SETSCI Conference Proceedings
SETSCI Conference Proceedings
20, 100-110, 2024

6th International Symposium on Innovation in Architecture, Planning and Design
9-10 November 2024, Ankara, Türkiye

SIAP2024

https://doi.org/10.36287/setsci.20.13.100

Investigation Into Architectural Design Processes With Daylight Point of View: Case of Museum Projects

Ayça Arslan
Architecture and Design Faculty, Usak University, 1 September Campus, Usak.
e-mail: ayca.arslan@usak.edu.tr
ORCID: 0000-0002-5262-1429

Abstract - This paper examines daylight usage as a design tool in architectural projects, as an inspiration point, and as a natural concept creator during building design. Architectural design which is a complex process, includes some basic steps such as; analyses-synthesis-evaluation. At this point, the daylight topic takes big attention during analyses of both the context and the site of the building to make main decisions about the orientation of spaces within the consideration of south-north and east-west directions through sunlight. The sun and daylight orientation of the site constitute an important part of the analyses. Secondly, how daylight usage will affect the form of the building is another important problem of the design process. Some sort of research problems have been developed here such as; Can 'daylight' be a source or an inspiration point and concept creator in the case of architectural design? And, detailed results have been presented after a comprehensive literature review and analyses of the selected star architects' projects. 'Daylight' is an important criterion during the architectural design process, and in the article, famous architectural projects have been examined such as; Steven Holl and Zaha Hadid, and Tadao Ando, and how they use daylight as a design tool in their projects have been presented.

Keywords: Architectural Design, Star Architects, Daylight, Context, Concept

I. BUILDING DESIGN AND LIGHT

This paper mainly aims to explore the design criteria of museum buildings, especially concentrating on exhibition spaces and daylight usage. To achieve this, in the study two main criteria have been researched reciprocally, the theories of architectural design principles, and architectural analysis of star architects' museum projects with their spatial, massive, interior finishings, empty-full surfaces, and material selections. The architectural design which is a kind of object design like industrial design, have both similar principles in the base, they both serve for some specific usages, but within different scale proportions.

Erdoğan (2017), describes architectural design as; ''the international factors of the architectural shaping features and the attempted action are the same as the features of a hardware until it comes to external factors and limitations; *i.emerges to meet specific purposes and needs, ii. defines the form suitable for this need, iii. it is a structured design that will sustain the form, iv. the use of materials and construction techniques to realize the desired shape''*. (Erdoğan, 2017)

Therefore, the design, belonging, and building carry out the same human-center factors. When we think about this perspective, buildings are some kind of sculptures that we live in. Or we can claim that as architects, buildings are sculptures through their aesthetics and artful necessities, but on the other hand, they are big-scale, human-scale belongings, or item designs in which space plays the leading role. Through this discourse, this paper concentrates on design criteria of star architects' museum projects and investigates the space features of the museums with formal approaches, locations, especially about being underground or on upper floors, their daylight usage details, materials, forms, and empty-full surface characteristics. In the end, this paper aims to explore the design criteria of museum buildings with their daylight usage, and makes comparative analyses of star architects' buildings, within the usage of location, material, and form concepts.

1.1. Aims and Objectives: This investigation mainly aims to explore daylight usage in museum projects, and the way star architects achieve to use daylight in their unique designs. The article mainly concentrates on; firstly space and spatial organization, secondly the daylight details, roof-skylights, Windows, and openings, the empty-fullness of the surfaces of spaces with building materials as solid-transparent features, and the environmental issues such as; a crowded city center or a huge green area.

1.2.Literature Review: In the study literature survey consists of; architectural design principles and daylight usage in museum projects with the spatial character of exhibition spaces by the academic studies, books, journals, and sample analyses.

1.3.Research Questions:

a. Can 'daylight usage' be a source or an inspiration point and concept creator in the case of architectural design?

b. How does the sculptural effect of the building change over day and night views?

After a comprehensive literature review and analyses of star architects' projects, the study will be able to introduce detailed results.

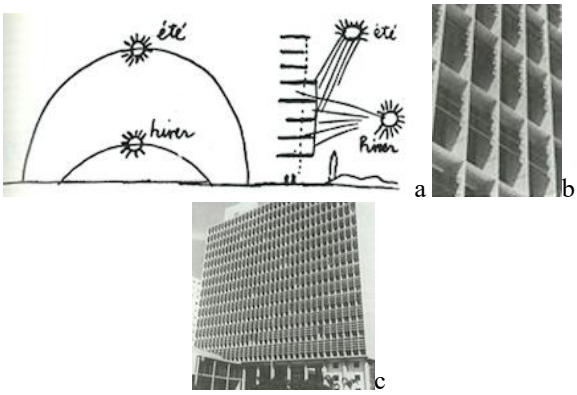
1.4.Methodology: This article is an investigation into daylight usage in museum buildings and makes case analyses of star architects museums. In the paper, respectively, museum projects of Steven Holl and Zaha Hadid have been analyzed by their spatial features, space types, materials analysis, and environmental properties, which are presented by architectural drawings; plans, sections, elevations and perspectives.

II. DAYLIGHT EFFECT AND ARCHITECTURAL DESIGN PRINCIPLES

According to Le Corbusier, architecture is defined as; 'the masterful, correct and magnificent play of masses brought together under light'.

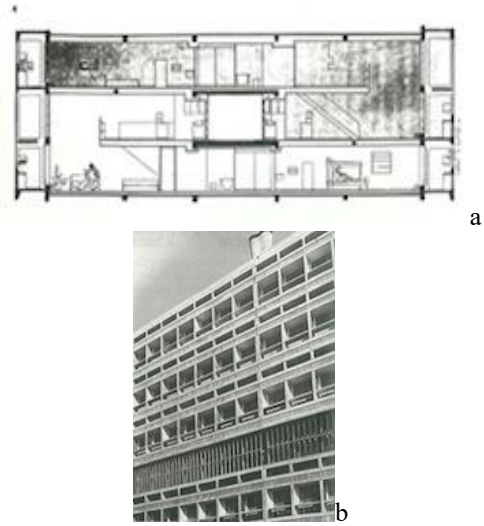
The relationship between Le Corbusier's architecture and daylighting is widely recognized in many studies and research that have shown the value of his design criteria and his innovations such as; bris-soleil, primarily showing his constant research into the improvement of performance of daylighting. It is possible to assume that Le Corbusier had always involved the sun and natural light in his design strategy. By studying the building's orientation, and the position of the sun in relation to the buildings, evaluating the use of horizontal windows which provided more access to natural light than vertical windows. (Iommi, 2019)

