
Buffalo, New York

"Preserving and Maintaining the Old Colony Railroad Bridge will be a magnanimous and innovative statement that modern transportation needs do not have to sacrifice historic transportation of the past." [3]

Michael Tyrrell
Chairman
Rolling Bridge Initiative

"If it were to be removed, they might as well give it to us.... It should be some sort of a gateway piece, perhaps something over an entrance to the expressway." [4]

Martin Ulman,
Artist/ Architect,
West Roxbury



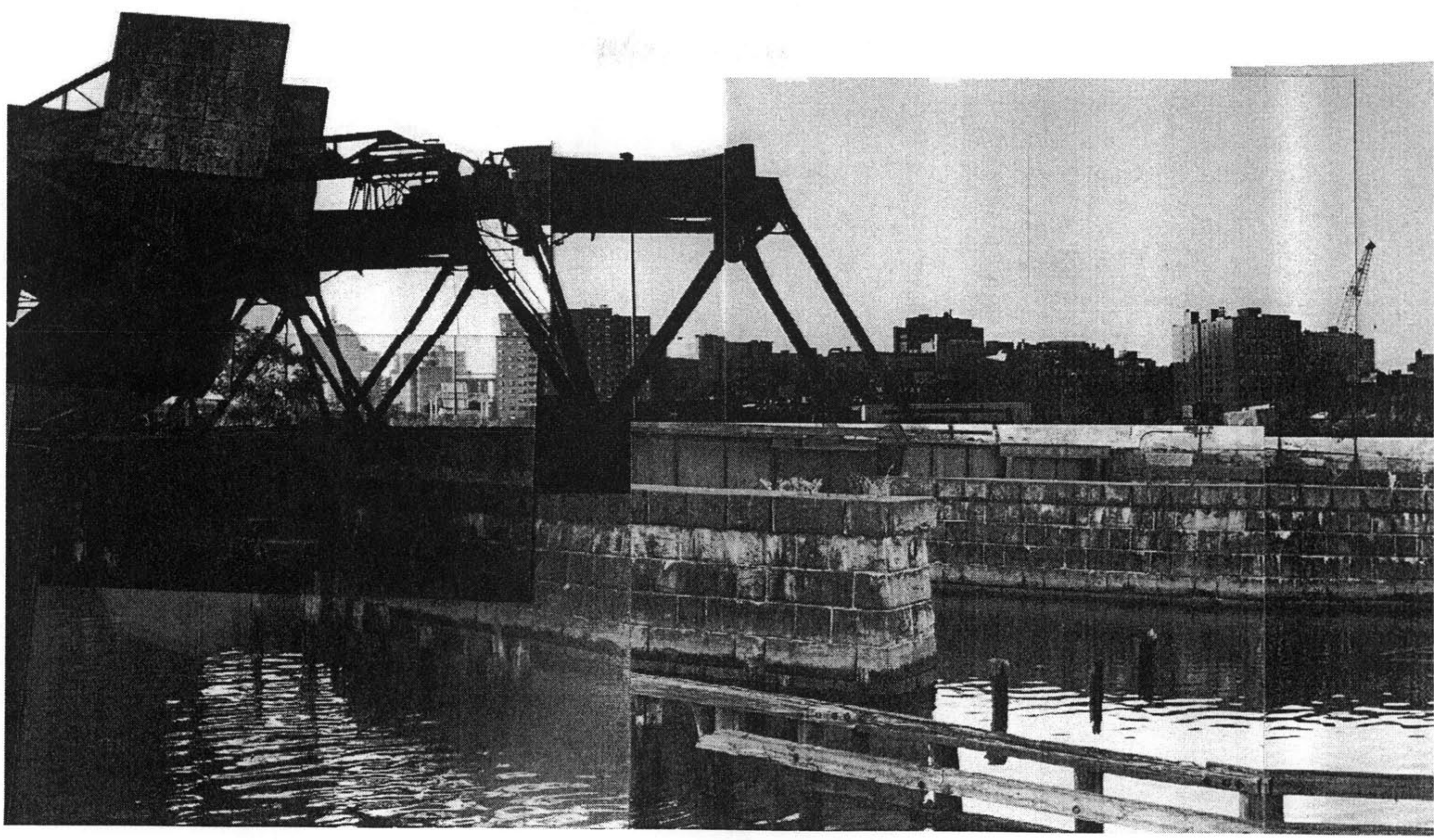
The Bridge

Demolition versus Preservation

The Rolling Bridge stands as a witness to the driving optimism and contradictions of the city. Technologically advanced for its time but now threatened by the onslaught of a different technological progress - the Central Artery Project - it has been the subject of numerous controversies over the last few years.

The Massachusetts Highway Department (MHD), the agency undertaking the artery construction, has awarded a contract to the automobile giant, Toyota, for the demolition of the bridge. The Boston Redevelopment Authority (BRA) has no desire to rehabilitate the bridge in its new Boston Harbor masterplan. A group of artists and architects came together last year for a major exhibition hoping to spark public outrage at the bridge's destruction. The Rolling Bridge Initiative, a private organization, argued that this historic landmark should be saved as a tribute to the industrial age.

Should the bridge be saved or destroyed?



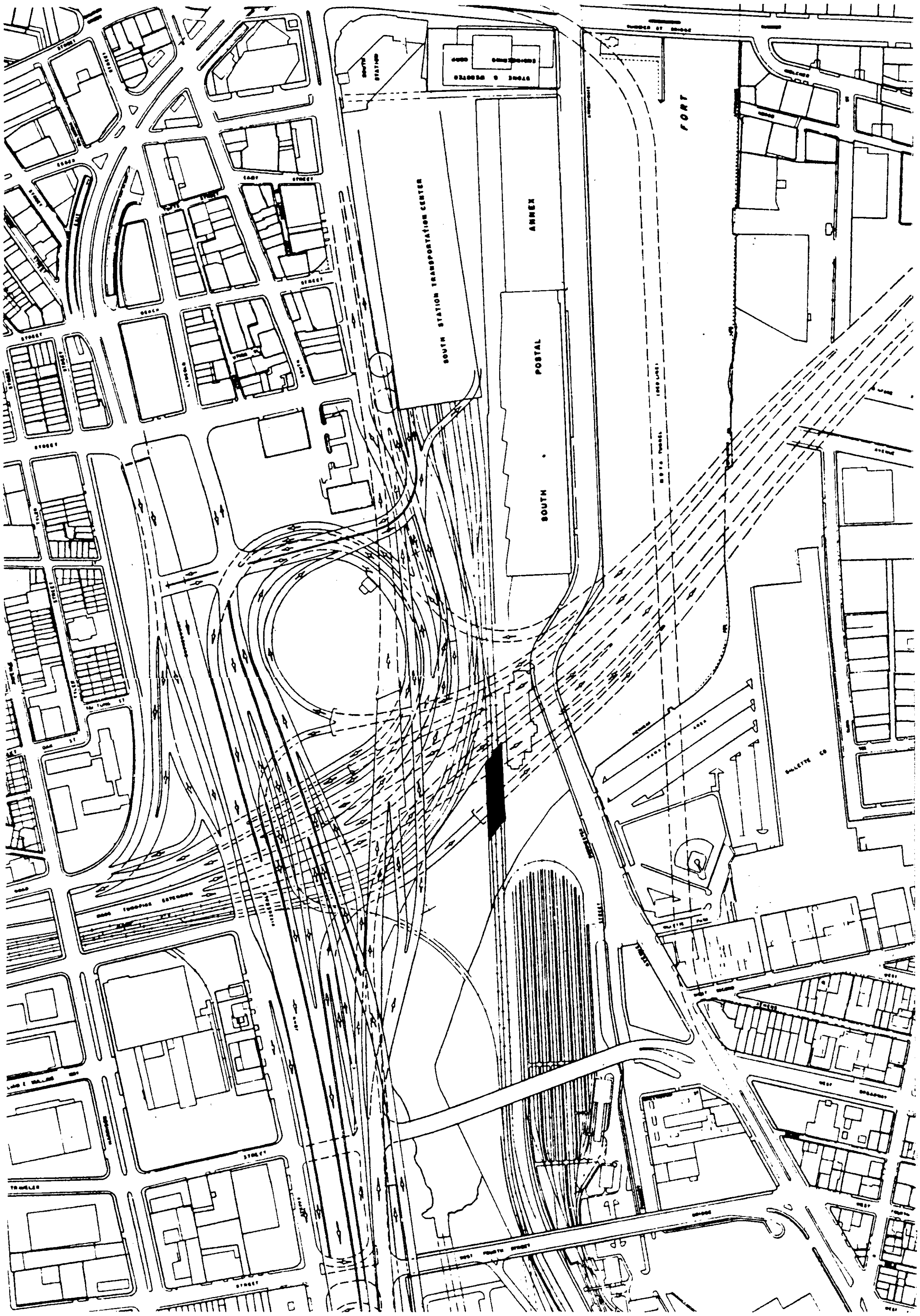


fig. 3 The Central Artery Tunnel Project as proposed by the MHD

The Central Artery/ Third Harbor Tunnel Project

The plan to depress the Central Artery is the largest public works project undertaken in the history of Massachusetts. At the current cost of $8 billion - the figures are still climbing - it is also the most expensive of its kind. Intended to undo many of the traffic problems caused by the existing elevated highways, the project appears to begin a new chapter of transportation for the city. However, it could also signal the end of the railway age for Fort Point Channel.

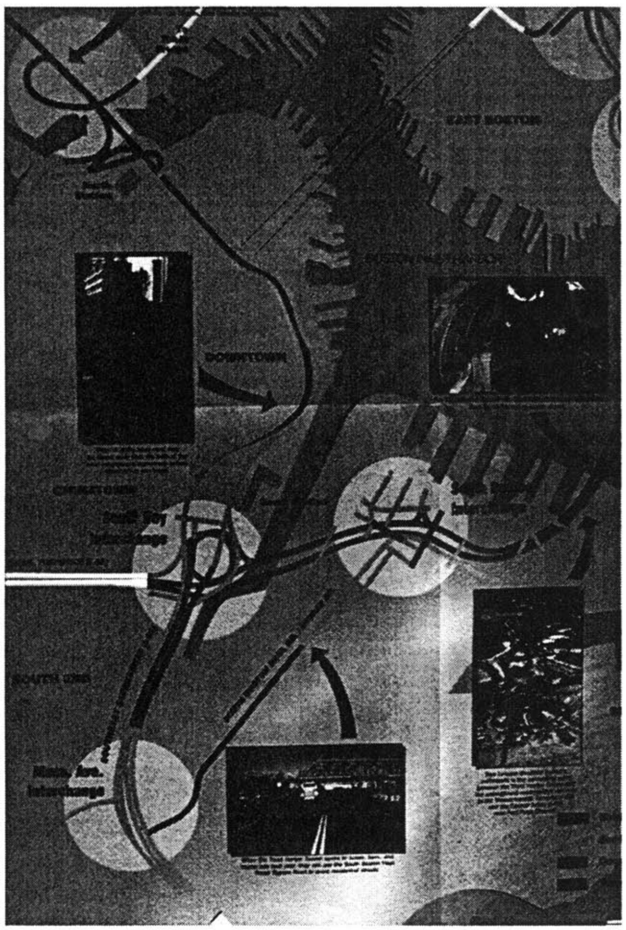


fig. 2 The Central Artery Project

From Charlestown over the Charles River, North Station through downtown and finally under the channel to Logan Airport and East Boston (fig. 2), this ambitious undertaking appears to undermine many forms of historic infrastructure. At Fort Point Channel particularly (fig. 3), the construction of a ten-lane highway tunnel will soon begin underneath the bridge piers. Due to the complexity of reinforcing the tunnel walls while retaining the piers, which will further escalate the construction cost, the MHD demanded the bridge's demolition. A new prefabricated concrete bridge, built on the same location, will eventually replace the original span.

Beginning from 1992, the MHD sought public recommendations for ways to take the bridge apart. Various groups have since responded with proposals to redeploy the bridge as a sculptural gateway either within the city, or as far as in Buffalo, New York. Due to limited state and federal funds however, cost for its removal was restricted to $500,000. This ruled out the more costly, though sympathetic, rehabilitation proposals. Last year, Toyota finally clinched the demolition contract. Its intention: to smelt the structural steel and recycle it into automobile components.

Despite the economics surrounding this decison, it is ironic that the automobile industry has finally found the lasting value of one hundred-year-old steel.

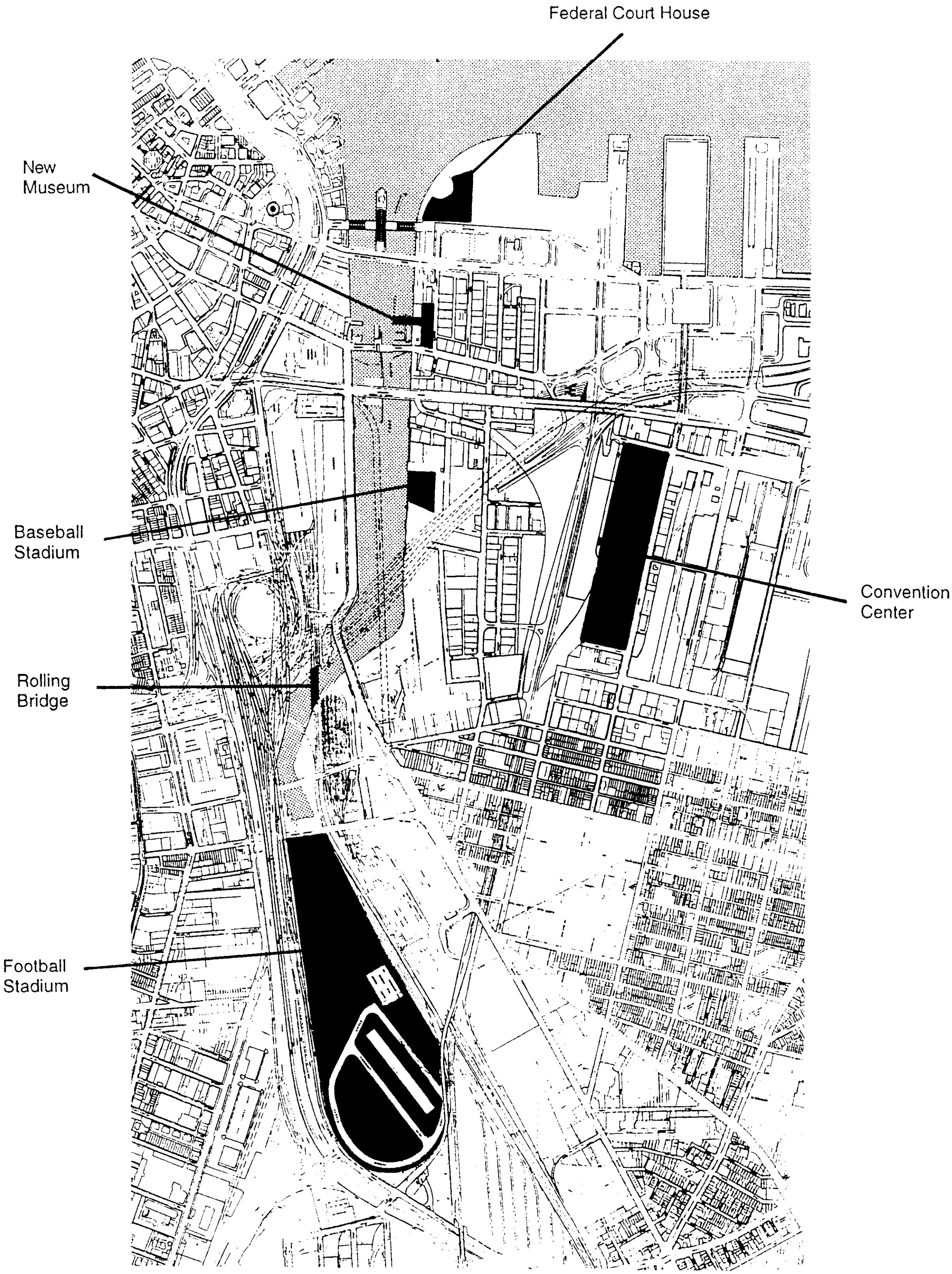


fig 4 BRA's proposal for the Fort Point Channel district

BRA's Masterplan

The revitalization of Fort Point Channel has been studied by the BRA over the last two decades. Along with private developments, it has introduced several urban proposals to bring life back to this once abandoned warehouse district. In addition to thematic waterfront restaurants and retail stores, the BRA has lined up a series of institutional and recreational centers to propel the area's development into the next century (fig. 4).

A landmark site along the mouth of the Channel, known as Fan Pier, is undergoing construction for the Federal Court House. Its neighbors, the Children's and Computer Museums, await Frank Gehry's waterfront addition. Deeper along the channel edge, a vacant parking lot has been allocated for the Red Sox Baseball Stadium. A new convention center, comprising 600,000 square feet of exhibition space, could possibly emerge two blocks behind it. At South Bay, approximately 10 minutes' walk from the bridge, another stadium has been proposed - this one a colossal arena for 90,000 football fans (fig. 5).

If accomplished, these developments will introduce unprecedented growth to a district currently devoid of a critical mass. Not only will the area undergo a dramatic transformation, its living and working population will also be redefined by a community - lawyers, sports enthusiasts, tourists and museum goers - currently foreign to this industrial zone.

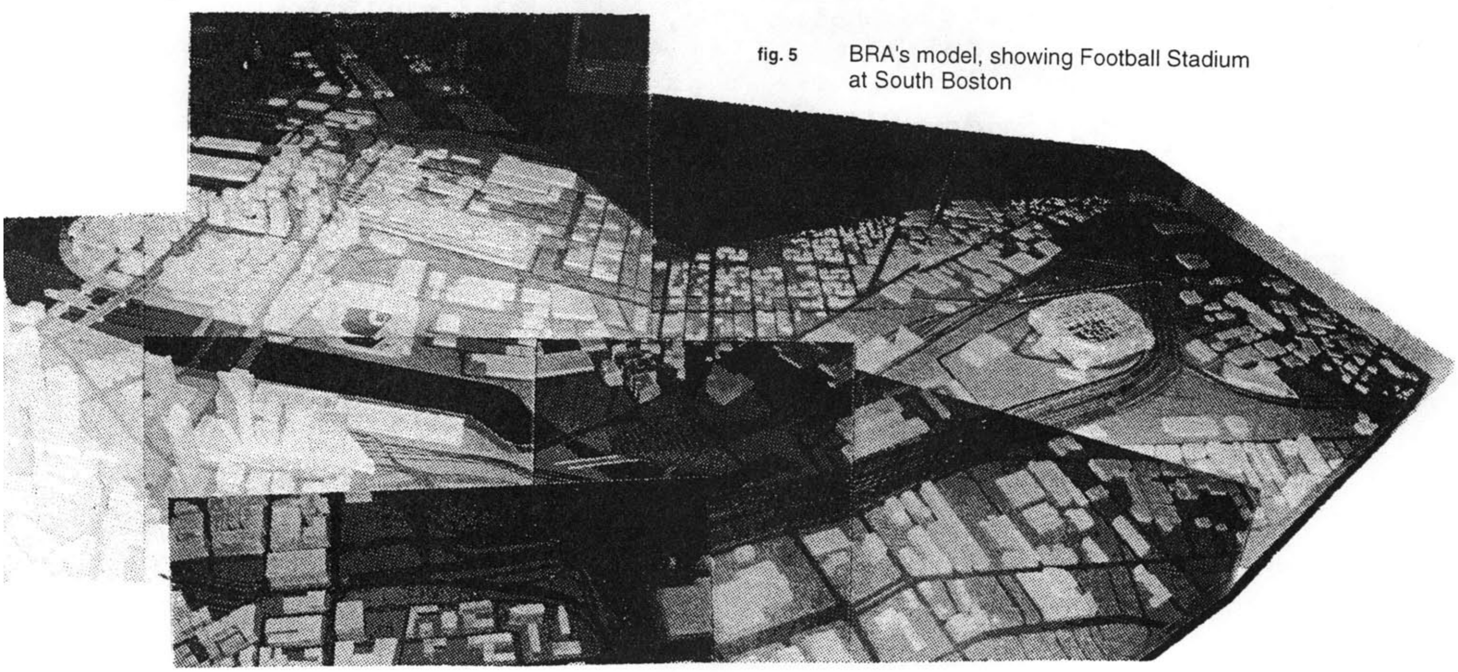


fig. 5 BRA's model, showing Football Stadium at South Boston

THE ARTIST AND THE ARTIFACT

Picture-perfect bridge: Show gives imperiled icon a lift

Thomas Durand's "Bridge With Yellow Sky," a painted photo of the Old Colony Railroad Bridge.

By Christine Temin
GLOBE STAFF

Large and small, in color or black and white, romantically blurred or crisply limned, the works on the walls of the Federal Reserve Bank Gallery vary in many ways – except in their subject matter. These prints, paintings, drawings and photographs all depict the Old Colony Railroad Bridge behind South Station, an urban icon beloved by artists. The rhythmically repeating arcs of the bridge symbolize America's turn-of-the-century industrial might. The majestic structure is, technically speaking, a counterweighted rolling lift bascule bridge, designed in 1897 by the Scherzer Rolling Lift Bridge Co. of Chicago and erected in Boston the following year.

Perspectives

Scherzer's system of curved lifts and counterweights allowed a railroad bridge to open vertically rather than swinging sideways, a factor that was crucial in spanning Boston's narrow Fort Point Channel.

Technologically advanced for its time, the bridge is now itself threatened by the march of progress – in the form of the Central Artery

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fig. 6 Article taken from The Boston Globe, Apr 5, 1995

The Arts Community

Artists residing in the Fort Point Channel district have been fascinated with the bridge as a historic and cultural icon since the early 1970's. Many felt that its huge, rhythmically repeating arcs suggest America's turn-of-the-century might. To them, this bridge is to Boston what the Eiffel Tower - similarly considered for demolition at one time - is to Paris. Knowing full well that its eradication signals an aesthetic and spiritual loss to the city, their exhibition at the Federal Reserve Bank Gallery became an opportunity to reflect upon its destiny (fig. 6). Their effort was comparable to Oliver Wendall Holme's 1830 poem "Old Ironside" which contemplated the planned destruction of the USS Constitution (the aircraft carrier was eventually saved).

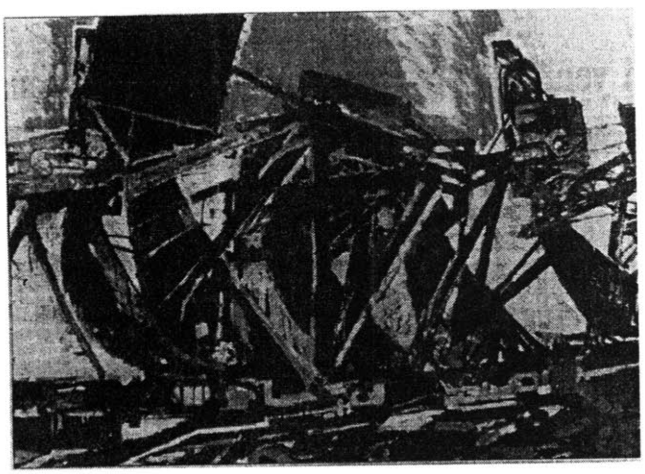


fig. 7 Black and white etching-aquatints by Sidney J. Hurwitz

All the artists found beauty in the rusty steel structure. From abstraction to photo-realism, their work drew upon the enigmatic forms which elicit multiple responses. One acrylic-and-paper collage conveyed the hectic movement and scattered light of its anthropomorphic shapes (fig. 7). The light splintered the vast silhouette to suggest an almost surreal motion. Another work, a black-and-white etching, portrayed the precision of its mechanical parts (fig. 8). Every line and shadow depicted the simple yet meticulous detail accorded to an engineering structure.

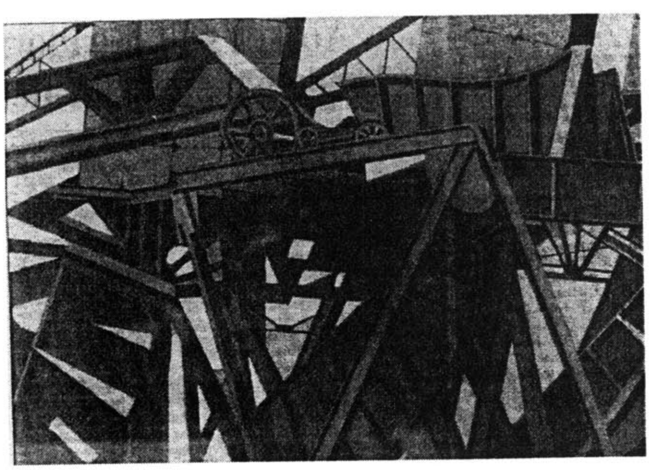


fig. 8 Acrylic-and-paper collage by Flora Natapoff

Some artists felt that Boston's long history of reutilizing colonial architecture - Faneuil Hall and Old State House were resuscitated under the Historic Preservation Act - could be used as a precedent for saving the bridge. Others maintained that the presence of steel bridges greatly enhanced the city's industrial character.

In spite of all the publicity generated by the exhibition, the artists' concern never won the full support of the authorities.

Group hopes to save last bridge of its type in US from demolition

By Andrew Blake
GLOBE STAFF

A group of private citizens has joined the Central Artery-Third Harbor Tunnel project to save a rolling lift bridge, the oldest remaining bridge of its type in North America, from demolition.

The so-called Old Colony Bridge in the Fort Point Channel near South Station, built between 1898 and 1900, stands directly in the way of the tunnel and artery construc-

The bridge was designed in 1897 by the William Scherzer Rolling Lift Bridge Co. of Chicago. What makes it unique is its system of curved lifts and counterweights that allowed the railroad bridge to open vertically so ships could pass through the Fort Point Channel. A more common swing bridge, which turns sideways on an axis, could not have been built in that narrow section of the channel, said Beth Bower, staff archeologist for the Central Artery project.

Tyrell told the group that at the very least, the working components of the bridge, if not the entire span, should be preserved, possibly in a sculpture park along the channel.

The bridge, still in use by Amtrak and commuter rail, now only carries traffic on three of its six original tracks. A temporary replacement rail bridge will be built during its removal or demolition and then a new span will be put in place.

Tyrell said several bridges of historic value have been saved by lop-

fig. 9 Article taken from The Boston Sunday Globe, Jun. 21, 1992

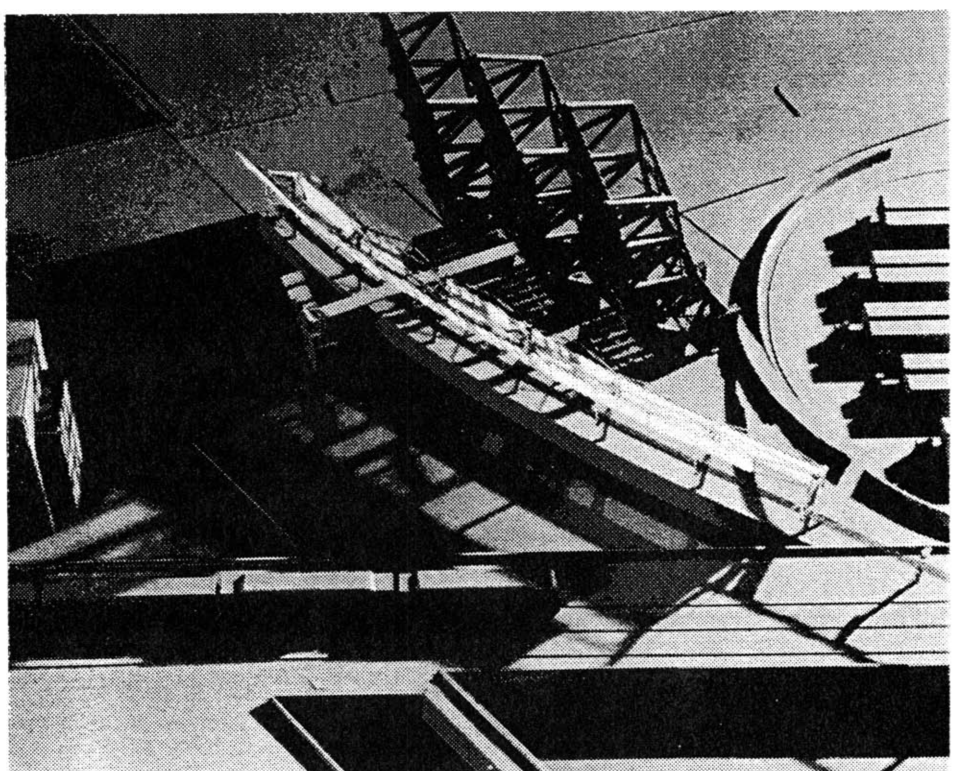


fig. 10 The Rolling Bridge Initiative's bridge rehabilitation proposal

The Rolling Bridge Initiative

Comprised of a group of artists and architects, this organization has been monitoring the events surrounding the bridge since 1991. It maintains that the bridge should be preserved to enrich the urban topography of Boston (fig. 9).

According to the group's chairman, Mike Tyrrell, several bridges of historic value have been successfully rehabilitated throughout America. Citing the restoration of the Walnut Street Bridge in Chattanooga, Tennessee, he argued that this option proved less costly than building a replacement bridge. Besides, a plain concrete span will be a poor surrogate for the highly-articulated steel structure.

His proposal for the bridge's preservation was boldly put forward in a collaborative project with Paul Lukez, another Boston architect[5]. Each of the three bridges, currently inoperable, was propped upright to recapture its former splendor (fig. 10). Visually prominent within the landscape, it became an iconographic gateway to the city. A raised walkway lined with scrims circumscribed the perimeter of the channel bank. Treading along this path, the visitor registered the shadows and glinting light cast by the bridges. One could ascend the structures - now three observation towers - to study the surrounding rail yards and warehouses.

Such an ensemble gave the bridges a hovering, melancholic presence within the industrial wasteland. It also evoked the Central Artery's looming destruction of the artifact. Nevertheless, the project remains captivated by the iconography of the artifact.

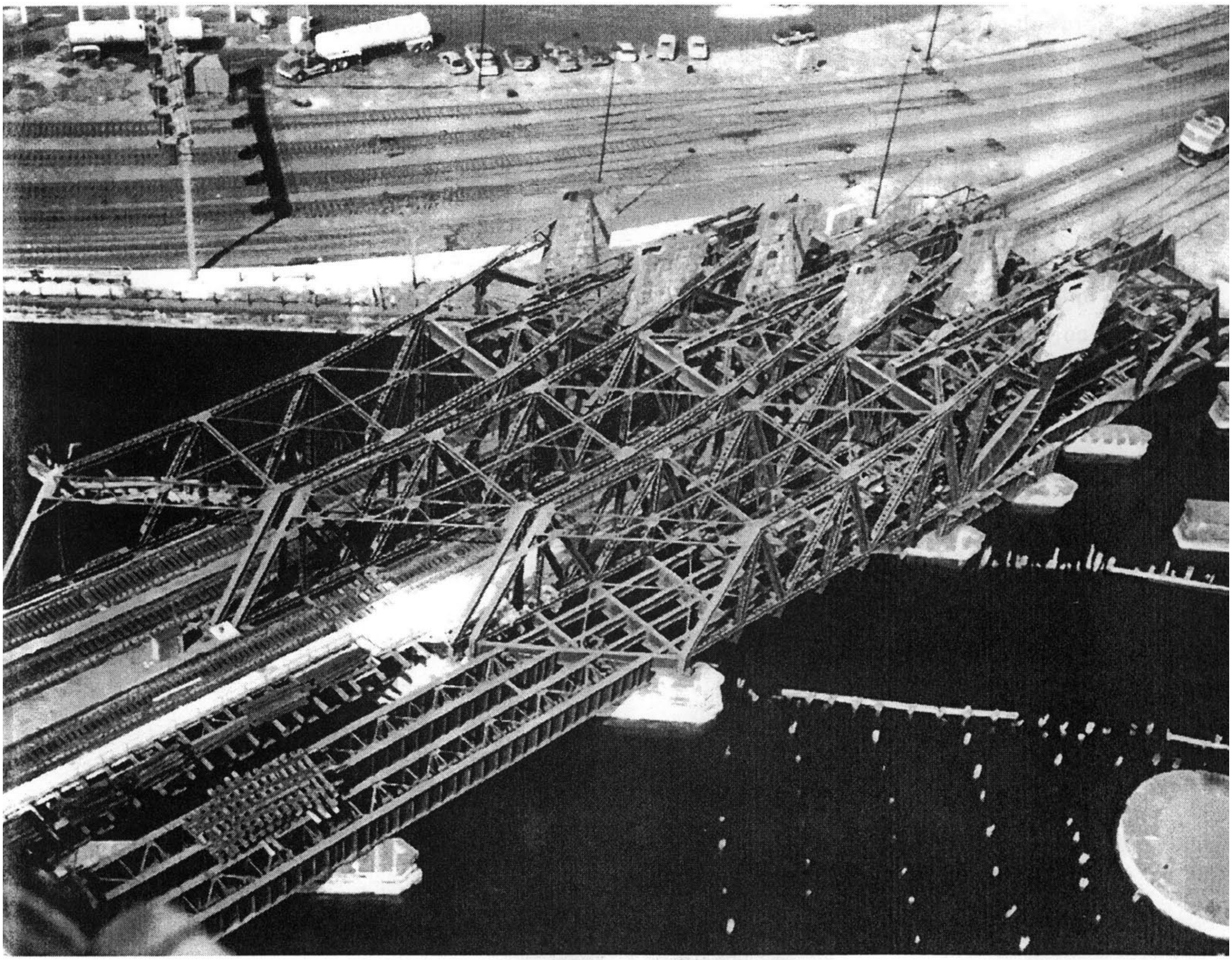


fig. 11 A heap of scrap metal?

Salvage

Is recycling the steel components a logical end to the bridge? Or should the icon be turned into a folly?

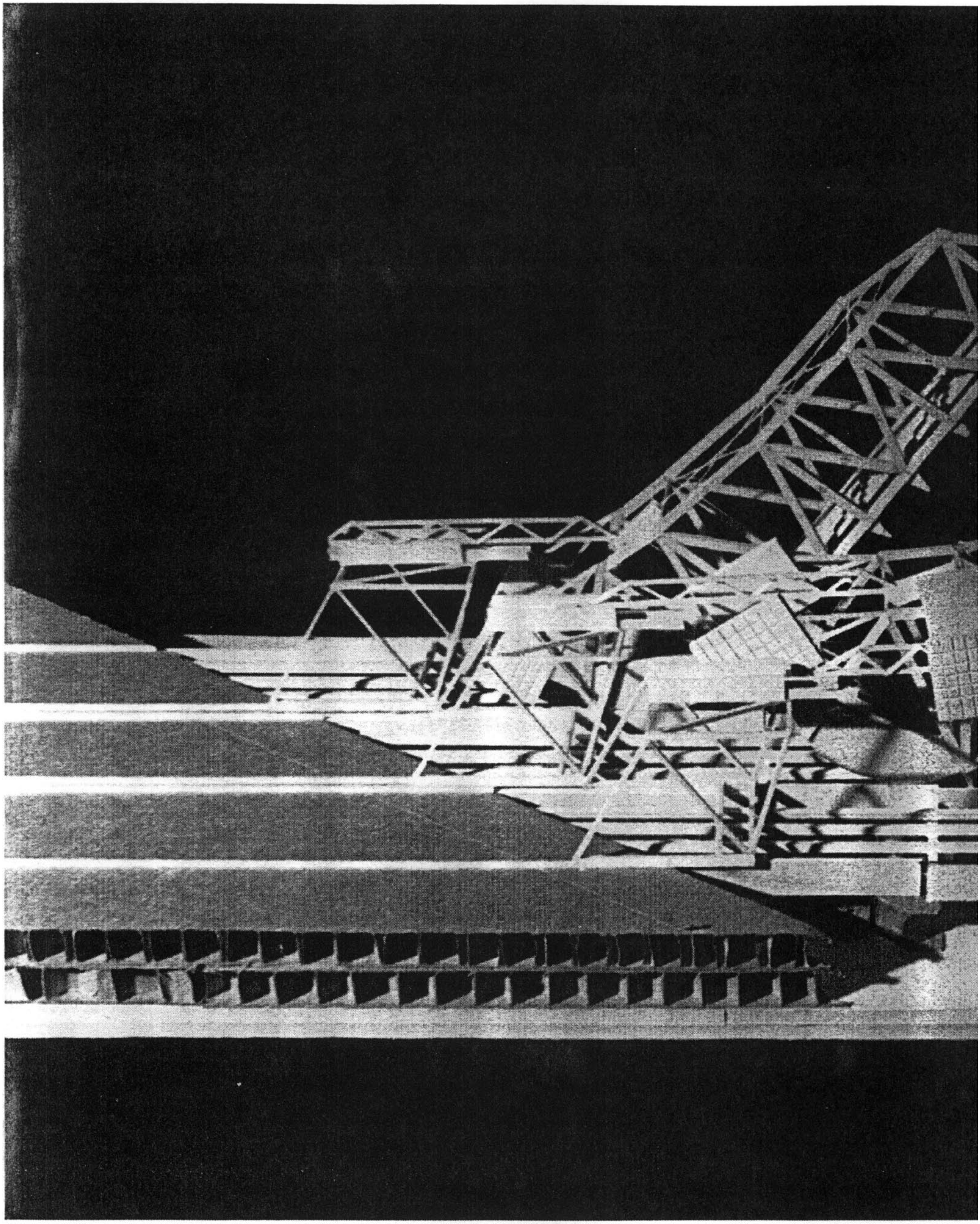
Among all imaginable solutions, the recycling option proves to be the most contested. Smelting the steel removes all traces of the bridge and desecrates it to museum walls. Industry's propagation of its own product at the expense of another demonstrates, however ironically, its resourcefulness. One realizes that with the appropriate technology, industrial artifacts can be resuscitated, albeit in different forms.

