# Ecological Design Approaches in Mosque Architecture

H. Derya Arslan

**Abstract**—Ecological buiding design has been on the agenda for the last two decades with the rapid increase of industrialization and the subsequent environmental pollution. Today, the decrease in energy resources and the orientation towards renewable energy sources have become an important parameter for ecological design. Ecological building design, especially in developed countries, especially schools, housing, museums, etc. as well as quite different types of structures. However, ecological searches continue in different building types. One of the most recent of these is the Cambridge Central Mosque, which was opened in the UK in 2019 with its eco-friendly slogan. Ecological design factors were used in the design and manufacturing elements of this mosque. However, although this mosque was introduced as the first eco-friendly mosque in the world, there are many examples of mosques built on the earth as environmentally friendly and built centuries ago. In this study, Cambridge Central Mosque is examined and a compilation of environmentally friendly mosques is explained and how new this mosque is in this context is explained.

**Index Terms**— Ecology, Architecture, Mosque, Design.

## 1 Introduction

The rapid increase in industrialization and subsequent environmental pollution has become one of the biggest problems of the 21st century. As a result, increasing use of renewable energy with increasing global warming and climate changes has made keywords such as sustainability and ecology very popular.

With the realization of the ozone depletion in the atmosphere after the 1980s, the real dimension of human ecological damage to nature and the world has been discussed and ecology has become a popular research topic.

The fact that global warming, environmental pollution, carbon dioxide emission and many subsequent problems are highly related to the building sector has led to the introduction of many new concepts in architecture such as global warming, ecology, sustainability, renewable energy, environmental design, smart structure, energy efficiency conservation and green architecture.

The main feature of green buildings or ecological buildings is that they do not disturb the ecological balance. Although there are so many man-made factors that disrupt the ecological balance in nature, buildings that are designed not to disrupt the ecosystem are important for awareness. The aim is to produce structures that will benefit both nature and human beings. Green building refers to both a structure and implementation of environmentally responsible and resource-efficient processes throughout the life cycle of a building: from planning to design, construction, operation, maintenance, renovation and demolition.

Ecological buildings that belong to the group called sustainable architecture are generally made of materials that produce their own energy, use natural and renewable energy sources, contain less toxic substances or are obtained by recycling. The main feature of this type of building is that it harms the environment less by using technological facilities. Therefore, these types of structures have started to be preferred in metropolitan areas. There are also types of rural buildings designed and produced as part of the ecological environment. All implementations carried out within this framework, especially in sustainable construction, are seen as important symbols that make the society aware of sustainability.

Despite the fact that the ecological buildings are so much talked about in developed countries today, their percentage in the total building stock is quite low. This is particularly true of these structures, which have a distinctive architectural character, in terms of mechanical and environmental influences, rather than architectural design. Today, ecological school, ecological housing, ecological museum, etc. quite different examples of ecological structures have entered the literature. The new one is the Cambridge Central Mosque, which was opened in England in 2019 with its environmentally friendly slogan. Although it is introduced as the first eco-friendly mosque in the world, there are many examples of mosques built on earth as environmentally friendly. In this study, a compilation of eco-friendly mosques was made based on the example of Cambridge Mosque in England and how new this mosque is in this context is explained.

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## 2 ECOLOGICAL DESIGN

Kremers (1995) [1] defines sustainable architecture as a phenomenon of architectural design that aims to reduce the use of natural resources and to balance production-consumption ratios. This concept is also defined as an approach that needs to be considered in terms of effective use of resources and to consider climate and topographic structure as an input by keeping the relationship between human and nature together. According to the Shaviv (1998) [2] , the aims of sustainable architecture are;

- Sensitive to the environment,
- Minimum energy consumption,
- It has been listed as the design of the buildings that provide healthy indoor comfort of the users,

Sustainability in the building sector was established by the United Nations in 1987 as the most important issue to be addressed in the field of contemporary architecture and engineering. Starting from the 1990s, the development of sustainability awareness has become increasingly important. Shaviv (1998) listed the main objectives of sustainable architecture as;

- efficient use of energy and resources,
- reduction of wastes,
- avoiding harmful substances to health and nature,
- protection of healthy indoor quality,
- protection of biological diversity and
- flexible structure design.

When these criteria are evaluated in general, it can be stated that under the sustainable design approach, the subject contains many dimensions that need to be addressed at different levels, from urban scale decision-making processes to the choice of the production of a building material.

The conceptual ideas of sustainable architecture combine into three main criteria. These three main criteria are; land conservation, resource conservation, indoor quality. In sustainable architecture, the environment of the building area and the protection of the ecosystem come to the forefront with the right choice of land. Resource conservation can be grouped as reducing the amount of non-renewable energy resources used in the building life cycle (energy conservation), reducing the amount of water to be used in the building (water conservation) and preferring local or recycled materials (material conservation). The quality of the indoor environment consists of factors such as the quality of the breathing air, the provision of thermal, visual and auditory comfort and the selection of materials that are harmless to health [3].

