RICE UNIVERSITY

Lions, Tigers, and Bears, Sky High!

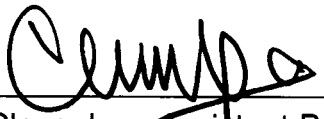
by

Andrea Manning

A THESIS SUBMITTED
IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE

Master of Architecture

APPROVED, THESIS COMMITTEE:



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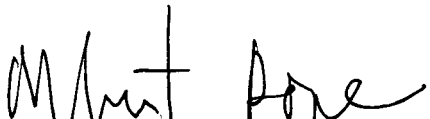

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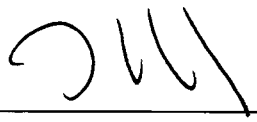

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ABSTRACT

Lions, Tigers, and Bears, Sky High!

by

Andrea Manning

The vertical zoo is a new zoo typology that rethinks both the organizational strategy of the traditional urban zoo and the tower building typology. By stacking the exhibits vertically the zoo program pushes exhibit organization in a new direction, providing opportunities for experiences not possible in traditional urban zoos. In addition, vertical stacking of the program is more efficient, taking advantage of the characteristic behaviors of heat, water and light to guide exhibit group organization. Furthermore, the verticality of the zoo program enables the zoo to become a more visual presence in an already dense urban environment. The new spatial organization of the zoo is accomplished through a reconfiguration of the systems integral to a traditional tower: the centralized core, the repetitive floor plate, and the nonspecific skin system.

ACKNOWLEDGEMENTS

To Greg, without whom this would have been impossible.

To my director, Clover Lee, who's support and dedication and patience meant everything to the development of this project.

To my dad, Jim, who refused to come down here and get the degree for me.

To my mom, Marlynn, who got me where I am today.

To Nick, who always believed in the project.

To Albert, who always gave the best advice at just the right time.

TABLE OF CONTENTS

1 Project introduction

3 History of the zoo: 3 exhibit types
10 Zoo in the city
11 Zoological networks

13 The future of the network: the vertical zoo
14 Vertical zoo site

15 Programmatic organization

17 Structural organization
20 Circulation
22 Exhibit plates
23 Skin

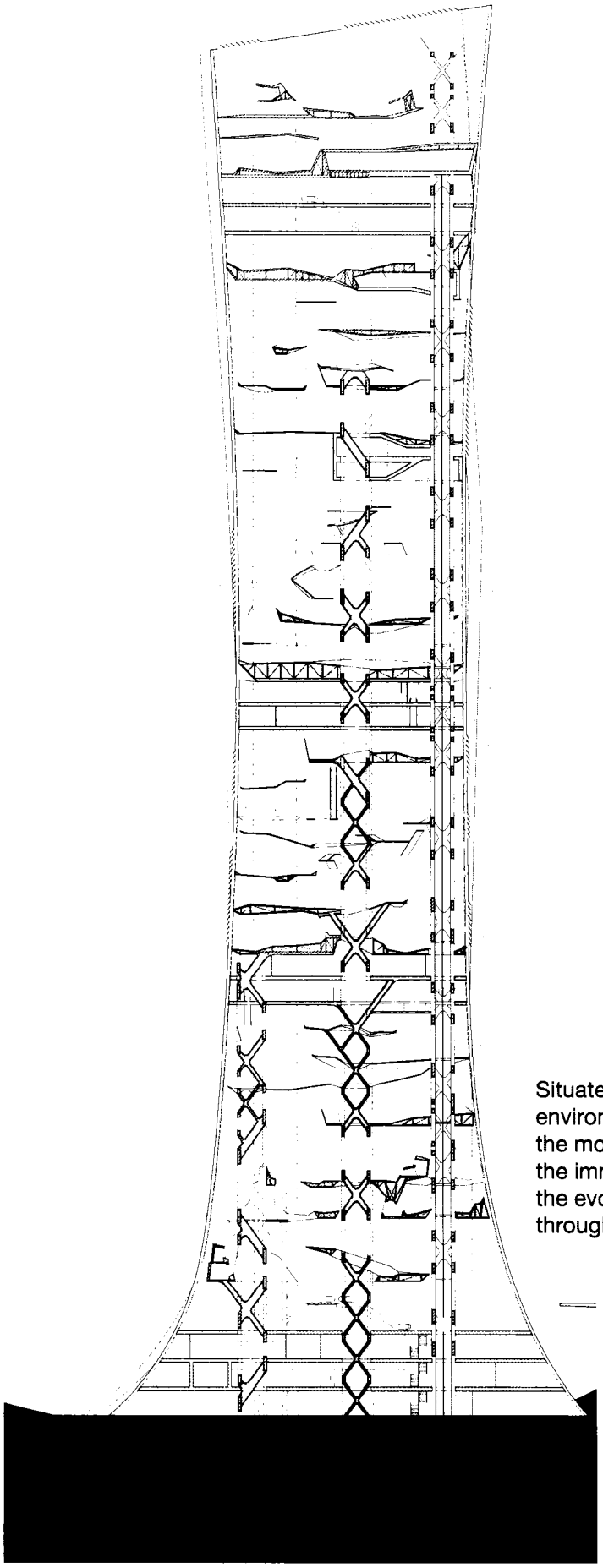
24 Project boards

41 Research boards

Modern society lives on top of nature.
Charlene Spretnak

Zoos are urban institutions. Originally parks on the city edge urban dwellers could visit when city life became overwhelming, it was a but a short time before zoos were enveloped in rapidly sprawling urban development.

For centuries zoos have provided unique opportunities for education, entertainment and research not found elsewhere in urban centers. In the last century, as knowledge of the natural kingdom changed and grew, zoos responded. Owned and operated by municipal governments, the initial responses of zoos to change were conservative. Today zoos are operated by private and not-for-profit companies and must compete for money and attention within urban and suburban settings. To woo visitors, zoos are changing in ways more radical than ever, creating and simulating entire environments into which the zoo visitor is immersed.



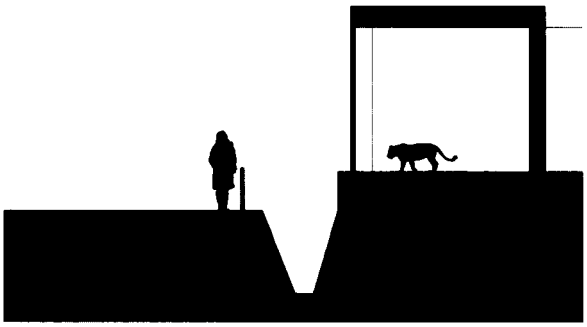
Situated in an extremely dense urban environment, the vertical zoo examines how the most successful exhibit type to date, the immersion exhibit, can continue to push the evolution of the zoological institution through stacking.

The history of the zoo: 3 exhibit types

How zoos have changed in time is reflected through the evolution of the exhibit typology. Exhibit evolutions are systemic and alter the zoo at three scales:

1. the specific exhibit
2. the grouping or organization of multiple related exhibits
3. the organization of exhibit groups on the scale of the zoo itself.

In the thousands of years that zoos have been urban institutions, there have been to this time only three polemical shifts in the evolution of the exhibit typology.

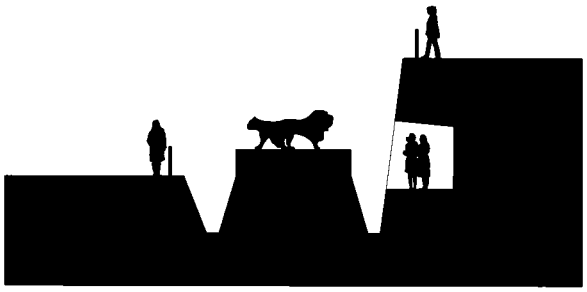


1 *Elevational exhibit*

The first milestone, the elevational exhibit, occurred in 1828 with the opening of the London Zoo. The elevational exhibit is defined by the perception of the exhibit through its frontal elevation. This scheme originally placed animals in a neutral environment, separated from the observer by an obvious barrier (i.e. iron bars or a visible moat). In the elevational exhibit scheme the animal and the observer have a one-to-one relationship. Elevational exhibits were often arranged linearly and according to taxonomy. These exhibit groups were further arranged according to animal family similarities.

1828

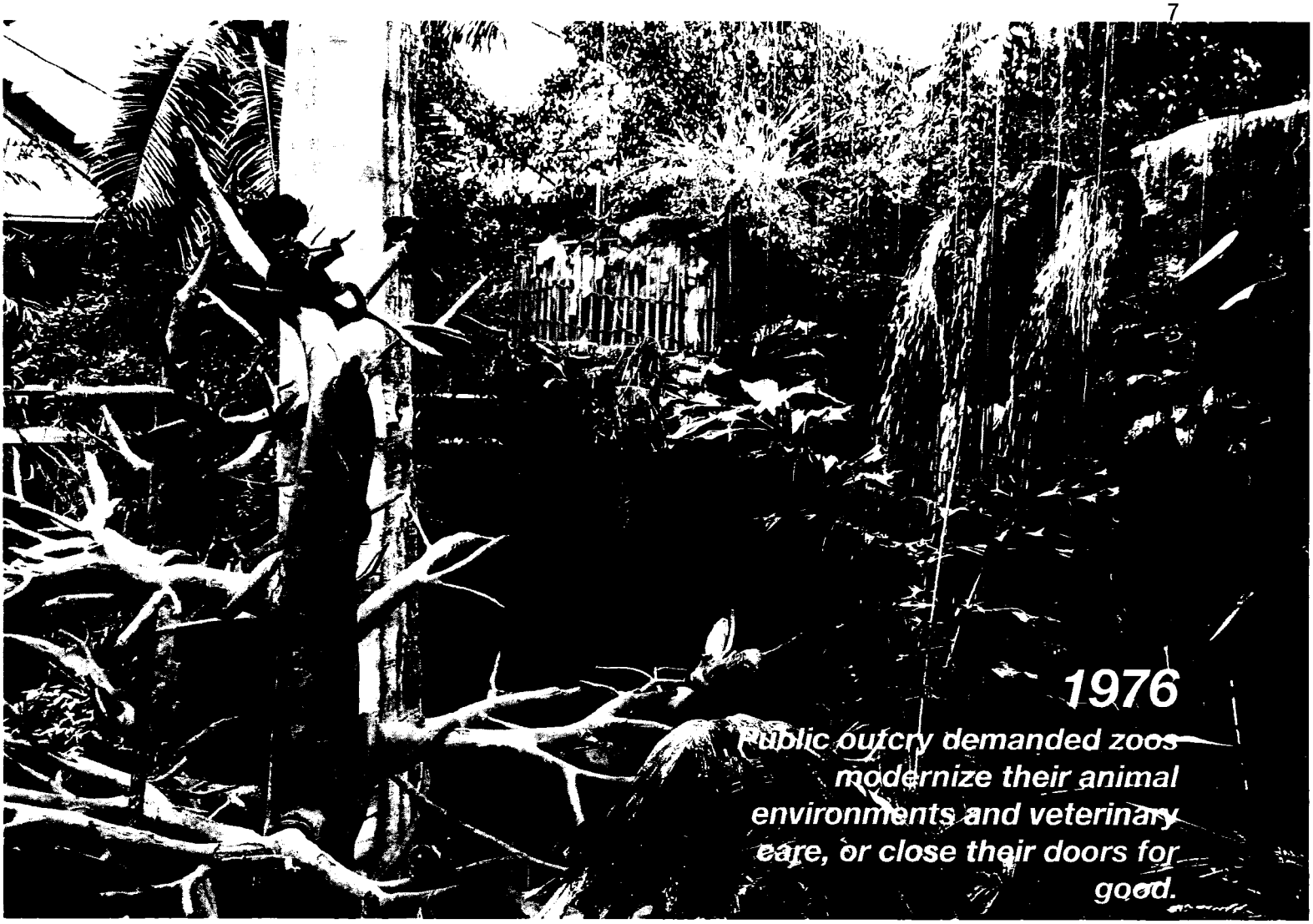
The London Zoo opens in Regent's Park. The world's first Zoological Gardens, the London Zoo was predicated on creating a scientific establishment for "teaching and elucidating zoology, and no public menageries..." (Hancocks)



② *Perimeter exhibit*

The second milestone, the perimeter exhibit, first opened in the late 1960's. This exhibit type did not replace the elevational exhibit but was added to the repertoire of zoo exhibit types. Like theater in the round, this type of exhibit enables observers to view animals from several different perspectives located around the exhibit enclosure, with views from above, below, over or under.

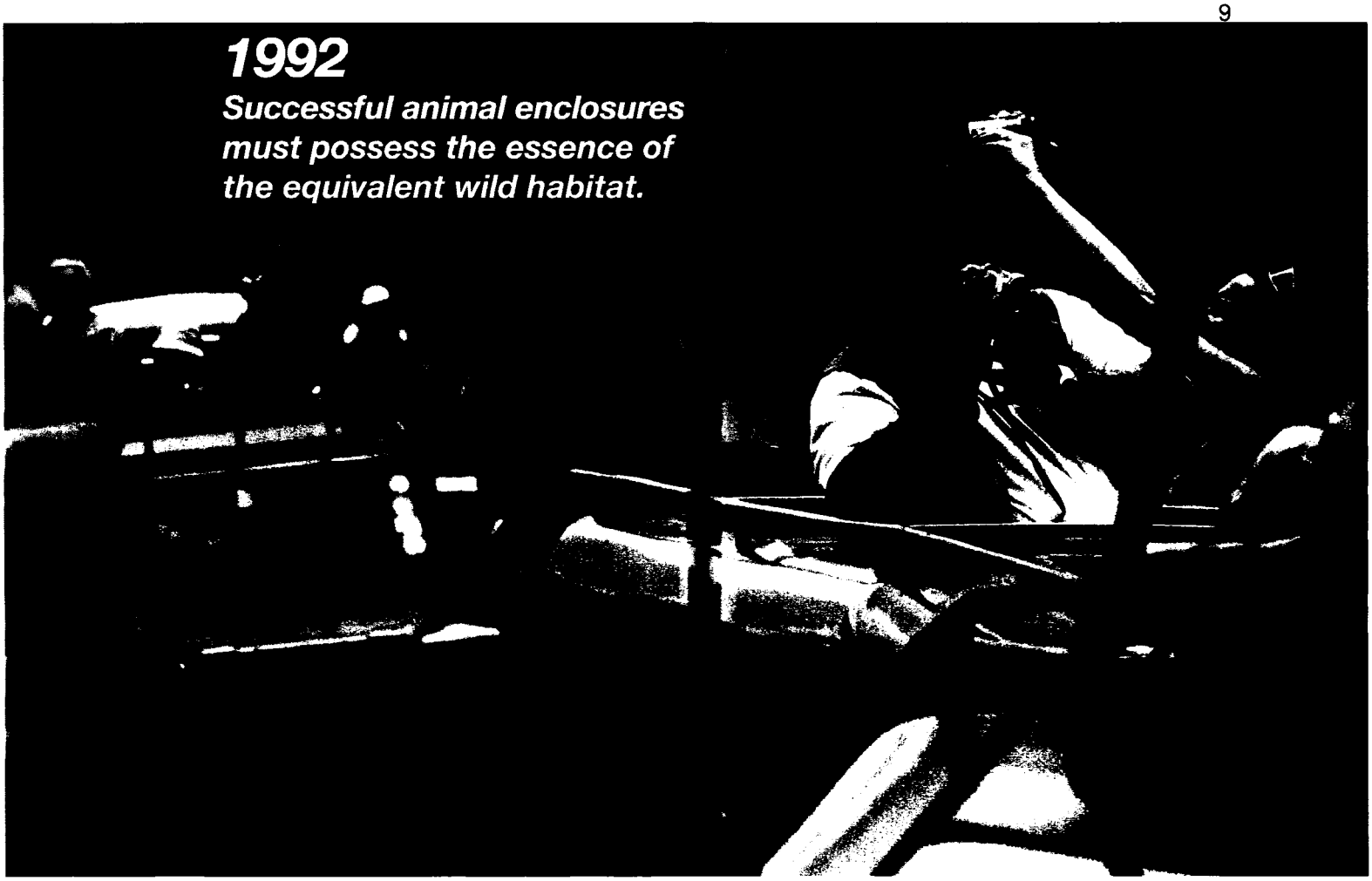
This scheme places pairs or small groups of animals in a naturalistic setting either indoors or out, separated from the observer by artifice and invisible barrier such as height or hidden electrical wire. In many cases perimeter exhibits were and are arranged according to country of origin. Groups of exhibits arranged by country of origin are often further organized with complimentary climatic zones adjacent to one another.


1976
Public outcry demanded zoos modernize their animal environments and veterinary care, or close their doors for good.

③ *Immersion exhibit*

In the early 1990's, the immersion exhibit scheme was added to the zoo exhibit catalog. The focus of the immersion exhibit is to recreate the natural setting and behavior of the animal inhabitants. Different from the previous two exhibit schemes, the immersion scheme locates the observer within the animal enclosure, looking outwards to the animal and exhibit borders beyond. The scheme places typical species groups in a setting reliant upon both natural and artificial ground condition and vegetation, again separated from the observer artifice and invisible barriers.

Similar to the perimeter scheme, immersion schemes are typically arranged according to country of origin, but require a larger area than the previous exhibit types. Space permitting the immersion scheme may occur in either an indoor or an outdoor setting.



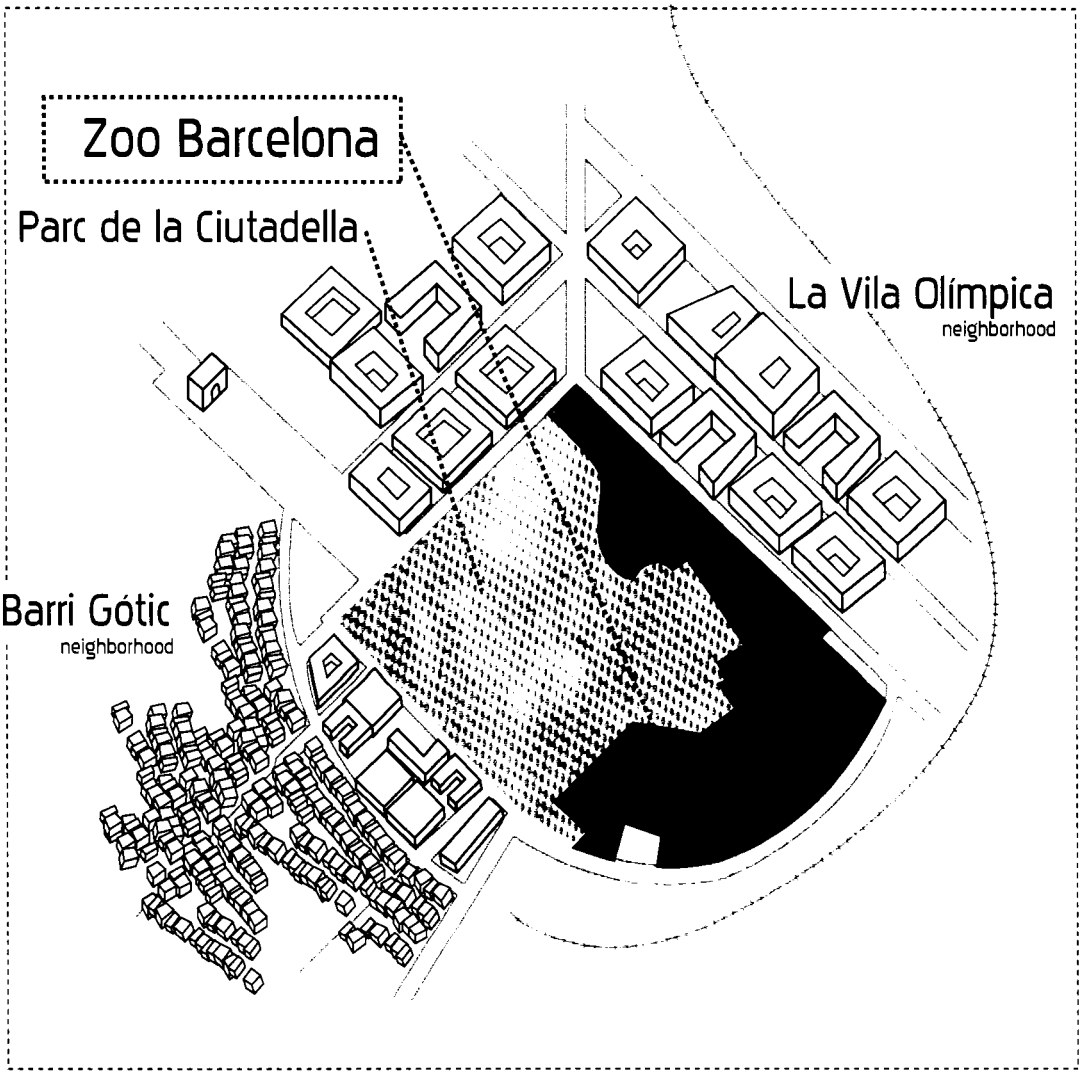
Of the exhibit types, the immersion exhibit scheme has been the most successful based on the following criteria:

1. animal health and welfare,
2. providing the zoo visitor with an experience that is entertaining and completely engaging,
3. and providing an educational experience, enabling the visitor to observe animals behaving in as natural a way as possible in an urban environment.

