

Brief Encounter: transformation of space underneath elevated expressway through surface design

by

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Bachelor of Science in Art and Design (BSAD)
Massachusetts Institute of Technology, Cambridge, MA 1999

**Submitted to the Department of Architecture in partial fulfillment of the requirements for the degree of
Master of Architecture at the Massachusetts Institute of Technology
February 2003**

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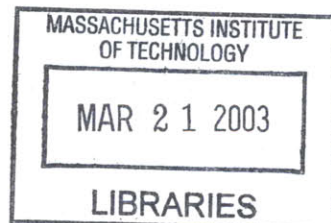


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abstract

The emergence of automobile culture has significantly influenced the development of contemporary cities since the late 19th century. On the theoretical level, fascination with the concept of “mobility” can be clearly traced from numerous visionary urban proposals by architects, ranging from members of CIAM and Team X to Japanese metabolists. Despite these creative attempts, the actual solution to the demands of motorization often resulted in erections of elevated expressways. These infrastructures are cost efficient remedy to growing traffic flow and to improve connections between points in and around cities. However, they often generate problems by breaking the continuity of urban fabric, therefore, interrupting pedestrian street life. The space underneath an elevated roadway is usually undesirable for inhabitation due to poor lighting and acoustical qualities. In regards, this thesis project intends to create an association between elevated structures and public space.

The thesis, titled “Brief Encounter”, investigates the possibility to transform the interstitial space, created by public infrastructure, into a container for pedestrian experiences. Taking the structural members of the elevated roadway as a given condition, the project aims to explore spatial qualities through various building skin/surface designs. The design concepts are guided by five parameters: usage, pattern of movement, light, acoustics, and materials. The use of natural and light-weight materials (bamboo, polycarbonate, water) is given priority. The topography generated by the surfaces responds to three program destinations: assembly, gallery/garden, and a chapel that can be transformed into an open market. These programs introduce a counter-rhythm to the everyday life, and create an anchor against the speed of automobile traffic. The goal the project is to search for a tectonic synthesis that mediates between the dynamics of different programs.

Thesis Supervisor: Wellington Reiter
Title: Associate Professor of the Practice of Architecture

acknowledgement

I would like to thank my advisor, Duke Reiter, for his constant support and encouragement. His advice and criticism have truly helped me to develop the project in ways that I would not have done so otherwise. I am also grateful for his open mind, and his ability to open and inspire new ideas. Throughout studio and thesis semesters, Duke has guided me to become a more matured designer.

My committee - Andrew Scott, Meejin Yoon, and John Fernandez - has inspired and helped me much along the way. Their insights have informed me of new ways of thinking and design. I thank Andrew for practical and generous advice; Meejin for provoking and pushing me forward with her intelligent and sensible thinking; and John for generously providing me with valuable resources on material and structure systems.

I am grateful to have Joe Ho as an “underground advisor”, who’s offered invaluable time and support for this project from the beginning to the end. He has helped me to overcome many difficulties and to see the potentials of this project. I thank him for taking this thesis to heart.

Thanks to the supportive “T Club”. Noah Luken, David McLean, and Kazuyo Oda have lent ears, consolation, and honest opinions about the project.

Finally, my most sincere gratitude goes to my family for their unconditional love and support. They have been, and continue to be, my constant source of strength, comfort, and wisdom. I especially want to thank my parents for showing me the way of life and inspiring my career path. Without them I would not be the person I am today. This book is a dedication to my family.

to my parents



table of contents

	Abstract		03
01	Introduction		09
	Background	The condition	09
		Problems	10
	General direction for the project		11
	Precedent studies	Urban-scale interventions	12
		Localized-scale interventions	13
		Temporary structures	14
	References on material systems	“Skin” categories	15
		Learning from kinetic systems	16
02	Site		18
	Overview		18
	Driving forces behind the project		18
	Specification of physical structure		19
	Site selection		20
	Urban-scale analyses		21
	Site condition analyses		24
03	Design strategy		28
04	Design Process & Exploration		31
	Program studies	Analysis & assessment	32
		Proposal	33

	Surface designs	Explorations	34
		Proposal	41
	Design proposals prior to Design Review		42
05	Material selection		48
	Supporting structure		48
	Vertical and horizontal surfaces		50
	Ground surfaces		52
06	Final design		55
	Main concepts		55
	Three tectonic components	supporting structure	58
		façade	59
		ceiling	60
	Programmatic components	garden & gallery	62
		assembly	66
		chapel/market	70
07	Conclusion		72
	Bibliographies		76
	Appendices		80
	Boards from final presentation		80
	Image credits		84

Background

The condition

The emergence of automobile culture has significantly influenced the development of contemporary cities since the late 19th century. With advancement in automobile technologies, individual ownership of cars multiplied, and city patterns were altered to accommodate increasing traffic. Mobility soon became an important issue concerning planners and architects in the 20th century. In 1933 Athens Charter was formulated at the CIAM Congress; efficient transportation was listed as one of the major problems faced by the planners at that time. As planners found formula from Athens Charter to be obsolete during the postwar (WWII) reconstruction period, new directions and concepts for urban planning began to emerge. At the CIAM Congress in 1953, the Smithsons and other young architects formed Team X to prepare the program for the 10th CIAM Congress in 1956. Their method of analysis and process of design were in terms of human association rather than functional organization, thus marking a radical break from architectural thinking of the Modernist period. The Smithson's have made important contribution to the thinking behind urban planning in the 50's and 60's. The developments of their projects are based on five parameters: association, identity, patterns of growth, cluster, and mobility.

Fascination with the concept of "mobility" can be clearly traced from many other visionary urban proposals by various international groups and individuals, ranging from European megastructuralists to Japanese metabolists: Archigram's "Plug-In City", Paul Rudolph's "Lower Manhattan Expressway", Frei Otto's "optimized path system" (using wool-thread to calculate the shape of city patterns)... just to name a few. These projects demonstrate new urban patterns and typologies with concerns to integrate or incorporate mobility and movement into daily life, such that working and living have their appropriate relation to motor traffic.

Despite these creative energies, the actual response to the demands of motorization often translates into erection of elevated expressways. Marshall Berman describes it as "the expressway world, the modern environment that emerged after World War II" (Berman, 1988). Comparing to construction of underground tunnels, erection of elevated expressways is relatively cheaper and faster. Different from addition of at-grade roadways, elevated structure requires less removal, if any at all, of existing structures. Perhaps, elevated expressway is the more cost efficient solution (even a sustainable one, when being compared to the Big Dig project in Boston) to service growing traffic flow and to improve connections between points in and around cities. Despite its cost-efficiency



FIG. 01-01



FIG. 01-02

some of the impacts that elevated expressways have on cities are quite significant. “The most important thing about roads is that they are big, and have the same power as any big topographical feature, such as a hill or a river; to create geographic, and in consequence social, divisions. To lay down a road therefore, especially through a built-up area, is a very serious matter for one is fundamentally changing the structure of the community.” (quoting the Smithsons, Lewis, 1967) Oftentimes, the construction of these infrastructures gave very little consideration to the communities in the path of the new roads, hence generating problems by breaking the continuous urban fabric and pedestrian street life. The Smithsons’ comment suggests the importance to establish a relationship between public roadway and community space.

Contrary to Robert Moses’s belief that “construction of the expressway will relieve traffic on these streets and allow this locality to develop in a normal manner that will encourage improved housing, increased business activity, higher property values, a general rise in the prosperity of the area, and an increase in the real estate tax revenues therefrom” (Robert Moses, 1961); the space underneath, and sometimes around, elevated roadways are usually undesirable for inhabitation due to poor lighting and acoustical qualities, thus in fact limiting these areas’ ability to participate in the city’s economic life.



FIG. 01-03

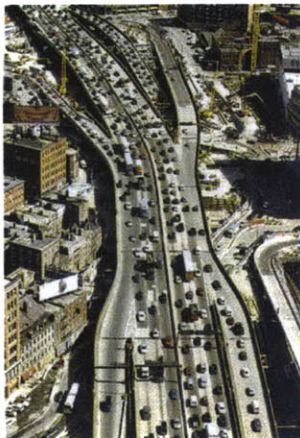


FIG. 01-04

The problems

The space underneath elevated expressways, if not already being used as transportation roadways, present the complexity of urban condition. It is a “in-between” space filled with instabilities, strangeness, imprecision, formlessness, and indeterminacies. In addition, these space often have poor physical conditions: excessive noise and lack of natural light. Therefore, although the real estate is high in metropolitan area, these spaces are usually undesirable. If they are being utilized at all, the programs are often storage, parking lot, gas station, car wash, or other facilities that service the transient traffic. They bear no association to life of inhabitants.

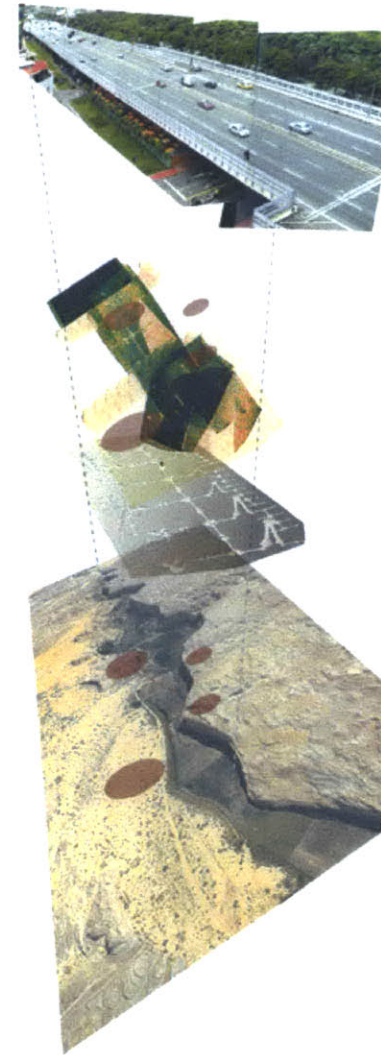
Advance technologies have made it possible to “hide” elevated structures underground. The Boston Big Dig project is one that responds to the problem of fragmentation in urban fabric by sinking transportation conduit. The solution of bringing the entire Central Artery beneath ground level is favorable to the city, as the people and economy would benefit from the creation of new open land. However, construction of the project has proven to be extremely costly, time-consuming, and environmental unfriendly.

Since “hiding” elevated expressway is not the optimal solution, is there a way to deal with existing condition? The thesis of this project is based on the belief that the unstable realities presented by the space underneath

General direction for the project

Without a specific program or building type in mind, the goal is to bring spatial intensity and sensibility through exploration and testing of ideas and possibilities. The project will address issues on urban, building and tectonic scales. Concerns for: linking the urban fabric (urban scale); integration of pedestrian experience, mediation between infrastructural and human scales, temporality (building scale); aesthetic, cost, and ease of construction (tectonic scale); will all inform the development of the project.

In *Structure, Space and Skin*, Nicolas Grimshaw comments, "even bridges are more than simple feats of engineering. They create space around and underneath themselves, and between the members; they lack only a skin... These structures define space. They define an area. They become symbols." (Grimshaw in lecture titled "Structure, Space and Skin", ed. Moore, 1993) This thesis will use the structures of the elevated expressway as a given condition to focus specifically on design of surfaces (façade, ceiling, ground). Final synthesis of tectonic expression and programmatic proposal will attempt to introduce a new environment, new experience, new possibility.



Precedent Studies

Urban-scale interventions

The case-study projects deal directly with problem of mobility and urbanism. They express the concern for the invention of building types appropriated to the new urban pattern that motorization demands. Each scheme proposes integration of pedestrian circulation and motor movement.



FIG. 01-05



FIG. 01-06



FIG. 01-07



FIG. 01-08



FIG. 01-09



FIG. 01-10

01 Opus Plan in Algier by Le Corbusier

Mobility pattern built into the city form, developed before the needs of modern transportation were matured. The two innovative ideas in the scheme were the introduction of a superblock that allowed for individual building types and the use of a highway to weave together the infrastructural dwelling. The project maintains an intimate relationship between road and housing zones.

02 Hauptstadt Berlin Proposal by Alison and Peter Smithson

The Smithsons strived to make a connective tissue between automotive and pedestrian. A series of perforated, open “pancakes” for pedestrian traffic flow over a lower level of traffic between buildings and city areas, providing an open surface zone for potential programs.

03 Trinitat Cloverleaf Park in Barcelona, Espanya by Enric Batlle and Joan Roig

The park resolves the crossing and intersection of the city’s new outer ring road and the motorways leading to the north and east. Two main goals of the project are to solve the gigantic scale of the highways and the road infrastructures, and to upgrade the edges of the district.

04 Manuel de Sola-Morales’s Moll de la Fusta in Barcelona

A project attempts to reconcile the presence of high-speed urban road with the quiet pedestrian areas. The highway is hidden and through a sectional manipulation of the road surface, which becomes links over the road for pedestrian traffic. The project also deploys various programs in close relation to, or occasionally over, the road that are integrated with pedestrian circulation.

05 Flamengo Park in Rio de Janeiro by Roberto Burle Marx

He created a large, open plan of a waterfront park through a sinuous highway winds. The plan provides views for the drivers on the highway, which is laterally traversed by a set of gently arching pedestrian bridges connecting parks, gardens, and museums.

Local-scale intervention

Specific building types that designers have proposed in order to occupy the space underneath elevated expressways. Similar to this thesis, these projects try to resolve the poor conditions of the underside space, as well as making connections to traffic (motor or pedestrian) above and around the space.

01 Motorway Development Center and A14 Viaduct in Bordeaux, France by Odile Decq/Benoit Cornette

The project consists a viaduct connecting an underground interchange to a motorway bridge, and the Motorway Development Center underneath the viaduct. The building is to maintain the transparency and visual continuity of the park. There is a clear division in the building's three main functions: the administrative building above ground floor, the police on the ground floor, and the garage in the basement.



FIG. 01-08, 09, 10

02 Workshop/studio under London's Westway (A40) by Great Western Studios

A scheme shows the possibility of making usable space from the most unlikely of sites. A project comprised of 97 workshops/studios gathered around a central courtyard, which uses the underside of the Westway as its soffit. Natural light penetrates into the concealed courtyard space through high-level perimeter glazing. Since the site occupies one of Brunel's 1830's railway siding, good acoustics are essential. The double-glazing incorporates acoustic laminates, such that no sound is transmitted through the Westway deck into the building.



FIG. 01-11, 12

03 Westway of London and Westside Highway of NYC

Localized attempts to make use of undesirable space underneath elevated structures, which are enclosed and turned into storage or carwash/gas station.



FIG. 01-13

Temporary structures

Numerous examples of temporary structures have been studied for this project - from large-scale pavilions, to small exhibition design. For the purpose of illustration, a few projects are selected for their inventive design of standardized/modular parts, lightweight and easily workable materials, joining techniques allowing fast construction and disassembly, and/or repetitive geometry. These are some common design principles shared by exterior and interior projects alike.

FIG. 01-14, 15
Temporary performance spaces created with tensile and pneumatic structures



FIG. 01-16, 17, 18
The Venezuelan Pavilion, Waclaw Zalevski and C. Hernandez Merchan, at the 1992 Exposition in Seville is an accordion truss that arrived from Venezuela in two cargo containers. The main structure was erected in less than a day. The pictures show the process of deployment.

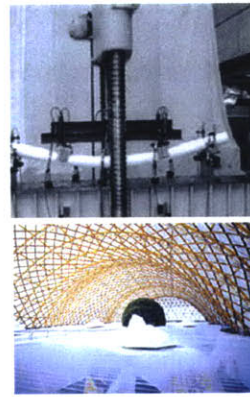
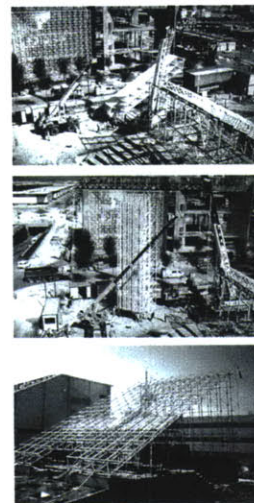


FIG. 01-19, 20
The Japan Pavilion by Shigeru Ban at the 2000 EXPO Hannover. The frame consisted of 440 20-meter-long paper tubes. A gigantic paper tube lattice of 72 meters by 48 meters was assembled on site, the surface was then raised slowly, with a jack, to create a shell. Top picture shows performance of bending test.



FIG. 01-21, 22
The IBM Travelling Pavilion by Renzo Piano is portable building. The load-bearing frame consists of glu-lam arches with the intermittent spaces between the arches being transparent sheets of polycarbonate. In its unaffected simplicity the refined and repetitive series forms a rich pattern..



FIG. 01-23, 24
Interim Bridge Project by Kennedy & Violich Architects. The prototype uses a standard wood frame construction system to form a conical volume. This form expands the gap between the structure and the exterior skin to provide space for the exhibition and establishes a generosity of enclosure along the public walkway.

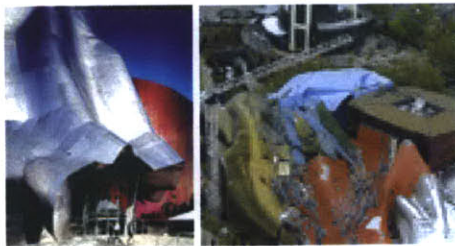
References on material systems

"Every process has its necessary form which always results in functional forms. They follow the law of the shortest distance between points; cooling occurs only on surfaces exposed to cooling; pressure only on points of pressure; tension on lines of tension; motion creates for itself forms of movement -- for each energy there is a form of energy." (quoting Raoul France, Moholy-Nagy, 1965)

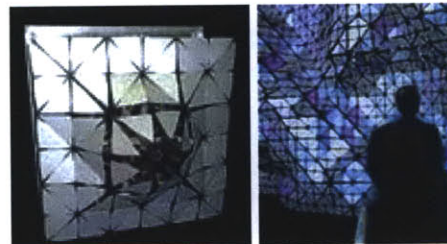
"Skin" categories:

Can surface do more than providing shelter and defining boundary? How do surface structure, stimuli from the environment, and the users influence each other, hence informing the way of occupation? How does surface captures the temporal changes?

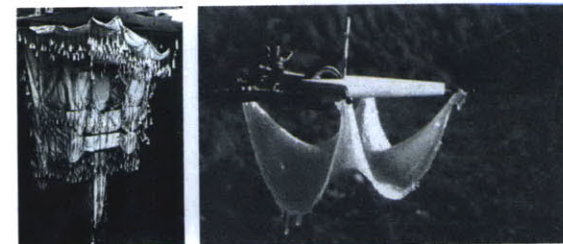
Since this project primarily employs design of surface structures, a general categorization of such structures based on their usage and functions is assumed. These categories are derived from hypothetical analysis, thus they might not accurately reflect the original design intentions. This study is a tool to organize and explore ideas for the project.



Sculptural skin: FIG. 01-25, 26
reflective of advanced fabrication method and computer-aided design process
(Frank Gehry, Experience Music Project)



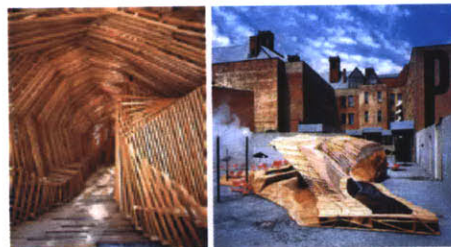
Sensory skin: FIG. 01-27, 28
digitally controlled movement
(dECOi, Aegis Hyposurface project)



Structural skin: FIG. 01-29, 30
responsive to dynamic forces
(form-finding experiments conducted by Heinz Isler and Antonio Gaudi)



Functional skin: FIG. 01-31
responsive to environmental changes



Dynamic skin: FIG. 01-32, 33
responsive to usage needs
(ShoP Architects, Dunescape project)



"Sign" skin: FIG. 01-34
literally tells the type of space
(Frank Gehry, chain link veils for the parking structure at Santa Monica Place)

Learning from transformable structural systems

Akin to the study of temporary structures, examination of these mechanic systems reveals the adoption of several design principles: the use of lightweight and workable materials, repetitive geometry or grammar (of members or formed-parts), and inventive joining device and technique.

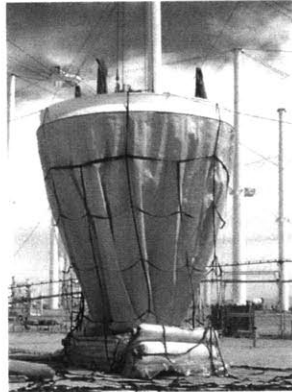


FIG. 01-35



FIG. 01-36

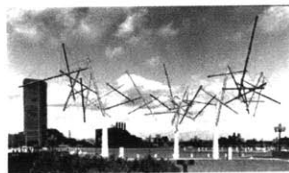


FIG. 01-37

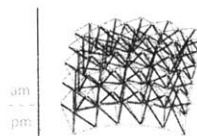


FIG. 01-38

01 Membranes

Frei Otto, Horst Berger, and David Geiger argue that only fabric membranes are truly lightweight, so only membranes are suited to spanning large areas. (Robbin, 1996) Membranes -- inflated by air pumps, retched over tent poles, or hung from exterior scaffolding -- are desirable for their quick construction and disassembly, their translucence, and their startling appearance.

“Surface of exchange” -- membranes can let anything in (sunlight, heat, fresh air), keep anything out (ultraviolet light, cold, moisture), push anything out (noise, excess heat), and keep anything in (heat, sound, coolness, moisture).

Not self-anchored -- tension structures must be attached somewhere; otherwise, the tension disappears and the membrane flies away. For this project, elevated structure could be considered as an inverted heavy anchor.