During the 1930s, Le Corbusier was working largely in hot countries, and the investigation of the brise-soleil seemed to be the answer to problems of heat gain. Clive Entwistle, wrote to Le Corbusier in August 1946; I take this opportunity on behalf of young people here to thank you for your latest gift to architecture: the brise-soleil, a splendid element, the key to infinite combinations. Now architecture is ready to take its place in life. You have given a lit a skeleton-independent structure, its vital organs communal services of a building, a fresh shining skin the piloti. And now you have given it magnificent clothes, adaptable to all climates. (Oeuvre Complete. Vol.IV. p113). (Mckenzie,1993)(Figure 1)



a b c

After the War, Le Corbusier's work began to get more involved with more passive means of environmental control, and ideas like the brise-soleil, and the grille climatique were adopted more often. There are sketches showing sun path diagrams and ClAM's 1951 Charter of Athens prescribed that at least two hours of sunshine per day on the shortest day of the year should be allowed to enter every dwelling. Le Corbusier's compositional concerns, to give one example, one of the main compositional elements in the designs for the Unite d'Habitation in Marseilles was his invention of the brises-soleils. For best results, the rectangular buildings should be oriented so that the long facade should face South or even slightly South-east so that the low morning sun can enter the building. Hot midday sun can be excluded by the brises-soleils and therefore only the shortest elevations face the low and intense evening sun. (Mckenzie,1993)(Figure2)



a b

Figure.2 a.Section through the Marseilles block showing sun-breakers in each side, b.Main elevation of Marseilles with vertical brise-soilelis on internal Street and horizontal sun-breakers half-way up each double storey apartments,https://www.architectural-review.com/archive/le-corbusier-in-the-sun.

According to Le Corbusier, the themes of transparency and natural light became the fundamental elements of building design with the paradigms of the international style. Le Corbusier proclaimed that; 'to bring in the sun, that is the new and most imperative duty of architect'. Thanks to innovations in materials and constructive systems, daylighting became an essential aspect of modern architecture, with the purpose of providing more comfortable and more efficient indoor environments. (Iommi, 2019)

2.1. Contextual Approaches of Design

In architectural design, first of all, a plot of land is needed for the realization of the building. The plot of land must be considered multi-dimensionally. Here, the data on the environment where the building will be located is needed. Where the structure will be built, its conditions must also be known. If it is built on the ground, it must be considered whether the building is located above or below the ground. Today, half of the skyscrapers are underground. Since artificial ventilation and lighting are provided, these factors are no longer a problem. Even if a skyscraper is built on the ground, instead of using natural ventilation and daylight, artificial ventilation and lighting can be provided. (Erdoğan,2017)

The building being considered must also be suitable for the condition of the plot. The fact that the building is above ground requires an architectural structure. If the building is to be located above ground, all data regarding the plot, such as; the size of the plot, the environment in which will be located, how the plot is approached (from traffic and pedestrian perspectives), the view it faces (sea, mountain, etc.), wind direction, north direction, slope (topographical condition), are collected and the building is designed and constructed accordingly. (Erdoğan,2017)

No structure can be designed without gathering information on the topography of the plot, and ground characteristics (groundwater, vegetation on the plot, direction and view of the plot, climatic characteristics of the environment, wind, rain, and sun conditions). Programming of the building constitutes an important part of the design studies, it is the determination of the physical environment suitable for human activities in

terms of quality and quantity. In other words, its the determination of the needs of the people-users who will line in the environment to be arranged while performing certain activities and actions in terms of tools, space, environmental conditions, and functional relations. (Erdoğan,2017)

Building programs mainly include two groups of information. The first is the functional and behavioral characteristics depending on the functions expected to be included in the buildings, and the second is the physical characteristics that determine the environmental conditions required for these functional and behavioral characteristics. Functional and physical features usually define the qualities of programs. Regarding quantity, the number of users, the number of spaces, and the area size are always included in the programs. (Erdoğan,2017)

İn creating a program with physical environmental conditions; i.) open spaces, green areas, city view, ii)land survey (physical environment, existing land, development control, neighboring lands,etc.), iii) indoor environmental conditions (natural-artificial ventilation, natural-artificial lighting, electricity, elevators, heating, etc.), iv) physical environmental factors (daylight, sun, view, noise), external environment (pedestrian traffic, vehicle traffic, park, lighting). (Erdoğan, 2017)

In terms of the limitation of space and the concept of interior space, the construction activity that we call Architecture is a different field of action. The structure indicates a piece of space that encloses the living being and separates it from the universal void. Thus, the first task of the architectural action is to create a limited volume in which people feel safe. (Erdoğan,2017)

Human beings limit the vast universal void and this part of the natural environment, which he has difficulty grasping with his eyes and imagination, in one or more directions; he turns it into an introverted, private void around himself. This is how architecture, which we call a special building activity, occurs. The limitation of the space is the event that initiates the special construction action. The determination of this limitation by only an eave is the most primitive situation. When the space boundaries consist of horizontal and vertical structural elements, both a visual limitation and a movement limitation arise. (Erdoğan,2017)

Vertical elements that limit the movement of a walking person and define a certain volume create a structure. For example, a simple stage with one side and top open defines a structure. In order to fully meet the need for protection, the limitation must be in every direction. Thus, a 'special structure' is defined as a limited space. The special space in which movement and things are done, which separates people from their surroundings to a certain extend- to the extent that people desire- is the most important element of a special structure, and we call this space 'Interior space'. (Erdoğan,2017)

The concept of interior space is always mentioned with three of its features:

1. Boundary elements are as important as bounded space: The space that defines the building space has other qualities than being the simplest volume. Building space is a phenomenon that the bounding elements create together in the bounded space. It is not possible to define a space only with the values of space (dimensions such as; depth, length, direction of movement, brightness, etc.) or only with the boundary elements.
2. Space is determined by movement: The fact that space constitutes the center of gravity of the structures is that it is the expression of its most real-life values. A living being is revealed by movement. Movement can only occur in space. Thus, being classified according to the potential movement possibilities within it is an important feature of the building space.
3. Space exists with light: Light is a natural feature that determines the existence of space in the structure. Light is an indispensable element of life as well as an inseparable part of the building space in terms of allowing the qualities of the bounded space to be shown.

