DESIGN CONSIDERATIONS FOR MUSEUM OF FINE ARTS

A DISSERTATION

Submitted in partial fulfilment of the requirements for the award of the degree of

MASTER OF ARCHITECTURE

By

MERID GIRMA

DEPARTMENT OF ARCHITECTURE AND PLANNING
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
ROORKEE-247 667 (INDIA)

FEBRUARY, 2002

CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the thesis entitled, "**Design Considerations for Museum of Fine Arts**", in partial fulfillment of the requirement for the award of the Degree of **Master of Architecture**, submitted in the department of Architecture and Planning, Indian Institute of Technology, Roorkee is an authentic record of my own work carried out during a period of August 2001 to February 2002 under the guidance of **Prof. P. K. Patel.**

The matter embodied in this dissertation has not been submitted by me for the award of any other degree.

Dated February 25 2002

(Merid Girma)

This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

Prof. P. K. Patel
Dip. of Arch. CEPT (Ahmedabad)
M. Arch. (Bldg. Sc. and Tech.) I.I.T., Roorkee
P.G. Dip (Housing, Planning and Bldg) IHS, Bouwcentrum, The Netherlands

ACKNOWLEDGMENTS

I express my heartfelt thanks to my guide, Prof. P. K. Patel, who during the whole progress of my work was helpful and approachable person making me feel at home in our discussion concerning my thesis.

I am deeply grateful for valuable suggestions and comments offered by Mrs. Pushplata, M. Arch. Coordinator, towards developing my thesis. I also thank Mr. S. Y. Kulkarni, Associate Professor, for his ability in creating a lively and friendly atmosphere. I also acknowledge the rare academic flavor characteristic of Dr. Mishra (ex-director CBRI) and Prof. Shankar who in some way influenced me for the better during the times I have attended their lectures.

Being a foreigner in a land far away from the usual acquaintances I would have faced many problems had it not been for some people around. I thank my Indian batch mates for their willingness to help in time of need. I specially enjoyed much comfort form being around two Ethiopian friends (brothers in Christ Jesus): Belachew Bantyirga and Dawit Benti.

I am also indebted to my beloved country's government for arranging and sponsoring this study. I feel greatly privileged to be chosen for this program. After staying this long in this institute all what I say is ' it was worth to have come to this place'.

My heart glows with special gratitude when I ponder the constant encouragement and concern that my family has shown to me.

Merid Girma

ABSTRACT

All of us one time or another had our own little collections of items worth keeping, due to various reasons; for a grown up adult it may be photograph of his or her early school days, for a child it may be a favorite toy, for a mother it may be the first milk teeth her daughter has plucked. From time to time we enjoy taking a look at it making sure it is in a safe condition as it is our treasure in our own way. This basic tendency is exactly what happens in large built museums in somewhat large scale, in a different context and serving the community at large. These two aspects of museum; ***preserving and experiencing*** *are almost timeless activities of mankind. They have found a built expression few centuries back as museums, among which fine arts museums are the most common ones. In this thesis it is attempted to probe into these two conflicting areas of fine arts museum aspects in terms of setting; design considerations and arriving at a balanced whole. Key literatures were surveyed in the area of the concern; among which are books by authoritative authors in the field. Representative case studies were analyzed according to a set of parameters to derive conclusions. Finally design considerations were derived for museum of fine arts based on the above study made.*

CONTENTS

CHAPTER-1

INTRODUCTION

Towards a Leisure Architecture-
Fine Arts Museum

"In a society where labor has become for the overwhelming majority of people [an] alienating activity... the world of leisure has become the relatively free place where people attempt to realize who they really are. The space of **"free time"** is where the physical and emotional damage of work is repaired, the place where people relieve all the piled up unmet needs of rest, fun, creativity, critical thinking, and social connection. In sum, leisure is the location of a struggle to become more fully human."

SANDY CARTER, "Pop Music and the Left,"
Zeta Magazine, October 1988

1.1. CONTEMPORARY ISSUES OF FINE ARTS MUSEUMS

Museums' role of the present age is to collect all works of art and displaying them according to museological concepts. Museuology is a concept applied on one hand to the theory and practice of museum construction and arrangement including architecture, planning and technical installation. On the other hand it is concerned with problems concerning acquision, methods of display, security and conservation measures, community activities, storage, auxiliary services, training programs and so on.

Apart from its main role of housing collections, museums perform social, cultural, scientific, and academic functions. They are similar to the purpose served by libraries in that they house visual arts just like libraries house literature or sciences.

In this thesis it is attempted to work out design considerations of both general and particular importance for architectural design aspect of fine arts museum.

Public image

The problem associated with generalities like public image, building typology springs from the museums' historical development. Nowadays museums are mixtures of old and new images. Museums are either built anew or are renovations and restorations of diverse building types like villas, factories, palaces, etc. There is no particular image to differentiate museums from other buildings. This may seem to be a fertile opportunity for architects' freedom of expression, but unlimited freedom by itself is a limitation by itself. Therefore its attempted to give comprehensive general directions to narrow down area of focus in the area of major decisions like selection of exhibition hall types, how architecture relates to the artworks it contains, its position within the urban context, and the way public area relate to gallery spaces.

Design process

It is also attempted to reassess the conventional design process that progresses outside in. It is seen from the practice of successful architects like F. L. Wright, the ***"from within outward"*** [15] process gives unified design solution, as seen in his projects like Imperial Hotel (Tokyo 1916-22). Mastering detail aspects from the outset as architectural vocabularies will enable the designer to formulate concepts on a sound base.

Increased leisure time

This era has seen tremendous reduction in working time that is required to fulfill basic life necessities. The way to spend time outside the working hour in a pleasurable fashion is a task awaiting every individual. There are various cultural institutions answering this basic question. Museums and more specially fine arts museums play a great role towards this end. Due to the increased leisure time available world wide museum going is increasingly becoming an integral part of the modern man's leisure activity.

International art market

An international survey shows that there is an increased purchasing and selling of art objects. In the present era it is considered as an alternative stream of investment that the expectation of loss is almost non-existent; art as it ages will increase its value. An instance of this is observed after the September 11 terrorist attack on New York World Trade Center [52], following this event there was a remarkable rise in the art market in New York showing that people seeking more secured investment venture. Artists who got buyers will be encouraged to produce more and more.

Mass tourism

Global movement of people of different nations is happening as never before bringing huge demand on places of interest among which fine arts museums are one. Globalization is making our planet closer and closer, what is happening at

one end of the world is known elsewhere at no time. The advancement of information technology and virtual reality helps to disseminate information concerning rich heritages and collections worth actual going on site for interested tourists in any corner of the earth.

Unpredictability and diversity of the type of work of art

In terms of the architectural implications nowadays the work of art to be housed in museums is so diverse there needs to be a certain degree of allowance to be made. In terms of size we may come across from miniature paintings and sculptures to gigantic sculptural works, in terms of style today art encompass a wide variety of themes that some works could hardly be recognized as works of art just decades back.

1.1. IDENTIFICATION OF THE PROBLEM

In the light of the above discussion the following problems are to be identified.

1. Museums' role as a civic design is contradictory. The museums' collection should be made available to be experienced by the public; on the other hand the valuable objects should be kept for future generation to be appreciated by the coming generation.

When collections are exhibited to the public various elements are responsible for their deterioration.

- The public usually bring with them dust that need some sort of solution not to spoil the exhibits. Knowingly or unknowing the public might be potential threats to the exhibits; visitors might be tempted to touch some objects or more dangerously burglars might snatch art objects from their position.
- Exhibits need proper lighting to be appreciated. Lighting level that is meant to illuminate the exhibits may be detrimental to the exhibits due to excessive duration of exposure or excessive level of illumination.

Lighting of both natural and artificial means should be controlled through architectural and other means.

- Environmental factors such as temperature humidity will have more effect in an effort to present the exhibits to the public. Where as they will remain secured if simply kept in protected condition.

2. Flexibility of gallery spaces needed for changing needs of temporary, permanent exhibition and increasing collections of works of art.
3. Need or striking a right balance between art to be displayed and the architectural enclosure.
4. Expanding role of museums apart from being containers of art to the more complex functions such as entertainment, educational centers etc.
5. Need of responding to different ways of having museums: new ones from scratch, expansion, or renovation.
6. Revision of the conventional design process. Outside-in is the conventional process mostly followed. In such case mistakes ones made are difficult to amend in later phases requiring expensive actions.
7. Nowadays museums stacked one upon the other in urban areas due to shortage of land creates lighting problems. Because roof is the most logical position to let in natural light.
8. Because day-lighting's nature of unpredictability, changing position and intensity through out the day, it is made a tough element to deal with in museum interior spaces.
9. Using exclusively artificial lighting is not advisable due to psychological reasons needed in such leisure architecture as museums. Visitors moving about the exhibits need orientation about the external outdoor condition like time of the day, mood of outside condition, etc. Further the contemporary trend of energy conservation in all spheres of building activity necessitates inclusion of day lighting as complementary source of illumination to artificial lighting.

1.2. SCOPE AND LIMITATION

The study is limited in the following mode:

- It shall be concerned with preparation of design considerations for ***nationally accredited*** fine arts museums of the contemporary era.
- Only those functions that are in direct contact with the visitors – exhibition spaces and public circulation areas - are researched here. The rest of the functions are supportive not having direct bearing on the character of museums like restaurant, archive, office-spaces, etc...
- Three levels of experiencing museum are dealt: The close contact of visitors with objects on display or (contents) having architectural implication, how exhibits relate to the interior architecture (container) and the public image of museums expressed in its exterior architecture especially in an urban setting.
- In the present age there are three options to have museums, as far as the architects' involvement is concerned. 1) A new one could be constructed on a new site form scratch. 2) An extension to an existing functioning museum. 3) Renovation of an old building formerly uses for a different purpose. The study will touch upon the above ways of having museums. The fourth option to have museums is virtual museums this option is not much of an architect's concern. [38] These types of museums will not be dealt here.

1.3. METHODOLOGY

Literature survey is the prime means of acquiring materials through analytic synthesis approach. This is done through surveying literature.

A number of case studies are analyzed critically for vices and virtues especially in areas pertaining to general and particular requirement of fine arts museums.

1.4. AIMS & OBJECTIVES

The intention is to give detailed design considerations for design of fine arts museums.

To achieve levels of understanding as to how to identity considerations pertaining to detailing out wall, ceiling, and floor planes resulting in a coherent architectural expression parallel to technical requirements of museums.

To study how recent trends have affected the image, complexity and functional composition of art museums.

CHAPTER-2

LITERATURE REVIEW

"Art is a constant expansion of activity in a steadily growing number of areas."
Herbert Bayer, exhibition designer

2.1. Development of museum

"MUSEUM is permanent nonprofit institution housing collections of objects of artistic, historic, or scientific interest, conserved and displayed for the edification and enjoyment of the public." [11]

Museum is a Latin word, derived from the Greek *mouseion*, originally meaning a temple dedicated to the nine Muses, which according to the Greek mythology represents the nine goddesses who were said to preside over literature and the arts and sciences. Museums as we know them today have started during renaissance in the 18th century housing collections of objects of beauty or worth. Former museums were collection belonging to royalties and were not accessible to the public. Later public art museums started to be popular. Public museums role at this time was:

- To develop enlightenment
- To preserve and keep works of art.

In the 20th century new approaches to art and architecture brought about reactions by the architects by considering museum problem anew:

- Developing circulation as a dominant theme.
- Open planning of exhibition spaces for flexibility by Mies Van Der Rohe.
- Museum of unlimited growth by Le Corbusier with flexible routes
- L. Wright's Guggenheim museum is the culmination of the concepts developed so far with additional central atrium space as a constant reference for visitors.

In 1971 Marcel Du Champ a follower of a style of art called Surrealism put a urinal inside museum interior as a challenge to the traditional role of museums as sacred space or temple.

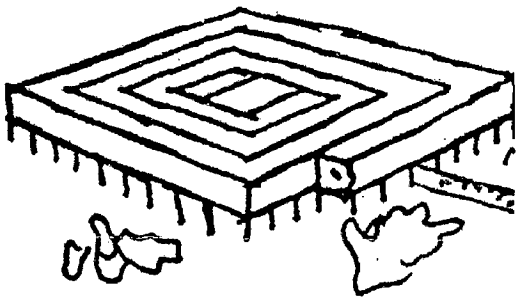


Fig.1 Le Corbusier museum of unlimited growth [1]

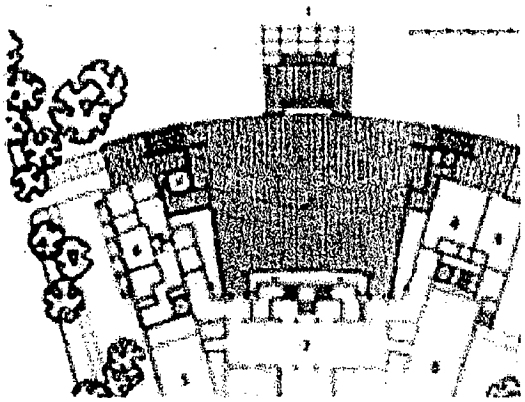


Fig.2 Mies Van Der Rohe Museo para una pequena [1]

Contemporary ideas of museums require that museums should not only serve as architectural enclosure but also as an outcome of the concept behind the art to be viewed, even more importantly as a facilitators of art viewing.

2.1.1. Characteristic of museum

Just like other building types there are no distinctive set of features that will characterize any museum building like other similar cultural architectural works like cinema, sports arena, church. This is because of primarily museum building could take many directions, as long as the final end fulfills certain basic requirements. These characters are identified in terms of external appearance, programmatic composition, and way of acquiring the building for the museum purpose.

Nowadays museums seem to fit any type of building form, from factories and warehouses to palaces and old villas as long as art works are displayed in safe and preserved condition. It is therefore difficult to arrive at a representative general building form, type, character or impression for all museums.

Major characteristic features of museums have to do with detail design and internal aspects as a reflection of, or even facilitators of works of art displayed. Once the detail design consideration is well taken care of any well worked out spatial organization works well for museum purpose, although there are ideal organizations for a particular museum collection.

In museums façade elements like windows and wall surfaces could be varied indefinitely. Windows may not altogether be part of the major surface area of the wall surface because normal windows will be out of place for gallery lighting. Lighting is provided either through top windows or more commonly through roofs, which frees the vertical wall surface from any stringent pattern of puncture from such openings. This is one of the reasons why we don't have representative museum appearance.

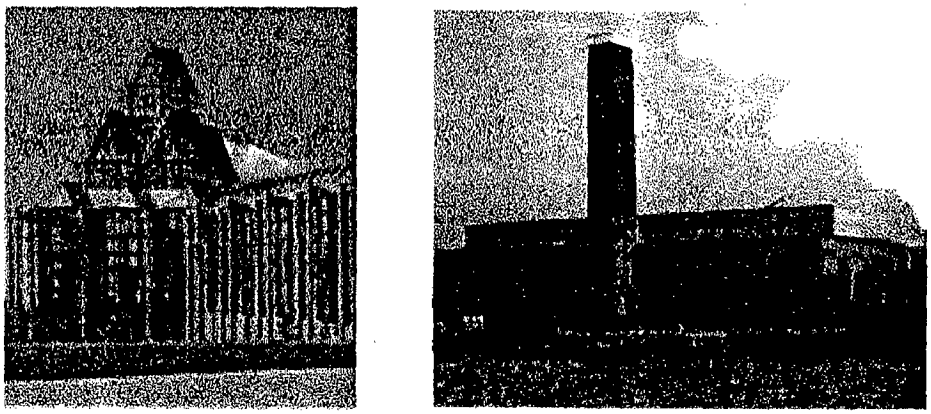


Fig.3 *Even though these two museums (National Gallery, Ottawa on the left and Tate Gallery [30]) have completely different external characters, impressions because they were meant for entirely different purposes; the first one is designed for museum purpose, while the second one formerly was a factory converted into museum. They have similar internal aspects in terms of display requirement, lighting, conservation aspects etc...*

2.1.2. Need of visitors

Social: in the contemporary era museum going could purely be motivated out of meeting people and interacting with them. The spaces responsible for these social events are restaurants, lobbies, atrium, cinema etc... These spaces are being given an importance as never before.

Intellectual: scholars in the field of museuology or other historical disciplines will definitely find museums a rich source of information.

Sacred: Especially in the former eras, for example renaissance, fine arts i.e. painting, sculpture, and architecture were serving other parallel sacred and religious ends. Then the works of art were kept primarily for their iconic values rather than their artistic values. In some instances this role of fine arts requires the art objects being kept in their original site where all the religious rituals could be performed, making the conventional practice of exhibiting objects of art difficult if not impossible. In such cases display, conservation, and security measures should be taken right on the spot where the art objects are serving their sacred role. Idols, icons, and other objects of religious contemplation all represent some visitors' primary motive of going to museums.

Educational: educational tours for different groups of people are common events in the contemporary. School children are taken on a tour purely for educational aims. Spaces like public areas of atrium, concourse should be well designed to cater for the peak load of such visitors.

Entertainment: as museum is one of leisure architectural projects it is being increasingly expected to fulfill visitors' need of entertaining by incorporating functions like restaurant, cinema, multipurpose halls of pubic use, shops, small markets, etc... nowadays a visitor may return home without ever visiting a gallery being engaged in the entertaining spaces.

2.2. Types of Museums

Museum types are classified according to major classification and minor classification.

Major classification: There are major types of museums such as archaeological, anthropological, history museums, fine and applied arts, science, ethnographical, etc.

Minor classification: under this category are museums with special collections forming what are known as specialized museums. They can be under the above mentioned types with collections of certain class. Some of specialized museums to be mentioned are sports museum, Dolls museum, Forestry museum, Medals museum, Kites museum, postal museum, decorative arts, crafts museum, children's museum etc [7]

2.3. Fine arts museum

For a museum to function it must have collections capable of attracting public attention, with qualified personnel to keep it running, and of course well designed building proper to house the collections and creating good working environment to the museum staff. Finally without visitors the whole idea of having museums effort would be futile, after all ever changing need of visitors should be catered for.

2.3.1. Collection types

"Fine art is an art that is appealing to the mind or to the sense of beauty specially painting, sculpture and architecture. "[11]the fact that fine arts museum is purely an agglomeration of all the component parts of fine arts is what makes it so unique. The best place to study fine arts could be to visit a fine arts museum

of reasonably rich collection. Contemporary fine arts are a diverse form of human creativity that needs to be staged with in an architectural enclosure, which it self is also a piece of fine art, in a very sensitive manner. [15]

Classification based on their physical entity

Fine arts collections depending on their physical existence could of the type: - paintings, sculptures, prints & drawings, etchings, and other bona fide work of art or rarity, historical value, or artistic merit.

***Painting*:** the skilful arrangement of colors on a surface to create an independent work. In many societies painting has been devoted largely to religious ends; but later various types of painting have developed: historical, portrait, landscape, realistic painting, and still life.

Sculpture: it is basically working in three dimensions by modeling in a soft material such as clay or wax, the result sometimes being cast in metal, or carving from some hard material such as stone or wood. In the 20th-c there has been much work done by joining together prefabricated pieces, a technique known as assemblage. Early Greek bronzes were cast from wooden models, using the 'lost wax' process, but most Renaissance and modern bronzes are cast from clay originals.

An alternative process involves firing the clay model in a kiln, to produce terracotta. Stone carving has been characterized by its greatest practitioners, notably Michelangelo, as a process of releasing from the block a formal idea conceived by the artist as already existing in the stone.

Throughout history and in all cultures, sculpture has been colored, but since the Renaissance the preference has been for displaying the natural surface of the material used. Marble, the most prestigious stone, has normally been given a high polish.

Etching: a form of engraved printing whereby the design on a copper plate is bitten with acid, rather than cut directly with the engraving tool. The greatest master of the technique was Rembrandt.

Classification based on style

In the 20th century art started to deviate from the realistic style to the more subtle forms of expression and representation. Artists increasingly found the new trend as a way of expressing their unrest with the political situation, stagnation of cultural values, futuristic projections, etc. some of the styles have even built expression in architecture, like cubism in Shroder Shraded house by Gerrit Retveld, a villa volume broken down in to an assemblage of cubist planes. Architect Hans Holein's Monchengladbach museum's [8] characteristic feature is that architecture and art are no longer distinct elements: they are read as a unified language. His experience in the fine arts has helped him to achieve this result. A museum designer's conceptual seeds might be cultivated from the fertile ground that the arts themselves set. It therefore imperative, that an architect should develop his vocabulary through study of the styles of fine art. Some of the most important modern styles are defined below.

Cubism: an art style in which art subject is broken down in to collections of geometrical forms. This style is dominant in paintings.

Surrealism: a 20th century art style. Art in this case is an expression of the subconscious mind; to this end it has used irrational composition principles.

Dada: an international art movement having many repercussions in literature and music. It is aimed at doing away with conventions in social life and art that were supposed to be hindrances to advancement of art. In relation to museum designing, work of Marcel Du Champ is a notable work that has challenged the age-old notion of museums being as sacred spaces, by putting a urinal in the space.

Futurism: a violent movement against traditional art towards movement and continuity. This style was initiated by younger generation in Italy to push the whole country towards new horizons, which at that time seemed to hibernate in most activities of the nation.

Constructivism: a movement developed in Russia where industrial or mechanical components are composed into non-representational and non-structural art works.

Neo classical: a treatment in art or other related fields where elements from past classical period are revived for present day use.

Abstract expressionism: an art style resulting in abstract art. It deals with emotional expression of a theme rather than physical object representation.

Minimalism: a style where simple and primary geometric forms are used with boldness. This again has notable reflections in recent interior architectural works.

Pop art: art based on mass media and modern popular idea. It is usually critical about the traditional art.

From architectural design point of view the above classification will be more complete if the following additional points are considered.

Size of fine arts

The size of fine arts could range from a *miniature art*, which needs magnification to view them clearly; to *gigantic* sculptures or paintings which common museum enclosures could be undersized.

2.3.2. Staff

Museum at national level relies on diversified and departmentalized staff.

Director

Responsible for

- *business administration* for which he may have a special staff of treasures, accountants, secretaries, fund raisers, and in connection with which he may be in consultation with a board of governors or museum trustees.
- *Educational programs and policies* for which he is assisted by instructors, lectures, publicity assistants, and research personnel.
- *Scholarly work* including art, historical research, museum publication, collection and exploratory expeditions.

Curatorial staff

If the museum collections extend to many fields of art, staff composition may include a chief curator for individual departments such as ancient art, far eastern collections, painting, sculpture, decorative arts, with supplementary assistants and research fellows.

Librarian and archivists

With responsibility for books, documents, records, and publications of the organization

Photographers, draftsmen, and printers

With separate archives and collection of graphic materials they take care of all the necessary publication needed.

Exhibition installers

They work out the details of the exhibitions with necessary installation, special facilities and handling of the display.

Conservator/restorers

Analysis, conservation, and repair of art objects it requires highly skilled manpower to carry out the high responsibility of taking care of exhibits in case of deterioration through age, mishandling before being acquired. It is here that works of art are checked for their ingenuity. Researches in methods and exchange of services and information between museums and presenting demonstrating methods and procedures are also carried out. These experts are assisted by carpenters, painters and crafts men.

Maintenance staff

Carpenters, electricians, round attendants and so on working on minor repair works at hand.

Security personnel

Manual security measures are still irreplaceable with electronic detection systems, therefore security guards are substantial part of the museum staff. Staff in this section should be well organized for the museum to keep its collection from theft or vandalism.

House keeper

Periodic cleaning, checking of items in the exhibition hall and else where. Carefully organized house keeping procedure will go a long way in tackling nuisances that could cause deterioration of museum objects. House keeping should be done in close collaboration with security staff when the museum is closed outside working hours.

Museum education service personnel

These professionals give service of guiding visitors who have come for educational tours.

Registrars and computer specialists

Documentation and organization database keeping for the whole complex.

2.3.3. The museum building proper

Museums are composed of mainly exhibition spaces, stores, support and servant spaces like restoration workshops, offices, etc. In addition to the aforementioned list contemporary trends require functions like retail spaces, auditoriums, temporary exhibition rooms, restaurant-bar, terraces, music school, theatres, etc. Because museums are non-profit service giving organizations funds should come form an outside source, further additional funds are generated from facilities which are business oriented like gift shops (selling items like reproductions of important collections), entertainment, etc. nowadays it is feared that museums are changing their focus from research and educating the public to fund raising activities. Incorporating such functions as an integral part of the museums could help to return to their proper role as museums.

These varieties are the result of societies needs in museums like 'social, intellectual, sacred, educational, and entertainment' [19]. Development of museum culture is due to mass tourism, lesser working hours, and new cultural trends and interests. Because of the increasing social role of museums the following spaces found importance: lobbies, lounges, theatres and restaurants.

Exhibitions are the public face of museums. There should be a thoughtful consideration of bringing in to contact the museums' collections with the public.

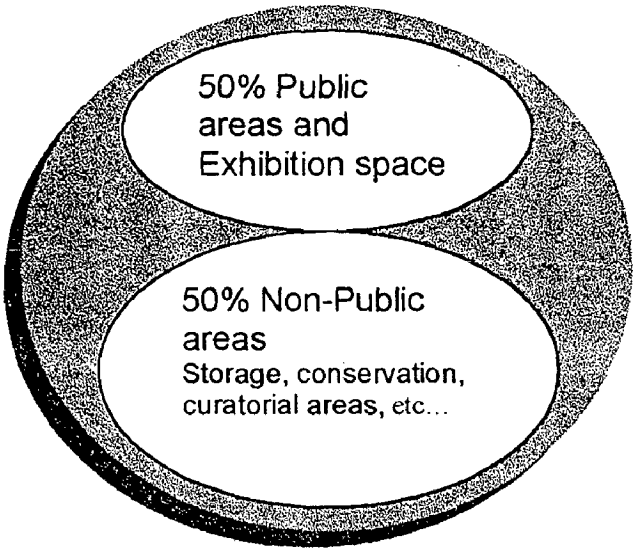


Fig.4 *This schematic relation between public spaces and non-public spaces can be used as a guiding start at the initial stage of the architectural design process*

2.1.1.1. Exhibitions

Exhibition galleries are the cores of the whole purpose of museums. They are part of the spaces comprising public side of museums.

There are three types of exhibitions:

1. *Permanent:* exhibitions to house limited amount of collections in a relatively permanent enclosure for a long period of time. In this type of exhibition conservation of the exhibits become an important consideration.

2. *Temporary:* excisions meant to last for a short period of time in conditions when there are collections recently acquired, or a group under a particular theme or when collections are needed to be kept until a permanent display area is prepared.

3. *Traveling:* exhibitions meant to be experienced by diverse people of culture, and different geographical locations. They have similar characters to that of temporary exhibitions.

2.4. Design standards for Museum of Fine arts

2.4.1. Display standards

In museums the main central issue of design standards comes into play while considering display aspects of showcases, plinths of various types, mounting of paintings and relief sculptures on wall planes and panels. The main considerations are to have ease of viewing and lighting.

Visions and viewing

The normal limit of vision without moving the head is a cone of 40°. A picture, therefore, can only be comfortably viewed as a whole from a distance of about double the diagonal. It is generally accepted, though, that a distance equal to the diagonal will enable the viewer to appreciate the details to the picture, but he will need to move his head to compass it all. [17]

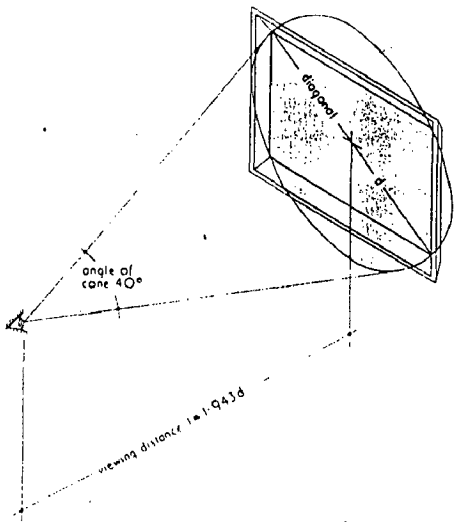


Fig.5 *cone of vision with head stationary [17]*

Lighting

Lighting for pictures should not come from an angle less than 45° but the sources should be screened against glare. Normal windows tend to leave adjoining walls, and any displays on them, in shadow. Where top light is not used, side lights can be substituted.

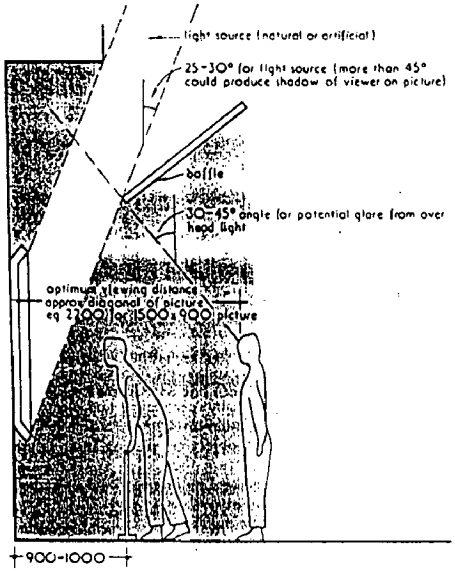


Fig.6 *Factors for satisfactory viewing, distance and lighting. With suitable design of top light, baffle may not be needed[17]*

Showcases

Showcases are normally viewed from close up. Here the lighting is usually artificial. But should be screened form direct view. The source should be isolated from the exhibit so that maintenance can be carried out without breaching security. The exhibits should also be protected against the heat of the lighting. And form the danger of damage during maintenance.

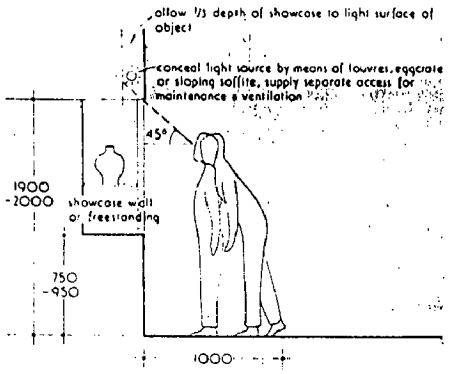


Fig.7 *viewing and lighting a showcase [17]*

Labels and descriptive panels

Text and captions should be of a type size relative to the distance form the viewer.

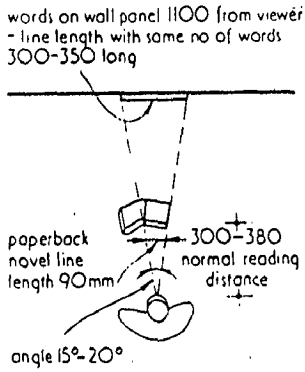


Fig.8 Method of sizing type for descriptive material, labels, etc [17]

Circulation

Adequate space should be provided for people to view the exhibits, and also to pass between groups of views. If objects are placed too near corners, congestion will tend to occur. Where there is a designed sequence, there may be queuing at peak period for the more popular items, and space must be allowed for this. Star exhibits should have extra viewing space, and should not be placed to near to one another.

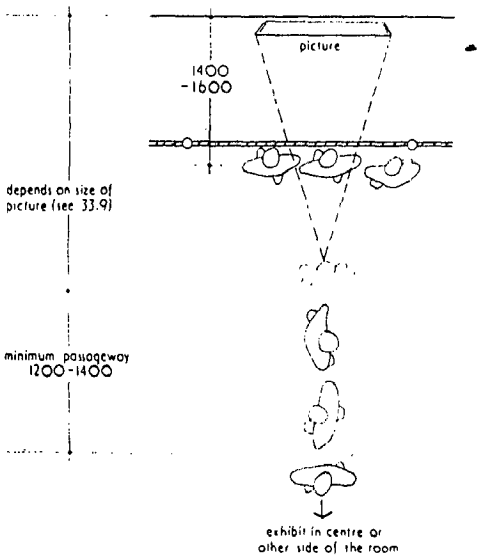


Fig.9 Viewing and circulation for objects or pictures on walls

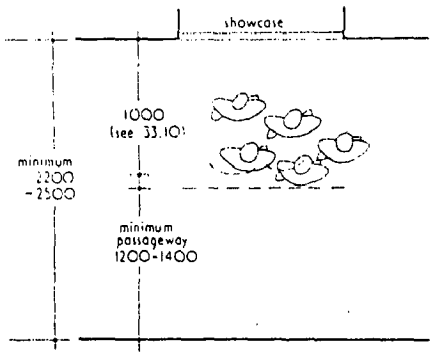


Fig.10 Viewing and circulation for showcases

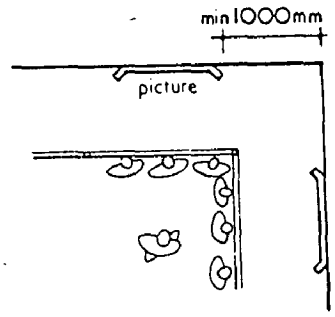


Fig.11 *Method of avoiding congestion in corners [17]*

2.4.2. Space standards

Waiting areas

Linear queues: width is queue can be reduced to 0.6m when barriers or other constraints are used. If unconstrained queue could reach a width of 1.2m. Down length of queue average distance between persons is 40cm-50cm under normal circumstance.

Bulk queues: most people feel comfortable in a crowd of $2p/m^2$. This can be useful design figure for waiting areas off main circulation routes. Where foyers and other areas are combined with circulation routes a density of $0.4p/m^2$ can be a good design value.

Type of users	Free flow: mean density or $0.3p/m^2$ less		Full design capacity one way flow: $1.4p/m^2$	
	Walking Speed(m/s)	limit of corridor Capacity with free flow (p/min per m w)	Walking speed (m/s)	Corridor capacity (p/min per m w)
Individuals	1.3	23	0.8	67
Family groups	1.0	18	0.6	50
School children	1.1-1.8	18-32	0.6	50

Table 1: *Approximate mean walking speeds on level walkways; approximate corridor capacities [17]*

2.4.3. Ergonomics: human comfort, safety, and accessibility

Physical accessibility to both normal and disabled visitors should be catered for. Comfort should also be maintained while going on a tour of the museum.
Some specific ways this standard is achieved are:

- ***Forewarning of the possible exhibits that may be provocative to the emotions of the visitors.***

Marcel Du Champ's urinal as work of art displayed in museum could be unacceptable for majority of common people. Presence of unusual exhibits should be informed in advance to respect the visitors' response. Although surprise is a desirable element that is aspired for in museum experience, it should not be overly exaggerated that it becomes unbearable.

