

VIETNAMESE INTERPRETIVE CENTER
FOR THE COMMUNITY OF PORTLAND, OREGON

by

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A THESIS

Presented to the Department of Interior Architecture
and the Honors College of the University of Oregon
in partial fulfillment of the requirements for the degree of
Bachelor of Interior Architecture

June 1997

ACKNOWLEDGMENTS

I would like to express my sincere appreciation to Professors Lyman Johnson, Linda Zimmer, and Max Grober, who, in their endless patience have provided me much assistance and encouragement into the exploration of a new way to explore the cross-cultural relations amongst two varying cultures. The understanding of the Vietnamese-American's role in the United States is still being defined. I am hoping that with help from Professors such as these, the role of the Vietnamese-American can be understood and translated into the built environment. Special thanks to my family in their role of raising me to continually ask questions of myself and my surroundings, to always look to understanding the world around me, and to seek the questions in which to constantly be looking for ways in which to answer them. I also thank the members of the Vietnamese-American community for their valuable input, and their willingness to share with me their experiences and feelings on what it means to them to be a Vietnamese-American, at any age.

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Introduction

We can circumvent, avoid and repress our history, and encourage our culture to be more decorative, distracting, and vapid, or we can directly face this part of our national history.¹

The Vietnam War was an era in which the meeting of two cultures, two governments, and a plethora of views met on the rice fields of Southeast Asia, in the hilltops of the surrounding mountains, from the air, and on American soil. Many lives and families changed because of an era that has not been spoken of except in the voices of controversy.

The war ended in April of 1975, but how many people can tell you when it started, how it started? How many veterans, how many refugees, how many lives touched by a period in time?

The Vietnamese community of Portland, Oregon, started its growth in the wake of the war era, a community of families settling where they knew of other family members and friends. Since 1975 the Southeast Asian community has grown to 3 percent of the population in the United States, with a projected growth to 9 percent by the year 2050. Specifically, the Southeast Asians of Vietnam make up for 6 percent of the U.S. population of foreign born in the U.S. Immigrants from Asia also form the largest group of immigrants to the United States since 1971.²

The statistics show the ever growing population of Asians integrating and learning how to adapt to the culture of the United States. The community of Asians, specifically that of the Vietnamese, has thrived in Portland, Oregon. Many families today embody a varying mixture of each culture. As the first generation of American born Vietnamese start to emerge, the issues of retaining and defining culture arise for this generation. They are born to parents of a Vietnamese heritage, but they interact and respond to the environment presented to them from their Western neighbors.

Children are usually brought up within the tight family structure of the Vietnamese household. When they go to school, or work, or play, they are exposed to many other cultures. Here, the question of family practice tends to come into direct conflict with the general culture. Many people of the younger

¹ Lippard, Lucy R. A Different War: Vietnam in Art. Whatcom Museum of History and Art, and Real Comet Press; Hong Kong. 1990. pp.8

² Montero, Darrel. Vietnamese Americans: Patterns of Resettlement and Socioeconomic Adaptation in the United States. Westview Replica Edition; Boulder, Colorado. 1979.

generation find themselves at odds with developing a more Western lifestyle and culture, and retaining what has been taught through the family structure.

According to a report in *The Christian Century*, it is found that among groups not wanted as neighbors, Vietnamese refugees ranked second. This poll indicates the need for education on both sides. The need for education of people to try to understand why the Vietnamese are the way they are, and the need for education of the Vietnamese refugees in the social interactions of the people of the United States.

The proposal of a Vietnamese Interpretive Center is the goal for outreach to a community of immigrants and their families, Veterans, and those family and friends who were affected by the influx of a new group of immigrants. The center's main objective is to present history, so that museum goers can make a connection with where they are today, and to strive for the future of an integrated community through the means of education.

The interpretive center will serve as both museum space, and support space. The following is a breakdown of spaces most often used by the community.

Interpretive Center

An interactive area of learning for visitors
Includes: Classroom/ meeting space

Gallery

Display space for changing exhibit

Pho (Noodle) Shop

Meeting Spaces

The following is a breakdown of spaces that may be accessed by the public, but will more often serve the community at large, and behind the scenes (whether through outreach, or as a resource for information).

Administrative Offices

Focus on ongoing information about the interpretive center itself

Outreach Organizations Offices

Rented space for organizations directly/indirectly involved with interpretive center

Resource Center

Formal groups/ meetings, etc.
Literature research area

II. CONTEXT

- A. THE SITE
- B. PHYSICAL
- C. HISTORICAL

A. THE SITE

The Site

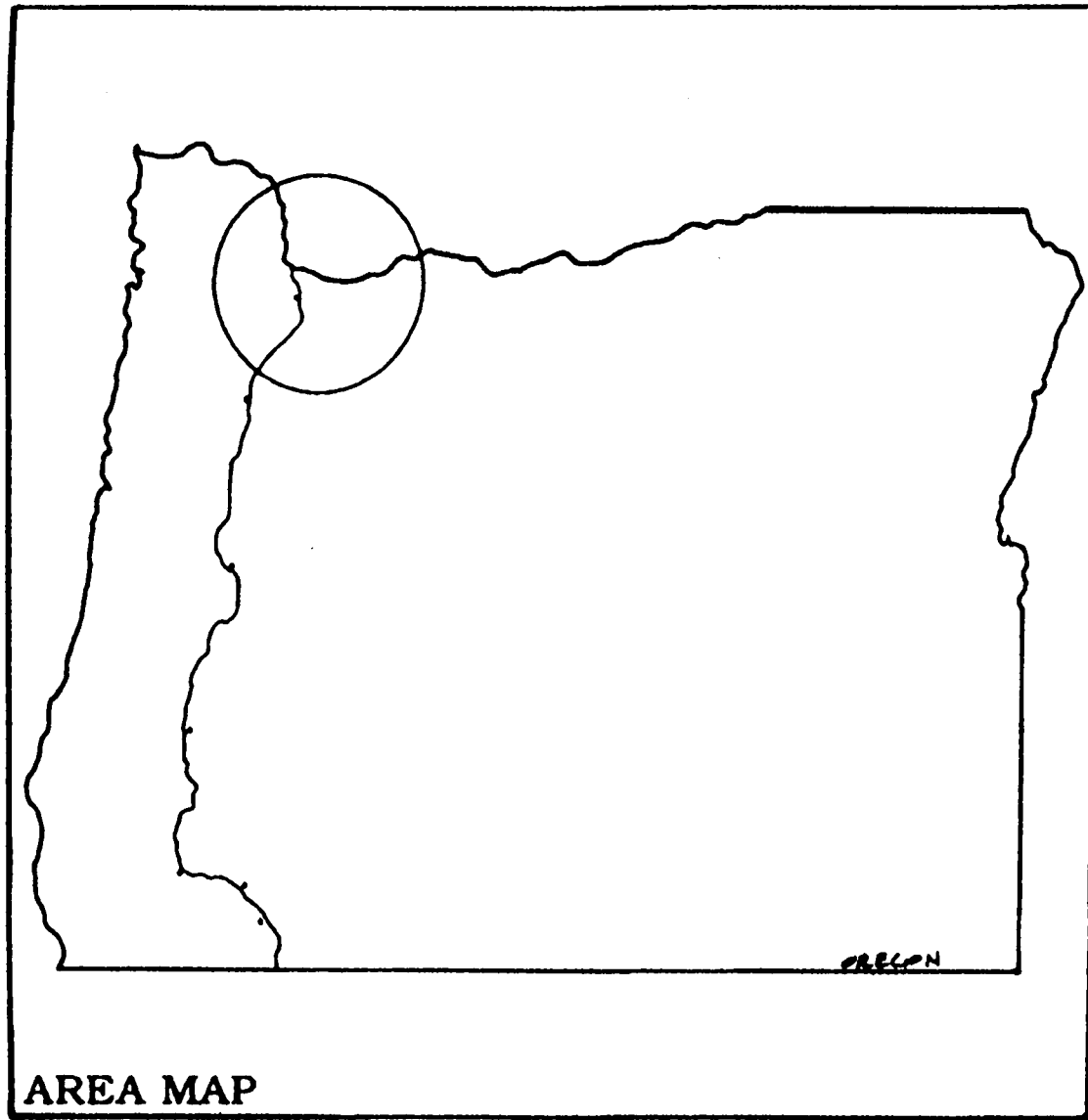
Currently, the proposed site is in downtown Portland, Oregon. It is located along Front Avenue in the Yamhill district. This area is home to a variety of art galleries ranging in themes from western art, to contemporary art, to the art of photography, and other media.

The site is readily accessible by the MAX Light Rail system, one block away in Fairless Square. This offers free service to the interpretive/resource center, and beyond within the downtown area. This is very important in that, with outreach resources housed within the facility, access is easier for those wishing to use the services, or to venture through the interpretive.

Downtown Portland, Oregon, was focused upon because it is not a specific community in itself. If this facility is to reach beyond the Southeast Asian community, it needs to be removed from the outlying areas that are culturally specific. The downtown area is also a central location that provides for more than just a specific group's visit to this facility.

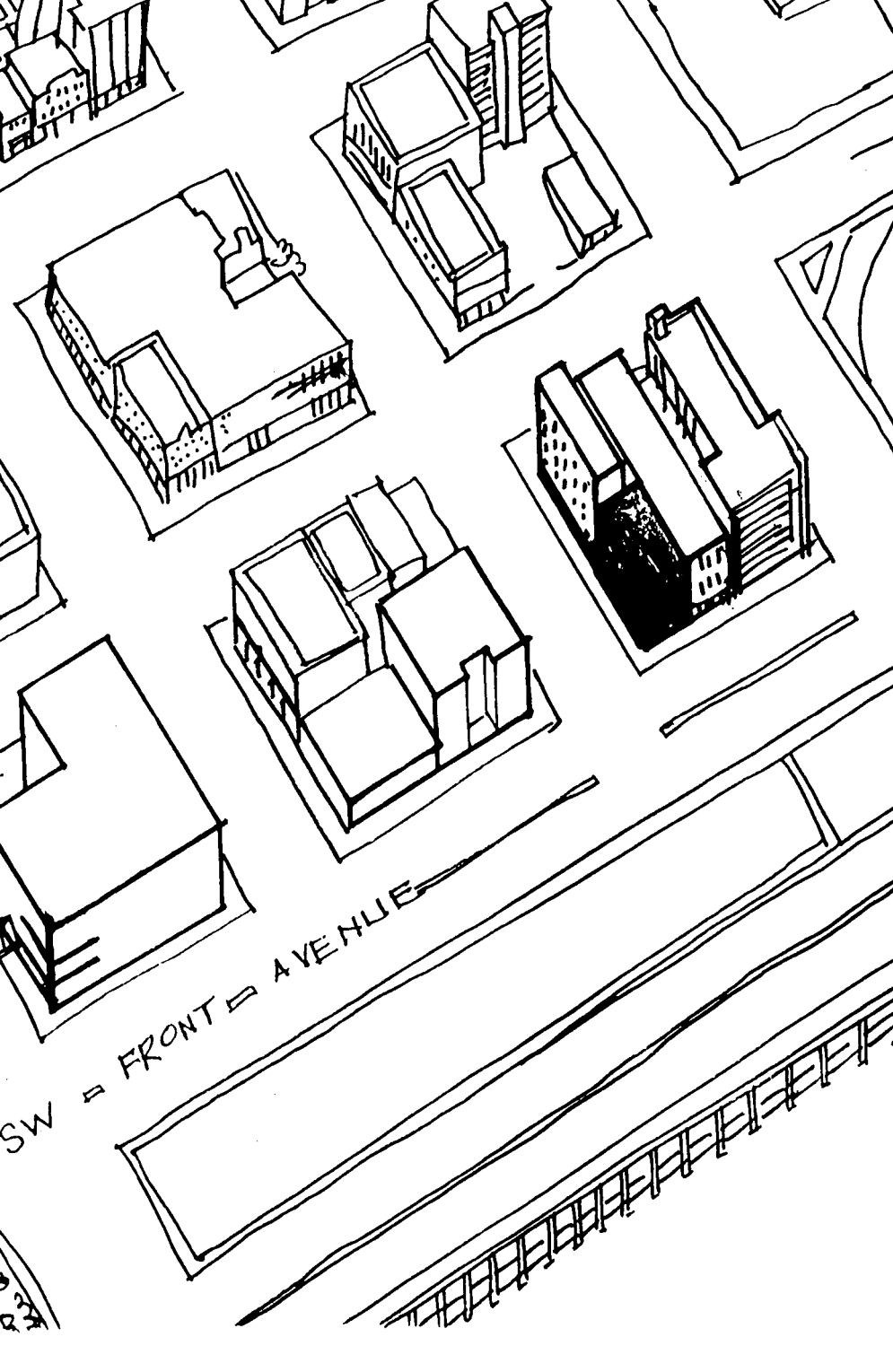
The site boasts riverfront access onto Tom McCall Waterfront Park, along with a clear view to Mount Hood and the Cascade Range. The pedestrian access to Waterfront park is just outside of the east side of the building, along tree lined Front Avenue.

The downtown area's growth in the last decade lends to the purpose of this interpretive/resource center. It provides a community of diverse services and cultural, educational opportunities.

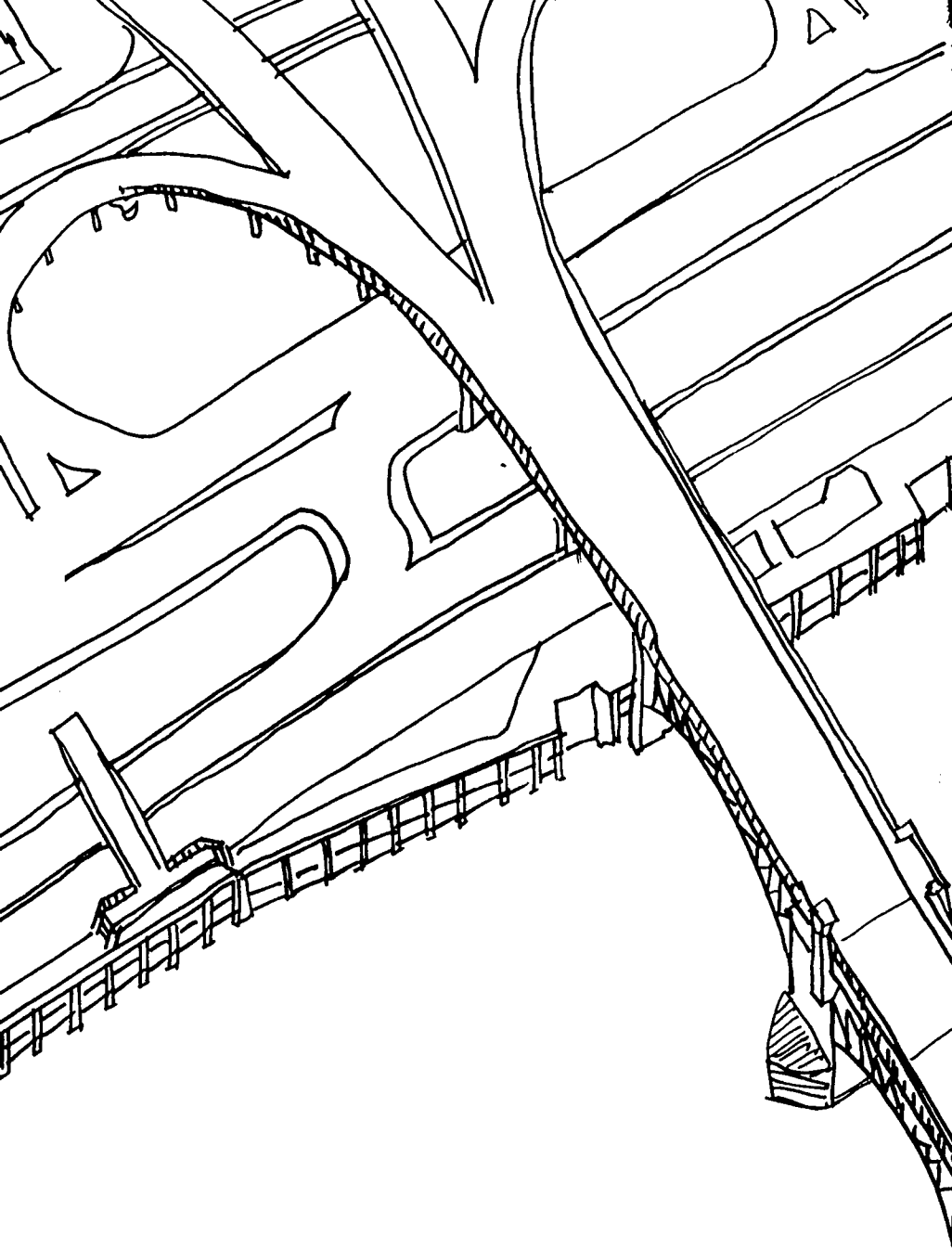




SHASTED COMPTONORS DO NOT MEET
NATIONAL MAP ACCURACY
AND

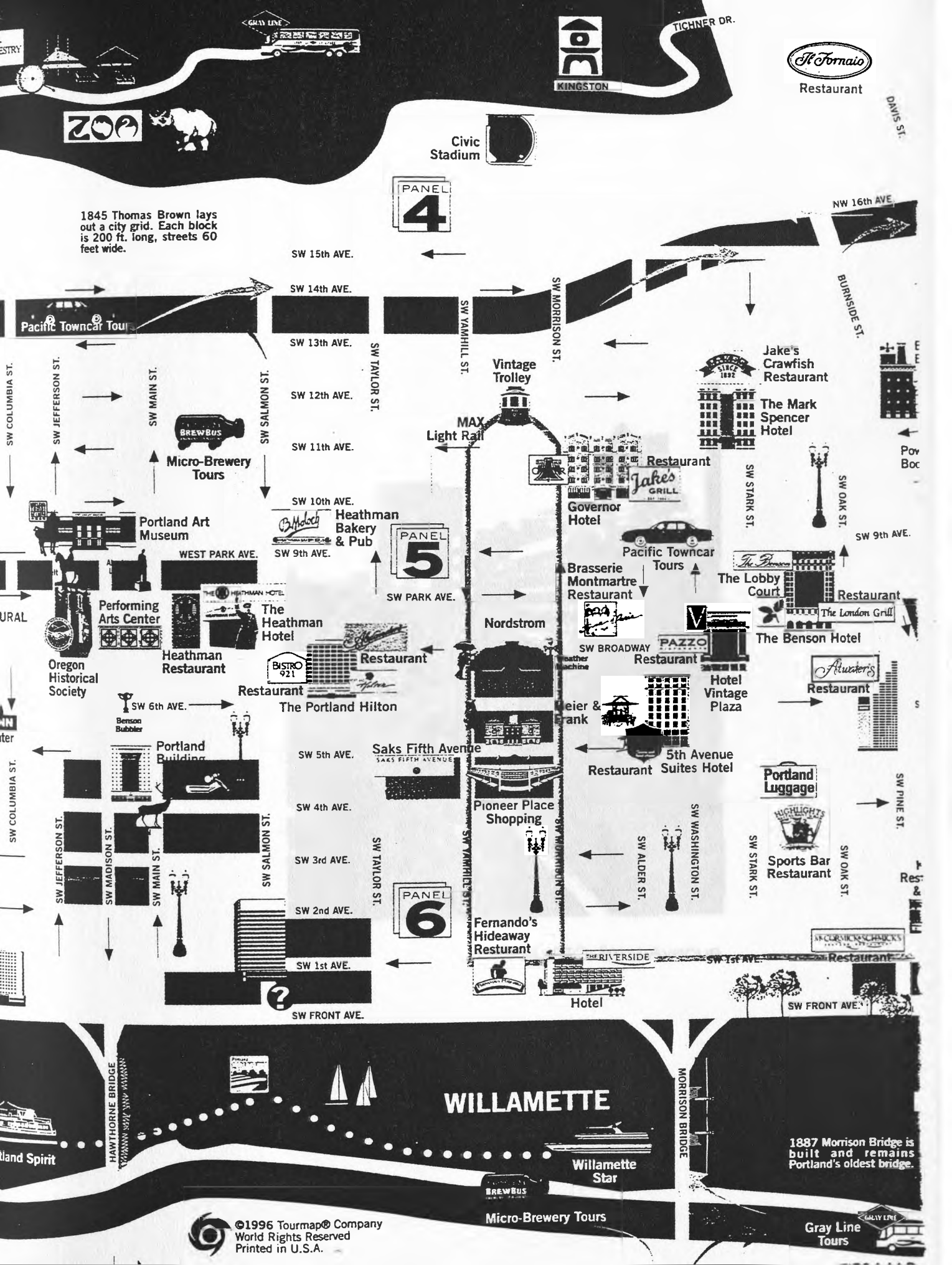


SW - FRONT AVENUE



AXONOMETRIC VIEW OF FRONT AVENUE





1845 Thomas Brown lays out a city grid. Each block is 200 ft. long, streets 60 feet wide.

PANEL 4

PANEL 5

PANEL 6

St. Fornio
Restaurant

1887 Morrison Bridge is built and remains Portland's oldest bridge.



PHOTO: Front Avenue

B. PHYSICAL

Physical

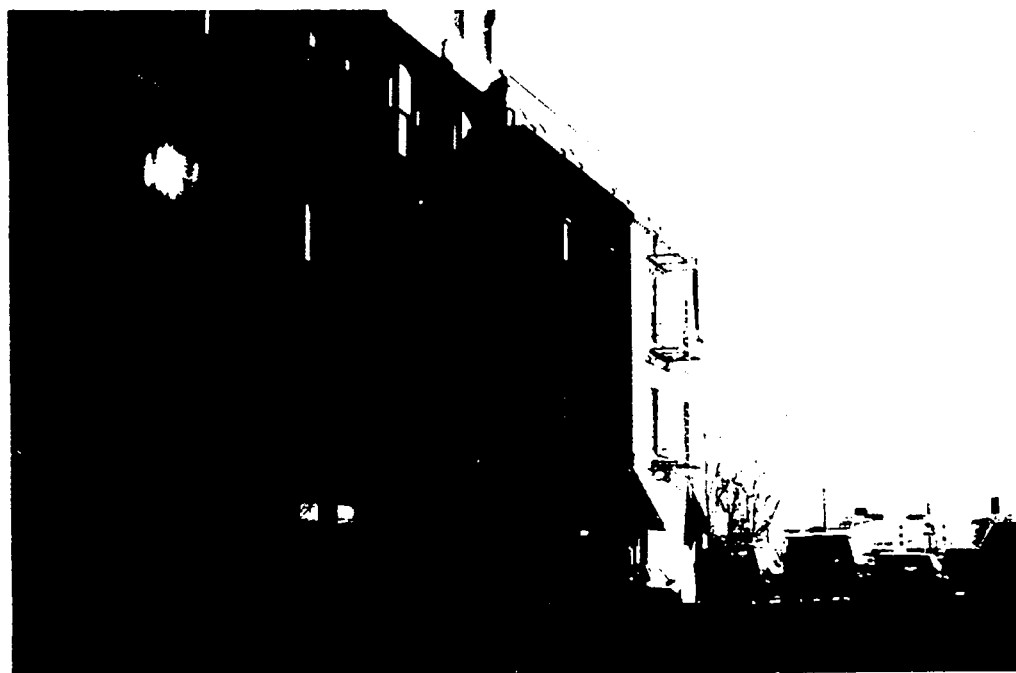
The building itself is a four story building with a basement. Its foundation walls are comprised of large stones cemented into place as the base for these once separate buildings.

Across the first level, a banding, seemingly supported by the pedimented east front divides the viewers eye, wrapping around the building to build continuity into the unaligned openings above the first floor.

Just above the third floor, the use of stacking to create a sense of bracketing alludes to the Italianate style the building has retained in all of its remodels since its original portion was constructed in 1858.

A fairly rectangular building, this gateway into the Yamhill district is faced with a number of challenges imposed by the building's current means of egress.

Entrance is currently gained via two separate entrances on the south side. One opens immediately into a law practice, while the other entrance approaches a lobby space, telling very little of its occupants on the floors above. Both signage and vertical circulation are difficult to locate immediately using the cues of architecture.



C. HISTORICAL

The historical background of the present study is the fact that the study of the history of the United States is a very important part of the study of the history of the world.

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Historical

The Northrup-Blossom Fitch building was established near the new age developing for the city of Portland, Oregon. Only a little over a decade before, in 1845, the town's name was determined with a toss of a coin.

In the first year that Portland was established as a city, sixteen blocks, measuring 200 feet by 200 feet were surveyed. Due to the difficulties in removing the large stumps from trees of the virgin woods surrounding Portland, lots of 50 feet by 100 feet (eight to a block) were drawn, determining the front dimensions for almost all the buildings to come.

Built in 1858, the Northrup-Blossom building was built for Edward J. Northrup-Blossom. Northrup-Blossom was a pioneer hardware company named for Edward, its owner, and Blossom, who was on an early climb up Mt. Hood, where Camp Blossom was named for him.

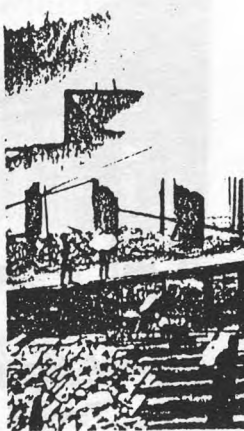
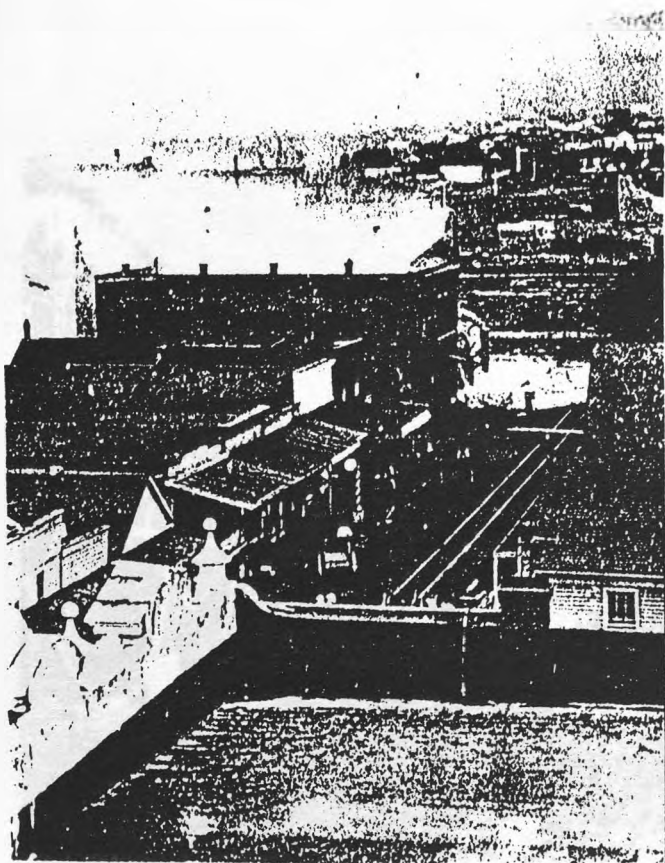
The Northrup-Blossom building had its start as a one story structure, joined in 1873 by a second story, and the Fitch building added next door in the same year. Sometime prior to 1894, the two buildings were joined, and an additional story was added to form the three story structure.

Removed from the original structure was the original portico and a portion of the original cornice. The windows on the south side were added in the ensuing renovations to the building.

The buildings brick is plaster finished, with a foundation of brick corbelling. Because of its history as two structures, the Fitch side of the building can be identified via its closer set windows.

In 1873, a fire in the Yamhill District consumed all but the Northrup-Blossom Fitch building, leaving it to be the last original standing building in the Historic Yamhill District. It is now the second oldest building standing in the city of Portland, Oregon. This can possibly be attributed to the fact that most of the Yamhill District, born of the era of cast iron, could not withstand the heat of the fire, whereas the Northrup-Blossom Fitch Building, with its primarily brick construction, was not faced with the inherent maleable nature of iron.

Today, the building carries atop its three clearly visible stories, a fourth story, tucked away from the edge by a three feet balcony.



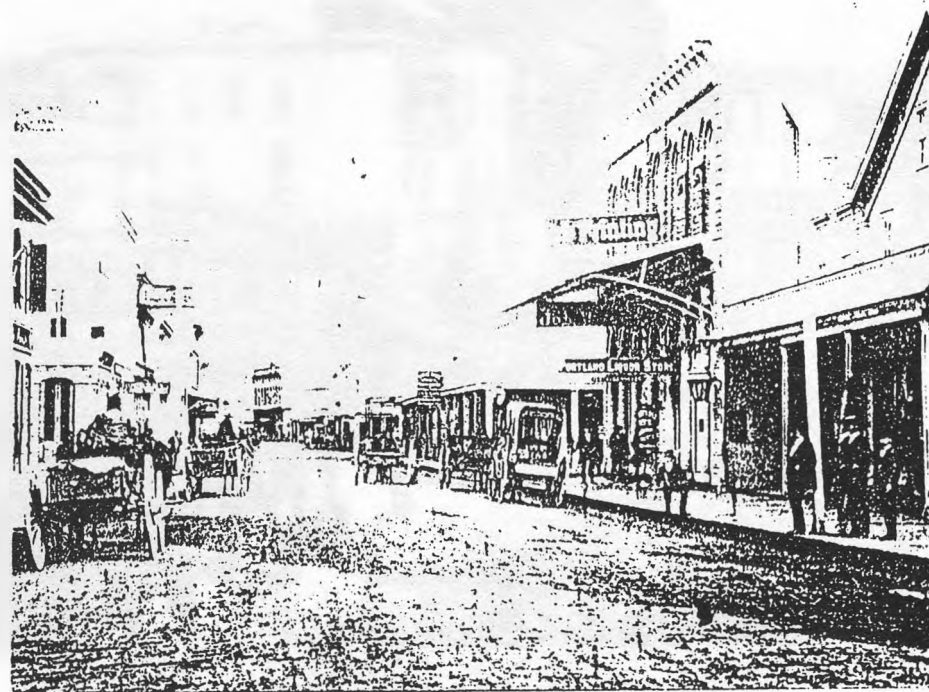
Fire of 1873, as viewed from Pearne Building

Soaked blankets
protecting the
mansard roof
after 1872 fire,
untouched 1858
Northrup Blossom
Fitch building.

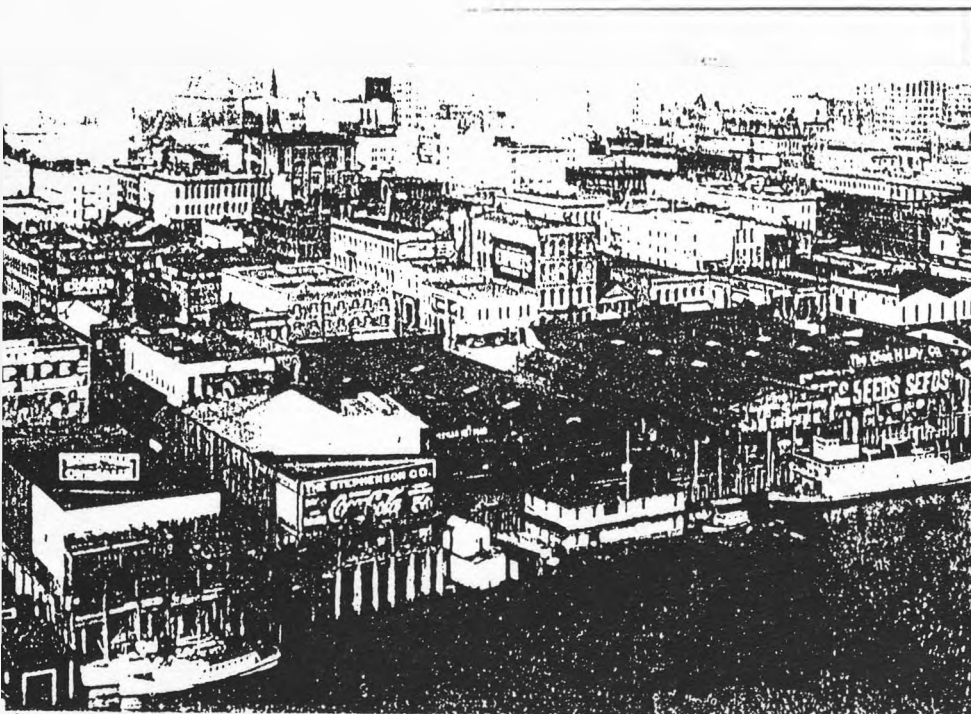




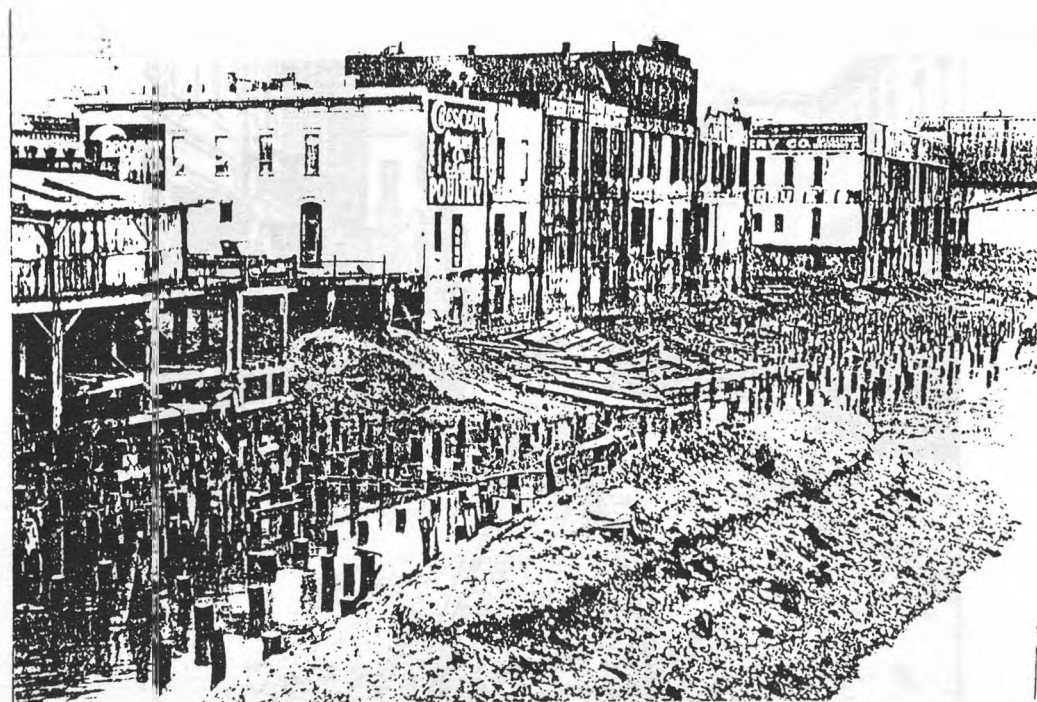
Front Street looking south from Alder, 1874



Front Street looking north from Alder, 1872

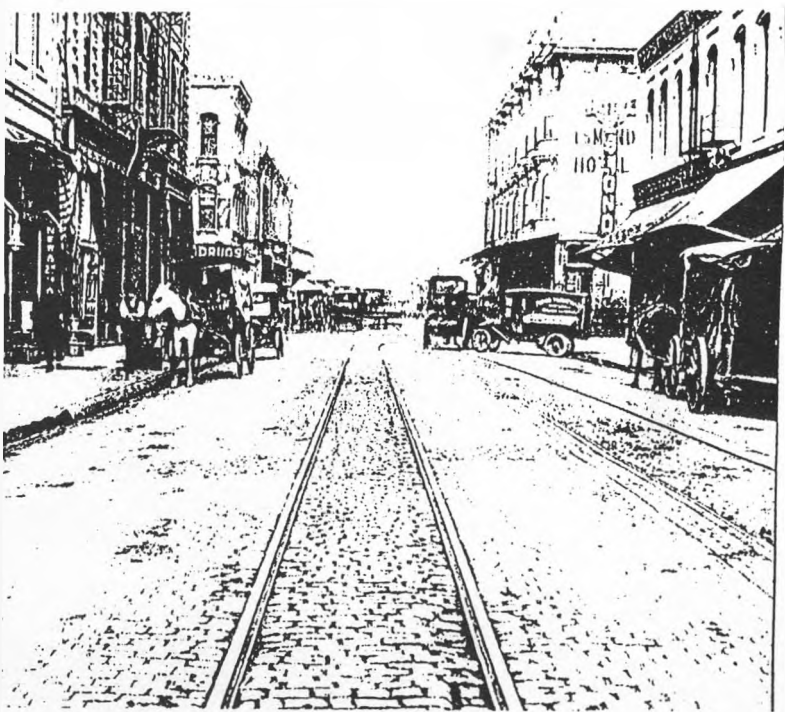


Waterfront view looking west between
Main and Yamhill, 1914



Waterfront, 1928





Front Street looking north from between
Yamhill and Morrison, 1930's

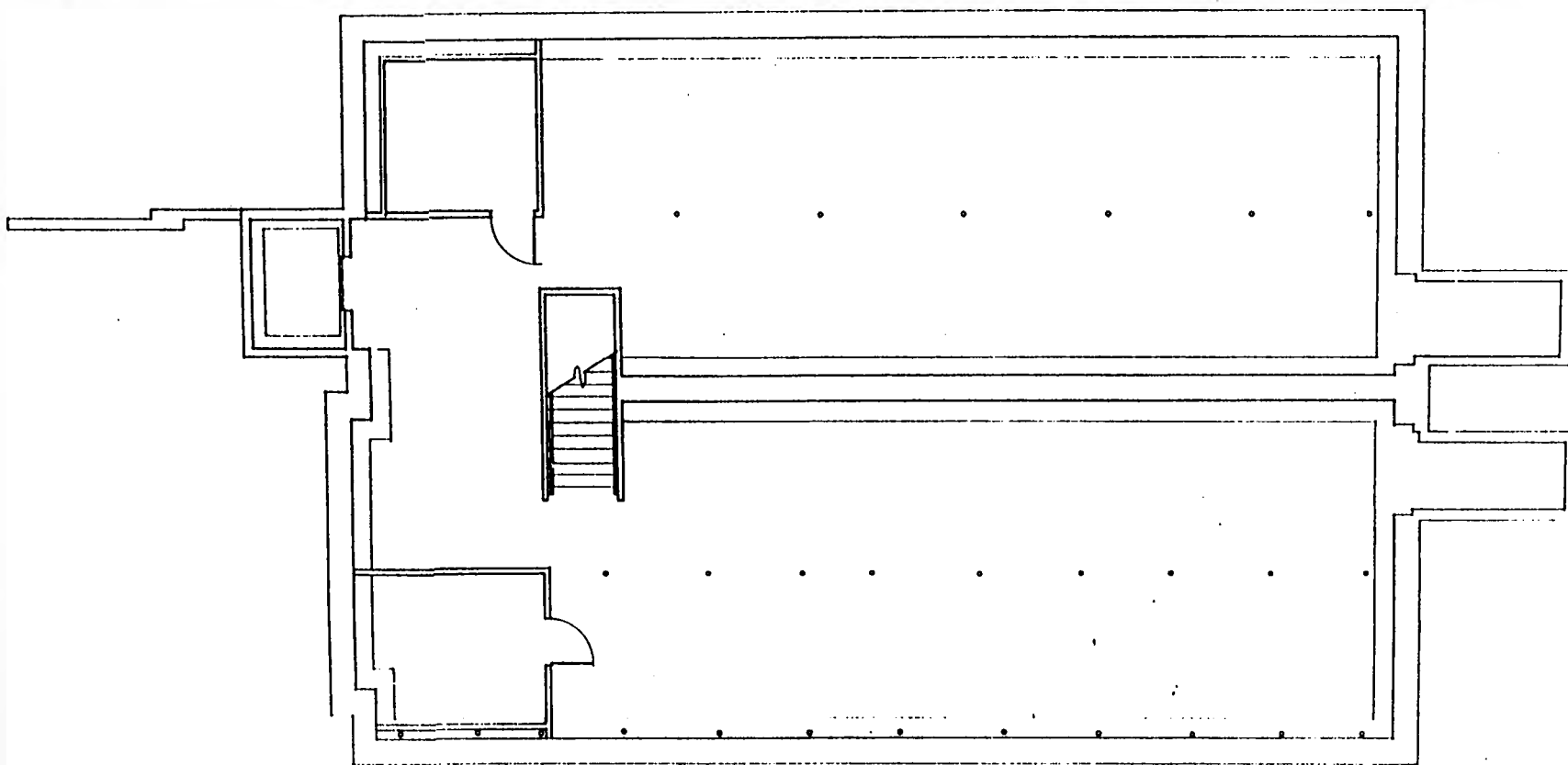
III. THE BUILDING

A. EXISTING

B. REMODEL

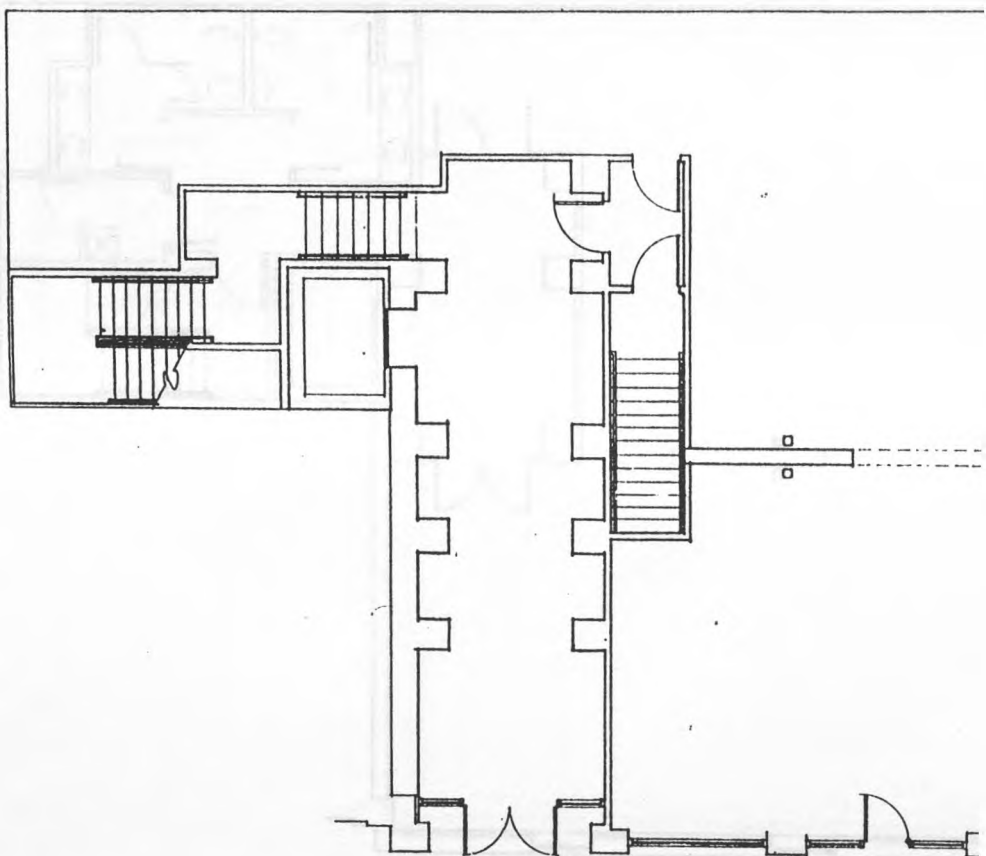
A. *EXISTING*



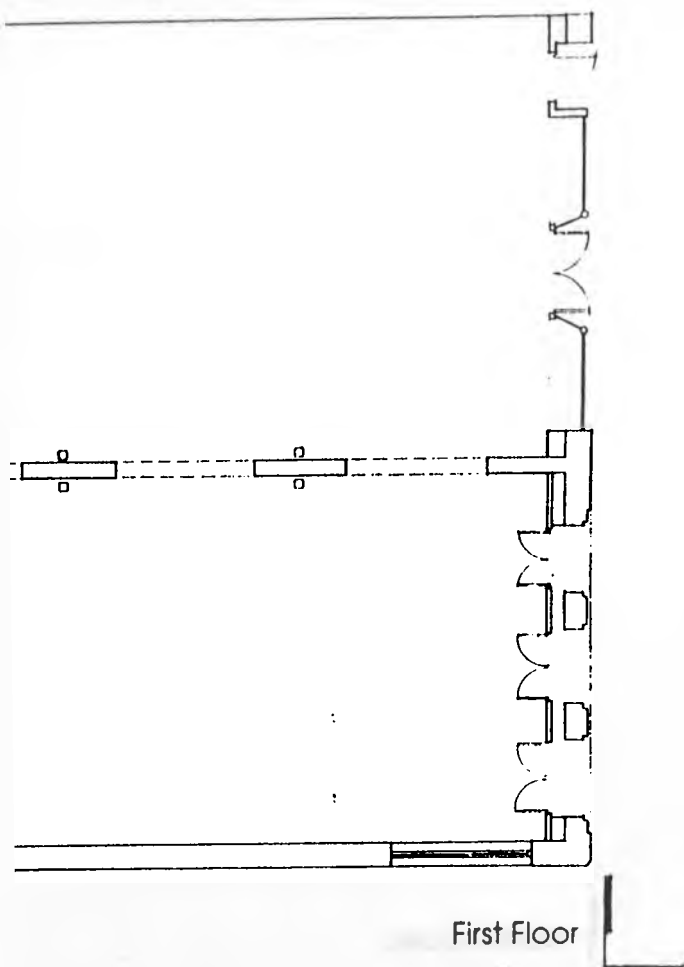


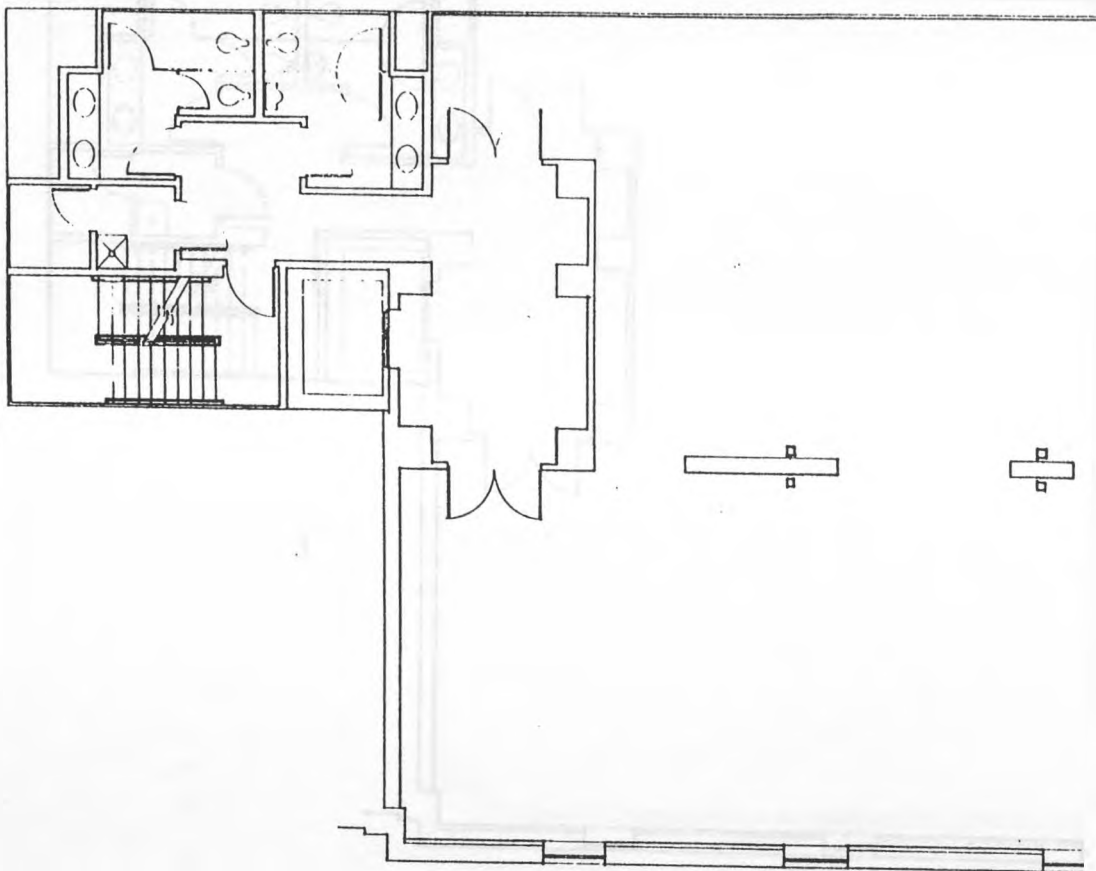
Basement

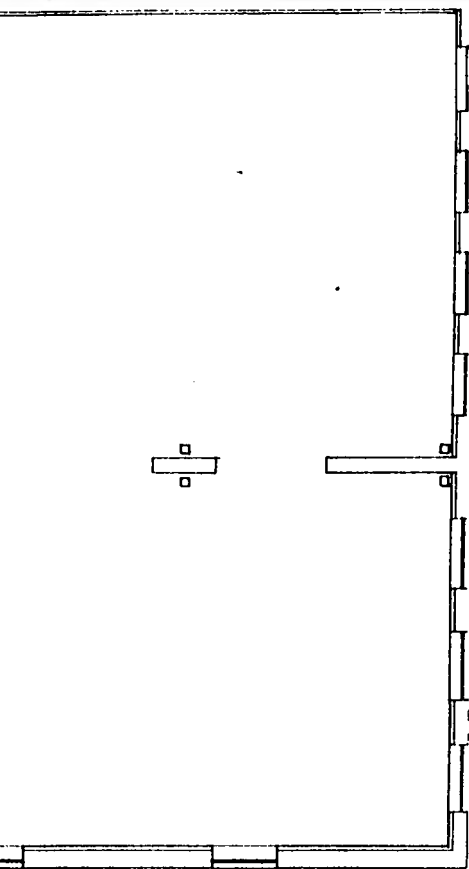




100' 0" 100' 0"

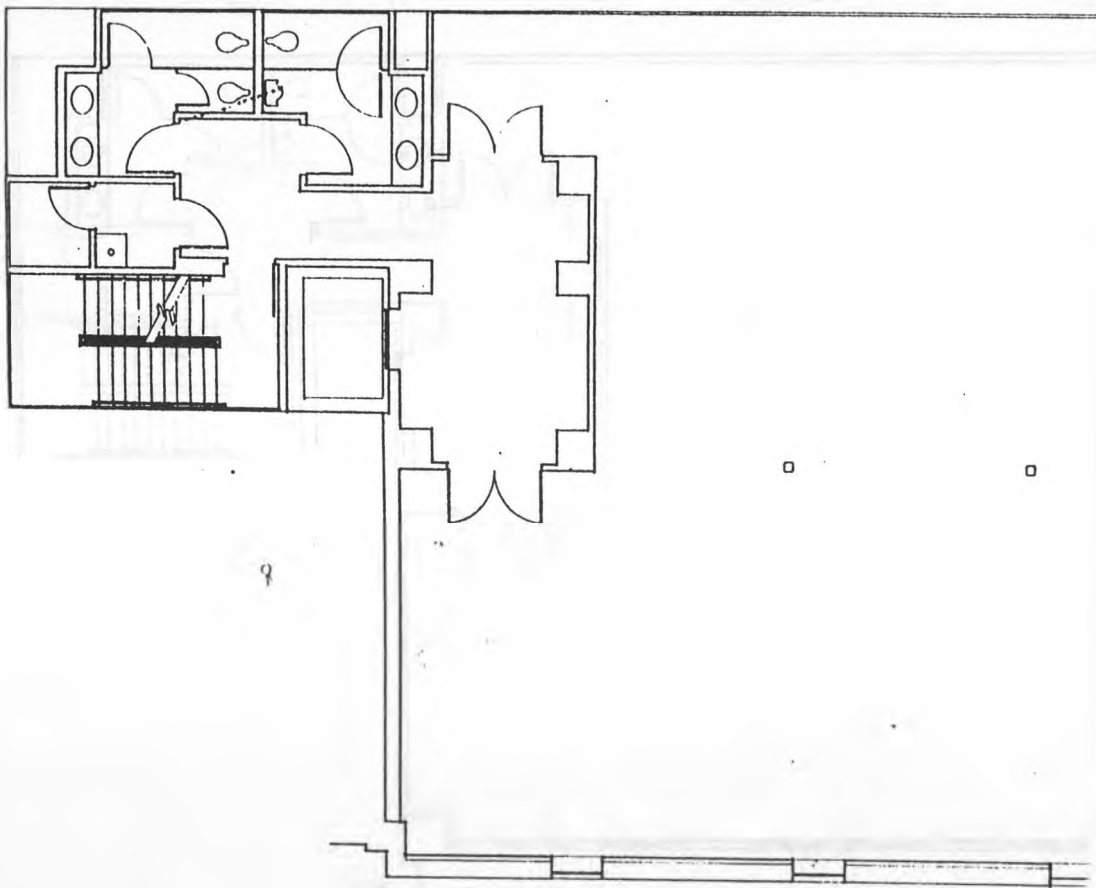


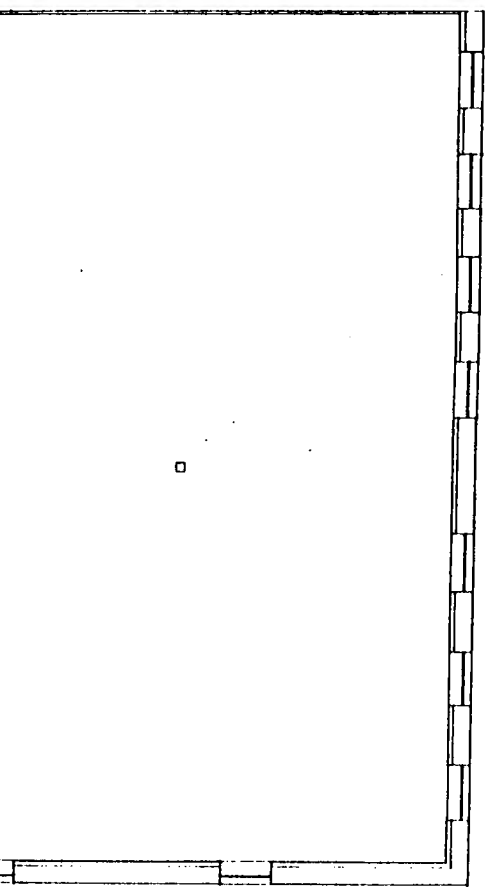




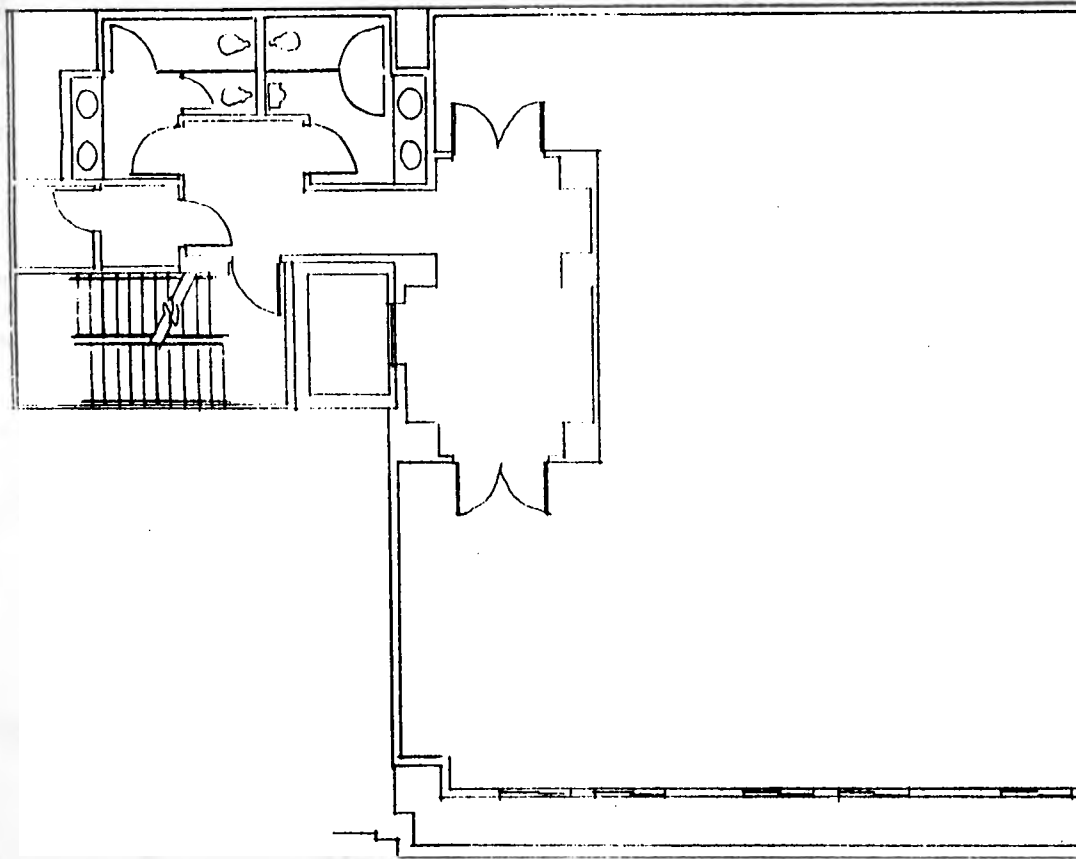
Second Floor

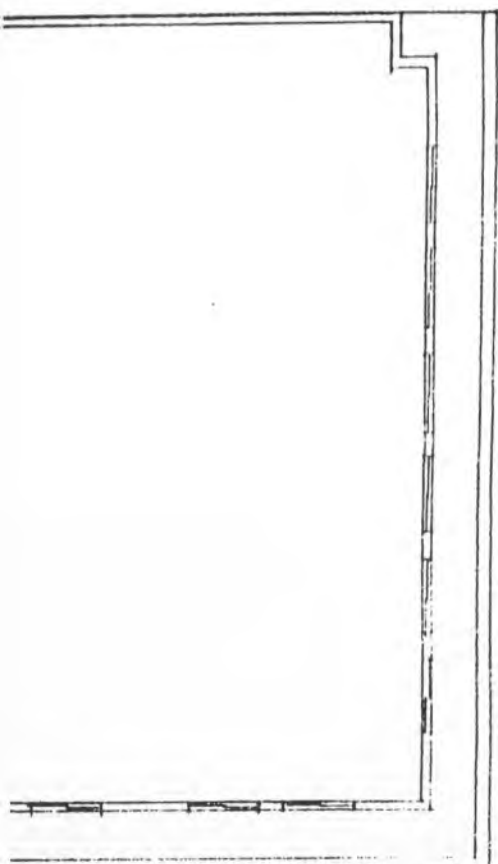




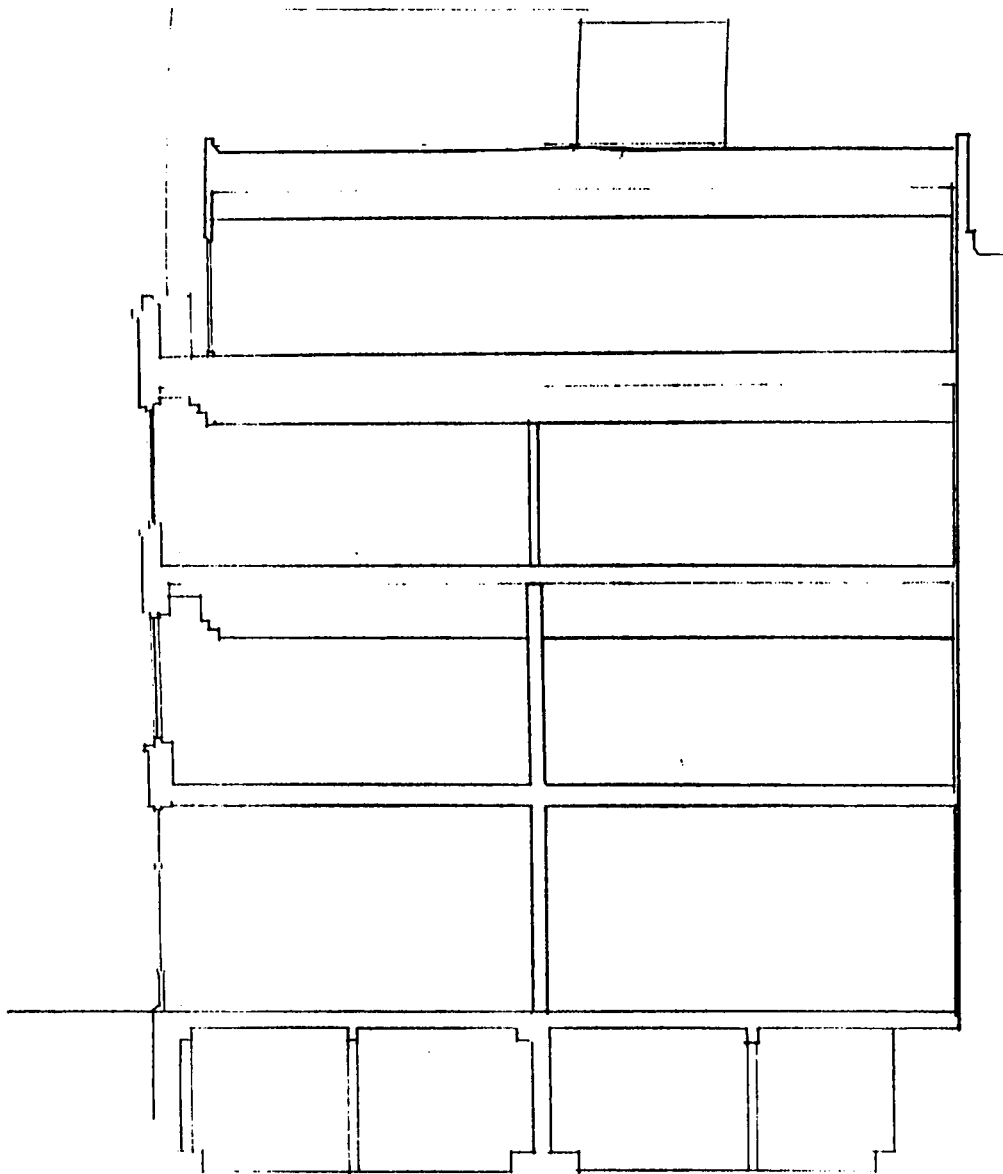


Third Floor

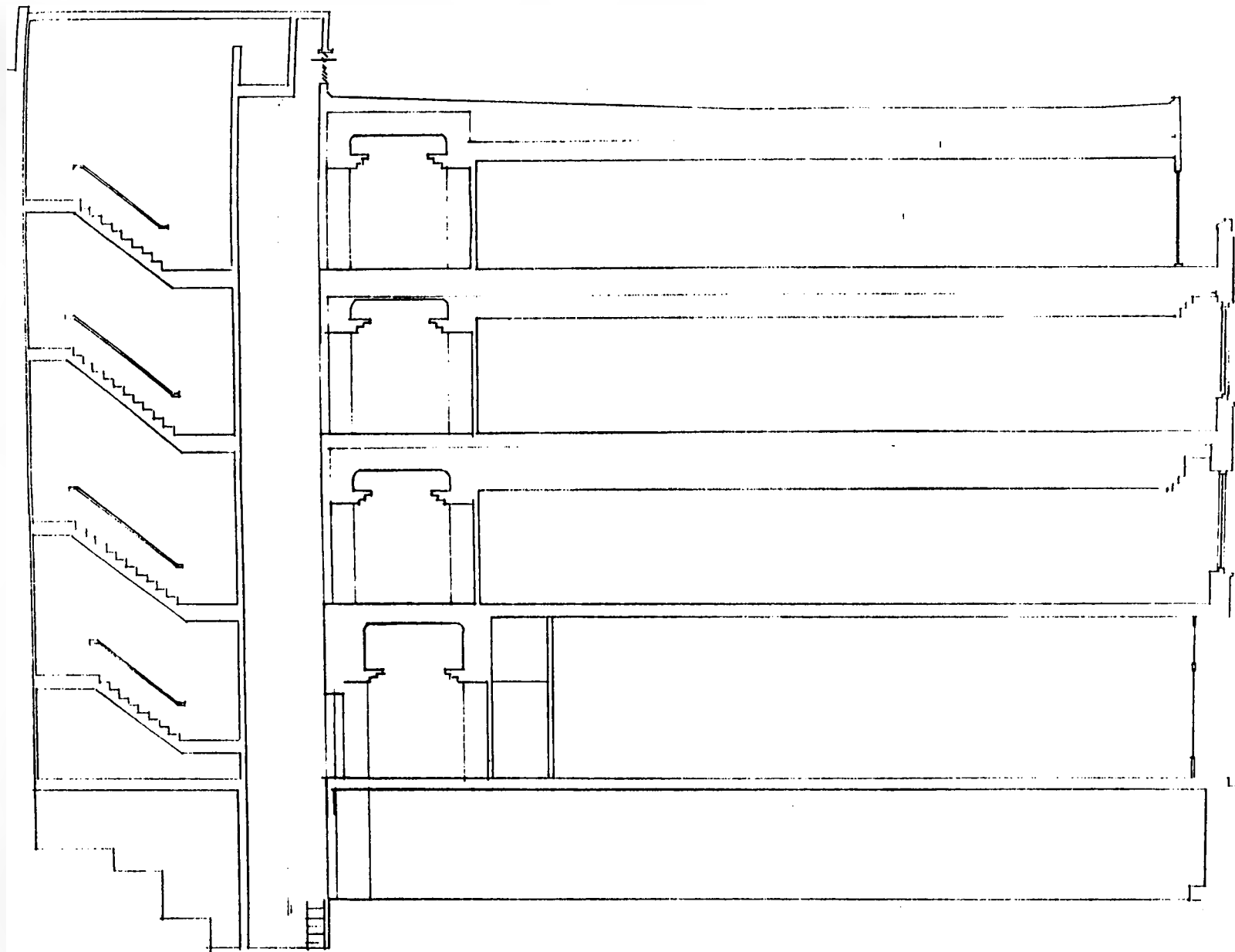




Fourth Floor



Section looking west

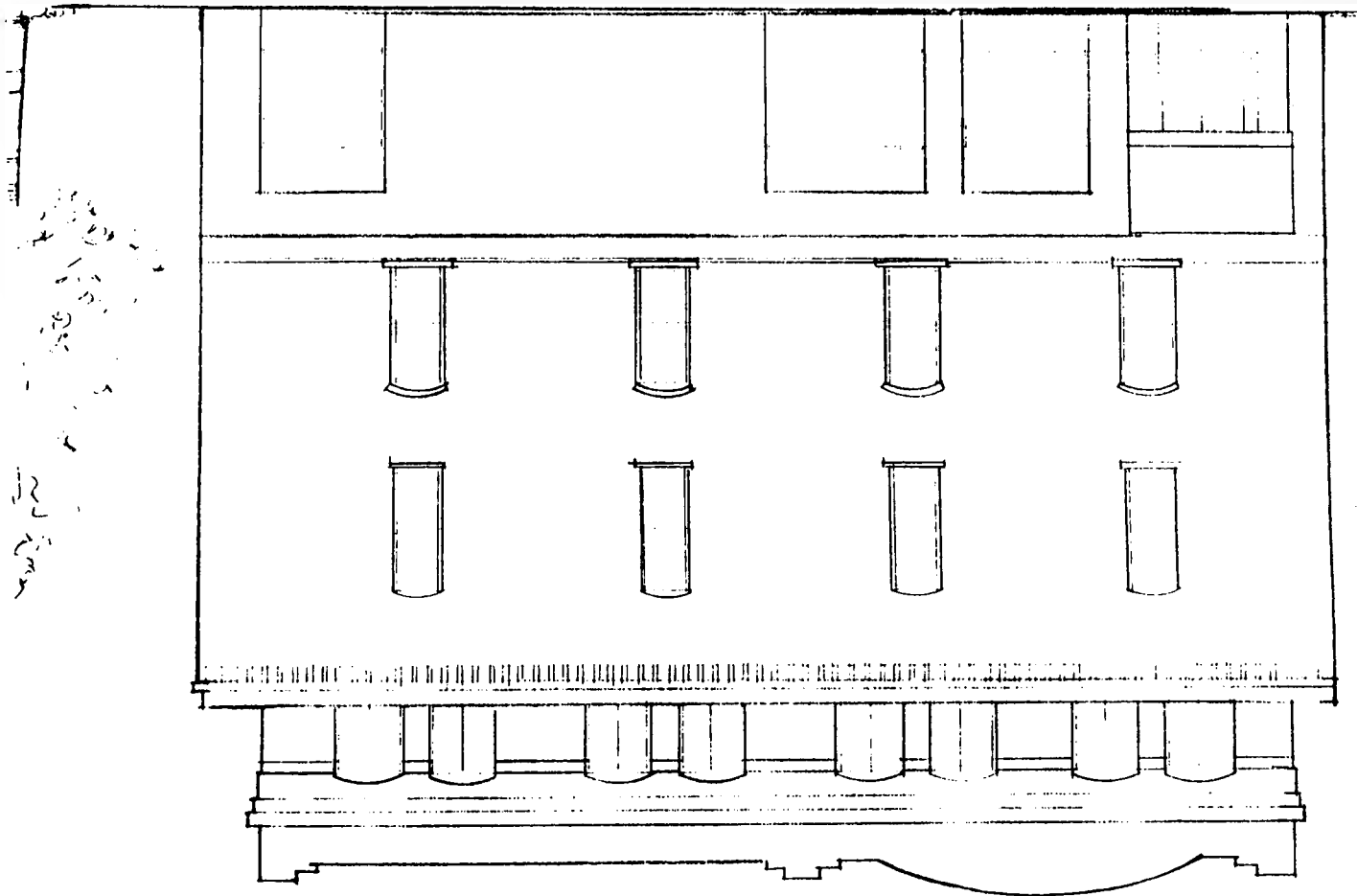


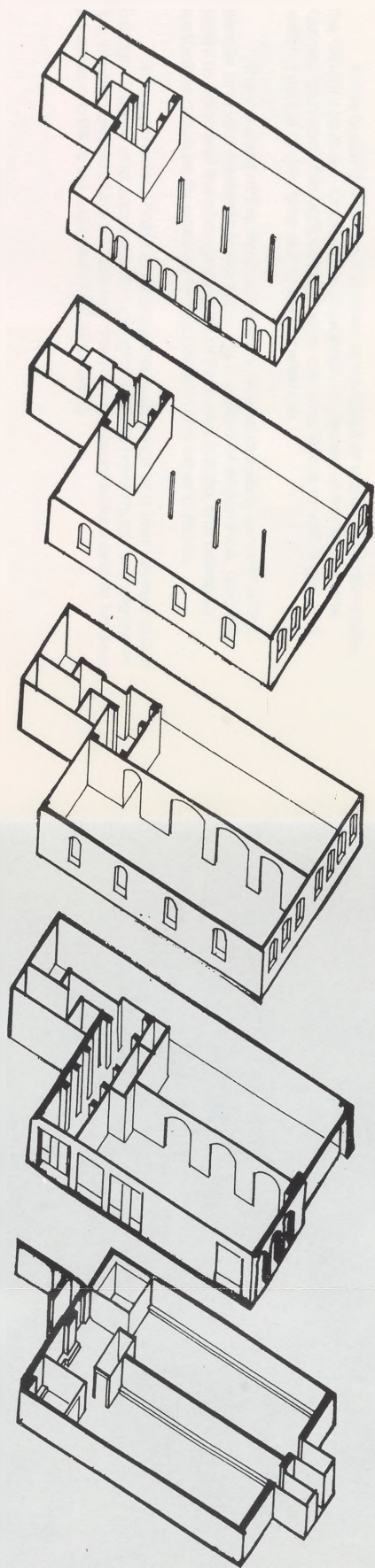
Section looking north



EAST ELEVATION

SOUTH ELEVATION





B. REMODEL

The Remodel

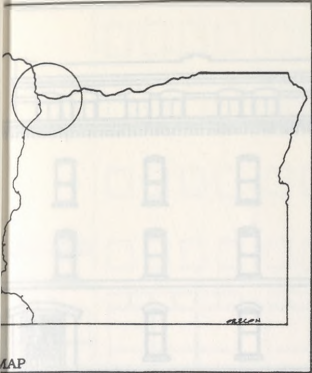
The remodel of the existing Northrup-Blossom Fitch Building is a design which takes on a number of directives in the hopes of achieving an interpretive center that will extend to the community the opportunity for knowledge.

From an architectural standpoint, the issues to be addressed are: 1) the design's ability to help viewers relate to those of the Vietnamese community whom they are familiar with (whether this be a father, a sister, a friend or a coworker), 2) the cues of circulation, to create a sense of being in a place, with the directive of learning through the senses, and 3) a beginning look at how the Vietnamese culture can be articulated through the built environment.

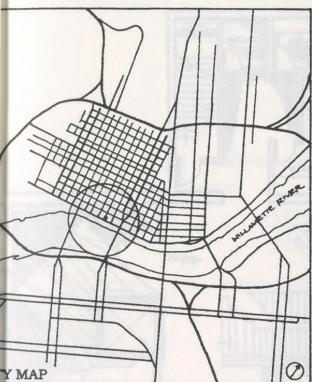
In the building's design, the idea, or concept of experience dominates the viewer's journey. Choices are presented to viewers at the start of the journey, and carry throughout the space, allowing visitors to visit, linger and revisit a venue at any time during the experience.

The concept of the remodel centers around the parti, or motif of the slender and vital elements of bamboo. As a symbol of endurance, and the ability to withstand the changing winds of time and culture, the bamboo symbolizes a culture for ages under the rule of many other cultures.

In this remodel, I hope to address the beginnings of a Vietnamese space. Though Chinese and Japanese art and architecture have much articulation in the Western architectural vocabulary, Vietnamese architecture and its hidden beauties are still to be explored in future projects.



MAP



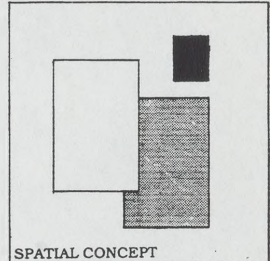
MAP



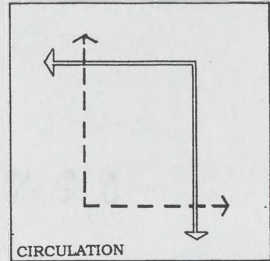
MAP



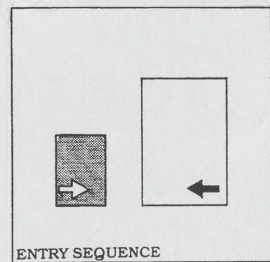
EXTERIOR PERSPECTIVE



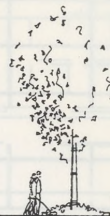
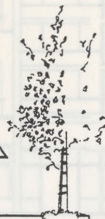
SPATIAL CONCEPT



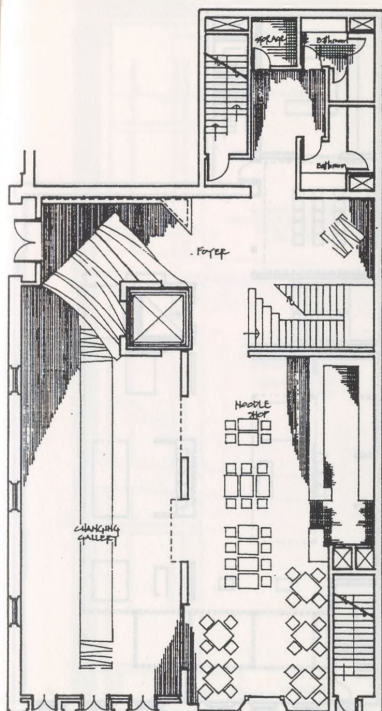
CIRCULATION



ENTRY SEQUENCE

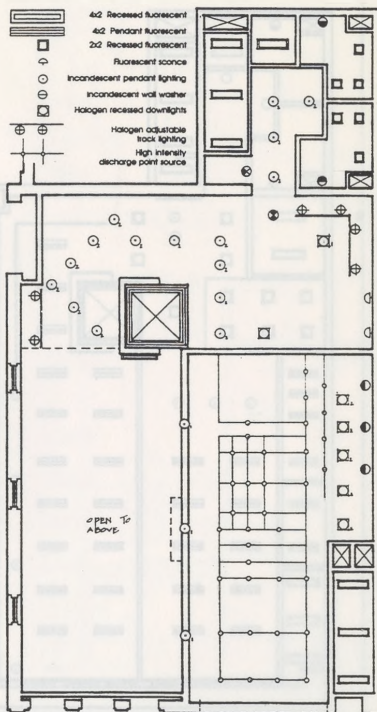


SITE ELEVATION LOOKING NORTH



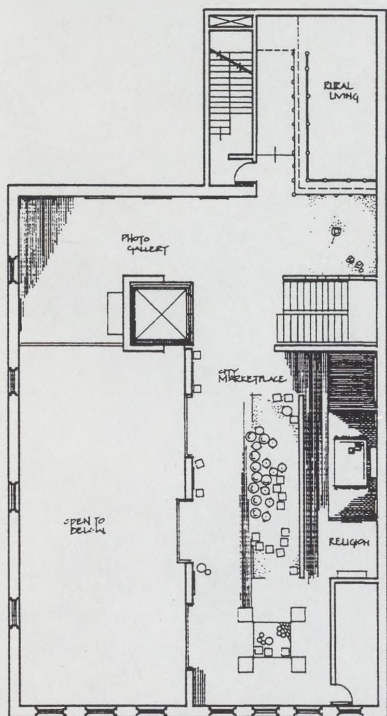
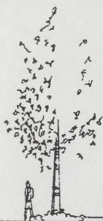
FIRST FLOOR PLAN

1/8" scale

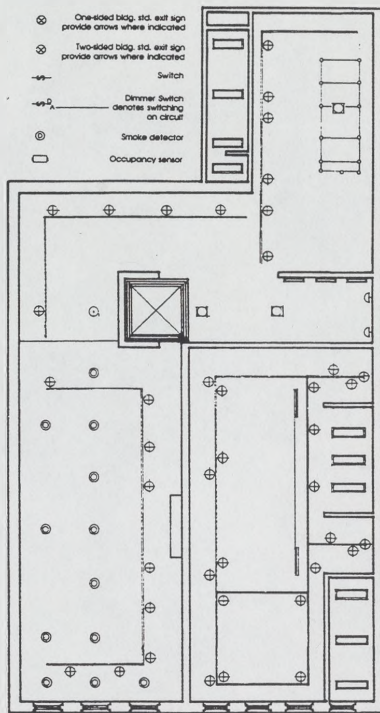


FIRST FLOOR - REFLECTED CEILING PLAN



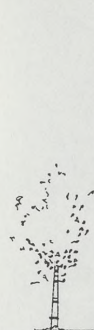
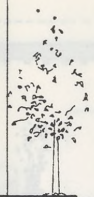
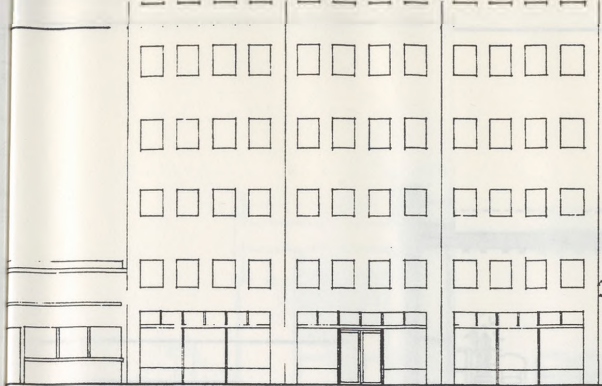


SECOND FLOOR PLAN 1/8" scale

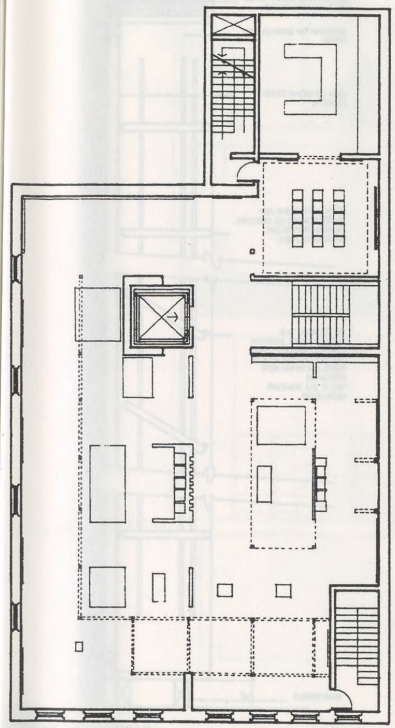


SECOND FLOOR - REFLECTED CEILING PLAN

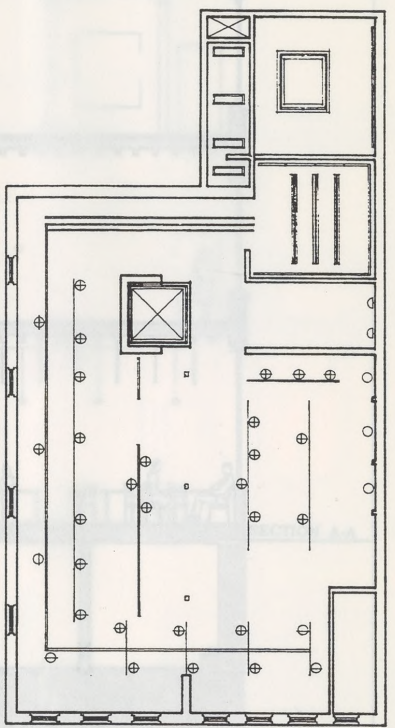




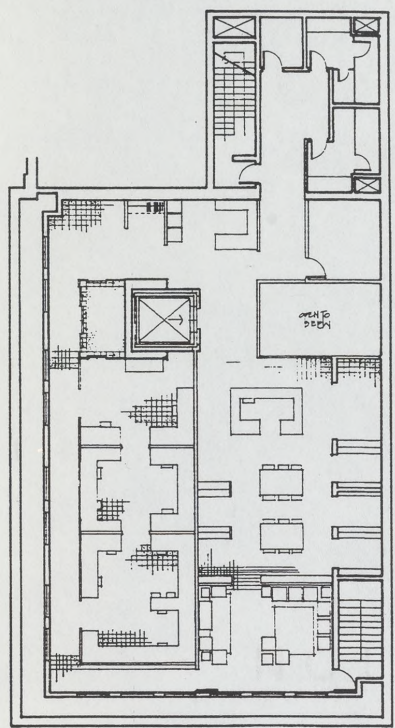
SITE ELEVATION LOOKING WEST



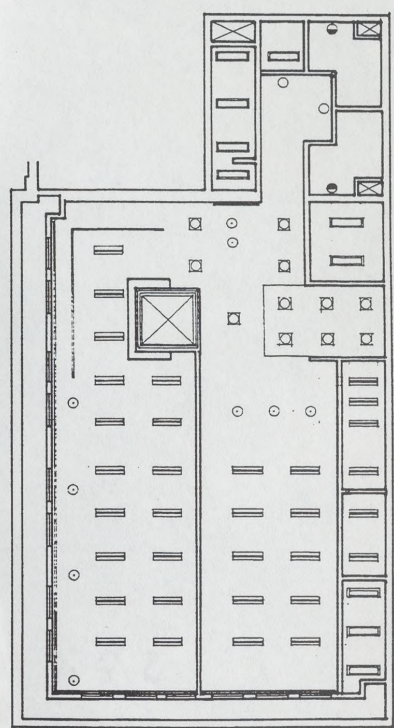
THIRD FLOOR PLAN 1/8" scale



THIRD FLOOR - REFLECTED CEILING PLAN

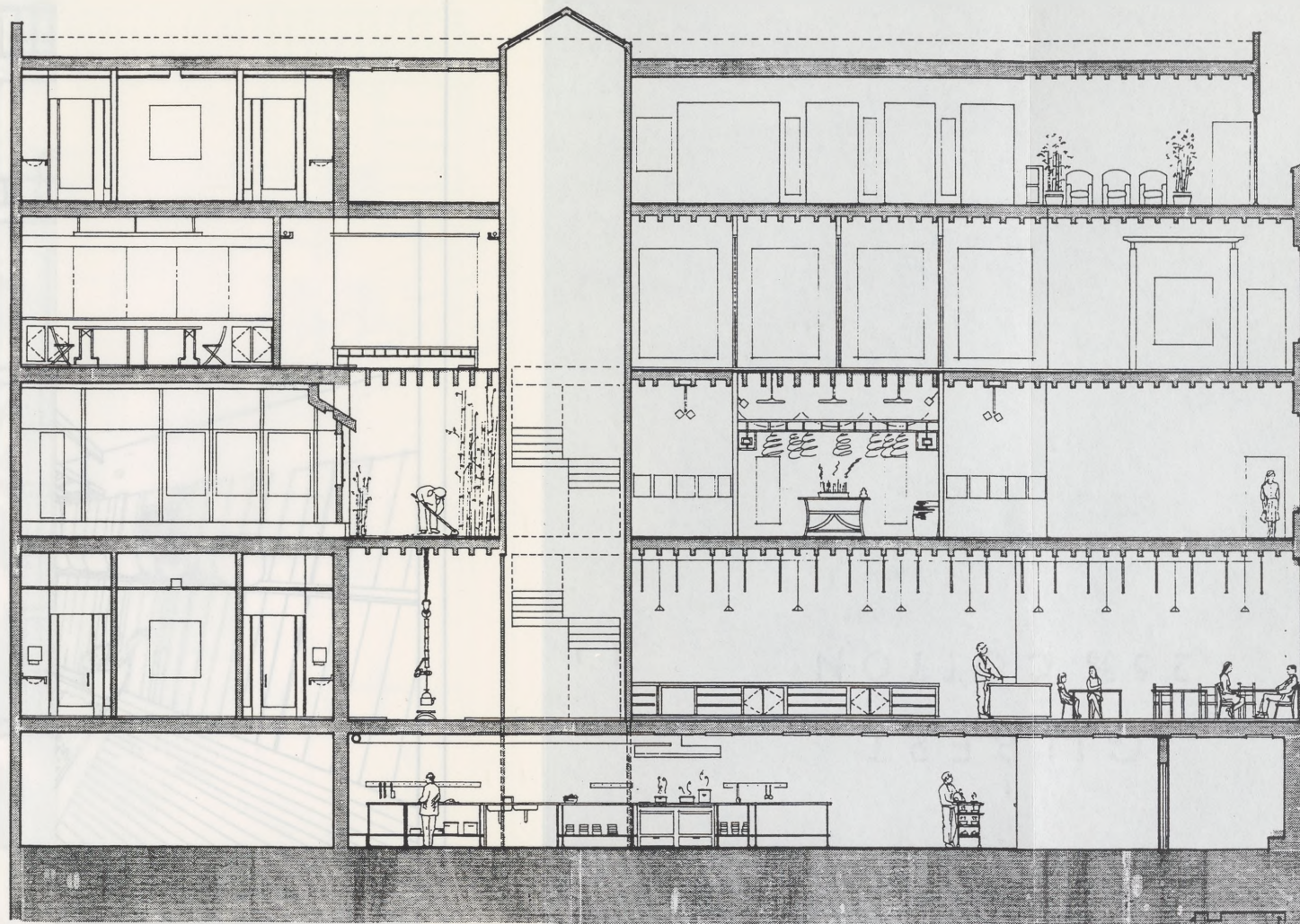
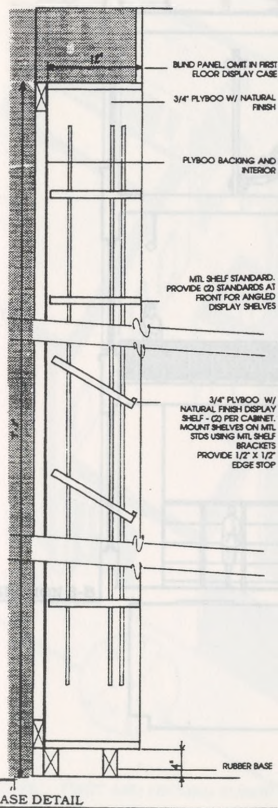


FOURTH FLOOR PLAN 1/8" scale



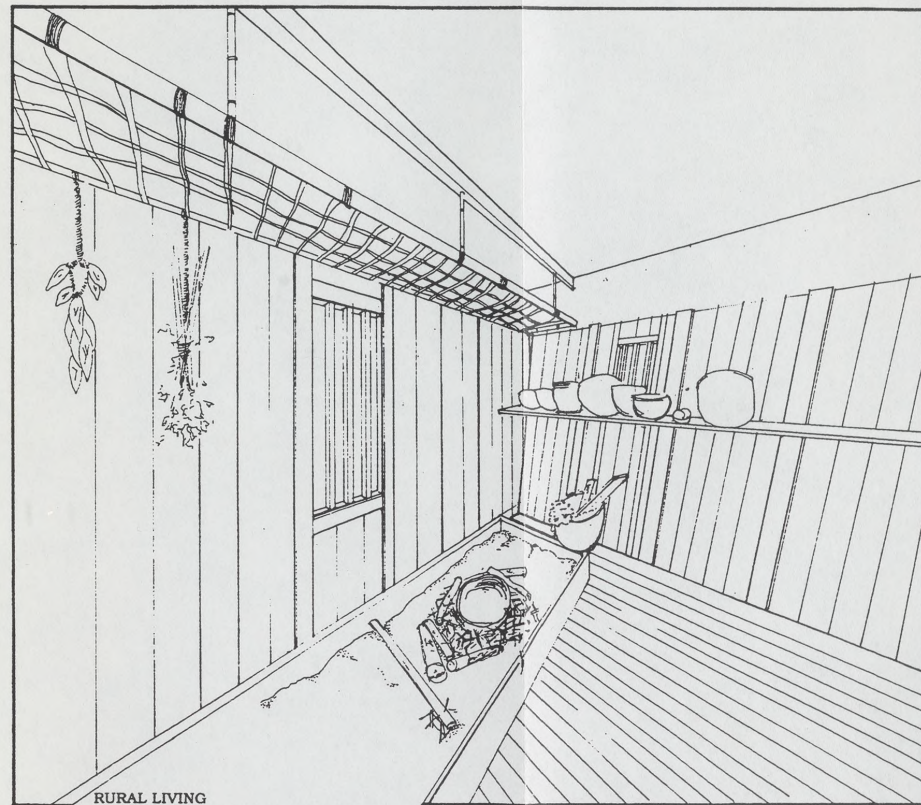
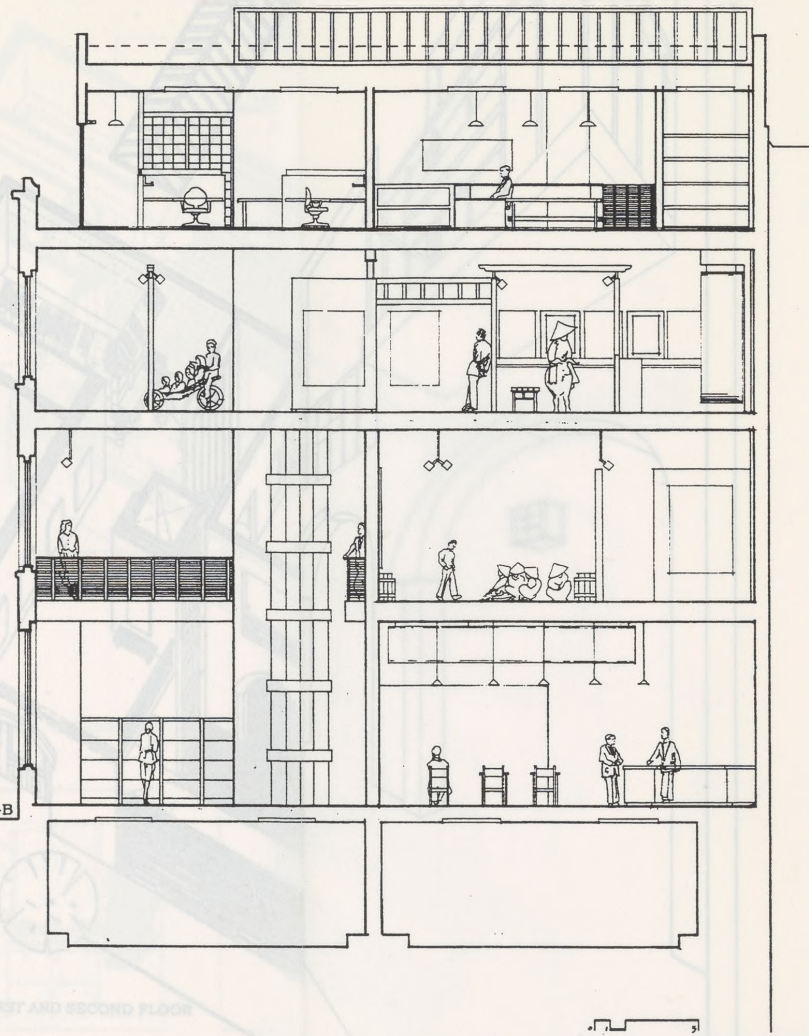
FOURTH FLOOR - REFLECTED CEILING PLAN