Indeed, the development of 'Interior Architecture' in human history has paralleled the development of natural lighting. (Erdoğan,2017)

When we say 'architectural space', we also understand a place that is not strictly limited by walls. In spatial establishment, it is not necessary for all vertical elements to be high and for the surroundings of the space to be created in this way. A certain space establishment with natural and artificial elements can generally be defined as follows:

-natural space with natural elements (earth, sky, horizon, bushes, trees).
-artificial space with artificial elements (walls, ceilings, beams, columns) (architectural space, urban space)
-natural and artificial elements (mixed space-architectural space, urban space) (Erdoğan,2017)

Every structure creates two types of spaces. One is the interior space or spaces limited by the structure itself, and the other is the exterior spaces created by the outer surfaces of the structure together with other structures around it. (Erdoğan,2017)

The surfaces that limit a space also determine the boundaries of the masses. Masses are perceived from the outside, while spaces are perceived from the inside. The perception of space is only possible with **light**. In other words, a person in an artificial environment is constantly in a state of 'stimulation' by all the physical factors that make up this environment. The brain's response to these stimuli is 'sensation' and 'perception'.

A person who maintains his/her relationships with his/her environment with the help of all sensory systems (seeing, hearing, smelling, touching, tasting) is most affected by the visual stimuli in his/her environment. Therefore, the most important type of perception in perceiving the external world and having this specific concept about 'Visual Perception'. (Erdoğan, 2017)

Space cannot be perceived without light, the perception of space is a complex task, there 3 types of perception:

1. perception of light,
2. perception of spatial organization,
3. perception of color . (Erdoğan,2017)

*Perception of light: the human perception of light is not based solely on physical stimulation. In other words, our eyes are sensitive to electromagnetic radiation with wavelengths

between 380-370 milimicrons. The perception of **light** occurs according to the energy carried by these rays.
Light is a mental phenomenon and cannot be measured by physical means. The measured light is the physical energy that is the stimulus that gives rise to the sensation and is also directly related to the sensory organ and the subjective state of the observer. In other words, we have to take into account the phychological phenomena that are effective in the perception of light. (Erdoğan,2017)

2.2.The Light Factor in the Formation and Perception of Space

Light plays an important role in the lived aspect of architecture. Changing the location and dimensions of the window openings in the same room can give the impression of a very different volume. Moving a window from the middle of the wall to the corner will change the entire character of the room. A space that is close on all sides and open on the sides can be considered as opposed to a space that is closed on all sides and open the top. In the first case, different light effects occur in different parts of the room, in the others, the room is planned to be equally and well lit. The best example of a completely closed space illuminated from above is the Selimiye Mosque. (Erdoğan,2017)

One of the problems that modern architecture often encounters is obtaining good and regular light in different parts of a large room. Windows that open from above are so good that they obtain good and regular light in different parts of a room. On the other hand, windows that open from above are not such a good solution because the light coming from there is too diffuse to create the shadows necessary to see the shapes and textures easily and definitely. Light coming from the side is better, but it is not sufficient on its own. (Erdoğan,2017)

Because it does not go deep. The solution was found with saw-toot roofs that provide light to every part of the room. These are a series of high and side-opening windows. The best light for seeing form and texture is light from a single or several sources that are more or less intense, that is, falling in the same direction. This also emphasizes the closedness of the room. Light can create a closed-volume effect. On a night, a campfire creates a cave of light surrounded by a wall of darkness. Those who stay within the circle of light feel a sense of security as if they were sitting together in the same room.(Erdoğan, 2017)

By following this, it becomes clear that when you want to create the effect of openness, you need to use intense light. Famous architect Frank Lloyd Wright realized this at the beginning of his career. In his buildings, which are considered open-plan, you will see that the walls and partitions do not extend to the ceiling, leaving room for openings from above. This gives the room a feeling of openness and allows additional light to enter. But Wright's interiors are mostly dark. Despite the large windows, the overhanging eaves and surrounding trees create an interior space that appeals to emotions and is based on indirect illumination. (Erdoğan, 2017) (Figure 3)

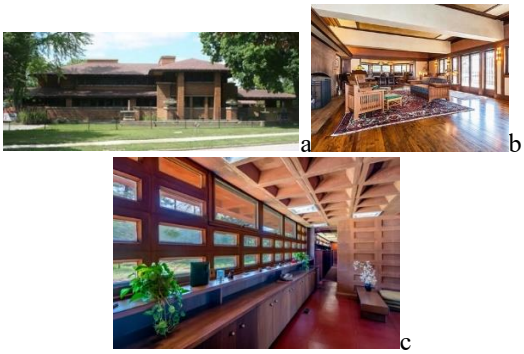


Figure 3. a.Robie House, Buffalo,NewYork (1904),b.1901-The F.B. Henderson House, c.1963-The Frank Bott House, Kansas-City (https://www.architectureanddesign.com.au/features/list/frank-lloyd-wright-the-greatest-american-architect)

For example, the lamp arrangement in Ottoman mosques shows how strongly the idea of space limitation can be evoked through lighting. There is usually a horizontal suspension arrangement, slightly above the floor, that carries individual lamps.

