big four railroad bridge
louisville, ky.

an adaptive reuse
david l. hillman
thesis study 77:78
THE BIG FOUR RAILROAD BRIDGE:
An Adaptive Reuse

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ABSTRACT

I. Discovery of the Reality of a Bridge Potential
   A. Volumes and dimensions of existing
   B. Site contextual analysis-edges, nodes,
      surrounding impacts, views of, views from.

II. Building Types Study
   A. Bridge development
   B. Industrialized systems
   C. Large scale organization

III. Design Considerations and Goals
   A. Link from Louisville to Jeffersonville
      and vice versa
   B. A tourist attraction
   C. A resident attraction
   D. Construction/erection
   E. Change and growth
   F. Integrity of the bridge structure

IV. Design Process
   A. Working with sections
   B. Developing the zones
   C. Working with a structure
   D. The module
   E. Pier development
   F. Keeping the excitement and uniqueness
   G. Working with a complex circulation system
   H. Elevation development-reading the
      horizontal and vertical elements, the
      panel system, movement, life, the existing
      structure
   I. Developing a workable floor organization
      with circulation on an extremely linear
      element.
   J. Final presentation

V. Conclusion
   A. The end of the beginning
   B. Now add the architecture details
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CREDITS AND SOURCES

Jasper Ward, Architect, Louisville, KY

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Schimpeler Corrading Associates, Louisville, KY.

ADDITIONAL SOURCE

University of Kentucky Student Research and Design Projects concerning the Reuse of the Big Four Railroad Bridge.

THESIS PROFESSOR

John E. Wyman, Professor of Architecture and Planning, Ball State University.

THESIS CRITICS

James Underwood, AIA, PE, Assistant Professor of Architecture.

Robert Taylor, AIA, Professor of Architecture.

David Hermansen, Professor of Architecture.

THESIS JURORS

Paul Laseau, AIA, Professor of Architecture.

Bruce Meyer, Associate Professor of Architecture.

Ken Carpenter, AIA, Professor of Architecture.
INTRODUCTION

Project Description
The author is attempting the adaptive reuse of an abandoned railroad bridge, known as the "Big Four Railroad Bridge," and adjoining land as the site for a commercial, residential, and recreational facility for residents of the metropolitan Louisville, Kentucky area, as an attraction to a slumping downtown Jeffersonville, Indiana and to supplement the Louisville waterfront development.

Site and Location
Louisville, Kentucky and Jeffersonville, Indiana, the easternmost span of the Ohio River in this area. Metropolitan Louisville, population well over 1.5 million, is on the Ohio River, 120 miles west of Cincinnati, 240 miles east of St. Louis, 100 miles south of Indianapolis, and 180 north of Nashville.

The site has access to I 65 North and South via Court Street and two blocks west in Jeffersonville.

It has access to downtown Louisville via I 65 or Clark Memorial Bridge only five blocks west in Jeffersonville and via I 64 through Butchertown. Also access to downtown Jeffersonville two blocks east via east-west street in Jeffersonville.

The immediate site consists of one abandoned railroad bridge and a strip of shore land on the North bank bounded by a street and houses on one side and the Ohio River on the other (south side) of the strip of land. The south end of the bridge is bounded by stockyards and junkyards and a street with a nine acre proposed site redevelopment area of Butchertown. On the north end in Jeffersonville, the bridge parallels a one block dead end street into the flood wall and is perpendicular to a residential street, Riverside Drive. On the south side the bridge parallels Clay Street and intersects River Road.

As can be seen in the photographs the adjacent housing is very old and gives an historical
appearance to the area. Also on the Indiana side is a new riverfront hotel the "America's Host" with riverfront views and an interior decor of the days of the riverboats and river trade. Downtown Jeffersonville with many buildings of the early 20th century are being remodeled and adapted to modern uses. The author feels that all of these things should be incorporated into the bridge project.

