

# Use Of Natural Light In Monumental Church Structures Of The Modern Era

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**Abstract** –Religion and belief systems have emerged to address the fundamental human need for belief. Over time, religion has evolved and become an integral part of societal culture. Temples constructed by polytheistic beliefs to perform their religious rites and ceremonies stand as early examples of religious architecture. Within the realm of monotheistic religions, the three Abrahamic faiths, namely Christianity, Islam, and Judaism, have developed their own religious structures. This study focuses on the architectural designs of churches associated with Christianity. Drawing inspiration from basilica architecture, churches have integrated natural light as a design element within their interior spaces. For the purpose of this study, church structures from various cultures from the 20th century have been chosen as examples. The selected church edifices include the Cadet Chapel in the United States, the Church of San Josemaría Escrivá in Mexico, and St. Johann von Capistran in Germany. The utilization of natural light within the interior spaces of these church structures, built during the 20th century and representing different societies, has been examined.

**Keywords** – *Natural Light, Church Architecture, Interior Space, Religious Structure, Interior Design.*

## I. INTRODUCTION

Since the dawn of human existence, there have been numerous fundamental needs. Among these basic necessities, such as shelter and sustenance, the act of belief has also emerged. This act of belief, manifesting as a fundamental need, has consequently led to the development of belief systems and religion [1]. Over the course of time, belief systems, shaped as cultural elements of societies, have introduced various rituals [2]. From antiquity to the present day, numerous religions and belief systems have arisen. These diversified religions and belief systems have incorporated their distinct rituals. Moreover, religions and belief systems have been influenced and enriched by the cultures of the societies that adhere to them.

Before transitioning to a sedentary lifestyle, humans perceived natural formations such as riverbanks, mountain tops, and the depths of forests as sacred spaces for performing religious rituals required by their belief systems. With the advent of settled life, they began constructing these sacred sites as physical structures [3]. As religions continued to evolve as cultural elements of societies, their associated religious edifices have taken various forms [4].

During the era of polytheistic beliefs within the evolving belief systems, temples were constructed. These temple structures stand as early examples of religious architecture [5]. Another realm of belief systems that developed encompasses the monotheistic beliefs. Today, Islam, Judaism, and Christianity emerge as the three Celestial religions, situated among monotheistic beliefs. All three religions have shaped their religious structures by blending them within their respective cultures. Church structures, which form the subject of this study, represent the religious architectural designs associated with Christianity. In the Eastern Roman period,

which adopted Christianity, there are numerous church remnants due to the presence of religious freedom. Basilicas were worship structures utilized by the affluent members of society. Subsequently, they began constructing new religious structures by emulating basilicas, thus establishing basilicas as the foundation of church architecture [6].

In the design of church architecture, light has been considered as a design element. In fact, the use of light in all religious spaces has been employed in ways that symbolize religious phenomenology [7]. In religious structures associated with various religions, light has been interpreted and utilized in diverse manners. Uniformly illuminated surfaces, effectively emphasized areas, openings through which light passes, and elements like domes have been factors influencing the spatial perception of religious structures [8]. The use of natural light holds significant importance in church architecture. In the initial periods, candles served as a source of light within churches. However, during the Romanesque period, churches integrated natural light into their interior design to create dim, subdued spaces. By the Gothic era, rose windows and stained glass were utilized to introduce natural light to the interior, thereby creating a mystical ambiance within church structures [7]. Especially in church structures, natural light was introduced to the interior through windows in the apse wall, sanctuary windows, and vaulted windows [9]. In church architecture, natural light has been deliberately employed to contribute to the creation of a specific atmosphere.

Within the scope of this study, the use of natural light in three monumental church structures, constructed under modern architectural principles and belonging to different cultures, has been examined. The church structures included in the study's sample are the Cadet Chapel located in the United

States, the Church of San Josemaría Escrivá in Mexico, and St. Johann von Capistran in Germany. The general framework of the study is an examination of the design of natural light usage, tracing back to the development of church architecture, through examples of monumental modern architecture. The objective of the study is to reveal how the introduction of light into the interior, initially solely through window design from the inception of church architecture, has been conceptualized within church interiors in conjunction with evolving technology.