- ***Clear and easy means of way finding.***

Employing proper textual, signage and symbols as additional tools of guiding and helping visitors finding way is an essential consideration.

- ***Provision of seating.***

Museum fatigue is undesirable feeling that may follow after spending time going about exhibition galleries. The visitor absorbed in the exhibits may not remember to rest along the route finally ending up tired and exhausted.

- ***Proper labeling***

Individual exhibit should be well labeled that it will address almost all potential visitors. Topology should be of the most common type. The visitors should be aware of the message conveyed rather than the letters themselves which may happen in an attempt to create interest.

- ***Addressing of all potential visitors***

All visitors, whether normal or disabled, should have easy access to every public space. Ramps for wheel chairs are required wherever there are level differences. Otherwise lifts should be provided. Escalators are also other alternatives for another form of disability that is caused by old age; further children will at the same time be taken care of.

Ramps for disabled

Gradient should not exceed 1:12 and should be greater than 1:20 when more than 6m long. Level platform of 1.8m should be provided at top; in long ramps. Rest platforms desirable at changes of direction. No changes of gradient along ramp. Minimum width of ramp is 1m in public buildings like museums. Handrail is required.

Slope	Maximum rise	Maximum horizontal projection
1:12	7.60m	9.0m
1:16	7.60m	12.0m
1:20	7.60m	15.0m

Table 2: *Sample ramp dimensions [17]*

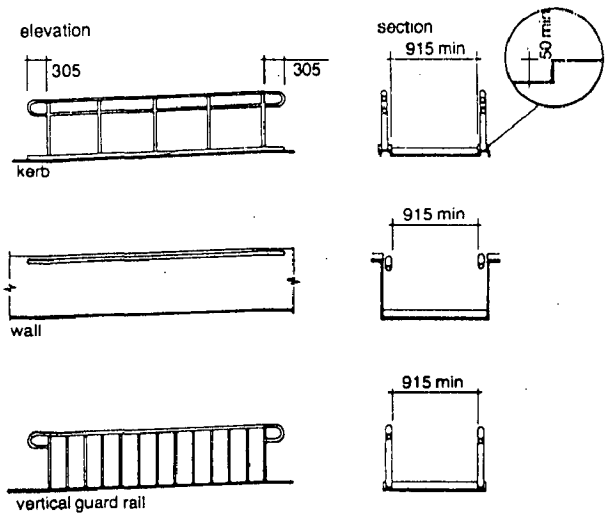


Fig. 12 *Examples of ramp edge protection and handrail extensions [17]*

Escalators

In some standards angle of elevation is limited to 35° when rise does not exceed 6m and speed along line of slope not greater than 0.5m/s. in all other instances angle must not exceed 30°. Manufactures will provide standard escalators that have ranges of dimensions.

Structure of escalators: is with steel truss supported at upper and lower landings, and usually at intermediate point when rise exceeds 6m.

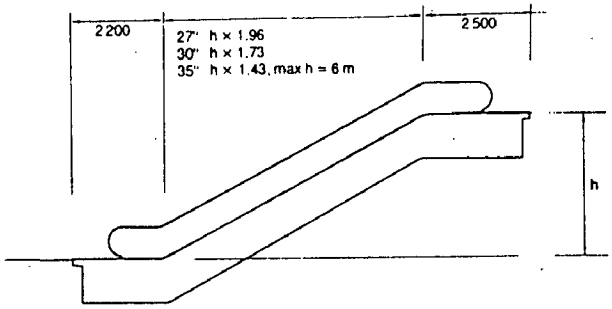


Fig. 13 *Basic dimensions of escalators for initial planning [17]*

Traffic capacity: depends on rate at which people step on to escalator which in turn depends on

Width of escalator, speed of escalator: up to about 0.75m/s increasing speed results in grater capacity; higher speeds tend deter passengers stepping on.

Tread width (m)	Maximum width between balustrades (m)	Overall width (m)	Appjroximate capacity (p/min)		
			Speed (m/s)		
			0.45	0.6	0.75
0.6	0.85	1.25	65	90	95
0.8	1.05	1.45	95	120	125
1.0	1.25	1.65	125	150	155

Table 3: *approximate width and traffic capacity of escalators [17]*

CHAPTER-3

CASE STUDIES

"A museum is like the lungs of a city- every Sunday the crowds flow though the museum like blood coming out purified and fresh."

George Bataille French critic

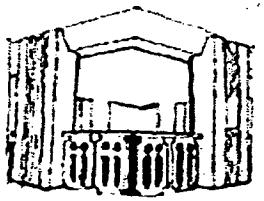
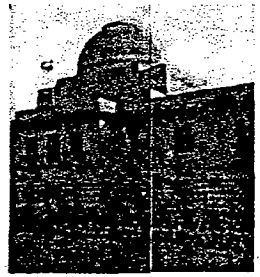
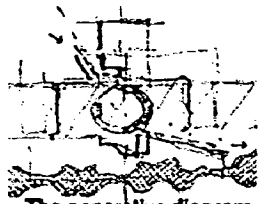
3.1. CRITERIA FOR SELECTION OF THE CASE STUDIES AND PARAMETERS OF ANALYSIS

The case studies are analyzed in terms of a set of thirteen parameters. These case studies with broad spectrum of time, cultural, geographical, economical and level of development, are intended to depict contemporary trends of fine arts museum design. All of them, in their own way, have a national status as one of the criteria of selection of the case studies. It was also the intention to incorporate actual going and experiencing the fine arts museum as part of the comparative study; apart from those popular much publicized internationally known fine arts museums. One should of course never forget that still in this modern age there are timeless lessons that we could derive from past older museums. Potential organizational aspects of space, display techniques, lighting methods are still to be found that are worth noting in older museums.

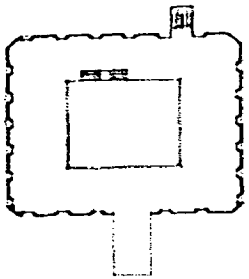
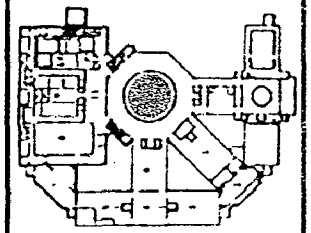
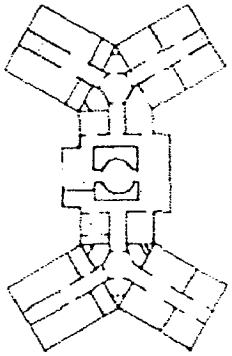
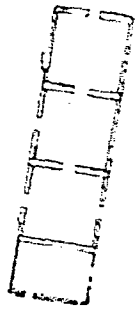
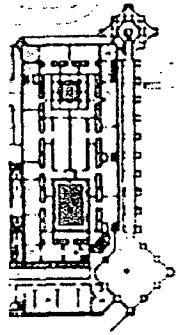
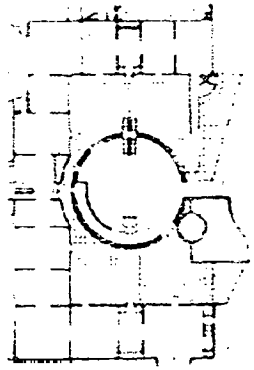
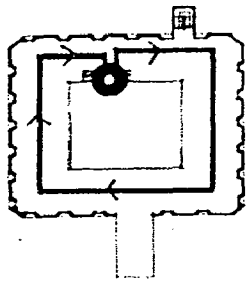
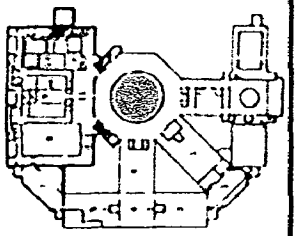
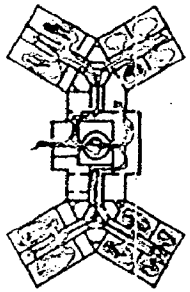
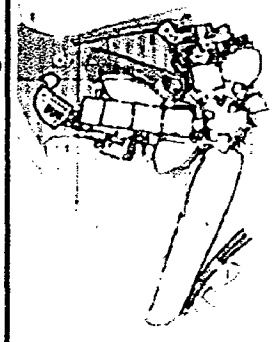
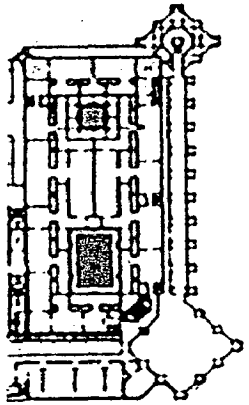
- **Concept:** referring to the deriving architectural force behind the initial design decision. In a civic design as museum sometimes the conceptual derive force is so powerful it could overrule all other constraints such as budget, and other stringent functional requirements. We can clearly see this from Acropolis of Athens where the concept of having an eye on the acropolis from the interior of the museum dictates all other design decisions.
- **Functional components:** analysis of functions within contemporary museums in order to see the diversity and magnitude of conventional and contemporary functions. To see the trend of functions being introduced as parts of museum.
- **External feature:** this specially refers to museums in urban stetting. In this direction the effect of museums within an urban fabric is analyzed.

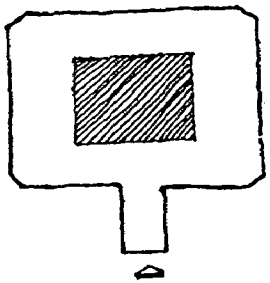
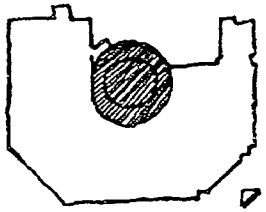
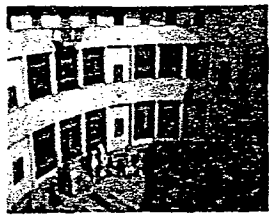
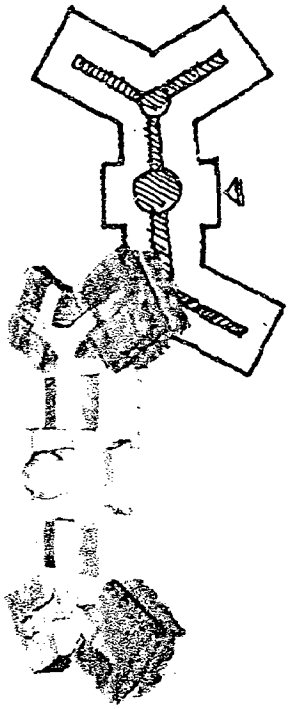
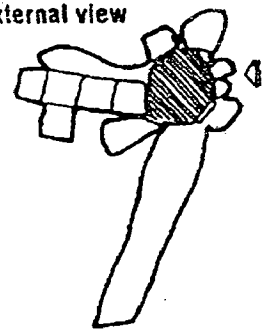
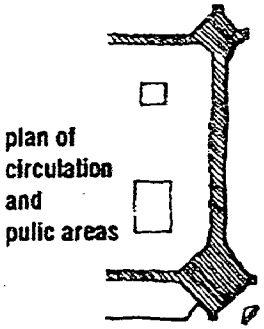
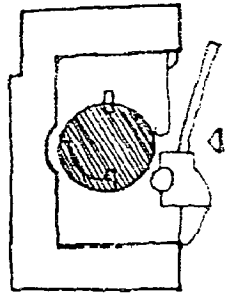
- **Typology of gallery layout:** set of most common layout options as to how the exhibition halls are arranged within the museum complex next to each other in different permutations and combinations.
- **Route of visitors:** the design idea behind how visitors go about the exhibition galleries is analyzed. Whether the route is free or controlled, whether the visitor has an option of making up his own selective tour.
- **Extroverted vs. introverted:** positional hierarchy of gallery with respect to public spaces.
- **Global reference:** orientation of visitors within museum complexes needed for clarity of way finding.
- **Art vs. architecture:** relative importance of art displayed and the enclosing architecture
- **Display techniques:** Architectural implication of display techniques within interiors. How display cases affect the architectural language.
- **Lighting:** Architectural implication of both natural and artificial lighting
- **Finishes:** material type, nature and selection criteria of the surfaces that serve as a backdrop for the exhibits being displayed.
- **Graphics:** color, texture, composition of elements inside interior spaces
- **Security:** protection needed against human intrusions that are potential threats to the safe keeping of the collections. This may take various forms; theft (intentional), iconoclasm (purposefully destroying or disfiguring artifacts, mishandling (unintentional). This also includes safety against fire.
- **Preservation:** maintaining proper environmental conditions that are needed for preservation and safety of exhibits. This includes dealing with humidity, temperature, pests, contaminants or pollutants

3.2. COMPARATIVE ANALYSIS

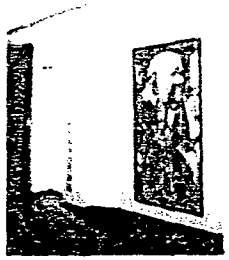
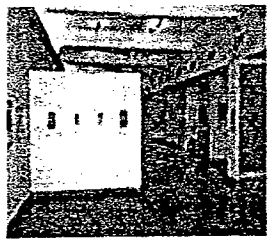
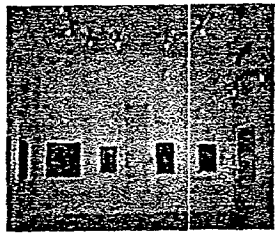
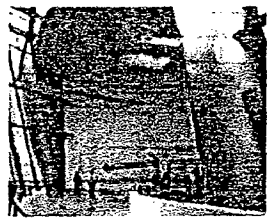
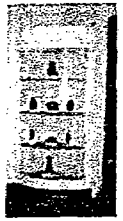
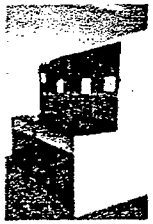
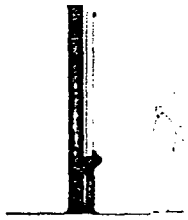
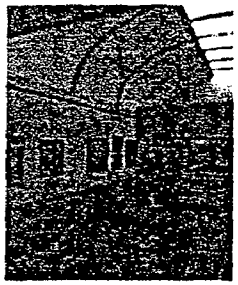
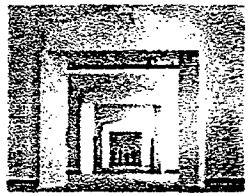
BASIS OF ANALYSIS	MUSEUM	National Museum of Ethiopia, Addis Ababa	National Museum, New Delhi	National Gallery of Modern art, New Delhi	Guggenheim Art Museum, Bilbao (Spain)	National Gallery, Ottawa (Canada)	Stuttgart Statsgalrie, Germany
	1. CONCEPT	Interior architectural motifs reflecting traditional architecture of Ethiopia 	Adoption of dome as a dominant façade element with sand stone as a major material 	Dome as a dominant façade element, and rustucated sand stone on exterior wall 	Breaking of the traditional gallery box. Free form of metal cladding. 	Organization of gallery spaces along an urban path. Conception of the building in 'microcosm' the colonnade, concourse and the great hall are conceived as urban open spaces while the main galleries are the building proper.	1) Route crossing the site making it both an urban path and gallery space. 2) Unifying diverse cultural programs that represent city in 'macrocosms' into one unified whole.  The generative diagram of museum
	2. FUNCTIONAL COMPONENTS	Galleries, restaurant, conservation department, documentation office and supporting facilities	Galleries of art, anthropology, ethnography, library, auditorium, offices, souvenir shop	Galleries of art, library, out door sculpture court	Administration, Galleries of temporary and permanent exhibitions, Library, Restaurant, Café Auditorium, Retail space, Bookshop, Public plazas, Atrium	Galleries, Offices, Research, scholarship and conservation, Libraries,Conservation laboratories, Carpentry workshops, Auditorium, Bookshop Landscaped courts open to the sky, Restaurant	Music school, Galleries, Library, Theater, Auditorium, Café, Sculpture court
	3. EXTERIOR FEATURE	Architecture of exposed concrete unsuited to leisure architecture like museum	Unified with the general image of that area through use of material, and architectural elements like dome, cornice...	Unified with the image required for such kind of civic design through use of elements like dome material (stone) with rustication.	It tries to assume a dominant position by searching for new forms. It relates to the surrounding buildings through responding to their story heights.	By respecting the surrounding scale of buildings and architectural vocabulary like spire form the nearby church 	The public is presented with a museum referring historic elements like Egyptian cornice, central drum shaped sculpture court of museums of 19th century. From the lower level of the site play of steel tubes and ramps with the central drum are the dominant features.

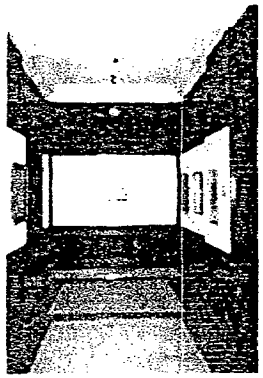
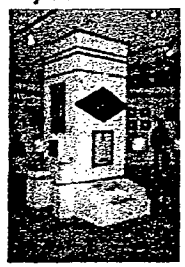
BASIS OF ANALYSIS

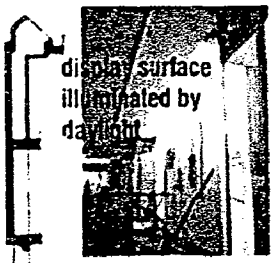
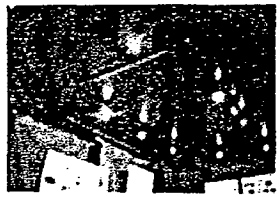
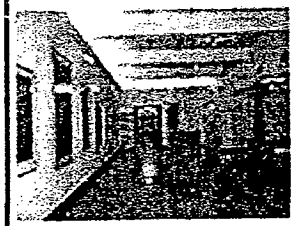
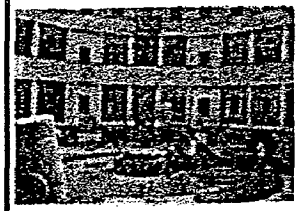
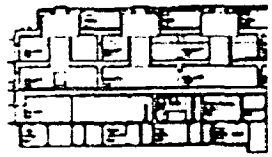
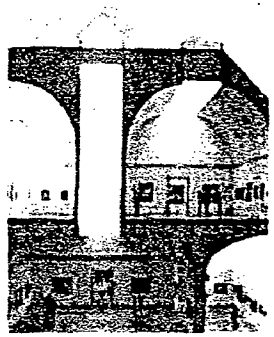
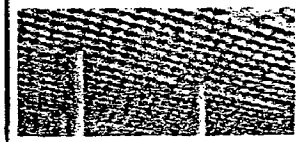
MUSEUM	National Museum of Ethiopia, Addis Ababa	National Museum, New Delhi	National Gallery of Modern art, New Delhi	Guggenheim Art Museum, Bilbao (Spain)	National Gallery, Ottawa (Canada)	Stuttgart Statsgalrie, Germany
4. TYPOLOGY OF EXHIBITION HALLS	System where exhibits are arranged around a central open well in three stories accessed by stair case 	Combination of two typologies: an open courtyard with stairs leading to various levels and corridors one opening into the other without intervening corridors. 	linear tunnel like arrangement of paintings and works of art. 	Exhibition halls one opening into another without intervening corridor space. The halls are column free large rectangular volumes. 	Galleries opening one into another with out corridor space. The spaces are composed of rectilinear shapes that are arranged around landscaped courts. 	U-shaped gallery layout each one opening into another. 
5. ROUTE OF VISITORS	Partially controlled and partially free. 	Every gallery is controlled in its own right, but once a visitor is outside in the common central space he has a freedom of visiting or skipping that particular gallery. 	The halls themselves are circulation areas. They start with a major spine and start to branch out in two segments towards the end of either wing. it is fully a dictated type of route where visitor has no choice but to follow the already set pattern. 	The presence of the atrium helped to have simple circulation in the seemingly complicated plan. 	'Short circuiting' mechanisms are used through out the complex so that the visitor can visit selectively only the galleries that are to his or her interest. 	Diverse possibilities of making one's own preferences through provisions like side access of short cuts to the halls, apart form the u-shaped procession of main designed 'preferred route'. 

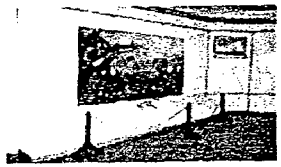
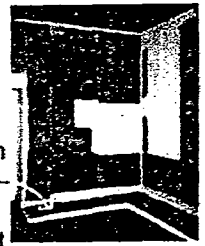
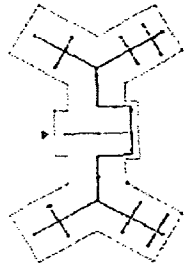
BASIS OF ANALYSIS	MUSEUM	National Museum of Ethiopia, Addis Ababa	National Museum, New Delhi	National Gallery of Modern art, New Delhi	Guggenheim Art Museum, Bilbao (Spain)	National Gallery, Ottawa (Canada)	Stuttgart Statsgalrie, Germany
	6. EXTROVERTED VS. INTROVERTED	Introverted the public and common areas located internally 	introverted public and common court open to the sky located internally   view of the central court	Introverted  internal circulation route widened at certain nodes	Introverted, it presents a blank wall to the outside but thanks to the curvilinear façade and the titanium shiny cladding it has a lively external view   view of the central atrium	Extroverted. The great hall, the concourse, the entrance pavilions are exposed as major elevation features.  plan of circulation and pulic areas  view of the external concourse	Partially extroverted. Due to the sloping site the introverted layout is opened up to the lower part of the site. The u-shaped layout also is partially open towards one side.  partially revealed central drum; climax of public space 
	7. GLOBL REFERENCE	The central rectangular open well serves as a reference	The open to the sky courtyard space: from here every type of gallery starts and it also ends here without effort of the visitor ever being needed to locate himself.	Double height domed space serves as a constant reference even if the complex is not that much complicated.	The atrium servers as a reference in this complicated layout of dynamic volumes	The great hall is a constant reference while the visitor makes a tour. Courtyards also serve as a means of connecting various levels visually.	An open to the sky central drum provides a constant reference for the visitors.

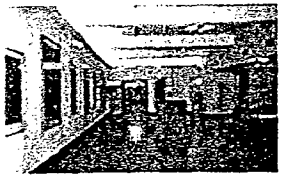
BASIS OF ANALYSIS

MUSEUM	National Museum of Ethiopia, Addis Ababa	National Museum, New Delhi	National Gallery of Modern art, New Delhi	Guggenheim Art Museum, Bilbao (Spain)	National Gallery, Ottawa (Canada)	Stuttgart Statsgalrie, Germany
8. ART VS. ARCHITECTURE	The architecture is not so loud it is a calm background for the artwork 	Architecture is a calm backdrop of the art being displayed 	It provides a perfect cozy intimate space that serves as a perfect backdrop for the artwork. there is minimal wall treatment with moulding, but not in a way to distract attention 	Both spaces of monumental and intimate spaces are used, that will allow exhibiting any size of art from miniature to gigantic. 	The gallery spaces are subdued, calm and peaceful that is necessary to view works of art. The vitality and vigor that is necessary for such civic design is provided by means of dramatizing public spaces.	Architecture is a neutral backdrop enhancing the art displayed.
9. DISPLAY TECHNIQUES	Pictures directly hung on the walls, sculptures on solid pedestals, and valuable items inside showcases. The solid pedestals are made to resemble like columns to visually integrate them with the architectural language. There also built in systems of display cases. 	Space saving display techniques of vertical drawers, corner display cases, multileveled glass shelves to use the same source of illumination for the various levels.  corner display element  vertically drawn display screens	pictures or 2D works mostly fixed on to the wall with direct method of nailing or screwing. Heavier paintings have support of projected stepped protrusion on the lower end of the picture frame 	Direct fixing of paintings and art objects, big artifacts are directly put on the ground plane. 	In most cases paintings are directly fixed on to the wall. For sculptures solid pedestals are used. 	Paintings hanged with conventional method, sculptures are displayed on pedestals. White walls provide a general backdrop for the works of art 

BASIS OF ANALYSIS	MUSEUM	National Museum of Ethiopia, Addis Ababa	National Museum, New Delhi	National Gallery of Modern art, New Delhi	Guggenheim Art Museum, Bilbao (Spain)	National Gallery, Ottawa (Canada)	Stuttgart Statsgalrie, Germany
	...DISPLAY TECHNIQUES	 Display case combined with screen	To manipulate the depth dimension on the vertical wall surfaces, another enclosure was constructed in Maritime Heritage Gallery. Tilting captions according to viewing angle. Structural columns that could have been disturbances are utilized constructively with some improvement in detail design to become display cases or good backgrounds. 	 Another background is used to mediate between paintings and the wall surface in color.	the 130 m long gallery provided a potential to create site specific works of art. like the rusting steel sculpture above.		
	10. GRAPHICS	Unifying white color	Interior coloring for the walls is primarily white or light shades of green or blue in some galleries. The ceilings are also mostly white in color.  illuiminated captions and pitcures	White color is the dominant color, with some variations around some galleries where the wall is dark colored wooden finish	Light colors dominate the space. Even if the colors are somewhat different taking their light shades helped to unify the whole picture.	All the interior surfaces are colored so that there is a dominant color that will unify all the different shades.	Contrasting colors in public areas. In gallery spaces colors are white forming the ideal background for the arts.

	MUSEUM	National Museum of Ethiopia, Addis Ababa	National Museum, New Delhi	National Gallery of Modern art, New Delhi	Guggenheim Art Museum, Bilbao (Spain)	National Gallery, Ottawa (Canada)	Stuttgart Statsgalrie, Germany
	11. LIGHTING	Both natural and artificial are used. Natural light is *admitted through* a detail provided on the wall as a reflected light and also as a general light through the skylight covering the central open well. Artificial lighting is exposed track lighting. It is provided both outside and inside the display cases.  section through the wall  track lighing	Apart from main artificial source, sculptures in the corridors and outdoor are lighted naturally. Flexibile metal tracks are used parallel to display walls. Different mood created by differing the lighting intensity meeting conservation requriements. Techniques like cove lighting *luminous ceiling are used.*  cove lighting  outdoor sculpture court	Only artificial light is the major means of illumination. Spot lights with track light or flush with the ceiling surface. In some galleries existing windows are covered by Venetian blinds to do away with the glare that could have resulted form daylight.  out door sculpture display area, but it is not integrated with design of the main building.	Natural and artificial, filtered day light is used from windows and roofs. Artificial lighting is of spot flush light. Light is provided through the roof forms for upper stories and for lower floors light wells are used.  light wells  Natural light provided through the atrium space through glass openings	Both natural and artificial lighting are used. Daylight is admitted through skylights in upper floors, also the lower floors are also provided with the same through light shafts that will deliver necessary illumination of about 85% of that provided upstairs.  light wells giving natural illumination to lower floors	Artificial and natural combined. Artificial light is provided as luminous ceiling of egg crate. Daylight is also present through big windows overlooking the terrace.  Egg crate luminous ceiling 
	12. FINISHES	Plastered and painted wall and ceiling, exposed concrete balustrade and columns, and carpeted floor	Flooring material is in most case terrazzo flooring. Marble is also used in some galleries.	Plastered and painted interior surface of ceiling and wall. Marble floor, terrazzo floor	Titanium cladding of façade and blasted stainless steel	The main wall finishing material is stone. In the colonnade concrete and glass are used. The floor is wood plank finished.	Stone masonry, glazed surfaces, metallic structures

	MUSEUM	National Museum of Ethiopia, Addis Ababa	National Museum, New Delhi	National Gallery of Modern art, New Delhi	Guggenheim Art Museum, Bilbao (Spain)	National Gallery, Ottawa (Canada)	Stuttgart Statsgairie, Germany
BASIS OF ANALYSIS	13. SECURITY	openness of plan contributed for ease of security	CCTV is installed in every nook and corner. Indirect physical means of ensuring security without making the visitor aware of it are used which prohibit visitor form approaching works of art more than viewing distance, through low posts kept at some distance interconnected with rope. Covering the prohibited area with material like red ash is also another method used.  low security posts  Red ash as securly element	A lot of personnel are patrolling in every wing for possible vandalism or theft. This may be due to the plan shape reflected in the so many bends and turns of the sight lines. Architecturally the building itself is secure by virtue of its hierarchy of space starting form entry to check point then an introductory double height space then finally galleries.  the plan shape dictates the need of having too many sight lines needing many security man power	Solid exterior gives secured look, in addition to other electronic means.	Because of simplicity of plan and straight invigilators could do their job easily	Straight sight lines and simplicity of plan will enable invigilators carry out their jobs easily.

	MUSEUM	National Museum of Ethiopia, Addis Ababa	National Museum, New Delhi	National Gallery of Modern art, New Delhi	Guggenheim Art Museum, Bilbao (Spain)	National Gallery, Ottawa (Canada)	Stuttgart Statsgalrie, Germany
BASIS OF ANALYSIS	14. PRESERVATION OF COLLECTIONS	Due to favorable climate through out the year, no so much stringent control is needed, apart from putting vulnerable items in controlled manner in carefully designed cases. In addition the massive concrete wall helps to balance extreme conditions passively.	Intrusion of services like air conditioning is made minimal by taking them to the perimeter of the walls where lower ceiling heights are taken to advantage by using these surfaces for mounting the lighting fixtures whereby they will be nearer to the exhibits which they illuminate.  	Air-conditioned gallery spaces. Readings from thermometer and hygro-meter closely follow the conditions of environment.	Services for this purpose are installed inside the space between ceiling and floor	In addition to lighting the roof plane provides for space for installation of services responsible for modulation of internal environment.	Services for this purpose are provided inside the ceiling.

3.3. CONCLUDING REMARKS

Concept: most of the cases considered tackle this step by taking images from existing architecture of the locality, there was not much daring step except the one taken by the Guggenheim Museum, Bilbao.

Functional components: in the more recent case studies, Bilbao and Stuttgart we see an immensely expanding museum programs. Functions that we associate with other building types are incorporated as components of other major parts of the museums. These additional functions are making museum design an adventure as well as a challenge in the hands of architects.

External appearance: some of the cases have taken up this step by putting a striking contrasting external appearance from the surrounding context, while the other cases tried to create diversity is unity with the rest of the surrounding context. Even in the first endeavor there is a hint of implying the surrounding architecture in a very subtle way.

Typology of gallery layout: certain preferred leading organization layouts seem to be taken for the case studies considered. Age old corridor less galleries arranged one after the other; rooms instead of common halls are still the chosen types of layout for exhibition galleries.

Route of visitors: for particularly fine arts museums analyzed here, preferred route suggested by museum authorities according to certain themes like chronological, geographical, etc with a possibility for visitor to take short circuit making his or her own route is prevalent.

Extroverted vs. introverted: in most of the cases taken introverted is common layout. National Gallery, Ottawa and Stuttgart Statsgallerie used extroverted

option with the result of creating drama of circulation and public spaces giving added vigor to the façade of the museums.

Global reference: most of the museums considered here have complex programs. Especially more functions are being introduced that are supposed to be accessed by the public, like recreation facilities, libraries, music schools, etc. with the increase of public functions the issue of how to orient visitors within the complex become a very crucial issue. Most of the cases tackled this aspect by introducing central orientation spaces in the forma of atriums and courts either open to the sky or closed.

Art vs. architecture: in the majority of the cases architecture is made to be a neutral backdrop for the works of art. Even in the case Guggenheim Museum, Bilbao, even though the external appearance is so loud in terms of architectural expression, the internal is a very calm backdrop to the exhibits.

Display techniques: space-saving and space maximizing techniques are employed. Showcases, pedestals and conventional hanging methods most of them in tune with the general theme of the architectural design language are used. Structural intrusions are also used to advantage by constructing display cases around the columns. This and similar inferences could be used when working with renovated museums of old buildings.

Lighting: in most of the cases both natural and artificial lighting are used. in some of them some exhibits are illuminated with artificial lighting only for the sake of keeping the exhibits from excessive illumination. Wherever daylight is used for exhibition purpose it is filtered to remove the harmful UV radiation. Multistoried day lighting is attained in the form of light wells in Guggenheim museum and National Gallery, Ottawa.

Finishes: most of the wall surfaces are plastered and painted white or light shades. Floor materials are wooden finishes, marble, terrazzo. Ceiling is of plastered and painted in most of the cases.

Graphics: white color or light shades of colors like blue, green and yellow are common for ceiling and wall surfaces. In cases where a different color than white is used another mediating surface was used between the wall surface and the picture.

Security: Apart form electronic means of achieving security for artifacts, architect's role in design of the building is observed. In most of the cases because exhibits are not supposed to be handled or touched visitors should be kept at safe distance. This is achieved though indirect means by putting elements like low posts interconnected by ropes, differing finishing material. Adopting simple plan layout which will allow to have straight line of sight is a good move in reducing no of security personnel as in National Gallery, Ottawa.

Preservation: in the cases studied services responsible for maintaining proper museum interior environment for the preservation of museum artifacts are handled in various ways in such a way they won't be hindrances to the sound layout of exhibits. In Guggenheim museum services are put in floors as separate service floors. In National Museum, New Delhi they are kept in perimeter areas of walls. In cases where they may contradict display requirements their effect was tried to be minimized.

CHAPTER-4

CONCEPTUAL ASPECTS OF FINE ARTS MUSEUM

"The museum has to functions as an instiiution for the presevention and cure of blindness in order to make works work. And making works work is the museum's major mission....Works work when by stimulating inquisitive looking, sharpening perception, raising visual intelligence, windening perspectives, bringing out new connections and contrasts, and marking off neglected significant kinds, they participate in the organization and reorganization of experience and thus in the making and remaking of our worlds....Even the most able work, however, does not always work. Whether it does ....will depend also upon the capacities and conditions of the viewer, and the surrounding and circumstances of the viewing."