In addition, accordingly, architect and academician Prof. Dr. Sema Soygeniş, architecture has a very close relationship with light and light is the main element that creates spaces. As indicated by Soygeniş; the use of light in architectural space is important. Depending on its use, light can bring liveliness and movement to a space. The atmosphere desired to be given in a space can change with the effects of light, and the effects desired to be created in a space are strengthened with the help of light. (Soygeniş,S.,2006)

With the history of architecture examined, many examples of effective use of light are encountered. Gothic architecture is an example of architecture where light is used effectively. Similarly, Louis Kahn and contemporary architects Tadao Ando use light successfully in the spaces they create. Tadao Ando says that architecture should remain silent, and nature should emerge with the breeze and sunlight and mentions that; *daylight changes its quality with the passage of time*. This statement shows how much the architect cares about the relationship between nature, daylight, and architecture, and how he uses daylight as an element that enriches the space. (Soygeniş,S.,2006)(Figure 4)

***Church of Light, Osaka Japan,1989**

Figure 4 Tadao Ando and church of light in Osaka Japan, a.interior black and white, b.exterior

In all my works, light is an important controlling factor. I create enclosed spaces mainly by means of thick concrete walls. The primary reason is to create a place for the individual, a zone for oneself within society. To achieve this, the walls are detached from the exterior environment, and natural light is used to bring change into the space.TADAO ANDO
(https://archeyes.com/church-of-light-by-tadao-ando-minimalism-and-the-play-of-light/)

Tadao Ando is a master of blending minimalism with spirituality, creating architecture that transcends the physical to touch the soul. His works often engage with nature, light, and raw materials, stripping away excess to reveal the essence of space. The Church of Light, located in the suburban town of Ibaraki, Osaka, is one of the most celebrated projects. This small religious structure, measuring only 113 square meters, embodies Ando's philosophy of using architecture to create profound, meditative spaces.

A dialogue between ***light and space***: however at first glance church appears very austere, this simplicity is intentional, allowing the building to be a canvas for natural light and spiritual reflection. Ando utilizes three materials; concrete, glass, and light. The raw concrete walls are left exposed, a hallmark of Ando's brutalist leanings, and the absence of adornment focuses on the building form and light. The famous cruciform window cut into the end wall is at the heart of the design, standing as both a literal and figurative representation of faith. This cross-shaped opening slices through the heavy concrete, bringing the outside world in through the changing intensity of light throughout the day. Light beams penetrate the dark interior as the sun moves across the sky. This dramatic contrast between darkness and light is central to the church's experience, turning the building into an evolving canvas for natural light. This dynamic interaction between light and space invites contemplation. (Figure 5)

Figure 5 Church of Light, interior details and perspective drawing

Louis Kahn also says that; sunlight does not know what it is before it hits the wall, emphasizing the importance of the shadow created by the sunlight on the wall surface and the effect of light within the space, and states that; no space that does not receive natural light can be accepted as an architectural space. Kahn, apart from the functional necessity to be provided by artificial lighting, expresses the effect of daylight on the quality of space design. In addition to all these features, the economic advantages that rational use of daylight will provide in the building usage process are also an issue that should be emphasized. (Soygeniş,S.,2006)

*Artificial and natural light: In cases where natural light is not sufficient due to construction or other reasons, or when the need for light is high due to functional reasons, artificial lighting is necessary for the continuation of activities in the structure. Functional requirements should be taken into account in artificial lighting design, and lighting design should be carried out by determining the light levels according to the nature of the work being done. In addition, it should be taken into account that horizontal light is an effective design element in design. Natural and artificial light can be used directly, filtered, or reflected and different effects can be created by using bulbs that give off different qualities and colors in artificial lighting design. A spatial effect can be created within a space with lighting. Different light intensities created within a space can be perceived as a different space within a space, as they determine sub-spaces within the space, and can strengthen movement between spaces.

*Light and movement: The presence of light in a space can, in some cases, strengthen movement in a space. Gaps on the surface of space and the presence of light seeping into the space from these gaps can cause people to move in the space and can be a sign that different views will be captured in the space. When various applications around us are examined, it is seen that the movement within the space is further strengthened by the light that supports them, as well as by circulation elements such as stairs. (Soygeniş,S., 2006)

III. CASE ANALYSIS

Steven Holl and Zaha Hadid's museum projects have been presented at this part as case analyses over pictures, drawings, plans, sections, elevations, and detail drawings.

3.1.Steven Holl Architects – The Nelson Atkins Museum of Art, 2007- the metaphor of daylight and artificial light

The museum was built in Kansas City in 2007 with an area of 15.329 square meters, as an extension of a traditional old existing building in the site area. The extension museum project is very unique in the way of light-usage concept in the project. Architect Steven Holl while designing the new art museum, not only created a building masses, but also he successfully created a unique and iconic work of art as the building itself, which the buildings are all both exhibition spaces and sculptures full of light. (Figure 6)

Figure 6. Site plan; the old traditional building and 5 new buildings called 'lens' in the descriptions

These 5 new buildings that have been built as the extensions of old museum have similar design characteristics, they are all low in height with just 2-3 levels and they are all transparent buildings with the help of translucent material that they have been covered. (Figure 7)

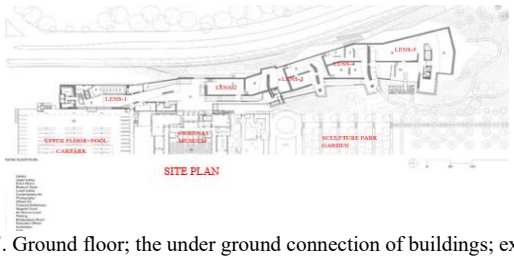


Figure 7. Ground floor; the under ground connection of buildings; exhibition spaces

Due to the topography of the site, there are level changes between new buildings and they are connected with ramps each other, these sections are helpful for the exhibition space connections with different heights. (Figure 8-9)

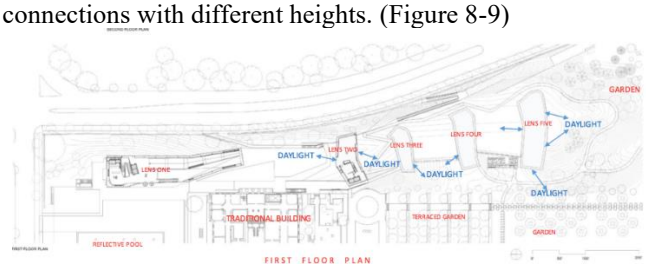


Figure 8. First floor,masses of new buildings changing through the topography

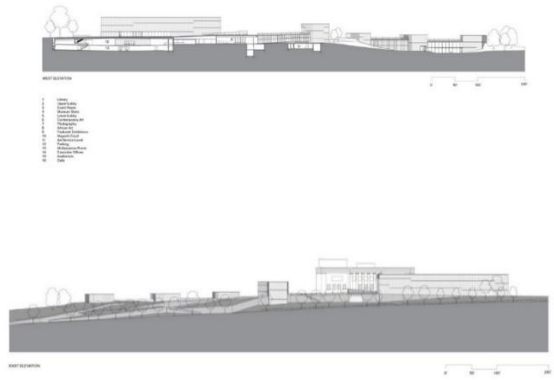


Figure 9. Sections of the site and musuem buildings both ol done and new ones

Steven Holl's unique design can be presented wholly with a longitudinal section that abstractly demonstrates daylight usage in the exhibition spaces at all buildings. Here the detail for daylight usage is very unique with its form **'T' detail**, and also creates the concept of the new additions with transparent material that covers and sticks to this unique **T- shaped** details. This project is so unique because of the way Holl designs exhibition spaces both underground and ground level about the topography and produces a unique module, a **'T' shape module** specially designed to take daylight into the building, that is the concept creator of the project. (Figure 10-11)