02 Tensegrity

Tensegrity systems are self-anchored; they pull only against themselves. Such structures are self-stressed in a “closed system. Choice of geometry heightens efficiency of structure

Tensegrity systems are the purest expression of forces: in a pure tensegrity structure the compression members do not touch, and relatively few compression members (struts) are suspended in a net of pure tension members. Buckminster Fuller defines tensegrity as “small islands [of compression] in a sea of tension.” (quoting Fuller, Robbin, 1996)

Pure tensegrity structures entail busy nest of cables, connectors, and rod ends that are visually overlapping from every vantage point. Visual simplicity can be achieved through hybrid tensegrity structure, where compression bars do join at their ends.

03 Deployable structures

Deployment concerns mainly the construction speed. Therefore, complete preassembly of an entire structure in a factory, the collapsing of the structure for shipping, and the unfurling, or deploying, of the structure on site are more important than the premanufacture of elements.

Avoid building structures twice -- eliminate temporary scaffolding

Mechanisms: pantograph (scissor), or foldable rhombic (unfolding of panels of various shape)

Usually covered with membrane or panel (panels adds structural stability)

The systems can be retractable and openable

Mamoru Kawaguchi's Pantadome system is exemplary to demonstrate the possibility of interactive buildings that change shape with use. Kawaguchi imagines a fundamentally adjustable building -- roofs of large stadia can be stepped down for small events or lowered for acoustical concerts; buildings can change shape at different times of year or perhaps even be flattened between uses to minimize heating or cooling costs.



FIG. 01-39

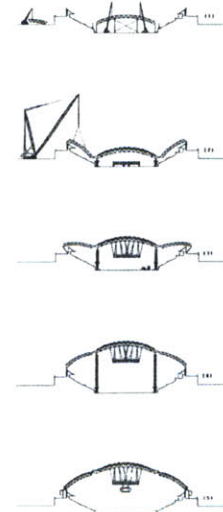


FIG. 01-40



FIG. 01-41



FIG. 01-42

04 Kit of parts

This concept is a combination of methods and mechanisms of aforementioned systems. "Kit of parts" relies on modulation and rhythm -- the relations of pattern and unit.

Standard parts could generate non-repeating pattern. Three-dimensional space is easily attainable.

Overview

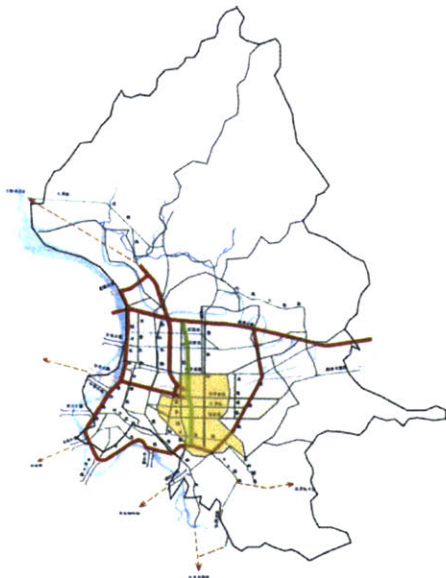


FIG. 02-01

Planning and construction of circumferential expressway around Taipei metropolitan area started in 1973 as a response to the increasing congestion resulted from the population and car ownership booms since 1968. Chien-Kuo Expressway made up the eastern border of the initial circumferential system; however, as the city continued to develop eastward, Chien-Kuo became the major north-south bound infrastructure centrally located in the city, crossing 9 districts (see map). The structure is flanked by two to three-lane street-level traffic on both sides; the entire Chien-Kuo roadway (street-level and elevated) has been designed to be one of the two main green avenue strips to connect the park systems in the city (similar to Commonwealth Mall of Boston that completes the Emerald Necklace). Trees are planted along the elevated expressway, forming a boundary for the interstitial space underneath.

Construction of the Chien-Kuo elevated expressway created a total of 9-hectare (968,800 sq.ft.) underside space. Ownership of the land belongs entirely to the city government. Since the entire area lies within the heart of metropolitan Taipei, the government has devised a zoning policy to maximize economic development and land use opportunities in 1978. The policy permits the underside space to be used -- where deem necessary and under no interference with street-level traffic -- for public facility (such as parking lot, fire and police station, gas station, and storage), retail market, or temporary marketplace (to be operated on weekends or holidays to serve the communities). The goal of the policy is to supplement public space and facilities to better serve the city, as well as to prevent void or misuse of valuable public land. (Taipei City Government, Plan for Development, 1979)

Driving forces behind the project

Selection of Taipei to be the site of implementation for the project is based on personal attachment to the place, as well as realizing the particular urban characteristics suitable for this project. Having grown up in the city, I have witnessed constant changes taking place at an amazing pace. While in search of a new identity to meet the standards for a "contemporary city" in the age of globalization, Taipei has retained much of its culture and tradition. There remains a strong association between the people, streets, and open space.

One of the most interesting architectural vernaculars in Taiwan is the “street arcade”. This is a covered walkway formed as ground level of buildings sets back from the street. Historically, “street arcade” was a sheltered space set up by stores to conduct business. During the period of Japanese occupation in 1930’s, the feature was officially included in the zoning code as area dedicated to pedestrian movement. Today, the arcade culture evolved to become a particular element to maintain the continuity and energy of street life.



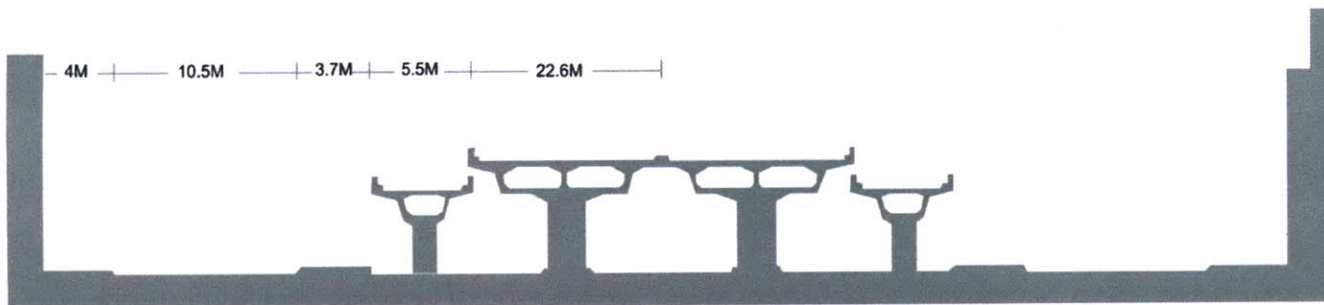
One of the Taipei urban planning policies is dedicated to the utilization of space underneath Chien-Kuo Expressway. The most fascination aspect of the policy is the transition between weekday parking lot and weekend open market, for it generates public activities in an environment that generally excludes such experience. The weekend market has been successful since its opening 30 years ago, and it has become a special character of the city. Its transitory emergence (only on the weekends) certainly does not imply a short life span. Much can be learned from the transformation of programs (parking and market): its flexibility, multifunctionality, and temporal duality would inform much of the development for this project. However, the space still seem architecturally disengaged from the urban scene. This project will propose a design to bring forth such connection.



The elevated structure totals 5375-meter (3.34-mile) in length, crossing the entire metropolitan center of Taipei. The width varies from 70-meter (230 ft.) to 20-meter (65 ft.) according to the traffic volume it accommodates (at one instance, at the intersection with Jen-Ai Ave., the width of the structure reaches 100-meter). Average clearance height underneath the structure is maintained at about 5.5-meter (18 ft.). The section with most clearance height (>6m, or 20 ft.) is designated as location for the double-story retail market.

Specifications of physical structure

The entire structure is of reinforced concrete box girder construction, with double to triple column depending on the transverse span. Ramps are supported by single columns. (see sectional diagram)



Site selection

For this project, a 600-ft zone between Jen-Ai Avenue and Shin-Yi Avenue is selected as the site (see map). The width of the elevated structure in this section averages at about 95-ft. Jen-Ai Avenue is the other one of the two main green avenue strips of Taipei. This section is surrounded by corridors of heavy pedestrian activities (Jen-Ai and Shin-Yi being major east-west thoroughfares, Shin-Shen Ave. and Fu-Shin Ave. being the north-south streets parallel to Chien-Kuo). It is also currently part of the areas that gets transformed into the weekend market.

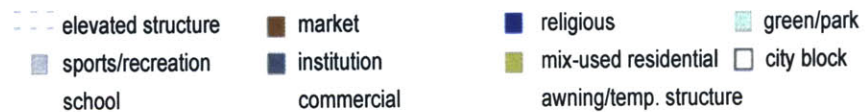
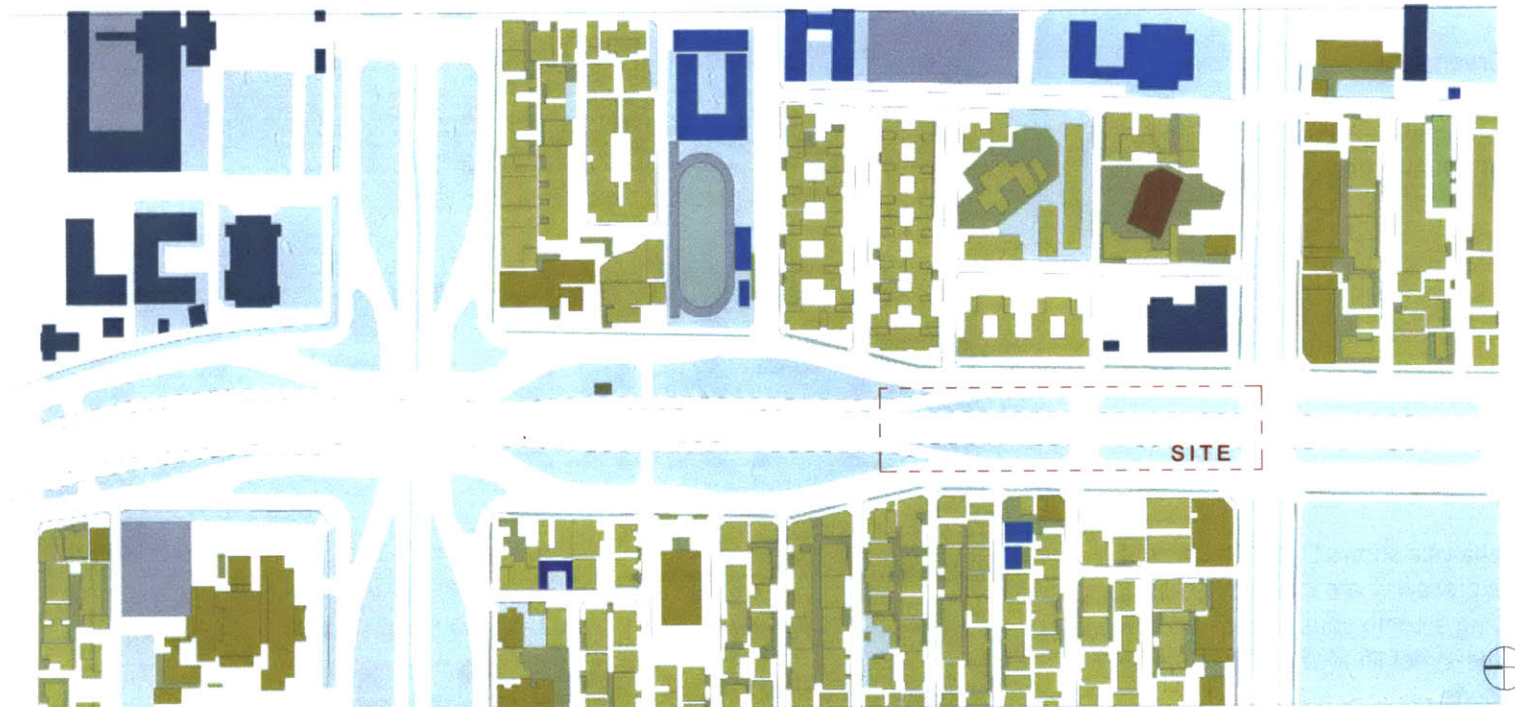
site



Urban-scale analyses

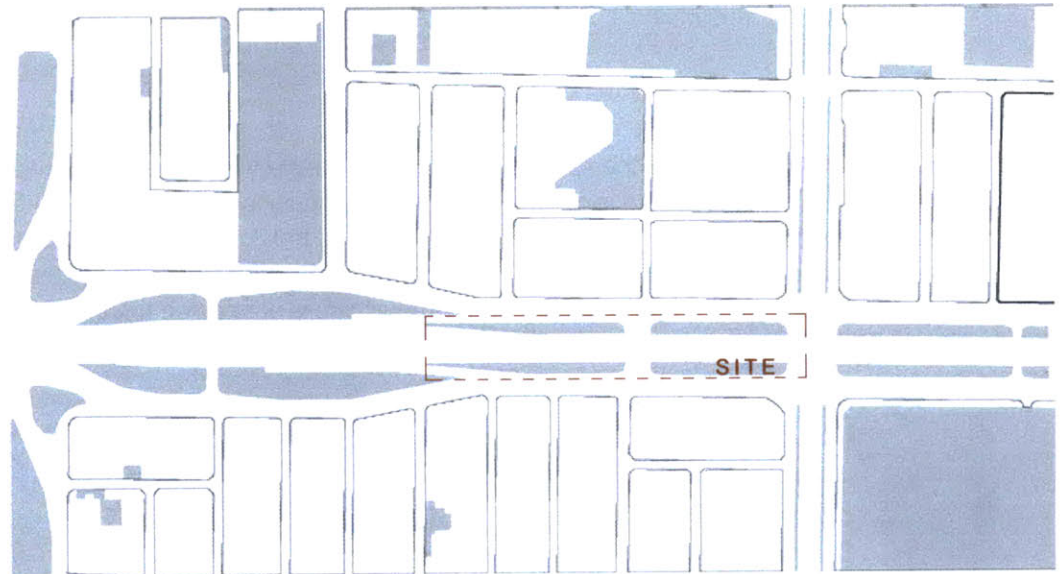
01 Usage:

the zoning map shows that the site is surrounded primarily by mix-used residential buildings, some are large scale apartment complexes built to replace slum/temporary housings. There is also a concentration of large governmental and education institutions: the air-force ground training base on the northeastern corner, district postal office on the southeaster corner, private middle school, and a public high school further to the east. To the southwest is the recently developed urban park (replacing slum housings), which is connected to other park systems around the metropolitan area by the two green avenues (Chien-Kuo Ave., and Jen-Ai Ave.).



02 Green space:

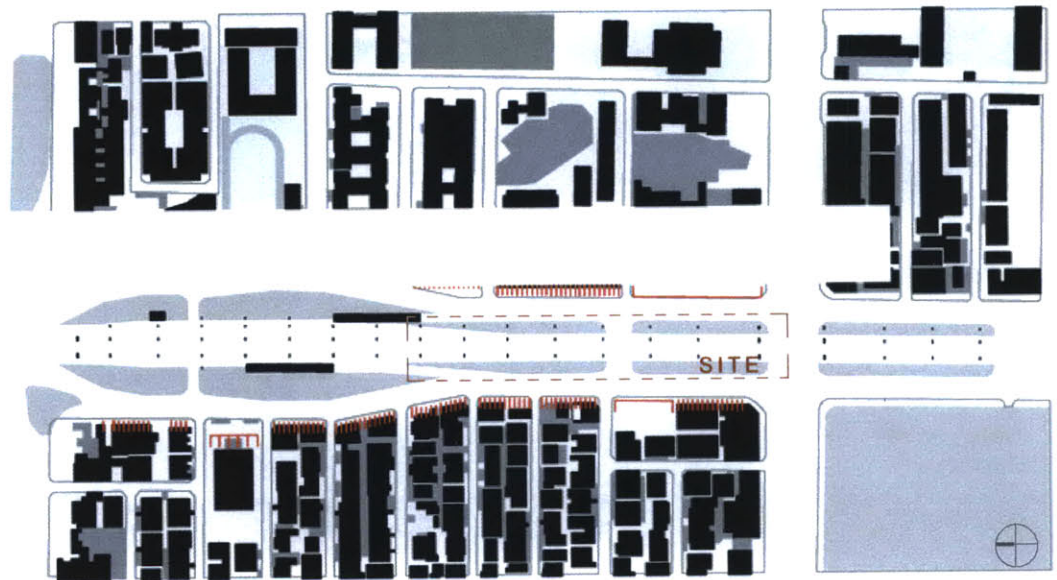
showing the Da-An urban park and two green avenues

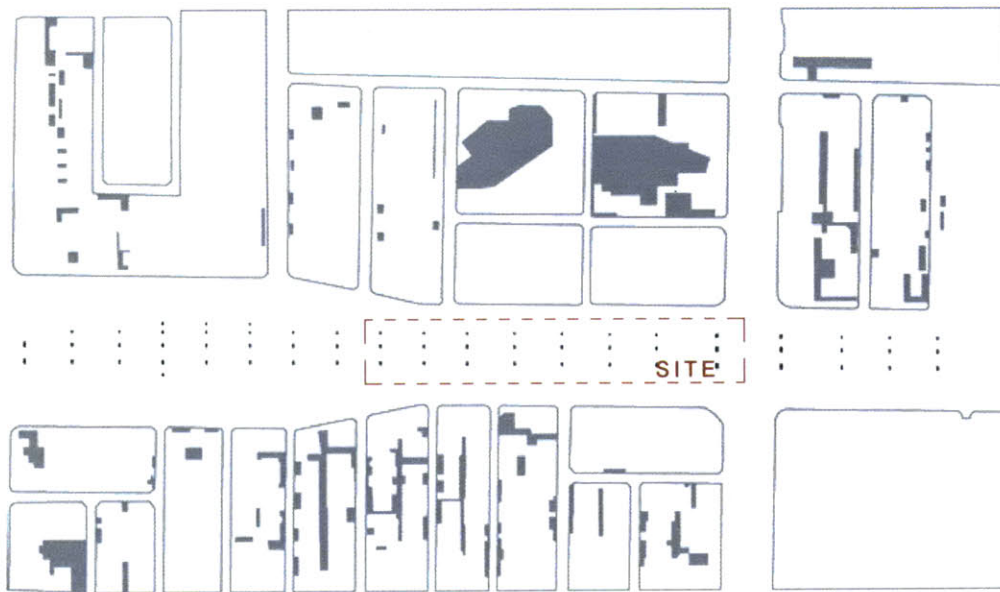


03 Street-level activities:

this analysis shows that both sides of the expressway are lined with retails, implying a continuous pedestrian flow and the street lifestyle of these neighborhoods.

private corporate commercial storefront





04 Temporary enclosure:

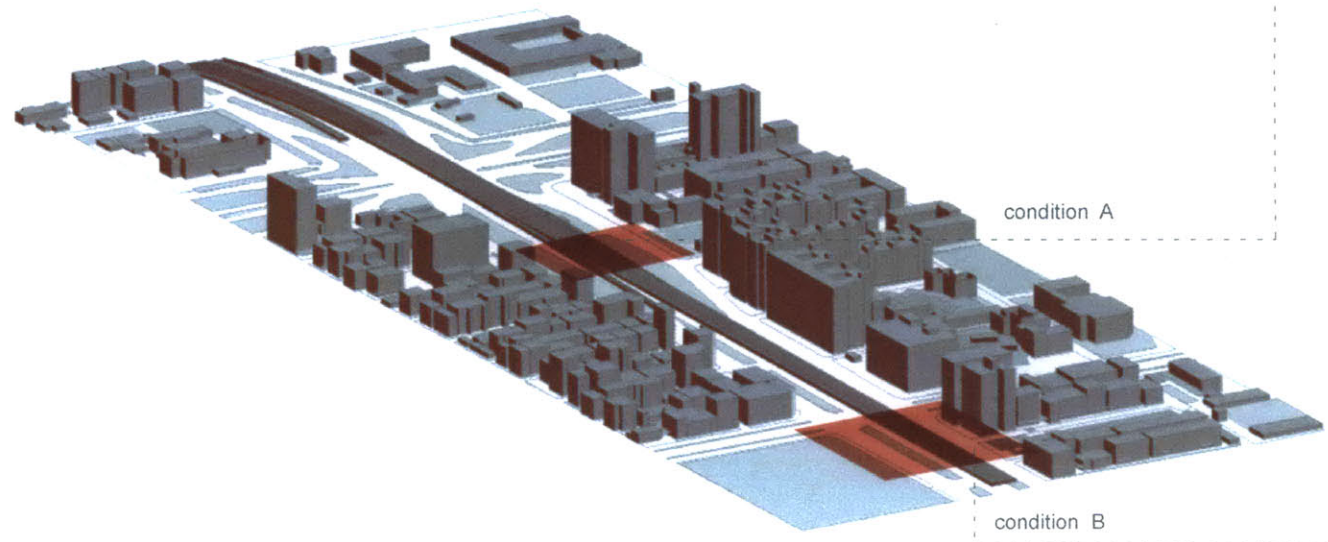
similar to “street arcades”, this is another local vernacular. The technique uses temporary sheltering devise (usually polyester, polycarbonate, or other cheap polymer sheets) to claim space for personal or community use (the grocery market area (brown, in zoning map) is a large-scale temporarily enclosed space). Although such structures are “temporary”, the life spans of these spaces can sometimes last as long as those of the buildings. These space are not in accordance with the zoning law, however, their existence composes an interesting disorganized pattern of the urban landscape, unique to the city of Taipei.