Nelson Goodman, (philosopher)

4.1. Introduction

In buildings of such civic importance, conceptual steps representing social, historical, political values are so crucial sometimes superceding all other limitations like budget, practical design steps. Fine arts museum is one of such building undertaking. In some instances the first conceptual move will be like an end by itself. All the rest of the steps will be in service of realizing the concept.

4.2. Contemporary Fine Arts Museum Program

In the contemporary era museum going is not just to view works of art. There are parallel social, intellectual, sacred, entertainment, educational purposes for it. All these additional activities need spaces making the museum program complex. The increased activity could be traced back to the contemporary trend of mass tourism, increased leisure time and increased visitor mobility. Public spaces like lobbies have started to be dominant features in museums. Because of huge in surge of works of art, museums' collections are expanding as never before requiring proportionally large storage spaces. A lot of new or old functions transformed with a new input form the current move were added; as a result: restaurant, cinema, entertainment, lobbies and clear circulation areas are now component parts of almost every new museum.

Diversity of museum programs gave rise to very complex functional relationships. Flow of visitors in these relationships is dictated by first and foremost easy way finding at the same time security is also an important consideration.

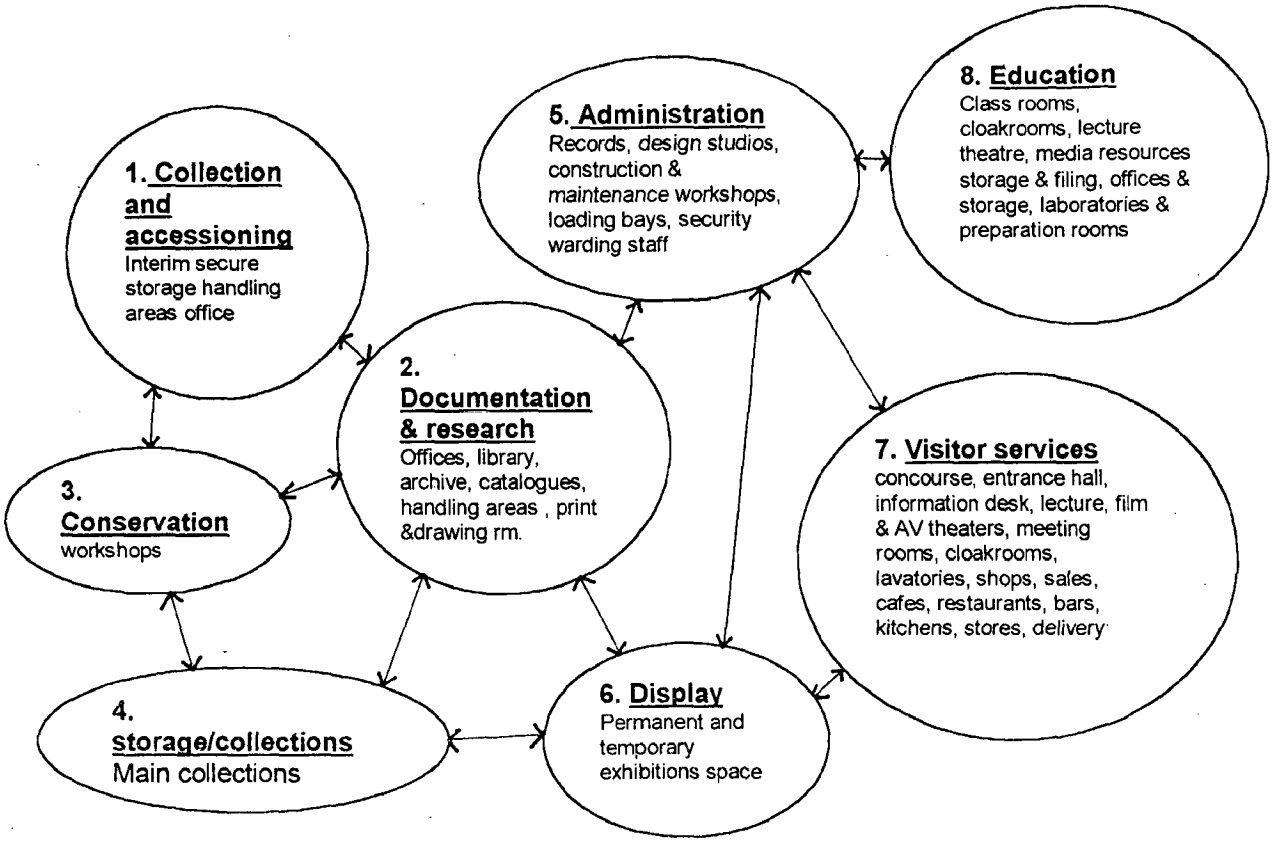


Fig14. *Functions of a typical museum [17]*

Because of the above mentioned reasons functional relationships should be reassessed with the new program requirements in mind.

4.3. Responding to the Existing Urban Set Up

As many other building of civic importance like theatre, cinema, library etc. museums are expected to have a distinct, acceptable and identifiable urban image. Museums' urban nature was achieved in the following ways:-

- Museum ***inherited images*** of other buildings like old railway stations, warehouses, and villas. In this case its image is identifiable because of its old features that are one or more generations back.
- ***Unique formal expression*** like that of Guggenheim museum and use of unique materials. The museum is no longer a neutral entity instead it has turned into a spatially diversified piece of architecture. One such example is

National Science, Technology and Industry museum in Paris by Adrien Fainsulber. Polished surface of spherical Cinema adjacent to the building and on the axis of the hall has become a landmark.

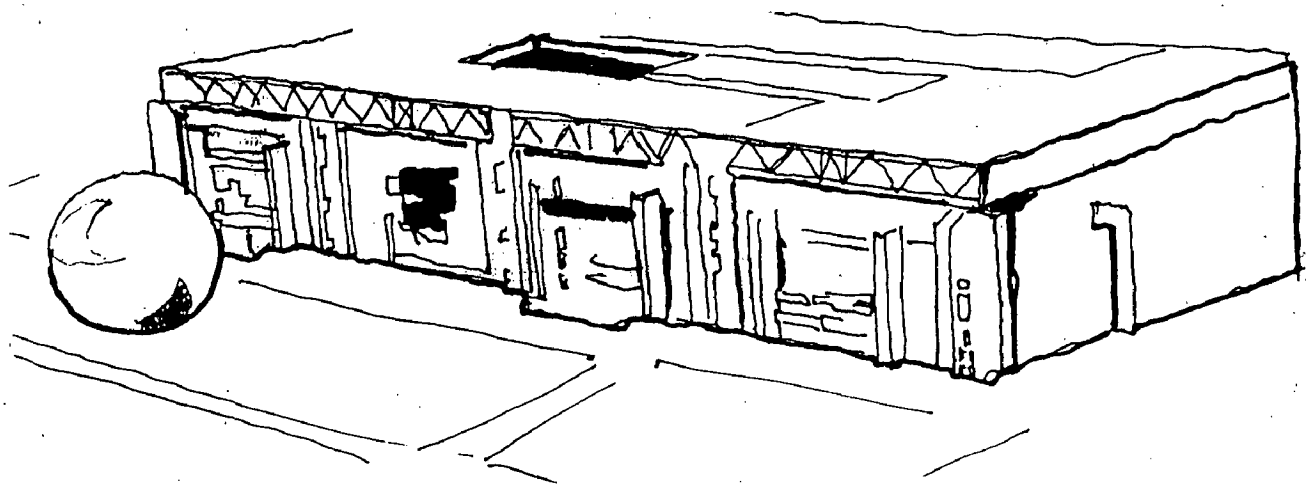


Fig15. National Science, Technology and Industry museum, Paris

- ***Adopting historical forms*** and using them in a new way. The adoption may be in abstract, typological or figurative manner. In Stuttgart museum rotunda which is derivation of a central covered or domed hall in older museums. It is still a central dominant feature but now a new recreation in the form of opening it to the sky is exercised. Again in the same museum the arrangement of galleries is the age-old typology of galleries opening one into another without intervening corridor space.

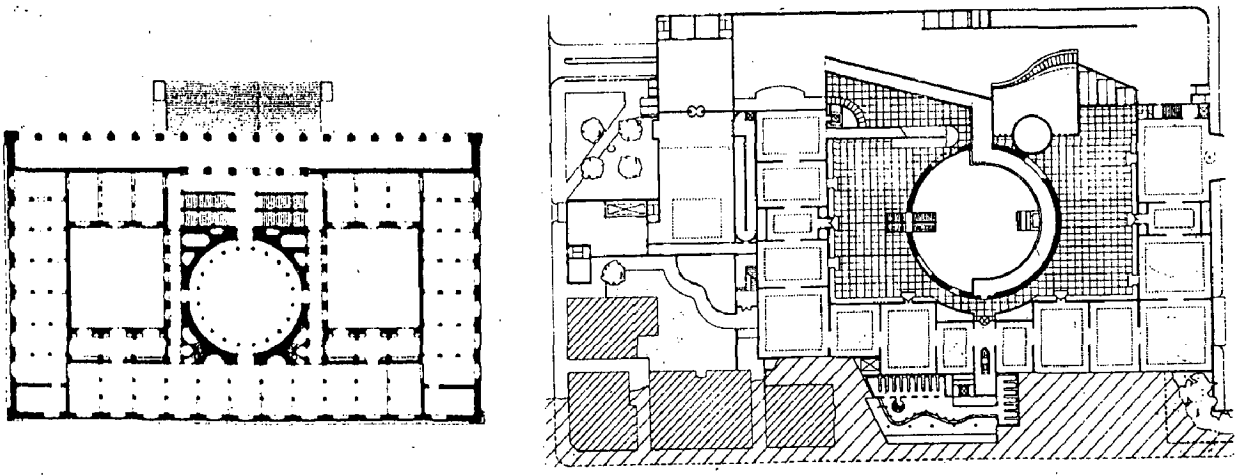


Fig16. Schienkel museum and Stuttgart staatsgalrie [8]

- By acquiring ***dominant site*** within an urban fabric. This may take the form of a building site where it is at the end of an axis of a street or as a culmination of a vista. Even if the building is not architecturally elaborate it will attain its unique image through its location. The location will pull it out of the mediocrity of its architecture. Of course for the museum to have such expensive site its collections must also be proportionally rich.

National Air Space Museum Washington D. C. is an example on Washington Mall, an urban area entirely for American art and history, near the capitol and in front of the national gallery.

- Building ***according to the context*** of the already existing language of story height, material usage, architectural style, fenestration, etc.

For example Guggenheim museum, Bilbao related to the already existing set up through story height. Its gallery block has the same height as the buildings surrounding it while the 50 m high atrium related to building s across the river.

Acropolis Museum

This museum incorporates a view of the acropolis itself through an opening analogous to human eye. The eye is opened on the museum's roof, an inclined marble slab of strong geometry, which seems to come out of ground. This is the main deriving force of this design; it has given it a strong link to the existing urban set up with unshakable character. The choice of the site is to create a visual link to its originator.

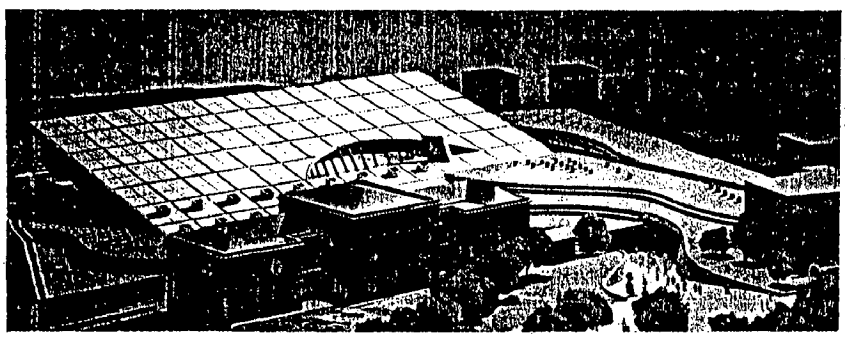


Fig17. *Acropolis museum [16]*

Mikata Jomon Museum *by Tohshihito Yokouchi and Associates*

A museum's first visual impression is that of a sloping lawn with gigantic concrete columns rising above the lawn. Large number or wooden objects excavated from old Japanese times are displayed in this museum. The architects wishing to express the importance of forest, especially the cedar trees, at that time chose to express it in the building image. The formwork of exposed concrete of the gigantic concrete columns expresses the depth of relationship that existed at that time. It is also symbolic representation of the gigantic trees in those times.

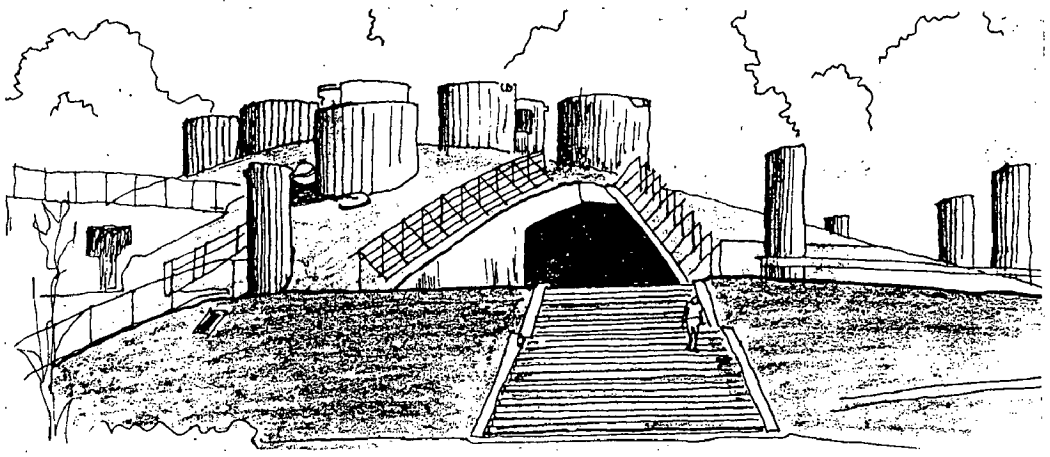


Fig18. *Museum taking image from the forest setting [33]*

- Limitations such as site constraint related to set back requirements, or regulations, architectural performance requirements pertaining to security or museum environment may affect adversely the way the museum expresses its presence in the streetscape. ***Emphasis of entrance architectural design*** in this case can play a dominant role. Projecting the entrance for example right up to where potential entrants to the museum are, reclaims and elevates the museums' presence.

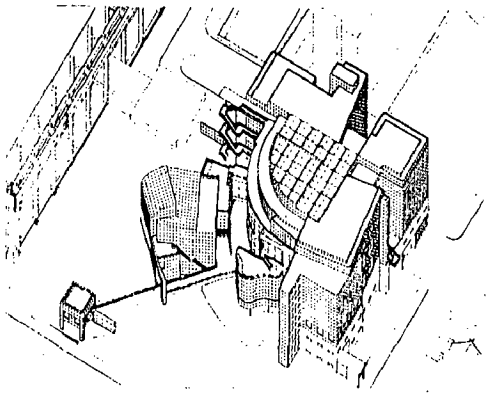


Fig19. *High museum, Atlanta by R. Meyer [8]*

- ***Integrating elements of the city*** like pedestrian way, square, terraces and arcades into the building complex give it a new dimension. A potential solution for museums increasing complexity is seen in this direction.

4.4. Fine Arts vs. Architectural Design

4.4.1. Fine arts and architecture complementing each other

Art and architecture here are no longer separate entities rather they are complimentary to each other. To reach this oneness the architect obviously should have a through knowledge of what sort of art that is going to be exhibited. This could go as far as designing for individual work of art incase of permanent exhibition with finite collection. The desired goal is achieved by using architectural elements as extension of display design. The museum, apart form serving its purpose as museum, it has become an integral part of the art itself.

In Hans Hollein's Monchengladbah spatial organizations and formal expression of the interior of the museum have found their inspiration from individual art themselves.

4.4.2. Dominance of architecture over fine arts

Over elaborate architectural expression if not balanced with the display could compete with, even dominated, the art. This happens mostly in the interior architectural expression and less frequently on the exterior. Design of wall, floor and ceiling surfaces must not stand out. Use of over manipulation of these elements could disturb the necessary peaceful or complimentary backdrop provided by these surfaces. Choice of material, color, textures are also points to consider, once the major decision in the preliminary stage is made.

Total ignorance of what is going to be exhibited beforehand in search of promoting architectural experimentation is to be avoided. Style of the art, type of the art (whether it is sculpture, painting, or graphical art), size of the art, and quantity are all to be considered in the initial design phase.

In this respect Guggenheim museum, Bilbao fails in bringing balance between art and architecture. The architecture is so loud the art contained is not properly given attention.

But the strong craving of architects for expression is a natural appetite which accordingly should be satisfied without subduing the art objects to be viewed. The architect has an ample opportunity of expression in other areas other than where strict functional requirements are not required, like restaurant, circulation areas (as in Stuttagart museum), public areas, etc...

4.4.3. Dominance of fine arts

Architecture now assumes simply a role of being a backdrop for display of art. As the architectural language is calm and silent, the art will find unrivalled position with in the interior of the museum. Traditional museums have this character. Their interior surface is as flat as possible with default white color. The art here enjoys the supreme position it has found. Ex. Stuttgart Museum

4.5. Spatial Organizations

Museum or any other components are composed with certain set of ordering principles enlisted here:

Linear organization: spaces organized following a defined path.

Grid organization: organization about a defined geometry of points placed at regular distance form each other forming a pattern. The grid could take form of square grid, hexagonal or any other regular geometric figure.

Radial organization: spaces emanating from a point at the center, the other elements are like spokes of a bicycle.

Centralized organization: organization of space about a center point or area.

Clustered organization: spatial elements are read as one whole because of their proximity to each other even though they may not be very similar in nature with each other.

Datum: apparently disorganized spatial elements being set into order by the presence of a more dominant spatial presence which will tie them together.

4.6. Varying Exhibition Space According to Characteristic of Fine Arts

4.6.1. Open plan

Exhibition hall is an inclusive general space for all collections. Movable temporary screens provide thematic division and display surfaces. An exceedingly flexible option with future expansion possibility; any prospective size of work of art could fit in this space. Visitors are not dictated to follow certain predefined routes, although there is still a suggested preferred route with in the freedom. Open planning requires long spanning structures and proportionally high ceilinged space.

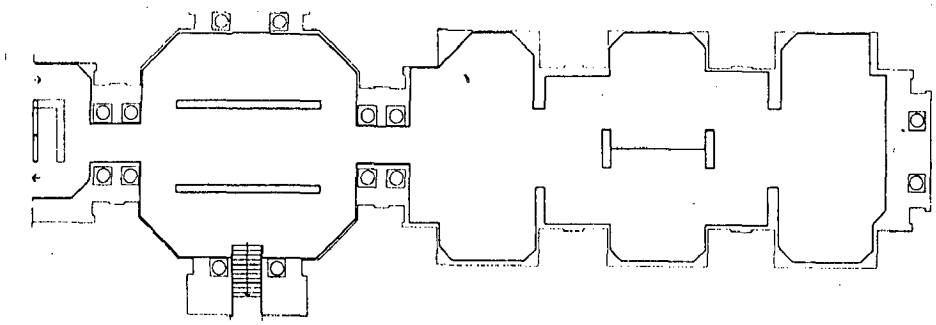


Fig20. *Open planning [1]*

4.6.2. Compartmental plan

It is an imposed network of rooms and corridors. The visitor has not much freedom of having his own circulation pattern. It is possible to have rooms in scale with works of art. This makes it indispensable for small works of art that need detailed scrutiny. This also helps to have concentration for the visitors while viewing the art works. Rearrangement is costly; if change is required. Ex. Stuttgart museum

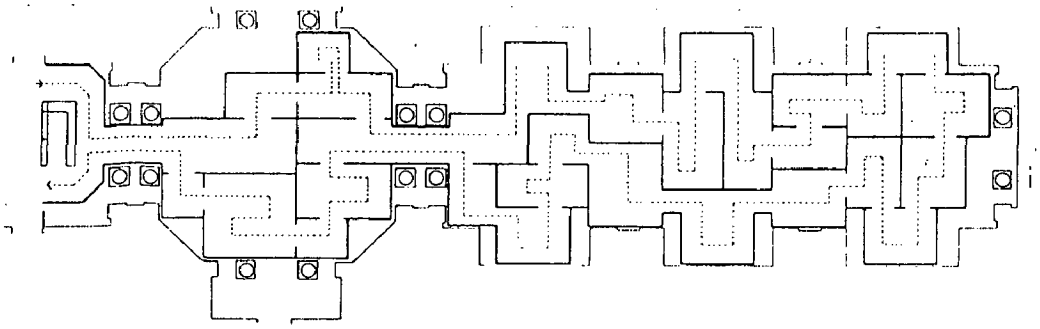


Fig21. *Compartment planning [1]*

In one museum both open plan and compartmental could also be combined for better results.

4.7. Positioning of Circulation Routes in Relation to Gallery Spaces

Basically this refers to the relative positioning between public areas of circulation, seating and relaxation areas with gallery spaces. One thing that is obvious is both spaces are connected to each other horizontally, which could be repeated vertically in multistoried building.

4.7.1. Introverted

Introverted organizes the galleries along the axes of circulation, enclosing the public spaces and presenting to the city primarily blank walls of galleries. This method used to be the traditional way of organizing exhibition halls.

Features of introverted layout:

- Sculptural exterior treatments are possible, which are not always possible with other buildings. This is a way of improving the boring blank surface in sculptural composition of recesses and projections. F.L. Wright's Guggenheim museum is a good example

- Gives secured look from outside. It is also practically less approachable for intruders because openings or light frameworks of circulation areas that are vulnerable elements are concealed from view.
- Monumental solutions are possible by leaving the blank wall as it is. Of course with additional effort to crate interest.

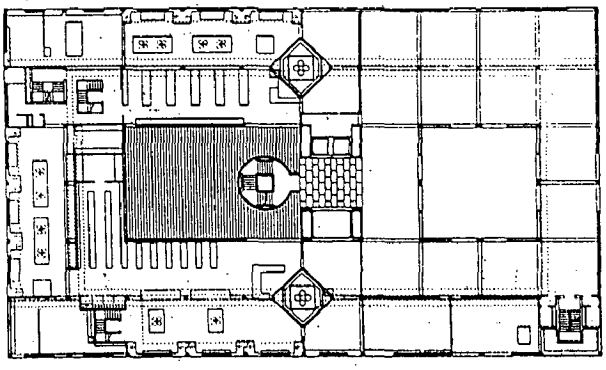


Fig22. *An introverted plan Khan's Yale Center for British Arts and Studies [1]*

4.7.2. Extroverted

Circulation and public areas will take up part or whole of façade. The galleries are now less external features than introverted. Public space is warped around the galleries.

Features of extroverted layout:

- Opens up means of having a lively façade instead of showing dead and blank façade to the public.
- Accentuates museum's civic role by being open.
- Dramatizes museum's main component i.e. circulation or route of visitors.

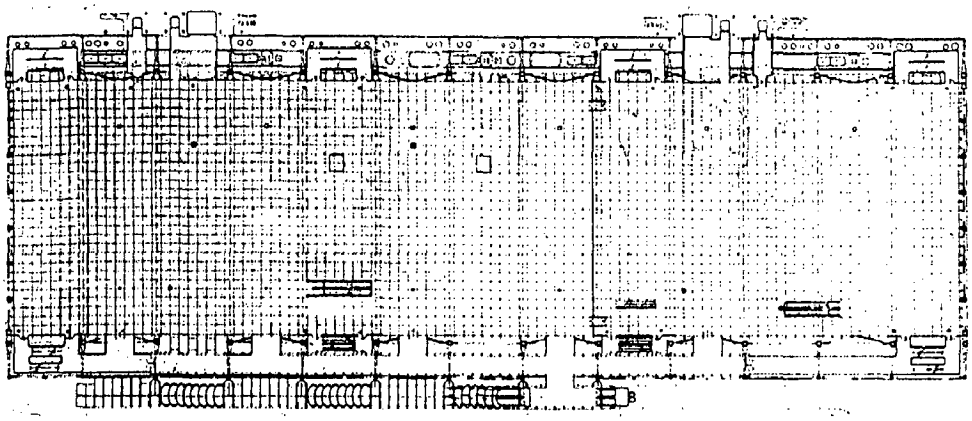


Fig23. *Typical floor plan Renzo Piano and Richard Rogers Pompidou Center, Paris [8]*

Sometimes there is no clear demarcation between the two approaches as is seen in Stuttgart museum. Stuttgart museum is introverted looking from the upper level of the site, the U-shaped galleries enclosing the public areas. It is yet also extroverted when approached from the lower level with flying ramps and rotunda exposed to the public.

4.8. Natural vs. Artificial Lighting

Choice of lighting influence the architectural expression especially roofing and façade treatment so much the architect should be clear about it form earliest design phases. With regard to major lighting choice we can approach the museum design in one of these four ways:

1. Purely artificial lighting without day lighting for illumination
2. Include glazing just for view and connection to the outside, but depending on artificial lighting only to illuminate the exhibits.
3. Add window of roof systems to use day lighting as a major source of illumination during daytime exhibitions.
4. Use both natural and artificial illumination in combination. Here we should not compromise conservation and display of artworks.

4.9. Alternative Fine Arts Museum Concepts

Concepts questing the basic and almost obvious noting that – visitors are the ones who go around the stationery exhibits- that is skipped without ever being reconsidered. These concepts have resulted because of the museums' increasing complexity making visiting museums a very tiresome task. The whole idea behind this concept says " why not reverse the conventional movement; from moving visitor and stationary exhibits to moving exhibits and stationary visitor. Information technology, gaining access in every endeavor of mankind is one solution supporting this concept. Other suggested solutions are physical and kinetic solutions.

Some of suggested solutions are:

4.1.1.1. Theatre

A lecture theatre will take the place of museum. In front of the stage that faces seats of the theatre is placed a revolving drum on to a revolving stage. A large number of pictures in this way could be shown to seated audience. Parallel to the visual presentation a spoken commentary could also be given.

This concept has a major drawback that it is impossible to make comparisons among different works of art. Different people also need different length of time to study a particular artwork that this concept could not provide.

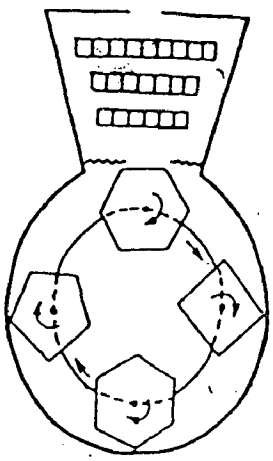


Fig24. *Theatre suggested as museum [26]*

4.1.1.2. Structural turnstile

A gallery where pictures are hung on a turnstile that serves as structural support for the museum at the same time. In the turnstile art works are stored. Through buttons placed outside it, selected three to four art works are flopped out at a time while the others give place to the newly summoned works. Space is also organized around these turnstiles.

This concept could work for few visitors at a time because no two groups keep equal pace wile maneuvering the same button to change exhibits.

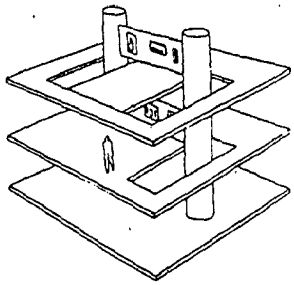


Fig25. *Turnstiles as major museum elements [26]*

4.1.1.3. Tram way

A mechanical devise taking a tour with visitors seated on to it, to move around the exhibits. It moves about the whole exhibits slowly without the visitors ever feeling fatigue.

Fig26. *Tramway as a means of making the route [26]*

4.1.1.4. Virtual museums

Basically the information technology is employed where visitor is seated in front of a display terminal and view, select from a set of options, change them at a click of a mouse, magnify certain details of interest, and get hard copy if needed.

The time seems still far away when virtual museums will totally takeover the conventional museum because: physical objects is more than its image:

- Size, color, scale, real color and other features that could not be digitized.
- The original setting of occurrence of the art while the artist creates it could not be reproduced by virtual museums.

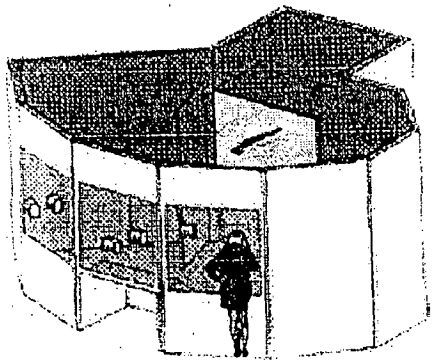


Fig27. *Looking at a figurine through equipment [38]*

This technique works perfectly well for miniature art objects which are too small to be appreciated with the conventional method of viewing art. The miniature can be viewed with magnified size, from different directions of top, bottom, side.

4.10. Future Trends

Recent trends show possibility of combining virtual museum with conventional museum. Outside the main museum proper visitors rather than directly going inside, they will examine images in front of computer screen in a small room (micro gallery)[38], select which ones they want to visit in detail, locate in which gallery they are found and trace the easiest way to get there. At the end of the virtual tour, the visitor will get a printed copy of plan of his own personal tour.

Hence the museums role in the coming ages will shift as a place to see originals after completing the virtual tour. Visitor defined tours will be executed with much ease saving time and energy of the visitors. Space need will also tremendously be reduced, especially those of circulation areas. There will also be a substantial rise of the common space where micro stations could be integrated with the lobby.

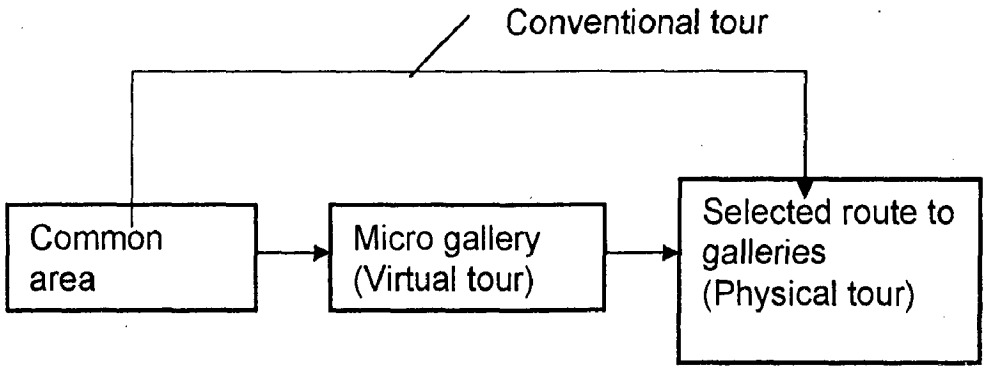


Fig28. *Movement of visitors in combined virtual and conventional museums*

From the discussion so far the architect will have quite clear direction once these prime approaches are dealt with and is ready for the next course of action. Even if these approaches are sometimes definite, at times there are overlapping cases where it is difficult to clearly mark the dividing line between different approaches.

CHAPTER-5

DESIGN CONSIDERATIONS OF FINE ARTS MUSEUM

"Art in the mass, for the masses is an artificial creation demanding the most deliberate handling; essentially it is a piece of exhibition technique."

Michael Brawne (Museum Architect)

5.1. Introduction

In the design of museums the guiding consideration is to achieve balance between architectural aspect of display on one hand in the interest of the public, and the curatorial aspect of preventive conservation (safeguarding) of the collections on the other hand. The architectural solution is judged how well these contradictory roles are brought into terms coupled with the architects' artistic creativity. The guiding considerations could be summed up as 'display while protecting'.

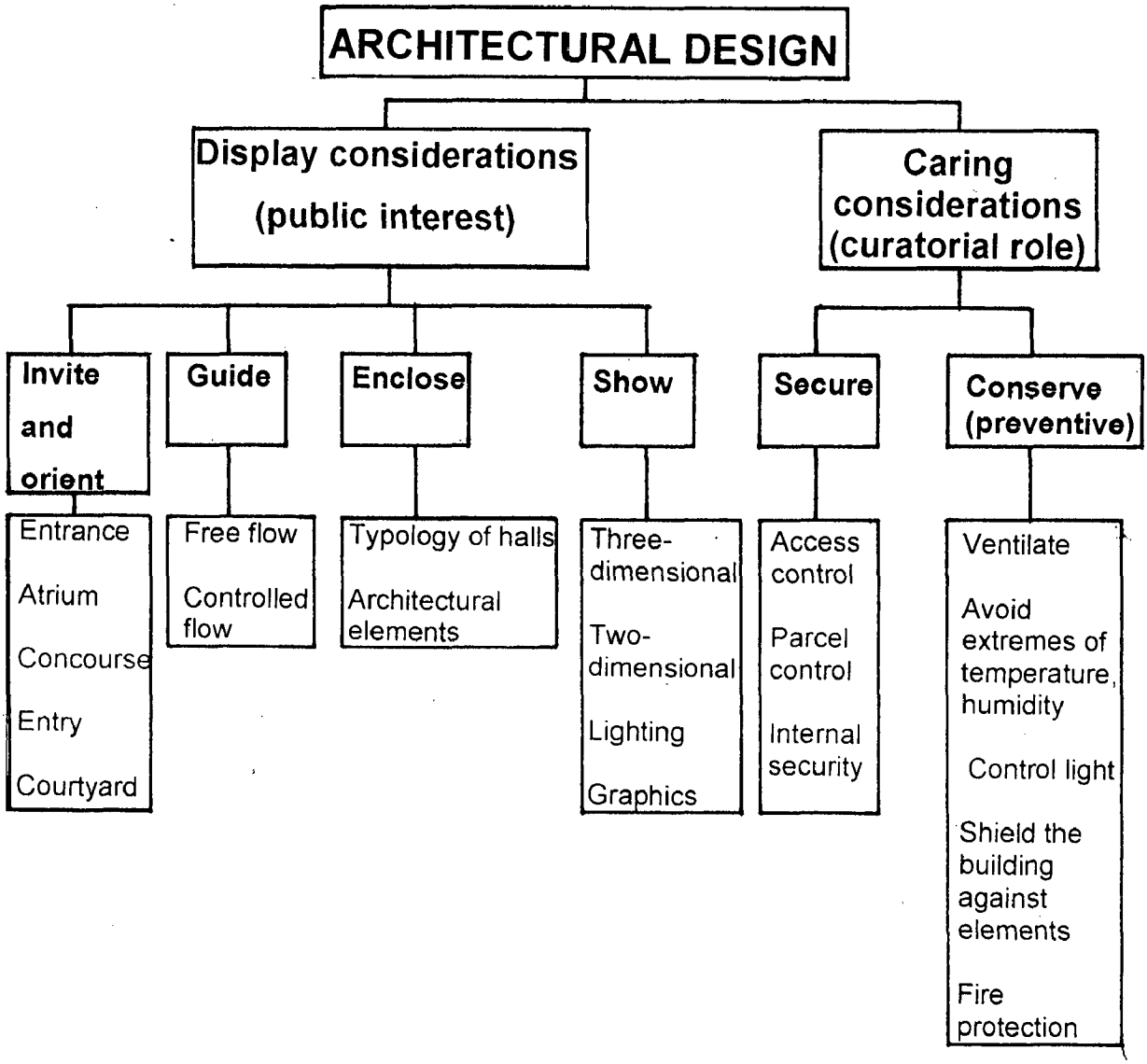


Table4: *Architectural design concerns*

5.2. Site Planning Considerations

Choice of site and designing according to it is an important step for a fuller realization of concepts undertaken or to derive inputs as initial driving force for conceptual development.