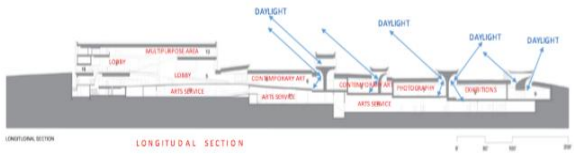


Figure 10. Longitudal section and **T** modüle

The spaces in the project are listed as; 1.library,2.upper lobby,3.event room, 4.museum store,5.lower lobby, 6.contemporary art, 7.photography,8.African Art, 9.Feature exhibitions, 10. Noguchi Court, 11.Art service Level, 12.Parking, 13.Multipurpose room, 14.Executive offices, 15.Auditorium, 16.Cafe

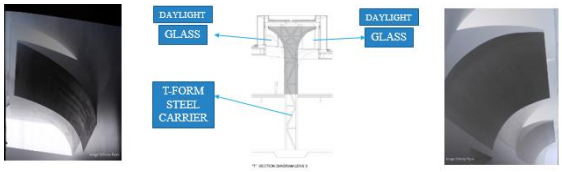


Figure 11. **T** module section

In addition, Steven Holl a star architect, designed a unique system detail for the project and created a module structure to carry this system detail, to realize his main aim to transform the museum into **a lighting item** at night. Holl had designed a museum building for daily usage and a lighthouse for nights. This metaphor created professionally by Holl, uses daylight in the museum exhibition spaces with the help of; the **'T' section module and transparent opaque material** that covers the structure, and at night buildings illuminate the green environment like lighthouses.(Figure 12-13)

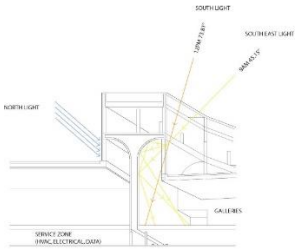


Figure 12. T structure module transport light down to the galleries along their curved undersides while carrying the glass

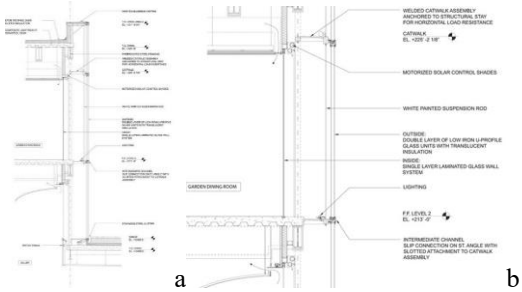


Figure 13. a.System detail and facade demonstration of the project, b.point detail

In the section, materials are listed from outside to inside as; outside: i.double layer of low iron u-profile glass units with translucent insulation, ii. intermediate channel slip connection on St. Angle with slotted attachment to catwalk assembly, iii. white painted suspension rod, iv. lighting, v.motorized solar control shades, vi. inside: single-layer laminated glass wall system.

Steven Holl designed this building as an extension of the old museum, thus, he designed the new building totally differently from the old traditional stone building. **The contrast of solid to transparent, heavy to light, massive concrete to steel opaque material, created a huge contrast between two different designs**. Holl integrates the new building into the existing one in a very creative way by putting the transparently designed light, White new buillding just in front of the water and pool, and makes the transparency effect more strongly felt. (Figure 14-15)

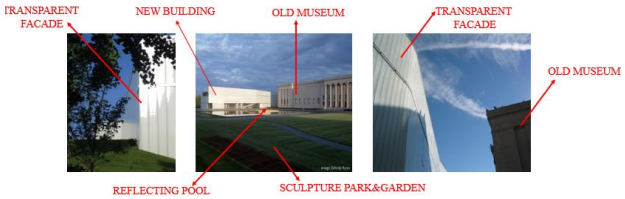


Figure 14. Building exteriors and relationship with the nature

Figure 15. Interiors of Nelson Atkins Extension Museum; **White and black**

In the interiors of Holls' design one can see the continuing contrast feature in interior spaces, while **T-shape module** structures carry the ramps, stairs, and upper floors, the facade serves as exhibition spaces with opaque transparency. On the other hand, circulation areas accommodate glass facades. White color had been used very strongly in both interior spaces and outside the building, except stairs and floor coverings which are black to create figure-ground expression and contrast, but the building's expression is totally **White and Light.** (Figure 16)

Figure 16 **Holl Architects**; **The Nelson Atkins Museum of Art, Reviews**

***Main findings:**

1. Site Plan Analyzes: In the project, new extension buildings with 5 transparent small same shape exhibition spaces, merge into the sculpture garden of the site and enlarge the massive existence of the old heavy museum with 5 small light interconnected museums that fit with the topography and big green areas. In this way Holl, not only created new exhibition spaces, but he also achieved to create a rote that surrounds all around the site with an exhibition walk manner, both inside, outside and bridges. In addition, the white color and opaque material used for the new buildings also create a very light effect on the existing green areas. On the other hand, the orientation also effects the design, Holl puts 5 new buildings on strong North-South axes thin and long, and the main exhibition spaces get daylight through east-west directions.

2. Section Analysis: Sections of Steven Holl's designs demonstrate that daylight usage occurs from an east-west direction and the long axis oriented building with a long section. As the longitudinal section indicates in the basement all 5 buildings are connected which is a good solution through the topography. Holl's unique and iconic structure design comes forward with the T module column design, in which he aimed to get daylight from the upper part and reflect into the interiors to create a shadow-light effect inside the museum. On the other hand, these T-module columns create the carrier of the buildings and also hold the exterior materials.