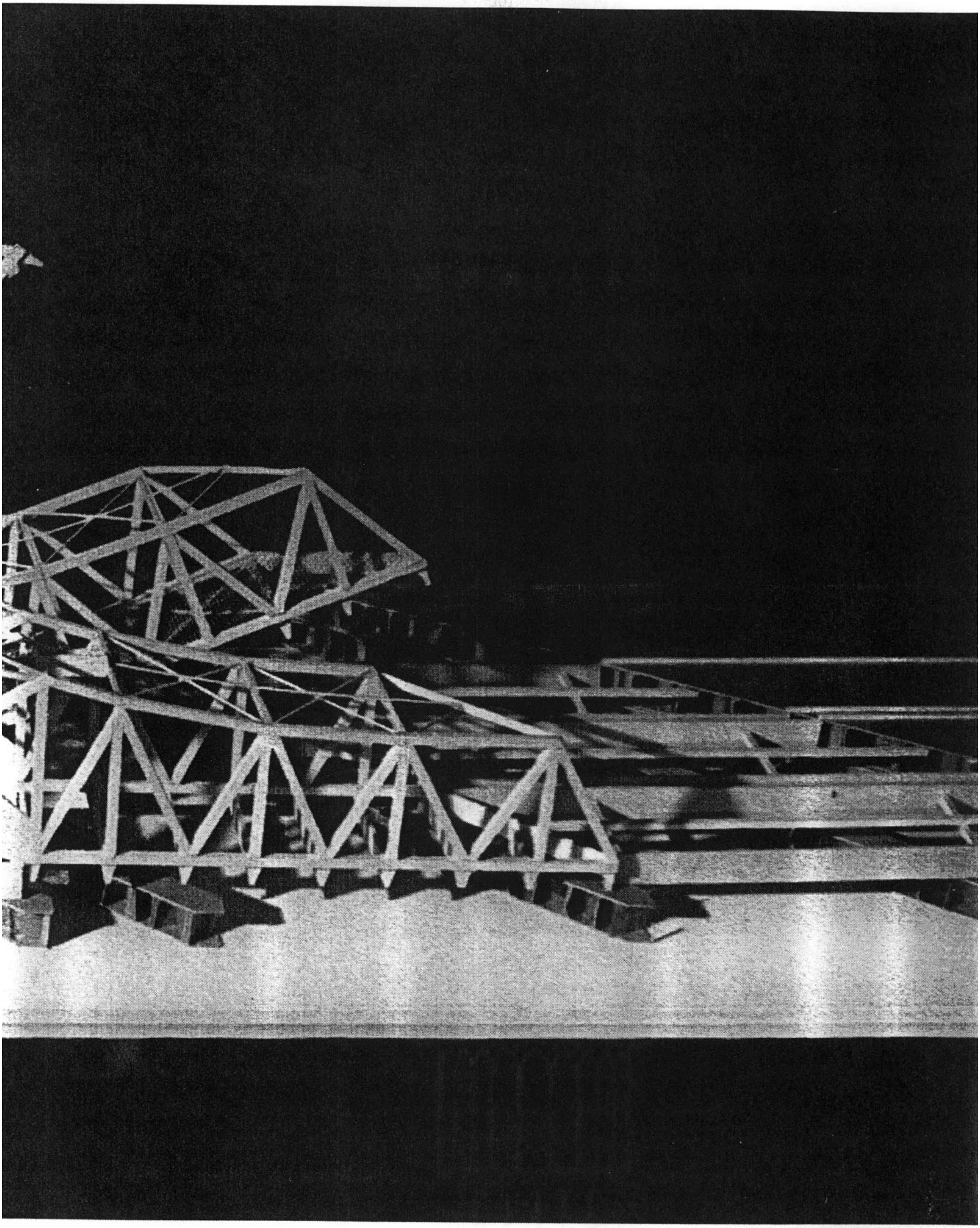
Despite Tyrrell's evocative proposal, there is a philosophical problem with his project. Instead of recreating a utilitarian structure, it memorializes the bridge as a kind of funerary monument. Is rehabilitation the only answer for preserving the obsolete structure? I doubt so. As one observer noted: "If it is not serving its function as a bridge, why keep it as an icon?"[6]

At this point, it seems necessary to come to new terms with this industrial *outcast* (fig. 11)*.* In considering BRA's vision for the Fort Point Channel, I observe that the revitalization program negates the connection between historical remnants - the bridge as a centerpiece - and their implication for the future. While the changing circumstances of the landscape makes it an anomaly, the bridge should be translated into a new living and working entity within the masterplan. Since the artifact has been revered by the artists, I suggest its resurrection as a communal art gallery. This program will simultaneously anticipate the audience suggested by BRA's masterplan.

How should the building reinvent the bridge? An architecture of the art gallery has to rid itself of all the encumbrances that the engineering structure proffers (fig. 11). To create a building that fulfills new conditions for artistic production - shelter, light and workspace - the structure of the bridge should not be kept intact. Rather, it must respond to new demands by using the most radical forms of adaptation - dismantlement and reassembly.

From this transformation, the art gallery will thus provide the symbolic and aesthetic backdrop for remembering the artifact. Its objective is to exhibit a *bridge* even when art works are not displayed.





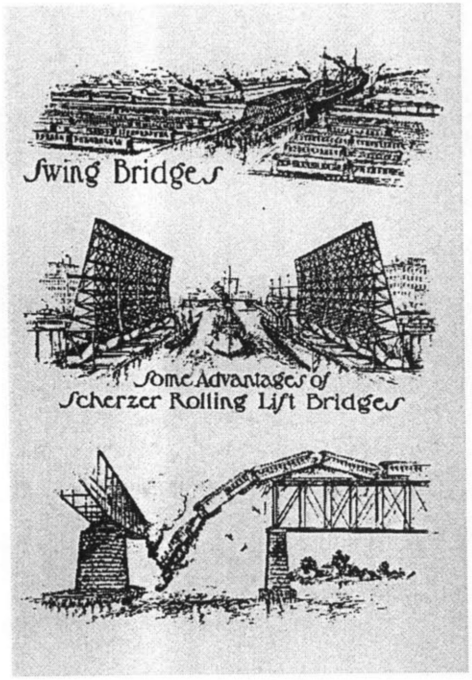


fig. 12 The Scherzer Rolling Lift Bridge could prevent potential disasters

Innovative Structure

The Rolling Bridge was among the first vertical lift bridges in America. It symbolized an important advance in bascule technology during the early age of industrialization (fig. 12).

Before its conception, the most common type of drawbridge was one which swung horizontally upon a pivoted end. This type of bridge presented some serious disadvantage, especially when traffic is heavy or when the banks of the river were used as berths for vessels. In the first case, the speed of moving a heavy and long structure over the stream was extremely slow. This caused serious delays at major railway and

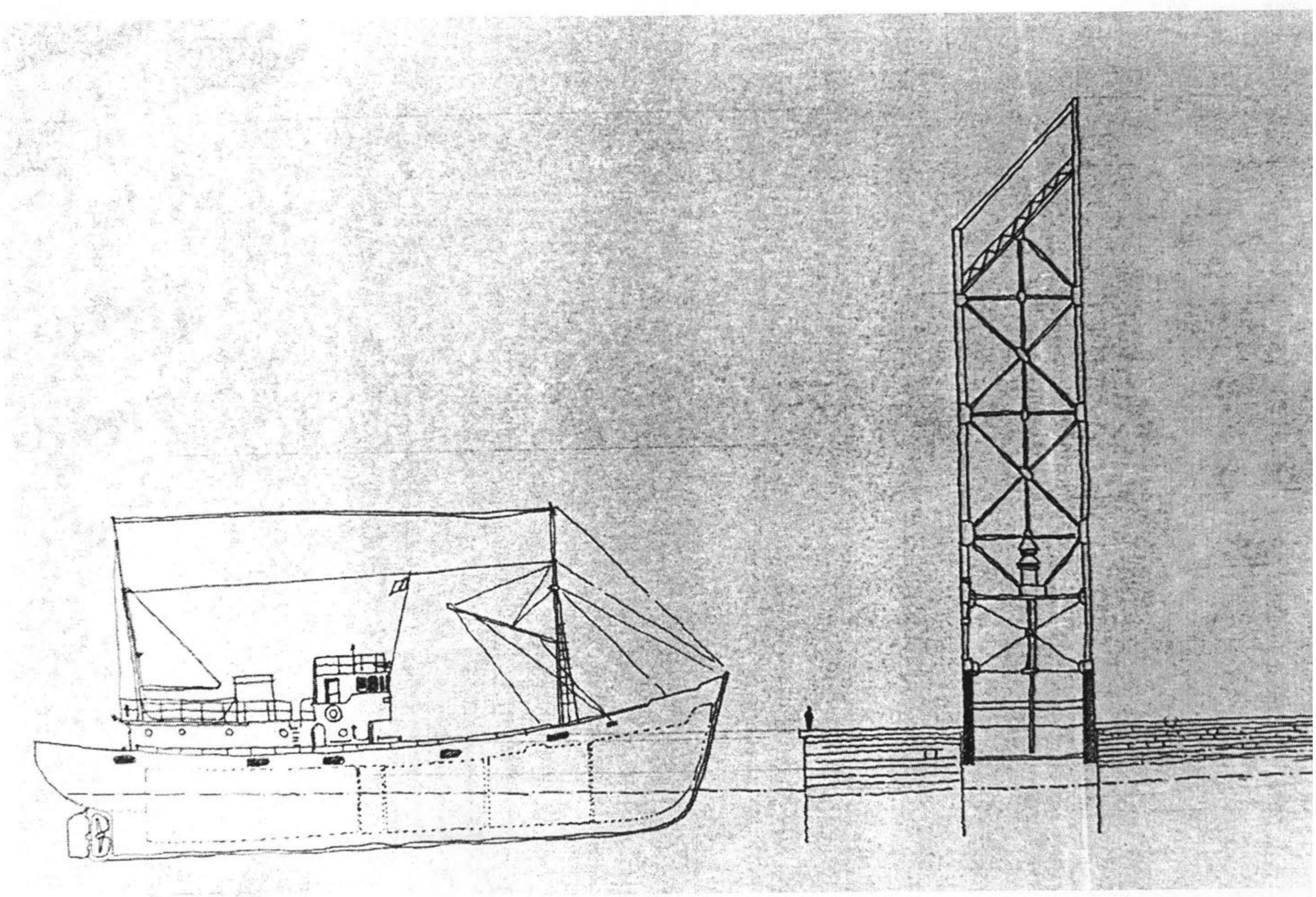


fig. 13a North Elevation

maritime intersections. Since the swing-bridge also required a considerable clearance space along its arc-of-swing, vessels either at the wharves or approaching the bridge had to be kept at a critical distance. In addition, if the bridges occurred at frequent intervals along the bank, they would be so close together that two swing bridges could not be opened at the same time.

To obviate these difficulties, the engineer William Scherzer (1859 - 1893) of Scherzer Bridge Company in Chicago, devised a new type of bascule bridge which rotated vertically instead of horisontally. It would occupy nothing more of the river or shore than what was covered by the spans. His invention required the use of counterweighted balance for quick operations. With an opening-closing time of about 30 seconds, the bridge would thus provide a smoother flow between vessels and vehicles at the intersection (fig. 13a and 13b).

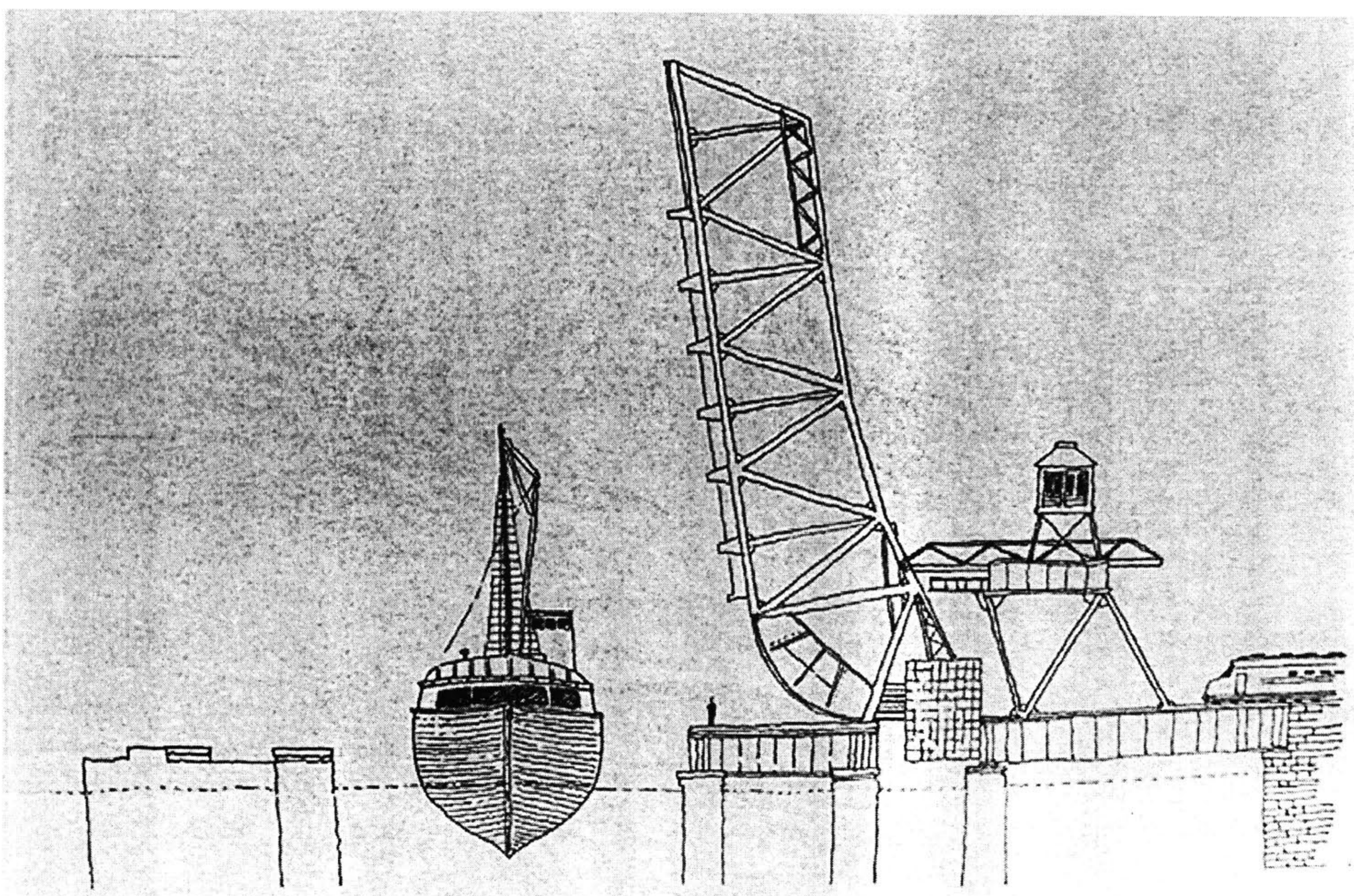


fig. 13b West Elevation

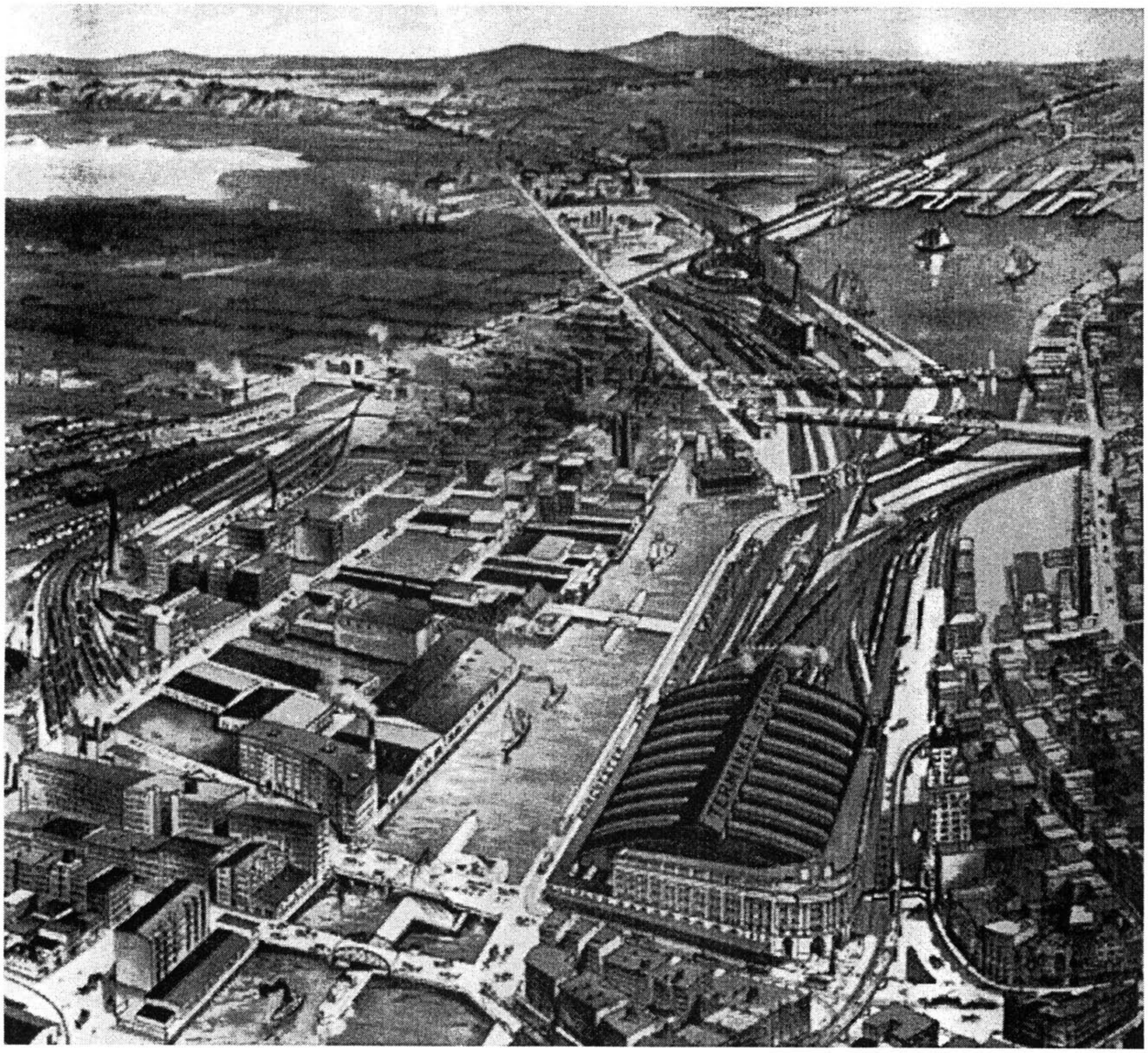


fig. 14 View of railway terminal and bridge. South Bay is seen at upper right corner

Bridge Facts

Also known as the Old Colony Railroad Bridge, this infrastructure was constructed in 1897 for the New England Railroad Company to connect Boston's cargo terminals with southern Massachusetts (fig. 14). By 1899, it had been incorporated into the railway network to the South Station passenger terminal (fig. 15).

The three double-track spans were designed to accommodate high railroad frequencies in correspondence with the extensive railroad tracks that converged in the old South Station Terminal (fig. 16). As railway activities diminished over the years, the operable tracks were reduced to half the bridge's intended capacity. They are presently used by the Post Office Terminal for cargo transportation.

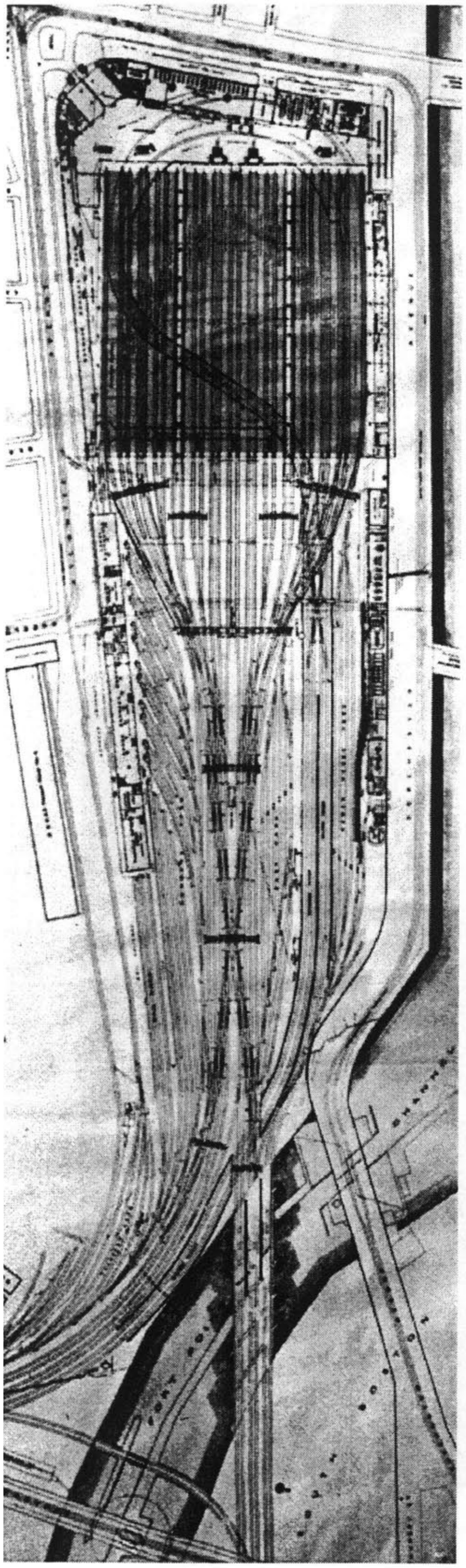
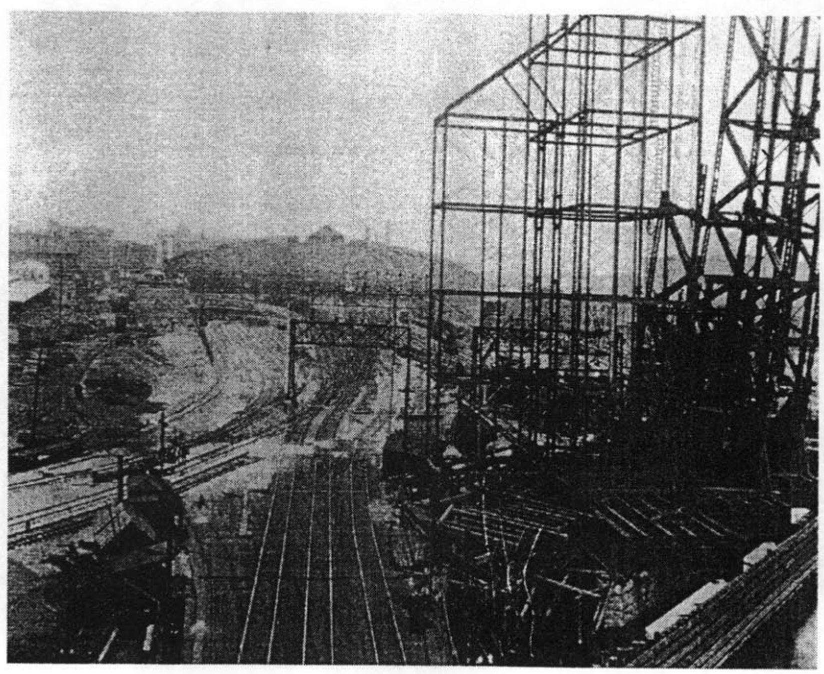


fig. 15 (left)
Location of the three spans in relation to South Station Terminal

fig 16 (below)
View of South Station



The north approach span, which is the subject of this thesis, carries six railroad tracks over three truss leaf spans (fig 17a). Each bridge comprises the railroad track, a pair of rolling bascule racks and counterweight panels, and the mechanical station with its attendant equipment. This system was designed to balance the vertical and horizontal forces required to erect the entire truss frame to the open position (fig. 17b). Since the decline of shipping activities in the mid-50s, the drawbridge has been fixed in the closed, horizontal position and has acquired a weather-beaten appearance.

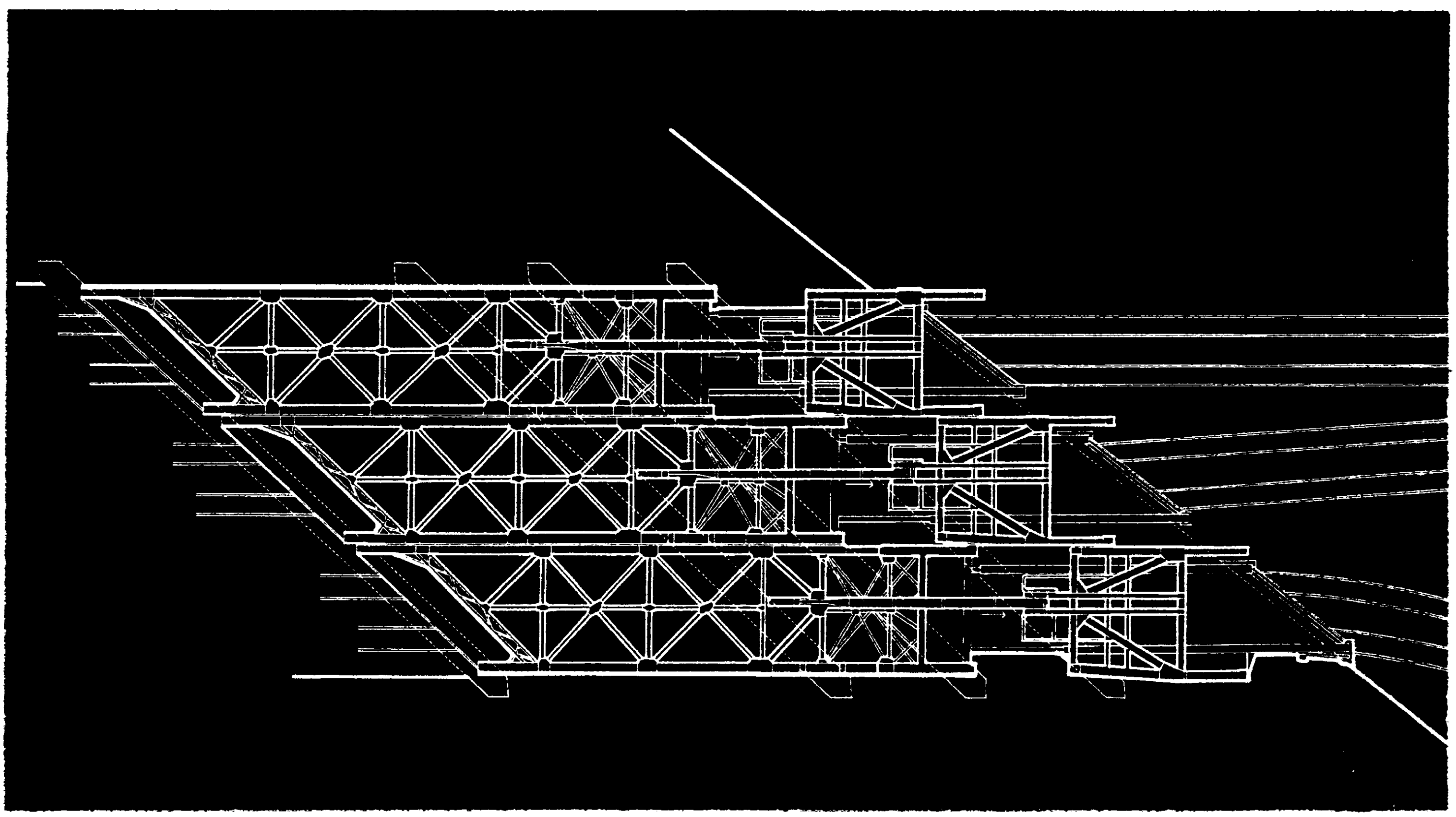


fig. 17a Plan showing the 45 degree angle skew

Each truss, weighing about five hundred tons, was constructed and operated autonomously. It is constructed of triangulated steel members (latticed or rolled channels), which in turn are riveted together by large gusset plates. To accommodate the linear tracks with the canted channel banks, the end of the truss is skewed at an angle of 45° to the direction of the tracks. Since the span is supported on skewed piers, its two truss-leaves are constructed of different lengths and given intermediate bearing supports on the channel piers. Staggered apart to form a trapezoid, the plan of the three spans measures 95 meters long and 29 meters across.

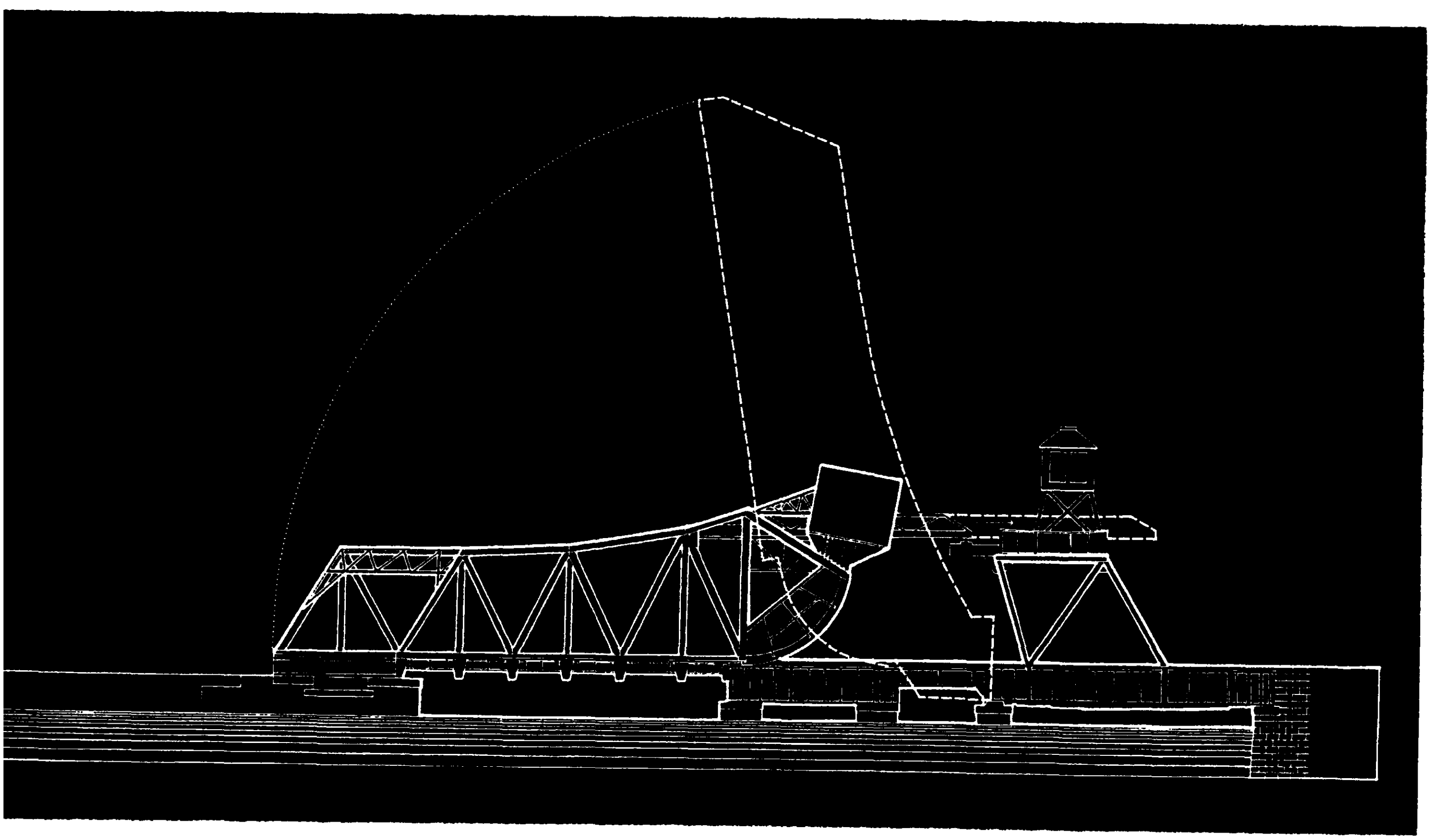


fig. 17b Elevation shows arc of rotation of the span

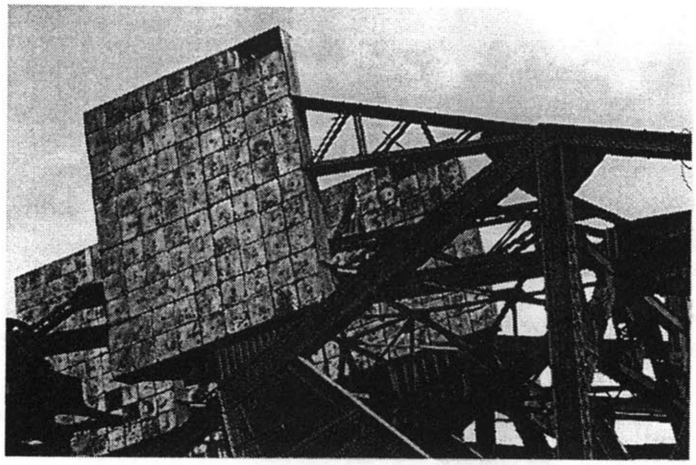
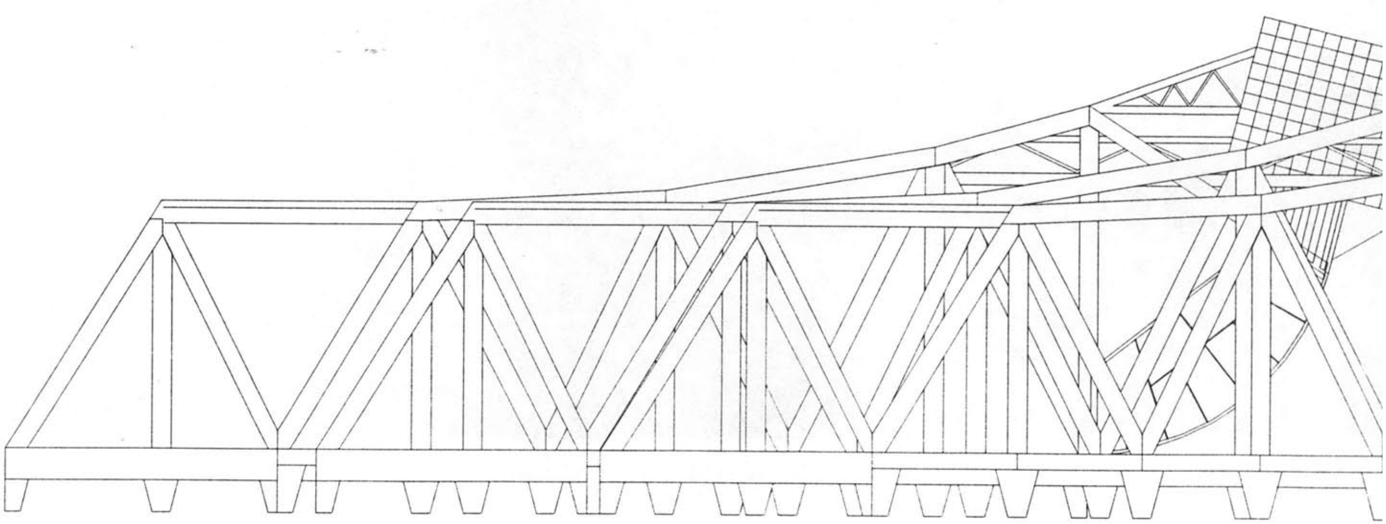


fig. 18a Counterweights

The counterweight panels are constructed of steel plates and bolted with cast-iron blocks (fig. 18a). Each cube is a square of 0.5 meters with a thickness of 0.3 meters. Since the span is skewed in length, the panels are sized relative to the counter-balancing force they exert on the two truss leaves. The panel supporting the longer truss was made heavier than that on the adjacent truss. To balance the longer leaf, the larger panel contains a total of 620 blocks. For the shorter truss however, the smaller panel carries 50 blocks less.