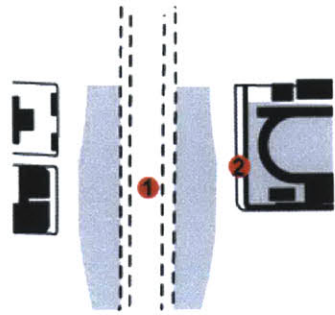
Site condition analyses

01 Acoustics

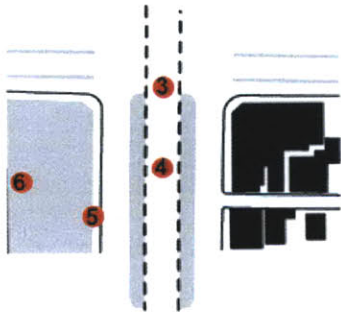
According to principles of acoustics, if the noise source is outdoors and its dimensions are small compared with the distance to the monitoring position (ideally a point source), then as the sound energy is radiated it will spread over an area which is proportional to the square of the distance. This is an 'inverse square law' where the sound level will decline by 6dB for each doubling of distance. Line noise sources such as a long line of moving traffic will radiate noise in cylindrical pattern, so that the area covered by the sound energy spread is directly proportional to the distance and the sound will decline by 3dB per doubling of distance.

The site is bombarded with noise from moving traffic in all directions. The noise level is the highest at streets intersections. Contrary to earlier on that the underside space will experience noise from moving traffic and vibration from the structure above, on-site ion and measurement actually show that almost no noise is transmitted through the elevated structure. This is probably attributable to concrete being a highly sound-absorptive material.

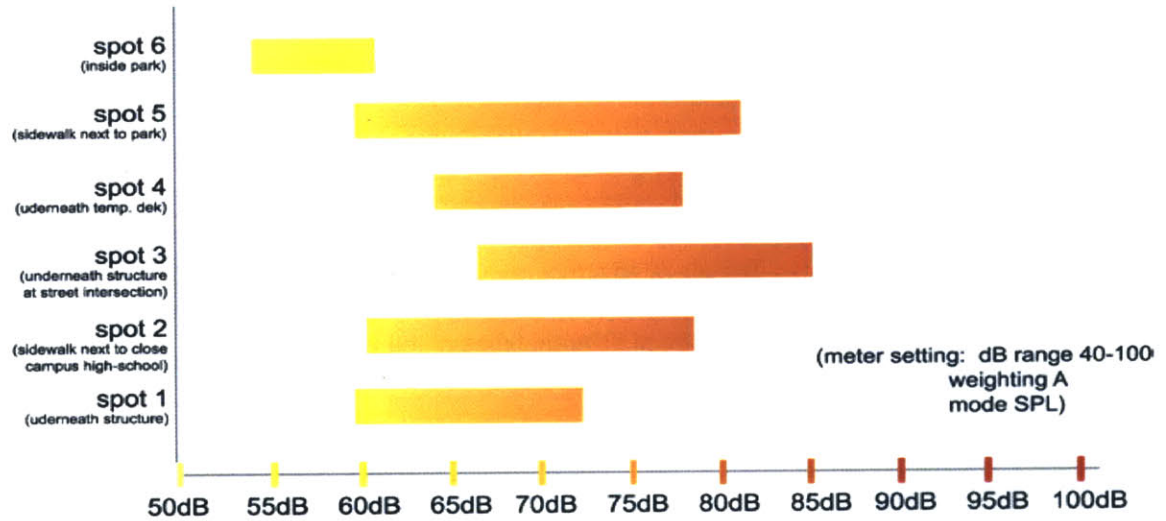




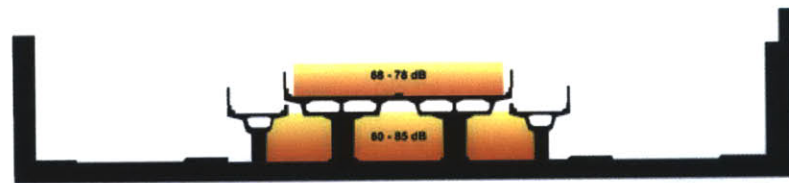
condition A: moderate traffic surrounding enclosed (school)



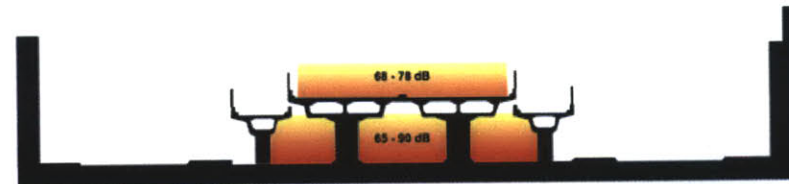
condition B: heavy traffic surrounding buffered (park)



Decibel levels measured throughout the site



weekday parking



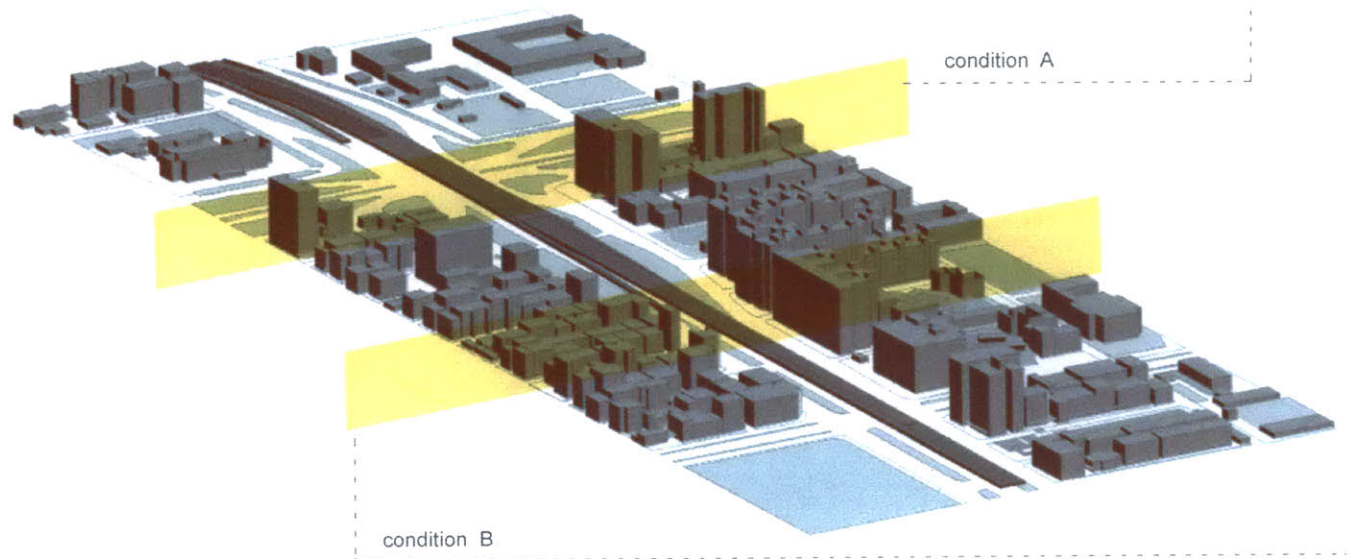
weekend market

Decibel levels measured above and below the structure



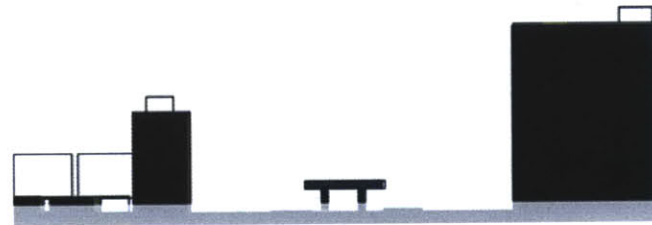
02 Lighting

The elevated structure runs in north-south direction, therefore the lighting conditions drastically vary throughout the day. The shadow diagram shows the average lighting condition derived from Lightscape analyses of different times of the year.

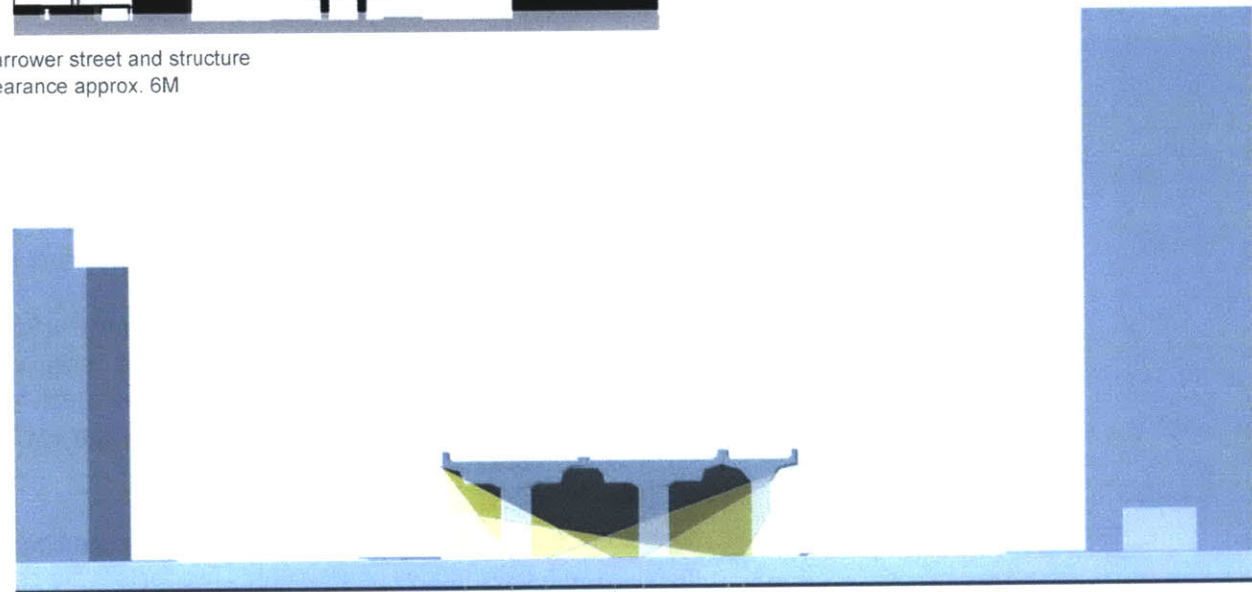




condition A: great distance of setback
wide sectional span of structure
clearance approx. 4.7M



condition B: narrower street and structure
clearance approx. 6M



Average lighting condition
throughout the day

12pm
2pm
7am
4pm
8am
5pm
10am

Since the project has identified a rather common urban condition that presents endless avenues and potentials for design, this project attempts to address the condition with focus on devising an architectural intervention on a smaller, local scale, while making a link to the tradition and culture of Taipei. The objective is to explore new possibilities in response to the 5 design parameters derived from results of site analyses and precedent studies. They are:

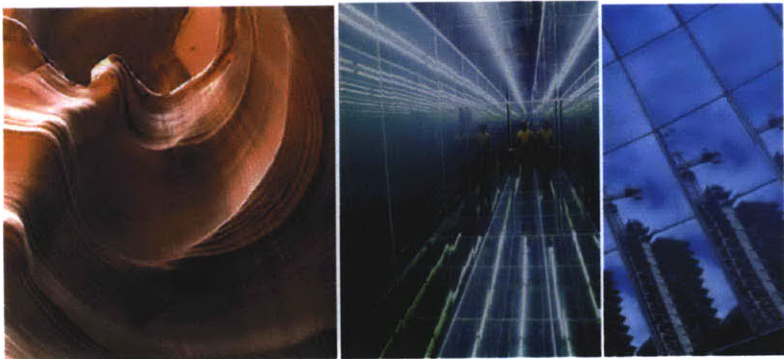
usage
pattern of movement
light
acoustics
material

The design methodology will be based on two parallel processes of explorations: program and tectonics. The two processes may seem disparate at times, but discoveries from each will inform the progress of each other and open new ideas. The final design will be a synthesis of both processes, a materialization of concepts, a unity of form and function. The design will strive to address issues on three levels:

on urban scale: This project is a study to test design ideas for creating new forms of urban public space to fill the breach in the urban fabric. This will be a provisional intervention that could possibly be applied to other locations beneath elevated structures. Temporality gives the project the chance to test its influence on the perceptions, and possibly future use, of such public land.

on building scale: The project will focus on integration of pedestrian experiences and mediation between infrastructural scale to human scale. The design will attempt to introduce spatial transformation of intimidation into intimacy. The architecture will break up a space that was rigid and monotonous by virtue of its scale, in ways to allow users to participate there at a personal scale and to feel entitled to the space.

on tectonic scale: The concept of a temporary intervention calls for the need to use affordable materials with easy modes of assembly. Two factors are crucial to the design: the material choices for surfaces, and the activation of their inherent properties to direct sound and light to correspond to different programmatic needs. This thesis project will search for ways to use local building materials and construction methods inventively to enhance public space experience.





This section documents the two processes of design exploration. These two processes are intended to be executed parallelly, such that they inform the progress of each other to help generating new ideas.

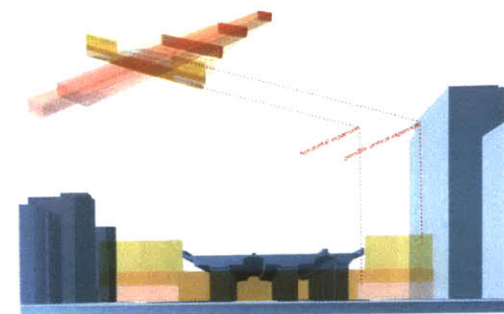
Initially, the premise of the project was to develop of a temporary structure that could be relocated anywhere underneath the elevated expressway to facilitate public use, with no specific program in mind. However, adoption of such strategy soon limited the potential for this project. General openness seems suitable only when all desired events are fully programmed in advance, as in the case of a convention center: it is flexible and open, but it does not engage itself in how events and situations emerge.

In order for the project to establish its identity, it must be infused with certain programmatic complexities; hence, the investigation for new possibilities.

04 design processes & explorations

Program studies

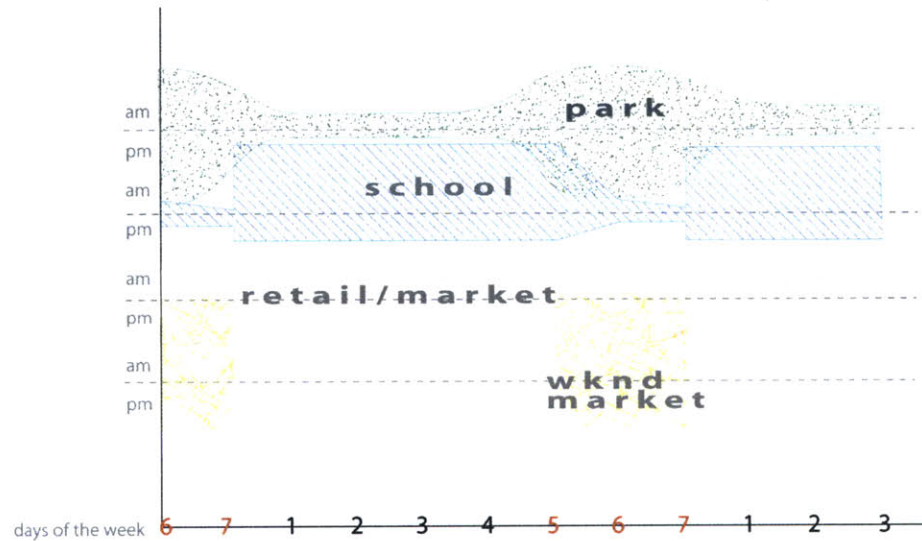
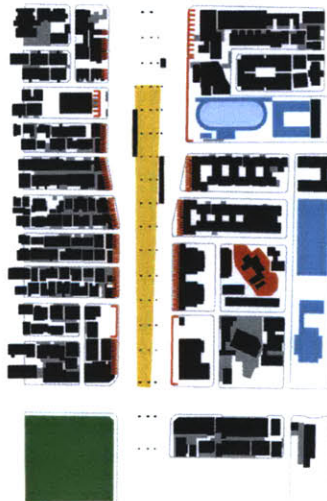
Possible zones for expansion



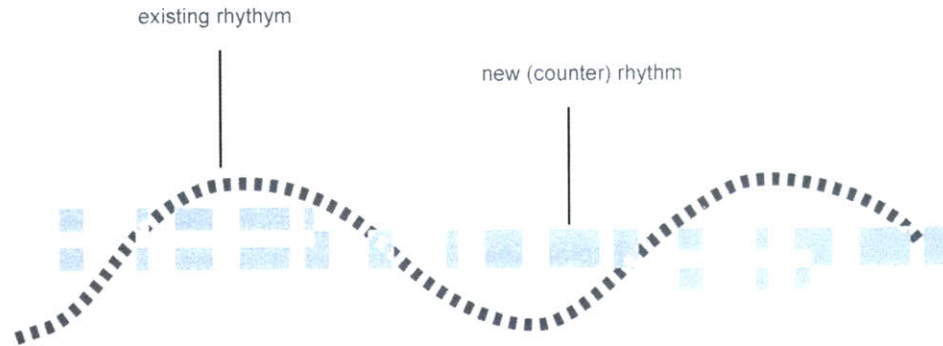
Analysis and assessment

The diagrams below illustrate the intensity of activities over the course of a week, reflecting both day-time and night-time intensity of use. When the individual patterns are merged together, they seem to morph into each other, hence forming an overall rhythm.

Question presented was whether to introduce a set of program that would serve people from different activities throughout the day (more retail/market oriented), or try to introduce a counter-rhythm against the transient pedestrian flow. What are the types of program that takes on a significant play of light? What kind of movement, or non-movement, can be generated? Would the environmental noise be buffered by these programs?



Analysis of rhythm/patter of existing programs around site



Proposal

“Instead we see two tendencies. The first is the erection of “default buildings,” that is, general architecture that represents corporate culture and the optimization of capital. A default building in Montreal will be very similar to one in Mexico City because both are functions of the same formula that seeks a return on investment. The second tendency is toward what the Spanish architect Emilio Lopez-Galiacho calls “vampire buildings,” symbolic buildings that are not allowed to have a natural death, but are kept alive artificially through restoration, citation and virtual simulations. Vampire buildings are forced to be immortal due to “architectural correctness.” (Rafael Lozano-Hemmer in “Alien relationships from Public Space”, ed. Brouwer, Transurbanism, pg146)

The two tendencies described by Lozano-Hemmer are what the project tries to avoid. The proposed program(s) should be informed by the value of public space in Chinese culture and tradition. An open market, characteristics of Chinese culture, will undeniably attract pedestrians and generate activities. However, seeing that the area around the site already has an intense association to consumption, this project seeks alternatives from the homogeneous shopping experience in order to instill a new sense of street life, to possibly install different kinds of dreams than the ones that everyday life generates. The interstitial nature of the underside space allows for experimentations with creativity and imagination. Precisely because it is “leftover”, the space could play by different rules.

The final programs proposed for the site comprised of three components: a CHAPEL (which transforms into a WEEKEND MARKET, playing on the provocative notion of changes between the sacred and the profane), an ASSEMBLY space that accommodates from casual performances to night time theater, and GARDEN and GALLERY serving as the buffer and extension zones between the two destinations. Fluid movement is allowed throughout the site.

Community uses of public space



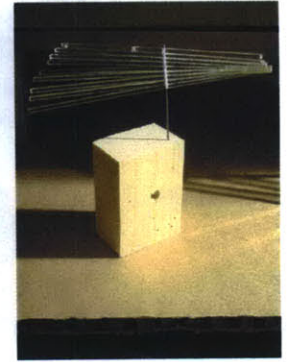
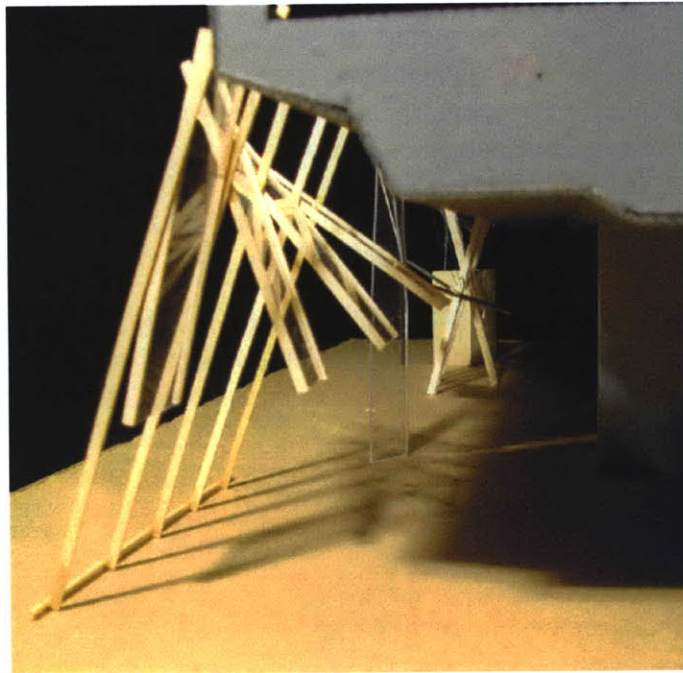
Surface designs

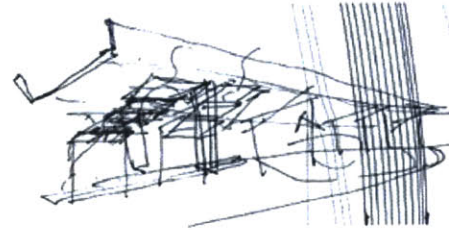
Information on materials and constructions accumulated from precedent studies serve as the basis for these design explorations. Ideas are mostly generated from sketches; some are translated into computer or physical sketch models with greater details for visualization and assessment. All ideas are concerned with at least one the four design parameters: usage, pattern of movement, light, and acoustics.