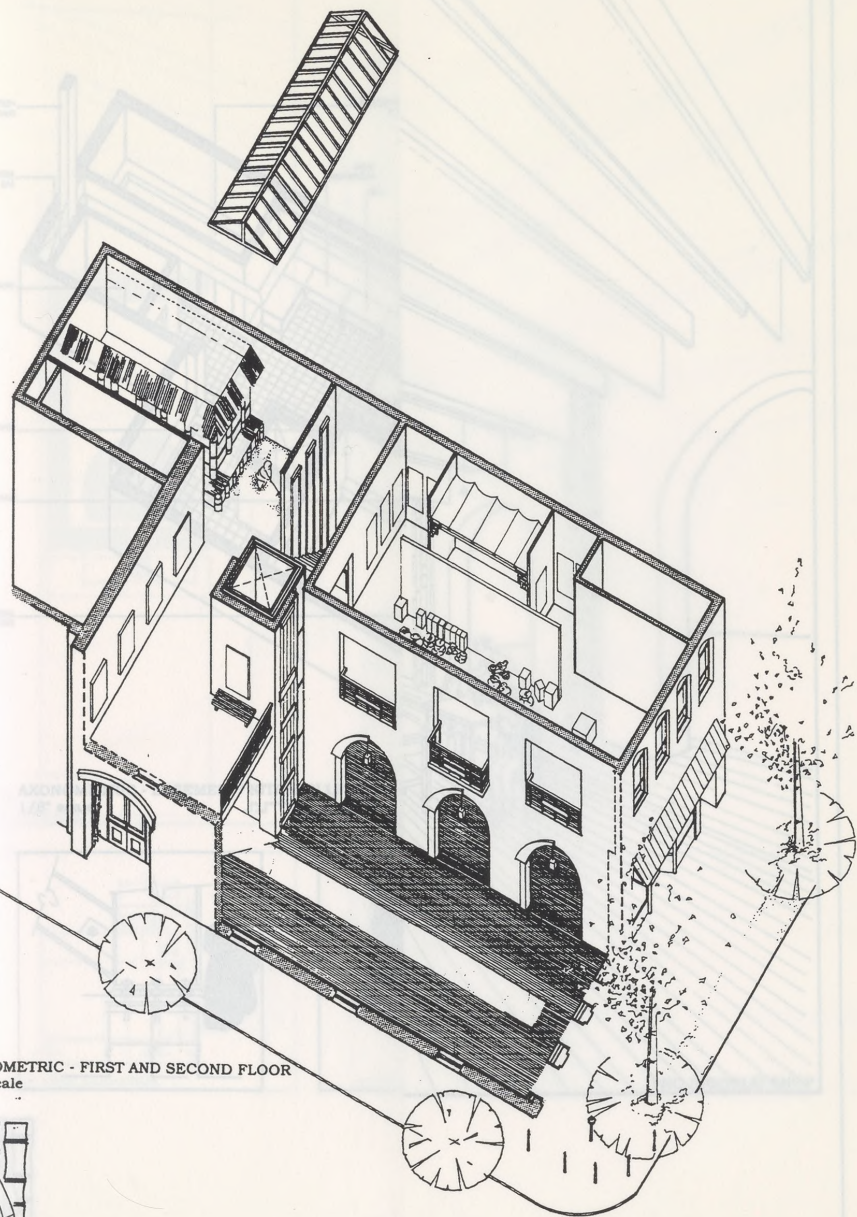


DISPLAY CASE DETAIL

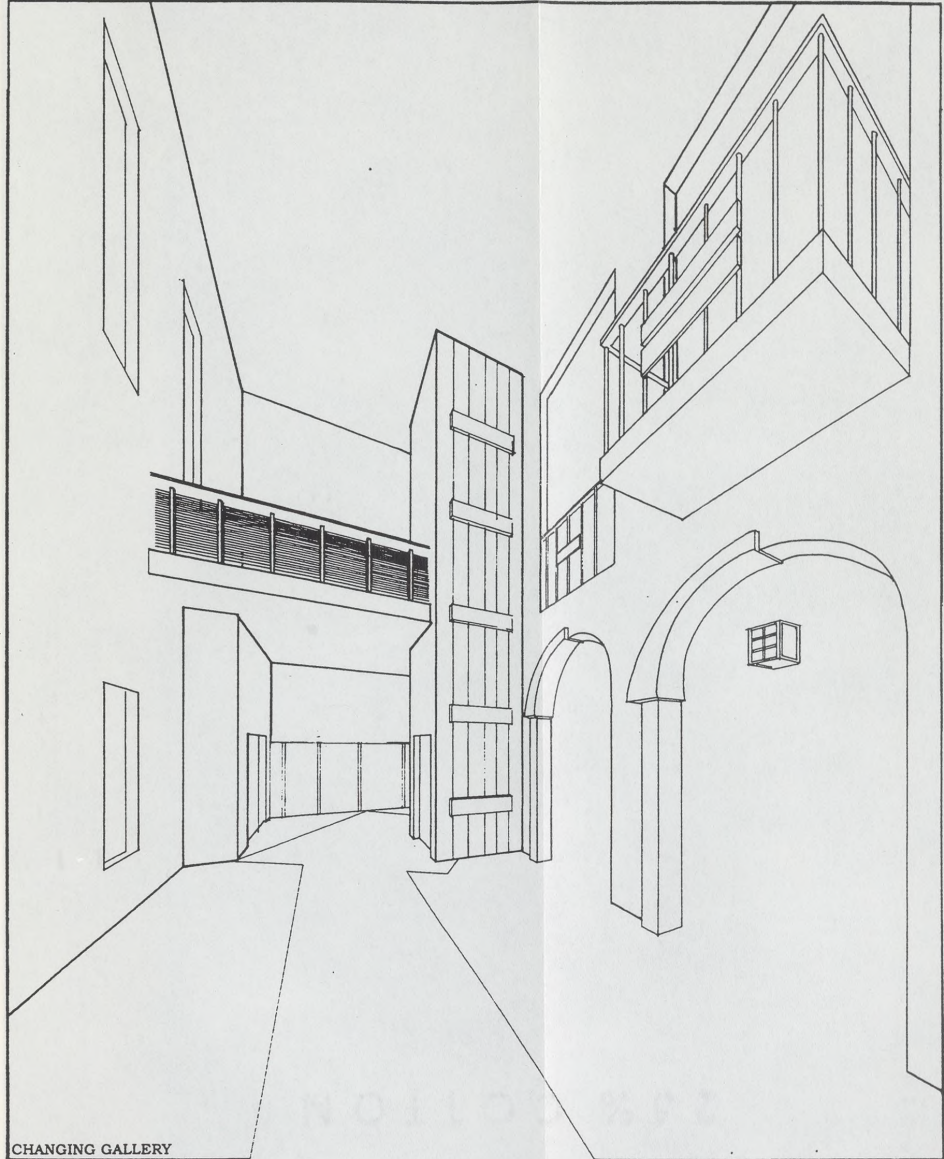
SECTION B-B



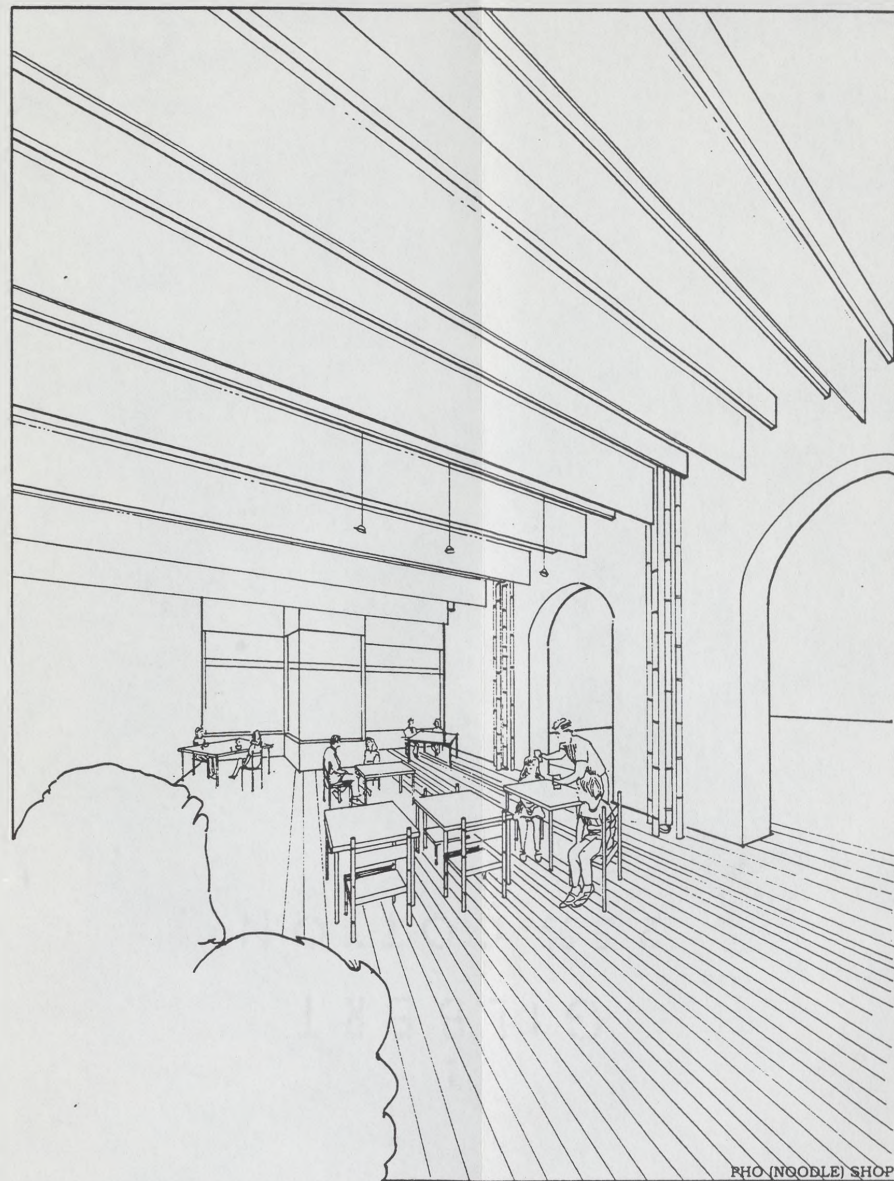
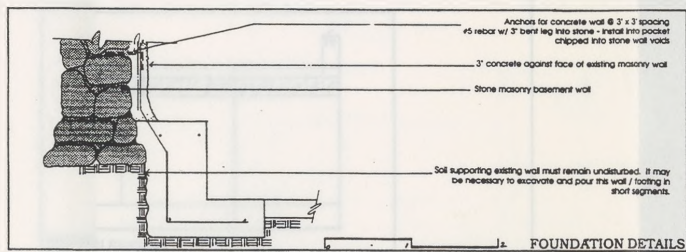
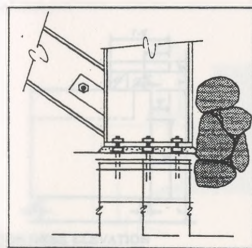
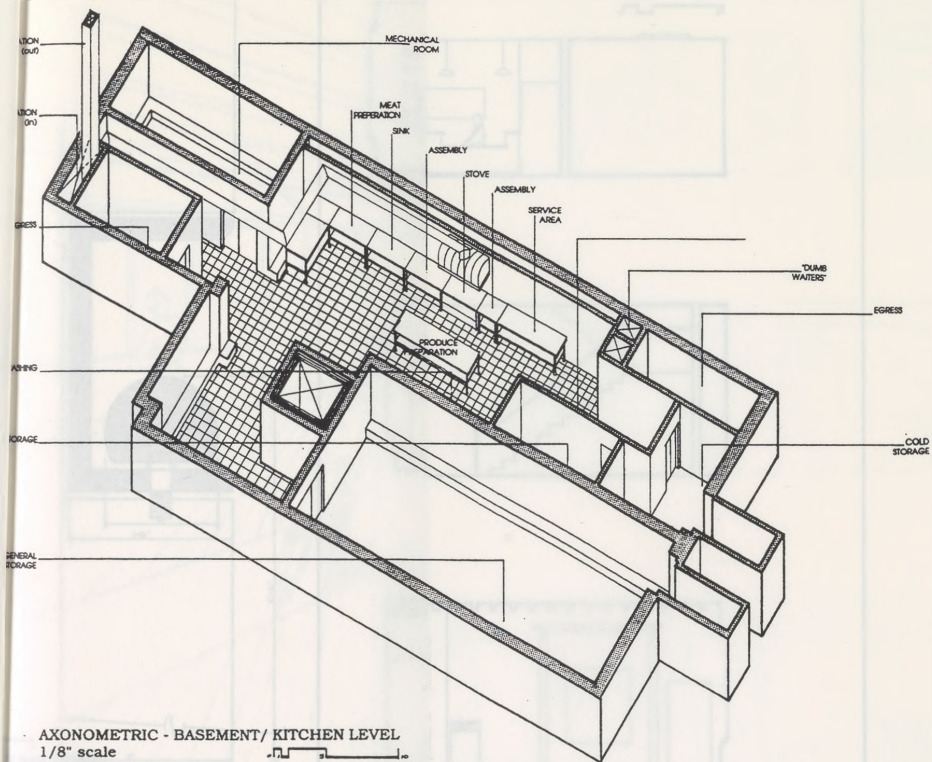
RURAL LIVING

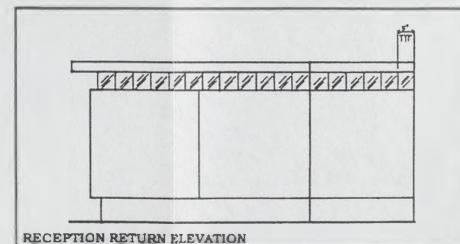
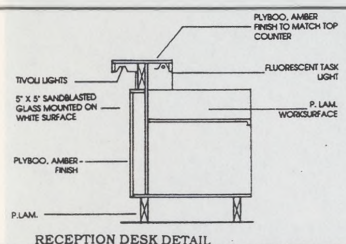
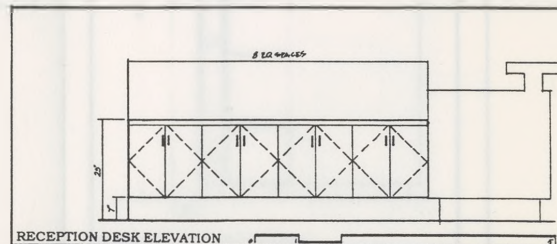
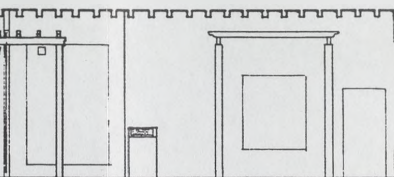
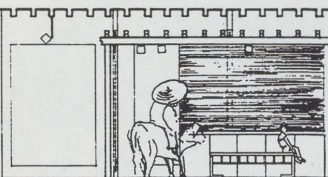
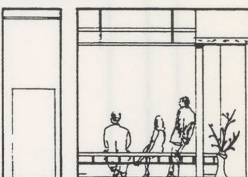
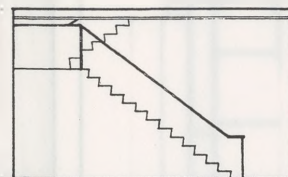
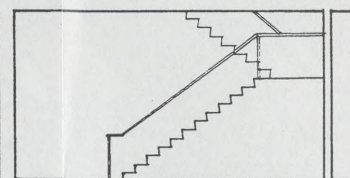
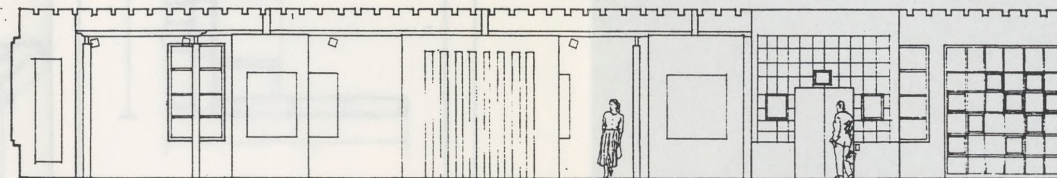
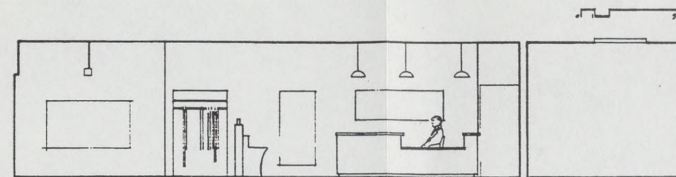
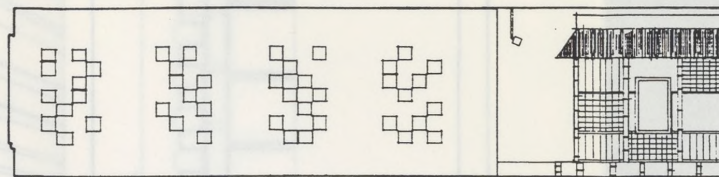
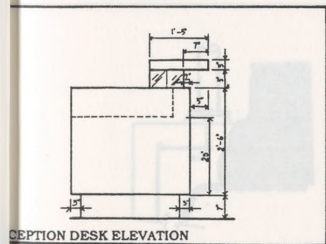
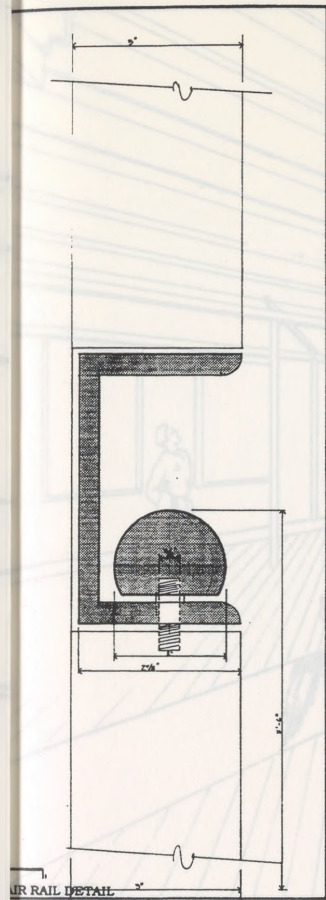


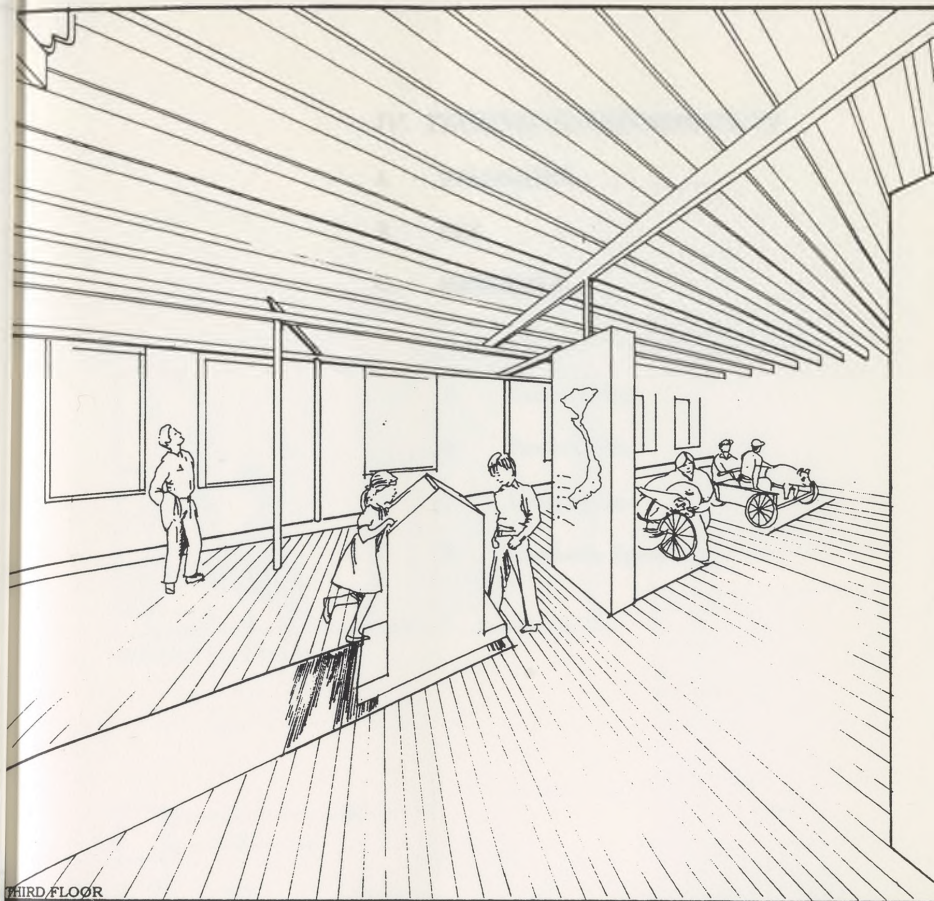
ISOMETRIC - FIRST AND SECOND FLOOR
1/8" scale



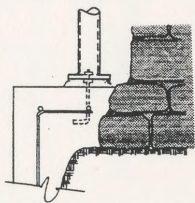
CHANGING GALLERY



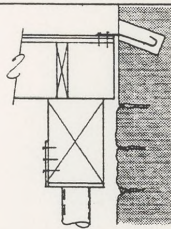




THIRD FLOOR

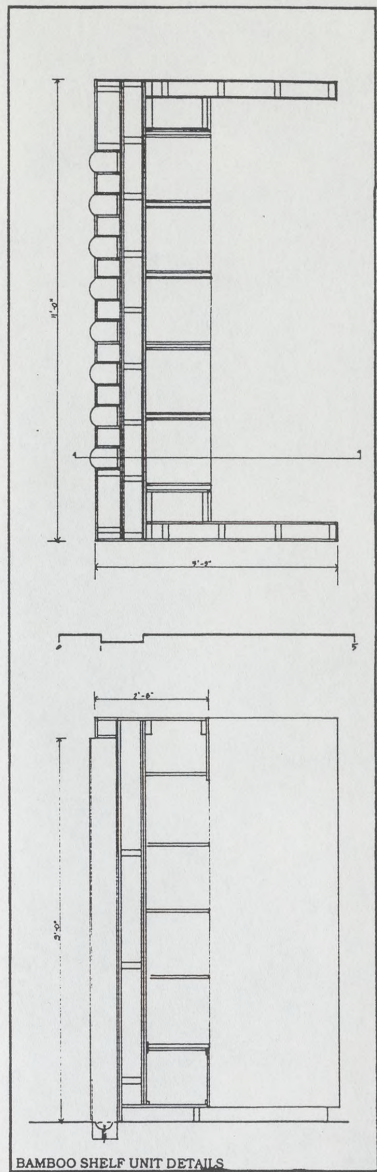
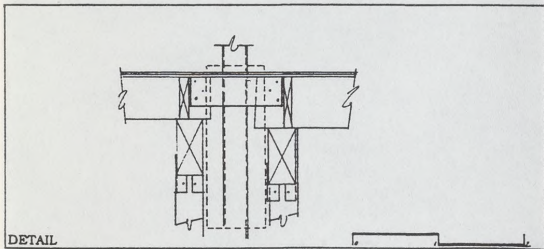


DETAIL



DETAIL



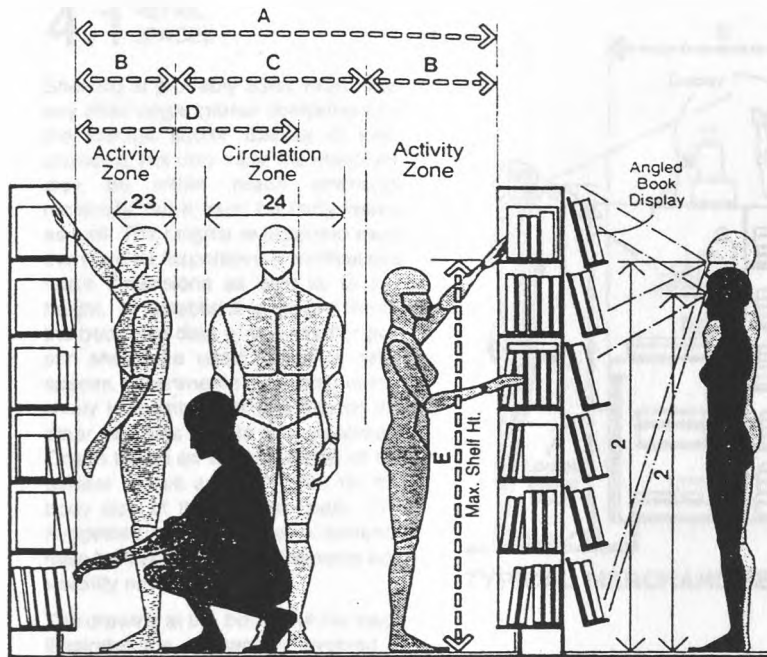


IV. TECHNICAL INFORMATION

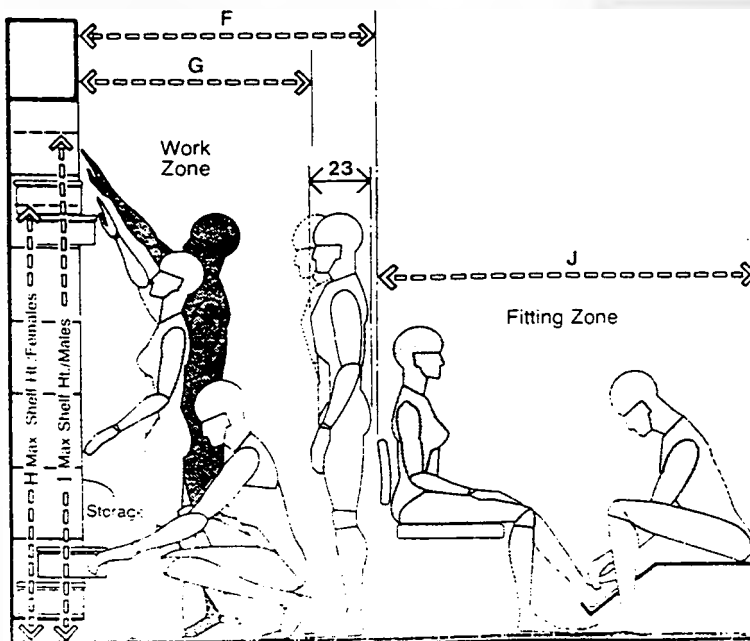
- A. STANDARDS
- B. ECS
- C. MATERIALS

A. *STANDARDS*

1. Retail / Display Spaces
2. Cooking Spaces
3. Reception Spaces
4. Conference Rooms
5. General Office
6. Private Office
7. Living Spaces
8. Circulation Spaces



BOOK STORE / DISPLAY AREA



SHOE STORE FITTING AREA

4.1 RETAIL SPACES

The drawing at the top of the page concerns book and magazine displays and suggests the anthropometric considerations involved. The rationale is essentially the same as that indicated for the general merchandise shelving on the preceding page. In regard to books, however, the question of visibility is even more critical. To perceive the basic form, shape, and color of general merchandise may be sufficient, but for books and magazines, the legibility of printed matter must be taken into account. The distance between the customer and the display, lighting, and angle of sight should all be considered. It is suggested that to supplement the information shown on the drawing, Sections 9.1 and 9.2 also be consulted.

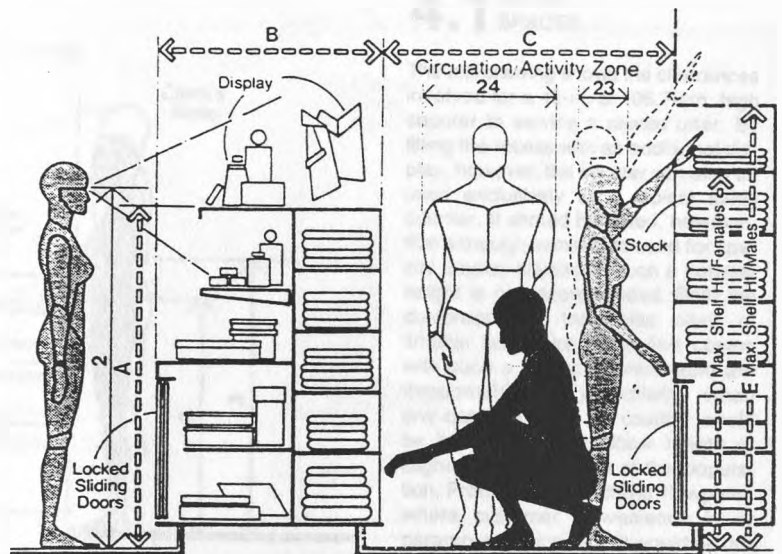
The drawing at the bottom of the page deals with human dimension and the fitting area of a shoe store. The fitting zone clearance should accommodate the body size of the seated customer and that of the sales clerk. The 60 to 66 in, or 152.4 to 167.6 cm, clearance should be viewed as a minimum. The buttock-heel length of the larger person was considered in anthropometrically establishing the clearance dimension. In regard to the workzone, vertical grip reach measurements of the smaller male and female should be used in establishing shelf heights, while maximum body breadth and maximum body depth of the larger person should be considered in establishing clearances.

	in	cm
A	66 min.	167.6 min.
B	18 min.	45.7 min.
C	30 min.	76.2 min.
D	36	91.4
E	68	172.7
F	48	121.9
G	36 min.	91.4 min.
H	66	167.6
I	72	182.9
J	60-66	152.4-167.6

4.1 RETAIL SPACES

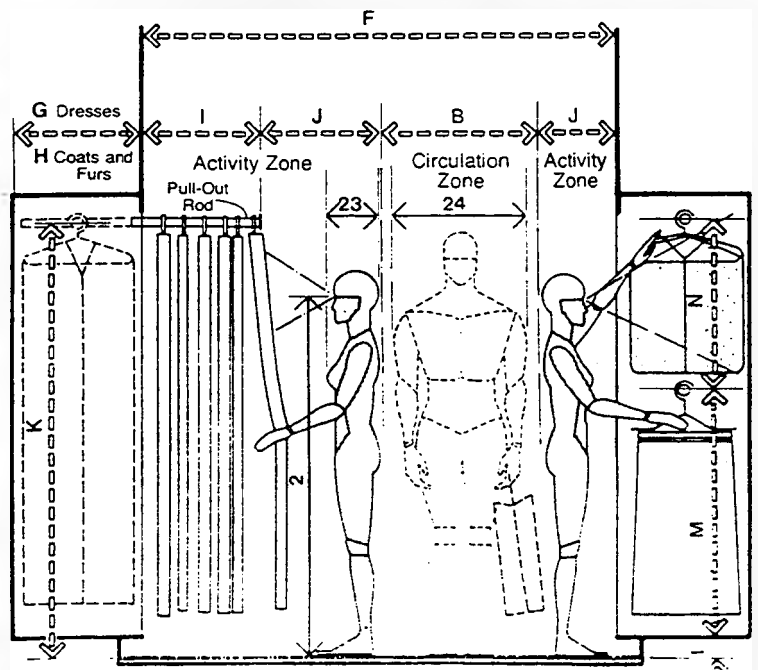
Shelving is probably used more than any other single interior component for the storage and/or display of merchandise. Not only must the merchandise be within reach anthropometrically, but it must be fairly visible as well. The heights established must therefore be responsive to vertical grip reach dimensions as well as to eye height. In establishing height limits, the body size data of the smaller person should be used. Since in retail spaces, departments may cater exclusively to members of one sex or the other, two sets of data are presented. One is based on the body size of the smaller female and the other on the body size of the smaller male. The suggested heights reflect a compromise between reach requirements and visibility requirements.

The drawing at the bottom of the page illustrates the clearances involved in hanging-type merchandise cases. Rod heights should be related not only to human reach limitations, but in certain cases to the sizes of the merchandise displayed. There is usually no conflict in respect to garments.

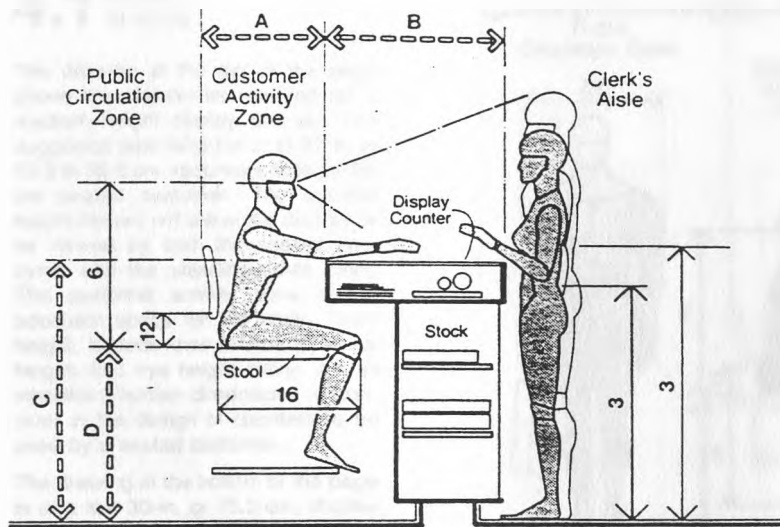


TYPICAL MERCHANDISE CASES

	in	cm
A	48 max.	121.9 max.
B	30-36	76.2-91.4
C	51 min.	129.5 min.
D	66	167.6
E	72	182.9
F	84-96	213.4-243.8
G	20-26	50.8-66.0
H	28-30	71.1-76.2
I	18-24	45.7-61.0
J	18 min.	45.7 min.
K	72 max.	182.9 max.
L	4	10.2
M	42	106.7
N	26 min.	66.0 min.



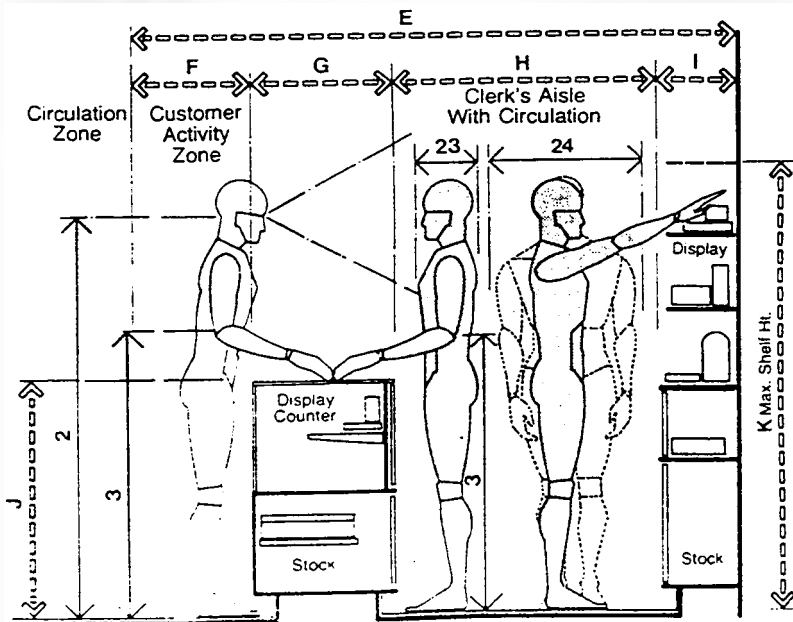
HANGING MERCHANDISE CASES



SEATED CUSTOMER / HIGH COUNTER HEIGHT

4.1 RETAIL SPACES

The top drawing shows the clearances involved for a 42-in. or 106.7-cm. high counter to service a seated user. By filling the recess with an additional display, however, the counter can also be used exclusively as a typical sales counter. It should be noted, however, that although sometimes used for special display situations, such a counter height is not recommended. Both the customer and the sales clerk of smaller body size would find coping with such a height uncomfortable anthropometrically, particularly when one considers that the counter would be higher than the elbow height of slightly over 5 percent of the population. From a merchandising viewpoint, where customer convenience is of paramount importance, it would be unwise to exceed 39 to 40 in. or 99 to 101.6 cm, as a counter height. In addition, the smaller sales clerk forced to tend such a counter for extended periods of time could be subjected to severe backaches and pains. Getting on and off a high stool for elderly and disabled people or those of smaller body size can be not only difficult, but hazardous. The bottom drawing illustrates the clearances for a typical sales counter.



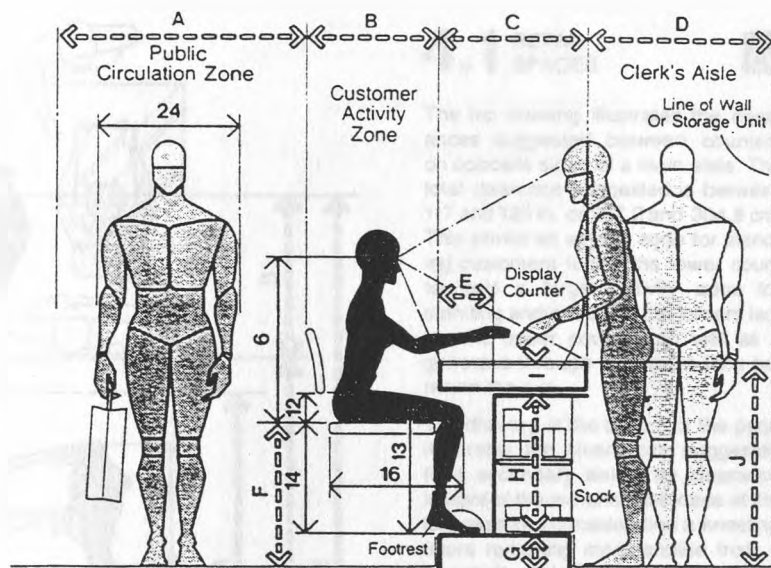
TYPICAL SALES AREA STANDING CUSTOMER

	in	cm
A	26-30	66.0-76.2
B	18-24	45.7-61.0
C	42	106.7
D	28	71.1
E	84-112	213.4-284.5
F	16	40.6
G	18-24	45.7-61.0
H	30-42	76.2-106.7
I	18-24	45.7-61.0
J	30-42	76.2-106.7
K	42	106.7

4.1 RETAIL SPACES

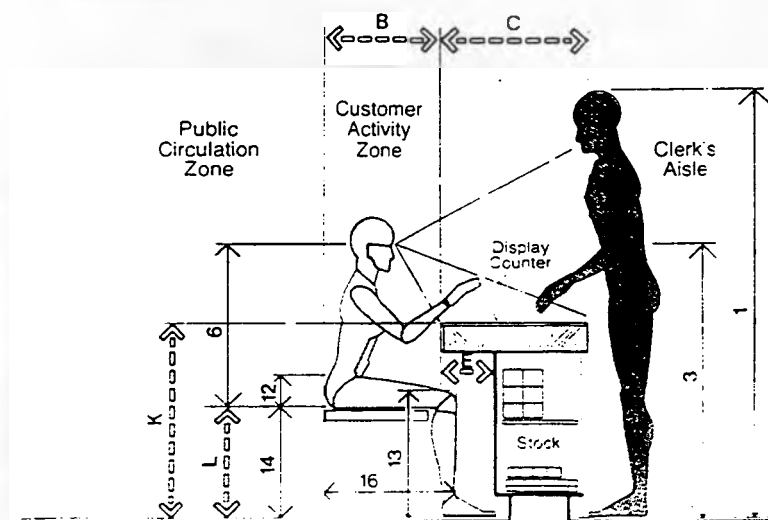
The drawing at the top of the page shows the clearances required for a medium height display counter. The suggested seat height of 21 to 22 in, or 53.3 to 55.8 cm, requires a footrest for the seated customer. The counter height shown will allow the display to be viewed by both the seated customer and the standing sales clerk. The customer activity zone allows adequate space for the chair. Knee height, buttock-knee length, popliteal height, and eye height sitting are all significant human dimensions to consider in the design of counters to be used by a seated customer.

The drawing at the bottom of the page is of a low 30-in, or 76.2-cm, display counter also for use by a seated customer. The anthropometric considerations are the same. Although the counter height is responsive to the anthropometric requirements of the seated customer, it is less than ideal for the standing clerk. For the standing user's optimum comfort, the counter height should be about 2 or 3 in, or 5 to 7.6 cm, below elbow height. This will allow a person to handle objects comfortably on the counter surface or use the counter as support for his or her arms. The 30-in height is too low to permit such use.

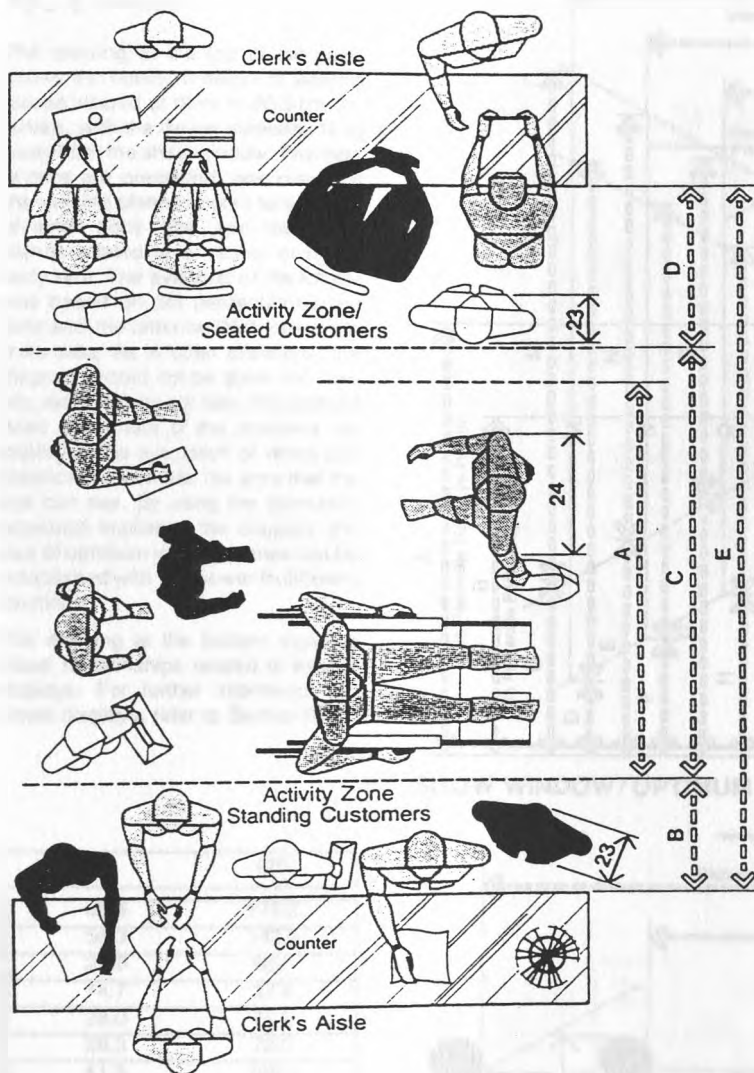


SEATED CUSTOMER / DESIRABLE COUNTER HEIGHT

	in	cm
A	36	91.4
B	26-30	66.0-76.2
C	18-24	45.7-61.0
D	30 min.	76.2 min.
E	10	25.4
F	21-22	53.3-55.9
G	5	12.7
H	23-25	58.4-63.5
I	4-6	10.2-15.2
J	34-36	86.4-91.4
K		76.2
L	16	40.6-43.2



SEATED CUSTOMER / LOW COUNTER HEIGHT



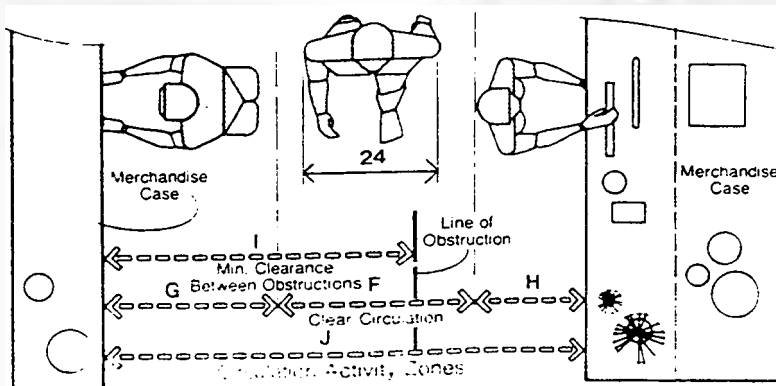
4.1 RETAIL SPACES



The top drawing illustrates the clearances suggested between counters on opposite sides of a main aisle. The total clearance suggested is between 117 and 120 in, or 297.2 and 304.8 cm. This allows an activity zone for standing customers facing the lower counter and a larger activity zone for standing and/or seated customers facing the upper counter, as well as a generous through circulation lane between the two.

The drawing at the bottom of the page illustrates the clearances suggested for a secondary aisle. The clearance in front of the merchandise case at the left takes into consideration a kneeling figure removing merchandise from a low shelf, while the clearance in front of the case on the right is only a minimum of 18 in, or 45.7 cm, which accommodates a person standing parallel to the case, either looking or handling merchandise displayed on the top surface. Although the maximum clearance between cases could be as much as 90 in, or 228.6 cm, a restricted minimum clearance of 51 in, or 129.5 cm, could be used if one is willing to accept some body contact or sidestepping required by a third person to pass between people engaged in activities on either side.

MAIN PUBLIC AISLE WIDTHS



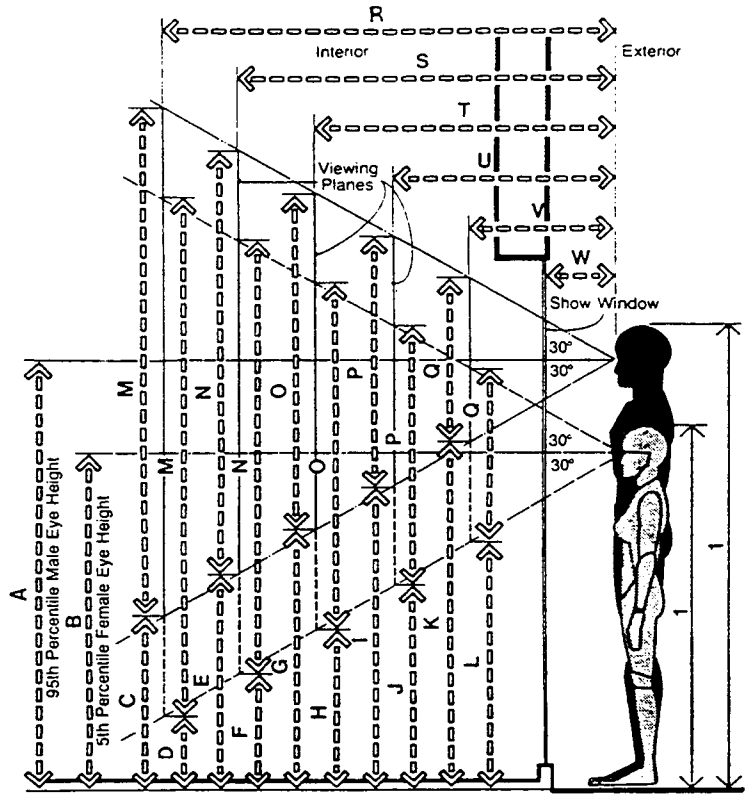
SECONDARY PUBLIC AISLE WIDTHS

	in	cm
A	66 min.	167.6 min.
B	18	45.7
C	72	182.9
D	25-30	66.0-76.2
E	115-120	294.5-304.8
F	30-36	76.2-91.4
G	18-36	45.7-91.4
H	18 min.	45.7 min.
I	51 min.	129.5 min.
J	51-90	129.5-228.6

4.1 RETAIL SPACES

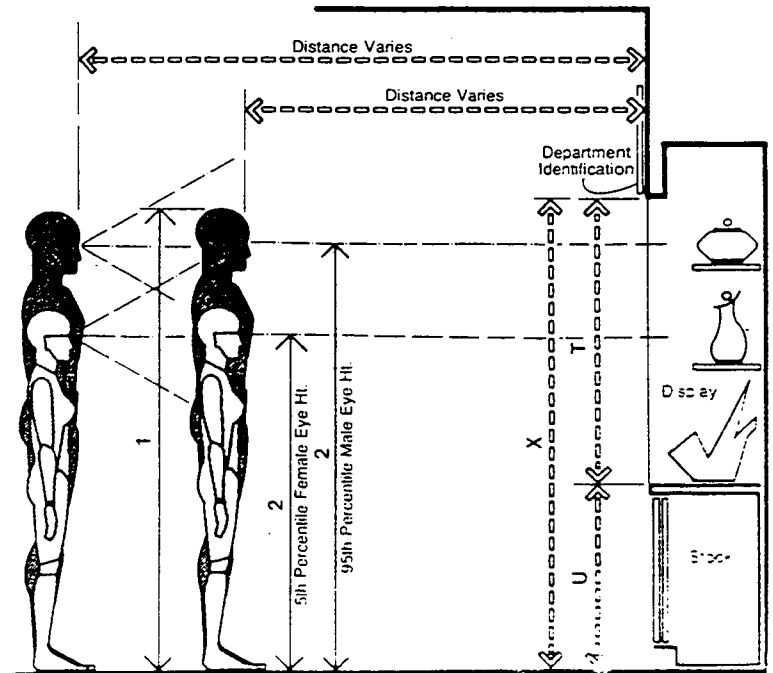
The drawing at the top of the page shows the optimum height of viewing planes located at 12-in. or 30.5-cm, intervals, with the viewer stationed 12 in away from the show window. Two sets of data are presented: one concerns the viewing planes related to a viewer of small body size, and the other, planes related to a viewer of larger body size. The eye level of the former was based on 5th percentile female data and the latter on 95th percentile male data. As in other situations, the diagram should not be taken too literally, since it does not take into account head movement or the scanning capability of the eye, each of which can significantly increase the area that the eye can see. By using the geometric approach implied in the diagram, the size of optimum viewing planes can be established with the viewer in different locations.

The drawing at the bottom explores visual relationships related to interior displays. For further information on visual displays, refer to Section 9.



SHOW WINDOW / OPTIMUM VIEWING PLANES

	in	cm
A	68.6	174.2
B	56.3	143.0
C	27.0	68.7
D	14.7	37.4
E	28.0	71.2
F	28.3	72.0
G	41.5	105.4
H	28.6	72.6
I	47.8	121.5
J	36.3	92.2
K	54.8	139.1
L	42.5	107.8
M	83.1	211.1
N	69.3	175.9
O	55.4	140.8
P	41.6	105.6
Q	27.7	70.4
R	72	182.9
S	60	152.4
T	48	121.9
U	36	91.4
V	24	61.0
W	12	30.5
X	94	239.4

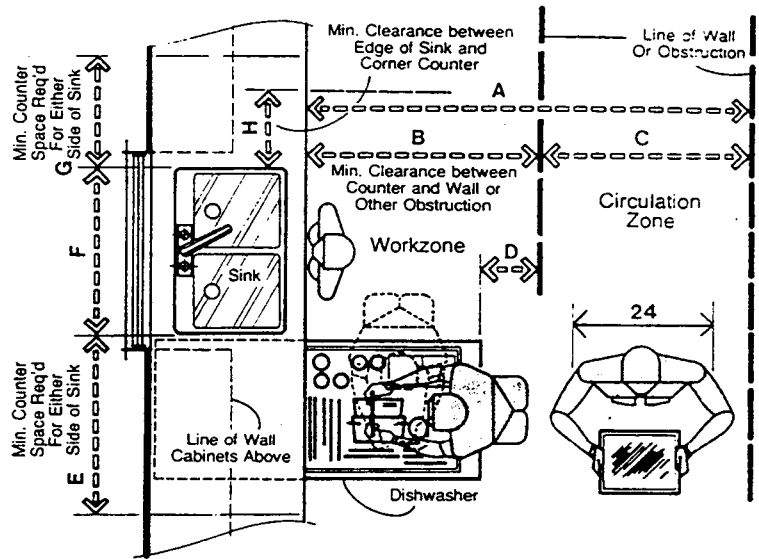


DISPLAY, VISUAL RELATIONSHIPS

2.4 COOKING SPACES

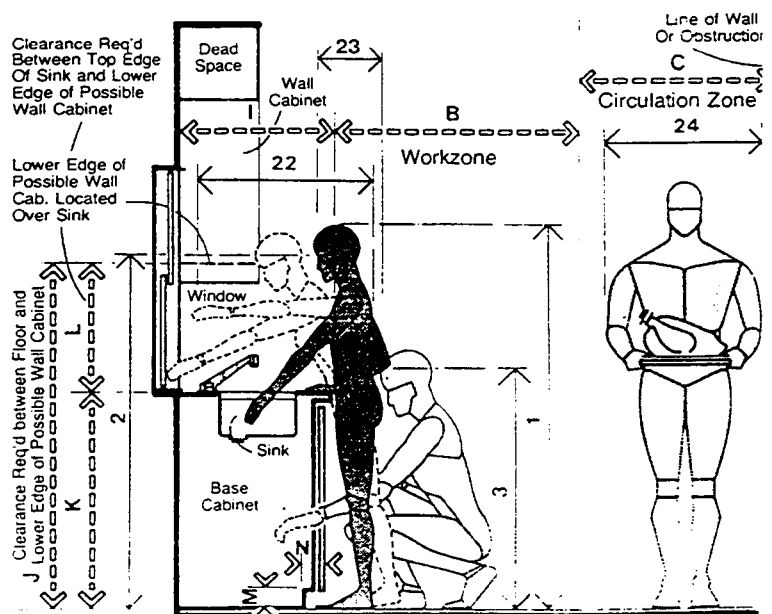
The drawing at the top of the page shows the horizontal clearances involved in the vicinity of the dish washing area. While loading or unloading the dishwasher, a clearance of at least 40 in, or 101.6 cm, is recommended to accommodate the human body and the extended dish rack and appliance door. To allow circulation as well, at least another 30 in, or 76.2 cm, should be added.

The drawing at the bottom of the page shows a sectional view through the same area. The recommended counter height is between 35 and 36 in, or 88.9 to 91.4 cm. If no window is provided over the kitchen sink and wall cabinets are to be provided instead, the height between the top of the counter and the bottom of those cabinets should not be less than 22 in, or 55.9 cm.

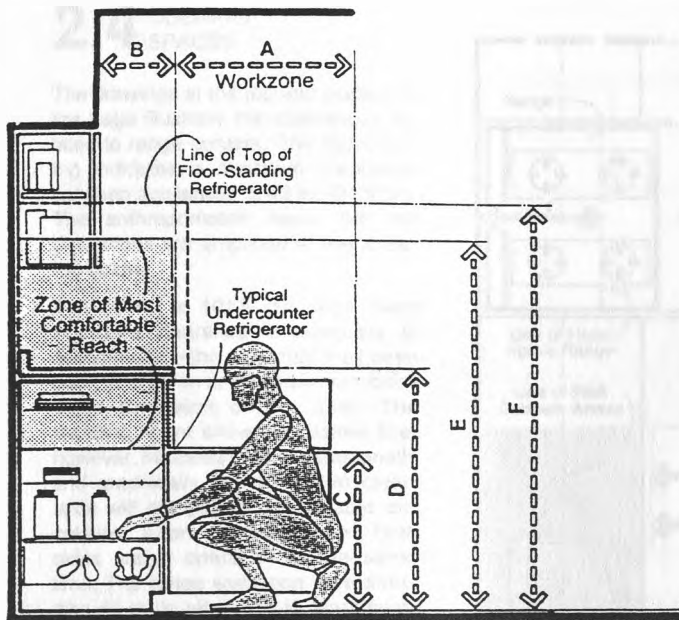


SINK CENTER

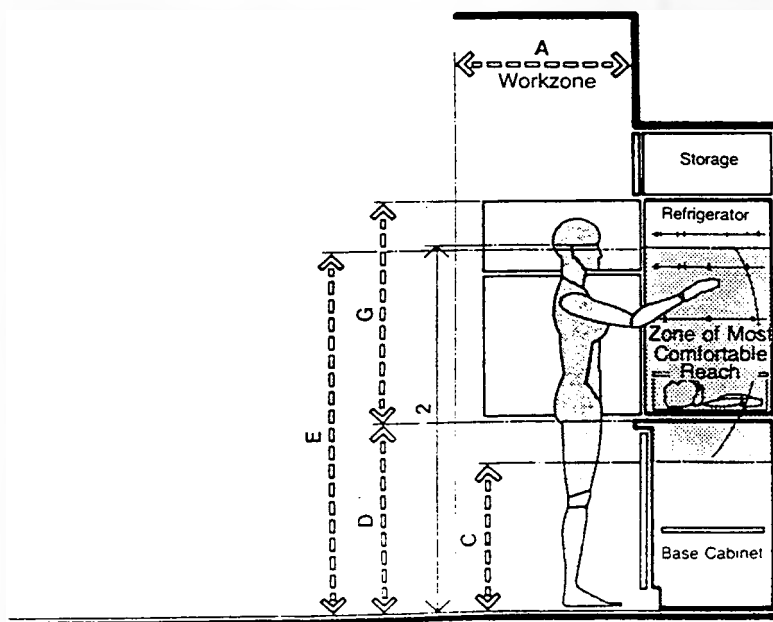
	in	cm
A	70-76	177.8-193.0
B	40 min.	101.6 min.
C	30-36	76.2-91.4
D	18	45.7
E	24 min.	61.0 min.
F	28-42	71.1-106.7
G	18 min.	45.7 min.
H	12 min.	30.5 min.
I	24-26	61.0-66.0
J	57 min.	144.8 min.
K	35-36	88.9-91.4
L	22 min.	55.9 min.
M	3	7.6
N	4	10.2



SINK CENTER



REFRIGERATOR CENTER/
TYPICAL REFRIGERATOR LOCATIONS



REFRIGERATOR CENTER/
PROPOSED REFRIGERATOR LOCATION

2.4 COOKING SPACES

The two drawings on this page deal primarily with the vertical dimensions related to the refrigerator installation within the kitchen.

The top drawing illustrates a typical floor-standing refrigerator installation as well as a below-counter installation. Superimposed on the sectional view in shaded film is the zone of most comfortable reach. To reach elements located above or below this area requires some additional effort. Below the area, for example, it may be necessary to kneel or stoop. Although, in both the floor-standing and the under-counter situations everything is within physical reach, elements located within the shaded area can be reached almost effortlessly.

The bottom drawing suggests the possibility of a third type of refrigerator that might be wall mounted or located on the top of the counter, so that most of its surface would fall within this shaded area. To allow for proper viewing of the interior, the height of the proposed unit exceeds the upper limits of the shaded zone. Despite its slightly greater height, the unit is just about in line with the height above the floor of the larger-size conventional floor-standing model.

	in	cm
A	36	91.4
B	11-14	27.9-35.6
C	25.5	64.8
D	35-36	88.9-91.4
E	59	149.8
F	55-69.5	139.7-176.8
G	30-36	76.2-91.4

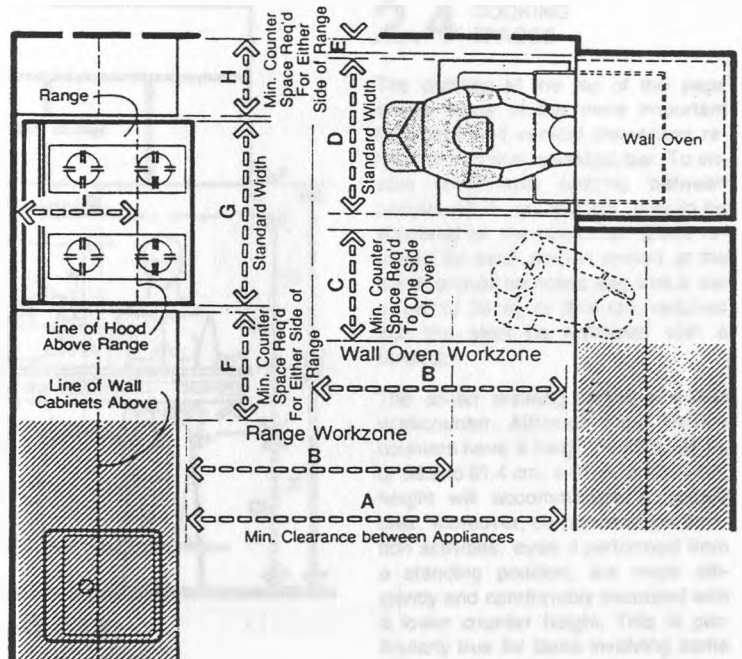
2.4 COOKING SPACES

The drawings at the top and bottom of the page illustrate the clearances related to range centers. The top drawing indicates a minimum clearance between appliances of 48 in, 121.9 cm. The anthropometric basis for the clearances are amplified in the drawing below.

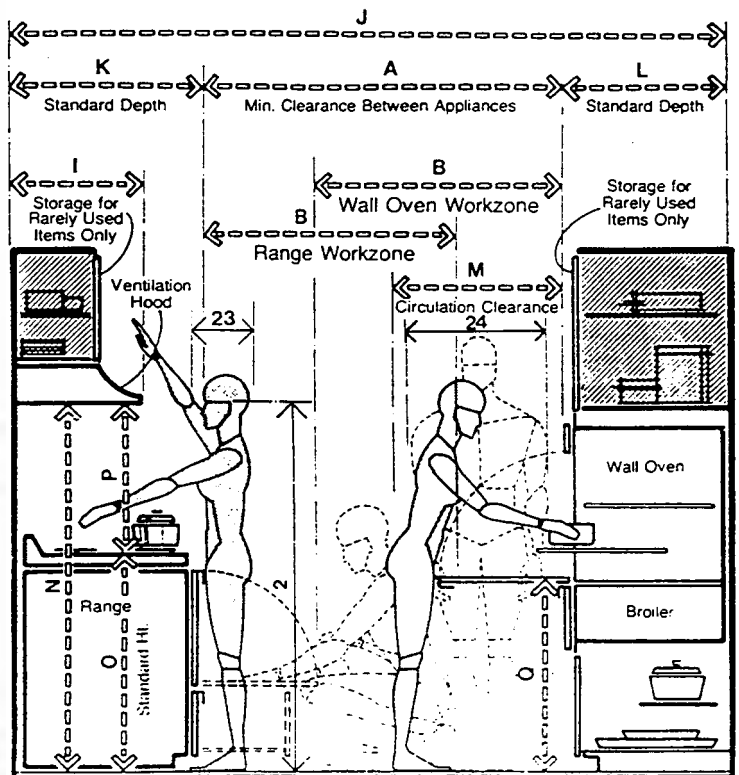
The 40-in, or 101.6 cm, wall oven workzone clearance is adequate to accommodate the projected wall oven door, in addition to the maximum body depth dimension of the user. The standing figure shown in broken line, however, indicates both dimensionally and graphically that the 40-in clearance will not permit comfortable circulation when appliances on both sides are in operation at the same time. The range workzone clearance, also 40-in, is adequate to accommodate the open range door and the body size of the kneeling user.

An extremely important, but frequently overlooked, anthropometric consideration in kitchen design is eye height. In this regard, the distance from the top of the range to the underside of the hood should allow the rear burners to be visible to the user.

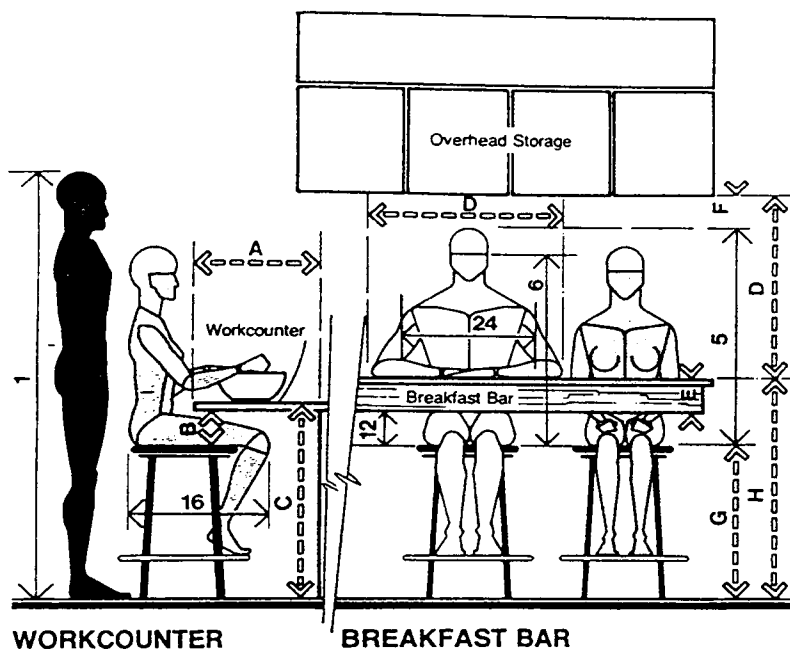
	in	cm
A	48 min.	121.9 min.
B	40	101.6
C	15	38.1 min.
D	21-30	53.3-76.2
E	1-3	2.5-7.6
F	15 min.	38.1 min.
G	19.5-46	49.5-116.8
H	12 min.	30.5 min.
I	17.5 max.	44.5 max
J	96-101.5	243.8-257.8
K	24-27.5	61.0-69.9
L	24-26	61.0-66.0
M	30	76.2
N	60 min.	152.4 min.
O	35-36.25	88.9-92.1
P	24 min.	61.0 min.
Q	35 max.	88.9 max.



RANGE CENTER



RANGE CENTER

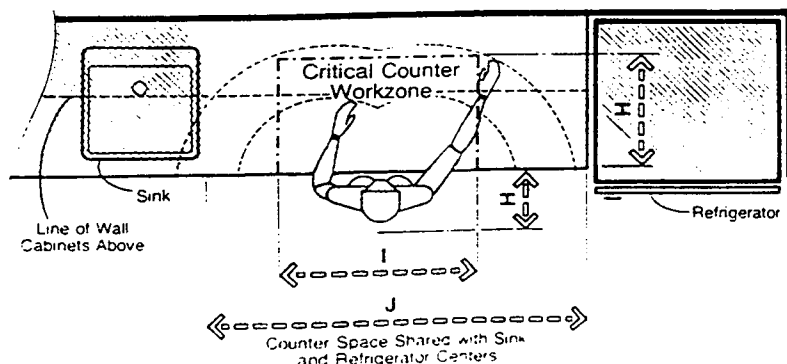


2.4 COOKING SPACES

The drawing at the top of the page shows some of the more important horizontal and vertical clearances related to a typical breakfast bar. To ensure comfortable spacing between people, 30 in., or 76.2 cm, should be allocated for the horizontal space required for each person seated at the bar. It should be noted also that a bar height of 36 in., or 91.4 cm, requires that the stool be equipped with a footrest.

The center drawing shows a typical workcounter. Although most kitchen counters have a height of 35 to 36 in., or 88.9 to 91.4 cm, a 32-in., or 81.3-cm, height will accommodate a seated user. Moreover, certain food preparation activities, even if performed from a standing position, are more efficiently and comfortably executed with a lower counter height. This is particularly true for tasks involving some degree of force from the arms and upper back muscles; the rolling of dough would be a good example.

The drawing at the bottom of the page shows the critical counter workzone of a standing user. The outer perimeter is defined by the horizontal thumb tip reach of the user having the smaller body size. The 18-in., or 45.7-cm, dimension indicated was adapted from 5th percentile female data. The critical counter workzone of 18 by 30 in., or 45.7 by 76.2 cm, constitutes the immediate work area directly in front of the user, all of which is comfortably accessible, with little or no side arm reach required. The counter surface beyond this area, which is accessible with some effort, is limited only by the reach capability of the human body, which varies with the size of the individual.

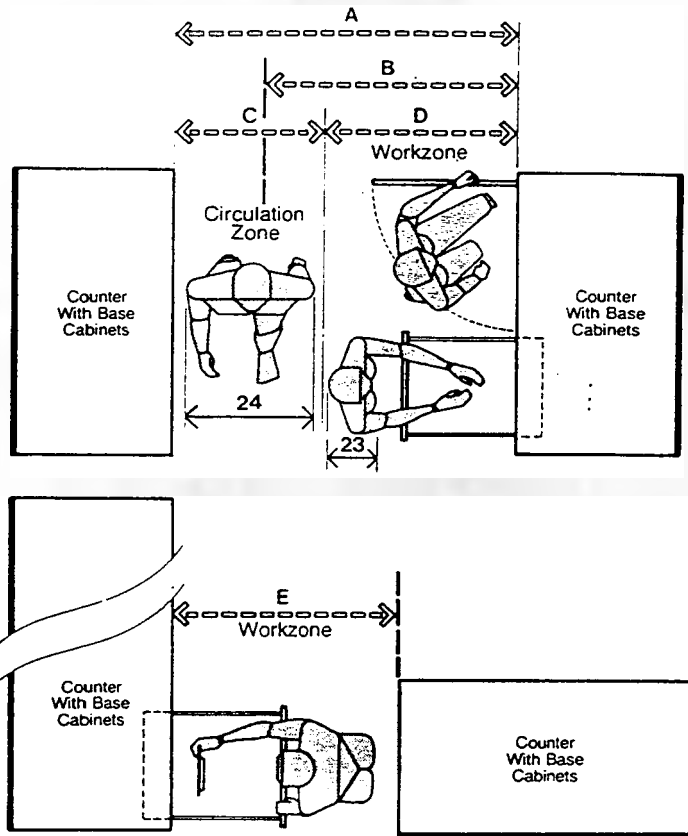


	in	cm
A	18 min.	45.7 min.
B	7.5 min.	19.1 min.
C	32	81.3
D	30	76.2
E	4 max	10.2 max
F	4	10.2
G	22-24.5	55.9-62.2
H	18	45.7
I	36	91.4
J	42	106.7

2.4 COOKING SPACES

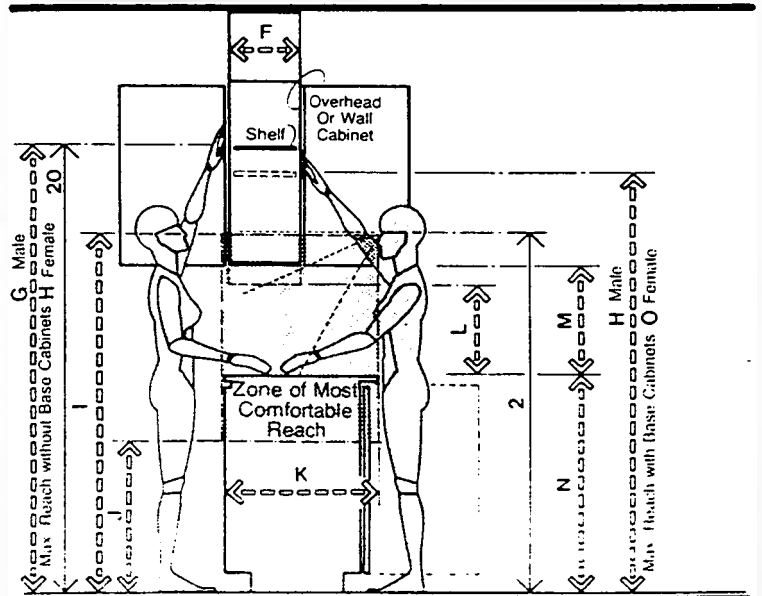
The drawings at the top and center of the page illustrate some of the basic horizontal clearances required in a kitchen. The drawing at the top shows clearances between two counters with base cabinets. A total clearance between cabinets of 60 to 66 in, or 152.4 to 167 cm, will accommodate the human body and an extended drawer or hinged cabinet door in the workzone and in the circulation zone the maximum body breadth of a person of larger body size. The B dimension of 48 in, or 121.9 cm, is a recommended minimum clearance between cabinets when the full circulation zone shown is not desired. The center drawing also shows a recommended clearance of 48 in between the face of a cabinet and the nearest physical obstruction.

The drawing at the bottom of the page deals with vertical clearances. The height of the shelf, shown in broken lines, within the overhead cabinets is within reach, allowing for the projection of the base cabinet. The height of the shelf, shown as a solid black line, is slightly greater, but also within reach, since the base cabinet does not interfere. The height of the shelves has been based on 5th percentile female vertical grip reach data to place them within reach of the user with the smaller body size.



COUNTER AND BASE CABINETS/
GENERAL CLEARANCE

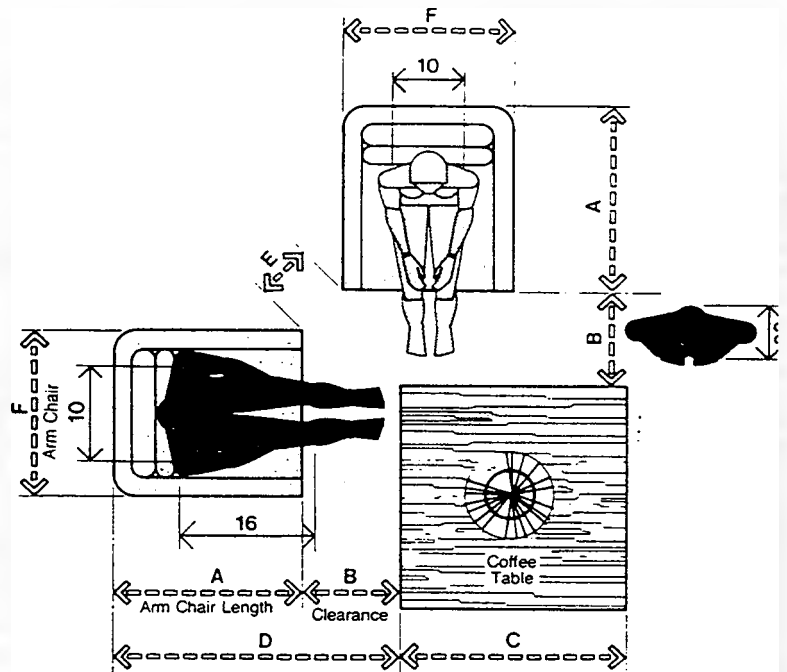
	in	cm
A	60-66	152.4-167.6
B	48 min.	121.9 min.
C	24-30	61.0-76.2
D	36	91.4
E	48	121.9
F	12-13	30.5-33.0
G	76 max.	193.0 max.
H	72 max.	182.9 max.
I	59	149.9
J	25.5	64.8
K	24-26	61.0-66.0
L	15 min.	38.1 min.
M	18	45.7
N	35-36	88.9-91.4
O	69 max.	175.3 max.



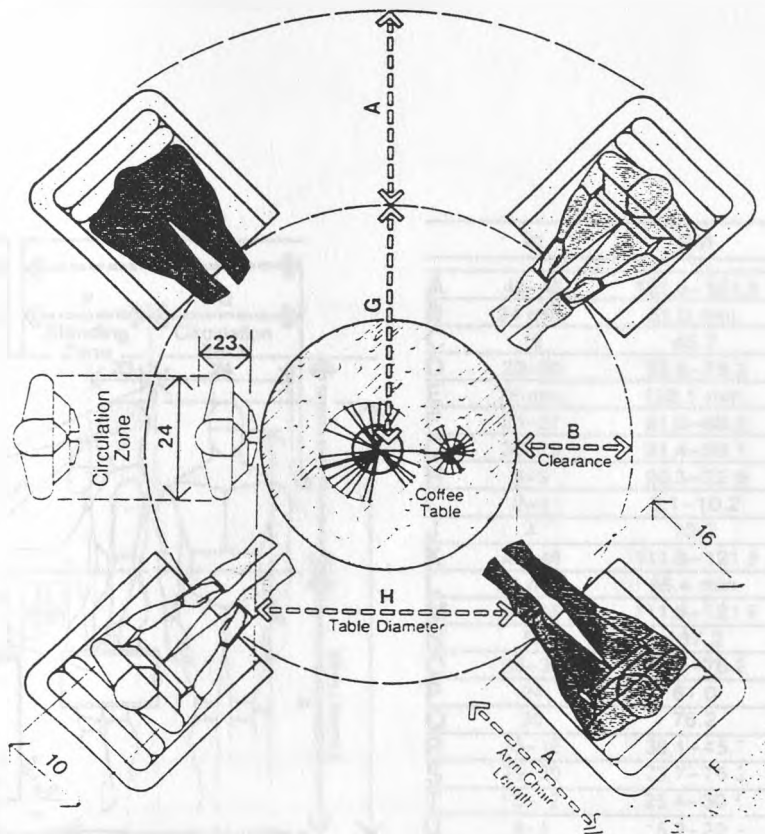
CABINET REACH COMPARISONS

3.3 RECEPTION SPACES

Typical reception room visitor seating arrangements are shown on this page, with emphasis on the individual seating unit instead of sofa-type seating. While the width of the individual seating unit varies, certain key anthropometric dimensions influence the placement of the unit as well as the overall dimensions. The primary anthropometric dimension determining seat width is that of hip breadth. Seat depth is determined by the buttock-popliteal length measurement. For a more detailed discussion of seating design criteria, Section 4 in Part A and Section 1 in Part C should be consulted. Location of the armchair in relation to a coffee table must take into account two conflicting requirements: clearance for circulation between chair and table and placement of the table to accommodate the reach limitations of the smaller person. There is no perfect solution. A distance between 15 and 18 in, or 38.1 and 45.7 cm, however, allows for the leg projection of the seated person and also accommodates the maximum body depth of the larger person so that he may sidestep, if necessary, to pass. Some body contact and/or adjustment of body position or posture of both seated and standing person may be required.

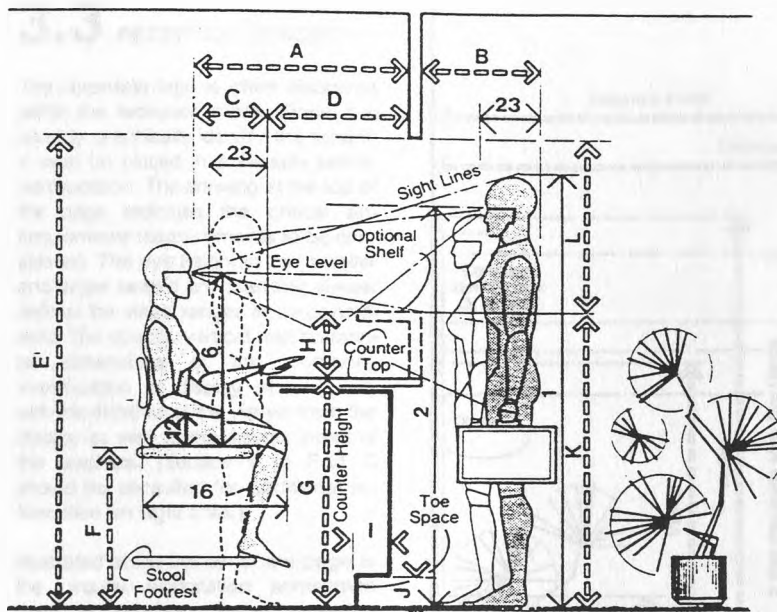


RECEPTION ROOM SEATING



RECEPTION SEATING CIRCULAR CONFIGURATION

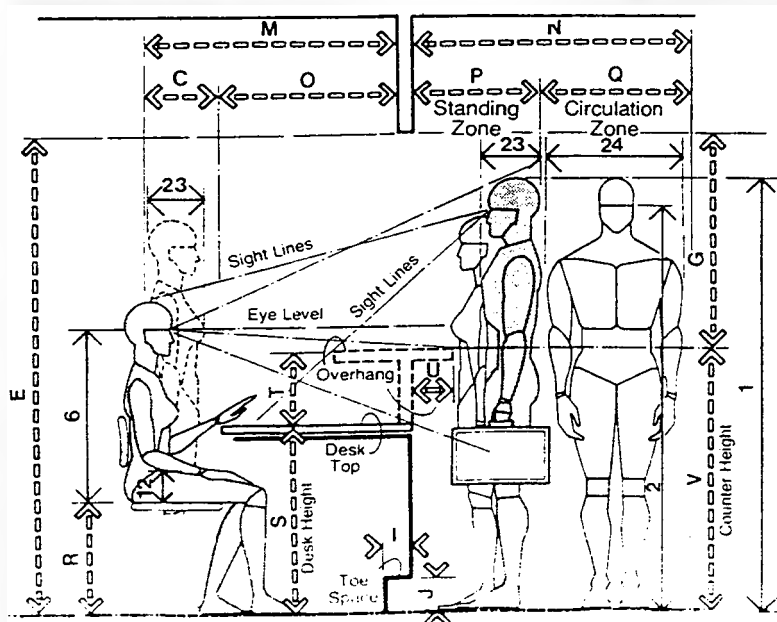
	in	cm
A	28-32	71.1-81.3
B	15-18	38.1-45.7
C	30-48	76.2-121.9
D	43-50	109.2-127.0
E	9-12	22.9-30.5
F	28-36	71.1-91.4
G	33-42	83.8-106.7
H	36-48	91.4-121.9



RECEPTIONIST'S WORKSTATION / COUNTER HEIGHT

3.3 RECEPTION SPACES

For the purpose of privacy or security, the receptionist's workstation is often an area physically separated by built-in furniture and/or partitions. The drawing at the top of the page shows a counter height receptionist's workstation. While the relationship of worksurface to seat height is key, other anthropometric considerations are eye height and sitting height normal. The minimum height of the opening above the floor has been established at 78 in, or 198.1 cm. Sitting height and eye height are significant in providing unobstructed vision. The drawing at the bottom depicts a desk height receptionist's workstation. The depth of the worksurface ranges from 26 to 30 in, or 66 to 76.2 cm, allowing for thumb tip reach required for the exchange of papers and packages. Both drawings show in broken line an added counter top element often provided for security or as a visual screen of the worksurface top.



RECEPTIONIST'S WORKSTATION / DESK HEIGHT

	in	cm
A	40-48	101.6-121.9
B	24 min.	61.0 min.
C	18	45.7
D	22-30	55.9-76.2
E	78 min.	198.1 min.
F	24-27	61.0-68.6
G	36-39	91.4-99.1
H	8-9	20.3-22.9
I	2-4	5.1-10.2
J	4	10.2
K	44-48	111.8-121.9
L	34 min.	86.4 min.
M	44-48	111.8-121.9
N	54	137.2
O	26-30	66.0-76.2
P	24	61.0
Q	30	76.2
R	15-18	38.1-45.7
S	29-30	73.7-76.2
T	10-12	25.4-30.5
U	8-9	20.3-22.9
V	39-42	99.1-106.7

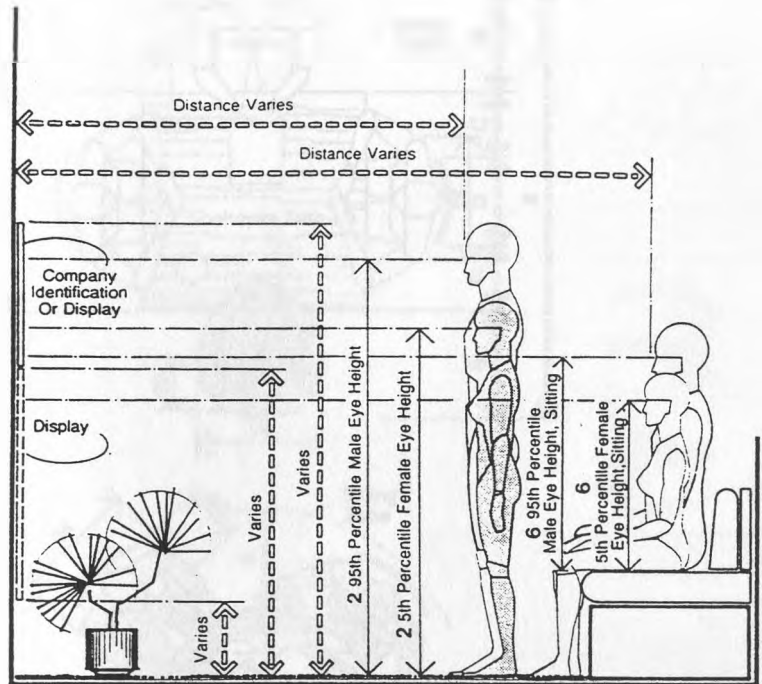
3.3 RECEPTION SPACES

The corporate logo is often displayed within the reception room. Since it is used to graphically identify the tenant, it must be placed in a visually prominent location. The drawing at the top of the page indicates the critical anthropometric measurements to be considered. The eye height of the smaller and larger seated and standing viewer defines the visual ranges to be considered. The specific vertical and horizontal dimensions of the company identification or display should vary with the distance of the viewer from the display as well as the design intent of the graphics. (Section 9 in Part C should be consulted for additional information on sight lines.)

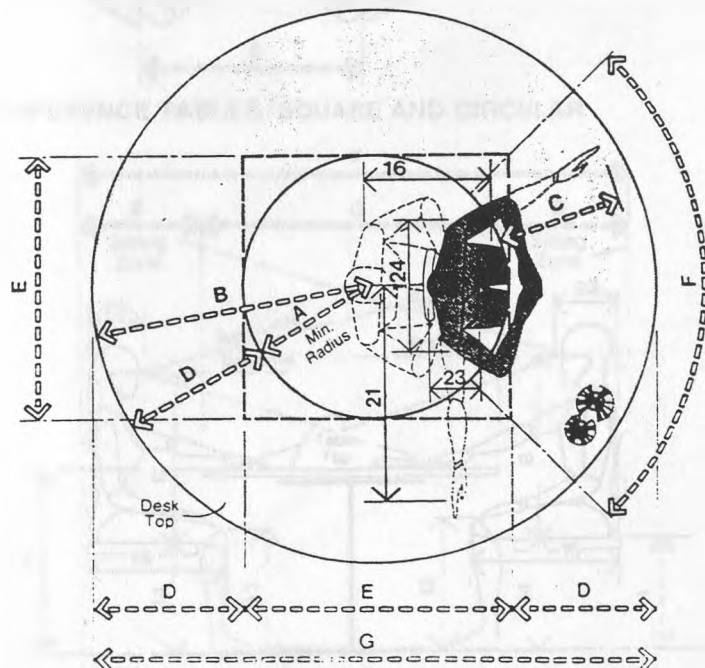
Illustrated at the bottom of the page is the circular workstation sometimes used in relatively large reception spaces. Two major factors that influence the ultimate size of this element are the minimum radius to accommodate the receptionist within the inner circular area and the circumference of the outer perimeter available to accommodate visitors.

The key anthropometric body dimensions required to accommodate the receptionist are that of buttock-knee length and body depth, permitting the movement and clearance of the chair. The minimum recommended diameter is shown as 44 in. or 111.8 cm. The depth of the worksurface, anthropometrically, should accommodate the side arm reach and thumb tip reach dimensions of the smaller person. A dimension in the range of 24 to 30 in., or 61 to 76.2 cm, is recommended.

	in	cm
A	22	55.9
B	46-52	116.8-132.1
C	18-22	45.7-55.9
D	24-30	61.0-76.2
E	44	111.8
F	76	193.0
G	92-104	233.7-264.2



DISPLAY / VISUAL RELATIONSHIPS

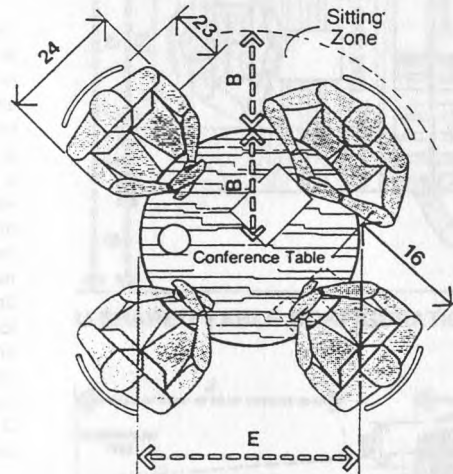
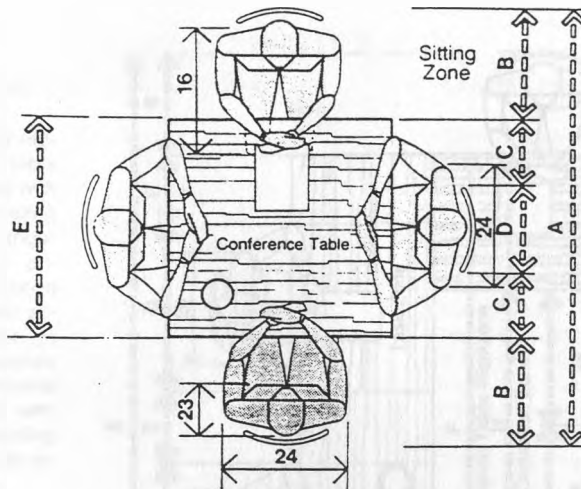


CIRCULAR RECEPTIONIST'S WORKSTATION

3.4 CONFERENCE ROOMS

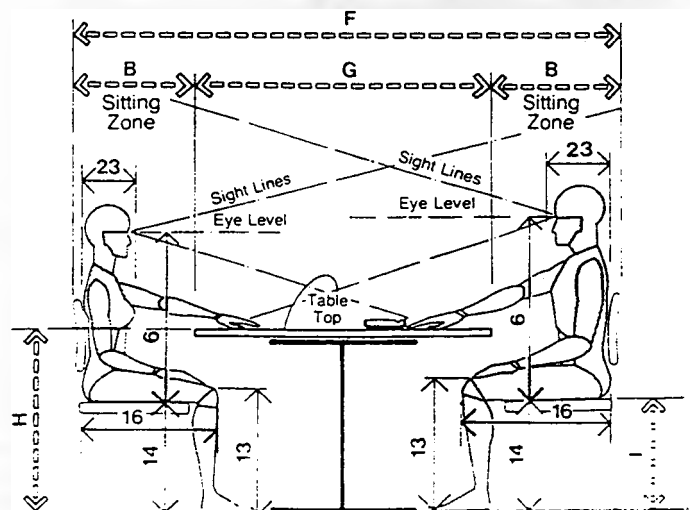
The two drawings at the top of the page illustrate a square and a circular conference arrangement for four people. Such a minimal-size table might be found within a small room or, more commonly, interspersed within the framework of a larger space or open office plan. A recommended distance of 18 to 24 in, or 45.7 to 61 cm, is shown for the distance required from the edge of the table to the back of the chair, with the chair in a normal position. Anthropometric considerations determining this dimension are buttock-knee length and maximum body depth measurements of people of larger body size.

The drawing at the bottom of the page shows the typical relationship of two people sitting across from each other at a conference table. The distance across the table becomes an important factor if papers are to be exchanged. A width of 36 to 54 in, or 91.4 to 137.2 cm, is recommended. Table height should also be analyzed for its relationship to popliteal height, knee height, and thigh clearance. A range of 29 to 30 in, or 73.7 to 76.2 cm, is preferred, with the smaller dimension favored where writing tasks are emphasized.