5.2.1. Urban site

Site in urban centers is very expensive but it has a very important aspect of public building; it is accessible. Museum going in such a case can be a by-the-way business drawing large number of drop in crowds, which would never have come to such a premise. At the same time museums' contemporary role of multi-functionality can so easily be catered for. Shops, restaurants, other recreation activities could be an important side revenues for the museum.

In such a case the museum plot will be very small, with further stringent local byelaws and regulations. The obvious means of making up for this is building in multistoried to maximize the precious area. The contemporary trend of using daylight will be limited to top story gallery spaces, or using devices like light wells, or passive solar optics technology to illuminate lower floors.

Renovations of old buildings will come into play owing to their central location could be an alternative to building new ones. The building could originally be meant for museums or could be for any other purpose.

The site will be vulnerable for pollution from the busy traffic passing by, which could affect the conditions of the collections adversely. Visitors dropping in could easily carry with themselves dust and other particles harmful for the collections. Wind blowing also could raise current of dust particles. These and other related conditions should carefully be studied for the wellbeing of the collections.
One such example is museum of modern art San Francisco by Mario Botta.

5.2.2. Suburban site

Although it is inaccessible, it is cheap; large plot of land could be acquired with substantial amount of gallery spaces spread on the ground level. Daylight can be introduced with ease in the form of skylights, clearstory windows. The whole building complex could be integrated with nature in the form of courtyards, guiding walls, and other architectural means.

The very festive nature of the site could by itself be an attraction for the public that was lost by its far away location. It is also free of contaminants that are detrimental to the collections, like dust, smoke from traffic, people..
One such museum is Brunnel's collection in Glasgow

5.3. Considerations for Auxiliary Functions

There is no hard and fast rule as what to include as auxiliary functions for museums apart from conditions governing that particular museum. But in general there are certain functions which are repeatedly incorporated as auxiliary functional areas. The relation between these functions and their inclusion is closely tied with other considerations like security, visitor comfort, and management factors. (See Sec.4.2.)

But basically the programs requirements should include the following.

Role	Social, intellectual, educational, entertainment	Display	Care for collections	Supportive
function	• Library • Archive • Lobbies, atriums • Auditorium • Lecture theatre • Shops • Theatre • Restaurant	• Galleries • Seating areas • Circulation route	• Security personnel office • Parcel control • Outside Mail room • Cloak room • Smoking area outside secured area • Loading bay • Rest rooms • Art store • Parking areas sufficiently segregated from gallery	• Offices • Administration • Restoration laboratory • House keeping

Table5: *basic program requirements*

5.4. Considerations for Main Functions

From the schematic relation in chapter-2 about 50% of the fine arts museum is composed of gallery spaces and public circulation and waiting areas, which is at the same time the core of what museums are.

5.4.1. The public areas

Because of the increasing diversity and complexity of museum program there is now a need of universal space from which a visitor would easily orient himself to which ever function easily whether it is a gallery, cinema, restaurant, or library.

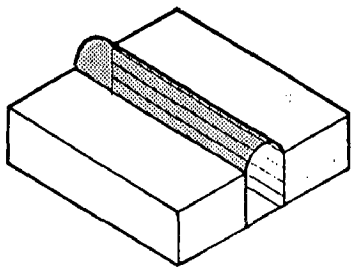
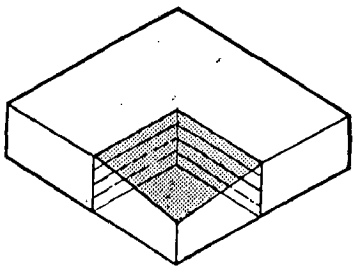
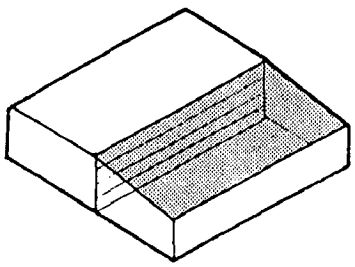
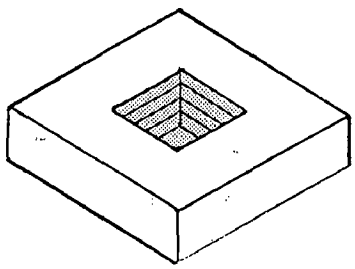
Museum going nowadays is not just to visit works or art; it may be to dine, to socialize, to do research, or to spiritualize. Therefore, a universal orientation space in the form of atrium, concourse, rotunda, or courtyard is indispensable.

5.4.1.1. The atrium

The museum and gallery increasingly resemble other building types in which circulation, ease of movement, display and purchase are important: like shopping center and airport. In this respect the atrium plays a great role in achieving these goals.

Atrium is a 'spatial expression of human activity' [27]. Apart from being a universal orienting space, it has many more architectural purposes. In such building of civic importance atrium provides attraction and focal point for sprawling and complex functions. It can also be used to display oversized art works, especially sculptures.

Although it is possible to come up with limitless solutions, we can broadly have the following classifications. These are atrium forms that show how this space relates to the main building proper: [27]

Atrium type	Conceptual sketch	Suitability for fine arts museum
1. Linear atrium form going from one end to the other through the building complex.	*Linear atrium* 	Need of thinking about focus for the space. Visitor tours can be integrated with the directional quality of the space.
2. Partially enclosed atrium taking up one of the four corners.	*Partially enclosed atrium* 	Can contribute to the external image of the museum , can become a dominant element in extroverted layouts like in National Gallery of Ottawa (see Ch. 3)
3. Lateral form attached in one or more sides of the building.	*Lateral atrium* 	More than any other types of atriums it plays a role of being external as well as internal element
4. Totally enclosed	*Enclosed atrium* 	Can serve as a big internal public, as well as an extension of exhibition galleries

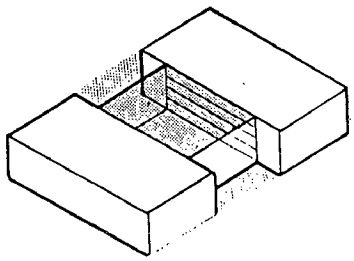
5. Connecting form between set apart forms.	*Connecting atrium* 	It is a good solution for expansion undertaking where the new volume could be united with the old one with greater ease.

Table6: *Atriums in fine arts museum*

Atrium plays a role of an urban open space in a way it is convenient for pedestrian movement. Just like an urban open space is a space from which to access the buildings surrounding it, the atrium is a common reference area to all other interior functions so planned. As such it also integrates and organizes social activities.

The atrium shape could be designed as independent of the building envelope. Or it could be designed to take certain formal organization dictating the building's shape. Both procedures provide solutions flexible enough for the architect to work with.

The atrium's volume provides a contrast with the low ceiling and intimated gallery areas, and helps to relieve museum fatigue psychologically.

5.4.1.2. The rotunda

An outdoor large space fully or partially enclosed. The enclosure could be just enough to classify it as a defined outdoor space. This space will serve as a reference by opening it up to circulation route that will be glazed to have view towards it.

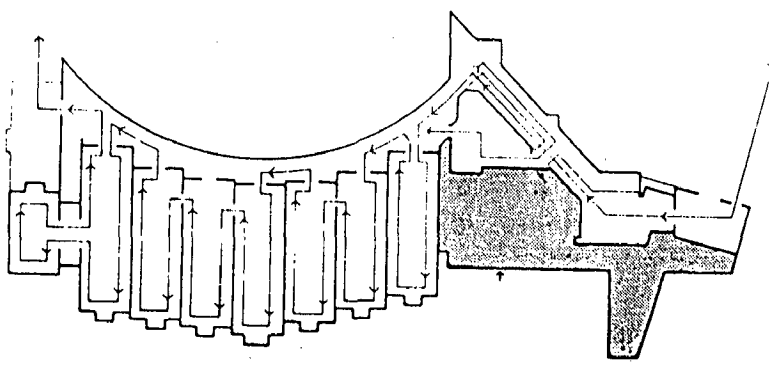


Fig29. *National Archaeological Museum, Amman by M. Brawne [24]*

5.4.1.3. The courtyard

Deep planned museum plans could be opened up for natural lighting and for interference of natural outdoor greenery through cut outs in the form of courtyards. Courtyards could be closed on all sides or U-shaped with three sides closed for acceptable enclosure. Apart form giving the necessary enclosure, they could also be placed as extensions of gallery spaces for outdoor sculpture court. To gain dramatic visual effect staircases and ramps could face this space at the same time fulfilling their purpose of referencing.

5.4.1.4. The concourse

Concourse is an open usually double or more storied linear space as an extension of lobby space. It is a sort of corridor or circulation area broadened to for aesthetical purpose, or to accommodate seating, and crowd waiting area. Even is smaller museums where courtyards are not possible concourse is a must; functionally it will cater for peak coaching load without creating congestion.

5.4.2. The route

All routes are almost always linear in nature. And they all have a starting and a destination point. Keeping these facts in mind there are certain configuration of routes which are influenced by themes by which the exhibits are arranged, choice of spatial organization of exhibition halls (see section 4.5.), and interest of the visitors. The configuration of routes may reinforce spatial organization by paralleling its pattern. The configuration may contrast with the form of the spatial organization and serve as visual counterpoint to it. Configuration of routes once understood will be of great help in orienting oneself within the museum complex because spatial organizations will be made clear.

Routes are not only to view art objects; approaches, break or rest areas are also important design elements that are more or less part of the route. Approaches could be by ramps, lifts or steps. These elements must be used to accentuate museum experience. They are to create a sense of expectancy for the visitor, whether it is at the beginning or at transition to other galleries. Rest areas, either on the path of the route

or as offshoots, should not be distractions of the route. Preferably comfortable seating, natural lighting, and view to outside should be provided.

5.4.2.1. Ordering exhibits

It may take one of the following forms:

1. *Chronological:* in fine arts museum the works of art may be arranged according to the year of creation of the artwork. In this classification we could have; prehistoric art, medieval art, modern art, etc.
2. *Stylistic categories:* artworks may be grouped according to the style to which they belong. Ex. Cubist, minimalist, futurist, surrealist
3. *Geographic:* grouping according to geographical location where that particular work of art is made. Ex. European art, eastern art, African art
4. *Dedication to works of a single artist:* different individuals have prominent roles for the start of certain styles of art. Picasso is pioneer of the cubism style. Such well known personalities may have quite a large number of collections that they need separate galleries, if number of such artists in single museums is significant their works might be arranged based on this theme. Eg. Roding Museum, Philadelphia, Thorvaldsens Museum, Copenhagen.

Based on the above three conditions route of visitors within the museum complex may be:

1. Free route
2. Controlled route
3. User defined route

5.4.2.2. Free route

The visitor is not strictly guided to follow certain predefined paths, although there is an indication of a preferred route. This kind of route is characteristic of pen plan museum galleries, where the screens are freely arranged on the floor.

5.4.2.3. Controlled route

The visitor has minimum freedom to go freely with in the museum complex. The visitors will be led to follow predefined routes. Sometimes this kind of route will be the only

solution where sequence of art objects is made to tell a story. Here the floor plan of route is a reflection in physical terms of the unfolding of the story telling.

Partitions, screens (in open plan), screens and sequence of rooms are ways to achieve route control of visitors. In open plan galleries route could be suggested by floor pattern to guide visitors.

Depending on the type of exhibits and their arrangement controlled route and free route might be combined in a single museum to utilize positive points of both features.

5.4.2.4. User defined route

Arrangement of exhibits one decided upon could be rigid as far as freedom of visitors to have their own theme of going about the exhibits is concerned. For example in museums where the art works are arranged chronologically a visitor may want to study the same collections with a different perspective say geographical occurrence of these art works. Employing architectural spatial organization could more or less solve this problem.

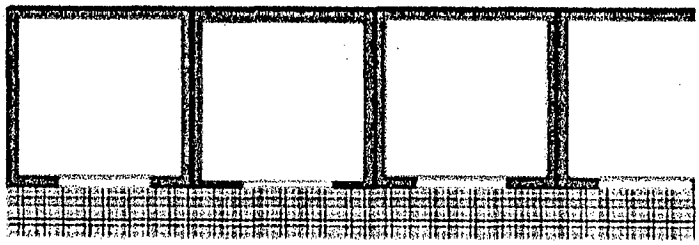


Fig30. *Plan layout not suited to user-defined route*

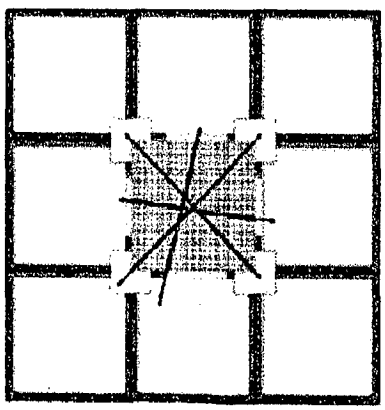


Fig31. *Plan layout facilitating user-defined route*

These are diagrammatic representations of typologies of halls. The first one is linear with collections arranged from one gallery to the next chronologically. For instance for a

visitor who want to study the collections geographically, it will be quite difficult with a need to go back and forth on this linear arrangement. But the second one will some how reduce this problem because of compact layout and common central space. Similarly, radial, central, clustered organizations simplify selective visits by virtue of their compact common space which could be allotted for common public space. Therefore such arrangements are quite good for user-defined routes.

5.4.3. Typology of exhibition halls layout

The contemporary fine arts need enclosures of various types. From multifunctional open plan to individual rooms. Both types of galleries are quite essential to house every variety of fine arts. For varied size of collections on a theme, open plan is the more suited, where gigantic art objects may be found. Where as for paintings; individual rooms are ideal settings. Even though modern movement, by its opponents like Mies Van Der Rhoe, advocated multiuse open plan for the purpose of fine arts museums individual rooms are still practicable. Therefore for a better combination series of contained and released spaces would be practical solution.

5.4.3.1. Open plan gallery

Main outstanding feature of this gallery type is its virtue of flexibility, adaptability, and expandability. For this the structural system chosen should be capable of spanning unobstructed distance some practical steps are: freeing internal space from obstructions like service, circulation, and other support functions. Pushing circulation spaces to corners increases flexibility.

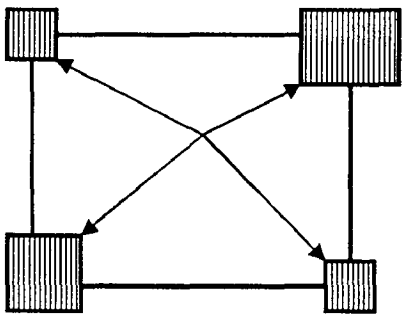


Fig32. *Corner circulation.*

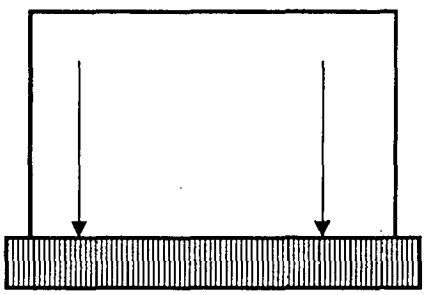


Fig33. *Linear circulation along a façade*

5.4.3.2. *Contained and open / contained gallery*

In the case of individual galleries, the question of relation between adjacent galleries and the galleries as a whole comes into play. The way rooms are laid out influences route or flow pattern. These are common typological classes.

1. Long tunnel like undivided single gallery spaces where art works can be seen in sequence on both surfaces.

Fig34. *National Gallery of Modern Art, New Delhi*

1. Rooms of same or different sizes opening one into another without corridors in between. E.g. National Museum, New Delhi

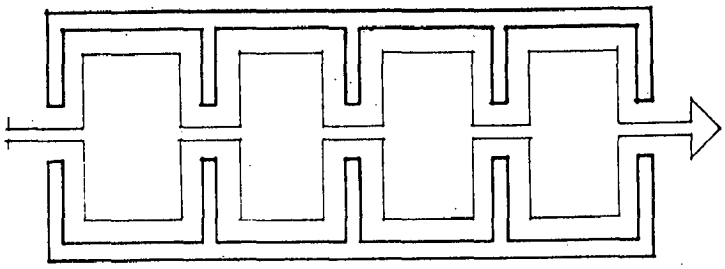


Fig35. *Galleries one opening into another*

2. Chain of corridor like spaces one after the other, a more complex version of the above.

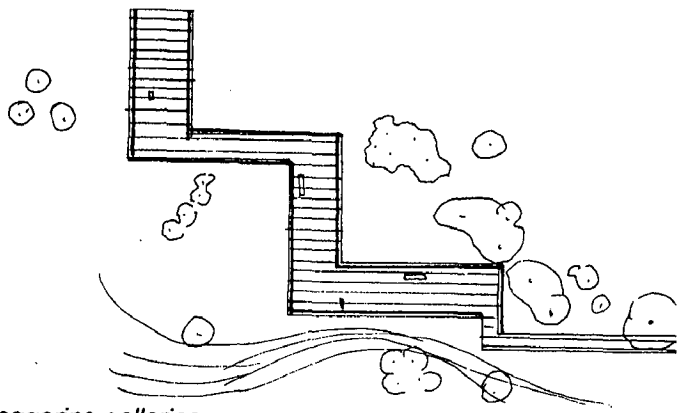


Fig36. *Chain of staggering galleries*

3. A variation of the above layout is seen in Solomon Guggenheim Museum where continuity and linearity is maintained spirally in three dimensions.

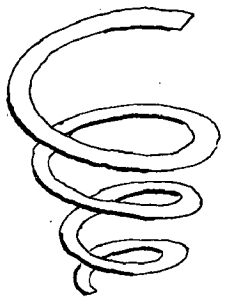


Fig37. *Continuity and linearly in three dimensions*

4. A linear and continuous main and defined route with variations along the path through branching off and see the rooms which lie to the side of it. This system allows a more or less continuous viewing by going through the exhibition galleries or for selective viewing of one or two galleries by going only to these from the corridor.

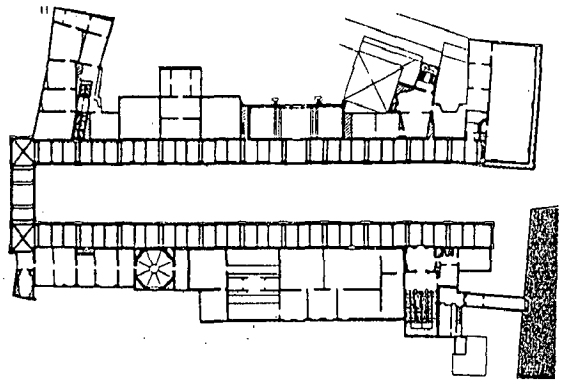


Fig38. *Main route with branching routes*

5. Exhibition halls piled up one upon the other around a central hall with identical circulation system on each floor. The above corridor in layout (5) can be combined with a staircase in multistoried galleries, where the same selective viewing from a dominant circulation zone is possible. Eg. National museum of Ethiopia

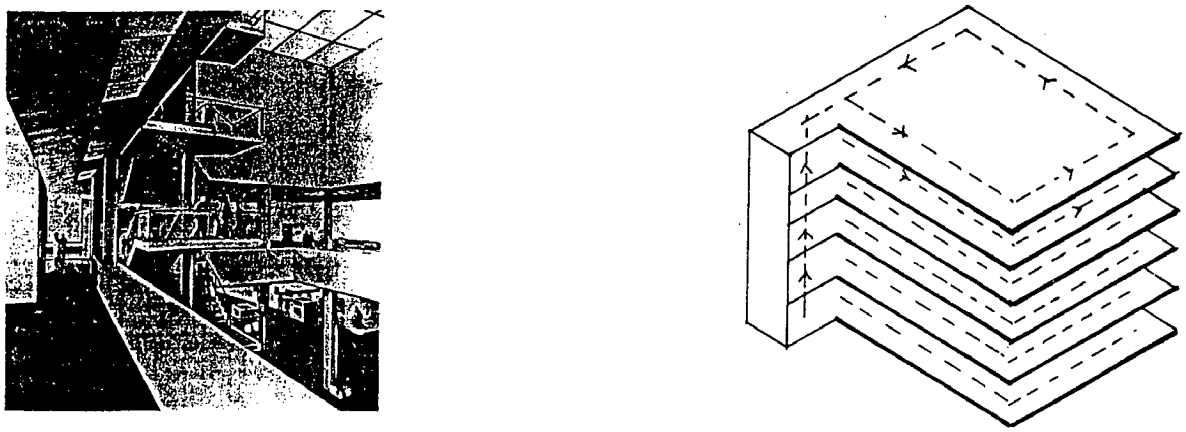


Fig39. Multistoried with common vertical connection

The last two types encourage selective visiting options for the visitors. These topological relations are not by themselves final steps for success of museums. They only suggest the route and the way exhibits are arranged for display purpose.

5.5. Considerations for Display Aspects

5.5.1. Display techniques

Display is presenting artwork in a suitable technique to the visitor that will show all or best qualities of the object.

Physiological capacities of the visitor should be studied beforehand among other things. This is expressed by field of vision. It is a way of arranging display material with respect to human height and cone of vision.

Every fine arts object could be shown using either as three-dimensional or two-dimensional display techniques. Two-dimensional technique is suited to most paintings and relief art works, whereas three-dimensional is suited to sculptures or to a three-dimensional art objects. Three-dimensional technique enables to experience all the three dimensions by going around the object.

Even if objects don't need enclosure just for the sake of relating in scale to the room, it is good to use showcases for display of small objects.

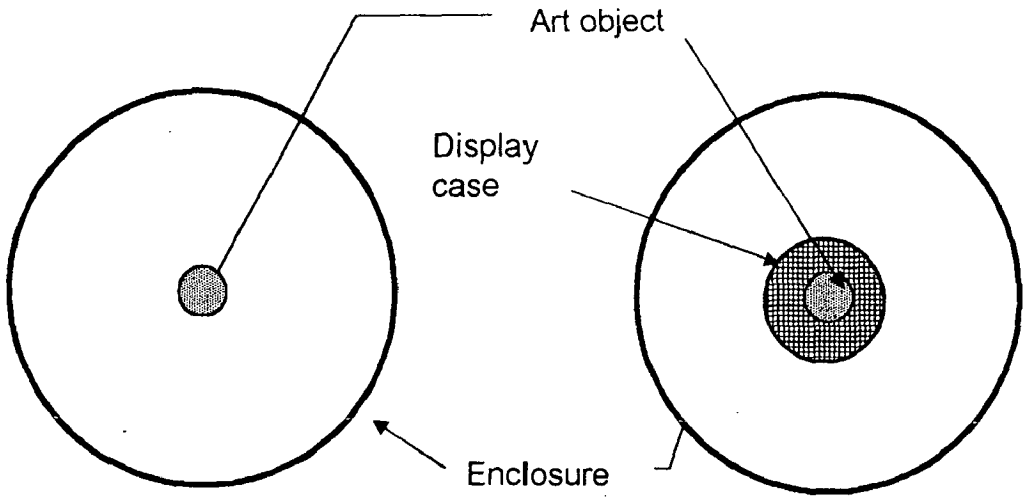


Fig40. *Advantage of using display cases as scale mediators*

Some objects could stand by independently themselves to be viewed without employing either two or three-dimensional technique.

Generally while displaying either two or three-dimensional objects the following should be observed:

- Isolation can make an exhibit more recognizable than the rest. This can be done for major works of art which need prominence over lesser important works.
- Among group of exhibits the one that is significantly big will seem important.
- Color and form can also be used to emphasize certain exhibits.
- Corners of walls are best for small objects that people may look closely without disturbing each other.
- If many rooms are used, connected by visual axes, place objects with strong form and color should be kept at far ends.
- Rotating exhibitions from time to time will help to avoid boredom for frequent visitors.

5.5.1.1. Two-dimensional display system

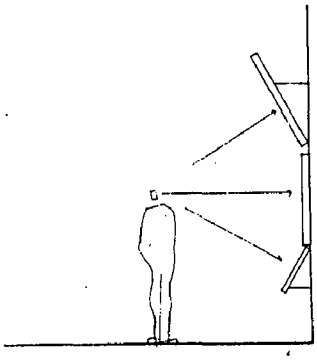
5.5.1.1.1. Field of vision

Conventional technique: two-dimensional work of art will be hung at eye level. The visitor will stand where the object will fit within his cone of vision for a general view. (See appendix)

Other techniques:

- By tilting towards or away from the visitor an object could be hung below or above the eye level, as long as the object falls with in the cone of vision at normal visitor position.

- With the visitor moving away from the display surface until the object fits into his cone of vision objects hung above eye level could be seen. This technique works where there is enough room height and where there are oversized objects.



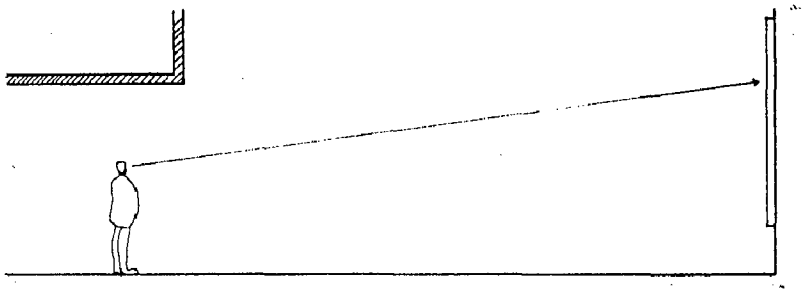


Fig41. *Object can be hung above or below normal eye level*

Fig42. *Moving away from the wall helps to view large paintings*

5.5.1.1.1.1. *Display screens*

Screen represents all temporary display surfaces that are not part of the permanent enclosure. Apart form holding the art works in position; they will also serve as suitable backgrounds against which the artworks are better experienced. They also cover up movement on the other side that will be distractive for concentration of the observers. Further they also serve as guides along the route to be followed.

Screens could also be used as additional problem solving elements related to interior organization of gallery spaces. Two examples of space saving techniques are discussed here:

Screen shelves: special screens which roll out of a shelf when needed to be seen and rolled back after use. Objects put inside these shelves also will have less time of exposure to lighting, hence this system is used to hold objects like water color, silk etc, which might easily be affected by over exposure.

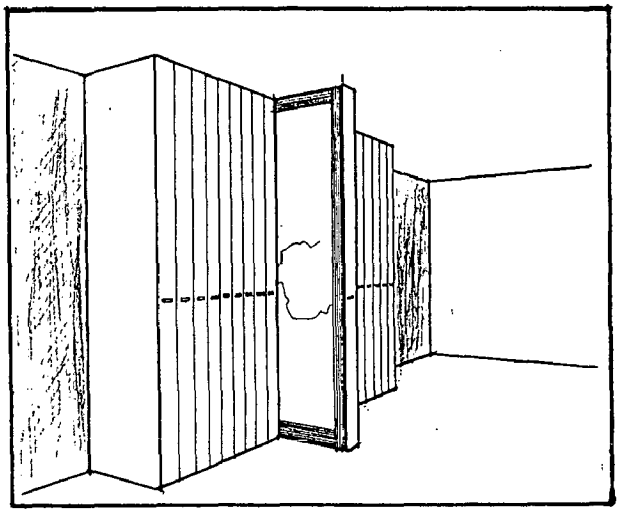


Fig43. Screen shelves

Movable screens: it is not easy to perceive the unlimited design possibility inherent in such system. This is left to the discretion the designer. Here one example, a design by Phillip Johnson, is presented to see the fertile ground for possibility of such systems.

From the onset the architectural approach itself seems to sprang from the display technique, which shows us mastering display technique is a prerequisite to arrive at original solutions, inside out approach advocated in this research. The form adopted is just an expression of the display technique; a cylindrical form. Radial screens are placed between circular guiding rails on the floor and ceiling. The visitors will roll each screen radially, just like a reader turns over pages of a book.

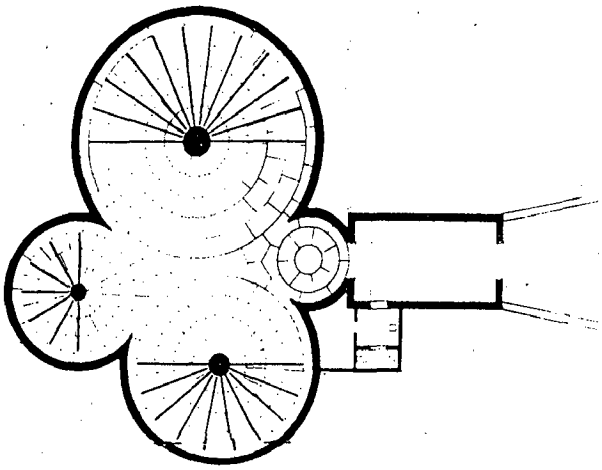


Fig44. *Paintings hung on screens suspended from circular overhead tracks on outer and inner edge [1]*

Types of screen systems:

1. Those that need support either top, bottom, or both top and bottom.

These systems need ceiling, or floor or both elements capable of taking the structural fixing as well as load of the screens. In the case of ceiling support, because they usually are extensions of the roof structure, the structural gird dictates their poison.

For those types supported between floor and ceiling, there could be no direct top and bottom fixing, instead the screen could be connected to rigid ceiling and floor.

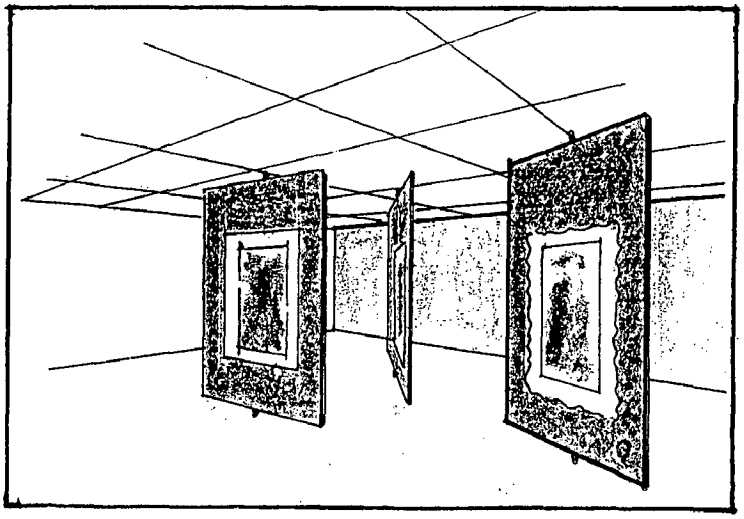


Fig45. *Screens supported between floors and ceiling*

2. Stable screen systems because of their geometry. (Staggered system)

This is the simplest of all systems. The disadvantage is because it has to make frequent and too many turns, it is not possible to have one long continuous surface. Otherwise it has the following advantages.

- Light structure can be made to have strength.
- Visibility from multi directions
- Could fit any shape of room because angle between the panels can be varied.

3. Stable screen systems because of their size.

This system is not frequently used because it is bulk due to its depth dimension, making it difficult to store or move. Its advantage is it can be adapted to display three-dimensional object as well, using its depth dimension with cover of glass on the face of the screen.

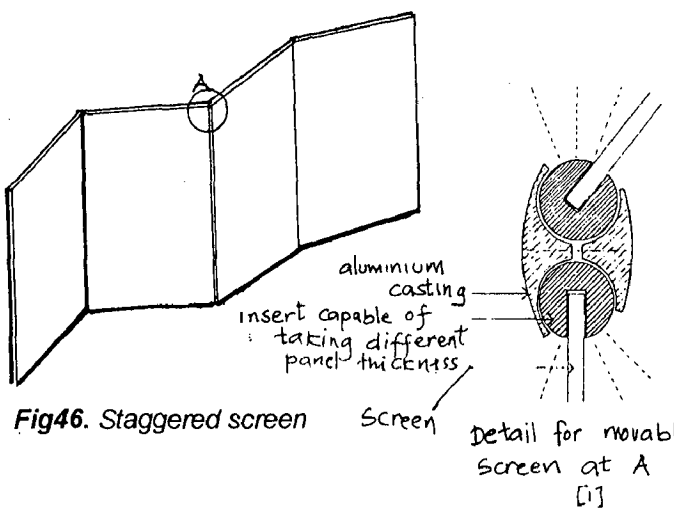


Fig46. *Staggered screen*

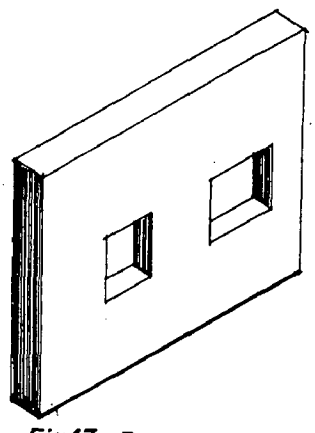


Fig47. *Deep screen*

5.5.1.2. Three dimensional display system

To view object in three-dimension objects should be put on pedestal or put in showcases. Visitors should be able to go around the object of display or all round view of the object should be seen. The fate of the object's appeal is dependent on the way we choose display techniques that fits the nature of the art object.