## 3 THE CASE OF THE ECO-MOSQUE: CAMBRIDGE MOSQUE IN ENGLAND

The Cambridge Central Mosque that opened in 2019 was designed by Marks Barfield Architects which is the England's most important architectural offices, is 'ecological" making it more popular. Cambridge, a global city in the heart of England, has a multi-cultural space with such a mosque. The most important feature of the mosque building is that it is a place of worship in accordance with Islamic geometries and architectural tradition with the latest developments in digital manufacturing and passive sustainable technologies. In Figures 1 and 2, the main plan of the place of worship taken by Morley von Sternberg is given with the floor plan drawn by Marks Barfield Architects.

Fig 1. Site Plan — Cambridge Central Mosque © Marks Barfield Architects (www-1)

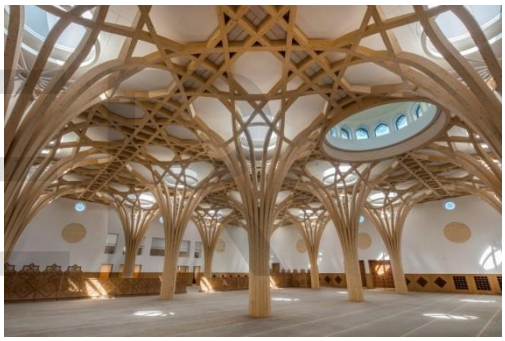

Fig 2. The Prayer Hall — Cambridge Central Mosque © Morley von Sternberg (www-1)

The Cambridge Central Mosque appears to be an ordinary structure among the other buildings around it, and symbolizes humility as the basis of Islamic religion. For this reason, the mosque does not announce its presence very high in this environment, and welcomes the visitor gently through a series of nuanced and calibrated thresholds that begin with a lively but quiet garden on the side of the road. The structure bears a sense of tectonic and geometric rhythms that are echoed appropriately within the building, with complex yet robust, tree-like spruce columns. It is possible to experience this feeling in the Nine Bridges Golf Club House 'designed by Shigeru Ban and Kaci architects" in South Korea, which is famous for its wood structure. Figure 3 shows the interior image of the building, taken by Shigeru Ban Architects. The similarity between Figure 3 and Figure 2 is remarkable. In this respect, it is felt that the load carrying system is not completely unique. For this reason, the building designed by Marks Barfield Architects is actually overshadowed by the claim to reflect and create a local Islamic architecture. The geometry of this building

(possibly the decisive detail of the building) is the 30 digitally produced tree pillars supporting the building's impressive hulking roof structure. The original columns are fabricated by Swiss timber construction (by Blumer Lehmann), the structural system have 145 different components and about 2700 individual components.

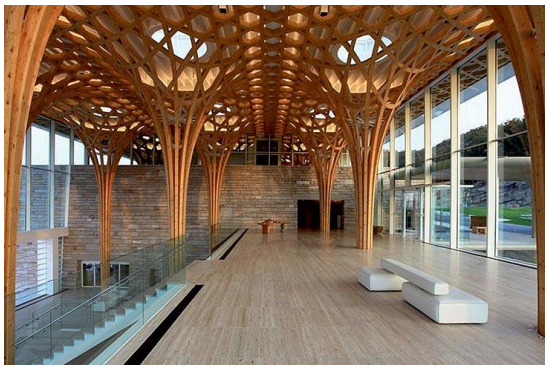

Fig 3. Interior of Nine Bridges Golf Club House (www-2)

Historically, it has been observed that the environment in which the mosque is built adapts to the formal, cultural and climatic conditions. Reflected on the brick tiles covering the mosque, Cambridge "Gault" bricks complement the mosque's street view. Sustainability concept is provided by using local materials.

The mosque is based on the premise of creating an oasis of calm and sustainability in an urban setting. Striking roof windows mean that the mosque will be naturally illuminated throughout the year, the building is well insulated and the temperature will be carefully optimized by heating or cooling using energy produced locally from energy efficient technologies and ground source heat pumps.

Although the Cambridge Central Mosque is known as the first ecological mosque in England, the first mosque known as the ecological mosque in England was built in 2003 in Manchester. An old birth and child welfare the mosque was replaced by a central mosque, which included solar panels, recycled wood, recycled stone, floor heating and other energy-saving measures.

There is a similar search for an ecological mosque in Germany, where Muslims in Europe are concentrated. The Muslim community in Norderstedt, Germany, started building mosques with wind turbines in their minarets. At the end of the 2.5 million-euro project, the mosque to be built in Norderstedt near Hamburg will allow the muezzin's call to worship to reach other believers with wind energy.