The segment at the heel of each truss on which the bridge rotates is known as the roller (fig. 18b). Nearly symmetrical about its center line, this arc structure measures 11.6 meters across its chord. In the past, the bridge was raised and lowered by rolling this segmental end over the track girders. At the rolling end, a steel platform is extended along the center line to support the mechanical equipment - operating strut, gears, guide roller and girder. The connection between



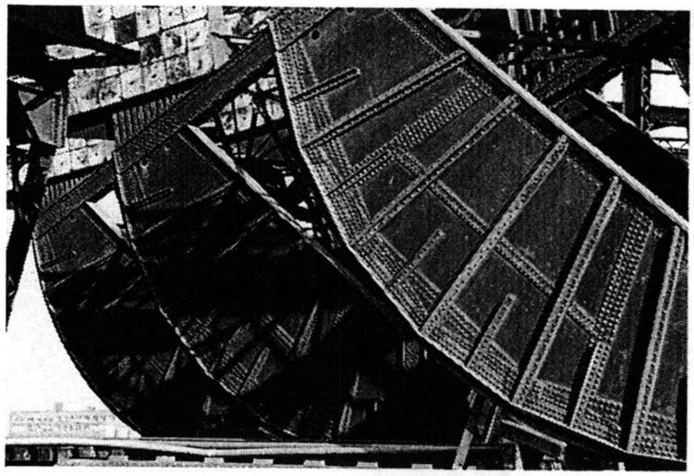
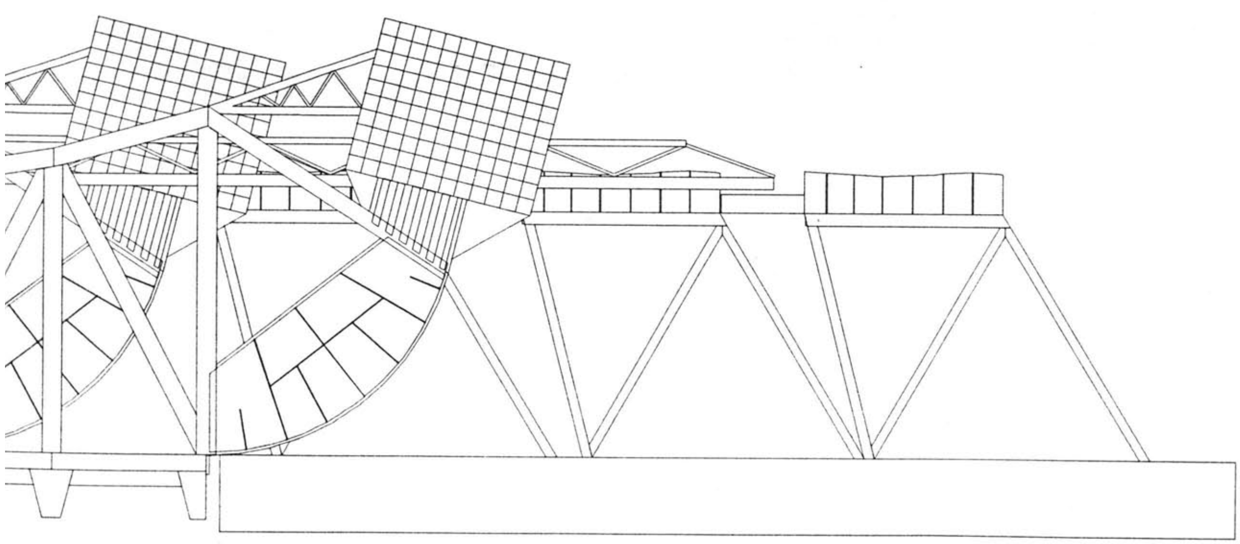


fig. 18b Rolling Bascule

the strut and the span was made at the fulcrum of the structure, located at the top end of the truss. Through a rack and pinion arrangement, this strut powered back and forth, opening and closing the truss respectively. To prevent the truss from slipping, the arc is perforated with rectangular holes that engage a series of teeth on top of the horizontal tracks.

As opposed to the three movable spans, the south approach spans (not the focus of this thesis) are constructed of plain steel riveted plate girders spanning over concrete piers. Each span is supported on independent railroad tracks through a system of open deck bridge ties.

All the above superstructure is supported on grouted masonry foundation over the neck of the channel - the substructure. This consists of two masonry abutments and three long narrow piers, all parallel and inclined at the same angle.



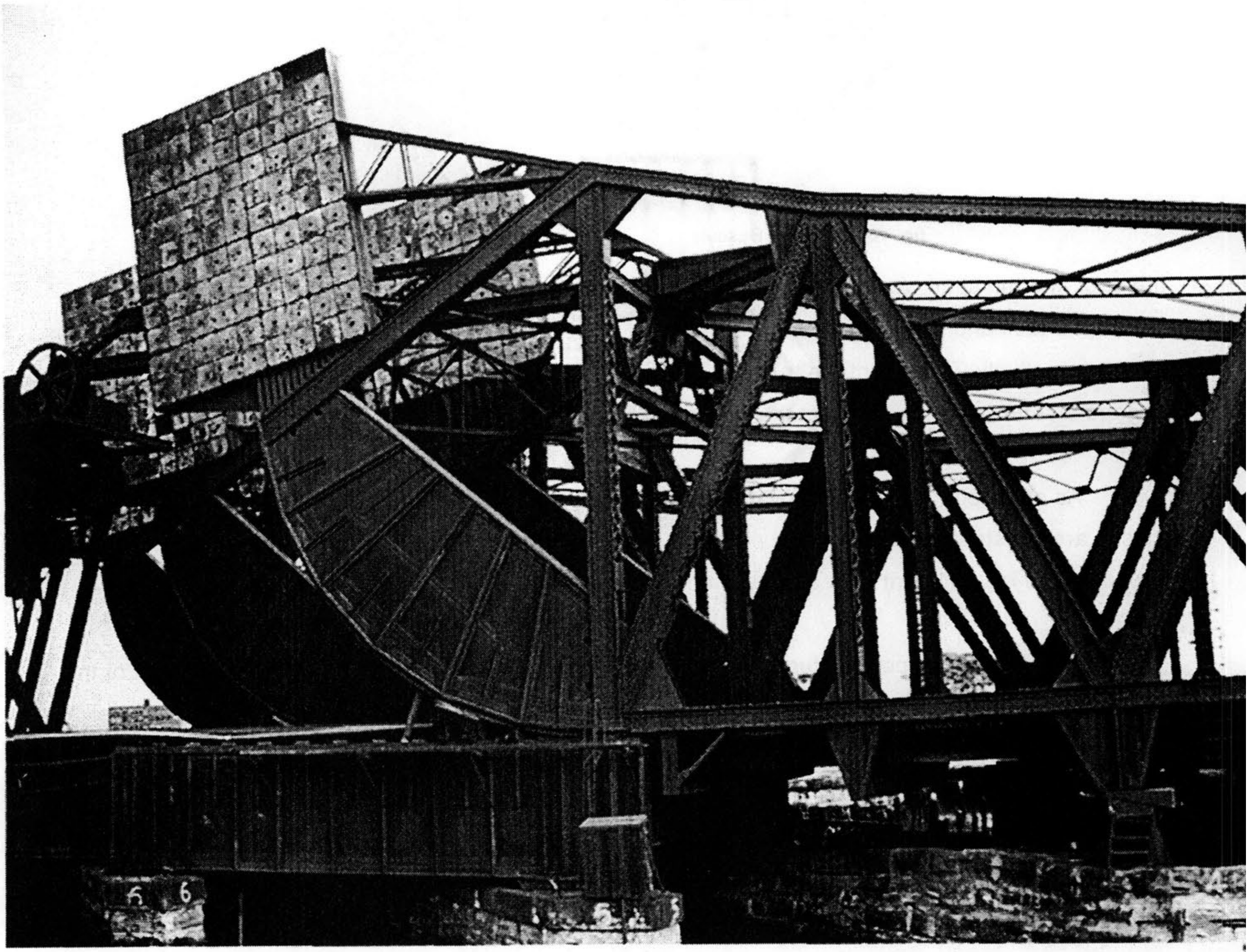


fig. 19 View of super- and substructures

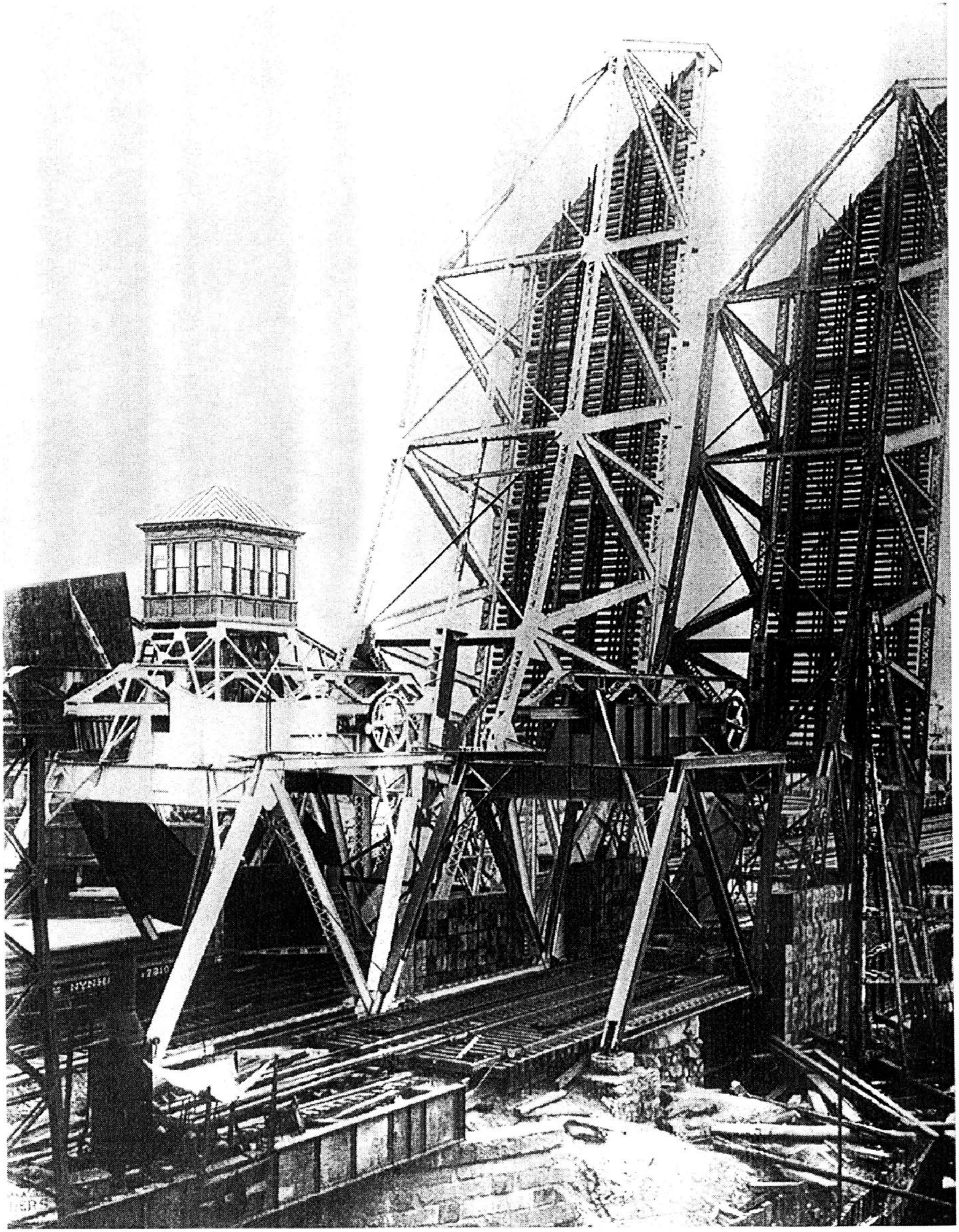
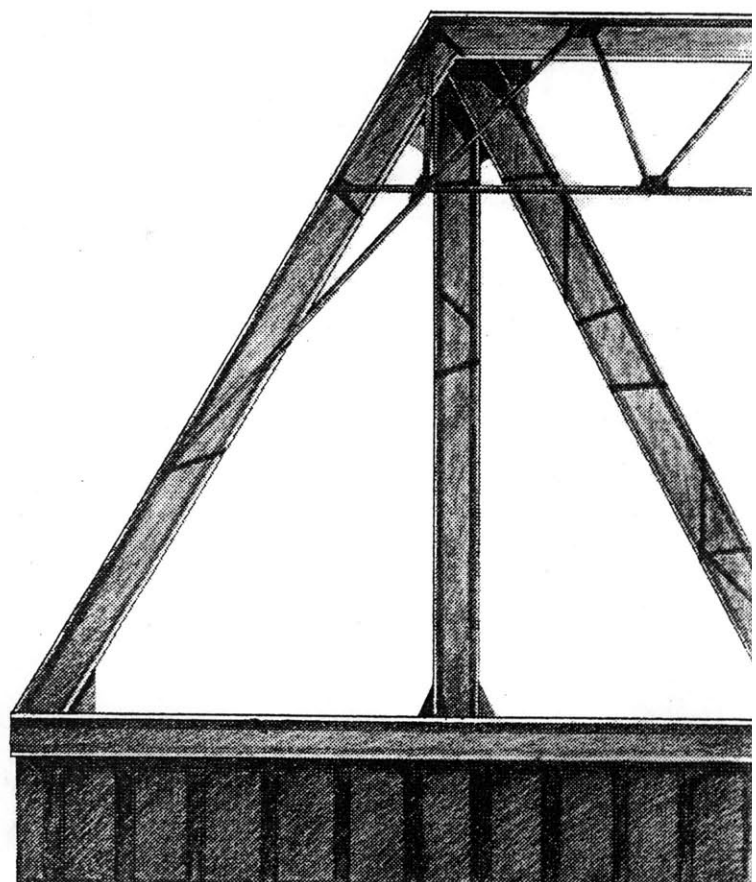
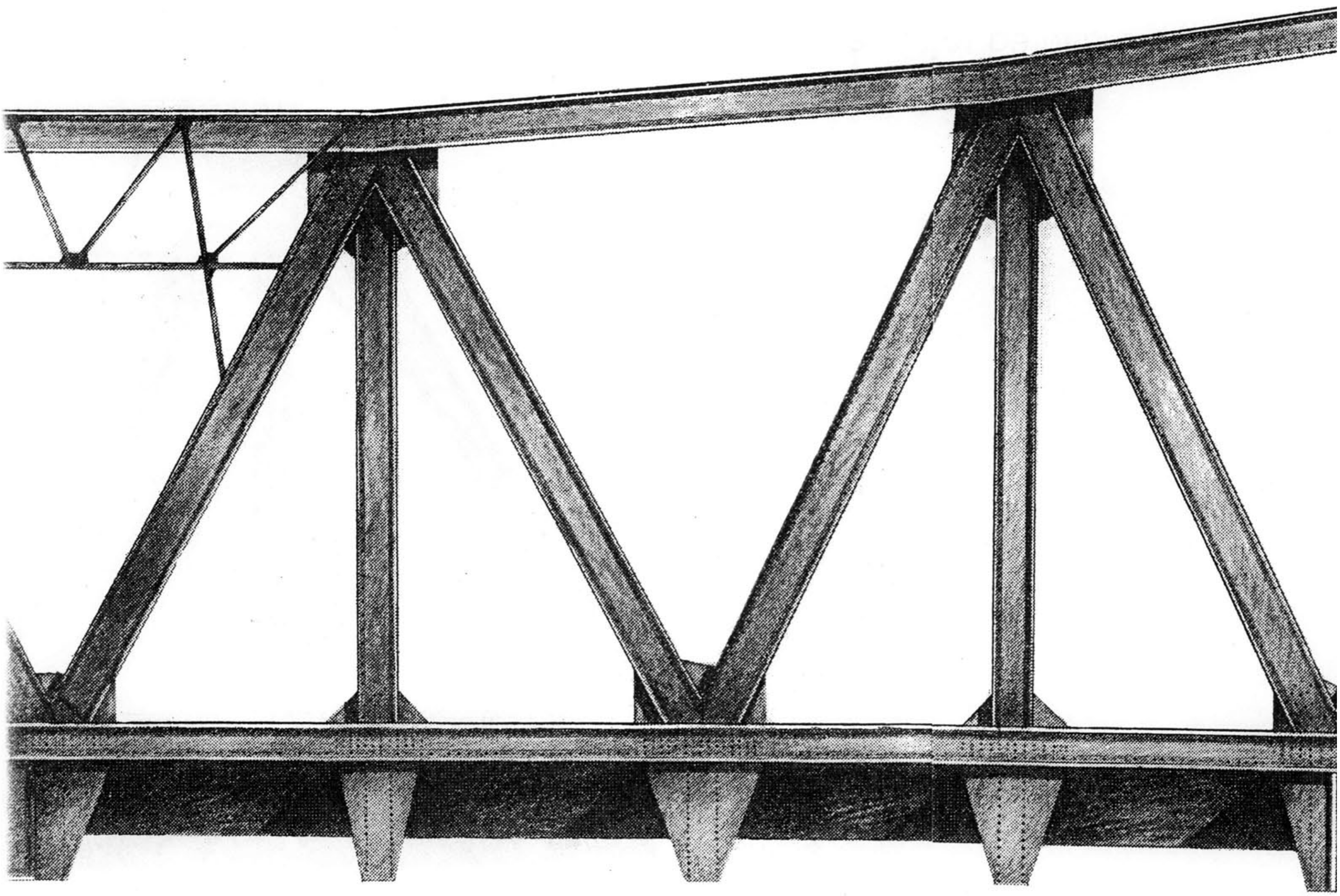


fig. 19 The bridge at its upright position

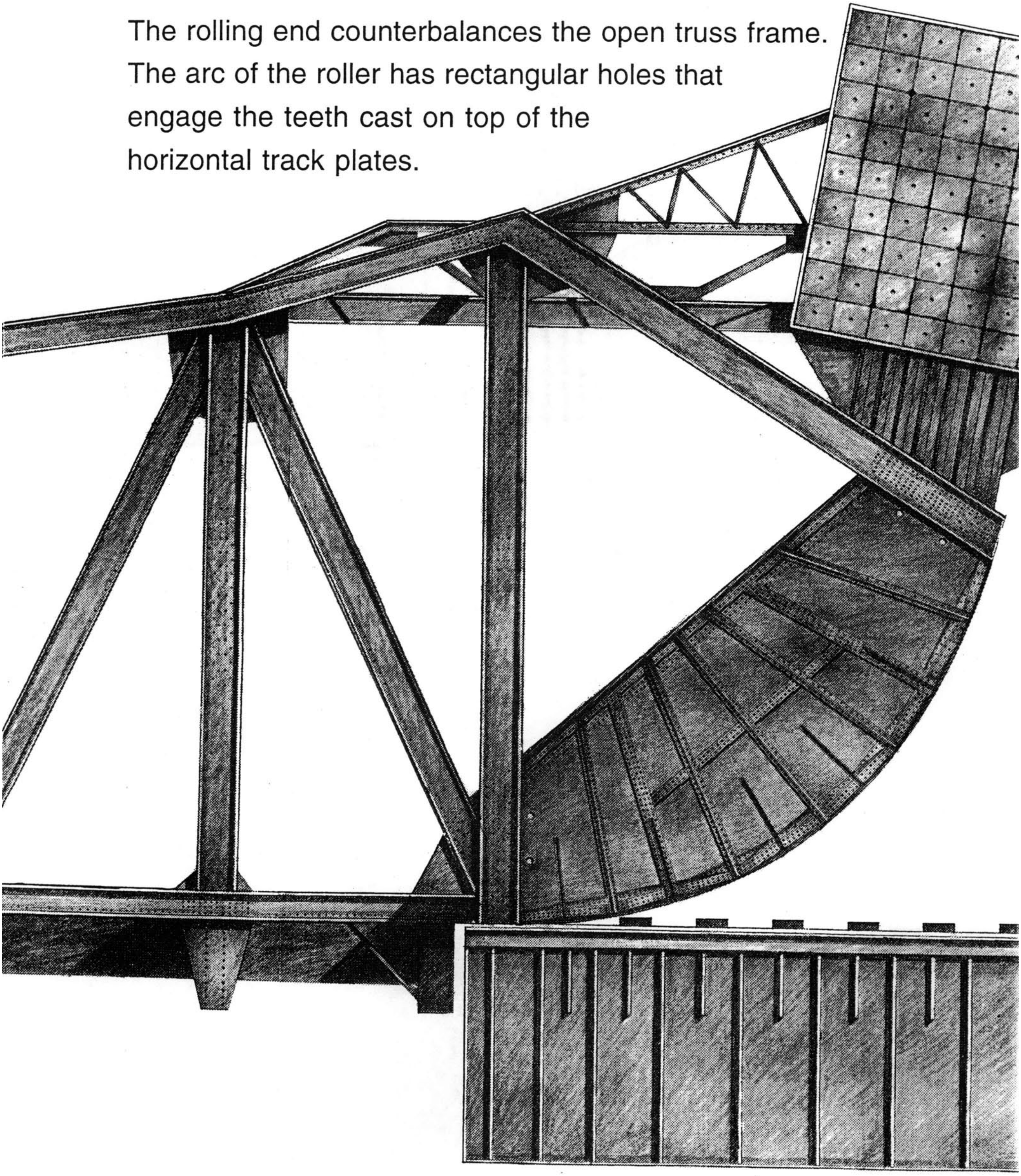
Three single trussed members - two ties and one strut - form the cantilevered end. Triangulated connections are riveted together by gusset plates.



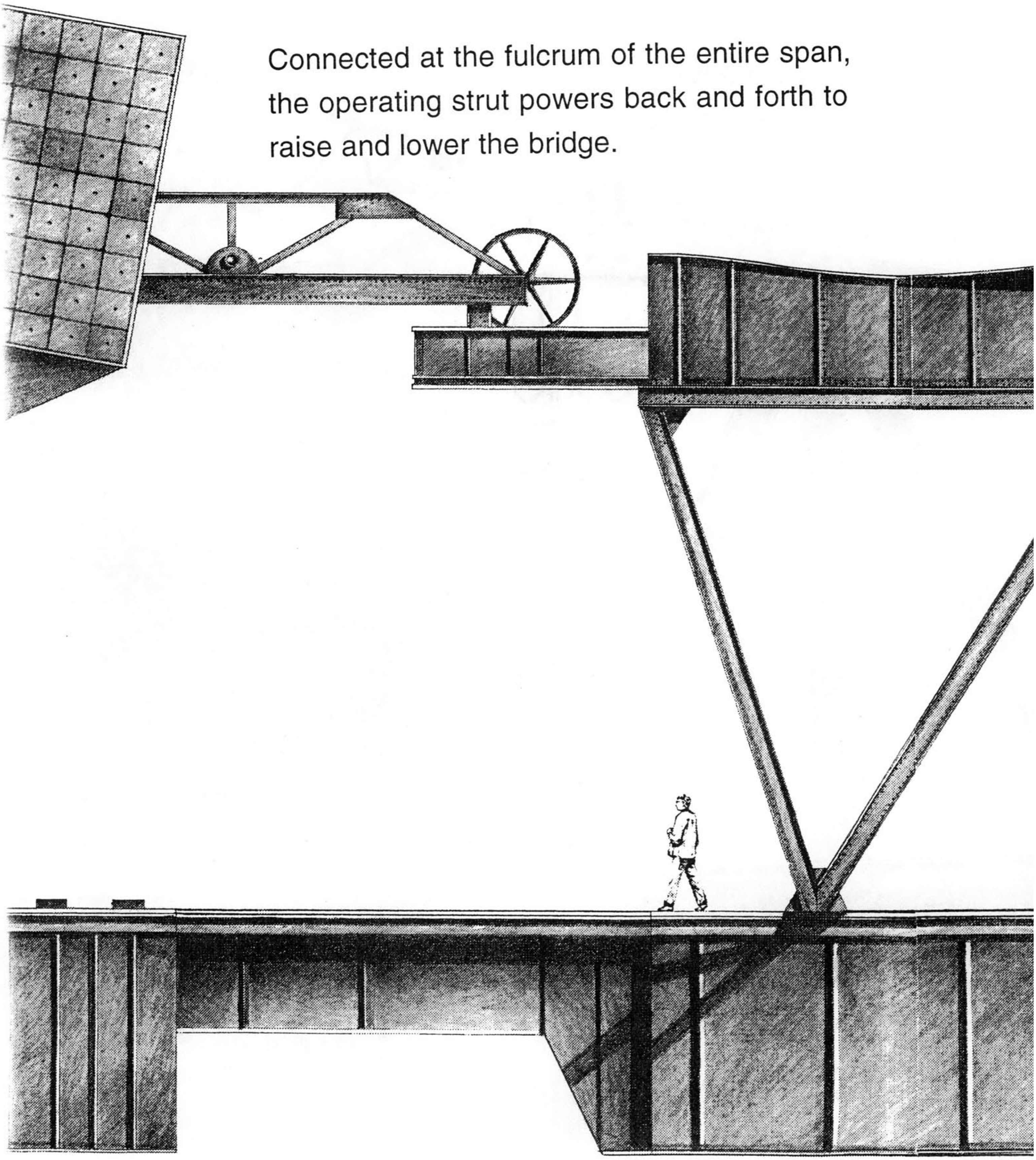
This mid-section, unlike the cantilevered end, is comprised of paired members. Each member not only has different end conditions, its length varies as the beams rise gently towards the rolling end.



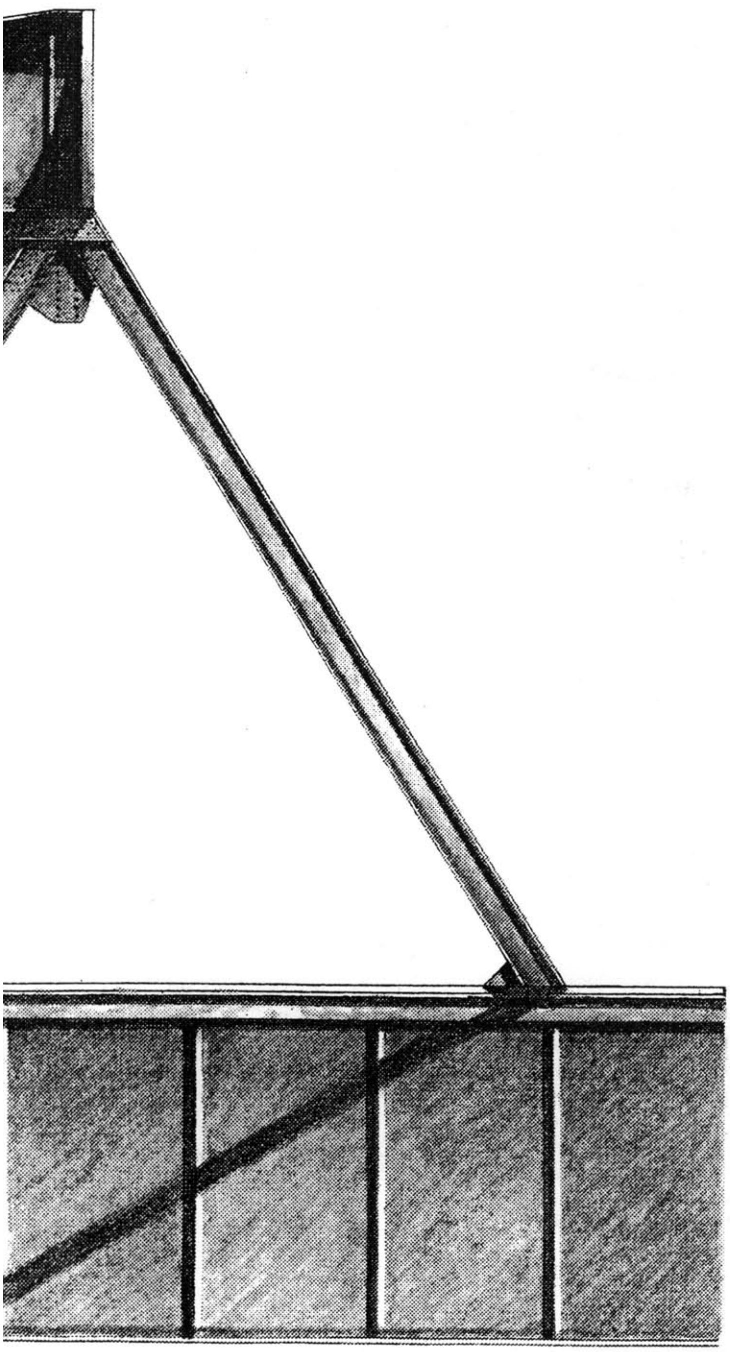
The rolling end counterbalances the open truss frame. The arc of the roller has rectangular holes that engage the teeth cast on top of the horizontal track plates.



Connected at the fulcrum of the entire span, the operating strut powers back and forth to raise and lower the bridge.



A set of gears engages and slides the operating strut along the guide girder.



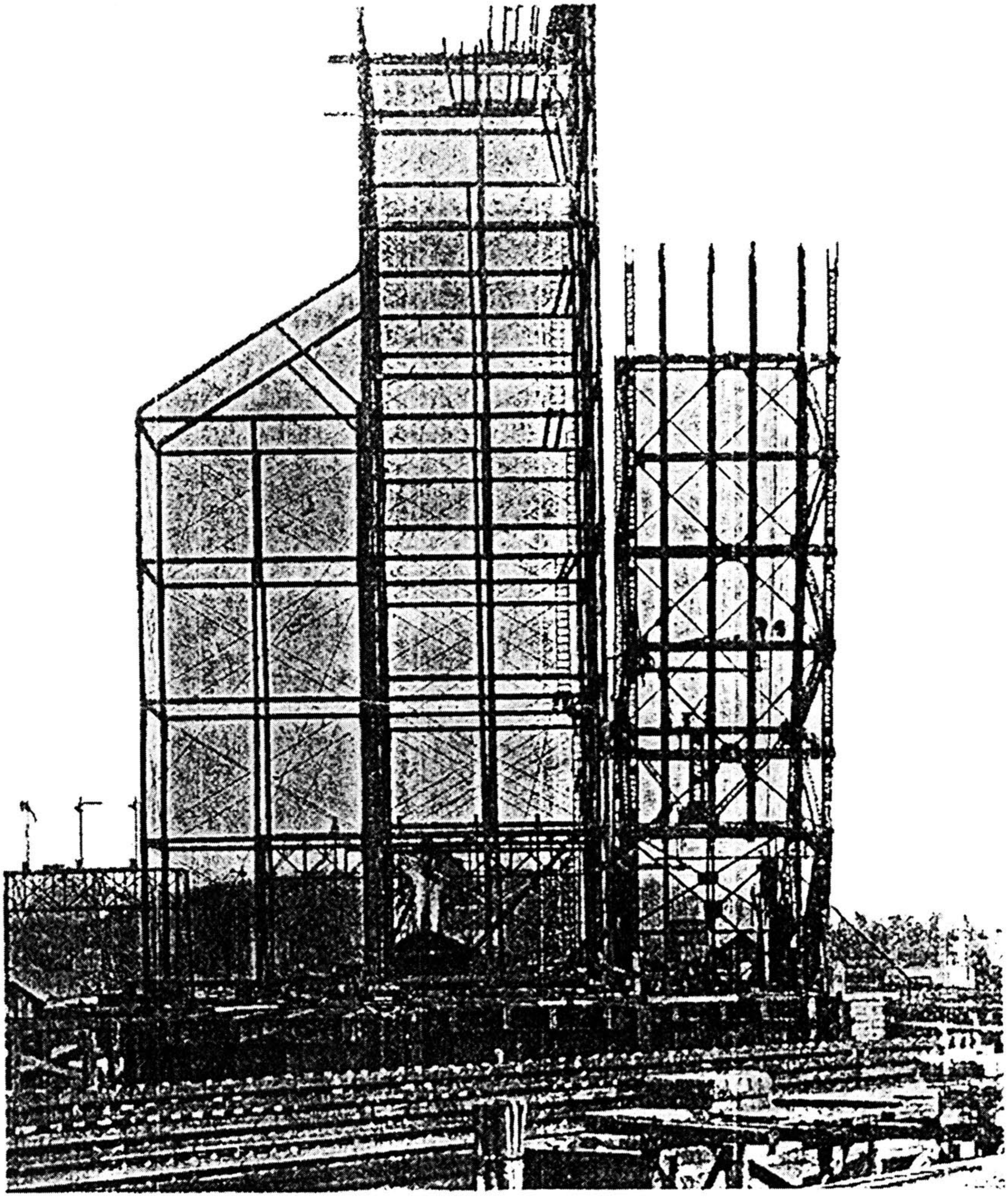


fig. 20a Trusses were constructed vertically in a series of box-frames

Construction Process

Due to the difficult site condition, the bridge had been erected in a vertical position to avoid obstructing ships crossing the channel. A bottom-up assembly, which made use of the bridge's counterbalancing action, was thus carried out (fig. 20a and b).

The roller was first anchored along its arc
on the horizontal track and
fixed to the counterweights on either sides.
Scaffolding was then erected from the base.
After the rollers and counterweight have been secured,
the truss was assembled as a series of boxed frames.
They were riveted together, frame-by-frame,
towards the top end of the span.
The operating station and its attendant machinery were later assembled.
After completing the truss frame,
the operating strut was activated
Each bridge was lowered and locked
to its horizontal, closed position.

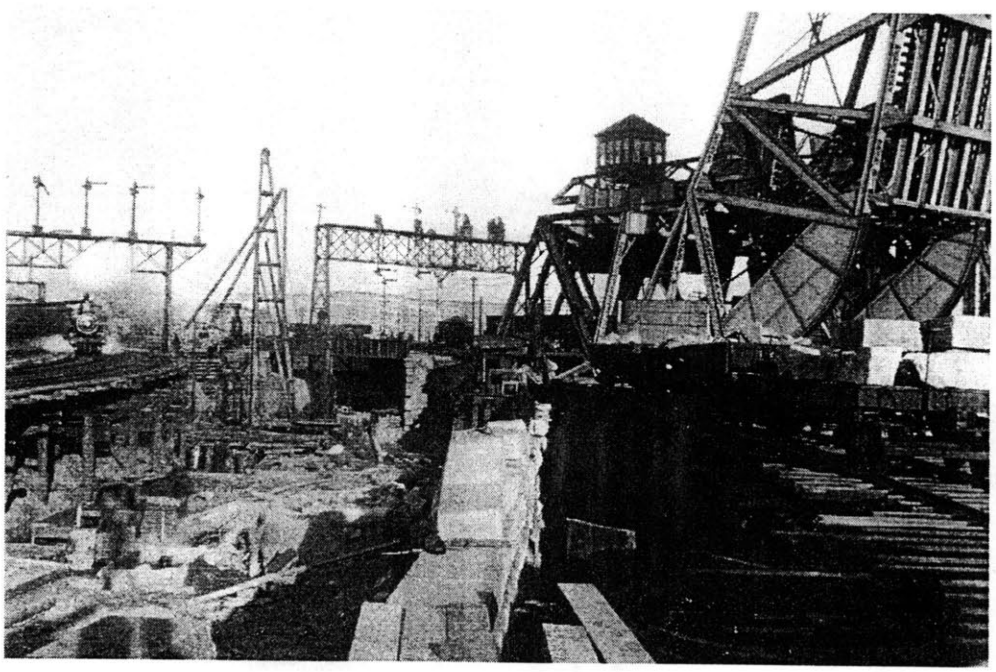


fig. 20b The counterweights and rollers were assembled prior to the trusses

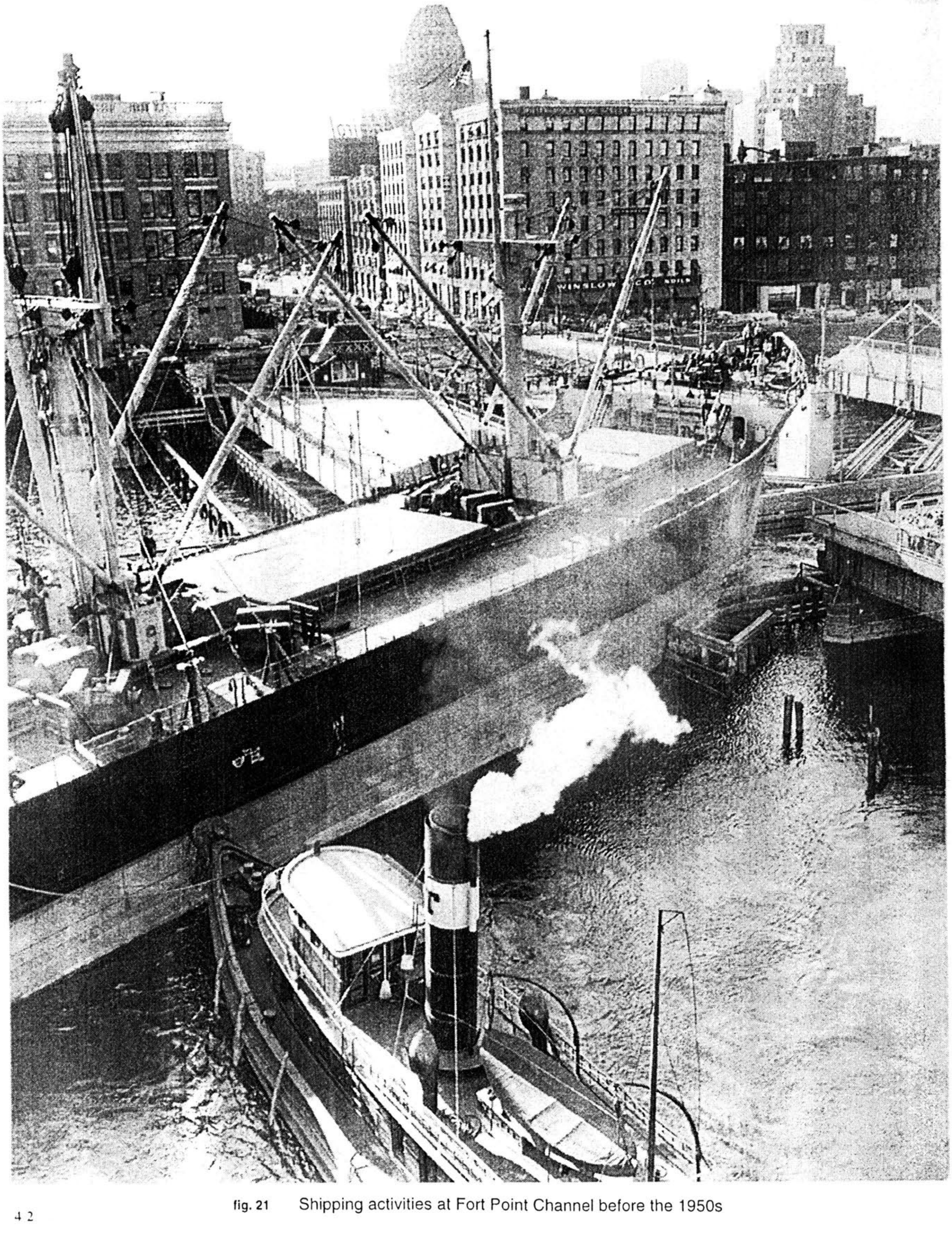


fig. 21 Shipping activities at Fort Point Channel before the 1950s

Site Profile

The Channel

The Fort Point District was once bustling with shipping and railway activities. Its wharves were the focus of Boston's maritime and railway transportation untill the mid-twentieth century (fig. 21). Currently, the site exists in a state of physical deterioration. The channel has ceased to be the shipping route to South Boston, formerly a large coastal basin. Many of the warehouses, built around the turn of the century, have been abandoned by the previous industry.