5.5.1.2.1. Pedestals

It is a raised solid pane that will bring the objects to suitable height to be seen. It defines a space, out of the general exhibition room, belonging to the art object. It also gives stability to the objects.

Small objects of varying sizes are best displayed on a common one big pedestal rather than providing for each one. Project small objects into the gallery so as to make them significant out of the danger of being ineffective because of the dominating large plane of display.

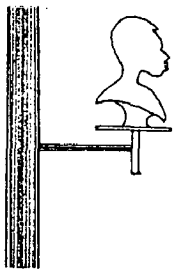


Fig48. *Displaying small objects*

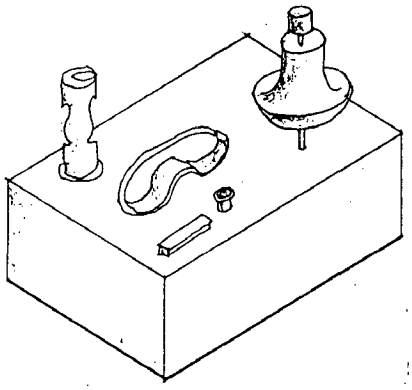


Fig49. *Display of varied size objects*

Material for making pedestals are usually timber or metal frames, covered with plywood or fabric and painted. Or in the case of more permanent requirement, pedestals could be made out of stone or concrete.

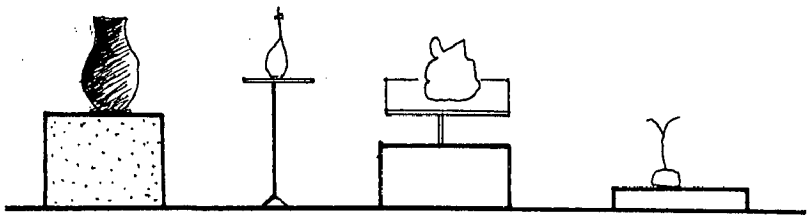


Fig50. *Support types of pedestals*

Types of pedestals could not be limited to certain grouping because there are endless problems to be dealt with accordingly.

5.5.1.2.2. Showcases

"Show cases can be considered as miniaturized and protected rooms." [1] Like galleries they have ceiling, walls, floors, pedestal, services and screens inside the glass enclosure. The problems are also similar.

It acts as a protective room for the art objects and also relates objects to the room enclosure in scale. Show cases give protection against:

- *Theft:* covered objects inside glass are not easy to pick up
- *Dust and insects:* because of the tight joints between the glass planes.
- *Adverse climatic condition:* it is economical and easier to regulate conditions inside the cases to suit the exhibit than trying to regulate conditions of the gallery.

Lighting showcases

- Inside or outside considering conservation aspect.
- Direction of lighting cases: from the side, the top, or from the bottom (usually for glass shelves stacking objects vertically.)
- For objects that don't need to be seen around the fourth wall of the display case can be made opaque to the advantage that it can be used as a backdrop for objects and at the same time providing the necessary structural support.

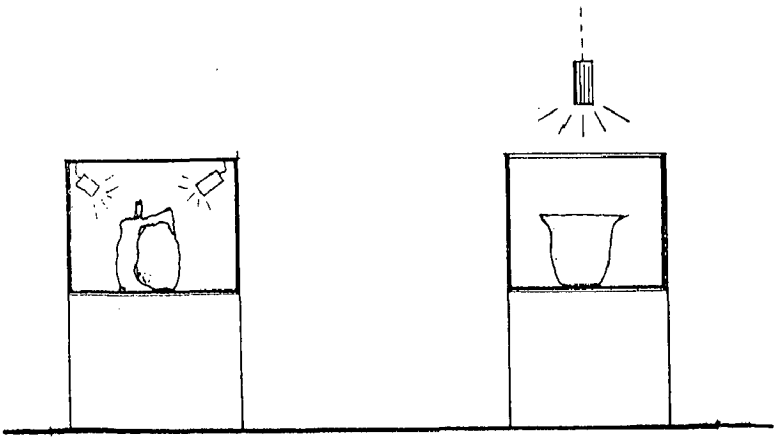


Fig51. *Lighting can be outside or inside the showcases*

Viewing art

Apart from the customary ways of displaying art objects, it is possible to have varied other options that will best bring out good features of the art object.

- Elevated views of things on ground that are supposed to be not walked upon.
- Art objects suspended in the air form ceiling
- Stretched between floor and ceiling by means of chains

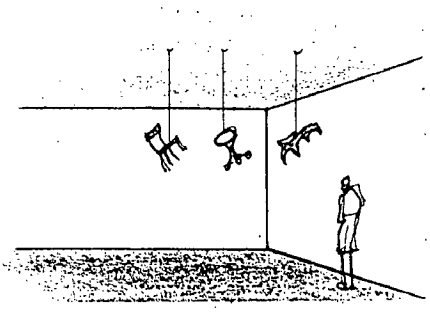


Fig52. *Suspended*

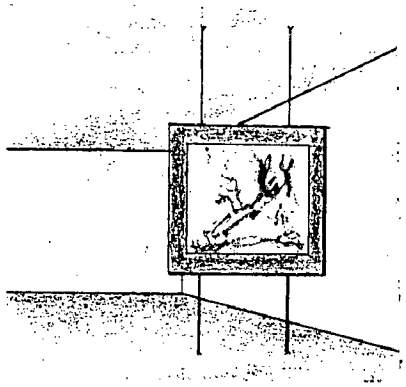


Fig53. *Stretched*

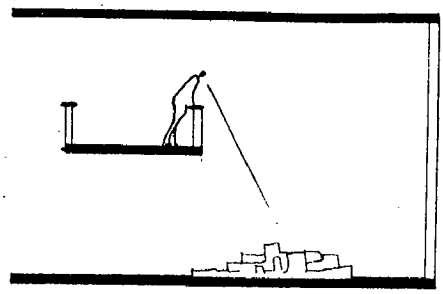


Fig54. *Elevated views*

A good display design has a character of bringing into view the most desirable features of an artwork. It also creates the missing link between art and architecture.

5.5.2. The role of architectural elements

Interior architectural surfaces apart from forming an enclosure, are also backgrounds for display they also carry necessary services. They are designed to respond to different nature of exhibits in their position.

5.5.2.1. The floor

Qualities expected of floor are sound absorbing qualities, strength, appearance, receiving fixing details and comfort. Choice of material should be checked for most of these desirable characters.

It is a surface on which the visitor walks, the pedestal and display case rest and also a backdrop against which objects are seen. The last point is especially true of large sculptures put on the floor without or with minimum pedestals.

In general it is good to make minimal interference on neutral floor surface through pattern or material. Too much pattern and surface differentiation also limit the way exhibits are placed over the floor.

Floor finish

Through careful selection of floor finish it is possible to assist museum experience, the subtle change of material, texture, reflected through acoustic and tactile experience could tell change of exhibits or theme from one gallery to another.

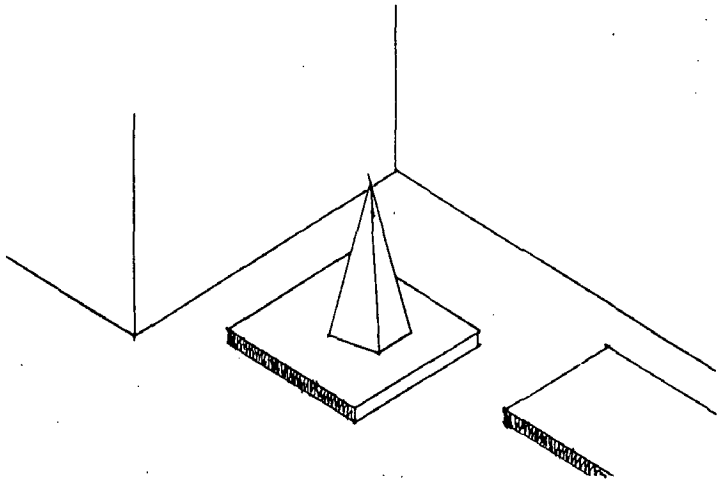


Fig55. *Raising floor just enough to demarcate it from its surrounding will make it into a display stand*

- Make minimum pattern or surface type on the floor to allow freedom of placing pedestals, stands etc.
- Use differentiating floor finish as subtle technique of telling transition between different exhibition halls.

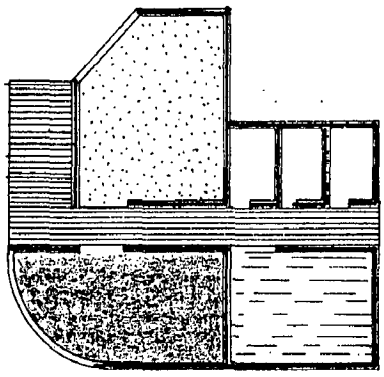


Fig56. *Material differentiation as additional dimensions to museum experience*

- Make minimum surface change through texture, material on the floor, to allow maximum freedom of placing exhibits on the floor. The three most common categories of museum materials are marble, stone or tile; hard wood; carpet.

Each material group will be selected in reference to the particular problem at hand.

5.5.2.2. The wall

Due to our position and cone of vision, of all the three surfaces the vertical wall surface is the most important one. This is the most used background for display purpose. Material selection, textural qualities are considerations for good object background relationship.

With scarcity of exhibition area we have to find ways of maximizing display surfaces by simple manipulation of wall systems. Ways of maximizing display surfaces by planning involve using surfaces above or below the customary eye level by maintaining proper angle of tilt. Further In linear spaces *staggering the wall* surface results in getting more length of display wall in plan; also constructing *secondary walls as mounting surfaces* to be used on both sides in addition to the main enclosure will greatly help to have more surfaces

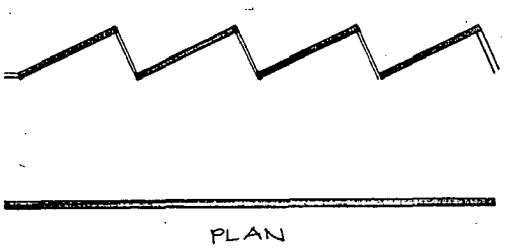


Fig57. *Staggered layout*

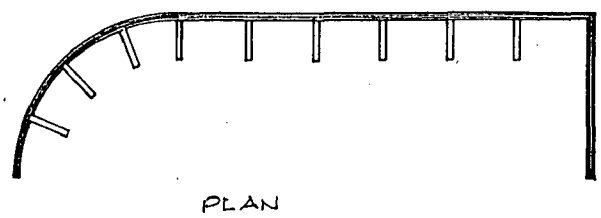


Fig58. *Secondary display walls*

Mounting methods

- Direct fixing by screwing on structurally strong background. The background is usually permanent wall of the museum. But this method is awkward if we want to make rearrangements because each time the holes have to be smoothened out. A better technique is to have another semi-permanent panel of fabric or plaster board fixed onto battens that are in turn fixed onto the permanent wall. Therefore each time a change needed to be done, it is a matter of replacing fabric or plasterboard.

- Top rail at the edge of intersection of wall and ceiling that support chains which in turn support paintings. Allows for quicker installation. The height as well as lateral position can be varied. The support system is freed from the background structurally.

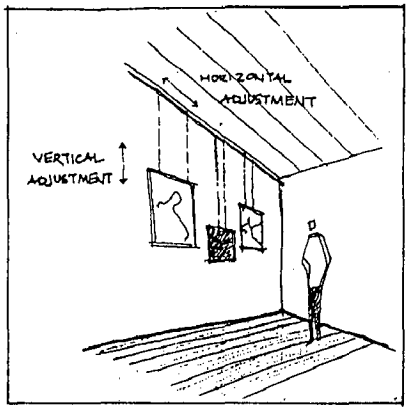


Fig59. *Painting hung form chains*

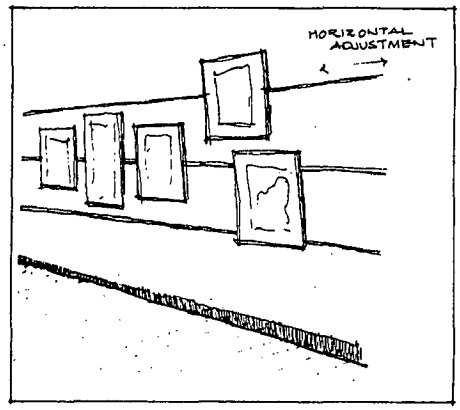


Fig60. *Rail hung paintings*

- Horizontal rails let into the wall serving as support; lateral position of pictures can be varied.

- Short length of chains fixed at the back of the frame for heavy pictures. Support is needed at the bottom of the picture for additional stability.

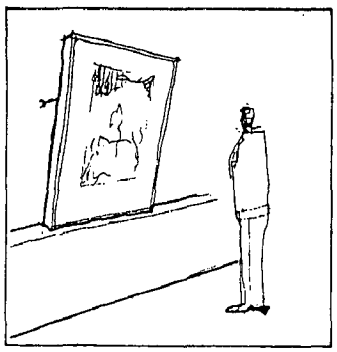


Fig61. *Hanging heavy pictures*

- Capacitive system can be adapted for hanging the exhibits in an electric field without installation working in the exhibition halls.
- Carpeted display walls are used to permit arrangement of the exhibits without visible damage to the walls.

Visual concentration

- Avoid dado or any sort of division at the middle not to take away attention form the hung pictures.

- Avoid vertical interruptions such as joints between panels or placing of columns so that they show on wall surface.
- Avoid drawing attention to specific points or areas by placing switch clock security devices within cone of vision if unavoidable you can make it as an art object itself.

5.5.2.3. The ceiling

The probability of objects being seen against ceilings is less. Therefore ceiling is an ideal surface for non-display supportive functions like lighting of both natural and artificial, ventilation, acoustics treatment, HVAC, and security. It may also carry fixing details for screens and other display items.

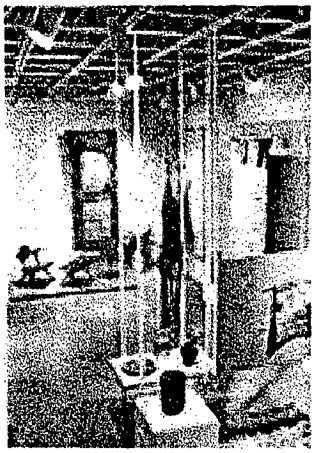


Fig62. *Ceiling plane as support for display element [8]*

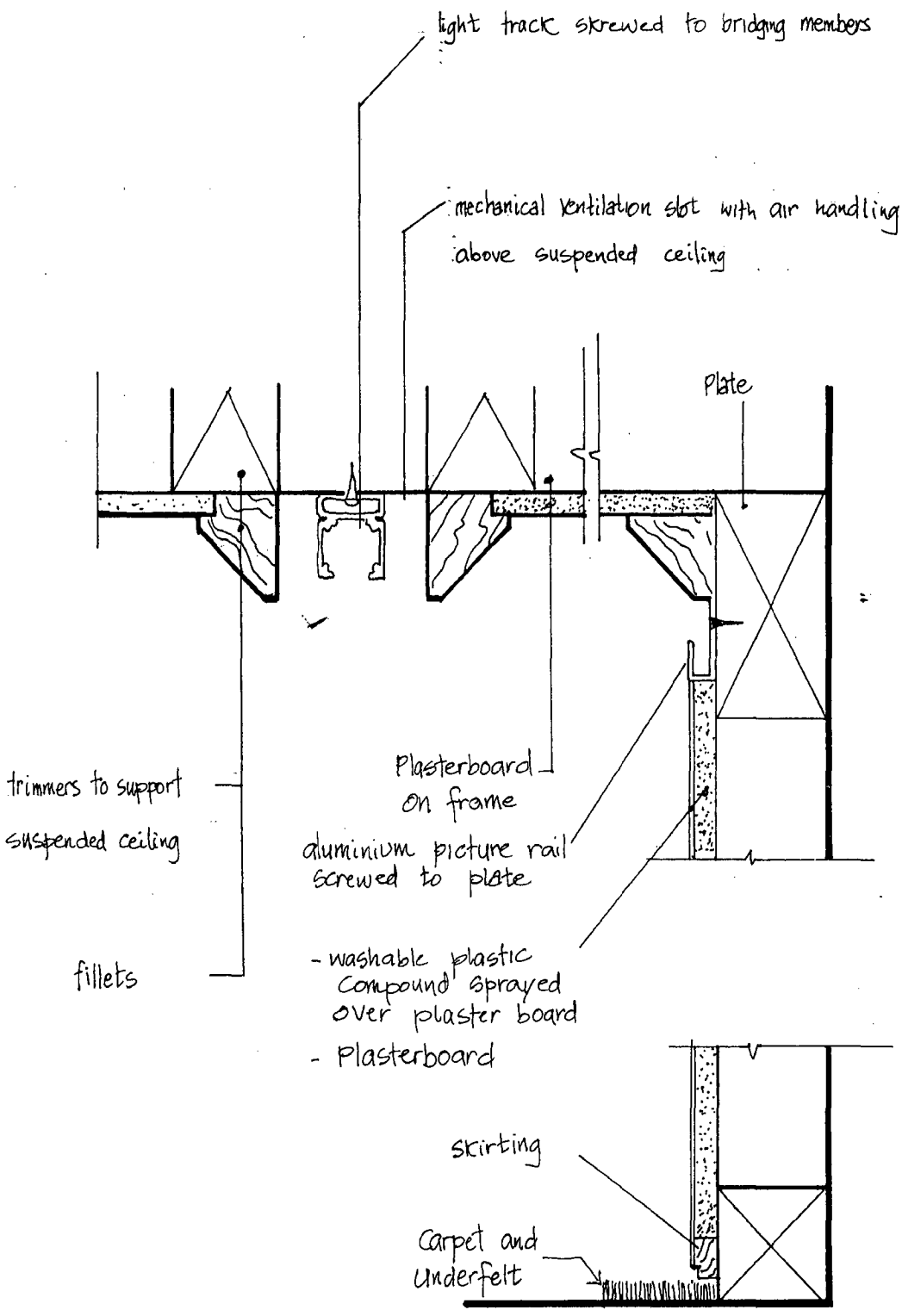
In open plan exhibition halls, the ceiling pane will be very dominant visually because of the effect of perspective. This problem should be dealt with accordingly by visual modulation.

5.5.2.3.1. Ceiling as space defining and modulating element

- *Suspended ceiling*

In exhibition halls having large height it may be needed to create cozy and intimate spaces. To do this it is essential to deal with the excessive height through temporary suspended ceiling surfaces supported on frameworks. The ceiling is expected to carry all the structural loads of appliances and screens. In such cases heat generated by appliances, people, lighting should be dealt with by creating gaps on the continuous surface to let out the stored heat.

Fig·61a suspended ceiling and wall sections for display



(Source: Brawne, Museum Interior)

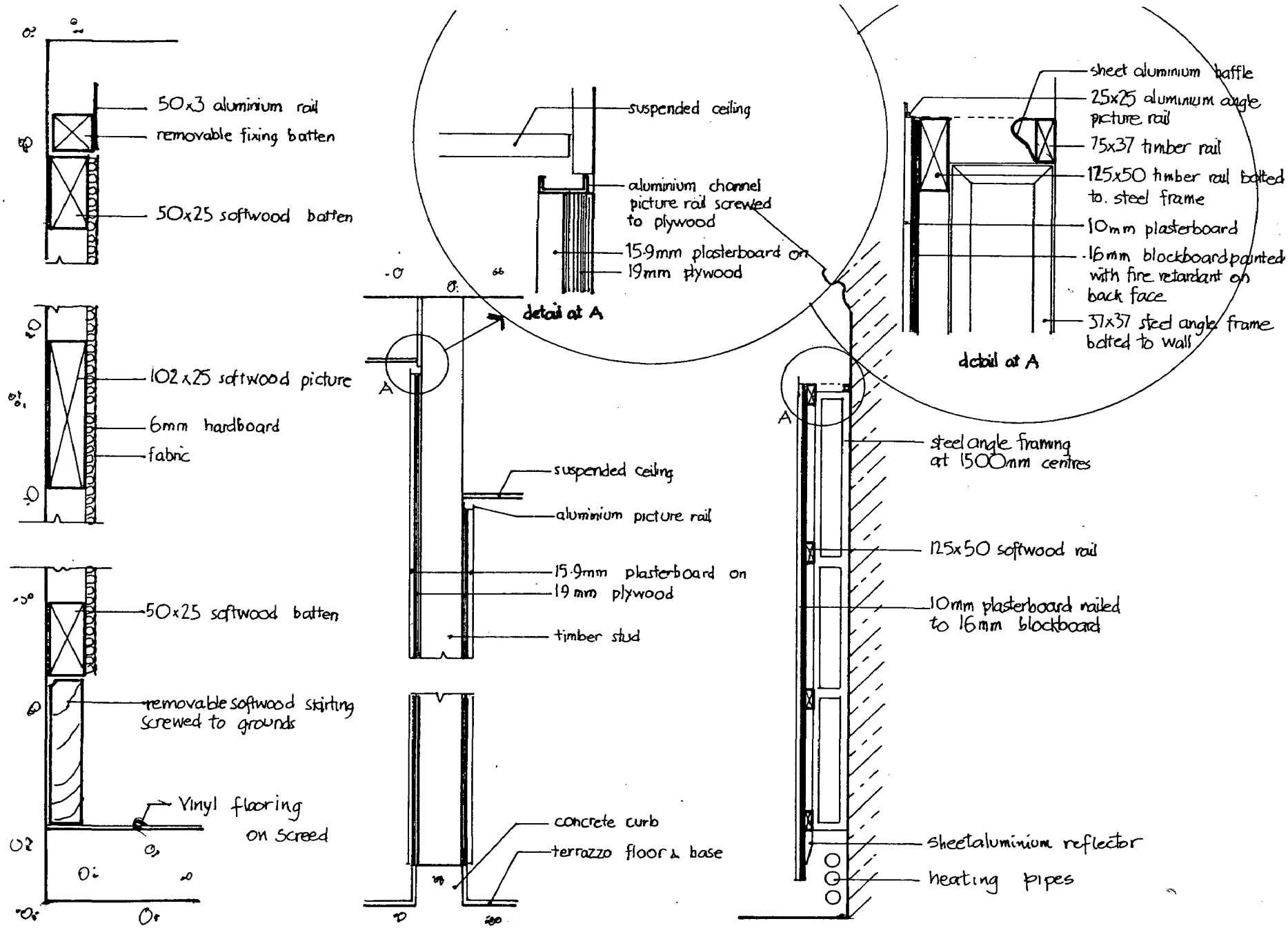


Fig.61b VARIOUS DETAILS FOR PICTURE HANGING ON WALL SURFACE [1]

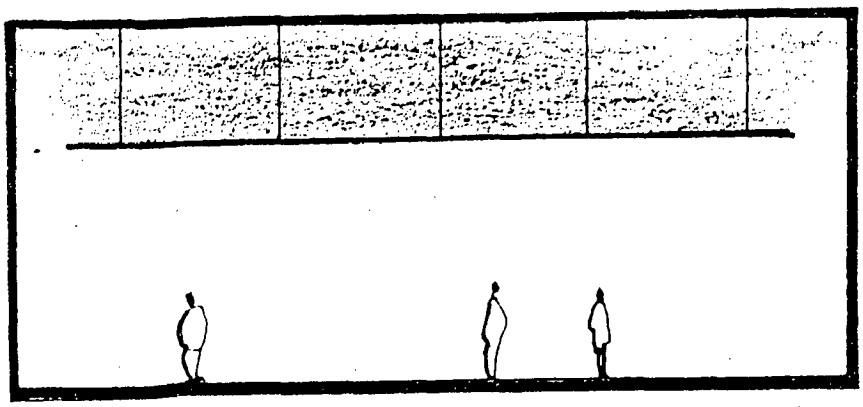


Fig63. Opening a vent not with in cone of vision

- Arrange a number of different horizontal planes by providing gaps through which ventilation could occur.

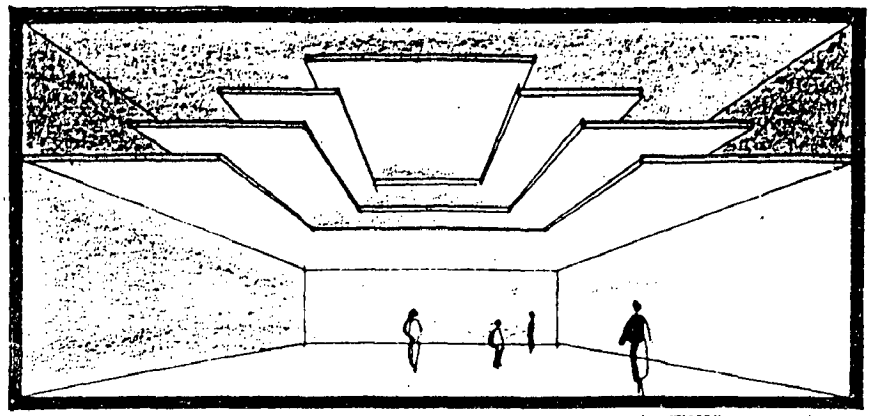


Fig64. Overlapping horizontal planes

- *Implied ceiling plane*

This plane is defined by series of suspended planar elements lowered to a required height. This has advantage over the previous one because the feel the volume is still there and yet also having intimate space.

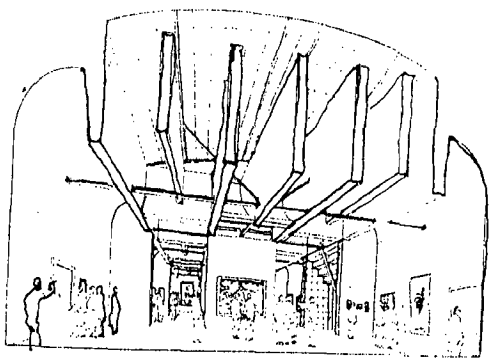


Fig65. Vertical baffles forming an implied ceiling plane [8]

- *Conventional simple plane*

Where simplicity of clear volume is required, ceiling can be made as one of the four walls and floor treated as simple rectangular panes enclosing a space. In this case this effect is achieved by using recessed ceiling plane for lighting.

- *Black void*

It is possible to control to what height form the floor the space of the gallery will be illuminated with general lighting. The rest will be left to remain in relative darkness. This will help to accentuate objects on the brighter lower portion. This is especially effective where objects are kept inside a bright showcase with relatively dim general lighting of lower portion.

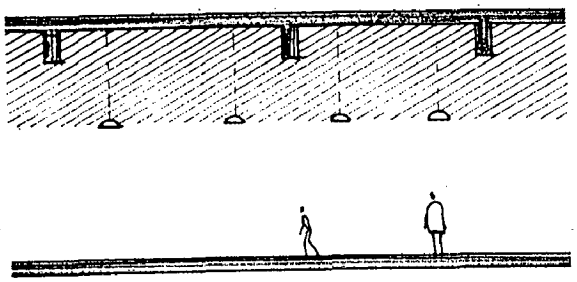


Fig66. *Ceiling height defined by differing lighting level*

5.5.2.4. Renovation considerations

In such undertaking the important thing is to identify peculiar potential features which will contribute to site specific peculiar solutions. Buildings under such process are usually old buildings with thick walls, and elements which will be hindrances for the new function of museum. The problems can be turned out into beautiful assets by considerate design.

- Incase columns come into open exhibition galleries their presence can be used positively by putting display cases around enclosing the column. In this way the column will also serve as a background for the art objects.
- Windows extending down to the gallery floor esp. in old building can be used to create niches for various pieces of objects.

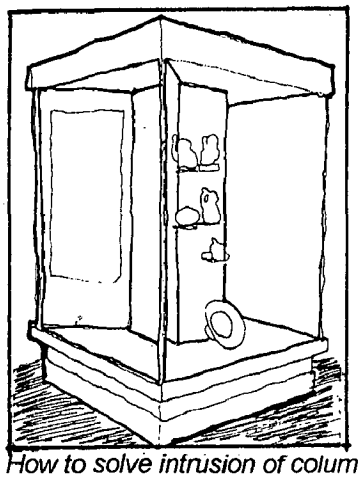


Fig67. How to solve intrusion of column

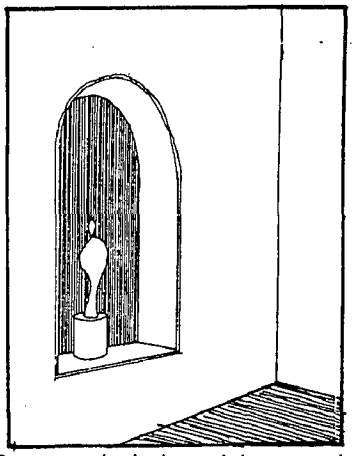


Fig68. Preserved window niches used to advantage

5.5.3. Lighting

"Architecture is play of mass in light"

Le Corbusier

5.5.3.1. Contemporary architectural lighting ideals

Display is meaningful only if there is also proper lighting inside the gallery. Lighting must be provided to best show the qualities of an object. But in doing so lighting should not endanger the longevity of the exhibit by over exposure. Harmful UV radiation or heat generated from it.

No.	Type of illumination	Exhibits	Maximum illuminance
1.	Day light and day light at about 6500°k	Metal, stone, glass, ceramics, jewelry, enamel, wooden objects that have largely been used out doors or have otherwise lost their natural coloring through design or use etc.	300 lux
2.	Daylight, tungsten lamps, fluorescent tubes cool types about 4200°k	Oil and tempera paintings on canvas, undyed leather, horn, bone and ivory, oriental lacquer, most wood materials	150 lux
3.	Only tungsten halogen lamps	Objects specially sensitive to light, such as textiles, costumes, watercolors, tapestries, prints and drawings, manuscripts, miniatures, paintings in distemper media, wallpapers, gouache, dyed leather, most natural history exhibits, including botanical specimens, fur and feathers, insect and plant material etc.	50 lux

Table7: *Recommended maximum illuminances [slightly adapted from 1 pp102].*

Lighting design must not be an after thought. It has to be integrated throughout the design process from the start. Correcting mistakes made in the initial design stages are difficult to amend in later stages.

Trends in fine arts museum lighting

In museum lighting has passed many generations of test to reach what it is now. At first natural light was used without any thought what it will cause to the exhibits, later it was found out it was harmful to the exhibits, which followed complete turn to use of purely artificial lighting. Contemporary philosophy is need integration of natural and artificial lighting in museums design; without compromising proper display and conservation aspect. Because depending on either source is unreliable, combining them will help to utilize strong characters of both. Natural light's variable nature and its uncontrollability will be counteracted by artificial light's constant nature and easily manageability. Artificial light's inefficiency to render natural color will be counterbalanced by natural light's ability to render natural color of exhibits.

Era	**Architectural elements of galleries**	**Lighting philosophy trends**	**Examples**
Old museums	Skylights and clearstory windows	Daylight and artificial light	Louver, Paris
Modern	Avoidance of window and skylight	Purely artificial, box architecture influenced by the idea of creating multipurpose space irrespective of the variation of exhibit types	Denver Museum, James Shudler Museum by Mier Van Der Rohe
Contemporary Museums	Scientific use of baffles, skylights fitted with filters for harmful radiation, reflectors	Combined natural and artificial, only natural, daylight limited to public areas only.	Daylight Museum, *Tadao Ando* Menil Museum, *Renzo Piano*

Table8: *trends of lighting in museums*

5.5.3.2. Natural lighting

"Architecture comes from the making of a room ... the plan is a society of rooms... the room is the place of the mind... a room is not a room without natural light. "

Louis Khan

Although natural light is perfect in its color rendering property, its UV component is destructive to artworks. This should be dealt with by filtering natural light by materials that will filter UV light; like laminated glass with UV absorbing inter-layer, or a special acrylic or polycarbonate sheets; or by limiting the duration of exposure. And by architectural detailing; when natural daylight is made to reflect on white painted surface before let into an interior space, UV content will be greatly reduced, even less than incandescent if bounced twice. Use of special materials of neutral-density window film which reduces the amount to light entering but still allows the visitor to look out, while from the outside the window appears darkened. Instead of blocking a window.

Visual contact to the outside conditions is also found out a necessary contact. Meeting this demand needs action against destructive nature of the full spectrum of day lighting.

As shown in the table objects in third category cannot be shown using natural light. Second category of objects can be illuminated with carefully controlled day light, while the first category can be illuminated freely in natural lighting condition.

5.5.3.2.1. Admission of Natural lighting

- Directional Sky lights work well for walls facing parallel to them. Adjacent walls will not be as bright as the walls facing the skylights. A lighting solution for permanent displays where every thing about the position of the panting is determined.

Fig69. *Linear one sided and two sided skylights [1]*

- Series of spot skylights these are ideal solutions for temporary exhibitions where the position of the exhibits is not known. But the disadvantage is that the brightest area will be the floor instead of the wall.

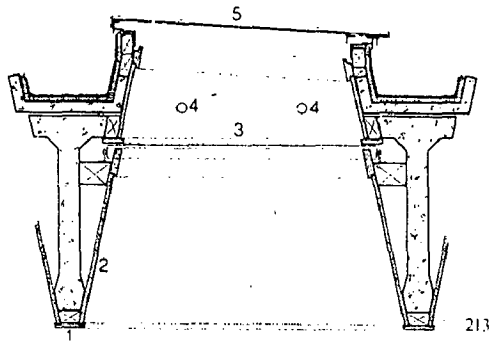
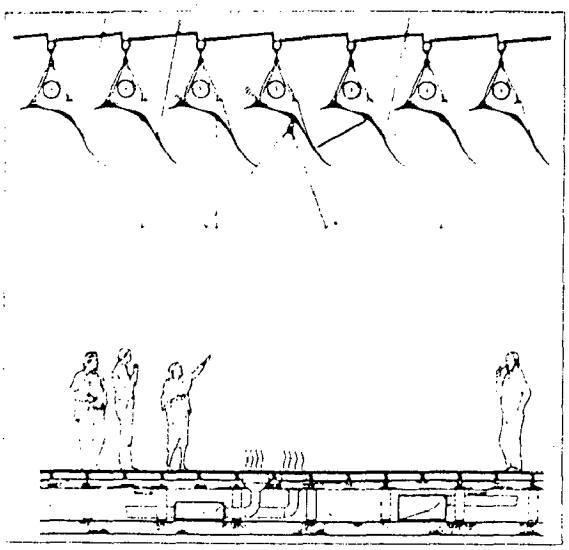


Fig70. *Coffered ceiling as series of skylights [1]*

- Prefabricated linear baffles extending the whole length or breadth of the gallery. Their geometry has to be carefully studied for inter-reflection to bring light inside form overhead outside exposure.
- Clearstory windows can be used to light walls by reflecting the light on another surface. Sufficient care should be taken not to disturb the viewer by giving direct view to outside through the window.