**The Bridge**

The "Big Four" bridge built in 1929 is presently owned by Penn Central Railways, now in progress of bankruptcy. It was the last major railroad bridge to use the Pratt truss system. It has six total spans, three of which are 550' in length, two at 341', and one at 210'. The larger spans top out at approximately 90' and shorter spans top out at approximately 50'. The bridge is approximately 80' above the water level and the ends are 35' from the ground. The approach ramps were dismantled in the mid 1970s leaving a bridge with sheared off ends on each bank. The bridge is 25' wide, a "one tracker" and 2525 feet long with 63,125 sq. ft. of rail area. The structure is now basically a skeleton with most of wood crossmembers burned away and the rails removed. It contains seven piers two of which are on dry land.
HISTORIC BUILDING TYPES STUDY
OLD LONDON BRIDGE

SECTION THRU

STRUCTURE - TIMBER BEAMS / STONE FACADE
INHABITANTS GET LOTS OF FRESH AIR AND SUNSHINE
Adequate sewer disposal for time
PONTE Vecchio

SECTION THRU

ALLows for FORCED CIRCULATION
LONG VIEWS UP RIVER
structure stone arches - timber
spaces work like a shopping center unified

VIEW ← RESID. PRIVATE ← VIEW
COMMERCIAL ← PEDESTRIAN CIRCULATION ← COMMERCIAL → VIEW
BRIDGE PASE ← WATER ← VIEW

VIEW ← STREET ← VIEW

VIEW ← SHOPS - RESID UP ← VIEW
COMMERCIAL ← CIRCULATION ← COMMERCIAL

VIEW ← RIVER TRAFFIC ← VIEW

VIEW ← SHOPS - RESID UP ← VIEW
COMMERCIAL ← SHOPS - RESID UP ← COMMERCIAL

VIEW ← STREET ← VIEW

VIEW ← SHOPS - RESID ← VIEW
COMMERCIAL ← CIRCULATION ← COMMERCIAL

VIEW ← SITE ← VIEW
SYSTEM TRIEDRO MILAN

THE PLAN
- LIVING SPACE
- SERVICE
- PRIVATE
- VERTICAL CIRCULATION
- HORIZONTAL

THE MODULE
STACK IT/ MODIFY IT
DESIGN IT YOURSELF
PARTICIPATION PREFABRICATION

MILAN

THE PLAN

FLOOR SERVES AS BASE STRUCTURE
COLUMNS FORM BASE FOR PARTITIONS AND VERTICAL STRUCT.

EXTERIOR SPACE (POSSIBLE SOLUTION)

VERTICAL CIRCULATION

HORIZONTAL CIRCULATION PUBLIC SPACE

THE STRUCTURE

BLDG. MAY CONFORM TO SITE CONFIGURATIONS
VIEWS ARE DETERMINED BY USER NEEDS & DESIRES
SPACE IS DIVISIBLE OPAQUE AND TRANSPARENT PARTITIONS
SPACE IS DESIGNED BY USER W/ ARCHITECT AS CONSULTANT
CLIENT DISCRITION

The Client/Developer

The client as such would be a developer interested in community improvement as well as a reasonable profit. His main concerns after construction would be in maintenance of the structure, leasing of spaces, supervision of new development and coordination of changes.

The Residential User

The resident would most likely be a high income tenant due to the high cost of the structure,
building maintenance, and constant protection. He would need a fast/rapid means of transportation because of the extreme linear site and would need access to educational facilities, support services (food, clothing, shopping, auto maintenance, public mass transportation, etc.) The immediate area includes a variety of all of these facilities and services.

The Commercial Client (Leasee)
These clients are small retailers oriented toward the tourists and supporting the residents. Because of minimal space, they would require a minimal stock with sale of small size merchandise. Their main or peak tourist season would be during the Derby festivities. A major department store could break into small separated stores such as shoes, mens, womens, etc.

The Commercial User
These can be divided into two groups, the tourists and site seers, and the residents. The tourists and site seers from the metro area and from out of town would be interested in the uniqueness of the structure as well as souvenirs, travel assistance or tour groups, and historic sites to be seen in the area.