This area is the product of numerous excavations and landfills, beginning as far back as the seventeenth century when Boston grew into an international trading port. During that time, the colonial ordinance allowed landowners to extend their land into the water to facilitate harbor operations such as the berthing of ships along the waterfront. Shipping activities was then at its peak. Marine-related industries, including spar makers, ship painters, sail makers and fishing, began to congregate around the waterfront.

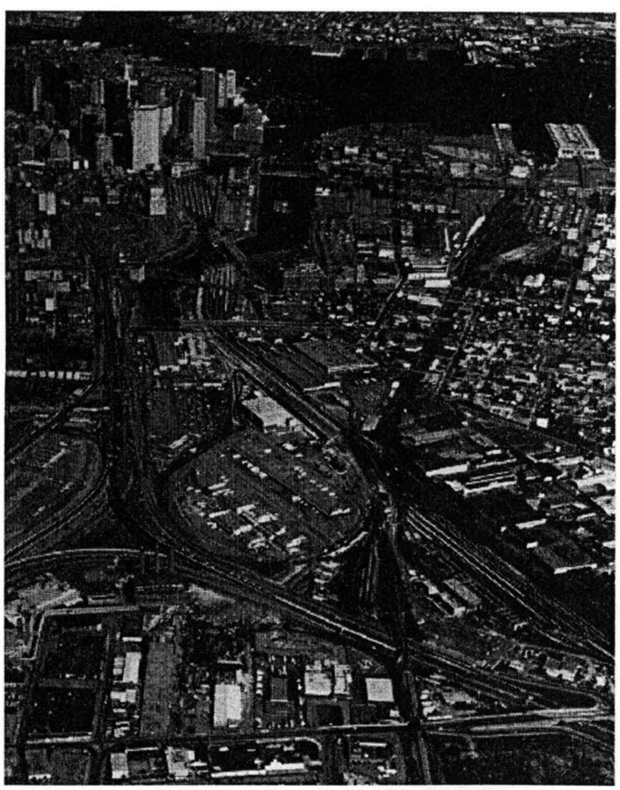
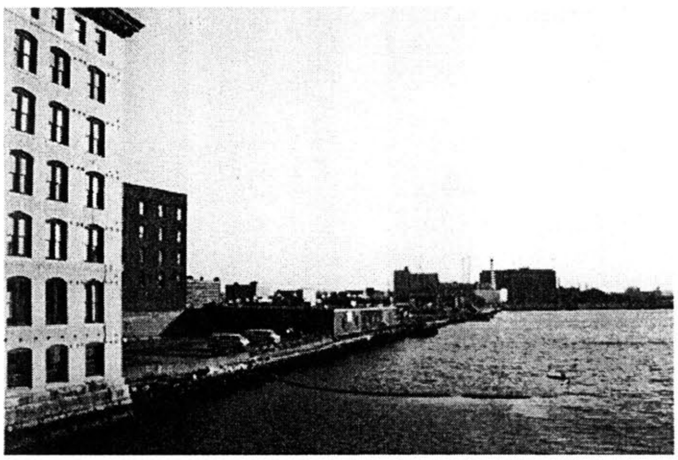
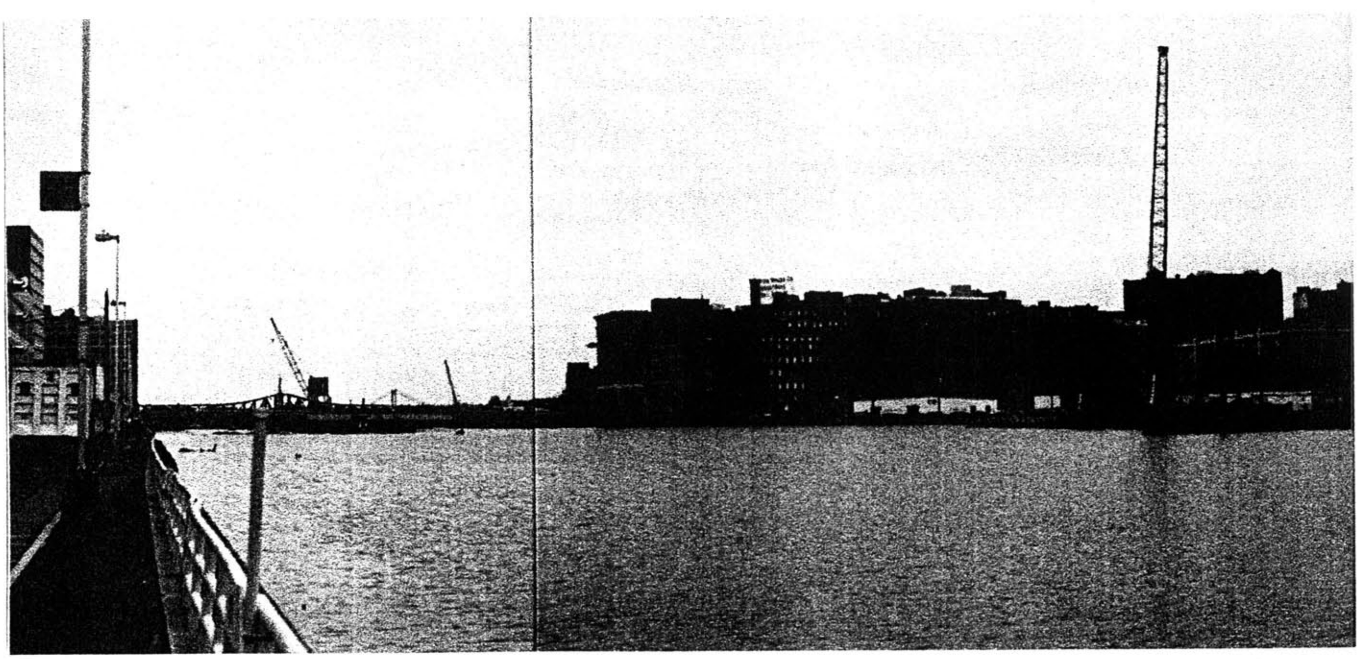


fig. 22 Aerial View of the district with the tranporatatoin complex in the foreground

Substantial land use changes started to appear during the 1830s with the arrival of the railroad. The early phase of land filling, initiated mostly by private individuals and small corporations, was replaced by large business enterprises such as the Boston Wharf Company. As the railroad infrastructure required large parcels of land, this company filled in a large basin at South Boston to create a vast transportation complex (fig. 22). It also developed terminals and rail yards along the channel edge. With the growth of the leather and wool industries, demand for spaces climbed dramatically. This propelled the extensive construction of warehouses and workshops.

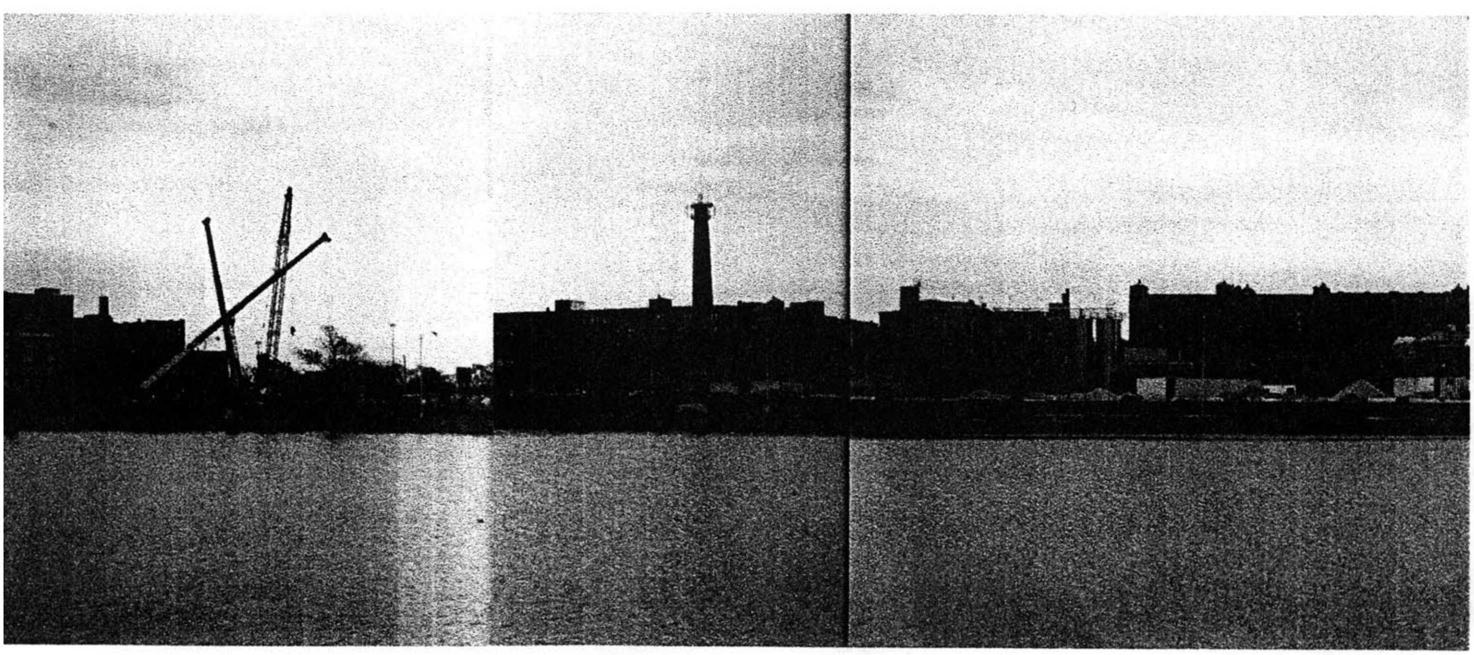
By the turn of the century, industry had taken a downturn. As it shrank, so did the railroad and shipping activities. Manufacturers and traders were forced to relocate to the periphery of the city or beyond. Fort Point Channel thus lost its former vitality. The vast landfill schemes never realized the creation of major industrial zones nor did shipping attract the anticipated maritime trade. While some industries remained, Gillette Manufacturing and the Boston Wharf Company among them, the overall level of industrial activity decreased. The area became populated with abandoned rail yards and underutilized dock facilities. Many vacant lots were paved over for parking, and various support industries -





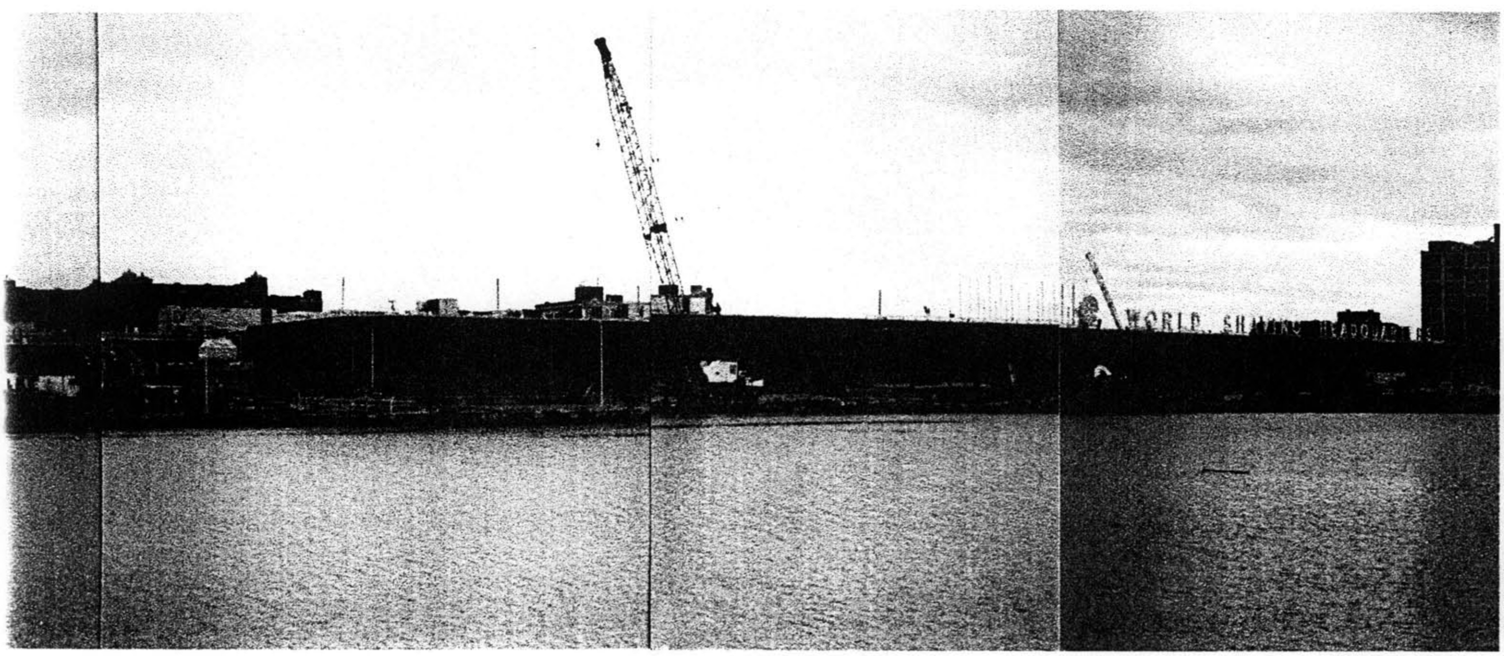
shipping, wool and leather - have disappeared.

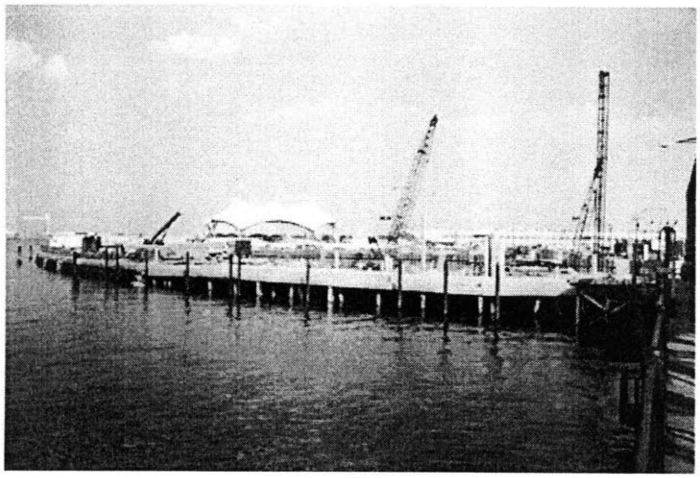
Since the 1950s, numerous warehouses and industrial buildings have been reinhabited by new groups of owners. These people, mostly artists or small business operators, were attracted to the spacious lofts left behind by the manufacturing industry. Though the area lacked convenience stores and supermarkets, its loft space was available and affordable. Moreover it is only a few minutes walk from South Station, a place where commuter and rail lines converge. South Station also marks the beginning of the district of tall office towers, which merges into the Financial District.



Despite the district's proximity to the financial center, there has not been any major development interest until 1980, when BRA created its new Harbor Vision. The BRA undertook a study in 1983 to identify mechanisms for creating new public amenities along the waterfront. The harbor, a source of economic growth and recreation, was used to drive the district's development into the future metropolitan center of the city.

Along with BRA's proposal, there has been renewed interest in the site over the last few years. With the artist and business

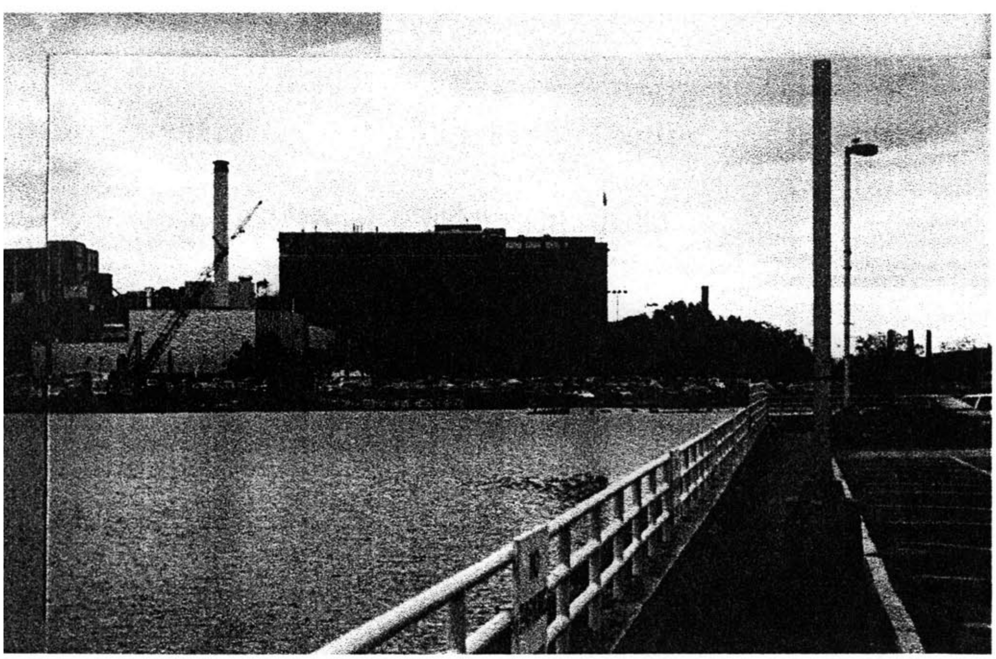


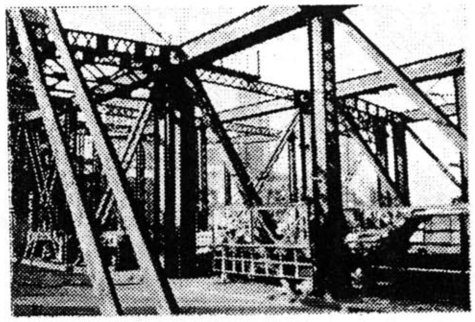


communities in residence, the Federal Court House and the new Children's and Computer Museum extension will mark a turning point for the district. It will bring people back to an area which had been formerly unknown except to the downtown workers at the Financial District.

Characteristics

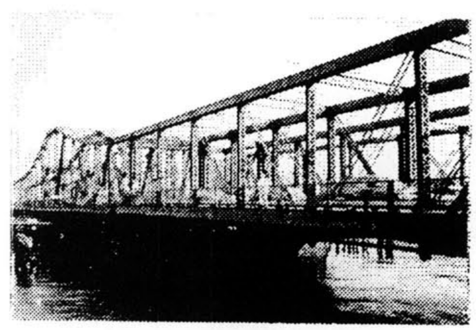
It seems necessary now to identify some key features of the Fort Point district. This area has a general consistency found in many industrial landscapes around urban cities. By examining some of its existing urban fabric, I will depict how its man-man landscape generates a set of patterns which is both physical and experiential.

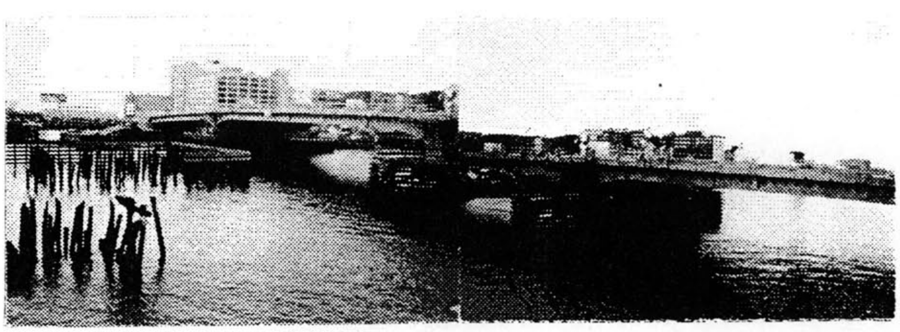


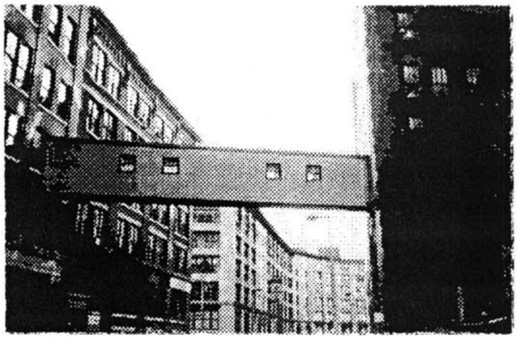


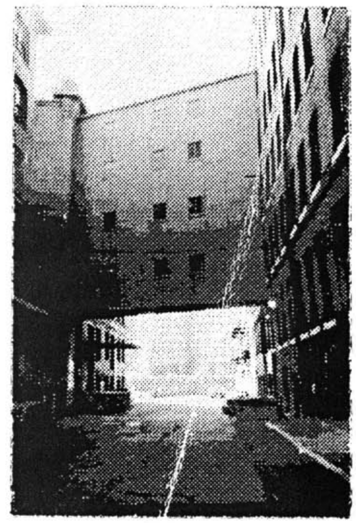
Bridges

Three other bridges span the channel, connecting the area to the Financial District. At the mouth of the channel sits the Northern Avenue Bridge, a swing bridge that is similarly slated for destruction. It too, will be replaced by another plain concrete span. The other two bridges, which individually continue Congress Street and Summer Street, are in a state of deterioration. Built around the same time as the Rolling Bridge, they seem unlikely to meet modern transportation demands. In other words, I anticipate their demolition within the next ten years.







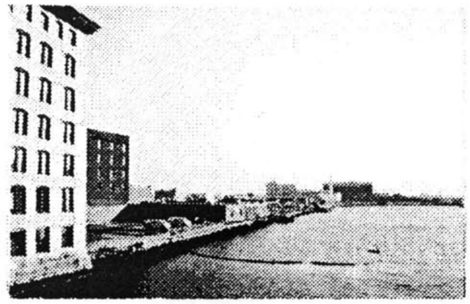


Shared Space

Some warehouses have been linked together by covered bridges to create residential apartments. Others have been converted into offices and showrooms. Here, living and work spaces typically share the same space for storage.

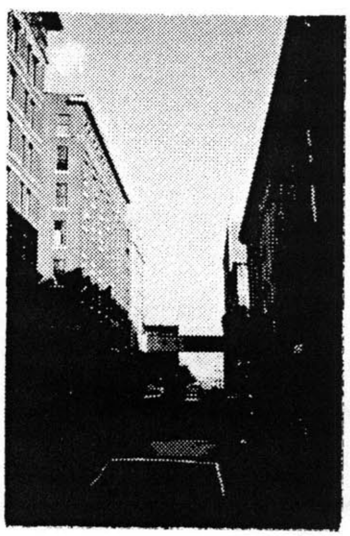
Wall

Five to seven story buildings with punctured windows line the main thoroughfares. These buildings run along the street edge without the usual setbacks and amenities of pedestrian streets found in the rest of Boston.



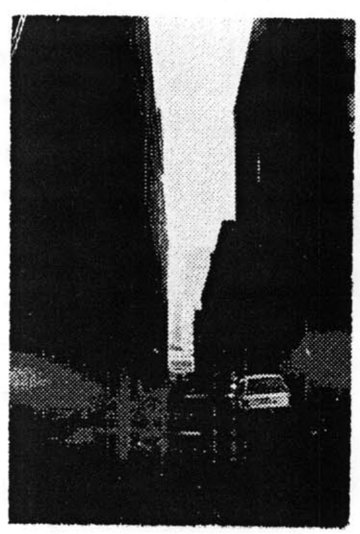
Void

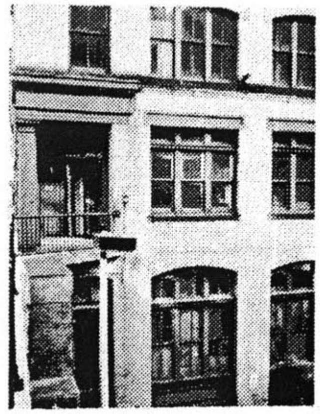
Many of the streets are lined with reserved parking spaces for loading trucks. All available open space has been converted into parking lots.

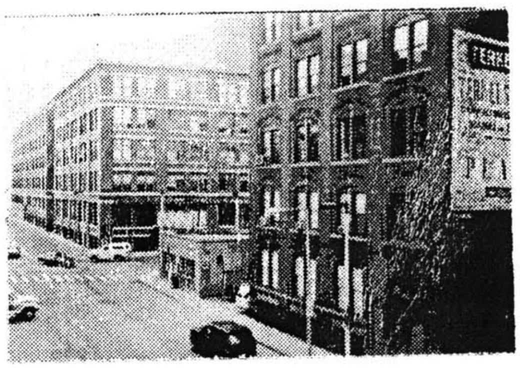


Slits

Warehouses, varying among four to six stories, create narrow alleys that accentuate sky openings.







Uniformity

Brick-covered facades pervade the building fabric. Since many of the warehouses were designed by the Boston Wharf Company, their construction details have an overall consistency.

Stairways

One commonly encounters fire-escape staircases decorating facade walls like steel formwork.

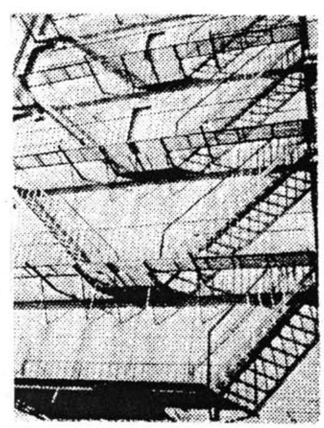
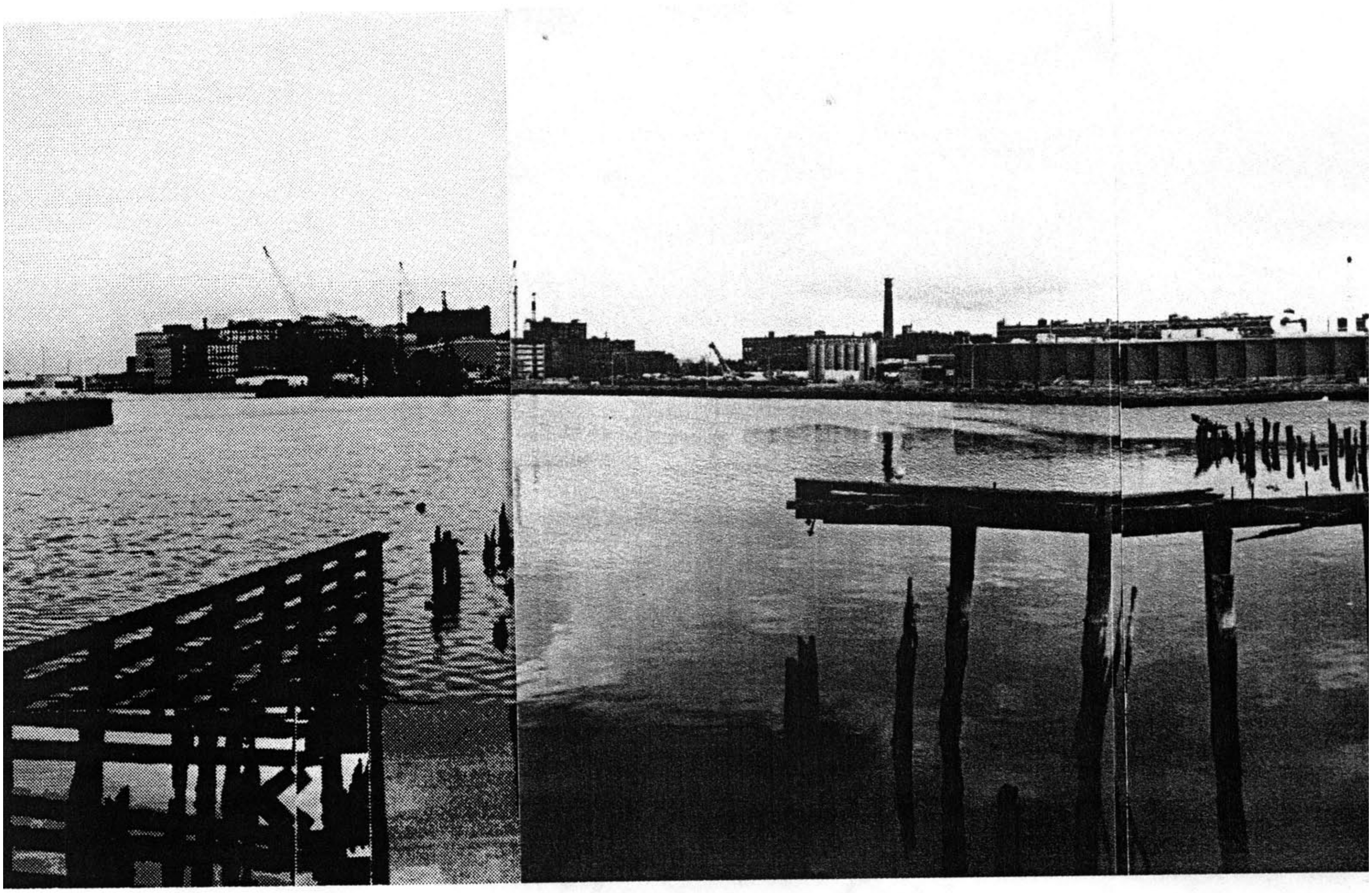


fig. 23 Building site in relation to the bridge

Transplantation

Since the bridge will be displaced by the tunnel, its relocation is inevitable. This suggests that the abandoned artifact will lend itself to a new context - at best, a vacant land devoid of any topographical references to the bridge site. While the bridge is located at the intersection of maritime and railway routes, the building will be sited 250 meters away on a relatively flat terrain (fig. 23). Its proximity will create a strong contrast in history and topography with the original icon.



The site was once geographically part of South Boston, but has now been removed from the residential neighborhood by the rail yards. It is bounded on one side by the Gillette warehouse, a 320 meter wall, and on another by a 4-acre parking lot. Surrounded by factories and smokestacks, this sprawling industrial wasteland will create a relatively open field around the building. A condition such as this will greatly enhance the building's visibility from the waterfront, in a manner similar to the bridge's prominence from the adjacent highway.

BRA has proposed a network of paths and linkages, known as Harbor Walk, to link the Fort Point district to the South Boston neighborhood. I took this as an opportunity to connect the development of the art gallery with the two future sports stadium. Located mid-way between these two crowd-pulling facilities, it will become a transitional space for tourists and sports fans.

By giving the new structure an urbanistic role within the future master plan, the transplantation could thus repackage the artifact for another wave of optimism in the Fort Point district. As such, the building will be introduced as a piece of architecture suited to the needs of the contemporary city.

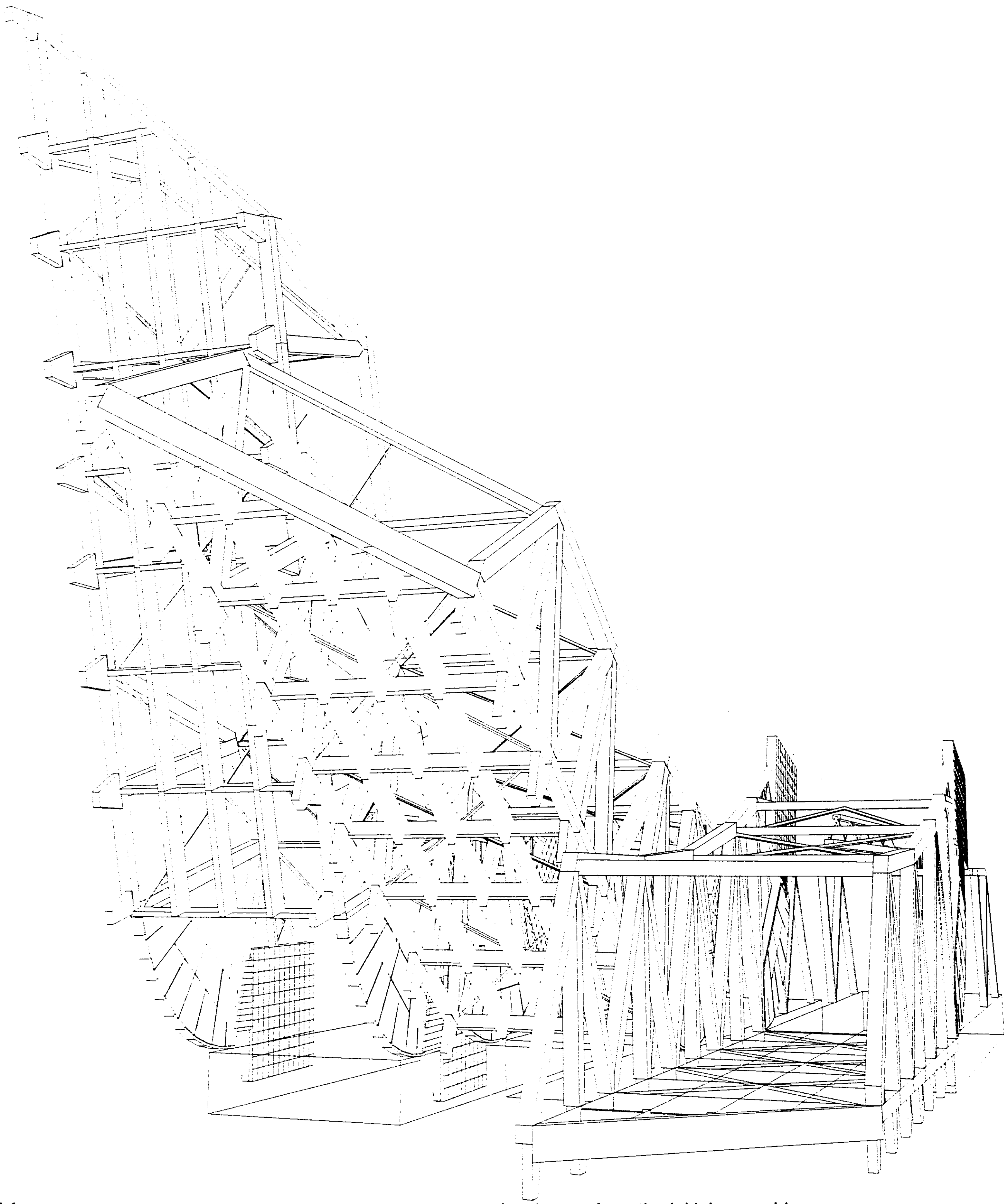


fig. 24 The dismantling process takes its cue from the initial assembly

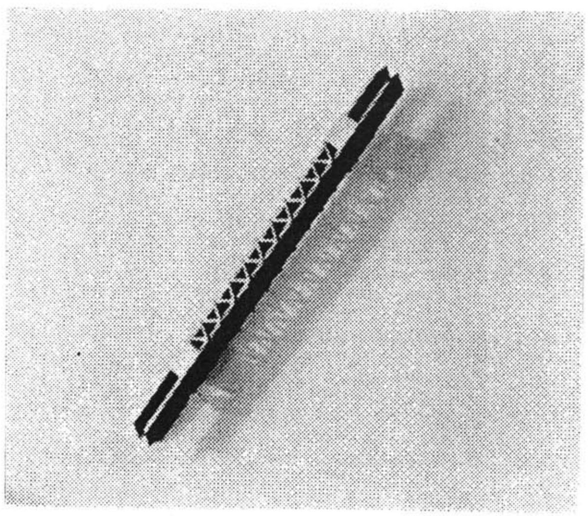
Dismantlement

Method

To what extent should the structure be taken apart? Instead of disintegrating the bridge into plates and channels, retaining the form of its structural members is suggested. This is a philosophical as well as a pragmatic decision. Each component, a vestige of the bridge, must be distinguished from scrap metal. Although it ceases to be a part of the original whole, the component should be made to support the building structurally. Along with structural performance, each member's size is also limited by its transportability. I suggest that the component be transported to its new site either by truck or ferry. This implies that its dimension will be controlled by the capacity of the vessel.