## II. MATERIALS AND METHOD

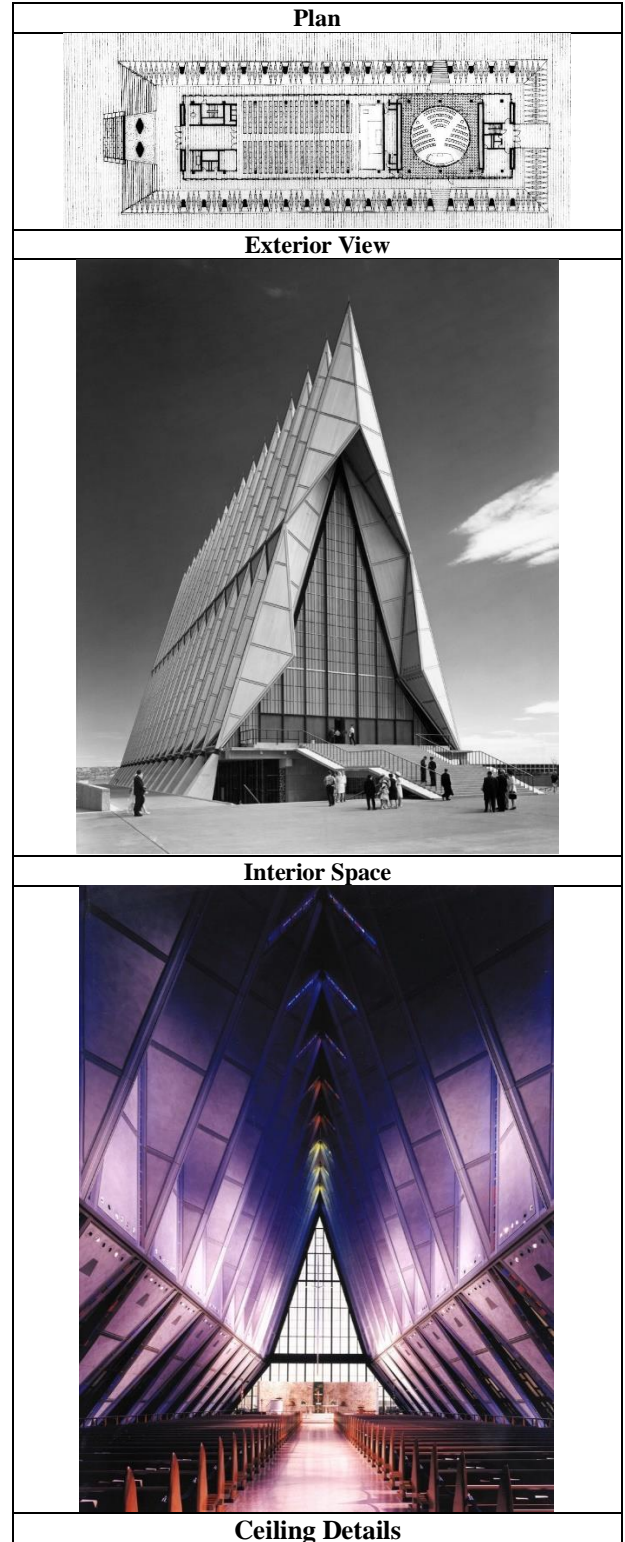
Various methods have been employed in the study. Firstly, a literature review was conducted to identify the problem. Research was carried out within the context of religious structures and the use of natural light. Subsequently, the concept of religious structures was narrowed down, with church structures chosen as the sample. This is because the design of church structures involving the use of natural light dates back to ancient times. At this stage, several examples from different periods related to church structures were analyzed. By the 20th century, it was observed that the ways natural light was introduced into church structures had diversified. Therefore, a secondary restriction was placed on the sample. The sample has been identified as church structures that possess modern architecture and have been constructed in a monumental manner for the research area. During the sample determination phase, numerous church structures constructed in the 20th century were examined. From the examples studied, three structures representing different societies were chosen to form the study sample. There are reasons for the selection of church structures included in the sample. The Cadet Chapel located in the United States, the Church of San Josemaría Escrivá in Mexico with its monumental architecture, and the St. Johann von Capistran structure in Germany are among the examples of monumental architecture from the modern era. Additionally, in the preliminary study conducted on church structures, it was determined that natural light plays a significant role in the design conception of the structures.