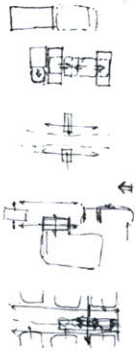
Explorations

EXP_01 Interaction with natural light:

Using information from the site lighting condition to find ways in which natural light is reflected, radiated, or filtered to render different spatial qualities.





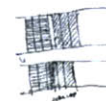
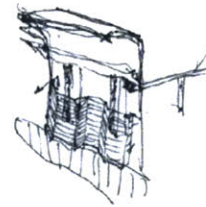
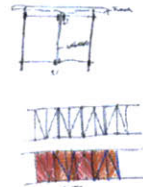
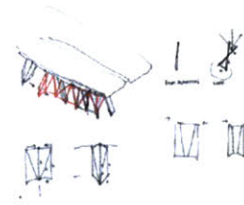


EXP_02 kinetic parts:

This series look into various surface compositions made transformable via different joining or supporting mechanisms, which allow movements like rotation, sliding, pivoting, folding, etc. These compositions, in their different states, form either enclosure or partition to define space of different sizes or direct movement of users. Consequently influencing the function of the space and way of occupation. The premises of these design exercises are to use kinetic parts to mediate between infrastructural and personal scales, and to modulate the underside space. The goal is to find certain composition(s)/technique(s) that are most versatile in spatial definition and least mechanically intensive.



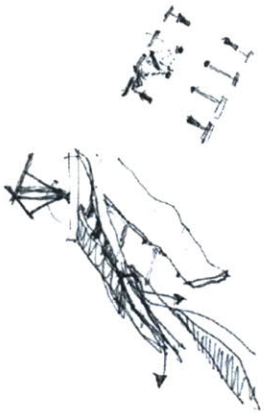
folding panels



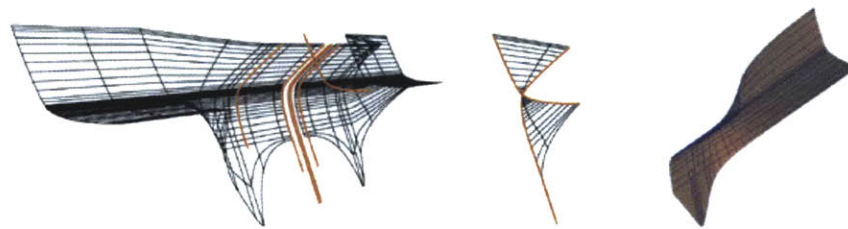
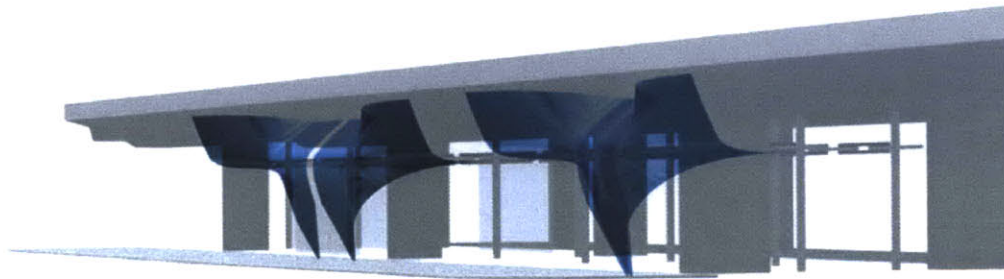
sliding members



changing between volumetric and planar definition



pivoting

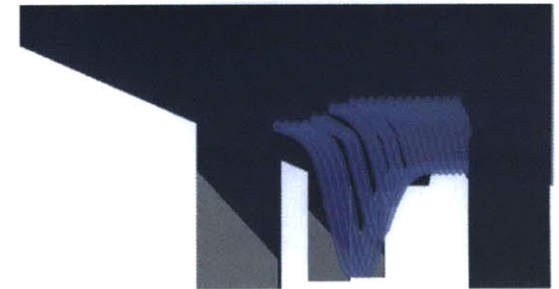


rotating members:
manipulation of standard or modular members to generate
flexible surface designs to contrast the rigid bridge structure

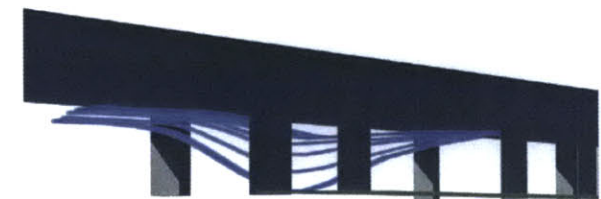
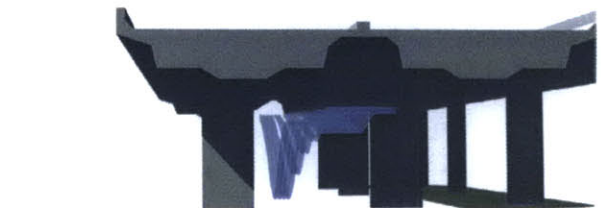
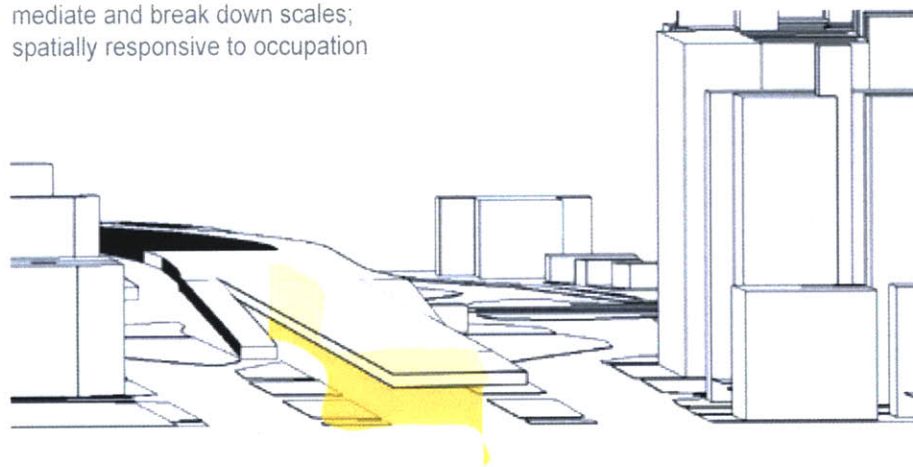


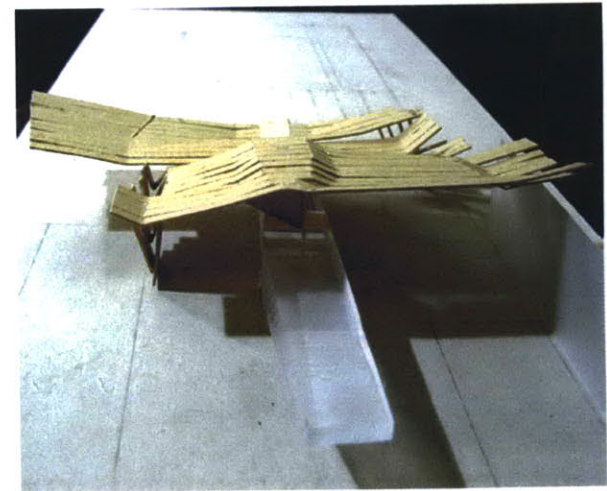
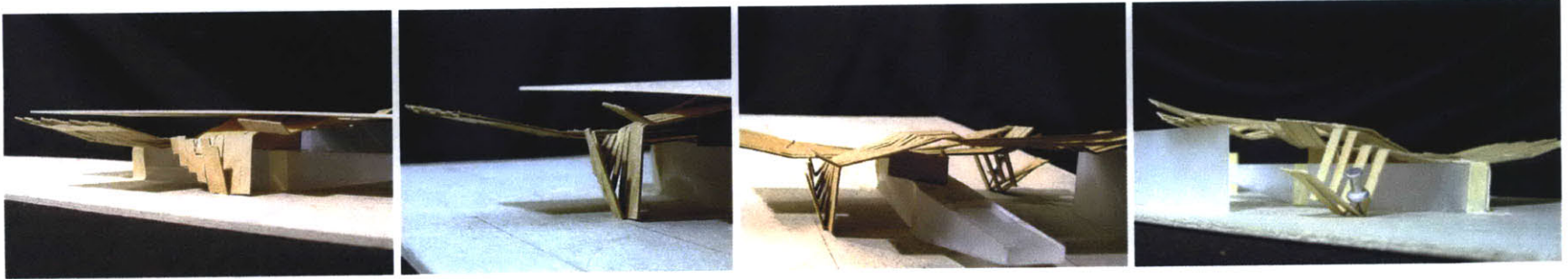
EXP_03 creating smooth topology:

These are proposals of using horizontal surfaces to create expansion and contraction of space. Smooth, curvilinear, or continuous surfaces help to moderate the monotonous repetition of space defined by the columns.

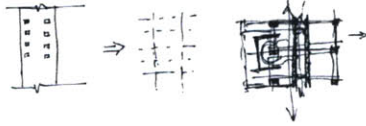


modulate the linear interstitial space:
mediate and break down scales;
spatially responsive to occupation

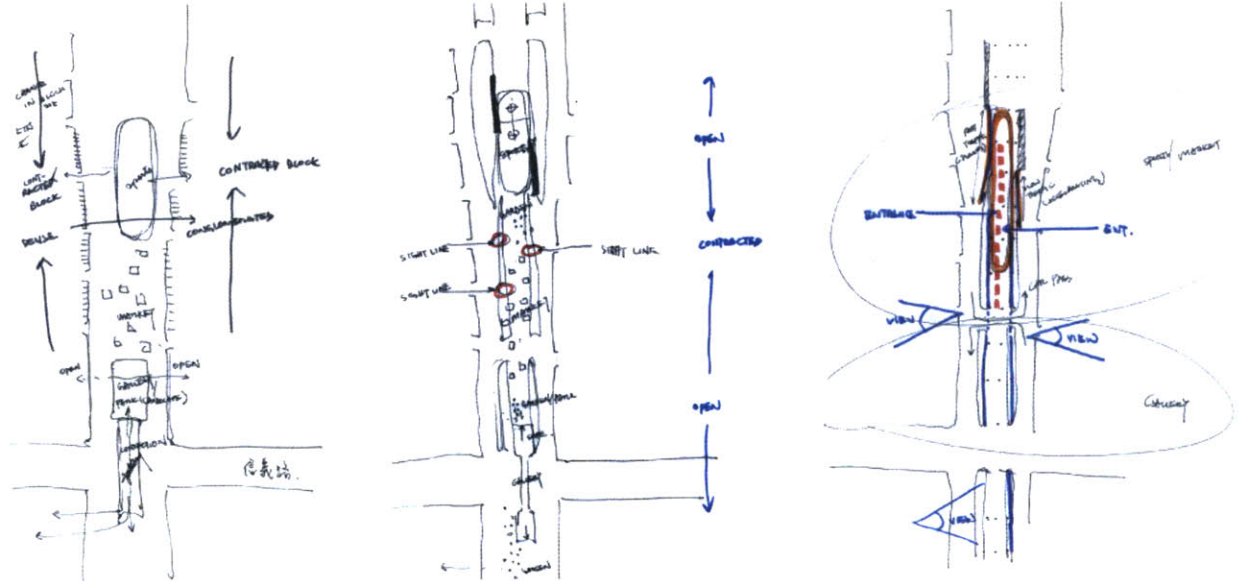


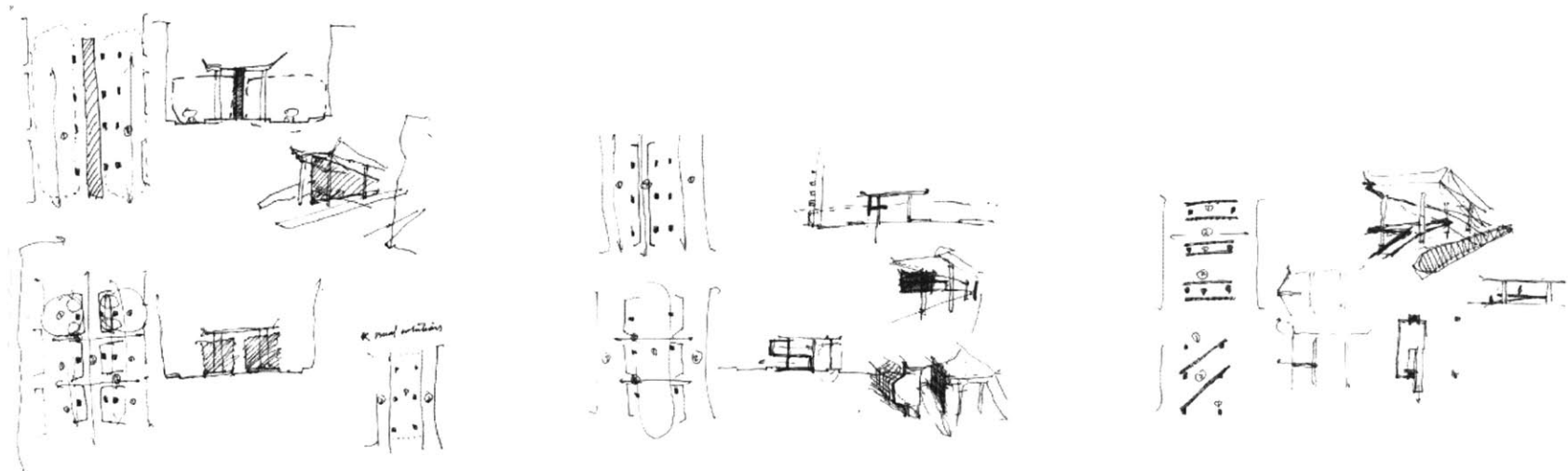


EXP_04 spatial configuration and modulation:



Zooming out to a larger scale that incorporates the entire site, these sketches are ideas of: 1. placement of entrance in relationship to streets; 2. compositions of closed, porous, and open façade to generate a certain rhythm of view and movement; and 3. internal organization of space.





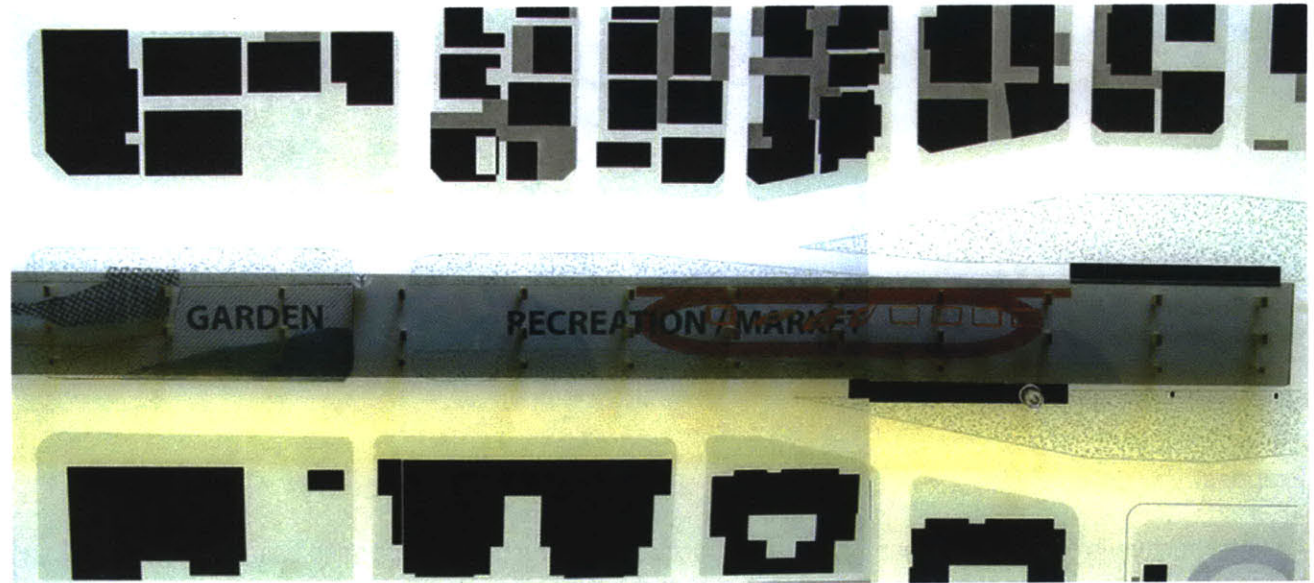
Proposal

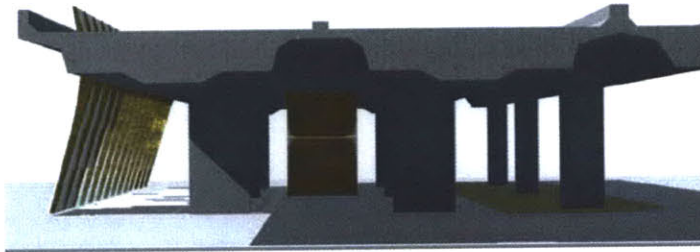
An infrastructure is proposed to bear the surface structures, for structural integrity and ease of construction of the intervention. Vertical and horizontal surfaces will be affixed to, or suspended from the supporting infrastructure. Such system helps to unify various components via one design language. From the design exercises, pivot and sliding joints have been determined to allow for fast and easy surface transformations without heavy mechanical devices. It's also recommended that, in addition to ceiling manipulation, moderate changes in ground level can add intensity to new topography. The main architectural move will be sectional. Design of transverse sections for each program will be influenced by considerations for lighting, acoustics, and visual or physical connections between the "interior", i.e. space underneath the elevated structure, and the exterior. Longitudinal section throughout the entire site will determine the fluidity of users' movement; it will add drama to each space through manipulations of spatial contraction and expansion.

Design proposals prior to Design Review

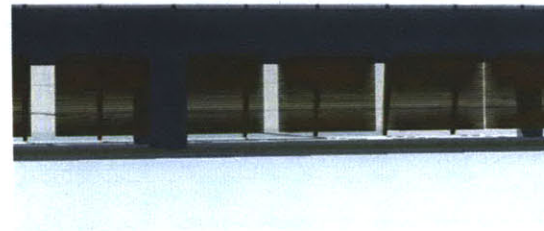
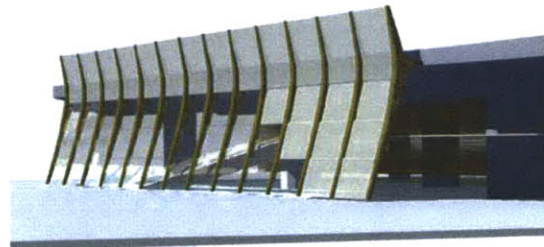
DESIGN_01:

At first, programmatic consideration was given to a landscape extension to the urban park, with various spatial configurations to provide an immediate “outdoor” space for the residents around. The space would transform and accommodate the weekend market. However, as the project progressed with material explorations, it seem appropriate to introduce certain types of usage that correspond to the temporal quality of the space, to register both the changes in natural condition (light), as well as the pattern (intensity) of usage for programs around the site.





This scheme comprising landscape extensions to the urban park, an open recreational space, and pedestrian bridge over Shin-Yi Rd. to provide uninterrupted connection throughout the site. The façade of the recreational space composes of glazing panels that can slide up and down, such that the space can be completely closed or open according to usage. Inside, “pockets” made up of foldable bamboo screens occupy the central dark zone. When expanded, these structures provide enclosed space for various needs. Day light penetrates the bamboo screen into the dark zone, creating an intimate setting. These volumes can rotate at corner edges to collapse into partitions to create a large, open space. Pools of water reflect light into the landscape zones.