CONFERENCE TABLES / SQUARE AND CIRCULAR

	in	cm
A	72-96	182.9-243.8
B	18-24	45.7-61.0
C	8-12	20.3-30.5
D	20-24	50.8-61.0
E	36-48	91.4-121.9
F	72-102	182.9-259.1
G	36-54	91.4-137.2
H	29-30	73.7-76.2
I	16-17	40.6-43.2



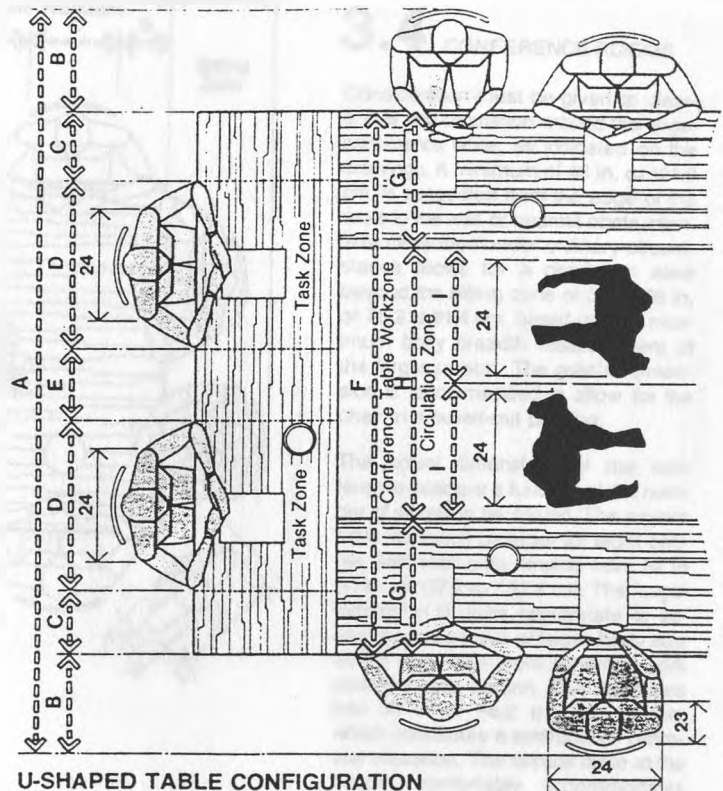
CONFERENCE TABLES / GENERAL
MALE AND FEMALE CONSIDERATIONS

3.4 CONFERENCE ROOMS

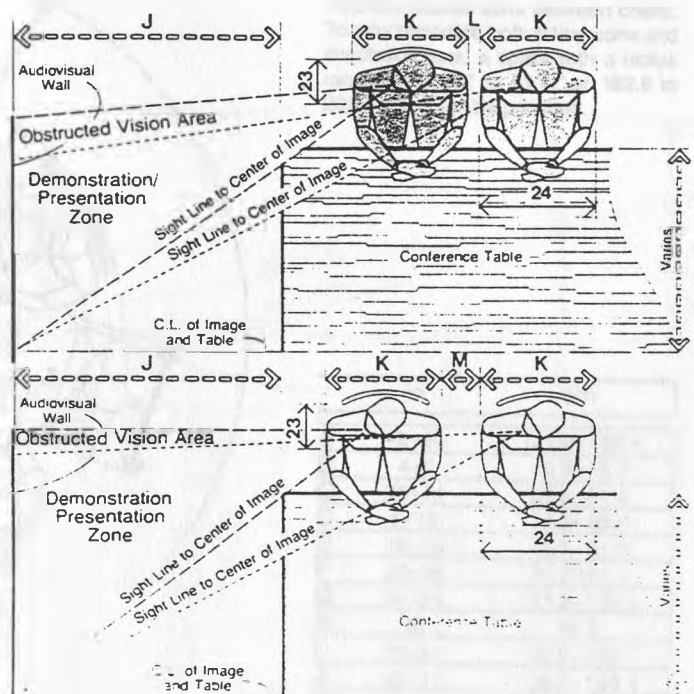
The drawing at the top of the page represents a U-shaped conference table that might ordinarily be associated with a large-scale corporate board meeting or a public hearing. Such an arrangement, in addition to the basic anthropometric considerations mentioned on the previous pages, must also accommodate access and circulation. In the situation shown, the conference table work zone includes an internal circulation zone for two people, with maximum body breadth the controlling factor in establishing the 54- to 60-in., or 137.2- to 152.4-cm, clearance.

The spacing of chairs is not only important in terms of defining appropriate work zones at the table, but essential in providing optimal sight lines where the room must also incorporate an audiovisual wall. As indicated in the two plans at the bottom of the page, a minimal clearance between chairs creates an unnecessarily large obstructed vision area, compared with the limited obstructed vision area when the chair spacing is increased. Sight lines and angles of vision are also a function of the distance of the table edge to the audiovisual wall. A minimum of 72 in., or 182.8 cm, is recommended. (Section 9, Audiovisual Spaces, in Part C should be consulted for more specific information.)

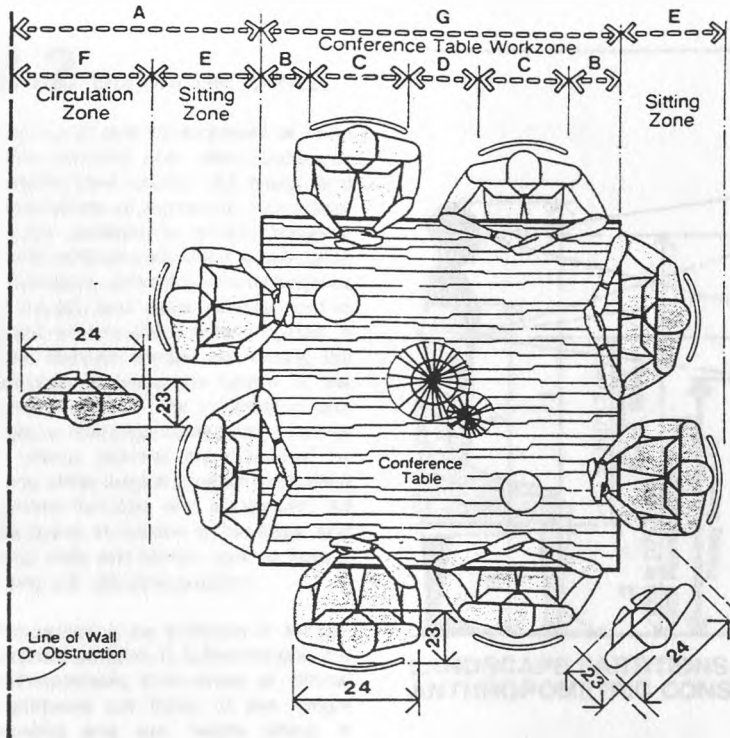
	in	cm
A	138-180	350.5-457.2
B	18-24	45.7-61.0
C	12-21	30.5-53.3
D	32-36	81.3-91.4
E	14-18	35.6-45.7
F	108-132	274.3-335.3
G	24-36	61.0-91.4
H	60	152.4
I	30	76.2
J	72	182.9
K	24-28	61.0-71.1
L	3-5	7.6-12.7
M	12-14	30.5-40.6



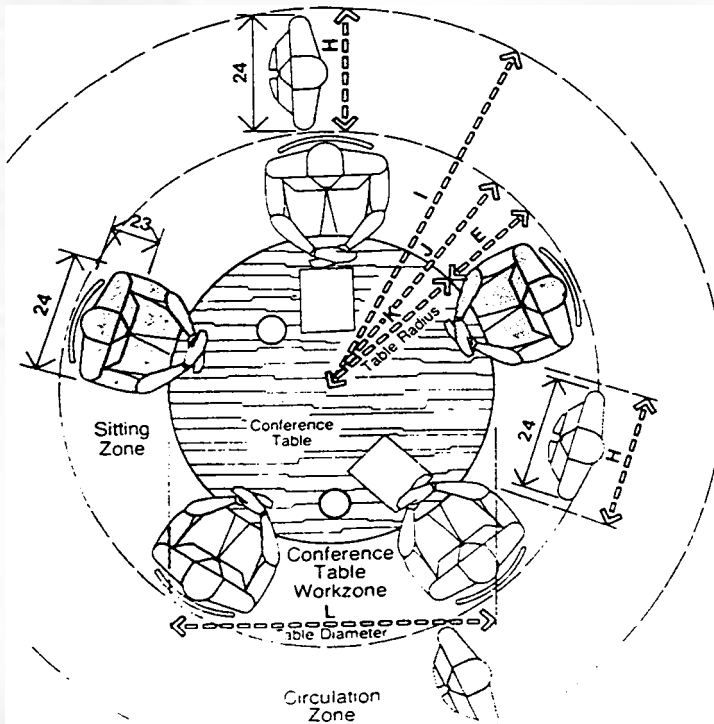
U-SHAPED TABLE CONFIGURATION



AUDIOVISUAL CONFERENCE TABLE CONFIGURATION AND VISION LINES



SQUARE CONFERENCE TABLE



CIRCULAR CONFERENCE TABLE

3.4 CONFERENCE ROOMS

Consideration must be given to clearances and circulation around the larger conference table, as indicated on the drawings. A minimum of 48 in, or 121.9 cm, is suggested from the edge of the table to the wall or nearest obstruction. This dimension under ordinary circumstance allows for a circulation zone beyond the sitting zone of 30 to 36 in, or 76.2 to 91.4 cm, based upon a maximum body breadth measurement of the larger person. The greater dimension is recommended to allow for the chair in a pulled-out position.

The actual dimensions of the conference table are a function of the number of people to be seated. The square table illustrated provides for eight people, with each side ranging from 54 to 60 in, or 137.2 to 152.4 cm. The larger dimension is more appropriate to accommodate people of larger body size and to allow for a more generous work zone for each person. This translates into 30 in, or 76.2 cm, per person, which constitutes a comfortable perimeter allocation. The circular table at the bottom comfortably accommodates five people while allowing for a 30-in, or 76.2-cm, access zone between chairs. To accommodate both sitting zone and circulation zone, a space with a radius ranging from 72 to 81 in, or 182.9 to 205.7 cm, must be provided.

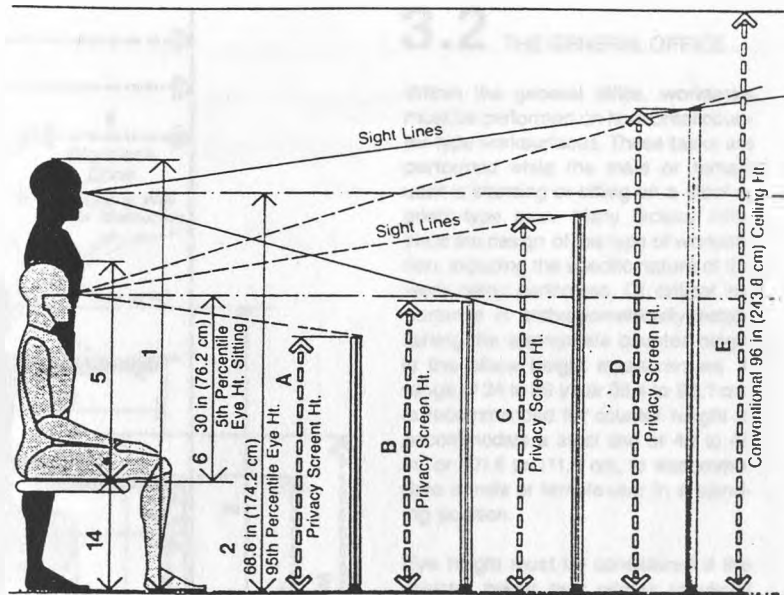
	in	cm
A	48-60	121.9-152.4
B	4-6	10.2-15.2
C	20-24	50.8-61.0
D	6-10	15.2-25.4
E	18-24	45.7-61.0
F	30-36	76.2-91.4
G	54-60	137.2-152.4
H	30	76.2
I	72-81	182.9-205.7
J	42-51	106.7-129.5
K	24-27	61.0-68.6
L	48-54	121.9-137.2

3.2 THE GENERAL OFFICE

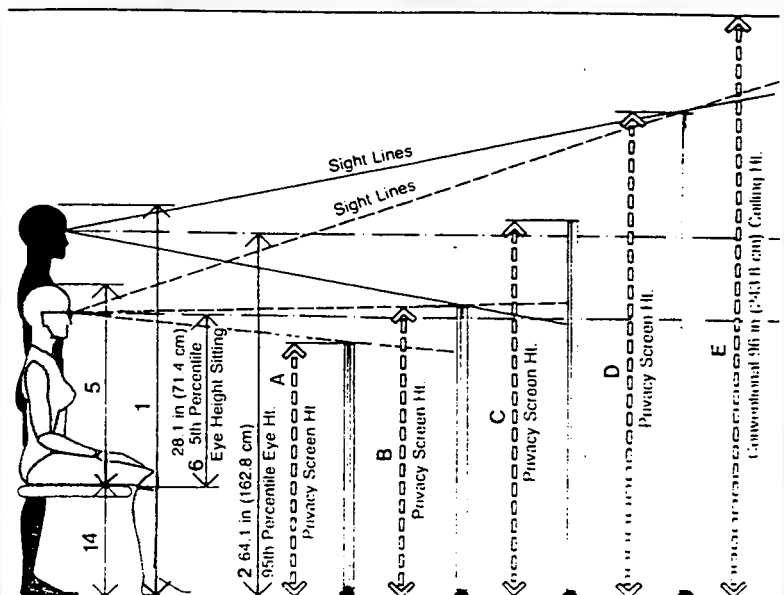
The growth and development of open office planning and office landscape systems have spurred the design and manufacture of numerous free-standing low partitions or privacy screens. These partitions are used to subdivide office space, providing various degrees of acoustic and visual privacy, and to define territory and circulation paths. A basic decision always confronting the designer concerns the height of the partition system. The information provided on this page represents a survey of privacy screens manufactured by some of the largest producers of office systems furniture and equipment. All are shown in relation to the large and small male and female user in both a sitting and standing position.

In considering the selection of the appropriate partition or screen height, the anthropometric dimensions of critical importance are those of eye height standing and eye height sitting. It should be understood, however, that sight lines are also important in establishing visual privacy. What should be considered too is the nature of the visual privacy desired. Is the seated person on one side of the screen to be shielded from the view of a standing or seated person on the other side of the screen? Is the seated person to be permitted to look over the screen? The purpose of the privacy screen will determine if seated or standing eye level data should be used and if that data should be 5th or 95th percentile data. (More detailed information on vision and sight lines can be found in Section 9.1.)

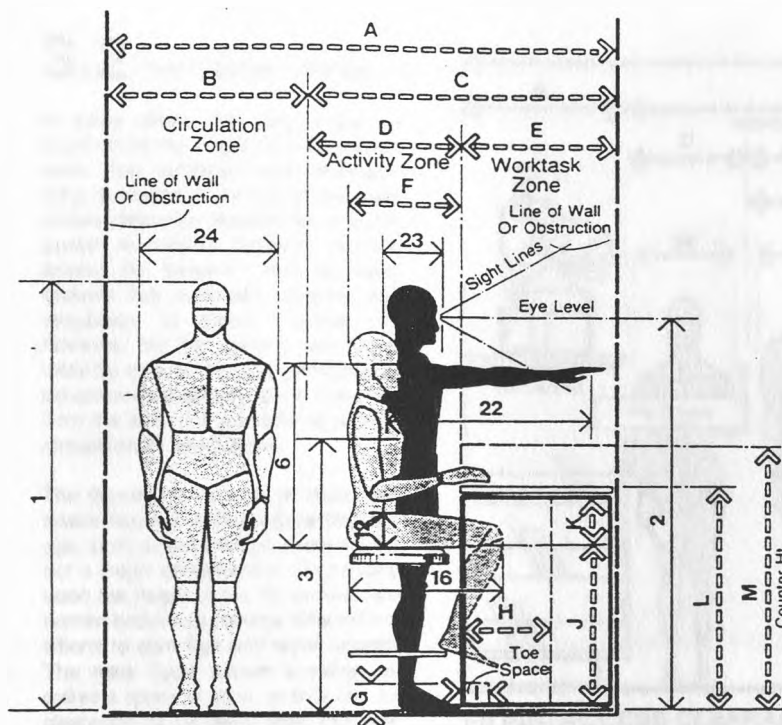
	in	cm
A	40-44	101.6-111.8
B	47-50	119.4-127.0
C	60-64	152.4-162.6
D	76-80	198.1-203.2
E	96	243.8



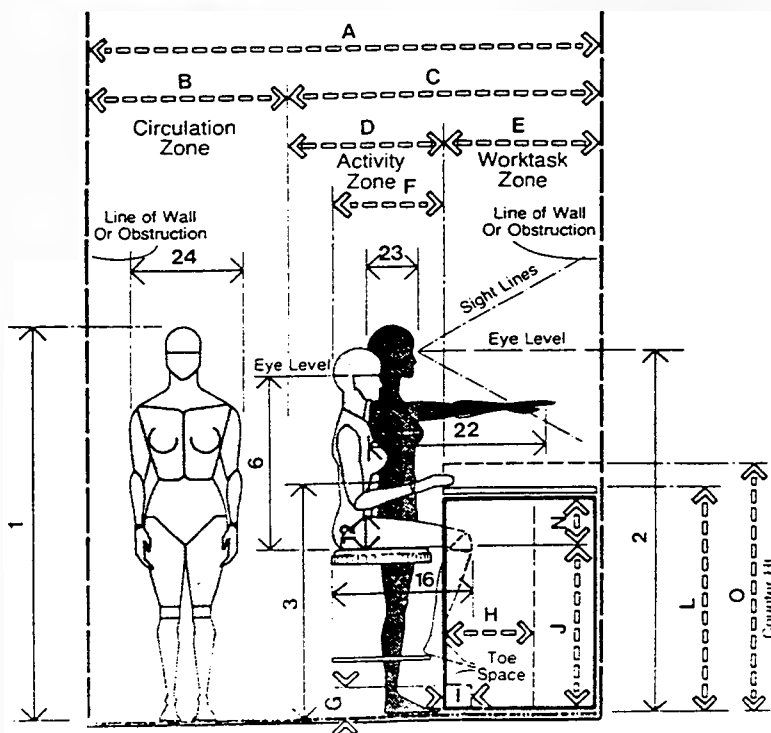
LANDSCAPE PARTITIONS / MALE
ANTHROPOMETRIC CONSIDERATIONS



LANDSCAPE PARTITIONS / FEMALE
ANTHROPOMETRIC CONSIDERATIONS



WORK COUNTER / MALE USER



WORKCOUNTER FEMALE USER

3.2 THE GENERAL OFFICE

Within the general office, worktasks must be performed on horizontal counter-type worksurfaces. These tasks are performed while the male or female user is standing or sitting on a stool or perch-type seat. Many factors influence the design of this type of workstation, including the specific nature of the work being performed. Of critical importance in anthropometrically establishing the appropriate counter height is the elbow height measurement. A range of 34 to 39 in, or 86.4 to 99.1 cm, is recommended for counter height to accommodate a stool and of 40 to 44 in, or 101.6 to 111.8 cm, to accommodate a male or female user in a standing position.

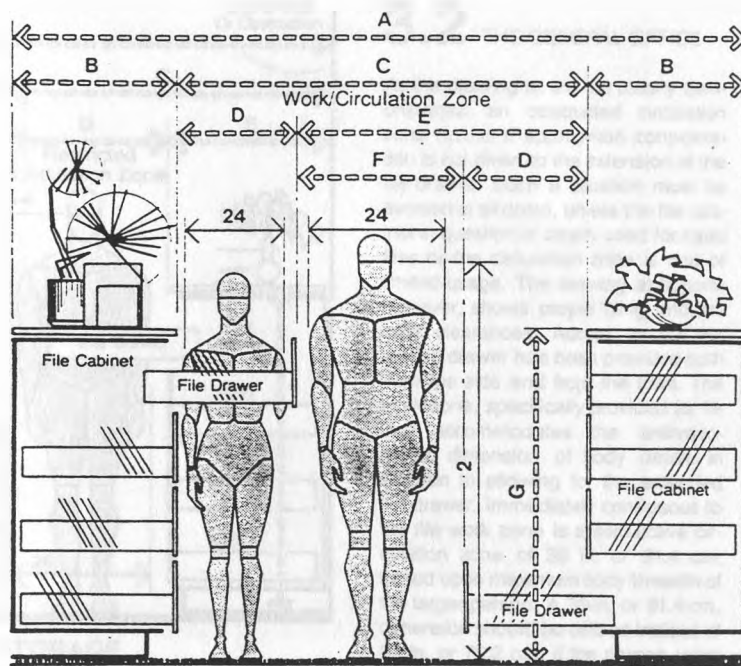
Eye height must be considered if the counter height task relates to visual displays or controls. To the extent that ease of access to these displays or controls is of importance anthropometrically, the thumb tip reach measurement of the smaller person is critical in establishing proper counter depth. The designer must also be concerned with thigh clearance and buttock-knee length in finalizing any design. (For additional discussion, see Section 7.3, Work and Crafts Centers, and Section 9.2, Workstation Displays.)

	in	cm
A	68-96	172.7-243.8
B	30-36	76.2-91.4
C	38-60	96.5-152.4
D	20-24	50.8-61.0
E	18-36	45.7-91.4
F	18	45.7
G	3	7.6
H	14-18	35.6-45.7
I	4	10.2
J	22-24.5	55.9-62.2
K	7.5 min.	19.1 min.
L	34-39	86.4-99.1
M	42-44	106.7-111.8
N	7 min.	17.8 min.
O	42-44	106.7-111.8

3.2 THE GENERAL OFFICE

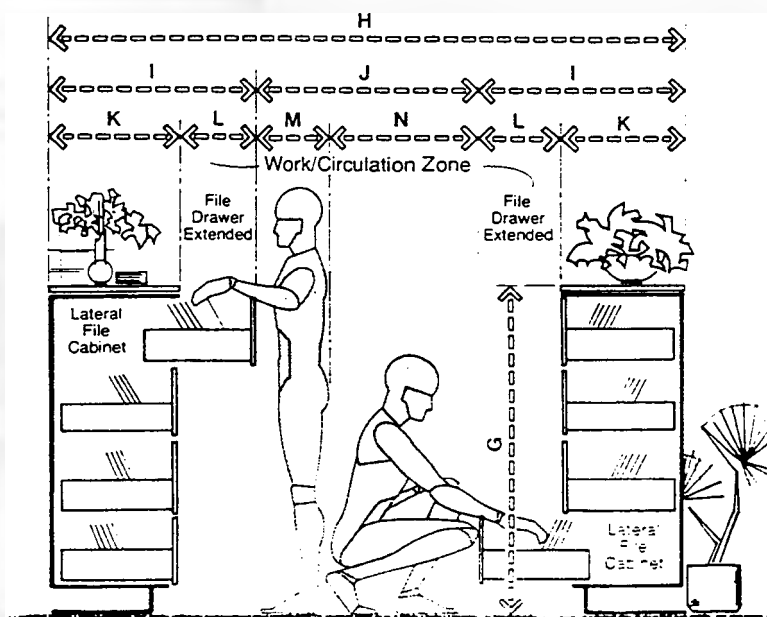
In many offices, file storage can be found lining the edges of a circulation zone. The combined work/circulation zone illustrated at the top of the page shows clearance required for a larger person to circulate between two extended file drawers. With opposing drawers fully extended, unobstructed circulation is clearly limited. If, however, the file drawers are separated by several feet along the path of circulation and access to the drawer is from the side, it is possible to provide circulation for two people.

The drawing at the bottom shows the space required within a typical file storage room where through circulation is not a major consideration. Depending upon the height of the file drawer, the human body must assume different positions to gain free and clear access. The male figure shown kneeling requires a space of 36 in., or 91.4 cm, for clearance. At the same time, the minimum work area needed for a person standing in front of a file has been established at 18 in., or 45.7 cm.

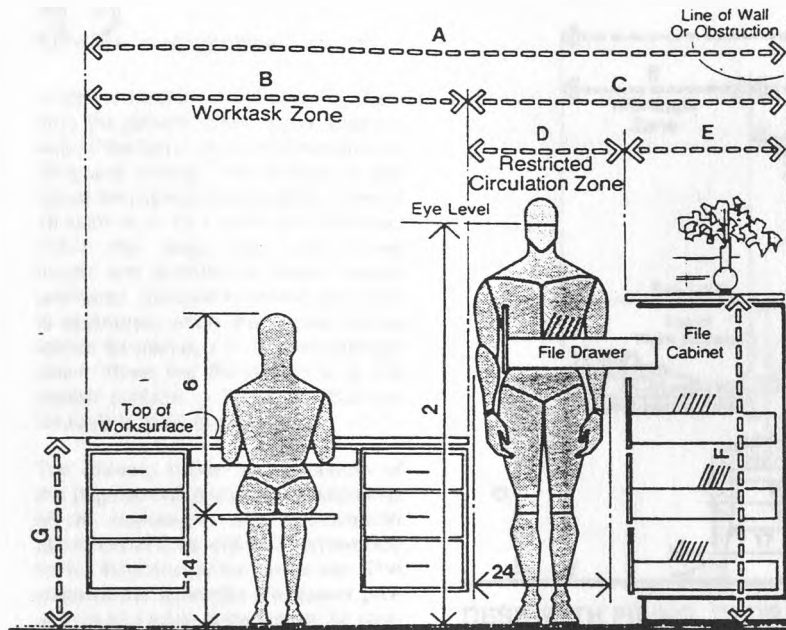


FILING/ACCESS CLEARANCES

	in	cm
A	106-138	269.2-350.5
B	20-28	50.8-71.1
C	66-82	167.6-208.3
D	18-26	45.7-66.0
E	48-56	121.9-142.2
F	30	76.2
G	54-58	137.2-147.3
H	122-138	309.9-350.5
I	34-42	86.4-106.7
J	40-54	101.6-137.2
K	18-22	45.7-55.9
L	16-20	40.6-50.8
M	18	45.7
N	22-36	55.9-91.4



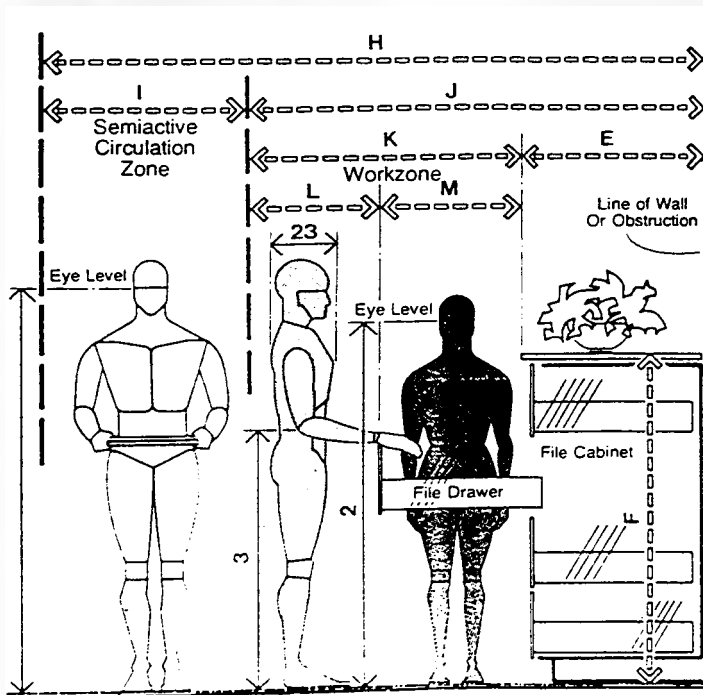
FILING ACCESS CLEARANCES



WORKSTATION WITH FILING AND STORAGE

3.2 THE GENERAL OFFICE

As the drawing at the top clearly demonstrates, an obstructed circulation zone results if appropriate consideration is not given to the extension of the file drawer. Such a situation must be avoided at all costs, unless the file cabinet in question is clearly used for dead files or the circulation zone is one of limited usage. The drawing at bottom, however, shows proper filing and access clearances. Access to the extended drawer has been provided both from the side and from the front. The work zone, specifically provided for filing, accommodates the anthropometric dimension of body depth, in addition to allowing for the extended file drawer. Immediately contiguous to the file work zone is a semiactive circulation zone of 36 in., or 91.4 cm, based upon maximum body breadth of the larger person. A 36-in., or 91.4-cm, dimension should be utilized instead of 30 in., or 76.2 cm, if the person using that path of circulation is also carrying files, folders, and so forth.



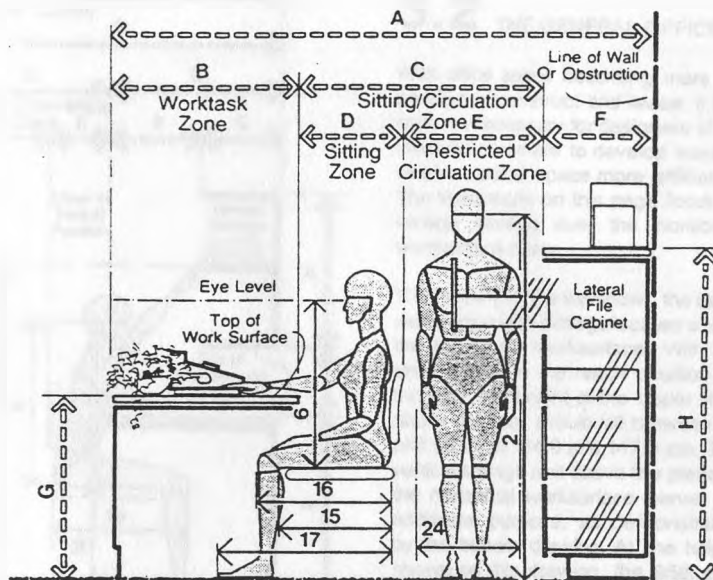
FILING ACCESS CLEARANCES

	in	cm
A	110-130	279.4-330.2
B	60-72	152.4-182.9
C	50-58	127.0-147.3
D	30	76.2
E	20-28	50.8-71.1
F	54-58	137.2-147.3
G	29-30	73.7-76.2
H	92-108	233.7-274.3
I	36	91.4
J	56-72	142.2-182.9
K	36-44	91.4-111.8
L	23	58.4
M	23	58.4

3.2 THE GENERAL OFFICE

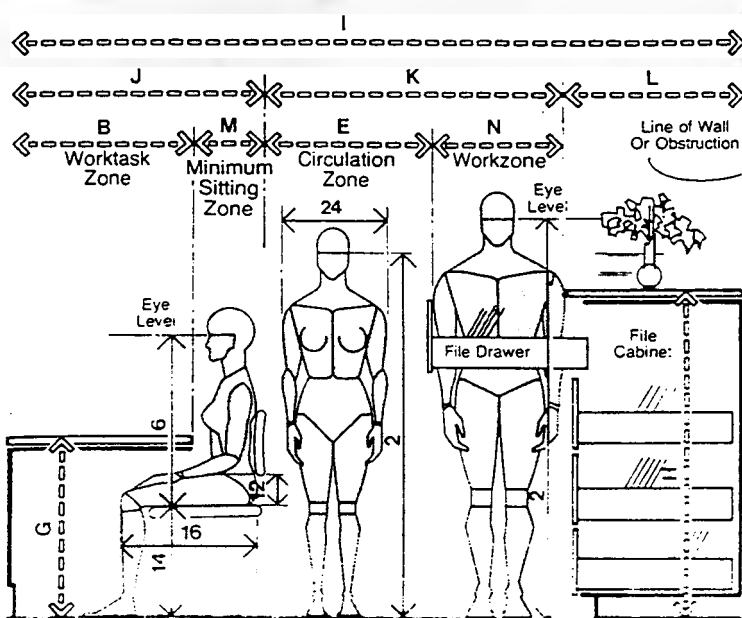
A typical situation that occurs in planning the general office is the relationship of the basic desk or workstation to filing and storage. The drawing at the top of the page shows a sitting zone of 18 to 24 in, or 45.7 to 61 cm. Reflected within this range are buttock-knee length and buttock-toe length measurements. Circulation behind the desk is obstructed when the drawer of the lateral file cabinet is in an extended position. When the file drawer is in the closed position, a 30-in, or 76.2-cm, circulation zone is provided.

The drawing shown on the bottom of the page demonstrates the relationship of the workstation with a circulation zone behind it, as well as an allowance for full extension of the file drawer. The distance the extended file drawer projects is a function of the type of file storage unit. An overall dimension range of 48 and 56 in, or 121.9 and 142.2 cm, is provided to accommodate a circulation zone and the file drawer in its extended position. It should be noted, however, that if constant access to the file cabinets is necessary, the circulation zone will be violated, in which case a different plan arrangement should be considered.

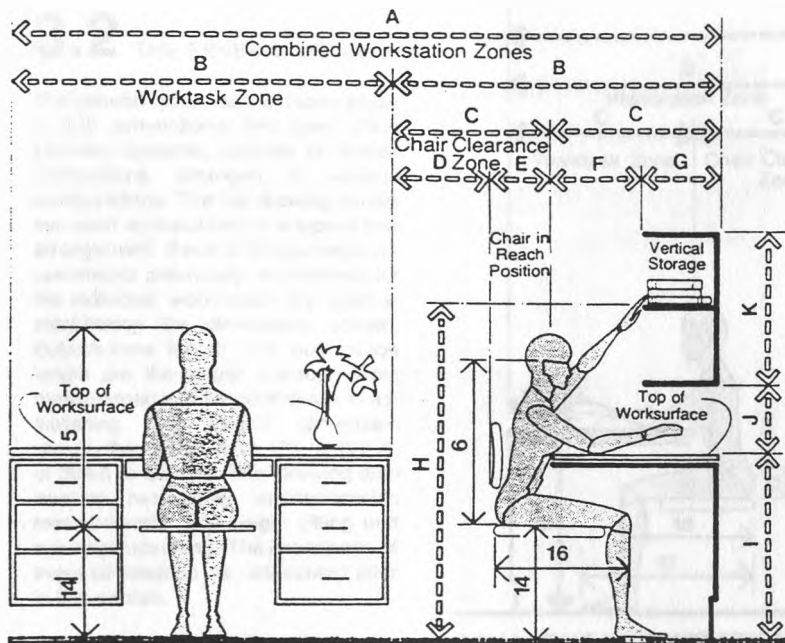


DESK WITH FILING, STORAGE, AND RESTRICTED CIRCULATION

	in	cm
A	96-112	243.8-284.5
B	30-36	76.2-91.4
C	48-54	121.9-137.2
D	18-24	45.7-61.0
E	30	76.2
F	18-22	45.7-55.9
G	29-30	73.7-76.2
H	54-58	137.2-147.3
I	110-136	279.4-345.4
J	42-52	106.7-132.1
K	48-56	121.9-142.2
L	20-28	50.8-71.1
M	12-16	30.5-40.6
N	18-26	45.7-66.0



DESK WITH FILING AND STORAGE

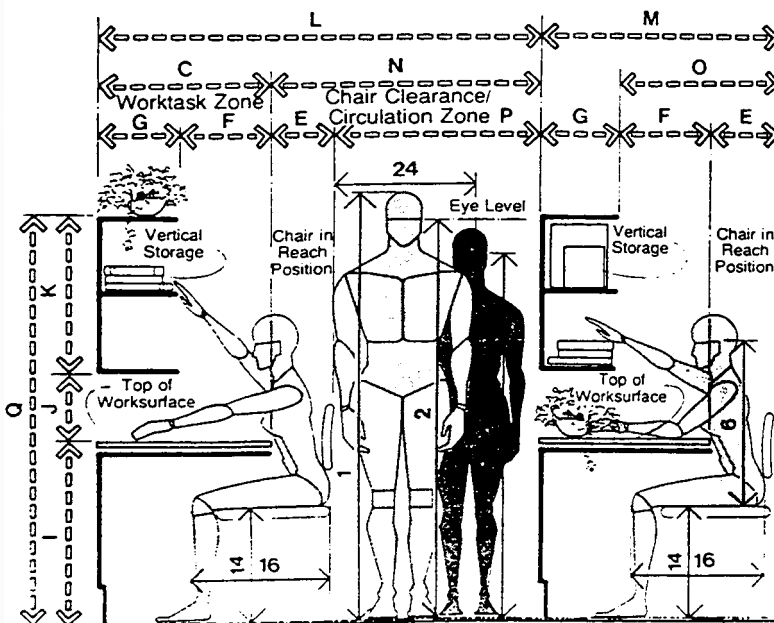


BASIC WORKSTATION WITH VERTICAL STORAGE

3.2 THE GENERAL OFFICE

With office space becoming more expensive to construct and lease, it has become necessary for designers of the office environment to develop ways in which to utilize space more efficiently. The illustrations on this page focus on vertical storage over the horizontal worksurface plane.

The drawing at the top shows the basic workstation with storage located above the top of the worksurface. With the chair placed in the reach position for the user, the height of the upper shelf above the floor should fall between 53 and 58 in, or 134.6 and 147.3 cm. The vertical storage unit above the plane of the horizontal worksurface serves an additional purpose, as demonstrated by the bottom drawing. At the height shown on this drawing, the 95th percentile eye height standing is approximately the same elevation as that of the storage element. The subdivision of space, thereby providing some degree of visual privacy, is accomplished without constructing more permanent floor-to-ceiling partitions.



BASIC WORKSTATIONS BACK TO BACK WITH VERTICAL STORAGE

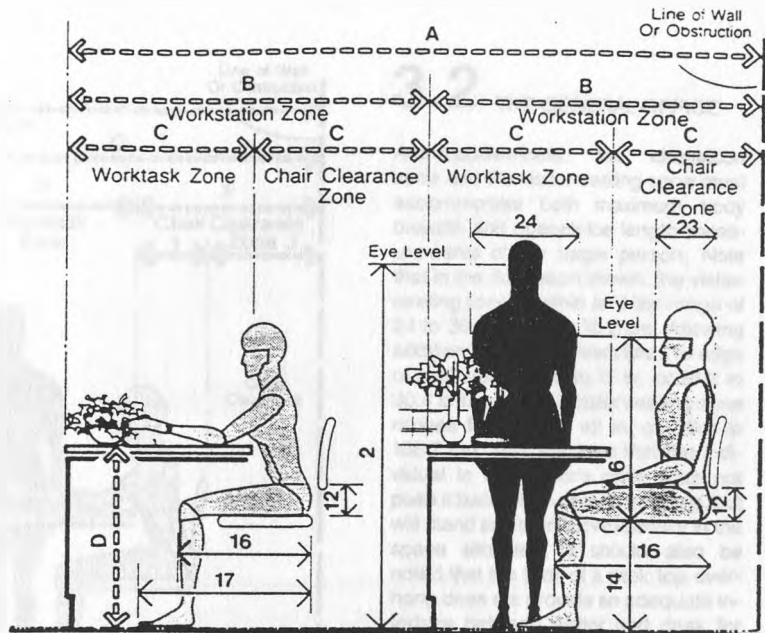
	in	cm
A	120-144	304.8-365.8
B	60-72	152.4-182.9
C	30-36	76.2-91.4
D	18-20	45.7-50.8
E	12-16	30.5-40.6
F	18-24	45.7-61.0
G	12	30.5
H	53-58	134.6-147.3
I	29-30	73.7-76.2
J	15 min.	38.1 min.
K	25-31	63.5-78.7
L	78-94	198-239.1
M	42-52	106.7-132.7
N	48-58	121.9-147.3
O	30-40	76.2-101.6
P	36-42	91.4-106.7
Q	48-76	121.9-192.9

3.2 THE GENERAL OFFICE

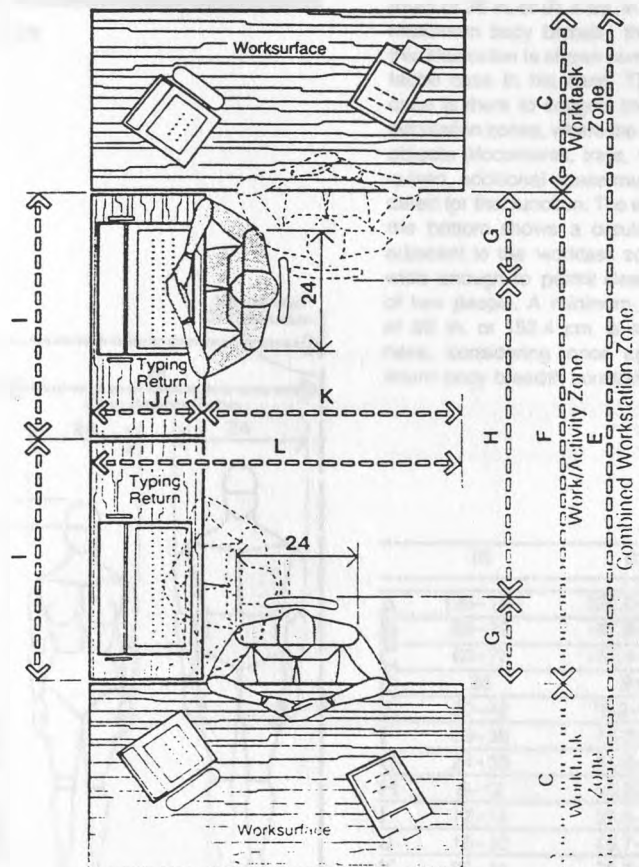
The general office, as it is known today in both conventional and open office planning systems, consists of similar workstations arranged in various configurations. The top drawing shows two such workstations in a typical row arrangement. Basic anthropometric requirements previously established for the individual workstation are used in establishing the dimensions shown. Buttock-knee length and buttock-toe length are the major anthropometric measurements to be considered in establishing the overall dimension shown; they range from 120 to 132 in, or 304.6 to 381 cm. This drawing also involves two other anthropometric measurements: eye height sitting and eye height standing. The importance of these dimensions is addressed later in this section.

Grouping the typical workstation in a U-shaped configuration is illustrated in the plan at the bottom of this page. Such a grouping is often used when the people assigned to the paired workstation share common responsibilities or work together on joint tasks or where the sharing of the combined workstation zone results in saving floor space. When such space is shared, the notion of territory is sometimes obscured due to the lack of any clear lines of demarcation. Clearly, the U-shaped configuration, in comparison with the row arrangement at the top, is less restrictive and less confining to the user.

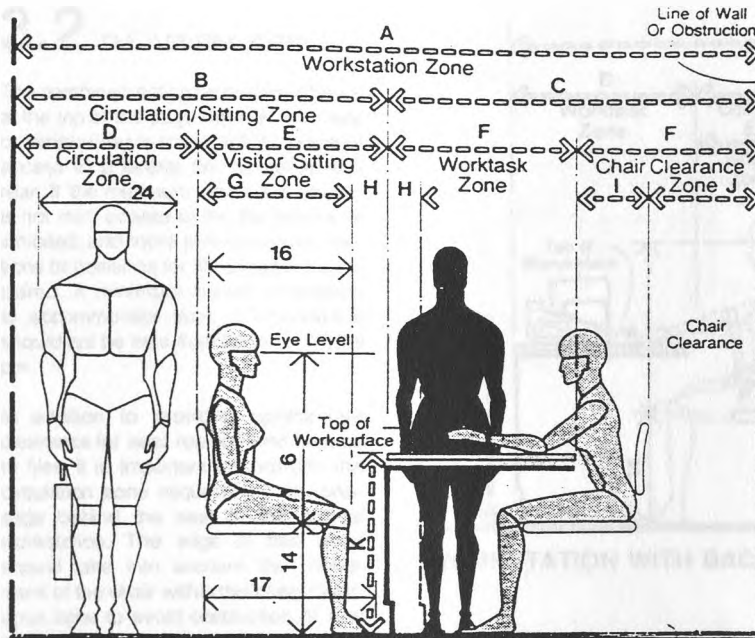
	in	cm
A	120-144	304.8-365.8
B	60-72	152.4-182.9
C	30-36	76.2-91.4
D	29-30	73.7-76.2
E	120-168	304.8-426.7
F	60-96	152.4-243.8
G	18-24	45.7-61.0
H	24-48	61.0-121.9
I	30-48	76.2-121.9
J	18-22	45.7-55.9
K	42-50	106.7-127.0
L	60-72	152.4-182.9



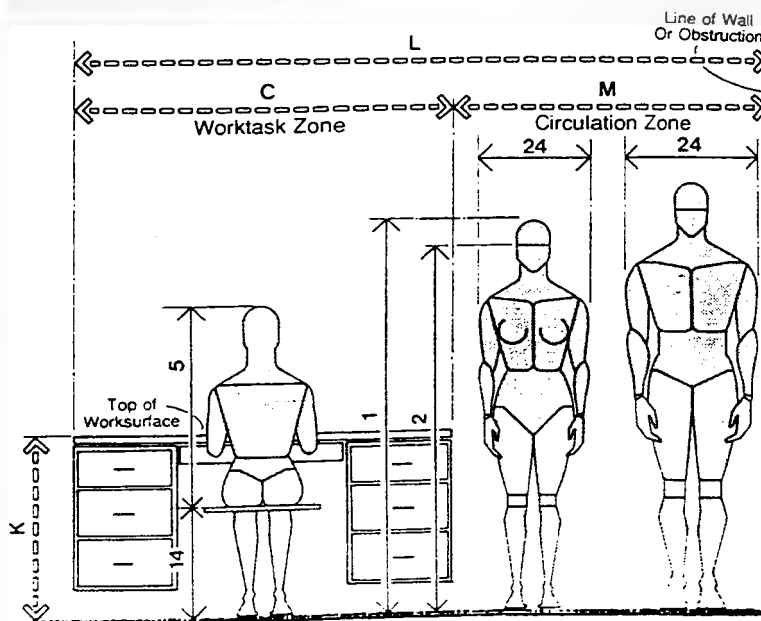
ADJACENT WORKSTATIONS / ROW ARRANGEMENT



ADJACENT WORKSTATIONS / U-SHAPE



BASIC WORKSTATION WITH VISITOR SEATING AND CIRCULATION



WORKSTATION AND ADJACENT CIRCULATION

3.2 THE GENERAL OFFICE

Anthropometrically, the circulation zone and the visitor seating zone must accommodate both maximum body breadth and buttock-toe length measurements of the larger person. Note that in the illustration shown, the visitor seating zone is within an initial range of 24 to 30 in, or 61 to 76.2 cm. Allowing additional clearance from knee to edge of workstation of 6 to 12 in, or 15.2 to 30.4 cm, an overall visitor seating zone ranges from 30 to 42 in, or 76.2 to 106.7 cm. This assumes that the individual in the visitor's chair does not push it back when coming or going, but will stand and then move laterally in the space allocated. It should also be noted that the lack of a desk top overhang does not provide an adequate interface between visitor and desk for close-up conferences. The circulation zone dimension is shown as a minimum of 36 in, or 91.4 cm. In addition to maximum body breadth, the figure in this illustration is shown carrying an attache case in his hand. The attache case is there to suggest that in those circulation zones, where the carrying of objects (documents, trays, files) is required, additional space must be allocated for that function. The elevation at the bottom shows a circulation zone adjacent to the worktask zone that is wide enough to permit clear passage of two people. A minimum dimension of 60 in, or 152.4 cm, is allowed for here, considering once again maximum body breadth constraints.

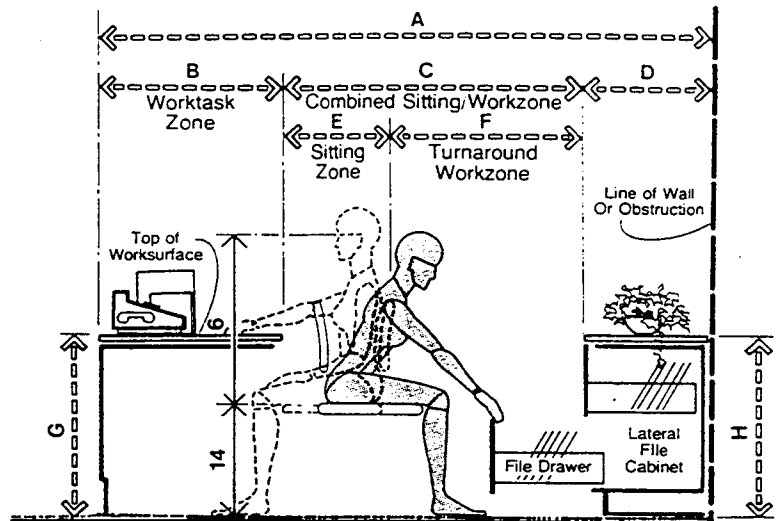
	in	cm
A	126-150	320.0-381.0
B	66-78	167.6-198.1
C	60-72	152.4-182.9
D	36	91.4
E	30-42	76.2-106.7
F	30-36	76.2-91.4
G	24-30	61.0-76.2
H	6-12	15.2-30.5
I	12-16	30.5-40.6
J	18-20	45.7-50.8
K	29-30	73.7-76.2
L	120-132	304.8-335.3
M	60	152.4

3.2 THE GENERAL OFFICE

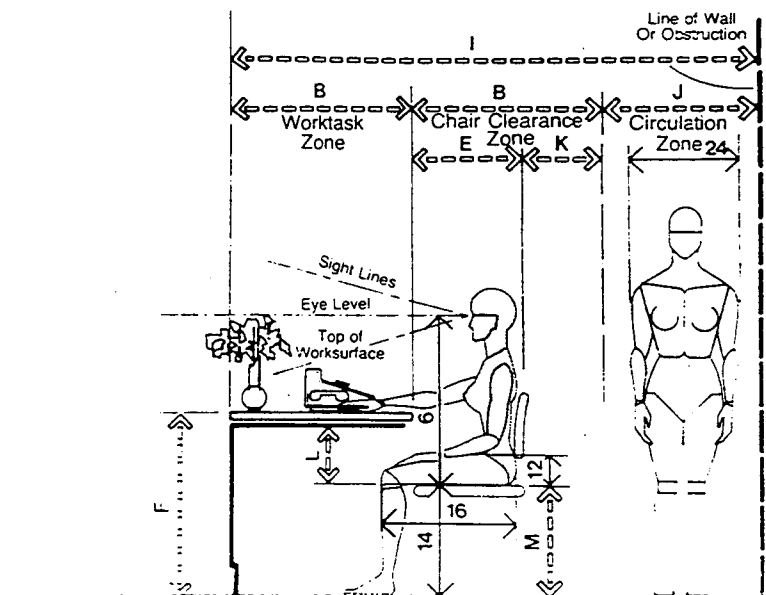
The combined sitting/work zone shown at the top of the page permits the male or female user to rotate 180° for ease of access to a lateral file drawer in the rear. If the minimum clearance shown is not met, access to the file drawer is inhibited, and more awkward body motions or positions for file access are required. A minimum overall dimension to accommodate such a workstation should not be less than 96 in, or 238.8 cm.

In addition to providing appropriate clearance for seat rotation and access to files, it is important to consider the circulation zone requirement for passage behind the seat at the typical workstation. The edge of this zone should take into account the movement of the chair within the chair clearance zone to avoid obstruction of any people circulating behind it. Minimal recommended clearance to allow for that circulation is predicated upon the maximum clothed body breadth of the larger user. Accordingly, this minimum dimension, allowing for the circulation of only one person, should not be less than 30 in, or 76.2 cm. Based upon this minimum dimension and allowing for the requirements of the worktask and chair clearance zones, the overall distance from the front of the worksurface to the line of wall or obstruction should fall between 94 and 114 in, or 238.8 and 289.6 cm.

	in	cm
A	96-128	243.8-325.1
B	30-36	76.2-91.4
C	48-68	121.9-172.7
D	18-22	45.7-55.8
E	18-24	45.7-61.0
F	30-44	76.2-111.8
G	29-30	73.7-76.2
H	28-30	71.1-76.2
I	90-102	228.6-259.1
J	30	76.2
K	12	30.5
L	7.5 min	19.1 min
M	15-18	38.1-45.7



WORKSTATION WITH BACK LATERAL FILE STORAGE



BASIC WORKSTATION WITH CIRCULATION BEHIND



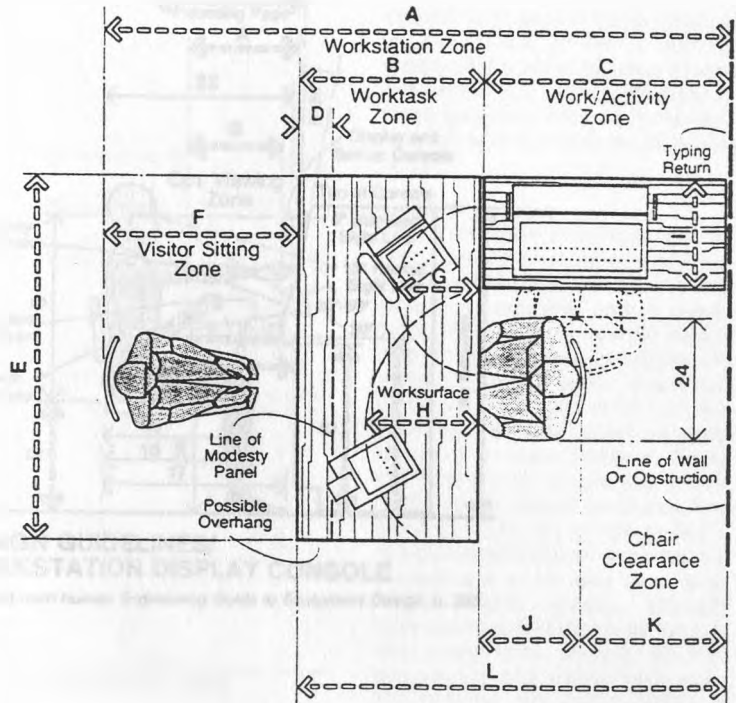
The two elevations at the top illustrate the major anthropometric considerations for the seated male and female user at both workstation and typing return. What should be noted is the seat height of the chair (a function of popliteal height) and its relationship to the specific task. When the worksurface is lowered to accommodate a specialized function, as in the case of the typing return, special attention must be given to the requirements for thigh clearance. Most standard office typing returns have been geared to the anthropometric requirements of the female user. The popliteal height and thigh clearance requirements of the larger male user may not be readily met.

The plan at the bottom shows the typical workstation expanded into the basic U-shaped configuration. The work/activity zone dimension range is shown as 46 to 58 in, or 116.8 to 147.3 cm; additional space is needed to allow for drawer extension of the lateral file. Not only does it provide more storage, the lateral file unit is generally the same height as that of the worksurface and is often utilized as a supplementary worksurface. The distance between this unit and that of the primary worksurface must be sufficient to allow for movement and rotation of the chair.

	in	cm
A	26-27	66.0-68.6
B	14-20	35.6-50.8
C	7.5 min.	19.1 min
D	29-30	73.7-76.2
E	7 min.	17.8 min.
F	18-24	45.7-61.0
G	46-58	116.8-147.3
H	30-36	76.2-91.4
I	42-50	106.7-127.0
J	16-22	40.7-55.9
K	22-32	55.9-81.3
L	24-34	61.0-86.4
M	32-42	81.3-106.7

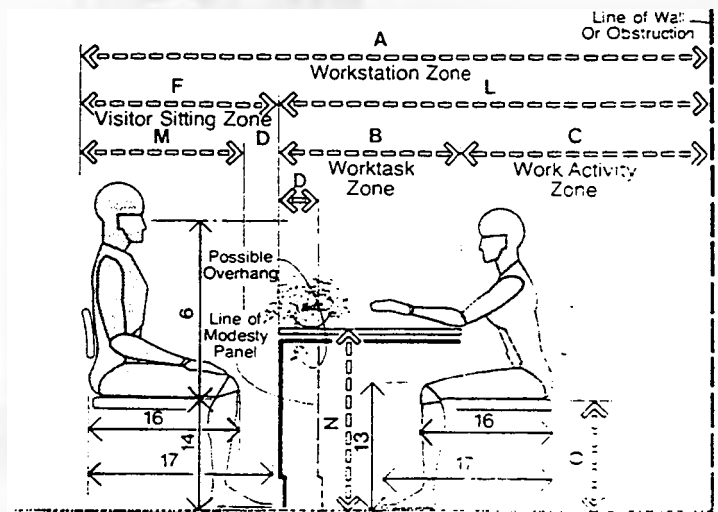
3.2 GENERAL OFFICE

The basic workstation, as illustrated in both plan and section on this page, is the fundamental building block in understanding the anthropometric considerations for the planning and design of the general office. The worktask zone must be large enough to accommodate the paperwork, equipment, and other accessories that support the user's function. The work/activity zone dimension, shown on the top drawing, is established by the space requirements needed for use of the typical return. In no case should this distance be less than the 30 in, or 76.2 cm, needed to provide adequate space for the chair clearance zone, ranging in depth from 30 to 42 in, or 76.2 to 106.7 cm, requires the designer to accommodate both the buttock-knee and buttock-toe length body dimensions of the larger user. If an overhang is provided or the desk's modesty panel is recessed, the visitor seating zone can be reduced due to the additional knee and toe clearances provided. The specific type and size of the seating (i.e., if it swivels or if it has casters) also influence these dimensions.



BASIC WORKSTATION WITH VISITOR SEATING

	in	cm
A	90-126	228.6-320.0
B	30-36	76.2-91.4
C	30-48	76.2-121.9
D	6-12	15.2-30.5
E	60-72	152.4-182.9
F	30-42	76.2-106.7
G	14-18	35.6-45.7
H	16-20	40.6-50.8
I	18-22	45.7-55.9
J	18-24	45.7-61.0
K	6-24	15.2-61.0
L	60-84	152.4-213.4
M	24-30	61.0-76.2
N	29-36	73.7-91.4
O	15-18	38.1-45.7



BASIC WORKSTATION WITH VISITOR SEATING

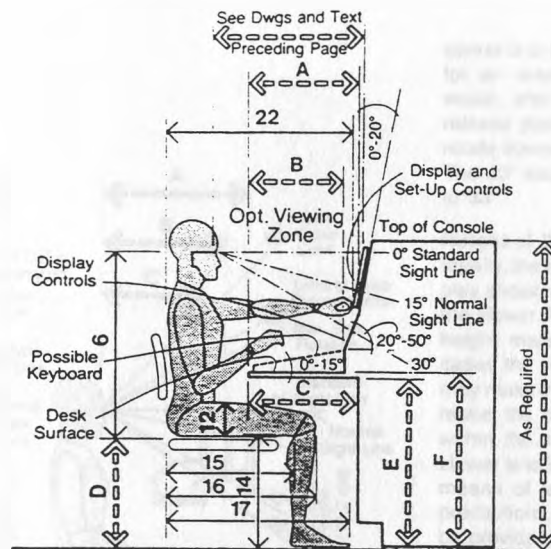
9.2 WORKSTATION DISPLAYS

The top drawing illustrates guidelines for use in establishing preliminary design assumptions for a workstation display console. Since the types of displays and the nature of the tasks associated with those displays can vary considerably, the drawing cannot be taken too literally. The configuration shown, however, is fairly representational. Certain basic factors should be noted anthropometrically. The use of an adjustable chair will permit the eye height of the seated viewer to be raised or lowered to view the display, as may be required depending on body size. An adjustment range between 15 and 18 in, or 38.1 and 45.7 cm, should be adequate to accommodate the eye height sitting requirements of about 90 percent of all viewers. Adjustability, however, will be of little value if the vertical distance between the underside of the desk and the floor is insufficient to accommodate the knee height and thigh clearance when the seat is adjusted to the appropriate position. If such distance is not less than 26.5 in, or 67.3 cm, the majority of viewers will be accommodated.

The location of the top of the display should align with the standard sight line for optimum viewing conditions. Since the eye and the head can rotate within certain limitations and, in so doing, increase the area that can be scanned, displays can be located above the standard sight line when absolutely necessary. It should also be noted that the more perpendicular the normal sight line is to the display plane, the greater the viewing comfort. Accordingly, consideration should be given to sloping the display plane since the normal sight line is about 15° below the horizontal.

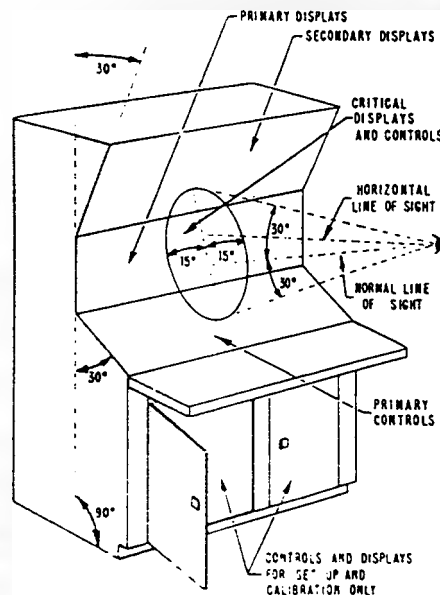
The drawing at the bottom is from another source and stresses many of the angular relationships involved in display console design.

	in	cm
A	16-18	40.6-45.7
B	16 min.	40.6 min.
C	18 min.	45.7 min.
D	15-18 adjust.	38.1-45.7
E	26.5 min.	67.3 min.
F	30	76.2



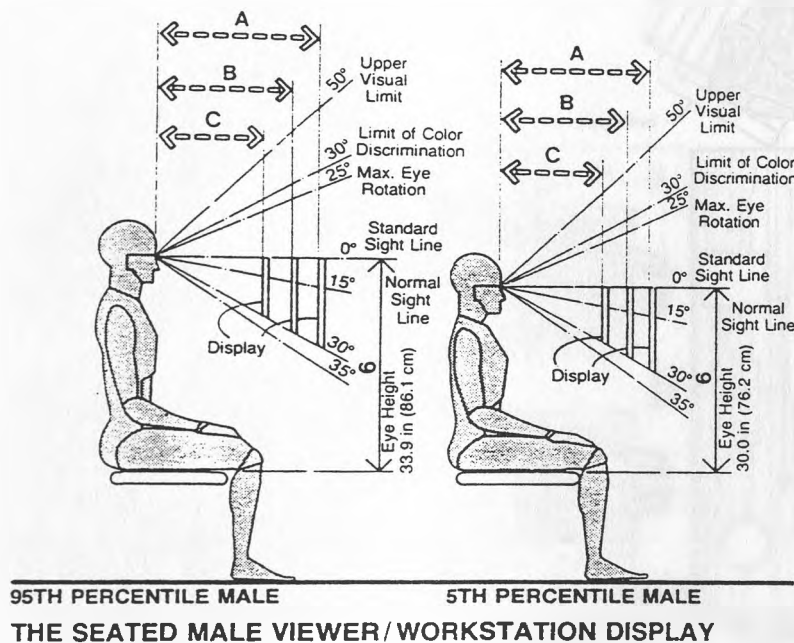
DESIGN GUIDELINES/ WORKSTATION DISPLAY CONSOLE

Adapted from *Human Engineering Guide to Equipment Design*, p. 393.



RECOMMENDED POSITIONING OF CONTROLS AND DISPLAYS ON VERTICAL SEGMENT CONSOLES

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server is to function at the workstation for an extended period of time, he would, after a while, assume a more relaxed position, causing his head to rotate downward a few more degrees. The 30° could therefore be increased to 33°.

Height of Display

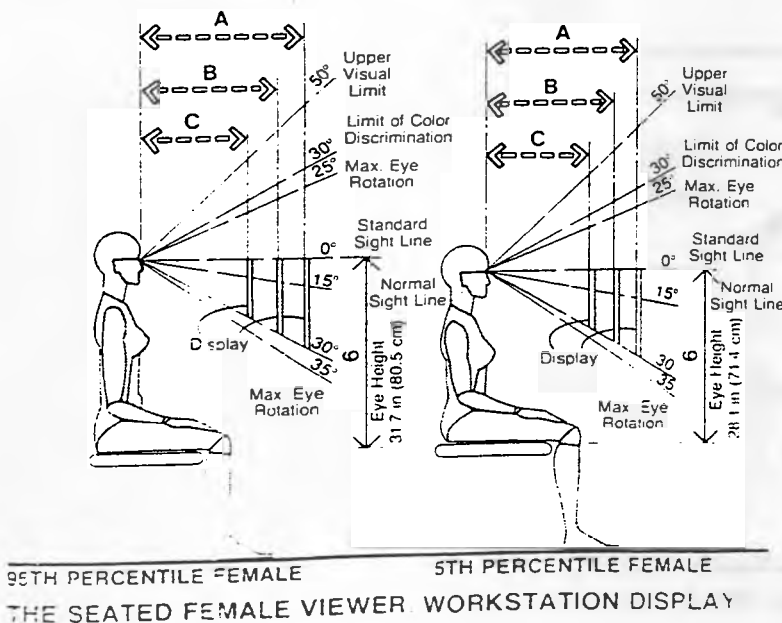
Ideally, the height of the top of the display should relate to the eye height of the viewer. The great variability in eye height measurements and in certain cases the size of the specific display may make this difficult. One solution to make the display within reach and within the visual field of the smaller viewer is to increase his eye height by means of a raised platform. Safety precautions, such as a railing, should be provided to prevent accidents. The platform should be movable so that it can be relocated at such times that the workspace is to be used by a taller viewer. Another solution, although more costly, is to develop an adjustable arrangement, whereby the display panel may be raised or lowered to suit individual eye height. Where a seated viewer is involved, the problem is less difficult. The variation in the eye heights of the tall and short seated viewer above the seat surface is much less than that of the eye heights above the floor of tall and short standing viewers. The difference in eye heights of the latter is about 12 in, or 30.5 cm, while the difference between eye heights of the former, as indicated by the drawings, is less than 6 in, or 15.2 cm. Accordingly, the problem of making the display within reach of the visual field of the smaller seated user can be solved quite easily by the use of a chair with an adjustable seat height.

Display Angle

Where possible, the angle of display should place the viewing surface perpendicular to the normal line of sight.

Controls

Controls should be placed within reach of the smaller viewer and located so that the body movement necessary for operation of the controls will not obstruct visibility.



	in	cm
A	28-29	71.1-73.7
B	18-22	45.7-55.9
C	13-16	33.0-40.6

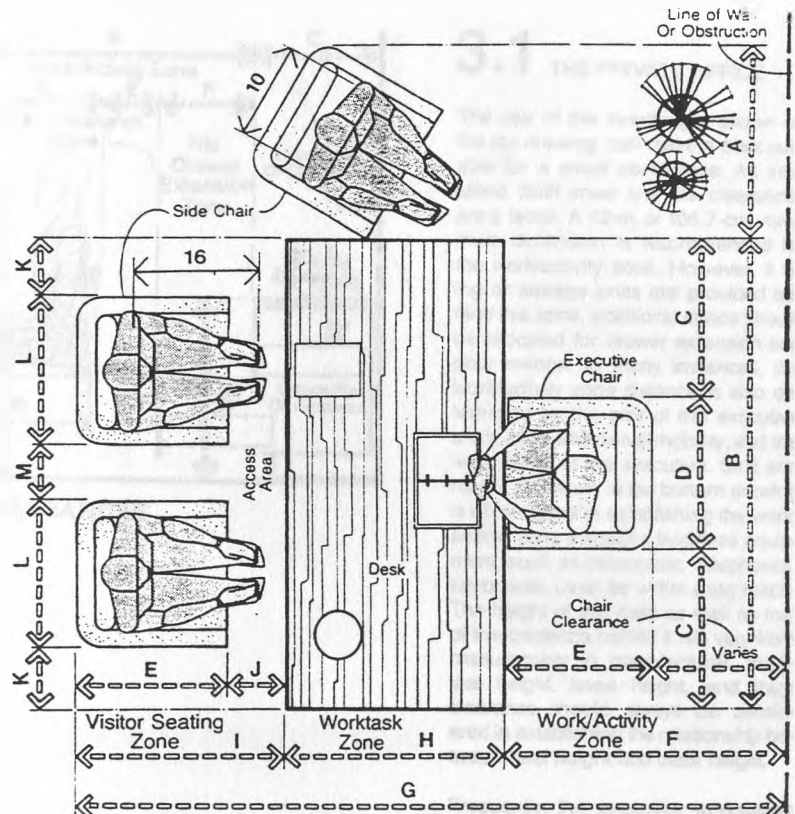
3.1 THE PRIVATE OFFICE

The drawing at the top illustrates the basic dimensional requirements of an executive workstation with visitor seating for three. While image and scale often dictate the size of the executive desk and the placement of the furniture around it, the generally accepted size suggested is 30 to 45 by 66 to 84 in, or 76.2 to 114.3 by 167.6 to 213.4 cm. The specific work habits of the executive and the nature of his or her business must be considered in determining the appropriate worksurface measurements.

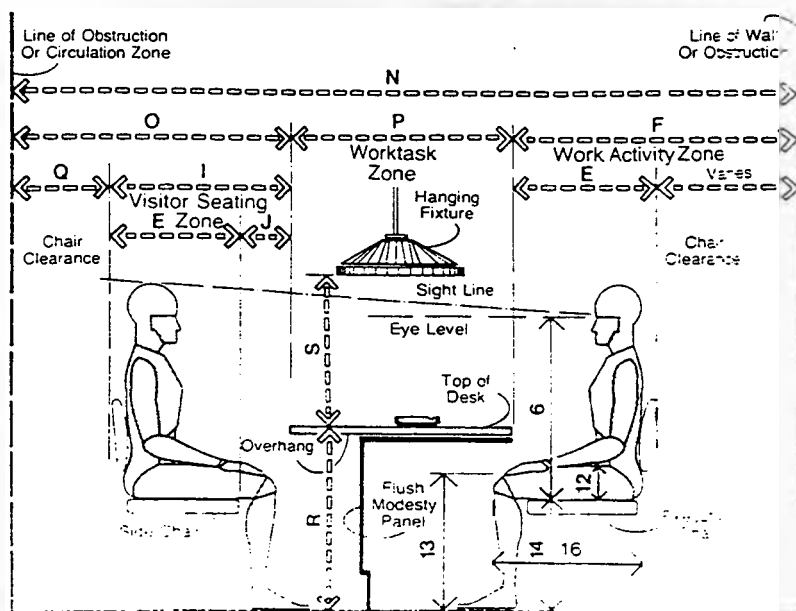
Critical attention must be given to the selection, placement, and clearances provided for seating around the desk. Both drawings indicate the need to carefully consider the buttock-knee length, hip breadth, and maximum body breadth measurements. The dimensions for the various zones and clearances, while predicated on basic anthropometric considerations, are often a function of circulation within the space and the furniture type.

Buttock-toe length as well as body depth determines placement of a visitor's chair in front of the desk, with the distance from the desk often a function of whether the desk has an overhang. Placement of a hanging fixture must relate to an appropriate determination of eye level and sight lines.

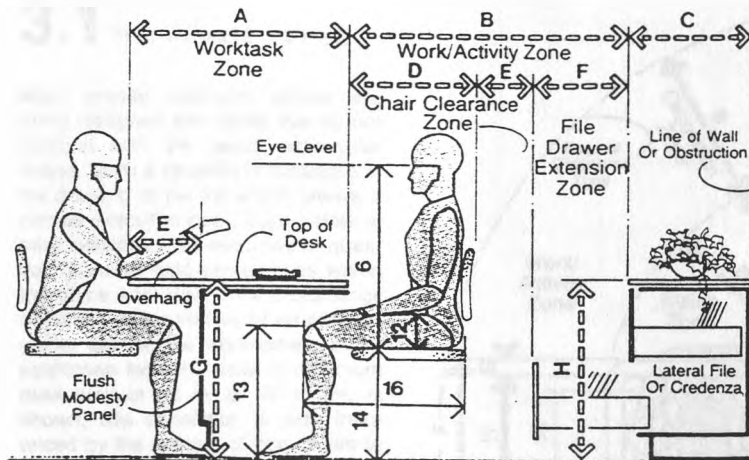
	in	cm
A	30-39	76.2-99.1
B	66-84	167.6-213.4
C	21-28	53.3-71.1
D	24-28	61.0-71.1
E	23-29	58.4-73.7
F	42 min.	106.7 min.
G	105-130	266.7-330.2
H	30-45	76.2-114.3
I	33-43	83.8-109.2
J	10-14	25.4-35.6
K	6-16	15.2-40.6
L	20-26	50.8-66.0
M	12-15	30.5-38.1
N	117-148	297.2-375.9
O	45-61	114.3-154.9
P	30-45	76.2-114.3
Q	12-18	30.5-45.7
R	24-30	61.0-76.2
S	30-32	76.2-81.3



EXECUTIVE DESK / VISITOR SEATING



EXECUTIVE DESK BASIC CLEARANCES

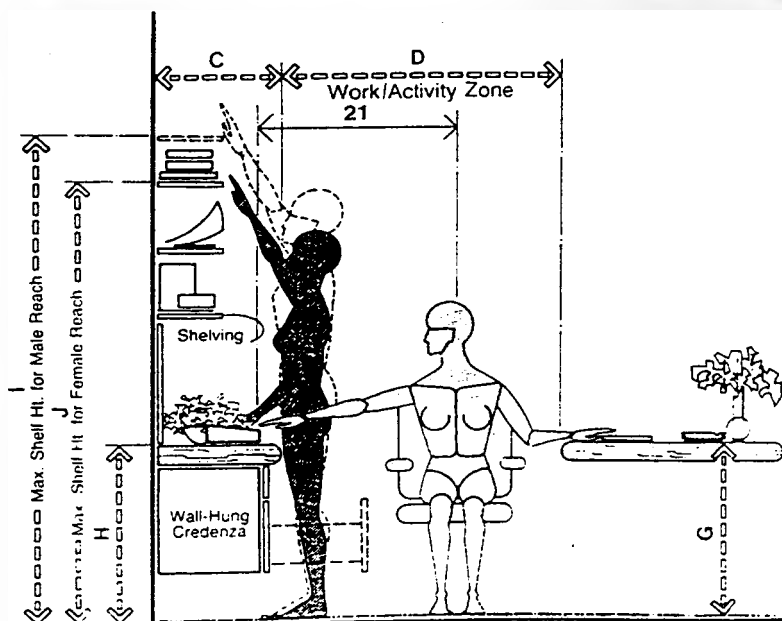


EXECUTIVE DESK/ BASIC CLEARANCES

3.1 THE PRIVATE OFFICE

The use of the overhangs, shown on the top drawing, can make a desk suitable for a small conference. As indicated, both knee and toe clearances are a factor. A 42-in., or 106.7-cm, minimum dimension is recommended for the work/activity zone. However, if filing or storage units are provided behind this zone, additional space should be allocated for drawer extension and door swings. In many instances, the work/activity zone distance is also determined by the size of the executive chair, its tilt and swivel mobility, and the work habits of the executive. Side arm reach, as shown in the bottom drawing is often critical in establishing the work/activity zone if specific business equipment, such as calculators, telephones, keyboards, must be within easy reach. The height of the desk as well as that of the credenza behind it will vary from manufacturer to manufacturer. Popliteal height, knee height, and thigh clearance should always be considered in establishing the relationship between seat height and desk height.

Frequently, the executive workstation will be provided with a credenza behind the desk, with vertical storage or shelving above. Assuming that ease of access to the top shelf is of importance, it is recommended that the maximum shelf height to accommodate male reach be no greater than 72 in., or 182.9 cm, and for female reach no greater than 69 in., or 175.3 cm.



EXECUTIVE DESK/ CREDENZA CONSIDERATIONS

	in	cm
A	30-45	76.2-114.3
B	42 min.	106.7 min.
C	18-24	45.7-61.0
D	23-29	58.4-73.7
E	5-12	12.7-30.5
F	14-22	35.6-55.9
G	29-30	73.7-76.2
H	26-30	71.1-76.2
I	72 max	182.9 max
J	69 max	175.3 max

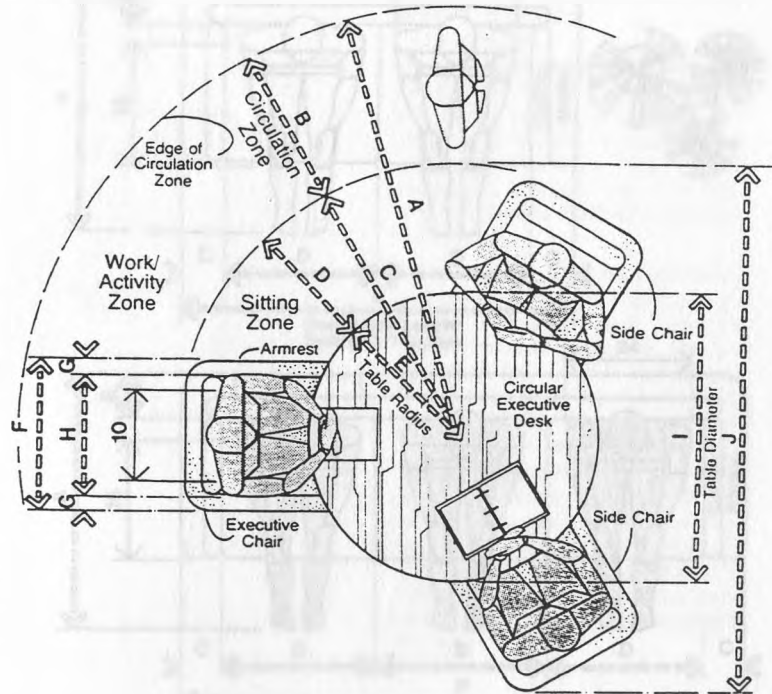
3.1 THE PRIVATE OFFICE

Many private executive offices are being designed with desks that do not conform with the basic rectangular shape. Such a situation is illustrated in the drawing at the top which shows a circular executive desk. Such a desk is often selected if the executive in question plans to hold conferences within the office and prefers the psychology of having either visitors or employees gather around the worksurface in an egalitarian fashion. While a minimum desk size of 48 in, or 121.9 cm, is shown, this dimension is also influenced by the number of side chairs to be grouped around the desk.

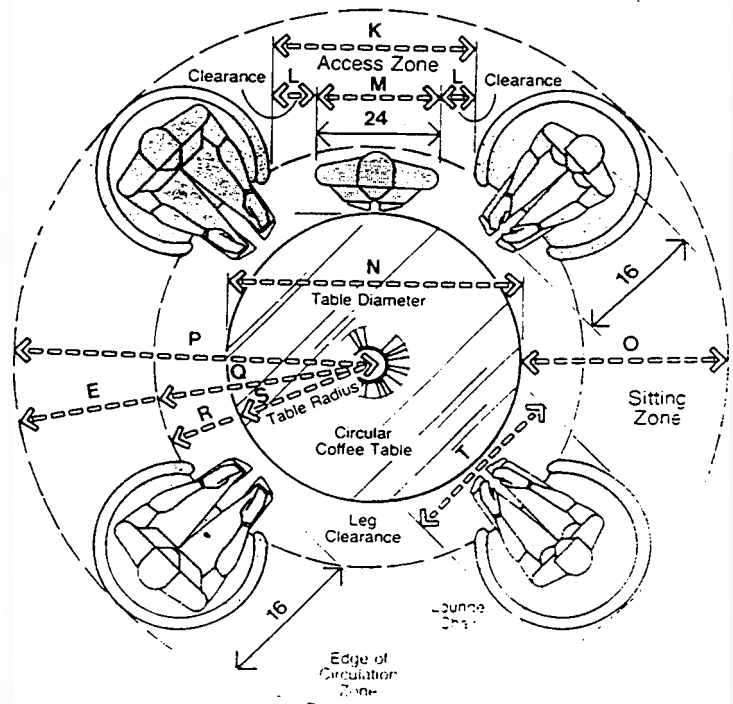
A circular executive desk must be supported by supplementary credenza or file storage within easy reach of the executive chair. Side arm reach relative to the work/activity zone must always be studied carefully.

The drawing at the bottom illustrates a typical circular lounge grouping found within an executive office. Providing for the appropriate leg clearance of 12 to 18 in, or 30.5 to 45.7 cm, is also determined by the sitting zone requirements. Buttock-knee length must also be considered.

	in	cm
A	77-88	195.6-223.5
B	30	76.2
C	46-58	116.8-147.3
D	22-28	55.9-71.1
E	24-30	61.0-91.4
F	24-28	61.0-71.1
G	2-3	5.1-7.6
H	20-22	50.8-55.9
I	48-60	121.9-152.4
J	92-116	233.7-294.6
K	36-42	91.4-106.7
L	6-9	15.2-22.9
M	24	61.0
N	42-60	106.7-152.4
O	36-48	91.4-121.9
P	57-78	144.8-198.1
Q	33-48	83.8-121.9
R	12-18	30.5-45.7
S	21-30	53.3-76.2
T	24-32	61.0-81.3



CIRCULAR EXECUTIVE DESK



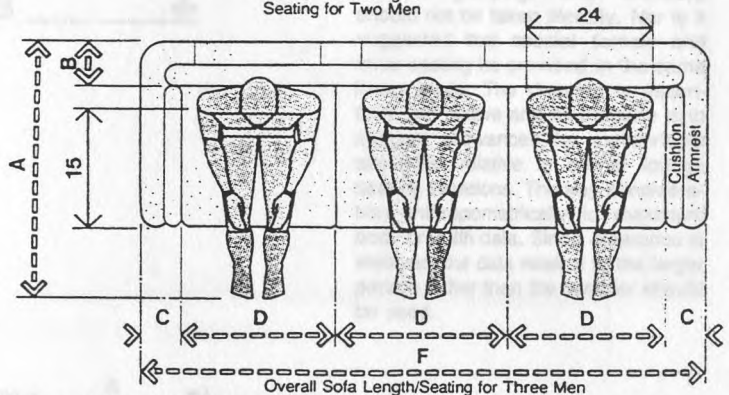
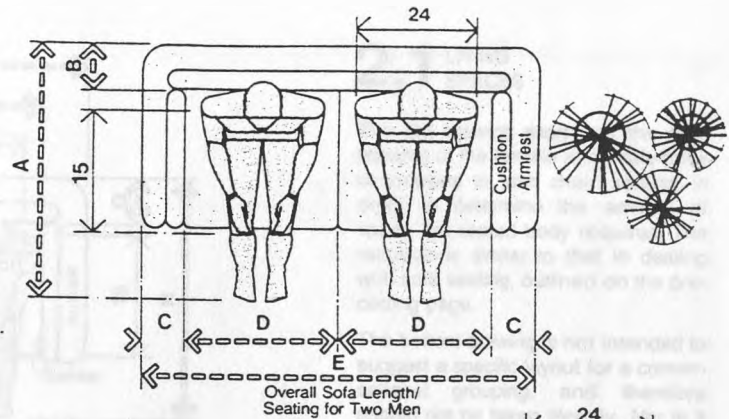
CIRCULAR LOUNGE GROUPING

2.1 LIVING SPACES

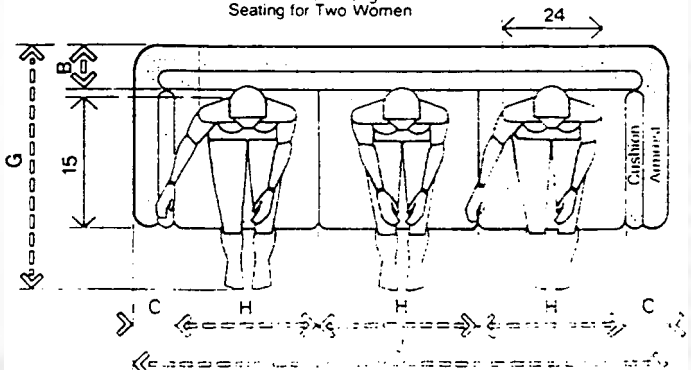
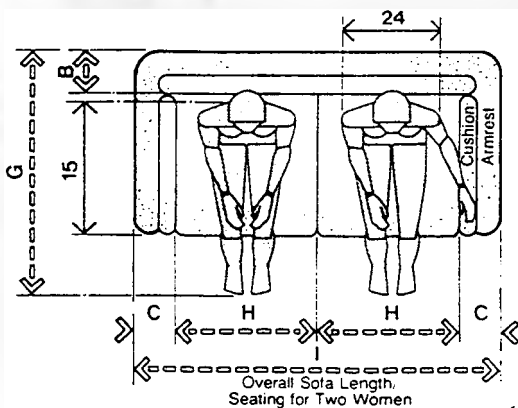
The drawings here examine the relationship of female and male body dimensions to sofa seating, in order to determine how much space the seated body requires. The anthropometric measurements of major interest here are maximum body breadth and buttock-popliteal length.

The top drawing deals with male dimensions; based on 95th percentile data, the maximum body breadth dimension is 22.8 in, or 57.9 cm, with a nude subject. Allowing for clothing and some body movement as well as change in posture and position, a minimum dimension of 28 in, or 71.1 cm, is suggested as a width allowance for a seated person. The overall dimension, therefore, includes the individual width allowances and the width of a sofa arm construction, which obviously can vary depending on personal design preference. A range of 3 to 6 in, or 7.6 to 15.2 cm, is suggested. Using the buttock-popliteal length of the smaller person and adding a similar allowance of 6 to 9 in, or 15.2 to 22.9 cm, for backrest construction as well as a minimum zone in front of the sofa for foot movement, an overall depth dimension of 42 to 48 in, or 106.7 to 121.9 cm, is suggested. The rationale for the drawing at the bottom dealing with female data is the same. The information should prove not only useful in providing a keener insight into the general relationship between body size and furniture but of specific value in establishing preliminary design assumptions for institutional seating in spaces designed exclusively for the use of males or of females. In spaces where seating is to be used by both sexes, the larger dimensions should apply.

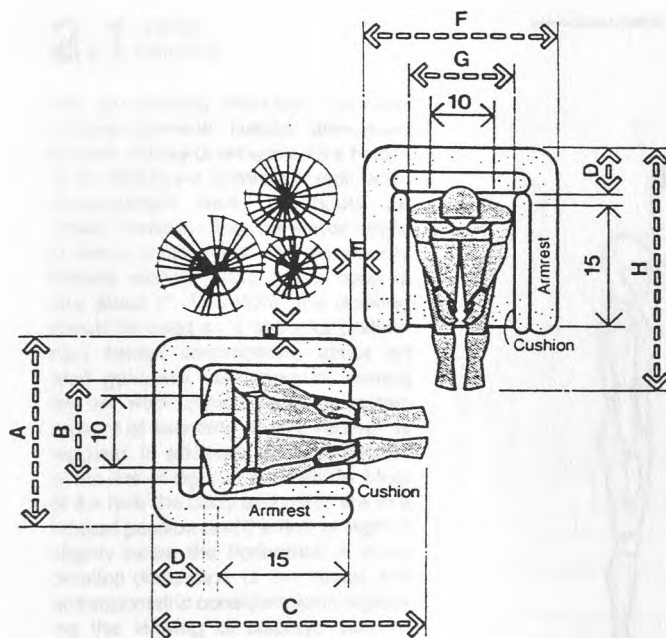
	in	cm
A	42-48	106.7-121.9
B	6-9	15.2-22.9
C	3-6	7.6-15.2
D	28	71.1
E	62-68	157.5-172.7
F	90-96	228.6-243.8
G	40-46	101.6-116.8
H	26	66.0
I	58-64	147.3-162.6
J	84-90	213.4-228.6



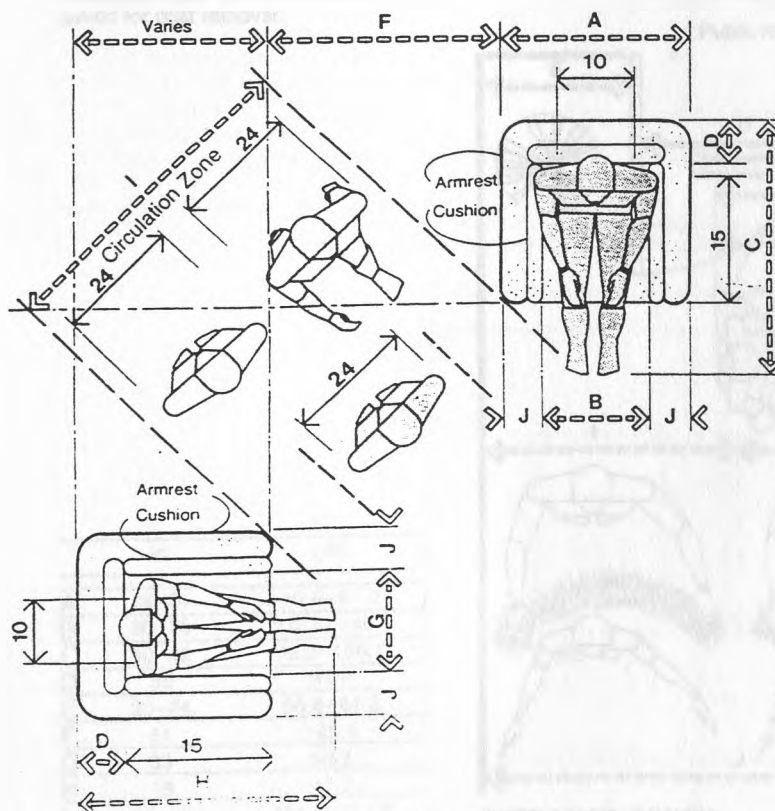
SOFA SEATING / MALES



SOFA SEATING FEMALE



**CORNER LOUNGE CHAIR SEATING/
MALE AND FEMALE**



CORNER LOUNGE SEATING WITH CIRCULATION

2.1 LIVING SPACES

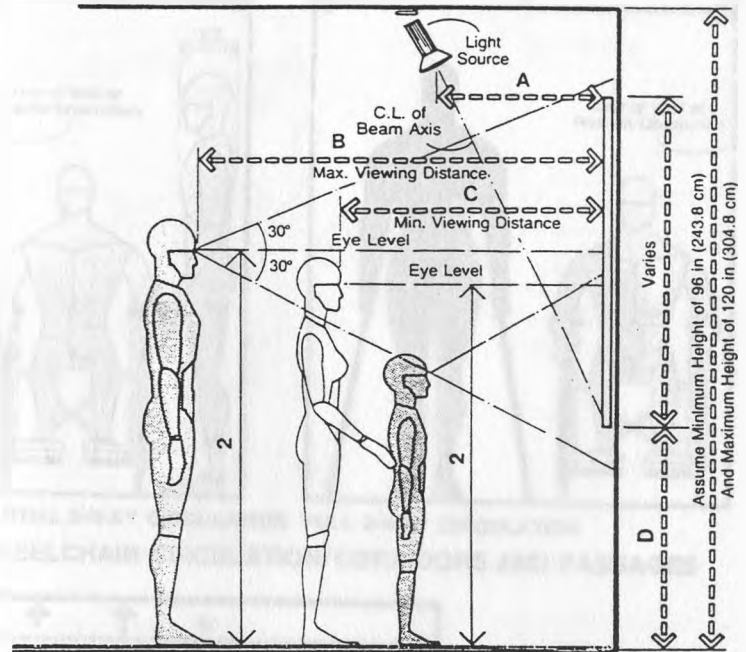
The top drawing examines the relationship of the female and male body dimensions to arm chair seating in order to determine the amount of space the seated body requires. The rationale is similar to that in dealing with sofa seating, outlined on the preceding page.

The bottom drawing is not intended to suggest a specific layout for a conversational grouping, and therefore should not be taken literally. Nor is it suggested that special female and male seating be provided in the same living space. The drawing is essentially informative and its purpose is to suggest allowances for comfortable circulation relative to corner lounge seating situations. The key consideration anthropometrically is maximum body breadth data. Since clearance is involved, the data related to the larger person rather than the smaller should be used.