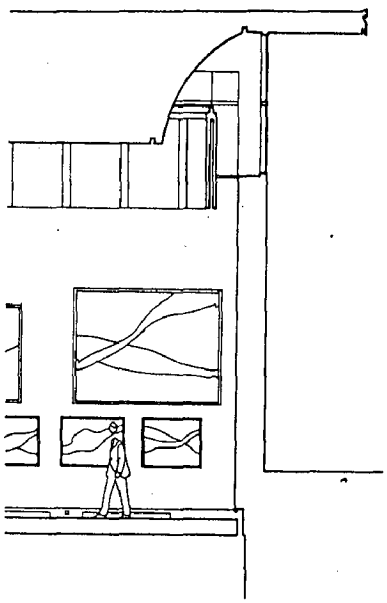


Fig71. *Menil museum by Renzo Piano [1 pp102]*

Fig72. Clearstory window [8 pp47]

- Translucent light weight fabric roof works well when the displayed items are sculpture or other objects that are not affected by strong illumination. It has also an ephemeral look.
- Galleries organized about atrium spaces

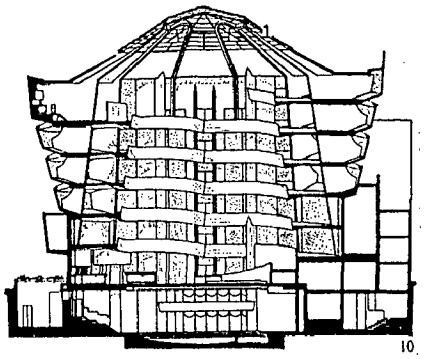


Fig73. Atrium provides lighting for all floors. [8]

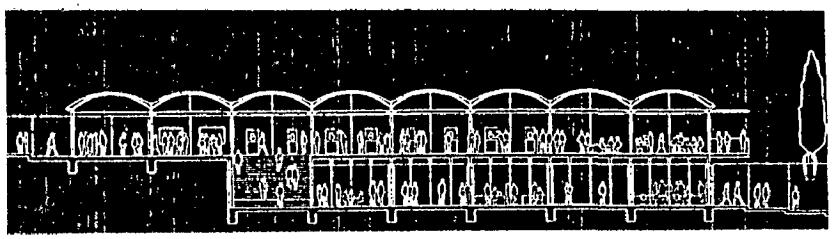


***Fig74.** Translucent fabric roof [l]*

- Carefully designed window systems of screens designed in such a way they adjust to changing sun's direction admitting only reflected light. These movable screens store energy passively to release it at night. They are closed at night for security reasons.

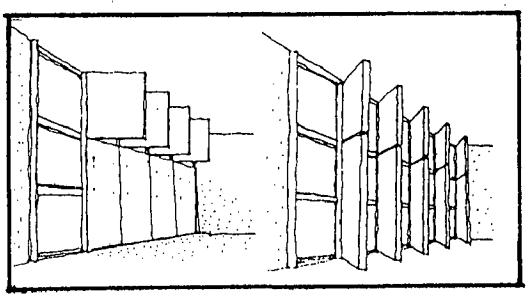
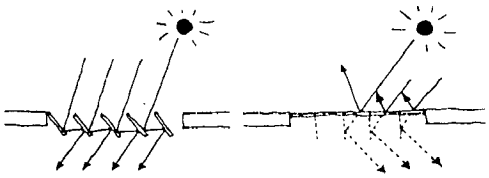


***Fig75.** Reflecting screen system on the wall [8]*



Windows and vertical openings

Usually windows are not provided in museums as a means of lighting exhibits, unless they are meant for general lighting. But in conversions of buildings to museums existing windows should not make any kind or disturbance in terms of glare, dazzling and problems of adaptation. These are all problems that need amendments through use of Venetian blind and some corrections of reducing glare.

Skylights

Overhead light is the most convenient position for museum lighting. Skylights are frequently used for galleries since they are able to provide uniform lighting for the walls. If the lighting is to be used for displays purpose it has to be filtered, reflected to reduce harmful UV radiation of the daylight.

Shielding of skylights

This is an important design consideration for visual comfort. There are two ways of doing this:

- The skylight as it is will be concealed form direct view from most of positions of the visitor inside the gallery. By carefully investigating the movement of the sun in relation to the orientation of the building, the detail will be resolved.
- Providing a secondary diffusing layer below the skylight.

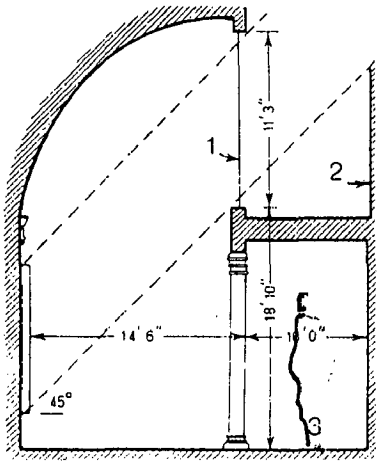


Fig76. *Detail of concealing direct sun light from view [1]*

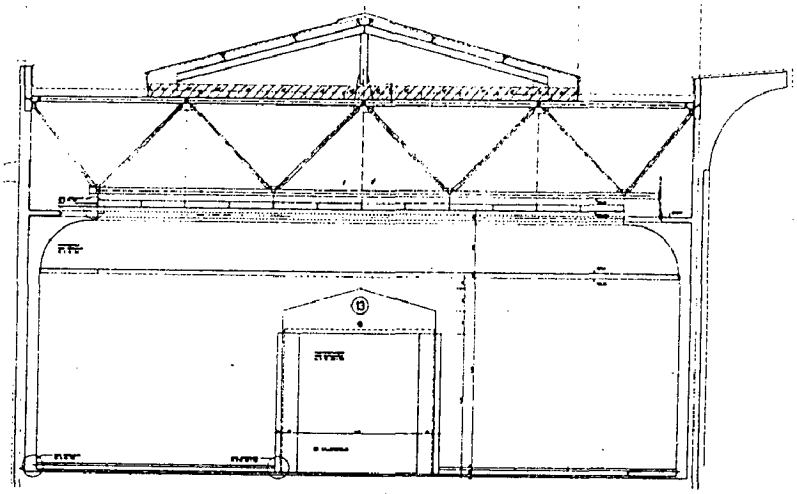


Fig77. *Diffusing layer [1]*

Architectural ingenuity for light that comes through diffusers

Diffusers used to filter daylight have one major architectural problems lack of ingenuity; it is difficult to tell whether the translucent diffuser surface is illuminated from natural or artificial sources, at day or night. Using reflectors or adapting lighting coming skylight through deep reveals or large baffles will solve this problem.

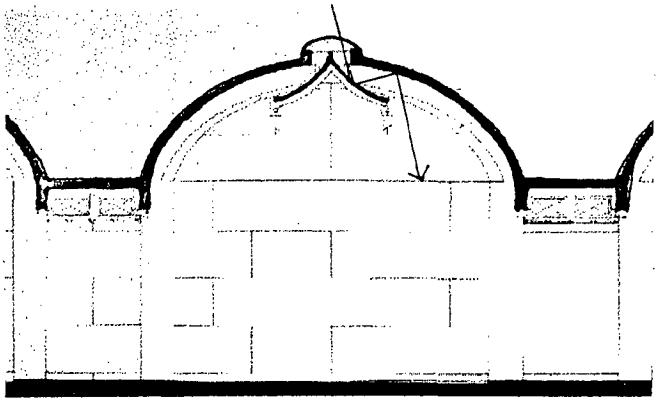


Fig78. *Reflectors letting reflected light [49]*

5.5.3.2.2. *Lighting multistoried floor of galleries*

Single storey is the most suitable height to illuminate a gallery naturally through skylight from above. In multistoried museums, which is the usual contemporary type, this in not possible limiting day lighting only to the uppermost storey. Using technologies combined with architectural detailing helps to let in natural lighting to lower floors. Here ***light shafts*** and ***optical day lighting*** are discussed.

Light shaft

As used in Moshe Safdie's National Gallery, Ottawa, lighting shaft takes natural light from the roof level and takes down it to the lower floor via its glazed interior surface by reflection.

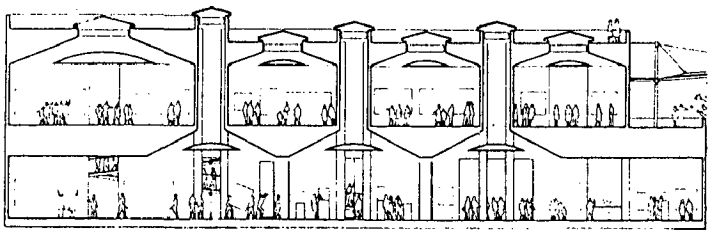


Fig79. *Light shaft letting light after inter-reflection [30]*

Passive solar optics

An old science but new technology used to light interior of buildings. Material used are Frenzel lens composed of micro lenses on acrylic plastic sheet which bend and guide light from sources to interior targets. Optics is employed to make light "shaped, bent, compressed, expanded and infinitely subdivided". [22]

The system combined with architectural design will help to deliver reliable and even daylight to building interiors. It can be designed to have all properties of industrial

product of cost, predictability reliability and precision during daytime. Using optical directed sunlight light can be fixed to a certain point through out the day even if the position of the sun is changing. It is also possible to have a brighter interior condition where the outside is cloudy.

Changing character of day lighting, its unpredictability can be improved using this technology by combining it with proper architectural detailing.

Day lighting has to be used in museum interiors with extreme care only for certain groups of collections. Necessary details have to be solved to improve its harmful effects on exhibits. But if conservation measure is well taken care of, day lighting is ideal means to illuminate art works in a pleasing and in their most natural color.

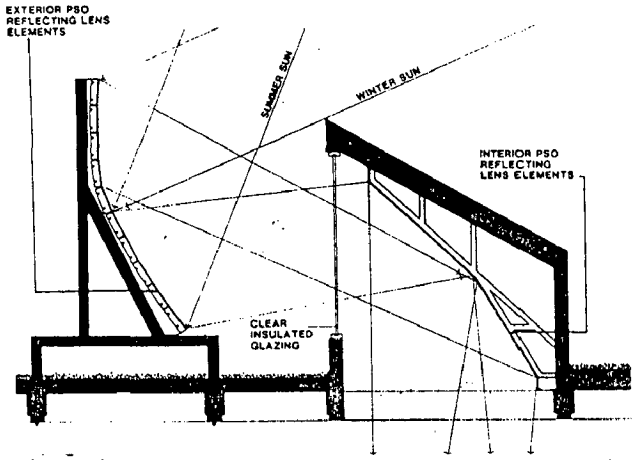


Fig80. *Passive solar apparatus integrated with architectural elements [22]*

5.5.3.3. Artificial lighting

Natural light, because it may be unsuitable for some exhibits, its variableness, or its insufficiency, has to be supplemented or totally replaced by artificial lighting. The display of vulnerable objects is possible only through artificial lighting at very low illumination level.

5.5.3.3.1. Features of artificial lighting

- One physiological nature of human being is his capacity to see even at very low light levels as long as proper progression of adaptation is made. Adaptation is achieved through progressive reduction of general lighting levels as visitor progresses from higher levels to lower levels or vice versa.

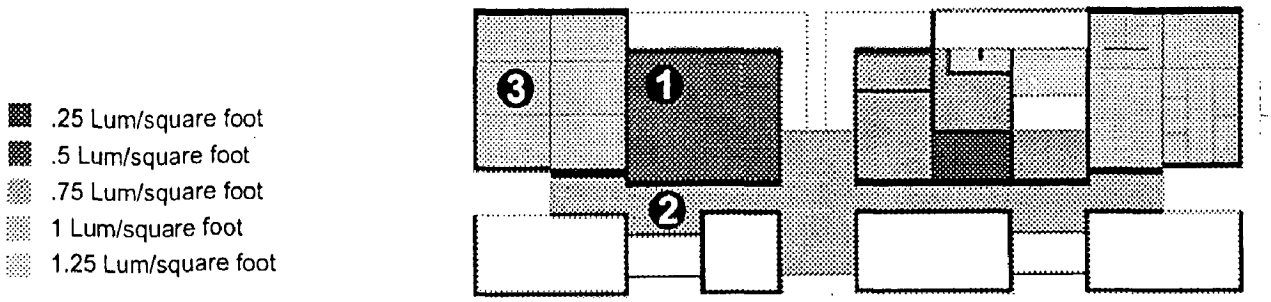


Fig81. Lighting levels progressively lowered or raised for smooth transition between galleries [38]

- It is controllable for conservation purposes
- Independent of weather conditions
- Selective lighting is more effective using artificial lighting. Certain aspects can be emphasized by illuminating them, while other unimportant details can be concealed by leaving them in relatively dark area.
- At lower illumination levels it is preferable to use warm colors (red or orange), instead of cold colors (blue).
- Aspects such as glare, dazzling, adaptation, and relative brightness of objects within the field of vision are important considerations.
- Under artificial lighting conditions objects are not seen in their natural color. Only few sources have a good color-rendering index close to natural lighting

5.5.3.3.2. *Ways of providing artificial lighting*

- Luminous ceiling covering most of the area of the ceiling giving uniform illumination
- Spot lighting with or without track directed on the object
- Light points flush with ceiling plane.

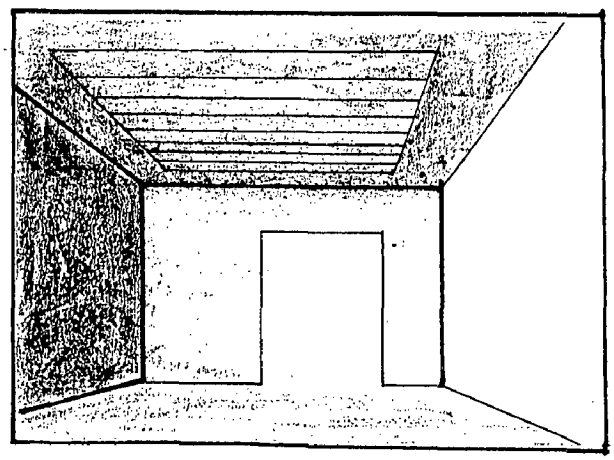


Fig82. *Luminous ceiling*

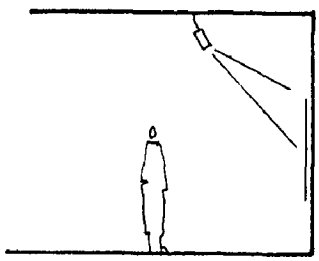


Fig83. *Spot light*

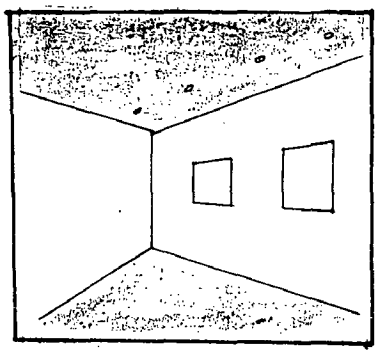


Fig84. *Light Points flush with ceiling*

5.5.3.4. Dealing with glare

5.5.3.4.1. Skylight

- Shield sky lights through secondary diffusing layer below the skylights or create a solid central area with the skylight hidden as it were from most viewpoints occupied by the gallery visitor.
- Visually simply lit coffered lighting is better than louvered ceiling or other baffling system. Of course these last two systems will be indispensable if excessive sunlight is admitted.
- Pyramidal light wells reduce the sharp transition or edge of brightness at the boundary of the view of the sky and the room.

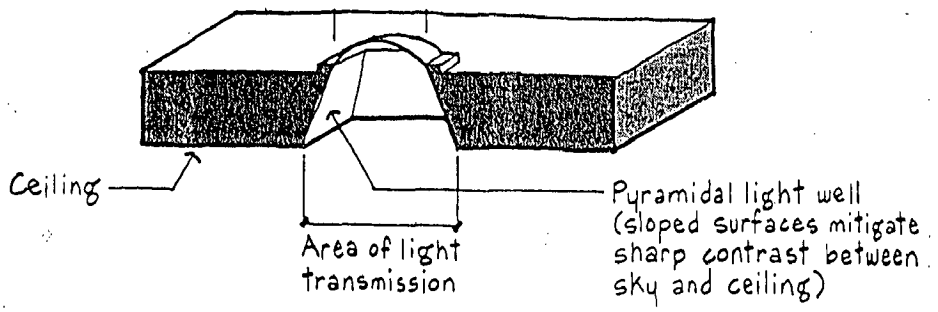


Fig85. *Pyramidal skylight [I-4]*

- Instead of using laylight or diffusers, use deep recesses or reflectors visible with in the gallery combined with skylight for architectural ingenuity.

5.5.3.4.2. Windows and openings

- Deep recesses of windows are used to eliminate or reduce glare if the windows are used to let in natural light. Sharp edge and narrow jamb produces sharp contrast

creating discomfort. Usage of rounded surfaces that gently slope away from the bright outside condition to the less bright inside space will tremendously mitigate this condition. Sloped or splayed concrete surface also plays similar role.

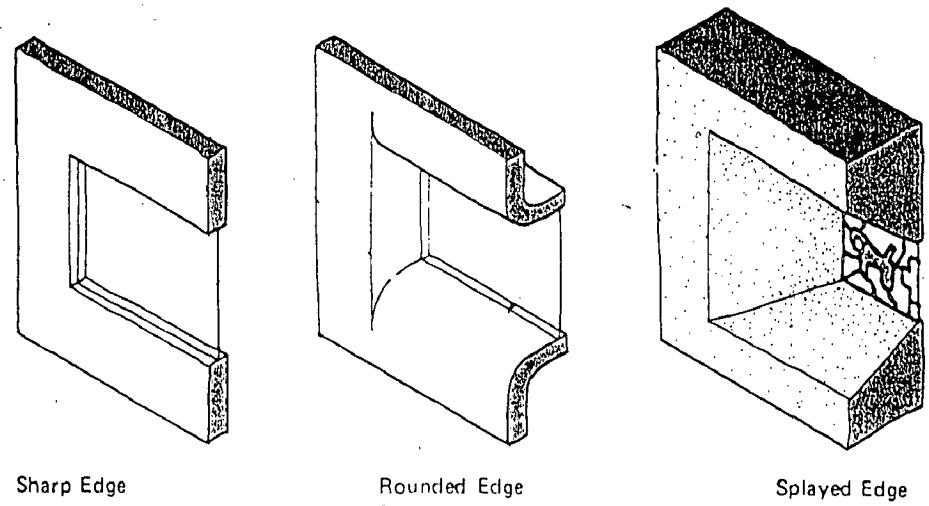


Fig86. Shape of window openings

- Windows should open into a shaded outdoor area to limit the brightness contrast.

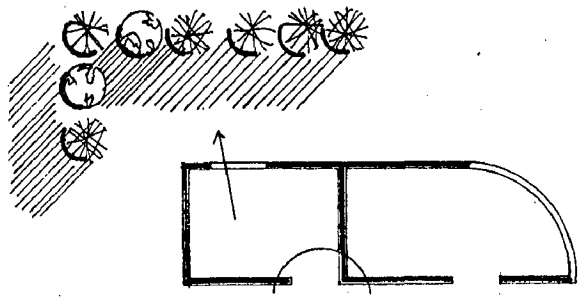


Fig87. Windows opening in to shaded area

- A single large window is better than many smaller ones. So that there are less number of art works near to it or in front of it that might be affected by its reflection.

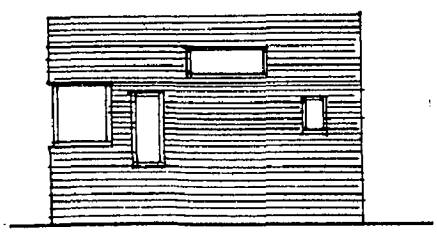


Fig88. Size of windows

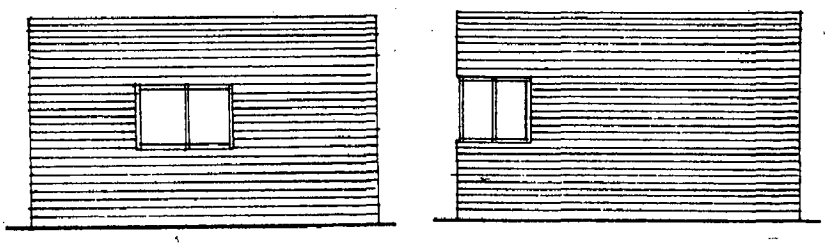


Fig89. Position of the window

- A single large window placed at the corner to illuminate adjacent wall is better than central one. It will interfere less with the way displays are placed in the middle of the room.
- Either the visitors or paintings should never directly face windows. This is to avoid glare and harmful UV component of natural lighting.
- Outside gallery spaces, windows at eye could be used for view and light, but inside gallery spaces they should be placed higher up on the wall surface above eye level and should be used as indirect source of top lighting. This way the windows will not compete for wall space that is needed for display purpose.

Indoor sculpture display areas can be used as means to connect the galleries with surrounding landscape through glazed walls or windows. This will help to tie it to the general context and at the same time admit the needed day light.

5.5.3.4.3. *Courtyards*

- Shield courtyards against glare, the paving of the courtyard should not be highly light reflective and that a deep courtyard cutting out a view of the sky from most positions is likely to be preferable to one revealing large areas of bright cloud or sun.

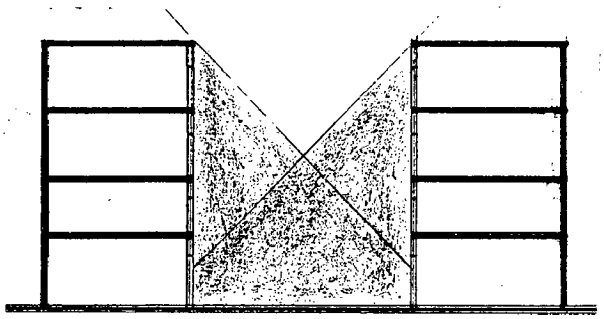


Fig90. *Shielding courtyards*

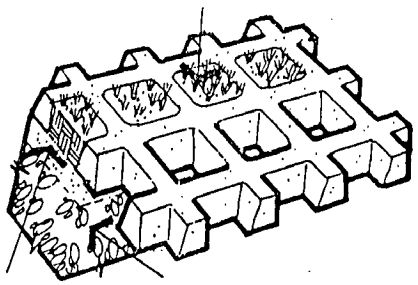


Fig91. *non reflective paving material [AFTER WATSON, DESIGN WITH CLIMATE]*

- Use Venetian blind or a series of vertical louvers to reduce the amount of light and also reduce the contrast between the source and the adjacent surfaces.
- In more extreme conditions use pierced screens of Moghul architecture.

Both natural and artificial lighting are used inside interior of museums as long as necessary design considerations are well taken care of. Both need control to suite a particular exhibit, but the means to achieve control are different. Artificial lighting can

readily be controlled through choice of fixtures, while the architectural detailing undertaken influences natural lighting.

5.5.4. Special Effects

Graphics is a last touch to the completed physical design. It comprises color, texture, labeling, and signage in such a way that it encourages visitors to go about the exhibits.

5.5.4.1. Color

All surfaces must be considered in isolation or combination for application of proper color.

Special points to observe

- Strong bright colors are essential where a sense of excitement must be generated in a relatively short period of time, for example, a museum front. Low chromas are needed in areas where dignified atmosphere is desirable, for example interior of exhibition.
- Warm exciting color tones are required in rooms in which higher stimulation is suitable, for example, rooms with northern exposure, cool temperatures, and smooth textures. Conversely cool, subdued colors create a restful atmosphere in rooms with southern exposure, abundant sun, lots of excitement, and rough textures.
- Contrast in color of the exhibits against background will help to attract attention.
- The mood that is felt inside is influenced by choice of colors.
- Lighting conditions can be improved by choice of colors according to level of reflectance and when putting together two surfaces of different reflectance care should be taken not to have big difference that will crate visual discomfort.
- The apparent size of an object is influenced by its color warm colors seem to come forward in the visual field where as cold colors recede.
- A light color makes an object seem larger, whereas a dark color makes it appear smaller.

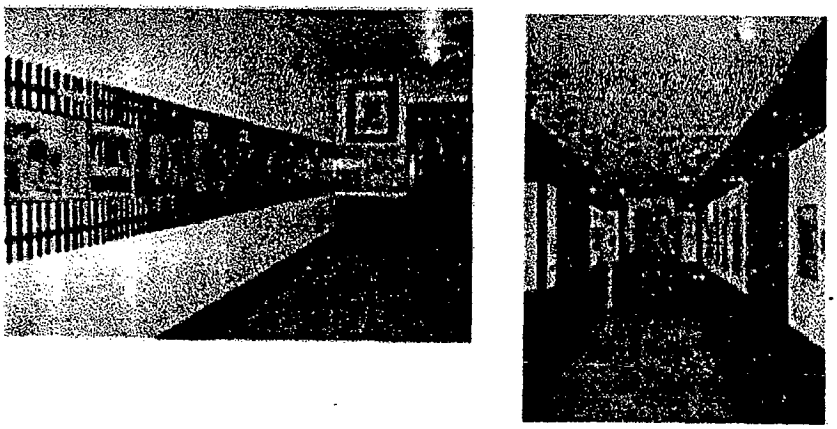


Fig92. *Gandhi National museum on the right and National Gallery of Modern Art on the left. Contrast in color to bring out the exhibits for visual appreciation, for this additional surface is introduced to mediate between the wall and the pictures.*

5.1.1.1. Texture

Surface nature pertaining to tactile quality which the eyes have adapted to differentiate every material has texture; it is indicative of construction process behind.

Some materials can be good backgrounds because of their texture as a back drop for the display of artifacts. For example fairly rough texture of plastered in larger aggregates and painted surface accentuates a smooth framed picture.

Textural differentiation can be used to solve unavoidable problems occurring due to close similarity in color. This lesson can be taken form Japanese gardens where elements in the garden are identified because of their textural quality out of a slight contrast in color.[14]

Texture in museum interior can be used as a facilitator of visual experience through variations in texture which can be seen, heard and felt. Flooring materials through their textural difference can be made to tell change of space, as visitors progress in their route. Click of a shoe as contrast to a muffled noise of carpet is an instance of this.

5.1.1.2. Composition

'A totally composed interior is organized to fulfill its function and spatial purpose, and at the same time offers a visually unified and coherent aesthetic statement.' [14]

Once the collection is decided upon and the architectural enclosure ready, the next step is to put together these to best affect visual appeal. Careful selection of each artwork should be done according to texture, color and shape.

Symmetry and balance: In any form of aesthetic creation there are two ways of establishing equilibrium- symmetry and balance.

Axis and alignment: All interior plans have an axis, but not all of them exhibit aspects of alignment. Axis pertains to a centerline; alignment concerns edge.

Repetition and rhythm: repetition is as a planned recurrence of a component. The components that are repeated must have a maximum of sameness and a minimum of difference in order to establish visual continuity.

Contrast and opposition: the aesthetic principle of contrast offers the satisfaction of differences. Contrast places interior components in relation to each other so that when seen side by side the components exhibit their individual diversities to the best advantage. Opposition is a similar principle with one variation: the component must exhibit equality in such characteristics as weight, height, color value, and shape.

5.5.4.4. Captions

Information is needed in the form of signage as complimentary supportive aids of way finding. Every artwork also needs some explanation attached to it.

The information must be offered such that all age groups and all kinds of people including those having disability grasp it. Labels should be concise that every body is encouraged to read them. Visibility and legibility are key considerations. Lighting, style, size, and location of labeling contribute to this end.

The style of the caption should be consistent in scale, style and character with the overall design of the gallery.

Graphics is the culmination of the whole design of museums. It is just like a conclusion of a very large novel, thus it must talk the same language told by other previous elements for unified wholesome task.

5.6. Considerations for Caring of the Collections

There are many potential dangers to the well-being of the museum collections which should be dealt with accordingly. Visitors (knowingly or unknowingly), relative humidity, temperature, light (natural or artificial), pests and pollutants are the major threats. The possible danger that comes from people could be prevented by proper security procedures which include architectural measures; whereas relative humidity, temperature, pests, and pollutants could be dealt by maintaining proper internal environment for the collections. The following table explains the details. [40]

5.6.1. Security

Security deals with safety of both occupants and more importantly protection of collections and displays against theft and vandalism.

Security design is usually an after thought in the design process resulting in many problems, like excess guards to amend layout mistakes, faulty details. Even the famous architects' buildings are sometimes security wise in efficient.

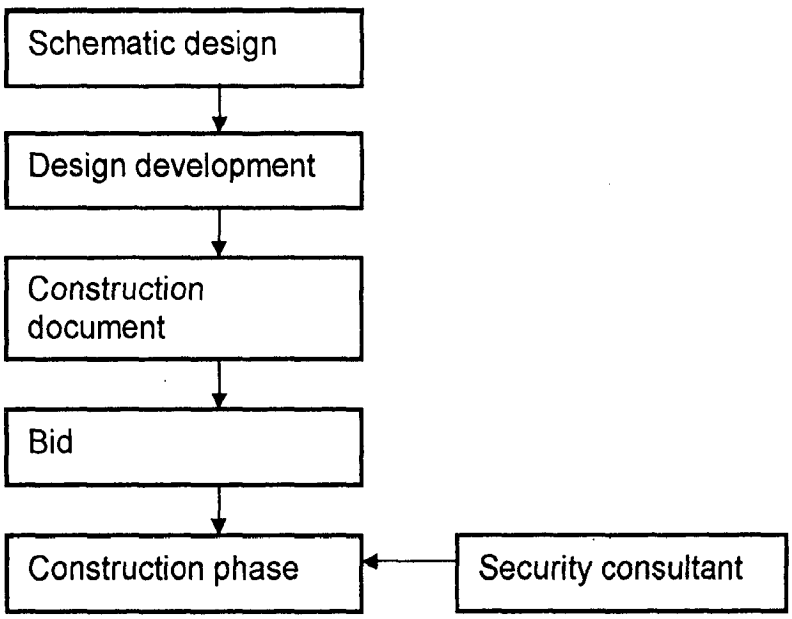


Fig93. *The customary design process bringing security concerns too late*

Architecturally security can be discussed most conveniently in the following manner:

- Control when museum is open to the public
- Control when the museum is closed to the public
- Control of removal of the objects themselves

5.6.1.1. Control when museum is open to the public

Invigilators will walk around or stand or sit at strategic positions to control visually any sort of activity that endangers security. This method should be supplemented with other planning and physical architectural solutions. Cloakrooms are used to keep large bags and sticks before entering gallery space that may be potential dangers. Security perimeter should also be well defined, with entry or exit security checkpoints.

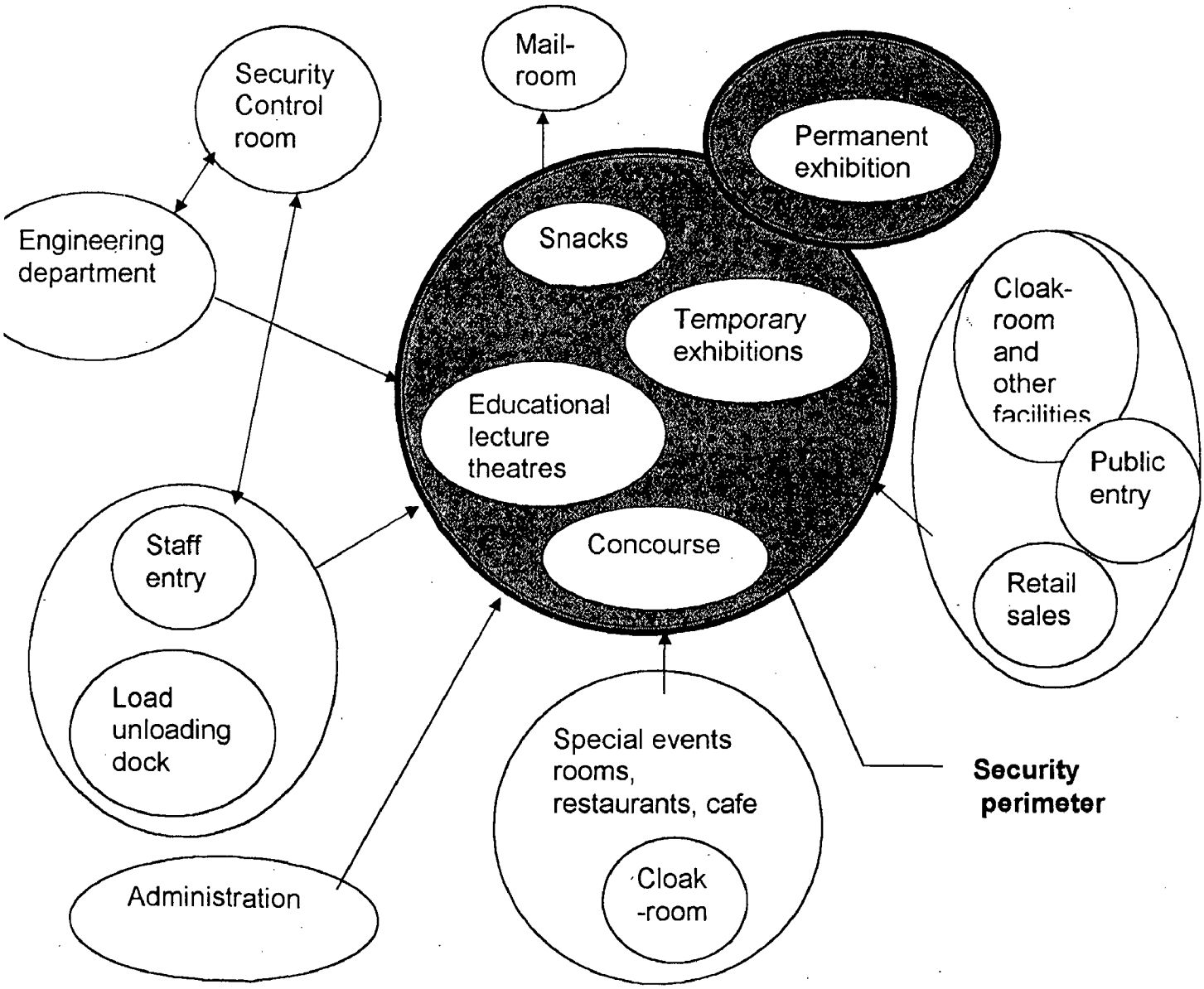


Fig94. *Diagram of containment showing relation between security perimeter and immediate vicinity functions*

5.6.1.1.1. Security perimeter

Security perimeter can be either the external envelope or internal envelope enclosing the most vulnerable collection. Building constructed out of external wall of brick or concrete is said to have external security perimeter. If it is not possible to provide external perimeter due to some reason, internal security perimeter must be provided selectively to the most valuable items.