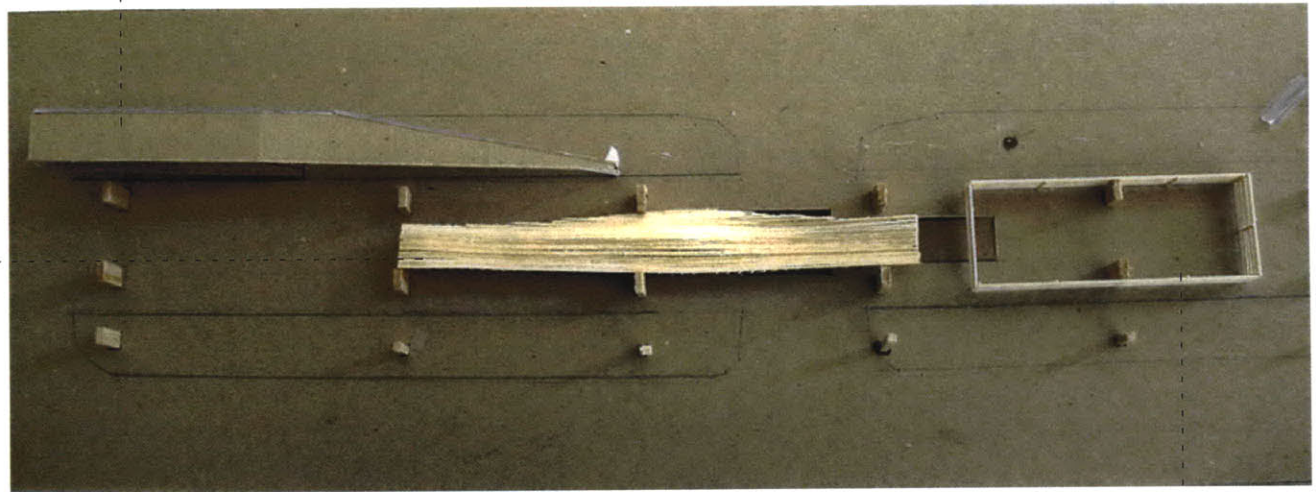


DESIGN_02:

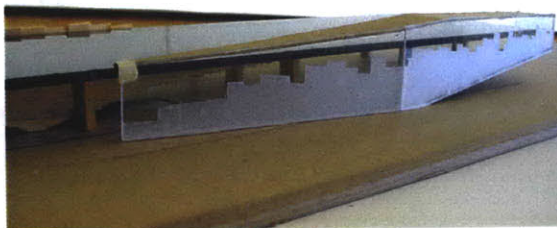
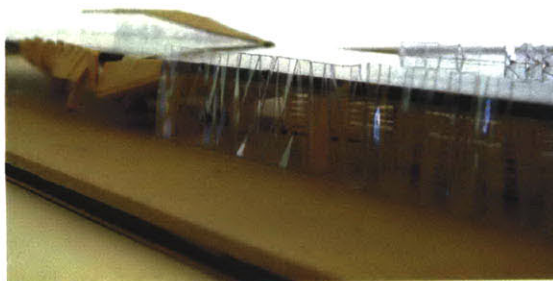
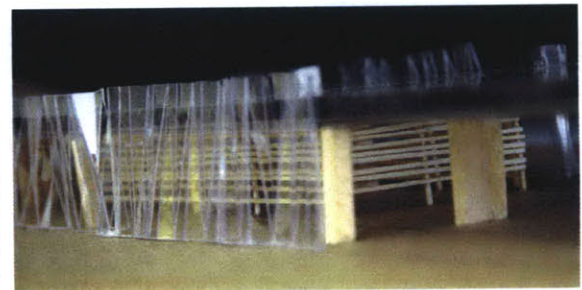
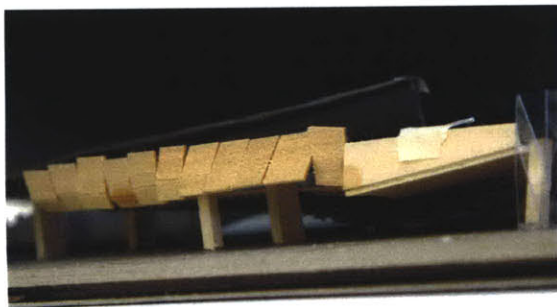
the programs are fully developed. The “pocket space” formed by bamboo screen is now enlarged to house the chapel. In this scheme, the gallery is an extension from the underside space to occupy a zone at higher elevation. Entrances to the site are identified. Instead of the previous infill system with sliding glazing units the façade in this scheme is a composition of folding panels and reflective panels suspended from the bridge. The folding panels can be expanded or contracted to change the edge conditions to allow for different movement through the site. The programs are now all residing on the same side of street (Shin-Yi Rd.) to avoid the need to construct physical connection (the pedestrian bridge in DESIGN_01) that spans the two sides.

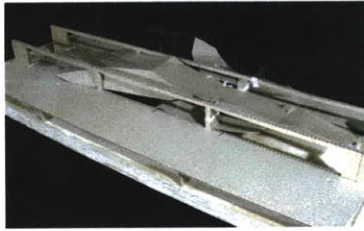
GALLERY

GARDEN & ASSEMBLY



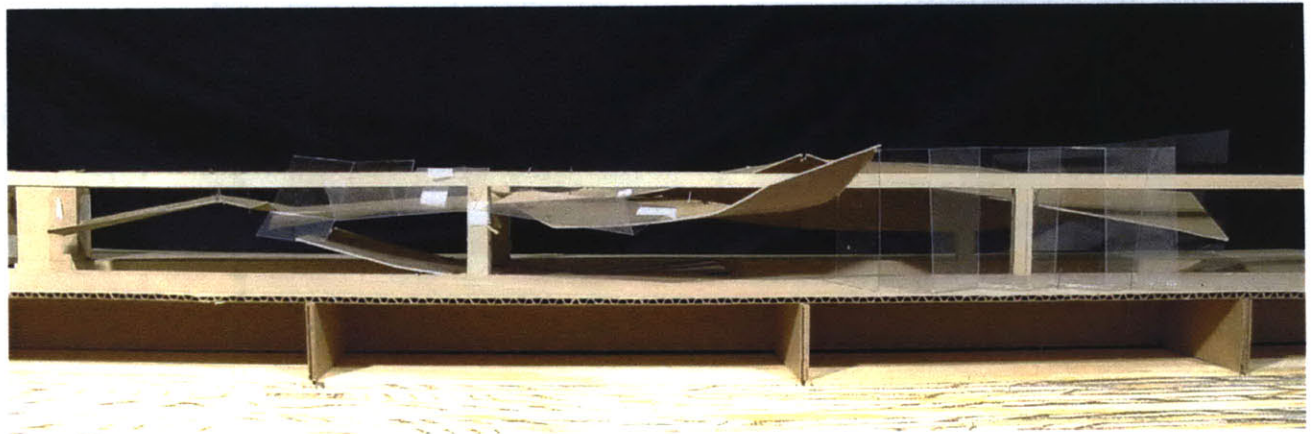
CHAPEL

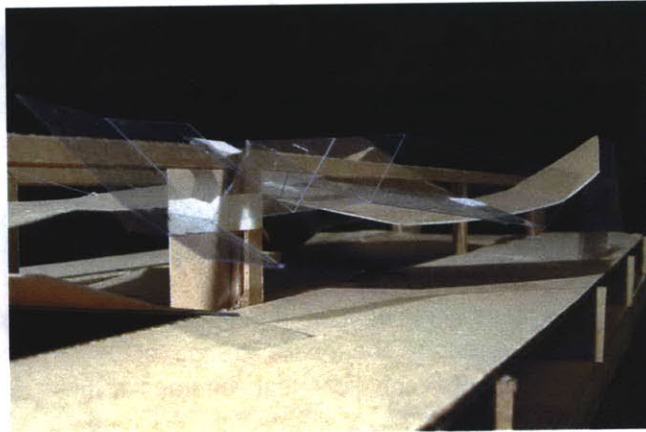
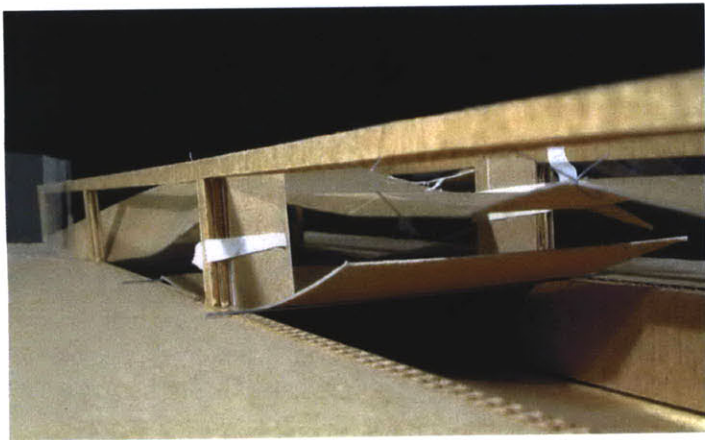




DESIGN_03:

this part looks at possibilities for surface manipulations, especially at and around entrances located from the previous scheme. The sectional model is used as a design tool. Ground and ceiling level changes are at time exaggerated to test out possibilities for new topology.





05 material selections

Supporting structural frame: bamboo



These materials are selected for their physical properties and low cost. From the previous research and exploration, it is determined that the design concepts will be evident through the use of these materials. These building materials - common to Chinese culture - render a sense of lightness and flexibility against the monotonous urban megastructure. In addition, construction with these materials is simple and speedy.

Selection of bamboo as the material for structural frame came intuitively, as Chinese people have a long history of constructing various aspects of life with bamboo:

"The Chinese make masts of it for their small junks, and twist into cables for their larger ones. They weave it into matting for floors, and make it into rafters for roofs. They sit at tables on bamboo chairs, eat shutes of bamboo with bamboo chop-sticks. The musician blows a bamboo flute, and the watchman beats a bamboo rattle. Criminals are confined in a bamboo cage, and beaten with bamboo rods. Paper is made of bamboo fiber, and pencils of a joint of bamboo, in which is inserted a tuft of goat's hair."
(<http://www.cwru.edu/edocs/7/469.pdf>)

The project site and this particular structural frame demand specific properties of the material. The chosen material must perform well under seismic and vibration stress (given that Taipei is an earthquake-endangered area; and that vibration from passing traffic could affect the structural frame if it is to come in contact with the elevated expressway), and it needs to be capable of spanning long distance across, or along, the underside of the expressway. The advantageous physical properties make bamboo a great building materials for this project.

The fibers of the bamboo run axial. In the outer zone are highly elastic vascular bundles that have a high tensile strength. The tensile strength of these fibers is higher than that of steel, however, it is not yet possible to construct connections that can transfer these tensile strengths. Bamboo is highly resistant to fire because of the high content of silicate acid. Filled up with water, it can stand a temperature of 400° C while the water cooks inside. The enormous elasticity of bamboo makes it a very good building material for seismic areas; it also behaves well in case of vibration. For a floor beam or a purling the amount of bamboo required is only 40 percent of the amount of timber needed for the same purposes. The low weight makes transportation and assembly of bamboo easy.

Easy of assembly can be mainly attributed to vast possibilities of joining techniques for bamboos, ranging from primitive methods to high-tech joints. Bamboo members can be held strongly together through simple ways.

In addition to its favorable structural properties, bamboo also inherits high ecological values. Bamboo-grade material is available in 3 years compared to wood material in 25 years. The rate of growth for bamboo is one third to that of wood. The fastest growing species can grow 2" inches an hour, and some species grow three feet a day with a maximum height of 60 feet in three months. Bamboo is completely renewable and requires low energy consumption in production.

strength

Material	Stress	Mass per Volume	Ratio
Concrete	8 N/mm ²	2400	0.003
Steel	160 N/mm ²	7800	0.020
Timber	7.5 N/mm ²	600	0.013
Bamboo	10 N/mm ²	600	0.017

stiffness

Material	E-modulus	Mass per Volume	Ratio
Concrete	25000 MN/m ²	2400	10
Steel	210000	7800	27
Timber	11000	600	18
Bamboo	20000	600	33

energy Consumption

Material	Ratio of energy for production to the unit stress in normal use
Concrete	240 MJ/m ³ per N/mm ²
Steel	1500
Timber	80
Bamboo	30



(top two) FIG. 05-01, 02: high & low tech connections (bottom two) FIG. 05-03, 04: structural lattice formed by bamboo

Vertical and horizontal surfaces: polycarbonate and fabric



The vertical (exterior façade) and horizontal (ceiling component) surfaces are to be fixed to the bamboo frame; therefore, it is most important that these materials be lightweight. They also must possess high transparency and reflectivity in order to enhance the lighting condition of the underside space. Acoustical property (reflectivity or absorption) is another determining factor. The vertical surface needs to be strong and durable against weather, while ceiling surface should render the experience of a light, fluid, and continuous interior space.

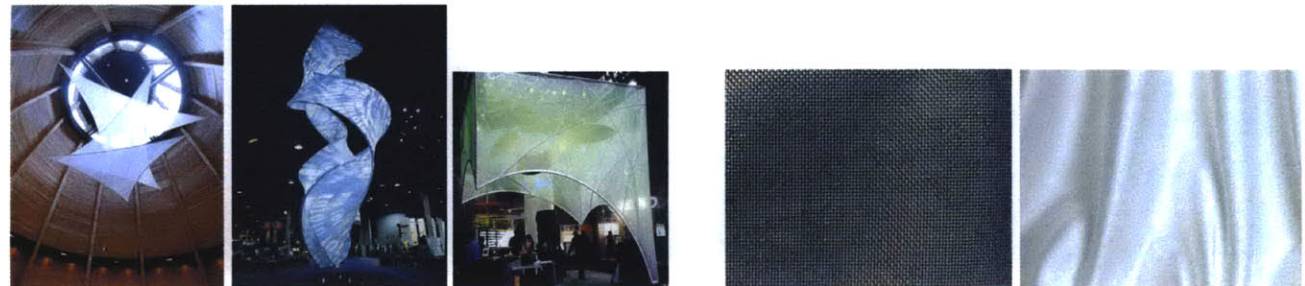
With such criteria in mind, polycarbonate sheets (polygal) and fabric are chosen, for their properties listed below, as materials for vertical and horizontal surfaces, respectively.

Fabric:

Some of the most striking fabric applications are structures for exhibitions or other temporary uses. Fabric is perfect for these situations, and fabric structures have as well long been used in bubble domes and other similar facilities. But the material use is not limited to these temporary or semi-permanent structures, with some current applications on building types with more exacting environmental standards. The advantages and quality of a luminous fabric roof are not sacrificed to other important considerations. In addition to lightweight, fabric yields a sense of “lightness”. Fabric normally diffuses light, but can also be made reflective when weaved with metallic or reflective materials.

(left three) FIG. 05-05, 06, 07 applications of tension fabric

(right two) FIG. 05-08, 09 examples of reflective fabric

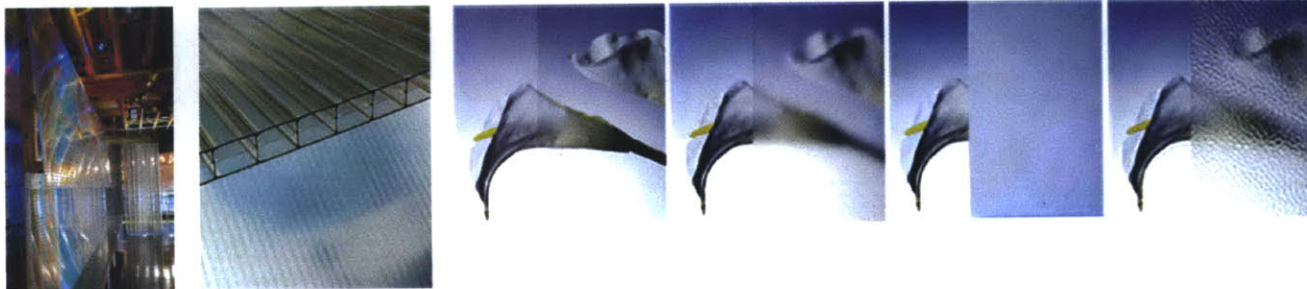
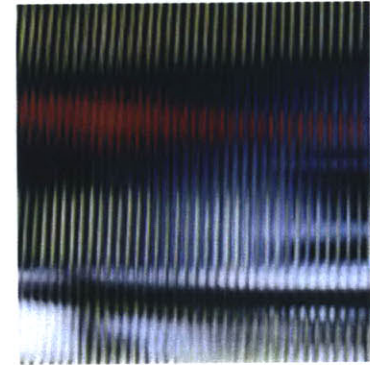


Polycarbonate sheet (Polygal):

Tough, lightweight structural panels (polygal) can be of insulating glazing sheet extruded from high performance polycarbonate. The hollow-core structure uses 80% less material than an equal thickness of solid glazing, weighs 1/6 as much as glass, 1/3 as much as acrylic. Results in lighter structures and reduced labor and handling costs.

Polycarbonate's low material cost and ease of installation combine to deliver overall installed costs, which are typically a fraction of those of comparable glass structures. A wide variety of construction configurations, styles, colors and sizes are available. Properties that make polycarbonate sheets a good choice for this project are as followed:

- IMPACT RESISTANT: 200 times the impact strength of glass
- TRANSPARENT OR TRANSLUCENT: clear sheet offers 90 % light transmission, same as glass
- WEATHER RESISTANT: retains original clarity and toughness for years under all conditions
- LIGHT WEIGHT: 50% less than glass, 43% less than aluminum of same thickness
- FLEXIBLE- can be bent hot or cold
- FORMABLE - can be thermoformed into virtually any shape
- EASY TO INSTALL- no special tools or equipment required
- FLEXIBLE- can be bent hot or cold
- MACHINABLE



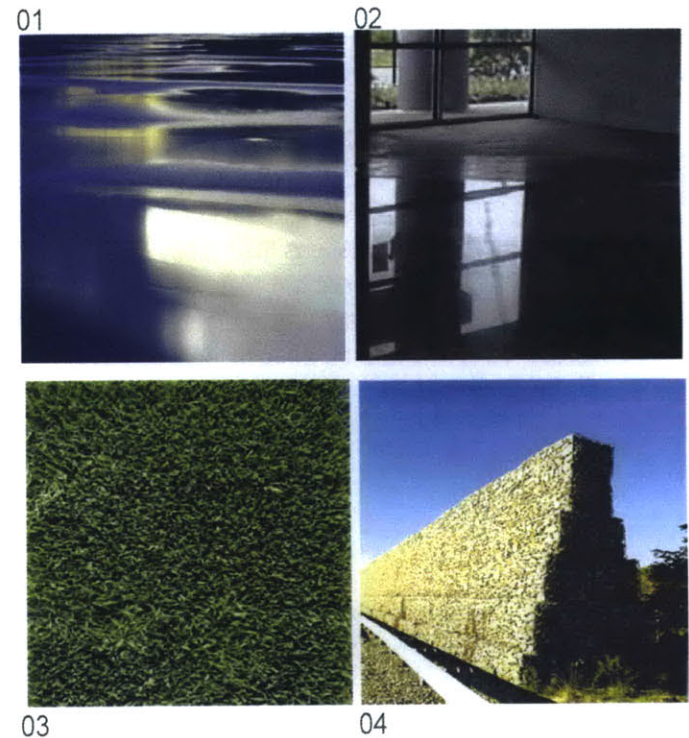
(leftmost) FIG. 05-10
interior application

(second left) FIG. 05-11
structure of polygal (polycarbonate)

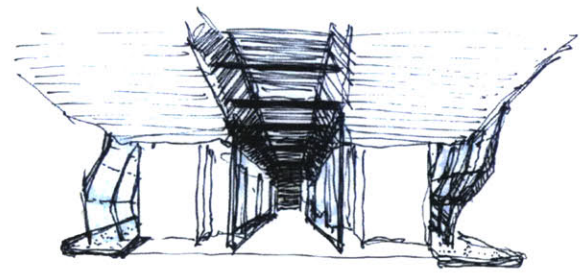
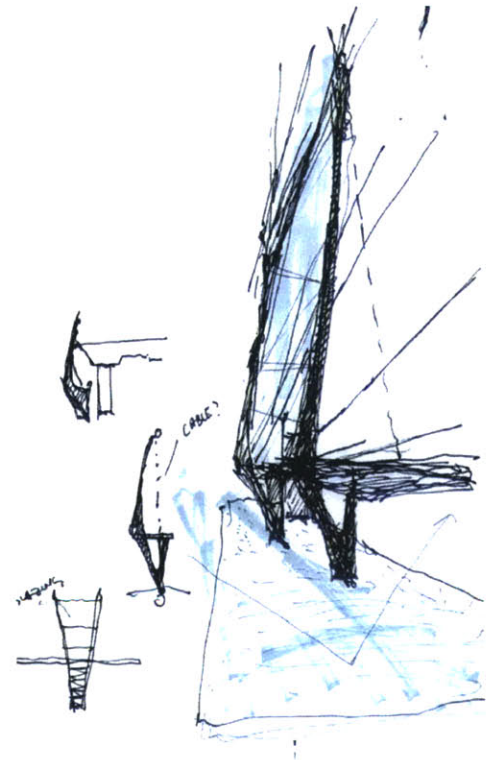
(right four) FIG. 05-12, 13, 14, 15
various level of transparency (and
texture) achieved by polygal

Ground surfaces

The aforementioned criteria for surface material selection apply to ground surfaces. In addition, the use of natural material is maximized whenever possible. Below is a list of possible materials for ground surface design:



- 01 water: reflecting light and create background sound to cancel environmental noise
- 02 polished concrete: reflecting light
- 03 grass: dampen sound
- 04 earth berm: insulate environmental noise



The genesis of the project lies in the desire to give the space underneath elevated expressway a “face-lift”, in order to turn the vehicular swamp into a pedestrian-friendly zone. The main goals are to create a community presence for the largely under utilized space, and to inducing a variety of public uses.

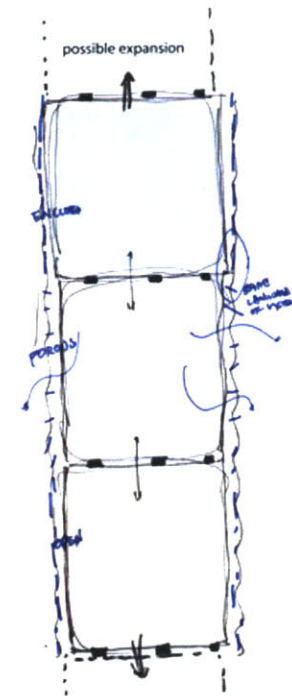
06 final design

Main concepts

The project is treated as a provisional intervention that could possibly be applied to other locations beneath elevated structures. Hence, the design is conceived with regards to the concept of “modular space”. Three boxes - each occupies a bay defined by the columns of the expressway - are constructed using various patterns of the same material systems. The variations create three different types of communal spaces. This strategy allows linear expansion or contraction of these volumes, while retaining a coherent architectural expression.