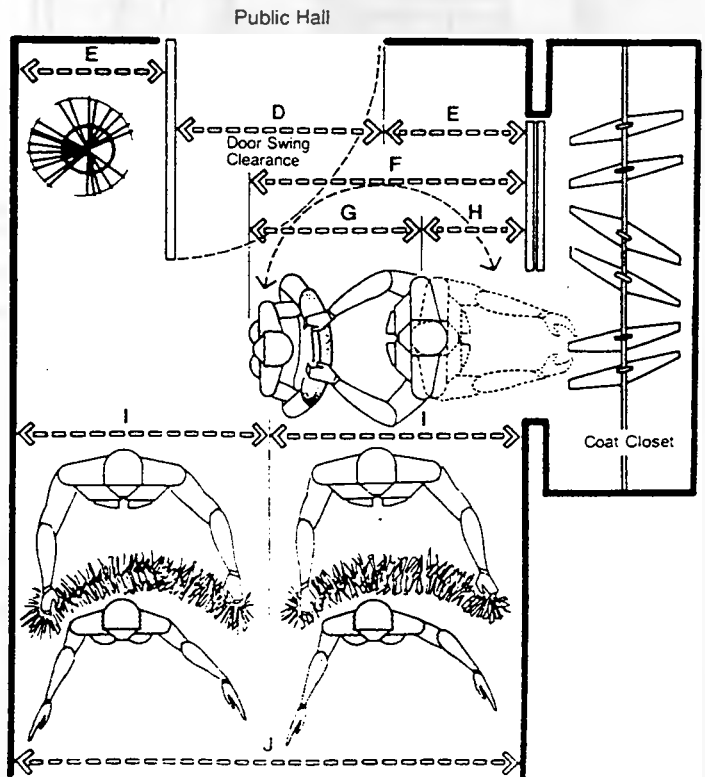
	in	cm
A	34-40	86.4-101.6
B	28	71.1
C	42-48	106.7-121.9
D	6-9	15.2-22.9
E	3	7.6
F	32-38	81.3-96.5
G	26	66.0
H	40-46	101.6-116.8
I	48-60	121.9-152.4
J	3-6	7.6-15.2

2.1 LIVING SPACES

The top drawing illustrates the relationship between human dimension and the display of art work. Eye height is the significant anthropometric body measurement here. It should be noted, however, that the visual angle in which small detail can be sharply defined without rotating the eyes is only about 1° . Therefore, the drawing should be used as a basis for preliminary design assumptions about art work generally, and even in viewing the art work shown here, a certain amount of scanning or eye rotation is required. In addition, the horizontality of the line of sight is theoretical. Most of the time the body and head are in a relaxed position and the line of sight is slightly below the horizontal. A more detailed discussion of the visual and anthropometric considerations regarding the viewing of displays can be found in Section 9 in Part C. The bottom drawing provides some useful information concerning human dimension and the clearances required for coat removal.



DISPLAY OF ARTWORK



ENTRANCE FOYER
REQUIRED CLEARANCES FOR COAT REMOVAL

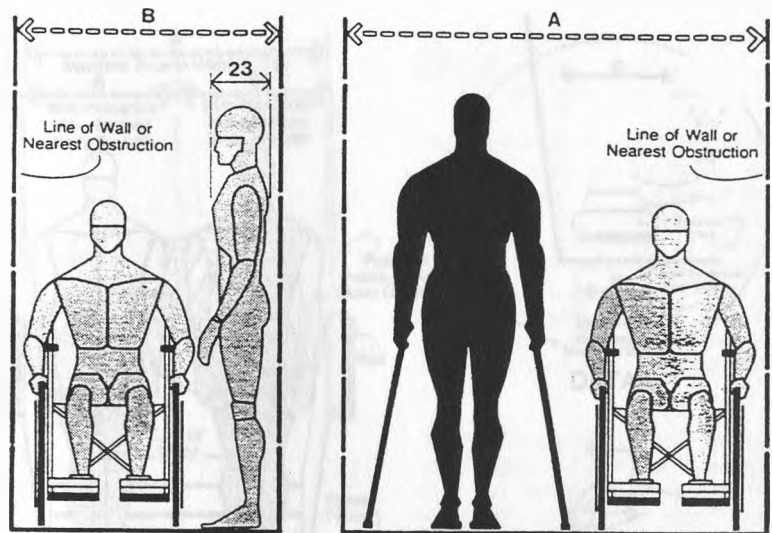
	in	cm
A	16-24	40.6-61.0
B	60-78	152.4-198.1
C	30-42	76.2-106.7
D	36	91.4
E	20-24	50.8-61.0
F	51	129.5
G	33	83.8
H	18	45.7
I	40-44	101.6-111.8
J	80-88	203.2-223.5

8.1 HORIZONTAL CIRCULATION SPACES

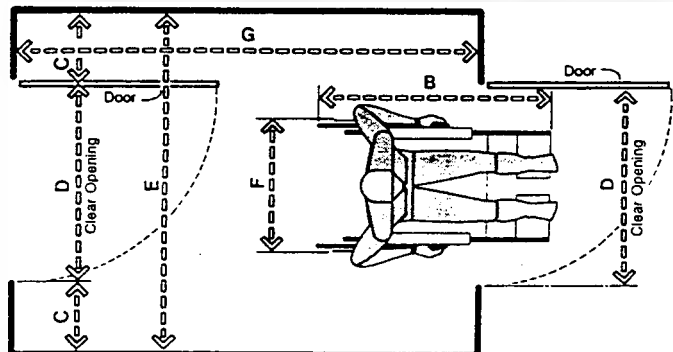


The top drawing indicates that a 60-in, or 152.4-cm, clearance is necessary for a person on crutches to walk along side or pass a person in a wheelchair. A 42-in, or 106.7-cm, clearance is needed to accommodate a person standing sideways, while allowing a wheelchair-bound person to pass. The other two drawings indicate the clearances necessary to accommodate a wheelchair in spaces where a series of two doors are involved. One drawing illustrates a situation where the two doors are in a row and the other where the doors are at right angles. A clearance of 84 in, or 213.4 cm, is necessary to allow the wheelchair to clear the first door as it swings shut. Since the length of the wheelchair is 42 in, or 106.7 cm, the 84-in dimension would allow for a door as wide as 36 in, or 91.4 cm, and an additional clearance of 6 in, or 15.2 cm, to spare. The 12-in, or 30.5-cm, minimum clearance on either side of the door allows enough maneuvering room for the wheelchair to approach the door at a slight angle and a person to grasp the door knob or pull and then back away. This is helpful when approaching the door from the in-swing side. When the doors are located at right angles to each other, it is essential that adequate space be provided to avoid interference between the two doors.

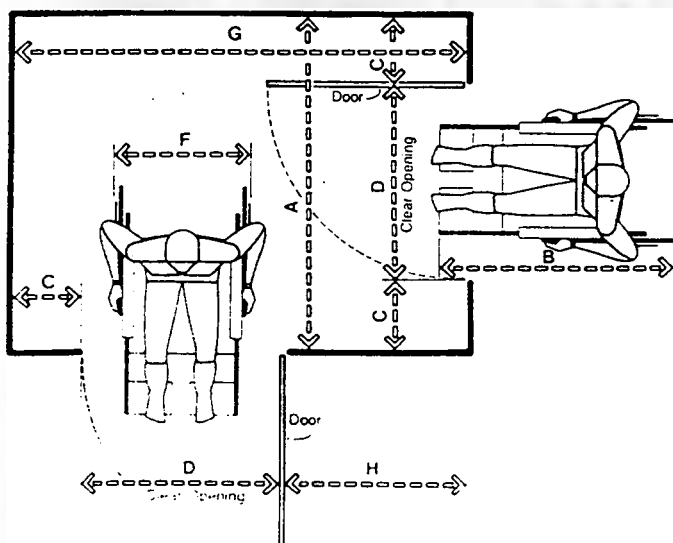
	in	cm
A	60	152.4
B	42	106.7
C	12 min.	30.5 min.
D	32	81.3
E	56 min.	142.2 min.
F	25	63.5
G	84	213.4
H	36 min.	91.4 min.



PARTIAL 2-WAY CIRCULATION FULL 2-WAY CIRCULATION
WHEELCHAIR CIRCULATION/CORRIDORS AND PASSAGES



WHEELCHAIR CIRCULATION / DOORS IN ALIGNMENT



WHEELCHAIR CIRCULATION DOORS AT RIGHT ANGLES

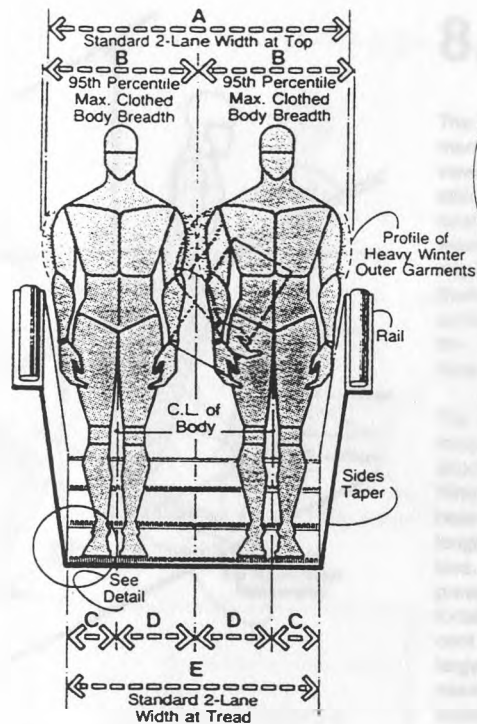
8.2 VERTICAL CIRCULATION SPACES

The drawing of the 48-in, or 121.9-cm, two-lane escalator is intended to illustrate that 48 in is inadequate to comfortably accommodate larger-sized people on the same tread. Moreover, the 40-in, or 101.6-cm, clearance at the bottom limits the user's stance, thereby reducing body stability. Stair motion, body contact, and lack of stability, taken together, present a safety hazard. This may account for the fact that the presence of two people on the same tread is not a very frequent occurrence.

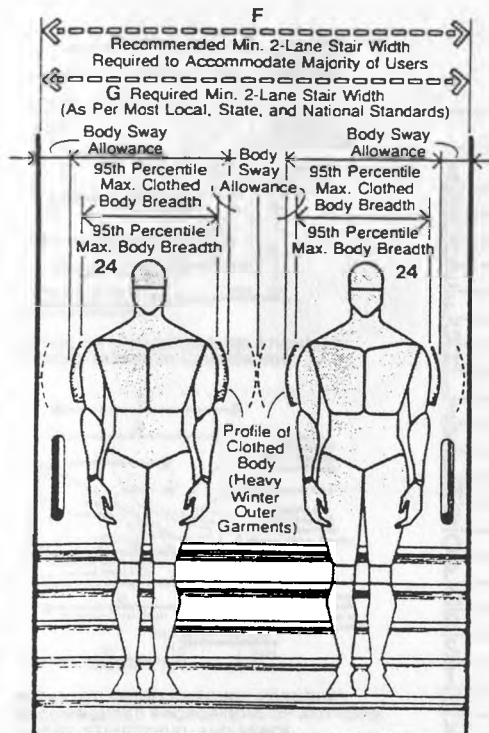
The authors contend that the standard 44-in, or 111.7-cm, stair width, based on two 22-in, or 55.9-cm, body increments, will not accommodate those of larger body size. The argument against the 22-in increment is presented in the text related to the first drawing in Section 8.1.

Rail clearance should accommodate the hand thickness of the larger user and handrail size, the inside grip diameter of the smaller user. Adding glove thickness to the data shown in the drawing, a 2-in, or 5.1-cm, clearance and a 1.5-in, or 3.8-cm, rail diameter will accommodate most people.

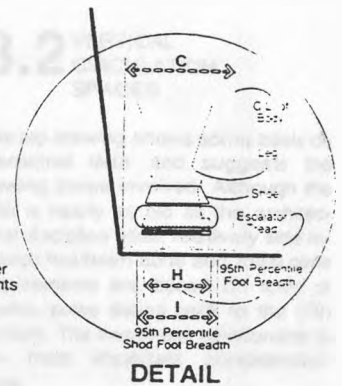
	in	cm
A	48	121.9
B	25.8	65.5
C	7.1	18.0
D	12.9	32.8
E	40	101.6
F	68	172.7
G	44	111.8
H	4.2	10.7
I	4.9	12.4
J	2 min.	5.1 min.
K	1.5	3.8
L	3.5 max.	8.9 max.
M	30-34	76.2-86.4
N	1.5 min.	3.8 min.



ESCALATORS



STAIRS EXISTING AND RECOMMENDED 2-LANE WIDTH

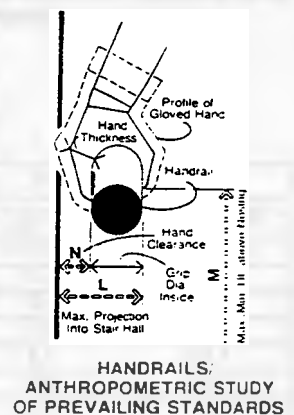


DETAIL

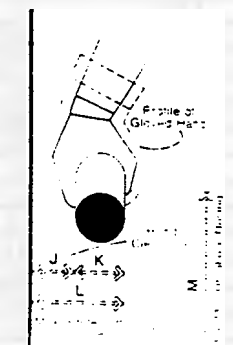


GRIP DIAMETER INSIDE

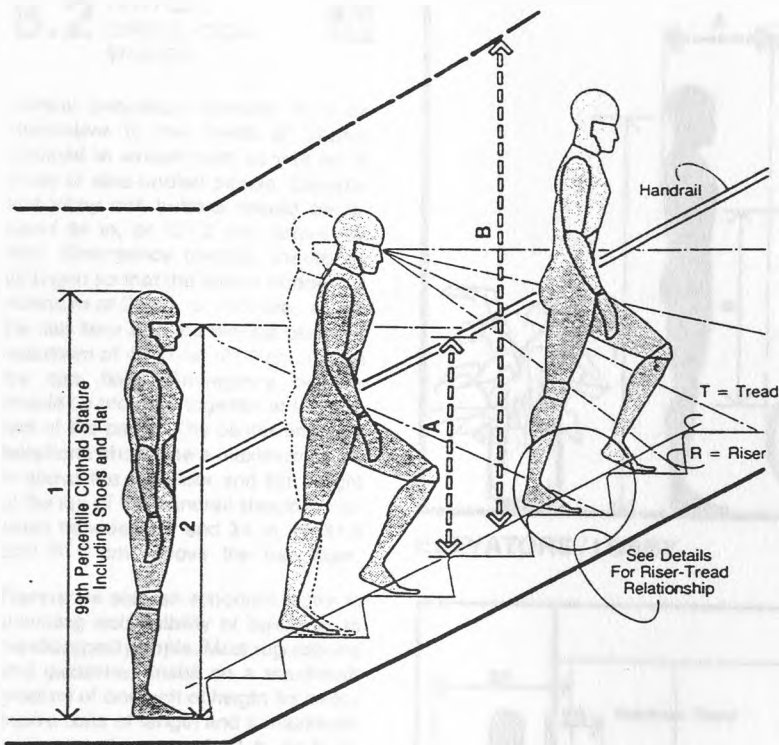
HAND THICKNESS



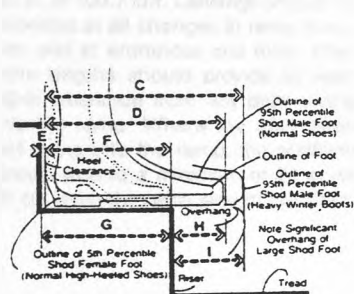
HANDRAILS: ANTHROPOMETRIC STUDY OF PREVAILING STANDARDS



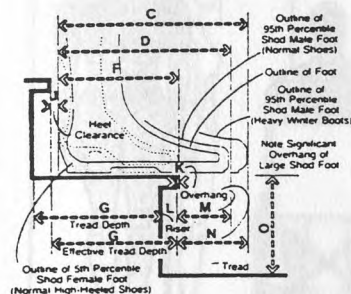
HANDRAILS: RECOMMENDED DESIGN BY AUTHORS



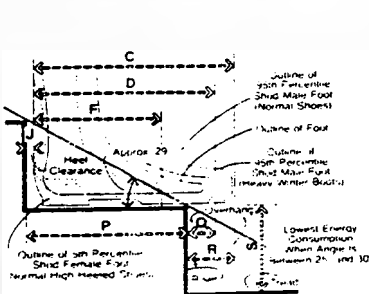
STAIRS



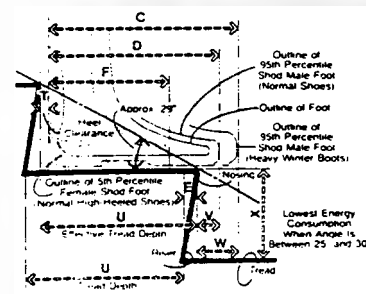
DETAIL OF TREAD-RISER RELATIONSHIP/
SCHEMATIC ANTHROPOMETRIC STUDY



DETAIL OF TREAD-RISER RELATIONSHIP/
TYPICAL DESIGN IN COMMON USE



TREAD-RISER RELATIONSHIP
RECOMMENDED PROPORTIONS
(LEHMAN, 1962)



DETAIL OF TREAD-RISER RELATIONSHIP
RECOMMENDED PROPORTIONS BY AUTHORS
WHERE STRUCTURAL AND SPACE
CONDITIONS PERMIT

DETAILS OF TREAD-RISER RELATIONSHIP

8.2 VERTICAL CIRCULATION SPACES

The top drawing shows some basic dimensional data and suggests the viewing zones involved. Although the stair is nearly as old as the architectural discipline itself, relatively little research has been done and most code requirements are based on rules of thumb, some dating back to the 17th century. The tread-riser relationship is the most important consideration here.

The bottom drawings show the anthropometric relationship between shod foot length and tread depth. Ninety-five percent of users with heavy winter boots have a shod foot length of about 9 in, or 22.9 cm, or less. The 9.5-in, or 24.1-cm, tread presently in common use allows comfortable tread contact for only 5 percent of the users, while the foot of the larger user overhangs the tread by more than 5 in, or 12.7 cm—certainly a cause for concern, especially for old and physically disabled people.

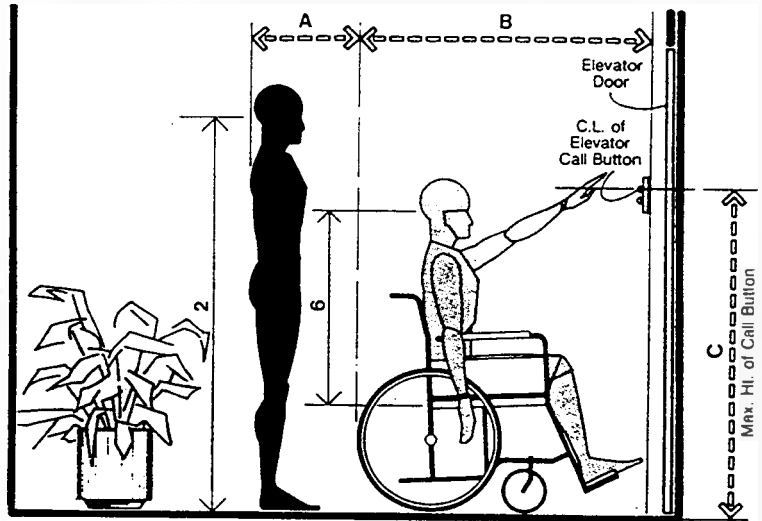
	in	cm
A	30–34	76.2–86.4
B	84 min.	213.4 min.
C	14.3	36.3
D	12.9	32.8
E	0.3	0.6
F	9.1	23.1
G	9.5	24.1
H	3.7	9.3
I	5	12.7
J	0.5	1.3
K	0.1	0.3
L	1.3	3.2
M	3.9	9.9
N	5.3	13.5
O	7.5	19.1
P	11.4	29.0
Q	2	5.1
R	3.4	8.6
S	6.7	17.0
T	5–1	13–25
U	11.8	29.8
V	5–2	13–51
W	5–2	13–51
X	5–2	13–51

8.2 VERTICAL CIRCULATION SPACES

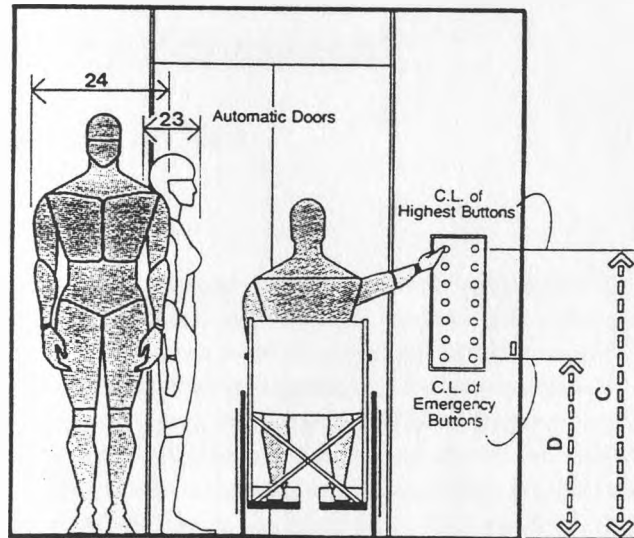


Vertical circulation systems must be responsive to the needs of people confined to wheelchairs as well as to those of able-bodied people. Corridor and lobby call buttons should be located 54 in, or 137.2 cm, above the floor. Emergency controls should be arranged so that the lowest button is a minimum of 30 in, or 76.2 cm, above the cab floor and the highest button a maximum of 48 in, or 121.9 cm, above the cab floor. Emergency buttons should be grouped together at the bottom of the panel. The center line of a telephone should be a maximum of 48 in above the cab floor and the height at the top of the handrail should be located between 32 and 34 in, or 81.3 and 86.4 cm, above the cab floor.

Ramps are also an important factor in providing accessibility of buildings to handicapped people. Most regulations and guidelines insist on a maximum gradient of one unit of height for every twelve units of length and a maximum horizontal distance of 30 ft, or 9 m, without a horizontal landing of at least 42 in, or 106.7 cm. Landings should be provided at all changes in ramp direction and at entrances and exits. Platform lengths should provide at least 42-in clearance from any door swing into the ramp. Where the door does not swing into the ramp, the platform should extend a minimum of 24 in, or 61 cm, past the latch side of the door.

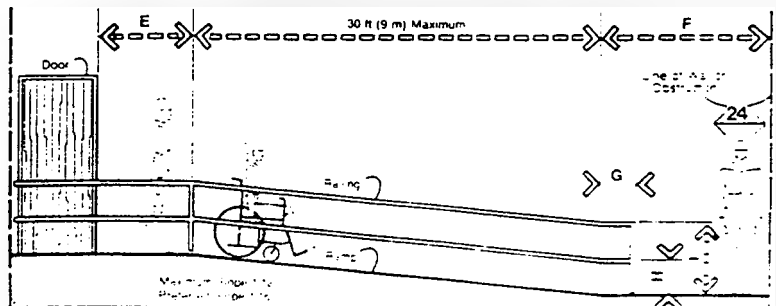


ELEVATORS / LOBBY



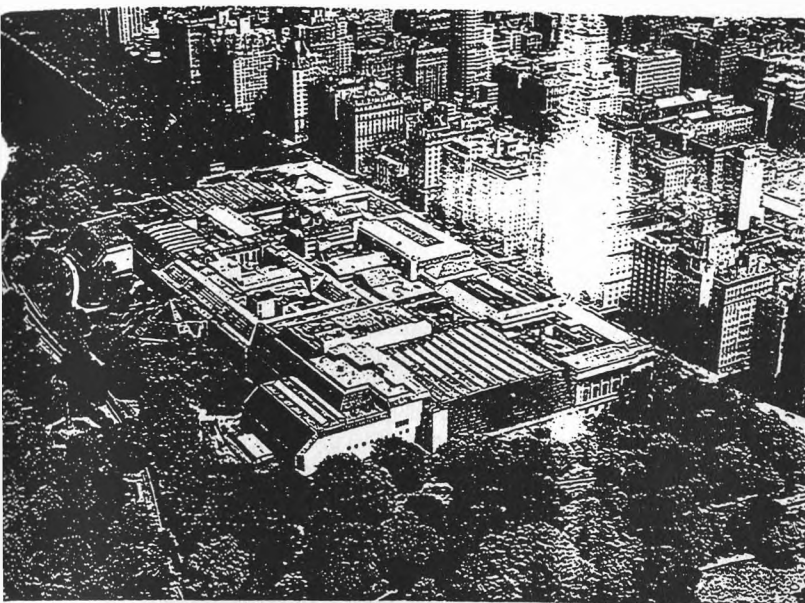
ELEVATORS / CAB INTERIOR

	in	cm
A	18	45.7
B	48 min.	121.9 min.
C	54 max.	137.2 max.
D	30	76.2
E	42 min.	106.7 min.
F	72 min.	182.9 min.
G	12-16	30.5-40.6
H	18-20	45.7-50.8
I	32-34	81.3-86.4



ACCESS RAMP

B. ECS



1. The Metropolitan Museum of Art, facing northeast

Color and Light in the Museum Environment

CHRISTOPHER MCGLINCHY

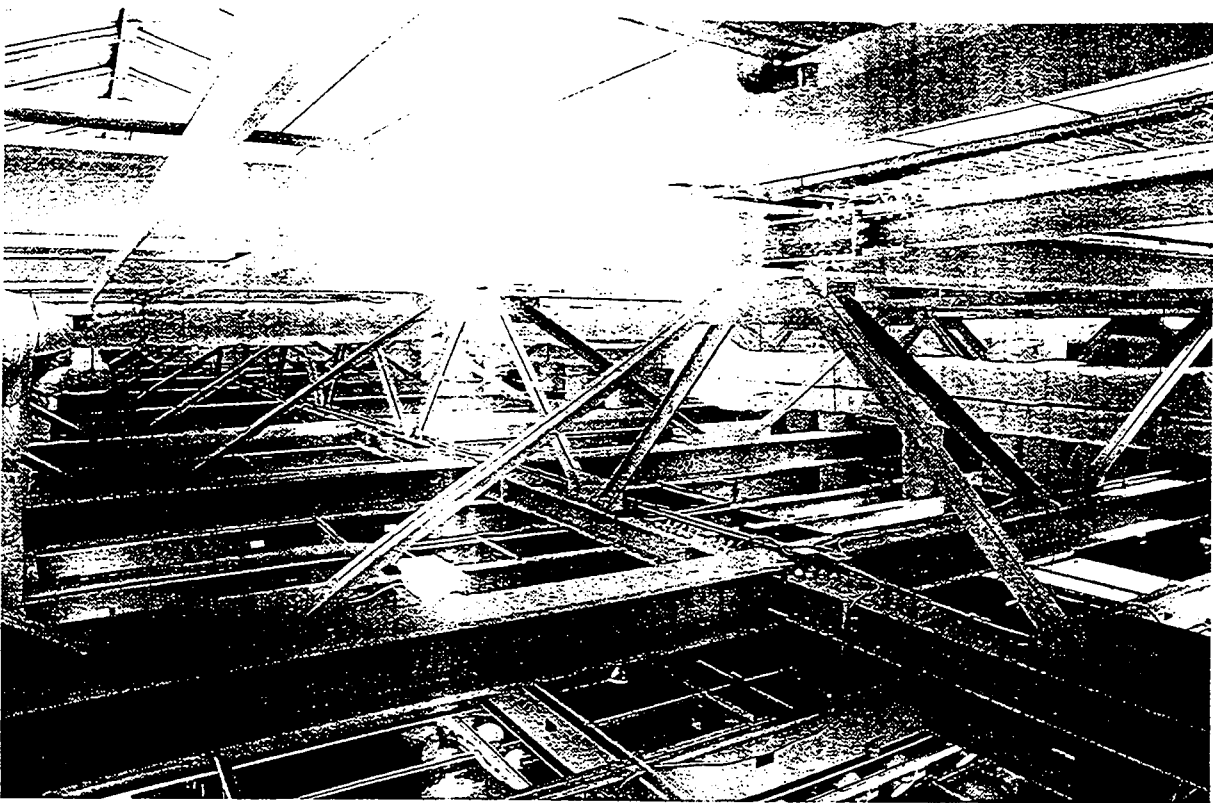
Research Chemist

Artworks displayed in museums come from a variety of origins. Consequently, it is impossible to reproduce the design elements from their original settings and still maintain a coherent display in a new museum environment. Lighting, however, can subtly tie together an arrangement of works of art with diverse provenances. Furthermore, for museum-goers who wish to examine closely an artist's technical execution and style, light that is carefully balanced for each picture is required to render these elements visible. Proper lighting will optimize the viewer's ability to see nuances of artistic intent without distraction or eye fatigue and at the same time will minimize detriment to the physical state of the work. This brief essay will discuss varieties of lighting, how they affect our perception of paintings, and what constraints museums must operate under to provide illumination that will not damage the art.

The sun is the standard against which other light sources are measured. However, the illumination cre-

ated by sunlight is very difficult to characterize in only one way since the sun's position in the sky and its interaction with the earth's atmosphere produce a wide range of light qualities. This range is contingent upon the dynamic relationships between the sun, the illuminated objects, and the viewer. Cloud cover is an additional factor that, when present, also modifies the quality of daylight. The standard, however, is based on the fact that the sun is a universal source of light. Fortunately, the sun emits a continuous band of radiation throughout the entire visible light spectrum. ("Visible light" is the term generally used to denote wavelengths perceptible to the human eye, although other species of animals may be able to discern light of wavelengths we cannot see.) Evidence of the continuous and broad range of colors in sunlight can be seen in rainbows.

In order for any color to be accurately registered by the eye it is necessary for light of that particular wavelength to be present in the light source. For instance, a green object seen in red light will appear



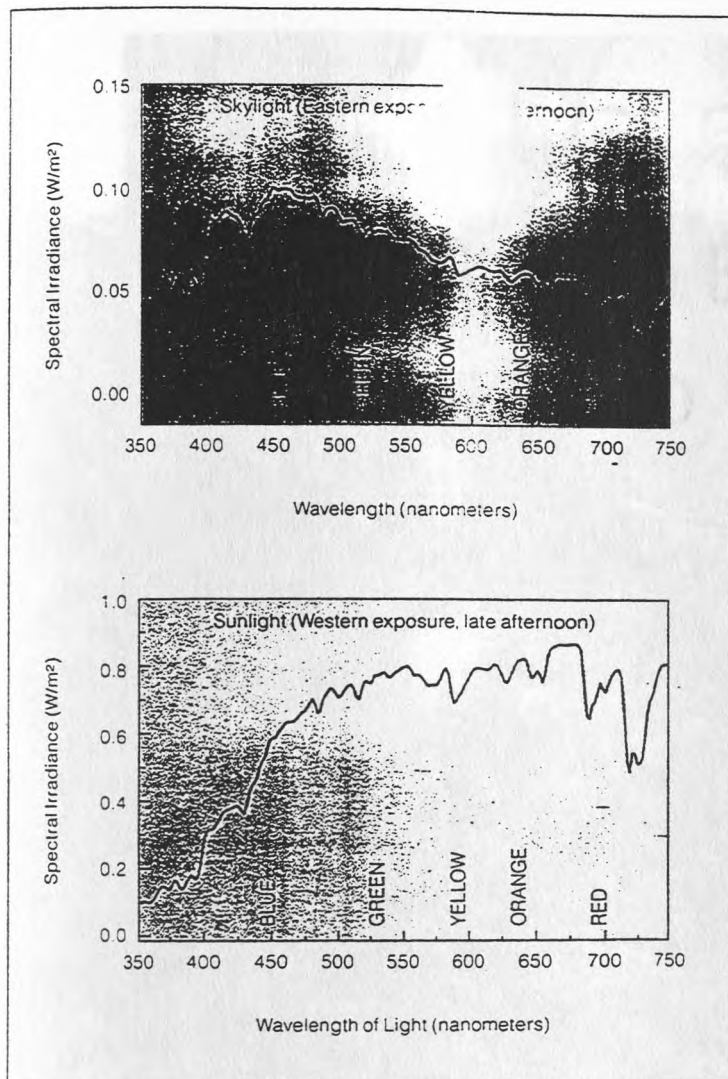
2. Attic space above the Nineteenth-Century European Paintings and Sculpture Galleries. As direct sunlight comes through the skylight (upper left) it is diffused through translucent panels (center top) to maintain an even distribution of light in the galleries as the sun changes position. Supplemental fluorescent lights (left) are reflected off the panels into the

gallery space below to supplement skylight when natural light is low. Spotlights (center bottom) are directed at the artworks below. (Note: The actual color of the fluorescent lamps is a warm yellow. Because a variety of light sources had to be accounted for, the film used for this photograph created an apparent green color shift in recording the fluorescent light.)



3. Manet Gallery in the exhibition space of the Nineteenth-Century European Paintings and Sculpture Galleries. Here Manet's paintings are displayed on all four walls. Fortunately,

from nearly every vantage point in the gallery glare has been eliminated so that the works can be compared instantly, without viewers having to reposition themselves.



4. The visible light distribution of late-afternoon summer daylight, from readings taken from the rooftop of the Metropolitan: top, detector facing east (skylight); bottom, detector facing west (sunlight).

The background of each graph is the color of the portion of the sky from which the measurement was taken. As the background color suggests, the curve of the top figure (skylight) shows relatively more blue than yellow, while the bottom graph (sunlight) indicates slightly less blue, hence somewhat more yellow, light.

5. Opposite: Cosimo Roselli, Italian (Florentine), 1439–1507. *Madonna and Child with Angels* (detail). Tempera on wood, 33½ × 23 in. (85.1 × 58.4 cm). The Friedsam Collection, Bequest of Michael Friedsam, 1931 (32.100.84)

The blueness of distant hills was faithfully depicted by artists, as demonstrated in this detail, long before scientists could explain what caused the effect. Although Leonardo da Vinci (1452–1519) showed by experiment that water vapor scatters light, it was not until John William Strutt, third baron Rayleigh (1842–1919), a noted British physicist, demonstrated the relationship between wavelengths of light and scattering that this phenomenon was fully understood.

gray, while in white light, which is actually composed of all colors, whether the source is natural or man-made, the object will appear green, as it can then reflect the green component of the light. Because of its continuous range of wavelengths, illumination from the sun provides unbiased color registration for all colors. Although the time of day, season, and type of weather alter natural light, the human eye, to a certain extent, can adapt to these changes and maintain the accurate perception of an object's color.

The most drastic alteration in sunlight's appearance is caused by molecules in the atmosphere that are capable of scattering the sun's radiation. These molecules can be anything from the gases that are the basis of Earth's atmosphere and those produced by living plants to various particles suspended in the

air, such as microscopic dust and other matter. The only requisite for this phenomenon is that the molecules be within a certain size range, which even at the high end is still below the detection limits of the unaided human eye. The degree to which light is scattered depends upon its wavelength, with the shortest wavelength, that is, blue, undergoing the greatest scattering. Consequently, once the sun's rays enter Earth's atmosphere, the blue component will be scattered away from the straight line between the sun and the earth. (Leonardo da Vinci noted that there is often sufficient atmosphere between a viewer and distant mountains to make them appear bluer than closer mountains; see fig. 5.) Scattered blue light (called skylight) forms the color of Earth's sky, while the subtraction of this blue component from the direct light path makes the remaining sunlight

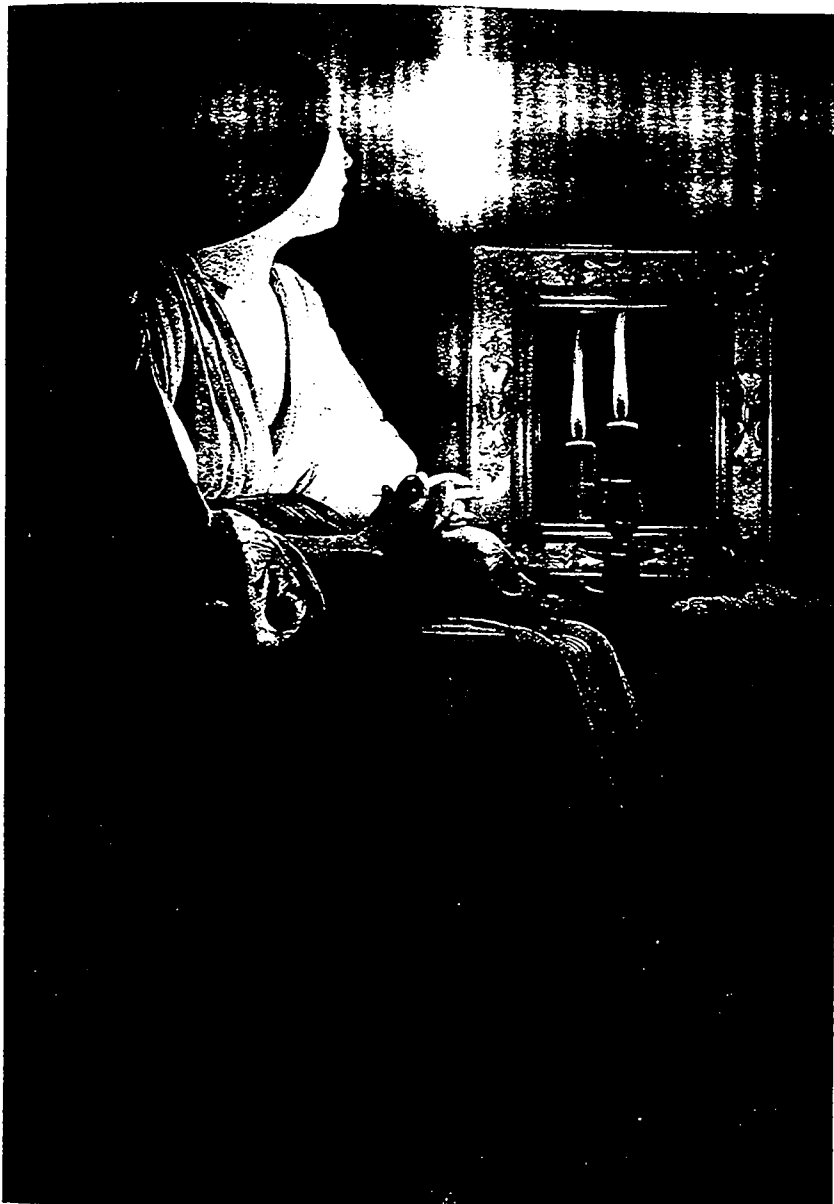


and the sun itself appear yellow. Together, sunlight and skylight constitute daylight (fig. 4).

At nearly any time of day it is possible to illuminate an object with a particular color of light, formed by sunlight or skylight, by adjusting how the object is positioned relative to the sun. For example, since in the northern hemisphere the sun travels through the southern sky, windows facing north will always transmit a consistent blue (often referred to as cool) skylight rather than sunlight. By contrast, illumination based upon sunlight (that is, from southern windows) will vary in color as the sun moves from east to west. Additionally, walls facing eastern exposures will appear warm in morning light and cool in afternoon light, while for those opposite western windows the reverse is true. It is perhaps artists' desire for consistent light that usually results in northern

exposures the preferred natural light source for those in this hemisphere.

In galleries that use daylight as a source of illumination, a painting's appearance can alter throughout the day. The extent of this change is dependent upon the conditions mentioned above, on how natural light is directed by the architecture of the space, and on the artist's palette and painting technique. If the artist's palette is restricted to certain colors, what is referred to as a color trait or key becomes apparent: that is, the painting will have a predominantly cool or warm tone, or may show a preponderance of a specific individual color. The technique of juxtaposing colors can affect the color trait. For example, small highlights of warm or cool pigments adjoining a neutral white area will make the entire white passage appear, respectively, warmer or cooler. Illu-



6. Georges de La Tour, French, 1593–1652.
The Penitent Magdalen, ca. 1638–43.
 Oil on canvas, 52½ × 40¼ in. (133.4 × 102.2 cm).
 Gift of Mr. and Mrs. Charles Wrightsman,
 1978 (1978.517)

In this painting La Tour was restricted to a warm palette since the candle and its mirror image are the sole illuminants for the scene. All of the elements in this picture, from the subject's skin tone and garments to the symbolic objects, contain small amounts of yellow, orange, or red pigments added to shift these elements to a warm tone. With his technique and palette, La Tour convinces the viewer that the light from the candle does not extend far beyond the boundaries of the frame and that there is no stray light from other sources.

mination conditions can either augment or diminish such chromatic leitmotifs. A painting in cool tones directly illuminated by natural light from western windows, for instance, is likely to appear more vibrant in the morning than in the afternoon, since in the early hours the illumination will be cool sky-light. The reverse would be true for a work in warm tones under the same conditions. Thus, in order to emphasize subtle colorations, regardless of whether or not the natural light of any particular moment supports them, properly colored supplemental lights can be directed on the painting. In this respect, the objective of gallery lighting, whether natural, artificial, or a mixture, is to provide suitable color or-

match in the wavelengths from the light source that the tone of the painting as originally intended by the artist is always apparent.

Incandescent lights produce light based on the same fundamental principles as sunlight. Elements within the bulb, or lamp, are heated to a high enough temperature that they begin to glow—the higher the temperature the bluer, or cooler, the appearance of the light. This concept is well known to photographers, who often have to know the color "temperature" of a subject's illumination so that they can use the corresponding film. A low color temperature implies a warm, or yellow, light, while a high temperature indicates a whiter light. Although

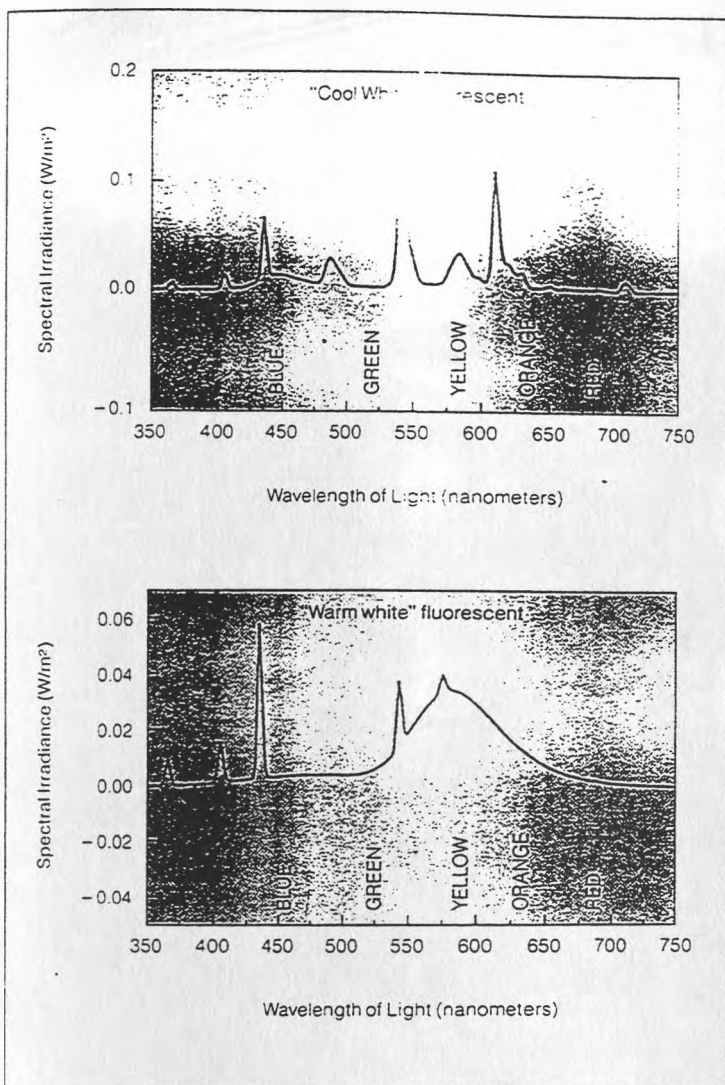


7. Johannes Vermeer, Dutch, 1632–1675.
Young Woman with a Water Jug, early 1660s.
 Oil on canvas, 18 × 16 in. (45.7 × 40.6 cm).
 Gift of Henry G. Marquand, 1889 (89.15.21)

In this painting Vermeer uses a predominantly cool palette. The skylight from the window cools the highlights in the young woman's skin. Her hood and collar have a crispness that was achieved by adding a small amount of blue pigment to the white garment: a cool blue light is also transmitted through the hood to provide a faint outline of the back of her head. The surfaces of the silver tray and jug that face the window or the reflective blue fabric are clearly shifted toward blue and the blue geometric pattern of the oriental rug is so intense it is difficult for the viewer to focus on it and the adjacent orange at the same time.

incandescent sources are good at mimicking direct sunlight they are still incapable of re-creating the bluish cast of skylight because of the insufficient distance, and hence atmospheric scattering, between the source and the viewer. Tungsten lamps filled with inert gaseous halogens (tungsten-halogen), which can burn efficiently at higher temperatures than conventional light bulbs, produce the whitest light available from incandescent sources; however, even these lamps cannot reproduce blue, northern skylight. If desired, it is possible to vary the appearance of incandescent light by transmitting it through blue-tinted filters or by reflecting it off walls that have a cool tint.

Fluorescent lights create illumination on a principle different from that of either sunlight or incandescent sources. The coatings inside fluorescent lamps absorb high-energy ultraviolet (UV) radiation from mercury vapor inside the tube and emit visible light at discrete wavelengths. In fluorescent light these discrete wavelength emissions correspond to different colors of visible light. The inner coating can be modified so that the resulting colors can add up to a light that appears similar to different types of daylight (fig. 8). For instance, there are several fluorescent tubes available that give off a moderately low-wattage, cool, northern or warm, southern type of light.



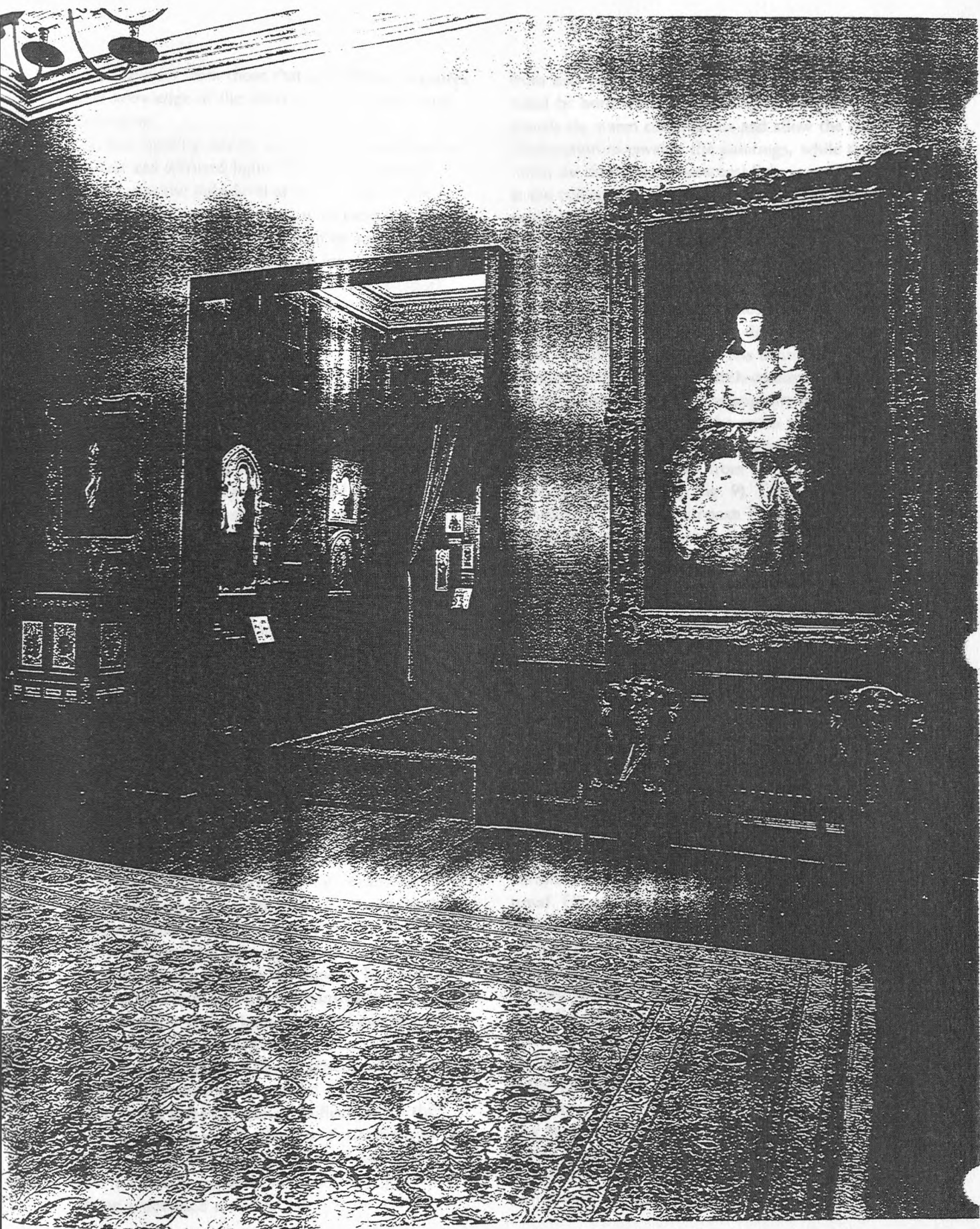
8. The visible light distribution of cool (top) and warm (bottom) fluorescent light. The background of each graph is the color of the fluorescent source from which the measurement was taken. The cool light source is slightly better at rendering color because it consists of roughly equal proportions of colors throughout the visible spectrum, while the warm light source contains predominantly yellow-orange light. However, for both sources poor color rendering exists for objects whose colors predominate where there are voids in the visible light distribution.

9. Opposite: Two galleries in the Robert Lehman Collection. This photograph illustrates the subtle changes in illumination that can be observed as one moves from room to room. Goya's *The Countess of Altamira and Her Daughter* hangs in a gallery where the light reflected from the wall is cooler in appearance than the ceiling, while the lighting scheme, visible through the passageway, for the fifteenth-century Italian paintings, which are hung against red velvet, is the opposite. Paintings in these galleries are seen to their advantage because the type of illumination used was determined by the paintings on display.

The ability of fluorescent lights to render colors correctly is a different issue. For example, if the intrinsic color of an object or pigment is poorly represented in the light source, that color will appear muted. Conversely, if the light emits an overabundance of that wavelength, the color will be amplified. This is especially a problem for red colors that are often poorly represented in the light source. To render a color accurately, light of that specific range must be present in correct proportion relative to the overall illumination. Because of the gaps in the wavelengths produced by fluorescence, accurate color rendering cannot always be achieved. Despite its limitations as a sole illuminant, however, fluorescent light can be used as an ambient source in the viewer's peripheral vision to suggest satisfactorily either a northern or southern light.

In addition to using lighting that points the tone

of a painting, it is necessary for museums to employ lighting appropriate to the needs of works that contain fugitive or unstable materials. For example, the yellowing of some varnishes is slowed considerably when they are no longer exposed to UV radiation. Fortunately, properly filtered UV radiation is nearly imperceptible to the human eye and consequently it is general practice to eliminate it from the gallery setting. However, even when UV is filtered out, fugitive dyes may be only marginally buffered from damage, since these dyes will fade after exposure to a critical dosage of visible light. By cutting the illumination intensity or exposure to visible light in half, in principle one doubles the lifetime for that particular dye's color. Paintings with fugitive materials are normally exhibited separately in galleries that have absolute minimal visible light levels and are usually displayed on a rotating basis. Distinguishing un-



stable materials from those that are lightfast requires either knowledge of the artist's practice or technical examination.

Gallery lighting usually consists of a combination of direct and diffused light. The two sources contribute to the light level at the surface of the painting. Paintings illuminated with excessive light, aside from the issue of fading, can be just as difficult to decipher as paintings that have insufficient light. Paintings illuminated with too much direct (spot) light, particularly varnished ones, from some vantage points may reflect specular "hot spots" of the light source rather than the image of the painting. This can be remedied by moving the light source so that the glossy reflection is directed away from the viewer's line of sight. When diffused light is excessive or improperly located, it has the tendency to cause certain paintings to lack depth and appear washed out or gray. Again, varnished paintings suffer the most dramatic effects when this illumination is not rectified; because they have a smooth surface they will reflect light primarily from the top surface of the varnish and not from the pigmented depth of the paint layer as they should. This condition may be difficult to perceive because the lack of darkness (or saturation) is even across the entire surface, the diffuse light causing a white sheen over the whole, and therefore the work could be mistakenly thought to have been painted with lighter colors. However, when the lighting is properly adjusted, the depth of the painting is immediately apparent through subtle contrasts, most easily noted in darker passages.

Ideally, therefore, a gallery should contain two types of lighting. There should be an over-all scheme that settles on an illumination that underscores the common traits found within an arrangement of paintings. Once this base has been established individual paintings, where necessary, should receive supplemental lighting that enlivens aspects otherwise imperceptible to the viewer. It is also necessary to use illumination with minimal or no UV at levels beneath a visible light threshold considered safe for the media on display.

Especially successful lighting schemes can be seen in several galleries throughout the Museum. For example, in the Robert Lehman Collection, in the gallery where Goya's *The Countess of Altamira and Her Daughter* and other paintings are displayed, the works are mostly rendered in a cool key, and the lighting is designed to reflect back to the viewer

from cool gray walls. Although the room is illuminated by both warm and cool light, the gray walls absorb the warm components and allow the cooler illumination to envelop the paintings, while the warm (in this case, fluorescent) light is only apparent at the ceiling. One can peruse passages in these paintings without any significant distraction from warm light reflected by the wall. This use of warm and cool lighting creates an agreeable interior space. The warm tone at the ceiling establishes it as a horizontal plane clearly distinguished from the vertical (wall) surfaces, without which differentiation the room would appear flat and less inviting. In the adjoining gallery, where fifteenth-century Italian paintings are on display, the opposite lighting configuration is required due to the warm tone of these pictures. There cool light is retained at the ceiling and warm light, reflected from the red velvet walls, surrounds the paintings (fig. 9). The newly installed Nineteenth-Century European Paintings and Sculpture Galleries also offer excellent examples of lighting used to optimize enjoyment of the works of art (see fig. 3). Here the Museum's lighting designer, Zack Zanolli, has satisfied both curatorial and conservation needs. The relatively shallow attic space required translucent diffusers to harness the arc of sunlight throughout the day and redirect it consistently downward. By using such panels Zanolli was able to create a dynamic natural light that concentrates on the floor rather than the walls, where raking light would cause disturbing glare on the paintings at certain times of day. During the construction process, materials with the best UV-absorbing qualities were selected. The result is an exhibition space that provides vistas of glare-free paintings in galleries where harmful UV radiation has been effectively eliminated. Clearly sensitivity to these details fosters an environment that welcomes viewers and helps create an atmosphere where they are encouraged to look at paintings in a relaxed manner.

With all these considerations in mind, museum specialists decode, as it were, the specific lighting needs encrypted within each artwork. For the large and diverse collections of the Metropolitan there are many unique lighting solutions. Perhaps the greatest challenge is to specify changes in lighting from gallery to gallery so that the variations are only briefly noted, if at all. By achieving this goal, museumgoers' attention will remain focused on the collection rather than the installation.

Display & conservation

THE DILEMMA OF LIGHT IN MUSEUMS



Light is destructive, specifically to those materials that give color in the natural world and have been adopted by humans as media to decorate or create. This phenomenon first came to the attention of the museum world in 19th-century London through studies by Russell and Abney on the rapid deterioration of watercolor paintings displayed in galleries. Since then, the profession of museum conservation has constantly reviewed these matters in a steady stream of publications.

Ultraviolet is by far the most damaging portion of the electromagnetic spectrum, and it adds little or nothing to our visual perception of objects. The exceptions are fluorescent materials such as Day-Glo paints or the optical brighteners added to laundry detergent, and these need to be treated as special cases when they form part of an exhibit. UV should be completely excluded from light in museums and galleries. Detailed coverage of this subject can be found in Stefan Michalski's paper "Damage to

Museum Objects by Visible Radiation (Light) and Ultraviolet (UV)."

Guidelines for exposure from the visible portion of the spectrum are set forth in numerous publications; however, the most specific and widely cited work is by Dr. Garry Thompson at the National Gallery of London and published in his book *The Museum Environment*. In general, these propose an illumination limit of 50 lux [4.6fc] for materials particularly susceptible to damage by light (light fugitive) and 200 lux [37.2fc] for less fugitive materials. These guidelines are frequently considered as absolutes and often are misunderstood by the very people who have daily responsibility for museum display and conservation.

The effects of light are a cumulative phenomenon; essentially, the light level may be considered to determine the rate of deterioration, but the time of exposure determines the total deterioration that occurs. In her paper "A Suggested Exhibition/Exposure Policy for Works of Art on Paper," Karen M. Colby

proposes a policy of limiting the period of exhibition of artifacts on the assumption of lighting levels being determined by the nature of the objects. I agree with this approach, which is slowly becoming standard practice in major museums such as the National Museums of Scotland and the Canadian museums discussed in Colby's paper.

From a lighting designer's perspective, I would counsel a further step, that of keeping an accurate exposure record by measurement and balancing this against a predetermined exposure value, measured in lux-hours, for objects to be exhibited from collections. Thompson recognized this approach in *The Museum Environment* and proposed cumulative exposure values in the appendix.

Accurate measurement of exposure serves a number of causes. First, it builds a body of practical data allowing for future accurate assessment of deterioration caused by light. It also allows greater flexibility of lighting levels on an object-by-object basis, determined by the

specific effects of light on the particular materials composing each object. Ideally, this approach allows a more effective use of time-limiting lighting control, whether by visitor-operated switches or by comprehensive lighting control systems.

This system also takes into account the shorter duration, high light levels encountered by conservators at work, curators reporting conditions, or when television lights are used at exhibition openings.

In essence, the system of conservation based on limiting the illumination falling upon objects has fundamental problems in providing information to the viewer. The experience of viewing is dependent on the amount of light reaching the eye, by reflection from the objects and from peripheries within a certain timeframe.

The human visual system is a marvel of evolution; it can provide functional information throughout a vast range of light levels from starlight in open country to full desert sunlight. However, within this operating range it can only provide detailed information over a much more limited range of light levels. It is therefore necessary for the curator, conservator,

exhibition and lighting designers to provide an environment that allows visitors the maximum visual access to objects on display.

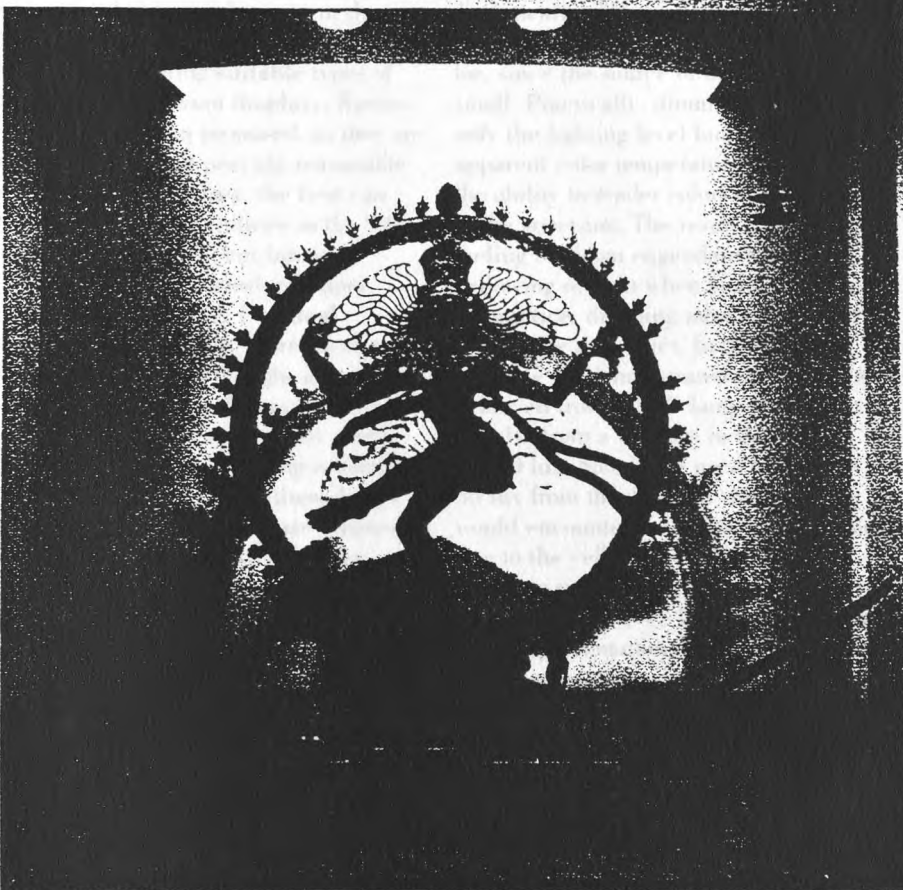
Lights on maximum illumination create frequent problems in presentation of objects. The lower standard level of 50 lux in museums is not acceptable anywhere where any level of visual clarity is required. Providing a maximum of 50

lux creates a series of problems. The first is simply that of the inverse square law.

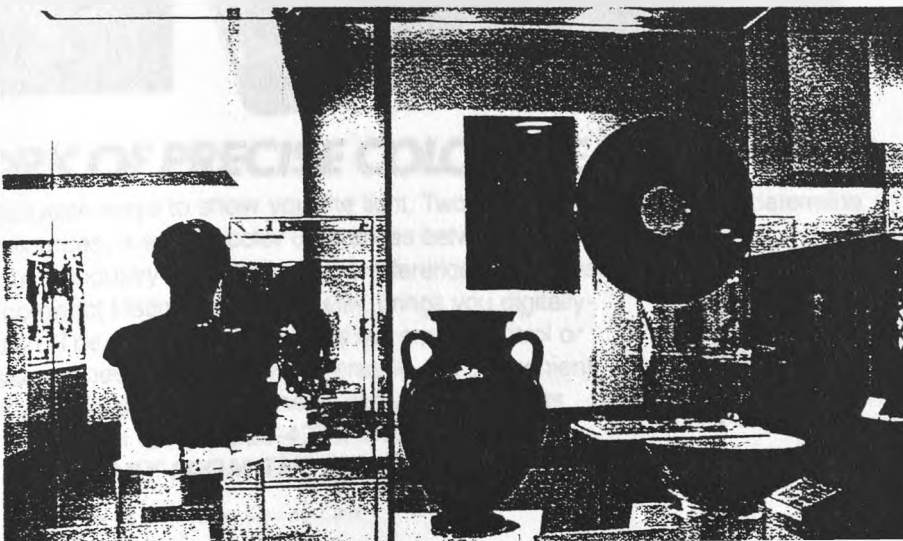
As the distance between the object and the light source increases, the level of illumination is reduced by the square of the distance. Imagine a typical display case with a full-height dressed figure (extending from 200mm [7.9"] below the base to 2m [70.7"] below the diffuser in the case top and 2m [70.7"] below the diffuser, 1.1m [43.3"] below the top of the figure translates 15.1 lux [1.1fc] at the foot of the figure, a hopelessly inadequate lighting level.

Another example would be a painting spotlighted from a track at 3m high and 1m from the wall using a 20W 38-degree lamp aiming at the center of the picture.

This results in 259 lux at the bottom, 225 lux at the top, and 70 lux at the sides [2.1fc, 2.1fc, and 0.5fc]. This is caused by the falloff of light across the



To dramatically light a Shiva statue (above) at St. Mungo's Museum in Glasgow, Shaw concealed a row of narrow-beamed, low-voltage reflector lamps in troughs on either side of the Gothic vault. A transformer with built-in dimming and voltage sensors prevents both noticeable voltage drop and cascade failure of the lamps. Bouncing light around the coffers over cases displaying the museum's Durer miniatures (below) and down the wall provides even, glare-free coverage of 50 lux without dimming. Daylight from large windows in the main gallery is controlled by filtration and mounted stained-glass exhibits (facing page). Light-sensitive objects are positioned closer to internal walls.



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ARCHITECTURE

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beam of the lamp. Remember that the quoted beam angle relates to the angle at which the measured intensity is half that of the maximum intensity at the center of the beam, and the effect of greater distance and increased angle of incidence at the bottom of the picture.

Absolutely flat lighting is impossible to achieve, at a practical level, since even wall washers or diffused or reflected light will vary substantially over height. This kind of diffused lighting is generally poor for revealing any of the texture, grain, or brushwork in artwork.

As a system, the human eye and brain will tend to average out variations in lighting levels. In display conditions, this gives rise to perception problems when areas of radically different brightness are simultaneously within the field of view. Experimentally, this is demonstrated in "Fechner's Paradox," which demonstrates that if a second, low-level light source impinging on one part of the retina is added to a primary brighter source, the eye responds by the pupil opening to an

average position between the two levels of light as the total light entering the eye increases.⁹ This effectively makes bright sources brighter in the field-of-view, making less bright areas more difficult to see. Called "disabling glare," it frequently occurs in museum exhibitions where lights are reflected in picture glasses or where poorly shielded luminaires are in the same field of view as pictures or objects.

When considering suitable types of illuminant for museum displays, fluorescent lamps are often proposed, as they are energy-efficient and provide reasonable color rendering—in fact, the best can offer color rendering indices in the 90s. The quality of fluorescent lamps is discussed in David Saunders' paper "Fluorescent Lamps: A Practical Assessment."¹⁰ This light source is suitable where a general wash of light is required. However, fluorescents do have some technical disadvantages, particularly where dimming is required. Dimming is complex simply because of the way these lamps work. Also, as these lamps are dimmed, there are perceptible shifts in color rendition. Manufacturers assure us that these shifts are slight; however, as the level is reduced, so is the perceived color

rendition, which is simultaneously being compromised by the lower light level.

The most common illuminant for museum display lighting is tungsten halogen (TH), and these days, specifically low-voltage TH. This has the advantage of a continuous color spectrum and therefore a color rendering index of 100. Technically, TH is easy to dim, and easy to design well-controlled light fittings for, since the source of light is relatively small. Practically, dimming reduces not only the lighting level but also the apparent color temperature and therefore the ability to render colors at the blue end of the spectrum. The result is the familiar feeling of gloom engendered by the yellowing of light when heavily dimmed. In practice, dimming more than 15-20% will create this effect. In the previous example we demonstrated that the levels achieved from a 20W lamp at 3m high and 1m from a wall are in the region of 250 lux. Should we need to achieve 50 lux from this lamp by dimming, we would encounter poor viewing conditions due to the yellowing of the light.

So, in practical situations, what can we hope to achieve? I believe that good-quality presentation can be designed

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without compromising the conservation of objects. It is now time to reconsider the setting of maximum lighting levels as the main method of preserving objects from light damage. Limiting the time of exposure by rotation of objects between archive storage and exhibiting, providing systems that reduce light level when objects are not being viewed, and limiting high-level exposure for condition reports, presentation work, and research will combine to provide acceptable life of objects. Ongoing research will allow individual objects to be categorized more accurately for their light sensitivity, and this information can be reflected in permissible exposure on an object-by-object basis.

With an exposure-recording system in place, the next step is to assess the appropriate lighting level for particular objects and exhibitions. Basic requirements for exhibition need to include the following:

- There should be no direct sunlight in the exhibition space.

- Daylight in galleries must be filtered to exclude UV.

- Maximum daylight levels should be controlled, keeping in mind that level variation should be allowed to reinforce the connection between the illuminated space and the natural world.

- Artificial light sources should provide optimum color rendition.

- Artificial light sources should be filtered to exclude UV as much as possible.

Now we have a foundation to set lighting levels appropriate to the viewing conditions. These will depend on the nature of the exhibition space; exhibition design; and coloring of wall, floor, and ceiling surfaces. It will become a design decision at this stage as to how to approach the lighting: Will it be by washes of light, spotlighting, or a combination? How will it interact with the viewer? How will it be controlled?

The individual objects can be addressed with reference to the allowable exposure and the curatorial and exhibition requirements for juxtaposition. Decisions can be made as to the average illumination to be received by each object to allow for maximum visibility in the context of the exhibition. This is not an argument to light all exhibits at uniform high levels. However, the visual experience is determined by the amount of light reflected back from an object in the visual context within which it lies, so average levels of 10 lux [3.7fc] may be adequate for a watercolor exhibited against a mid-tone wall in an otherwise dark area. The same picture exhibited in a partially daylighted gallery with pale walls may need to receive an average of 100-150 lux [93-140fc] to be equally viewable. In the context of a total recorded exposure policy, both situations would be acceptable within the life of the object, provided that suitable times of archival storage were allowed between periods of exhibition.

I have witnessed many situations in which erroneous measurement and inappropriate measurement devices have resulted in devastation of a museum's visual environment. Occasionally, my work requires me to make investigations into perceived lighting problems brought about by poor understanding of light measurement. The proposed conservation methodology relies on a uniform and comprehensive approach to measuring and recording lighting levels. In this

context we are interested in three measurement parameters: average illumination at the object, UV radiation as a proportion of the illuminant, and exposure over time.

The methodology we use for these measurements in working toward a proposal for a uniform system includes:

Average illumination at the object. This basic measurement should be made with a meter equipped with an integrating sensor; typically, these will have a slightly domed opaque cover over the measuring cell. This should be fully cosine corrected, meaning that it accepts light from many different angles and accurately integrates it in the indicated measurement. It should also conform to the CIE curve for spectral response, which matches that of the human eye. Most modern, general-purpose light meters meet these criteria.

This sensor should be held parallel with the principal plane of the object. Measurements should be taken at no less than five points, close to the center to determine the point of peak illuminance and close to the four corners, with one reading taken at the point of minimum illumination. In the case of objects having more than one principal plane, such as sculptures, measurements should be repeated on each plane. These readings provide a guide to the actual spread of illumination across the object; in general, the maximum and minimum readings should not exceed the ratio of 1:3 to provide perceived evenness of illumination, unless there is a positive reason for highlighting a particular portion of the object. When averaged, they will give a realistic light exposure for the object. The light meter should not be pointed directly at the light source unless this is normal to a principal plane, as this will give a false high reading. Similarly, a directional sensor on the light meter will give a false low reading when parallel to the object plane and a false high reading when pointed at the light source. Also, remember that even high-quality light meters are only accurate to $\pm 3\%$ even when newly calibrated; therefore, two meters can be expected to show variations of up to 6 lux on a measurement of around 100 lux.

Ultraviolet radiation. As this is expressed as a proportion of the light emitted from a light source, a number of devices have been manufactured to give either a direct reading or a "hit-and-miss" reading by way of light-emitting

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diode indicators. Theoretically, these devices are independent of light level and should be able to give a rapid and accurate assessment. In practice, they have severe shortcomings. At low light levels they are less accurate than is desirable, and the type with an LED readout is even more limited in terms of the information it provides. Our preferred method is to use a direct-reading UV radiometer and calculate a result from a simultaneous light measurement. In this case, both instruments should be pointed directly at the light source and the result directly calculated.

I propose the formulation of a set of absolute levels of UV radiation. As UV is acknowledged to be the most damaging part of the spectrum, its exclusion will provide the greatest benefit in terms of conservation. UV is inevitably present in any light source, so essentially we are measuring the effectiveness of some filter medium in reducing or eliminating it. This subject is extensively covered in David Saunders' article on filtration of UV. The 75 microwatt per lumen standard derived from Thompson's work is based on the unfiltered output from a standard incandescent lamp.⁸ His book also specifies an ideal UV filter. Current dichroic coating technology has provided us with such a filter. Saunders proposes a maximum UV level of 10 microwatts per lumen, which is only achievable through the use of these filters. His article also points out the shortcomings of many other commercial UV filters. Using these simpler filter media, and through careful manufacturer selection of lamps, it is easy to achieve levels of 35-50 microwatts per lumen. I would propose the following absolute limits of UV as practically achievable within the majority of museums and galleries.

The table below indicates the original standards in Thompson's book⁹ for comparison. These figures are offered for discussion and are not to be considered as prescriptive.

	Milliwatts per square meter	Lux	Milliwatts per lumen
Old standard	3.75	50	75
Old standard	18.75	200	75
Max level sensitive	1	100	10
Max level normal	8	200	40

Exposure over time. This is the key measurement for this proposed method of conservation lighting. The methodology

will vary according to a range of factors, depending on the particular object and exhibition conditions. At the simplest, if we consider the example of an exhibition with a single set lighting state, the measurements required above will be recorded and it is simply a matter of recording the length of time the lighting is switched on in an exhibition log. At the end of the exhibition, the exposure, determined by measurement, is simply multiplied by the number of hours recorded in the log.

More complex situations include visitor-controlled lighting. In this situation, a time-recording device should be attached to the visitor-controlled circuit and readings logged. Daylighting creates an even more complex situation. This is a significant variable and monitoring must be undertaken in a systematic way. It is technically possible to provide a data-logging device for each object that can be downloaded into a computer for record-keeping and analysis. I suggest a data-logging device mounted on each wall that receives natural light, and exposures for each artwork based on the initial measurements taken compared to the logged data for the time the measurement was taken, then pro-rated according to the recorded lighting level data over the period of exhibition. Over the course of two or three years, the recorded data can be used to determine annual exposures for each wall with variations over the year, and this data can be used to assist in organizing future hangs to keep the most sensitive exhibits away from the walls receiving the most light.

I must reiterate that the existing system of conservation based on limiting the maximum illumination of objects is fundamentally flawed and requires a more sensitive and flexible approach to providing optimum display conditions for museum exhibits without compromising conservation efforts. In the end, this fundamental change of approach depends on a reasonable, aesthetically aware, and open-minded team of conservation and

design professionals, willing to forego the comfort of established conservative methodology in pursuit of common clarity.

- ⁸ A.S. Brommelle, *The Russell and Alnwick Report on the Action of Light on Water Colours*, SIC 9, (1984).
- ⁹ *Proceedings of the Bristol Conference on Lighting in Museums, Galleries, and Historic Houses* (The Museums Association, 1987).
- ¹⁰ C. Thompson, *The Museum Environment* (London: Butterworths, 1989).
- ¹¹ Montreal Museum of Fine Art, 1991. Internet, <http://www.web.com/lighting/>
- ¹² R.L. Gregory, *The Eye and the Brain*, 4th edition (Waldenfield Paperbacks, 1980).
- ¹³ D.R. Saunders, *Fluorescent Lamps: A Practical Assessment* (National Gallery Technical Bulletin 11, 1987).
- ¹⁴ D.R. Saunders, *UV Filters for Museum Light Sources* (National Gallery Technical Bulletin).
- ¹⁵ Thompson, op cit.
- ¹⁶ Thompson, op cit.

Keran R. Shaw has been a lighting designer for more than 20 years practicing in fields as diverse as rock and roll, floodlighting, museums, and light sculpture. For the past seven years he has headed up his own consultancy based in Edinburgh, concentrating on architectural lighting; its World Wide Web address is <http://www.web.com.com/spider/KRSLD-web/KRSLD-home.html>. Shaw thanks Lisa Della Rocca for editorial assistance.

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Heat control and lighting systems design

OPTICAL COATINGS SEPARATE LIGHT FROM HEAT

Incandescent light sources are very inefficient; only a small proportion of the electrical power they draw is converted into visible light. For example, Figure 1 shows the theoretical output radiance for a 3200K color temperature source, such as a tungsten bulb, as a function of wavelength. The narrow band of wavelengths visible to the human eye, from blue (400nm) to red (700nm), is highlighted in the graph. What is immediately obvious from this graph is that the peak emission from a source at this color temperature is far outside the visible spectrum, and that the bulk of the energy output from such a source is at wavelengths not visible to the human eye.

The wavelengths at which most of the output of this source occur are longer than the reddest which the eye can perceive, and are called infrared. They are sensed by the human body as heat, and are also sometimes called thermal radiation.

What difference does this make to the designer of lighting systems? When the entire output from this type of source is concentrated, such as in a spotlight, a tremendous amount of unnecessary heat is also put through the system. This can make it uncomfortable for human performers or damaging to heat-sensitive materials such as scenery items or optical filters.

Ideally, we would like to be able to separate the infrared heat radiation from the useful visible light. There are two ways to accomplish this—optics that selectively reflect the unwanted infrared,

or optics that selectively absorb the infrared. This article examines the use of optical coatings to achieve these goals. To understand the uses and limitations of these coatings, we first need to take a look at how they operate and how they are manufactured.

When light encounters an interface between two materials of differing refractive index (e.g. glass and air), part of the incident energy is reflected and part is transmitted; the basic geometry of this situation is shown in Figure 2a. This partial reflection can be readily observed from the surfaces of glass, water, and so on. The relative magnitudes of the transmitted and reflected parts are dependent upon the angle of incidence of the light, its state of polarization, its wavelength, and the refractive index difference between the two media.

Now, suppose the surface is coated with a thin layer of material whose index of refraction is higher than air but lower than the substrate. As shown in Figure 2b, there are now two reflected rays, one from the air/coating interface and one from the coating/substrate interface, respectively. If the coating thickness is about 10 wavelengths of that light or less, a phenomenon known as interference occurs. This interference is a result of the wave nature of light (light is an electromagnetic wave).

Figure 3a shows two extreme cases of interference. When two identical waves are exactly in phase, the result is a wave with an amplitude equal to the sum of

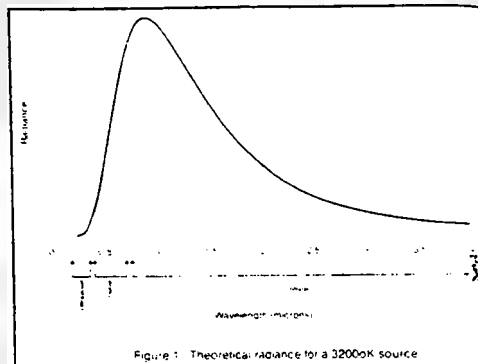


Figure 1: Theoretical radiance for a 3200K source

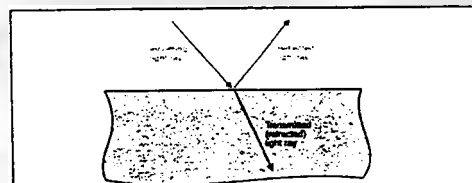


Figure 2a: Geometry of reflection and refraction

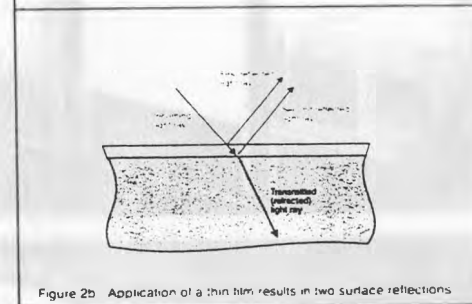


Figure 2b: Application of a thin film results in two surface reflections

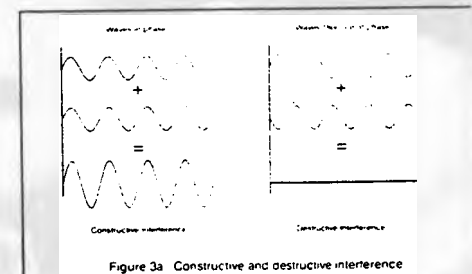


Figure 3a: Constructive and destructive interference

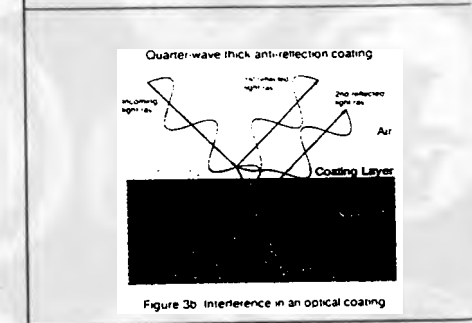
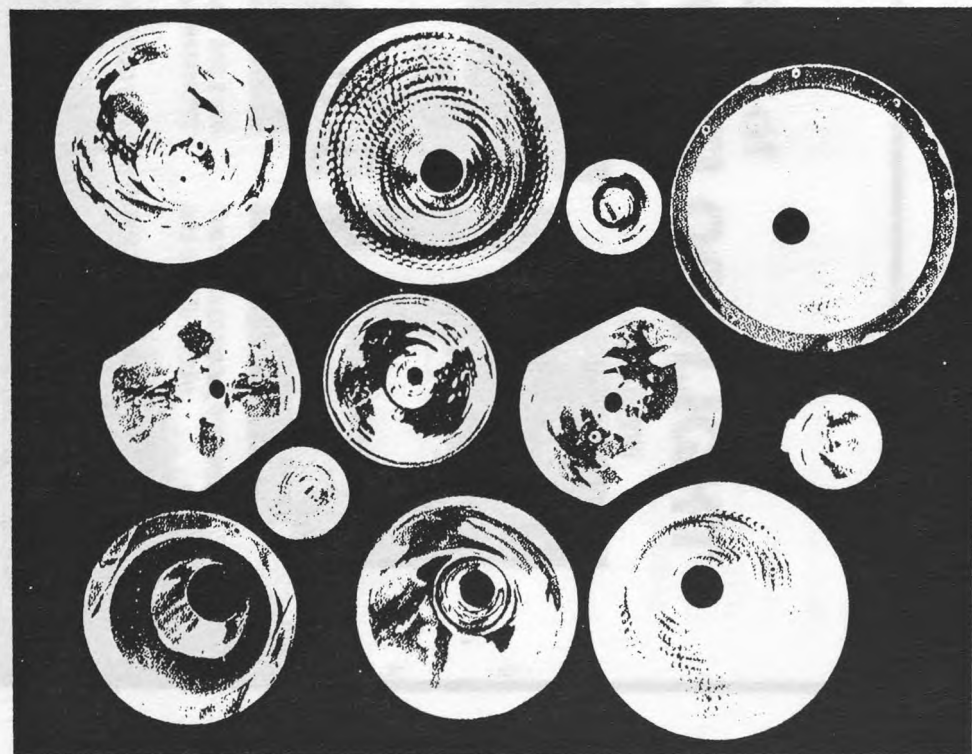
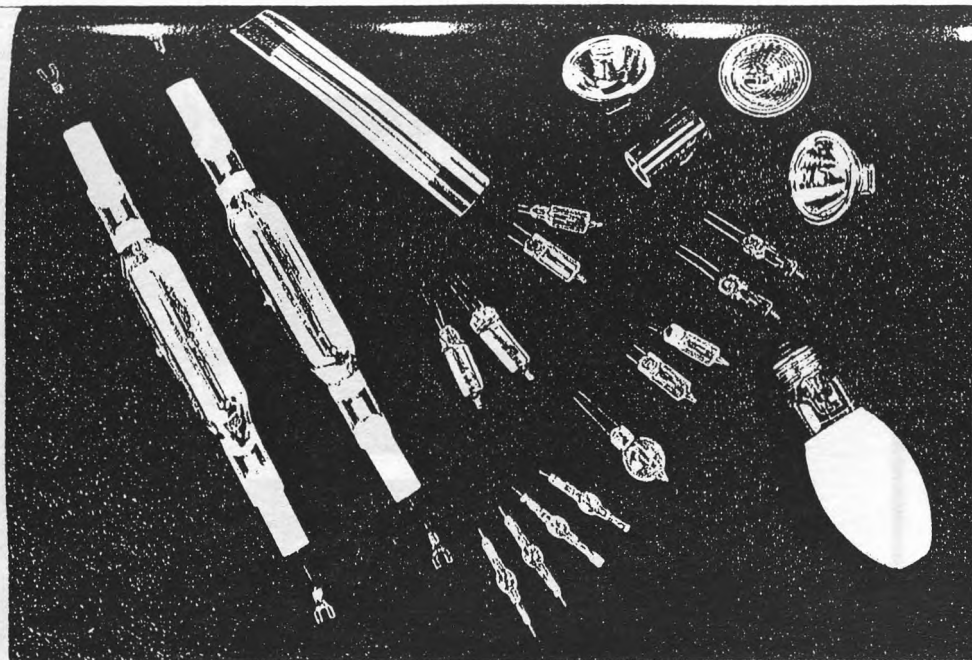
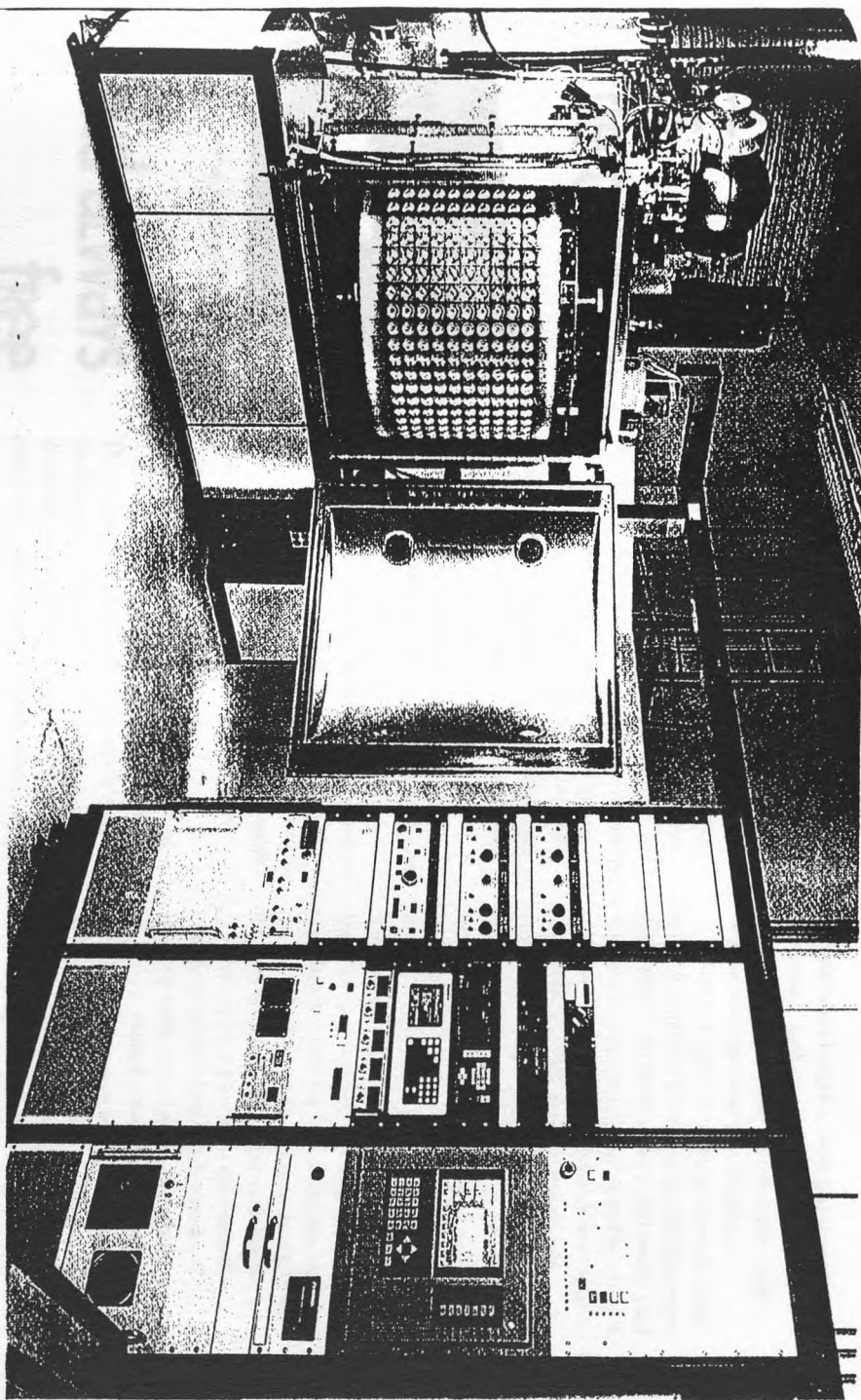


Figure 3b: Interference in an optical coating

Sputtering machines at work at the Deposition Sciences, Inc., plant (facing page, top). Products that use the firm's optical coating technology include a range of bulbs (facing page, bottom left) and an assortment of glass and metal reflectors (facing page, bottom right) used primarily in theatrical lighting equipment.





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the original waves—constructive interference. This is the same phenomenon that can create abnormally large ocean waves near breakwaters. However, when the two waves are exactly out of phase (or 180° out of phase), they cancel out, which is called destructive interference.

How does this apply to our thin film coating? The second reflected ray in Figure 3b travels through the coating layer twice before being recombined with the first reflected ray. If the distance it travels on each trip through the coating is exactly one-quarter of a wavelength, then the total path difference it experiences is one-half wave, or 180°; this is the condition for destructive interference just described. The net effect is to suppress reflection and then by enhance transmission—an anti-reflective coating. The same single-layer coating, when analyzed at a wavelength which is shorter than the original by a factor of two, will produce constructive interference and no anti-reflection. We thus have a mechanism of selectively reflecting light of

certain wavelengths, as a given path difference will cause constructive interference at some wavelengths and destructive interference at others.

Practical optical coatings have to consist of many layers of varying thicknesses. This allows them to reflect efficiently and selectively a range of wavelengths, as well as function at a range of incidence angles.

Based on this general approach, multilayer coatings can be designed to alter the reflecting characteristics of the substrate to produce anti-reflection, high reflection, spectrally selective and polarization-sensitive effects over both a broad wavelength range as well as a large range of incidence angles. The coatings we will discuss here are spectrally selective coatings, which separate the visible and infrared wavelengths.

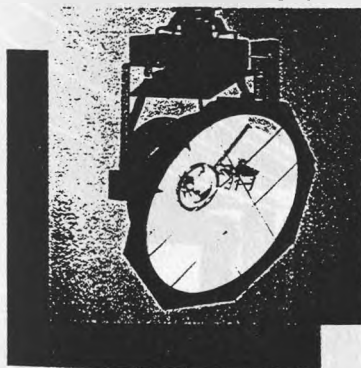
Optical coatings are conceptually simple to understand and, thanks to modern software, easy to design. However, manufacturing them is as much an art as a science. To achieve the desired result, it is necessary to control precisely the layer thicknesses and material indices of refraction. Good

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MARUMO

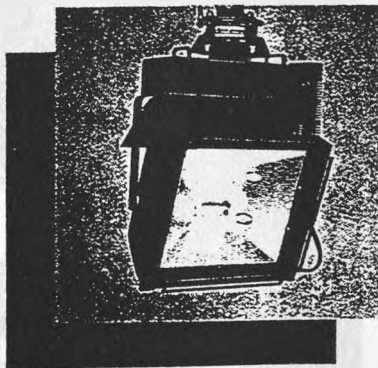
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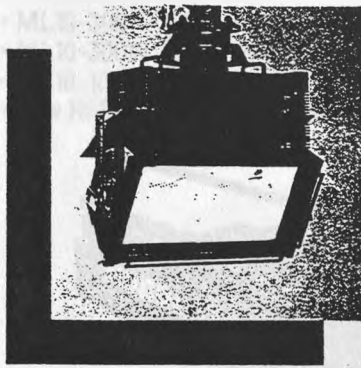
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adhesion and layer integrity are also important if the optical coating is to be environmentally durable. Given that layer thicknesses are typically less than a quarter of a micron and that minute changes in material microstructure can influence refractive index, this is not simple to accomplish, especially on a production basis.

There are three general methodologies for producing thin-film optical coatings, with each technique having its own variations. These are evaporation, sputtering, and low-pressure chemical-vapor deposition (LPCVD). Each of these techniques has its own advantages and disadvantages, and can be used to best effect for certain situations.

Evaporation is the oldest method in use for producing optical coatings. In evaporation, the parts to be coated are held on a movable rack inside of a chamber, which can be evacuated to achieve a very high vacuum. Once evacuated, parts in the chamber are typically heated using radiant heating. Needless to

say, this restricts the use of evaporative coatings to materials which can withstand heating in such a manner. Various coating materials are then evaporated in the chamber, using either resistive heating or electron-beam bombardment.

Atoms or molecules of the evaporated coating material stream out from the source and recondense onto any surface in the chamber that has a direct line of sight to the source. Because the coating process is highly dependent on the distance of the surface to the source, and the angular orientation between surface and source, the parts to be coated are typically moved around inside the chamber during deposition so as to promote coating uniformity.

Since the evaporation technique has been in use for many years, it is well understood, and is a reliable method for producing coatings on a production basis. It is also a flexible technique, allowing the use of a diverse range of metallic and dielectric coating materials. However, newer methods deliver the ability to produce coatings with better structural characteristics, and greater durability.

Sputtering is typically performed in a cylindrical chamber, where the

sputtering targets (coating materials) are arranged around the periphery, and the parts to be coated are held on a rotating drum concentric with the chamber.

In action, the chamber is first evacuated and then filled with a low-pressure inert gas such as argon. A voltage is applied to the coating material target(s), usually a metal or semiconductor, which ionizes the gas in the region around the target, forming a plasma. Ions from the plasma are accelerated into the target, causing atoms to sputter off the target material. These atoms then fill the chamber, and some are deposited on the surface of the optics. Due to the presence of the low-pressure gas, the movement of the sputtered atoms is partially randomized, causing uniform coating, even over highly curved surfaces or parts with unusual geometries.