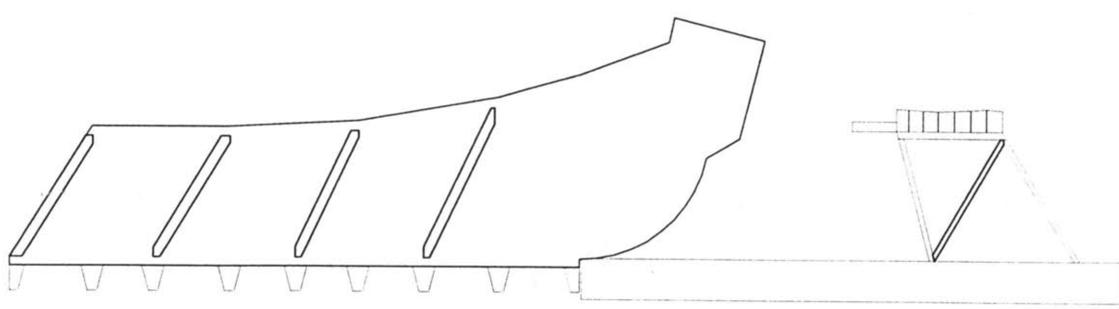
In deciding how to dismantled the structure, I took cues from its initial assembly. The dismantlement will be carried out in the **opposite** direction of this process.

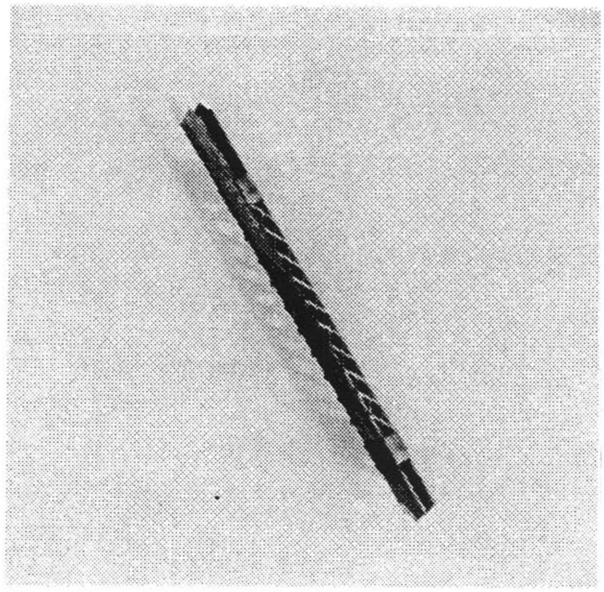
The bridge is propped upright by removing
the wedges that secure the entire span.
Once vertical, its trusses are reinforced with scaffoldings.
The top-most member, in this case the diagonal strut at the
open-end of each truss, is removed by cutting away the gusset plate.
Each rivet will be torched around its circumference, creating a small hole.
While the gusset plate is discarded,
the circular hole of the rivet will be retained.
Other members are similarly taken apart, piece-by-piece.
The latticed member, now a generic column,
is lifted off and delivered to the documentation site.
Other members - struts, ties and girders - are dismantled successively, until the
entire truss frame is decapitated from the rolling end.
Having dismantled this frame,
the counterweight panel will be severed from the roller.
Finally, the operating station and its
attendant machinery will be detached from the rail tracks.

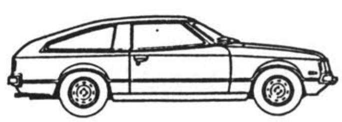


Diagonal Strut (Type A)

Quantity :	9 (one single and 4 doubles) x 3 = 27
Type :	Double rolled or built channels with lattice bracing
Dimension :	Length varies from 7.6 to 11.5 m; Typical cross-section 0.5 x 0.48 m
Similarity :	No; all pairs have varying lengths and end conditions

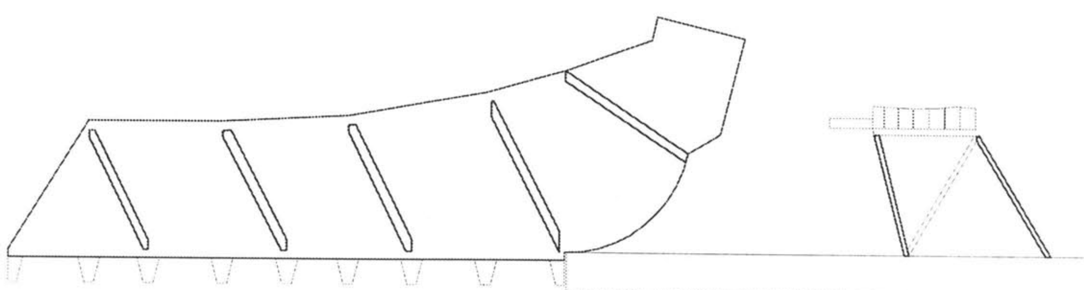


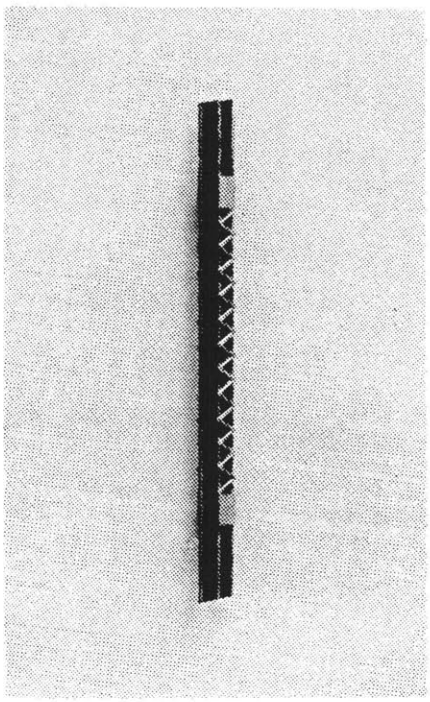




Diagonal Strut B (Type B)

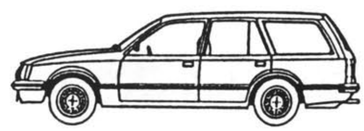
Quantity :	13 (one single and 6 doubles) x 3 = 39
Type :	Same as type A
Dimension :	Length varies from 9.0 to 10.6 m; Typical cross-section 0.48 x 0.48m
Similarity :	No; for same reasons as type A

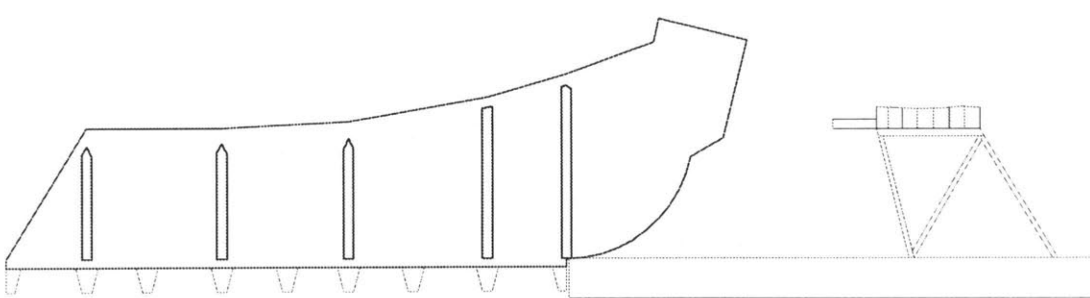


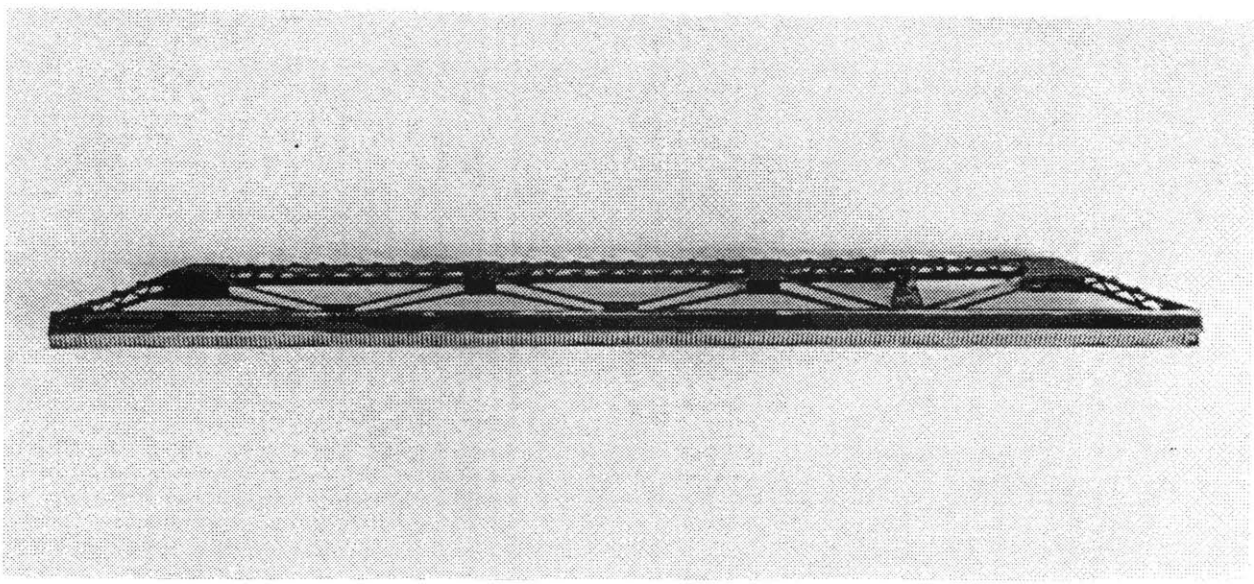


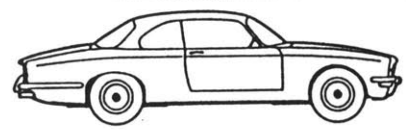
Vertical Strut

Quantity :	9 (one single and 4 doubles) x 3 = 27
Type :	Same as diagonal struts
Dimension :	Length varies from 7.2 to 11.5 m; Typical cross-section 0.5 x 0. 48 m
Similarity :	No; for same reasons as diagonal struts



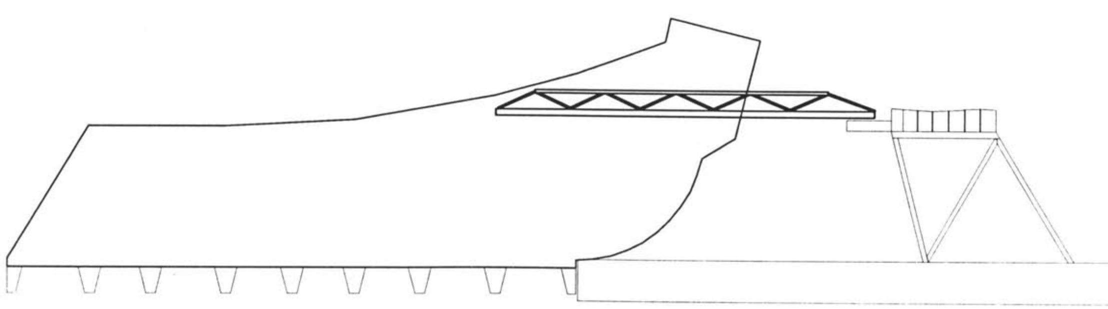


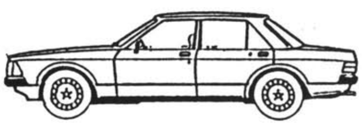


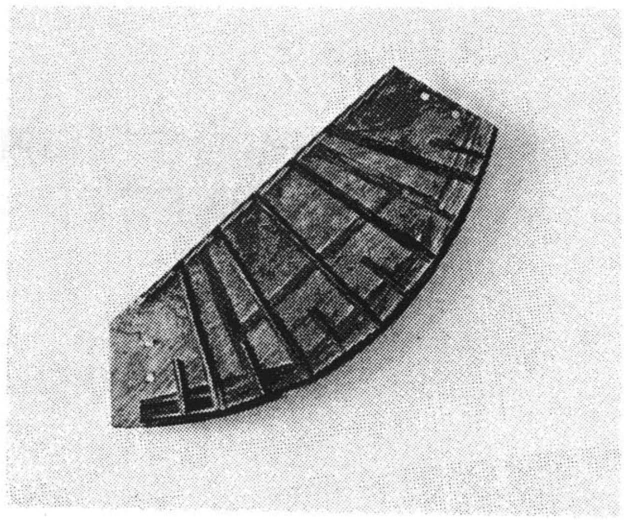


Operating Strut

Quantity : 3
Type: Truss-linked double rolled channels; proportioned for a tension and compression strain of 126,000 lbs
Dimension: 18.2 m (length) by 1.5 m (depth) by 0.6 m (thick)
Similarity: Yes

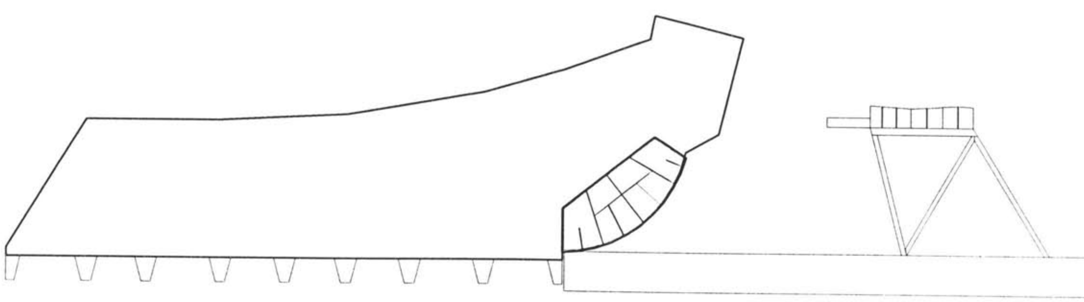






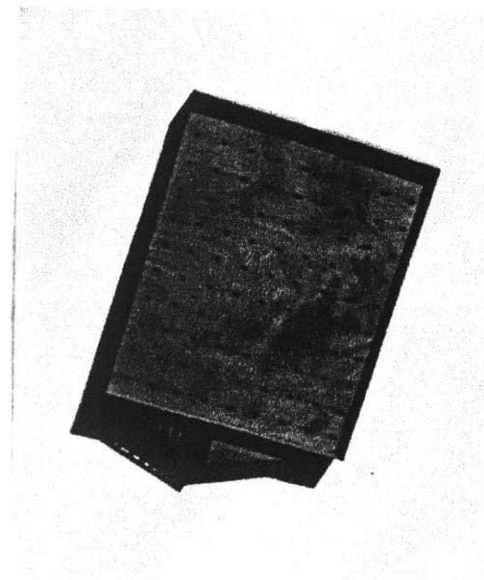
Rolling Bascule

Quantity : 2 x 3 = 6
Type : Double-web plate girder
Dimension: 2.3 m (narrowest) to 3.3 m (widest)
Geometry : 80 degree arc segment of a 16.6 m \diameter circle)
Similarity : Yes



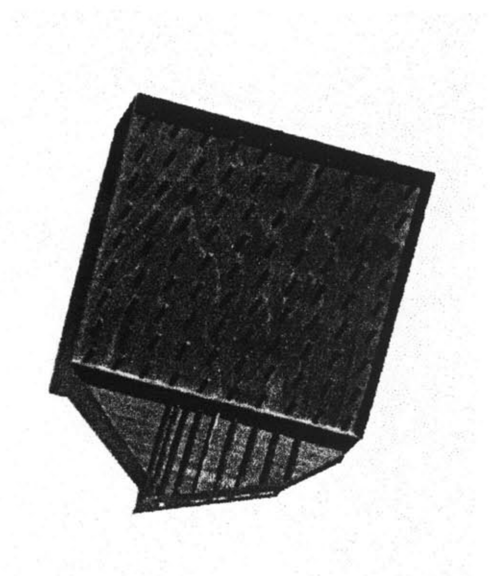
Counterweight Panels

Quantity:	3 each of panels A and B
Type:	Vertical web plate with
cast-iron	blocks bolted on both sides
Similarity:	Not between the two sets of panels



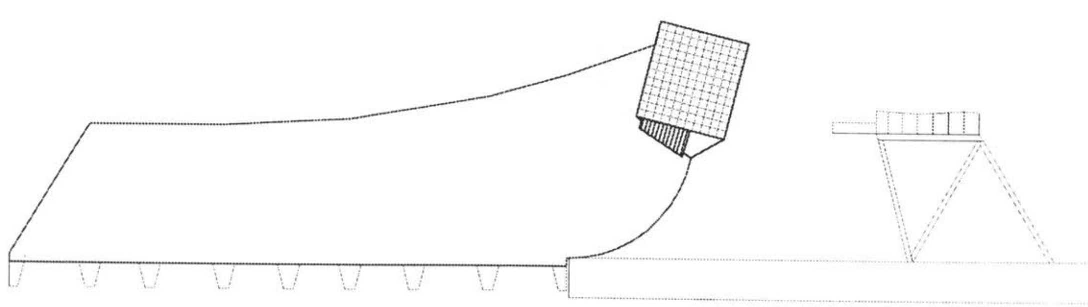
Panel A (for longer truss)

Dimension:	4.0 m by 5.4 m with 620
cast-iron	blocks
Similarity:	Yes

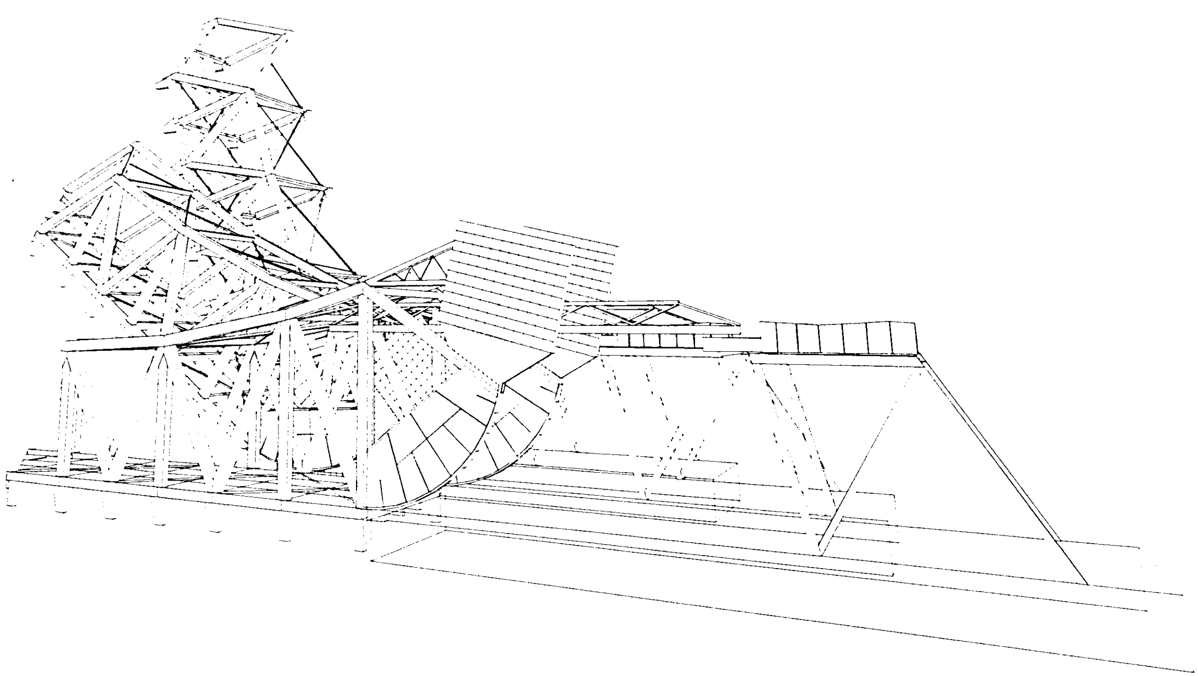


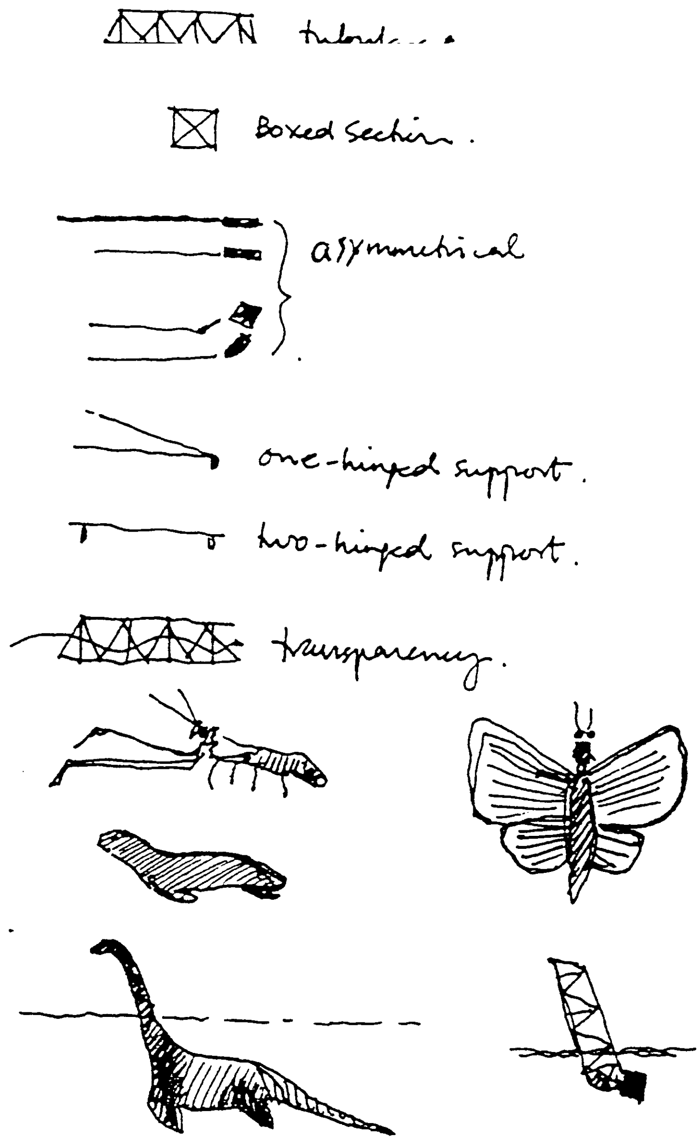
Panel B (for shorter truss)

Dimension:	4.5 m by 4.0 m with 570
cast-iron	blocks
Similarity:	Yes



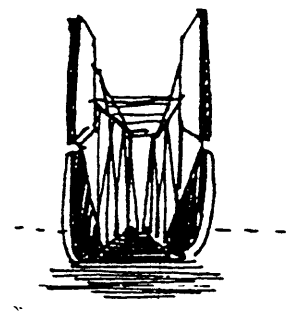
Detour?

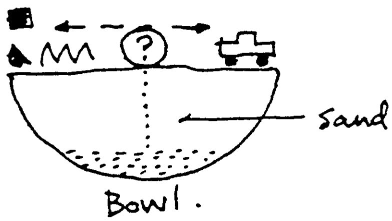



Boxed Section.
asymmetrical
one-hinged support.
two-hinged support.
transparency.

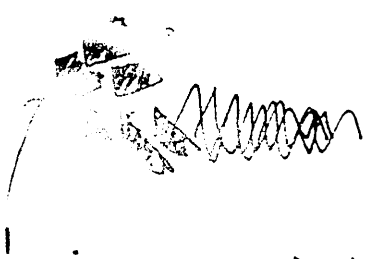
It seems that one has to subvert all original traces of the bridge.
Eventually, only the 'symbolic representation' of bridge is <u>conveyed</u>.

<u>Idea of Bridge</u>
- Frontal Collapse.
- Visual collapse





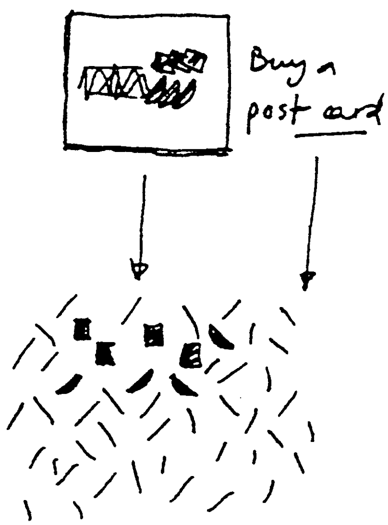
???



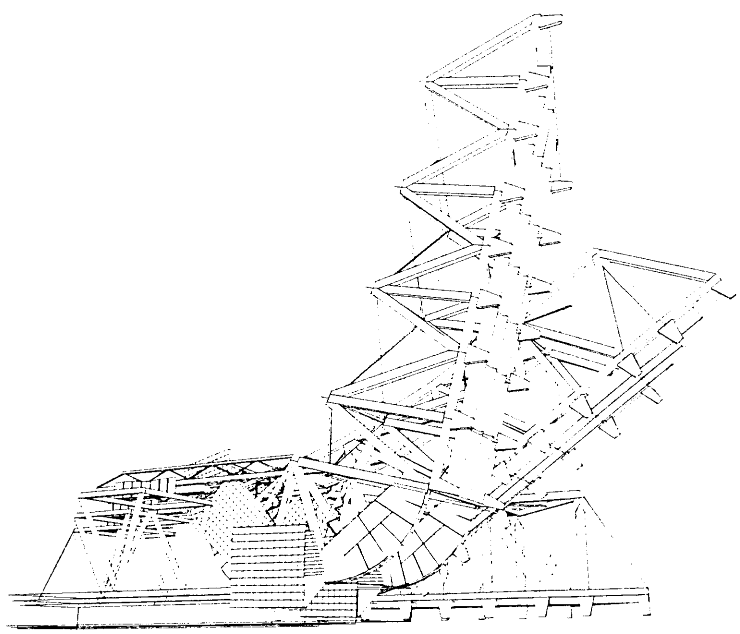
frontal collapse.

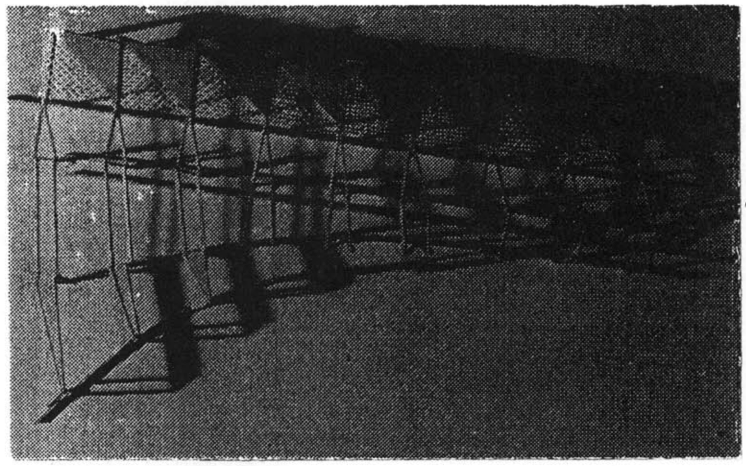
hovering [illegible] ights.

- ground plane must be retained
- Visual perception that evokes the form of the original <u>bridge</u>.



totally dismantled & totally distributed like sculptural pieces in landscape

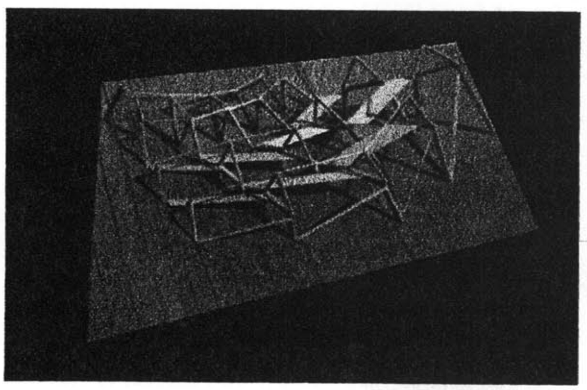




Early October.

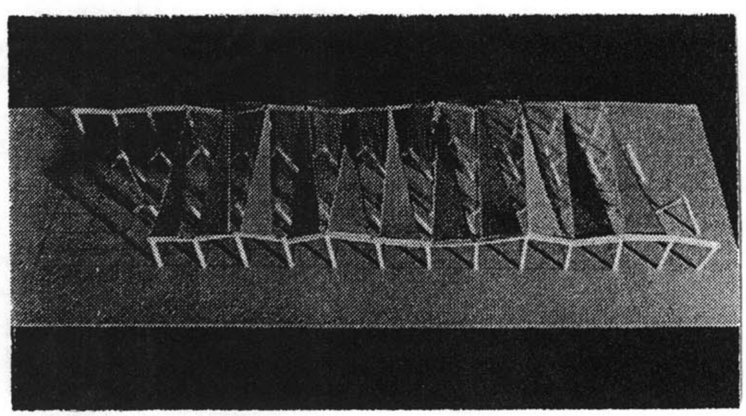
Can the components be arranged

in a curve that reveals the differently sized members?



Mid-October.

How can I convey the mobility of the bridge?



Late-October.

What if the columns configure the roof form?

Committee Review on 9/29/95 Friday

with Duke, Ellen, Yule.

1. The idea is fine / good / unconventional.
2. It needs substantial research / argument to back up & offer a design impetus.
3. Duke's Question: Why does 'reprogramming the bridge' has to be such a significant impart in my thesis?
4. What does the bridge say about ~~contemporary city~~ current urban initiatives?
5. How was it significant to Boston's railway age?
6. What does the BRIDGE mean to me?
7. Maybe it has something to do with the 'ideological optimism' (Yule's) that drove ~~19th~~ early 20th c. Boston to consider building it?
8. Funereal Monument to the Industrial Age?
9. Duke: Maybe the thesis is Research ~~oriented~~ rather than design ~~des~~ orientated.

→ Document the bridge extensively & come up with conclusive evidence that it should be preserved???

Why do you want to pursue this project?

1. I'm CONFIDENT of making a good design intervention.

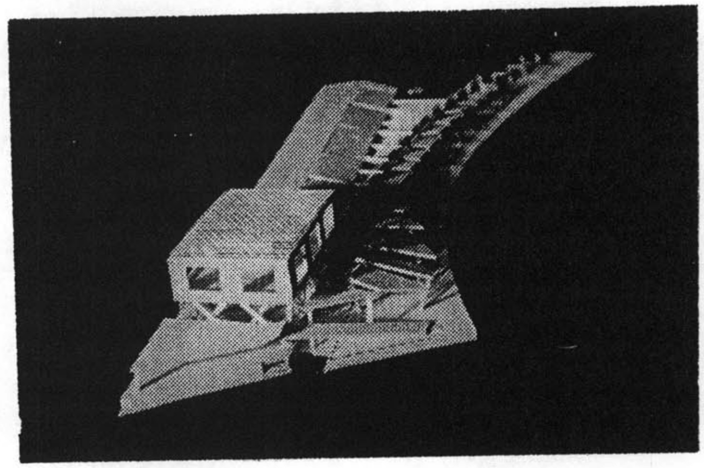
2. There are enough controversies surrounding the preservation / demolition of the infrastructure
→ no one good answer holds truth.

3. It's a challenging, unconventional project because it deals with a specific form of 'historic preservation' to industrial architecture. This inquiry has not been pursued whole-heartedly by architectural preservationists.

4. I'm fascinated by the ENGINEERING FORM and HONESTY of the structure.

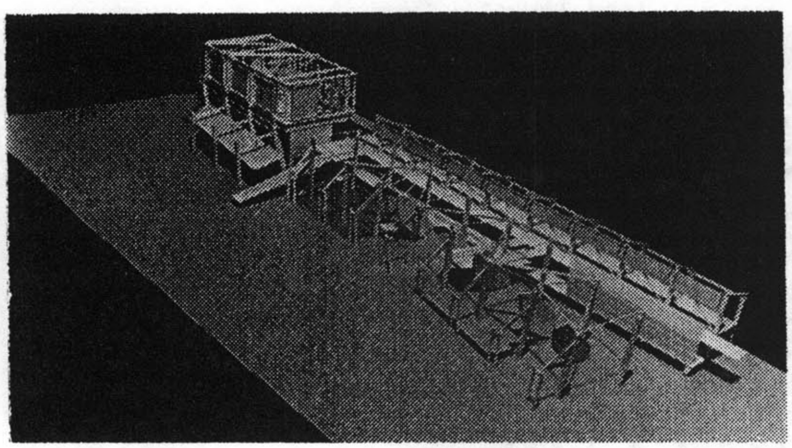
A time when ~~technology~~ the engineer . . .

- precision about bridge building.
- making connection betw. science & art.
- the art of good bridge design
- combination of steel & concrete in ~~any~~ an unusual manner.
- a type of cantilevered bridge.



Mid-November.

20% bridge components, 80% new construction?



Early-December.

Where was I going?

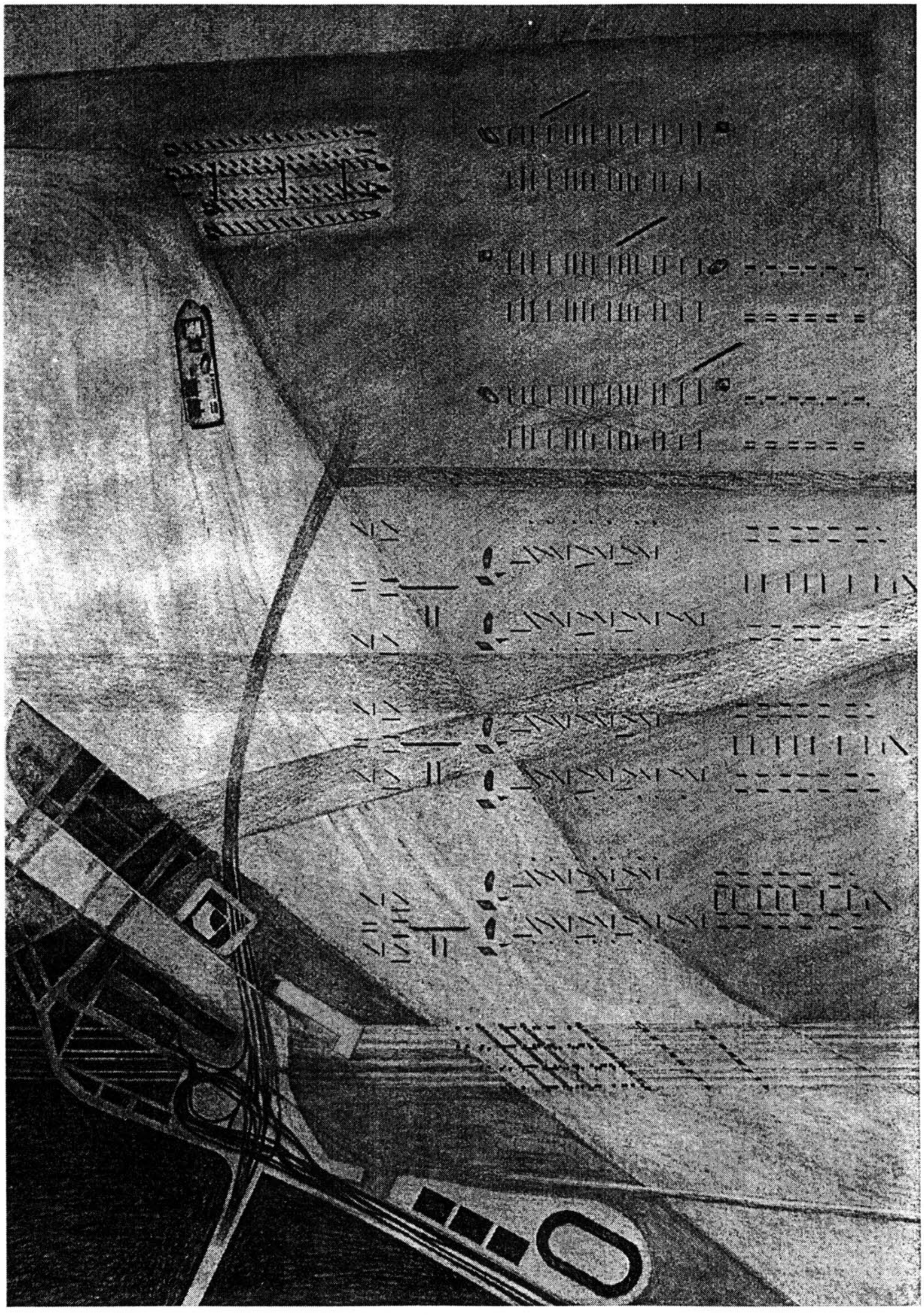


fig. 25 Dismantle, Distribute, Rearrange and Reassemble.