However, this model of immersion exhibit is difficult to implement in dense cities because of its large area requirement.

Zoo in the city

Most zoos rely on nothing but a very thin line of park space to both delineate and protect the zoo from its urban environment. This thin park line also means the zoo has little to no room to grow outwards and thus must seek other ways in which the immersion exhibit experience can be provided.



While the north and east edges of the zoo are buffered by the Parc de la Ciutadella. the south and west edges are bounded by the neighborhood. La Vila Olimpica. A 4m stone fence and zoo exhibit buildngs are the only barriers between the zoo and the adjacent urban environment. The audio and visual presence of the city is apparent continuously along the eastern edge of the zoo.

Zoological networks

Many zoos have specialized and institutionalized into zoological networks in order to find the space that enables the network now, instead of the independent zoo, to provide the full immersive experience. The network is composed of newer zoo typologies that function alongside the traditional urban zoo:

the wild animal park

the regional park

the endangered species park

and the aquarium.

These zoological institutions are then united to form zoological networks, examples include CRES (Conservation and Research of Endangered Species) that includes the San Diego Zoo and Wild Animal Park, and the WCS (Wildlife Conservation Society) network that includes the Bronx Zoo, three other New York City zoos and an aquarium.

One of such networks is Zoo Net, Tokyo's zoological network. The vertical zoo is situated in very dense and very active Shibuya Ward, in Tokyo. Zoo Net includes five other zoo institutions:

a traditional zoo

a regional zoo

an aquarium

and two endangered species zoos.

Zoo Net is active in preservation and conservation efforts with other zoos worldwide. The vertical zoo is the new urban component for Zoo Net, much like the Bronx, London, or San Diego Zoos.

The future of the network: the vertical zoo

The vertical zoo is a new zoo typology intended to function alongside other zoological institutions in a zoo network.

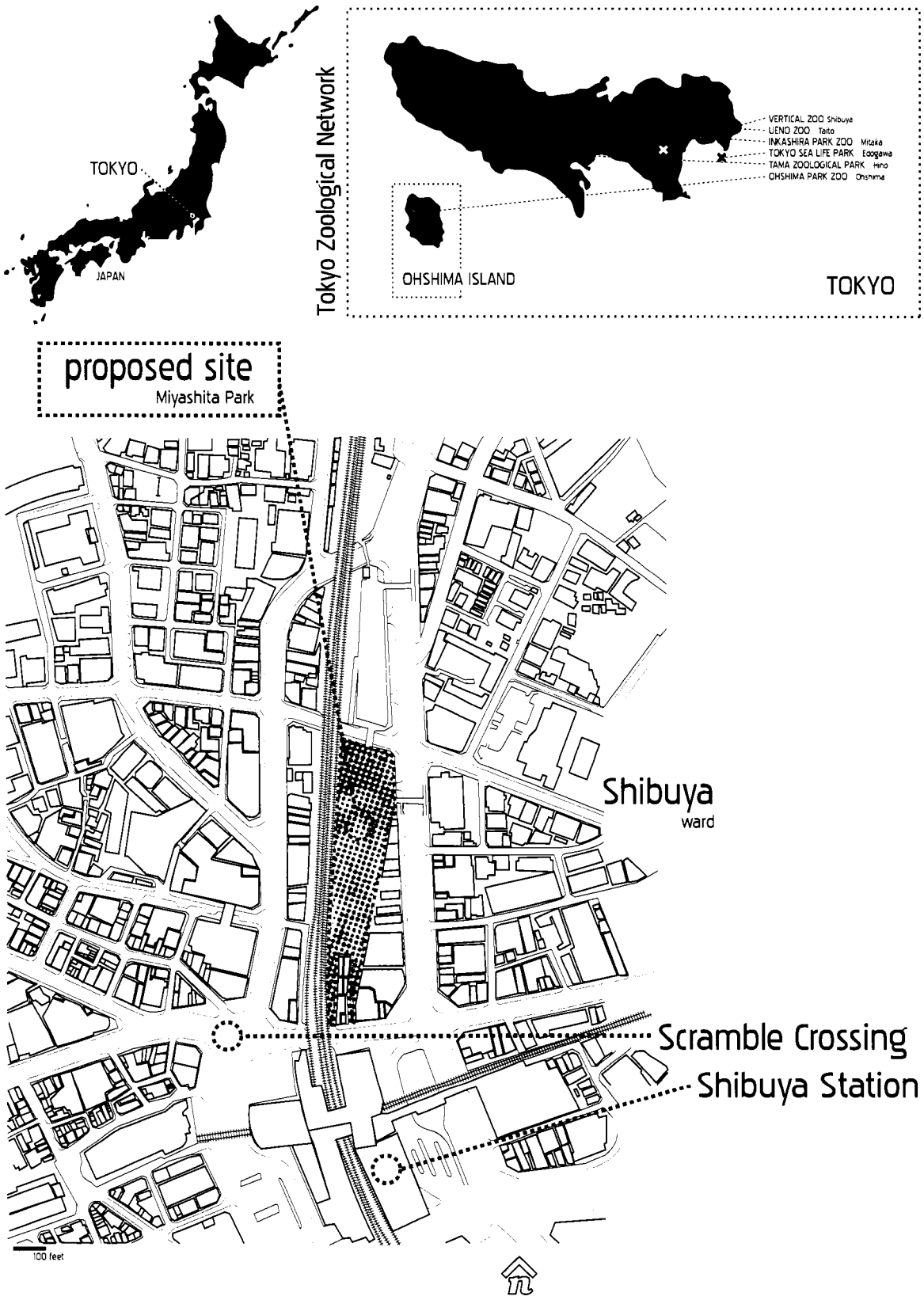
The vertical zoo rethinks the immersion exhibits spatial orientation and the relationships between various exhibits by stacking the exhibits and exhibit groups vertically.

Taking advantage of vertical space enables the zoo to maintain an urban site, which is important for visitor accessibility and crucial for a continued zoo presence in the city.

By enclosing immersion exhibits in an indoor setting, the zoo is able to recreate the many varied animal environments more accurately.

With the addition of the vertical zoo, a zoological network can redistribute its program more advantageously, improving exhibit space in all of the zoological institutions within the network.

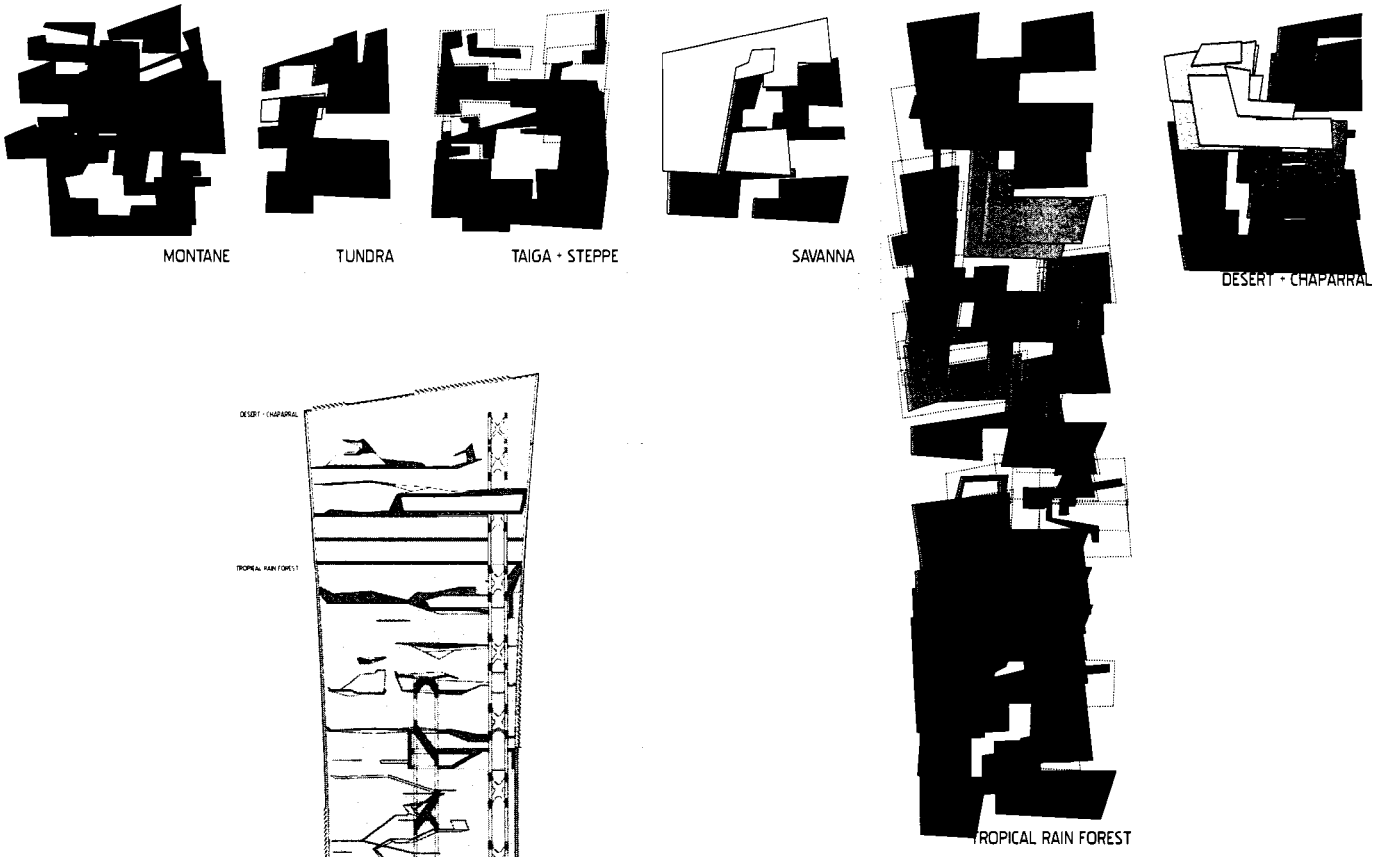
Vertical zoo site



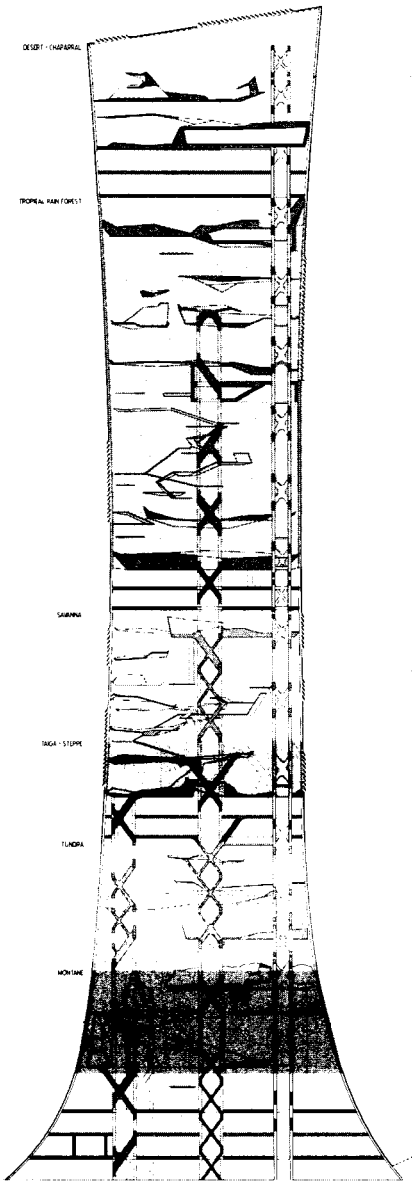
Programmatic organization

The vertical stacking of the immersion exhibits is a more efficient spatial model. Although the vertical zoo's site is only 2.4 acres, 80% of the vertical zoo's area is dedicated to exhibit space. This can be compared to traditional zoos where exhibit space is typically around 10% of the total site area.

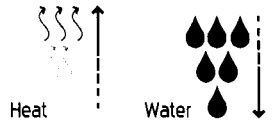
Vertical stacking of the immersion exhibits is also more energy efficient, taking advantage of heat rising and water falling. To this effect the exhibit program is organized according to bioclimatic zone. The immersion zones are then stacked in terms of the needs for more or less heat, more or less water, and more or less light. For example, in the vertical zoo, the Montane and Tundra bioclimatic zones that require cooler temperatures and less light are at the bottom of the tower, while the Desert Chaparral zone that requires significantly more light, much warmer ambient temperatures, and less water is at the top.



Program is arranged according to species
BIOCLIMATIC ZONE
of origin.

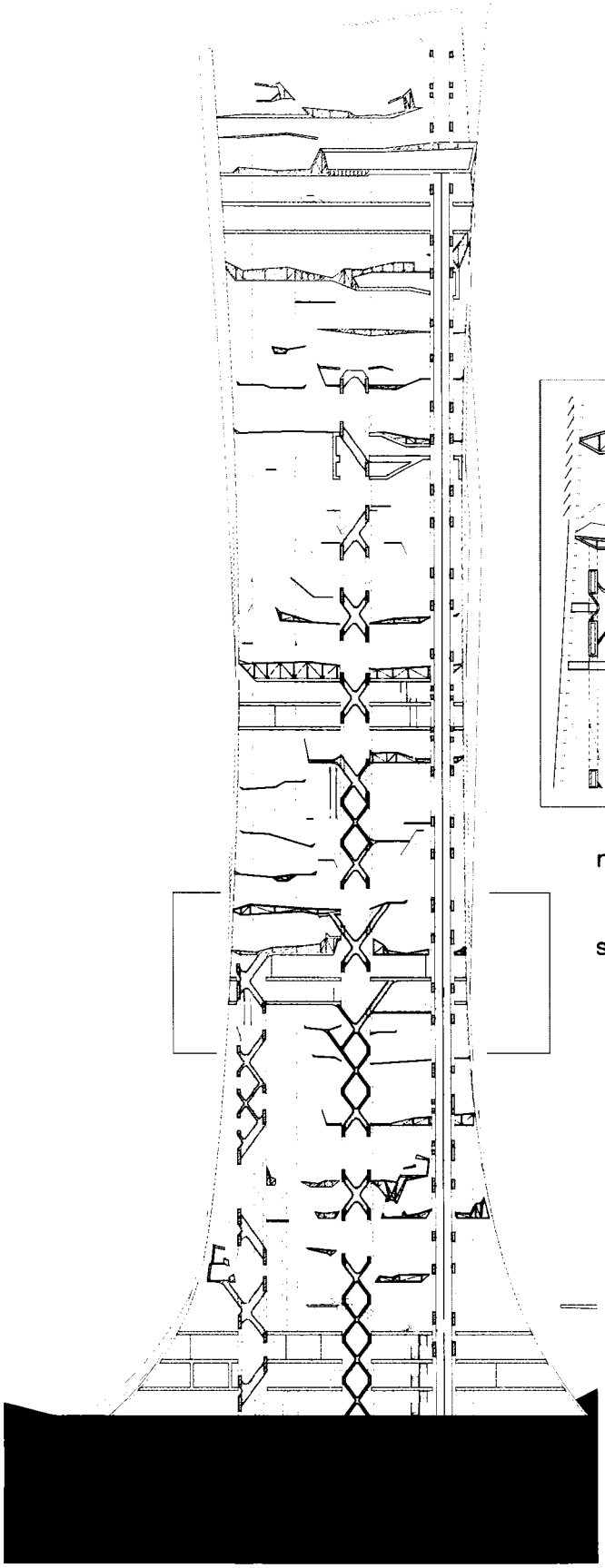


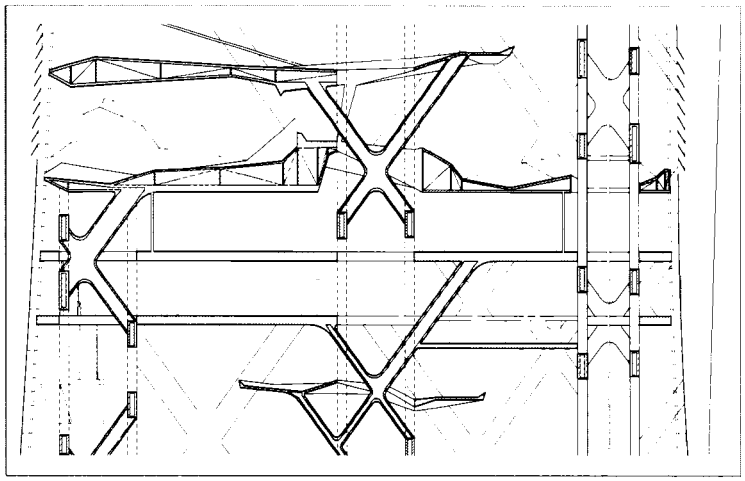
Bioclimatic zone stacking is more energy efficient, taking advantage of the properties of heat rising and gravity's pull downwards on water.