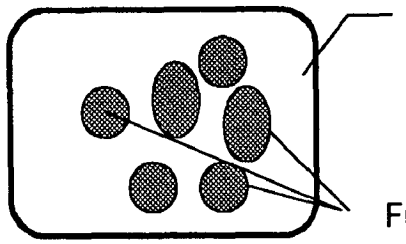


Fig95. External security perimeter

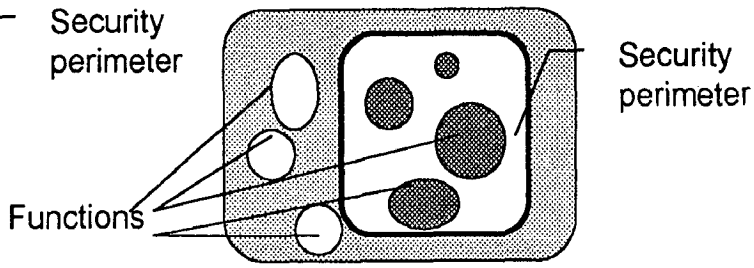


Fig96. Internal security perimeter

CCTV is also used as additional aid for the manual control by placing these devices at strategic positions.

5.6.1.1.2. Security physical barrier

Provision of guard rails and barriers to keep visitors at safe distance especially for some exhibits which are need more security or which visitors might be tempted to touch out of curiosity. It is just to keep visitors at safe distance without making them aware.

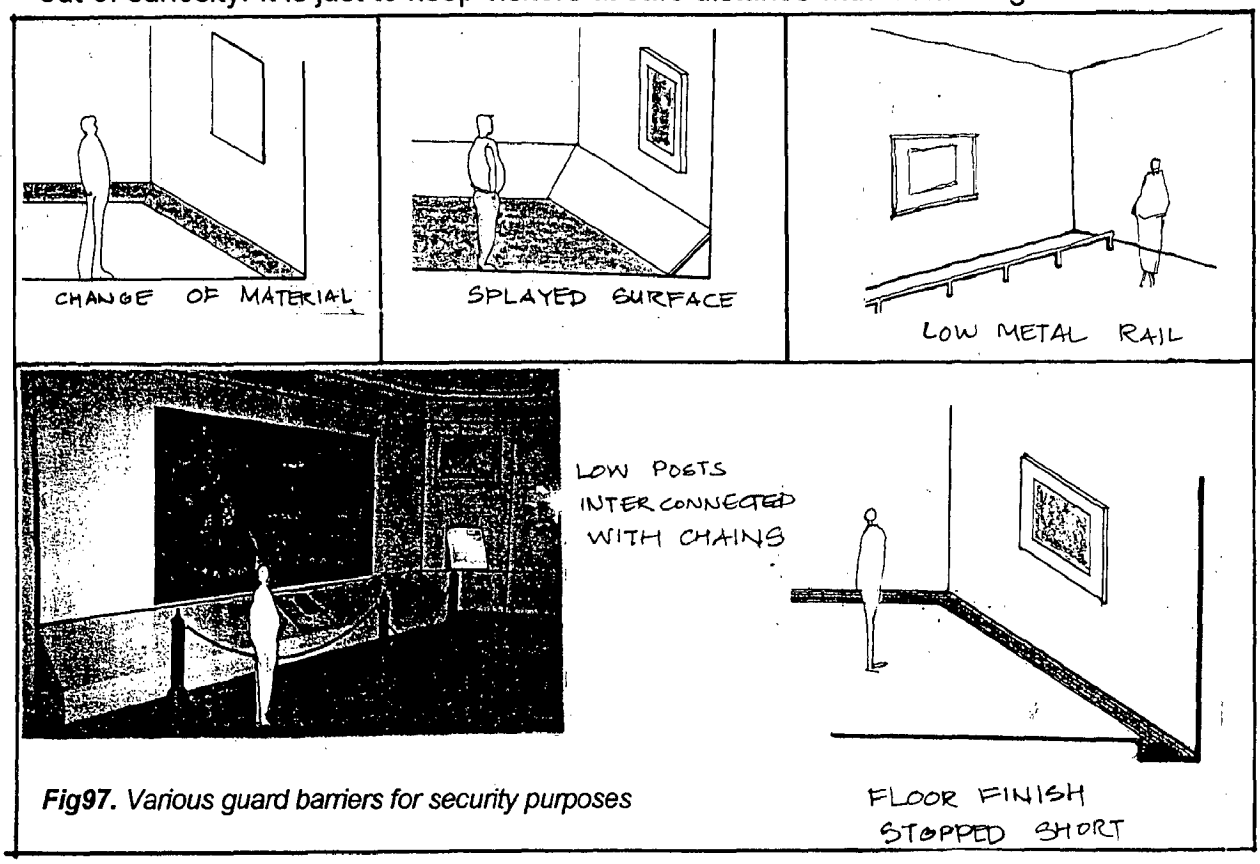


Fig97. Various guard barriers for security purposes

5.6.1.2. Control when the museum is closed to the public

Both physical planning and electronic devises should be used in combination for better results.

5.6.1.2.1. Physical planning:

This is to stop burglars before they enter the premise of the secured zone of the museum. It will either completely stop burglars or delay them until security personnel are ready or to respond when the alarm went off.

The outer shell of roof and wall of sound construction are responsible for this kind of defense. Using strong materials like brick and concrete give the best security. Openings in the outer shell such as doors, windows and roof lights must be reduced in number and size as far as possible. And if at all these are provided they should be strengthened with additional details.

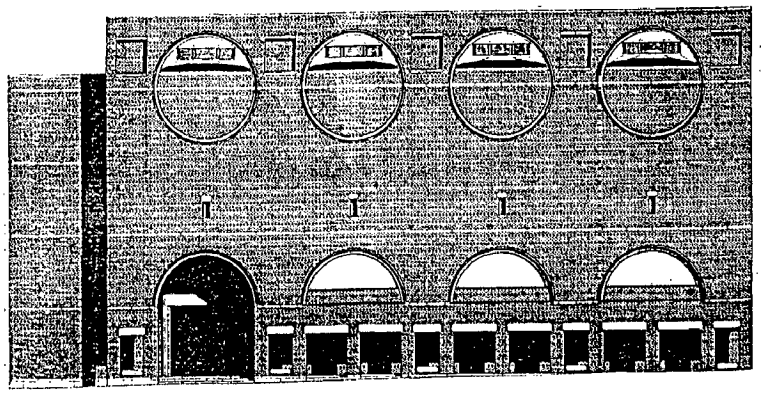


Fig98. *Massive construction for security [8]*

Emergency exits although they should allow easy escape, they should not be escape ways for thieves.

For renovated buildings converted into museums, because they were not designed as such, all previous openings, layouts must be redesigned to meet the new requirements.

5.6.1.2.2. Electronic devises:

Alarm systems that will detect any attempt of unauthorized entry and also any attempt of staying behind inside the museum for later breaking out are indispensable.

5.6.1.3. Control of removal of the objects themselves

General planning and detail designs will be employed to secure valuable items, in additions to manual invigilation, of course planning could greatly assist manual work or even helps to reduce number of guards to a minimum.

5.6.1.3.1. Internal layouts and visitor flows:

Just observing certain planning techniques will reduce the risk of theft.

- Sightlines should be as unobstructed as possible to the invigilators.
- Location of doors and placement of exhibits should be such that thieves won't take advantage.

Detail design:

- Display design should be such that, it won't allow easy removal of objects.
- Small, visually appealing, and fragile objects must be kept inside display cases.
- Fix paintings properly to the wall surface with screw.

planning for Security

- Use internal security perimeter especially for renovated building with too many windows or weak external envelope. Even in buildings having external envelope collections that need exceptionally high security could have additional internal security perimeter.
- Provide enough cloak room space so that all potential visitors will be catered for at once with out being turned away or let in along with their coats.
- Place the mailroom outside the security perimeter so that some employees may not send mails form the museum addressing to themselves and take out museum collections disguising as mails. Naturally personal mails could are not supposed to be checked by security personnel.
- Galleries that are located above ground or away form perimeter walls are more secure than otherwise.

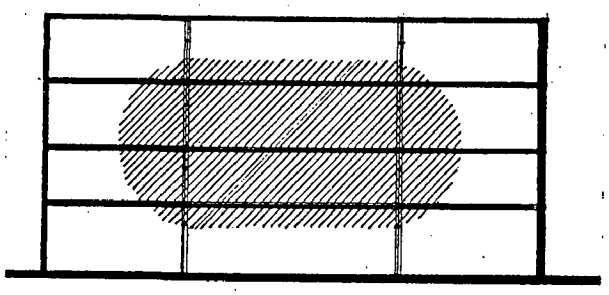


Fig99. *Locationally the most secured area within a building*

Security manpower

- Wherever possible combine loading dock and employees' entrance to reduce manpower.
- Security control room can be combined with engineering and phone operations office, if not possible make them close to each other.

5.6.1.3.2. Security control room

- Provide enough space and designed just like other important museum spaces.
- Fortify it with proper envelope material choice use also minimal windows to outside. Internal windows' glazing must be bullet resistant.

5.6.1.3.3. *Windows and doors*

- Narrow windows openings of not more than effective width of 18 cm are more secure.

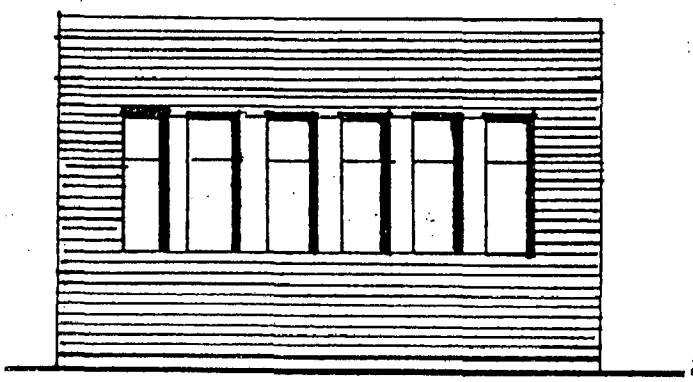


Fig100. *Narrow windows are more secure*

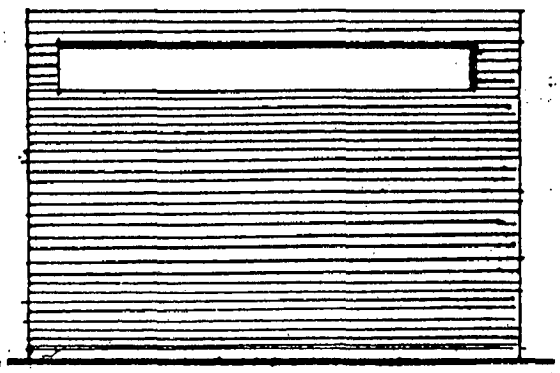


Fig101. *High windows are more secure*

Use secondary protective measures:

- Steel rollers or shutters, Iron or steel bars, and collapsible gates or grilles
- Secondary glazing using glass, polycarbonates glass laminations.
- Exterior door must be of solid hard wood or solid hard-core construction. For further strength steel doors and laminated security doors with reinforced plastic of steel sheet inserts.
- A doorframe must always be as strong as the door itself.

- Glazing to doors should be protected by steel rollers, shutters, steel gates, or laminated security doors fitted inside the main door.
- Objects that need stricter security control should not be placed near doors.

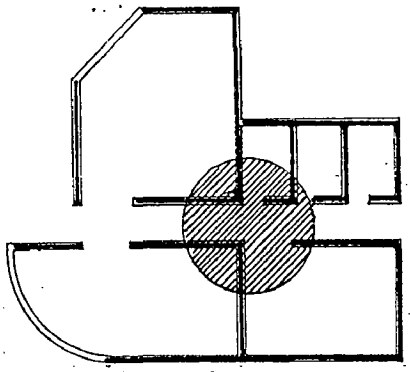
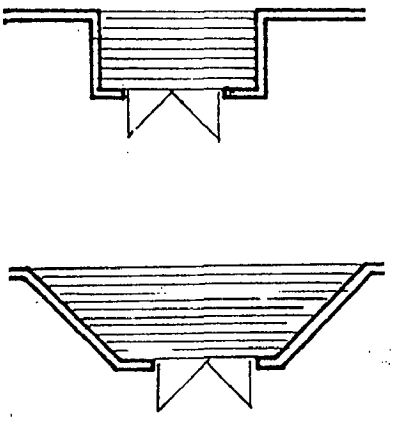


Fig102. *Space near door opening is unsafe for valuable art objects*

- Layout of partitions and planning should be such that sightlines should provide invigilators unhindered views so that there is no hidden corners form view.

- Outdoor vegetations, deeply recessed doors, porches, adjacent buildings could be potential hiding places for thieves. Therefore use minimum thick vegetation around the outside envelope of the building. In the case of deep recesses minimize the effect by splaying the corner wall to maximize exposure to the surrounding open area.



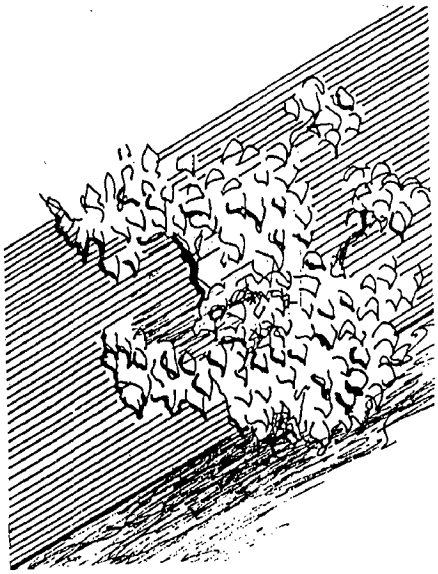


Fig103. *Dealing with deep recesses*

Fig104. *Avoid thick foliage near the outer wall of the museum*

Security should be behind every design activity that concerns gallery spaces. Architectural design decisions could greatly reduce the risk of theft if not will assist electronic or manual security methods.

5.6.2. Fire protection

In museums what is a potential danger is, not only the fire itself causing the smoke to deposit on art objects but also, the attempt to put the fire off. In the process water thrown upon the fire will damage the artifacts. Therefore what is more important is detection of fire. Organic artifacts are more susceptible to the fire attack.

To mitigate fire therefore in fine arts museum is an entirely a different challenge. It should concentrate more on the prevention side rather than fire fighting. Smoke should be detected even before it is visible to the human eye by a scientific method called air sampling method. Even then architecturally building elements should be designed and planned for fire.

No.	Building element	Architectural Measures against fire
1	Planning	use fire compartment zoning, and separations
2	Roof	Fire retardant coating, and proper detailing where there is contact with electrical systems
3	Door and window	Fire doors and windows kept closed
4	Floor	Non-organic fire retardant material
5	Wall	Fire resistant material
6	Stair way	Closed well instead of open
7	Display systems	Apply fire retardant coating and smoke tight cases
8	Electrical systems	Insulation of cables and wires should be halogen free to avoid aggressive acid and poisoned smoke.
9	Loading bay fire from vehicles carrying art objects	Use fire suppression systems
10	storage	Leave enough space between wall and storage shelves to block spread of fire [52]

Table9: *preventive measures for fire protection*

5.6.3. Pests

Insects could be agents of deterioration of museum objects by tearing, consuming, eating, and excreting which will destroy or disfigure them. They are especially attracted towards material of organic nature, like wood, leather, textiles, paper and other similar materials. Birds, vermin, and other animals also could foul artifacts with faeces and urine, gnaw consumable materials, displace smaller items. Mould and microbes also disfigure organic as well as inorganic materials.

- Inside and outside the museum building around structures which have details or parts that could be a resting place and breeding area for these pests.
- Isolate food and garbage areas.
- Use non attracting lighting.
- Use non organic building materials like stone, metals, glass, etc...
- Seal details around loading bays and access doors.
- Provide quarantine room for incoming artifacts near loading bay
- Keep all spaces accessible for ease of control of pests.
- Avoid wool carpets in exhibition halls
- Keep store cool as most of pests need warm temperatures to thrive
- Because some pests ex. Carpet beetle feed on pigeon droppings, remove their droppings or more importantly prohibit their staying on ledges.
- Proper maintenance of building shell
- Reduction in area of glass surface and using double or even triple planes reducing cold bridges between outside and inside.
- Shading and reflective roof surfaces in order to minimize solar gain
- Double forms of construction so that there is the maximum isolation between internal and external surfaces.
- Massive construction as in Merida museum of Roman art in Spain

5.6.4. Water

If water gets in to the museum interior in some way it causes efflorescence in porous materials. It also attacks metallic artifacts. Artifacts with laminated layers will be destroyed. Paintings, especially water colors will be permanently damaged. The

protection measures starts form site selection. As much as possible avoid sites with in floor plains and floors below ground plane for gallery purpose and loading bay area. Rainwater should be disposed using pitched roof without being let into courtyard spaces and closed internal spaces from outside.

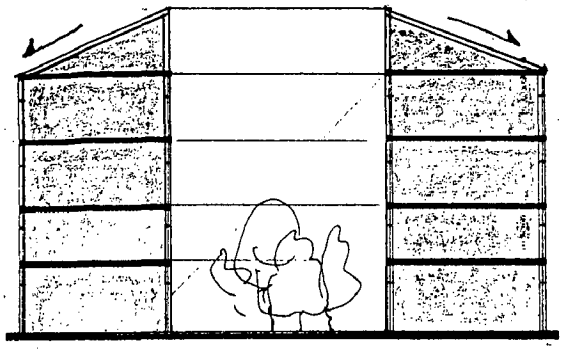


Fig105. *Use pitched roof with rain draining outside courtyard space*

5.6.5. Internal environment aspects

Creation of suitable environment with respect to temperature, humidity, and air quality is utmost importance for the preservation of the exhibits and collections. Generally if it is possible to create comfortable conditions for occupants of the building at the same time conditions will fit also the requirements for the collections with slight variation.

Pollutants

Agents of pollution of indoor air could be gases, air particulates suspended in the air. They have an effect of corroding, discoloring, disintegrating artifacts of porous and reactive nature. These agents could come from a nearby road, industry, or from the museums parking area..

Some practical solutions could be:

- Use curved skirting to avoid or reduce dust collecting at interior junctions.
- Where site of the museum is adjacent to a road, set back the main building to mitigate effect of dust and dirt. Use also air filtering vegetations.

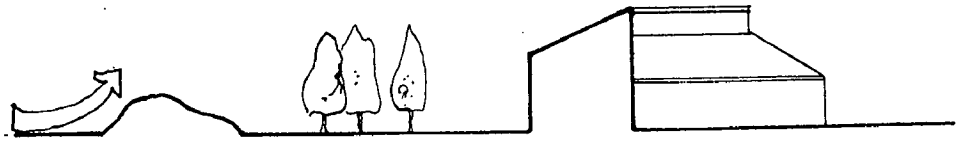


Fig106. Air filtering and dust breakers

5.6.5.1. Architectural means

Stable internal conditions could be created with mechanical means but it will also be greatly assisted by architectural design. Some of the ways are:

- Massive outer shell will help to avoid extreme fluctuations of temperature acting as a reservoir of thermal capacity.
- Using materials like timber and fabrics that will absorb the excess moisture form the internal space.
- Environmental services integrated with the architectural envelope.
- Improve air circulation and insulation of buildings

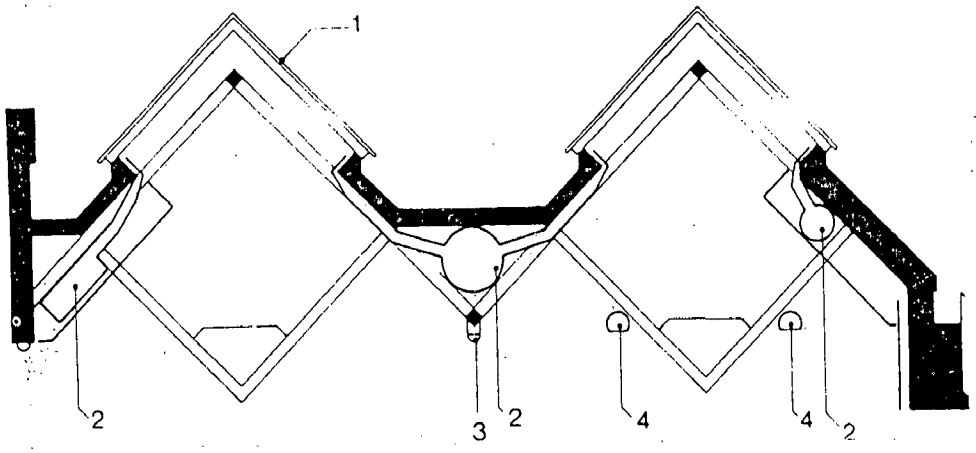
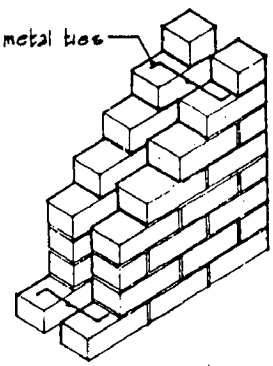


Fig107. Use double cavity wall system

Fig108. lighting, fire alarm, duct integrated with, architectural element of roofing [8]



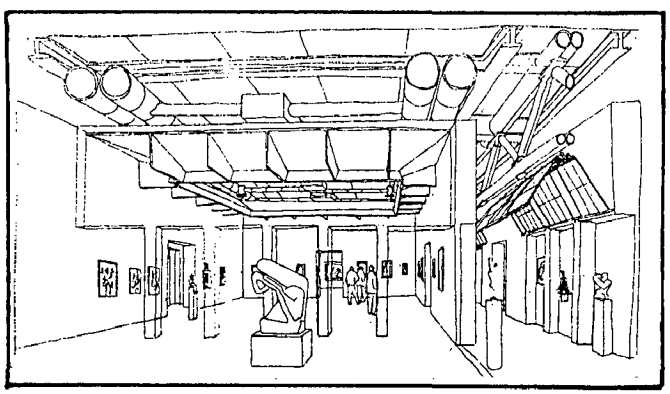


Fig109. Center Pompidou leave the whole duct system exposed [8]

Environmental zoning

- Make environmental zoning. This is to move collections to the best environmental characteristic. Because all collections have not identical ideal environmental conditions. Such segregation helps to avoid making dangerous compromises.

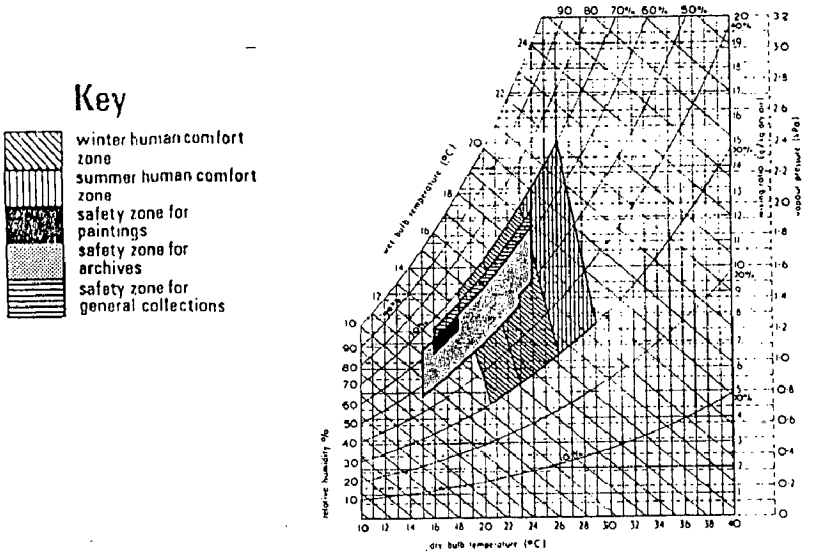


***Fig110.** .psychrometric chart showing different safety and comfort zones for museums and art galleries (Gary Thomson)[17]*

Scarcity of energy nowadays necessitates rethinking of methods that take up huge energy. At least architecturally those methods that conserve energy should be more relied upon instead of embracing energy intensive methods. Most architects find services as a hindrance to their creativity, but if services are well resolved in cooperation with the concerned specialist it is possible to integrate them to enhance the architectural language.

5.7. Considerations for design process

Particularly for fine arts museum at certain stages the conventional design process is incomplete to solve peculiar problems.

- For more command of the museum wall, in the initial design process interior wall elevations are drawn in large scale and the position of every extraneous element such as switch point, security device...is marked and agreed upon. This is because the conventional plan omits a great deal of crucial information. In relation to this

prepare an 'ideal-hung' drawing of the collections especially if the collection is unlikely to change or for permanent exhibitions.

- Museums with or without collections should make different design approaches so that unforeseen future collections are accommodated.
- Lighting design should not be an after thought, rather from the early stage of design it should be taken up as an integral part of the whole design process. Lighting design is not an independent undertaking, with sensitive design approach it is a part and parcel of the architectural elements, especially daylight. Lighting specialist from the earliest phase of design process should be made member of the design team.
- Security consultancy which usually is done at the last phase of the design process without causing much inconvenience for other buildings should be done very early for museum. A great deal of saving in man power, efficiency of security system can be saved this way. Architectural planning could contribute to an efficient security system, only if the security consultant works hand in hand to interfere so that security matters are taken as inputs as early as possible.

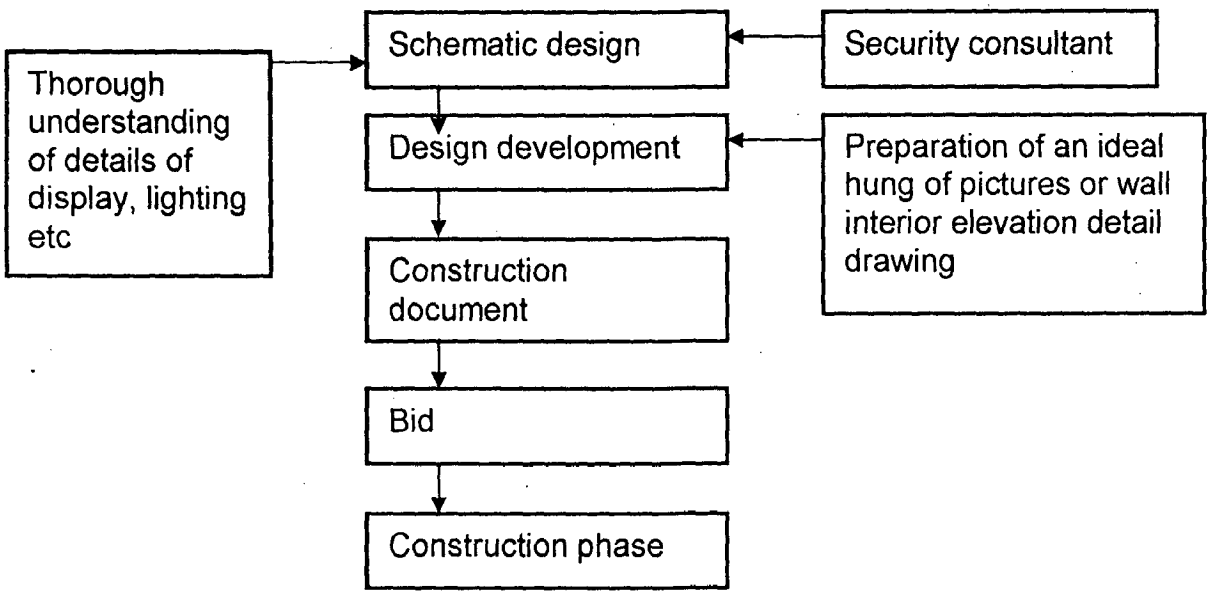


Fig111. *Recommended design process*

CHAPTER-6

CONCLUSIONS & RECOMMENDATIONS

6.1. Conclusions

1. *Complexity of museum program*

Nowadays museums are not just meant for what they used to be -visiting work of art, additional functions like restaurant, library for research, auditoriums, theatre... are taking root along side galleries, making museum design a complex task.(Sec.1.1.)

2. *No more traditional museum box*

This is a major shift of the contemporary museums towards curvaceous and irregular forms. Architecture no loner remains a neutral backdrop; it rather has become an art object by itself complementing and acting as a catalyst for art viewing. (Sec.3.3.)

3. *Route*

Route of visitors outside the gallery spaces become a dramatic feature, reflecting the prevailing theory in this area "*promenade arhcitecturale*". (Sec.3.2.)

4. *Design process*

When designing museum building some modification in the design process is needed in area of internal aspect of architectural elements and lighting. It is seen ***"from within outward"***[15] process gives unified design solution rather than the reverse. (Sec 4.6.)

5. *Freedom of expression*

Museum unlike most other buildings has no definite formal expression on the outside apart from it has to look a building of some civic interest. This may be one of the reasons why museum has become a fertile ground of testing different timely architectural ideas. (Sec.3.2.)

6. *Recreation of past*

Even though museums incorporate new ideas and styles, they are also forms of recreation of past architectural elements and typologies in figurative, abstract ways. (Sec.4.1.2.)

7. Future trends

The conventional way of museum experience, where visitor moves about stationary exhibition will be replaced by the reverse order – stationary visitor and changing exhibits. This has already started in virtual museums. (Sec. 4.1.8.4.)

6.2. Recommendations

6.2.1. Concept

Sources for urban image

- The landscape, the city and the existing architecture
- Introducing elements of the city like pedestrian path, terraces arcades and square
- The nature of the exhibits themselves i.e. the style of the art works to be displayed.

Use introverted layout when:

- High degree of security is desired, because what is exposed to out side is the strongest surface, the blank wall, against burglars.
- Monumental and sculptural façade is desired
- To relieve the uninviting façade use lively entrances to counteract this effect.

Use extroverted layout when:

- Lively façade full of movement is desired
- One wants to truly express movement aspect of the function of museums.
- When stringent technical requirements (appendices) won't allow freedom of expression on the gallery spaces in which case they will be subdued while public spaces are dominant.

The route

- Route of visitors should be combination of controlled and free flow.
- Should be graspable as far as possible at a glance for visitors.
- In many galleries relief space should be provided to reduce museum fatigue at nodal points. (Sec 5.4.2.)
- Provide universal space in the form of rotunda, atrium, courtyard, and symbolic sculptural form as an annex to the main proper to give global reference. (See sec.4.3.)

- In computerized museums use virtual tour as an option to be taken by visitors. (sec3.9.)

Gallery spaces

- Use a combination of open and contained spaces for exhibition halls to use the good points of both.
- Push circulation spaces to corners to increase flexibility of exhibition spaces in the case of open planned galleries.

6.2.2. Display aspects

Display techniques

- Proper use of display techniques helps to form the missing link between art and architecture.
- For renovated buildings use features already existing to advantage instead of trying to construct costly display system. (sec. 5.5.4.2.)
- Apart from the enclosing walls of the gallery space use techniques which will maximize display surface.

Viewing art

- Don't be conformed to the conventional way of viewing art, i.e. hanging with a screw on a wall. Responding to the work of art and architectural enclosure try various options which will best amplify the quality of the work of art. (sec. 5.5.1.2)

Floors

- Exploit the potential of floors in aiding visitors' museum experience to the fullest by using texture, material differences, and patterns.

Walls

- Plastered and painted surface is not the only solution as background for paintings because of special hanging methods
- Avoid items that will cause visual distractions on wall surfaces as far as possible.
- Surfaces above or below the customary eye level are also potential surfaces to be used as additional display surfaces.

Ceilings

- By using suspended ceiling it is possible to modulate the feel of a room not designed particularly for fine arts display hall.

Lighting

- For best results integrate natural and artificial lighting in museum interiors.(sec.5.5.3.1)
- In general it is good to limit natural lighting to public areas and transitional spaces between galleries rather than to the galleries themselves. At the same time these transitional spaces could exhibit stone or metal sculptures.
- Provide transitional spaces for movement of visitors between galleries where there is a sharp difference in lighting levels for adaptation reasons.(sec. 5.5.3.3.)
- Make the general lighting at slightly lower level of illumination than objects on display to attract attention.

Artificial lighting

- The architect should see to that optimum illumination by careful selection of fixtures is provided without distracting attention form the objects that may occur when the exhibits are overly elaborate that they become exhibits themselves.
- Through lighting certain desirable aspects can be emphasized while lack of lighting helps to conceal mechanisms and dull corners.

Natural lighting

- Use of natural lighting will enable to generate subtle spatial differences to the galleries.
- Directional light of saw tooth or other type of directional sky light is not recommended where uniform lighting is required through out all the floor plan.
- Sunlight should be admitted through small areas of clear glass and bounced off white surfaces of baffles or light wells.