3. Plan Analysis: The ground floor is the biggest level and through the topography, some parts can get daylight. The ground floor consists of basement level of 5 new museum buildings that are connected underground and create a long building. In addition, the basement consists of a reflective pool that is used at the car parking level and the large auditorium space under the existing old building. Thus, the ground floor is the basement and connection of all spaces. On the first floor there, are two of the new buildings entering the section and the existing building with its enterance space. Due to the topography, other 3 new museums' roof plans are connected with the sculpture garden on the right side of the green area, which is the lower part. The site is like a ramp between the right and left side and, Holl designed 5 new buildings parallel to this slope, thus visitors experience also green areas, sculpture garden and exhibition spaces together while walking on the site.

4. Elevation Analysis: Elevation indicates the silhouette of the site with same height buildings, that are connected with green areas. The harmony of old and new building heights went under demolition by contrast of old and new buildings facade effects such as; stone-opaque, massive-glass, dark color-white, dualities.

5. Detail: All new buildings exhibit unique **T-shape module** structures that carry a white opaque facade.

6. Color: All of the 5 new buildings are designed with clearly white color both from the outside and inside. White color usage of Holl especially indicates the introverted space characater of museum and exhibition activity, and the figure-ground design principle which transforms building structure into grounds and all art exhibitions into figures.

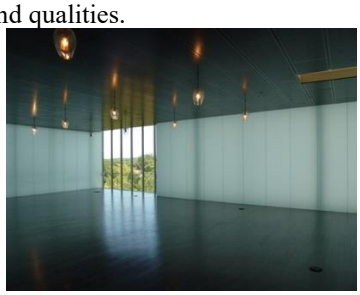
7. Daylight Analyses: T shape module structural column design of Holl, gets daylight at the roof level reflects into the interiors, and creates shadow-daylight play inside the exhibition spaces. At facades, the white opaque material is used at all walls with a 360-degree approach, which means of the cubic buildings, all 4 sides have been covered with white opaque material that reflects daylight into the museum. In addition, the lighting detail in front of the opaque material from inside, transformed these 5 new transparent white buildings into lighthouses at night which is the concept created by the architect.

8. Space Analyses: The spatial organization of the 5 museum extension buildings exhibits harmony between functional spaces such as; all main exhibition spaces connected at ground level, thus, there is a long exhibition route of approximately 700 meters. On the other hand, all 5 building accommodate their lobbies, halls, galleries, stairs, and ramps, individually, as they are separated buildings at the garden level. And five buildings accommodate spatial harmony.

Evolution of the Project: It's found that building(s) extremely suit the site and environment, flowing parallel to the topography and the slope of the site, where interior ramps find

their provisions in the garden with exterior site ramps. In addition, as an extension of the old museum, the usage of **light as a concept creator** has been found very valuable in the project. Daylights have been used inside the museums, all 5 new buildings in a natural way, taking the daylight with an **opaque material and T module** structure detail, both creating a great play of daylight/reflection/shadow in the exhibition spaces and museum buildings.

In addition, as a reciprocal concept, 5 of the new buildings, in addition to their functions, also act as **lighthouses at night** for the large and extreme site and environment, with the help of artificial lighting detail of the facade system. Thus 5 of the new museum buildings are designed by star architect Steven Holl, as an iconic project that have extreme daylight and artificial light details and qualities.



interior space, artificial lighting

3.2. Zaha HADID Architects- ROME CONTEMPORARY FINE ARTS MUSEUM IN ITALY

The center of contemporary Arts addresses the question of its urban context by continuing the low-level urban texture of the former army barracks as set against the higher-level blocks on the surrounding sides. (Hadid, Z., 2004)

In this way, the center is more like an **'urban graft'**, a second skin to the site. At times it affiliates with the ground, yet it also ascends and coalesces to become a mass where needed. By intertwining the circulation patterns with the urban context, the building's tendril-like paths and open spaces overlap with those of the city. The architectural elements are also geometrically aligned with the urban grids, further assimilating the building with its context. (Hadid, Z., 2004)

The proposal offers a **quasi-urban field**, a world to dive into, rather than the building as an object. The campus is organized and navigated based on **directional drifts** and the distribution of densities rather than key points, reflecting the porous and immersive character of a center as a whole. (Hadid, Z., 2004)

Both the external and internal circulation follow the drift of the geometry, with vertical and oblique circulation elements located at areas of confluence, interference, and turbulence. The **move from object to the field** is critical to the architecture and the art that it will house. The path leads away from the sanctification of the object towards fields of multiple associations. In architectural terms, this is most radically executed by the wall. In opposition to the traditional coding of the museum wall as the privileged and immutable vertical armature for displaying paintings or delineating discrete spaces to construct order and linear narrative, the wall here becomes a versatile engine for staging extensively across the site, cursivery. The lines traverse inside and out, letting urban space coincide with gallery space. (Hadid, Z., 2004)

Further, deviations from classical composition occur where the walls become floor or twist to become ceiling, or are voided to become large windows. By constantly shifting in dimensions and geometry, the walls adapt themselves to whatever curatorial role is needed. A versatile exhibition within the gallery spaces a series of potential partitions that hang from the ceiling ribs. These movable elements enable 'sets' to be constructed, materializing or dematerializing according to exhibition requirements and allowing the drama to change. (Hadid, Z., 2004)

Fine Arts Museum of Rome which was designed by star architect Zaha Hadid, is a very iconic building design especially because of the way it integrates with the city of Rome. The museum building, is a reflection of urban design of the existing and nearby area, in which urban streets continue inside the buildings with the long slim white vertical walls and black floors like the streets in the city. Museum resemblance and design connection with the city transform this building into a museum with semi-closed and open spaces and the continuation of the streets of the city. The light detail of the flat roof of the building contributes to this urban design and Street concept, today glass with metal carries detail and transforms into city sky, urban sky, architecture with a transparent glass roof , almost roofless concept.