Since the bridge structure cannot be changed, the idea of surface manipulations is developed in order to transform the space. The main architectural gesture is best described sectionally. The articulations of ceiling, vertical, and ground surfaces respond to the spatial qualities designed for each program -- garden, assembly, chapel, market. The surface design addresses the issue of temporality in two ways: 1. it registers changes in daylight to alter the perception of the spaces; 2. the flexibility achieved through surface transformations maximize the potential for public usage. Three tectonic elements - supporting frame, ceiling, and the vertical panels - establish a physical and visual connection between the heterogeneous programs. Composition of the tectonic elements renders a sense of lightness and playfulness that contrasts the brutal monotony of elevated structure. The elements are also designed to mediate between personal and mega-structural scales, so that users feel intimate to the space.

The project is based on a simple plan. The organization of the spaces is along a linear circulation to allow a continuous pedestrian flow. Entries into the site are located in two garden zones. The main entrance at the Shin-Yi Rd. intersection and two side entrances facing neighborhood streets all connect to the existing pattern of circulation around the site. The garden zones lead into two destination areas, the assembly and chapel, bringing visitors' pace to a halt. The vertical surfaces that define the volume of the chapel are kinetic. When the surfaces are transformed, the chapel turns into an open market place with porous boundary. At this instance, the movement from garden zone into the space becomes continuous.



Although the plan is simple, the experiential quality is complex. The spaces become volumetrically complex through articulating the tectonics of each material system. Ceiling and ground surfaces delineate a new topology. Vertical surfaces create a perception of the architectural intervention that is twofold: the view of it from the fleeting traffic, and the experience from within. As one traverse through the entire site, there is a sense of continuous discovery.

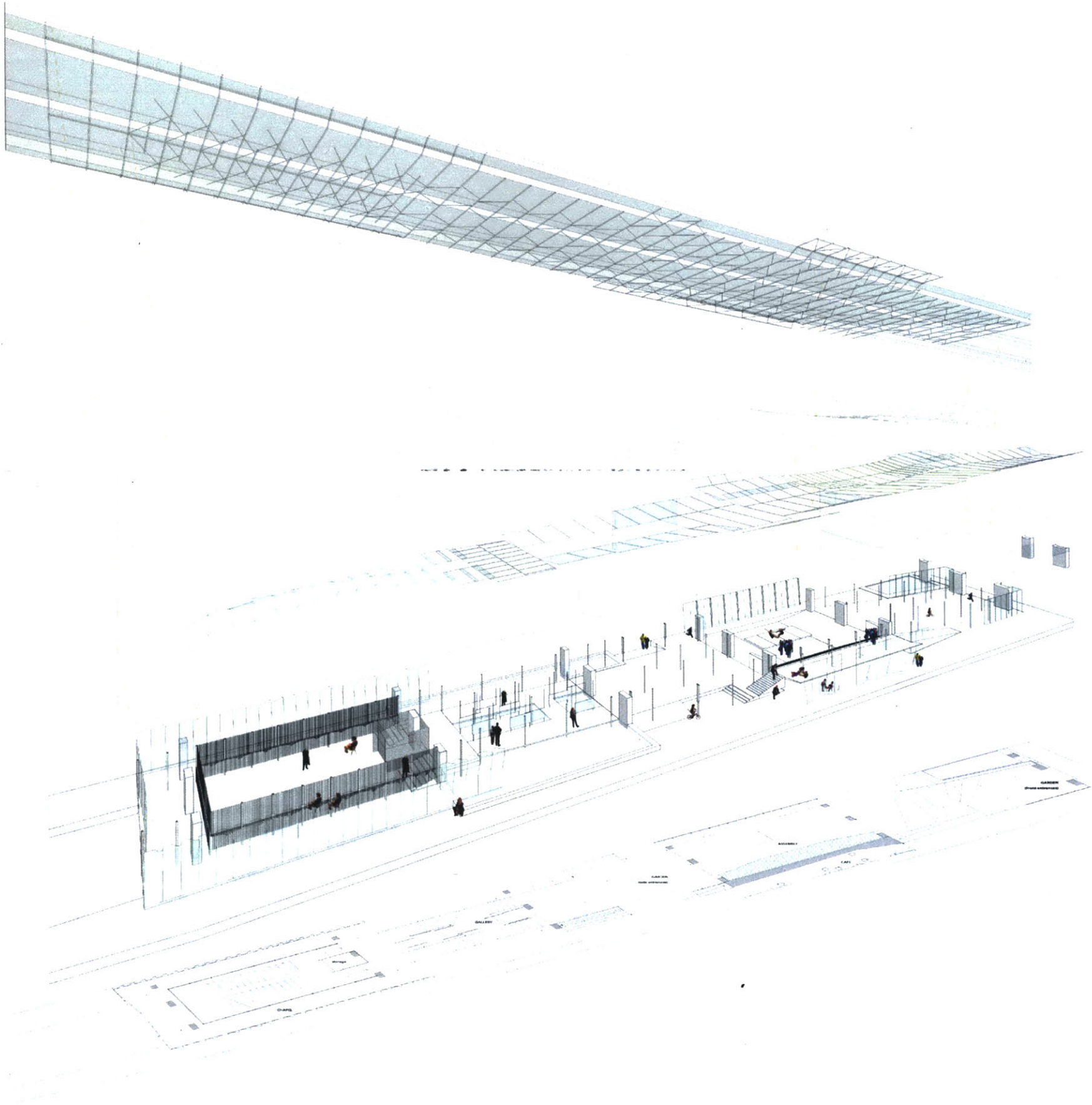
The project proposes that the ownership of the space be partially given to the local community of the neighboring districts. While the city government provides the infrastructure and guidelines for the intervention, the community is entitled to determine its usage and alter the spatial configuration. Within the guidelines, the community has the power to some degree of expansion, reduction, or transformation of module spaces.

tectonic components:

supporting structure, ceiling, façade

programmatic components:

garden & gallery
assembly (and café)
chapel/market

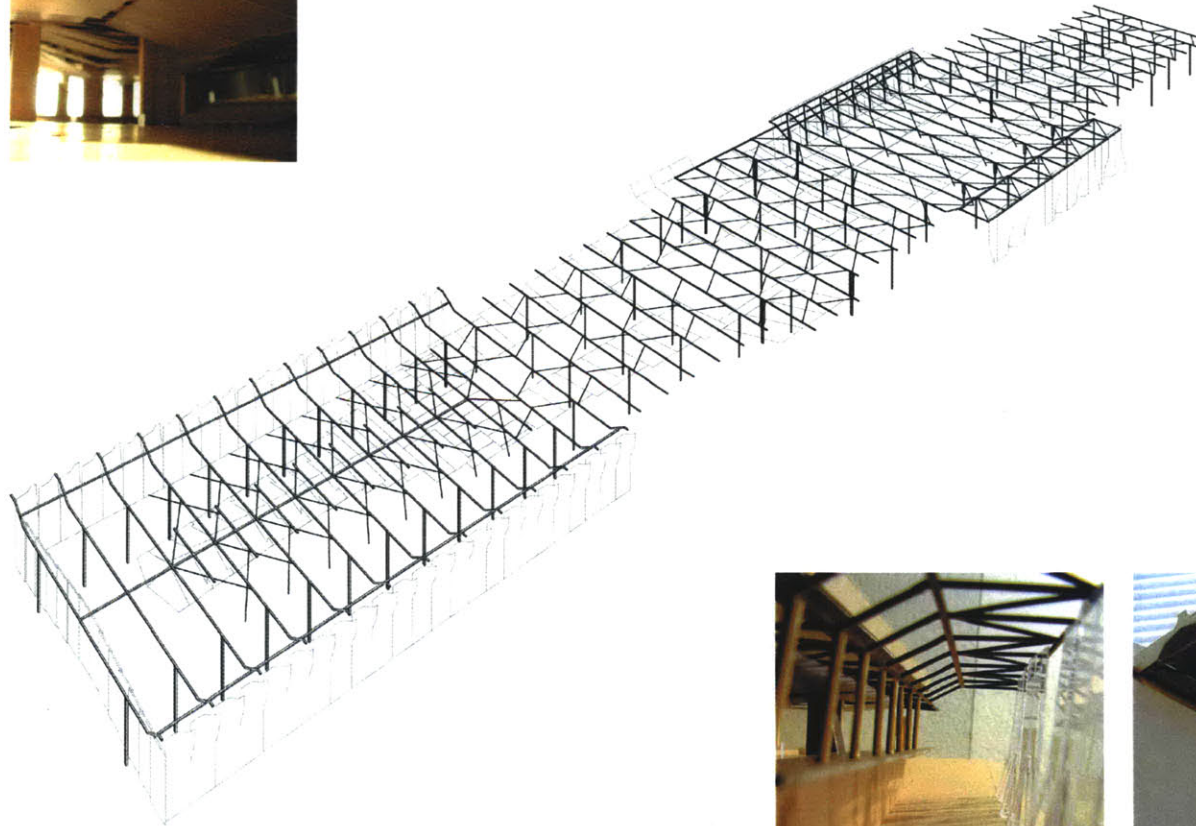


exploded perspective showing
the tectonic and programmatic
components

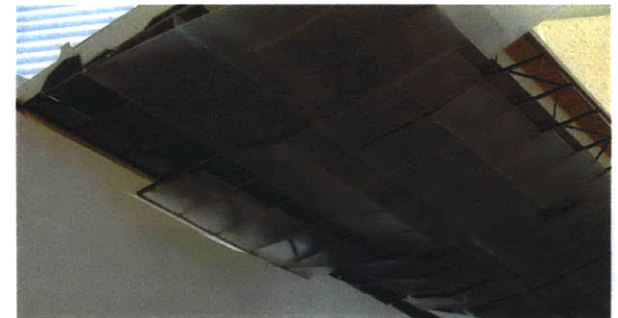
Three tectonic components



01 Supporting structure:



The bamboo columns and frame serve as the infrastructure to which the vertical and horizontal surfaces are affixed to. This “infrastructure within the infrastructure (the bridge)” allows for structural integrity and ease of construction of the intervention. The transverse members of the frame span the entire width of the bridge, with a consistent 12-ft. spacing in between each member. The diagonal bracings are placed at 45 or 60 degrees to the transverse members; a variety of patterns is thus generated using bracers of two lengths. The lattice is supported by bamboo columns that are placed randomly in the garden zones to yield a “forest-like” space; and the placement becomes orderly in chapel and assembly to delineate boundary as well as maximize column-free space.



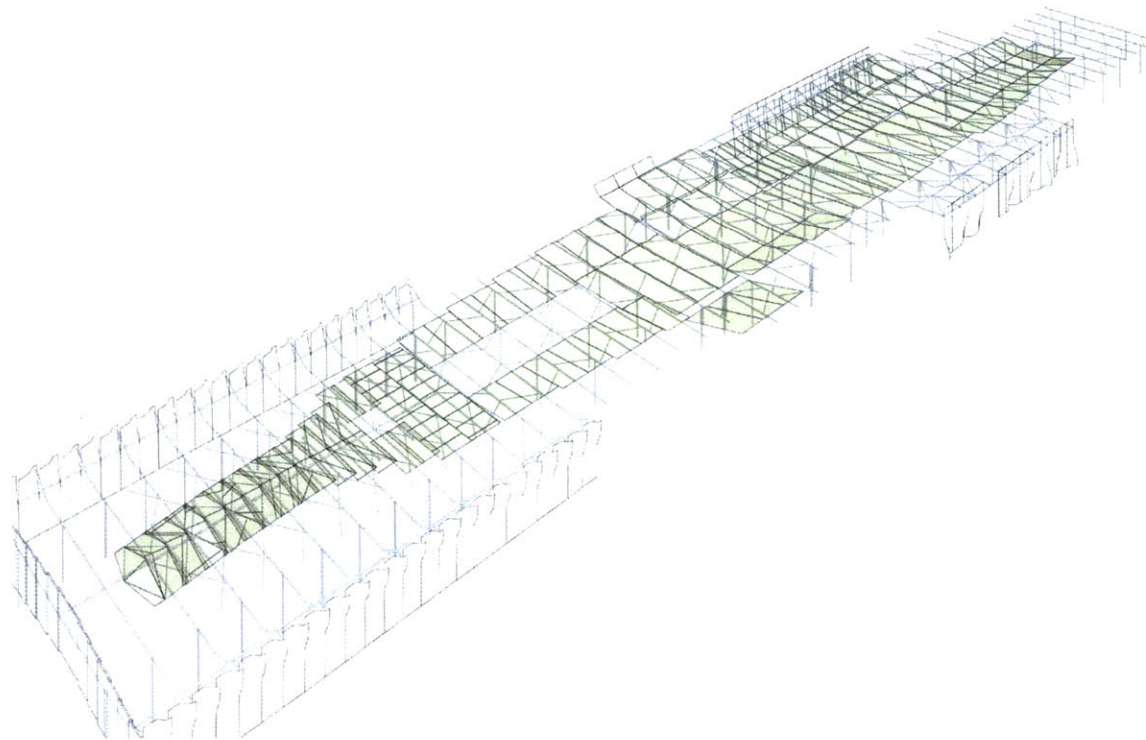


TEC_02 Ceiling:

Tension fabric and polycarbonate panels, all 12-ft. wide at various lengths, are suspended from the bamboo lattice with cables. Height, shape, and configuration of these panels differ from one zone to another, yet the assemblage in entirety reads as one smooth, continuous element that link the entire site.

White, translucent fabric is used in garden zones to diffuse and radiate natural light as it is reflected onto the surface. In the assembly space, thin translucent panels are used to reflect and direct sound to the audience. Reflective panels are used in chapel to bounce light back and forth from the polish concrete ground surface, thus creating an illusion for the height of the space and dramatize the overall effect. At the side entrances, the panels fly out to proclaim presence for the intervention that's tucked under the elevated expressway.

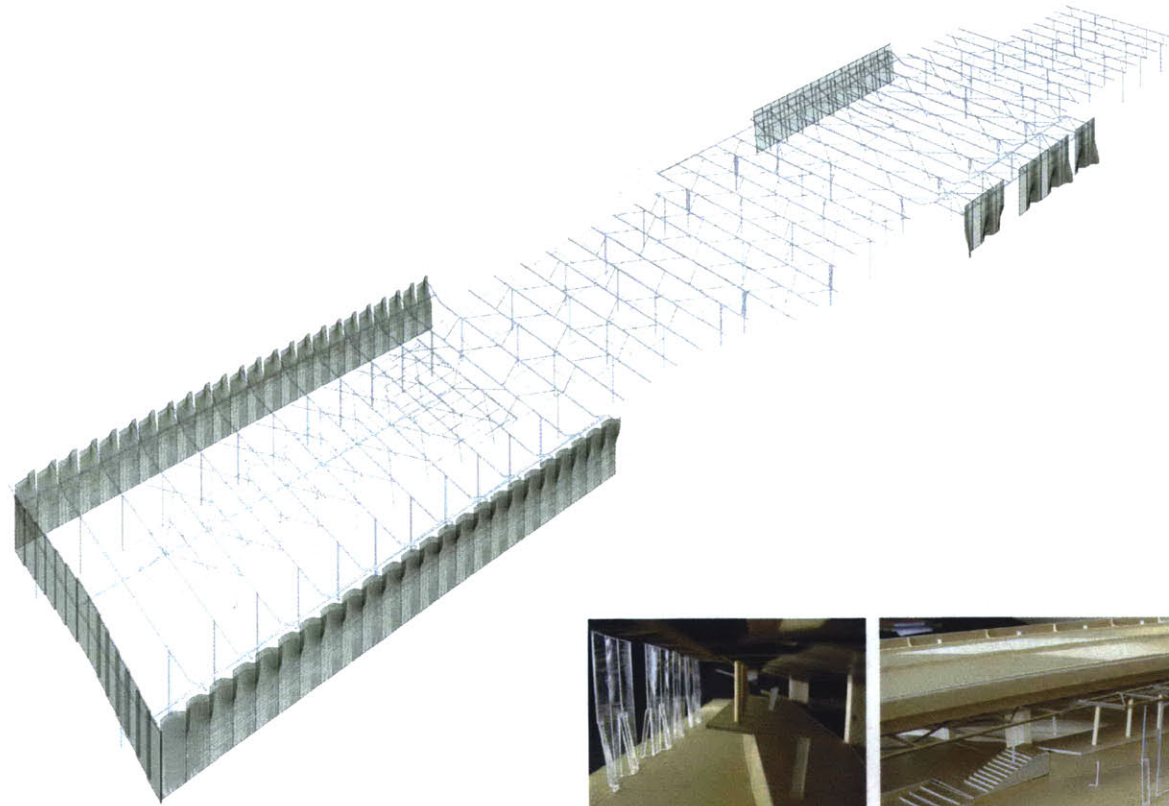
Silhouette of the bamboo frame is visible through the ceiling element. At some instances, the height of adjacent panels differ drastically to reveal the elevated structure.



TEC_03 Facade:

The vertical panels are made of cold-form polycarbonate panels (polygal). The curvilinear form adds depth and texture to the entire facade. The curved form is also functional, as it is generated from observations made from previous study models. It is responsive to change in daylight condition.

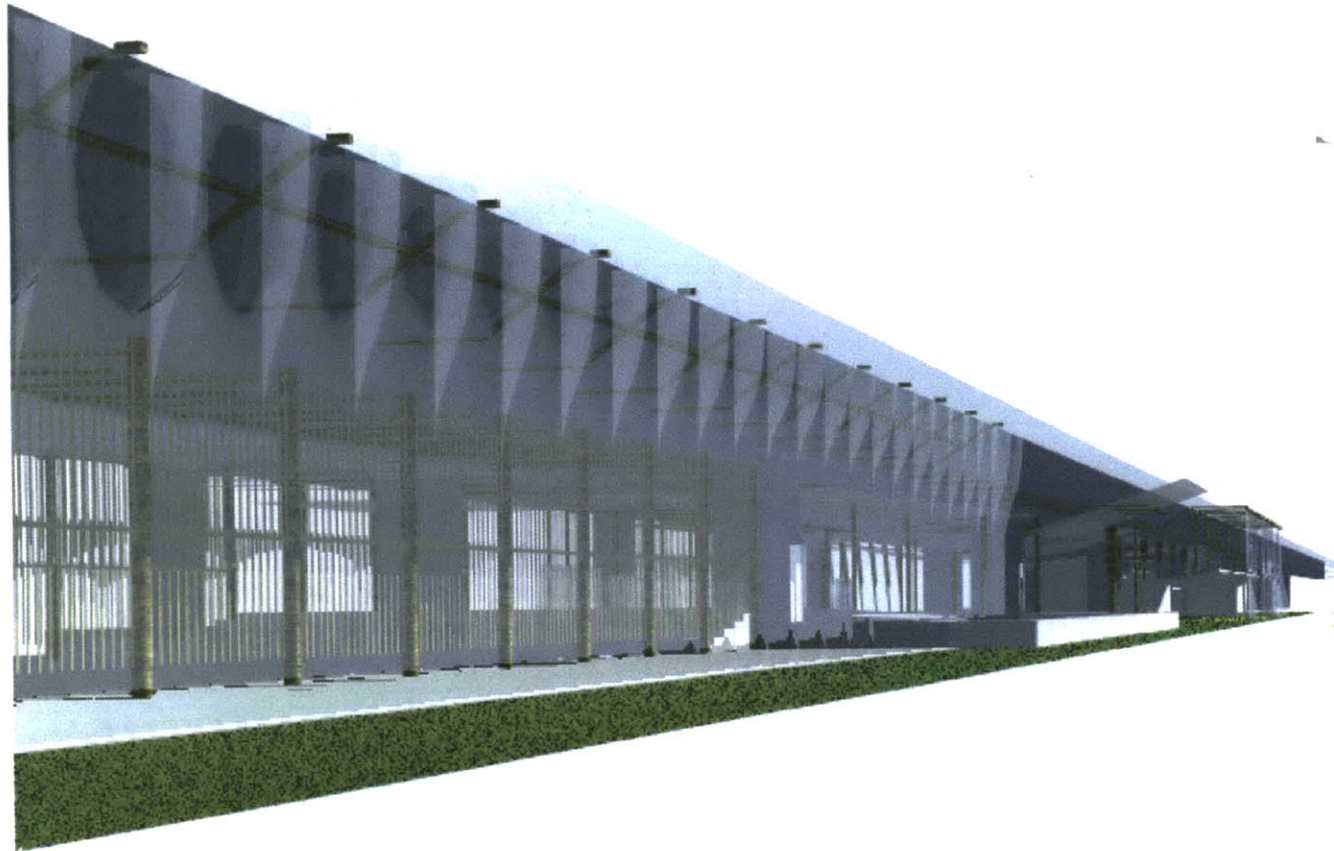
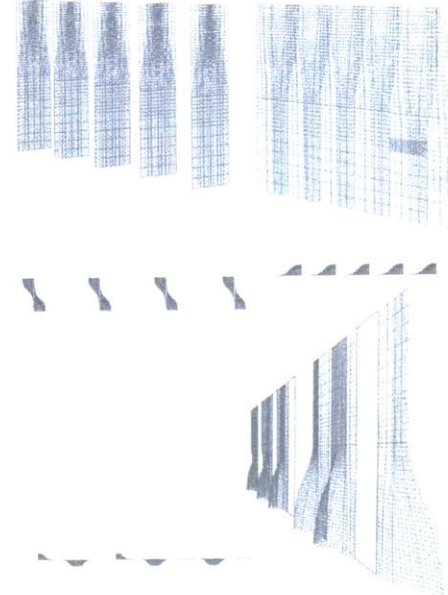
The experience created by the rhythm of facade is trifold. As one gazes straight through the panel, it appears transparent. Peer in at an angle, the facade becomes a translucent screen. For views from the fleeting traffic, the effect is dramatic as form and light interact with each other. The facade appears to respond to motion.