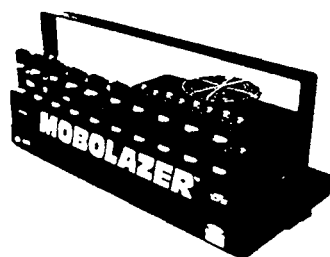
If a small amount of oxygen is introduced into the machine during this process, sputtered material atoms will react with it, depositing oxides on the substrates. This process, called reactive sputtering, allows for the production of multilayer oxide coatings having excellent

(continued on page 72)

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mechanical and thermal characteristics.

Deposition Sciences Inc. (DSI) of Santa Rosa, CA, has developed a new approach to reactive sputtering, the MicroDYNTM process. In MicroDYN, sputtering is augmented by a microwave plasma that forms a wider range of oxygen species (ozone, etc.) to enhance the reaction process.

In all sputtering techniques, the sputtered target atoms come out with a large amount of energy, leading to inherently harder coatings than achieved through evaporation. By harder coatings, we mean coatings which have greater mechanical and thermal stability.

Additionally, sputtering does not require heating the coated parts to very high temperature, and can thus be used on a wider range of substrate materials. Also, for a given coating chamber, the usable coating area inside is significantly larger than for evaporation, meaning higher throughput and lower cost.

In LPCVD, the coating material is created through a chemical reaction,

rather than being evaporated or sputtered from a target of the material itself. Specifically, in LPCVD, the parts to be coated are put into an evacuated chamber called the reactor, and heated to a temperature sufficient to drive a surface chemical reaction. The reactor is filled with a chemical vapor, and all exposed parts of the substrate are uniformly coated. This makes LPCVD particularly useful for coating parts with unusual shapes, such as lamp envelopes, or even coating both sides of a part at once. Furthermore, since parts do not have to be in a line of sight with a coating source to be coated, the entire volume of the reactor can be filled with parts, meaning higher throughput and lower coating cost. LPCVD coatings are, in general, hard and durable, with good heat handling characteristics.

While optical coatings for heat control have been available for quite some time, problems with high temperature handling in these films have limited their use to specialized applications, such as high-intensity slide projectors. Only recently, with the introduction of more advanced coating techniques, have optical coatings had the durability

and production flexibility to be of widespread use in display and stage lighting applications.

Depending upon the type of components being used and the allowable geometry of the setup, there are a number of possible approaches to the deployment of heat control coatings. In all cases, however, the goal is the same: to separate the usable visible wavelengths from the longer, damaging infrared heat wavelengths.

One way of accomplishing this goal is to introduce a component into the light path which reflects visible wavelengths and transmits infrared wavelengths. Such an element is called a cold mirror. With a cold mirror in place, the visible light is redirected into the desired path, and the heat energy is passed through (Figure 5), where it either continues on out of the system, or is absorbed at some point.

Given this functionality, cold mirrors must be fabricated from substrates that transmit infrared radiation. Commonly used materials for cold mirrors are glass, Pyrex and fused silica; the latter are desired because of their high heat-

continued on page 71

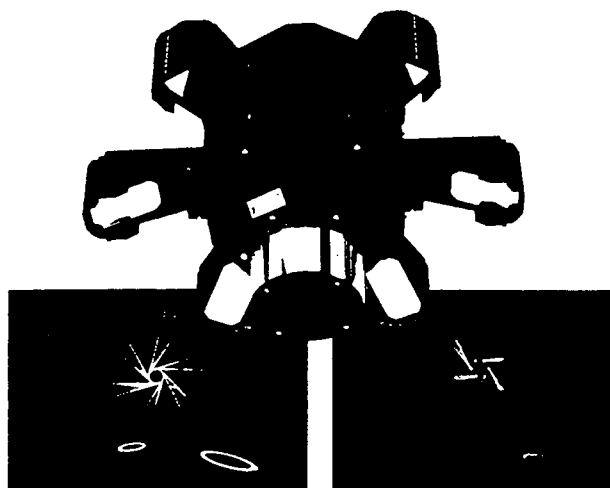
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"NEW MODEL WITH THE ADDITION OF THE
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Centre-piece with 6 independent heads, three programmable levels with 6 dichroic filters and gobos each offer a great deal of scenographic combinations.

A rotating mirrored drum enrich this unit with astonishing effects. Black out and strobe functions programmable.

This unit has a high output optic system, it's driven by stepper motors and can be run by DMX512 or LAMPO AS34 controller. It can also run in automatic/musical mode thanks to its built-in game sequence.



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TECHNOLOGY

continued from page 12

handling capability. These can be ground and polished on a wide variety of shapes, including flat mirrors or curved reflectors which collect and redirect the bulk of the light from a source.

The cold mirror coating itself is a complex multilayer film. Some cold mirror coatings available, such as the HeatBuster™ from DSL, use either sputtering or LPCVD to deposit several materials into a film with very high temperature handling capabilities, meaning long lifetime in actual use. This is in contrast to earlier soft, evaporated coatings which degraded with use over time.

Components that do the opposite of a cold mirror, namely reflect the infrared and pass the visible, are called hot mirrors (Figure 5). As before, these are complex multilayer films, usually produced using reactive sputtering or LPCVD technology, and typically deposited on high temperature handling, transmissive substrates. Their fabrication

and use is essentially the same as for cold mirrors, other than requiring a different geometry to take into account their reversed functionality. As a result, hot mirrors are generally produced on flat substrates, and are not generally applied to curved reflectors.

One specialty application of hot mirror technology is so-called envelope coatings, recently developed at DSL. In this case, a hot-mirror coating is deposited directly on the glass envelope of the bulb itself. For example, imagine a roughly spherical bulb envelope in which the filament is well-centered. With a hot-mirror coating applied to this bulb, a portion of the infrared output is directed right back onto the filament, and never escapes the bulb. The infrared light which is focused back onto the filament acts as another energy source for heating it up. The result is that less electricity is required to bring the bulb up to a given color temperature output. So, this approach provides the dual benefit of eliminating heat right from the beginning of the system, as well as yielding a more energy efficient source.

Producing bulbs with these coatings requires close cooperation with the lamp

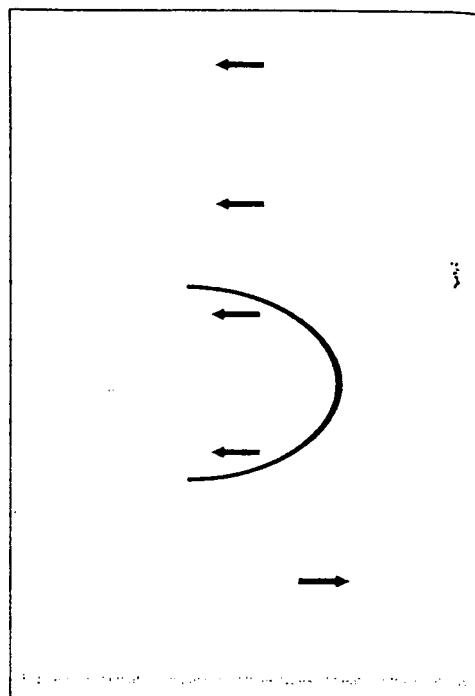
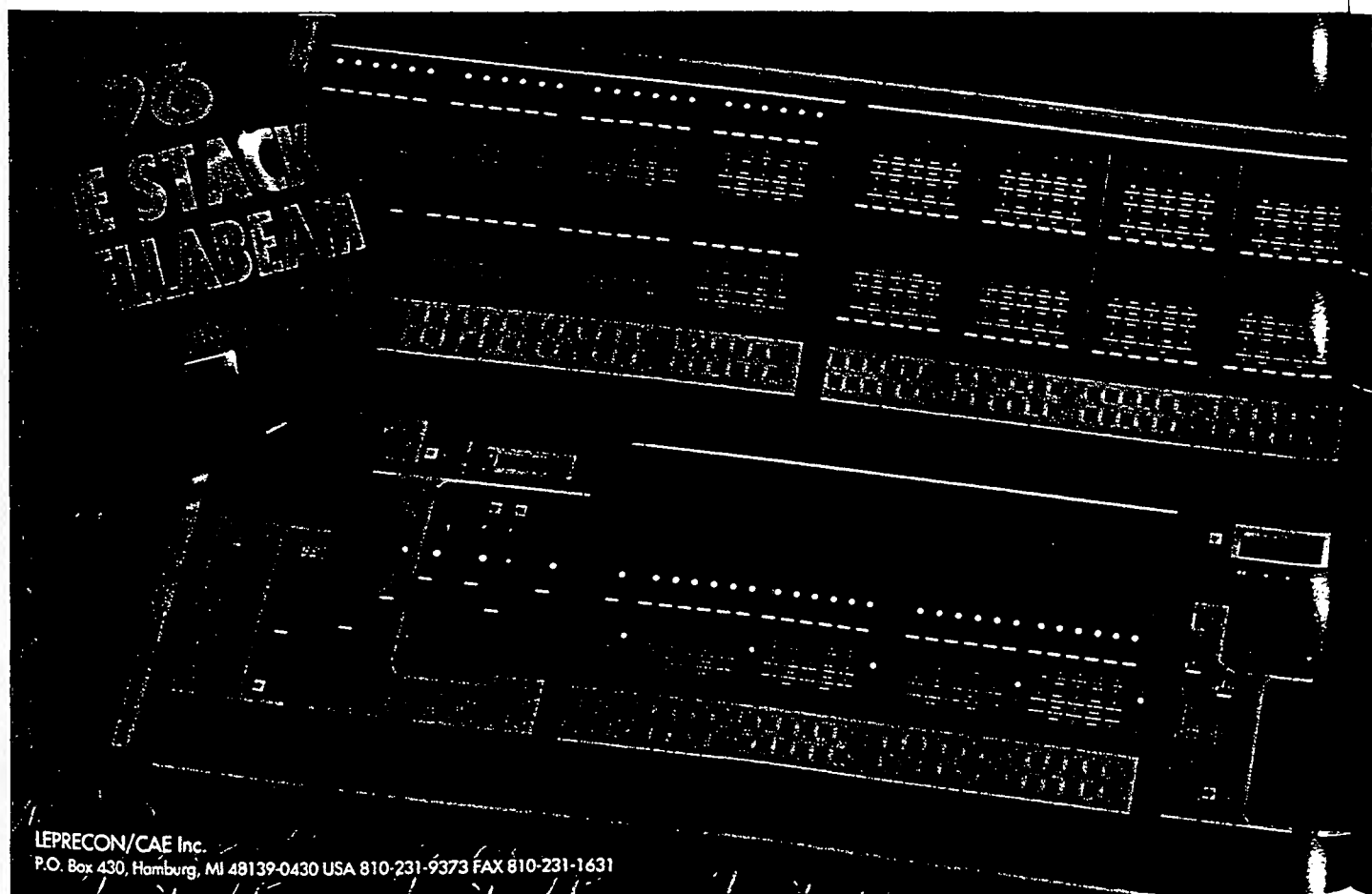


Figure 5: Envelope coating concept. The envelope coating reflects infrared light back onto the filament.

manufacturer. Bulb envelope shape, filament size, placement and shape, and coating design must all be optimized to work together. Unfortunately, it is typically not possible to coat existing bulbs for end users.



LEPRECON/CAE Inc.
P.O. Box 430, Hamburg, MI 48139-0430 USA 810-231-9373 FAX 810-231-1631

Many high-intensity stage lighting systems use spun aluminum metal reflectors, as opposed to glass reflectors. These offer superior mechanical durability to glass, and are easier and cheaper to fabricate in large sizes. Normally, aluminum has higher reflectivity in the infrared than in the visible, so that heat is efficiently collected and passed through the optical system, the exact opposite of the desired effect.

Since the substrate material (aluminum) is not transmissive to infrared radiation, the standard cold-mirror coatings described earlier are not useful in this situation by themselves. Instead, it is desirable to coat these reflectors with a coating that enhances absorption of the infrared radiation, so that it is not passed through the optical system. While this does cause heating of the reflector itself, this can be dissipated through subsequent conductive (heat sink) or convective (fan) cooling.

Coatings that absorb infrared in the manner just described are known as dark mirrors. Due to the large amount of heat they must tolerate, it is imperative that dark mirrors have excellent thermal durability.

To further enhance the reflectivity of the aluminum reflector in the visible, a cold mirror is also usually applied on top of the dark mirror just described. This type of coating can also be used to adjust the color characteristics of the reflected light, and is thus useful as a means of altering color temperature.

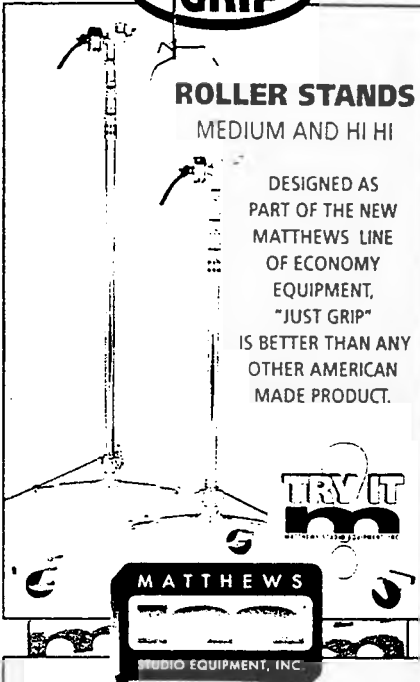
Modern coating technology now offers a variety of means for the lighting system designer to deal with heat radiation, as well as to produce filters and other optics for color control or specialized visual effects. Given the numerous options to achieving these results, it is imperative that the systems designer work with a coating provider who understands the tradeoffs and priorities of our industry, and who can provide the manufacturing method required to achieve an optimum cost-effective solution.

Eric Krisl, Ph.D., is vice president of operations of DSL.



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See Us at LD Booth #3553

IF WE COULD HAVE LOOKED INTO A CRYSTAL BALL...

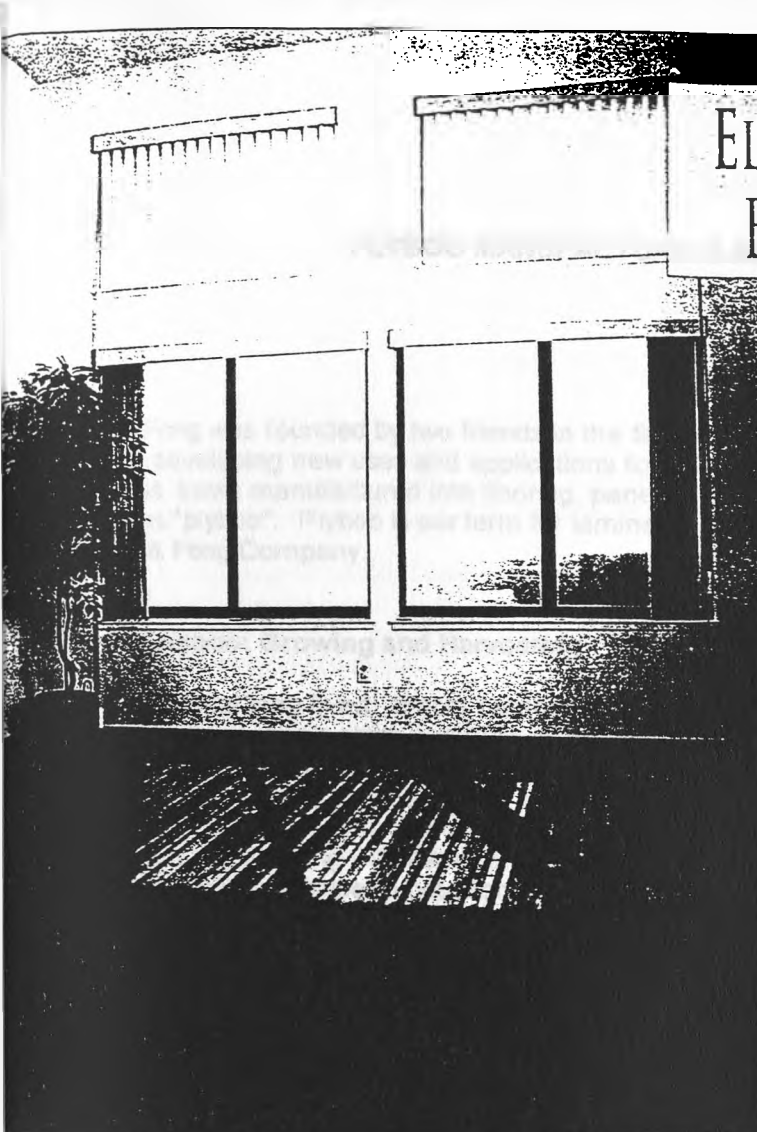
Who would have guessed that when we introduced a 24 channel console at the first ever LDI show that it would become so widely accepted in the lighting industry. Since its introduction in 1989, the LP-2000 has undergone extensive changes, evolving to meet the needs of the market.

With 1000 Cue Stack scenes, 1000 color memories, Intellabeam interface and patch to 1024 dimmers, it is easy to see why the LP-2000 is right at home in a theatre or on the road. With consoles ranging from the 48 channel up to the 96 channel Cue Plus there is an LP-2000 to fit every need and every budget.

Peer into your crystal ball... we bet that you will see an LP-2000!

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C. MATERIALS



ELEGANT AND ENVIRONMENTAL - BAMBOO...THE NATURAL CHOICE

SPECIFICATIONS

DIMENSION :

5/8" X 3 5/8" X 72"

CONSTRUCTION :

100% BAMBOO LAMINATE.
THREE PLY

INSTALLATION :

REFER TO INSTALLATION
INSTRUCTIONS

HARDNESS : (JANKA BALL TEST. PSI)

CHERRY/950 BB /1130
RED OAK /1290

RELATIVE STABILITY :

RED OAK /.00369 CHERRY/.00248
BB /.00175

*BAMBOO IS TWICE AS STABLE AS RED OAK.

MOISTURE :

6 TO 9%

COLORS :

NATURAL AND AMBER

*AMBER SHOWN BELOW

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P L Y B O O
- F L O O R I N G -

FOR INFORMATION ON PLYBOO FLOORING
CONTACT SMITH & FONG CO.
2121 BRYANT STREET SUITE 203
SAN FRANCISCO CA 94110
PH 415 · 285 · 4889
FAX 415 · 285 · 8230
[HTTP://WWW.PLYBOO.COM](http://WWW.PLYBOO.COM)

MEMBER



SINCE 1993



PLYBOO MANUFACTURING AND INFORMATION SHEET

Smith & Fong was founded by two friends in the Spring of 1989. Since then we have dedicated our efforts to developing new uses and applications for bamboo. With imagination and technology bamboo is being manufactured into flooring, paneling and plywood. The base material for all our products is "plyboo". Plyboo is our term for laminated bamboo and is a registered trademark of Smith & Fong Company.

Timber Bamboo: Growing and Harvesting

Fast growing and long lived, timber bamboo grows to a height of forty feet with a diameter exceeding six inches. Bamboo is a grass and from an environmental standpoint this is important. Unlike a traditional forest, when harvested, bamboo does not require replanting. Mature bamboo has an extensive root system that continues to send up new shoots for decades. Our bamboo is grown in managed forests in China. Harvesting is done by hand, minimizing the impact on the local environment. By working with bamboo and understanding its growth patterns, bamboo farmers are able to maximize timber production, maintain healthy forests and avoid the dangers of land erosion.

Manufacture of Plyboo

All our products are made from bamboo strips. Bamboo is hollow in the center and what we are concerned with is the wall thickness of the stalk. The wall at the base can be more than an inch thick and will taper over the length of the stalk. A flat strip is milled out of the core of this wall.

This strip is then boiled in a bath of boric acid and lime solution. The purpose of the bath is to extract the starch that attracts termites or powder post beetles. Boric acid and lime is a natural non-toxic repellent to insure that our products will not be affected by pests.

The strips are put into a kiln and dried to below 1% moisture content. After kiln drying, the strips are given a sanding to get a smooth surface for laminating. The strips are then laminated side by side to create a single-ply panel. These panels are then laminated again to each other to create a multi-ply bamboo plywood. Thus, we have plyboo.

We offer our products in two colors, amber and natural. The natural is, as the name implies, the natural color of the bamboo. The amber color is derived from a hot steam treatment that cooks the bamboo and gives it a warm, tea-stained color. This coloration is permanent and will not fade or sand out.

Membership

Smith & Fong Company is both a member of the National Wood Flooring Association and the American Bamboo Society. And we respect the standards of professionalism established by these organizations.

For further information on plyboo and Smith & Fong Company please e-mail us or call 415/285-4889.

Smith & Fong Company
Plyboo Bamboo Flooring

Installation Instructions For 5/8" Flooring

The installer must first be working with a wood subfloor. This can be an older fir T & G over joists or a 3/4" plywood over joists. If you are working with a concrete floor, you must first install 3/4" plywood per NOFMA instructions. Your subflooring, whether new or old, must be solid, flat, clean and dry.

Be sure to use your moisture meter to check moisture levels in both subflooring and the flooring to be laid before installation. If there is greater than a 3% moisture difference between the subflooring and the bamboo flooring, the flooring should be unbundled and left to acclimate until the moisture levels are within the 3% range.

Begin laying your floor with a 1/2" nail gun and a 1 1/4" to 1 1/2" cleat, spaced 8" to 10" apart with a minimum of 2 nails per board near the ends. Our recommended nail gun is the Primattech for 1/2" flooring. This gun works best as it is designed for a slimmer contemporary floor. Other guns that may be used are the Powernail model 50 C for 1/2" floor with 1 1/4" to 1 1/2" cleat or the Bostich Mill FS air powered staple gun set for 1/2" flooring with a 1 1/2" staple.

Bamboo flooring can be sanded like an oak floor using the same techniques and sanding patterns with drum or belt and edge sanders. Bamboo is about 90% the hardness of red oak (oak 1290 psi, bamboo 1130 psi). Use this as a gauge and begin your first cut with the least coarse grade of sand paper that will flatten the floor.

Stains and Finishes: Bamboo flooring will take both dyes and stains very well. Water or oil-modified finishes will also perform well on our flooring. Our product has been tested with Basic Coatings, Glitsa, Preferred Products and Pacific Strong finishes with excellent results. Other quality brands of finish have also been used with equally good results. Always follow the manufactures recommendations for application, coverage and dry time. Smith & Fong does not recommend direct application of an oil to the flooring in place of a floor finish.

Maintain your bamboo floor as you would a hardwood floor. The key to your floors long life and good looks is periodic cleaning and refinishing when necessary. We recommend the Boni Kami floor cleaning kit for cleaning your floors. Protectors should be placed under the legs of furniture and floor mats should be placed at entrances to the outdoors to collect dirt that can damage your floors. Always follow the finish manufacturer's recommendations for periodic recoating and avoid using water as a cleaner on your bamboo flooring.

Smith & Fong bamboo flooring has a five year warranty from date of purchase. Should our product delaminate under normal conditions within the warranty period we will repair or replace the damaged flooring, incurring both the cost of material and labor to correct the problem. To honor the warranty, Smith & Fong or an authorized representative must inspect the floor and assess the cause of damage before we will honor a damage claim. If you have a problem with any of our products, please call us at 415/285-4889.

If you have any further questions, ideas or comments regarding our products, please feel free to contact us. Thank you for your business.

Bamboo Tambour Paneling

By Smith & Fong / Plyboo Bamboo Products

Tambour Construction

Smith & Fong tambour paneling is made of kiln dried bamboo strips laminated to a thin self-adhesive foam backing. These strips have a fine micro beveled edge and are finished with a matte polyurethane. The panels measure 3/16" x 24" x 39.4" and come in both a natural and amber color.

Moldings

For installation as a wall paneling we have available a prefinished baseboard, crown molding and joiner strip. These are milled with a 1/4" inset to accommodate the paneling. These pieces measure 3/8" x 2" x 72".

Installation

Surface preparation: Prior to installation of the tambour panel, the application surface must be cleaned to remove all dirt, grease, oil, wax or any other foreign material that could cause a poor bond with the adhesive backing of the tambour. Surfaces with peeling paint or plaster board, surfaces that are uneven or unsound must be repaired. Application to surfaces that experience excessive moisture is not recommended.

Once the area has been prepared, peel off the wax backing of the tambour and press firmly with even pressure to the surface. The bond should occur immediately upon contact. With a piece of 2x4 and hammer, tap the paneling in place to assure that the backing has made full contact with the wall or cabinet surface. The 2x4 should be smooth and even so not to damage the finish. Temperature in room should be between 68 and 80 degrees. A warmer room and a warmer surface aids the adhesion process. If you are not getting good adhesion, check your surface preparation again for any foreign materials or moisture causing the problem.

Baseboards, crown molding or joiner strips can be attached with adhesive, drilled and screwed in place or fastened with a pneumatic pin nailer. Adhesives leave no mark and this is the method most often recommended. When using baseboards with paneling, the baseboard can be installed first and the paneling sent into the groove at the top of the baseboard. Paneling can also be installed first as long as measurements are made to accommodate the baseboard installation later.

For further questions on tambour paneling installation or use, please e-mail or call us at 415/285-4889.

Price and Availability (Wholesale)

Bamboo tambour paneling sells for \$3.85 per SQFT. and the moldings sell for \$2.25 per LF.
All prices are quoted FOB San Francisco, CA

**OTHER PRODUCTS FROM SMITH & FONG
PLYBOO BAMBOO PRODUCTS**

BAMBOO FOUR-PLY PLYWOOD

Our Plyboo bamboo plywood is a four-ply, cross laminated material measuring 7/8" x 24" x 72". This material comes in both an amber and a natural color. It can be used for countertops, cabinetry or custom furniture. Price: \$95.00 per sheet

BAMBOO SINGLE-PLY PANEL

Our Plyboo, bamboo panel is a single-ply linear laminated material measuring 3/16" x 12" x 72". It comes in both an amber and natural color and can be used for countertops, to face cabinets and can be laminated to wall surfaces as a wall paneling. Price: \$14.00 per sheet

BAMBOO TWO-PLY PANEL

Our two-ply panel is linear laminated and measures 3/8"x 12" x 72". It comes in both the amber and natural colors and has greater stability than the single-ply material. Its uses are similar to the other two materials. Price: \$30.00 per sheet

BAMBOO STRIP

The bamboo strip is the basic building component of all our products and can be used for any number of applications. The strip is non-laminated and measures 3/16" x 3/4" x 72". These strips can be used to edge band both bamboo and other plywoods. They can be woven into screen panels, or bent and laminated for furniture or decorative applications. These strips are sold in bundles of 100 pieces. Price: \$1.10 per strip

Please call us for pricing and availability.



Welcome To Our Home Page

Did you know that Giant Timber Bamboo is quickly becoming one of the most sought-after plants by today's homeowner?

Homeowners who are losing their privacy through loss of trees or new construction, are looking for unique Privacy Barriers, and Timber Bamboo provides them with an affordable and practical answer to their needs.

The elegant large *Black* and other colored *Timber* bamboo is fabulous as Highlights in gardens or next to hot tubs.

Fast-growing and hardy erosion-control *Dwarf* bamboos resolve embankment problems quickly and permanently, with more success than anything else we've seen. In all likelihood, this bamboo will be the plant of the decade. Until recently, the supplies generally have not been readily available. We at Bamboo Giant however, have a supply in stock are making them available on a "first come first serve basis".

Rare and hardy timber bamboo is our specialty

We have many cold hardy bamboos which can withstand temperatures well below freezing.

5-gallon containers of Moso bamboo are available, which is the largest most beautiful species of hardy timber bamboo and quite difficult to find. Can you imagine standing next to a bamboo as large in diameter as an oatmeal container or telephone pole in your gardens?

We also have large specimen sizes of *Phyllostachys Viridis* - (Robert Young), *Phyllostachys Bambusoides* , - (Giant Black Timber bamboo) which gets 3.5-inches thick, *Phyllostachys nigra* - (Henon) - a giant Grey-Blue timber, as well as *Chimonobambusa Quadrangularis* - (Square bamboo).

There are over 100 species, many which are quite rare.

Sizes available: From 5-gallon containers to 36-Inch boxes or larger field-dug specimens.

To order bamboo:

You are welcome to come to visit our gardens, one of the largest display gardens in North America, but please call first for an appointment to take a tour - phone: (408) 685-1248.

Come tour our Web Display Garden

Our Most-Popular Bamboo

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Thanks for visiting with us. Have a good day.

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[[Mailto: _moso@cruzio.com](mailto:_moso@cruzio.com)]



GARDENS OF BAMBOO GIANT

FEATURING:

RARE & ANCIENT EXOTIC BAMBOOS

Have you ever felt the tranquility of standing in a giant, timber bamboo grove? Due to the rarity of these ancient oriental giants, most people in North America have never had this experience. The gentle sound of the leaves and canes as the balmy breezes surround you. You feel your energy levels rise as you breathe in the freshness of the air produced by these ancient plants. A peace comes over your mind and heart, as you meditate on the magnificence of the cathedral-like towering plant's amazing beauty. These are only a few of the delights you can expect. Since ancient times, bamboo has been praised throughout Japanese and other ancient oriental histories.

These exotic species can be found on our 31 acre site with many acres of rare specimen bamboos including over 188 species and many mature groves. It is said to be one of the largest display bamboo gardens in the U.S.A. It also consists of several hundred rhododendrons, camellias, azaleas, deciduous magnolias, ginkgos, dogwoods, lilacs, roses, palms, purple leaf plum, birches, irises, calla, canna, clematis, honeysuckle, jasmine, wisteria, giant tree dahlias, ceanothus, redwood groves, oaks, cedars and water garden with water lilies, water irises and lotus, etc.

It takes approximately an hour for the long tour through all of the groves. The short tour is 28-38 minutes.

You will see Giant timber Moso, giant ebony black timber, bright green timber, timber with beautiful green stripes on banana yellow canes, as well as black stripes on green canes. There are green canes with yellow grooves. Grey-green canes with black spots, known as snakeskin. Additionally, there are crooked canes, purple, brown, red, square canes and Buddha belly, etc.

Some new shoots are pink, bluish/gray, etc. Some new shoots are growing over a foot per day.

Some bamboos are of species that have been known to reach 188 feet tall contrasting with short dwarf ground cover bamboos.

The bamboos range in size from one gallon to 36" boxes and larger, field dug specimens. Bamboo can be purchased at the garden.

We are located on the Monterey Bay next to sunny Santa Cruz, where you can find many excellent and renowned Bed and Breakfast Inns. The garden is located in Aptos, Ca. (45 minutes west of San Jose and 45 minutes north of Monterey/Carmel). It is necessary to call for an appointment prior to your visit, as the gardens are still in development stages.

To contact us:

Phone: 408-685-1248
Fax: 408-662-8328
E-mail: moso@cruzio.com

Address: Bamboo Giant
P.O. 422
Capitola, CA 95010

Pictorial Auto-Tour (Netscape Browser Required)

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"GIANT MOSO SPECIAL"

THESE PLANTS HAVE
MULTIPLE STEMS AND ARE
THREE FOOT + TALL

5 PLANTS FOR \$188.

Phyllostachys heterocycla pubescens - Moso

"Giant Chinese Timber Bamboo"

- Largest of the hardy timbers. Beautiful, giant grey/blue/green canes can get one foot wide, with contrasting small, feathery leaves and arching tops with a terraced branch structure. Fresh moso shoots are a real delicacy in the orient. Young shoots are covered with a fine, fuzzy covering that looks like velvet. This is a true Giant. Can you imagine standing in a grove of giant moso that has canes the thickness of small telephone poles? One of the most beautiful and probably the most magnificent of the Giant hardies. Rare.

Tall: 88' Dia. 8" Temp. 8 F

BAMBOO GIANT
P.O. 422 CAPITOLA, CA. 95018
CAPITOLA, CA. 95018

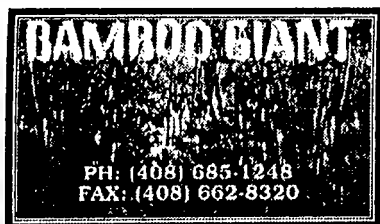
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SELECT BAMBOO COLLECTIBLES

FROM THE GARDENS OF

Bamboo Giant

Address: P.O. BOX 422 CAPITOLA, CA 95010
Phone: 408-685-1248 FAX 408-662-8320
email: mosa@cruzio.com

• *Bambusa multiplex Alphonse Karr* - "Alphonse Karr"

- Canes are yellow with green stripes. Makes a good hedge. Tall. 35' Dia. 1.5" Temp. 13 F

• *Bambusa multiplex riverorum* - "Chinese Goddess"

- Tall with delicate-looking leaves. More delicate looking than fern leaf bamboo. Very beautiful with its arching culms. 6' .25" 12 F

• *Bambusa ventricosa* - "Buddha's Belly"

- Can get interestingly swollen internodes under dry conditions. Otherwise turns into a timber bamboo. 55' 2.25" 15 F

• *Chimonobambusa marmorea variegata* - (no common name)

- Same as Marmorea, except the leaves have narrow, white stripes. Rare. 6' .5" 18 F

• *Chimonobambusa quadrangularis* - "Square Bamboo"

- Square cross section, rough dark-green canes. Beautiful drooping foliage. Looks best in shade. 25' 1.5" 18 F

• *Phyllostachys aurea* - "Golden Bamboo"

- The most commonly cultivated bamboo in the U.S. Easily identified by one of several short internodes at the base of some of its canes. Good bamboo for potted plant. 38' 2" 8 F

• *Phyllostachys aurea albovariegata* - "Variegated Golden Bamboo"

- Same as Golden Bamboo above, but with beautifully white and green variegated leaves. This plant really stands out nicely in a garden. 38' 2" 8 F

• *Phyllostachys aurea flavescente-inversa* - "Yellow Grooved Golden Bamboo"

- Same as Golden Bamboo but has the green canes with yellow grooves. Unusual. 38' 2" 8 F

• *Phyllostachys aurea koi* - "Green Grooved Golden Bamboo"

- Same as Golden Bamboo with yellow canes and green grooves. Unusual. The canes turn from green to yellow after the first 6 months, but the canes grooves remain green. Similar in color to Castillon. 38' 2" 8 F

• *Phyllostachys aureosulcata* - "Yellow Grooved Crockstem"

- o Green canes with yellow grooves. The internodes are rough to the touch. Some individual canes zigzag near the base. A very hardy bamboo and very beautiful. 26' 1.5" - 20 F
- ***Phyllostachys aureosulcata spectabilis* - (no common name)**
 - o Most beautiful new shoots in the spring. Canary yellow with violet streaks and green stripes. At maturity many canes are fascinatingly crooked. Very hardy and very beautiful. 26' 1.5" - 20 F
- ***Phyllostachys bambusoides* - "Giant Japanese Timber"**
 - o A fast growing timber with shiny, bright green canes. The second largest hardy timber. A real giant. 72' 6" 5 F
- ***Phyllostachys bambusoides* - *Allgold* - "Allgold Japanese Timber"**
 - o The canes are entirely golden yellow except for an occasional thin green stripe. Cane color is very exotic, almost has a transparent look to it. 35' 2" 5 F
- ***Phyllostachys bambusoides* - *Castillon* - "Green Grooved Japanese Timber"**
 - o It has beautiful gold yellow canes like Allgold, but also has contrasting green grooves. An occasional leaf is striped with yellow. 35' 2" 5 F
- ***Phyllostachys bambusoides* - *Castillon Inversa* - "Yellow Grooved Japanese Timber"**
 - o As its *Inversa*' name implies, this bamboo is the opposite of Castillon, with green canes that have yellow grooves. 35' 2" 5 F
- ***Phyllostachys bambusoides Tanaka* - (no common name)**
 - o Green canes with random black blotches similar to P.n. Borianna, but much more rare. 35' 2" 5 F
- ***Phyllostachys bambusoides violascens* - (no common name)**
 - o Quite unusual because it goes through several color variations. Starts with dark, purple streaks which disappear in a few weeks. Gets yellow stripes changing to brown stripes. 50' 3" 8 F
- ***Phyllostachys heterocycla pubescens* - "Giant Chinese Timber Bamboo (Moso)"**
 - o Largest of the hardy timbers. Beautiful, giant grey/blue/green canes can get one foot wide, with contrasting small, feathery leaves and arching tops with terraced branch structure. Fresh moso shoots are a real delicacy in the orient. Young shoots are covered with a fine, fuzzy covering that looks like velvet. This is a true Giant. Can you imagine standing in a grove of giant moso that has canes the thickness of small telephone poles? One of the most beautiful and probably the most magnificent of the giant hardies. Rare. 80' 8" 8 F
- ***Phyllostachys nigra* - "Black Bamboo"**
 - o Canes turn jet black after the first 6 months to one year. Probably the most popular bamboo in the U.S. because of its graceful habit and the sharp accent of its cane color. Beautiful, lacy green foliage. 25' 2.25" 8 F
- ***Phyllostachys nigra Dikokuchiku* - "Giant Black Bamboo"**
 - o Large, jet black canes. Beautiful, lacy green foliage. A stunning giant. 60' 3.3" 8 F
- ***Phyllostachys nigra* - *Bory* - "Leopard Bamboo (or snakeskin)"**
 - o Canes get blue-gray-green with random black splotches, never turning completely black. Beautiful, lacy green foliage. Very exotic. 50' 3" 5 F
- ***Phyllostachys nigra* - *Henon* - "Blue Gray Timber Bamboo"**
 - o Usually much larger than black bamboo. The distinctive looking canes are rough to the touch and blue/grey/green in color. Beautiful, lacy green foliage. 54' 3.5" 5 F
- ***Phyllostachys nigra megurochiku* - (no common name)**
 - o Similar to Henon, but the culm grooves are brown or purplish-black. Beautiful, lacy green foliage. 54' 3.5" 5 F
- ***Phyllostachys nigra Pungtata* - "Black Striped Timber Bamboo"**
 - o Random canes get black streaks. Looks like marble. Very unusual and unique rare plant. Beautiful, lacy green

foliage. 54' 3.5" - 8' F

• ***Phyllostachys viridi* - (no common name)**

- Excellent wood with straight canes. 35' 2" - 5' F

• ***Phyllostachys viridis* - (no common name)**

- Similar to *Phyllostachys bambusoides* with arching culms. 47' 3.25" - 5' F

• ***Phyllostachys viridis* - Housseau - "Housseau"**

- Beautiful, green arching culms with bright yellow grooves. Exotic looking. 45' 3" - 5' F

• ***Phyllostachys viridis* - Robert Young - "Robert Young"**

- The canes turn sulphur green to a bright banana yellow with bright green stripes of variable width are displayed on many internodes. A truly exotic, tropical-looking timber bamboo which is very hardy. 40' 4" - 5' F

• ***Phyllostachys uluax* - (no common name)**

- A fast growing timber with shiny, bright green canes. Similar to *bambusoides* but considerably harder. Has a white, powdery band beneath each node. 70' 5" - 8' F

• ***Pleoloblastus chino vaginata variegata* - (no common name)**

- Ground cover bamboo with variegated leaves. Graceful foliage with slender white striped leaves. 2-4' 3/8" 10' F

• ***Pleoloblastus viridi-striatus* - (no common name)**

- In spring/ summer, leaves are brilliant yellow with contrasting green stripes 3' .25" - 8' F

• ***Pseudosasa japonica* - "Japanese Arrow Bamboo"**

- The canes are erect with large, slightly drooping foliage. Some leaves can be a foot long by 1.5" long. Great bamboo for a tropical effect. Does well in pots. 18' .75" - 8' F

• ***Sasa palmata* - (no common name)**

- Looks best in shade. Has large broad leaves, 15" long and 4" wide. 7' .25" 15' F

• ***Sasa tessellata* - (no common name)**

- Usually no more than 4' tall. It has the largest leaves of any bamboo in cultivation. Up to 24" long and 4" wide. 7' .25" - 15' F

• ***Sasa veitchii* - "Kuma-sasa"**

- The large, dark green leaves turn white along the margins, giving the plant a unique and striking appearance, especially at a large clump at a distance. 5' .25" - 10' F

• ***Sasaella masamuneana albostrata* - (no common name)**

Thick green leaves striped with white or creme-striped leaves. Makes a beautiful ground cover. 6' .25" - 10' F

• ***Semiarundinaria fastuosa* - "Temple Bamboo"**

- Handsome, tall stately, narrow branched bamboo brown to purple canes. 30' 1.50" - 10' F

• ***Shibataea kumasasa* - (no common name)**

- Short, broad, holly like leaves 6' .25" - 10' F

• **Other rare collectibles:**

We have very many other rare bamboos available in limited quantities such as several forms of variegated "Moso", variegated *Phyllostachys nigra* Henon, variegated *Bambusa* "Oldhamii" and many others. If you are interested in some certain species, please give us a call, fax or e-mail us.

» Garden Tours:

Come and visit our 31 - acre display gardens. Walk through the many groves. Call for an appointment and directions.

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[\[Mailto:moso@cruzio.com\]](mailto:moso@cruzio.com)



'OHE

(For more information on the many incredible values and uses of 'Ohe / bamboo, see the list of related web sites at the bottom of this page.)



This versatile and giant member of the grass family is able to grow more rapidly than any other plant. After two months of growth it is the size it will remain for its lifetime. Bamboo, as well as niu, coconut, is one of the most useful and practical plants for humankind, providing food, shelter, medicine, raw materials for household and garden use, musical instruments and more.

'Ohe is said to be one of the "canoe plants" brought to Hawai'i Nei by early Polynesian settlers in their oceanic navigation. This plant may have originated in India or Java.

The two types of 'Ohe or "Hawaiian Bamboo" both have thin walled culms and long internodes. One is *Schizostachyum glaucofolium* and the other is a green *Bambusa*. Both are clumping bamboos. They seldom flower. Most bamboo do flower, but only once in 60-120 years, with large heads much like those of sugar cane. After blooming, all of the bamboo plants of the same species die back. This happens worldwide at the same time! Quite a remarkable feat, right out there with the similar global songs of the Humpback whales. Overall, there are more than 1000 kinds of bamboo, all of them relatives of the sugar cane and of corn.

This vigorous and fertile plant flourishes in warm moist forests. Growing to more than 50 feet high, some bamboo can reach 100 feet in height, growing up to 18 inches a day. The stems have hollow thin-walled internodes with thick hard nodes joining them. The beauty and purity of line is very pleasing to see.

Bamboo grows in clumps of culms called sympodial, the term for tropical bamboo that grows directly from the parent, where the culm and rhizome are one. Other kinds of bamboo have a single free-standing culm and are called monopodial, which means they grow out of a rhizome that travels fast and far underground.

Valuable in the control of soil erosion, bamboo can be propagated from young rhizomes or from cuttings. The plant needs rich moist soil, full sun and nitrogen. Upon Maui's Haleakala's slopes above Keano in an area called Waikamoi, it is said that the Polynesian goddess Hina planted a grove of 'ohe brought from Tahiti.

The leaves of 'ohe are long, flat, thin and pointed, with rough undersides that can cut. They are different lengths, depending upon the variety, the largest being about 14 inches long by 2 inches wide. Most varieties shed their leaves yearly, growing new ones that appear immediately.

The Japanese name for bamboo is take, while the Chinese call it chu.

Bamboo's usefulness takes many forms. People of ancient Hawai'i used 'ohe to kindle fires, blowing air through hollow tubes onto the embers. This tool was called 'ohe pūhi ahi.

To irrigate their crops, kanaka would cut the 'ohe in half lengthwise, then cut out the middle of the node walls, allowing water to flow down these irrigation troughs from the stream into the different levels of the taro pond fields.

A traditional knife for cutting the umbilical cord of a newborn was fashioned of bamboo, as were skewers to string kukui nuts for candies, lama or kali kukui.

In the tapa cloth-making process, women used lapa, bamboo sticks, to apply dye. Also, 'ohe sticks were cut out to create designs that were then stamped with dye into intricate geometric patterns on the kapa. The stamps of bamboo were called 'ohe kapala.

The 'ohe stem is a valuable plant for hula accompaniment. A three-holed nose flute, 'ohe hano ihu, is made from the hollow stem of the thin-walled bamboo, as well as percussion instruments, including the pu'ili, fringed split bamboo tubes about two feet long that rattle when hit. Other sounds can emanate from the 'ohe ka 'aka'aka, tubes of the thick-walled bamboo, with closed nodes on the bottom end. These are alternately struck on the ground to make tones. Another instrument using bamboo is the 'ohe kani, somewhat like a Jew's harp.

Bamboo wood has silica in its cell walls and is hard, straight, strong, flexible, light and easily split.

Lengths of 'ohe with closed ends can be used as a water carrier. Surely, these vessels of water would have been invaluable on ocean voyages. Along with the gourd, ulu, the needs for water vessels was well met. Other uses for the bamboo stems are for building, posts, bridges, vessels, gutters, floats, hives, canes, flutes, masts, furniture, utensils, agricultural tools, ladders, ornaments, toys and fishing poles. If the bamboo is dried correctly, the esthetic smooth beauty of bamboo stalks can be maintained for years. Otherwise, rot and mildew can occur.

Split bamboo can be made into mats, hats, screens, baskets, fans, umbrellas, brushes, paper, ropes, roofing tiles, wall mats, or

as a part of the sleds of old Hawai'i, called holua.

As food, the young shoots are eaten, as are seeds of some varieties.

Ohe is said to be the kinolau, body form, of the Polynesian creator god Kane, along with kalo/taro and ko/sugar cane.

For more information on the many incredible values and uses of bamboo, visit the following related web sites:

Bamboo Societies, Networks, and Educational Pages:

- [Bamboo Web](#) (Kauai, Hawaii)
- [American Bamboo Society](#)
[List of Bamboo Resources on the Internet](#)
- [Australian Bamboo Network](#)
- [European Bamboo Society](#)

Commercial Bamboo Nursery Pages:

- [Tradewind's Bamboo Nursery](#) (Oregon)
- [Bamboo Giant](#) (Santa Cruz County, California)
- [Bert Associates Bamboo](#) (Westford, Massachusetts)
- [Endangered Species](#) (Tustin, California)

The 24 "Canoe Plants" of Ancient Hawai'i

Ape - Awa - Awapuhi - Iiau - Iou - Kahu - Kamanii - Ki - Ko - Kou - Kukui - Māla
Mila - Miu - Noni - Ohia - Ai - Olena - Olona - Pila - Uala - Uhi - Ulu - Waukea

 [Return to the Canoe Plants Home Page](#) or the [Table of Contents](#)

The 1996 ABS Bamboo Product Source List

The following people and companies supply things related to bamboo, such as books, building material, landscape architecture supplies, crafts and musical instruments. The first table gives the categories of supplies, the second table gives the contact information.

This list was compiled by Richard Haubrich (email: rahau@att.com). If you can supply additional information or updates, please contact him. His postal address is listed under the ABS National Organization information.

Bamboo Products

Product	Kind	Sources
Agriculture Consultants		Bp
Bamboo Plywood and Paneling		Sm
Books		DKTD, Ab
Crafts		CMN, Bs, St
Fences, Screens, Water Pipes, etc.		COMN, Br, Br, Bs
Fertilizer	Soluble Silicates	Dy
Hardwood Flooring	The Temperate Bamboo Quarterly	M, Al, Pl, Sm
Landscape Consulting		CDEGKMNRASACD, Wa
Magazines		T
Musical Instruments		K, En, Ka, Wa
Poles		ADGMSTU, Br, Bp, Br, Fr, Pr
Rhizome Barriers		BCGMNPRAD
Seedlings, Cuttings		CCTAD

The Companies

Code	Name and Address	Phone	Products
Rb	AB5 Bookstore Herbert Hillery 1989 Richcreek Rd. Austin, TX 78757	512-452-7146	Books, reprints of articles and reproductions of out of print books plus back issues of <i>The Journal of the American Bamboo Society</i> . Send a SASE for a list.
Al	Alpha Flooring 2718 Suffolk Houston, TX 77027	713-622-5777 713-622-3911 fax alphafl@aol.net	Polyurethane-coated bamboo flooring in the Houston market, will also ship throughout the U.S. and to export markets.
Bf	Bamboo Fencer 31 Germania St. Jamaica Plain, MA 02138	617-524-6137 617-524-6188 fax	Fences, gates, bamboo constructions, poles; wholesale and retail, will ship anywhere.
Bp	Bamboo People 322 North 82nd St. Seattle, WA 98183	206-781-1437	Consults and designs bamboo plantings on farms and acreage nationwide. Brokers bamboo shoots and poles in Western Washington. Non-profit corporation
Br	Bamboo & Rattan Works 478 Oberlin Ave. S. Lakewood, NJ 08701	908-378-8228 908-985-8386 fax 800-4-BAMBOO	Custom bamboo fencing, gates, poles, rattan & other related items. Wholesale & retail; will ship worldwide.
Bs	Bamboo Smiths PO Box 1801 Nevada City, CA 95959	916-292-9449 916-273-8818	Custom work, fences, gates, garden structures and other items using bamboo, wood and brush materials.
Dy	Dyna-Gro 1865 Broadway San Pablo, CA 94806	800-DYNA-GRO (800-396-2476)	Dyna-Gro Plant Nutrients are liquid formulas that supply calcium, magnesium, sulfur and 18 trace minerals as well as N-P-K. In addition, Dyna-Gro Pro-Tek1 supplies soluble silicon solution containing potassium silicate.
Ex	Experimental Musical Instruments PO Box 784 Nicastro, CA 94946	415-662-2182 http://www.windworld.com/eml/	A magazine devoted to unusual musical instruments of all sorts. Articles on bamboo instruments have often appeared. Subscriptions \$24/yr. (\$27 Canada, \$34 overseas). Sample available on request.
Fr	Frank's Cane & Rush Supply 7252 Hehl Ave. Huntington Beach, CA 92647	714-847-8919 714-843-5646 fax	Bamboo poles and cut bamboo in all sizes; also sugar palm and coconut fiber twines for Japanese style fences. Wholesale and retail.
Ka	Michael Kanner 581 Beverly Ave. Capitola, CA 95018	408-476-2259	Bamboo flutemaker; transverse, Shakuhachi, repairs; children's workshops on flutemaking; performances, ethnomusicology.
Pl	Plyboo America, Inc. 745 Chestnut Ridge Rd. Kirkville, NY 13082	315-687-7888 315-687-5177 fax	Bamboo flooring from China, wholesale and retail, will ship within the U.S..
Pr	Progress Trading 2301 Tomich Road Hacienda Hts., CA 91745	818-913-2888 818-965-6774 fax	Bamboo poles imported from Guangdong Province, China. Minimum order is one bale (about \$50 to \$180).
Sm	Smith & Fong 222 1/2 Winfield St. San Francisco, CA 94118	415-285-8238 phone and fax	Bamboo plank flooring; wholesale and retail, will ship within North America. Also bamboo plywood, bamboo paneling and bamboo gifts.
St	Stone Forest PO Box 2840 Santa Fe, NM 87504	505-986-8883 505-982-2712 fax	Crafts, including water spouts, water hammers, ladles, Japanese stone lanterns and basins. Will ship within the U.S.
Wa	Richard Waters, MFA PO Box 1071, Pahoa, HI 96778	808-965-8955 BambooMuse@aol.com	Wind, string and percussion - musical instruments, sonic devices and sonic sculptures. Worldwide shipping. Lectures, performances & landscape consulting.

V. *RESEARCH*

A. HISTORICAL

B. DESIGN APPROACH

A. HISTORICAL

Timeline

PREHISTORY - FOLKLORE

a combination of legend and folklore

Inhabitants of the country of Vietnam

Austro-Negroid

Mongolian Tribes

Chinese

Earliest known kingdom:

Van Lang, came into existence between 1000 and 500 B.C.

Au Lac, who conquered Van Lang, existing only 50 years

1000 YEARS OF CHINESE RULE

Country: Nam Viet

111 B.C. Nam Viet conquered by Chinese under Han dynasty

900 YEARS OF INDEPENDENCE

939 A.D. Vietnamese seized opportunity of a China weakened by internal strife

Independence was interrupted by one brief period of Chinese rule under the Ming dynasty from 1406 to 1416 A.D.

EUROPEANS DISCOVER VIETNAM

1535 A.D. Portuguese arrive in Vietnam

1636 Dutch arrive in Vietnam

1672 English open a trading office

1680 French open a trading office

1700 English influence virtually ends
Dutch traders fade out of picture

1777 Ban on Christian religion ends when French Bishop of Adran, Pigneau de Behaine saves life of 16 year-old son of the Nguyen king

1883 With death of Emperor Tu Duc, French quickly move in to claim Vietnam

THE FRENCH IN VIETNAM

1883 Treaty OF Protectorate signed with France, making Vietnam a French colony

WAR IN VIETNAM

- 1946 Following WWII, France returns to claim Vietnam with agreement signed with Vietminh, recognizing it as the only legitimate native political regime for all of Vietnam.
- 1950 Communists, under Ho Chi Minh, gain recognition for Democratic Republic of Vietnam from Communist party in China
- 1953 US, fearing all of Asia would fall under Communist rule after the Communist take over in North Korea, start to supply aid to French in Indochina.
- 1954 - French defeated by Communists
- Geneva Agreements ended eight year struggle by French to reassert colonial rule in Vietnam, dividing Vietnam along 17th parallel.
- Governments of North and South Vietnam consolidate their positions.
- 1956 Scheduled national elections to reunite Vietnam as one country never occurs.
- 1960-1962 Communist escalate war to "war of liberation"
- 1963 Diem overthrown by Communist, followed by a country ruled by a series of military and civilian governments.
- 1966 US continues military aid to match Communist escalation, amounting to full-scale military involvement.
- 1975 US withdraws from Vietnam, fall of Saigon to North Vietnamese troops ensue.

VIETNAMESE REFUGEES EMBARK ON SETTLEMENT IN OTHER COUNTRIES

B. DESIGN

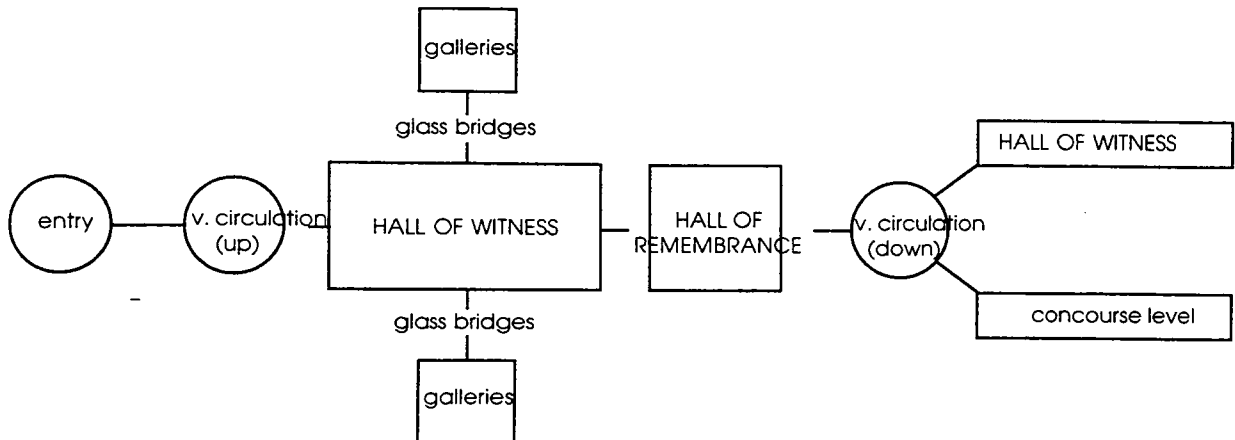
1. United States Holocaust Memorial
Museum
Washington, D.C.
Architects: Pei Cobb Freed &
Partners
2. Chikatsu-Asuka Historical
Museum
Osaka Prefecture, Japan
Architects: Tadao Ando and
Associates
3. Washington State History Museum
Tacoma, WA
Architects: Moore/Andersson
Architects
4. High Desert Museum
Central Oregon

Articles of reference:

"Architecture: Museums as Art"
"People and Places"
"The Constructivist Museum"

ANALYSIS I: United States Holocaust Memorial Museum, Washington, D.C.

by: Pei Cobb Freed & Partners, Architect
Notter Finegold & Alexander Associate Architect



IMAGERY:

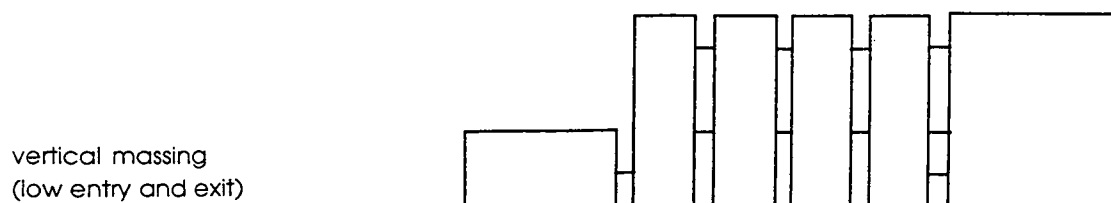
Holocaust, Nazi German Concentration Camps of WWII
confinement
emotionally gripping
cold / heartless
building devoid of emotion, yet, housing much emotion

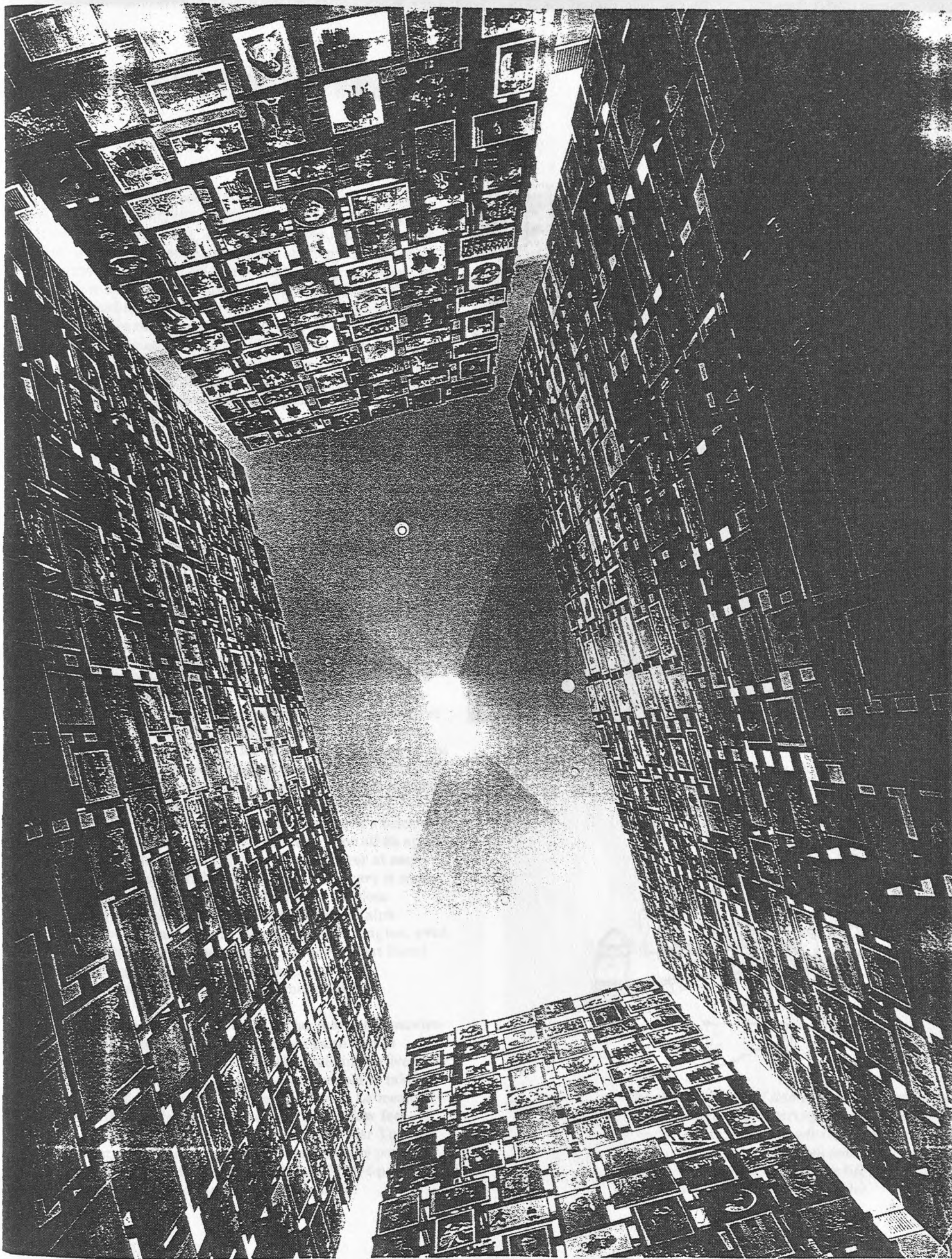
ACHIEVED VIA:

1. CIRCULATION PATTERN: starts with herding visitors into box car-like elevators, into defined / confined spaces displaying poignantly sharp elements of life in the concentration camps, ending in feelings of "relief" as visitor comes back down to area of exit. However, the visitor is left changed--for the realization that millions of others never had the chance to feel the "relief" / release.

2. MATERIALS:

- built up bars and angles into large, exposed framing members fastened and bolted with tension rods to allude to railroads and industrial infrastructure, lending to the killings on a massive scale
- etched glass bridges, casting ghostly shadows overhead
- brick - warehouses used for incinerator plants
- raw nature of connections in the wooden beams and supports forming the displays throughout





Permanent Witness

*United States Holocaust Memorial Museum
Washington, D. C.
Pei Cobb Freed & Partners, Architect
Natter Finegold & Alexander,
Associate Architect*

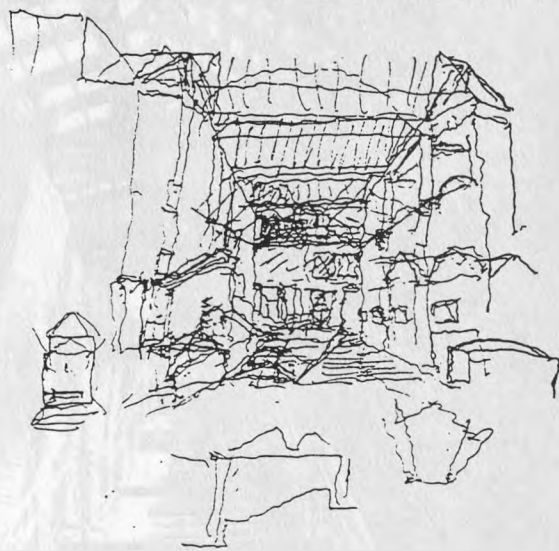
For nearly a visitor to the United States Holocaust Memorial Museum commented, "I never thought I could be so affected by architecture." If others share this view, James Ingo Freed, partner at Pei Cobb Freed, will have succeeded in a daring strategy. He sought nothing less than to use the very fabric of a building to convey the criminality of the systematic, industrialized extermination of some six million Jews and other so-called enemies of the Nazi state. Freed had other options. He could have designed a dignified, neutral container, suited to its site adjacent to the Washington Mall. Others worried that architecture could only prettify this searing historical event. Don't risk trivializing the memory, they argued. They said Freed should at best put the museum underground, perhaps marking it with some greenery.

Freed shared many of these misgivings, but after a visit to some of the death camps, he began to feel that the architecture of the Memorial could embody the deliberateness and frightening efficiency with which the "final solution" was carried out. The building's external form hints at this strategy, while respecting its surroundings. The apparently deferential yet disconcerting monumentality of the 14th Street entrance "gives you a premonition of loss," says Freed. In the Hall of Witness, the central space around which the museum is organized, the architecture metaphorically moves the visitor from the idealistic precincts of the Mall to the horror of the Holocaust.

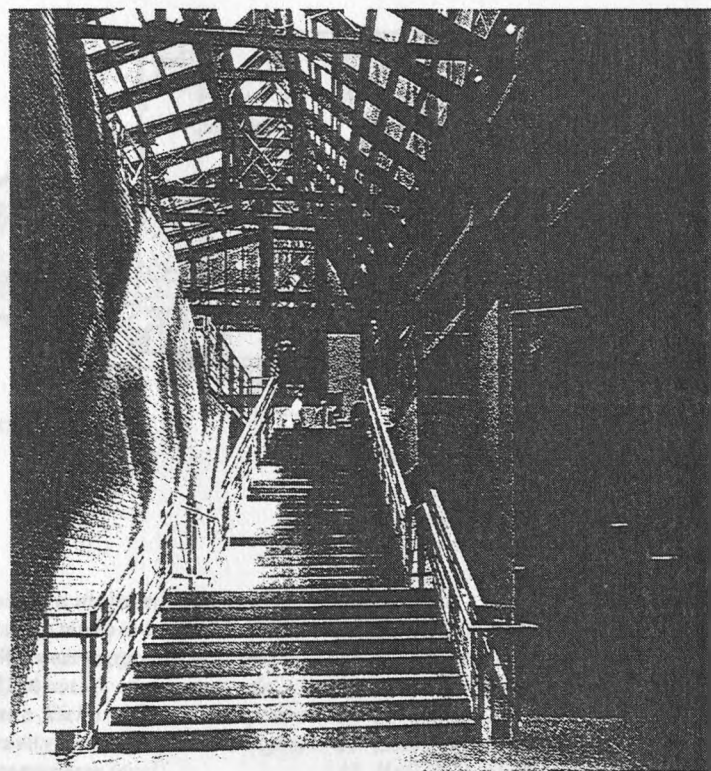
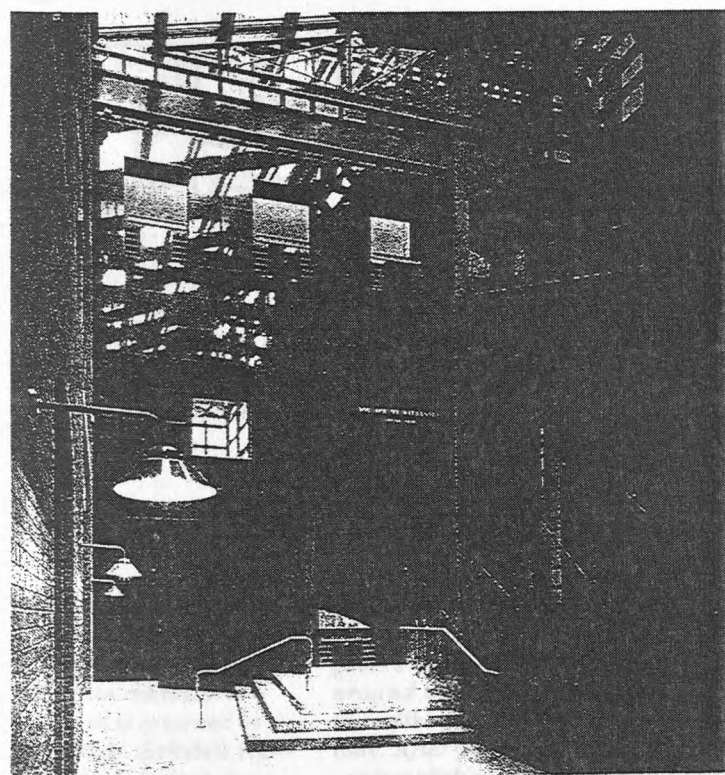
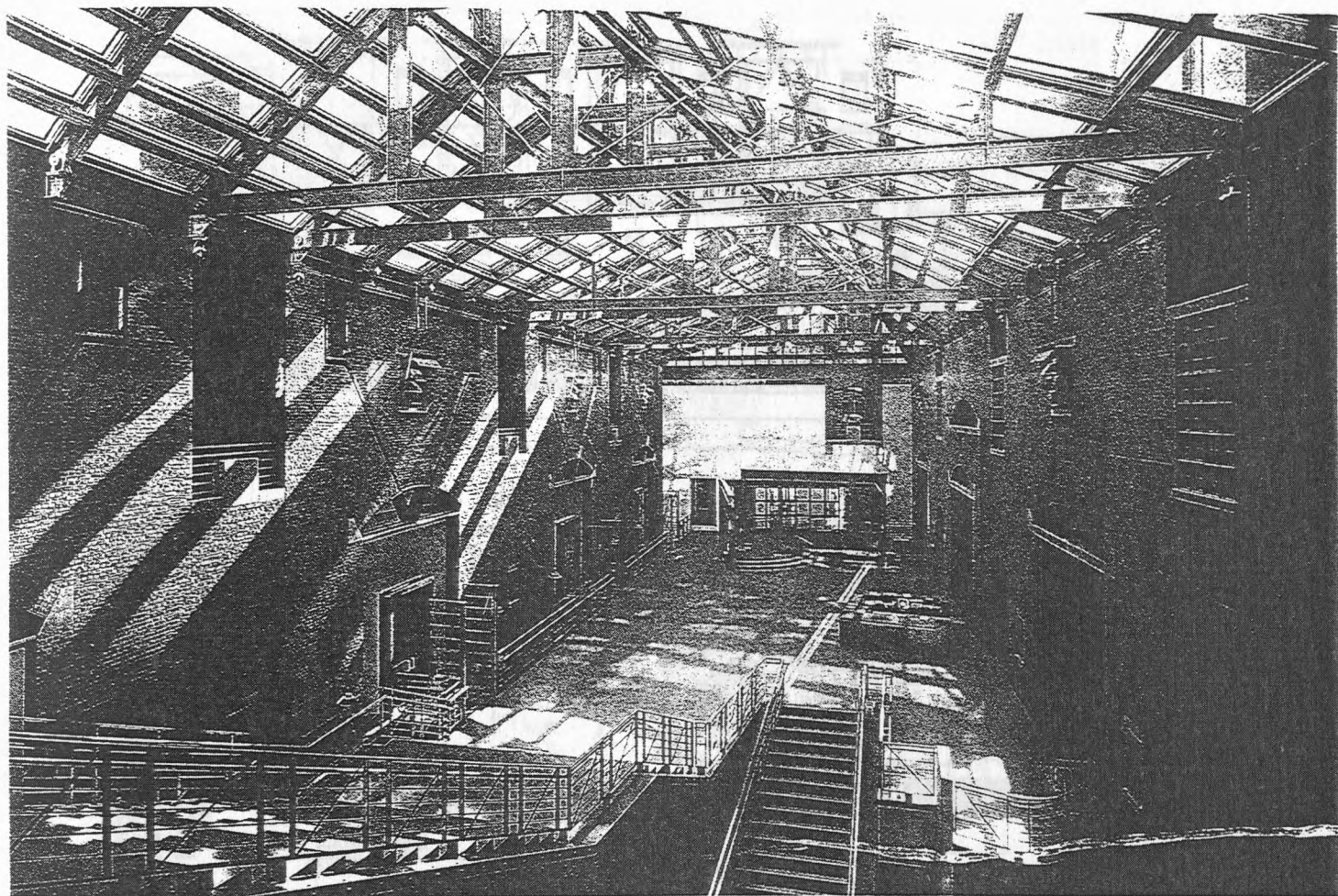
Freed, a man used to turning technology to good ends, was particularly affected by the Nazi's twisting of the instruments of modern life—medicine, law, engineering—to the manufacture of annihilation. Visitors see in the exhibits what Freed saw: the handsome yet chilling wood trusswork of a bridge meant to separate Jew from gentile; an ordinary boxcar once used for death-camp transports; the manufacturer's trademark on oven doors that cremated thousands. As the visitor repeatedly encounters the Hall of Witness in the process of passing from one side of the building to the other on disturbing yet beautiful glass bridges, one sees in Freed's brick and steel a permanent reminder of industry's collusion. For all its apparent success (visitors seem enormously moved, and linger at each display), this approach has pitfalls. The menacing imagery is sometimes at war with the elegance of Pei Cobb Freed's flawless detailing. (Some argued, according to exhibit designer Ralph Appelbaum, that the museum should have been much rougher, even creating physical discomfort among visitors.) Freed's most literal symbolism risks being theatrical or trivializing: *Stalag 17* light-fixture louvers or an armor-plated information desk.

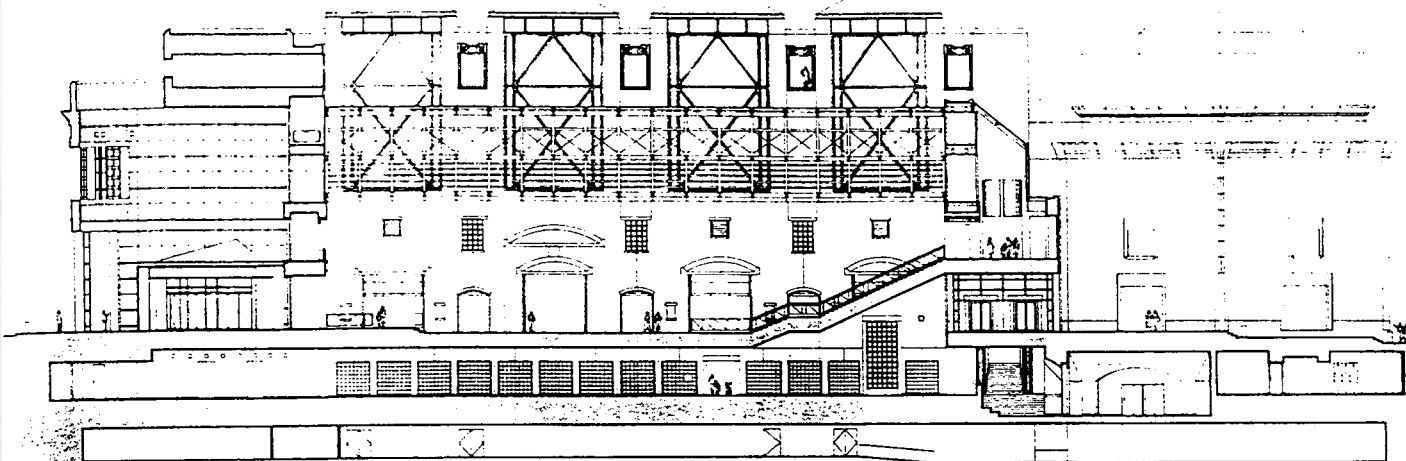
Placing the museum facing the tidal basin in the heart of monumental Washington was a controversial decision (see page 66 and RECORD, April 1988, page 65). Freed wanted his building to live up to the site and the nation's commitment, even cause people to take action. At the Memorial's dedication, survivor and Nobel Laureate Elie Wiesel pleaded with President Clinton—sitting only a few feet away—to "do something to stop the bloodshed in [former Yugoslavia]." This moment, broadcast around the world, held the power it did because Wiesel was standing in front of this 285,000-square-foot mass of brick, steel, and limestone. *James S. Russell*

Jeff Goldberg, Esto photos

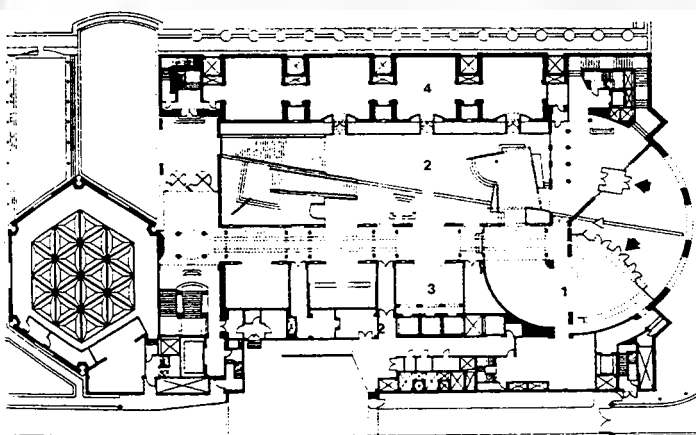


The six-sided Hall of Remembrance, next to the Bureau of Engraving, faces the Mall (top). The 14th Street facade (middle) displays a disturbing Neoclassicism. 1,500 photographs document prewar life in the Polish shtetl of Ejszyski (opposite).

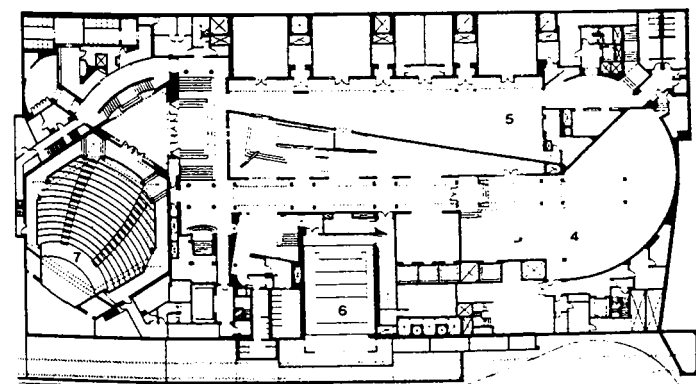




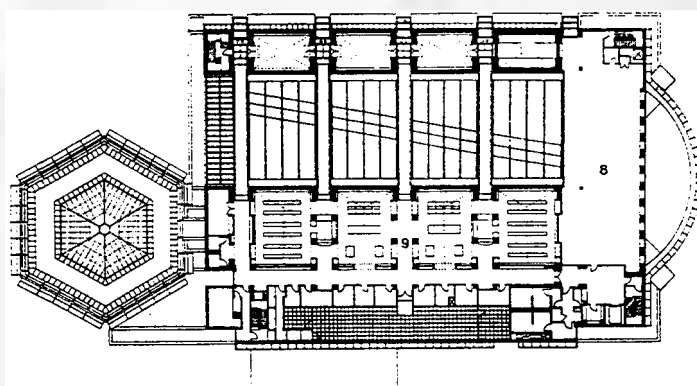
SECTION LOOKING SOUTH



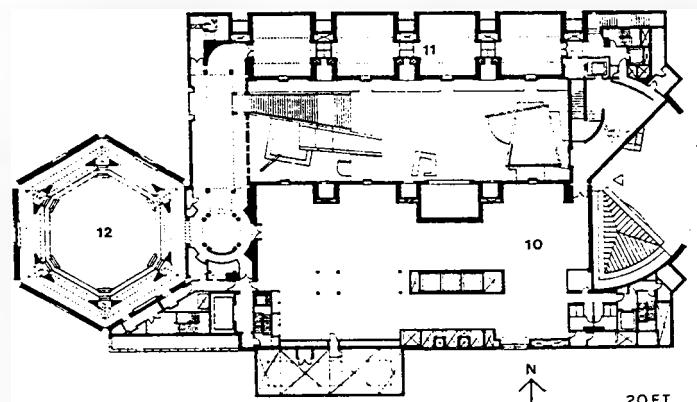
MAIN FLOOR



CONCOURSE LEVEL



FIFTH FLOOR



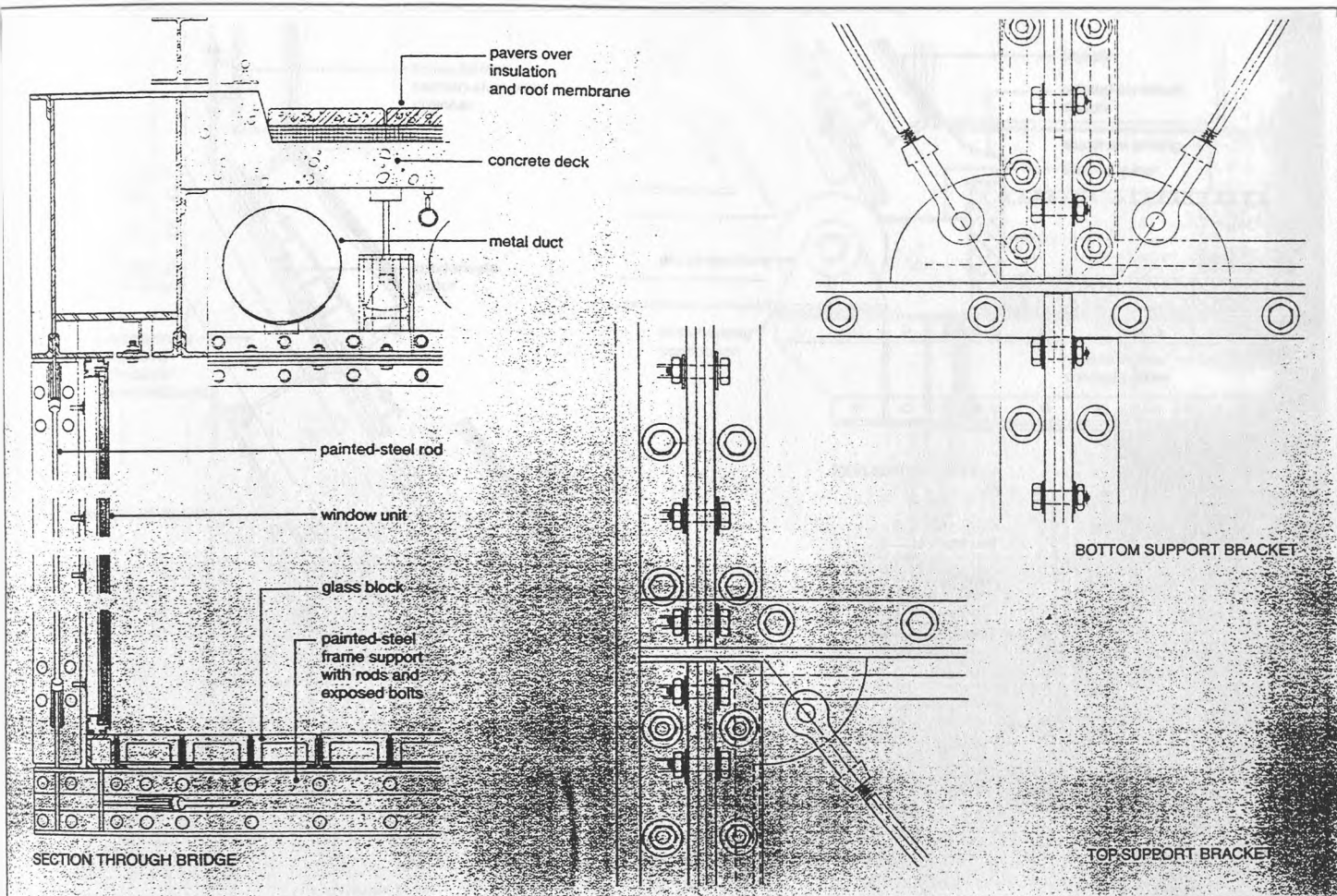
SECOND FLOOR

1. Entrance lobby
2. Hall of Witness
3. Elevators to exhibits
4. Temporary exhibits
5. Education center
6. Cinema
7. Meyerhoff Theater
8. Administration
9. Library/archive
10. Permanent exhibit
11. Learning center
12. Hall of Remembrance

In the Hall of Witness (opposite), rough brick suggests the camps; metal strapping resembles that of the crematorium ovens, and all is crowned by a skewed skylight. Exhibits begin on the fourth floor (not shown).

it and the third floor are similar to the second, above), and glass bridges carry visitors around the Hall of Witness to towerlike galleries laid enfilade. After pausing in the contemplative Hall of Remem-

brance, a monumental stair returns visitors to the Hall of Witness (opposite bottom left). Another stair descends past a Richard Serra sculpture (Gravity, opposite bottom right) to concourse level.



The bridges

To the architect, the building's power derives from its permanence and the thoroughness of its detailing. "So much of the museum is documentary or photographic," says Freed.

"you want to put the person in touch with real materiality."

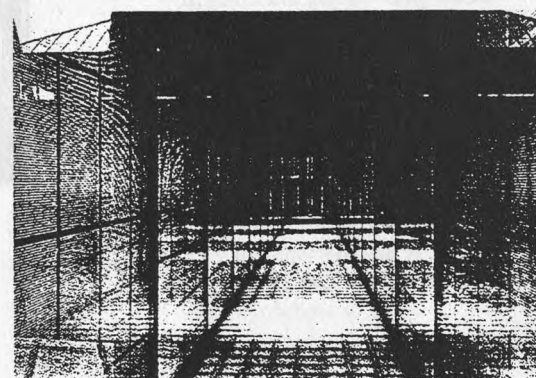
To him, among the chief horrors of the Holocaust was the industrialized methods it employed. With engineers

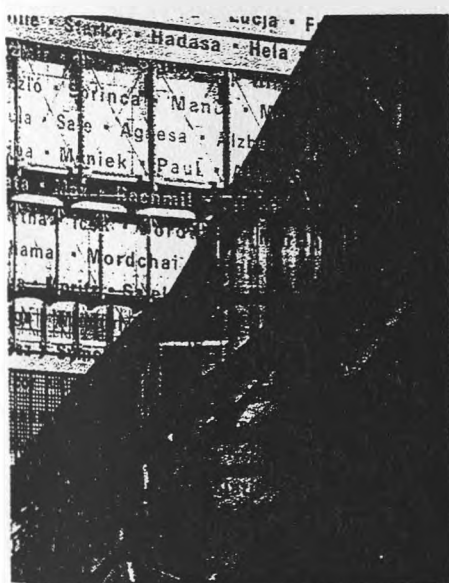
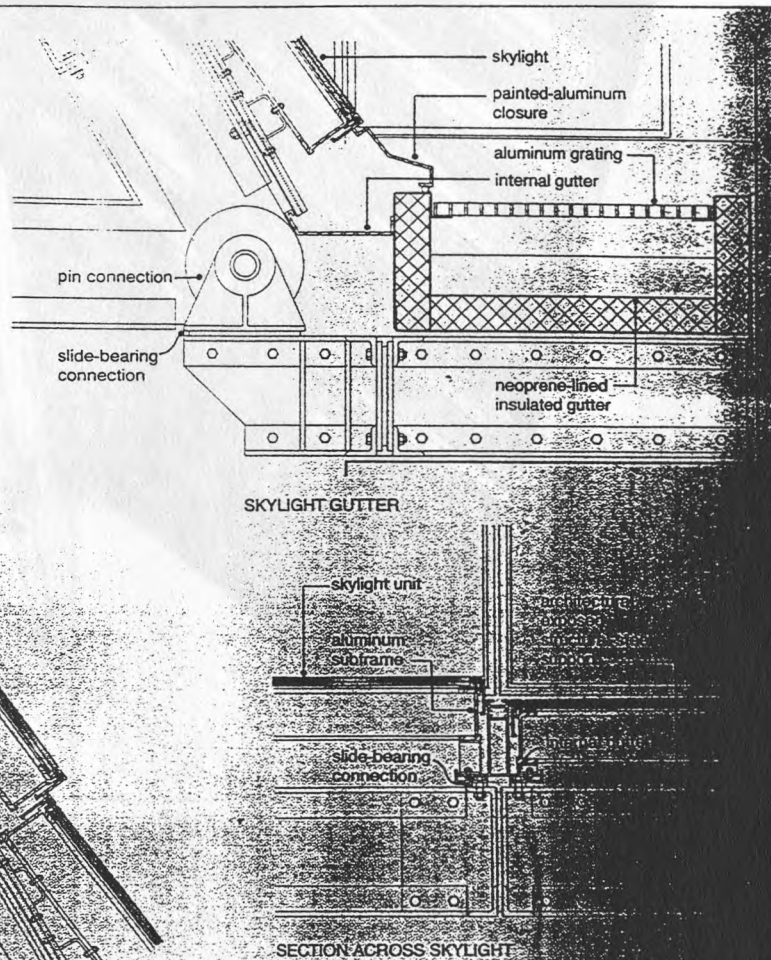
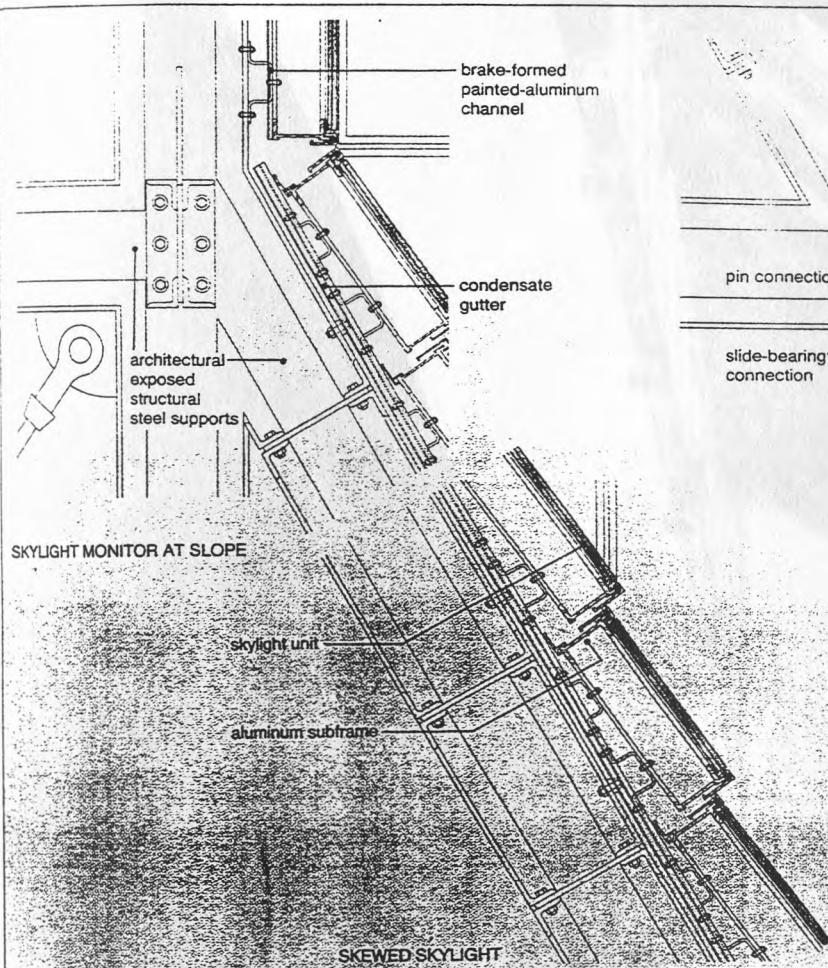
Weiskopf & Pickworth, the firm designed "architectural" structural steel as framing for bridges and a giant skylight.

Rather than use today's large welded-steel sections, the architect and engineer built up bars and angles into large, exposed framing members fastened with bolts and tensioned with tie rods. These techniques are rarely used now, but recall the railroads and other industrial infrastructure that made kill-

ing on the scale of millions possible. Even if visitors don't read the specific metaphors that drove the design, Freed feels that they will recognize that this is "an emotion-driven building."