The Restaurant Client
He/They would be interested in a service restaurant for tourists and residents of the metro area. Private spaces for group accommodations and dining areas should be designed around the view of the river, adjacent skyline, and the waterfront development.

The Restaurant User
The user is interested in a unique setting as well as good drink and dining. His attitudes are much the same as the commercial user.

DESIGN CONSIDERATIONS
Clients/users must have access from both sides requiring some use of vertical people and mer-
chandise mover is needed from space to space, from one end to the other. For instance if a movable sidewalk were used allowing a total of 10 feet in width for two-way travel, 15 feet in width would be left with 37,875 sq. ft. left over the main level only.

Other spaces may be obtained by hanging onto the sides and by using upper sections. A division of commercial and residential spaces may come from section/span division or by level differentiation. At any degree the site is extremely linear, and a separation of areas is mandatory. To allow this separation and achieve a through pedestrian circulation, sectioning or zoning by spans on the circulation level is undesirable. Zoning on upper levels may be desirable by spans. Use of the underside of the bridge is restricted by federal navigation laws.

**DESIGN ELEMENTS THAT MUST BE CONSIDERED:**

The forms and lines drawn by the structure (cross diagonal bracing, the curve of the top chords, the vertical piers, the "V" formed by joining spans.)

The visibility from adjacent and distant areas.

The shear height and mass of the structure.

The slim linear appearance.

The exciting views from the structure.

The potential of fright of structure and site (safety, psychological and physical.)

A demountable probably modular system.

The load bearing ability (vertical and horizontal).

Vertical egress and access of the bridge ends.

Adjacent historical areas and sites.

Design approaches considering a continuity of spans, a breaking up of each span or a combination of both.

The structure tends to say expose me, use me, don't cover me or my parts.
GROWTH AND CHANGE

Because of the space restrictions of a bridge structure and site, additional growth to this development would follow acquisition of additional land not being used in this project. Change should be able to take place by removal and replacement of a demountable structure such as a modular system if the design should enable such a process.
SITE ANALYSIS
AVERAGE TEMPERATURES

DEC.-FEB.: JUNE-JULY-AUG.
36°            64°-78°

MAR.-MAY: SEPT.-NOV.
43°-64°        70°-45°

AVERAGE MONTHLY RAINFALL
3.5"  OHIO

ACCESSIBLE TO EXTENDED PERIODS OF HIGH POLLUTION LEVELS. UNACCEPTABLE & DANGEROUS

SITE

CONTOURS
GROUND COVER
MAJOR VEGETATION
TREES
HGT. - 50:7
SPRD. - 30:6
NOTE AREA MAP

The Louisville CBD, only five blocks from the nine acre Butchertown development area serves as an impetus for energy to the bridge development. The Jeffersonville CBD will most likely develop because of the increased energy demand with residential users, marina development, and tourism.

The site is well served on both sides of the river by interstates and main routes of city traffic. The area is also a very high energy intersection by the complexity of all the hiway systems and river traffic.

The area map also shows the parking areas in solid, the interstate exits/entries, and the vertical access points.

NOTE THRU SITE SECTION

The site section shows the proximity of the bridge height to the water level and the adjoining shores. A preliminary zoning shows private/residential areas on span one and two and public/commercial on spans three through six.

The Kentucky shore is mostly industrial with towers and elevators. The Indiana shore is lined with a marina and residential buildings. Eaching end of the bridge is sheared off as the approach ramps were removed.
NOTE SITE CONCLUSIONS

Shows the two different views from the bridge, east view being a greenscape with trees and parks and some industry. The west view is a cityscape looking at bridges and tall buildings, the urban scene.

Span number one: Visibly enclosed by trees, smallest of all spans but most important as a link to the other spans and as a point of possible vertical egress/access.

Span number two: Visibly important to Indiana shore.

Span number three: Overall the center of mass of the bridge, the least enclosed span, and the major focus for the structure.

Span number four: Furtherest span major from the Indiana shore, and the closest major span to the Kentucky shore.

Span number five: Plainly visible but not prominent.

Span number six: Visible from either side, a prominent vertical object to Kentucky side, surrounded by fenced-in, extremely negative area, important as a vertical egress/access point.