Reassemble

Cues

Mass and heaviness, two intrinsic properties of nineteenth century industrial structures, suggested to me a way of translating the structural elements into a building vocabulary. By grouping and isolating these elements to illustrate their peculiarities, I drew a contrast in structure and technology between the bridge and the architecture. In addition, the physical properties of the three bridges led me to establish basic rules of reconfiguration. These will allow the building to evolve into a relative of the bridge.

Structural Clue One

Since the bridge tends to stay upright, the sum of its rolling end carries more weight than the entire frame. In other words, the counterweight and roller are both **heavier** than all the other truss members.

Structural Clue Two

The bulk and mass of the latticed members suggest that they could carry large **compressive** forces.

Physical Clue One

The three spans being similar imply that their components occur either in **pairs** or **triplets**. With the exception of the counterweights and the operating struts, which consist of three similar parts, all other components come in pairs. Each member of the set is different in physical dimensions from other groups.

Physical Clue Two

The columns and beams are all different in **lengths**. Column lengths vary anywhere between 7.4 and 11.5 meters, while beams measure between 4.3 and 4.6 meters. When rearranged, their lengths could be made a function of both the structural bay and roof form of the building.

Along with structural and physical clues, two fundamental assumptions were made. When they are fulfilled, the old components will create a rich interplay with contemporary materials and methods of construction.

Assumption One

The **structural integrity** of the components will not suffer as a result of the dismantling process. These parts will perform their intended structural role without having to add new strengthening members.

Assumption Two

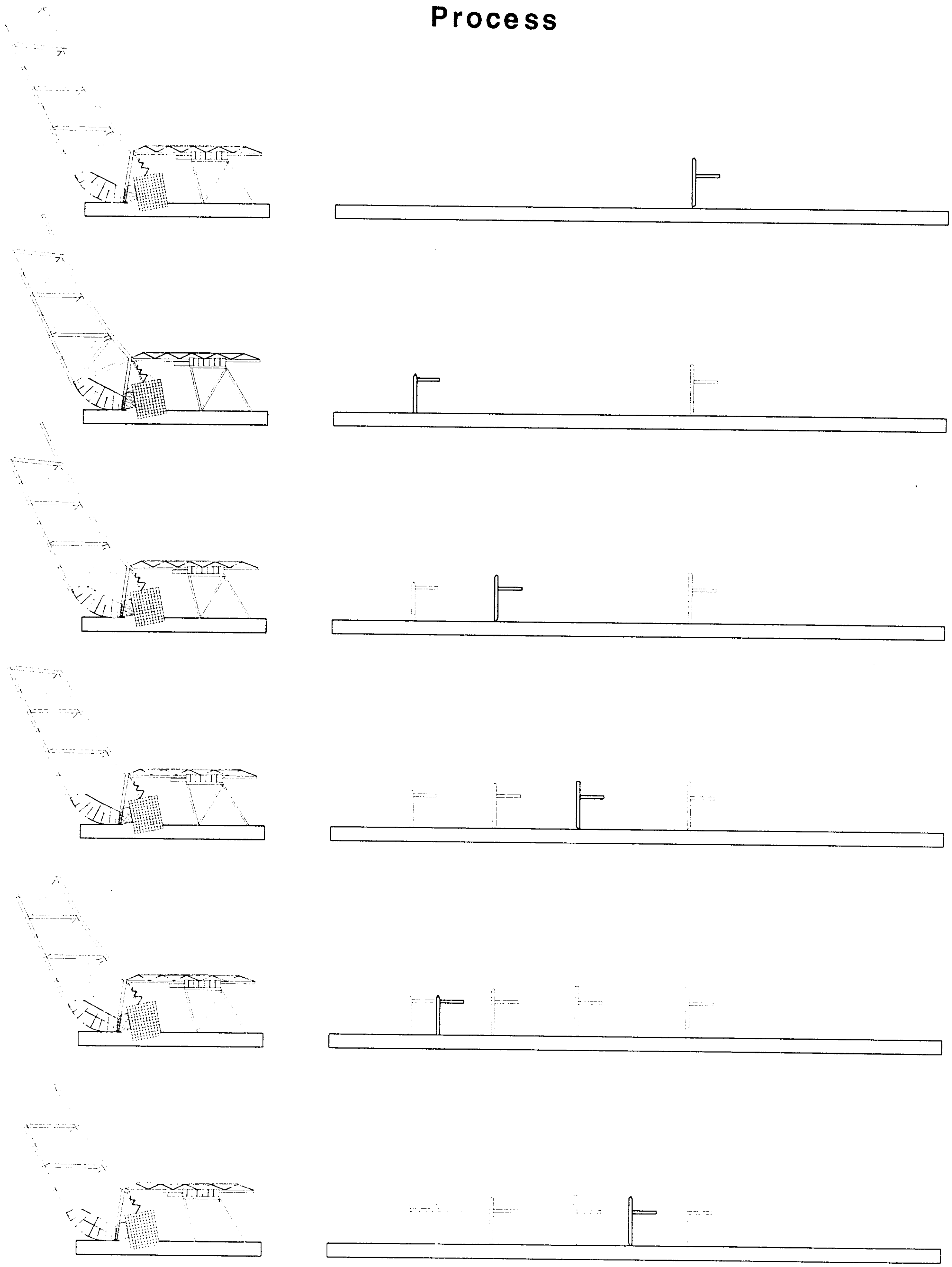
Each unique **end condition** of the members is retained upon removing the gusset plates. One understands where and how the members have been dismantled from the bridge. The different end conditions will also enrich the construction vocabulary.

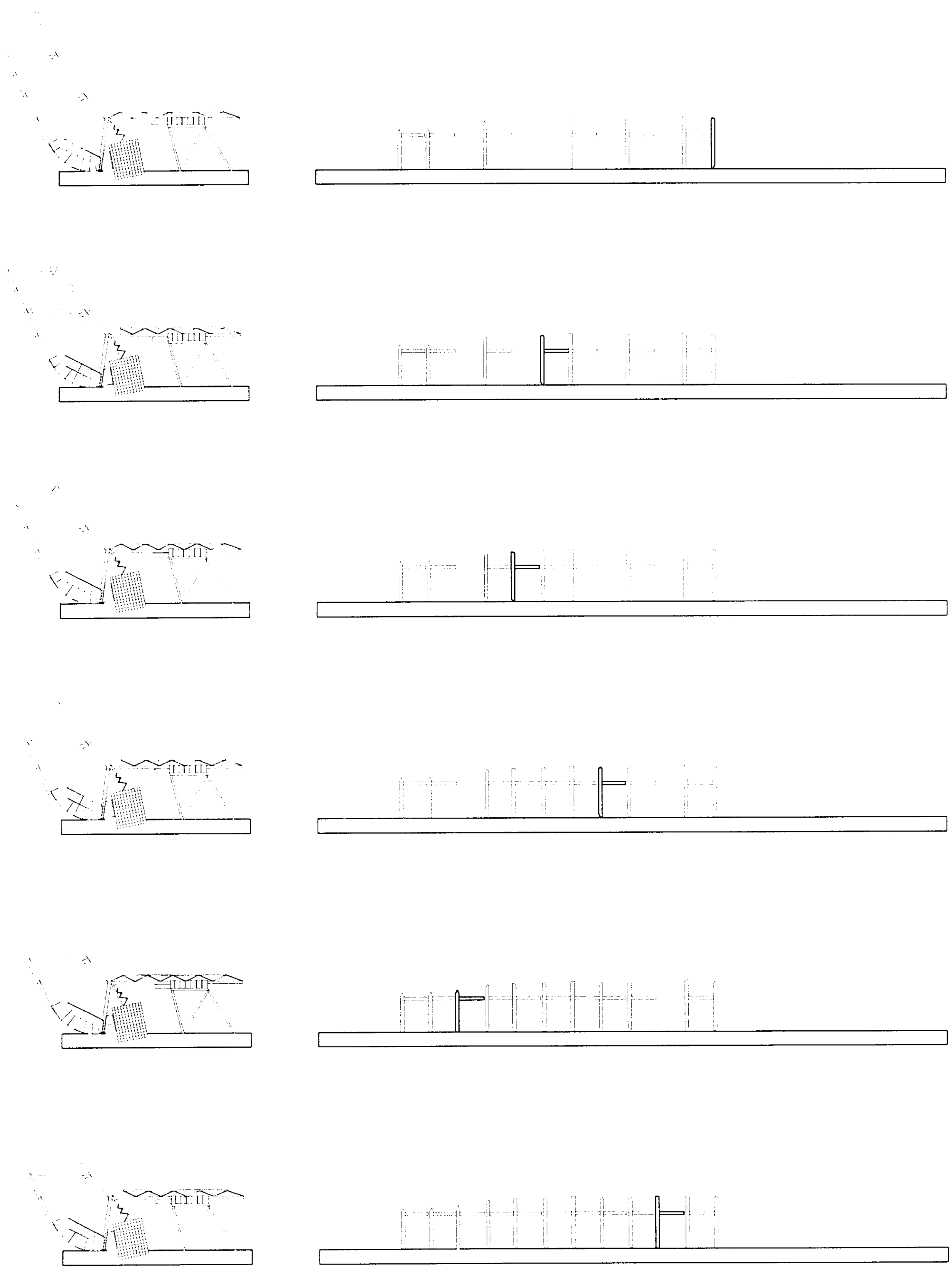
Strategy

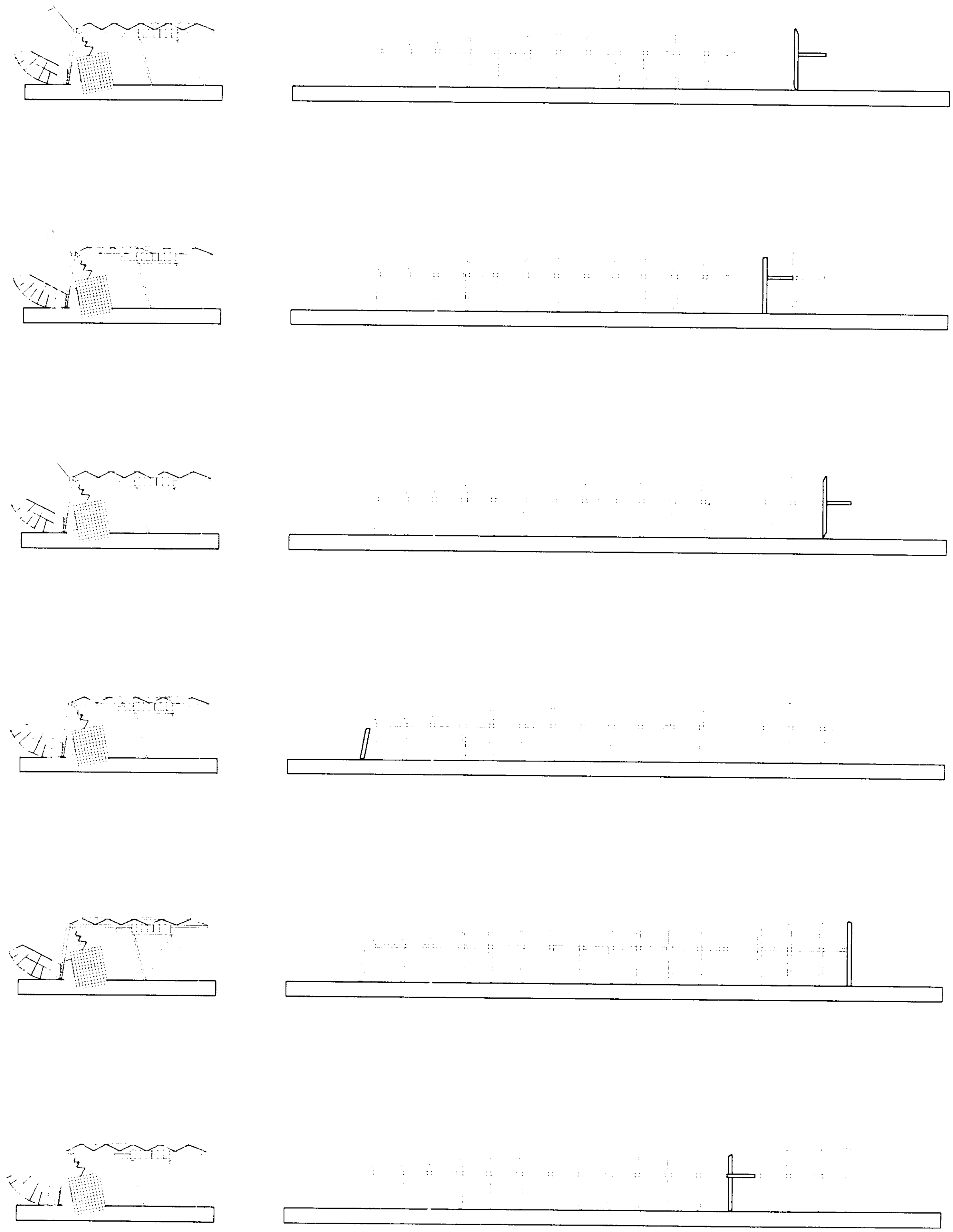
The reassembly is a study of gravity action in the building. It lends itself to a prototypical section, which promote the larger idea of similarities and differences between the pieces.

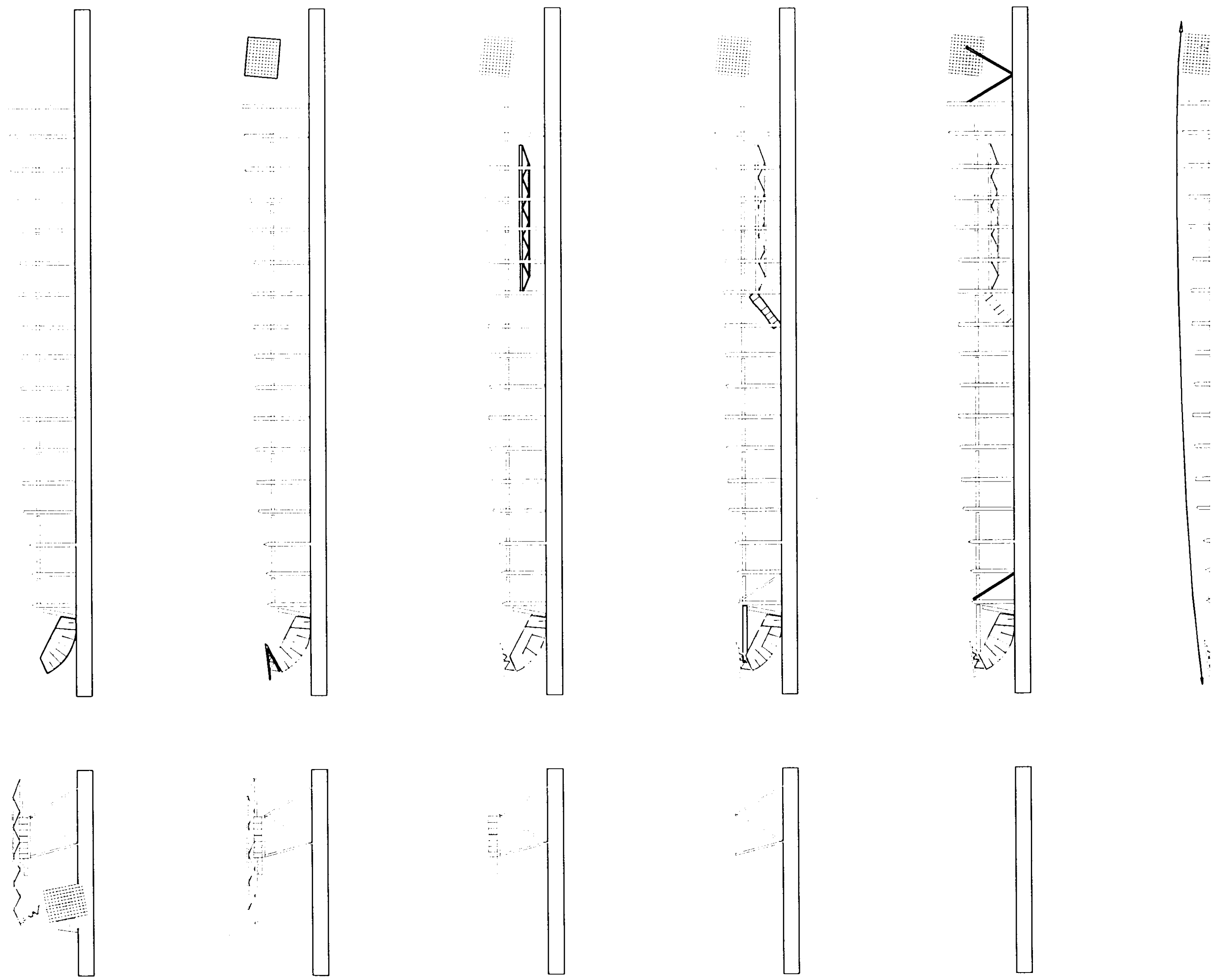
Every latticed member from a bridge
was redeployed as a column support in a single building.
Arranged in ascending lengths, the members were distributed in
a linear order whose structural bay corresponded
with the length of the beams.
Once all the columns along the section have been distributed,
the roller was poised on one end of the section
while the counterweight was placed upon the other.
A cable structure was attached from the roller to
the counterweight and
to the apices of the columns.
The tensile force created on the cable
by the exertion of the two heavy components at
either ends effectively compresses each column into the earth.
From this push-and-pull interaction,
a **bow-string arch** roof is generated.

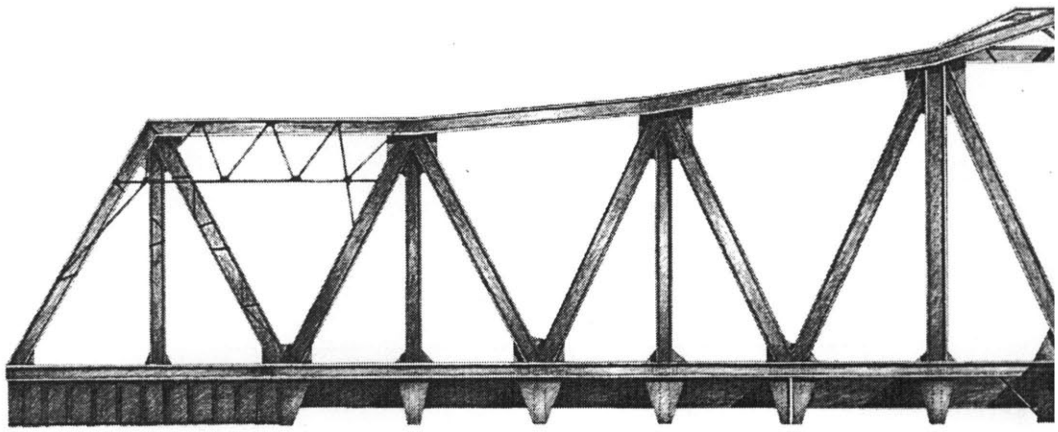
Process

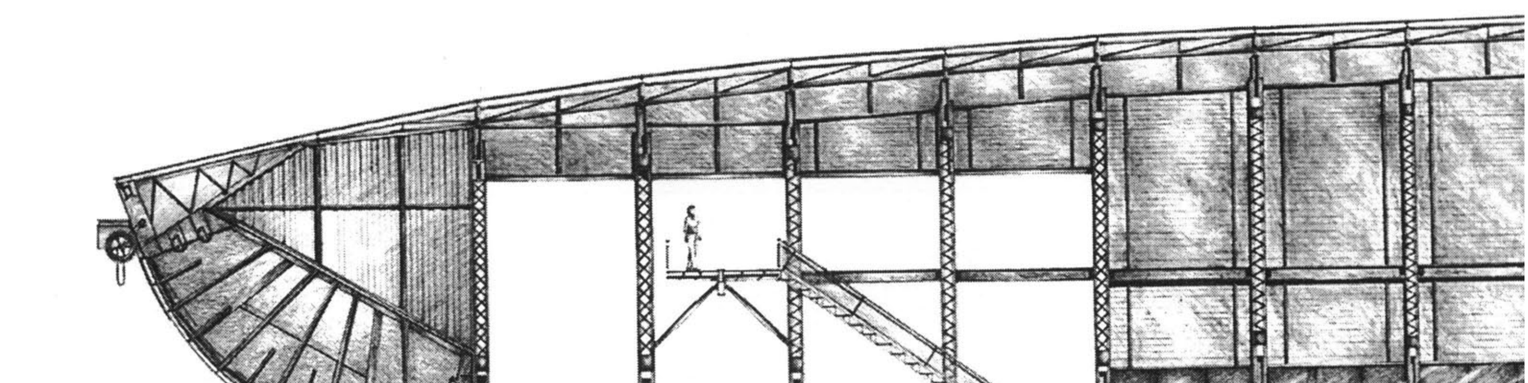


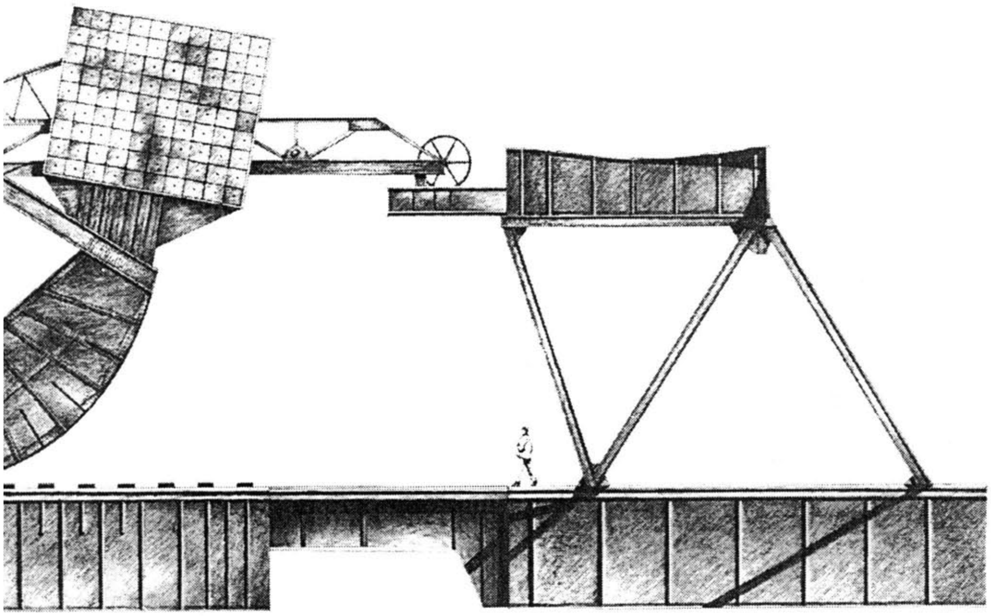




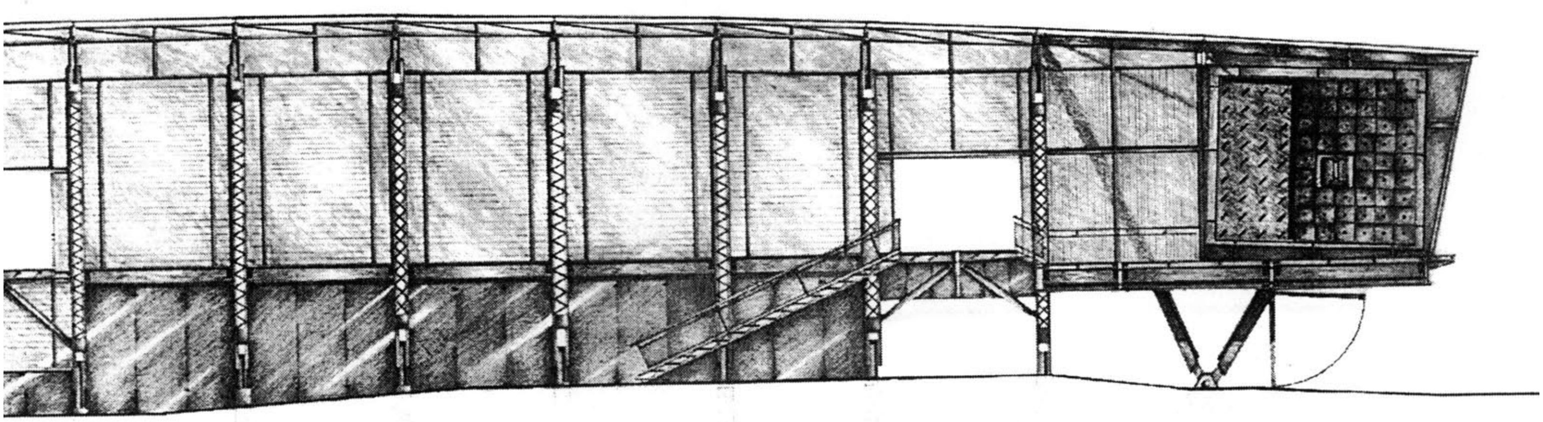




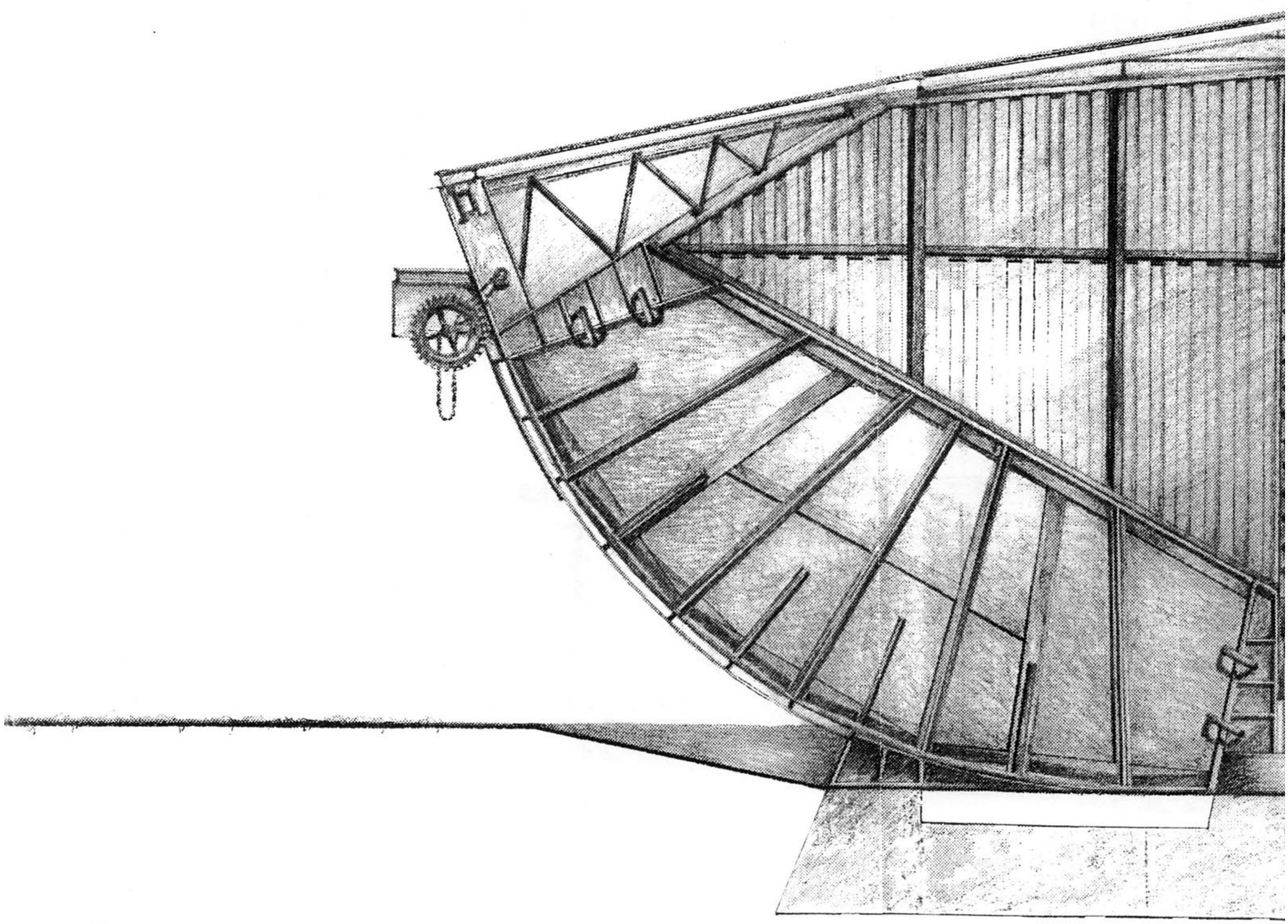




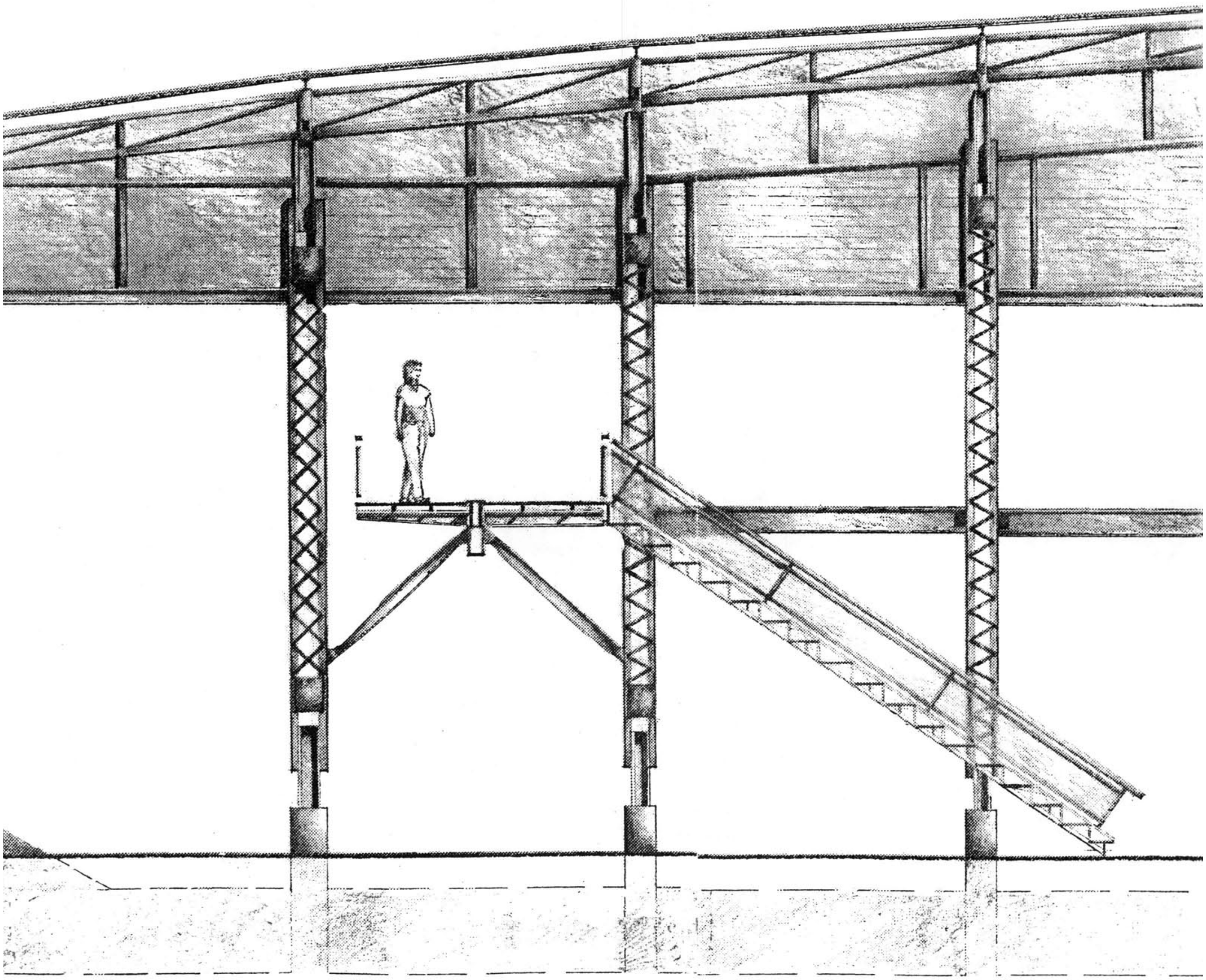
The Building



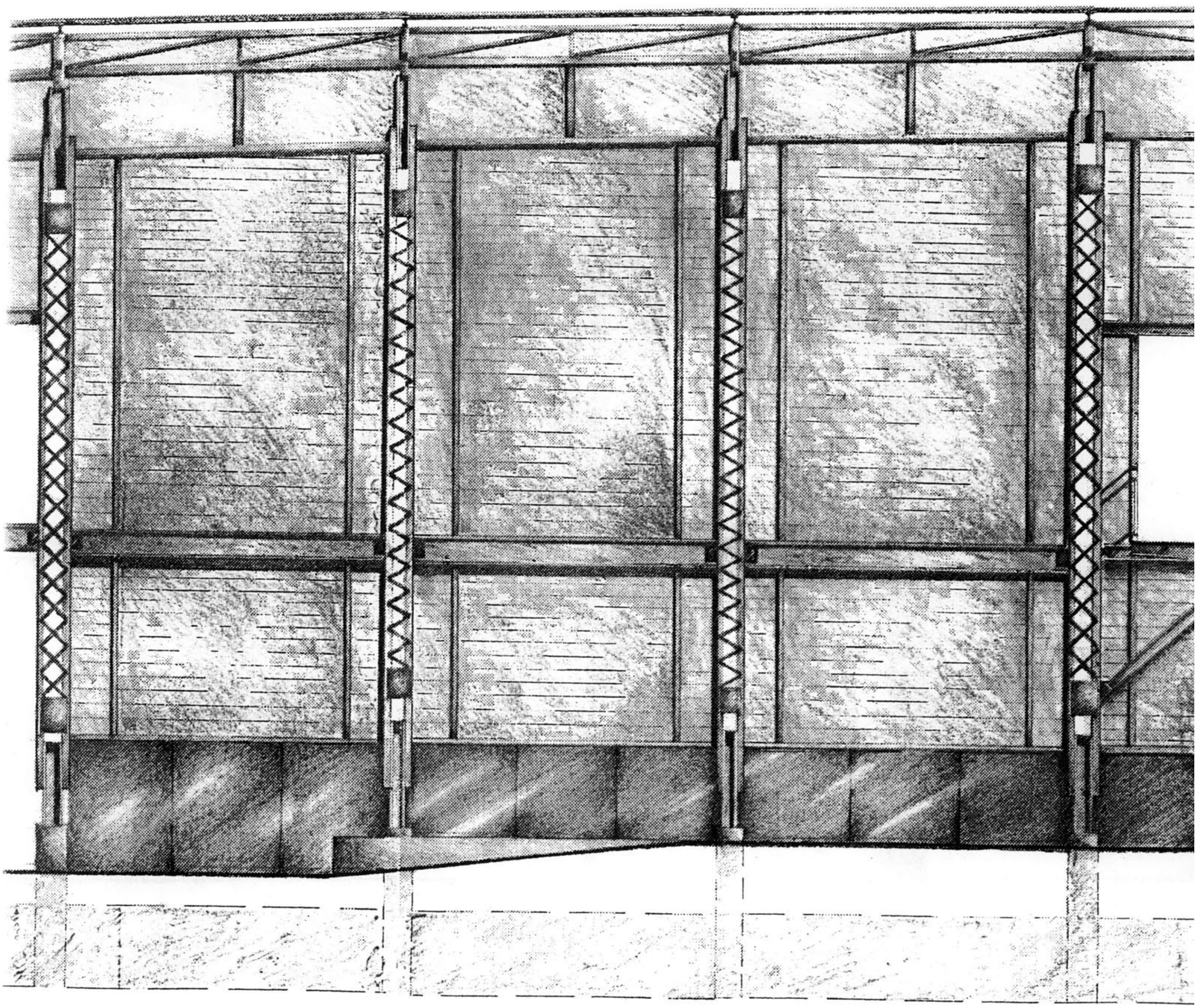
The roller becomes the entrance piece. Its arc engages a curved garage door operated by the bridge gears. Its connections to the hanger and column are made by two pairs of bolting rods.