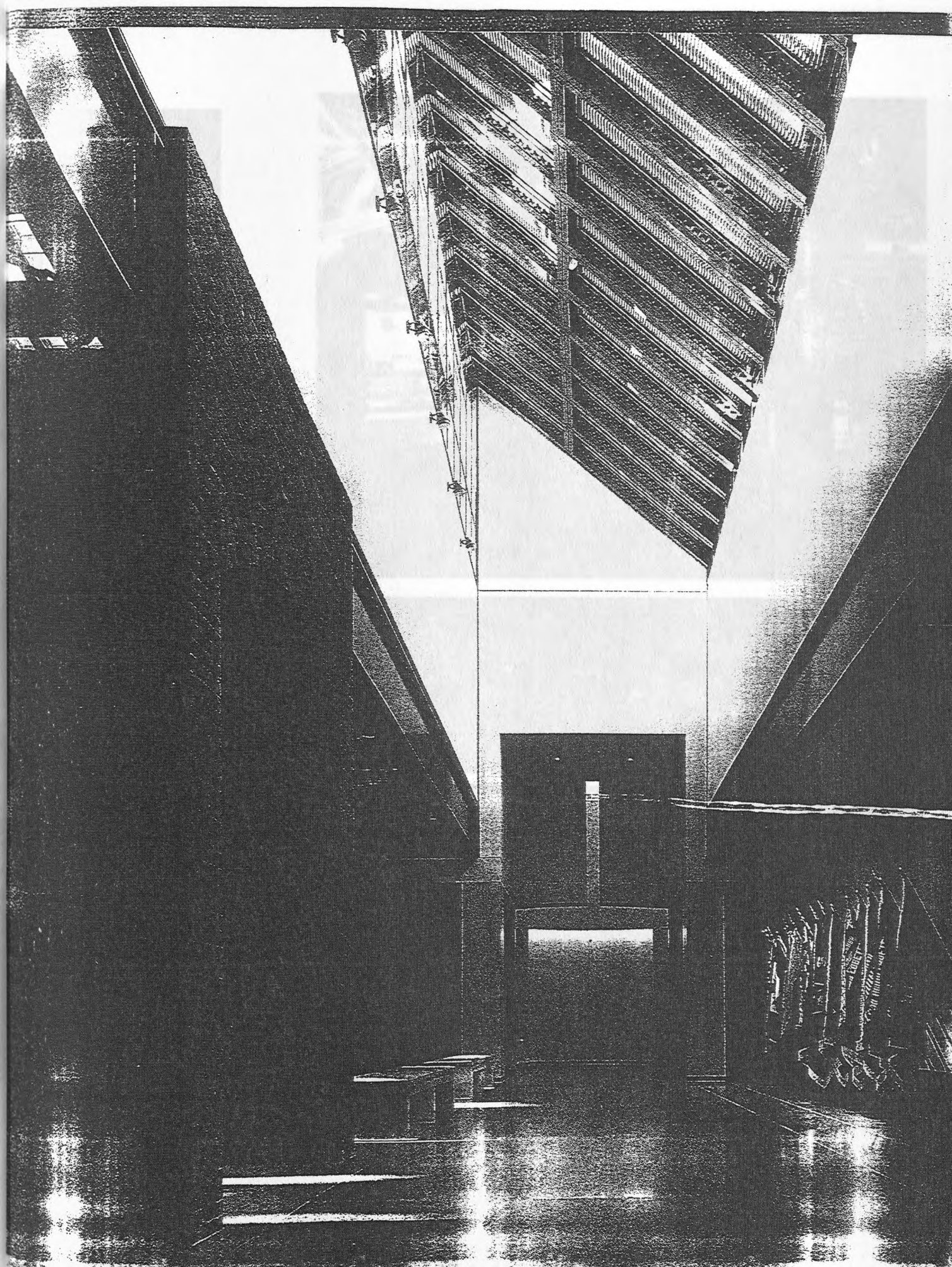
Within the bridges, light fixtures, sprinkler pipes, and ducts run exposed under a visible concrete-slab roof. As visitors exit a segment of the museum devoted to suppression and ghettoization, they encounter the first names of victims fused into the bridge's glass walls using ceramic frit. The places of origin of those who went to the death camps are emblazoned on another bridge. Glass block floors convey a disquieting fragility to those walking across while casting shadows on those passing below.

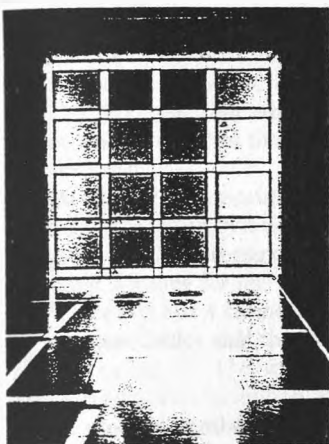




The skylight

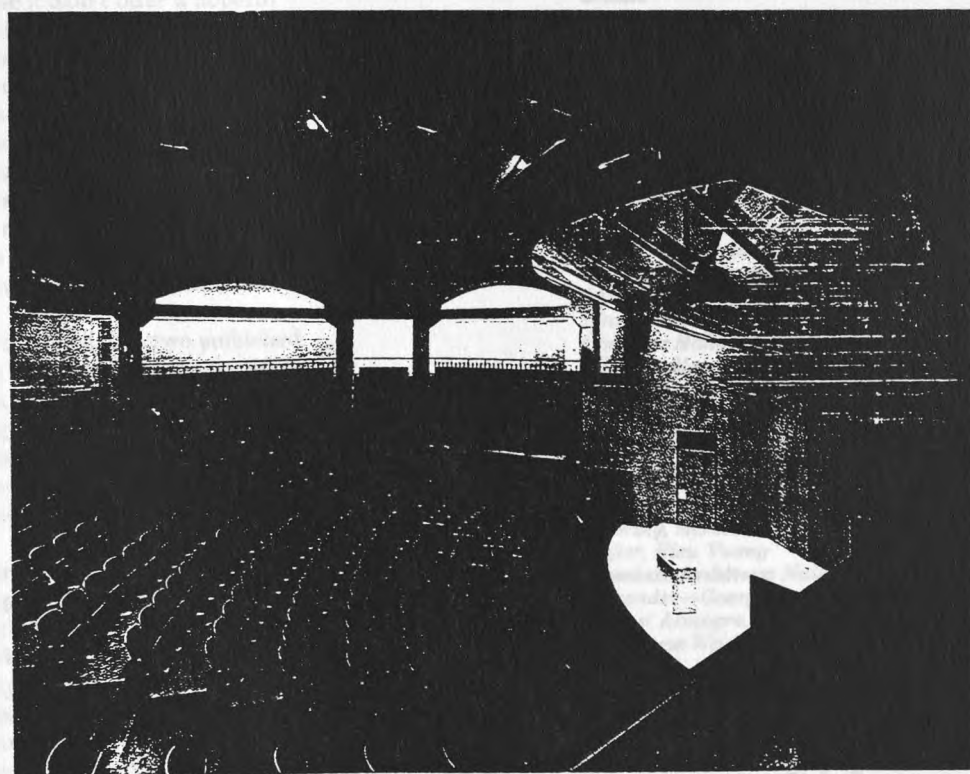
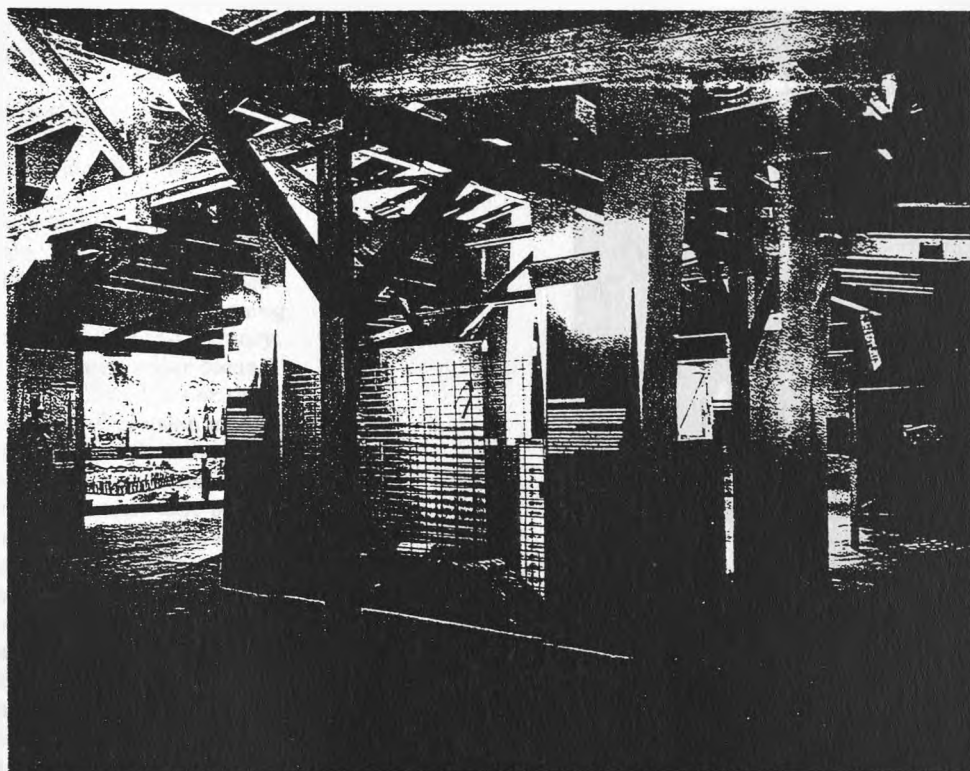
Drawn at an angle across the rectangular Hall of Witness the glass roof resolves its geometries through warped surfaces (far left). According to Jack Greenberg of subcontractor Architectural Glazing, "we had to calculate the elevation at every corner of every panel while making a constant increment of [elevation] difference between each unit." The depth of aluminum supporting channels varies to position the glazing. The channels are isolated from steel framing by Teflon bearing pads. Structural butt-glazing holds laminated glass to aluminum subframes. The glass units are capped by an extruded ring, and weather-sealed. A similar technique was used to bridge the gap between units.





Advised by a committee of both survivors and scholars, curators and designers divided the exhibits into three segments, 1933-1939, 1939-1945, and 1945-present—each occupying one floor. These dispel any preconceived notion that the visitor will be exposed only to the Holocaust's most horrific aspects. Instead, the exhibits persuade largely through photos and films of faces—faces in the ghettos, faces on identity cards, faces of people forced to flee or march. The few actual artifacts ("the contents of people's pockets," says interpretive designer Ralph Appelbaum) thus take on unexpected power. The exhibits unflinchingly remind us that humankind's obligations are not just historical: The debate over whether to bomb the death camps resonates as if it were occurring today. On the third floor (top right) curators have reassembled parts of a barracks from Auschwitz-Birkenau. Low walls surrounding a kiosk permit visitors to choose whether to view films showing the museum's most grisly images.

A brick portal (opposite) leads visitors exiting exhibits back to the Hall of Witness. Framed in stainless steel and faced with limestone, a blind "window" (above) gives visitors only glimpses of the Mall outside. Right: the Meyerhoff Theater.



interview

Excerpts from an interview with Edward T. Linenthal, a professor of religion and American culture at the University of Wisconsin, Oshkosh, who is completing a history of the U.S. Holocaust Memorial Museum.

RECORD: Some said that America was not the place for this Memorial...

EL: Having a memorial on American soil was for many survivors a final affirmation by the U.S. government that the Holocaust happened, that it is recognized. I think there is an element of America doing penance for not recognizing the event while it was happening. Where it is has a tremendous impact on the stature of the memory.

RECORD: Critics said the Memorial should have had a wider focus.

EL: The big question was, is this about the six million Jews or the Jews plus the two million others? Elie Wiesel saw European memorials which remembered "Polish" victims and "socialist" victims, but didn't mention Jewish victims. Distinctions are important here. Some unresolved tension remains, but clearly the argument made by the Memorial is that the six million Jews are at the center of the story. It becomes universal in understanding the particularity of the six million with reference to other victim groups.

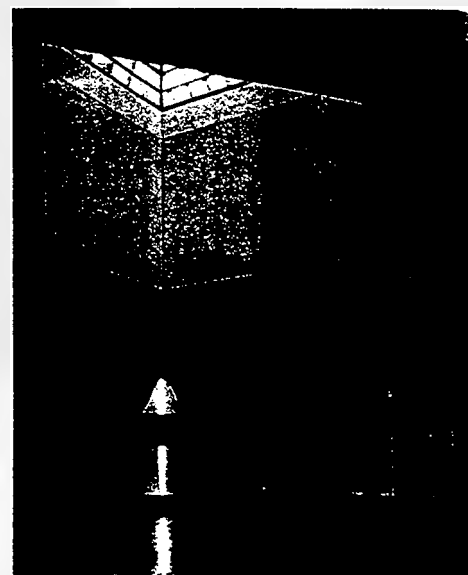
RECORD: Wasn't Pei Cobb Freed's design controversial?

EL: Freed wanted the building to be a good neighbor, but believed it couldn't just exist as squeezed between its site lines, so the Hall of Remembrance protruded a few feet [toward the Mall]. The Fine Arts Commission forced it back to the line. Freed had bricked-up windows in the Hall of Remembrance, reminiscent of the Warsaw ghetto. Some commissioners opposed that because it didn't offer a hopeful story on the Holocaust. The essential conflict was whether you need to have a redemptive message. Freed wants to displace visitors from Washington; he wants to immerse them in the world of the Holocaust, and return them changed. He says he didn't know how to design for hope. Some commissioners asked for what Lawrence Langer, a professor of English who analyzes Holocaust literature, calls preferred narratives—you make it more acceptable. In a kind of compromise, Freed took out the brick and installed limestone. It's still a blank window, but it doesn't evoke the ghetto.

RECORD: Is architecture an appropriate medium for a statement on the Holocaust?

EL: You don't have here an empty or neutral shell, but two embodied statements about the Holocaust: Freed's statement and the permanent exhibition. Some have said there is a danger that people will get swept up in the excellence of the building, that it is a magnificent cathedral-like building. Is this problematic in its own way? There had been suggestions that no building could be appropriate, that no design would be an eloquent enough statement.

I was surprised at how I responded to the camps esthetically. Auschwitz is this camp of old red brick buildings and this dingy, ordinary military-looking stuff. At Birkenau, the killing center at Auschwitz, there is an incredibly vast area of barracks and the remains of four crematoriums. Many barracks have collapsed, so all that's left is chimneys and foundations—like the bones of the Nazis. I was struck by the awesomeness of that scene and the ordinariness of Auschwitz. There's a question of the very newness and monumental power of Freed's building. Some say it does not express that sense of banalization that maybe the old red brick buildings do. Freed's is not at all a banal building. What's also interesting is that the building can be seen as an evocation of the universe of the perpetrator and the exhibits an evocation of the world of the victim. It's an interesting accommodation. The proof of the pudding is in the eating. What they're going away with. ■



After viewing the exhibits, patrons linger in the six-sided Hall of Remembrance (above). They may stroll an ambulatory (opposite) or pause to light candles in niches set into the limestone walls.

Credits

*The United States Holocaust Memorial Museum
Washington, D. C.*

Architect: Pei Cobb Freed & Partners—James Ingo Freed, partner-in-charge/design; Werner Wandelmaier, Michael D. Flynn, partners; Craig Dumas, Beatrice Lehman, associate partners; Michael Vissichelli, Harry Barone, Wendy Evans Joseph, Marek Zamdmer, senior associates; Jean-Pierre Mutin, Stephen Ohnemus, Alissa Bucher, Abby Suckle, Deborah Campbell, associates; Jou Min Lin, Anne Lewison, Jeff Stumacher, Steven Valentine, Jeffrey Rosenberg, Leslie Neblett, Ray Lee, Howard Settles, Fritz Sulzer, Gianni Neri, Christine Mahoney, Jennifer Adler, Paul Albrecht, Marcos Alvarez, Giovanna Brancaccio, Quin Chen, John Coburn, Monica Coe, Karen Cox, Steven Derasmo, Paul Drago, Richard Dunham, Richard Gorman, Rossana Gutierrez, David Harmon, Reginald Hough, Kevin Johns, Jennifer Nadler, Michael Ngu, Camillo Rosales, Amiel Savaldi, Emily Sidorsky, Mercedes Stadthagen, Deborah Taylor, Hieu Vuong

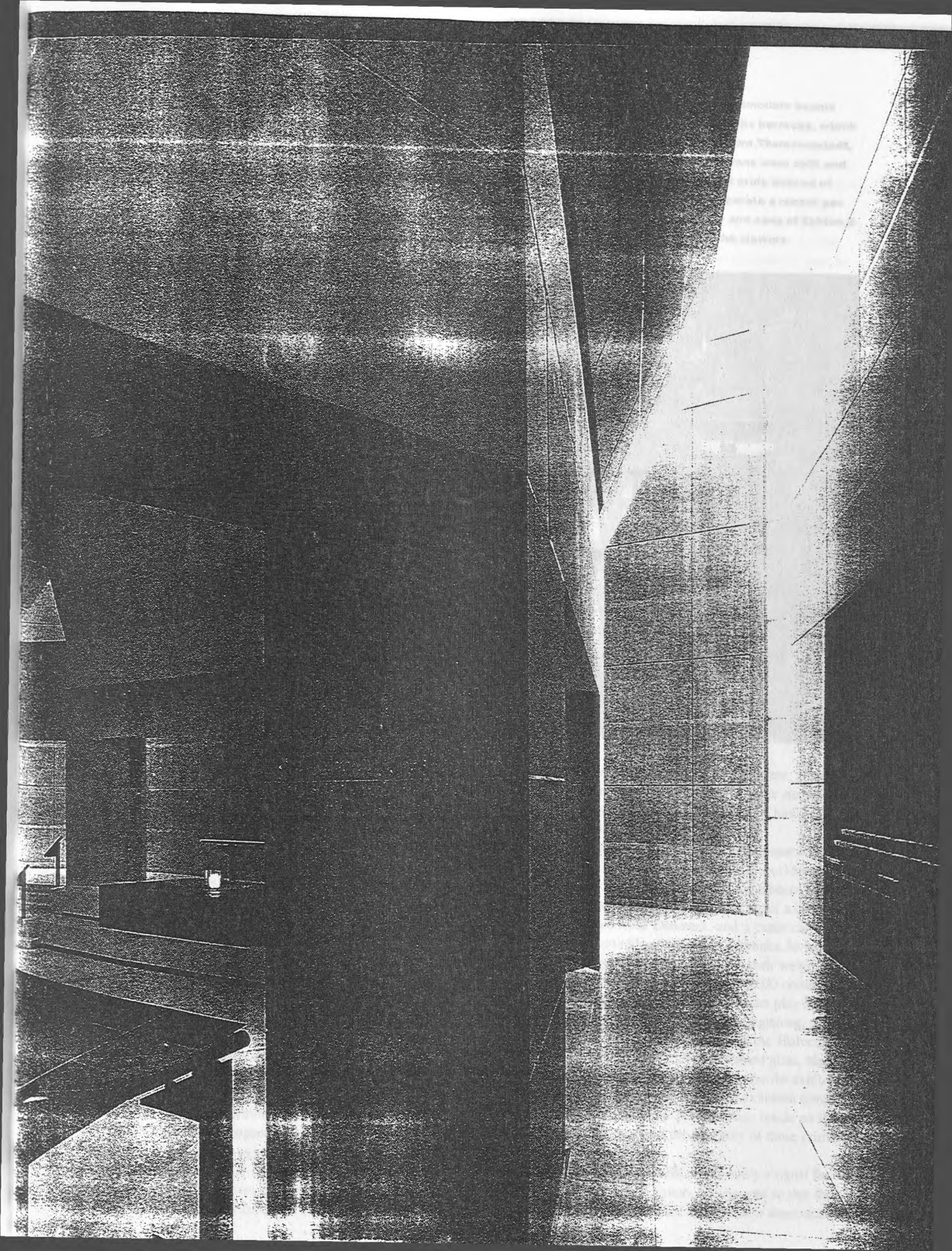
Associate Architect: Notter Finegold & Alexander—George Notter, partner-in-charge; Manuel Almagro, project manager

Engineers: Weiskopf & Pickworth—J. Richard Savignano, associate (structural); Cosentini Associates (mechanical/electrical);

Consultants: Rolf Jensen & Associates (life safety); Jules Fisher/Paul Marantz (lighting); Jaffe Acoustics

General Contractor: Blake Construction Company

...the house
is burning, which
is, I think, what
the world is all about
and the only way
to survive is to
be a survivor.



The World Must Know

Ralph Appelbaum Associates create an unforgettable interior for the U. S. Holocaust Memorial Museum

Text by Karin Tetlow

Below: To accommodate beams from an Auschwitz barracks, which housed Jews from Theresienstadt, structural columns were split and enlarged. Steel grids instead of plate glass separate a recast gas chamber door and cans of Zyklon B pellets from the viewers.



JEFF GOLDBERG/STO PHOTOGRAPHICS

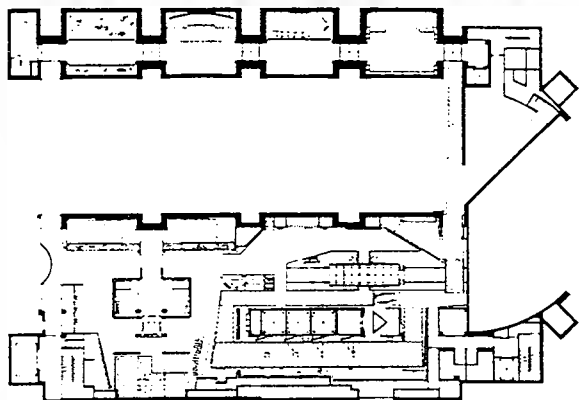
Gently touching the arm of a cart which carried the dead from the "model" Theresienstadt ghetto, noting the meticulous details of the Polish sculptor Mieczyslaw Stobierski's scale model of Crematorium II in Auschwitz, or walking over a room of odd shoes, visitors at the U.S. Holocaust Memorial Museum are caught in a time warp of what must be the most affecting account of the Holocaust. Wrapped in an architecture so seamless as to be invisible, silent viewers move, impervious to time, through a series of events which are timeless in their messages. Emotionally engaged, yet distanced enough to allow the mind to contemplate, they track a history in which a government, sanctioned by law, rationally set about exterminating forever its unwanted and their cultures. As Ralph Appelbaum, president of Ralph Appelbaum Associates and designer of the United States Holocaust Memorial Museum's exhibition interior spaces, points out, "We had to tell the story of a bureaucratic crime of modernity which used the tools of modern society—its rail system and punch-card computers—in a purely evidentiary way to counter the revisionists who claim it never happened."

Precious personal belongings, Nazi-generated photographs, footage of medical experiments and the fate of thousands of Polish Jews shown on some 70 video monitors, and objects such as eye color cards for categorizing Jews, all

contribute to documenting this most terrible event, provoking visitors to ponder the United States' choice not to get involved, and to ask themselves, "What if I had been a bystander, what would I have done?"

Responsible for fitting out the raw concrete space in Pei Cobb Freed's brilliant and appropriate building on Independence Avenue in Washington, D.C., Appelbaum helped search out objects to tell the story. With promises of a barracks from Auschwitz, a boat from Denmark, and a cattle car from Poland to be mounted on rails which led to Treblinka, he helped revise the base building plans to accommodate their weight and dimensions, proposed inscribing the names of 5,000 obliterated villages on glazed bridges, and laid out a three-act play for the fourth, third, and second floors recounting the beginning, genocide, and rescue and remembrance phases of the Holocaust. Architectural materials including canted unframed glass, blackened steel, and raw concrete form the backdrop for the exhibits. Yet the darkened spaces lit by spots are scaled to human dimensions to help viewers access their private space inside so that they may attempt to comprehend the enormity of those crimes against humanity.

Appelbaum's work is exceptional and is surely a signal for a new kind of museum in which visitors are engaged so that they may reflect rather than be entertained to divert their attentions.



Left: The plan of the third floor shows the carefully constructed circulation path drawing viewers to the video monitors through the rail car into the Auschwitz barracks and across the bridge to another wing containing the room of shoes from Majdenek, a Polish concentration camp. Below: Appelbaum's design required the architects to modify the structure to create a tower to house over a 1,000 photographs of Jewish villagers from Ejszyski in what is now Lithuania. Mounted on a canted steel frame, they were collected by a survivor of the single day's shooting where her family and friends perished along with 1,500 neighbors.

Lighting: LSI Edison Price, LSI; *Video Monitors:* John H. Hampshire, Inc. (fabricator); *Custom fabrication:* Charles Malbie Assoc.



Building Design Fact Sheet

ARCHITECT:

James I. Freed of Pei Cobb Freed & Partners of New York City developed the design for the building in association with Notter Finegold and Alexander Inc. of Washington, D.C., and Boston. Freed's mandate from the United States Holocaust Memorial Council was to design a Museum of "symbolic and artistic beauty that is visually and emotionally moving in accordance with the solemn nature of the Holocaust."

LOCATION:

The Museum adjoins the National Mall in Washington, D.C., 400 yards from the Washington Monument, on Raoul Wallenberg Place (formerly 15th Street), just south of Independence Avenue, S.W. The Museum extends across the entire block between 14th Street and Raoul Wallenberg Place, flanked by the Bureau of Engraving and Printing Building, the Museum's Administrative Center and the U.S. Forest Service headquarters, housed in the Auditor's Building. The west face of the building overlooks the nearby Jefferson Memorial, Washington Monument, the Tidal Basin and, in the distance, the Lincoln Memorial.

SITE:

1.9 acres of land made available by the federal government.

FLOOR SPACE:

265,000 square feet of floor area on five levels above ground and two levels below grade. The Museum's Administrative Center occupies approximately 42,000 square feet.

ARCHITECTURAL FEATURES:

* The Hall of Remembrance, the national memorial to the victims of the Holocaust, is a six-sided, 60 foot-high, 6,000-square foot structure illuminated by a skylight. The Hall is designed as a place for both contemplation and public ceremonies and special events such as the national Days of Remembrance ceremony.

* The Hall of Witness is a 7,500-square-foot skylit space that serves as a central gathering place through which visitors will to all parts of the building. At one end, the Hall of Witness features a grand staircase leading down to the concourse level auditoriums, Gonda Education Center and special exhibition spaces.

* The Museum's Permanent Exhibition, tells the story of the Holocaust through text panels, artifacts, audiovisual displays, photographs, documents and eyewitness testimonies, occupies a 36,000-square-foot area encompassing the fourth, third and half of the second floor.

* The Wexner Learning Center, a computer-based learning facility located on the second floor, adjacent to the Permanent Exhibition, offers visitors an opportunity to independently explore specific aspects of the Holocaust and the era.

* Two special exhibition galleries comprising approximately 8,000 square feet, are situated on the first floor and concourse levels. The first floor gallery houses "Remember the Children", a special exhibition for children ages 8 and up and their families. The concourse gallery currently houses "Liberation, 1945".

* Two auditoriums, with 414- and 178-seat capacities, are located on the concourse level. They are available for films, lectures, symposia, musical presentations, etc.

* The Library and Archive occupy 16,000 square feet of space on the fifth floor, plus additional stack space in the basement. The Museum is collecting extensive records of Holocaust-related material from national and international institutions and developing a major library with current holdings of 40,000 volumes. The Museum also houses expanding collections of photographs, oral histories, and film and video, as well the Vladka and Benjamin Meed Registry of Jewish Holocaust Survivors. Together, these facilities comprise the U.S. Holocaust Research Institute, an international center for Holocaust scholarship.

* The Children's Wall of Remembrance features more than 3,000 tiles, each handpainted by an American schoolchild depicting his or her view of the Holocaust. The wall, located on the concourse level, serves as a memorial to the approximately 1.5 million children murdered by the Nazis.

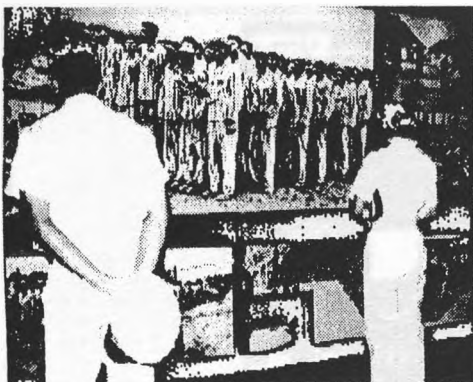
* The Gonda Education Center features three classrooms and a Teacher's Resource Center located on the concourse level.

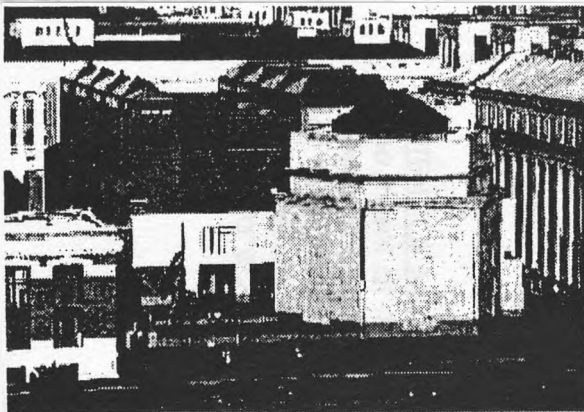
* The Administrative Center, a historic federal building at the corner of the Raoul Wallenberg Place and Independence Avenue, S.W. houses the Museum's administrative offices.

THE PLAZA:

An expansive plaza located on Raoul Wallenberg Place, linking the Museum and the Administrative Center, features a landscaped area and a large open space for public gatherings.







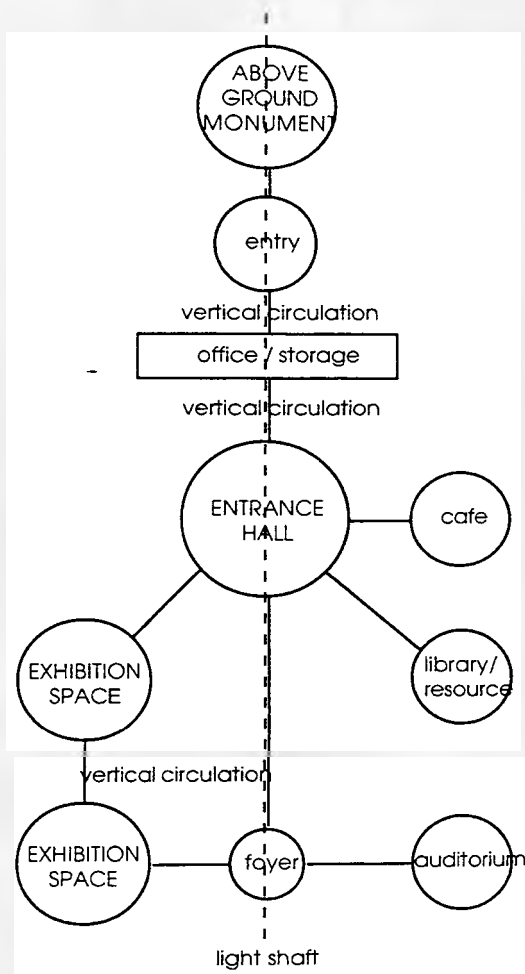
This is an aerial view of the museum looking east.

USHMM Staff photo

[\[return to Home Page\]](#)

ANALYSIS II: Chikatsu-Asuka Historical Museum, Osaka Prefecture, Japan

by: Tadao Ando and Associates, Architects



IMAGERY:

descending into a tomb
transition from world of the living
(above) to realm of the dead
(below)

ACHIEVED VIA:

1. CIRCULATION PATTERN:

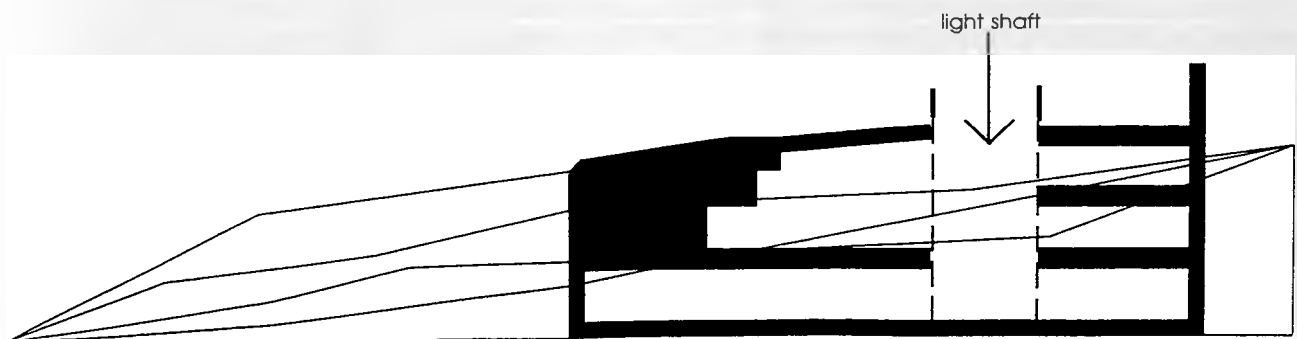
descending circulation connected
via the senses of sight and feel of
warmth, surrounded by a massing of
concrete walls and walkways
"buried" within the earth.

2. MATERIALS:

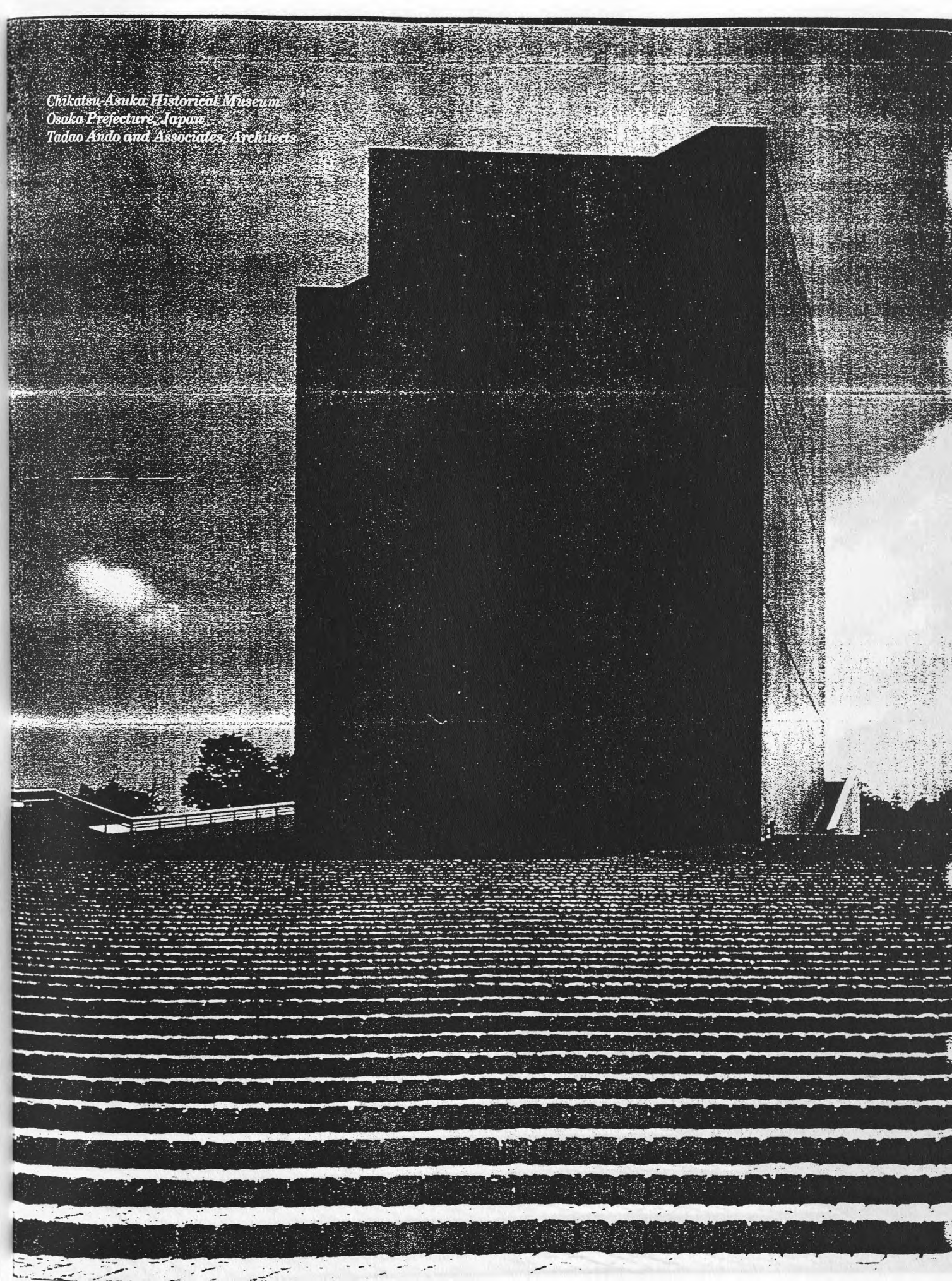
- reinforced concrete
- skylight of glass/ only open
connection with outside world while
within space of entrance hall, foyer.

INTENT OF MUSEUM:

The intent of the museum is to create a museum devoted to ancient Japanese tombs. Broken into the realm of the living and the dead, the utilization of the light shaft helps to both bring light into the space, as well as to delineate between the lighted world of the living, and the darker, closed spaces associated with the realm of the dead, below ground.

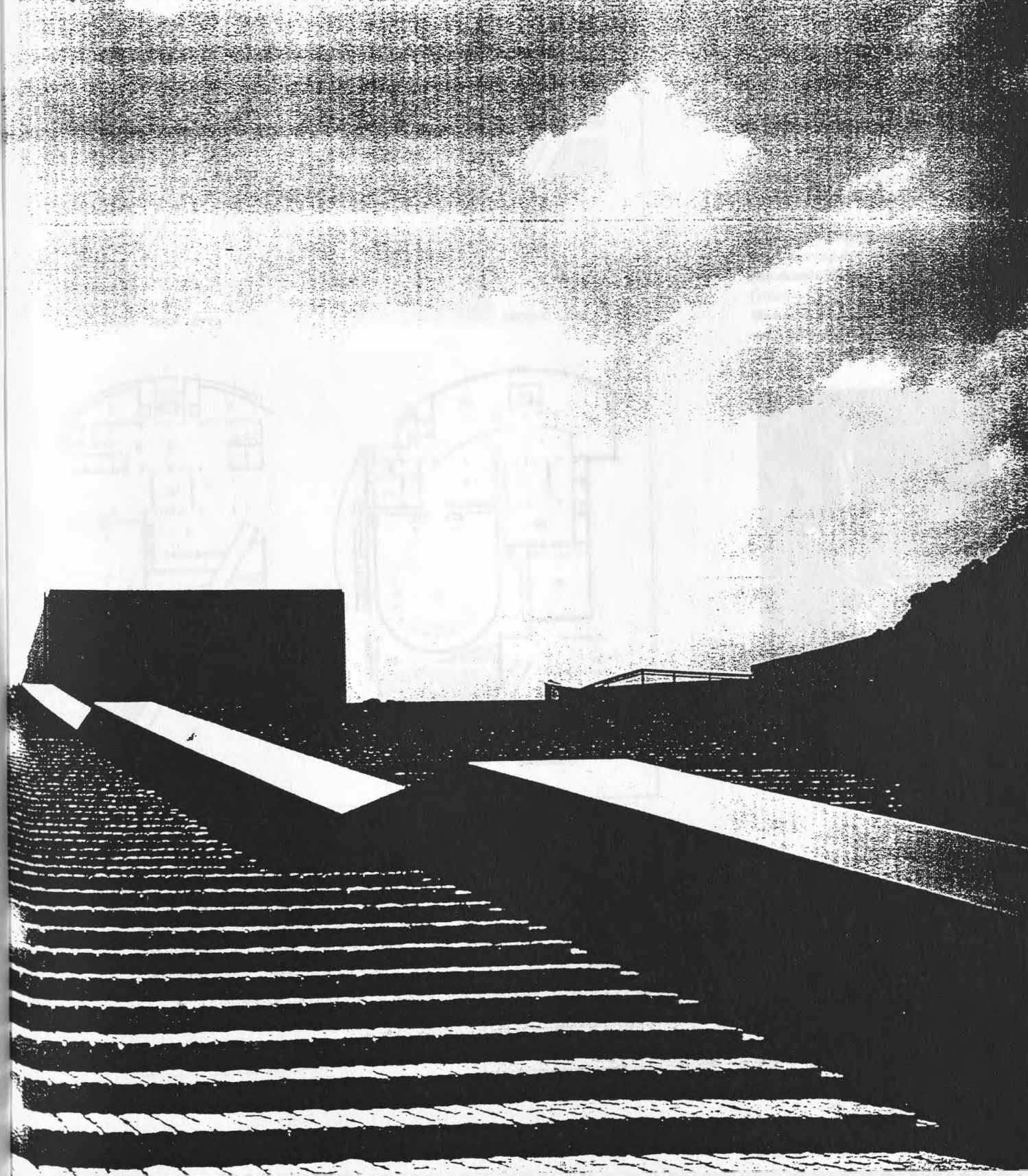


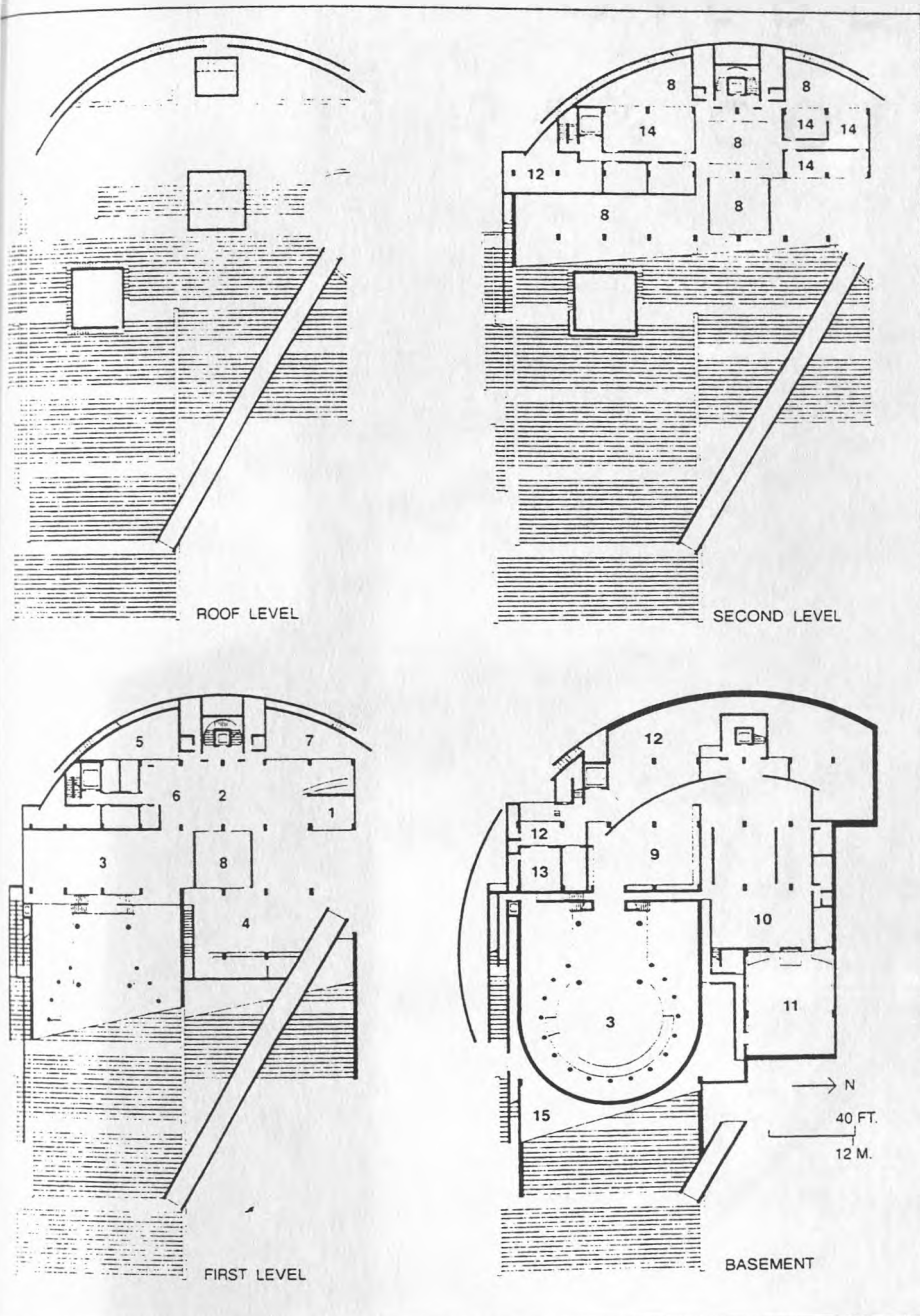
*Chikatsu Asuka Historical Museum
Osaka Prefecture, Japan
Tadao Ando and Associates, Architects*



Palace of the Living and the Dead

*A stepped building joins park-
land to create a museum devoted
to ancient Japanese tombs.*





The stepped roof is punctured by an observation tower, an elevator shaft, and a skylight that crowns the sculpture court. The court visually links the basement-level galleries with the entry level and resource center above (section and photo opposite).

Credits

Chikatsu-Asuka Historical Museum

Osaka Prefecture, Japan

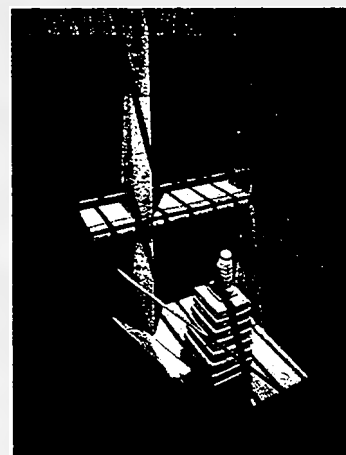
Owner: Osaka Prefecture

Architect: Tadao Ando and Associates

Structural Engineer: Ascoral Engineering Associates

Mechanical Engineer: Setubi Giken

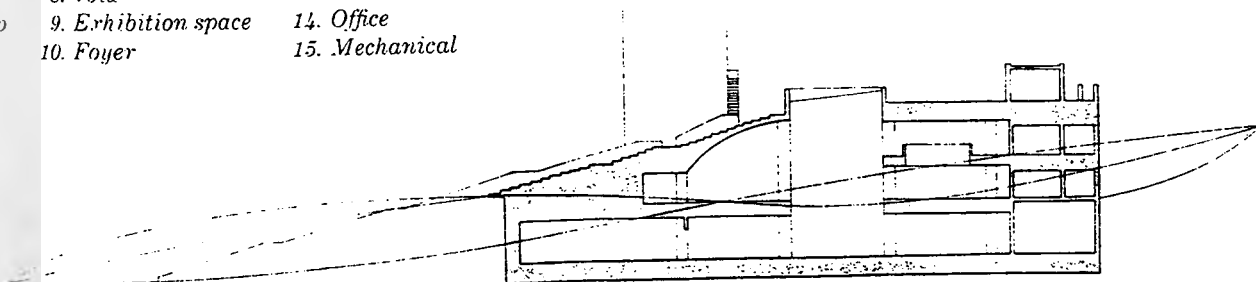
General Contractor: Joint venture of Konolke Construction and Mitsubishi Construction

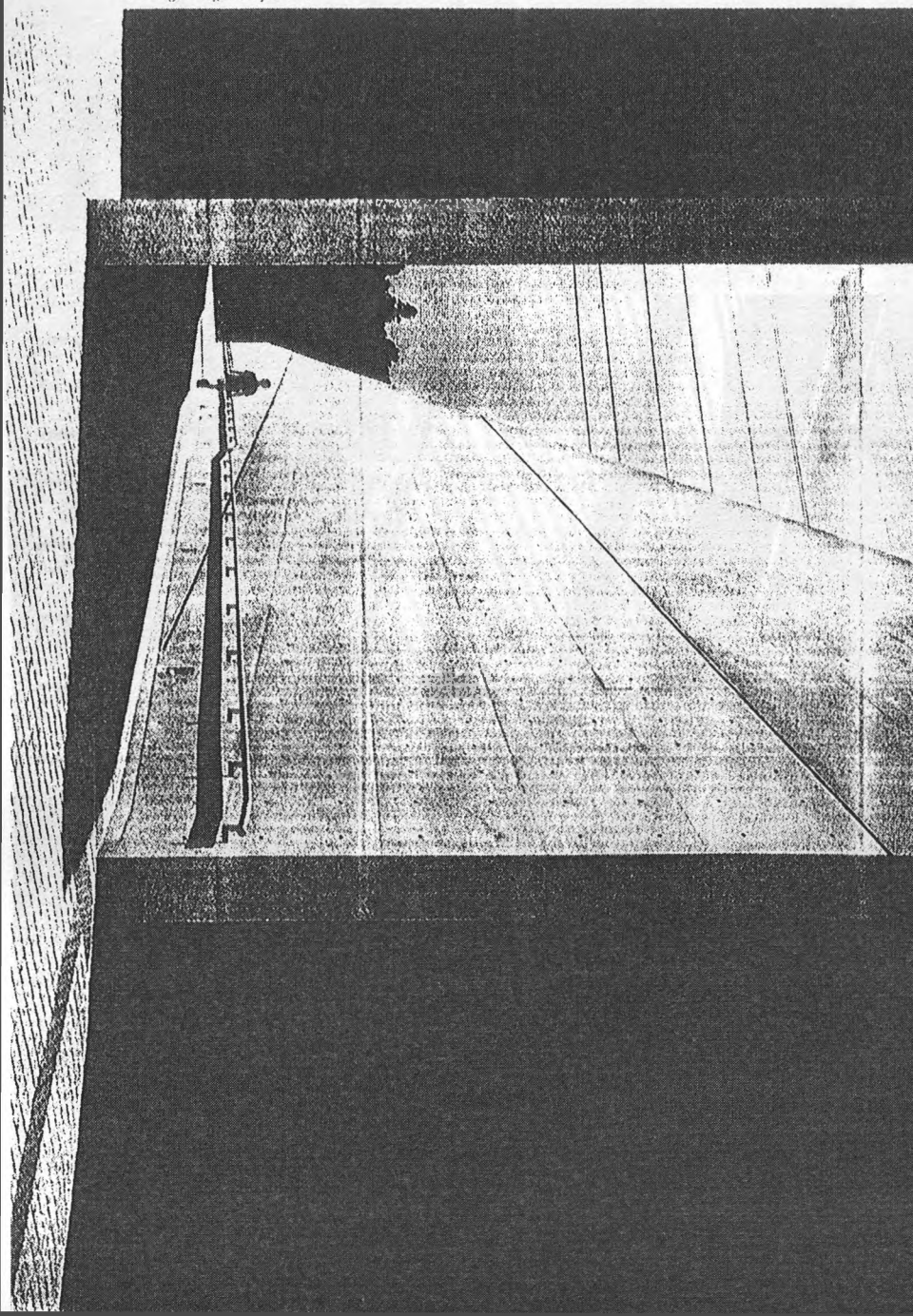


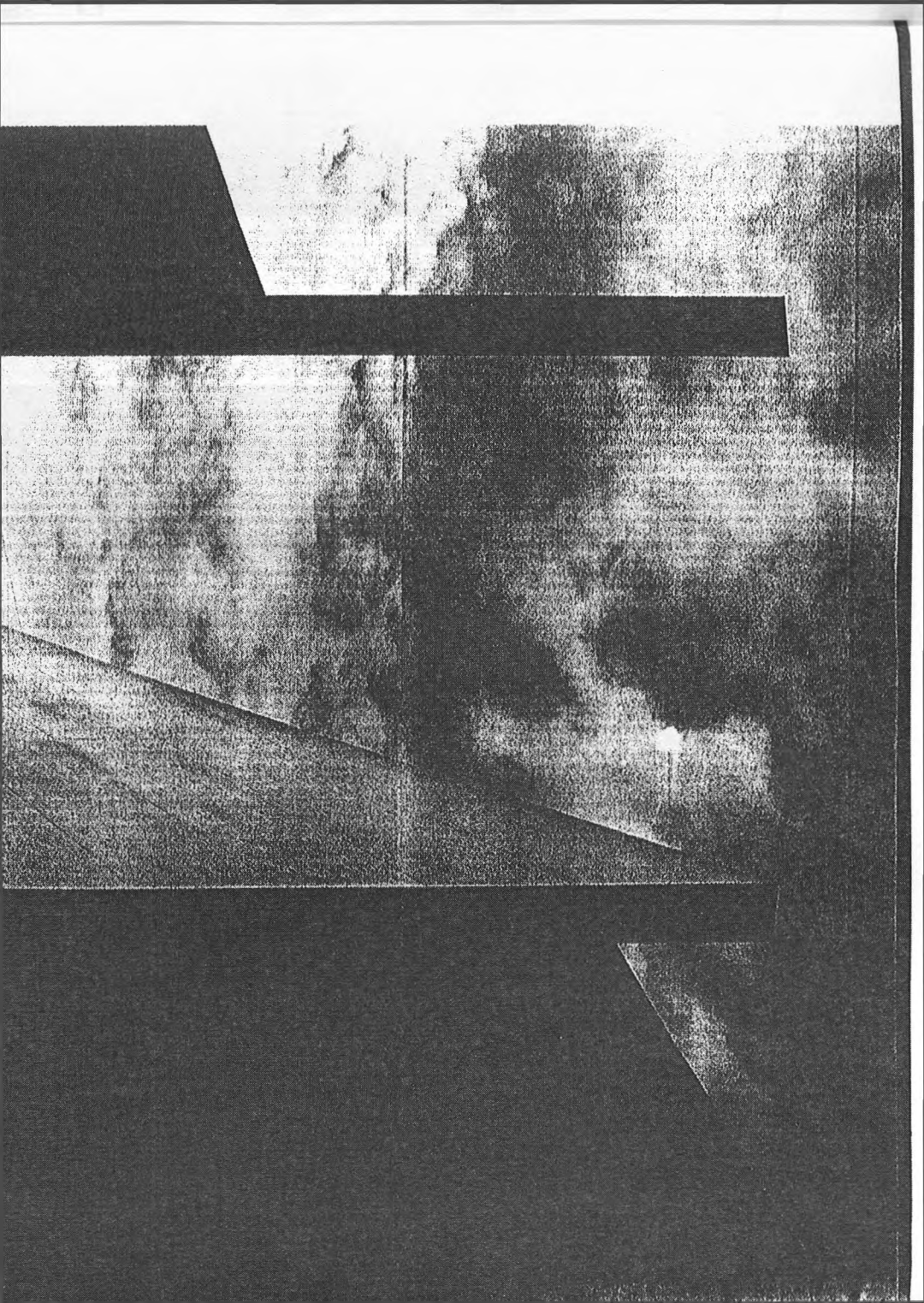
Entrance
Entrance hall
Exhibition space
Library/workshop
Cafe

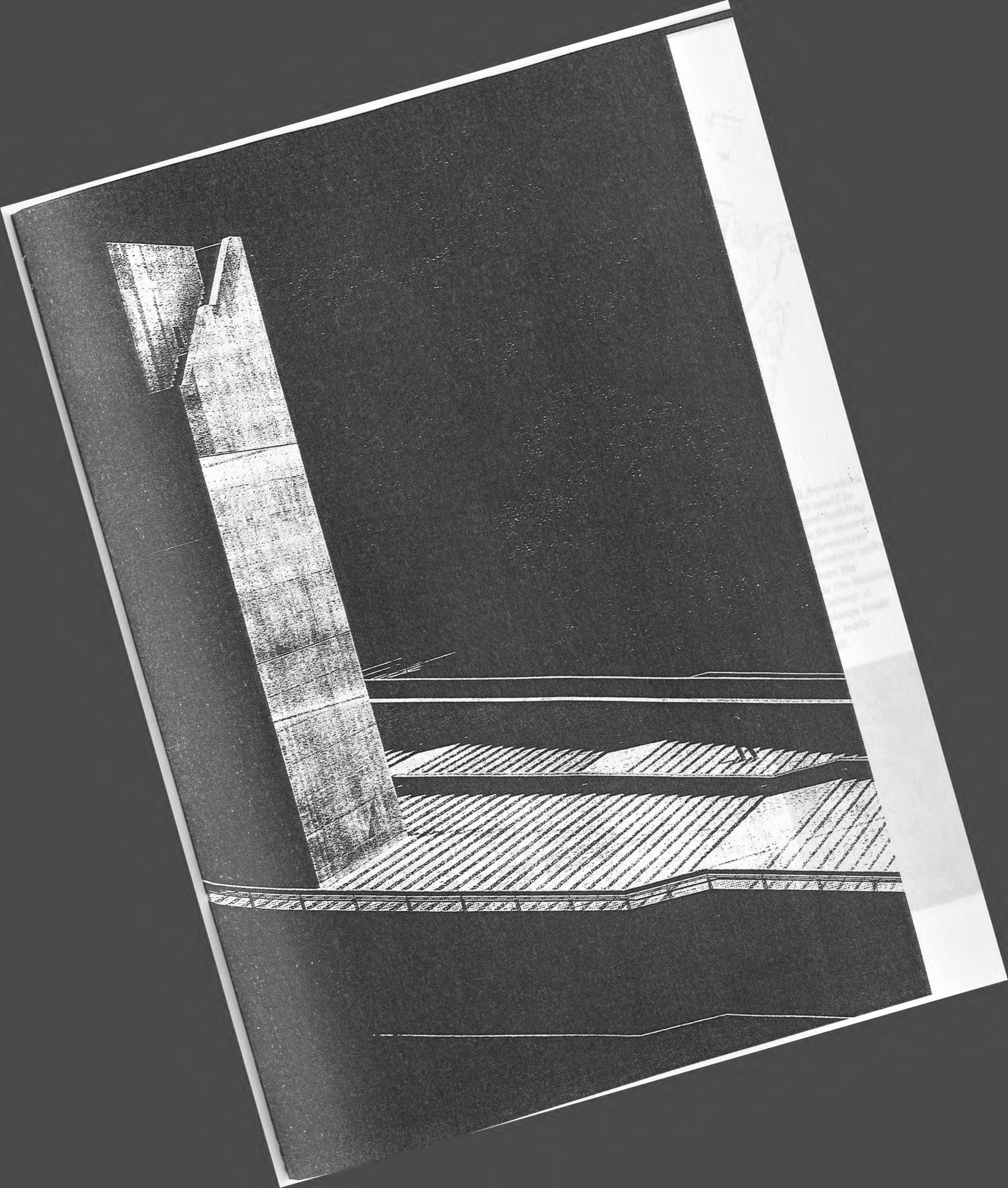
6. Reception
7. Court
8. Void
9. Exhibition space
10. Foyer

11. Auditorium
12. Storage
13. Photo studio
14. Office
15. Mechanical









These days, Japan's Kansai region is better known for its state-of-the-art airport than for its rich history. But just an hour and a half from bustling Osaka, near the early imperial capital of Asuka, sits Tadao Ando's Osaka Prefectural Chikatsu Asuka Museum. Devoted to *kofun*, keyhole-shaped burial mounds that proliferated during the fifth through the seventh centuries A.D., the museum is a quiet homage to Japan's ancient past.

The 64,000-square-foot building forms the nucleus of an indoor-outdoor museum, where visitors can view excavated artifacts, as well as kofun in their original state. The surrounding Fudoki-no-Oka Historical Park is the burial site for some 200 graves, including those of four emperors. Embedded in the earth like an enormous tomb, the building conceals exhibition space below, and forms a man-made hill to survey the tomb-filled setting. In the form of a monumental stairway of 147 granite-paver steps, the building fans out into the landscape, and embraces the lush, natural scenery in one broad sweep.

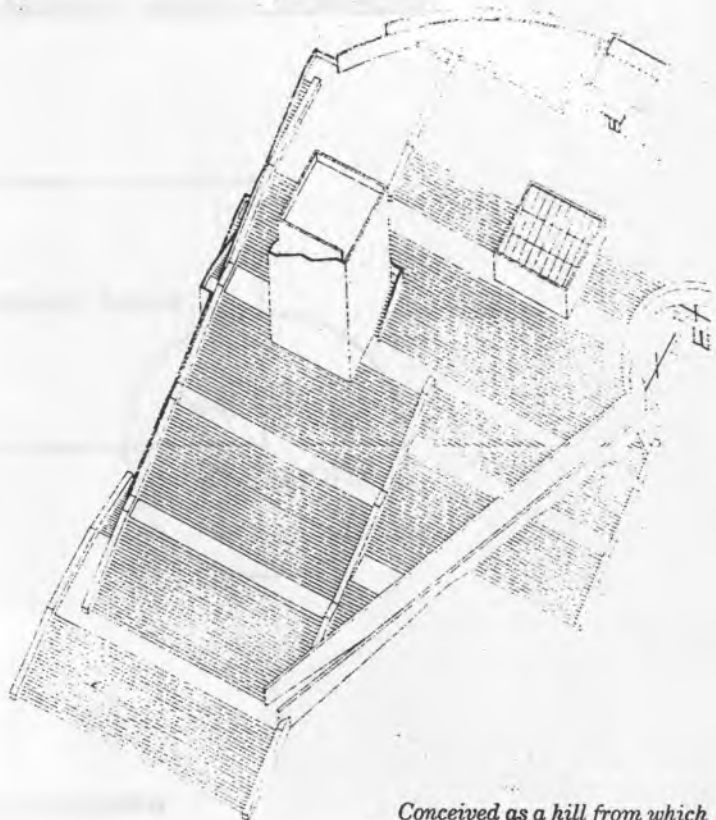
Slicing across the sloped roof is a narrow, open-air corridor that leads visitors to the front door on a tomb-like entry shaft that would seem to be guiding the deceased to their final resting place. Soaring a dramatic 26 feet, the sheer concrete walls frame closely cropped snippets of sky, forest, and pond. "Blocking panoramic views and leaving just a little opening is a very traditional idea that enables viewers to see nature more clearly," explains Takaaki Mizutani of Ando's office.

Inside, the three-story building is divided into two parts; the first is the realm of the living, which uses skylights and picture windows to animate its entry lobby, resource center, and curatorial offices. The second part is the realm of the dead, where level changes, geometry, and the absence of light recreate the atmosphere inside kofun in the exhibition halls. Descending from the airy entrance into the sunken galleries, sunlight and exterior views are extinguished. In their stead, muted electric light dimly illuminates ritual objects and scale models.

Ultimately, all light is doused within the *yumi no to*, or "tower of the afterworld," hovering ominously above the permanent collection's kofun-shaped gallery. Though it doubles as a concrete-clad observation tower outside, offering sun-drenched views in every direction, the interior of the 82-foot-high void is filled with nothing but receding light, which is finally swallowed up by matte blackness. Forging a direct link between the subterranean and the heavens above, the gallery sequence culminates in a skylit triple-height sculpture court housing a replica of a nine-tiered tower from nearby Rokutanji Temple.

In keeping with the architect's desire to harmonize with the environment, natural materials are used throughout the steel and reinforced-concrete building. Blond wood floors and furnishings balance Ando's ubiquitous unfinished concrete walls, whose silky surfaces are the product of urethane-treated formwork. Devoid of ornament both inside and out, the building relies on the play of light and shadow to enliven its masonry walls.

An added benefit to submerging the building is its presumed stability in the event of an earthquake. Largely unscathed by the Hanshin earthquake, which jolted Kansai earlier this year, Ando's buildings have a very strong track record, and he is currently working on several potential projects for blighted Kobe. Thus, there may be many earthquake-safe Ando buildings to come. *Naomi R. Pollock*

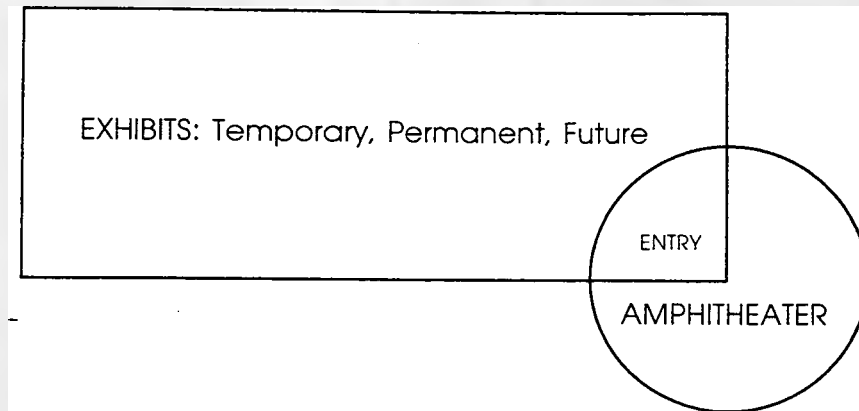


Conceived as a hill from which the tomb-filled park could be admired, the stepped building doubles as a venue for concerts and theatrical performances (above.) Sinuous concrete walls draw visitors in from the parking lot, and tie the building to the landscape (below). A narrow, walled passage leads visitors toward the main entrance (opposite).



ANALYSIS III : Washington State History Museum, Tacoma, Washington

by: Moore / Andersson Architects



IMAGERY:

Historical Precedence

Train Depot

Technological forms married to regional charactre

Educational exploratorium

Bays of learning

ACHIEVED VIA:

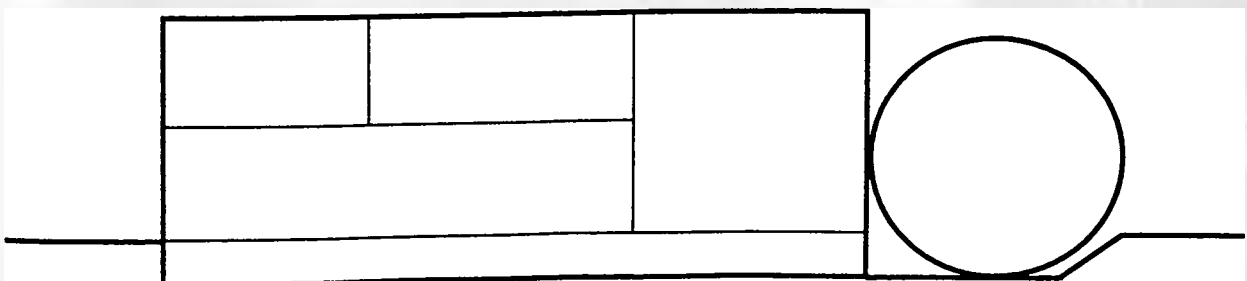
1. CIRCULATION PATTERN: entry sequence starts with public amphitheater open space, transitioning into open, high entry lobby; exhibits subdivide into smaller compartments of learning.

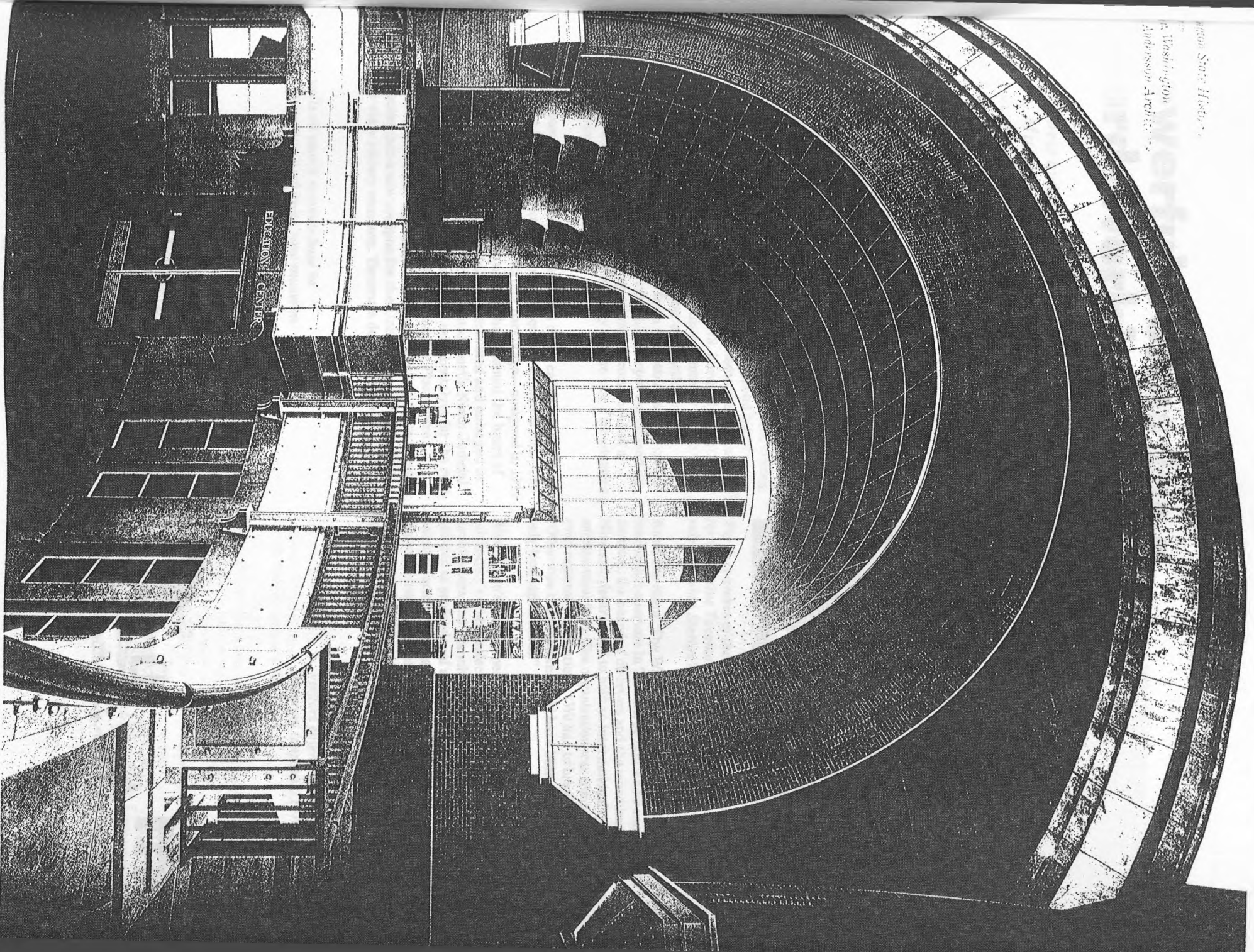
2. MATERIALS:

--brick, massive forms, lending to both domes adn arches.

--aluminum underside at outside arches, carrying strength and lending lighter reflections to underside of arches.

--concrete, lining most of interior carries from exterior bands into planes of interior surfaces, with subdivision of each exhibit united by concrete.





Powerful Forms for a Hard-Working Town

A major new building, the Washington State History Museum, is helping revitalize downtown Tacoma. How the project was conceived, designed, and built offers lessons for architects.

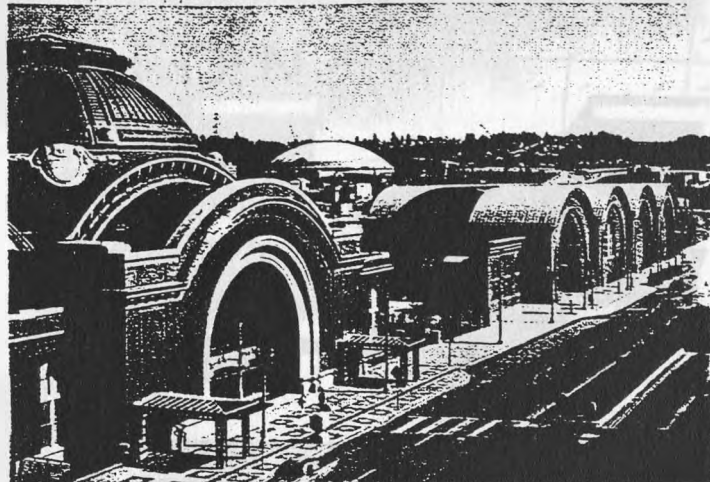
The Washington State History Museum helps complete Tacoma's urban puzzle. This major museum set in a small, working-class city fits alongside its neighbor, Tacoma's historic Union Station, like a long-lost, equal wing. How the project came to be built there reveals a great deal about the complex process of making architecture: the nature of contemporary architectural practice, of competitions, of great names and unknowns, how joint ventures work, the vital role of a good client and the advantages of vision and civic will.

The story begins with Tacoma, a muscular city of paper mills, cranes, and docks. The nation's sixth busiest port boasts a proud history: Tacoma had been the terminus of one of the transcontinental railroad's main lines, the Northern Pacific, in 1873. Formerly Seattle's competitor in population and prosperity, this community of 180,000 people lagged in the shadow of Mt. Rainier as Seattle blasted skyward into aero/cyberspace. Cut off from the waterfront by train tracks, highways, and decrepit warehouses, her depot abandoned by AMTRAK in 1985, her downtown languishing, Tacoma needed a boost. Its leaders sought a renewed identity for the city. The adaptive re-use of the depot came first.

Tacoma's finest historic building, a railroad depot called Union Station, was a local architectural icon. The copper-domed Beaux-Arts building boasted strong form and strong parentage—designed in 1911 by Reed and Stem, the architectural firm that planned the heart of New York City's Grand Central Station. Renovated and enlarged in 1991 with a low-scaled addition for the federal court's Ninth Judicial District, the renovated depot served as the initial catalyst for the revitalization of Tacoma's historic warehouse district. Plans were formulated for two other significant changes, including the renovation of warehouses into a new campus for the University of Washington and a new state history museum. Tacoma's downtown was changing.

Brick walls sit over a concrete base in Moore/Andersson Architects' new museum.

© Timothy Hursley photos



The four arches of the new museum (above far right) line Tacoma's Pacific Avenue, and mirror Union Station's forms (above left).

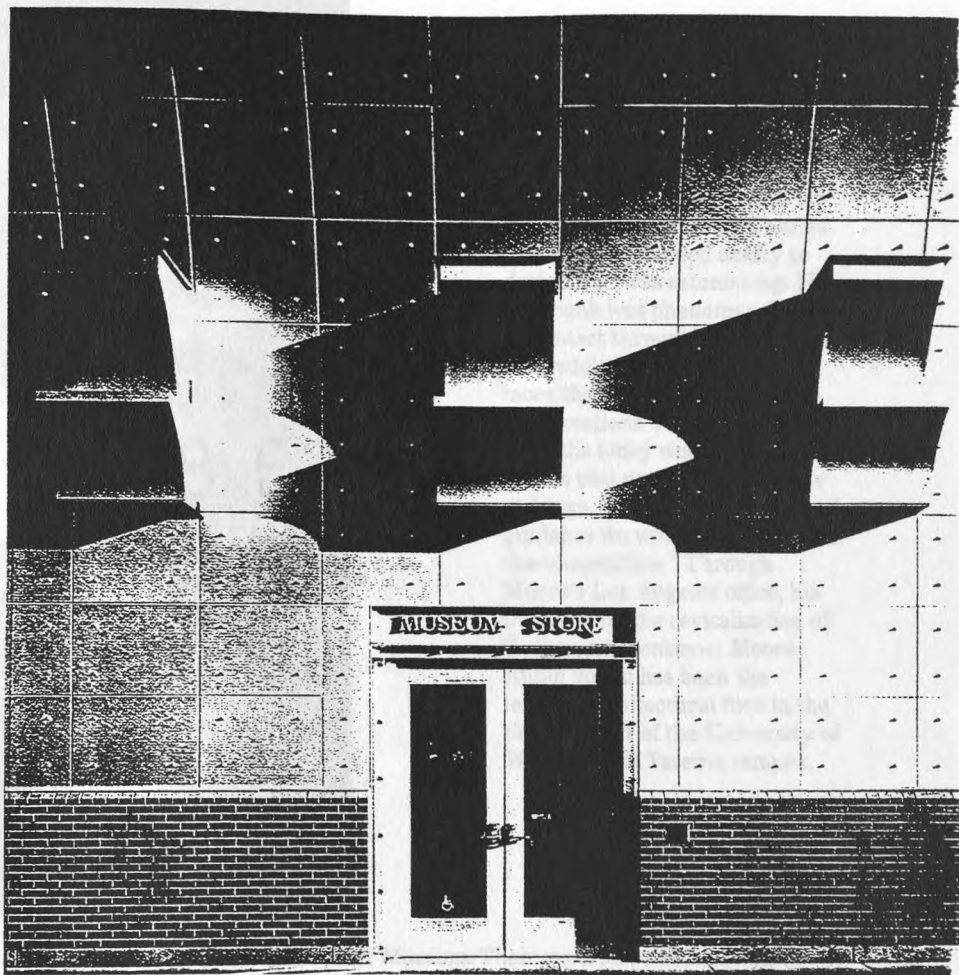
Enter the client. The Washington State Historical Society, housed in inadequate quarters in Tacoma, sought a new museum. In a critical decision, the board of directors and the museum director, David Nicandri, determined to hold an international competition to select an architectural firm. The organization was committed to exceed local or even regional expectations. "We had to break the paradigm," he says. "Otherwise the museum would have been designed and funded with only local significance."

Washington's Department of General Administration and the Historical Society's board selected Bruno Freschi, dean of the School of Architecture and Planning at SUNY Buffalo, to assist with the competition as professional advisor. No stranger, Freschi had been helping Tacoma forge a new vision for the city, particularly along the waterfront. Freschi's international contacts and his experience with competitions helped convince the board to aim high. "I tried to position this for Tacoma's next century."

Visitors enter the Washington State History Museum (opposite) through a grand arch.



Polished aluminum panels with custom hex nuts line the undersides of arches (right). Masonry arches (opposite right) exhibit corbelling and spring from metal brackets. Lead-coated copper fascias mimic curved forms, although they are actually constructed from segmented, straight pieces. Large aluminum-framed, paned windows bring light into the main lobby, and scale to the building entrance.



After a program was devised by the San Francisco firm of Robinson Mills + Williams, Freschi helped structure a competition. All Washington architects could submit; 48 others with special qualifications were invited. Thirty architects from 11 states and 6 countries responded. The Society's board of trustees narrowed the list to four finalists, each of whom received \$35,000 to produce a conceptual design: Moore/Andersson from Austin, Texas; Vancouver and Los Angeles architect Arthur Erickson; Michael Graves from Princeton, New Jersey; and Hammond Beeby and Babka from Chicago.

Winner includes an outdoor amphitheater

The seven-person jury, chaired by former Governor Daniel J. Evans, included architects, architectural critics, and prominent Washingtonians. After reviewing schemes that ranged from an evocation of the Pacific Northwest (Graves) to a nostalgic interpretation of historic national park hotels (Beeby), the jury unanimously selected Charles Moore's and Arthur Andersson's winning submission on May 4, 1991.

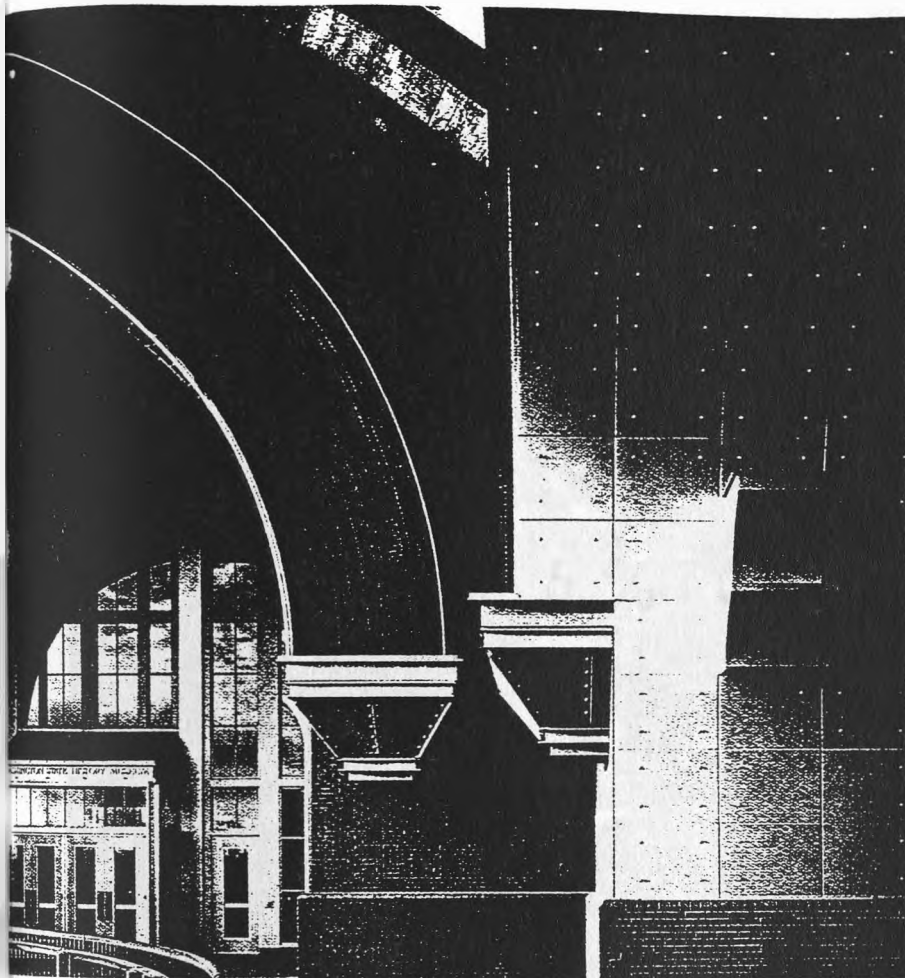
Michael Sullivan, who was a board member of the historical society and the city's former preservation officer, lauds the architect's solution above the others: "They were all interesting, but they did not capture the context and sensibilities of the city" (as the Moore/Andersson scheme did). He admires that the team borrowed the "brick and forms unabashedly and the...metal roof that mirrors Union Station, but not so grand as to match Union Station."

"We developed a train barn to the train station," says Andersson.

Moore/Andersson composed a simple palette of materials, primarily brick and concrete, markedly less ornate or embellished than Union Station's. The winning scheme offered one amenity its competitors did not—an outdoor amphitheater, a large urban space that was to become the project's "gift to the city."

The competition forced the architects to address fundamental questions up-front. The height of the building became an early issue. Nicandri reports that rather than set the history museum at the lower height of the court's new wing, the determination was made to allow the museum to mirror the scale of warehouses across Pacific Avenue. Another fundamental understanding was "separating off and opening up" the building from the depot. Rather than connect the museum with the depot at the concourse level, 88 feet of landscaped hillside clearly separate the two buildings.

Andersson mentions the "materiality" of the museum, a quality that he attributes in part to early conversations with Freschi. Both interior and exterior are detailed with an eye for brick's ability to arch, for concrete's plastic qualities, and for its pliancy in mass and form. Undersides of exterior arches are covered in aluminum panels, a material that adds luster to dark recesses. Moore's initial suggestion, by contrast, was for small-scale, gold ceramic tile to underscore the arches, a decision which would have lessened their mass. Inside, the program called for over 100,000 sq ft of exhibit, storage, administrative, and public spaces. The permanent exhibit alone, described in the program as "the great survey exhibition of the



Moore's Last Project?

The Washington State History Museum can claim to be Charles Moore's last project. Moore died in 1993, ten days after the ground-breaking. Partner Arthur Andersson, who had worked with Moore since 1981, described his mentor's contribution: "Charles had a single-handed ability to design that was astonishing. His idea bank was phenomenal and was intact through his 80's. His role, while very critical, was more than lines on paper. His conversations with us were about what the lobby would be like: spaces that were like Piranesi's etchings. Without his energy and guidance we would not have won the competition." Through Moore's Los Angeles office, his influence on the revitalization of Tacoma will continue: Moore Ruble Yudell has been the leading architectural firm in the development of the University of Washington's Tacoma campus.

of the State of Washington." demanded clear spans across of the 20,000 sq ft exhibit gallery; a requirement that forced the architects to consider concrete vaulting. Freschi believes that the competition yielded an additional benefit by preparing the board to be knowledgeable and conversant with the issues they would face as the project moved toward construction.

Architects face a 25 percent cut in funds

Seeing the process throughout, formally conducting selections and representing the client-agency at the state level was Copland, a senior architect with the State of Washington. His project manager for the state, as he describes it, was to "see that all parties were represented fairly to protect the process and the client." Most projects that fail, he thinks, can be traced to inadequately prepared or informed owners.

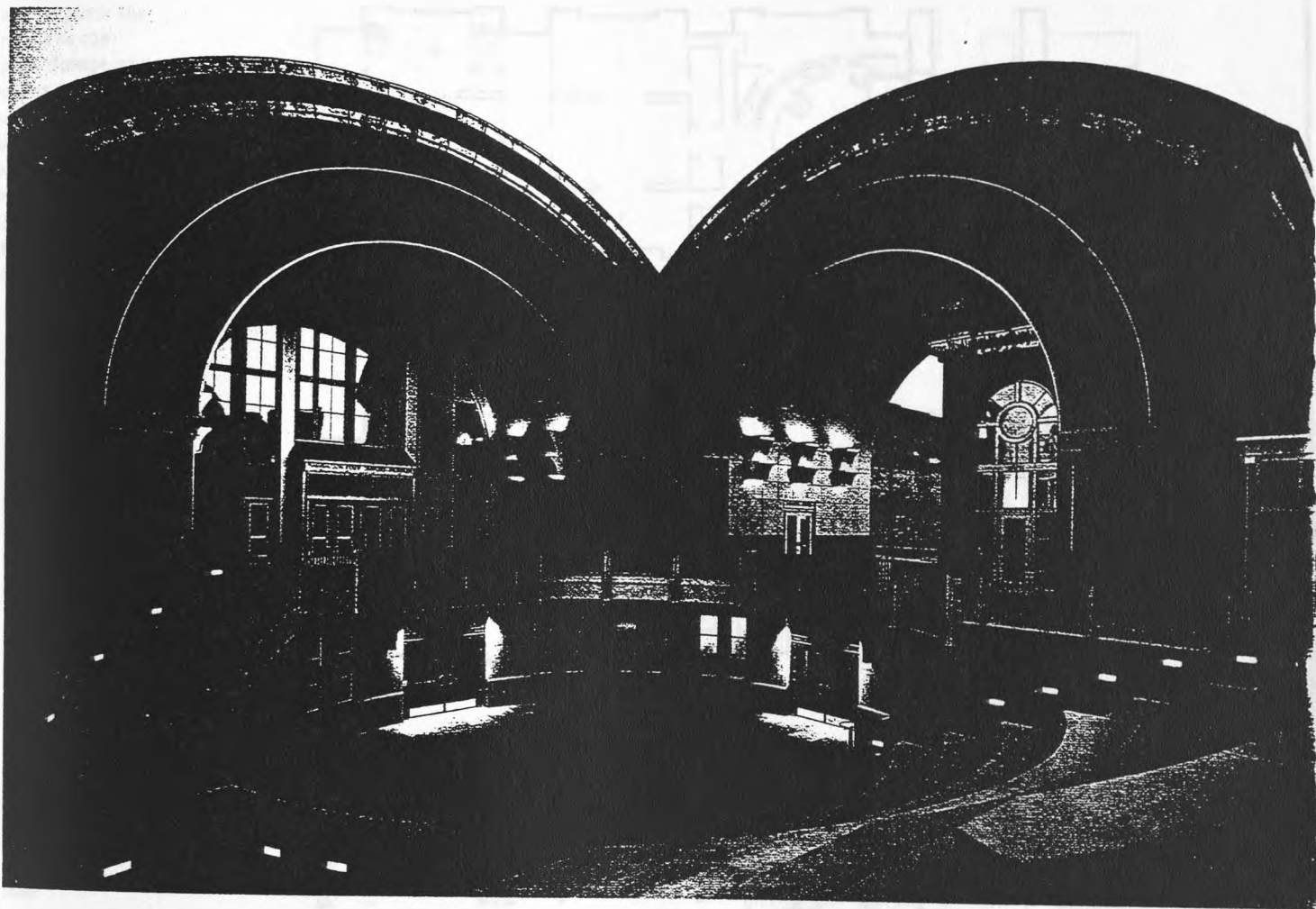
Immediate concern owners and architects faced was a 25 percent cut in total funding. Upon notification that they had won, Moore and Andersson were immediately informed that an underground parking garage, a component of the design, had been eliminated with a stroke, and that other alterations would be needed. Moore, unfazed by the cuts, declared that less money often produces better results.

Another crucial requirement was securing an associate architect for the project. Copland helped serve as broker, introducing the Texas firm Olson Sundberg. Seattle architects who had just completed

work on the Seattle Art Museum. Their experience with architect Robert Venturi served as "an eight-year master class" in architecture, according to Rick Sundberg. Olson Sundberg had developed a reputation for craft, care, and skill in how things are put together. Unlike Moore/Andersson's six-person office, Olson Sundberg's 18-person office relied on the computer. The match was made when Moore walked into the firm's office, surveyed their careful detailing and finish work, and declared, "O.K., now we can get going here."

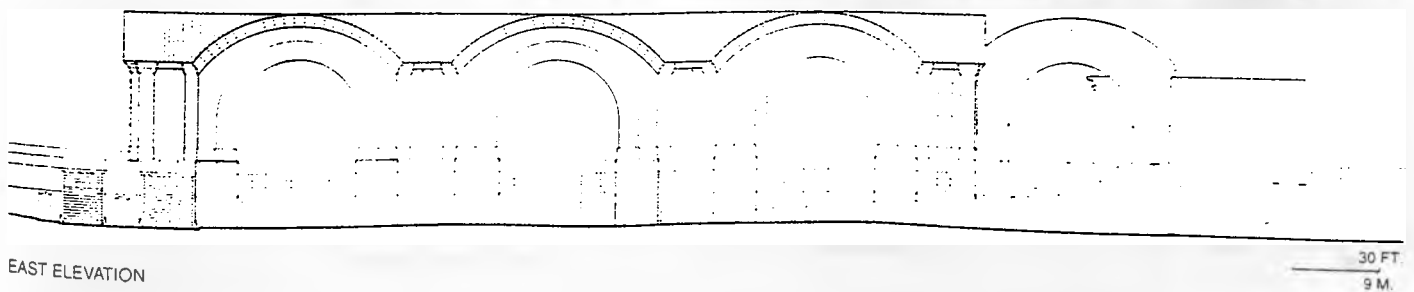
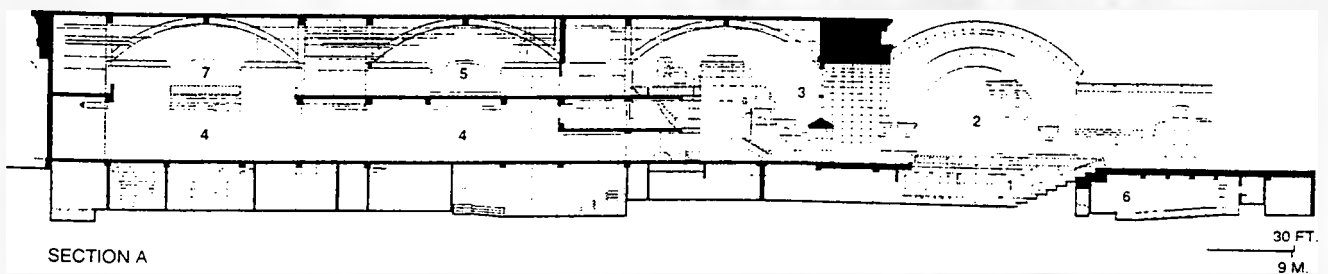
Each firm brought clearly identified strengths. Moore/Andersson, which had developed significant elements of the design in the competition, led the effort through the schematic phase. When the project reached design development, "we became more invested in the project," says Sundberg, "and began working with sub-consultants." He acknowledges the complementary nature of a relationship based on shared values; however, initial decisions were often deferred to the design architect for concurrence. "We were not trying to outshine Moore Andersson," Sundberg says. He also cites airline travel for face-to-face meetings between the associated architects as a boon to the relationship.

Work shifted between Texas and Seattle as the job progressed. The topics were far-ranging, but conversations were compressed by a quick five-month window for construction-document preparation. Both companies had to agree, quickly, on the esthetic issues surrounding detailing of brick and concrete, the primary building materials. Here is how they worked: Moore/Andersson developed the

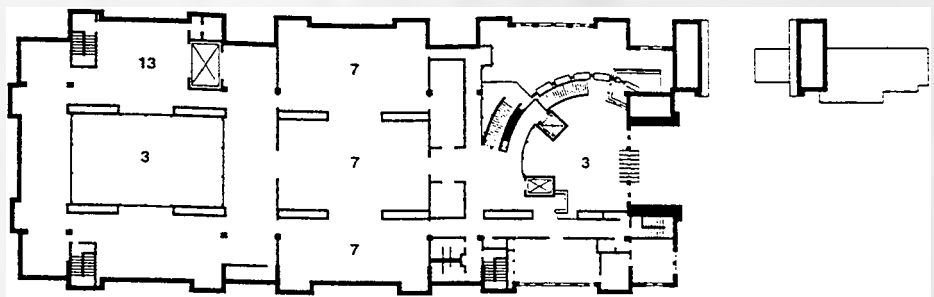


The outdoor amphitheater (above), rises from the concourse level to the entrance.

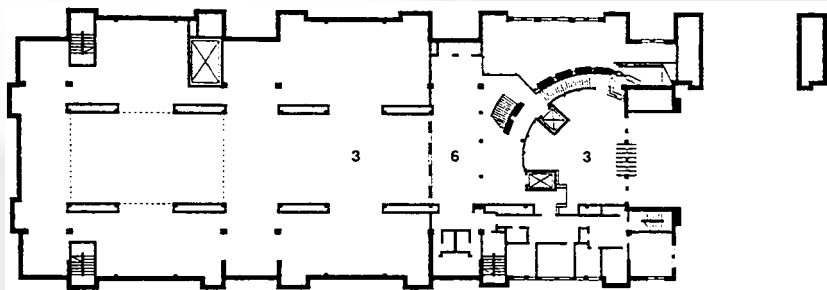
- | | |
|-----------------------|-----------------------|
| 1. Amphitheater | 5. Temporary exhibits |
| 2. Open | 6. Auditorium |
| 3. Lobby | 7. Future exhibits |
| 4. Permanent exhibits | |



Building plans explain the
 program. The con-
 level houses storage and
 ion functions, including
 rooms and the auditorium;
 ment exhibit space is on
 st level behind the lobby;
 and community-meeting
 are on the mezzanine. The
 level includes traveling
 tions and the board room.