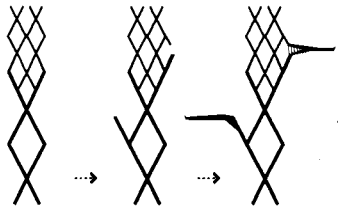
Structural organization

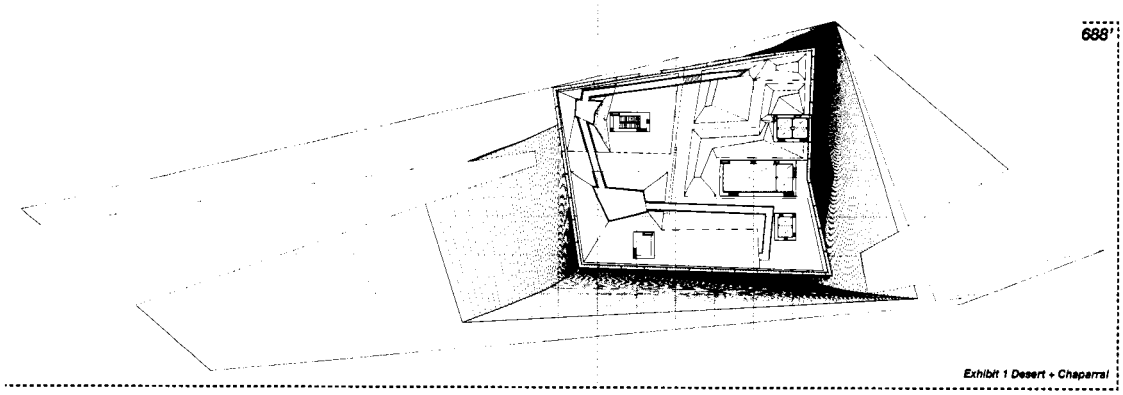
The bioclimatic zones are supported by a system of distributed structural cores that continue to different heights through the building and accommodate the different loading conditions and diverse spatial configurations of the various climatic zones. These cores utilize a dynagrid structure, a dynamic grid not uniform in aperture, to create super columns. These super columns require less structural steel, can more adequately support uneven loading conditions, and enable more light to move unimpeded into the building. Additionally, these cores enclose the intense mechanical support the zoo program requires. Further, the dynagrid of these cores branches out to help form the framework for the secondary structure that directly supports the exhibit armature and visitor circulation.

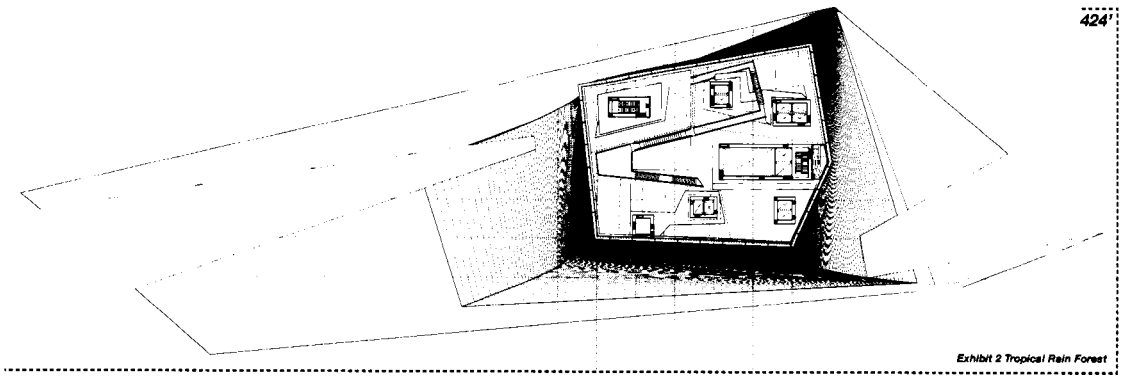


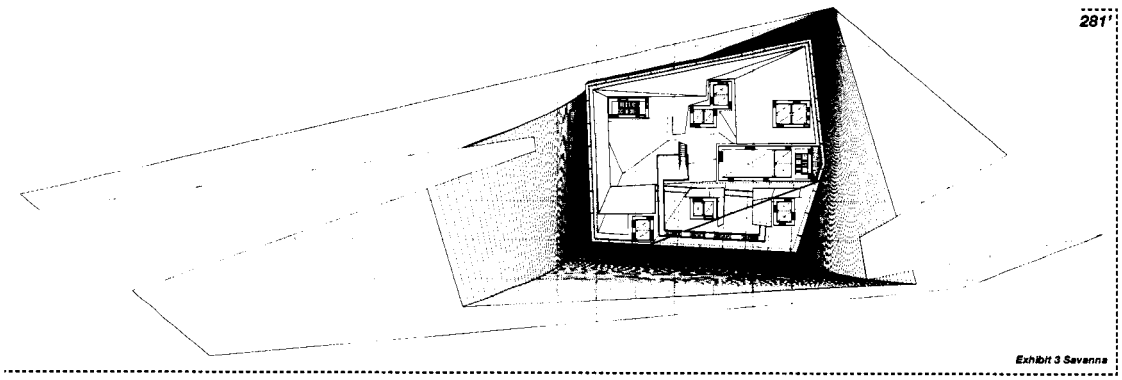


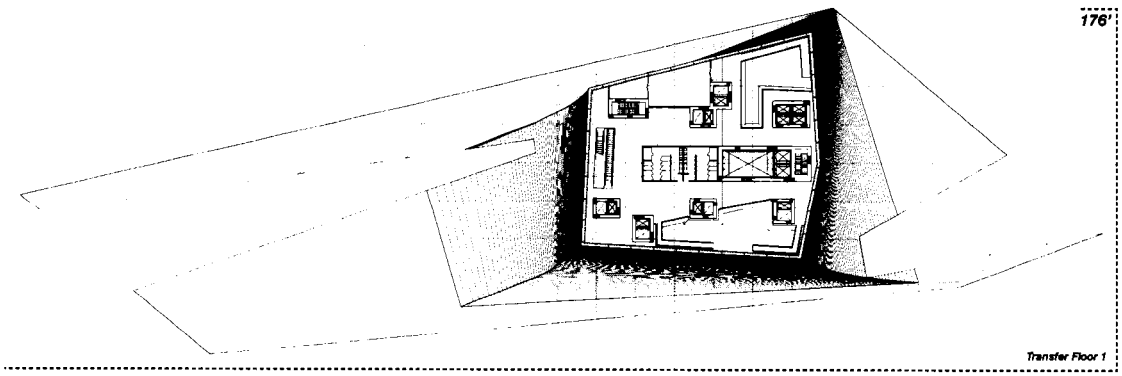
The cores utilize a dynagrid structure, a dynamic grid not uniform in aperture, to create super columns. These columns travel to different heights through the building and at moments, branch out to form the secondary structure that directly supports the exhibit platforms and the circulation.




688'
Exhibit 1 Desert + Chaparral


424'
Exhibit 2 Tropical Rain Forest


281'
Exhibit 3 Savanna


176'
Transfer Floor 1

Circulation

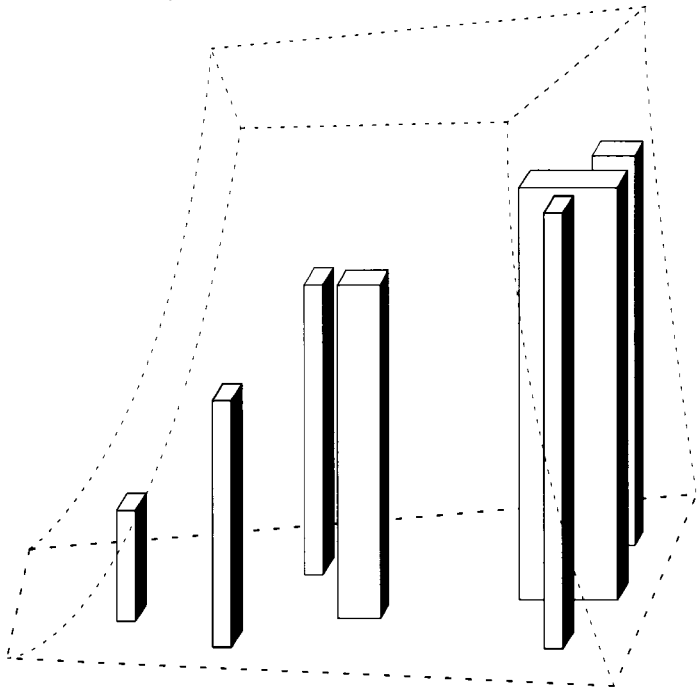
The zoo program requires multiple threads of circulation to occur and interact simultaneously. To accomplish this, the vertical zoo utilizes a circulation system consisting of a fast primary element and a slow secondary element. The primary circulation routes occur in tandem with the distributed structural cores. Each of these cores supports an elevator bank that ascends to different levels within the tower. These cores move people quickly to any of two types of destinations within the tower: transfer floors or intermediate floors.

Transfer floors are distinct from the bioclimatic zones and house the non-exhibit program of the zoo. These floors function as lobbies and support space. Here can be found cafés and retail boutiques, as well as staff administrative offices, education space and related facilities.

Intermediate floors are much smaller and are located within the bioclimatic immersion zones. These floors serve as launching platforms from which visitors move directly into a bioclimatic zone.

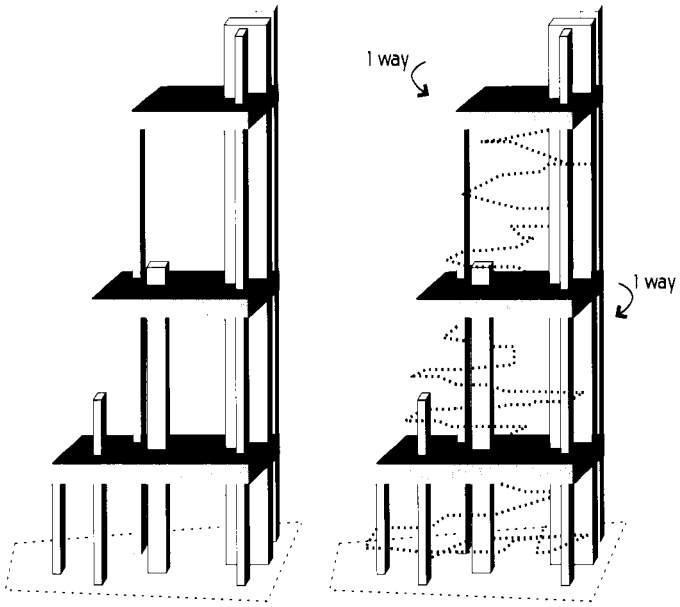
The secondary circulation route is accessible from both the transfer floors and the intermediate floors and consists of a series of catwalks, ramps, stairs, and escalators that move visitors among and through the immersion exhibits within the bioclimatic zones. Accessible from the secondary circulation are viewing platforms and short paths that take advantage of the vertical orientation of the space and enable visitors viewing vantage points that are typically not found in traditional zoos.

The structure and primary circulation are combined in 9 mega columns that ascend to different heights through the tower.

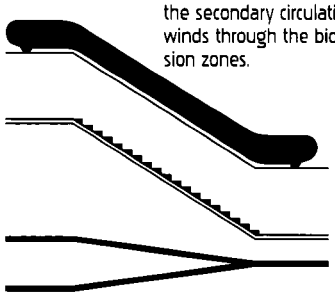


Relationship of mega column height to light penetration and filtration through the tower.

Within each dynagird mega column is an elevator bank that functions as part of the primary circulation core.



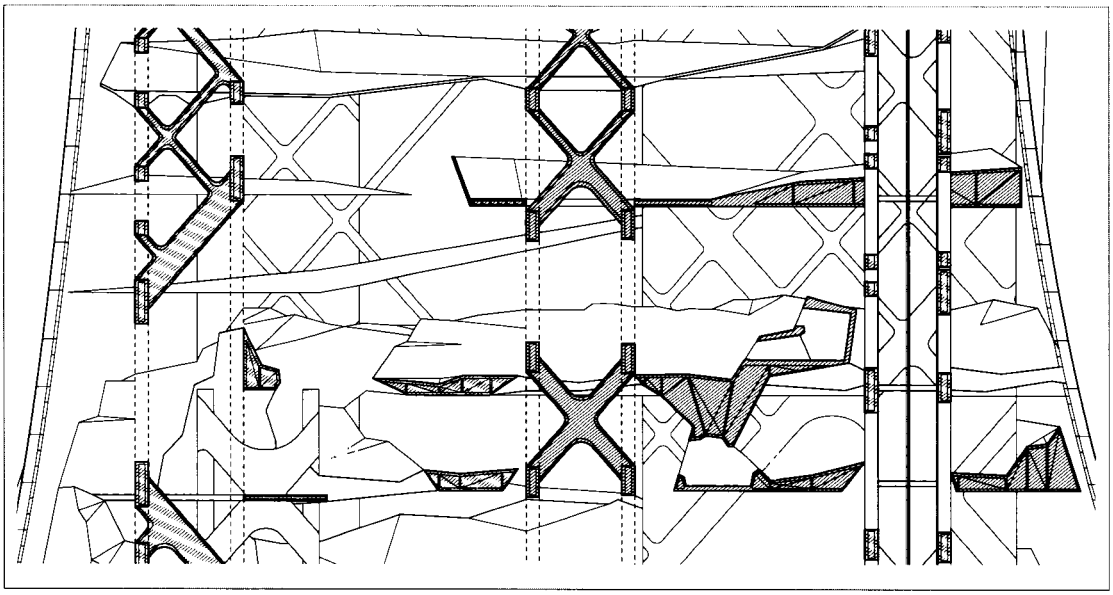
Escalators, stairs and ramps compose the secondary circulation system that winds through the biodimatic immersion zones.

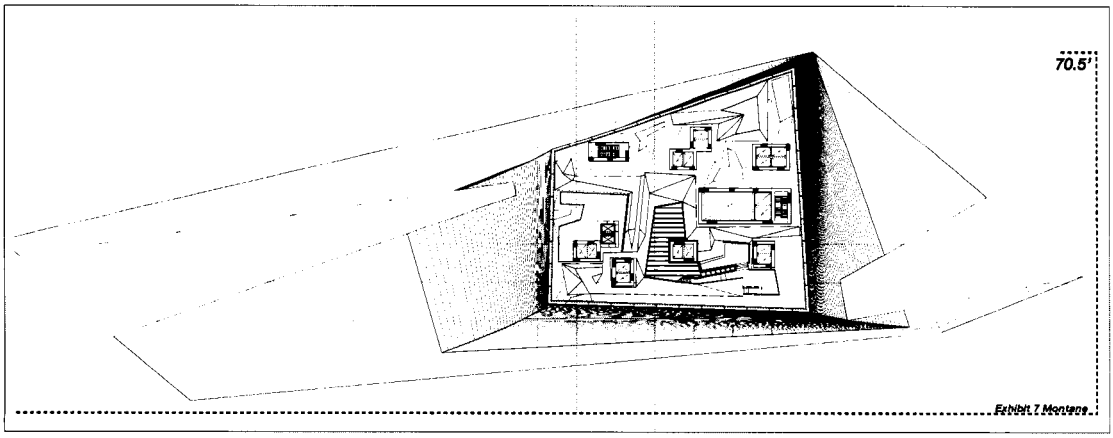


The secondary circulation is a one way path that winds downwards through each of the bioclimate zones, with entrance and exit points at each of the three transfer floors and the small intermediate platforms that occur at the upper termination point of each elevator.

Exhibit plates

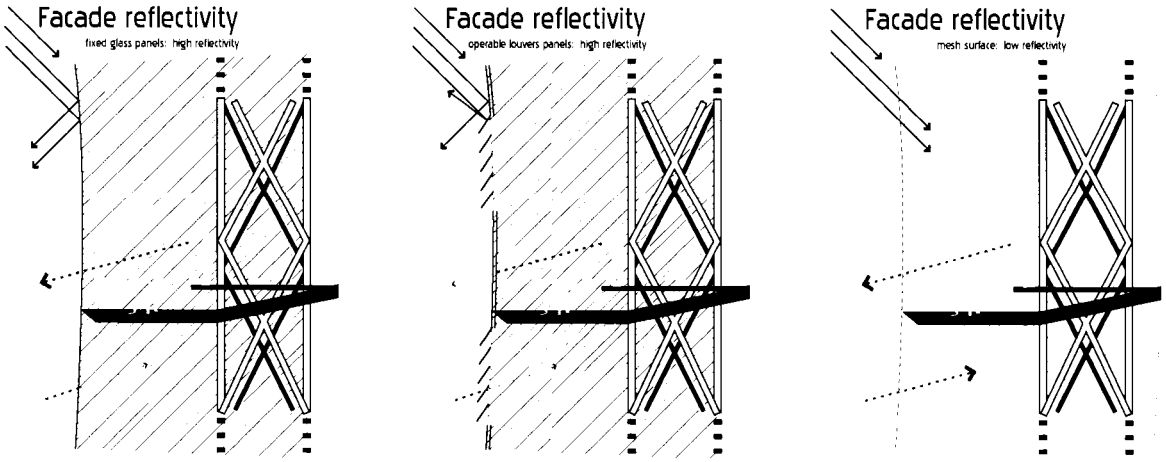
The exhibit platforms act as framework for the groundwork and vegetation that will later fill out the exhibit space. Conceived as plates that overlay a steel skeletal frame, exhibit platforms may become deep to create steep slopes for what will become mountainous terrain, as seen in the Montane bioclimate zone, or diversely may be thin with upturned edges acting as shallow trays to eventually hold soft ground matter like sand or mud. Exhibit platforms are not designed to be specific to an animal inhabitant, but rather to provide a substrate that can support the bioclimatic zone and the conditions typical to that zone in which it is located.





Skin

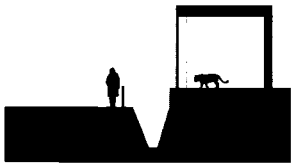
The exhibit platforms are contained by a double layer skin consisting of a glass exterior and wire mesh interior. This skin regulates the interior environment, as well as to determine what can be seen from within the exhibits looking out, and from outside looking into the tower. These conditions are achieved by alternating the arrangement of the glass and mesh components of the skin or by completely removing one of the components, such as the glass, leaving only a mesh exterior. Inoperable skin occurs in climatic zones that are incompatible with Tokyo's native environment, such as the Desert Chaparral zone. Operable skin occurs in climatic zones that are maintainable with exposure to Tokyo's climate. In the zones where the skin is operable, the exterior of the skin would require more technical support, and the skin's armature would appear heavier when viewed from within the inside. In certain zones the glazing of the skin will pull in entirely, leaving only the mesh along the surface of the tower.



Project boards

The vertical zoo is a new zoo typology that rethinks the spatial orientation of the immersion exhibit within the individual exhibit and between the groups of exhibits, the bioclimatic zones. By stacking the exhibits vertically, the zoo program is more efficient, taking advantage of the movement of heat, water, and light to guide bioclimatic zone organization - pushing exhibit organization in a new direction. The verticality of the vertical zoo tower enables the zoo program to become a more visual presence in an already dense urban environment.