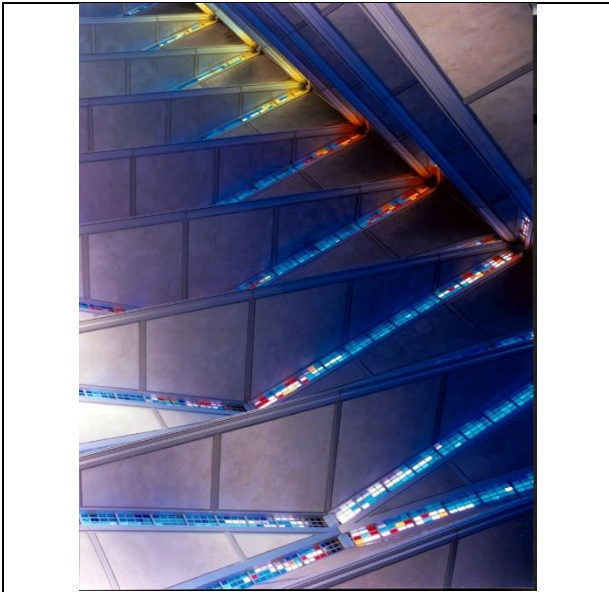
Following the literature review and the determination of the sample, the church structures have been introduced within the scope of the study. In the evaluation section of the study, the use of natural light in the structures was examined by comparing them with each other. In the conclusion section, the findings obtained from the conducted examination are explained.

## III. INTRODUCTION OF THE WORKING AREA

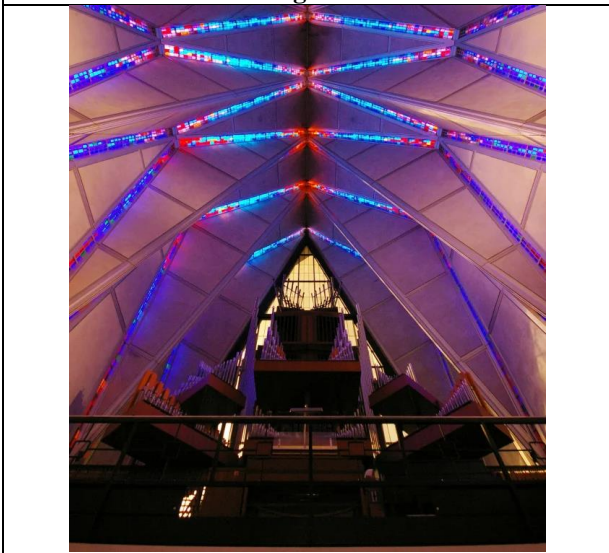
Construction of the USAF Academy Cadet Chapel began in 1959 and it was opened to the public in 1963. The architect of the structure is Walter A. Netsch Jr. In fact, the building contains sections for three different denominations [10]. However, the main focus within the scope of this study is on the primary section. The iconic Protestant Chapel, with its tetrahedron-based walls and pointed roof, is the main area where natural light is designed [11]. The floor plan and visuals related to the structure can be found in Table 1.

Table 1. Cadet Chapel, [10], [11].





**Ceiling Details**



The building's general framework employs materials such as a steel frame, vitam panel, aluminum panel, and glass. Particularly on the entrance facade, the use of glass allows the full penetration of natural light into the interior. Upon entering the interior of the church, the distinctiveness of the apse wall is immediately noticeable. The apse wall, situated directly opposite the entrance facade, is also constructed entirely of glass. Natural light enters the interior from both surfaces. However, the detail in the church interior that makes the natural light particularly striking is located on the ceiling plane. The joining detail on the ceiling consists of colored glass fragments. The church's interior is illuminated from above by natural light filtering through these colored glasses.