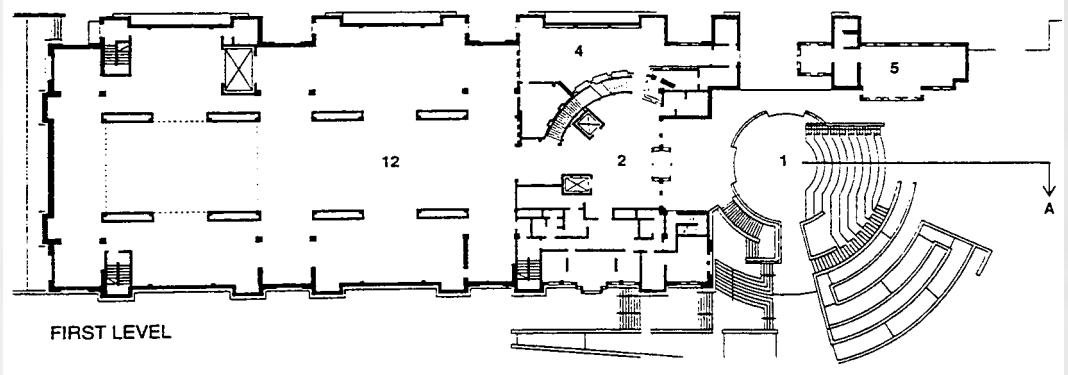


SECOND LEVEL

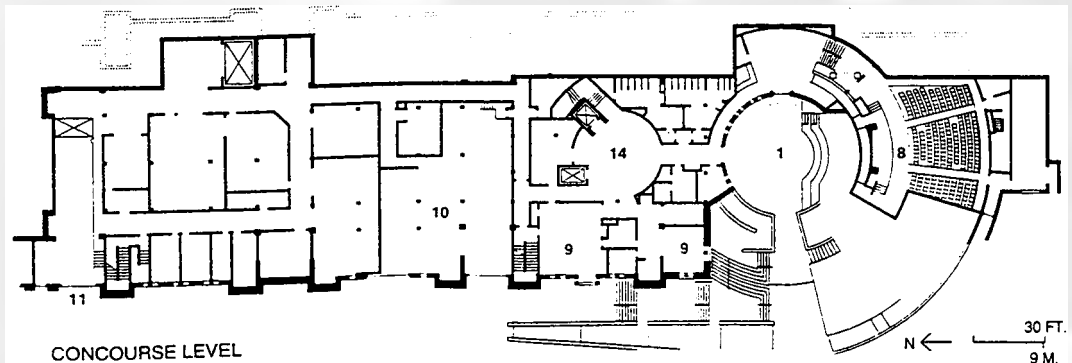


MEZZANINE LEVEL

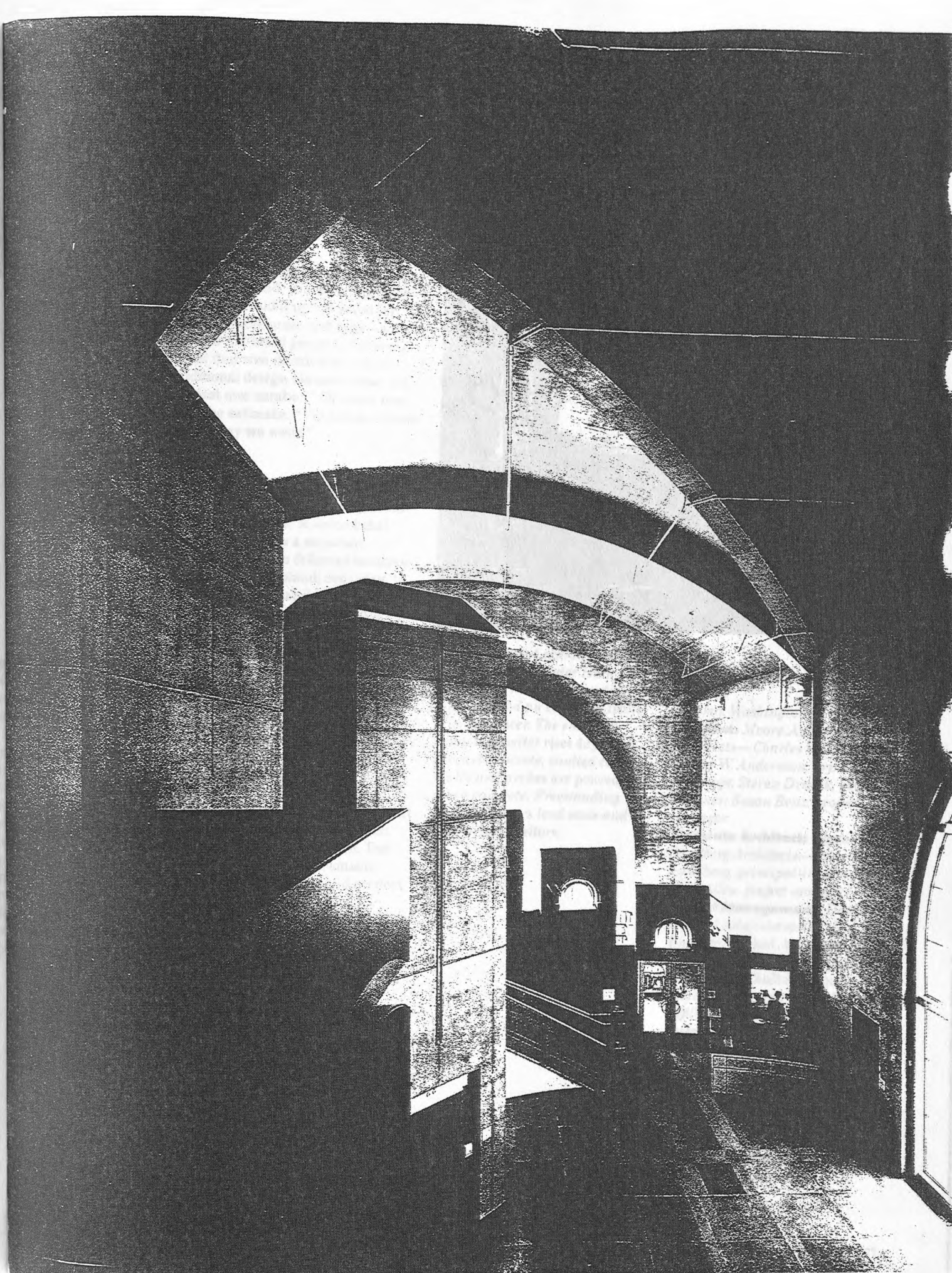
Amphitheater
 lobby
 men to below
 bookstore
 life
 mezzanine
 temporary
 exhibits
 auditorium
 activity room
 mechanical
 equipment
 loading dock
 permanent
 exhibits
 culture exhibits
 concourse lobby



FIRST LEVEL



CONCOURSE LEVEL



proportioning systems for the large masonry arches in Texas; Olson Sundberg, which had little experience in brick, detailed the walls to achieve the proportions. Olson Sundberg, which had a strong history in concrete detailing, took the lead in working out that material's handling. Andersson, who wanted a curved metal fascia, allowed the Seattle architects to devise a faceted, segmented substitution—a more practical solution. Although both architects mention the challenges posed by the heroic scale of the concrete work, "structurally, the building went together beautifully," Sundberg says.

The association of architects paid off. When the history museum was completed, "we had wonderful drawings," says Copland, the state's project manager. Contractors were pre-qualified for bidding, reviewed for previous experience on projects of comparable scale and type—a first for the State of Washington for a design-bid-build project. Nevertheless, there were risks involved in a bid that was decided on lowest price. "There were no alternates [additional design elements that are sometimes used to control bid cost], just one number." Of seven final bidders, three were within \$50,000 of the estimate. "We had a contract [Ellis-Don Construction, Inc.] and away we went."

Complicated schedule of change orders

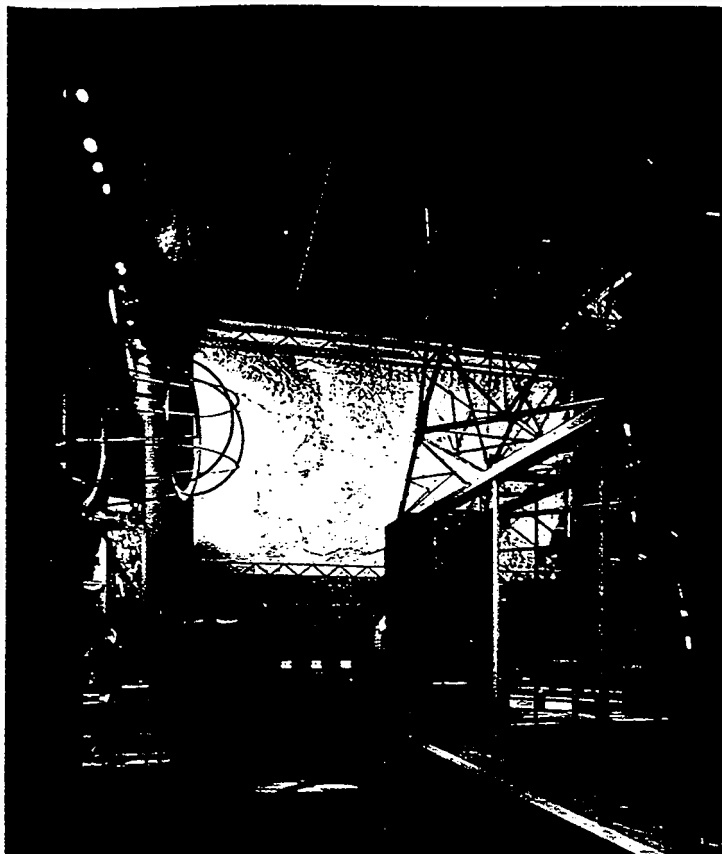
Factors compounded the builders' difficulties. First was the challenge of pouring 52-ft-high concrete walls. Many were accomplished in single pours; one of the first pours took 14 hours. A second challenge was the phasing of exhibit design, written on a separate contract, with general construction. Exhibit design followed construction of the building by one phase, according to Copland, requiring "a third project in between—modifying the building as it was being constructed—and a lot of electrical and communication work."

Keeping track of the complicated schedule, of change orders and the pressure could have been daunting to a museum with a small staff and no experience in new construction. A licensed engineer employed by the Historical Society followed the project throughout the construction phase as a special construction manager, acting much like a traditional "clerk of the works." In addition, the museum had designated a project coordinator within its executive staff, Redmond Bennett, who has since become the head of exhibits.

Though the schedule had to be modified as it progressed, the project was completed on time. Change orders brought the building's total construction cost, exclusive of exhibits and fees, to \$23 million. The possibility of adding a second phase for the total project remains, pending further funding. "We could continue to function and connect additional bays like opening a valve," says Copland.

The building opened to favorable reviews on August 10, 1996. Michael S. Smith thinks that the demanding process worked for Tacoma: "The firm has been the creator of character and purpose, defining the landscape, bringing people here for leisure and intellectual time." According to Nicandri, the staff appreciates the new museum's "capability, its ability to hold things and people." But he says that the flattering reviews have come from patrons who "thought that the building had always been there and had just been remodeled."

* Iry



The permanent exhibit hall, as conceived by designer Herb Rosenthal, houses interactive displays and an electrical transmission tower. The entrance lobby (opposite) rises 52 ft to a precast-concrete, vaulted ceiling. Walls and arches are poured-in-place concrete. Freestanding elevator towers lend scale and help orient visitors.

Credits

Washington State History Museum
Tacoma, Washington

Architect: Moore Andersson Architects—Charles W. Moore; Arthur W. Andersson, principal-in-charge; Steven Drorak, project designer; Susan Benz, project manager

Associate Architect: Olson Sundberg Architects—Rick Sundberg, principal-in-charge; Scott Allen, project manager

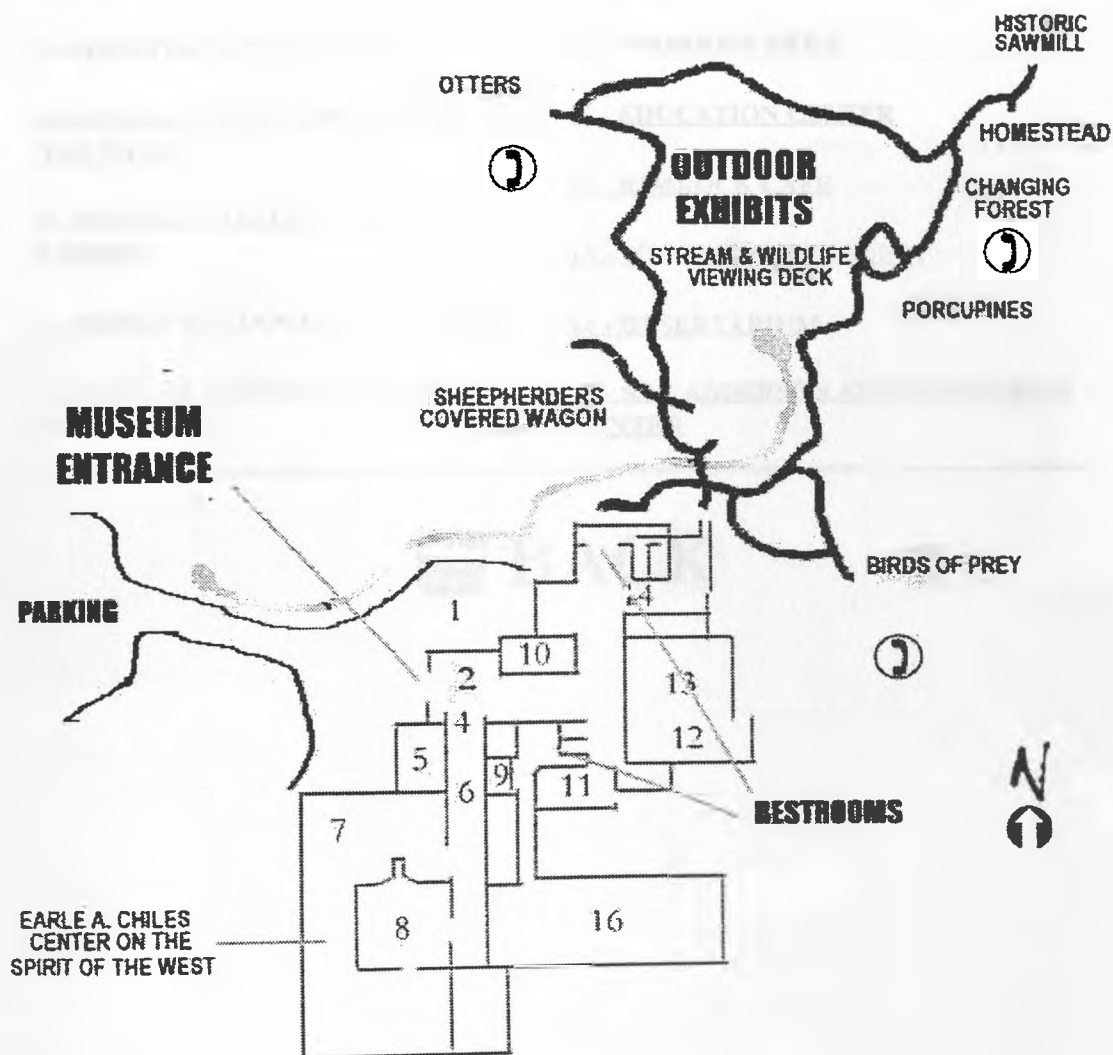
Project Management: Dept. of General Administration, Div. of Engineering and Architectural Services, State of Washington

Engineers: Chalker Putnam, Collins & Scott (structural); Affiliated Engineers, Inc. (mechanical/electrical);

Consultants: Summit Technology (civil); Nakano Dennis Landscape Architects (landscape); Peters & Myer Illumination Design Collaborative (lighting)

General Contractor: Ellis-Don Construction, Inc.

HIGH DESERT MUSEUM MAP



1 - SCULPTURE GARDEN

8 - SPIRIT OF THE WEST GALLERY

2 - ADMISSIONS & VISITOR
INFORMATION CENTER

9 - EVA CHILES MEYER HISTORICAL
LIBRARY

3 - ORIENTATION GALLERY

10 - PROGRAM AREA

4 - CHILES CENTER ON THE SPIRIT OF
THE WEST

11 - EDUCATION CENTER

5 - BROOKS GALLERY - CHANGING
EXHIBIT

12 - RIMROCK CAFE

13 - SILVER SAGE TRADING

6 - NANCY R. CHANDLER GALLERY

14 - DESERTARIUM

7 - HALL OF EXPLORATION &
SETTLEMENT

15 - S.M. ANDERSON ADMINISTRATIVE
CENTER

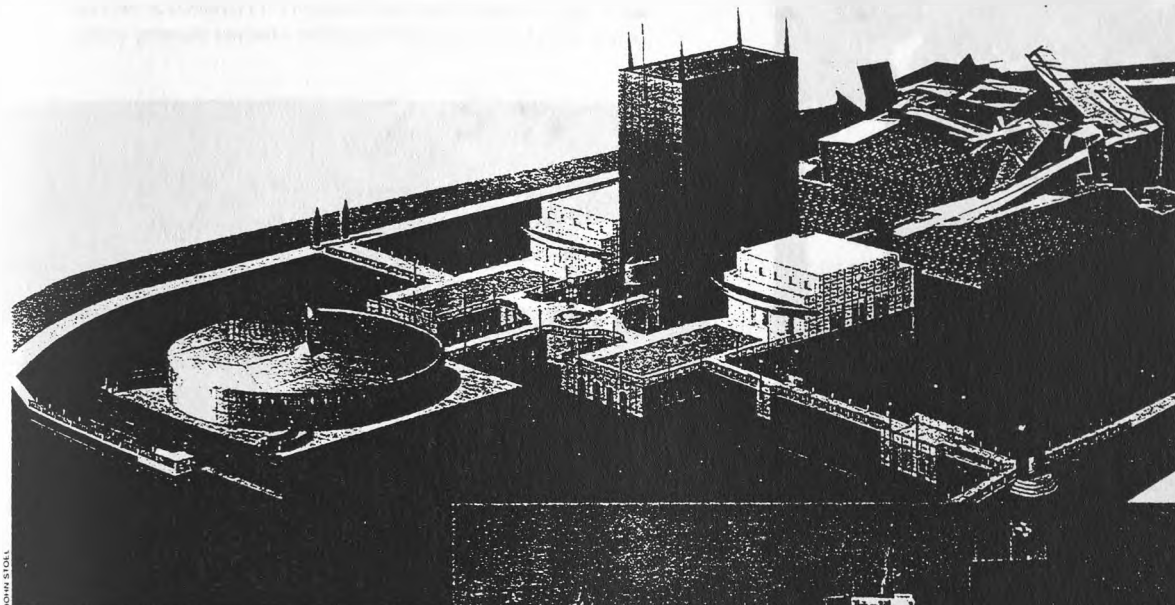


BACK

ARCHITECTURE: MUSEUMS AS ART

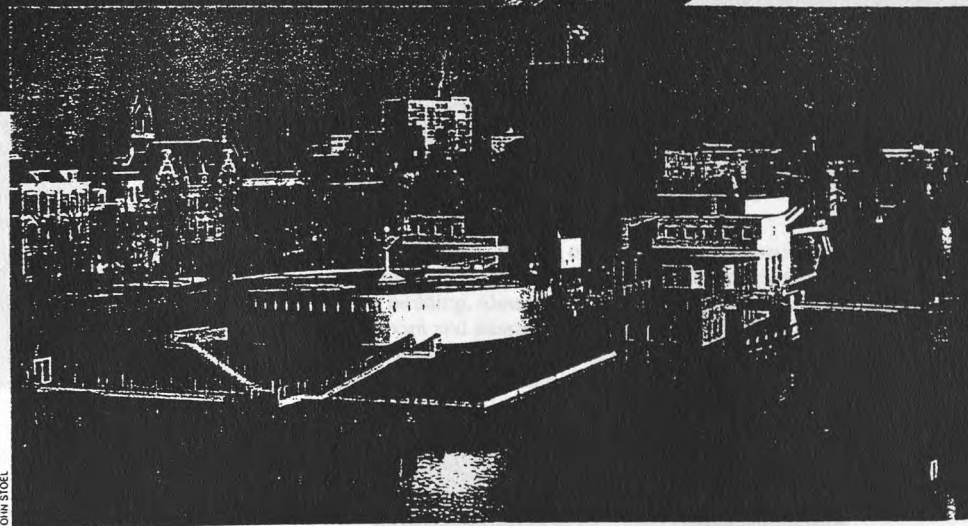
NEW SPACES FOR THE NEXT CENTURY

By Victoria Newhouse



Last October the opening of a new museum in a small city in northern Holland received international press coverage and attracted architects from around the world. What is unusual about the Groninger Museum is its creation not by one but by four high-profile architects. Alessandro Mendini, the Italian architect and designer, was chosen to work with three other architects: Michele de Lucchi, also from Italy; Philippe Starck, from Paris; and the Vienna/Los Angeles firm of Coop Himmelblau. The Groninger is an extreme example of the current trend toward museum architecture that makes a statement equal in importance to—sometimes even preempting—the art it contains. It is a startling alternative to the modernist concept of the museum as neutral white space.

The modern museum, as formulated in the first half of the twentieth century, was to consist of large open spaces that could be partitioned into smaller rectilinear areas of various sizes; its galleries were in no way to compete with the art displayed in them. But for more than thirty years the desirability—or even the possibility—of creating such



Several new museums, by some of the world's most visionary architects, promote the theory that the structure's design is at least as significant as the art it holds. ABOVE: Holland's controversial Groninger Museum, designed by four different architects, is sited as three islets in the Canal Link. TOP: A computer-generated model of the Groninger shows Philippe Starck's aluminum-sheathed pavilion, left, crowning one by Michele de Lucchi. Coop Himmelblau's deconstructivist shell, right, seems to collide with an Alessandro Mendini building; the gold-laminate tower is also by Mendini.

Challenge is a recurring word in discussions about new museums.

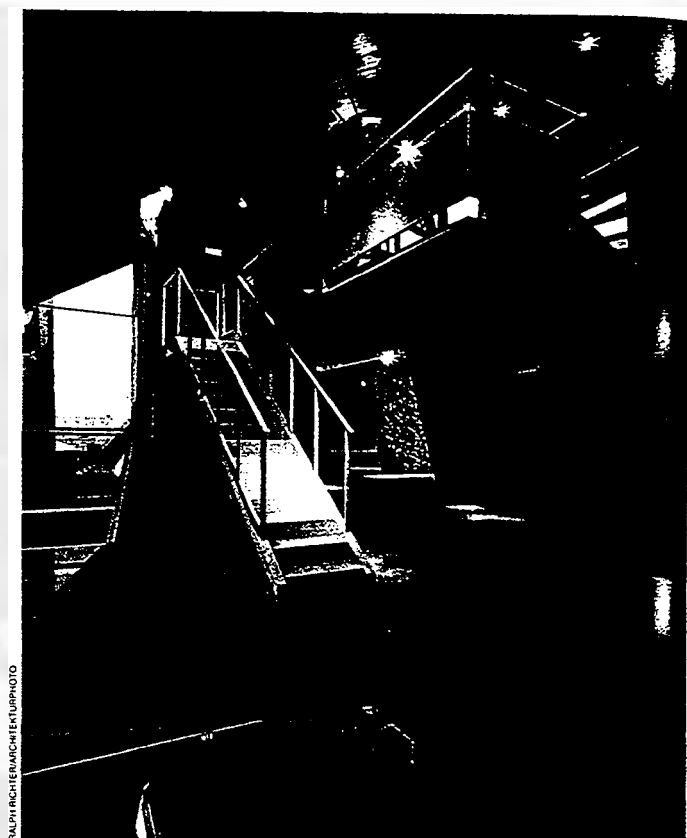
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ARCHITECTURE: MUSEUMS AS ART

NEW SPACES FOR THE NEXT CENTURY

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Of the architects whose work makes up the Groninger Museum, Coop Himmelblau was unique in not aligning the architecture with the nature of the objects displayed. The most conceptual of the structures, Coop Himmelblau's east pavilion was designed to exhibit the museum's collection of old-master paintings; 20th-century art has since been included. **BELOW AND RIGHT:** The platforms, stairs and bridges in the gallery provide varied vantage points and circulation paths.



RALPH RICHTER ARCHITECTURE PHOTO

BELOW: For the opening of the Groninger Museum's pavilion for contemporary art and temporary exhibitions, the architect of the building, Alessandro Mendini, designed a glass-mosaic-tiled room and passageway to represent the interdisciplinary focus of his firm. The colorful short-term installation suggests a cross-pollination of architecture, design and painting.

an "ideal" environment for art has been questioned. Today there is a rebellion against it.

From the beginning of widespread museum building in the nineteenth century, communities have taken pride in the architecture of these institutions. Now, in addition to their role as civic status symbols, museums may perform a number of other functions. They can be an attempt to compensate for the mediocrity of a collection; they can even substitute for a collection. Architect Richard Meier says he has "no idea what will go into" his Museum of Contemporary Art in Barcelona, Spain, which is scheduled to open this fall. Meier started the project in 1987, but the collection—for art beginning in the mid-1980s—is only now in formation.

Some museums feel the need to heighten the visibility of a collection with challenging architecture. Indeed, *challenge* is a recurring word in discussions about new museums. Richard Koshalek, director of the Museum of Contemporary Art in Los Angeles, uses it to describe the Groninger.



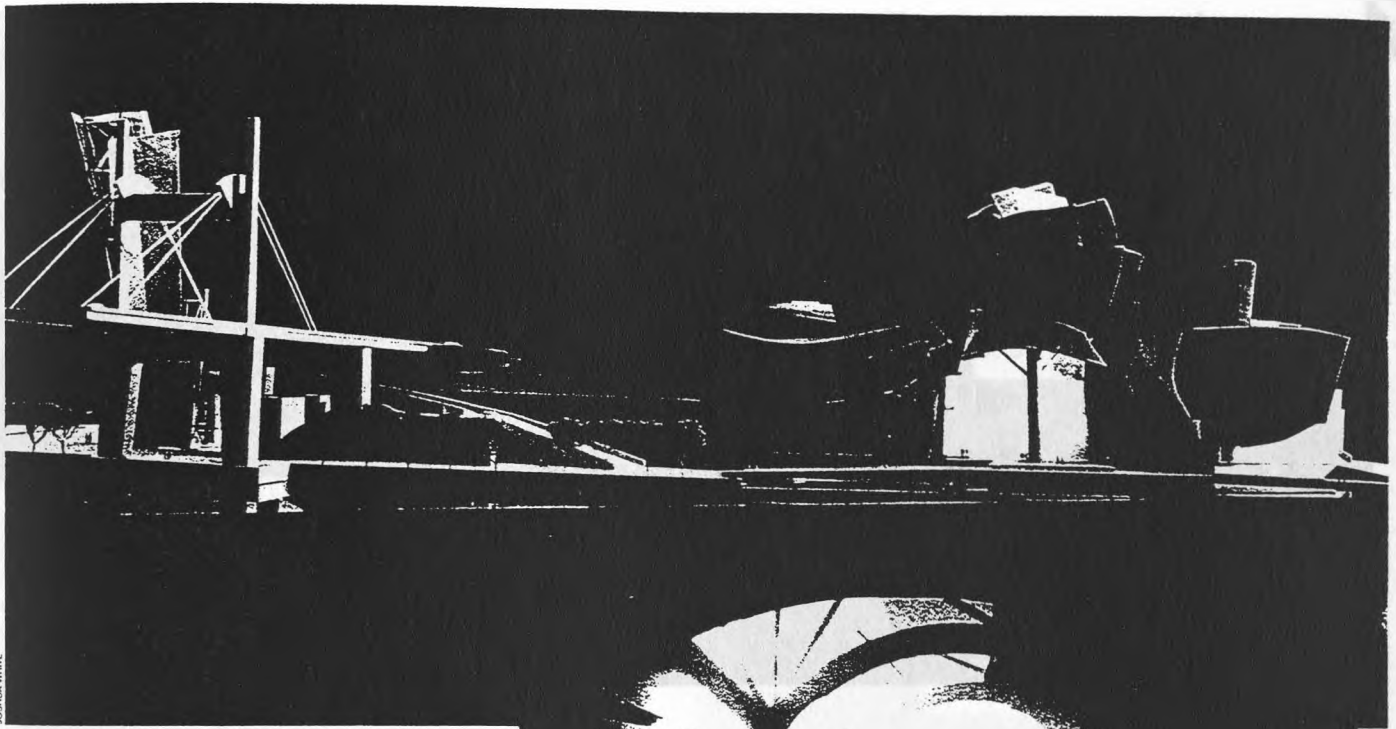
RALPH RICHTER ARCHITECTURE PHOTO

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ARCHITECTURE: MUSEUMS AS ART

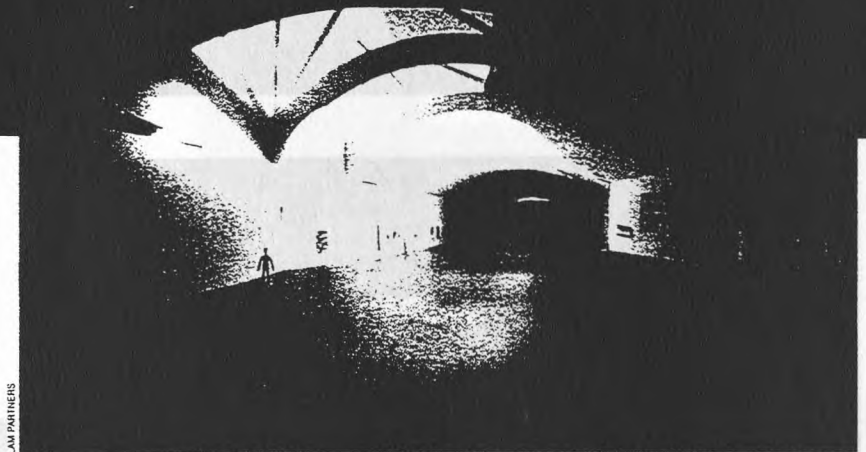
NEW SPACES FOR THE NEXT CENTURY

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JOSHUA WHITE

Many feel that the public must be shocked out of preconceived ideas to see art from a fresh point of view.



LAM PARTNERS

"It is what the public needs—it needs to be challenged." And Wolf Prix, a principal in the Coop Himmelblau firm, says that the larger "challenge of the twenty-first century is the development of new strategies to deal with art." Within the last two decades the nature of contemporary art has changed. There are no longer any organizing principles—no styles, schools or even clear trends—that dominate art. Rudi Fuchs, director of the Amsterdam Stedelijk Museum, feels this change has left a vacuum that is being filled by "an outrageous, expressive chaos of individuality." For Prix, the challenge formerly posed by art has now been taken up by architecture.

In the case of the Groninger, director Frans Haks wanted a building that would reflect the diversity of its four-part collection: local archaeology and history; decorative arts; old-master art; and contemporary art. He envisioned a "self-museumizing" system in which the architecture would be exhibited together with the artifacts. Instead of merely observing an object, the visitor to the museum is

TOP: As revealed in a model, the Frank Gehry-designed Guggenheim Museum for Bilbao, Spain—scheduled to open in 1997—is a group of stacked, interconnected structures. Both the main building, with its explosion of curvilinear titanium forms, and the limestone tower evoke the riverfront's history of large-scale industrial activity. ABOVE: A single gallery defined by a sculptural ceiling and skylight is planned for temporary installations and performance art.

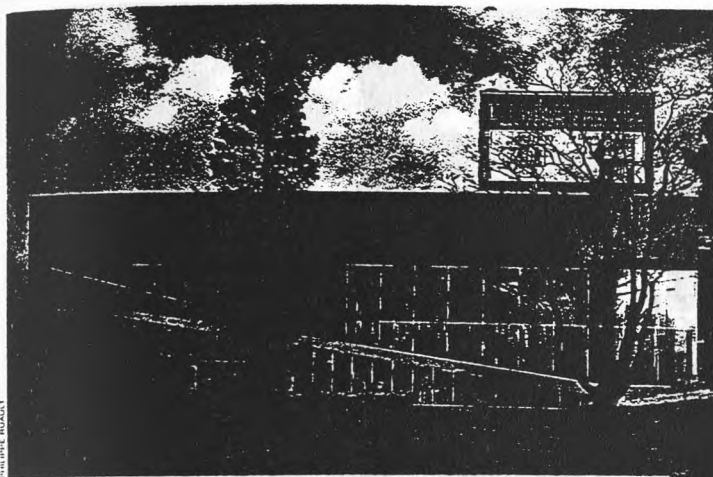
meant to "playfully experience" the artifact and its history.

The collaboration produced three discrete volumes placed on small islets connected by corridor/bridges in the so-called Canal Link. Except for the Coop Himmelblau galleries, the buildings' exteriors reflect their contents. Starck's circular decorative arts pavilion is sheathed with aluminum sheeting embossed with vase-shaped reliefs. De Lucchi's archaeology and history pavilion is covered with red brick traditional to the region. Mendini rejects standard hierarchies such as valuing painting above decorative

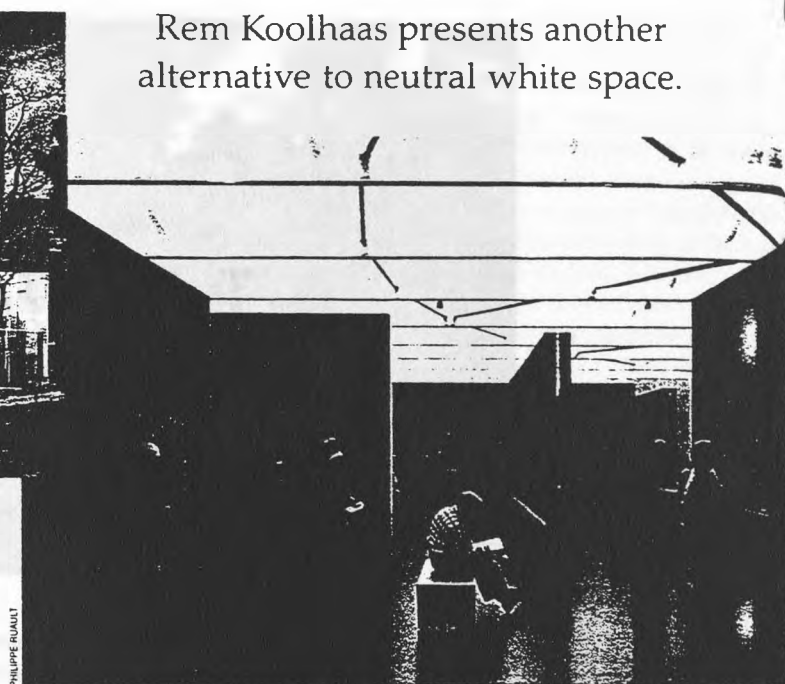
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ARCHITECTURE: MUSEUMS AS ART

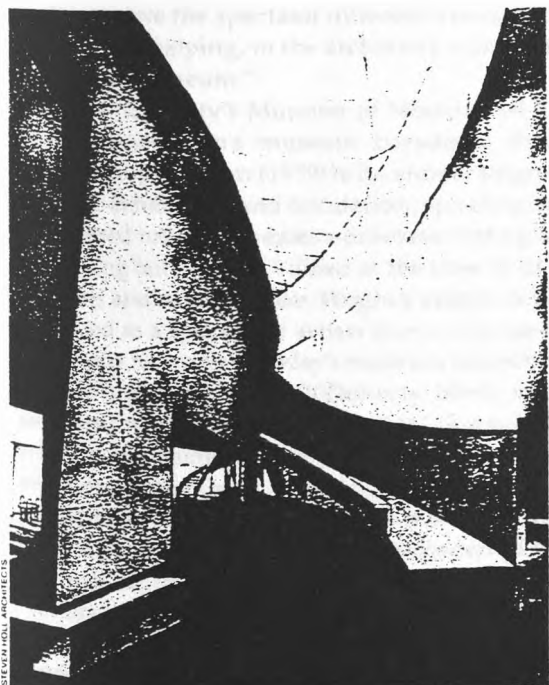
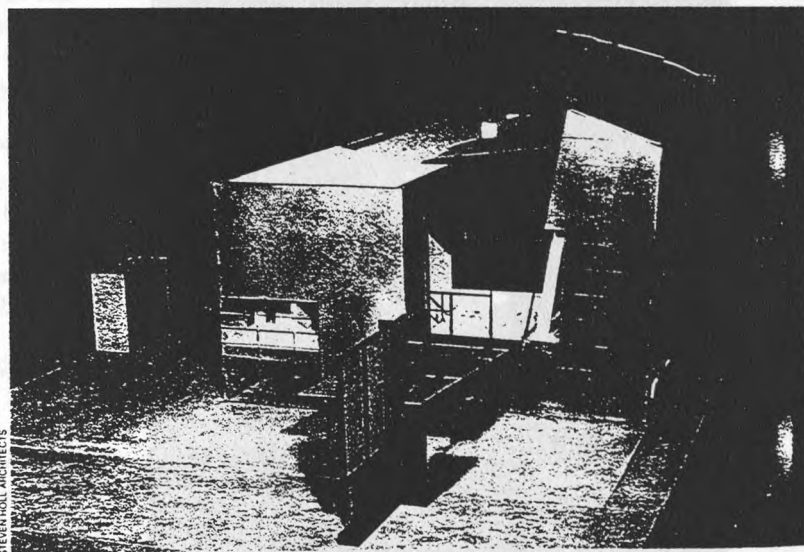
NEW SPACES FOR THE NEXT CENTURY
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ABOVE: Rem Koolhaas's KunstHal in Rotterdam, Holland, is a study in asymmetry, with leaning columns contributing to the seemingly basic box's sense of dislocation. One of three ramps that are intricately woven throughout rises at the west elevation. RIGHT: Hall 2 of the KunstHal features a translucent ceiling pierced by orange girders.



RIGHT: Still in model form, Steven Holl's winning competition entry for the Museum of Contemporary Art in Helsinki has cladding of zinc and glass. BELOW: A watercolor rendering of Holl's museum lobby shows his use of perspective to draw visitors through the white-plastered spaces. Windows, track lighting and detailing are eliminated in order to reinforce the purity of the viewing experience.



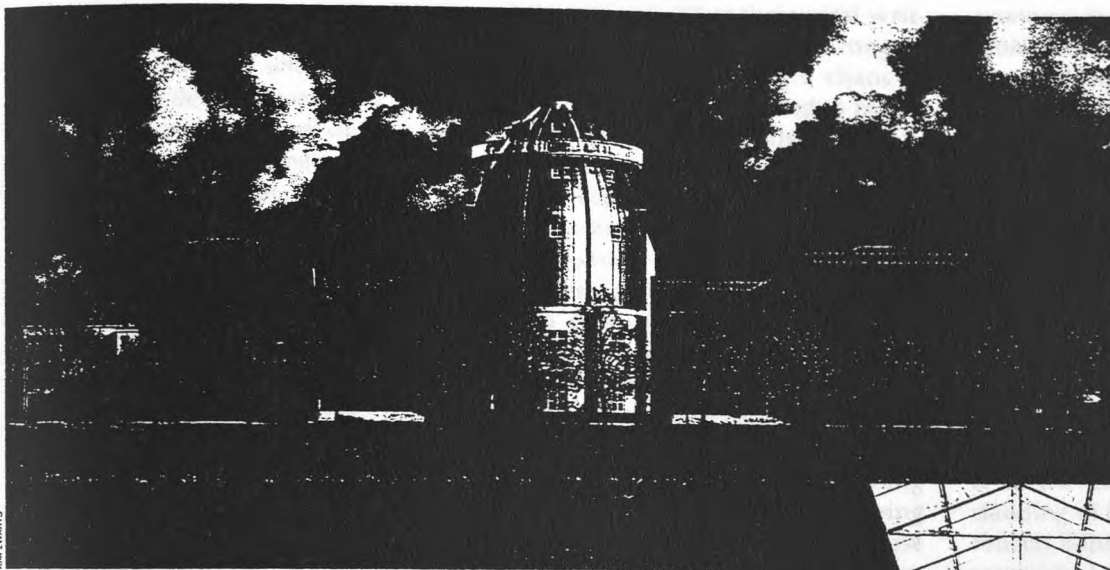
art, as well as the separation of different disciplines and historical classifications. This attitude is embodied in his use of a detail of a painting by the nineteenth-century Pointillist Paul Signac for the colorful design of the laminate that clads his pavilion for contemporary art and temporary exhibitions. The central part of these three museum-islands is dominated by a gold-colored tower containing storerooms—the gold suggesting a treasury from which continually changing displays will be drawn.

Mendini's spaces are relatively conventional—simple rectilinear rooms of varying sizes arranged in enfilades—

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NEW SPACES FOR THE NEXT CENTURY

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but topping them in the east pavilion are Coop Himmelblau's galleries, which were designed for old-master paintings and which have been likened to "an explosion in a glass factory." Looking as if it were coming apart at the seams, the space consists of rust-colored steel plates alternating with laminated glass; it is punctuated by stairs, bridges, ramps and viewing platforms and is the only exhibition space within the complex to have natural light. Among the sources for his design, Prix cites the Picasso Museum in Paris (a seventeenth-century town house renovated in 1985 by Roland Simounet) and his project for a studio/museum for the artist Anselm Kiefer. In both, ramps and stairs give the spectator different views of the art object, thereby helping, in the architect's words, "to liberate art from the museum."

If New York City's Museum of Modern Art (1939) represents modernism's museum paradigm, Frank Lloyd Wright's Guggenheim (1959) is its antiparadigm. Wright's ramp for exhibitions and circulation, spiraling around the vast domed rotunda, creates a dramatic setting for art that is anything but neutral. Vilified at the time of its unveiling by artists and curators alike, Wright's unique design is now perceived as a space that artists like to engage—and as a touchstone for many of today's museum projects.

Artist and critic Brian O'Doherty labels modernism's sacrosanct white cube "a ghetto space" that symbolizes the artist's estrangement from society. Many architects and museum directors concur, feeling that art must be seen as part of the complex world in which it is made and that the public must be shocked out of its preconceived ideas in order to see art from a fresh point of view. As Koshalek says, "You don't want to isolate the public from the real world."

A new generation of museum curators are also acutely aware of "the real world," which to them means the world



TOP: While drawing from Italian Rationalism, Aldo Rossi employed strong classical elements in his design for the Bonnefantenmuseum in Maastricht, Holland. The prodigious dome and overall symmetry are traditional museum characteristics; however, Rossi demonumentalized the façade by placing his zinc-clad tower at the rear elevation instead of the street. ABOVE: A gabled skylight illuminates the Bonnefantenmuseum's main stairway.

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as it was at the time and place the art was created. Whereas artifacts were formerly exhibited with as little as possible to detract from their purity, there is now a school of thought that requires them to be seen within a meaningful context. A part of the Groninger's ceramic collection, which was found at the bottom of the South China Sea, is shown reimmersed in a sunken aquarium. And even Richard Meier's Getty Museum in Brentwood, California, scheduled to open in 1997, will have gallery walls covered by designer Thierry Despont with crushed velvet, brightly colored fabric and tinted plaster. This wall treatment, together with Meier's own inclusion of traditional elements such as skylights, coved ceilings and some wainscoting, is meant to relate the galleries to the period of the art on display. Meier explains his departure from the crisp white spaces usually associated with his work as "the combination of a contemporary museum with a traditional installation."

Appearing at first glance to be a simple Miesian glass-and-steel horizontal box embellished with travertine, orange girders on the roof and a translucent billboard tower, Rem Koolhaas's KunstHal in Rotterdam (1992) presents another alternative to neutral white space. Inside, a sloping auditorium, leaning columns and a complex crisscrossing of ramps give the structure a disorienting feeling of asymmetry. The galleries are unlike any previous exhibition spaces. One hall has a translucent undulating ceiling laced with orange structural girders. The ceiling of a smaller space beside it consists of a see-through metal grid that also serves as the floor of the gallery above it. In a lower exhibition space with a black ceiling, columns are made to look like stripped tree trunks to suggest a transition with the adjacent park. Koolhaas describes the building as a "boring box with excitement generated within."

Koolhaas, the author of *Delirious*

New York and other theoretical writing, believes in a "culture of congestion." For him the city's chaos is an asset to be incorporated in public buildings. To do this at the KunstHal, he has created a continuous circuit of three separate outdoor and indoor ramps between the building's four autonomous parts. The interweaving of these ramps, separated in places by a glass wall, is as unsettling as city streets can be. But, in contrast with the circulation spaces, Koolhaas insists on the serenity of the galleries themselves.

Today's museums may have strong architectural identities without being monumental in massing, size and use of materials. Sited strategically so that they become integral parts of the community's circulation pattern, they often play an important role in revitalizing their neighborhoods as well as attracting tourists to the cities in which they are located. The bridge that links the Groninger's islands with the facing canal banks also connects the railroad station with the inner city. It has become a gate-

Gehry's museum reflects Bilbao's history and regional materials.

way through which 1.8 million people are expected to pass each year. The KunstHal is built next to a highway that runs along the top of a dike; the building descends to a park fifteen feet below. Straddling a roadway that runs parallel to the base of the dike, its central pedestrian ramp provides major circulation from the Museum Park to the street entrance.

Frank Gehry's Guggenheim Museum for the Basque city of Bilbao (scheduled to open in 1997) is also meant to encourage development in its immediate neighborhood and to increase tourism and to stimulate the

economy throughout the Basque region. Looking to the series of museums built in the 1980s in Frankfurt, Germany, Bilbao has made the Guggenheim the centerpiece of its riverfront redevelopment plan. Despite its monumental size (more than 240,000 square feet), the museum is no imposing monolith. Rather, it is conceived as a series of linked and stacked buildings with the traditional museum dome shattered into a cluster of curvilinear metal forms, creating what Gehry calls "the flower." The scale of the building's parts connects it to the city across the river. Its cladding of local stone and titanium reflects Bilbao's history and regional materials. A tall sculptural stone tower (referred to by Gehry as "the high-reader tower") serves as a signpost, visible from the entire city.

Like his sculptural Vitra Design Museum in Weil am Rhein, Germany (1989), Bilbao represents an expressionistic aesthetic, but on a much larger scale. Gehry has designed three types of exhibition spaces for it, some fairly classical and other, more dramatic spaces whose gently curved walls rise to dramatically shaped ceilings where giant catwalks carry artificial lighting to supplement natural illumination from skylights. What the architect calls "stodgy" rectilinear galleries with traditional skylights will be reserved for the Guggenheim's collection of twentieth-century art—for those artists who, as he says, "can't defend themselves." Attached to these spaces will be seven galleries for contemporary artists who will interact with the more complex architecture; they are placed in such a way as to facilitate comparisons with the permanent collection in the adjoining spaces. "Nothing comes from nowhere," says Gehry. "I was comforted by [discovering] the linkages, and I think other people are too." Also included at Bilbao is one megagallery (described by Gehry as "the size of a football field") for temporary

ARCHITECTURE: MUSEUMS AS ART

NEW SPACES FOR THE NEXT CENTURY
continued from page 44

installations and performance art: a huge rectilinear space articulated only by a monumental skylight.

Projected but not yet approved by the city, Austrian architect Hans Hollein's Guggenheim Museum in Vienna will also have a plurality of spaces within its 239,000 square feet. Hollein points out that whereas a work consisting of paint and canvas requires a specific number of square feet to display and to store, artwork made in a variety of media can now require several hundred square feet. His conclusion: "All museums today have to have the potential for change." To accommodate the collection for his innovative Municipal Museum Abteiberg at Mönchengladbach, near Düsseldorf (1982), Hollein created a dozen different types of spaces organized in a random circulation path with galleries lit by natural, fluorescent or incandescent light. He will apply some of the same principles to the Vienna design. "I don't think neutral space exists," asserts Hollein, who believes that a museum should have "strong, characteristic spaces."

Another project, recently approved, is Steven Holl's winning competition entry for the Museum of Contemporary Art in Helsinki, which he calls a *kiasma*, or intersection. Holl uses the word to imply an intertwining of art, architecture, culture and materials with the city's geometry and landscape. It's possible that the museum will actually bring the water of Töölönlahti Bay into its spaces. Built partially of blue-green zinc, partially of U-shaped glass planks, two sides of the structure will be rectilinear; the other two are part of a long curved horn shape that houses the galleries and auditorium. Interiors will be white plaster with concrete floors; there will be no columns, moldings, window openings or track lights. Secondary skylights in the curved roof of the gallery area and skylights in the atrium between the museum's two differently shaped parts allow Helsinki's peculiar horizontal light into the galleries. The museum is un-

usual in that both upper and lower levels have natural light. The curve of one wall in every gallery and the variations in room size provide a continuous unfolding of changing perspectives. Holl describes the galleries as being "as neutral as possible, but perspectival." It is this perspectival element that animates the spaces, drawing visitors through them. The architect seems to be trying to create a museum experience that is almost mystical in its suggestion of a calm oasis of infinite space and light, with elements of mystery and surprise.

The appeal of sculptural architecture has led to museum commissions

Museums are rising worldwide in a spirit of fierce competition.

from artists like Frank Stella (see *Architectural Digest*, July 1994), and experimentation with deconstructivism and other innovative design philosophies continue. Meanwhile, a number of new museums have adhered to the classical tradition, including San Francisco's Museum of Modern Art, by the Swiss architect Mario Botta, and the Bonnefantenmuseum in Maastricht, Holland, by Italian architect Aldo Rossi.

Botta and Rossi have returned to symmetry and to classical museum requirements: a monumental entrance and dome, a grand flight of stairs and, in the case of San Francisco, galleries laid out in enfilades around an atrium. But the same vocabulary can produce different results in different hands. In contrast with the exterior monumentality of Botta's truncated cylinder, Rossi deemphasizes his zinc-clad ninety-two-foot-high dome by placing it behind the museum's four-story central section. On the interior, Rossi has constructed his main stairway in wood and has squeezed it between floor-to-ceiling skylit brick

walls. Botta's masonry stairs, embellished with balconies, rise within a grandiose atrium. However, the galleries in both museums—rectilinear, white-walled and of varied sizes—appear to have been informed by a similar design philosophy. The Bonnefanten's director, Alexander van Grevenstein, has written: "In many new museum buildings, even something to the effect of covetousness is displayed towards art. The packaging becomes so important that the art can no longer breathe." This is clearly not the case in the Maastricht and San Francisco galleries.

With new art museums currently rising worldwide in a spirit of fierce competition, it appears that their architecture will continue to supply a wide spectrum of solutions. One is unlike any of those considered here. Koshalek and Prix have arrived independently at a different vision of the future: the disappearing museum. It would be small in size and have a built-in solution to the perennial problem of expansion and variation. The core building would consist of administrative offices, storage and a small exhibition area. If larger exhibition spaces were needed, Prix feels they could be rented in local shops, shopping centers, schools or empty lots, the choice to be made jointly by the museum and the artist whose work would be displayed. Both men give the new museum a specific life span. At that time, according to Koshalek, it could become a permanent exhibition space for the work of that period and a new museum would begin. Prix would periodically disseminate parts of the collection to the city, realizing "the architect's intention to integrate art with the city."

Prix has already realized his concept symbolically: At the Groninger, he used a quasi-indestructible material to paint the sketch for his pavilion on its uppermost steel plates. Anticipating that the steel will eventually rust, and the museum thereby disappear, he hopes that at least this record of it will remain. □

People and Places

Liz Hall

A creative project using paintings and artefacts with people with long term mental health problems.



The Education Section of Nottingham City Museums has recently completed a project working with people with long term mental health problems. The project **People and Places**, worked with four groups in the community for a period of six weeks, preparing and planning for a Victorian Garden Party to be held at Newstead Abbey. What has proved to be most productive from the project are the benefits people have experienced in the close association of objects and the creative process - these forming bridges of communication which can help to bypass or dampen current

mental disturbances. People who are dealing with a long term mental health issue are constantly facing complex difficulties in coping with everyday situations that others may take for granted. Relationships with family and friends may have broken down and forming new contacts may be very difficult. They may experience periods of confusion, obsessional behaviour or voice hearing which may severely impede the ability to concentrate and communicate appropriately. Any physiological problem may be further exacerbated by possible side effects from drugs used in the treatment of some mental health conditions. Likewise society's response is more inclined to alienate and stigmatise behaviour which it does not find acceptable.

It was in an attempt to meet the very specific needs of this traditionally non-user group that the project was formulated. A lot of work has been done in museums and galleries concerning access for people with a physical disability but less provision exists for people with learning difficulties or for people with mental health problems. But just as we have a responsibility to provide physical ramps for people, we must consider the psychological ramps needed if we are to show commitment to equal opportunities and equal rights of access.

The Outreach Section had already been working with this particular client group for approximately two years and it has been obvious since our first contacts in 1993 that a gradual build up of trust and confidence is essential for any beneficial outcomes to take place. There are few immediate returns and to expect them sets both the group and ourselves up to fail. After several one-off projects within the security of the group's own centre and initial social and workshop based visits to the Castle Museum, it seemed appropriate to consider a more structured project in which people could commit themselves to a longer and more practical involvement with the City Museums.

This opportunity arose when a small amount of funding became available through the City Council to develop our work with adults with long term mental health problems. The aims of the project were to further develop our existing contacts with the groups while introducing them to the other museums within the city group, extending their social contact with other staff and arts workers and to give people a sense of working together towards a final goal. It seemed suitable for that goal to be a special party given in their honour – an experience which was, perhaps, out of the ordinary for this particular group of people.

The project consisted of four sessions. The first session took place in their Centre and was an introduction to what like might have been like in Victorian times – how people would have dressed, eaten and how they would have entertained themselves. We also introduced the idea of the party and outlined the other preparatory sessions.

The second session, which took place in the Castle Museum and Costume Museum, looked at costume. Using the resources of paintings, collections and handling materials, the groups made their own accessories for the party. For the last session before the party we went to Newstead Abbey itself, familiarized ourselves with the site of the party and made butter and table decorations in the great kitchen. The party itself took place in a flower festooned marquee in the gardens at Newstead with food, drinks, Victorian style entertainments and a professional photographer who recorded the event for each group in a sepia print.

Each part of the project focused heavily on looking at visual images and handling objects, and this provided people with an extremely effective stimulus for group interaction. Simply passing an object amongst the group provided an opportunity for people to practise the most basic but essential skills such as turn taking, communication, listening and valuing other people's opinions.

Investigating images or talking about how objects were made provided the seeds of ideas about making objects themselves. The physical use of objects and the effect of memory can 'root' someone who may be experiencing some form of mental disruption. In one of the early sessions of the project the group were looking at Victorian artefacts. One man had remained on the outskirts of the group and was responding angrily to his voices which would not stay quiet. Someone passed him a school merit medal which attracted his attention because he too had been awarded a medal for his achievement in his school. This was too positive a memory to let pass and he was able to tell his voices to back off and let him have some time to remember. Using reminiscence with elderly people with Alzheimer's has the similar effect of 'bypassing' the current mental disturbances to access memory that was laid down before the onset of the illness. Another example is the focus practical activity can provide for people hearing voices. By concentrating on making, voices can sometimes be shut out for a while, allowing the person a degree of control over their situation. Through active making-experiences we can learn to ask questions about objects and start to investigate our present and past.

We can investigate objects, ask pertinent questions about their manufacture, social and material implications and so on and this approach can be used to talk with a group about work they have made and to help place their activity in a context. We could then go on to use the same process with historical objects, hopefully with a greater understanding of a process and a structure. When people find it very hard to think strategically about any aspect of their lives, it is important to provide a structure for them to work within.

One of the activities that we worked on in an early session in the museum was making masks based on the Circle of Life gallery. We looked at the different examples of masks and body adornment from around the world and I tried to get the group to develop their thinking about the objects we had seen but it wasn't until we had made our masks and had used that process of questioning - Why did we make masks? What material did we use and why? - that they were able to see the relevance of asking questions about other objects.

People and Places was a successful blend of investigating, making and celebrating in some cases considerable achievement by the user group, and we have certainly created a new audience. We must now respond to the needs and expectations of this group and develop a service which provides continual access, rather than

one which is restricted to the timescale of a particular project. We are currently working with professional staff involved in provision for adults with mental health problems in Nottingham to determine ways of developing better links. As yet we are unsure how to go about it and what impact this may have on our regular service, the museum and gallery itself and our traditional audiences. We must however move closer to a more integrated provision for this user group, which will allow a more equal right of access to our shared material and visual culture.

A video of the People and Places project is available at a cost of 5GBP including postage and packing. Cheques should be made payable to Nottingham City Council. Please apply to...

Education Section
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First published in GEM News Spring 1996
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The Constructivist Museum

George E. Hein

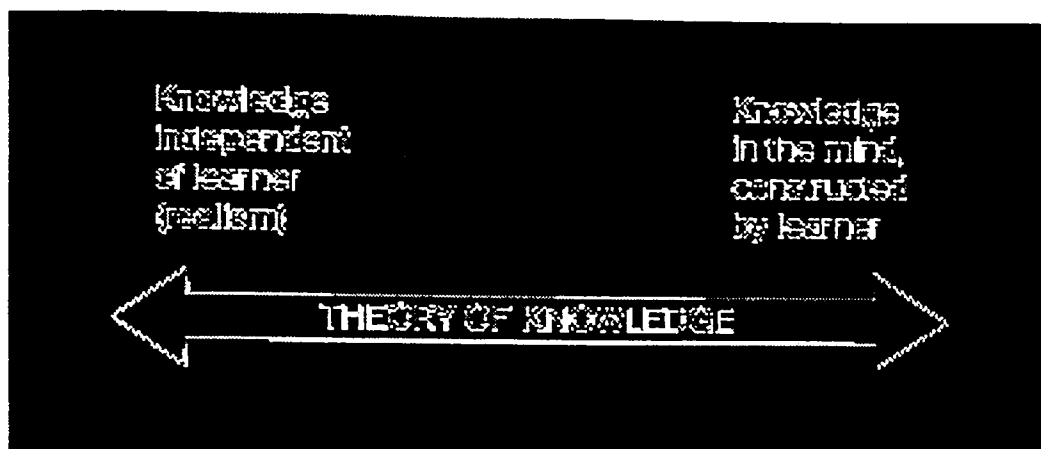
Introduction

Current education literature is dominated by discussions of constructivism. This new name for a set of old ideas has major implications for how museums address learning. Constructivism is particularly appropriate as a basis for museum education if we consider the wide age range of museum visitors. How can we accommodate this diverse audience and facilitate their learning from our objects on their voluntary, short visits?

The elements of any theory of education

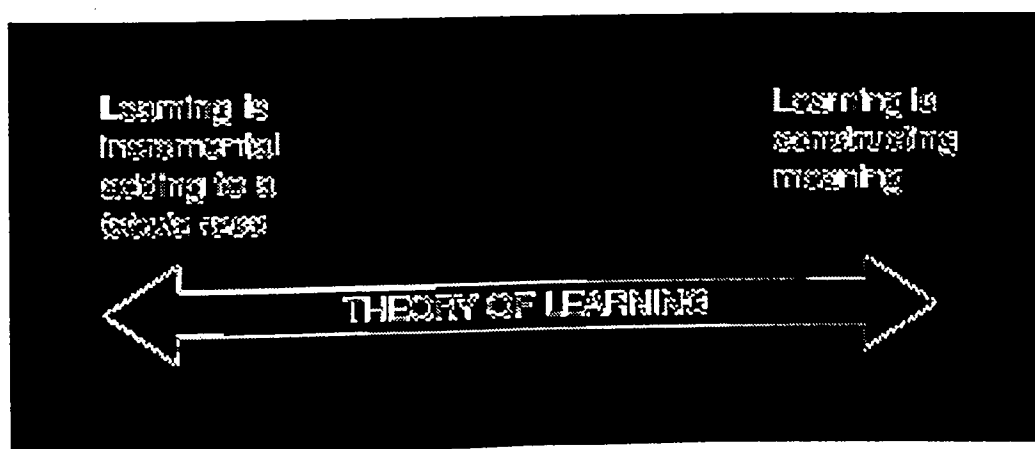
In order to understand constructivism, it is useful to consider the nature of any theory of education. As two articles in last year's Journal of Education in Museums point out (2) an educational theory consists of two major components: a theory of knowledge and a theory of learning. In order to consider how a museum is organised to facilitate learning, we need to address both what is to be learned and how it is to be learned.

Our beliefs about the nature of knowledge, our epistemology, profoundly influence our approach to education. It makes a difference whether we believe that knowledge exists independently of the learner, as an absolute, or whether we subscribe to the view that knowledge consists only of ideas constructed in the mind. Plato believed in the existence of ideal forms, independent of the learner. Thus, for him, learning consisted of arriving at knowledge through an intellectual process. Conversely, Berkeley believed that knowledge existed only in the mind of the knower. Thus, he answered in the negative the hypothetical question about the sound of a tree falling in the forest when no one is there to hear it. We can represent this epistemological dichotomy as a continuum, with the extreme positions at each end, as illustrated below:



The second component of an educational theory encompasses our beliefs about how people learn, our psychology of learning. As was the case for the epistemological domain, two extreme positions are possible. One assumes that learning consists of the incremental assimilation of information, facts and experiences, until knowledge results. This view leads to a behaviourist position; to the conclusion that learning consists of the addition of a myriad number of simple associations (responses to stimuli) and that the resultant 'knowing' is simply the aggregate of these small steps. Usually associated with this view is the belief that the original condition of the mind is a tabula rasa, and that all that is known has been acquired through experience. Locke is the best known proponent of this view. A diametrically opposed view of learning postulates that the mind constructs schemas and that learning consists of selecting and organising from the wealth of sensations that surround us. This synthetic view of learning is exemplified by Piaget's work. Proponents of this view also usually take the position that certain structures, such as learning language, are part of the anatomy with which we are born (3).

This second dimension of educational theory can also be represented by a continuum along the dimension of the process of learning thus:



These two dimensions of any educational theory can be combined to produce a diagram that describes four possible combinations of learning theory and epistemology. Figure 1 illustrates this combination. Each of the quadrants represents a different approach to education. One familiar position is represented by the top left quadrant, which I have labelled traditional lecture and text. Within this traditional view of education, the teacher has two responsibilities. First, s/he must understand the structure of the subject, the knowledge that is to be taught. This structure, the logical organisation of the material, is dictated by the content that is to be learned. Much of the intellectual work of the Western world since the Renaissance was devoted to elaborating systematic domains of knowledge with the assumption that the resulting schemas referred to something that existed independently of the minds that organised it. This intellectual work attempted to develop laws governing the movement of the solar system, classifications of plants and animals, or rules for the organisation of societies that would be true under all conditions, independent of the humans that developed them.

The second responsibility of the traditional teacher is to present the domain of knowledge to be taught appropriately so that the student can learn. Thus, there is a logical order of teaching dictated by the subject to be taught that would make it easiest to learn. The concept of a linear textbook, a great 19th century invention, is predicated on this view of learning. The author presents material in a logical sequence, starting with the simplest elements of the subject and moving on to more complex, until the entire field is covered. This approach to education can lead to 'The plain, monotonous vault of a school room,' containing, 'the little vessels then and there arranged in order, ready to have imperial gallons of facts poured into them until they were full to the brim' (5).

A second educational position represented on the top right quadrant of Figure 1, is discovery learning. It subscribes to the same positivist belief about knowledge as the previous one, but it takes a dramatically different view about how this knowledge is acquired. Proponents of this position argue that people construct knowledge themselves, they come to realise concepts and ideas as they build them up using personal, mental constructions. Thus, they also can acquire misconceptions. Proponents of discovery learning believe that in order to learn, students need to have experience; they need to do and see rather than to be told. Rather than organise the subject matter based on its logical structure, from the simplest to the more complex, the teacher organises it so that it can be experienced. Pedagogic simplicity takes on a practical aspect rather than an intellectual one. But the purpose of this hands on approach is still for the student to comprehend ideas and concepts that are independent of the learner. Through experience, misconceptions will be replaced by correct conceptions.

Knowledge is
constructed by the learner

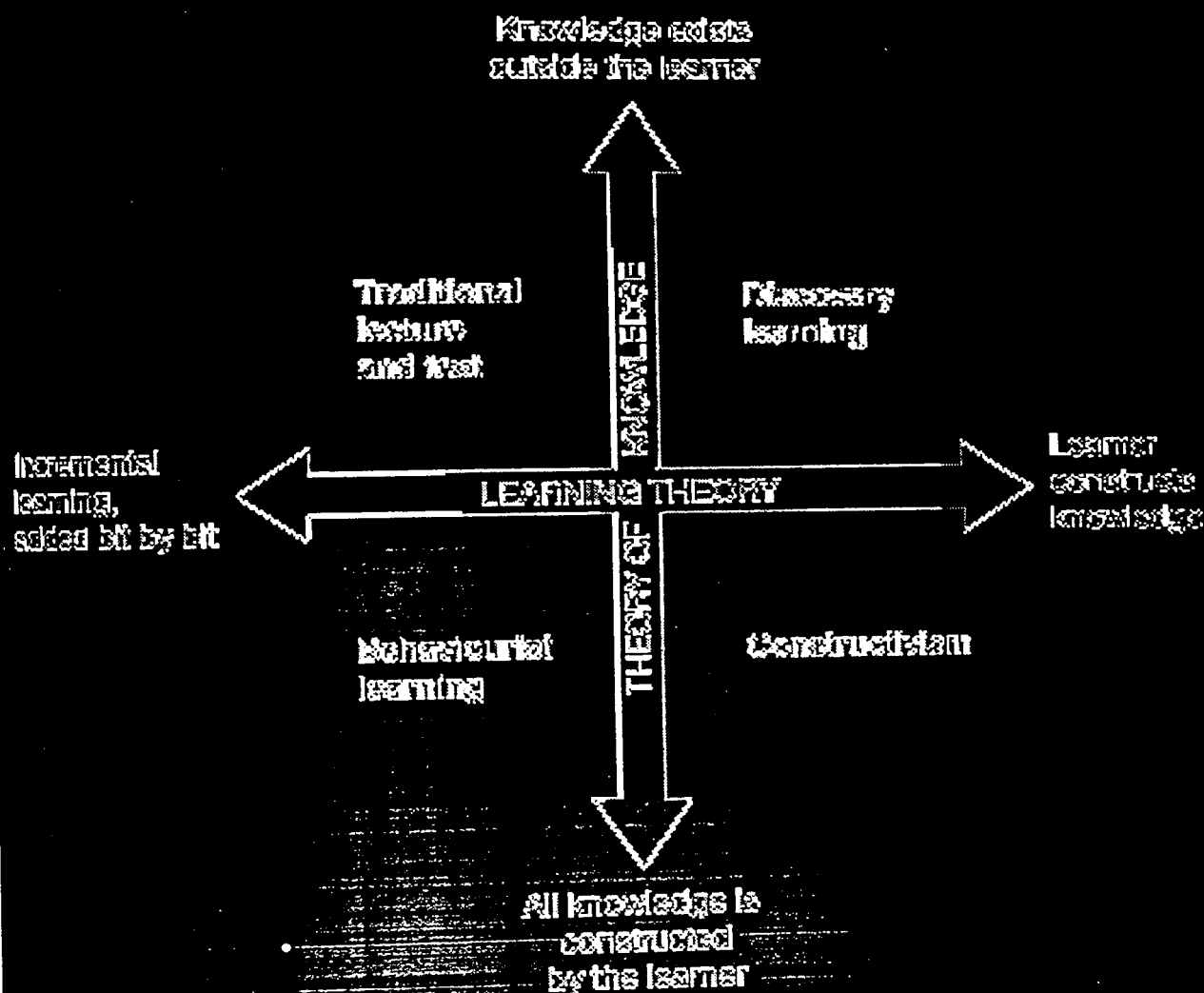


Figure 1

Constructivism, the bottom right hand corner, represents still another quadrant of the diagram. Constructivism argues that both knowledge and the way it is obtained are dependent on the mind of the learner. This view, based on idealist epistemology as well as developmental psychology, and in recent years supported by research in cognitive psychology, comes as a shock to those who wish to preserve the idea of knowledge independent of individual learners or communities of learners. It has been called radical constructivism (6). Proponents of constructivism argue that learners construct knowledge as they learn; they don't simply add new facts to what is known, but constantly reorganise and create both understanding and the ability to learn as they interact with the world. Further, the knowledge that is constructed through this process is individual or social, but has no ontological status outside the

mind of the knower.

There is, of course, a fourth position illustrated in Figure 1, that based on the belief that knowledge is gained incrementally but need not have existence outside the learner. Simple behaviourism fits into this quadrant, since behaviourism was originally a psychological learning theory and made no claims about the status of the knowledge gained from responses to stimuli.

The constructivist museum

The educational positions outlined above can be applied to museums. For any consideration of learning in museums, we can ask an epistemological question, What is the theory of knowledge applied to the content of the exhibitions? We also need to ask a question about learning theory, How do we believe that people learn? These two components of our museum educational theory will lead to a set of four positions, similar to the ones described above, each of which represents a different kind of museum. These are illustrated in Figure 2.

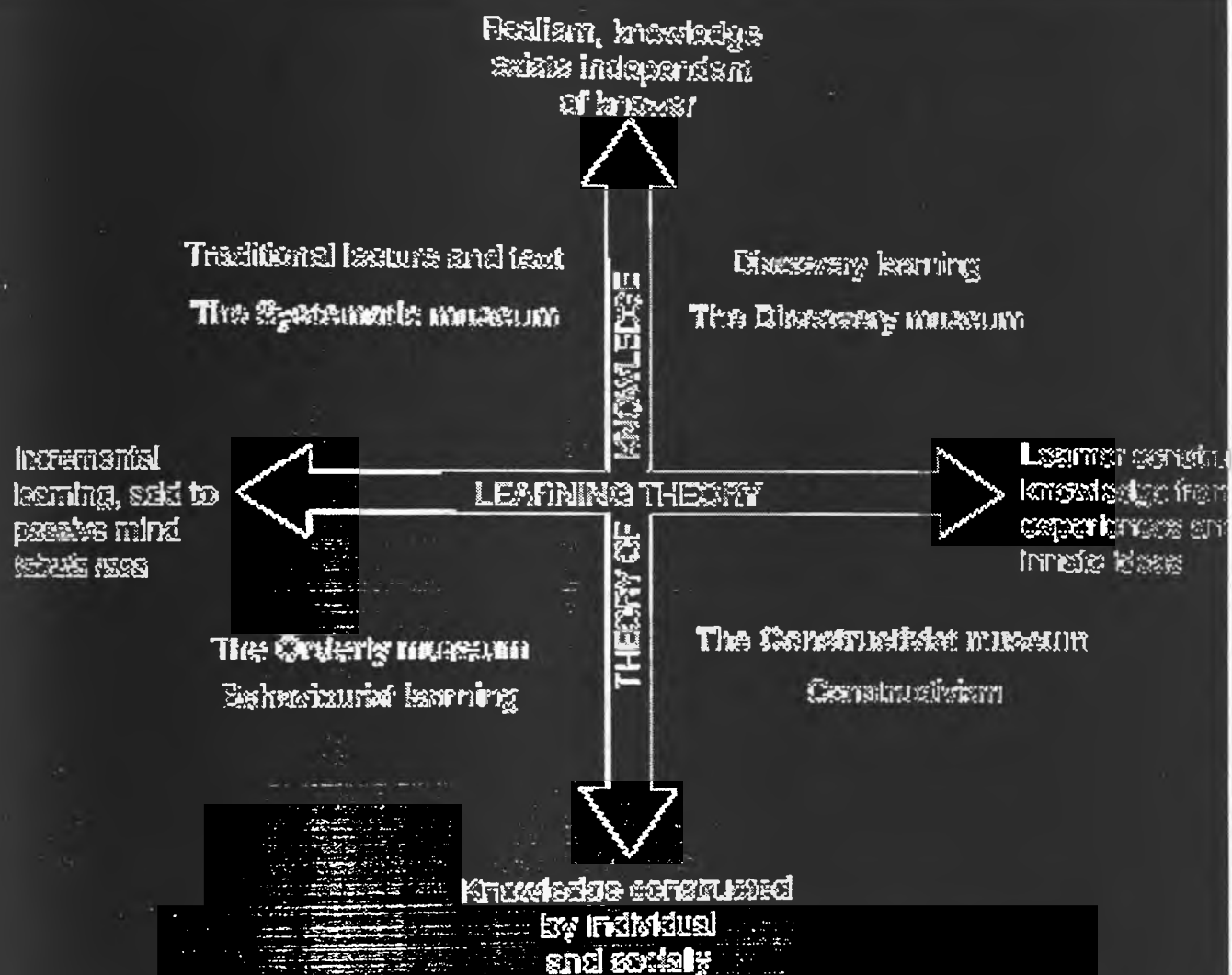


Figure 2

1. Realism, knowledge exists independent of knower
2. Traditional lecture & text. The Systematic museum
3. Discovery learning. The Discovery museum
4. Incremental learning, add to passive mind tabula rasa
5. Learner constructs knowledge from experience & innate ideas
6. The Ordinary museum Behaviourist learning
7. The Constructivist museum Constructivism
8. Knowledge constructed by individual & society

hangs its paintings chronologically on the assumption that this order will make most sense to its visitors. Similarly, it is common for exhibits to present material in a single, orderly manner deemed by the exhibit designers to be best suited for visitors to learn the message of the exhibit. In contrast, proponents of the constructivist museum would argue that:

1. The viewer constructs personal knowledge from the exhibit
2. The process of gaining knowledge is itself a constructive act (7)

Examples of constructivist museums are harder to find, but exhibits that allow visitors to draw their own conclusions about the meaning of the exhibition are based on this constructivist principle. There is also an increasing number of exhibitions that are designed so that multiple paths are possible through the exhibit and the learner (visitor) is provided with a range of modalities to acquire information.

Within this alternative and diametrically opposed educational view, the logical structure for any subject matter and the way it is presented to the viewer depend not on the characteristics of the subject nor on the properties of the objects on display, but on the educational needs of the visitor. In such a museum, it is not assumed that the subject matter has an intrinsic order independent of the visitor, nor that there is a single way for the visitor best to learn the material. Constructivist museum exhibits have no fixed entry and exit points, allow the visitor to make his or her own connections with the material and encourage diverse ways to learn (9)

The characteristics of the constructivist museum

What does a constructivist museum look like? The lack of predetermined sequence has already been mentioned, as has the use of multiple learning modalities. Howard Gardner had the constructivist museum in mind when he used the museum as a model for education. Another component of the constructivist museum would be the opportunity for the visitor to make connections with familiar concepts and objects. In order to make meaning of our experience, we need to be able to connect it with what we already know. Constructivist exhibits would encourage comparisons between the unfamiliar and new. Inviting South Asian immigrant women into the V&A to design and make their own embroidered tent hangings (11) can achieve the aim of making the museum more accessible to the community. Inviting hundreds of youngsters from diverse countries to make exhibits about their local rivers and to share them in a grand festival (12) can help them all learn about each other's cultures.

Conclusion

Constructivist educational theory argues that in any discussion of teaching and learning the focus needs to be on the learner, not on the subject to be learned. For museums, this translates into the dictum that we need to focus on the visitor, not the content of the museum.

Museums are remarkable sites for learning. Their power and influence for people is attested to by the amazing learning associated with them. Individuals can recount instances of epiphany-like experiences in all types of museums (13). Yet, the museum experience, on the whole, is fleeting and elusive.

By considering both the epistemological basis for our organisation of exhibitions and the psychological basis for our theory of learning, we can develop museums that can respond to the dispositions of our visitors and maximise the potential for learning. The constructivist museum acknowledges that knowledge is created in the mind of the learner using personal learning methods. It allows us to accommodate all ages of learning.

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Professor George E Hein, director of the Program Evaluation and Research Group at Lesley College, Cambridge, MA, USA, has carried out extensive visitor studies in museums. During the spring semester 1996, he spent part of his sabbatical leave in England, associated with the Leicester University Museum Studies Programme, at work on a book on visitor learning in museums.

This article was published in *Journal for Education in Museums* No. 16, 1995 p21-23

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VI. PROGRAMMING

- A. PHASE I
- B. PHASE II
- C. PHASE III

A. PHASE I



Diagram 1: A tree structure with a root node branching into two child nodes, each of which further branches into two leaf nodes.



Diagram 2: A tree structure with a root node branching into two child nodes, each of which further branches into two leaf nodes.

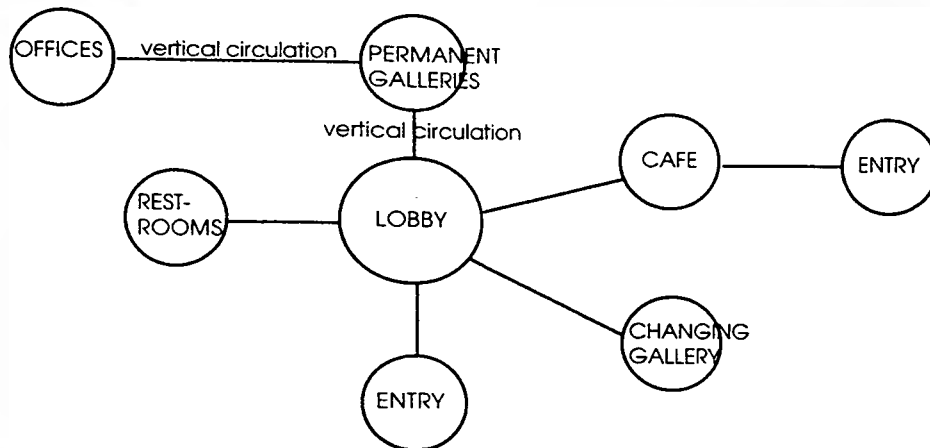


Diagram 3: A single node with a horizontal line passing through it.

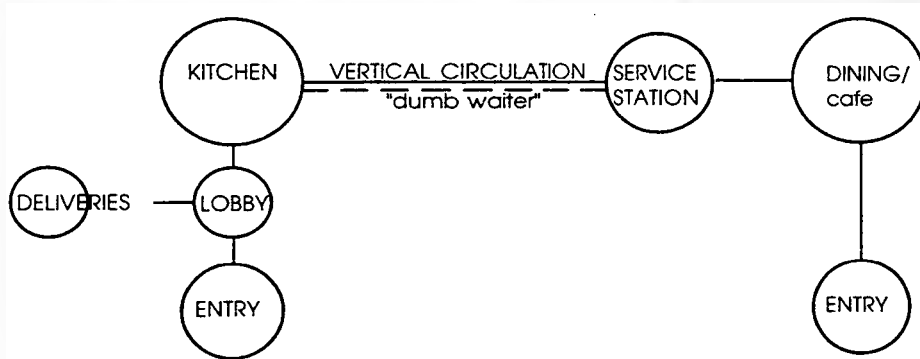


Diagram 4: A single node with a horizontal line passing through it.

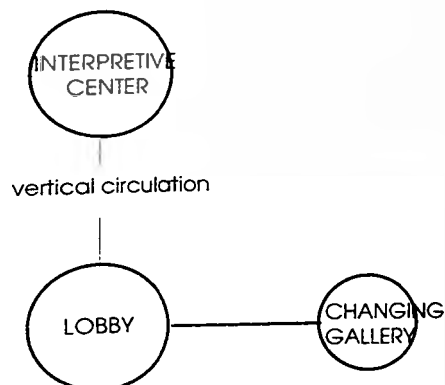
ENTRY SEQUENCE



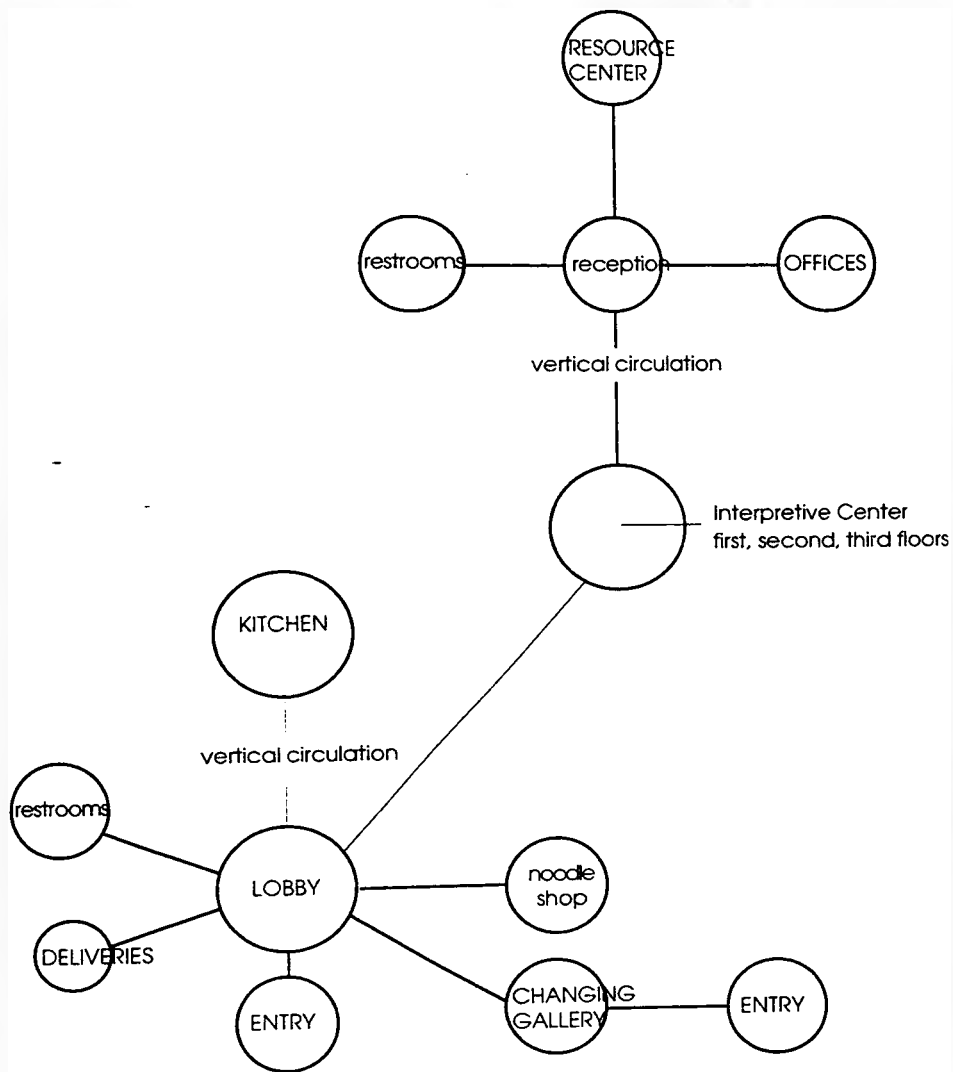
FOOD AND BEVERAGE ADJACENCIES



GALLERY ADJACENCIES



PROGRESSION OF SPACES BETWEEN FLOORS



B. PHASE II

1. *Phase II - 1970*

2. *Phase II - 1971*

3. *Phase II - 1972*

4. *Phase II - 1973*

5. *Phase II - 1974*

6. *Phase II - 1975*

7. *Phase II - 1976*

8. *Phase II - 1977*

9. *Phase II - 1978*

10. *Phase II - 1979*

11. *Phase II - 1980*

12. *Phase II - 1981*

13. *Phase II - 1982*

14. *Phase II - 1983*

15. *Phase II - 1984*

16. *Phase II - 1985*

17. *Phase II - 1986*

18. *Phase II - 1987*

19. *Phase II - 1988*

20. *Phase II - 1989*

21. *Phase II - 1990*

22. *Phase II - 1991*

23. *Phase II - 1992*

24. *Phase II - 1993*

25. *Phase II - 1994*

26. *Phase II - 1995*

27. *Phase II - 1996*

28. *Phase II - 1997*

29. *Phase II - 1998*

30. *Phase II - 1999*

31. *Phase II - 2000*

32. *Phase II - 2001*

33. *Phase II - 2002*

34. *Phase II - 2003*

35. *Phase II - 2004*

36. *Phase II - 2005*

37. *Phase II - 2006*

38. *Phase II - 2007*

39. *Phase II - 2008*

40. *Phase II - 2009*

41. *Phase II - 2010*

42. *Phase II - 2011*

43. *Phase II - 2012*

44. *Phase II - 2013*

45. *Phase II - 2014*

46. *Phase II - 2015*

47. *Phase II - 2016*

48. *Phase II - 2017*

49. *Phase II - 2018*

50. *Phase II - 2019*

Design Approach

note: all square footage is based on an estimate reflecting minimm space

Entry

a) bathrooms	300sq ft
b) foyer/entry sequence	333sq ft
c) gallery entry (only)	<u>200 sq ft</u>
	833sq ft

Gallery/ Interpretive Center Space

a) CHANGING GALLERY

- to serve as entry sequence to other areas of interpretive center
- to be used for changing displays of community art work

1250 sq ft

b) INTERPRETIVE CENTER

i. gallery overlook	400 sq ft
ii. rural living	425 sq ft
iii. marketplace	320 sq ft
iv. waterways	75 sq ft
v. worship	190 sq ft
vi. gallery	400 sq ft
vii. transportation	730 sq ft
viii. rice production	800 sq ft
ix. AV space	290 sq ft
x. gallery	400 sq ft
xi. resource center	900 sq ft
xii. office space	1000 sq ft
xiii. reception	<u>50 sq ft</u>
	5980 sq ft

(Design Issues)

Circulation (approx.

Arrangement of spaces, and sizes

Scope of experience for public

Classroom/ Meeting Space - 340sq ft

Breakdown for gallery space -1000sq ft

Storage

equipment/	
general	1127 sq ft
Janitorial	16 sq ft
files	80 sq ft
coat	<u>8 sq ft</u>
	1231 sq ft

TOTAL: 10634+ 3500(CIRC.)= 14134SQ FT

KITCHEN

Heavy Equipment:

Dish / Warewashing:

(size of machine):

$$\frac{\# \text{ of pieces per person} \times \# \text{ of persons per hour}}{20 \text{ pieces per rack}} = \text{racks per hour required}$$

- 2 pieces per person
- 150-190 approximate persons per hour

(approximate persons per hour based on heavy lunchtime activity to full capacity based on maximum capacity of square footage of total dining area alone)

63 capacity - first floor; 128 capacity - fourth floor (capacity reflects dining area alone, not entire floor space of building)

$$\frac{4 \text{ pieces per person} \times 150 \text{ persons per hour}}{20 \text{ pieces per rack}} = 30 \text{ racks per hour required}$$

$$\frac{4 \text{ pieces per person} \times 190 \text{ persons per hour}}{20 \text{ pieces per rack}} = 38 \text{ racks per hour required}$$

TOTAL racks required : approx.30-38 (capacity of dishwashing system needed)

Refrigeration : recommended storage for refrigerated foods

<u>Food</u>	<u>Temp (deg F)</u>	<u>Storage Period</u>
Dairy Products		
milk (fluid)	40	3 days
ice cream and ices	10	3 months in original covered container
Eggs	45	7 days
Fish		
fresh	36	20 days loosely wrapped
shell fish	36	5 days in covered container
Fruits	50-70	7 days - 2 weeks
Poultry	36	7 days
Meat		
Ground	38	2 days
Fresh Meat Cuts	38	6 days
Liver and Variety Meats	38	2 days
Cold Cuts (sliced)	38	6 days
Ham (tender cured)	38	1-6 weeks
Ham (canned)	38	6 weeks, original container
Dried Beef	38	6 weeks
Vegetables		

Leafy	45	7 days
Potatoes, Onions,		

Refrigeration (continued) :

<u>Food</u>	<u>Temp (deg F)</u>	<u>Storage Period</u>
Root Vegetables	50-70	7-30 days, dry in ventilated containers

Refrigeration : recommended storage for refrigerated foods

<u>Frozen Food</u>	<u>Maximum Storage Period at 0 degrees F</u>
Eggs	6-12 months
Fruit	8-12 months
Vegetables	
Meats	
Beef	6-12 months
Pork	3-6 months
Sausage and Ground Meat	1-3 months
Cooked Meat, not covered with gravy or other sauces	1 month
Meat Sandwiches	1 month
Poultry	
Chicken	6-12 months
Turkey	3-6 months
Giblets	3 months
Cooked poultry meat	1 month
Cooked poultry dishes	3-6 months

based on menu and storage requirements, delivery of products varies as follows:

- Meats: once a week
- Vegetables: three times a week
- Dairy and Eggs: twice a week
- Fish ("fish meat balls"): twice a week

NAME OF SPACE Entry / Exit Lobby (South Entrance)

TYPE OF ACTIVITIES PERFORMED entry sequence as lobby/foyer into upward circulation of Gallery

NUMBER OF OCCUPANTS TO BE ACCOMMODATED varies

RELATIONSHIP TO OTHER SPACES - IN COMBINATION WITH foyer

ADJACENT TO changing gallery, noodle shop

restrooms, vertical circulation

IN CLOSE PROXIMITY TO

ESTIMATED MINIMUM SQUARE FOOTAGE REQUIRED 100 sq. ft.

SERVICE REQUIREMENTS - WATER ☒ POWER ☒ SUCTION ☐ AIR ☒ GAS ☐

OXYGEN ☐ DRAIN ☐ OTHER ☐

ILLUMINATION REQUIREMENTS - ELECTRIC to highlight various regions of entry

- DAYLIGHTING

FENESTRATION

ACOUSTICAL REQUIREMENTS possibly white noise, or sounds of "calm" / water

EQUIPMENT REQUIREMENTS - (ITEMIZE AND INDICATE FREE STANDING, BUILT-

IN, QUANTITY) built-in / elevator (1)

STORAGE REQUIREMENTS

COMMUNICATION REQUIREMENTS - TELEPHONE ☒

- INTERCOM ☐

- VISUAL possible

- MUZAK ☒

SURFACE RECOMMENDATIONS - FLOOR bamboo lumber and honed slate

- WALLS brick/ glass/ plastered gyp board

- CEILING slats of wood

SPECIAL REQUIREMENTS AND/OR CONSIDERATIONS adjacency to "dividing" wall element

STATEMENT REGARDING OVERALL DESIGN CHARACTER OF SPACE Entry Sequence should be a unifying element between the components of entry, Changing Gallery, and Noodle shop, with regards to directionality towards vertical circulation.

NAME OF SPACE Entry / Exit Lobby (East Entrance)

TYPE OF ACTIVITIES PERFORMED provide for Changing Gallery to stand by itself, or entice further exploration into other spaces of building

NUMBER OF OCCUPANTS TO BE ACCOMMODATED varies

RELATIONSHIP TO OTHER SPACES - IN COMBINATION WITH Changing Gallery

ADJACENT TO noodle shop

IN CLOSE PROXIMITY TO vertical circulation

ESTIMATED MINIMUM SQUARE FOOTAGE REQUIRED 200 sq. ft.

SERVICE REQUIREMENTS - WATER ☒ POWER ☒ SUCTION ☒ AIR ☒ GAS ☐

OXYGEN ☐ DRAIN ☐ OTHER ☐

ILLUMINATION REQUIREMENTS - ELECTRIC to highlight various regions of entry

- DAYLIGHTING some filtered from entrance

FENESTRATION

ACOUSTICAL REQUIREMENTS possibly white noise, or sounds of "calm" / water

EQUIPMENT REQUIREMENTS - (ITEMIZE AND INDICATE FREE STANDING, BUILT-IN, QUANTITY) built-in / elevator (1)

STORAGE REQUIREMENTS

COMMUNICATION REQUIREMENTS - TELEPHONE ☒

- INTERCOM ☐

- VISUAL possible

- MUZAK ☒

SURFACE RECOMMENDATIONS - FLOOR bamboo lumber and honed slate

- WALLS brick/ glass/ plastered gyp board

- CEILING slats of wood

SPECIAL REQUIREMENTS AND/OR CONSIDERATIONS adjacency to "dividing" wall element

STATEMENT REGARDING OVERALL DESIGN CHARACTER OF SPACE Entry Sequence should be a unifying element between the components of foyer, Changing Gallery, and Noodle shop, with regards to directionality towards vertical circulation. This entry plays on role of more small scale, human scale entry.