The history of the zoo:
3 exhibit types



1828

150 years ago the world 'zoo' first appears in the OED

Elevational Exhibit

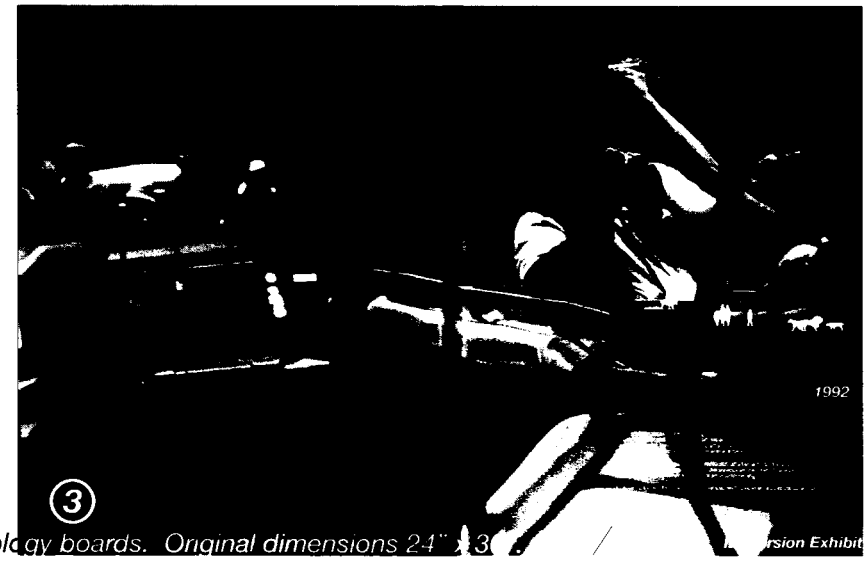
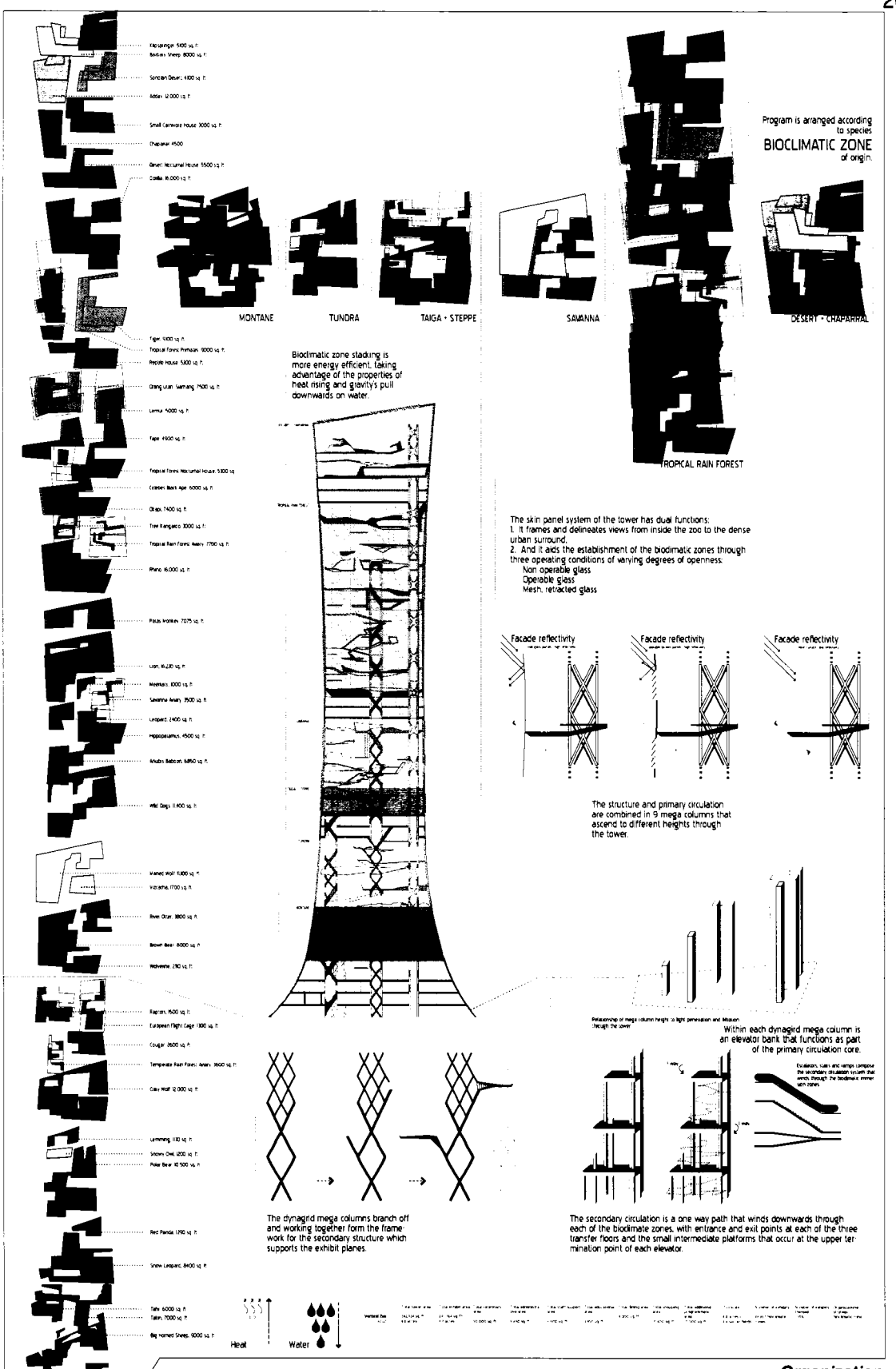
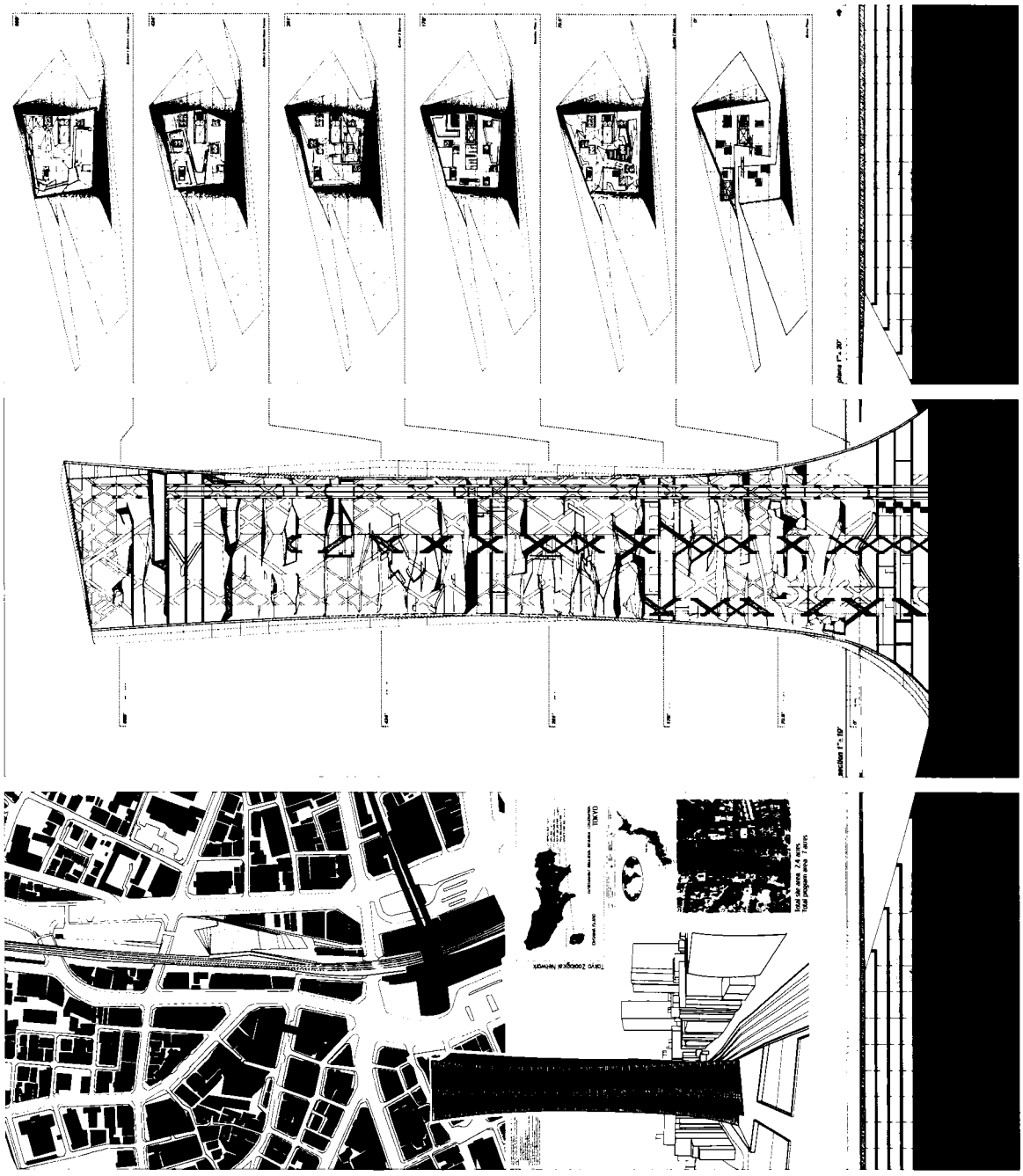


Exhibit typology boards. Original dimensions 24" x 3[illegible]

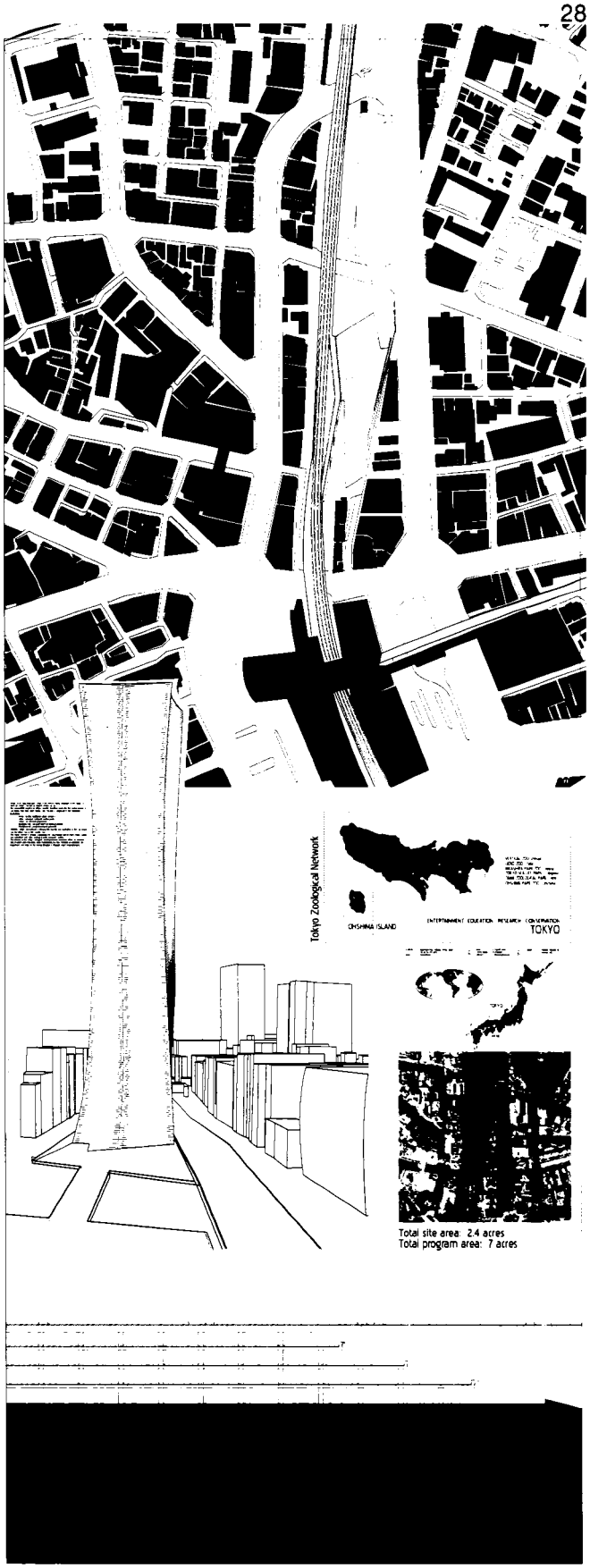


Program diagram board. Original dimensions 56" x 36".

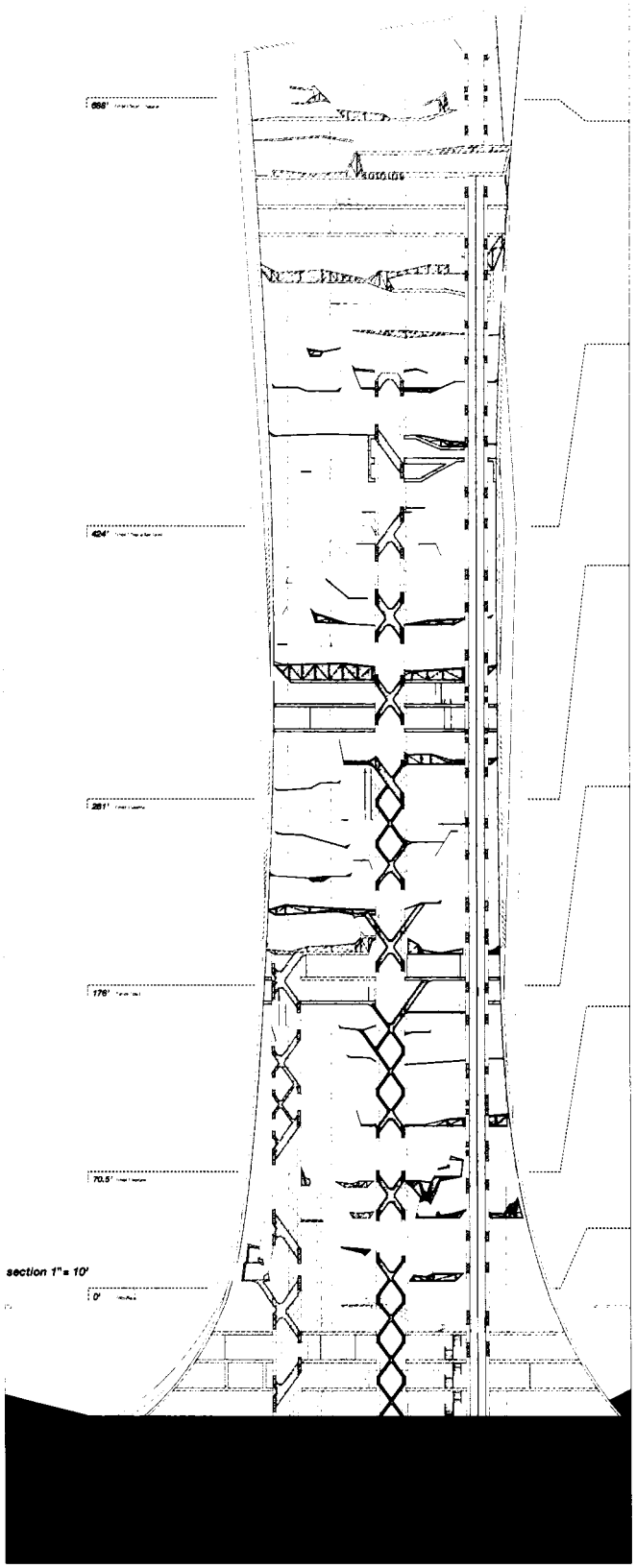
Organization



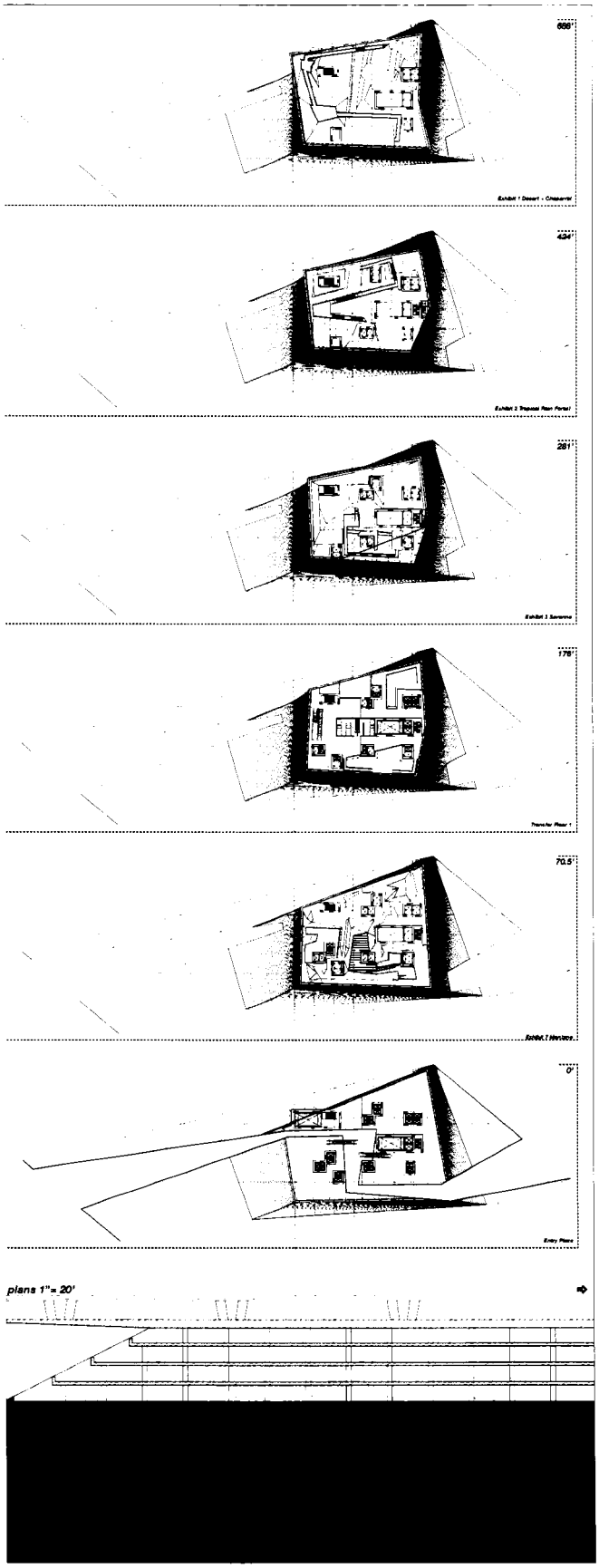
from bottom to top: site board, section board, plans board. Original dimensions 96" x 36".


Tokyo Zoological Network
OHSHIMA ISLAND
TOKYO
Total site area: 2.4 acres
Total program area: 7 acres

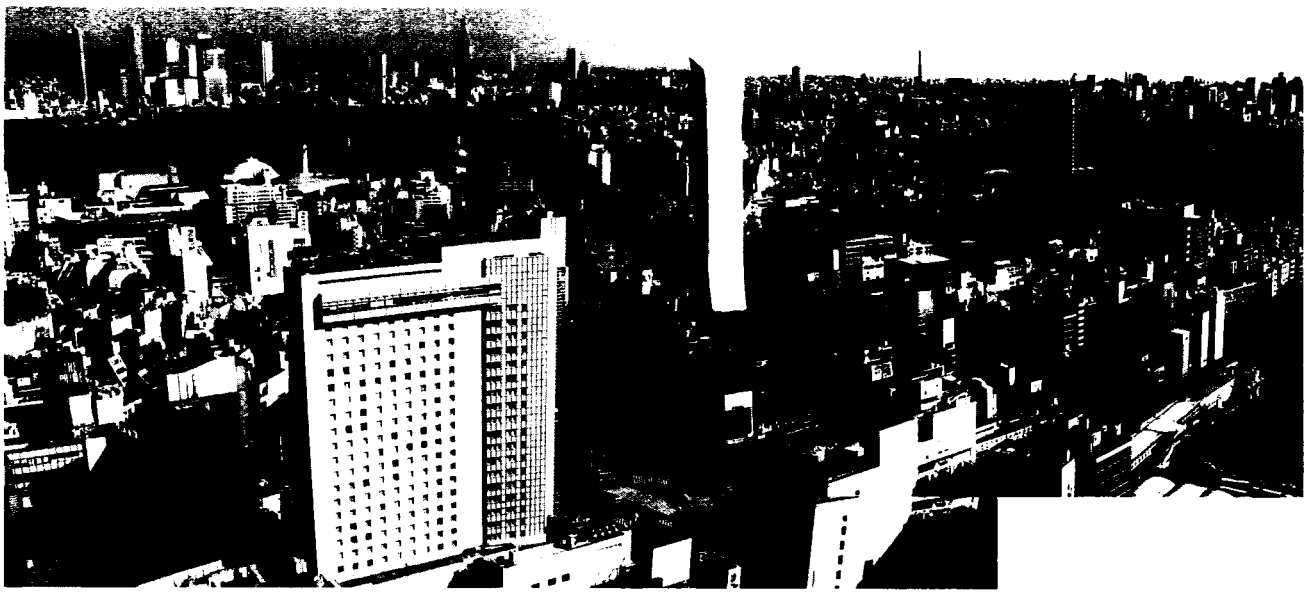
Site board.