NOTE VOLUMETRIC STUDY

This was the first realization of the space contained within the bridge.
### Span # 1

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<tr>
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<th>Volume in Cubic Feet</th>
<th>HGT</th>
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DESIGN PROCESS IN STAGES
ZONING BY SECTION

The first thing done was an analysis of the bridge and the capabilities it had spatially and structurally. It was capable of eight levels and the spacial divisions were from public below to private above. The different arrangement of space can be seen in the different diagrams. "Public Open" is the circulation across the bridge. "Public Enclosed" is the commercial and circulation space. "Semi Private" and "Semi Public" is the commercial space. "Private" is the residential space.
SPACE ORGANIZATION BY LINEAR SECTION
(Diagrams are in sequence of development)

Top left diagram
Early arrangement of profile circulation on top, residential space top within span, commercial in the middle above circulation along the bottom. Vertical circulation interrupts the open space in the center.

Bottom left diagram
Development at the end of first quarter. Concerned with circulation: horizontal at the top profile level, the middle, and the bottom level interior. Leasable space divided by middle horizontal circulation and vertically by service circulation vertical and pedestrian vertical circulation at quarter points and mid span. Also shows dealing with the pier point as a systems manufacturing point.

Top right diagram
Dealing with the efficient distribution of circulation on the horizontal. The idea was to diminish up and down wasted motion of the pedestrian from one space to another.

Bottom right diagram
Dealing with the division of leasable space by vertical elements and serviced by one main horizontal circulation system.
Space Organization by Cross Section

Diagrams are in sequence of development

Top left diagram

Early distribution of space zoning residential above commercial stacking all horizontal movement below, including; tram car, public walkway, service transport, systems, and moving sidewalks. Residential and commercial spaces are fully extended.

Bottom left diagram

Commercial and residential spaces are contained within, along with vertical circulation on the exterior. Tram car on lower level and upper level along profile. Other circulation contained on lower interior level.

Top right diagram

Commercial spaces only in this span with profile circulation and horizontal circulation at the mid level and lower level. Vertical circulation is contained within.

Bottom right diagram

This is the culmination of all the previous sections except taking the cantilever ability only in special cases to be determined by need, finances, and structural integrity.
DESIGN DECISIONS

Travelway should be open day and night for thru pedestrian travel.

1st level and 5th level will contain minor horizontal circulation elements working like corridors from one end of span to another.

Individual spaces shall be responsible HVAC probably electric w/ heat pumps.

Electric should be distributed thru systems area to individual spaces.

Heating system to be integrated w/floor panels as in resistance heating.

Panels: suding glass, lightweight insulated sandwich panel one soud opening, opaque or transparent.

Each store owner should provide part of a module f for store front public space adjoining to a vertical or horizontal circulation element.

Rest area public open space to form transition between commercial and residential.

Mass transit running alongside walking area from one end to the other.

Stock retrieval area on south end of bridge in industrial site to serve commercial and residential needs.

South end mass transit to bridge over interstates to parking areas and public transportation systems, vertical element at stock retrieval system.

North end bridges over floodwall to residential parking areas and has connection to marina north shore line.

One system of public slow moving third level of each span allows movement up and down of similar incriments.

Restaurant to use upper level of span & drawing people to commercial area not too close to residential (A hi-lite).

Elevators to service each level of 8 levels each space to be located not more than one level from such service.

Spaces are to be organized around elevators, service shuttles and public levels.

Service shuttles to serve any developed level from stock retrieval center.

Span #4: Major attraction restaurant.

Span #3: Major attraction major department store.

Span #5 & 6: Attraction is traffic flowing thru.

Travelway should be open but enclosed glass for wind protection and light day and nite.

CIRCULATION

Circulation to be taken from open space.

Fast transit/walking side by side.

South end bridges over interstates to public parking, transportation systems and connects to stock retrieval system.
North end bridges over floodwall to residential parking areas.

Should be passable 24 hrs.

To minimize up and down wasted motion each level should have minor circulation elements giving at least 2 egress.