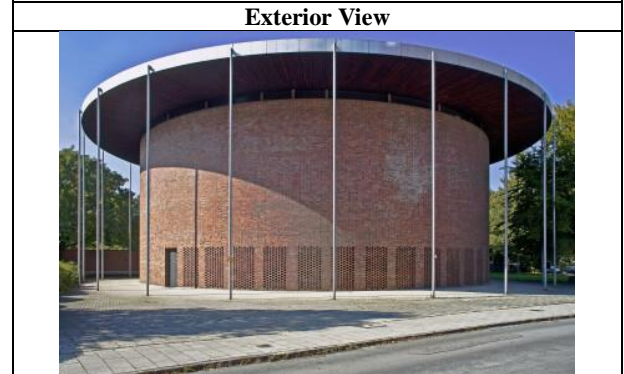
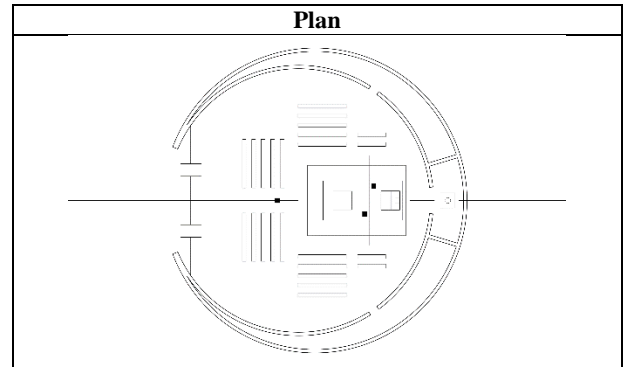
The San Josemaría Escrivá Church, located in Mexico, was constructed in 2008. Its architects are Javier Sordo Madaleno Bringas, Marcos Hernández R., and Mario Rogero Jiménez [12]. The design was inspired by one of the sacred symbols of Christianity, the fish figure. The layout consists of a rectangular plan placed within two elliptical main lines [13]. In the interior of the building, wooden and zinc materials are utilized on curved surfaces. Where these curved surfaces converge and on the wall planes, a design was implemented to create a void in the shape of a cross. This void allows natural

light to enter the interior space [14]. The plan diagram and visuals related to the San Josemaría Escrivá Church are located in Table 2.

Table 2. San Josemaría Escrivá Church, [13].

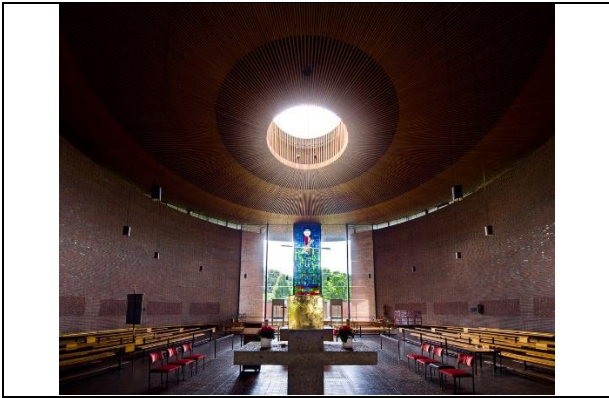
<p style="text-align: center;"><b>Plan</b></p>
<p style="text-align: center;"><b>Exterior View</b></p>
<p style="text-align: center;"><b>Interior Space</b></p> <p style="text-align: center;"><b>Interior Space</b></p>

Table 3. St. Johann von Capistran Church [15] [16].



The perception of the church from the exterior suggests a closed and monumental architecture. The interior is characterized by progressively narrowing vertical planes. However, the slits created on and at the junctions of these vertical planes, allowing natural light into the interior, mitigate the sensation of constriction. The introduction of natural light is felt throughout the space, but it particularly accentuates the apse plane.

Initiated in 1958, the construction of the St. Johann von Capistran Church culminated in its inauguration as a Catholic establishment in 1960. The architectural design was conceived by Franz Joseph Ruf. The edifice exhibits a circular floor plan, and its design intricately incorporates two concentric circles, resulting in a crescent-shaped interstice between the larger and subordinate circles. The church's internal fabric is predominantly characterized by the extensive use of brick. Notably, within the apse segment of the building, a glass-constructed dome delineates the ceiling [15]. The floor plan and visual representations pertaining to the St. Johann von Capistran Church can be found in Table 3.