Section board.

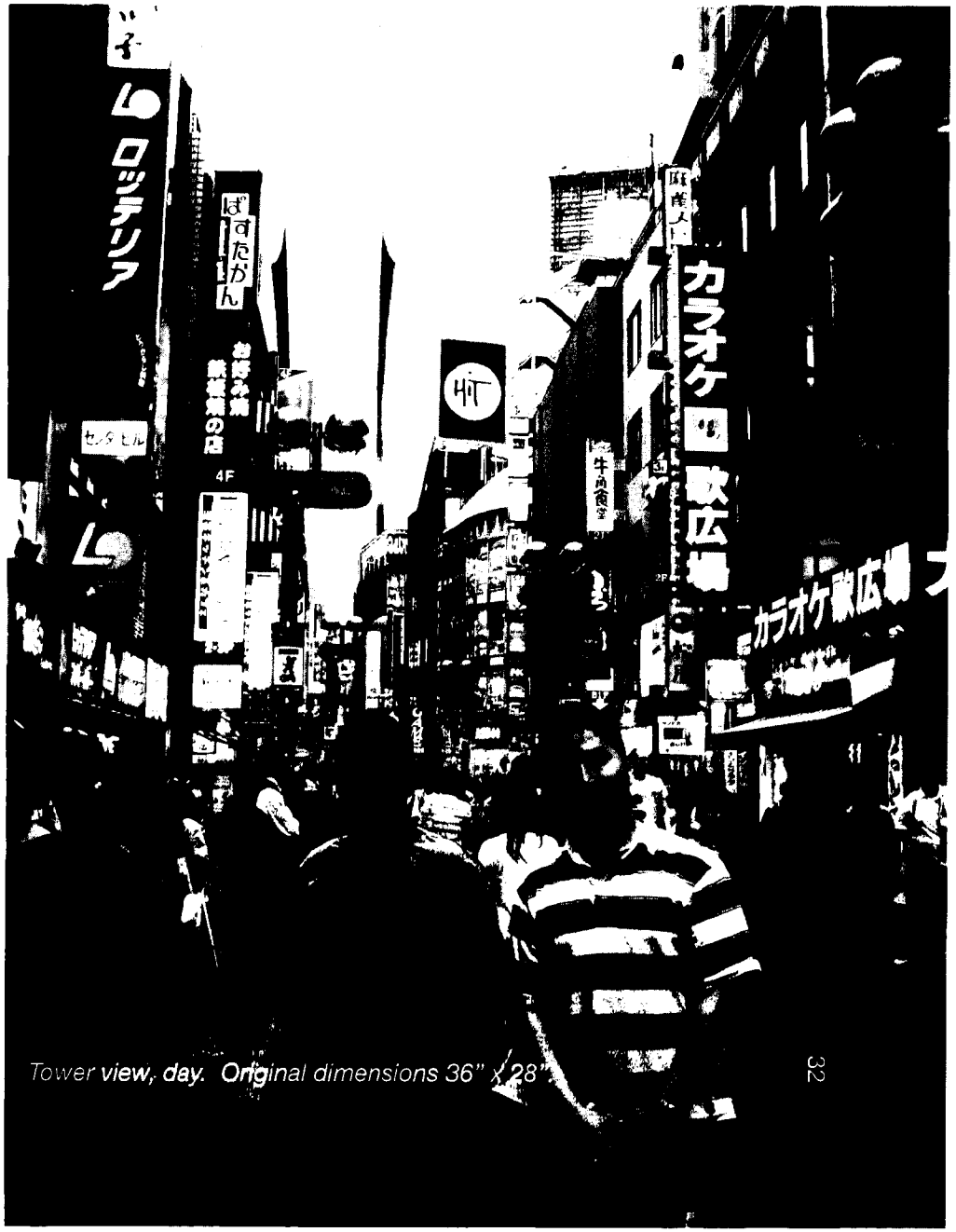


Plans board.



Shibuya skyline and vertical zoo. Original dimensions 20" x 36".

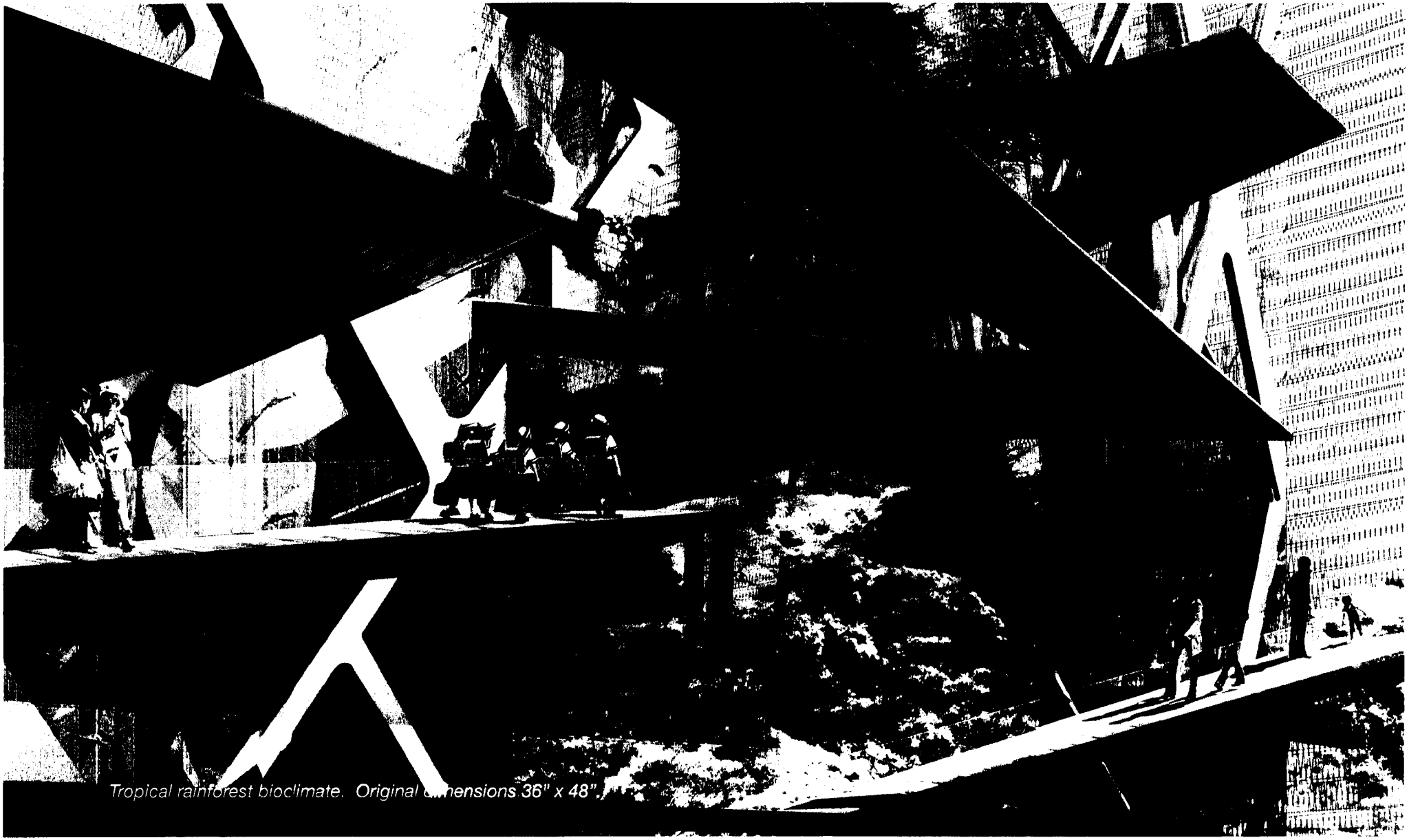
Tower view, night. Original dimensions 36" x 28".



Tower view, day. Original dimensions 36" x 28".

Tower overall ... ons 56" x 36".

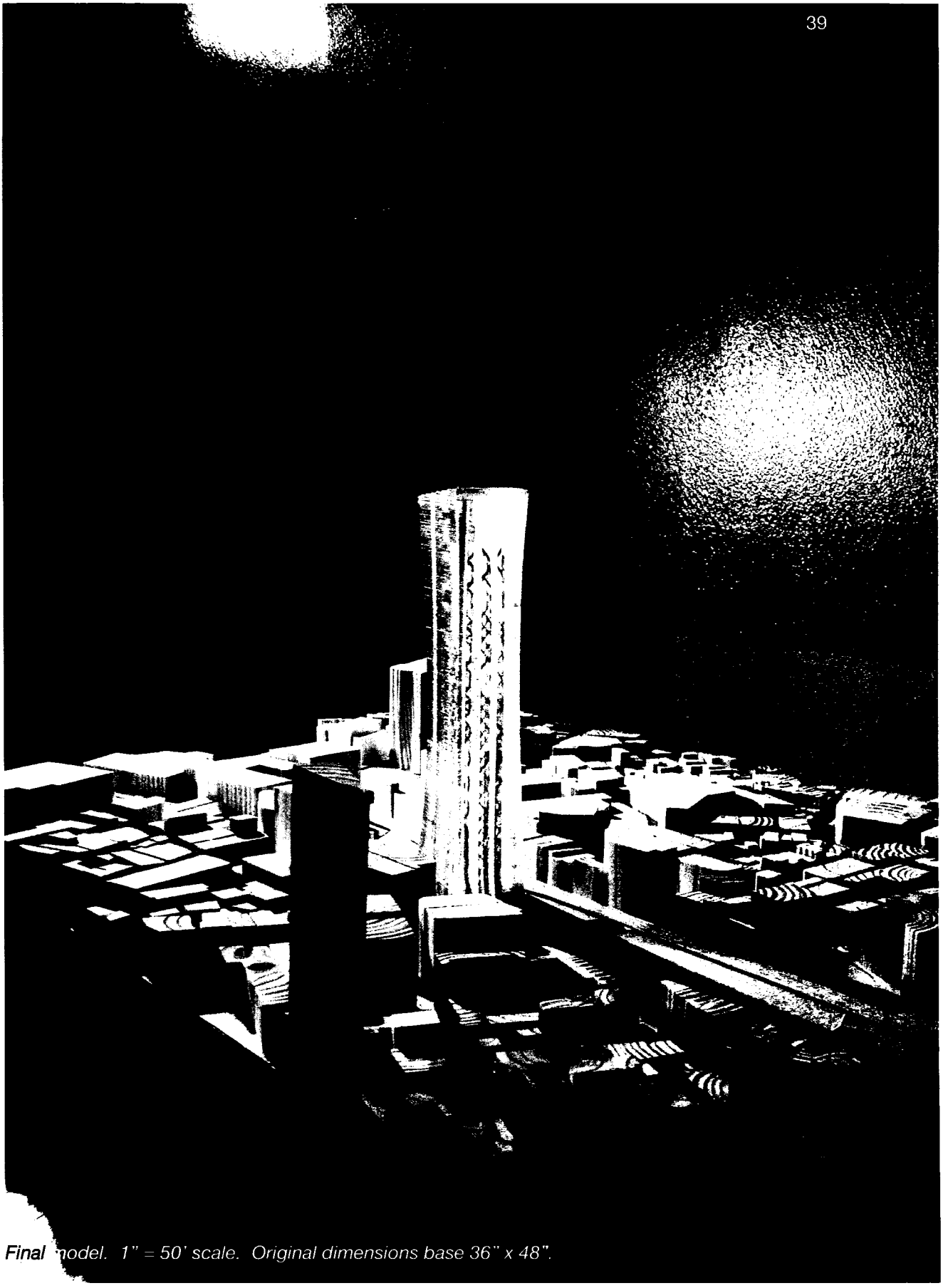
Entry plaza level and montane bioclimate. Original dimensions 36" x 48".



Tropical rainforest bioclimate. Original dimensions 36" x 48".

Transfer floor view into tropical rainforest bioclimate. Original dimensions 36" x 48".

Desert/chaparral bioclimate. *Original dimensions 36" x 48".*



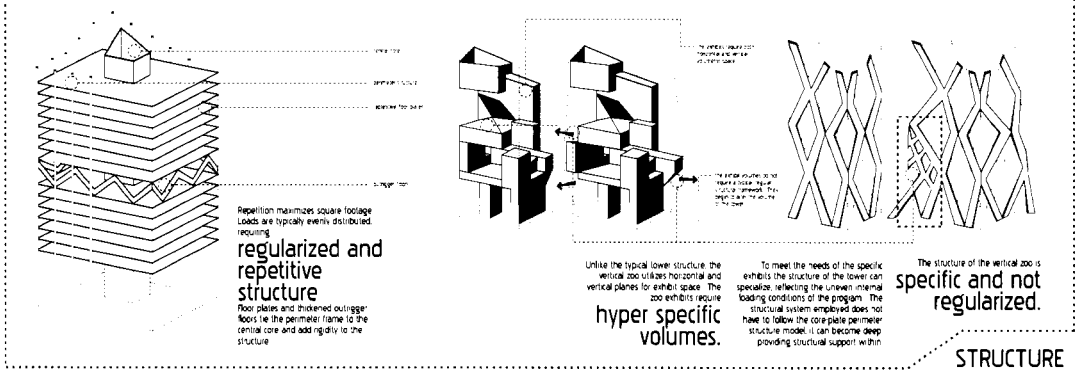
Final model. 1" = 50' scale. Original dimensions base 36" x 48".

Final presentation January 11, 2007. Photo by Richard Hofstede

Research boards

The tower + the zoo

EXHIBITS + ORGANIZATION in:



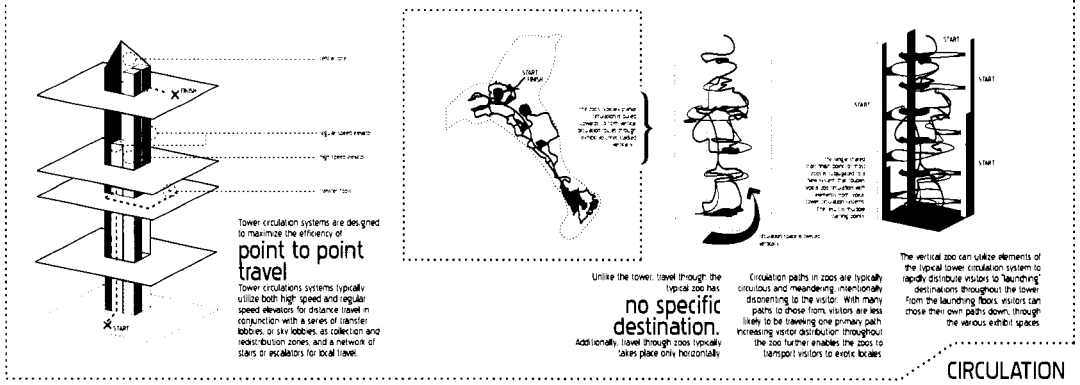
Repetition maximizes square footage
Loads are typically evenly distributed, requiring
regularized and repetitive structure
Floor plates and thickened outrigger floors tie the perimeter frame to the central core and add rigidity to the structure

Unlike the typical tower structure, the vertical zoo utilizes horizontal and vertical planes for exhibit space. The zoo exhibits require
hyper specific volumes.

To meet the needs of the specific exhibits the structure of the tower can specialize, reflecting the uneven internal loading conditions of the program. The structural system employed does not have to follow the core-plate perimeter structure model; it can become deep providing structural support within

The structure of the vertical zoo is
specific and not regularized.

STRUCTURE



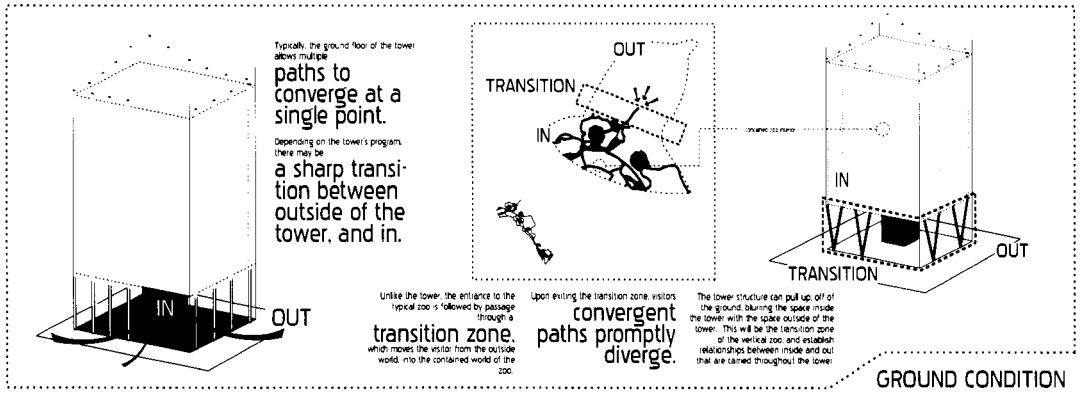
Tower circulation systems are designed to maximize the efficiency of
point to point travel
Tower circulations systems typically utilize both high speed and regular speed elevators for distance travel in conjunction with a series of transfer lobbies, or sky lobbies, as collection and redistribution zones, and a network of stairs or escalators for local travel.

Unlike the tower, travel through the typical zoo has
no specific destination.
Additionally, travel through zoos typically takes place only horizontally

Circulation paths in zoos are typically circuitous and meandering, intentionally disorienting to the visitor. With many paths to chose from, visitors are less likely to be traveling one primary path increasing visitor distribution throughout the zoo, further enables the zoos to transport visitors to exotic locales

The vertical zoo can utilize elements of the typical tower circulation system to rapidly distribute visitors to "launching" destinations throughout the tower. From the launching floors, visitors can chose their own paths down, through the various exhibit spaces

CIRCULATION



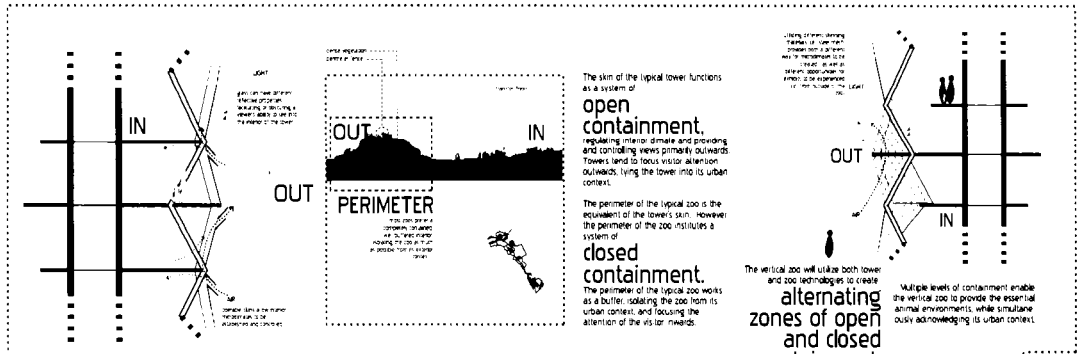
Typically, the ground floor of the tower allows multiple
paths to converge at a single point.
Depending on the tower's program, there may be
a sharp transition between outside of the tower, and in.