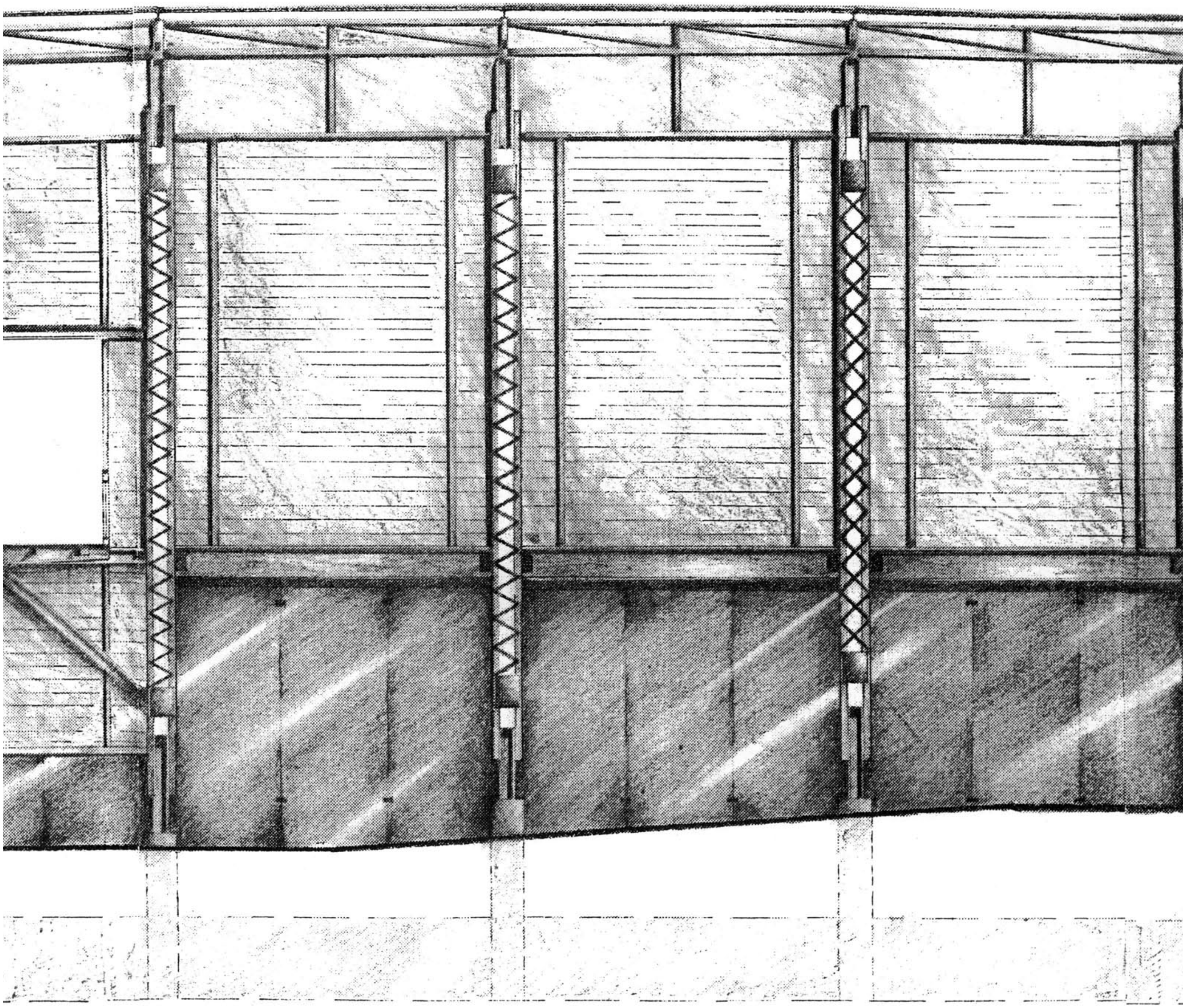
A voluminous space greets the visitor to the gallery. One could ascend to a bridge to examine the lattice columns or the art exhibits. The translucent cladding mask these columns from the exterior.



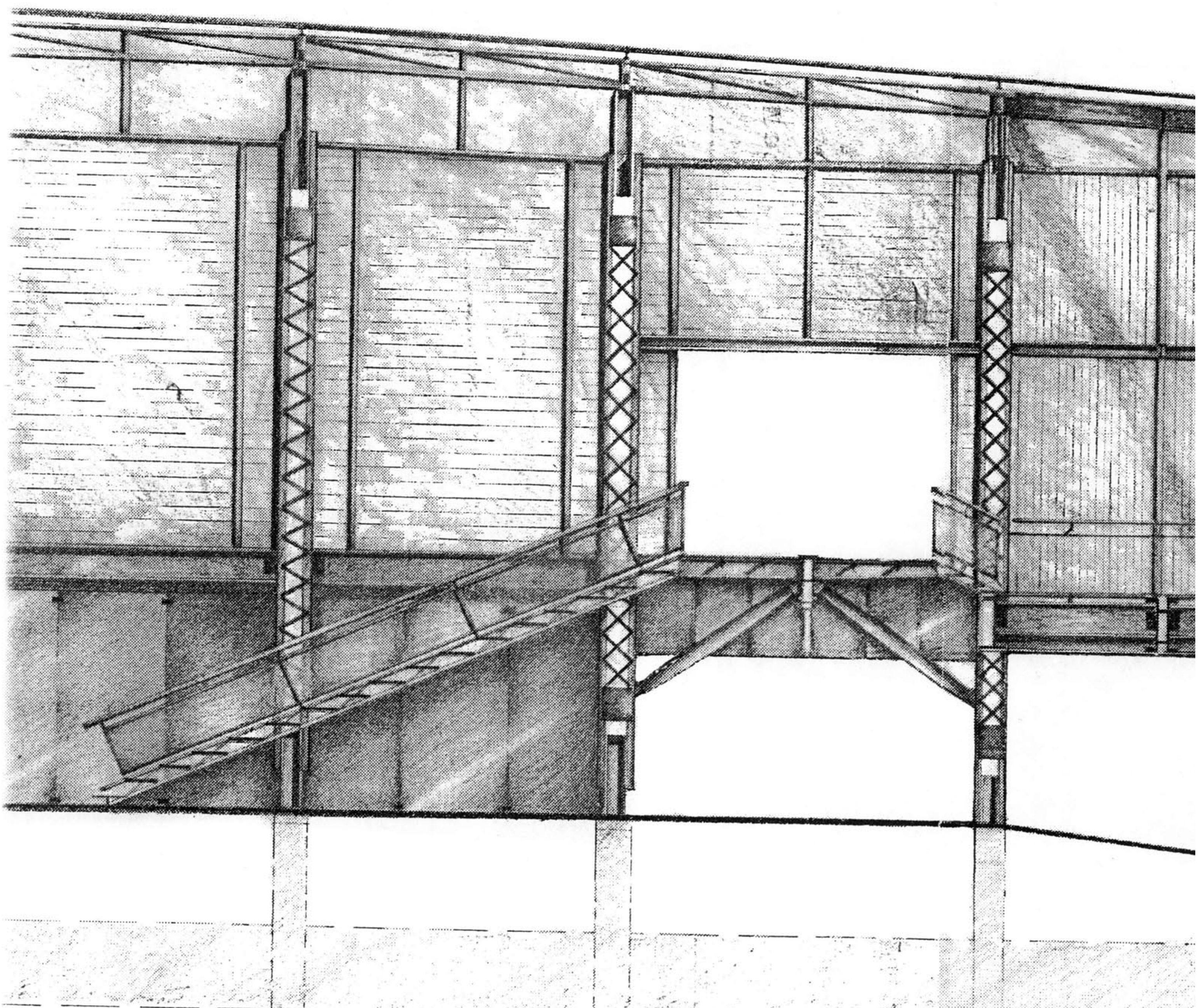
Construction details are simple and modest in contrast to the articulated steel members. New I-channels are bolted to the columns and connected to the pile-foundation.



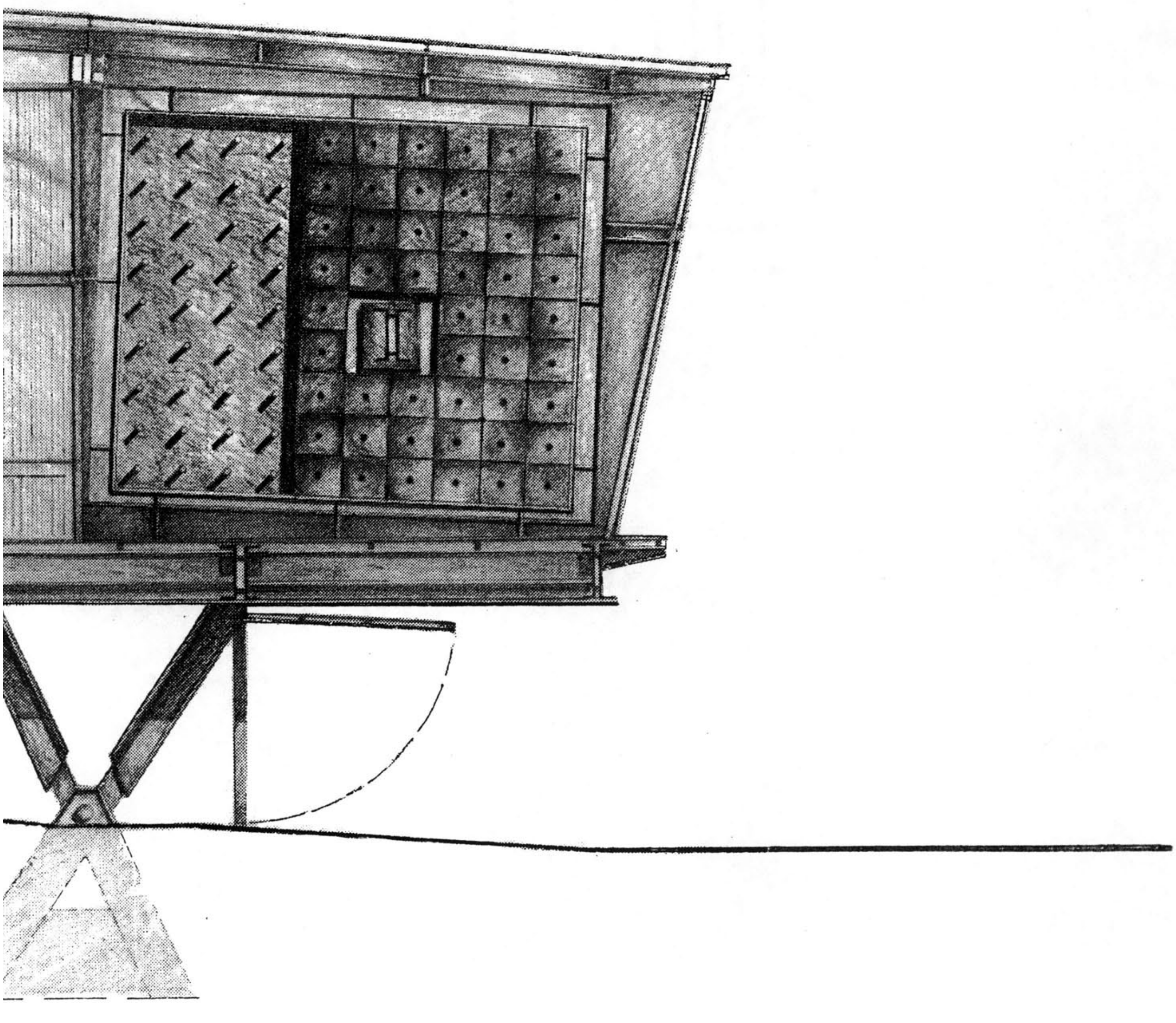
A second bridge hangs above the ground plane that rises and falls in response to the changing column heights.



The third and final bridge connects to the workspace behind the walls of the counterweight.



Some of the cast-iron blocks have been removed to relocate the center of gravity of the counterweight. The amount of blocks will thus determine the tensile force exerted on the cables.



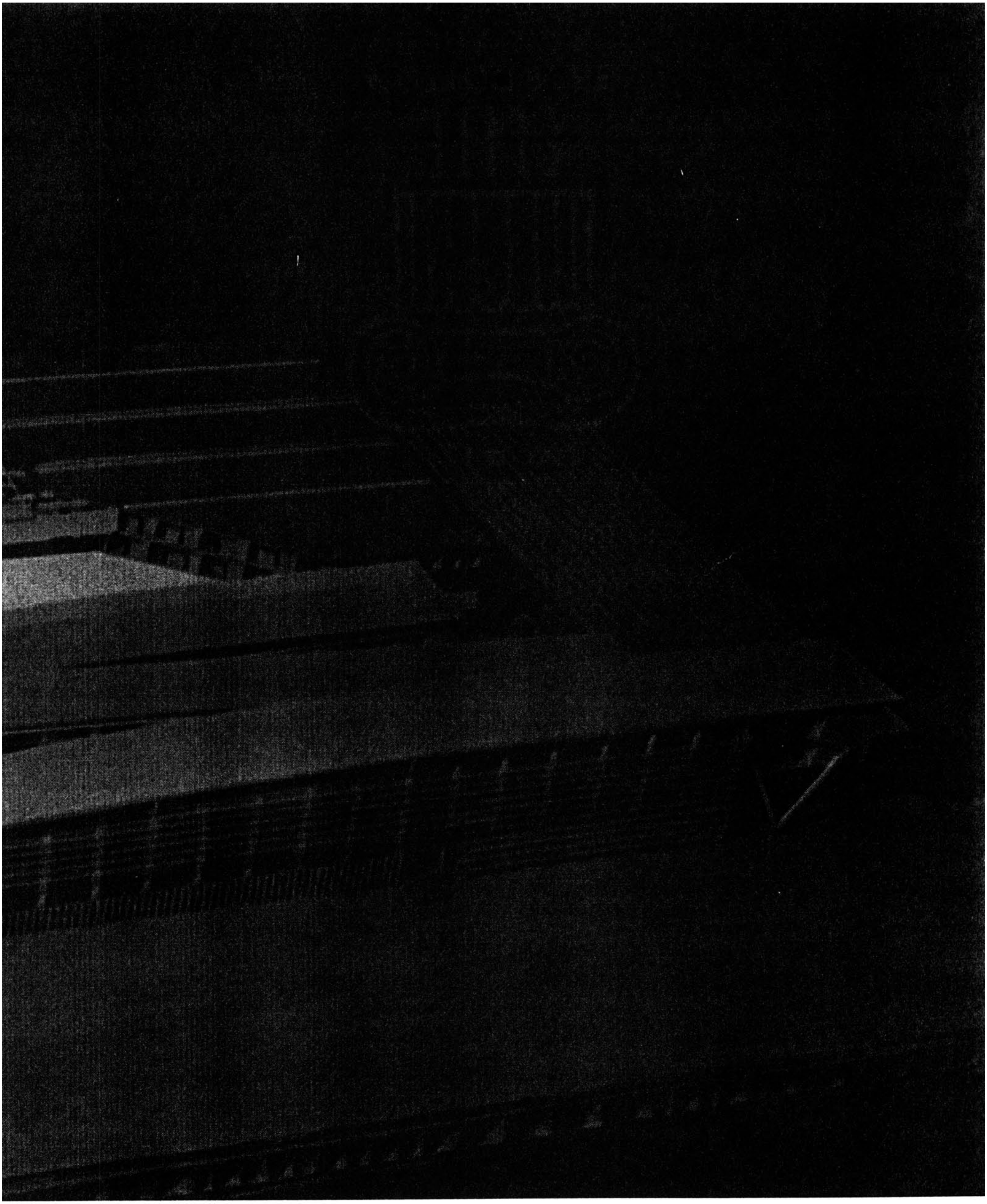
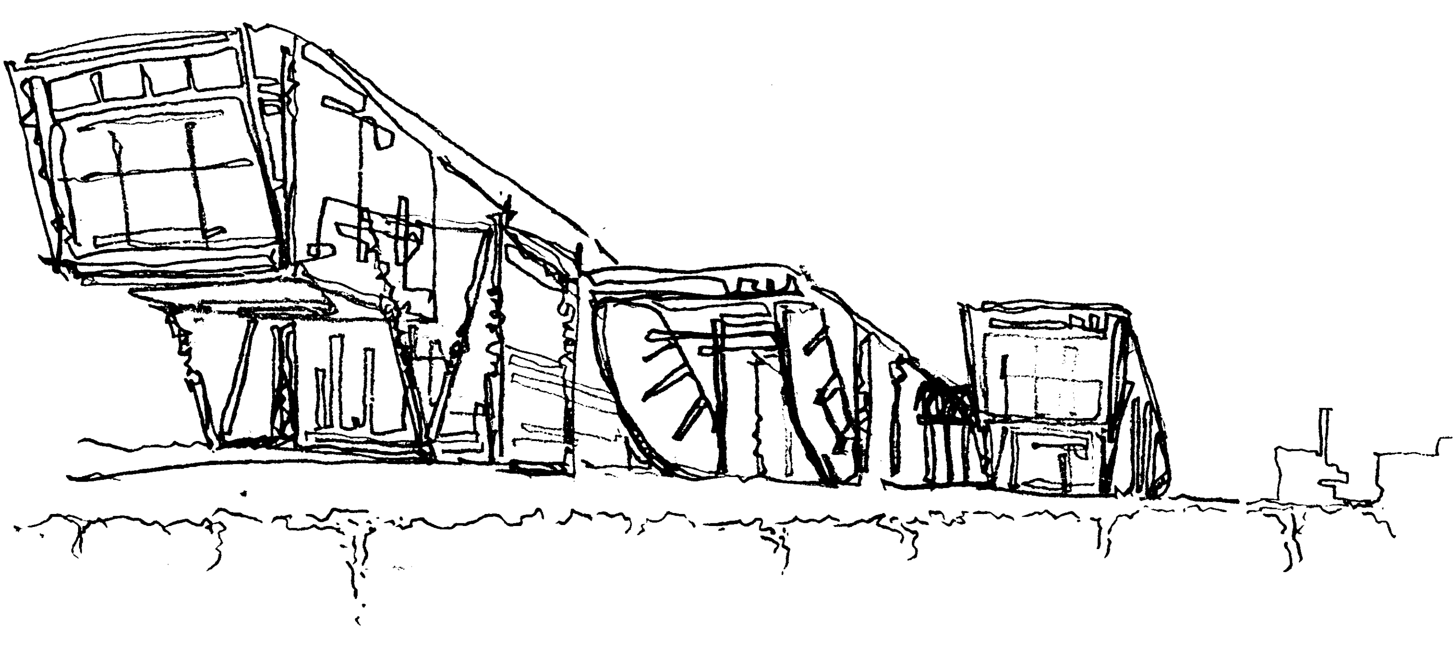
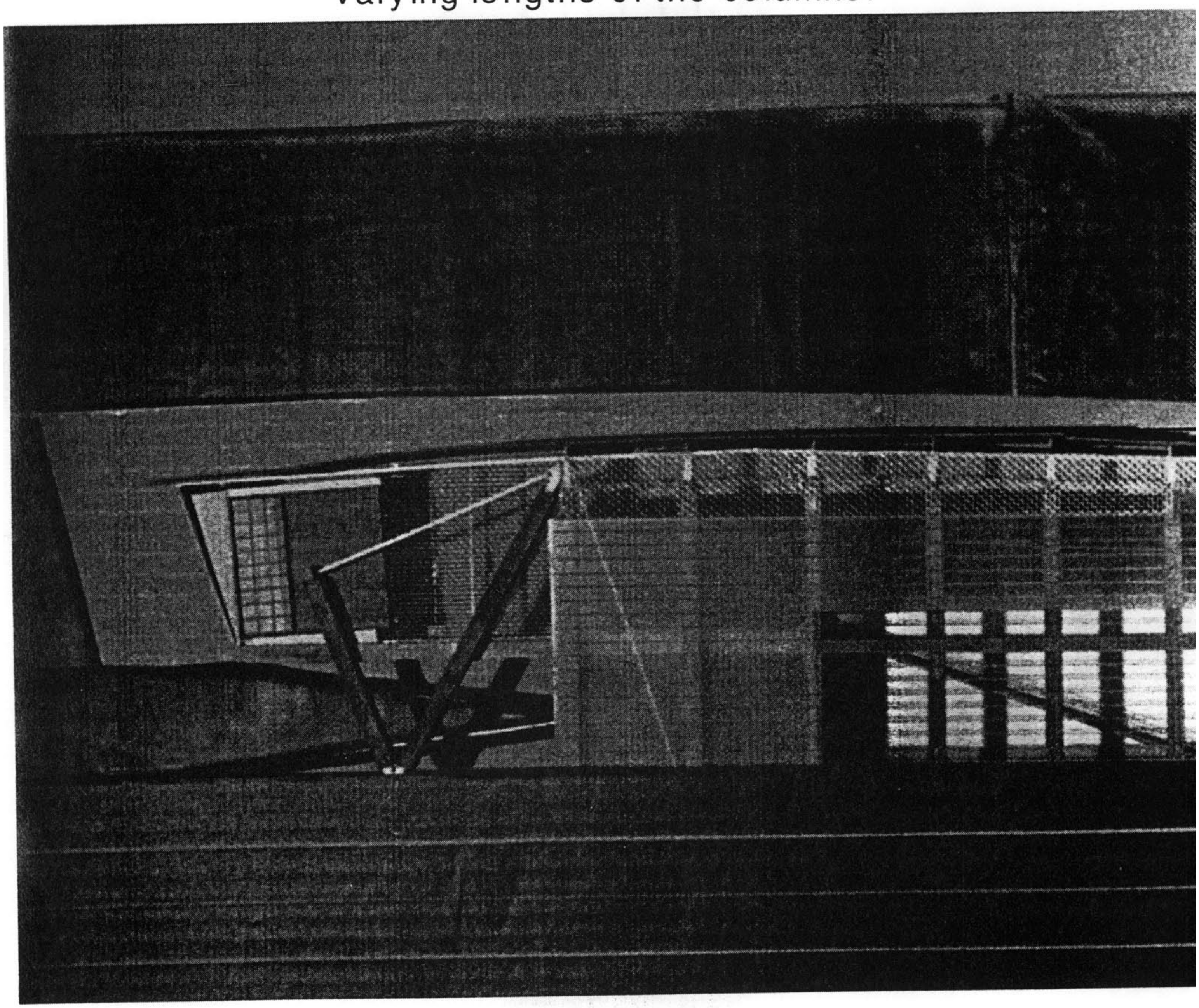


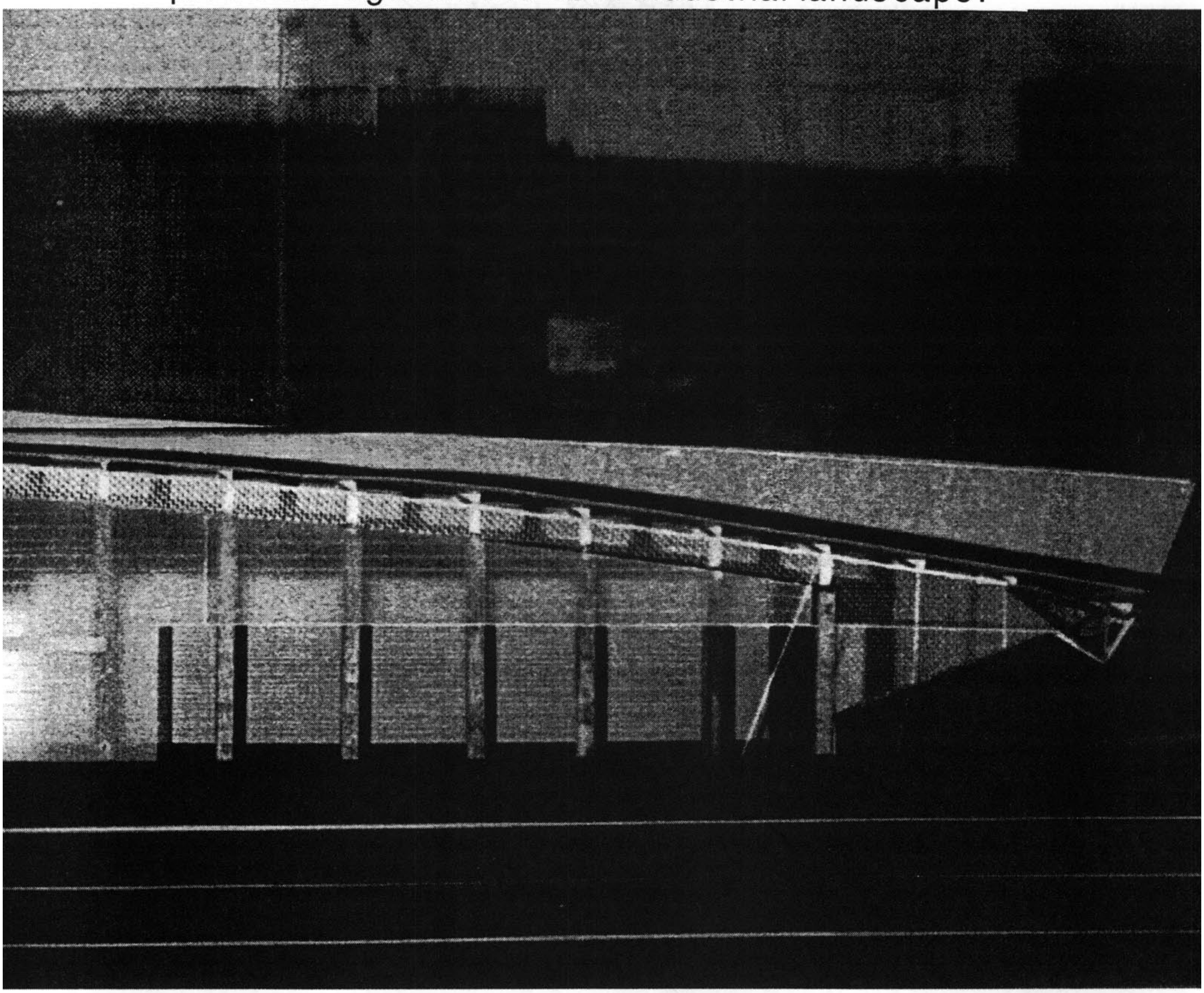
fig. 26 The curved roofs evoke the bridge's mobility



Making an envelope around the art gallery serves, aside from providing shelter, to contrast the building with the bridge. Special attention has been given to the construction detail of this envelope around the components. Joints between columns and beams have been articulated to reveal the end conditions and varying lengths of the columns.



New slender frames contrast with the massive old steel. A thin, translucent cladding weave in and out between the columns. This allows the building to assume perceptual differences. In the day, natural light cast onto the skin exalts the voluminous space within the gallery. At night, artificial lighting gives the building a luminous presence against the dark industrial landscape.



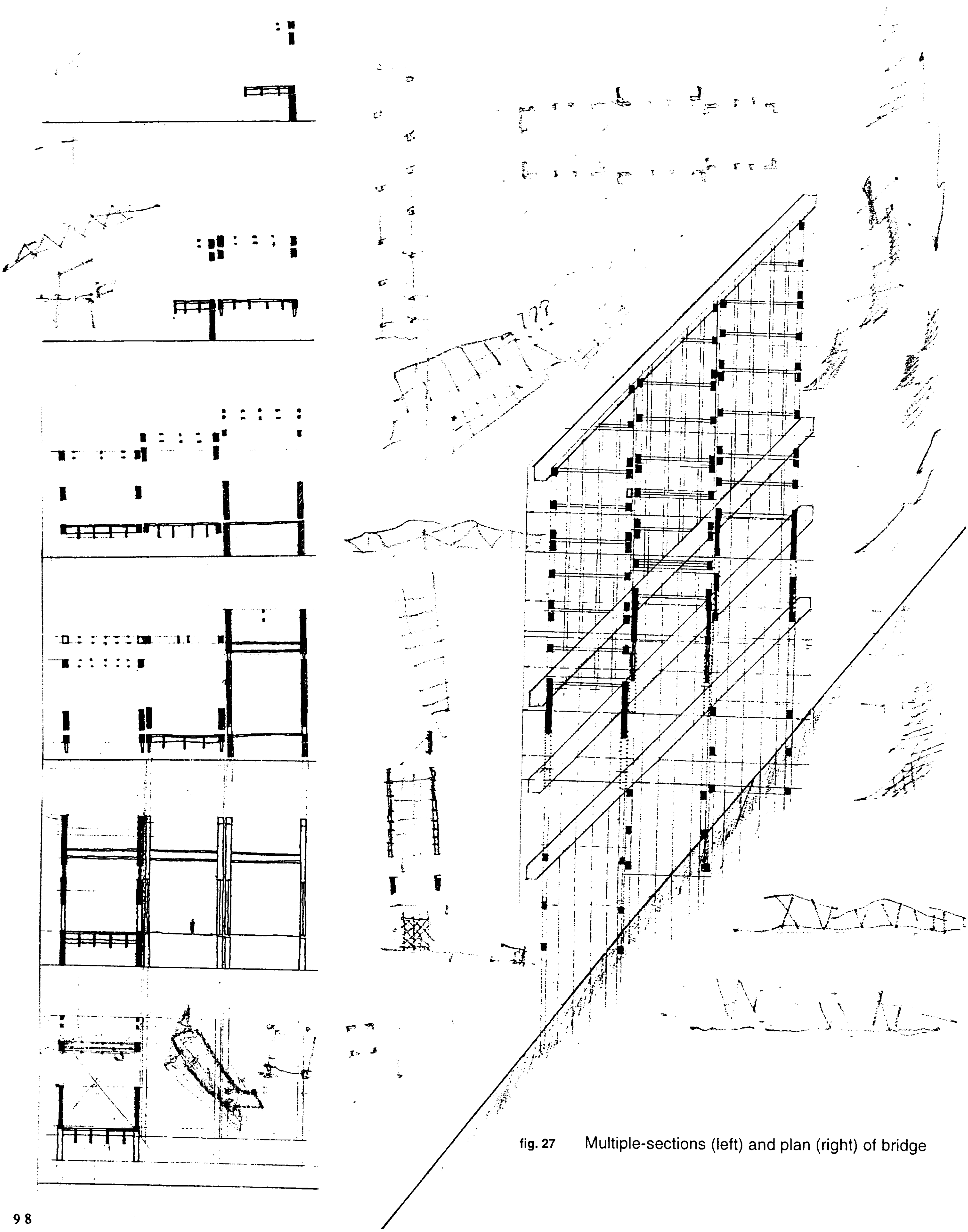
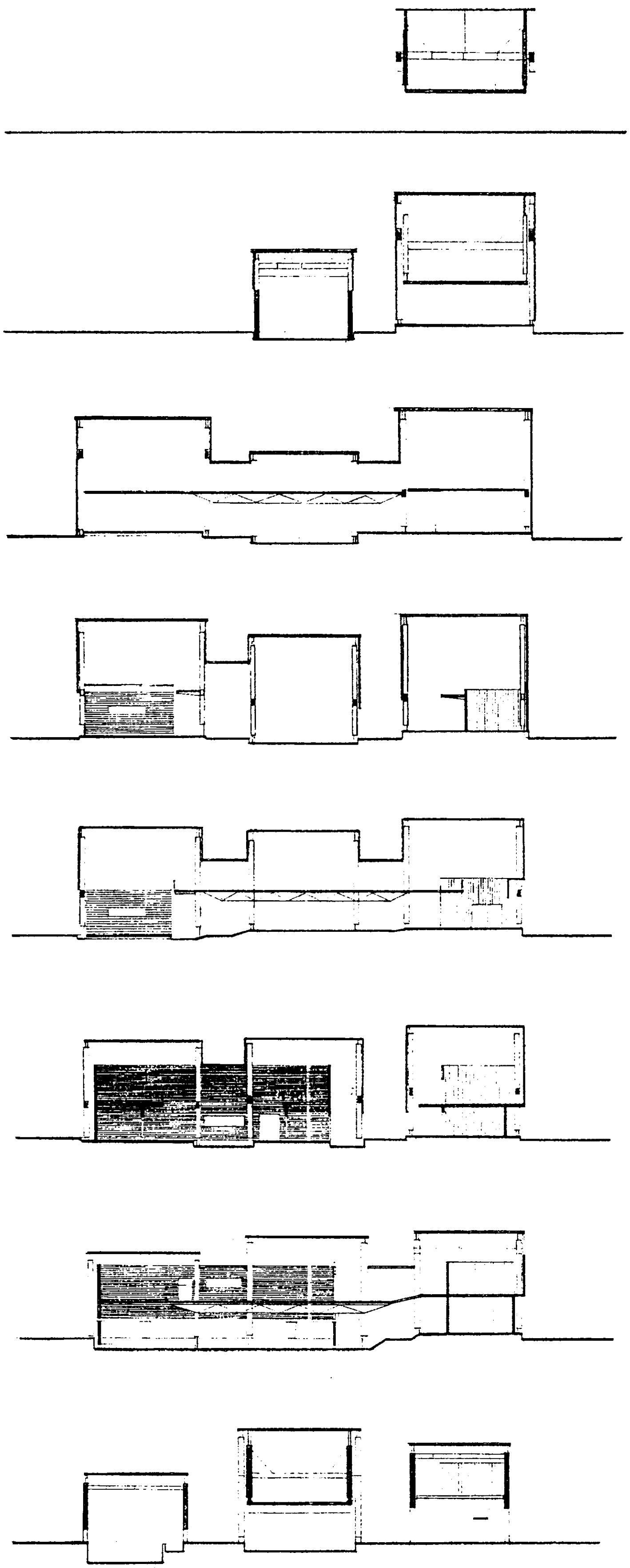