## 4 DISCUSSION

The ecological mosque is actually very old among Islamic traditions. Simply put, all mosques built before the industrial revolution is actually ecological. The Islamic religion (and naturally the same as in other places of religion) says that all buildings should be environmentally friendly structures without effecting negatively to the environment. For instance, embodying the most original examples of mosque architecture should also Turkey Seljuk Empire period, both ecologically based we set the Ottoman Empire and both early important part of the mosque Republic of Turkey period today as the criteria are incorporating the important parameters of the design philosophy. It follows that ecological concerns are the concerns of this period. Ecological architecture is actually the problem of this era. Human beings are looking for solutions to the problem created by their own hands. There is no such problem in the traditional period.

One of the first examples in this context is the Cenne Grand Mosque, which was built of mudbrick, an example of ecological places of worship in the world, and one of the first examples of wind catchers as a natural ventilation method in Salih Tala-I Mosque in Cairo. Similar features are found in the architecture of the Seljuk and Ottoman mosques. In the Islamic cities, mosques have been used frequently to protect the shade, weather protection, natural ventilation and natural privacy. Historical mosques were built with inspiration from an ecological approach. The use of building materials to balance and store the heat of the sun in the summer or the cold in the winter, or the integration of water into the design as a cooling method, and the production of natural methods that will maximize the benefit of the wind can be exemplified. Mosques are examples of Islamic architecture to this ecological approach.

The Great Mosque of Cenne, given in Figure 4, has been standing since the 1300s. One of the greatest achievements of the Sudani-Saheli architectural style, this mosque is made of mud only. There are more than 100 columns in the mosque. The Grand Mosque of Cenne is repaired by the public every year on the Mud Festival. The mud collected by the children and young people from the river beds is carried with containers and carried to the masters who will plastering the walls. The ventilation of the adobe mosque is provided by the chimneys called 'Ladis' which are made of soil again.

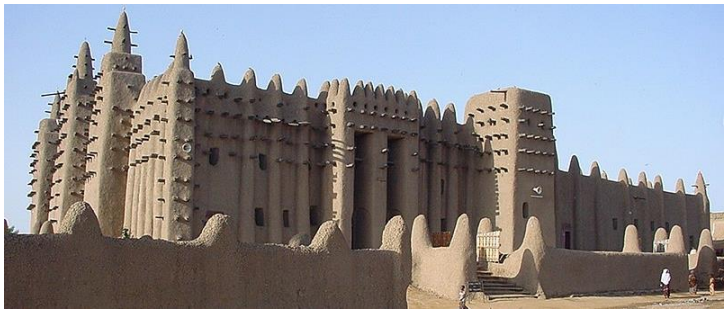

Fig 4. The Great Mosque of Cenne - Sudani-Saheli architectural style (www-3)

Salih Talâi Mosque, which is given in Figure 5, is a historical mosque in the Egyptian capital of Cairo dating back to the Fatimid era. It was built by the vizier Al-Salih Talâi ibn Ruzzik in 1160 during the Fatimid Caliph al-Fa'iz period. It is one of the two mosques built by the viziers of the Fatimids period. It was destroyed in 1303 earthquake and re-built.

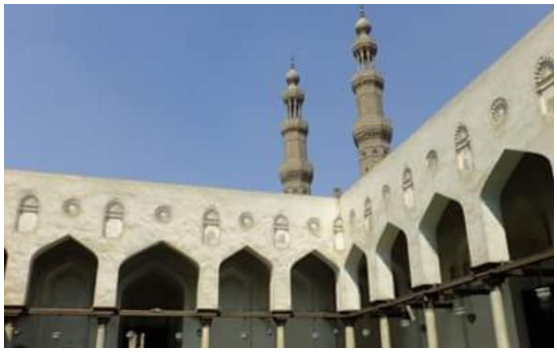

Fig 5. Salih Talâi Mosque (www-4)

## 5 CONLUSION AND FINAL REMARKS

Cambridge Grand Mosque and other similar examples considered in this study are actually negligible structures that remain at very innocent levels in terms of polluting the environment, wasting resources and leaving a carbon footprint.

The world is threatened by industrial facilities, unmanaged waste, life-threatening chemicals, endless constructions and irreversible wastes, regulations that upset biological balance. From this point of view, only a few mosques are in total in a proportion that does not have any meaning. However, the ecological mosque in fact carries a symbolic mission and is worth considering in terms of being an example. Because, as in all religions, it is known that waste is also prohibited in Islam.

They do not waste energy in mosques. It is also a positive approach to think about the architecture of the Cambridge Mosque on an ecological level, but it is a reminder that this approach is not new in traditional Islamic architecture, but it is a reminder to Muslims living in England with today's techniques.



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