Unlike the tower, the entrance to the typical zoo is followed by passage through a
transition zone,
which moves the visitor from the outside world, into the contained world of the zoo.

Upon exiting the transition zone, visitors
convergent paths promptly diverge.

The tower structure can pull up, off of the ground, blurring the space inside the tower with the space outside of the tower. This will be the transition zone of the vertical zoo, and establish relationships between inside and out that are carried throughout the tower

GROUND CONDITION



The skin of the typical tower functions as a system of
open containment,
regulating interior climate and providing and controlling views primarily outwards. Towers tend to focus visitor attention outwards, tying the tower into its urban context.

The perimeter of the typical zoo is the equivalent of the tower's skin. However the perimeter of the zoo institutes a system of
closed containment.
The perimeter of the typical zoo works as a buffer, isolating the zoo from its urban context, and focusing the attention of the visitor inwards.

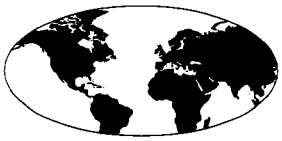
The vertical zoo will utilize both tower and zoo technologies to create
alternating zones of open and closed containment.

Multiple levels of containment enable the vertical zoo to provide the essential animal environments, while simultaneously acknowledging its urban context.

SKIN

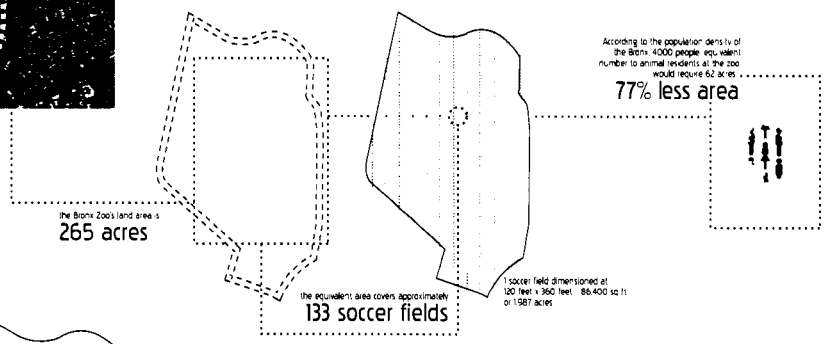
founded in 1899

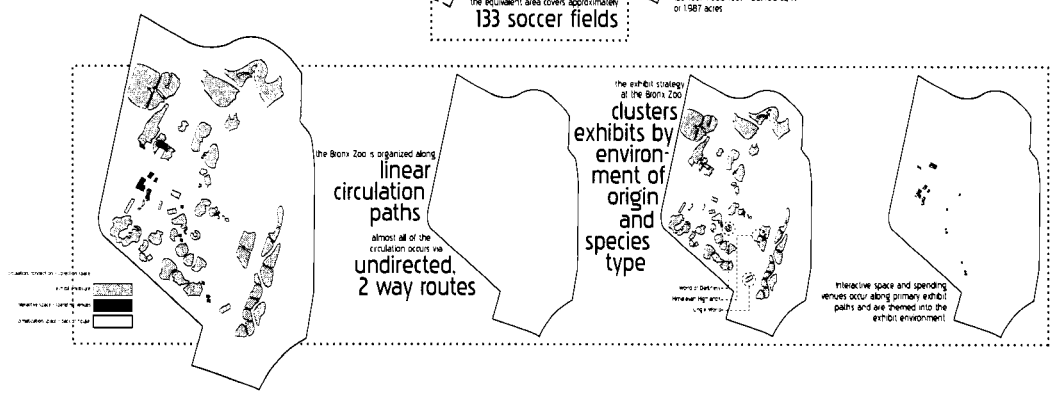
ENTERTAINMENT EDUCATION RESEARCH CONSERVATION

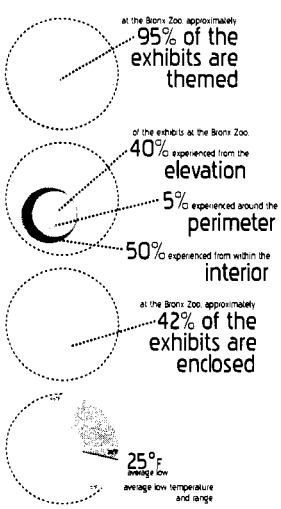


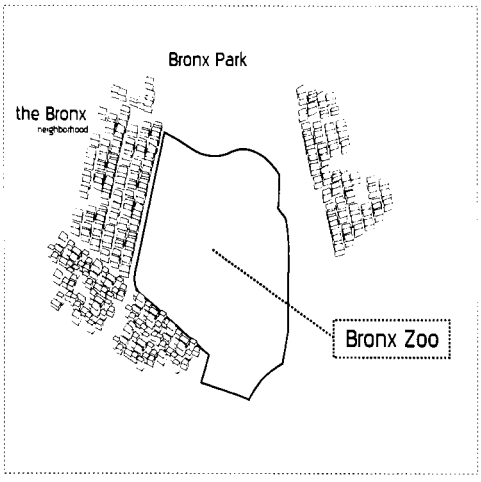
The Bronx Zoo is operated by the Wildlife Conservation Society. Since 1895 WCS has worked from the Bronx Zoo headquarters to save wildlife and wild lands throughout the world. They uniquely combine the resources of wildlife parks in New York with field projects around the globe to inspire care for nature, provide leadership in environmental education, and help sustain our planet's biological diversity. Today WCS is at work in 53 nations across Africa, Asia, Latin America and North America, protecting wild landscapes that are home to a vast variety of species from butterflies to tigers. Their pioneering environmental education programs reach millions locally, nationally and internationally. And the more than 4 million visitors who annually experience our Bronx Zoo, New York Aquarium and Central Park, Queens and Prospect Park Zoos are encouraged to learn about our natural world and inspired to care about its future.

LOCATION	Bronx Zoo, New York, New York	CITY	AREA	26,880 acres	ZOO	AREA	265 acres
	40° 50' N 73° 52' W		POPULATION	1.3 million		POPULATION	2 million visitors annually
CLIMATE	humid continental						4000* resident animals
							* approximate









While the north and east edges of the zoo are buffered by the Bronx Park, the south and west edges are bounded by the surrounding neighborhood. A tall, chain link fence and dense vegetation are the only barriers between the zoo and the adjacent urban environment. The audio and visual presence of the city is very apparent along the eastern edge of the zoo.

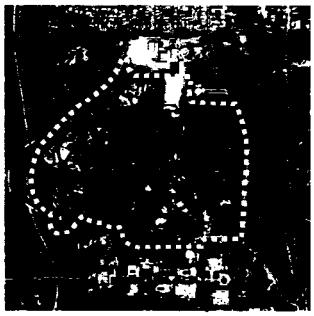
	Zoo Scale: Relative density (amount of space equal to people required)	Zoo Relative density	Zoo Scale: Absolute	Number of Animals: Species	Number of Animals: Individual	Number of * Exhibits: Approx	Number of * Exhibits: Themed	Number of * Exhibits: Types (Elevation, Perimeter, Interior)	Percent enclosed * exhib structure: Temps low+range	Venues: Spending + Interactive	Number of Visitors Annually	Number of City Residents	Organizational Strategy	Circulation opportunities
Bronx Zoo 1899	4000 anml 265 acres	4000 ppl 62 acres	3 x more than city	265 acres + 133 soccer fields	4000	20	19 + 95%	Elevation: 40% Perimeter: 5% Interior: 50%	40% avg low: 25 F range: 60 deg	spending: 15 interactive: 1	2 million	1.3 million	environment	walking shuttle monorail gondola

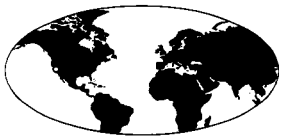
* approximate

San Diego Zoo

founded in 1916

ENTERTAINMENT EDUCATION RESEARCH CONSERVATION

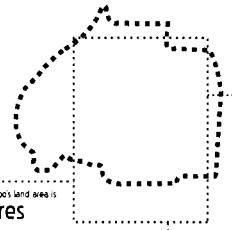




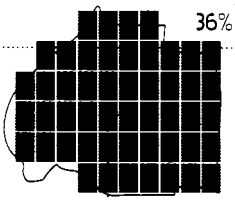
Operated by the not for profit Zoological Society of San Diego the San Diego Zoo is part of the largest zoo based multidisciplinary research team in the world, currently working in over 22 countries
The San Diego Zoo participates in six key research areas of interest
- sustainable populations
- bioresource banking
- wildlife health
- habitat conservation
- restoration biology
- conservation education

The San Diego Zoo's Education Department's mission seeks to increase the knowledge and appreciationof animals and plants in people of all ages through a wide variety of educational programs and services

LOCATION	San Diego Zoo, San Diego, California 32° 44' N 117° 08' W	CITY	AREA	238,080 acres	ZOO	AREA	100 acres
CLIMATE	Mediterranean		POPULATION	1.2 million		POPULATION	3 million visitors annually 4000* resident animals 850* species represented * approximate



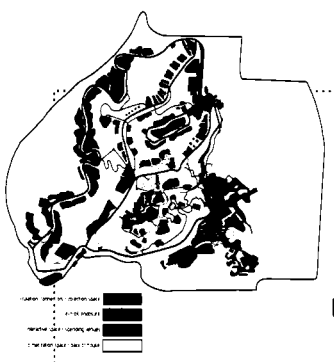
the San Diego Zoo's land area is
100 acres



According to the population density of San Diego 4000 people equivalent number to animal residents at the zoo would require 64 acres
36% less area

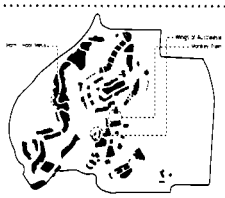
1 soccer field dimensioned at 120 feet x 360 feet 86,400 sq ft or 1.987 acres

the equivalent area covers approximately
50 soccer fields

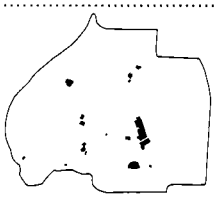


the San Diego Zoo is organized along
linear circulation paths

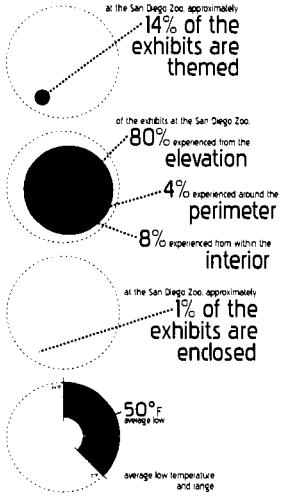
all of the circulation occurs via
undirected, 2 way routes

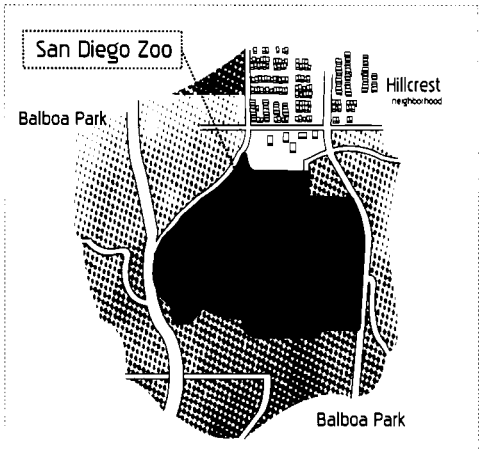


the exhibit strategy at the San Diego Zoo
distributes exhibits by thematic environment and species type



interactive space and spending venues
occur along primary exhibit paths
and maintain the theme of the closest exhibit environments.





The San Diego zoo weaves along valley ridges in a lush park near the summit of a large hill. The elevation change and the dense park surrounding buffer the zoo entirely from the nearby highway and Hillcrest neighborhood.

	Zoo Scale: Relative density (amount of space equal to 1 of people required)	Zoo Relative density	Zoo Scale Absolute	Number of Animals: Species	Number of Animals Individual	Number of * Exhibits Approx	Number of * Exhibits Themed	Number of * Exhibits Types (Elevation, Perimeter, Interior)	Percent enclosed * exhib structure Temps low-range	Venues, Spending + Interactive	Number of Visitors Annually	Number of City Residents	Organizational Strategy	Circulation opportunities
San Diego Zoo 1916	4000anml 100 acres 4000 ppl 64 acres	66 x more than city	100 acres + 50 soccer fields	850	4000	100	14 + 14%	Elevation: 80% Perimeter: 4% Interior: 8%	1% avg low 50F range 28 deg	spending 20 interactive 2	3 million	1.2 million	species type + environment	walking shuttle gondola

* approximate

San Diego Wild Animal Park

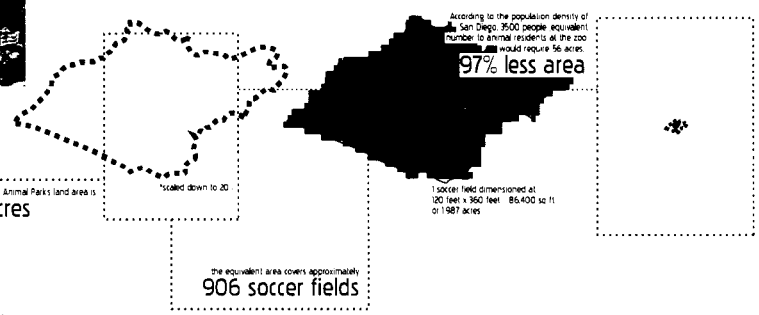
founded in 1972

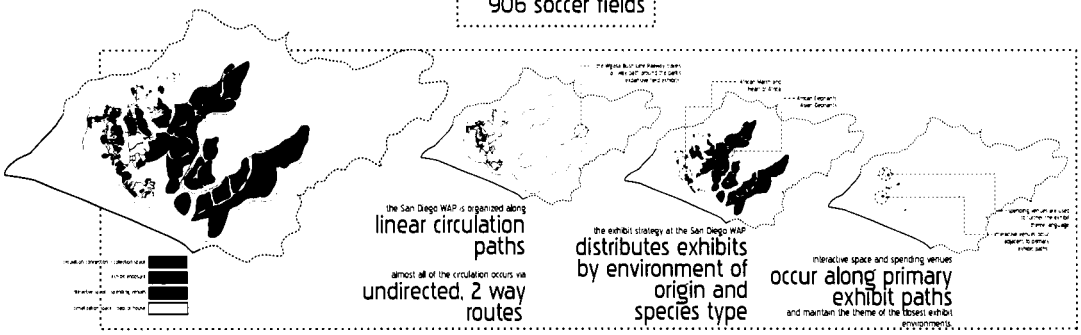
ENTERTAINMENT EDUCATION RESEARCH CONSERVATION

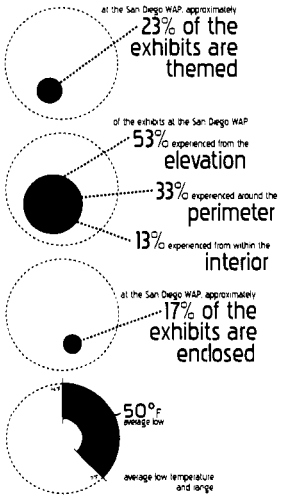
Operated by the not for profit Zoological Society of San Diego, the San Diego Wild Animal Park is part of the largest zoo based multidisciplinary research team in the world, currently working in over 22 countries.
The San Diego Wild Animal Park participates in six key research areas of interest:
- sustainable populations
- bioresource banking
- wildlife health
- habitat conservation
- restoration biology
- conservation education

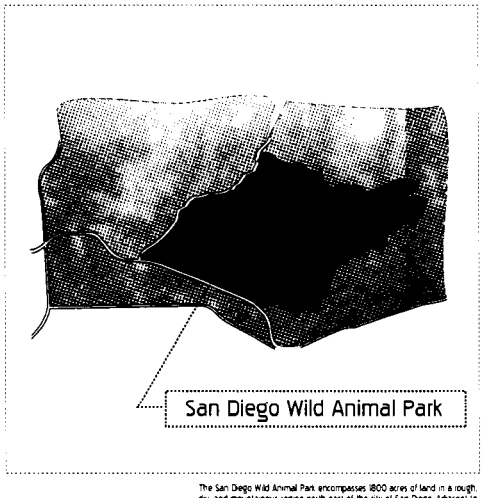
The San Diego Wild Animal Park's Education Department's mission seeks to increase the knowledge and appreciation of animals and plants in people of all ages through a wide variety of educational programs and services.

LOCATION	San Diego Wild Animal Park, Escondido, CA 33° 05' N 116° 59' W	CITY	AREA	238,080 acres	ZOO	AREA	1800 acres
CLIMATE	warm, semi arid		POPULATION	12 million		POPULATION	2 million visitors annually 3500* resident animals 400* species represented * approximate









The San Diego Wild Animal Park encompasses 1800 acres of land in a rough, dry, and mountainous region north east of the city of San Diego. Adjacent to the Wild Animal Park, the land in the valleys has been reserved primarily for agriculture and leisure use.

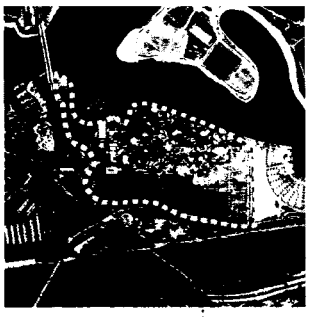
	Zoo Scale Relative density (amt of pay-to-pay if of people require)		Zoo Relative density	Zoo Scale Absolute	Number of Animals Species	Number of Animals, Individual	Number of * Exhibits: Approx.	Number of * Exhibits, Themed	Number of * Exhibits Types (Elevation, Perimeter, Interior)	Percent enclosed * exhib structure: Temps low-range	Venues: Spending + Interactive	Number of Visitors Annually	Number of City Residents	Organizational Strategy	Circulation opportunities
San Diego Wild Animal Park 1972	3500 anml 1800 acres	3500 ppl 56acres	3.3 x more than city	1800 acres + 906 soccer fields	400	3500	30	7 + 23%	Elevation: 53% Perimeter: 33% Interior: 13%	17% avg low: 50 F range: 28 deg	spending: 15 interactive: 2	2 million	1.2 million	type + environment	walking train ballon shuttle

* Type of Index

SeaWorld

founded in 1964

ENTERTAINMENT EDUCATION RESEARCH CONSERVATION



With more than 100 million visitors since its opening on March 21, 1964, SeaWorld is San Diego's number one tourist attraction and one of the most popular marine parks in the world. The founding principles of education, entertainment, research and conservation make SeaWorld San Diego an ideal place to learn about, enjoy and gain an appreciation for some of the ocean's most fascinating creatures.

Established in 1963, the Hubbs SeaWorld Research Institute is a public, nonprofit research foundation that conducts scientific investigations on the world's living creatures and natural resources. Its mission encompasses bioacoustics, aquaculture, physiology, conservation and ecology studies with an emphasis on marine and coastal ecosystems.

For more than 40 years, Anheuser-Busch Adventure Parks have worked with and supported conservation organizations around the world that share their vision and commitment. Partners include the National Wildlife Federation, The Nature Conservancy, World Wildlife Fund and the Ocean Conservancy.

Since beginning formal instruction in 1972, SeaWorld San Diego's education programs have benefited more than six million students through activities such as sleepovers, classroom outreach, instructional Field Trips in the park and Adventure Camp programs.