Vertical panels are placed only at the “destination” zones to define boundary, as well as shelter the spaces from environmental noise and weather. The buffer zones (gardens) are left completely open such that definition of “interior” and “exterior” become blurry at these open spaces.

The panels in the chapel zone are kinetic. They are connected to the bamboo frame and ground with hinges. As the panels pivot open, they form a smooth, curvilinear partition with the adjacent panel. As the boundary becomes porous, the opened panels transform the chapel into an open market place.

The standard panel is placed invertly at the cafe area behind the assembly space. The curvatures from each panel interlock with one another to form recesses that allow occupation on a personal scale.



Top perspective and plan show the panels for the church (in both states of transformation). The bottom perspective and plan show the arrangement of panels for the assembly space.

Rendering on the left shows view of chapel from fleeting traffic.

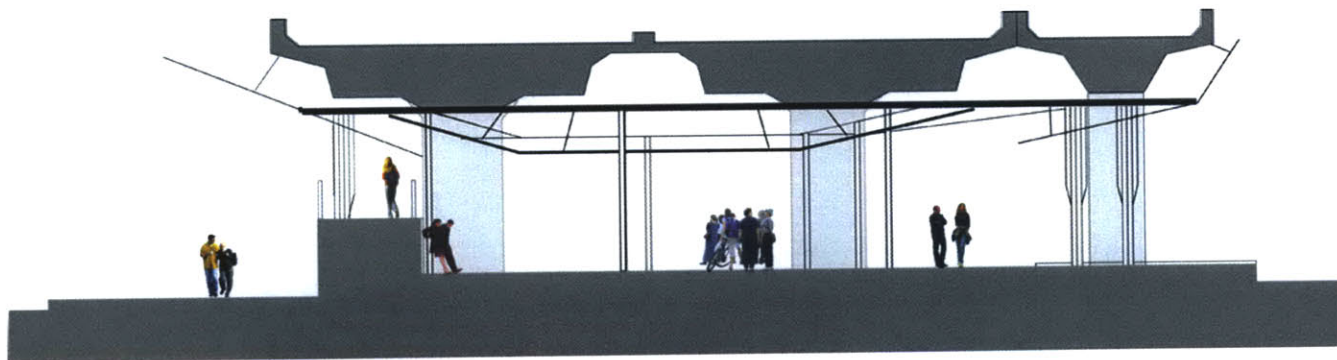
Programmatic components

PROG_01 Garden & Gallery:

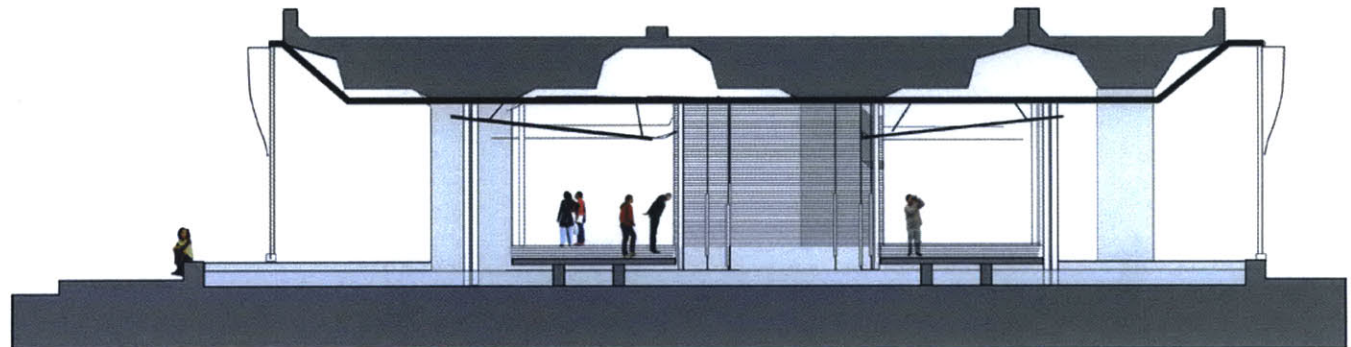
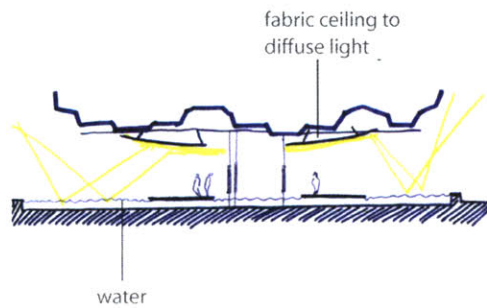
These are the buffer zones between destinations. Changes in ground surface and ceiling levels create an exciting environment for fluid movement through forest-like bamboo columns. The boundary for these zones are suggested by the overhead elevated structure, not an actual facade element.

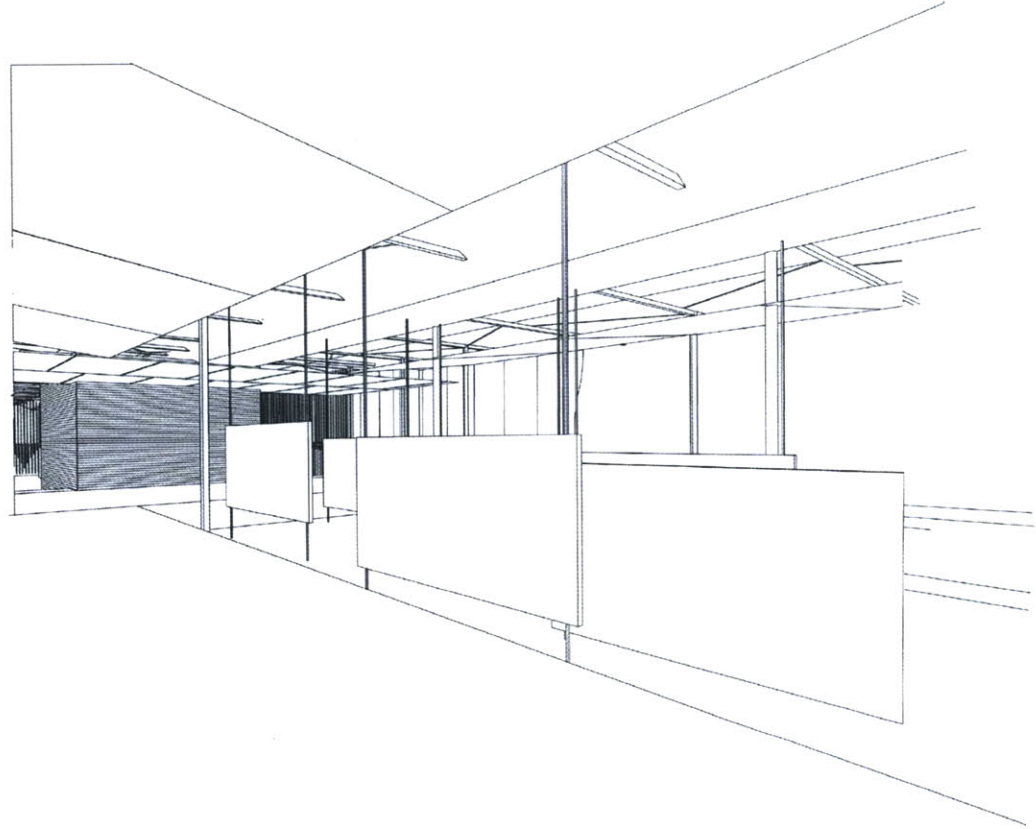
Water is used to reflect natural light, which is then diffused into the space by the ceiling fabric. Main entries into the site are located in these zones. The entrance link the existing pedestrian circulation to the newly generated movement.



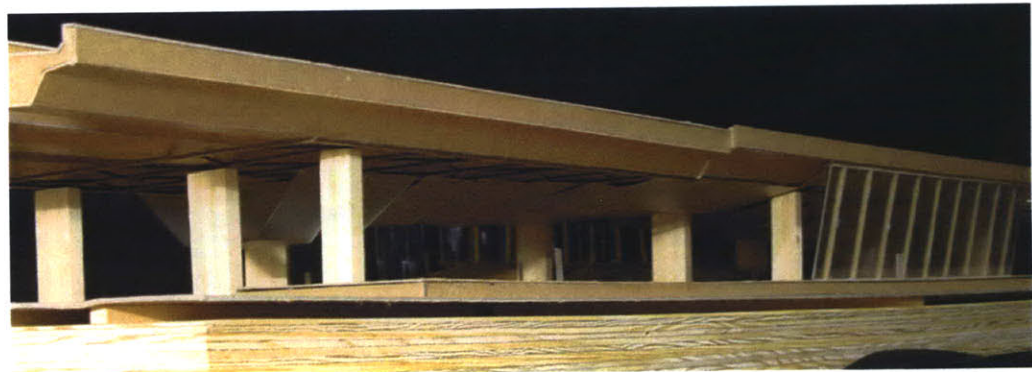


The gallery is a direct extension of the chapel; it is composed of two arcades suspended above a pool of water. Display surfaces are suspended by cable from the bamboo lattice, they can slide to form different exhibition conditions. The ceiling panels diffuse light reflected from water onto the display surfaces.





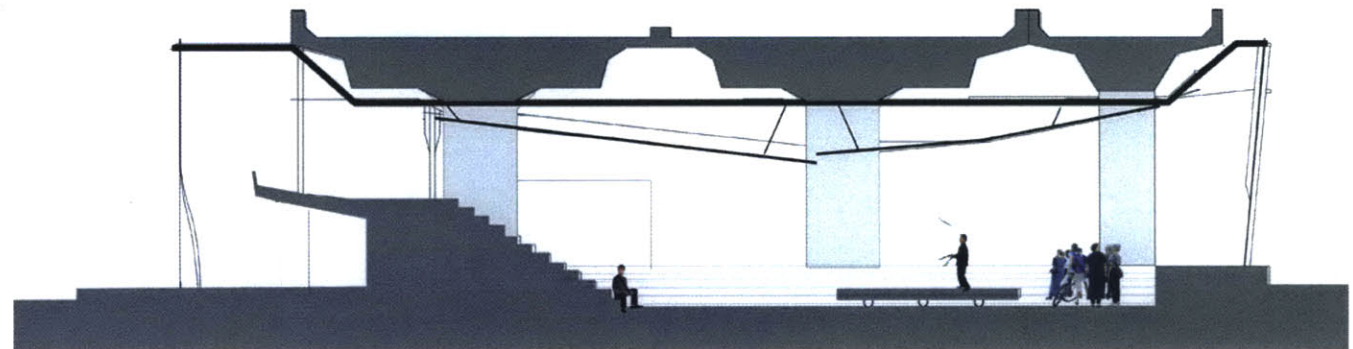
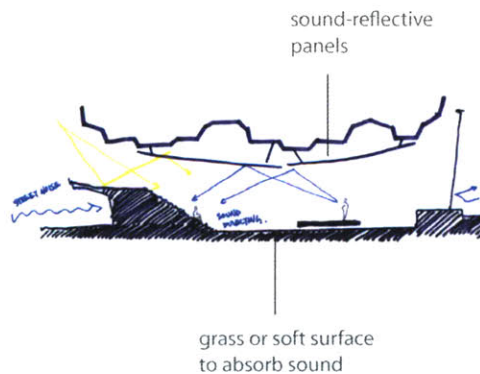
View of gallery showing the display surfaces over pool of water. Entrances into the chapel are shown in background.

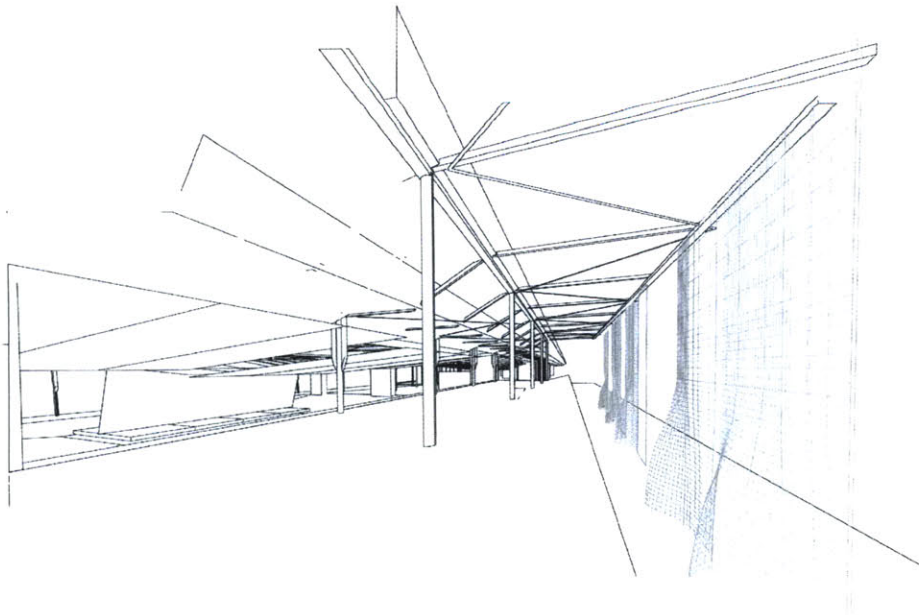
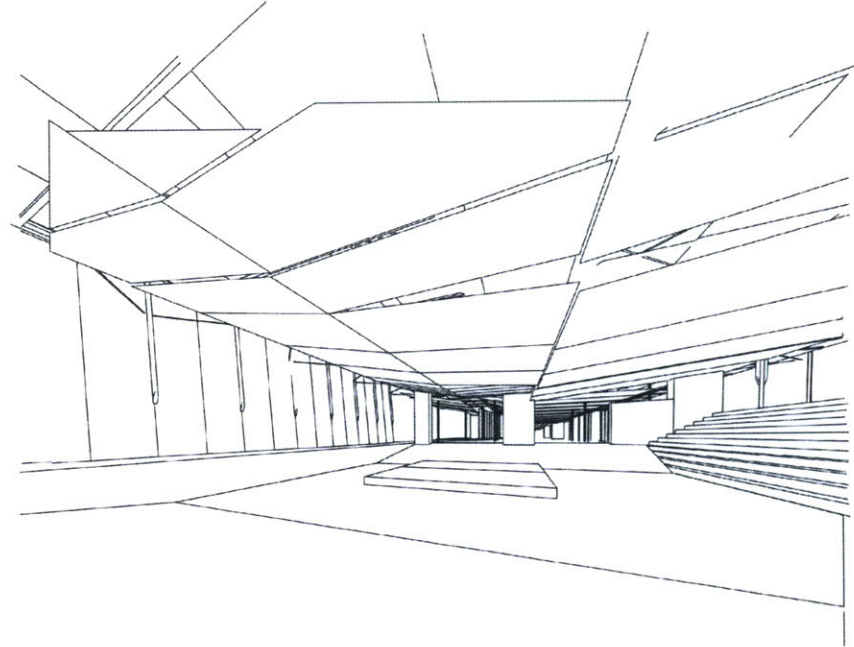


VIEW OF MAIN ENTRANCE

PROG_02 Assembly (and Cafe):

This is a destination for communal gathering. The space also provides settings for performances, film display, as well as casual engagements. The design is generated primarily by concerns for acoustics quality needed for an outdoor assembly environment. Sectionally, the space relies on the tensile strength of the bamboo lattice, which is supported only on the perimeter basis to leave the interior space unobstructed. The seating platform on the west forms an earth berm that blocks environmental noise. The space behind and below the seating platform becomes a cafe space, which is enclosed by the undulating facade panels. To the east, behind the performance stage, flat polygal panels make up the other facade; its street-facing surface can be used as a board for display for the fleeting traffic.





Transformation of "plaza" to outdoor theater:

drop-down screen for movie
stage can be expanded and push back to the edge to create
hierarchy of performance and audience spaces

When the stage is pushed inward, the assembly space becomes
a plaza-like space, with a small stage in the center for casual
performances, while leaving the sides for continuous movement

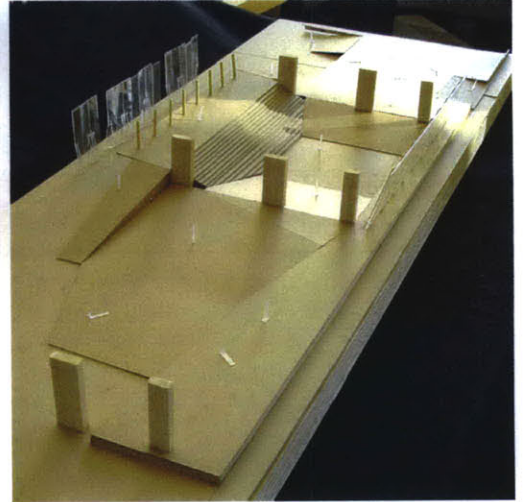
Transformation from centrally focus performance to casual
gathering

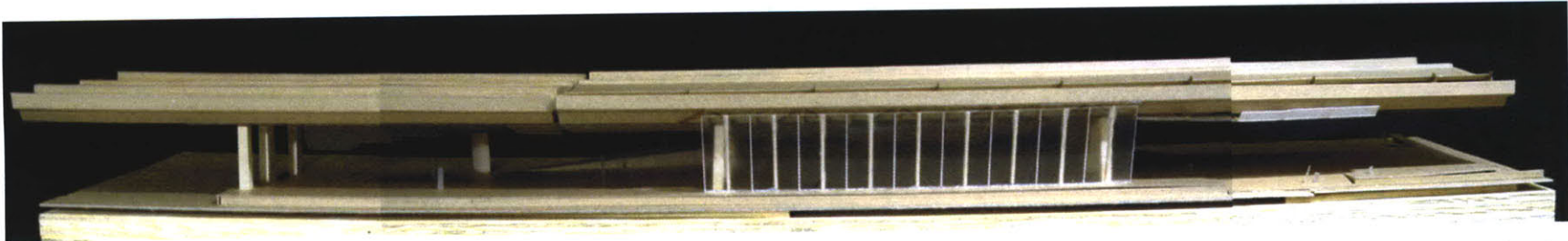


views of cafe



assembly and entrance garden





east elevation

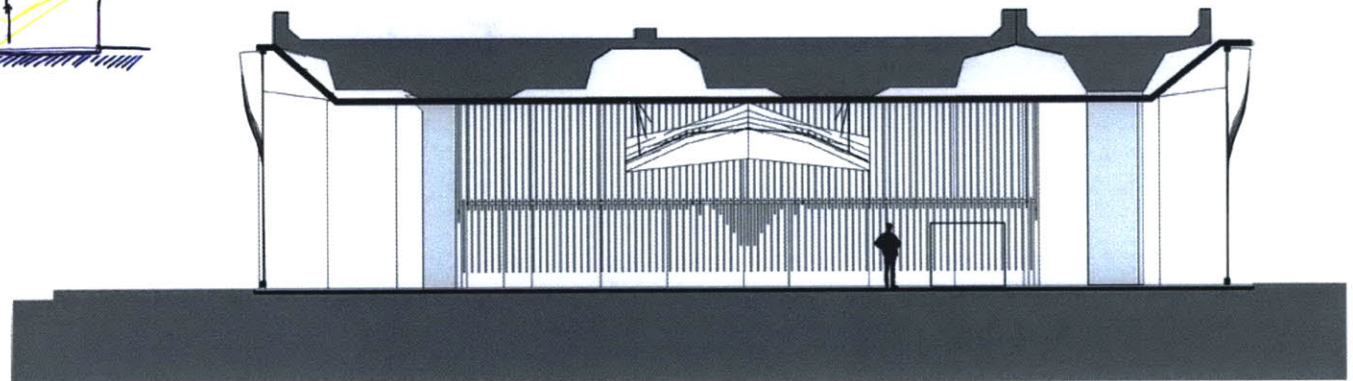
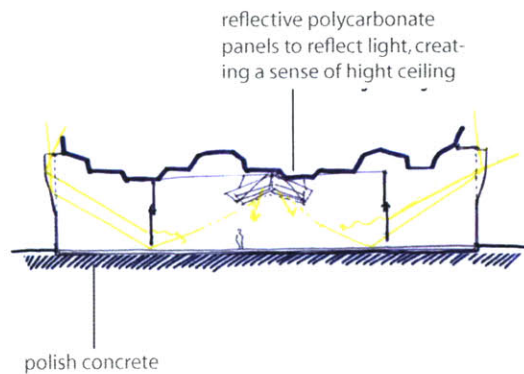
PROG_03 Chapel / market place:

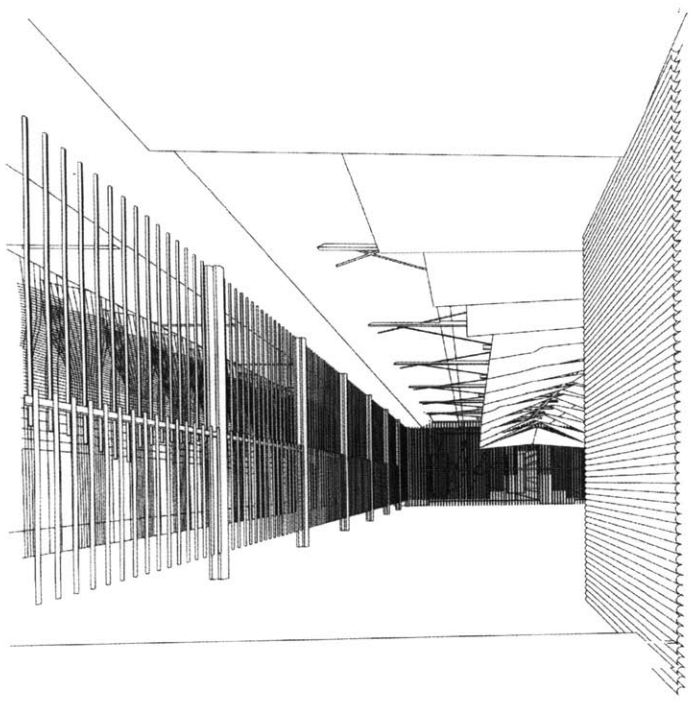
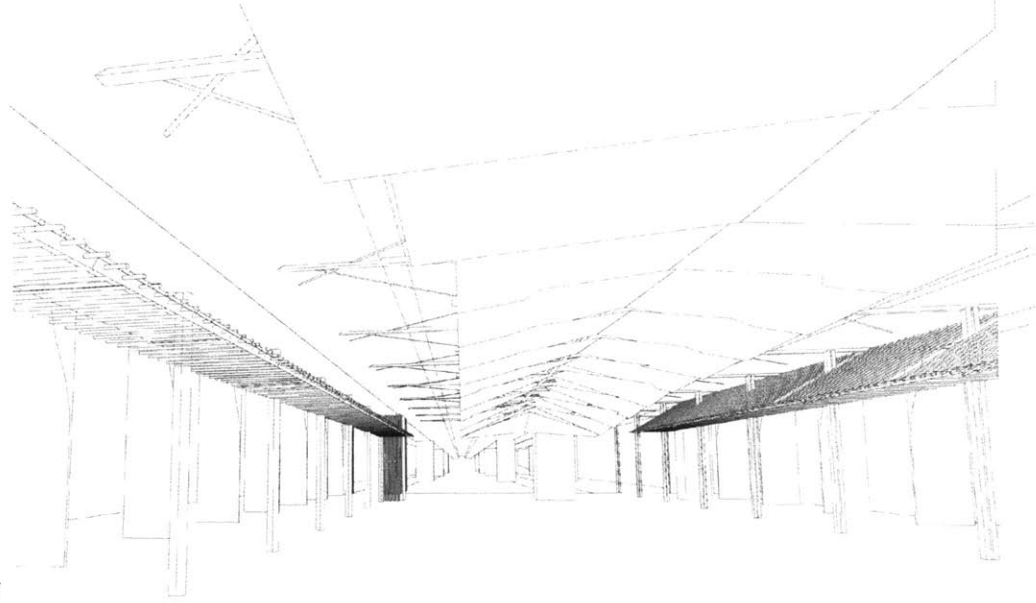


FIG.06-01 Natural light softly filtered through bamboo veil

The final destination of the intervention, this space plays on the provocative concept of transformation between a chapel and open market place - an ironic notion of change between the sheltered and exposed, sacred and profane. The purpose of the chapel is again community oriented. This neutral space serves multiple functions and events, religious or not. The quiet, enclosed environment provides an oasis from the busy street life. During the day, natural light is filtered through the bamboo screen and reflected between polished concrete ground and reflective ceiling panels. At night, the condition is reversed; artificial light from within the chapel space spills out through the bamboo screens, which appear as floating lanterns to the viewers from the outside. The sense of height for the space is thus accentuated.