In the Rome Museum of Zaha Hadid, the introverted character of spaces is very strong and all S-shape concrete walls are solid, to exhibit art pictures, collections, and exhibitions. All galleries both temporal and constant exhibitions accommodate glass roofs, like walking through a long street, and while the walls' white color serves for exhibition role, the black color of the floors resembles street floor materials. The unique daylight detail continues throughout all exhibition spaces and all along the roof, thus, the linear effect of the masses, gets much stronger with the linear running of metal carrier detail all around the roof.

The Rome Musuem is one of the most successful buildings in the World. It had been designed in harmony with the context, in the center of Rome, which is a traditional, low rise and horizontal city. The city pattern, streets, and squares integrate with the interior, transforming the museum into a semi-urban space. One can very easily visit the galleries by walking in the street with the natural route of the entrance hall and circulation spaces that reach long and diverse galleries on the upper floors. Due to its resemblance of circulation and exhibition spaces with the urban streets of Rome, the wholly adapted skylight detail of the roof, the roof becomes the sky. And at night, museum's artificial lighting, indicates the S shape form by line-design lights the entrance hall and indicates the circulation path and exhibition tour route. (Figure 17-18-19-20-21-22-23)

DAY VIEW

NIGHT VIEW

Figure 17. Day and night views of the museum, Site view of the museum, Main entrance and exterior space of the museum

Figure 18. Interiors , circulation elements , black stairs and white long corridors, the concept of **Black and White**

Drawings and analysis:

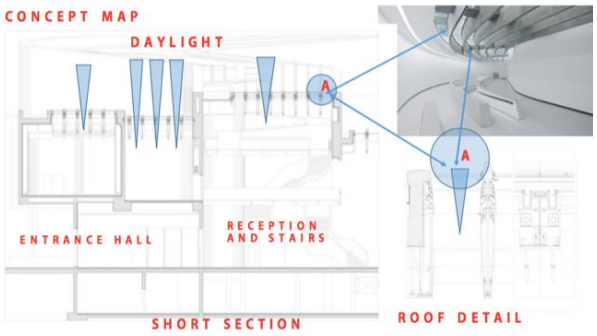


Figure 19. Concept map of project; section indicating daylight detail at the roof level, daylight detail

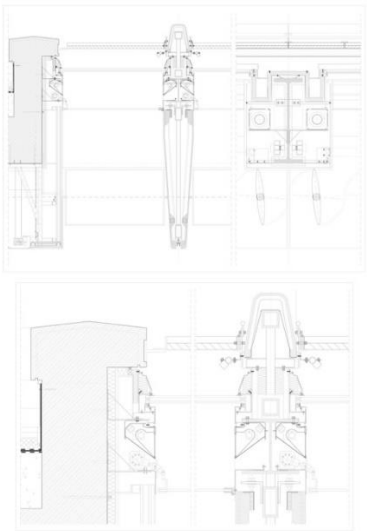


Figure 20. Section of daylight detail, glass and metal profile

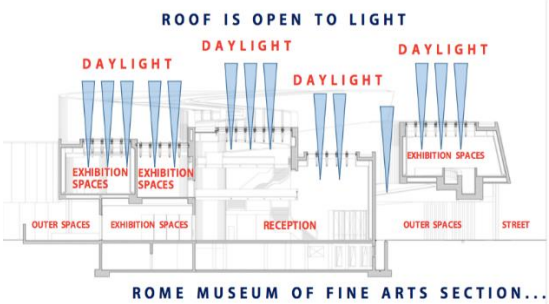


Figure 21. Long section of the museum, exhibition spaces with daylight detail

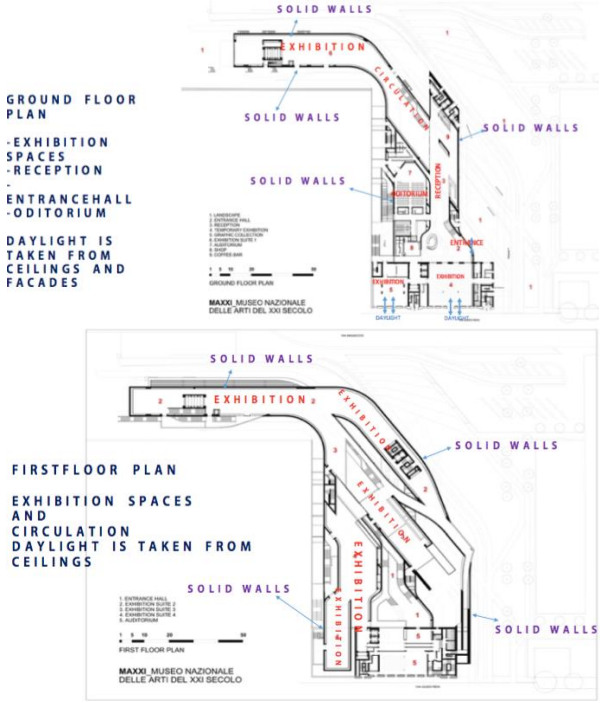


Figure 22. Drawings; plans; ground and first plans, daylight analysis

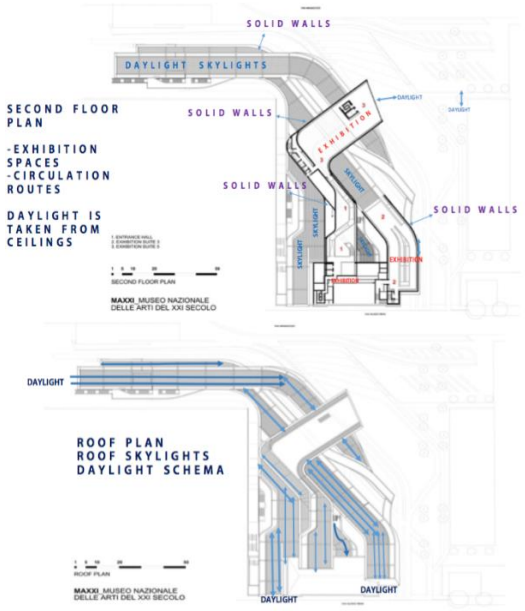


Figure 23. Drawings; plans; second and roof floor plans, daylight analysis

3.3. Chapter evolution

Case analyses have been realized at this part, and there have been two star architects' iconic museum projects have been introduced the first one is Steven Holl's Nelson Atkins Arts Museum in Kansas City and the second one is another star architect Zaha Hadid's iconic Roma Museum in Italy. Both projects have iconic features with high aesthetic design criteria and the way that architects integrate their buildings within the environment. Especially both projects are selected and presented in the paper with their highly formal designs with material choices, and lighting design that they have represented both daylight and artificial lighting. Both projects have common space characteristics, such as special space topic arts museum, and they both exhibit museum spatial and

aesthetic characteristics. On the other hand, museum projects generally exhibit introverted spatial characteristics, where the interior spaces serve for art exhibitions, thus, they commonly have solid surfaces as walls, to create exhibition areas.