LOCATION SeaWorld, San Diego, California
32° 48' N 117° 13' W
CLIMATE Mediterranean

CITY
AREA 238,080 acres
POPULATION 1.2 million

ZOO
AREA 189 acres
POPULATION 5 million visitors annually
20,000* resident animals
550* species represented
* approximate

According to the population density of San Diego, 20,000 people equivalent number to animal residents at the zoo would require 320 acres

70% more area

SeaWorld San Diego's land area is
189 acres

1 soccer field dimensioned at 120 feet x 360 feet 86,400 sq ft or 1.987 acres

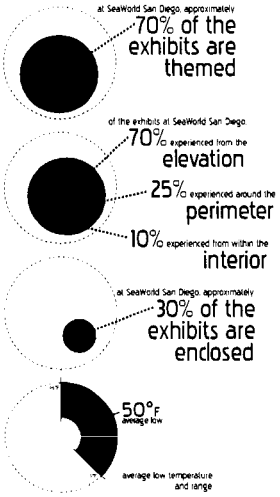
the equivalent area covers approximately
95 soccer fields

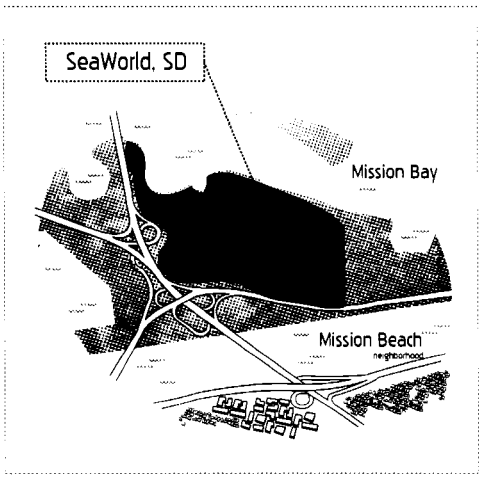
SeaWorld San Diego is organized along a
network of circulation paths

almost all of the circulation occurs via
undirected, 2 way routes

the exhibit strategy at SeaWorld San Diego
distributes exhibits by species type

interactive space and spending venues
occur along primary exhibit paths
and while the varied exhibit zones all of the spending venues are themed





The San Diego zoo weaves along valley ridges in a lush park near the summit of a large hill. The elevation change and the dense park surrounding buffer the zoo entirely from the nearby highway and Hillcrest neighborhood.

	Zoo Scale: Relative density		Zoo: Relative density	Zoo Scale: Absolute	Number of Animals: Species	Number of Animals: Individual	Number of * Exhibits: Approx	Number of * Exhibits: Themed	Number of * Exhibits: Types	Percent enclosed * exhib structure Temps low+range	Venues: Spending + Interactive	Number of Visitors: Annually	Number of City Residents	Organizational Strategy	Circulation opportunities
SeaWorld, San Diego 1964	20,000anml/ 189 acres	20,000ppl/ 120acres	160 x more than city	189 acres + 95 soccer fields	550	20,000	20	14 + 70%	Elevation: 70% Perimeter: 25% Interior: 10%	30% avg low: 50 F range: 26 deg	spending: 23 interactive: 8	5 million	1.2 million	species type	walking

London Zoo

founded in 1828

ENTERTAINMENT EDUCATION RESEARCH CONSERVATION

The London Zoo is operated by the Zoological Society of London, whose focus includes conservation, science, and learning. The ZSL is consists of five operating divisions that include the London Zoo, Whipsnade Wild Animal Park, Institute of Zoology, Conservation Programmes, and Fellowship Services.

The ZSL mission:

- To achieve and promote the worldwide conservation of animals and their habitats.
- Keeping and presenting animals at London Zoo and Whipsnade Wild Animal Park in accordance with best practice giving priority to species that are threatened in the wild.
- Increasing public understanding of animals and their welfare and of the issues involved in their conservation.
- Maintaining an outstanding education and information program, particularly for schoolchildren and families.
- Undertaking field conservation programs, both in Britain and abroad.
- Developing its role as a leading centre for research and conservation biology and animal welfare.
- Fulfilling its role as a learned society and 'force for zoology and animal conservation through publications, scientific meetings, lectures, the award of prizes for outstanding achievement and the promotion of conservation policy.

LOCATION London Zoo, London, England, UK
51° 32' N 0° 09' W
CLIMATE temperate, wet

CITY
AREA 390,170 acres
POPULATION 7.5 million

ZOO
AREA 36 acres
POPULATION 900,000 visitors annually
5,000* resident animals
650* species represented
* approximate

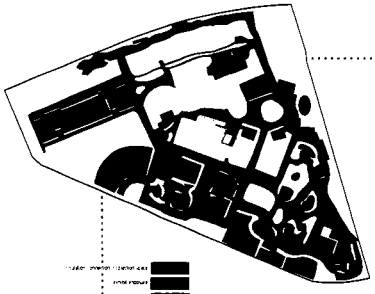
1 soccer field dimensioned at
120 feet x 360 feet 86,400 sq ft
or 1.987 acres

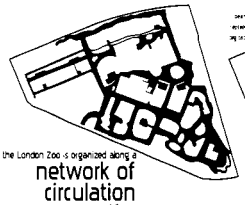
the London Zoo's land area is
36 acres

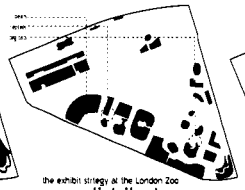
the equivalent area covers approximately
18 soccer fields

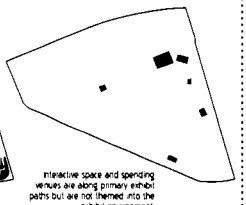
According to the population density of London, 5000 people equivalent number to animal residents at the zoo would require 262.5 acres.

630% more area







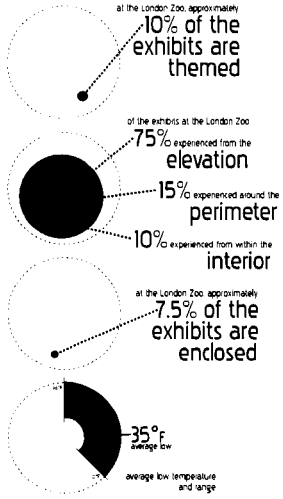


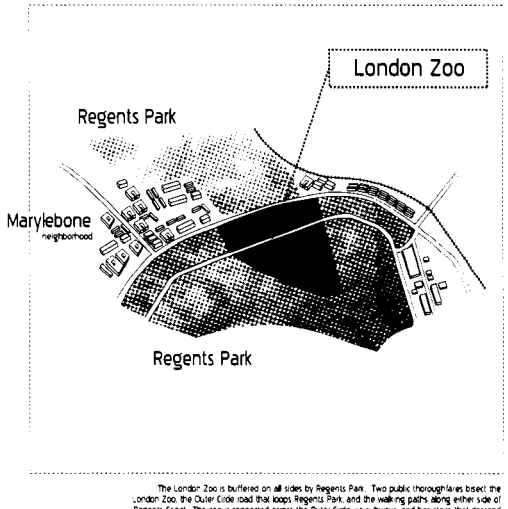
the London Zoo is organized along a
network of circulation paths

the exhibit strategy at the London Zoo
distributes exhibits by species type

interactive space and spending venues are along primary exhibit paths but are not themed into the exhibit environment

almost all of the circulation occurs via
undirected, 2 way routes





The London Zoo is buffered on all sides by Regents Park. Two public thoroughfares bisect the London Zoo, the Outer Circle road that loops Regents Park, and the walking paths along either side of Regents Canal. The zoo is connected across the Outer Circle via subways, and has stairs that descend to the walkways alongside the canal, although they appear to now be closed.

	Zoo Scale Relative density		Zoo Relative density	Zoo Scale Absolute	Number of Animals Species	Number of Animals Individual	Number of * Exhibits Approx	Number of * Exhibits Themed	Number of * Exhibits: Types	Percent enclosed * exhib structure Temps low-range	Venues Spending + Interactive	Number of Visitors Annually	Number of City Residents	Organi-zational Strategy	Circulation opportuni-ties
London Zoo 1828	5000 anml 36 acres	5000 ppl 262.5 acres	490 + more than city	36 acres + 18 soccer fields	650	5000	40	4 + 10%	Elevation: 75% Perimeter: 15% Interior: 10%	7.5% avg low: 35 F range: 35 deg	spending + interactive: 0	900,000	7.5 million	type	walking

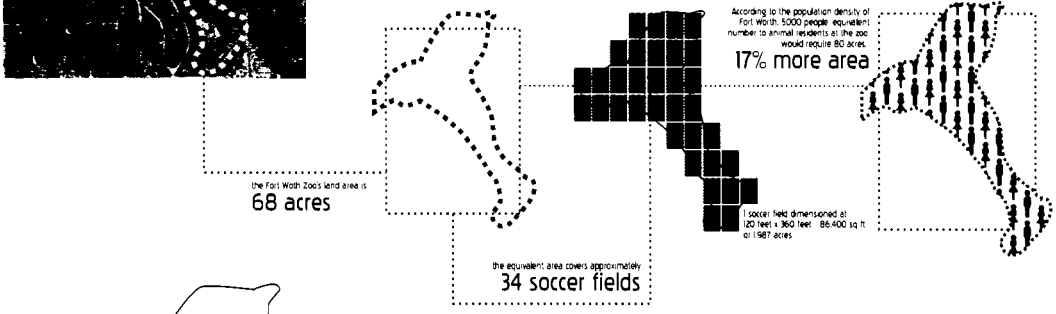
Fort Worth Zoo

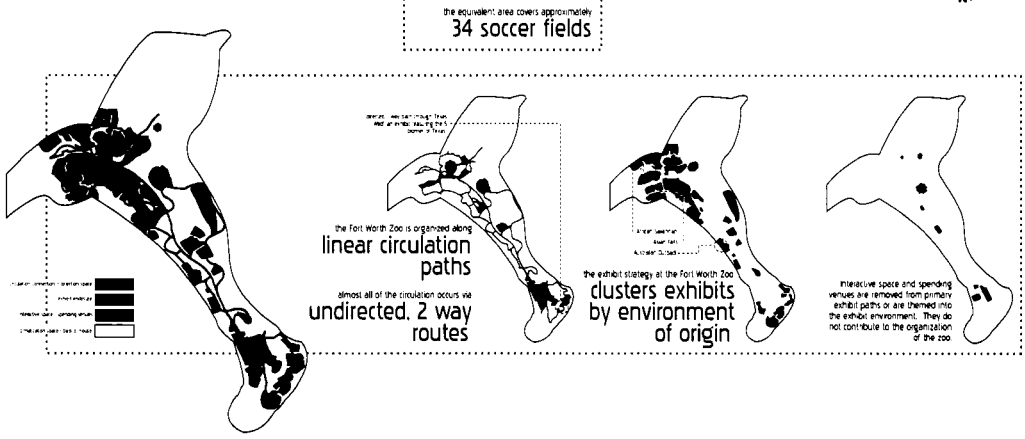
founded in 1919

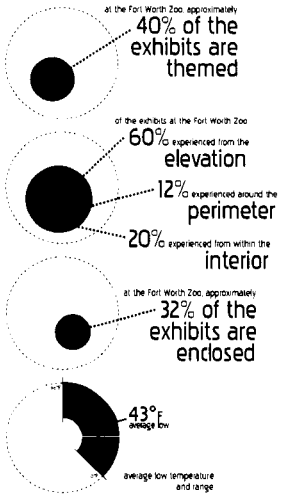
ENTERTAINMENT EDUCATION CONSERVATION

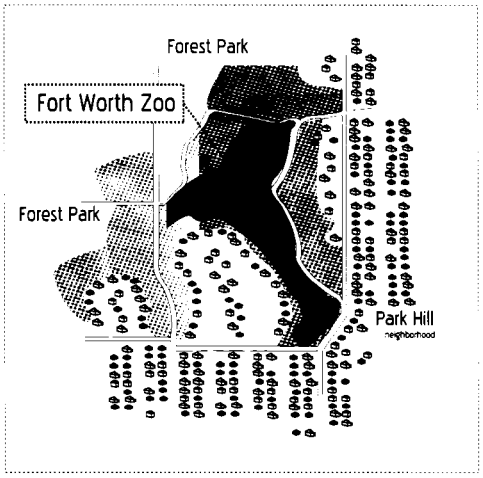
The Fort Worth Zoo seeks to strengthen the bond between humans and the environment by promoting responsible care of wildlife and ensuring diverse high quality education and experiences at and on behalf of the zoo. The three corner stone principles of the zoo are:
- CONSERVATION: through the facilitation of conservation and scientific study currently at work in 25 countries
- EDUCATION: providing factual information to nurture the appreciation of and respect for wildlife and the environment. The education department provides classes, camps, workshops, and out reach programs for people of all ages
- ENTERTAINMENT: through a commitment to excellence with the hope of always exceeding expectations

LOCATION	Fort Worth Zoo, Fort Worth, Texas 32° 43' N 97° 21' W	CITY	AREA	192,000 acres	ZOO AREA 68 acres
CLIMATE	Humid, subtropical		POPULATION	535,000	POPULATION 1.2 million visitors annually 5000* resident animals 400* species represented * approximate









The densely wooded park surrounding the entire zoo perimeter buffers the zoo and isolates it from the presence of the nearby Park Hill neighborhood

	Zoo Scale: Relative density		Zoo Relative density	Zoo Scale: Absolute	Number of Animals: Species	Number of Animals: Individual	Number of * Exhibits: Approx	Number of * Exhibits: Themed	Number of * Exhibits: Types	Percent enclosed * exhib structure Temps low-range	Venues: Spending + Interactive	Number of Visitors: Annually	Number of City Residents	Organizational Strategy	Circulation: opportunities
Fort Worth Zoo 1909	5000 anml/ 68 acres	5000 ppl/ 80 acres	258 x more than city	68 acres = 34 soccer fields	400	5000	25	10 = 40%	Elevation: 60% Perimeter: 12% Interior: 20%	32% avg low: 43 F range: 42 deg	spending: 9 interactive: 1	1.2 million	535,000	environment	walking

* approximate

Zoo Barcelona

founded in 1892

ENTERTAINMENT EDUCATION RESEARCH

Zoo Barcelona adheres to the World Zoo Conservation Strategy for preservation, research and education. Zoo Barcelona collaborates on several international and European programs for breeding and preserving species, and contributes to many species reintroduction programs. The zoo is also involved in several diverse areas of research on many species of animals.

The Zoo Barcelona Education Department's primary focus is children, but the department offers programs for people of all ages. Promoting quality education experiences and opportunities is the zoo's primary social objective.

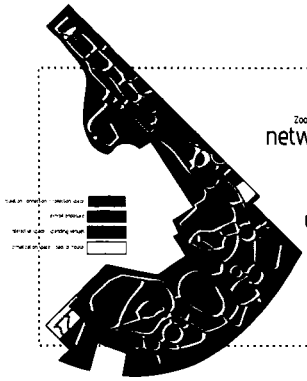
LOCATION	Zoo Barcelona, Barcelona, Spain 41° 23' N 2° 11' E	CITY	AREA	24,809 acres	ZOO	AREA	35 acres
CLIMATE	Mediterranean, subtropical		POPULATION	1.6 million		POPULATION	1.2 million visitors annually 7500* resident animals 400* species represented * approximate

Zoo Barcelona's land area is
35 acres

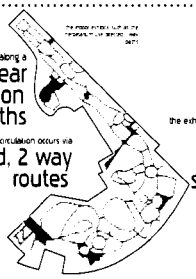
According to the population density of Barcelona, 7500 people equivalent number to animal residents at the zoo would require 117 acres
330% more area

* soccer field dimensioned at 120 feet x 360 feet : 86,400 sq ft or 1.987 acres

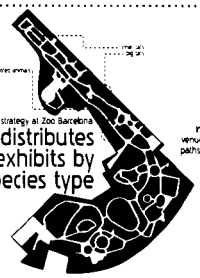
the equivalent area covers approximately
18 soccer fields



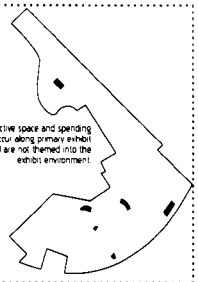
Zoo Barcelona is organized along a
network of linear circulation paths
almost all of the circulation occurs via
undirected, 2 way routes



the exhibit strategy at Zoo Barcelona
distributes exhibits by species type



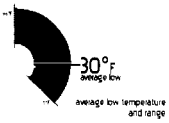
interactive space and spending venues occur along primary exhibit paths and are not themed into the exhibit environment



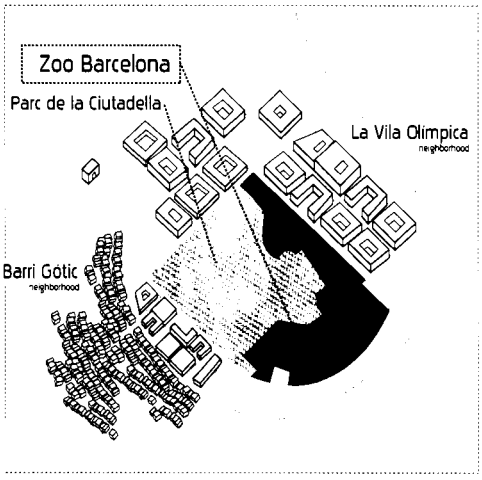
at Zoo Barcelona, approximately
6% of the exhibits are themed

of the exhibits at Zoo Barcelona
69% experienced from the **elevation**
25% experienced around the **perimeter**
1% experienced from within the **interior**

at Zoo Barcelona, approximately
10% of the exhibits are enclosed



average low temperature and range



While the north and east edges of the zoo are buffered by the Parc de la Ciutadella, the south and west edges are bounded by the neighborhood, La Vila Olimpica. A 4m stone fence and zoo exhibit buildings are the only barriers between the zoo and the adjacent urban environment. The audio and visual presence of the city is apparent continuously along the eastern edge of the zoo.

	Zoo Scale: Relative density	Zoo Relative density	Zoo Scale: Absolute	Number of Animals: Species	Number of Animals: Individual	Number of * Exhibits: Approx	Number of * Exhibits: Themed	Number of * Exhibits: Types	Percent enclosed * exhibit structure: Temps low-range	Venues: Spending + Interactive	Number of Visitors: Annually	Number of City Residents	Organizational Strategy	Circulation: opportunities
Zoo Barcelona 1892	7500 anim/ 35 acres / 7500 ppl / 1 acres	225.5 x more than city	35 acres = 18 soccer fields	400	7500	60	5 - 6%	Elevation: 69.75% Perimeter: 25% Interior: 1.25%	10% avg low: 30 F range: 54 deg	spending: 9 interactive: 2	1.2 million	1.6 million	distributed	walking

* approximate

Los Angeles Zoo

founded in 1964

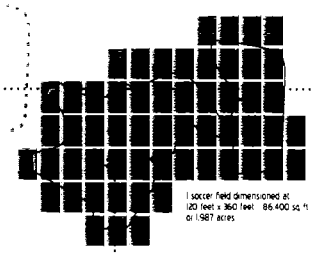
ENTERTAINMENT EDUCATION CONSERVATION

The Los Angeles Zoo is committed to providing an interesting and educational experience for visitors and excellent living conditions for residents. The zoo participates in conservation programs with the aim of preserving native habitats. The Los Angeles Zoo also offers local educational outreach programs, camps, lectures, zoo shows and activities.