Upon external examination, the ecclesiastical edifice exhibits a monolithic and contiguous form. The circular configuration evident in the architectural plan resonates consistently across all spatial dimensions. Transitioning into the church's interior reveals a judicious application of natural light. The apsidal area is distinctly highlighted by a domed structure overhead. Furthermore, a notable architectural feature is the crescent-shaped void, a result of the confluence of two circular designs, which manifests as an interspace within the wall planes. This design approach facilitates the ingress of natural light from both vertical and lateral surfaces.

IV. RESULTS AND DISCUSSION

In the scope of the study, the Cadet Chapel, San Josemaría Escrivá Church, and St. Johann von Capistran Church were introduced in the previous section based on their general characteristics. Specifically, within the context of this research, the natural lighting used in the interiors of these structures has been examined. The churches selected for this sample exhibit monumental massing. The rationale behind this selection is the reduced use of fenestrations in structures with monumental architectural features. Upon examination of these church structures, it is evident that fenestrations are minimally employed. However, as is the case with almost all religious edifices, the utilization of natural light within the interiors of the chosen church structures remains of paramount importance. Therefore, the orchestration of natural lighting in the interiors of these churches, which do not conventionally receive natural light through their façade planes, has been scrutinized.

Within the evaluation framework, aspects such as the surface from which the natural light emanates, the technique employed on the surface, resultant condition in the interior space, **Highlighted Area within the Interior** have been considered for all church structures. The findings from this evaluation are presented in Table 4.

Table 4. Assessment of Natural Lighting in the Interiors of Church Structures

Natural Light's	Cadet Chapel	San Josemaría Escrivá Church	St. Johann von Capistran Church
Originating Surface	Ceiling Plane, Wall Plane	Ceiling Plane, Wall Plane	Ceiling Plane, Wall Plane
Technique Employed on the Surface	Grid Glass Wall Plane, Skylight	Skylight, Glass Wall Plane	Dome, Glass Wall Plane
Resultant Condition in	Light	Light	Light

the Interior Space			
Highlighted Area within the Interior	Altar	Altar	Altar

In all of the structures, natural light has been introduced into the interior both from the ceiling plane and the wall plane. In the Cadet Chapel and St. Johann von Capistran Church, the wall plane through which natural light is introduced has been designed as a broad opening. In the San Josemaría Escrivá Church, the light entering from the wall plane had been orchestrated to give the impression of emanating from a fissure. As for the natural light admitted from the ceiling plane, the St. Johann von Capistran Church distinguishes itself by employing a dome. In other examples, skylight have been utilized to introduce light from the ceiling plane. The effect created by the incoming light in the interior is one of light. During this examination step, it was investigated whether any additional materials were used on the surfaces admitting natural light to create shading effects. In all samples within this study, light has been allowed to enter unobstructed from the surfaces purely to establish brightness, with no play of light and shadow implemented. The final observation, which pertains to the area emphasized by the natural light in the interior, is consistent across all examples: it is the altar area. This space has been distinctly accentuated by natural light in every instance.

V. CONCLUSION

The utilization of natural light in religious structures has been a practice since the earliest periods. However, with the diversification and advancement of technology, the use of natural light in modern architecture can be exhibited in varied forms. Consequently, within the scope of this study, contemporary and monumental church architectures have been examined.

The study sample has been specifically chosen from structures possessing monumental architectural characteristics, as monumental architecture typically consists of forms with fewer openings. The objective is to evaluate the use of natural light within the interiors of such religious edifices. The sample includes the Cadet Chapel located in the United States, the San Josemaría Escrivá Church situated in Mexico, and the St. Johann von Capistran Church based in Germany.

The structures lack conventional window openings in their monumental exteriors. However, in all buildings, natural light has been employed as a design element within the interior. This natural light has been introduced to the interior through both ceiling and wall planes. No play of shadows has been incorporated into the lighting of the spaces. In all the churches, the altar sections have been emphasized using natural light. Although the churches in the sample were constructed in different cultural contexts, they share many similarities in terms of the use of natural light.

This preliminary study is believed to contribute to a deeper and more comprehensive investigation of the use of natural light as a design element in religious structures, considering various parameters.

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