In this respect, museum projects generally exhibit intoverted empty spaces, and solid walls with fewer openings to outside to get daylight. These case analyses have been selected especially the way architects brought out architectural solutions to their museum interiors and exhibition spaces to get daylight.

Firstly, Steven Holl's Nelson Atkins museum project as an extension of a traditional museum building, indicated a unique, highly aesthetic, and technological solution for lighting problems.

Holl designed 5 new exhibition buildings with two levels each, like opaque boxes, and carried them with a special T module structure which reflects daylight into exhibition and circulation spaces and covered facades with an opaque-glass material. The material that Holl used for the light facades of 5 buildings resulted in the concept of lighthouses full of light at night that give light to the environment. In this way, Steven Holl's museum project transformed into an iconic lighthouses at night and exhibition spaces with shadowy daylight in daytime, which star architect aimed to realized.

The second project, star architect Zaha Hadid's Rome Contemporary Arts Museum project as an iconic building represents a unique way of design through daylight concept. In the museum, a flat and transparent roof turns all around the museum with glass, to get daylight into the circulation and exhibition spaces. On the other hand, the transparent, glass-designed roof detail that turnS around all building, transforms interior spaces into urban streets, like visitors walking in the museum, they feel like walking in the streets of city Rome with glass and transparent ceilings, and S shape roof. Hadid's inclined white walls for art exhibition and glass roof for circulation, create an urban space concept.

To sum up, both iconic projects have high design qualities and daylight detail solutions, both daylight and artificial light. At night by artificial lighting solutions, both iconic museums transform into sculptural lighting items that give light to their environment and their site.

IV. CONCLUSIONS

* Answers to Reserach Questions

a.Can 'daylight usage' be a source or an inspiration point and concept cretaor in the case of architectural design?

Yes, the main findings of the research demonstrated that daylight usage have been used by star architects as concept creator element, especially for *Fine Arts Museums* designs which require aesthetical, artistic and artfull design criteria with exhibition spaces and introverted spatial characteristics.

b.How does sculptural effect of the building changes over day and night views?

Star architects; Steven Holl and Zaha Hadid s projects indicated that especially contemporary arts museum projects accommodate iconic features with their high aesthetic facade and formal designs and they become sculptural objects for their cities. And, in addition to their functional usages during daytime as museums, art exhibition spaces, by artificial lightings they become aesthetical, sculptural, and iconic lighting items at nights and give light to their environment and the city they belong. They are both landmarks at daytime and nights.

*To Sum Up

After a comprehesive literature review and analyses of star architects' projects, research have been demonstrated that daylight is an important design element during architectural design processes, and concept creation period. Star architects projects today become iconic, aesthetical sculptures for their cities, today, especially contemporary arts museum projects. Both star architects musuem projects, Steven Holl and Zaha Hadid s projects indicate that by their distinctive formal designs, daylight usages and artificial light designs for nights, they become sculptural objects for their cities.

References

Zaha Hadid,2004, Major and Recent Works , Thames & Hudson, 2004

Erdoğan, Nevhinal, 2017, 'Building Information I: architectural design preparation principles lecture notes', Eastern Mediterranean University Library.)

Sema Soygeniş, Mimarlığı Düşünmek Düşlemek, YEM, 2006

Iommi, M. (2018). Daylighting performances and visual comfort in Le Corbusier's architecture. The daylighting analysis of seven unrealized residential buildings. Energy&Buildings,184 (2019) 242-263.https://www.sciencedirect.com/science/article/pii/S0378778818331281

Le Corbusier in the Sun, 17 February 1993 by Christopher Mackenzie Archive
https://www.architectural-review.com/archive/le-corbusier-in-the-sun

Mehmet Sait Cengiz,DOI: 10.31590/ejosat.1113599,*European Journal of Science and Technology No. 38, pp. 247-258, August 2022 Copyright © 2022 EJOSAT*

Bahar, Z., Yalçınkaya,B.,(2021). Bir Tasarım Öğesi Olarak Gün Işığı: Jean Nouvel. Düzce Üniversitesi Bilim ev Teknoloji Dergisi.DOI:10.29130/dubited.894120

Çiftçi,M.,Arpacıoğlu Ü.,2021. Gün Işığı Yönlendirme Sistemleri. Mimarlık Bilimleri ve Uygulamaları Dergisi, MBUD 2021, 6 (1), 59-76 e-ISSN: 2548-0170

https://www.architectureanddesign.com.au/features/list/frank-lloyd-wright-the-greatest-american-architect

https://archeyes.com/church-of-light-by-tadao-ando-minimalism-and-the-play-of-light/

https://www.archdaily.com/960558/beyond-artificial-lighting-museums-exploring-the-benefits-of-daylight

https://www.daylightandarchitecture.com/project/2022-daylight-museum/?consent=preferences,statistics,marketing&ref-original=https%3A%2F%2Fwww.google.com%2F

https://www.archdaily.com/4369/the-nelson-atkins-museum-of-art-steven-holl-architects

https://www.archdaily.com/984378/flugt-refugee-museum-of-denmark-big?ad_medium=office_landing&ad_name=article

https://www.archdaily.com/995561/albert-kahn-museum-kengo-kuma-and-associates?ad_medium=office_landing&ad_name=article

https://www.archdaily.com/785442/museum-of-tomorrow-santiago-calatrava?ad_medium=widget&ad_name=category-museum-article-show
https://www.archdaily.com/951508/nancy-and-rich-kinder-museum-steven-holl-architects?ad_medium=office_landing&ad_name=article
https://www.archdaily.com/768565/ad-classics-v-and-a-spiral-daniel-libeskind-plus-cecil-balmond?ad_medium=office_landing&ad_name=article