fig. 27 Multiple-sections (left) and plan (right) of bridge



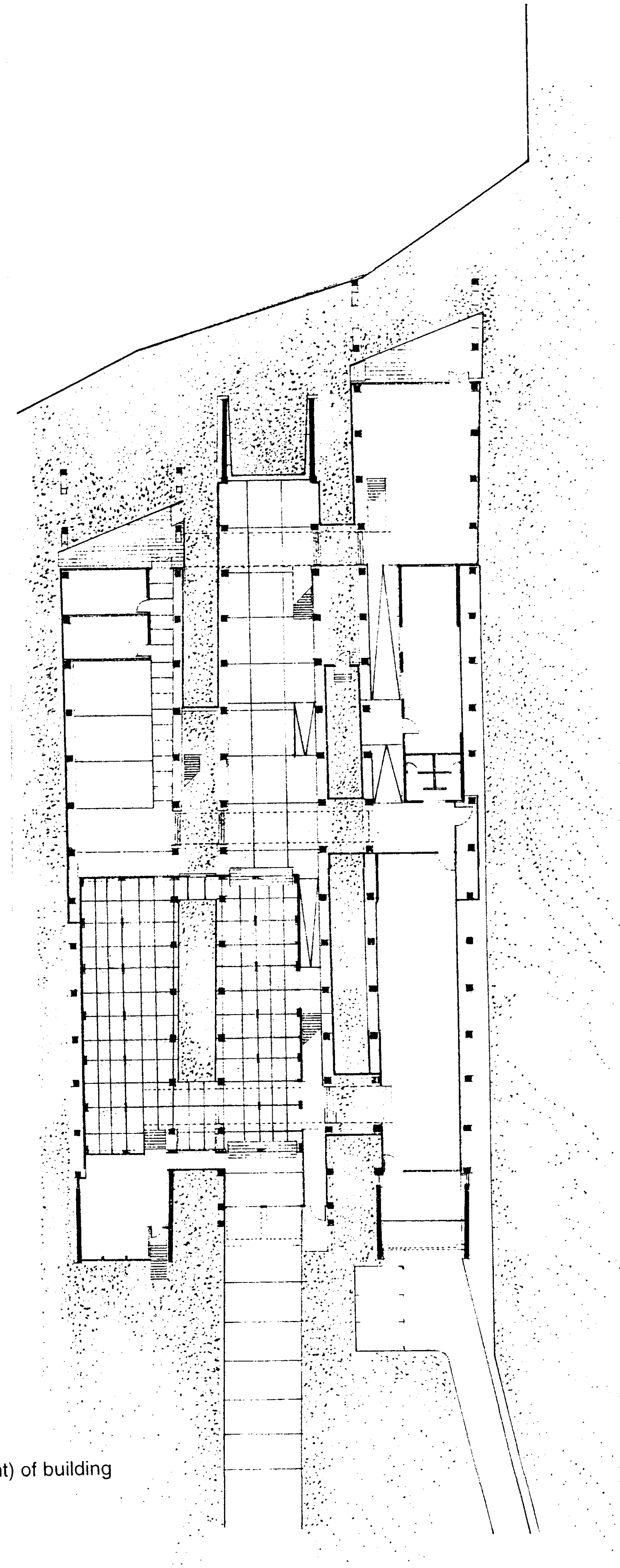


fig. 28 Multiple-sections (left) and first floor plan (right) of building

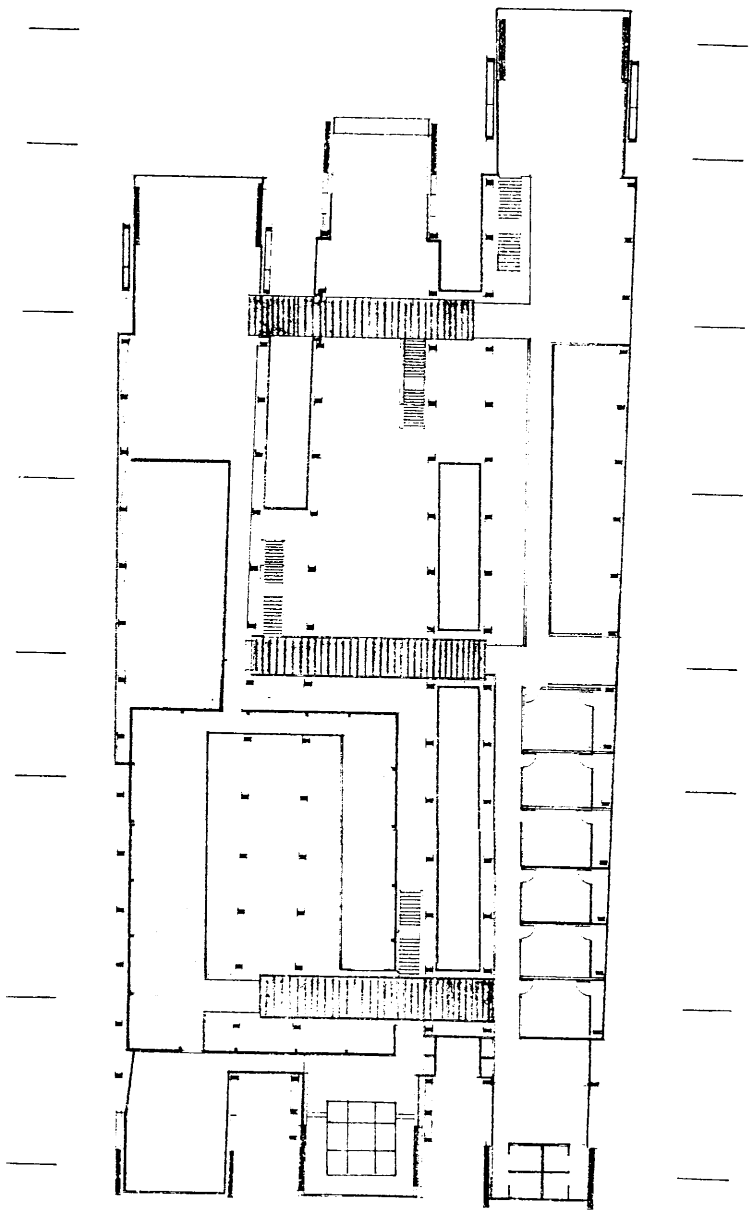


fig. 29 Second floor plan of the gallery

fig. 30 Site model shows the buildings along the edge of the channel

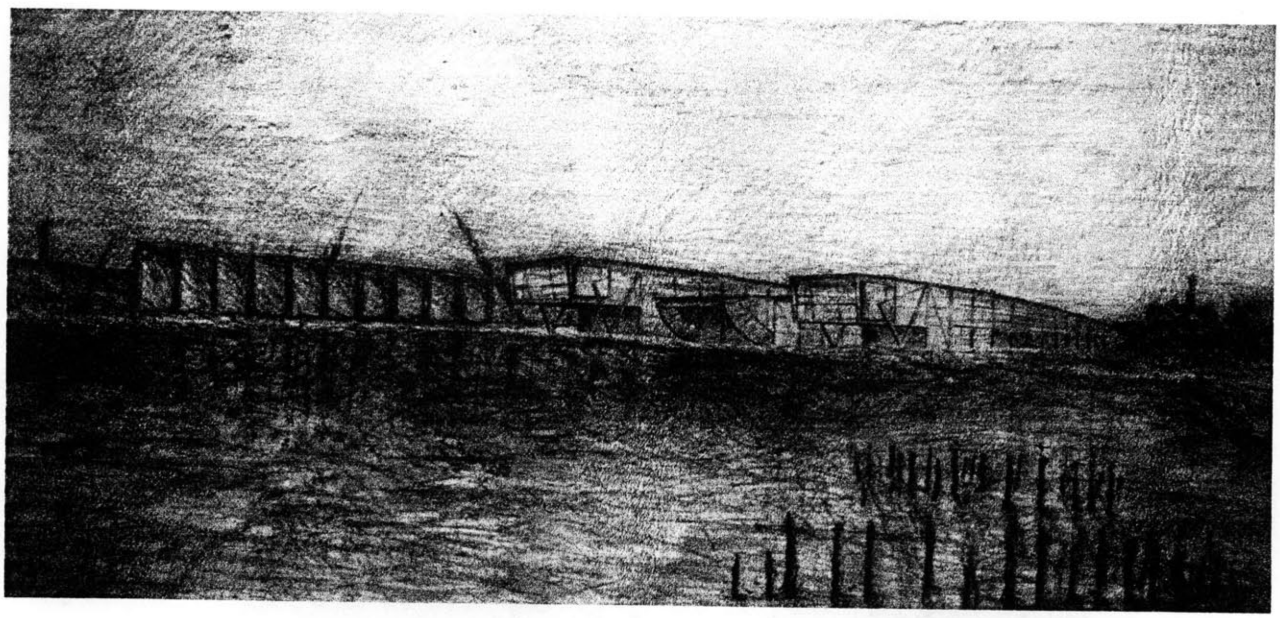


fig. 31 View of the buildings from the channel

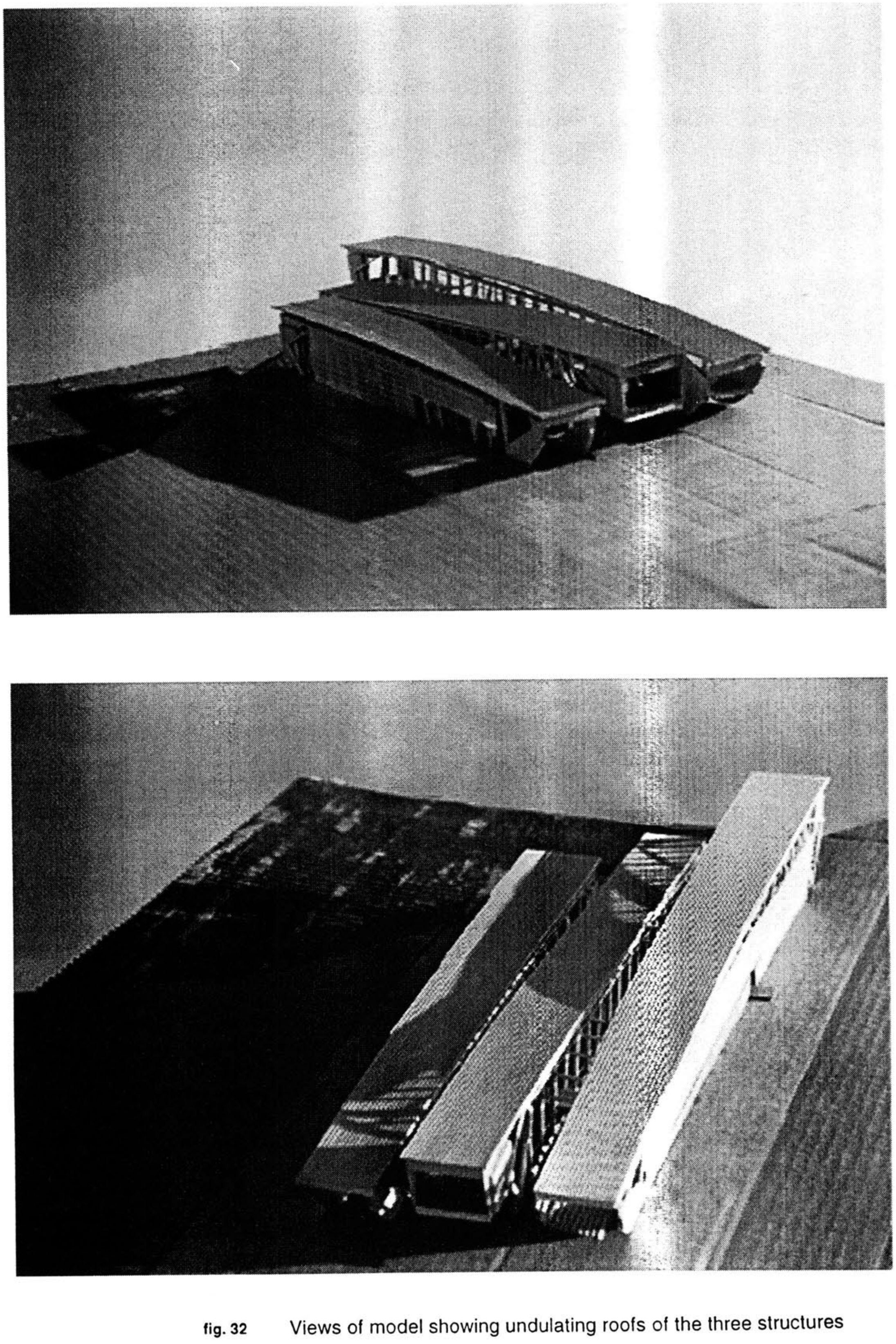
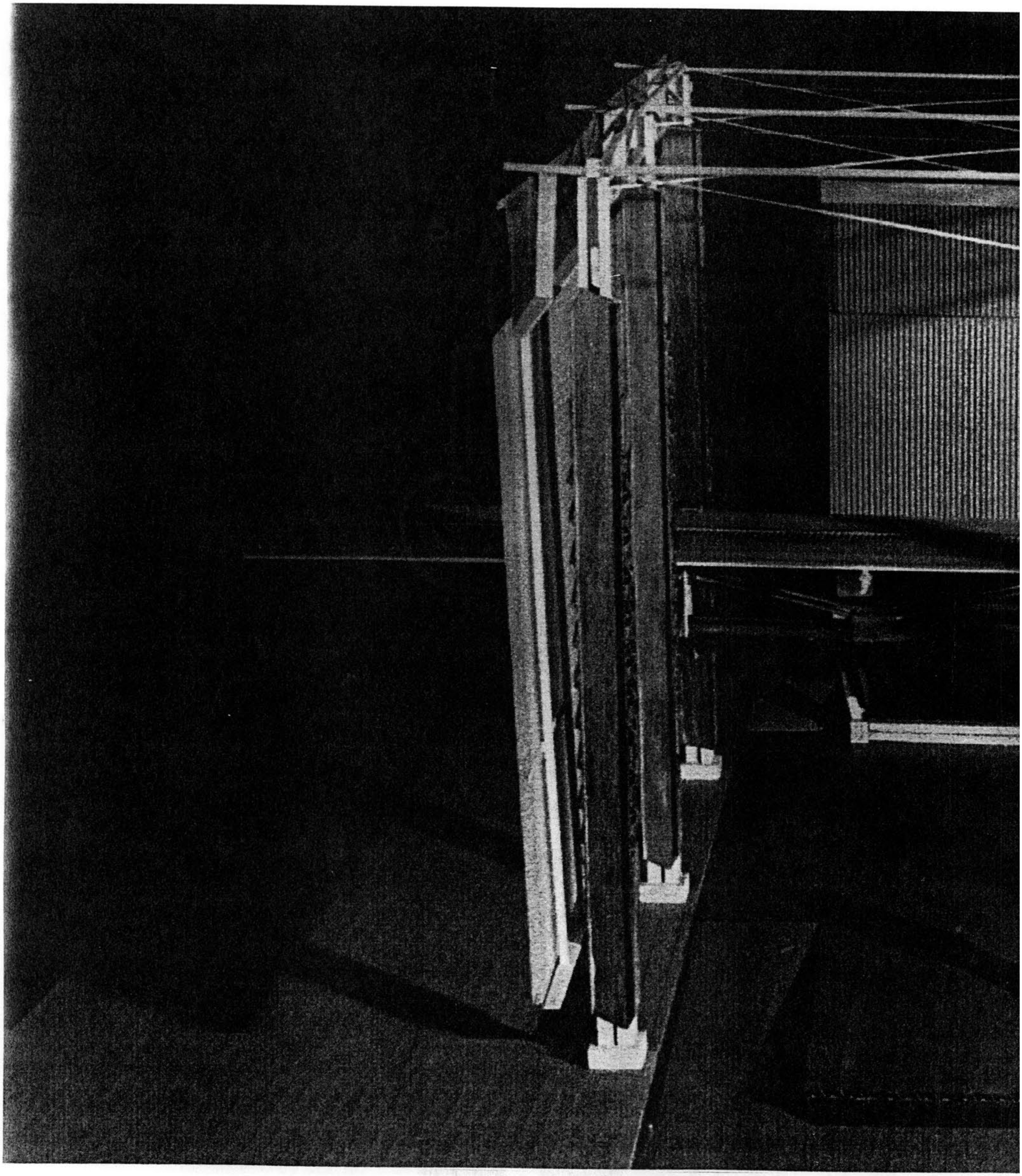
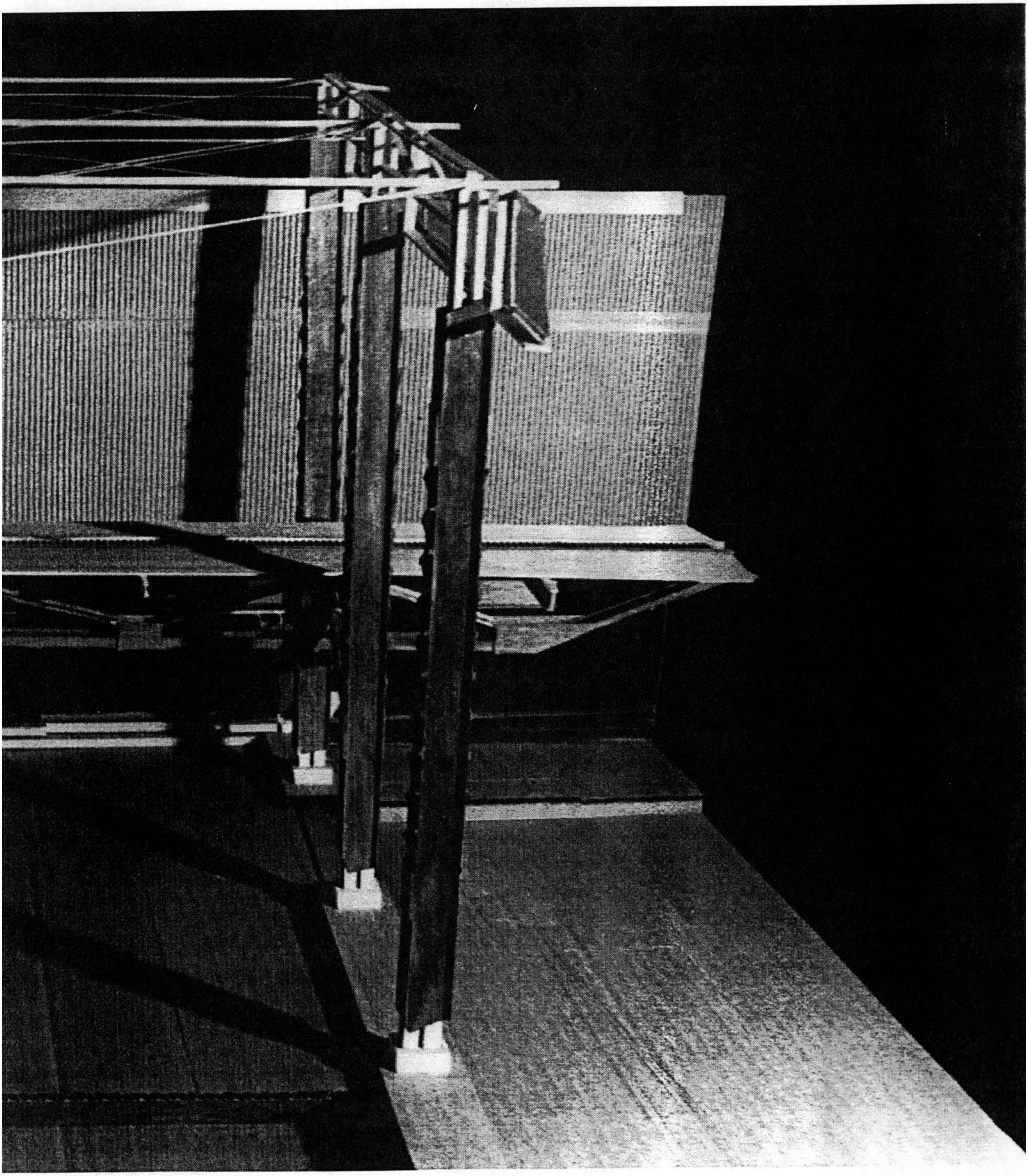


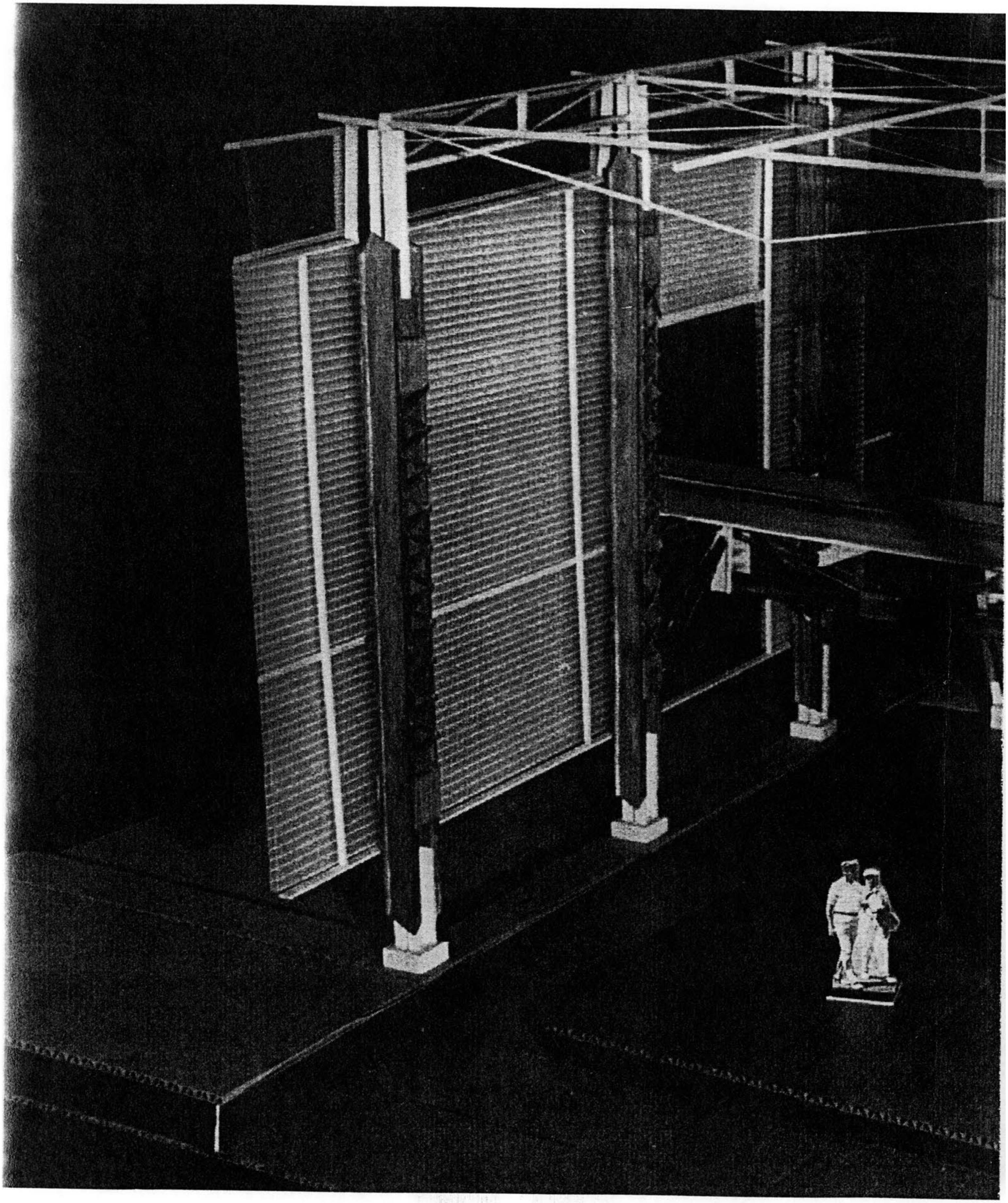
fig. 32 Views of model showing undulating roofs of the three structures



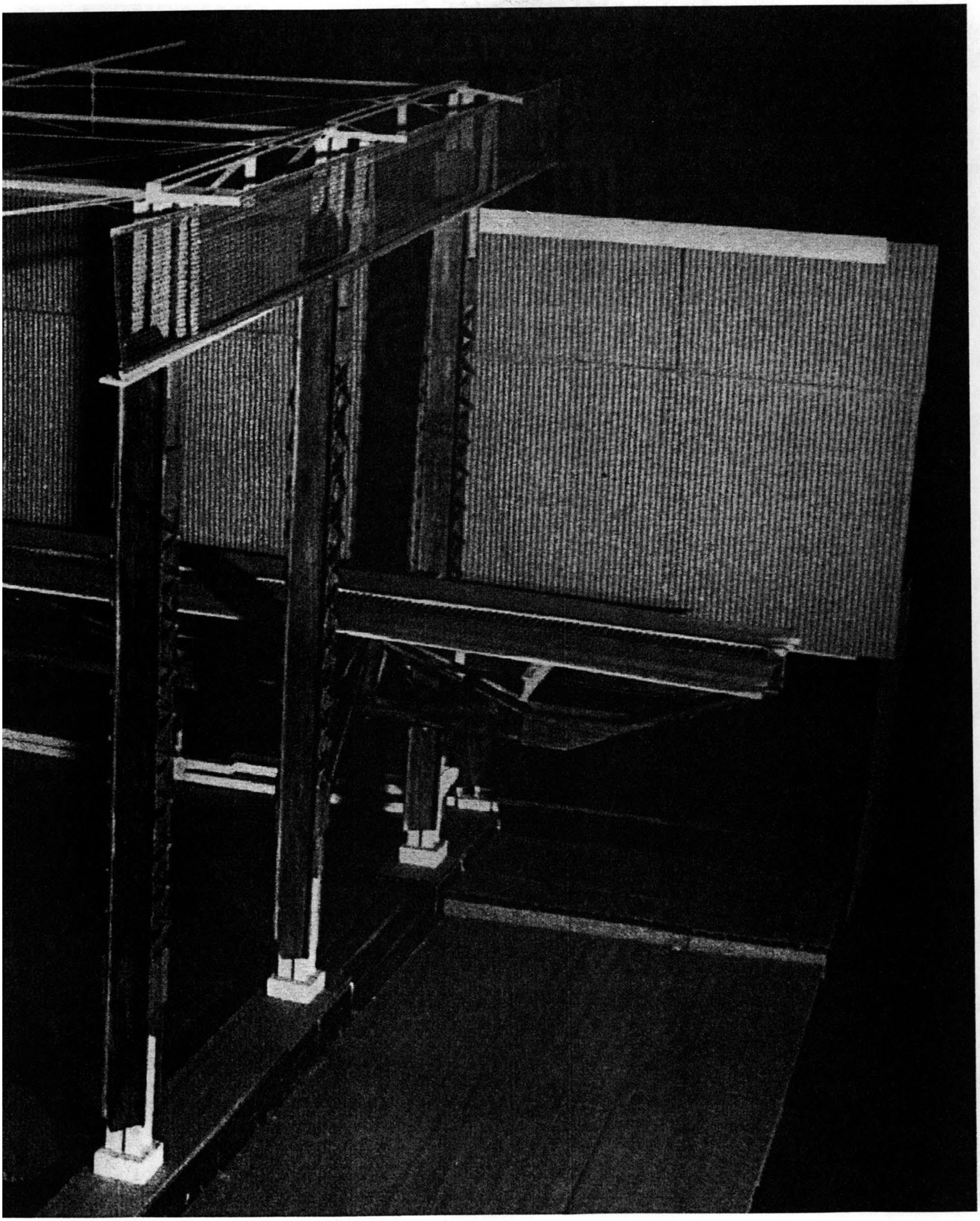
A bridge, made from the operating strut, hovers



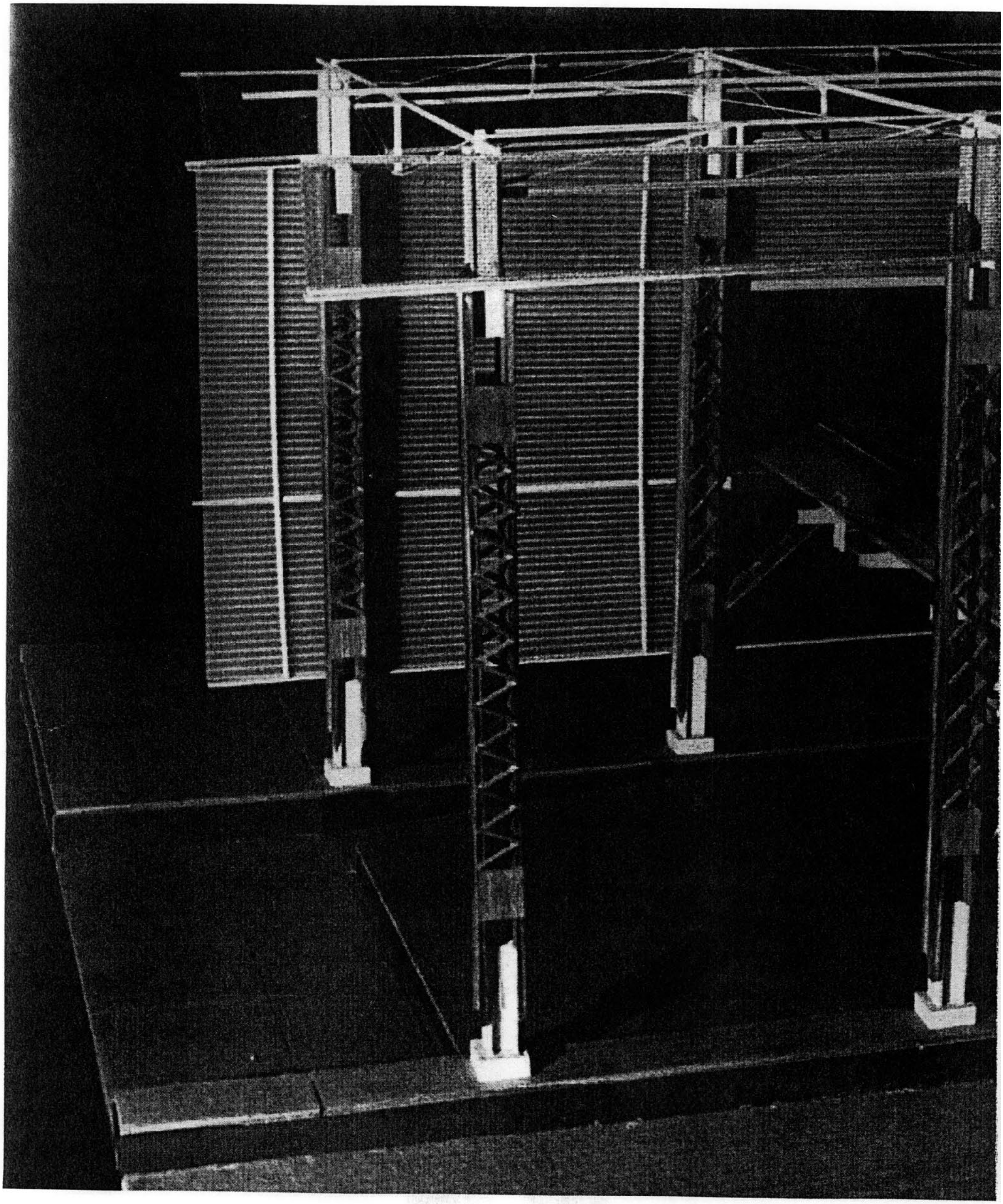
over the mid-section of the gallery. It punctures



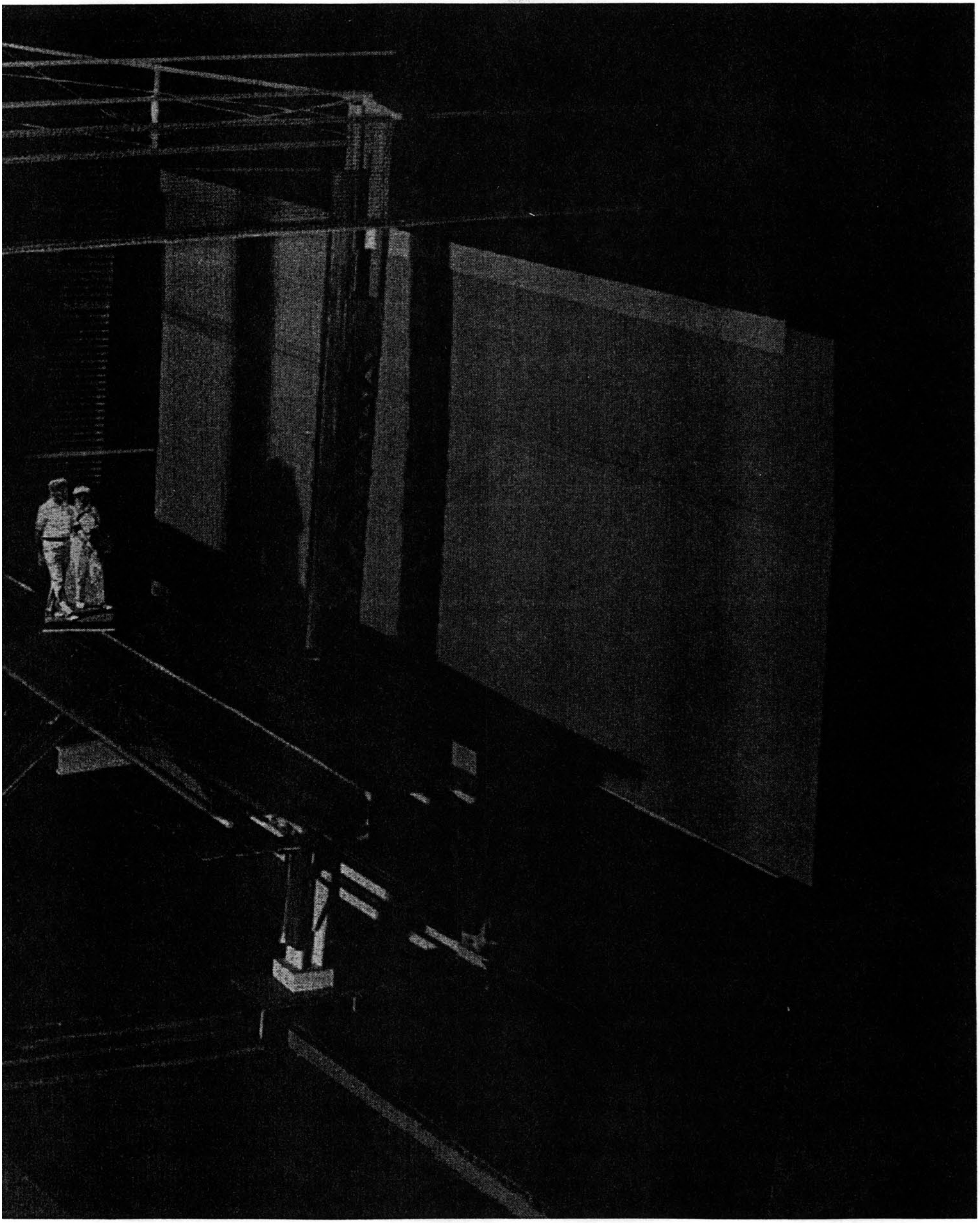
into the cladding to connect adjacent spaces.



The latticed columns - either diagonal or cross-



braced - are interspersed along a set of grids to



illustrate peculiarities between the members.

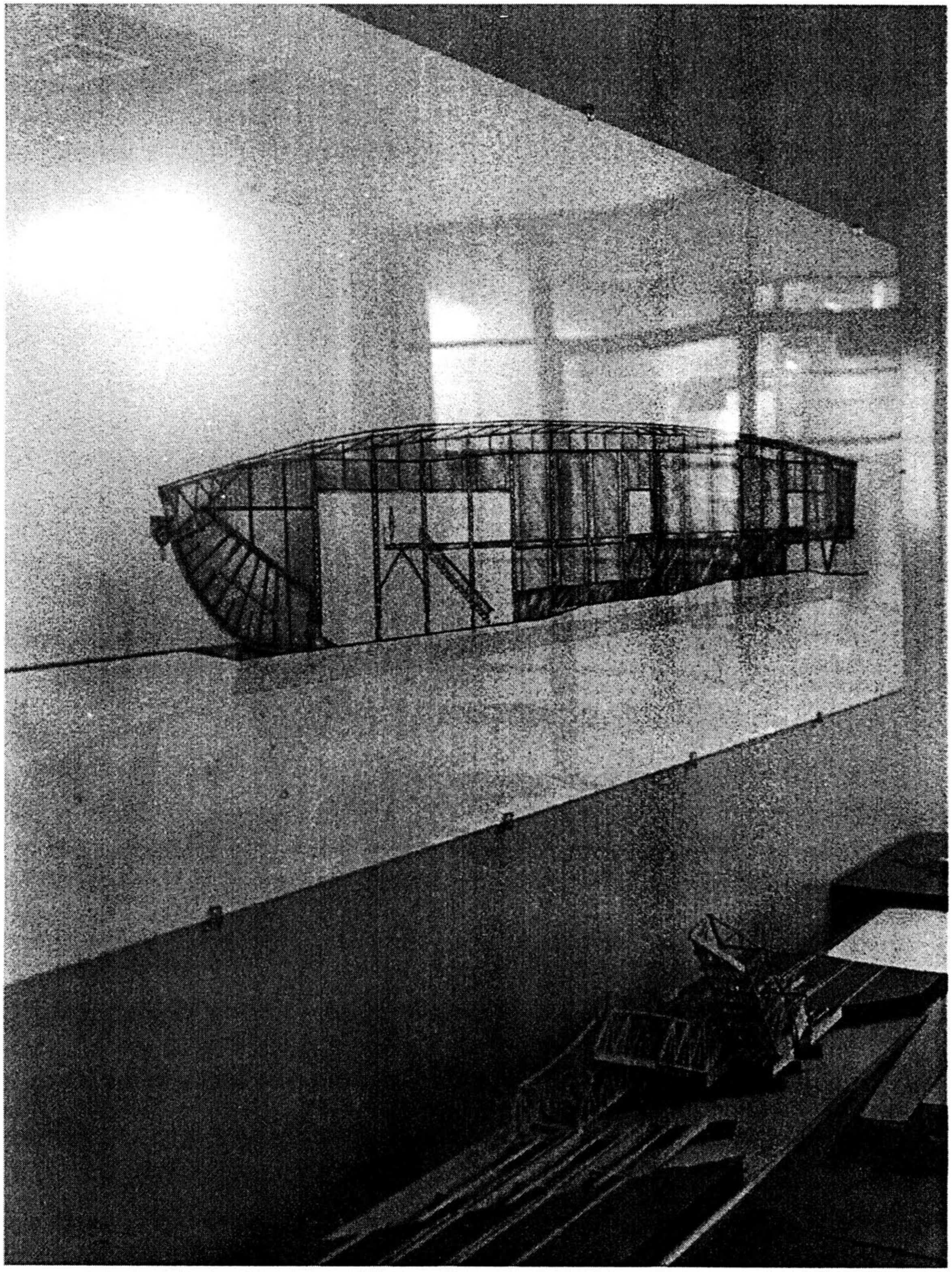


fig. 33 The author's work at the visiting committee exhibition, March 1996

Afterthoughts

This thesis exploration had a dichotomous beginning. Since I was initially fascinated by the iconography of bridges, I had been inclined to preserve the bridge at its fullest splendor. Upon deeper reflection however, I realized that this monument of the industrial age has outlived its original use and that a new attitude towards preservation had to be engaged.

Industrial archaeological remains - warehouses, mines, harbors and railway bridges - could be viewed as working places that continue to serve later needs. These structures should be altered by different sets of people other than those who conceived them. In other words, new use must be found for them.

Adapting them to such use often involve fairly radical interventions - a scheme which became more clearly defined towards the end of the thesis. In the case of the bridge, one thing was clear to me. As a crossing between railway and maritime transportation, it had a specialized role to play within the city. Its pre-fabricated structure had been conceived as a perfectly finished object. This meant it is not readily adaptable to functions other than that of a *bridge*.

How then could one make sense of a steel bridge? I guess this depends on how much one would like to live in it. If for a bridge its overpowering scale is unbearable, a building made for inhabitation should not. Its transformation should therefore begin from its smallest components - by manipulating these parts so that they relate to human scale and proportion. This, in retrospect, was the challenge and struggle of the thesis: to dismember and reconfigure a structure in the guise of a surgical operation.

Credits

All Illustrations are by author unless otherwise indicated.

Fig. 2	Courtesy of the Massachusetts Department of Transportation
Fig. 3	Courtesy of the BRA
Fig. 4	Courtesy of the BRA
Fig. 10	Photograph of model, **Architecture of Transportation** in *Architectural Design*, Vol. 64, No. 5/6, May - June 1985
Fig. 12	Courtesy of Michael Tyrrell
Fig. 14	Courtesy of the Museum of Transportation
Fig. 15	Courtesy of Michael Tyrrell
Fig. 16	ibid.
Fig. 17a & b	Photograph from **Engineering News**, pp. 171
Fig. 19	Photograph taken from **Rolling Lift Bridge at the Boston Terminal**, Engineering News, vol. 63, no. 11, Mar 15, 1999, pp. 170
Fig. 20a & b	Photograph taken from **The Fort Point Channel Bridge**, The Engineering Record, vol. 40, no. 12, Aug. 9, 1899, pp. 262
Fig. 21	Courtesy of Michael Tyrell
Fig. 23	Satellite Map. Courtesy of the BRA

Footnotes

1 Quote from the article **Bridge for Sale**, *The Boston Sunday Globe* by Jennifer Kingsom Bloom, Nov 22, 1992

2 Ibid

3 Tyrrell, Michael, **Among the First Vertical Lift Bridges**, in *Rollsign*

4 Bloom, Nov 22, 1992

5 This project was published in **Architecture and Transportation**, *Architectural Design*, Vol. 64, No. 5/6, May - June 1994

6 Quote from Curtis Davis in the article **A Bridge to be Treasured**, *The Boston Sunday Globe* by Christine Temin, Jan 2, 1994

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