NAME OF SPACE Rural Living

TYPE OF ACTIVITIES PERFORMED a gallery of senses to key viewers into experience of rural living, and to offer exploratory venues for the "experiential" experience

NUMBER OF OCCUPANTS TO BE ACCOMMODATED varies (ave. 5-8)

RELATIONSHIP TO OTHER SPACES - IN COMBINATION WITH _____

ADJACENT TO vertical circulation

IN CLOSE PROXIMITY TO Gallery Overlook

ESTIMATED MINIMUM SQUARE FOOTAGE REQUIRED 425 sq. ft.

SERVICE REQUIREMENTS - WATER X POWER _____ X SUCTION _____ AIR X GAS _____

OXYGEN _____ DRAIN _____ OTHER _____

ILLUMINATION REQUIREMENTS - ELECTRIC spotlighting displays, and ambient lighting

- DAYLIGHTING some filtered from entrance

FENESTRATION _____

ACOUSTICAL REQUIREMENTS tropical noises, or workers in nearby fields

EQUIPMENT REQUIREMENTS - (ITEMIZE AND INDICATE FREE STANDING, BUILT-
IN, QUANTITY) _____

STORAGE REQUIREMENTS _____

COMMUNICATION REQUIREMENTS

- TELEPHONE _____
- INTERCOM _____
- VISUAL possible
- MUZAK possible

SURFACE RECOMMENDATIONS

- FLOOR bamboo lumber, with natural fiber,
woven rugs
- WALLS natural woven panels
- CEILING "roof" system of the hut

SPECIAL REQUIREMENTS AND/OR CONSIDERATIONS ramp up 1:20

STATEMENT REGARDING OVERALL DESIGN CHARACTER OF SPACE The space is to create a sense of walking into a rural hut, possibly smells and sounds to contribute to separation from the rest of the interpretive center.

NAME OF SPACE Noodle Shop

TYPE OF ACTIVITIES PERFORMED restaurant type space displaying the Vietnamese cooking tradition of a quick bowl of noodles at the lunch hour or at a snack time.

NUMBER OF OCCUPANTS TO BE ACCOMMODATED varies (max. 60)

RELATIONSHIP TO OTHER SPACES - IN COMBINATION WITH changing gallery

ADJACENT TO changing gallery, foyer

restrooms.

IN CLOSE PROXIMITY TO vertical circulation

ESTIMATED MINIMUM SQUARE FOOTAGE REQUIRED 1250 sq. ft.

SERVICE REQUIREMENTS - WATER ☒ POWER ☒ SUCTION ☐ AIR ☒ GAS ☐

OXYGEN ☐ DRAIN ☐ OTHER ☐

ILLUMINATION REQUIREMENTS - ELECTRIC to create experience of outdoor eating

- DAYLIGHTING some filtered from entrance

FENESTRATION

ACOUSTICAL REQUIREMENTS possibly white noise, to maintain level of conversation

EQUIPMENT REQUIREMENTS - (ITEMIZE AND INDICATE FREE STANDING, BUILT-

IN, QUANTITY) built-in / dumb-waiter (1) counter tops; free-standing / tables,

chairs, service ware

STORAGE REQUIREMENTS kitchen equipment, possibly tables and chairs

COMMUNICATION REQUIREMENTS - TELEPHONE ☒

- INTERCOM ☐

- VISUAL possible

- MUZAK ☒

SURFACE RECOMMENDATIONS - FLOOR bamboo lumber

- WALLS brick

- CEILING banners

SPECIAL REQUIREMENTS AND/OR CONSIDERATIONS

STATEMENT REGARDING OVERALL DESIGN CHARACTER OF SPACE The feel should be of outdoor dining, not in the European sense, but, under the natural elements of mountain and sky.

NAME OF SPACE Resource Center

TYPE OF ACTIVITIES PERFORMED functions much like a library space for start of research into topics of Vietnam, history, and present

NUMBER OF OCCUPANTS TO BE ACCOMMODATED varies (max. 45)

RELATIONSHIP TO OTHER SPACES - IN COMBINATION WITH reception and librarian

ADJACENT TO offices, vertical circulation

restrooms, "dividing wall"

IN CLOSE PROXIMITY TO galleries

ESTIMATED MINIMUM SQUARE FOOTAGE REQUIRED 1250sq. ft.

SERVICE REQUIREMENTS - WATER _____ POWER _____ X SUCTION _____ AIR _____ X GAS _____

OXYGEN _____ DRAIN _____ OTHER _____

ILLUMINATION REQUIREMENTS - ELECTRIC illuminate resources, and study tables

- DAYLIGHTING some filtered from windows

FENESTRATION _____

ACOUSTICAL REQUIREMENTS separate from office

EQUIPMENT REQUIREMENTS - (ITEMIZE AND INDICATE FREE STANDING, BUILT-

IN, QUANTITY) built-in / resource displays () freestanding / tables, chairs, librarian table and chair, files, computers

STORAGE REQUIREMENTS _____

COMMUNICATION REQUIREMENTS - TELEPHONE X

- INTERCOM _____

- VISUAL possible

- MUZAK X

SURFACE RECOMMENDATIONS - FLOOR carpet tiles

- WALLS brick / plastered gyp board

- CEILING _____

SPECIAL REQUIREMENTS AND/OR CONSIDERATIONS _____

STATEMENT REGARDING OVERALL DESIGN CHARACTER OF SPACE Festive carry over in flooring pattern, fairly restrained walls for resource and other displays, with ceiling to carry over enclosed study areas.

NAME OF SPACE Permanent Exhibits

TYPE OF ACTIVITIES PERFORMED display of permanent exhibits that will facilitate hands on learning on part of visitors

NUMBER OF OCCUPANTS TO BE ACCOMMODATED varies (max. 500)

RELATIONSHIP TO OTHER SPACES - IN COMBINATION WITH _____

ADJACENT TO vertical circulation

IN CLOSE PROXIMITY TO Changinga gallery,

Waterfront Park

ESTIMATED MINIMUM SQUARE FOOTAGE REQUIRED 4350 sq. ft.

SERVICE REQUIREMENTS - WATER _____ POWER _____ X SUCTION _____ AIR _____ X GAS _____

OXYGEN _____ DRAIN _____ OTHER _____

ILLUMINATION REQUIREMENTS - ELECTRIC to highlight various displays

- DAYLIGHTING some filtered from window

FENESTRATION _____

ACOUSTICAL REQUIREMENTS possibly white noise, to maintain level of conversation

EQUIPMENT REQUIREMENTS - (ITEMIZE AND INDICATE FREE STANDING, BUILT-

IN, QUANTITY) free-standing / changinga displays

STORAGE REQUIREMENTS areas to store displays when not in use for particular exhibits

COMMUNICATION REQUIREMENTS - TELEPHONE _____

- INTERCOM _____

- VISUAL artwork

- MUZAK possible

SURFACE RECOMMENDATIONS - FLOOR bamboo lumber

- WALLS brick

- CEILING slats of wood

SPECIAL REQUIREMENTS AND/OR CONSIDERATIONS _____

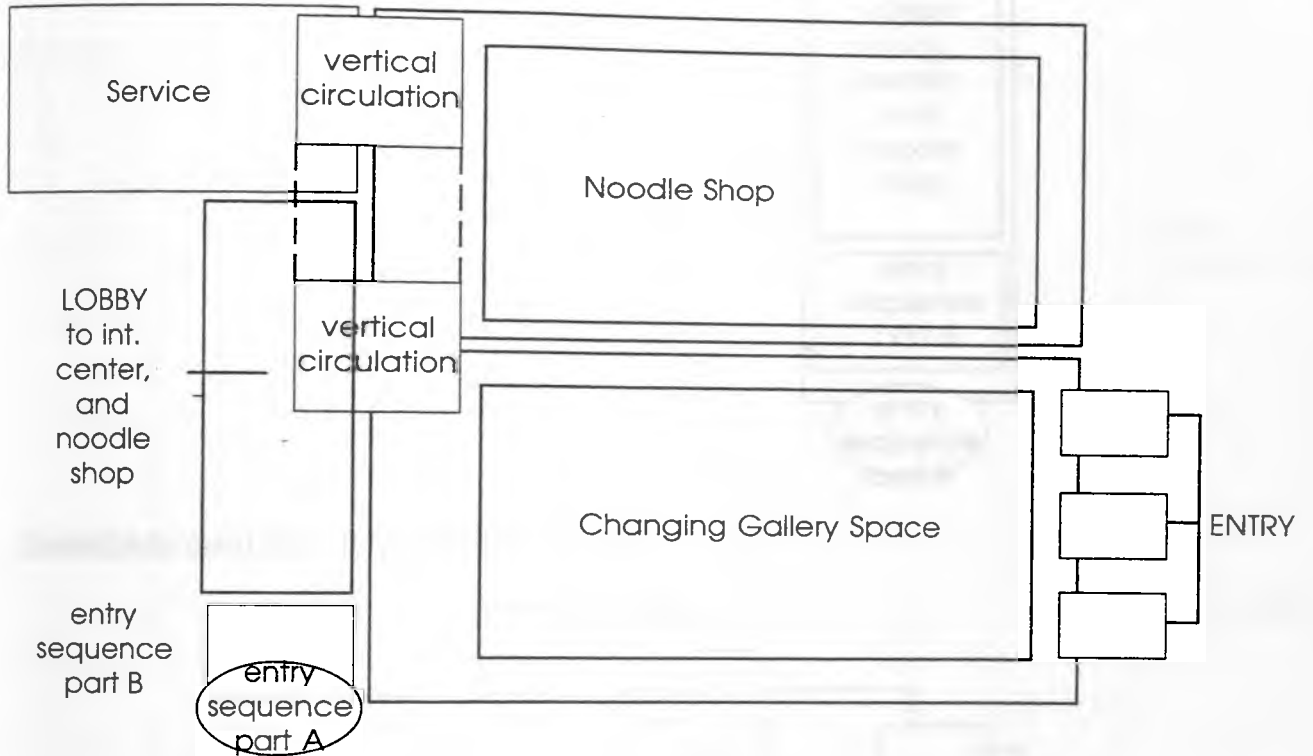
STATEMENT REGARDING OVERALL DESIGN CHARACTER OF SPACE To enhance the experience of a variety of groups in education of what the Vietnamese American carries in heritage.

C. PHASE III

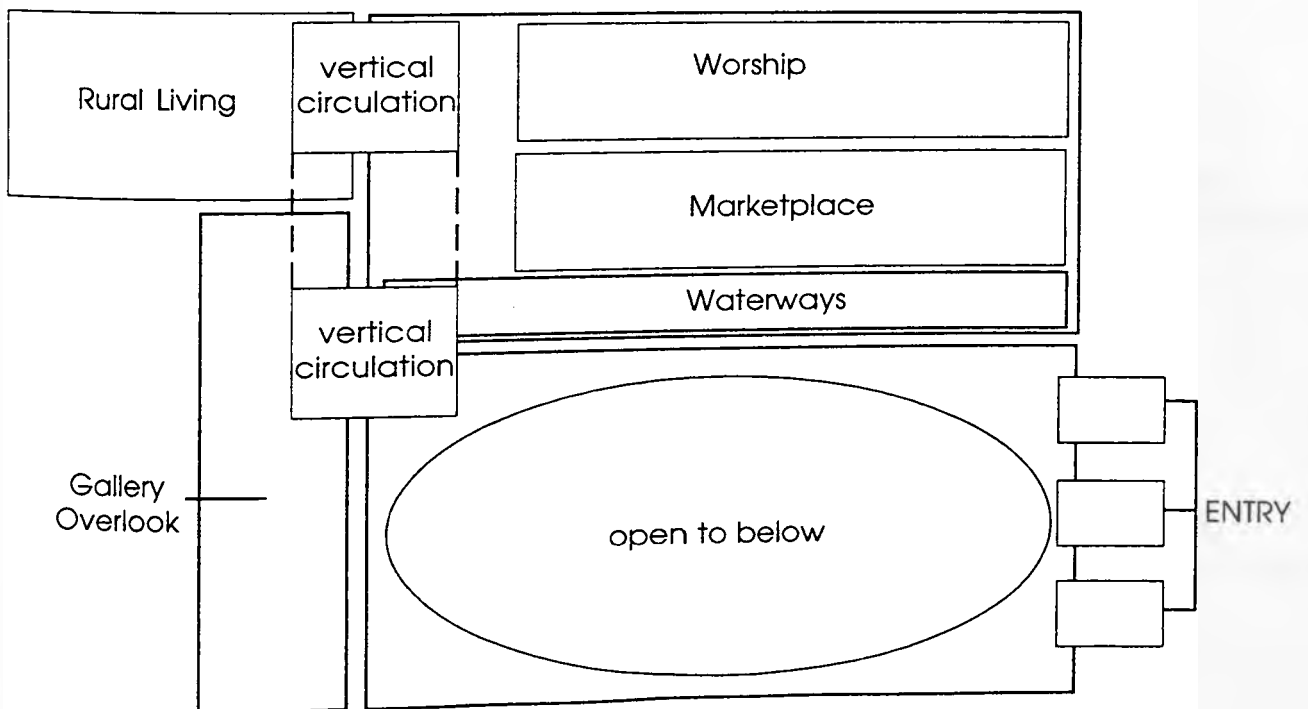


GRAPHICAL REPRESENTATION OF ACTIVITIES

FIRST FLOOR

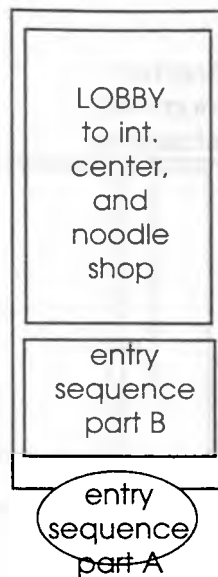


SECOND FLOOR

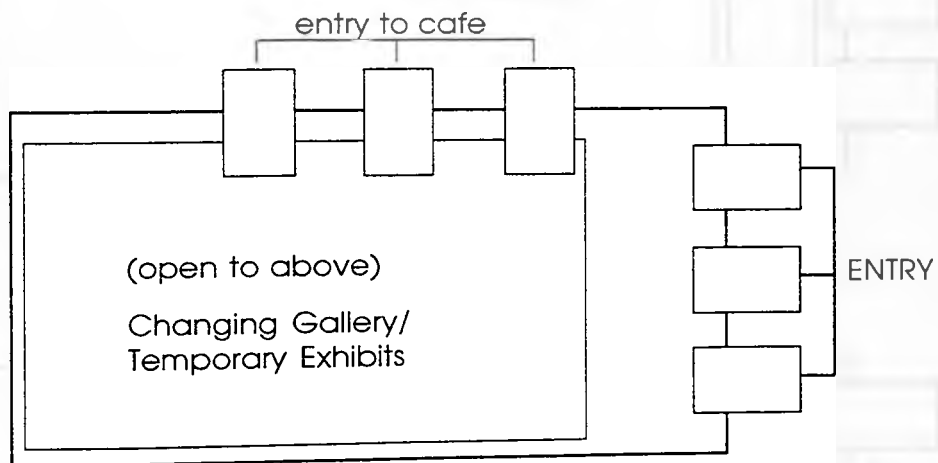


GRAPHICAL REPRESENTATION OF ACTIVITIES

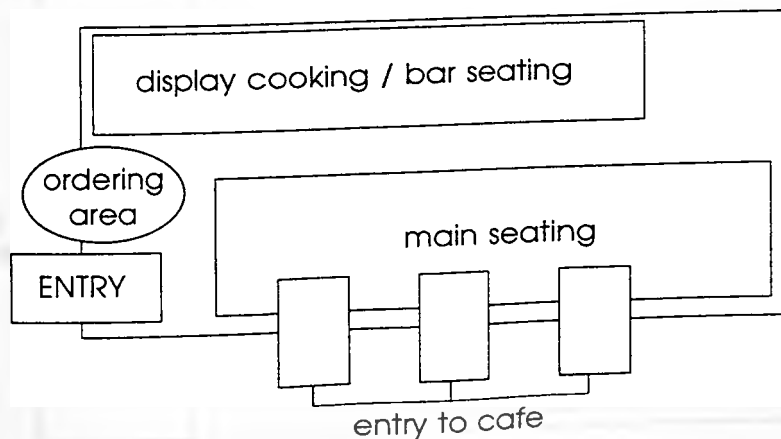
ENTRY SEQUENCE TO SHARED SPACE



CHANGING GALLERY/ TEMPORARY EXHIBITS

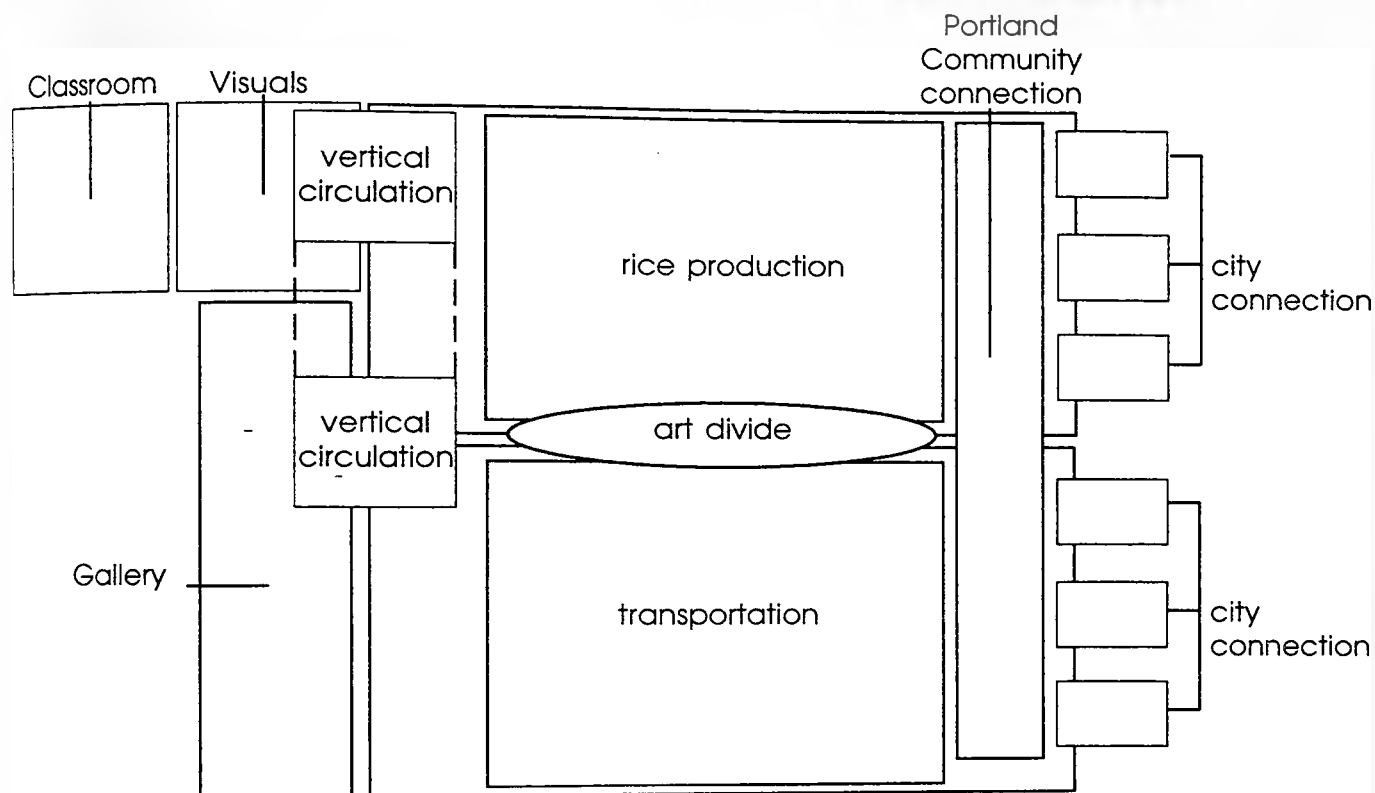


NOODLE SHOP

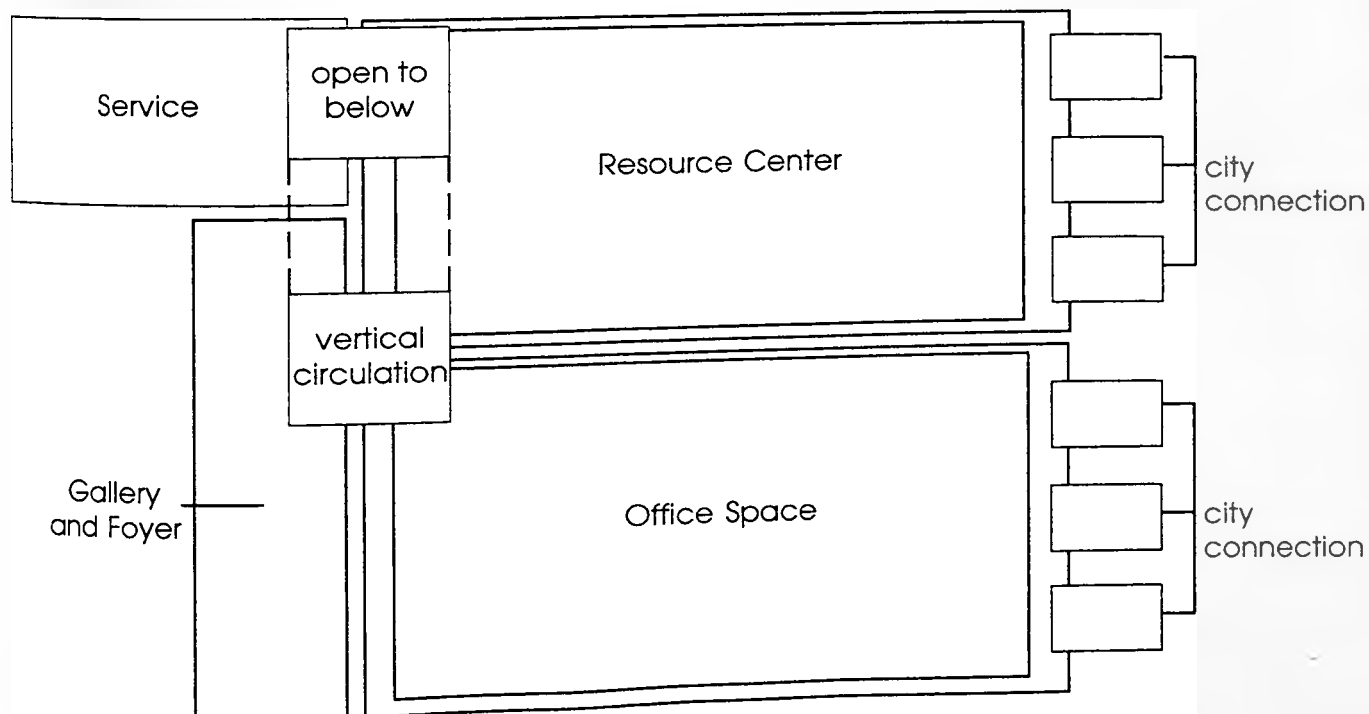


GRAPHICAL REPRESENTATION OF ACTIVITIES

THIRD FLOOR



FOURTH FLOOR



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Gould, Ketayun H. "Asian and Pacific Islanders: Myth and Reality". *Social Work*. Vol.33 No.2, March-April 1988. Pp.142-147. FirstSearch.

"Events and People: Prejudice Increasing". *Christian Century*. Vol.104 No.9, March 1987. pp.265. FirstSearch.

Duster, Troy. "Social Implications of the 'New' Black Urban Underclass". Vol.19 No.3, May-June 1988. pp.2-9. FirstSearch.

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APPENDIX

HC Approach

1. History of Vietnamese Culture (pre Vietnam War)
2. People, who they were:
 - A. VIETNAMESE (farmers, city dwellers, etc./ elders, parents, grandparents, children, etc.)
 - B. SOLDIERS/VETERANS (U.S., French, etc.)
 - C. THE PEOPLE AT HOME (U.S. families of the Northwest)
3. The Vietnam War
turning point?-in that events culminated to this point of change
4. People, who they are today:

documentation of previous list/ since war - where they have been (physically, emotionally), patterns of resettlement, socio-economic adaptation--different life decisions/ careers/ places of settlement (approach-interviews)
5. What does this mean today and for the future?

With possible incorporation of "An interpretive vision of the road ahead through the arts.

In the 1980's, the Asian population (in Vermont) increased 137 percent, of which almost 70% of newcomers were Vietnamese...In 1992, as a response to clearly identified needs to improve language access to essential public health services, Vermont initiated a project to train interpreters to assist refugees in medical appointments.

In Los Angeles, 39% of the city's students don't speak English well, and in Seattle, 21% come from homes where English is not the family's first language.

During the past decade (in the United States), the nation's Asian and Pacific Islander population grew seven times as fast as the general population--from 3.8 million in 1980 to 6.5 million in 1988.

In 1980, the top three API groups were the Chinese, the Filipinos, and the Japanese. By 1990, the top 3 groups are predicted to be the Filipinos, the Chinese, and the Vietnamese.

Vietnamese make up 12% of all Asian Pacific Islanders.

While the 1980 census found that Asians were more diversely distributed in different regions of the United States than they had been in 1970, it also found that many still lived in the West. With 59% residing in the West in 1980.

National Endowment for the Arts' Survey of Public Participation in the Arts, "twenty-nine percent of 18-to-24 year olds (in the United States) in 1992 reported attendance at an art museum or gallery during the previous 12 months--compared with 23% in 1982."

Lessons, or classes suffered a drop in attendance, from 41% in 1982, to 24% in 1992.

Art appreciation rose from 22% in 1982, to 27% in 1992.

Annual audience for professional dance has grown from 1 million to 16 million + over the past 28 years.

31% of suburban adults visited art museums, versus 29% of central city adults

390 million visits were recorded nationwide in 1979, and 600 million ten years later.

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AUTHOR: Duster, Troy
TITLE: Social Implications of the 'New' Black Urban Underclass.
SOURCE: Black Scholar, v.19 no.3, May-Jun 1988, p.2-9.
ISSN: 0006-4246
ABSTRACT: "Between 1970 and 1980, the Asian population in the U.S. more than doubled, moving from 1.5 million to 3.5 million. From the 1970 census, the subgroups, in descending order of number in the population, were Japanese, Chinese, Filipino, Korean and Hawaiian." The 1980 census included Guamanians, Samoans, and Vietnamese immigrants. "The growth pattern of each group was quite different, and for the most part reflected immigration patterns rather than birth rate differences. While they had been second in 1970, the Chinese were the largest Asian minority in the U.S. in 1980, they numbered 806,027 nearly double the 1970 total of 435,062. It will surprise some to learn that in 1980 the second largest group was not the Japanese (number 1 in 1970), but Filipinos, with 774,640 (an increase of 125 percent over 1970)." (p6)
DESCRIPTOR: ALIENS, ASIAN - UNITED STATES

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TITLE: Events and People: Prejudice Increasing.

SOURCE: Christian Century, v.104 no.9, 18-25 Mar 1987, p.265.

ISSN: 0009-5281

ABSTRACT: A recent Gallup poll shows that "Among groups not wanted as neighbors by 44 per cent of the population (as compared with only 20 per cent in 1981) are members of religious sects and cults. Cuban and Vietnamese refugees are not wanted as neighbors by 25 per cent and 17 per cent respectively. Also, 14 per cent do not want religious fundamentalists living next door, and 13 per cent feel the same way about unmarried couples living together. Furthermore, 23 per cent of southern whites and 10 per cent of northern whites say that they do not want blacks as neighbors." (p265)

DESCRIPTOP: PREJUDICES - UNITED STATES

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AUTHOR: Gould, Ketayun H.
TITLE: Asian and Pacific Islanders: Myth and Reality.
SOURCE: Social Work, v.33 no.2, Mar-Apr 1988, p.142-147.
ISSN: 0037-8046
ABSTRACT: "Asian and Pacific Islanders currently are this country's fastest growing minority. Taking into account births, deaths, and continuing immigration, especially of refugees from Southeast Asia, Gardner et al. estimate the Asian and Pacific Islander Population at 5.1 million (about 2.1 percent of the total U.S. population) as of September 30, 1985. This figure represents a gain of 48.5 percent in five and one-half years; the 1980 census counted 3.5 million Asian and Pacific Islanders The 1980 census compiled information on more than 20 Asian populations and specifically indentified five Pacific Islander groups. The major Asian and Pacific Islander groups are Chinese (21 percent of the total in 1985), Filipino (20 percent), Japanese (15 percent), Vietnamese (12 percent), Korean (11 percent), and Asian Indian (10 percent). The census also provided detailed data on Hawaiians, Guamanians, and Samoans, with the rest of the groups categorized as 'Other.'" (p142)
DESCRIPTOR: ASIAN AMERICANS

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People of Asian And Pacific Island Heritage in America

The many individual countries which make up the Asian and Pacific Islander groups (China, Japan, Korea, the Philippines, Southeast Asian countries, the Polynesian Islands, and others) are far from alike in their cultures, although they share a large common geographic area. There are many distinct racial groups, languages and histories among them.

The largest Asian population in America is Chinese, with almost one million people. Filipinos make up the next largest group, with Japanese American population third in size.

All of the major world religions originated in Asia: Buddhism, Christianity, Hinduism, Islam, Judaism, Sikhism, Taoism, and Zoroastrianism. Although a time-consuming task, it is important to study these religions and the particulars of each culture to get a detailed view of bereavement practices among Asian and Pacific Islanders since many of their strictly followed modern customs spring from these religious roots.

Immigrants to the United States usually adopt, and adapt to, most of the new customs which exist in their new country, both out of choice and necessity. Yet, what is familiar can often offer comfort, and immigration is a very stressful experience. Some, especially during the first years following immigration, hold onto their old ways out of fear and feelings of being displaced. But it is very difficult to maintain exact cultural practices when one has migrated to a vastly different culture. When immigrants migrate to a strong ethnic community and are somewhat insulated from mainstream American lifestyles, quite often, they are slower to give up the ways of the old country. It is not unusual in circumstances such as these for distinct old world customs to be practiced side by side with entirely new customs.

The blending of four primary religions, Buddhism, Taoism, Shamanism and Confucianism, is the basis for the dominant traditional Chinese bereavement customs. Set in the midst of this is ancestor worship. Strict adherence to ways of announcing a death, preparing the body, arranging the funeral and burial, and after-burial grieving are required. Burning objects made of paper such as lanterns, flowers, and money is an important ritual practiced during the entire mourning process.

Incense, flowers, food and scriptures are used to assist the spirit of the deceased on a safe journey to the Lower Spirit World, a point of entry from this world, where judgment

is passed. If all goes well, the spirit then passes on to Western Heaven where Buddha rules and then on to Upper Heaven where the Emperor rules. There is no guarantee that the deceased's soul will safely complete the journey, so the loving and devoted assistance of relatives is essential. Worship of the dead ancestor motivates the relatives to do all possible to give assistance. Helping the deceased complete this journey also helps prevent any evil from returning to the living.

Traditionally, the Chinese believe that a dead family member has three souls which reside simultaneously in the body in the grave, with the spirits in the clan temple, and in the family shrine. The third day following the funeral and burial is ceremonially significant. Ceremonies are also held on the 21st, 35th, 49th and 60th days following the death. For a year following the death, a bowl of rice with meat and vegetables and chopsticks is placed on a table before a tablet set aside for the deceased. Three great festivals of the dead occur during the year, one each in the spring, summer and fall. Great respect is shown to Chinese dead throughout the lifetimes of surviving relatives, both in memory and in ceremony over the years.

The dominant religion practiced among the Japanese is Buddhism. Shintoism is also practiced simultaneously without conflict. Shinto emphasizes the worship of nature, ancestors and ancient heroes, and the divinity of the emperor. Although life on earth is important, preparation for the afterlife is crucial among Buddhists. For that reason, many Japanese people go to a Shintoist shrine when a child is born, but attend ceremonies at a Buddhist temple when there is a death since the Buddhist priest helps them to care for all matters concerning death and life after death.

A Japanese National is a person born in Japan. An Issei is a first generation American, isolated from both American and Japanese cultures. Nisei refers to a second generation American, the first to have interactions with Americans other than Japanese Americans. Kibei-Nisei are persons born to Issei parents and are sent to Japan to get an education and then returned to America. Sansei are third generation Americans of Japanese descent.

Certain practices need to be observed when working with Japanese people. Physical contact should be avoided. The Japanese and other Asian people prefer not to look directly into another person's eyes. To do so is considered rude. Do not ask a question beginning with "Don't you.....," or compliment a Japanese person on how well they speak English. Do not chew gum or eat standing up. Expect that a Japanese person, in order to be polite, may say "no" three times before giving you their true answer. Do not assume that a nod or smile means agreement or understanding. Ask the person if they understand what you have said.

Say "It's Ok" to mean "no." To show respect, add, "San" (pronounced son) at the end of the last name. Find out who is in charge in the family and talk to that person. Emphasis is on "we" rather than on "I," on the needs of the group, the family, rather than on the needs of individuals.

Find out exactly what the family attitudes are toward receiving assistance from outside the family circle since some Japanese may be embarrassed about needing assistance. It is important to involve the entire family so no single family member bears this feeling alone.

As Japanese people age, they may return to speaking Japanese. As others of the same age die, there may be fewer people who can understand the mother tongue, and so the elderly may feel isolated.

Death is considered a passage. There are various rituals to observe with a death. The body of a dead loved one is prepared by close family members, beginning with a bath, usually of warm water, followed by purification rites before the body is wrapped in a white kimono.

Traditionally, family and friends "visit" with the deceased for two days. There is prayer, and those visiting the home burn incense and bring gifts, usually an offering of money. Many ceremonies are held according to religious convention. Over the last few decades, many of the complex and slow paced practices in observance of a death have given way to simpler ceremonies in response to the increased pace of daily life. Cremation has virtually replaced earth burial.

Still, certain days remain important and are ceremoniously honored. The most important days are the 7th day, the 49th day, the 100th day following the funeral, and the first, the second, the sixth and twelfth anniversaries of the loved one's death. Ask which particular rituals the family follows.

A large proportion of Filipinos are Catholic. Those who follow the most traditional customs in America, as practiced in the Philippines, wear dark clothing (the men wear black armbands or small black ribbons pinned to their shirt pockets, the women black dresses) for a length of time according to how close they were to the deceased.

Wreaths are sent to accompany the casketed body from funeral home to cemetery and the home of the deceased is sometimes draped with a wide black cloth. It is still important among some Filipino families to place as large an announcement of the death as they can afford in the newspapers, giving the date and time of the funeral, and asking for prayers and blessings on the soul of the deceased.

Buddhism is the dominant religion among Vietnamese. Many Vietnamese believe that birth and death are predestined; that their *Karma* determines their fate. Problems are not easily shared with people outside the family or the most immediate community.

After the body of the deceased has been bathed and dressed in the best clothes available, a few grains of rice are placed inside the mouth. Money is also placed with the deceased to allow for the purchase of drinks to accompany the food. It is important that the dead relative be comfortable on the journey to the afterlife.

Friends are invited into the home to view the remains. So that the deceased will not be unaware of the arrival of each new person, music is played to announce each visitor's entrance. All in attendance wear white. The immediate family spends the last moments before the funeral procession in prayer, saying their final goodbyes. Cremation is preferred. Traditionally, mourning is observed for the first 100 days following a death.

How customs vary from each family to family and person to person often depends on whether they live in a closeknit Asian or Pacific Islander community, like the Chinese American communities of San Francisco and New York, or whether they live in a predominantly Eurocentric American community with little or no contact with others of the same cultural background.

In some communities where there is a mixture of cultures, customs within each household are often maintained, while neighbors, especially the children, share and trade customs through daily associations and friendships. Examples of this can be found in Hawaiian communities where Polynesian, Chinese, Japanese, Asian Indians and Koreans often live side-by-side.

Many Asian and Pacific Islanders have completely assimilated, and practice none of the old world customs, and like many European and African Americans, are "typical" Americans in their religious and other cultural practices.

All people share similar feelings of loss at the death of a loved one, and this is common ground for both needing and giving assistance.

Suggested Readings

Kim, Hyung-Chan, Ed. *Dictionary of Asian American History*. New York: Greenwood Press, 1986.

Kitano, Harry L. *The Japanese Americans*. New York: Chelsea House, 1987.

Illegal immigration is a particularly sensitive issue for many Americans, one that prompts them to worry about the price society pays for an "open door" policy. Illegal immigration involves not only people who sneak across the U.S. border, but also those who come as tourists or students and decide to stay. In 1986, legal sanctions were imposed on employers who hire unlawful immigrants, but they have been difficult to enforce because identification documents are easily forged. Legislation pending in Congress would create a national identification card for every American,¹ but this worries many who feel that a national identification card would be a dangerous intrusion by government.

Opinions about the merits of America's current immigration policy are sharply divided. Those who believe immigrants should be welcomed argue that the cultural and economic contributions of immigrants are part of America's historical tradition and that the economic benefits from more workers and people who start businesses and pay taxes far exceed any social costs.² Those who think the demographic change is too great, on the other hand, note that current levels of immigration will cause Americans from the European ethnic groups that dominated this country for most of its history to become a minority of the population the middle of the 21st century.³

But this is not just a political numbers game. It is an intensely personal issue for millions of Americans whose close family ties or business interests are regulated by the immigration law. Reuniting families is a primary goal of U.S. immigration law, and businesses in the rapidly growing high technology sectors of the U.S. economy, as well as American corporations with a multinational workforce, want the freedom to bring foreign-born employees and their families into the United States without excessive red tape.

Most current immigration to the United States cannot be justified as bringing some general economic benefit to other Americans, but neither can it be attacked as an economic drain. Though national statistics do not clearly show any particular economic costs or benefits to the country as a whole,⁴ the family members and employers who sponsor immigrants believe very strongly in the economic contributions of the individuals they know.⁵

The abstract question whether there is too much immigration today tends to dominate the debate (along with the problem of illegal immigration). But the issue is hard to resolve. For those people directly affected, the concern is whether the government will permit a particular, valuable person to live and work in the United States. For other Americans, the issues are less clear-cut. Candidates must be prepared to help their constituents resolve them.

THE FACTS

Immigrants and Welfare

The generous welfare benefits provided by most states and the federal government are intended to help individuals and families in need. Many people take advantage of this system to avoid assuming their family responsibilities and performing work. It certainly seems plausible that people from impoverished countries would want to come to the United States because of the higher standard of living, as well as to assume that many would come to be on welfare, since welfare benefits in the United States are higher than the incomes of most people in less developed countries. But there is no evidence that large numbers of working age immigrants come to America to go on the dole.

The labor force participation rate among male immigrants is 77 percent -- slightly higher than among native-born Americans (74 percent), according to the 1990 census. The highest labor force participation rate, 83 percent, is among Hispanic immigrants.

The median age for legal immigrants in 1993 was 28, slightly younger than the average American's

age of 33. More than 80 percent of immigrants arrive before age 45, and only about 5 percent arrive after retirement age to join family members.⁷

Newly arrived immigrants, "legal permanent residents," generally are prevented from receiving welfare. They cannot receive most direct aid during their first three years⁸ in the country because their sponsors' income is counted as their own during this period in determining eligibility. They also can be deported as a public charge if they use public benefits during their first five years in the country. Elderly immigrants, however, who typically are sponsored by their children, are able to take advantage of the Supplemental Security Income (SSI) program after five years. Their sponsors' financial responsibility ends, and SSI is an entitlement for those with a low income after age 65.

The Immigration Reform Act of 1986, which established procedures to legalize immigrants, barred those taking advantage of the amnesty from receiving public benefits for five years. After that, they can receive welfare. Undocumented aliens are not eligible for most public assistance, except for emergency medical treatment under Medicaid and nutrition benefits under the Women, Infants, and Children (WIC) program. The states were mandated by the 1986 immigration law to establish a computerized system, the Systematic Alien Verification for Entitlements (SAVE), to screen the immigration status of non-citizen applicants for Aid to Families with Dependent Children (AFDC) and other federal benefit programs.⁹

A recent study of welfare participation over a whole lifetime by immigrant families, based on the years they arrived in the United States, shows a trend toward increasing use of welfare among immigrants in recent decades.¹⁰

Expected Welfare Costs over the Life Cycle for a Typical Household Lifetime Costs (1979 Dollars)

Natives	\$4,624
Immigrants arriving before 1950	\$2,683
Immigrants arriving 1950-54	\$4,197
1960	\$646,312
1965	\$697,109
1970	\$747,016
1975	\$807,925

This trend in lifetime welfare outlays for the foreign born is explained by the demographic pattern of recent immigration rather than by a growing tendency among immigrants in general, most of whom are young men, to go on welfare. More elderly immigrants have a higher lifetime dependence on welfare benefits for elderly people than the native born because they have fewer resources in the form of Social Security, private pensions, and accumulated savings. In addition, the number of refugees and political asylum seekers coming to the United States has increased since the 1960s, and this category of immigrants is eligible for welfare immediately upon arrival.

Still, it is important to keep this in proportion:

Elderly Immigrants

Elderly immigrants show up on the welfare rolls in greater numbers than younger immigrants, or the native born. But immigrants over age 65 who have lived in the U.S. for at least 20 years are only slightly more likely to receive welfare than elderly natives (8.7 percent versus 6.9 percent).

- Most native born recipients receive other retirement income, including Social Security, that is not counted as welfare. But Supplemental Security Income (SSI) is available when other sources of income are small. For most of the elderly immigrants on SSI, their monthly check is their only source of income.¹¹
- In 1982, there were 127,900 non-citizens receiving SSI. In 1992, this number had increased to 601,000, equal to about 11 percent of the total elderly poor. It continues to increase rapidly: By 1994, it had climbed to 738,000.¹² SSI recipients also qualify for Medicaid, food stamps, and local welfare services.

Most non-citizens on SSI have relatives able to support them. Support is a condition of sponsorship for immigration, but after five years is no longer mandatory. After five years as a legal permanent resident, an immigrant can become a naturalized citizen, and no restrictions on welfare eligibility apply. Significant changes in the federal means-tested welfare standards were included in the Balanced Budget Act of 1995.¹³ Welfare benefits for refugees and other "qualified aliens" would have ended after five years. The income of a sponsor would have been used to calculate eligibility for SSI and other means-tested entitlements, without a three- or five-year limit. The legislation also would have required all non-citizens to reapply for benefits, with the incomes of their sponsors to be used in the recalculation of eligibility. But even this regulation ends if the elderly immigrant qualifies for citizenship.

Immigrants and Crime

Ethnic communities with a high proportion of immigrants typically are located in the inner city, where higher crime rates are common. The issue: Do immigrants cause crime, or do they simply tend to live in high crime-areas? The notion that higher immigration rates and higher crime rates are causally related cannot be dismissed out of hand. In every ethnic group, young males commit most of the crime, and immigrants are predominantly young males particularly illegal immigrants. In the United States, moreover, economic opportunity often depends on education and cultural advantages that immigrants from poor countries do not possess.

Many Americans assume this makes immigrants more inclined to commit crimes. But it is wrong to assume that educational disadvantages and other factors mean that immigrants are more likely to be involved in crime than native born Americans.

For the nation as a whole, the number of non-citizens in prison is approximately the same proportion as the number from the general population.

Of the five states with the largest proportion of alien prisoners in 1992 California, New York, Florida, Illinois, and Texas only New York had a greater share of non-citizens in its prisons than in the general population.

Survey of State Prison Inmates, 1991

	Non-citizen Prison Inmates	General Population Rate
All States	4.0%	4.7%
Illinois	1.0%	4.6%
Texas	4.3%	5.9%
Florida	7.0%	7.3%
California	10.4%	14.9%
New York	12.4%	8.6%

Source: National Institute of Corrections, 1992.

The federal prison system has a much greater proportion of non-citizens (not necessarily immigrants) in custody than the state prisons, with approximately 25 percent. One reason for this is that federal law enforcement tends to concentrate on different kinds of crime, such as drug smuggling, in which foreigners on tourist or business visas are caught entering and leaving the United States. Federal prison statistics tell us nothing about criminality among immigrants. Among the non-citizens in federal prison, 80 percent were convicted for crimes related to the war on drugs, including former Panama dictator Manuel Noriega.¹⁴

The ethnic groups represented among non-citizen prisoners also have no significant correlation with the size of those immigrant groups in the general population. If immigration in general were a source of crime, we would expect to find a higher statistical correlation between members of specific ethnic groups in the prison population and their share of the general population.

The Burden on State and Local Governments

Immigration policy, including the control of borders to halt illegal immigration, is a responsibility of the federal government. But state and local governments have to support public schools, hospitals, emergency rescue, police and fire departments, and other services for immigrant communities -- including many illegals who live and hide among the much larger legal foreign born population. Thus, if the federal government fails to secure America's borders, the states pick up the tab for illegals who receive services. The federal government clearly has failed to control the Mexican border. Moreover, the President and Congress annually set the quota for refugees, who are entitled to federal and local welfare benefits. The flood of political asylum seekers and foreign visitors who overstay their visa periods and melt into the population as illegal immigrants is entirely the result of Washington's failure to discharge its responsibility.

Federal law requires state and local governments to provide public schooling¹⁵ and emergency medical care for illegal immigrants. States have grown increasingly angry in recent years at what they see as an unfair financial burden placed on them by a federal government that is unwilling to enforce its immigration laws. California's Proposition 187 and other measures to deny state and local government services to illegal immigrants are prompted by the rising cost of services paid for by state taxpayers.¹⁶

The governors of the most heavily affected states have demanded federal reimbursement of the estimated costs imposed by illegal immigration on their state and local governments. In Washington, this argument is made in support of legislation to strengthen federal immigration controls, particularly at the Mexican

border, to stop illegal crossing.

In the Balanced Budget Act of 1995, Congress for the first time voted to eliminate one unfunded mandate (for emergency medical care, including childbirth, provided to illegal aliens) by authorizing a supplemental allotment of federal money to reimburse states. The Act also explicitly disqualified payments for non-emergency medical care for illegal aliens under the Medicaid program. To comply with the rules and obtain federal money, medical providers would have had to determine the immigration status of patients, which they do not now do.¹⁷ The legislation was vetoed by President Clinton.

What is the cost of illegal immigration? Illegal aliens are assumed to be a net cost to states. However, while they are among the poorest immigrants and pay fewer taxes than legal immigrants or the native born, many are employed and do not receive services paid for by taxpayers. Thus, figuring the costs that illegal immigrants impose on a community, and comparing this with benefits to that community from sales tax payments and other financial contributions, is no easy task. Illegal immigrants in general have more difficulty getting benefits from the welfare system than legal residents, and do not identify themselves as illegal if they do. As the RAND Corporation has observed, "Congress, state, and local policymakers still have no reliable answers to basic questions about the costs and benefits of immigration for state and local governments, for the economy as a whole, and for the nature and speed of integration of new immigrants into U.S. society."¹⁸

A review of the econometric studies of the fiscal burden on state and local governments from immigration by the RAND Corporation found that "there is general agreement that currently illegal immigrants contribute less than those who received amnesty, who, in turn, contribute less than legal immigrants, who contribute less than the native born. However, this finding merely reflects differences in the average incomes of these various groups rather than their immigration status per se."¹⁹

In nine different studies²⁰ examined by the RAND Corporation, the available data about the costs of immigration are conflicting and inconclusive. "Existing studies of the costs of immigration do not provide a reliable or accurate estimate of the net costs and benefits of immigration even wcosts/benefits are defined narrowly. Moreover, without reaching consensus on a host of conceptual and accounting issues, we doubt that additional studies will shed light on these important policy questions."²¹ This is because they use different definitions for immigrants and public assistance, and even count tax revenues differently. Estimates of the per capita costs of providing federal, state, and local services to immigrants ranged from a low of \$2,638 to a high of \$4,476. The per capita revenue estimates varied from \$1,051 to \$3,644. When the costs and benefits were compared in each study, the conclusions were as widely apart as a surplus of \$1,400 per immigrant to a net cost of \$1,600.²²

RAND's analysis of the six state and local government studies of the cost of immigrants found that the methods used to calculate costs and benefits tended to include a full list of outlays for public services but only a partial list of revenues, including transfer payments from higher levels of government. The flawed accounting methods showed that neither immigrants nor the native born pay their way at the state and local levels. Where estimates were made separately for immigrants and the native born, the studies found that the "deficit" for immigrants is larger. What the studies actually seem to find is only the higher average income, and higher taxes paid, by the native born.²³

States and local communities with large immigrant populations probably have a disproportionate concentration among them of illegal aliens, who tend to be poorest. Mandates for social services and welfare, and lax enforcement by social workers of rules against aiding illegal aliens, probably impose a financial burden on those state and local governments. Because the federal government has failed to prevent the illegal immigration, the argument that the federal taxpayer should pay any imposed costs is

sensible. But the size and nature of the costs of illegal immigration have not been clearly established. Moreover, the task of identifying the immigration status of almost all poor people in America's ethnic communities is one that state and local governments may not want to undertake.

Are There Too Many Immigrants?

Many Americans are concerned that the higher rate of immigration to the United States in recent years may be too great for the cultural assimilation of so many people. Immigration has been increasing, and many commentators are concerned that this is changing the culture of America.

The assimilation of the foreign born could be a problem if their numbers were too great. The question is: Are they too great?

- In 1993, more than 904,000 legal immigrants and as many as 300,000 illegal immigrants settled permanently in the United States. The decade 1981-1990 saw 7.4 million legal immigrants, which was almost double the 4.5 million who arrived in 1971-1980. The decade of greatest immigration to the United States was 1901-1910, with 8.8 million new arrivals.
- In every decade between the Civil War and the Depression, e than 13 percent of the U.S. population; today, they are approximately 8 percent.

The principal concern about legal immigration is that the rate is increasing every decade, and the current immigration rate plus the birth rate among the groups that are arriving in this country is higher than the birth rate for other Americans.

During the 1980s, immigration contributed 37.1 percent of the growth in the U.S. population. In the 1970s, it contributed 32.6 percent.²⁴ In 1990, immigrant women aged 35 to 44 had given birth to an average of 2.2 children, compared with 1.9 children among native born women in that age group. The fertility concern is amplified by the fact that a greater percentage of immigrants than of native-born Americans are of reproductive age.²⁵

Although the proportion of immigrants in American society today is relatively low, and the numbers that come to the United States every year are well within historical levels, the demographic trend today will produce higher and higher proportions of immigrants in the general population.

By the year 2050, the proportion of immigrants in the general population will rise to approximately the same level as in the six decades following the Civil War (over 13 percent). But because the population of the United States has increased, and will continue to grow, the number of immigrants living in the United States by the middle of the next century will be about six times greater than in the earlier period.

Another important demographic trend that concerns opponents of more immigration is the very significant increase in immigration from Asia and Latin America.

In 1981-1990, 37.3 percent of immigrants were from Asia, 22.6 percent were from Mexico, and 18 percent were from other Latin American countries. The great wave of immigration to the United States after the Civil War was mostly from Europe and essentially Caucasian. But a large proportion of the late 19th century immigrants were from the very poor regions of southern and eastern Europe and were very different culturally from those who originally settled the United States.

The demographic projection of population growth represented by immigrants and the children of

immigrants shows that by the middle of the next century, Asian or Hispanic immigrants and their immediate children will account for roughly a quarter of the American population.²⁶ The population as a whole will change from today's proportions of 3 percent Asian, 9 percent Hispanic, 11 percent non-Hispanic black, and 77 percent non-Hispanic white to approximately 9 percent Asian, 13 percent non-Hispanic black, 19 percent Hispanic, and 59 percent non-Hispanic white.²⁷ These estimates do not account for changes that would result from intermarriage among members of these groups.

The concern that opponents of current immigration policy feel about too many immigrants in the next century is exacerbated by the tendency of immigrants to move into their own ethnically homogeneous communities. More than 90 percent of immigrants move into cities and live in highly visible ethnic enclaves. The increased visibility of Hispanic and Asian communities reinforces the issue, just as the ghettos of Irish and Jewish immigrants in the last century and black Americans from the rural South after World War I aroused concern. The immigrant population is much more concentrated in Southern California, Texas, New York, and Miami than in the rest of the country.

Just 12 metropolitan areas received 55 percent of new immigrants in 1993. One in every three new immigrants now settles in California. Of these, 3 in 5 choose to live in the Los Angeles metropolitan area. Los Angeles is now 40 percent foreign born.²⁸

The question is whether the current U.S. trend is toward balkanization or a melting pot. Do large concentrations of immigrants living in their own communities, near others with similar backgrounds and cultural practices, resist Americanization and sustain a separate loyalty to a minority group? It is easier for large ethnic community to use a non-English language outside the home, and public schools can be forced to offer bilingual education. Assimilation into a more uniform American culture would seem less likely to occur, but the evidence actually indicates that urban concentrations of immigrants, particularly from countries from which large numbers have come, are more likely to become naturalized citizens.²⁹

For example, in the mid-18th century, Benjamin Franklin complained: "Why should Pennsylvania, founded by the English, become a colony of *aliens*, who will shortly be so numerous as to Germanize us instead of Anglifying them, and will never adopt our Language or Customs any more than they can acquire our complexion."³⁰ But he was wrong. In New York and Chicago for example, the concentrations of Yiddish-speaking immigrants so characteristic in the earlier period have disappeared.

Opponents of current U.S. immigration policy maintain that assimilation of so many from the last great wave of immigration, which ended in the 1920s, was possible because (1) almost all immigrants came from Europe, and many from English-speaking countries; (2) the influx was stopped for a period of time to permit the assimilation of the immigrant minorities into the dominant American culture; and (3) the birth rate among the native born population was significantly higher than it is today. Only 27.8 percent of the growth in the U.S. population came from immigration during the 1901-1910 peak period, compared with 37.1 percent in the 1980s.³¹

But the current rate of assimilation is very rapid. Research on immigrants to Southern California that looks at the age cohorts of recent immigrants has found very rapid increases in English language proficiency, naturalization rates, occupational mobility, self-employment, and income, in addition to significantly reduced poverty rates.³²

In Southern California, "all immigrant children showed a tremendous rate of increase in English ability, though the trend was especially marked among Latinos."³³

- By looking at age cohorts of Latino immigrants who arrived in California in the 1970s, demographers can see that poverty actually declined from 25.7 percent to 15.7 percent as the 15-to-25-year-old arrivals matured and became assimilated.³⁴

Should population patterns be changed? Author Peter Brimelow, in his recent book *Alien Nation*, points out that the 1965 immigration law, which opened the doors to higher rates of immigration from Asia and Latin America, was passed by Congress with the understanding that it would *not* change America's historical population patterns.³⁵ Since the law has caused such a demographic change, however, particularly as the 1986 amnesty for illegal aliens has further shifted the family reunification preferences in favor of very recent immigrants from Asia and Latin America, he argues that the pattern of immigration must be corrected.

This raises both political and non-political questions about what immigration policy the United States should adopt. From a political standpoint:

- The American people as a whole do not get to choose the nation's future demographic profile. But on their behalf, Congress does set immigration quotas, and these can be written to discriminate either for or against people.
- The federal government has a constitutional responsibility to control the national borders, and the requirement that foreigners entering the country must have a visa and submit to customs inspection is important in maintaining that control.
- The federal government sets requirements on individuals wishing to live permanently in the United States: extensive documentation of good character, sponsorship for immigration, and financial responsibility. Additional requirements involving financial responsibility, English language proficiency, or ethnicity could be added by Congress.
- Both the size of immigration quotas and the categories of people who qualify were set in the 1990 Immigration Act and may be amended in 1996. But determining whether to increase or decrease immigration quotas will have a very small effect on the long-term demographic profile of the country.

The non-political considerations of immigration policy affect the nation's demographic patterns. Within the quota system, individual families and employers control the decisions over who can immigrate to America by virtue of their power to sponsor those individuals. Particular families or employers generally choose to sponsor immigrants for very personal or economic reasons, and there often is a long waiting period before an immigration visa is granted. The question is whether this choice should remain essentially personal or should be regarded as a significant public interest that requires more political control.

The Immigration Law

The Immigration and Nationality Act establishes the rules and quotas for immigration to the United States.³⁶ The visas issued to immigrants allow them to become permanent residents. The law provides that after five years, and after fulfilling a requirement to show some knowledge of American history, permanent residents may become naturalized citizens of the United States. Prior to 1965, specific quotas favoring predominantly European countries were enforced. In 1965, Congress repealed this system of quotas and established a worldwide quota for immigration, with a limit per country. This major change in U.S. immigration law put the priority on family unification individual Americans sponsoring relatives to come here.³⁷ The law fundamentally changed the emphasis from specific nationalities and opened the process

much more widely to immigrants from Asia. Spouses and most children of American citizens are exempt from the quota system, while other relatives are given priority over foreigners with no American relatives.

The quota system, with its "preference categories," is an extremely complex area of immigration law. Combined with the limits on immigration from individual countries, the preference system requires some immigrants to wait many years after applying for U.S. permission before receiving it. Immigrants from other countries, however, are not subjected to such prolonged delays. The quota preference system also includes categories for occupations and skills, but these have much smaller quotas and are ranked lower in the preference categories.

The quota system and its preferences were revised by the 1990 immigration law, but the family unification priority was not changed. Current law provides for up to 675,000 immigrants annually. Of these, 480,000 (71 percent) are sponsored by relatives in the United States, and another 140,000 (21 percent) are "economic" immigrants whose acceptance is determined on the basis of skills, education, or willingness to invest and create jobs. A special preference category was created for "diversity" immigration, allowing 55,000, or 8 percent of the total, from countries where immigration was lowest in prior years. This provision is intended to ease immigration from Ireland and other European countries.

Refugees. The Refugee Act of 1980³⁸ provides general authority for the admission of refugees, who were removed as a category under the quota preference system. The number that will come to the United States annually is determined by the President in consultation with Congress, and there are procedures for admitting larger numbers in emergency situations, such as the Haitian and Cuban boatlifts. In 1993, 119,482 refugees were admitted.

Political asylum is granted on a case-by-case basis to aliens who meet the definition of refugee but already are in the United States or at the border. The requirement for case-by-case determinations is a significant administrative burden for the Immigration and Naturalization Service (INS). In 1993, there were 150,386 applications for asylum, and the backlog of cases had reached 333,000. While waiting for the INS to schedule a hearing for political asylum, these individuals generally are allowed free movement within the country, and a large number disappear and become illegal aliens.

Illegal Immigrants. The Immigration Reform and Control Act of 1986 (IRCA)³⁹ was enacted to control illegal immigration. The intent of the law was to focus on the motives of illegal immigrants, who come to the United States and get jobs that offer better wages and working conditions than they can find in their native lands. The principal change in the law prohibiting employment of illegal immigrants, however, was to make the employer guilty of breaking the immigration law as well. To cut off the job opportunities being sought by illegal immigrants, employers were made responsible for enforcement. All job applicants must prove their citizenship or legal residence to their potential employers by completing an INS form (I-9) before they can begin work. The employer must verify this information and keep the documents with other personnel records. IRCA imposed both civil fines as high as \$10,000 on employers who hire illegal aliens and criminal penalties for a repeated pattern of violations.

Because it was known that millions of illegal aliens already were living and working in this country, the Congress established procedures by which they could apply for legal resident status. By 1988, more than 3 million people had applied for "legalization" under the 1986 law. These legalized immigrants in turn have provided a newly enlarged pool of families that are seeking to sponsor other relatives for immigration.

Citizenship. A legal permanent resident in the United States may apply for citizenship after five years. The Immigration and Nationality Act sets out a number of specific requirements for becoming a naturalized citizen: a test of the applicant's knowledge of U.S. history and the Constitution, proficiency in the English

language, and an oath renouncing all allegiance to foreign governments and swearing loyalty to the United States and a willingness to defend it. Congress also could enact additional financial responsibility requirements.

The Problem of Illegal Immigration

There were an estimated 3.2 million illegal aliens in the United States as of October 1992, according to the INS.⁴⁰ The number of illegal residents is estimated to be growing by 300,000 per year.

- Fifty-five percent of the illegal immigrants in the United States are estimated to be Mexican. Another 22 percent come from Central America.
- Although Mexicans comprise about 90 percent of those apprehended at the southern U.S. border, one survey found they were joined by representatives of 70 other nationalities.⁴¹

In addition to crossing the border illegally, many violators of the law just stay in the United States after their non-immigrant visas expire.

- In 1993, there were 21 million visas issued to non-immigrants, including 17 million tourists and almost 3 million business visitors; 165,000 temporary foreign workers and 257,000 foreign students also were admitted. In addition, foreign journalists, foreign government officials, and the families of persons working for international organizations come to the United States freely.
- During the 1986 fiscal year, the INS apprehended 1.8 million illegal entrants. Of these, 243,000 had overstayed their visas.⁴²

These statistics do not provide a good picture of the extent of the problem, however, because most illegal immigrants who enter the United States with a valid tourist or student visa are not identified unless stopped by the police for some reason.

Illegal immigration is a serious problem that law enforcement has not been able to control. The shortage of border patrol officers and adequate physical barriers along the U.S.-Mexico border has been widely cited as a large factor in the problem, and improved enforcement at key locations in California, Texas, Arizona, and New Mexico certainly should be undertaken to curb illegal crossings. But the larger problem would not be solved by those measures alone, because illegal entry is only one source of illegal immigration. The problem of individuals misusing tourist visas also must be addressed.

Identification Cards

Employer sanctions under IRCA have failed to reduce illegal immigration and may have increased racial or ethnic discrimination in the workplace.⁴³ Employers who suspect a job applicant may not possess legitimate credentials for legal residence or citizenship face a difficult problem. In an effort to solve this problem, legislation now before Congress would set up a pilot program covering approximately 47 million workers, or almost 40 percent of the workforce, to test a computerized national worker identification system.⁴⁴ In theory, if an employer needed to verify the right of a job applicant to work, he could make a telephone call and obtain a verification number, just as businesses now do to verify credit cards and checks. This would be the employer's defense against any subsequent discovery that the new employee was in fact an illegal alien.

Unfortunately, this idea is both impractical and potentially dangerous. It would solve a problem caused by

less than 1.5 percent of the population that is here illegally by dramatically increasing government regulation of every American's life. Even the pilot program would require over 100 million names and numbers, since non-working spouses and children potentially are part of the labor force. What ought to be a private contractual arrangement between employers and job applicants would become an illegal relationship unless the employer first obtained government authorization. The danger that such a system would create an underground economy with crime and tax evasion is overwhelming. If the authorization were denied, for whatever reason computer data errors, bureaucratic mistakes, or even sabotage by a criminal computer hacker the job applicant would be forcibly unemployed. As the logical implications of this system of legal sanctions against employers become clearer and more threatening to the civil rights of ordinary people, public opposition is likely to increase.

Most advocates of a computer registry admit that it would work only with a secure national identification card. Without such positive identification, an employer would have no way to determine whether the Social Security number being used actually belonged to the job applicant. Senator Alan Simpson (R-WY), sponsor of the immigration reform legislation pending in the Senate, has described the two functions the worker identification system would have: "It must verify that a name corresponds to someone who is authorized to work. And then verifying the identity, that the person claiming the name and the number is not an impostor. The use of a biometric identifier, such as a fingerprint, is needed if this function is to perform reliably."⁴⁵

Before a national computer system to identify every American could be installed, there would have to be significant improvement in the data stored in the federal government's computers. With approximately 6.5 million Americans changing jobs every year, an error rate of just one percent would cause 650,000 innocent victims to be denied a job until bureaucrats in Washington could be persuaded to correct their mistakes. The Social Security Administration has estimated that a national computer registry would cost between \$3 billion and \$6 billion about 10 to 20 times more than its advocates have claimed.⁴⁶

The proposal for a national computerized worker registration system does not address the basic problem of illegal alien employment. Since employers are required to verify the right of job applicants to work in the United States today, violations of the law may occur because some employers simply ignore it. Advocates of the plan are enthusiastic about increasing the number of work site inspections for labor law and OSHA violations, along with the worker verification. The proposed computer system is an expensive, new invasion of every American worker's privacy and a threat to law-abiding employers who would have to deal with federal inspectors. Employers who violate the law today could continue to do so simply by going further underground and evading the new computer system.

Employer sanctions is a misguided concept. The assumption is that because an illegal immigrant has broken the law, any employer who provides a job is a criminal accomplice. But employers are more likely to be the victims of document fraud. A solution to the criminal problem of illegal immigration ought to involve less government regulation of business, not more. Criminal penalties should focus on deterring illegal immigration by punishing the criminal, not the rest of the nation.

THE RECORD

THE CLINTON ADMINISTRATION

The Clinton Administration has emphasized toughening the sanctions on employers who hire illegal aliens and increasing the number of inspections by the U.S. Department of Labor.⁴⁷ In addition, INS funding and personnel increased significantly in FY 1995 and FY 1996: Increases of 26 percent in budget (to \$2.6 billion) and 3,200 new full-time employees (to approximately 25,000) are scheduled. This will include an

increase of 1,000 Border Patrol agents "on the front lines." The budget for FY 1995 was increased by 25 percent over the prior year, mostly to finance improvements in the agency's computer technology. The INS will spend more this year on detention and removal of deportable aliens, including people who have been denied political asylum. A detention facility operated jointly with the U.S. Marshal Service is being built in Batavia, N.Y., and a "triple fencing pilot project" is being placed on the border south of San Diego.⁴⁸

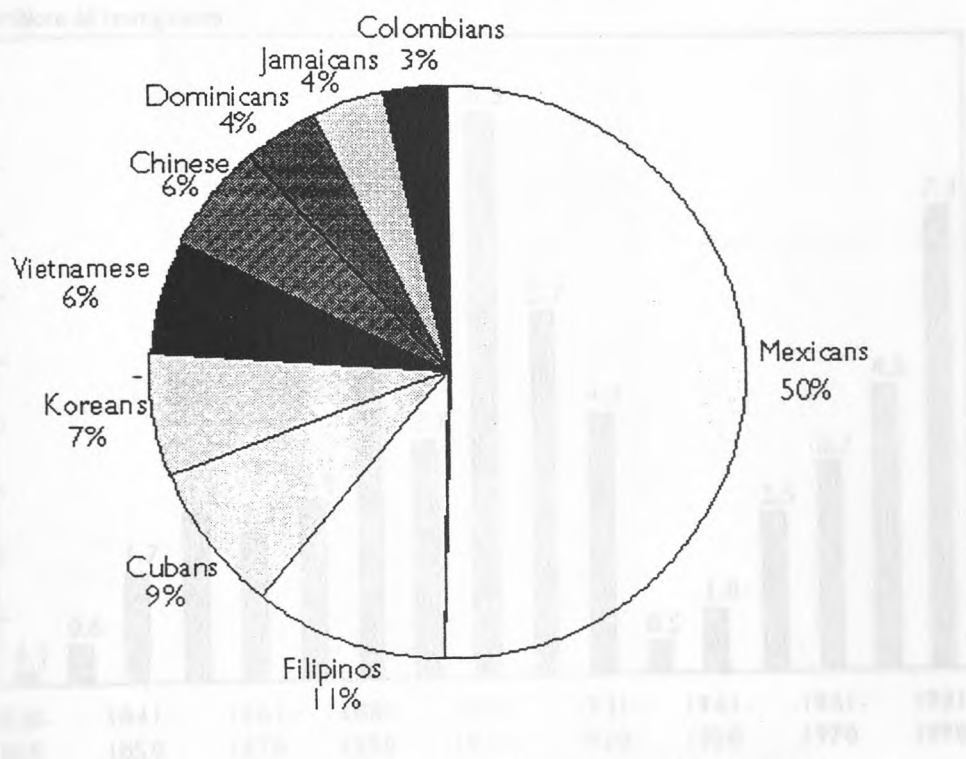
The U.S. Commission on Immigration Reform⁴⁹ released its interim report to Congress, which addressed illegal immigration, in 1994, and a report on legal immigration in 1995. A final report covering issues related to immigration will appear in 1997. In general, the Commission has supported increased personnel and spending to enforce immigration laws at U.S. land borders and ports of entry.

The Commission recommended "development and implementation of a simpler, more fraud-resistant system for verifying work authorization." It endor>

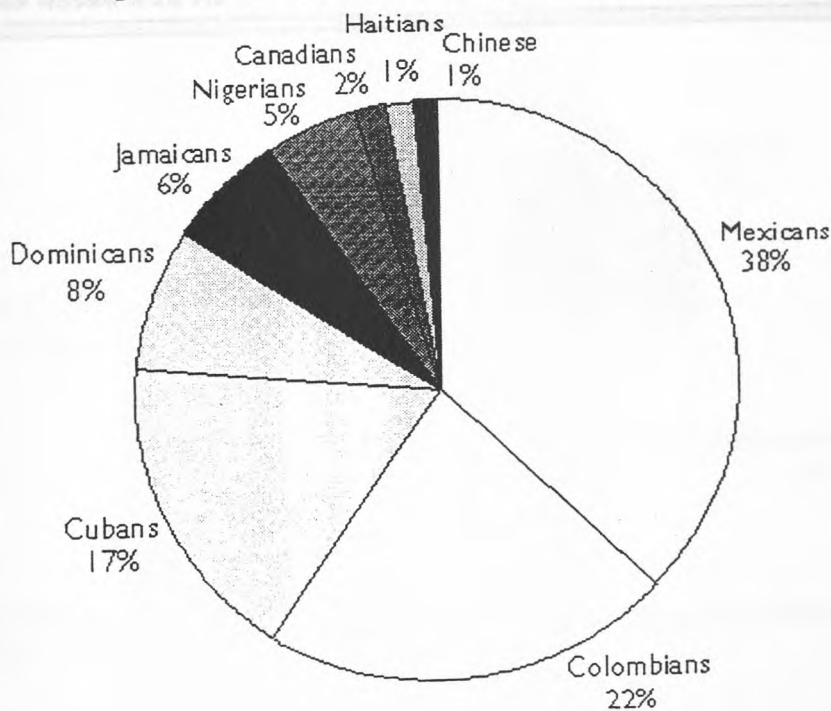
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Chart 1

Foreign-Born Population, by Country of Origin



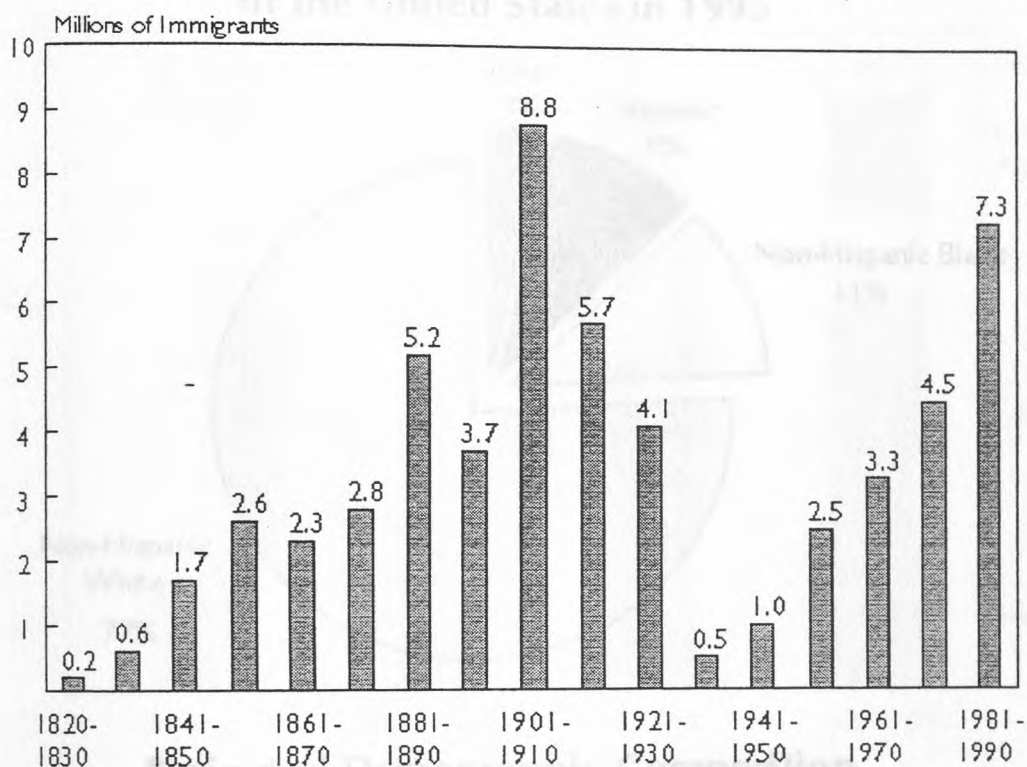
Foreign-Born Prisoners, by Country of Origin



Sources: Statistical Abstract of the United States; U.S. Bureau of Prisons

Chart 2

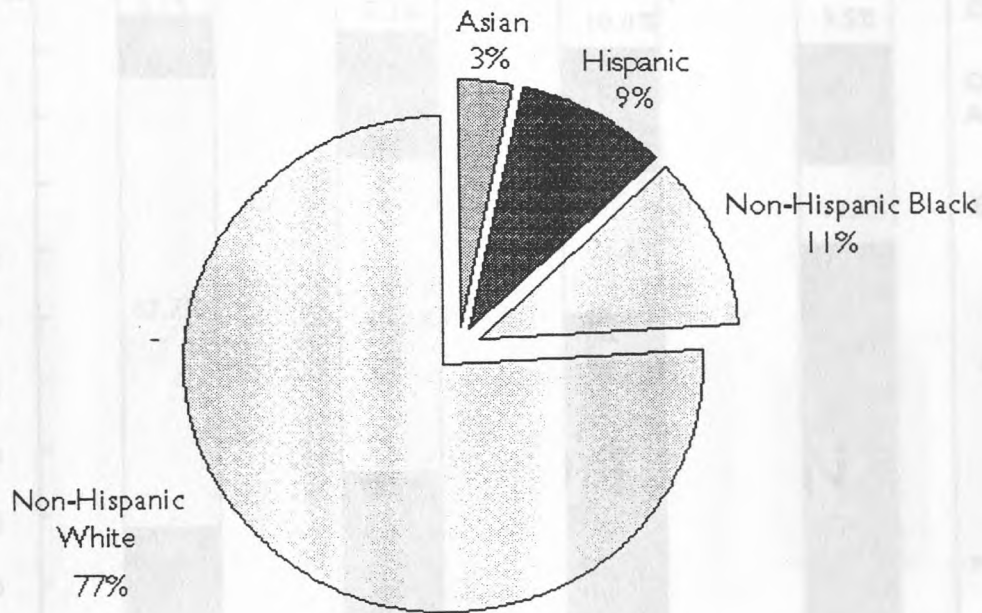
Number Of Immigrant Arrivals by Decade, 1820-1990



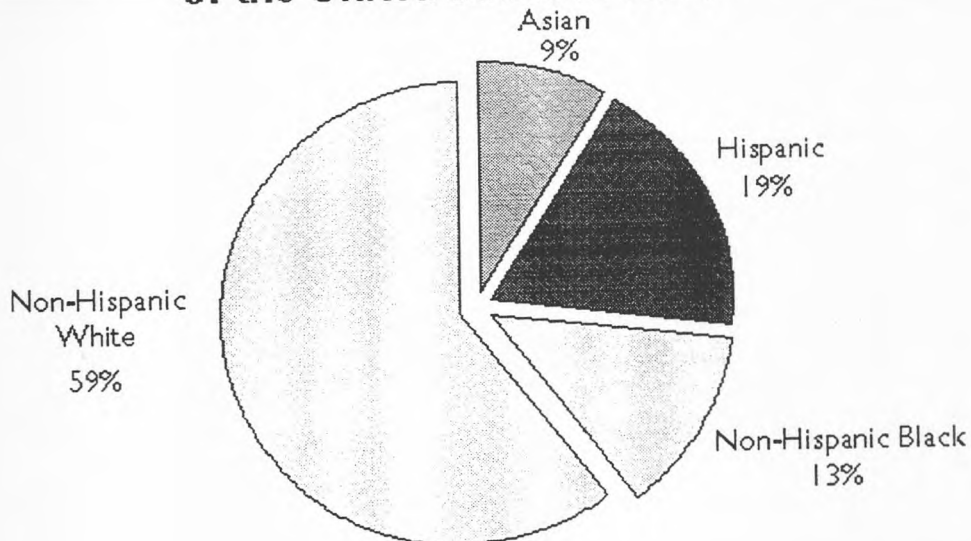
Source: Statistical Yearbook of the INS.

Chart 5

Demographic Composition of the United States in 1995



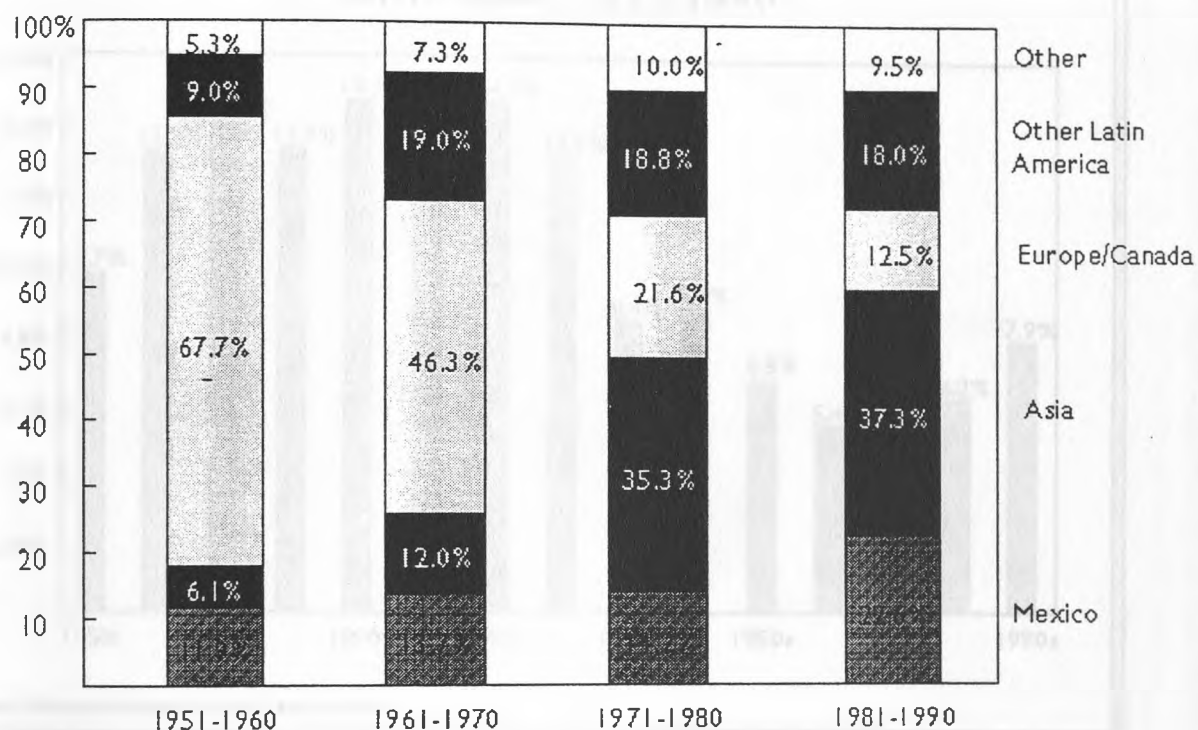
Projected Demographic Composition of the United States in 2050



Source: *Statistical Abstract of the United States*

Chart 4

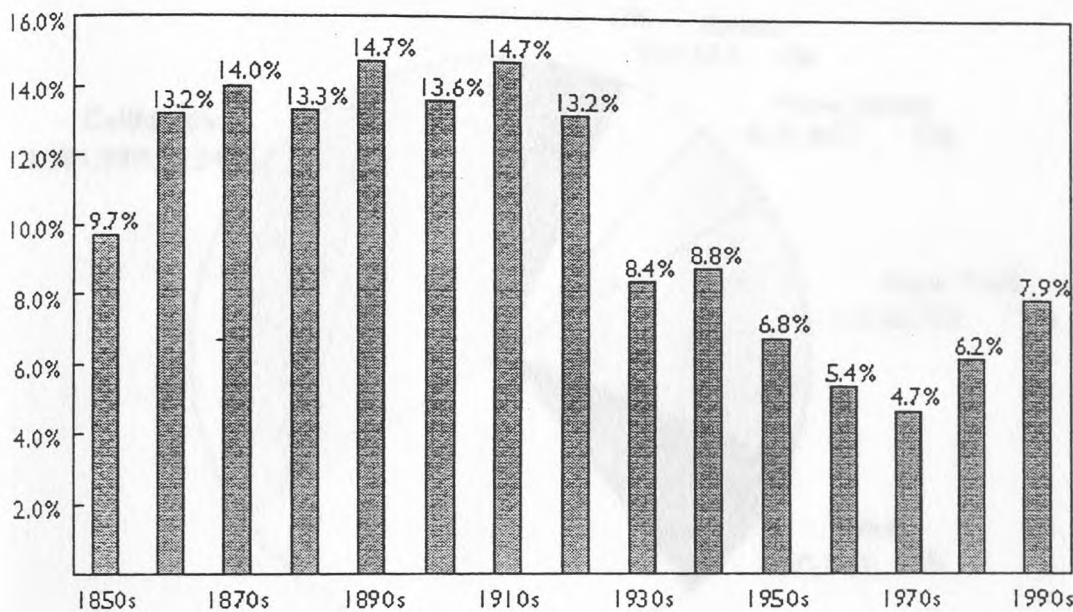
Origins of Immigrants



Source: Statistical Yearbook of the INS.

Chart 3

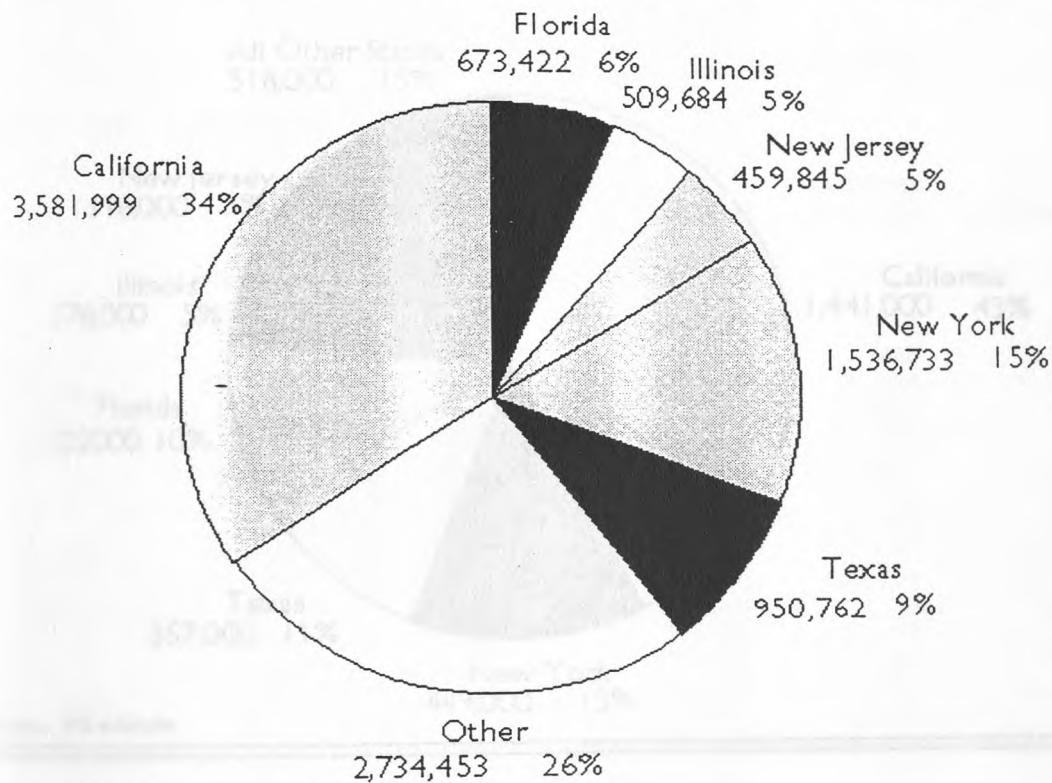
Immigrants as Percentage of the U.S. Population by Decade, 1850-1990



Source: Statistical Abstract of the United States.

Chart 6

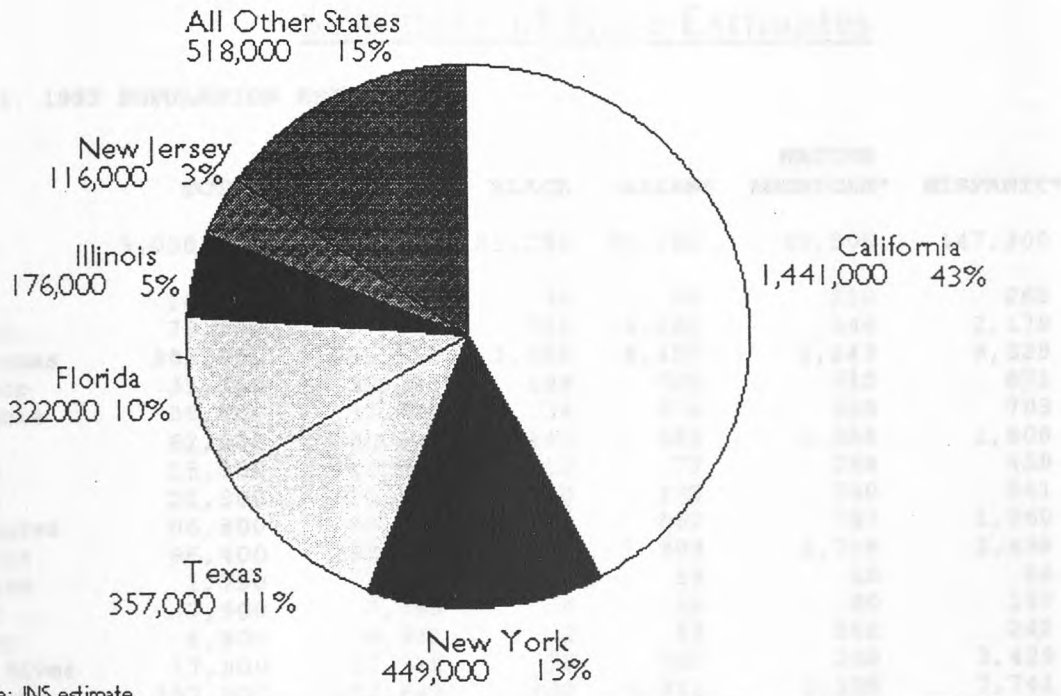
Immigrant Destination by State, 1982-1993



Source: Statistical Yearbook of the INS.

Chart 8

Illegal Immigrants, 1992



Source: INS estimate.

Experimental Race Estimates for Oregon and Its Counties: July 1, 1993

Summary of Race Estimates

JULY 1, 1993 POPULATION ESTIMATES

	TOTAL	WHITE	BLACK	ASIAN*	NATIVE AMERICAN*	HISPANIC*
State	3,038,000	2,855,150	51,250	86,100	45,500	147,300
Baker	16,100	15,801	30	59	210	265
Benton	73,300	67,661	728	4,265	646	2,179
Clackamas	302,000	291,710	1,582	6,459	2,249	9,329
Clatsop	33,700	32,533	129	523	515	871
Columbia	38,800	37,724	34	374	668	703
Coos	62,500	60,010	146	686	1,658	1,608
Crook	15,300	14,949	10	77	264	459
Curry	21,300	20,375	20	175	730	541
Deschutes	86,800	85,373	98	562	767	1,960
Douglas	96,400	93,603	191	888	1,718	2,498
Gilliam	1,750	1,721	0	19	10	26
Grant	7,900	7,798	4	18	80	147
Harney	6,900	6,582	3	53	262	242
Hood River	17,900	17,312	73	307	208	3,429
Jackson	157,000	152,649	432	1,811	2,108	7,741
Jefferson	14,900	11,889	25	94	2,892	2,007
Josephine	66,600	64,955	164	489	992	2,270
Klamath	60,300	56,741	482	546	2,531	3,824
Lake	7,350	7,123	5	43	179	332
Lane	298,000	284,780	2,580	6,840	3,800	8,660
Lincoln	40,000	38,148	99	453	1,300	846
Linn	96,100	93,710	189	966	1,235	2,611
Malheur	27,500	26,168	69	839	424	6,141
Marion	247,400	235,840	2,286	5,033	4,241	25,055
Morrow	8,450	8,283	14	28	125	1,345
Multnomah	615,000	535,951	37,774	33,925	7,350	23,425
Polk	53,600	51,697	233	769	901	3,432
Sherman	1,850	1,820	0	12	18	47
Tillamook	22,900	22,320	46	197	337	470
Umatilla	63,000	59,715	381	652	2,252	6,543
Union	24,300	23,536	126	339	299	432
Wallowa	7,200	7,115	6	43	36	105
Wasco	22,500	21,040	88	327	1,045	1,604
Washington	351,000	328,566	2,800	17,261	2,373	20,731
Wheeler	1,500	1,490	1	2	7	18
Yamhill	70,900	68,462	402	966	1,070	5,404

APRIL 1, 1990 U.S. CENSUS COUNTS

NATIVE

	TOTAL	WHITE	BLACK	ASIAN*	AMERICAN*	HISPANIC*
State	2,842,321	2,684,543	47,017	70,239	40,522	112,708
Baker	15,317	15,080	30	54	153	276
Benton	70,811	65,695	625	3,913	578	1,735
Clackamas	278,850	270,814	1,144	4,869	2,023	7,129
Clatsop	33,301	32,355	116	451	379	648
Columbia	37,557	36,708	44	285	520	684
Coos	60,273	58,130	148	583	1,412	1,353
Crook	14,111	13,817	13	51	230	388
Curry	19,327	18,707	32	123	465	354
Deschutes	74,958	73,763	87	450	658	1,526
Douglas	94,649	92,325	144	679	1,501	2,225
Gilliam	1,717	1,698	0	9	10	30
Grant	7,853	7,741	6	18	88	152
Harney	7,060	6,745	3	40	272	221
Hood River	16,903	16,315	52	314	222	2,752
Jackson	146,389	142,636	353	1,450	1,950	5,949
Jefferson	13,676	10,870	24	62	2,720	1,448
Josephine	62,649	61,163	132	468	886	1,749
Klamath	57,702	54,338	405	473	2,486	2,984
Lake	7,186	6,927	5	49	205	270
Lane	282,912	271,882	2,131	5,613	3,286	6,852
Lincoln	38,889	37,500	70	352	967	598
Linn	91,227	89,130	186	810	1,101	2,177
Malheur	26,038	24,727	74	847	390	5,155
Marion	228,483	218,295	2,262	4,272	3,654	18,226
Morrow	7,625	7,491	8	31	95	825
Multnomah	583,887	513,621	35,598	27,605	7,063	18,390
Polk	49,541	47,823	205	692	821	2,802
Sherman	1,918	1,880	0	14	24	28
Tillamook	21,570	21,124	39	164	243	374
Umatilla	59,249	56,197	390	564	2,098	5,307
Union	23,598	22,947	101	285	265	381
Wallowa	6,911	6,844	6	25	36	113
Wasco	21,683	20,447	69	243	924	1,065
Washington	311,554	293,899	2,140	13,582	1,933	14,401
Wheeler	1,396	1,382	1	2	11	12
Yamhill	65,551	63,527	374	797	853	4,129

* Asians include Pacific Islanders; Native Americans include Eskimos and Aleuts; Hispanics may be of any race.

The 1993 population estimates are not counts and thus are subject to error. As with most population estimates, the accuracy generally increases with larger numbers. It is suggested that the user consider these estimates as rough approximations of the actual counts. Caution should be used when making policy decisions based on small numbers.

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 May 1996