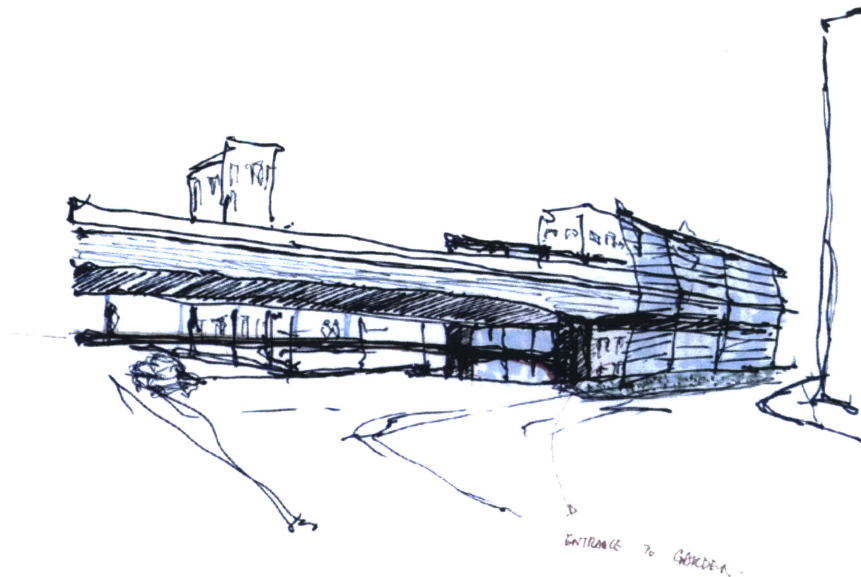
The kinetic facade and bamboo screen transform to open the space up for weekend market, at which instance the pedestrian movement becomes fluid and unobstructed again. The facade panels, in their open state, form alcoves for vendors.





Transformation of chapel into market:
the bamboo screens fold up to pick up the ceiling line
curved panels on the side rotate into pairs of partition

from enclosed to porous, destination to movement.



Construction of elevated expressways has fulfilled men's desire for faster travel through shorter distances. It promotes the growth and development of cities. However, the underside spaces left over from such construction have become a generic urban condition of contemporary cities. Poor physical conditions make these spaces undesirable. As they remain underutilized, these interstitial spaces create divides in urban fabric, thus affecting surrounding neighborhoods in negative ways. This thesis project was conceived on the premise that remedy to this complex urban condition could be sought through inventive architectural proposition. The underside space presented an opportunity to introduce new, unique, forms and spaces for public usage.

The goal of the thesis was to encourage possibilities for new ways of public occupation of the space underneath elevated expressway. The formal and programmatic strategies, however, were not determined at the conception of the project. They were derived from, and served as a synthesis of, the research and design processes. The focus of the project thus lied primarily in the methodology: the program and design explorations conducted on the basis of knowledge gained from background research and analyses. Findings from every exploration were evaluated against the five design parameters initially outlined: usage, pattern of movement, light, acoustics, and material. Integration of learning and discoveries from the two parallel processes set directions for development.

Given the complexity of the problem set forth, and the myriad avenues that could be tackled, this thesis project could not present a comprehensive study. Nonetheless, it did attempt to incorporate various aspects, and to address the issue from different levels. Instead of examining only urbanistic strategies, the combination with inquiries into material and construction has lent the project with new opportunities and challenges. The final proposal of the material system coincided with the initial

interest in devising a temporary structure to activate underutilized spaces. Studies of conventional materials and joining techniques have inspired affordable, but creative, architectural intervention to facilitate greater pedestrian mobility and programmatic diversity. Site planning also permits potential expansion and relocation of the project. The final design offers a pedestrian environment with new elements and opportunities for the community.

The limited time available for development has set a cap on the scope of the project, leaving some issues from being fully explored. Although the thesis succeeded in provoking new approaches to claim and inhabit the space underneath elevated expressway, there was no time allowed to revisit the urban analyses with newly constructed scenarios. The material systems and their joining techniques need to be further developed and defined. Sectional manipulations of the ground level (carving pool in garden areas and building up for seating in assembly zone) need to be re-evaluated for their impact and implication of future use of the space once the temporary intervention is removed. This leads to another issue that has not been fully addressed by the thesis project: the temporality and relocation of the proposed design. It seems possible for the material and construction system to fit different types of bridge structure, since the two bodies bear no structural association. Easy of construction also allows for short life spans, but the project proposed a 10 to 25 year time frame to give the intervention a chance to be fully engaged in the community life.

This thesis was based on the belief in the power of architecture to associate, mediate, and engage people to their surroundings. The method of design articulated in this project encourages new approaches to create public environment within the existing fabric. Final synthesis of formal and programmatic strategies demonstrated a new typology for public use that is unique to the culture and life style of Taiwan. Taking the proposal for the selected site as a case study, it is hoped that this thesis will influence the perception and future use of interstitial spaces created by urban infrastructures, and that it will inspire new vision of our cities.



books

On site, and elevated structures Bureau of Public Construction - New Construction Division
Plan for Development of Ground Level Space Underneath Chien-Kuo Elevated Expressway
Taipei City Government, October 1979

Bureau of Public Construction - New Construction Division
Plan for Traffic Control Facilities for the Initial Expressway System of Taipei
Taipei City Government, February, 1981

Bureau of Public Construction - New Construction Division
Report on Effects of New Elevated Expressways on Street-level Circulation
Taipei City Government, July, 1987

Dan-Jiang University Urban Planning and Development Research Office
Report on Research of Metropolitan Activity Systems and Related Facilities in Taipei
Taipei City Government, February, 1979

Robert Moses, The Lower Manhattan Expressway, pamphlet
Triborough Bridge and Tunnel Authority, 1961

On urbanism, invention, and intervention

Boyarsky, Nicholas & Murphy, Nicola
Action Research / Boyarsky + Murphy
Black Dog, London, 1998

Brouwer, Joke, et. al.
TransUrbanism
V2_Publishing/NAI Publishers, Rotterdam, 2002

Carl, Peter
On certain possibilities for the irrational embellishment of a town: ten urban artifacts
Black Dog, London, 2000

Davidson, Cynthia
Anywise
Anyone Corporation, New York; MIT Press, Cambridge, Mass., 1996

Hensel, Michael
Urbanisations : .O.C.E.A.N. UK
Black Dog, London, 1999

Ireson, Ally; Barley, Nick. eds.
City levels
August, London; Birkhäuser, Basel; Boston, 2000

Lewis, John
Urban Structuring: Studies of Alison & Peter Smithson
Studio Vista, London, 1967

Rhowbotham, Kevin
Field Event / Field Space
Black Dog, London, 1999

Salter, Peter. Architectural Association, School of Architecture
TS, intuition & process
Architectural Association, London, 1989

Smithson, Alison Margaret
Without rhetoric: an architectural aesthetic, 1955-1972
MIT Press, Cambridge, Mass., 1974

Smithson, Alison Margaret
Changing the art of inhabitation
Artemis, London, 1994

Weibel, Peter
Olafur Eliasson: Surroundings Surrounded (Essays on Space and Science)
The MIT Press, Cambridge MA & London, England, 2001

XIX Congress of the International Union of Architects
Present and Futures, Architecture in Cities
UIA Barcelona, 1996

On space and time

Giedion, Sigfried
Space, time and architecture: the growth of a new tradition
Harvard University Press, Cambridge, 1967

Hall, Edward T.
The hidden dimension
Garden City, New York, 1966

Lefebvre, Henri
The production of space
Blackwell, Oxford, UK; Cambridge, Mass., 1991

Moholy-Nagy, László
Vision in motion
Paul Theobald and Co., Chicago, 1965

Parkes, Don
Times, spaces, and places: a chronogeographic
J. Wiley, Chichester, UK; New York, 1980

Thompson, D'Arcy Wentworth
On growth and form, 2v. ed.
Cambridge, UK, University Press, 1952

- On mobility and architecture
- Barley, Nick
Breathing Cities: the Architecture of Movement
Birkhäuser, Boston, 2000
- Easterling, Keller
Organization space: landscapes, highways, and houses in America
MIT Press, Cambridge, Mass., 1999
- Bell, Jonathan
Carchitecture
August, London; Birkhäuser, Boston, 2001
- On materials, structures, temporary structures
- Angerer, Fred
Surface structures in building structure and form
Reinhold Pub. Corp., New York, 1961
- Drew, Philip
Frei Otto :form and structure
Westview Press, Boulder, Colo., 1976
- MacDonald, Angus J.
Structure and architecture
Butterworth Architecture, Oxford; Boston, 1994
- Moore, Rowan
Structure, space and skin: the work of Nicholas Grimshaw & Partners
Phaidon, London, 1993
- Rispa, Raul
Expo '92 Seville: architecture and design
Electa, Milan; Abbeville, New York, 1993
- Robbin, Tony
Engineering a new architecture
Yale University Press, New Haven, 1996
- Universität Stuttgart Institut für Leichte Flächentragwerke
IL 31 (Bambus - Bamboo)
Institut für Leichte Flächentragwerke, Stuttgart, 1992
- von Vegesack, Alexander & Kries, Mateo
Grow your own house: Simón Vélez and bamboo architecture
Vitra Design Museum und Autoren, 2000
- Yoh, Shoji
Shoji Yoh: in response to natural phenomena
L'Arca, Milano, 1997

Zannos, Alexander
Form and Structure in Architecture: the role of statical function
Van Nostrand Reinhold, New York, 1987

Arkitektur DK
1992 v.36

Detail : Zeitschrift für Architektur & Baudetail & Einrichtung
2000 no.4-6

Quaderns d'arquitectura I urbanisme, v. 220-221
Col·legi Oficial d'Arquitectes de Catalunya, Barcelona, 1998

Quaderns d'arquitectura I urbanisme, v. 230-231
Col·legi Oficial d'Arquitectes de Catalunya, Barcelona, 2001

Deployable structures
http://people.sd.polyu.edu.hk/~sdmafox/sss/readings/Depl_Struct_chp4.doc

Maiply-TECH
<http://www.maiplytech.com/>

on bamboo
<http://www.cwru.edu/edocs/7/469.pdf>

Construction with Bamboo
<http://bambus.rwth-aachen.de/index.html>

Polygal U.S.A.
<http://www.polygalusa.com/>

MIT Kinetic Design Group
<http://kdg.mit.edu/Matrix/matrix.html>

Westgeneral Inc. (acoustical)
<http://www.westgeneral.com/acoustical/prod.html>

Moss Inc. (fabric)
<http://www.mossinc.com/history/>

Campanella Acoustics
<http://www.campanellaacoustics.com>

journals

websites

appendices

Boards from final presentation

Joy C.Y. Hou
M.Arch Thesis 2002

BRIEF ENCOUNTER: transformation of space underneath elevated expressway through surface design



ABSTRACT:

The emergence of sustainable culture has significantly influenced the development of contemporary cities since the late 1980s. This century, the design of urban infrastructure and the development of existing cities is being re-evaluated from both environmental and social perspectives. Architects, engineers, and urban planners are being challenged to create a new paradigm of urban design that addresses the needs of a sustainable city. This project explores the possibility of transforming the elevated expressway into a public space through surface design. The design process involves the integration of urban scale interventions, localized interventions, and design parameters to create a dynamic and responsive structure that can be transformed into a public space through surface design.

PRECEDENTS:

urban scale interventions:

- Urban Scale Interventions: A series of images showing various urban interventions, including a bridge, a walkway, and a public space.
- Urban Scale Interventions: A series of images showing various urban interventions, including a bridge, a walkway, and a public space.

localized interventions:

- Localized Interventions: A series of images showing various localized interventions, including a bridge, a walkway, and a public space.
- Localized Interventions: A series of images showing various localized interventions, including a bridge, a walkway, and a public space.

DESIGN STRATEGY
skins and surfaces

design parameters:

- USING
- patterns of movement
- light
- acoustics

Can surface be more than providing shelter and defining boundary? Can surface structure not define form the environment and create space with other, hence informing the way of occupation? How can architecture surface change over time?

This project will explore how building skins/surfaces can be used to, and react to, different scales of change, both internal and external. The aim is to create a dynamic and responsive structure that can be transformed into a public space through surface design. The design will explore various scales of change, both internal and external. The aim is to create a dynamic and responsive structure that can be transformed into a public space through surface design.

Every process has its necessary form. Design is a process of finding the form that is necessary for the process. The form is not a static object, but a dynamic process that evolves over time. The design process is a series of decisions that lead to a final form. The form is not a static object, but a dynamic process that evolves over time.

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01					
04					

process & exploration

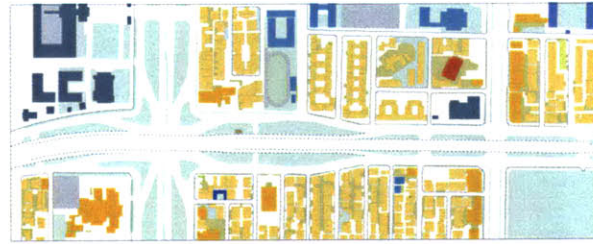
reflecting & filtering natural light

kinetic parts

ROTATING & SLIDING MEMBERS

FOLDING & PIVOTING MEMBERS

transformation of space and movement



zoning map

- residential structure
- apartment structure
- school
- public institution
- religious
- mixed-use residential
- government
- city block
- workshop structure

PROJECT SITE:
space under Chien-kuo expressway
Taipei, Taiwan

PAVE AND GREEN SPACES

TEMPORARY ENCLOSURE AND OCCUPATION

STREET LEVEL ACTIVITIES (shops, restaurants, commercial destinations)

SITE CONDITIONS:
acoustics measurement

condition A:
moderate traffic, surrounding enclosed (school)

condition B & C:
heavy traffic, surrounding buffered (park)

decible levels measured throughout the site

decible levels measured above & below structure

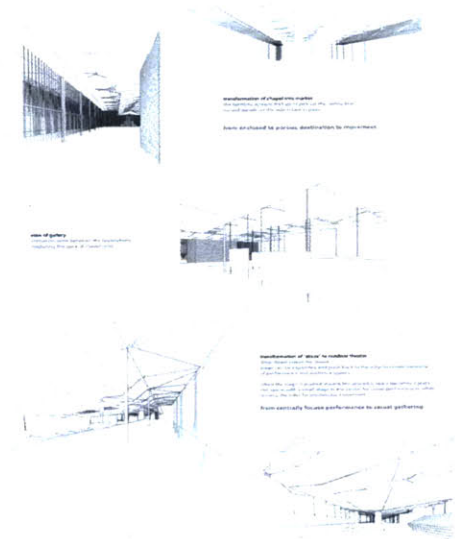
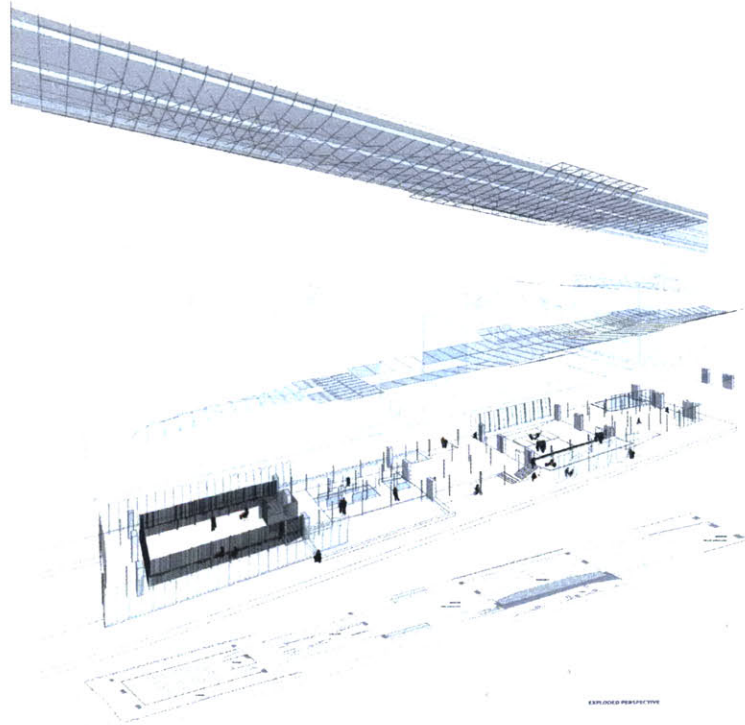
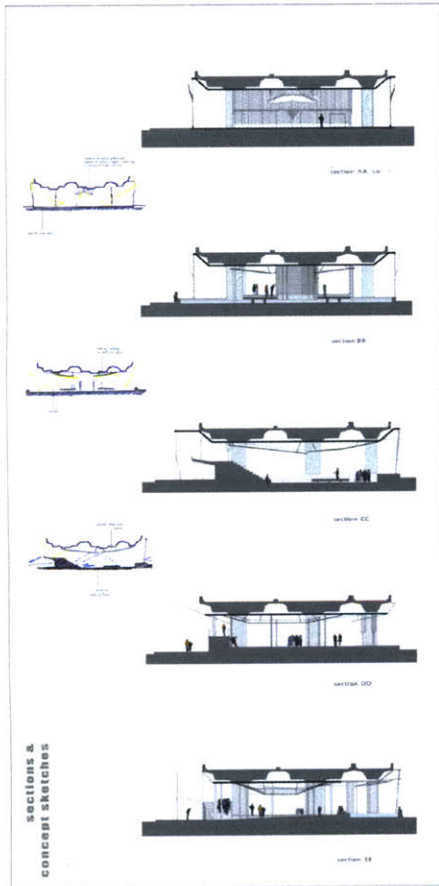
lighting studies

condition A: great distance of setback, wide sectional area of structure (clearance approx. 4.7M)

condition B: narrower street and structure (clearance approx. 0.8M)

average lighting condition

	02			
	05			



			07	08	09

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01-01 ~02	Carchitecture
01-03 ~04	http://www.bigdig.com
01-05 ~06	http://urbanismo.8m.com
01-07	Urban Structuring: Studies of Alison & Peter Smithson
01-08 ~13	Present and Furtures, Architecture in Cities
01-14 ~15	http://www.polyned.nl/eng/frameseteng.htm
01-16 ~18	http://people.sd.polyu.edu.hk/~sdmafox/sss/readings/Depl_Struct_chp4.doc
01-19 ~20	http://www.takenaka.co.jp/takenaka_e/t-file_e/hannover_e/
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01-25 ~34	http://www.arcspace.com
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