Skylights

- In a gallery for temporary exhibitions, use a coffered ceiling lighting to have uniform lighting conditions on display walls.
- Reduce the sharp transition or edge of brightness at the boundary of the view of the sky and the room.
- Strive for architectural ingenuity while admitting natural light. i.e. visitors should not be confused about the incoming type of light, whether it is natural or artificial.
- It is possible to provide natural illumination for lower floors in multistoried museums using light wells or passive solar optics.(See sec. 4.4.3.2)

Windows and openings as means of letting light

- A single large window is better than many smaller ones to reduce the number of art objects affected by the light.
- A single large window placed at the corner is better than central one.
- Windows should not be placed at eye level in gallery spaces, rather at higher level usually connection between roof and wall.
- Courtyards should be shielded against glare.

Colors

- In interiors single hue is recommended with slight variations of its value.
- Museum experience can be heightened by sensitive use of colors in different spaces according to the mood required to create.

6.2.3. Caring for the collections

Security

Security perimeter

- Use external security where choice of material will allow use of exterior envelope of concrete or brick with few openings.
- Use internal security for cases where all part of the museum could not be secured through use of strong building envelope. Only those areas containing art works will have such strong envelope and others will be left as buffer zone.

Ancillaries

- Keep coat check facilities and retail sales outside the museum security perimeter, so that parcel control can be done easily.
- Separate cloak rooms, rest rooms and access control must be provided for such functions as cinema, recreational, and social outside the working hours of the museum, so that there won't be a need of using functions inside the main museum which will risk the safety of the museum.
- Place the mailroom outside the security perimeter.(sec.5.6.1.)
- Security control room must be well designed just like any other core important function of the museum.

Security manpower

- Design for minimum-security manpower by adjusting sightlines, and combining functions; of loading bay and employee's entrance, ...

Windows as security elements

- Narrow windows openings of windows are more secure than normal windows. Use also secondary protective measures for added strength.

Doors as security elements

- Exterior door must be of strong enough for possible burglar and thieves' attack with glazing to doors should be protected by additional details.
- Avoid thick outdoor vegetations, deeply recessed doors, porches that are likely places for thieves hiding.
- Be aware of extensions and protrusions from the surface of the wall, for they could be used as stepping elements to climb.
- Use physical architectural details that will control visitors from touching the exhibits without their being aware of them.

Museum environment architectural solutions

Temperature and humidity

- Cloak rooms must be used properly especially on rainy days
- Improve insulation of buildings for better temperature and humidity control.
- Mount lighting externally outside display cases

Pollutants

- Where site of the museum is adjacent to a road, set back the main building to mitigate effect of dust and dirt. Use also air filtering vegetations.

Pests

- Detail out every nook and corner that there won't be gaps that are potential corners where pests could get shelter.

Site planning

- Well drainage of site against surface run off of rainwater to protect rising damp from getting the foundation of the building.

Museum building design for proper environment

- Use pitched roofs instead of flat roof as much as possible for proper drainage of rainwater. Incase of overhead lighting, use as much low glazed area as possible.
- Use small glazed areas and few windows.
- Compartmentalization for fire protection and easy access.
- Avoidance of mixed use of public access and other spaces because it will lead us to make compromises.

Services carrying out environmental control

- Architects awareness is needed in advance that service can be accommodated in wall, floor, roof with different techniques and combinations.

Design process

- Study drawings of ideal hung of paintings should be made in the preliminary design phase of the design process. (sec.5.7.)
- Lighting design and security consultants should be involved from the earliest preliminary stage of the design process.

BIBLIOGRAPHY

I. Books

1. Brawne, Michael, **The Museum Interior: temporary + permanent display techniques**, London, 1982
2. **Buildings for the Arts,** 1987. United States of America: Mc Graw Hill inc. An Architectural Record Book
3. Carmel James H., **Exhibition Techniques, traveling and temporary,** Reinhold Publishing Co./New York, 1963
4. Egan M. David, **Concepts in Architectural Lighting,** 1983
5. Gardner James and Caroline Heller, **Exhibition and Display,** USA, 1960.
6. Hunt Wayne, **Urban Entertainment Graphics,** New York, 1997
7. **Limca book of records, 8th edition,** 1997. New Delhi: Ajanta offset & packaging Ltd.
8. Montaner Joseph and Jordi Oliveras, **The Museum of the Last Generation,** New York, 1986.
9. **Museums Vol. 9.** 1981. Tokyo: Global Architecture Book.
10. Nelson George, **Display**, Whitney public. Inc. 1956
11. **New millennium encyclopedia** 1999 Simon & Schuster, Inc. and its licensors
12. Phillips Derek, **Lighting Modern Buildings**, Great Britain, 2000
13. Sorcar, Prafulla C., **Architectural Lighting for Commercial Interiors,** USA, 1987
14. Tate Allen, G. Ray Smith, **Interior Design in the 20th Century**, New York, 1986
15. **The Europess Encyclopedia**, 1999, Cambridge university press
16. **Architects and designers for commercial and public spaces in Europe and Asia., vol. 2**, France: Publisher DID S.A.R.L. La Vielle Maison, The international directory of architecture and design.
17. whunter Gemma, "museums and art galleries " **New metric hand book**" 1976

II. Journals

18. 1981, "Museum of modern art (MOMA)", **Architectural Record,** vol. 169, no. 4
19. 1997, "Contemporary Museums", **Architectural Record**. Vol. 67, no. 9, pp 19-24
20. 1997, "Light in Architecture", **Architectural Record**. Vol. 67,no.4, pp65-69
21. Ada Louis Huxtabel, "Stuttgart Promenade". **Architecutal Review**. Vol. 12, pp 76-78
22. Bennett, David, 1992. "Optical lighting: A design alternative for India". **Architecture + Design**, May-June, pp65-70
23. Brawne, Michael, 1959. "The picture wall". **Architectural Review**, may, pp 315-325

24. Brawne, Michael, 1984. "Museums". **Architectural review**, vol.2, pp17-18
25. Davie, Peter, 1997. "Museums in an n-dimensional world". **Architectural Review**, vol. 8. pp 36-37
26. khan, Louis, 1995 "From his sketch books" **Architectural Review**, vol. cxcvii no 1175
27. Lehrman, Jonas, 1984. "Atriums & Architecture". **The Canadian Architect**, July, pp13-24
28. Lighting design and the life of museums, 1987. **Architecture**, vol. pp
29. Pastier, John, 1987. "L.A. Art: Dissimilar Duo". **Architecture**, Feb. pp41-48
30. Safdie, Moshe, 1984. "The architect's statement". **The Canadian Architect**, Feb. pp 22
31. Vischer, Jacqueline C., 1987. "The psychology of day lighting." **Architecture**, June: pp 109-111
32. Wagner, George, 1995. "Keeping Secrets." **The Canadian Architect**, Nov. pp 23-26
33. Yokouchi, Toshihito, Mikata Jomon Museum. **Japan architect yearbook** 2000 vol. pp.

III. Internet sites

34. http://www.arthistory.tcu.edu/ah_museum.html
35. http://www.arup.com/insite/features/Exhibition_lighing.natural.light.htm
36. http://www.clickshelving.co.uk
37. http://www.cs.ucl.ac.uk/local/museums/NationalGallery.html
38. http://www.digimuse.usc.edu/Architecture/Introduction.html
39. http://www.dpalighting.com/dayl/daylight.html
40. http://www.emms.org.uk/Preventive%20Consrevation.htm
41. http://www.GreatBildings.com/types/types/museum.html
42. http://www.icms.org.pl/ARTICULARS/ARTIC2.htm
43. http://www.icom.org/ICOM/ethics
44. http://www.mitpress2.mit.edu/e-books/city_of_Bits/Recombinant_Architecture/GalleriesVirtualMuseums.html
45. http://www.museumlighting.com/about.html
46. http://www.museums.gov.uk
47. http://www.spnhc.org/
48. http://www.stevekeller.com
49. http://www.ucalgary.ca/evds/intetvention/1997w/perception.html
50. http://www.webcom.com/spider/KRSLD-Web/Lectures.html
51. http://www.webcom.com/spider/KRSLD-Web/Lectures.html
52. http://www.museum-security.org/

GLOSSARY OF TERMS

1. **Adaptation**

It is our eye's ability to change size of pupil to regulate the amount of light levels available to see objects.

2. **Atrium**

Atrium is a central full height space as interconnection of multileveled gallery spaces. It gives sky lit space.

3. **Closed circuit television (CCTV)**

Any system of image presentation in which a video camera and its display screen are directly linked, even at a considerable distance, rather than by broadcast transmission or intermediate recording. Applications include surveillance, surgical and scientific demonstration, and industrial remote examination.

4. **Color rendering index (CRI)**

The degree of closeness of rendering natural colors is called CRI (color rendering index). Conventionally a CRI of 100 represents daylight.

5. **Color temperature**

Color temperature refers to the absolute temperature in degrees Kelvin of a theoretical blackbody or full radiator whose color appearance matches that of the source of light.

6. **Curator**

A keeper or custodian of museum collection

7. **Dazzling**

It occurs if laws of reflection in lighting, 'light reflects off a surface at the same angle as it hits it', are not observed in the relative positioning of the light source, the object of display, and the observer creating a discomfort to the eye.

8. **Electromagnet spectrum**

Range of all components of white light with different wavelengths.

9. **Glare**

It is experienced when we look at bright objects against relatively dark background.

10. **Hue of color**

The attribute of a color by virtue of which it will be named red, blue, etc. red yellow and blue are fundamental primary color hues; orange, green, and purple

are secondary color hues. Mixture of two primary colors will produce one of the secondary colors.

11. Iconoclasm

Purposeful action of destroying icons or religious artifacts done especially within the premises of the museum complex

12. Illuminance

In photometry, the incident luminous flux per unit area, i.e. the amount of visible light available to provide illumination per square meter; symbol E, units lx (lux); also called illumination. It decreases with the square of the distance from the source. The human eye can detect down to 10-9 lux.

13. Infrared radiation

Electromagnetic radiation of a wavelength a little longer than visible light. Invisible to the naked eye, we perceive it as 'radiant heat'.

14. Lux

SI unit of illuminance; symbol lx; defined as 1 lumen of luminous flux incident on 1 square meter.

15. 'Promenade arhcitecturale'

A design approach initiated by Le Corbusier proposing the importance of circulation as the central top most prioritized activity of a public building. It based on the notion that we are aware of spaces while in movement rather than seated in a confined space.

16. Reflectance

It is the measured ratio of incident intensity of light to reflected intensity.

17. Saturation

It indicates the purity of a hue-one that is unadulterated by another hue.

18. Ultraviolet radiation

Component of electromagnetic radiation with wavelength shorter than visible light that is invisible to the eye.

19. Value

The lightness or darkness of a hue produced by the introduction of black or white intermixed with primary, secondary, or tertiary color hues. Tints are made intermixing white; shades sometimes called tones are made by intermixing black.

20. Virtuality

Use of computer screens for visual experience with out actually coming into physical contract with the object.

Appendix I. Association of color with mood *(Brawne, Michael, The Museum Interior)*

No.	Type of color	Mood
1.	red	Warmth and comfort, exciting and stimulating, heat and danger
2.	golden	Royal and luxury, cheering, joyous , glittering , ornamental
3.	orange	Social, cheerful, and luminous warm and exciting , discomforting , upsetting
4.	blue	Tranquility and calmness, soothing and peaceful, cool, soft, and restful, sadness
5.	green	Tranquility and calmness, soothing and peaceful, natural, cool and restful
6.	white	Purity, and cleanliness, monotonous and boring, glaring
7.	purple	Devotion and quietness, solemnity, elegant
8.	yellow	Cheering and joyful
9.	brown	Unhappy, dejected, earth tone and neutral
10.	black	Mourning, solemnity, death and despair, sadness

Appendix II. Some Correlation Color Temperatures (CCT) [I-1]

(Brawne, Michael, The Museum Interior)

"Color temperature refers to the absolute temperature in degrees Kelvin of a theoretical blackbody or full radiator whose color appearance matches that of the source of light."

Color temperature is not a measure of actual light source temperature but is that of a blackbody heated to the same color (chromaticity); for example, an incandescent lamp is claimed to have a color temperature of 3000 K, which indicates that this is the matching color of a blackbody radiator heated to 3000 K.

CCT

Clear blue sky.....15000 – 30 000 K
Overcast sky.....6500
Zenith sun in clear sky.....6200
Sun above horizon in clear sky.....4100
Tungsten halogen lamp.....up to 3500
Normal gas filled tungsten lamp.....2700 – 3100

Appendix III. Types of artificial lighting *(Brawne, Michael, The Museum Interior)*

Fluorescent

It is a linear source consisting of a glass tube which has the inside coated with a powder and the tube filled with mercury vapor and argon. When electricity is passed through a tungsten wire electrode at the ends of the tube, the radiation emitted by the mercury is absorbed by the phosphor powder and re- emitted as visible light. The color temperature of this light can be close to that of an overcast sky, about 6500 K, or as red as that of a tungsten lamp at 3000 K, depending on the chemical composition of the materials used.

- Available in cold, white and pink warm colors this is an important virtue of these lamps.
- Economical
- Much lower heat emission hence they are very useful to lighting in and around showcases where heat emission is critical.
- Shadow-less flood light
- Cannot be focused or used to project parallel beams of light.
- Louvers are used to reduce glare but do not direct the light.
- The tubes reach their maximum efficiency when used next to a flat white surface which reflects light from the back of the tube.
- Most useful for general background ceiling illumination.
- Can be used in conjunction with filament lamps to provide directional lighting from one side.
- Useful means of duplicating, or used in combination, daylight behind a laylight or an egg crate.
- UV component of fluorescent tubes is excessive form many museum uses and the lamps will require a filter.

Filament (incandescent)

For museum application it has tungsten filament heated to 2700 °C. A number of tungsten bulbs can in some cases be combined within a fitting and the wattage of the lamp can also be selected so as to provide the precise amount of light needed for a particular situation.

- Less economical
- More flexible in use
- Useful for special lighting effects such as directional light, inside a fitting it can become a point source with a cone of light according to the shape of the housing.
- Frosted filament lamps can be used in lines or batteries for general lighting but warmer and less diffuse.
- Flood lamps in one direction are possible.
- Parallel beam reflectors will throw light in a beam for a considerable distance with sharp shadows like searchlight.
- If these lights are directly put inside the display cases ventilation will be an important consideration.

- Additional care should be made to protect the radiant heat that may damage objects of display.

In museum application we can have two choices of tungsten lamp: common tungsten lamps and tungsten halogen lamps.

Ordinary tungsten lamp

- Ultraviolet component of the lamp is so low filter is normally not needed. This is a very good attribute of these lamps.
- Their disadvantage is that they produce high heat output consequently inefficient in power saving terms.

Tungsten halogen lamp

- It has a shape of short linear lamp.
- Produce whiter lamp than ordinary lamps.
- More efficient
- It is a powerful source for small-scale flood lighting. It can light a large part of a wall from a distance.
- Its ultraviolet component is high and the fitting must include a heat–resistant glass filter when UV can in any way cause damage.

"On balance at present Tungsten Halogen is the first choice for lighting in museums with high color rendering fluorescent second." [III-17]

Fiber optics lighting system *(www.webcom.com/spider/KRSLD-Web/Lectures.html)*

Fiber optic lighting systems has got useful application for museums and exhibitions.

It offers tremendous flexibility as well as the safest method of lighting valuable artifacts.

Fiber optic systems consist of three main components:

1. Fiber optic projector. This consists of a lamp and reflector designed to project light on to the end of the fiber optic harness.

2. Fiber optic harness. Thousands of strands of glass transmit visible white light through the harness whilst virtually eliminating harmful ultraviolet and infrared wave lengths.

3. Fiber optic spotlights. Various designs are available all of which allow designers to precisely control the size, quantity, shape and color of light emitted from the fiber optic harness. [III-11]

The advantages of using Fiber Optics are the following:

Security

By using a remote light source located in an accessible position the need to enter a showcase is eliminated. Should a lamp require replacing it could be done without opening the case and exposing the object inside the case to dust, moisture and most importantly risk of theft.

Precise Optical control

Because fiber optics use a lens to collect and control the light emitted from the glass harness it is possible to control the light distribution and intensity with a precision no other lighting system can match. Certain details of the object of display can be emphasized while background can be subdued. The visual impact of the exhibit is further enhanced.

Protection from UV and Infrared damage

Paper, textiles and pigments etc. are all damaged when exposed to light. With fiber optic systems the harmful heat and ultra-violet content found in most other lighting systems is virtually eliminated. Exhibits can therefore be displayed within recommended guidelines for longer without fear of damage.

One lamp, many spotlights

One lamp can be used for many spotlights in a display case. The result is an even distribution of light from the top to the bottom of the case.

Miniature spotlights

The nature of fiber optics allows spotlights to be reduced to a minimum. Multiple spotlights ensure greater control and many more display options. Because there is no heat at the output end of the harness it is possible to add colored or neutral density filters to the spotlights to change the color or light level as required.

Appendix IV. Potential threats to museum objects

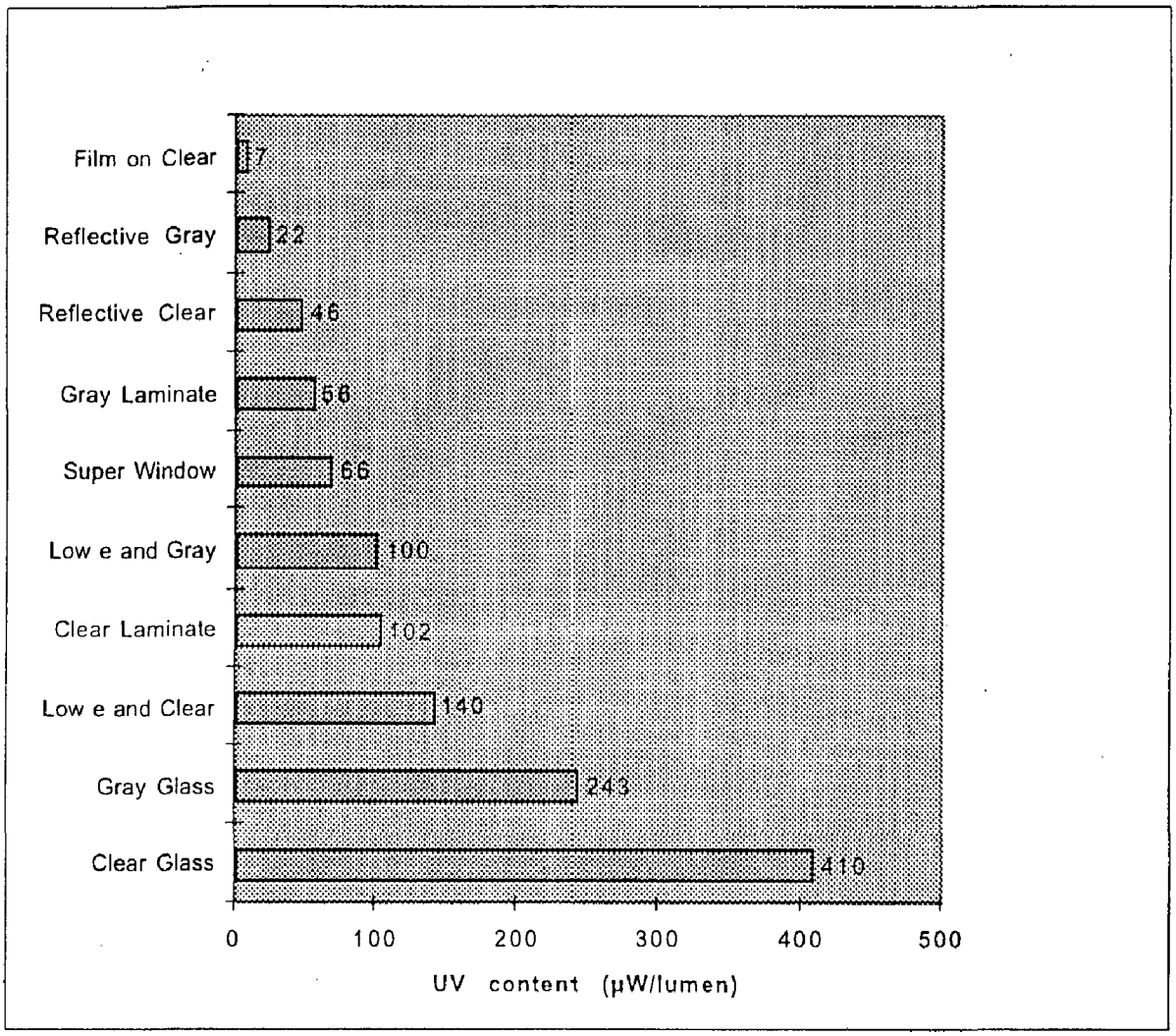
(www.ems.org.uk/Preventive%20Conservation.htm)

THREAT	SPECIFIC	DAMAGE	FREQUENT CAUSE	PREVENTIVE ACTION
People	Staff Visitors Intruders	Breakage Abrasion Crushing Theft	Unnecessary handling - open displays - badly organised stores - inadequate labelling Incorrect handling Inappropriate cleaning Insufficient supervision Inadequate physical or electronic protection	Prevent visitors touching objects Re-organise the store Label stored objects clearly Handle only as required, using approved procedures Upgrade physical and electronic security Train & motivate staff
Relative Humidity	Incorrect humidity level (high or low) Rapid fluctuation in RH	High humidity causes - mould growth - corrosion Low humidity causes embrittlement Fluctuation causes - splitting - cockling - warping[1]	Weather changes Floods & leaks Damp visitor clothing Wet-cleaning of floors Building re-decoration Rising damp Poor building insulation (temperature and/or humidity transmission) Poor ventilation Inappropriate heating source[2] or temperature control regulation	Regularly measure & record RH Move collections to best environment Improve air circulation Introduce visitor cloakrooms Improve insulation Attempt to impose RH control (by humidifiers/dehumidifiers, air-conditioning or use of heating/temperature control[3])
Temperature	Incorrect temperature (high or low) Rapid fluctuation in temperature	Heat causes - increase in degradation[4] - embrittle- ment Fluctuation causes - splitting - cockling - warping[1]	Weather changes Poor building insulation Poor regulation of heating Radiant heat from display lighting	Regularly measure & record temperature Improve insulation Mount lights externally to display cases Control temperature (by air-conditioning or use of heating/humidity control)

Light	Exposure to excessive light especially - high intensity light - short wavelength light (ultraviolet)	Fading Discolouration Embrittle-ment[1] Destruction	Natural & artificial light Too many windows Objects wrongly positioned Inappropriate artificial light sources Lack of filters or blinds	Measure light intensity & ultraviolet (UV) levels Filter to reduce UV light Reduce light intensity in display areas Reduce display times If appropriate, set annual lux hours exposure limit Block out all light from stores
Pests	Birds Rodents - Rats, Mice Insects - Moth, Beetles Mould Fungus	Objects eaten Objects soiled[5]	Gaps in building shell Damp (high relative humidity) Unchecked new acquisitions/loans Poor cleaning Attractants & food sources used in displays (eg plants & display props)	Regularly monitor with traps Inspect all new acquisitions Label & regularly inspect vulnerable items Isolate infested items immediately Keep store cool Maintain building shell Avoid damp or humid areas Regular & thorough cleaning of stores & display areas
Pollutants	Wind-borne gas & particle pollutants, especially - oxidant & sulphiding gases - dirt & dust	Degradation of materials	Close proximity to road Lack of air-filtration Poor door/window fitting Poor housekeeping Poor control of building/decorating works Inappropriate cleaning methods & agents	Identify the type & sources of gaseous & particulate pollution Determine the degree of risk Reduce ingress and/or circulation - create air/dust breaks - use mechanical air- filtration - repair the building shell - never use a duster Reduce impact on objects - box or wrap objects in store - use housekeeping regimes that remove dust & dirt

Appendix V. content of UV radiation fro various glazing under natural light

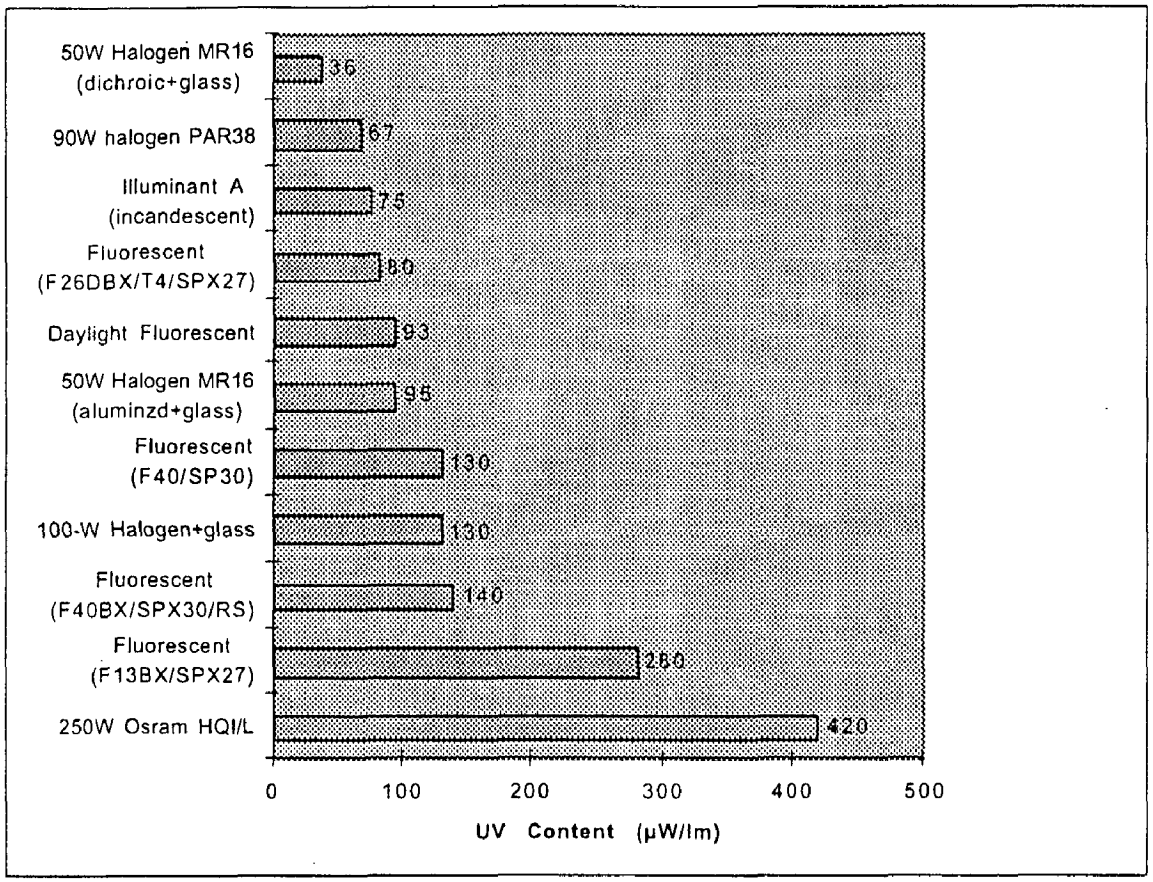
(www.stevekeller.com)



Ultraviolet content (in µw/lumen) for the overcast sky with various glazing options.

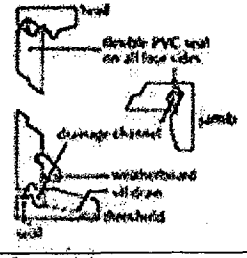
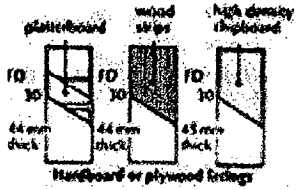
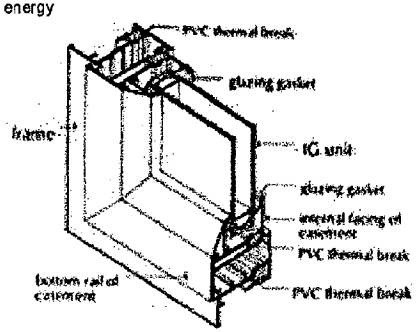
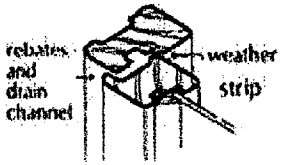
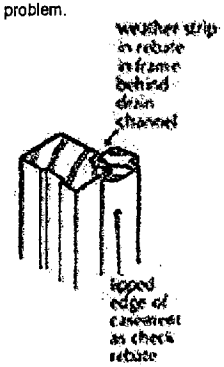
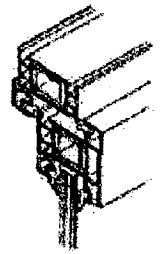
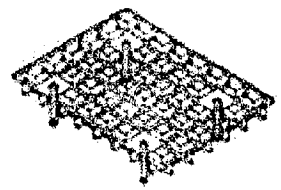
Appendix VI. Content of UV radiation for various electric light sources

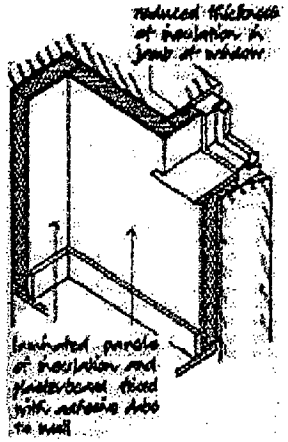
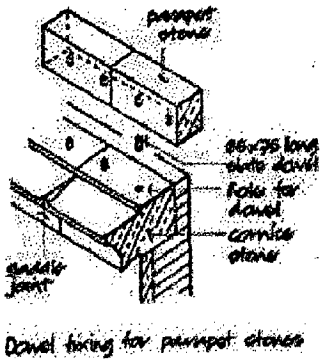
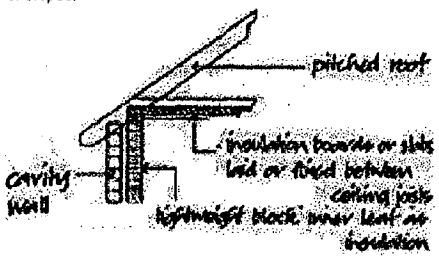
(www.stevekeller.com)



Ultraviolet content (in µw/lumen) for various electric light sources. Data f

Appendix .VII *Material and methods of major fine arts building components*

TYPE OF ELEMENT	ENVIRONMENTAL CONTROL PERFORMANCE	SECURITY PERFORMANCE	WATER TIGHTNESS	AIR TIGHTNESS	FIRE RESISTANCE	PREFERRED MATERIALS FOR MUSEUM USE
Door	Not a big issue , taking care of other factors will at the same time solve this aspect	Use safety glass to doors and door side panels up to 1.5m above finished floor level. It is to this level that hand and wrists get hurt from breakage of glass	More care should be taken for doors which open towards inside. In this case a porch or some sort of verandah is required. For maximum weather tightness a door will need effective weather stripping which will make opening more difficult and a high or complex threshold which may obstruct ease of access. 	Detailing similar to windows below will do.	Doors especially those along the fire compartments of restricted floor area are required to be as resistant as the other components of the compartment ;floor and wall 	Glazed steel doors. They double as fire doors also. Especially useful for heavy duty areas. Paneled wood doors, glazed wood doors, for interior uses. And with careful detailing for external
Window	**Insulating glass(IG) units, double glazing** for thermal insulation needed for controlled interior environment and conservation of energy 	Glazing of **wired glass** because even after breakage it will impede access. Glazing of **laminated glass** for security reason where secured areas are located.	Gaps and clearances gaps around openings are vulnerable to rain penetration. Especially where there is high wind driven rain it is required to have high performance in this respect. 	Air leakage contributes wastage of heat by an access of cold airflow of air through windows is caused by pressure difference between out and inside use of rebates and weather stripping will alleviate this problem. 	Window is considered as an element responsible for the spread of fire externally. It must be treated with fire retardant coating.	**Aluminum framed windows** are used as double sections with a link of plastic bridge to act as a thermal break. **Bronze windows** have attractive color and choice of texture **High impact uPVC** window as the materials formed by extrusion it is practical to form a variety of rebated and grooves to accommodate draught seals.  uPVC window section
floor	Not responsible in a significant scale	Not vulnerable	For gallery use avoid basements as far possible.	-	In service floors adequate provision must be made to separate electrical networks from dangerous contacts. Sufficient access space should be provided around these elements fro maintenance staff.	Coffered slab which accommodates mechanical and electrical systems easily 

wall	Double cavity wall for insulation of internal environment. Incase of solid brick and block use another material with a low transmittance coefficient to reduce heat loss in the form of thermal bridge. Use insulating materials of glass fiber, rock wool, EPS(expanded polystyrene), XPS(extruded polystyrene) to be applied in the internal side of the walls.  	External walls should preferably of stone concrete with minimum openings	Walls extended up to parapet level need special detailing to protect entrance of water though weak joints. Use also DPC in places where potential risk of dampness is seen  	--	Internal surfaces of walls should be applied with fire retardant mixture fro added safety. Walls forming component parts of the fire compartment should be of materials like stone, brick, or block works.	Natural stones of granite, limestone, sandstone, slate, marble most of the time in the form of ashlars
Roof	Pitched roofs are preferred for this purpose. Because the materials of roof and roof covering are usually poor insulators use of good insulators such as lightweight boards, mat or loose fill is recommended. When laying insulation material it should be fixed to ceiling joists the area of which is less than the roof slope or slopes.  since glazing is required if lighting is provided adequate detailing should be made in junctions of gaskets and caps between the glass and the roof covering. The types of glass used are float glass that is transparent and has flat, parallel. Bright, fire polished surfaces with little distortion, UV filtering glass with other system of accessories to deal with harmful solar radiation, wired glass to minimize the danger of breaking glass harming people down.	Should be made inaccessible avoiding excessive use of projections like buttresses, gutters and other projections.	The space inside a pitched roof is a void space that should be separated from other void spaces or cavities by cavity barriers that seal the junction of the cavities to prevent unseen spread of smoke and flames. Cavity of wall should be separated from that of roof.	Through system of suspended celling a relatively air tight controlled internal condition can be achieved.	Limit roof construction with in a site complying with the regulations of set back, etc...	Aluminum, treated sheet metal, concrete barrel vault,

(Adapted from Barry series, The Construction of Buildings, 5th ed.)