Vertical - large spans, 3 major people carrier areas 1 mechanical and 2 stairwells.
PIER POINT DEVELOPMENT
Diagrams are in sequence of development

Top left diagram
Early development for pier point with keystone idea overlapped with contrasting suspension element. Modules of 1/2 the dimension of bays plugged into the bridge interior.

Bottom left diagram
Suspension element exploited with the modular element plugged in. Cross section also showing extent of cantilever. Developed to exploit the excitement and energy of the position.

Top right diagram
Continued refinement of the suspension element adapting module to fit into system.

Bottom right diagram
Combination of the two ideas, keystone and suspension using the module of 1/2 the bay width and a truss system to support the pier development, combined with the horizontal circulation. Midterm second quarter development.
Left diagram

Pier point developed from a truss system with cantilever modules to solid mass form containing system manufacture, a manned firestation, and a series of offices, restaurants, or residential service areas. Fire stairs are incorporated into the structure down the piers to floating platforms at the water level.

Right diagram

Floor plan of restaurant area showing position of stairs, elevators, and service elements.

Four diagrams of pier points

From criticism in juries, trying to develop an aesthetic at pier point to satisfy personal desire.
columns resting on panel points of the truss which are supported by the bridge bed existing. The truss also spans from either end of the bridge to parking areas.

**Bottom left diagram perspective**
Shows position of truss and extension of truss from the southern end of the bridge spanning over the interstate highway.

**Top right diagram**
Early study of floor plan adaptability of 45° angles with minor horizontal circulation flow through the center and on outer edges.

**Bottom right diagram**
Module size of 15' wide by 25' long, showing preliminary residential arrangement of space.

**FLOOR PLAN DEVELOPMENT**

**Top left diagram**
Showing development of horizontal circulation element designed as a truss to span the bridge supporting the upper levels by a system of
ELEVATION STUDY

Left diagram
Isolated point showing floor levels, module size, one full bay, horizontal truss system, panel fenestration, and complexity of the elevation system.

Right top diagram
Showing 1/2 span and pier point using minor horizontal circulation on the exterior, expressed differently from the leasable modules. Also shows the use of the module.

Right bottom diagram
Elevation showing the use of a rigid connection. Abstracted flat truss carrying the horizontal circulation on two levels. Also shows the module use with differentiation of minor horizontal circulation with contrast to leased modules. Also shows that leased modules are cantilevered only where the diagonal bracing of the bridge structure does not interrupt it from popping out. The darker modules are the cantilevered elements. End of the second quarter development.
DETAIL DIAGRAMS

Top left diagram
Section through horizontal circulation truss showing views out, pedestrian circulation, tram car circulation, service circulation, and systems chase. Upper section drawing shows form of cantilever fenestration, rounded to provide maximum angle of view. Also allows for differentiation from leasable space.

Bottom left diagram
Section through cantilever showing sandwich construction with systems space below feeding into the ceiling. Curtain wall system would be applied from the exterior by crane from the top rail of the bridge or from barges below.

Right diagram
Study of how to use the floor to the advantage of the person using fenestration.
Section at midspan

Section at vertical element

CROSS SECTIONS

(End of second quarter development)
Section at pier point

Section at pier point (further development)

Shows intersection of minor horizontal circulation (curvilinear fenestration).
FINAL PRESENTATION
interior perspective

exterior perspective pier development
commercial

floor plans span 3'
big four railroad bridge

louisville, ky.

an adaptive reuse
david l. hillman
thesis study 17170
CONCLUSION

This project was an extremely overwhelming problem of grunt-work and a lot of organization. Having had little experience of this magnitude, I have gained a lot of perseverance in tackling large orders.

I only wish I could have began at this point and made this project a good example of fully developed architecture.

I dealt with the goals of linking Louisville and Jeffersonville, making an exciting and unique attraction to the area, and saving the integrity of the structure existing. These problems have been solved in my terms successfully. Many details are anxious to be developed and I would hope that I or someone else will strive to complete them.
BIBLIOGRAPHY