LOCATION Los Angeles Zoo, Los Angeles, California
34° 08' N 118° 17' W
CLIMATE Mediterranean

CITY
AREA 318,720 acres
POPULATION 3.7 million

ZOO
AREA 113 acres
POPULATION 1.3 million visitors annually
1200* resident animals
* approximate



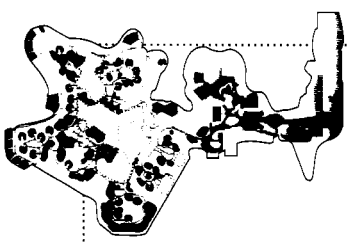
According to the population density of Los Angeles, 1200 people equivalent number to animal residents at the zoo would require 17 acres.

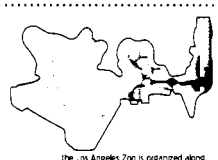
85% less area

the Los Angeles Zoo's land area is
113 acres

1 soccer field dimensioned at 120 feet x 360 feet 86,400 sq. ft or 1,987 acres

the equivalent area covers approximately
57 soccer fields

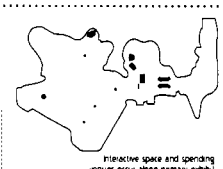




the Los Angeles Zoo is organized along
linear circulation paths

almost all of the circulation occurs via
undirected, 2 way routes

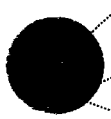
the exhibit strategy at the Los Angeles Zoo
follows no organizational logic



Interactive space and spending venues occur along primary exhibit paths and are not themed into the exhibit environment

at the Los Angeles Zoo, approximately
5% of the exhibits are themed

of the exhibits at the Los Angeles Zoo
88% experienced from the elevation



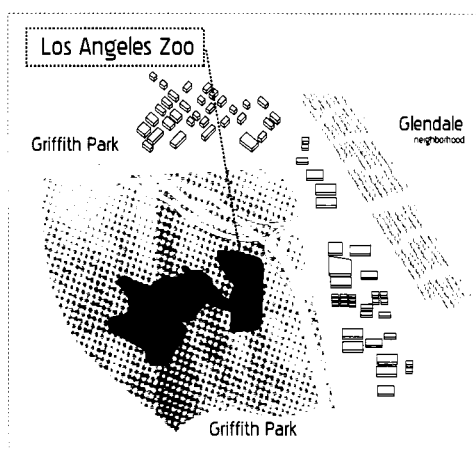
4% experienced around the perimeter

4% experienced from within the interior

at the Los Angeles Zoo, approximately
4% of the exhibits are enclosed

48°F average low

average low temperature and range



The densely wooded park surrounding the entire zoo perimeter buffers the zoo and isolates it completely from the adjacent highway and city

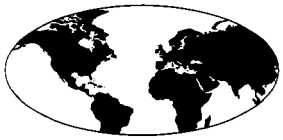
	Zoo Scale Relative density (sm. of space equiv. of people equiv.)		Zoo Relative density	Zoo Scale Absolute	Number of Animals: Species	Number of Animals: Individual	Number of * Exhibits: Approx.	Number of * Exhibits Themed	Number of * Exhibits Types (Dendron, Perimeter, Interior)	Percent enclosed * exhib structure: Temps low-range	Venues Spending - Interactive	Number of Visitors Annually	Number of City Residents	Organizational Strategy	Circulation opportunities
Los Angeles Zoo 1964	1200 anml 113 acres	1200 ppl 17 acres	8.6 x more than city	113 acres + 57 soccer fields		1200	80	4 + 5%	Elevation: 88% Perimeter: 4% Interior: 4%	4% avg low: 48 F range: 34 deg	spending: 16 interact. ver. 2	1.3 million	3.7 million	distributed	walking shuttle

* Type is more

Houston Zoo

founded in 1914

ENTERTAINMENT EDUCATION RESEARCH CONSERVATION



The Houston Zoo is involved in conservation and research through a variety of on site and field research initiatives based on good science, sound economics, environmental and cultural sensitivity.
The Houston Zoo also offers educational programs through classes at the zoo, camps, and outreach programs.

LOCATION Houston Zoo, Houston, Texas
29° 42' N 95° 23' W
CLIMATE humid, subtropical

CITY
AREA 384,640 acres
POPULATION 2 million

ZOO
AREA 55 acres
POPULATION 1.5 million visitors annually
4500* resident animals
800* species represented
* approximate

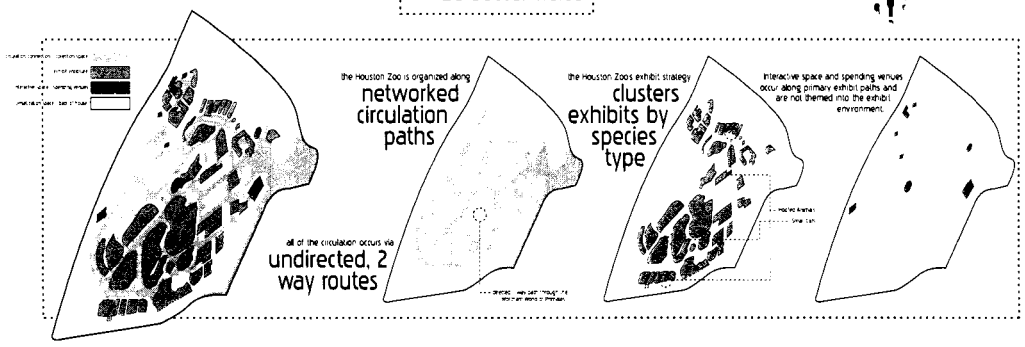
According to the population density of Houston, 4500 people equivalent number to animal residents at the zoo would require 75 acres

36% more area

the Houston Zoo's land area is
55 acres

1 soccer field dimensioned at 120 feet x 360 feet 86,400 sq ft or 1.987 acres

the equivalent area covers approximately
28 soccer fields

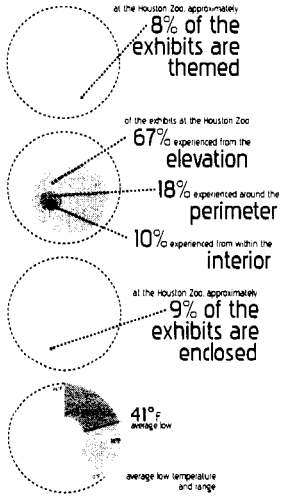


the Houston Zoo is organized along
networked circulation paths

all of the circulation occurs via
undirected, 2 way routes

the Houston Zoo's exhibit strategy
clusters exhibits by species type

Interactive space and spending venues occur along primary exhibit paths and are not themed into the exhibit environment.



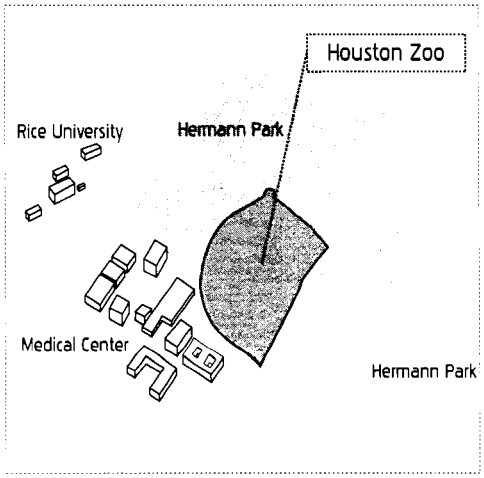
at the Houston Zoo, approximately
8% of the exhibits are themed

of the exhibits at the Houston Zoo
67% experienced from the elevation
18% experienced around the perimeter
10% experienced from within the interior

at the Houston Zoo, approximately
9% of the exhibits are enclosed

41°F average low

average low temperature and range



The Houston Zoo is buffered on three sides by Hermann Park. The Houston Medical Center south west of the zoo is apparent over the south west edge of the zoo from several places

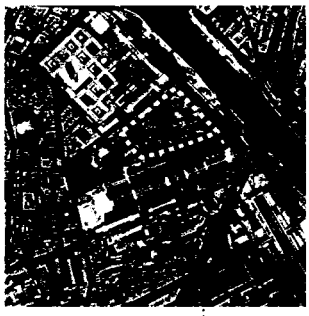
	Zoo Scale: Relative density		Zoo Relative density	Zoo Scale: Absolute	Number of Animals Species	Number of Animals Individual	Number of * Exhibits Approx	Number of * Exhibits Themed	Number of * Exhibits Types	Percent enclosed * exhib structure Temps low-range	Venues, Spending + Interactive	Number of Visitors Annually	Number of City Residents	Organi-zational Strategy	Circulation opportun-ities
Houston Zoo 1914	4500 anml/ 55 acres	4500 ppl/ 75 acres	154 x more than city	55 acres = 28 soccer fields	600	4500	45	4 = 8%	Elevation: 67% Perimeter: 18% Interior: 10%	9% avg low: 41 F range: 54 deg	spending: 9 interactive: 1	1.5 million	1.9 million	type	walking

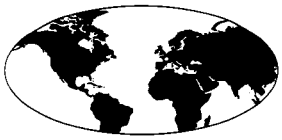
* approximate

La Ménagerie du Jardin des Plantes

founded in 1794

ENTERTAINMENT





La Menagerie du Jardin des Plantes recognizes the importance of the contribution of zoos to animal and habitat conservation and preservation efforts, as well as the necessity of the zoo to educate the public

LOCATION La Menagerie du Jardin des Plantes, Paris, France
CLIMATE 48° 50' N 2° 21' E oceanic

CITY AREA 2,489 acres
POPULATION 2.1 million

ZOO AREA 13.6 acres
POPULATION 500,000 visitors annually
1000* resident animals
* approximate

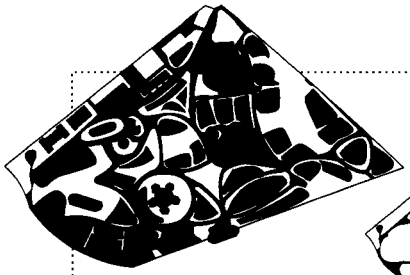
According to the population density of Paris, 1000 people equivalent number to animal residents at the zoo would require 10 acres

26% less area

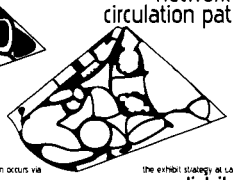
La Menagerie's land area is
13.6 acres

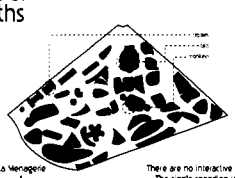
1 soccer field dimensioned at
20 feet x 360 feet 86,400 sq ft
or 1987 acres

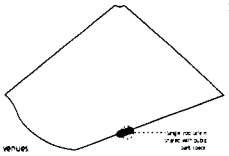
the equivalent area covers approximately
7 soccer fields



La Menagerie is organized along a
network of
circulation paths



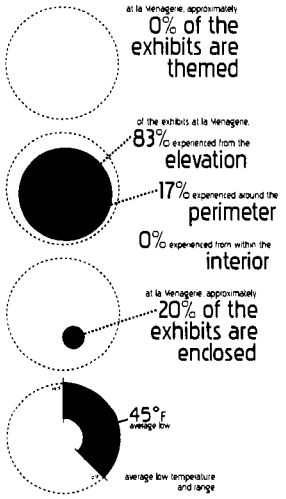


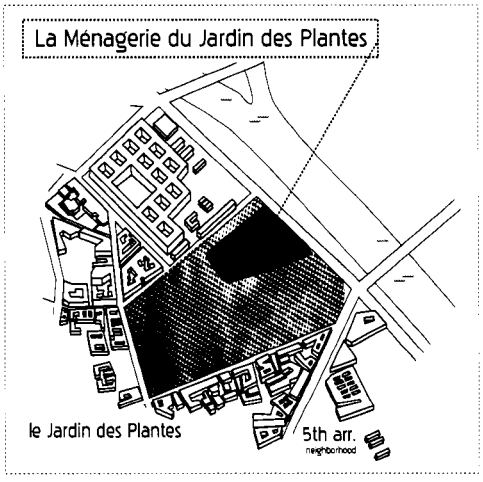


all of the circulation occurs via
undirected, 2 way
routes

the exhibit strategy at La Menagerie
distributes
exhibits by
species type

There are no interactive venues
The single spending venue, a
restaurant, is shared with the
public park space on the southern
edge of the zoo



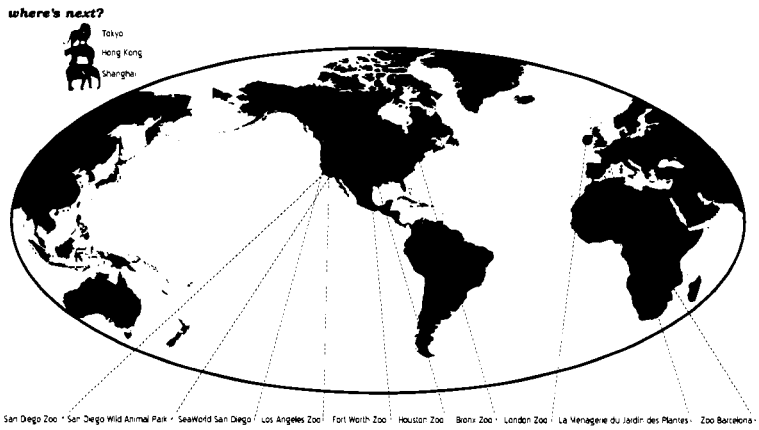


While the south and west edges of the zoo are buffered by the city park le Jardin des Plantes, the south and west edges are bounded by the neighborhood of the 5th Arrondisement. A large hedge and zoo exhibit buildings are the only barrier between the zoo and the adjacent urban environment. The audio and visual presence of the city is apparent continuously along the north and western edges of the zoo

	Zoo Scale: Relative density	Zoo Relative density	Zoo Scale Absolute	Number of Animals: Species	Number of Animals: Individual	Number of * Exhibits: Approx	Number of * Exhibits: Themed	Number of * Exhibits: Types	Percent enclosed * exhibit structure: Temps low+range	Venues: Spending + Interactive	Number of Visitors: Annually	Number of City Residents	Organizational Strategy	Circulation opportunities
La Menagerie du Jardin des Plantes 1794	1000 anml/ 1000 ppl 13.6 acres 10 acres	49.6 x more than city	13.6 acres + 7 soccer fields		1000	80	0	Elevation: 83% Perimeter: 17% Interior: 0%	20% avg low: 45 F range: 30 deg	spending: 1 interactive: 0	500,000	2.1 million	type	walking

* approximate

Case study analysis



Zoos are urban institutions. Originally intended to be parks on the city edge to which urban dwellers could visit when the city became to much, it was a but a short time before zoos were enveloped in more rapidly sprawling urban development.

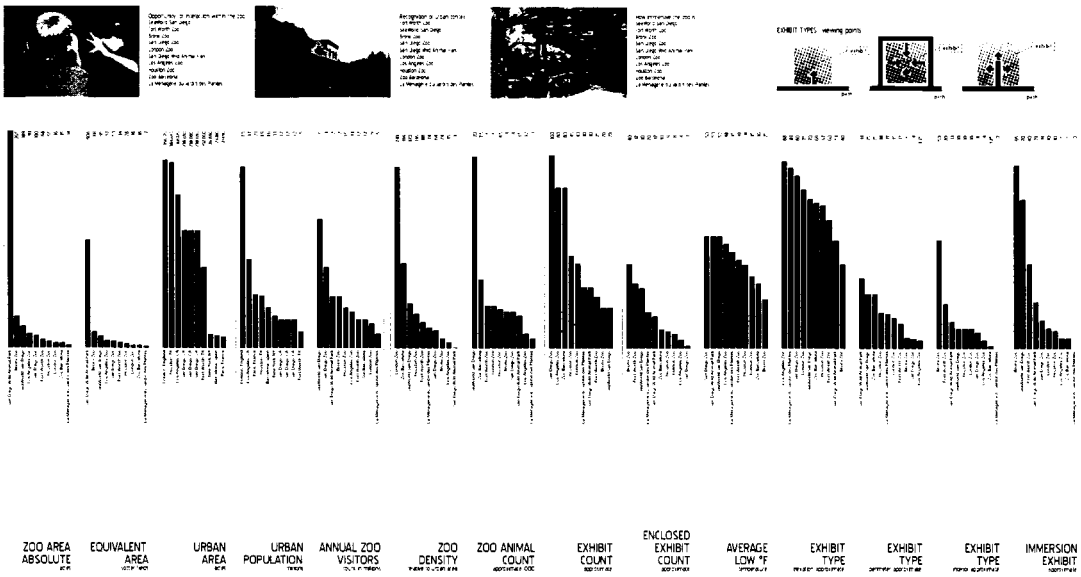
For centuries zoos have provided unique opportunities for education, entertainment and research not found elsewhere in urban centers. Throughout time as knowledge of the natural kingdom changed and grew, zoos responded. Originally municipal institutions, zoo's initial responses to change were often conservative. Today, the majority of accredited zoos are operated by private and not for profit companies. As such, zoos now must compete for money and attention within urban and suburban settings. To woo visitors, zoos are changing in ways more radical than ever, creating and simulating entire environments in which the zoo visitor is immersed.

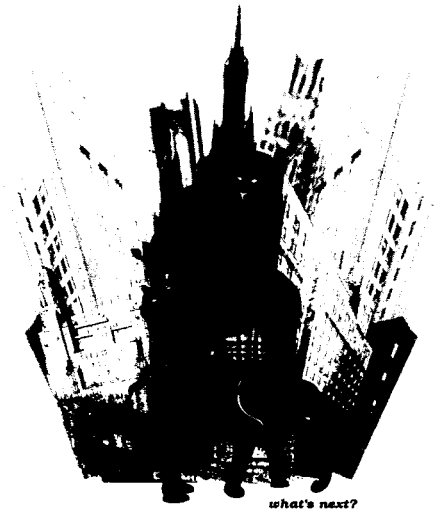
It has been over 40 years since the last major zoo reform, in a modern history that spans only 200 years. This analysis investigates the zoo in its urban context quantitatively and qualitatively, seeking to understand what the relationships are if there are any, between zoos and the cities that house them. Further, this analysis begins to investigate the fabric of zoos themselves.

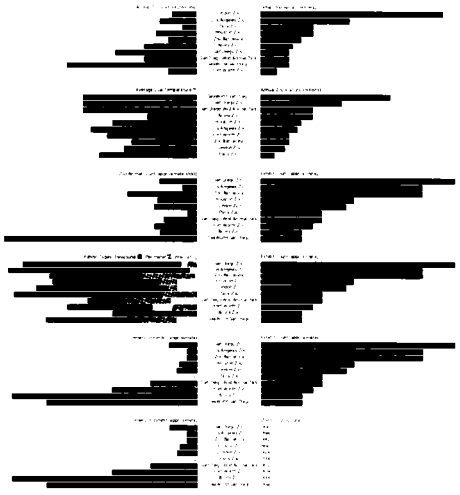
- how regional, social, and cultural concepts of what is natural, wild, and exotic have influenced the construct of zoos, especially in their planar arrangement, animal exhibit space, and the type of interaction in which visitors can expect to participate.

- zoo exhibit typology, specifically in how they currently reinforce the human nature division, and how that division may be subverted.

From this information, I hope to gain an understanding that will lead to the design of a new zoo typology. The new zoo will reflect both its urban locale, as well as the broad scale changes in the natural environment worldwide.







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