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THE POTENTIAL OF VERNACULAR MATERIALS TO THE SUSTAINABLE BUILDING DESIGN: EXPERIENCE OF CONSTRUCTION DESIGN WITH ADOBE MATERIAL

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ABSTRACT

In order to achieve sustainable architecture, cultural and sustainable design principles should be considered in a complementary relationship. Sustainable design implies the recycling of energy, either by the use of passive energy or renewable energy. It also requires harmony with local economies and data supporting biological diversity. Adobe traditional building material which is a cheap, environmentally friendly and abundant and has been used extensively for construction around the world. For this purpose, this study promotes the use of adobe as a sustainable material. Also this study is aimed to evaluate the progress in designing skills of students by using adobe as a sustainable material in architectural design education with a studio sample. The architectural design practice and use of adobe were evaluated with all positive and negative aspects within the context of students projects. These studies provide an excellent contribution for the recognition of the advantages of adobe as a building material, encouraging its use in new architecture and architectural education.

Keywords: Energy efficiency, Sustainability, Sustainable design, Adobe, Architectural education, Studio sample.

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Contribution/ Originality

This study is one of very few studies which have investigated the use of adobe as a sustainable material in architectural education.

1. INTRODUCTION

Sustainability is not only satisfying present needs, but also ensure future generations can satisfy theirs. This includes socio-economic and environmental targets and is a concern to all sectors of human activity and development and housing is one of the more energy demanding sectors [1]. Throughout a buildings lifetime (construction, use, dismantling), it has a

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direct impact on the environment through resource and energy consumptions. Some reasons for green building include reducing energy consumption, greenhouse gas emissions, water use, waste production and many more. The environmental impact of a building depends on the choices made during the different phases of a building's life, specifically; the choice of construction materials has a strong environmental impact. As mention above, selecting a material with a Low Life-Cycle Cost (LCC) and high technical performance reduces the building's impact on the environment [2].

It has been observed that there is a significant shift to new building design strategies taking into account sustainable considerations in the last twenty years. However, in most countries, sustainable buildings are still at a nascent phase of development. The construction industry has more needed knowledge, and industry professionals (in both the design and construction disciplines) continually seek for best solutions in practices in order to understand of how to apply sustainable considerations to buildings. The growing awareness of sustainable buildings potential to positively impact environmental issues pushes knowledge to the forefront. In this respect, vernacular architecture presents simple solutions for the sustainable issues because it has significant environmentally features that respond to sustainability such as low-energy techniques to provide for human comfort, approaches that are integral to the form, orientation, and materials that are obtained from local resources. Hence, in recent years professionals have begun to rediscover vernacular architecture features due to the increasing challenges about providing sustainability in a built environment. A review of existing literature on vernacular architecture indicates that vernacular buildings and correspondingly settlements have ecological implications for sustainable architecture today. Vernacular architecture reveals the combination of local climate conditions, locally available materials, simple construction techniques, living style, traditions and socioeconomic conditions of the region. According to Lawrence [3], vernacular buildings are human constructs that are the results of relationships among ecological, economic, material, and social factors. Due to the fact that vernacular architecture has evolved through trial and error methods, vernacular buildings and site planning depend on substantially experience, surrounding conditions, and local materials such as adobe, stone and timber.

Sustainable construction is achieved using natural resources, such as adobe, in such a way as to meet economic, social and cultural needs, but not depleting or degrading these resources to such an extent that they cannot meet these needs for future generations. Industrially-produced materials require a high energy-intensity and have considerable environmental impacts, while natural materials such as adobe have positive impacts in the overall life-cycle assessment.

A sustainable approach to architecture and urban design should assume a core position in the training of building practitioners, starting from the earliest stages of curriculum and feedings forward unto lifelong learning. Education plays fundamental role in raising awareness amongst students and professionals, and in giving them the knowledge and commitment to put sustainable development into practice. For this reason this paper examines the teaching of sustainable design within adobe as a vernacular building material. In examining the range of teaching practices in the Selcuk University Department of Architecture it explores the experience in recent years in

aligning sustainability to a core position within the syllabus and asks how we support and nurture sustainable design practice with adobe within architectural education?

2. RESEARCH METHODOLOGY

A sustainable approach to architecture and urban design should assume a core position in the training of building practitioners, starting from the earliest stages of curriculum and feedings forward unto lifelong learning.

This article proposes a design studio teaching/ learning method based on sustainability in architecture experience, exploring the design process itself as a methodology. For this purpose an experimental educational design problem dealing with the issue of sustainability issue with adobe material was posed to students at Selcuk University in the 2013–2014 spring Semester 2rd Year architectural Design Studio. Firstly a trip, study field of which was shown was organized and meetings were performed about the structures students has researched Sarayönü vernacular architecture which was designed within adobe sustainable building material. Sarayönü, a small town of Konya is an important vernacular settlement that used adobe as the primary construction material. it has preserved its original texture up to the present. So that design area for 'carpet factory project' was given from here. After that students were requested to be inspired from these vernacular building for their new carpet factory designs.

3. CASE STUDY: USE OF ADOBE IN ARCHITECTURAL EDUCATION

3.1. Adobe Use in Sarayönü Vernacular Architecture

Sarayönü is a small vernacular settlement in the Central Anatolia region of Turkey, and one of the villages of Konya (Figure 1). A continental climate pervades the village where the people are generally engaged in agriculture and stockbreeding. Displaying a unique form of architecture in terms of its overall planning scheme, the Sarayönü Village used adobe as the primary construction material in houses (Figure 2). Adobe is a low cost construction material, locally available with good thermal and acoustic properties and it is also associated to simple construction techniques. In Sarayönü the adobe has been used in masonry walls, exterior and interior walls, mostly building on parallelepiped rectangular adobes. The skill in building a house lay in the clever way that half adobes and third adobes were used to close a corner, support eaves and make windows or doors in the walls (Table 1).The majority of the adobe vernacular houses are normally associated with a high quality of space and ambiance in Sarayönü.

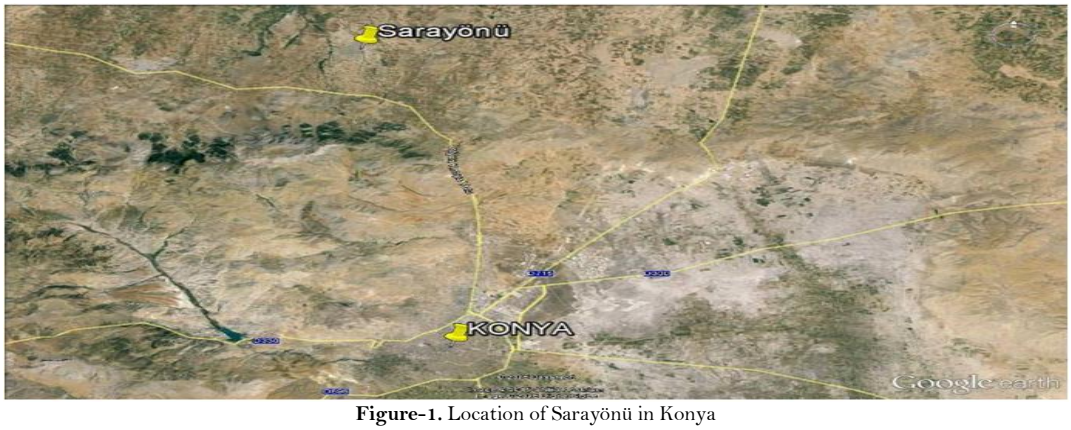


Figure-1. Location of Sarayönü in Konya

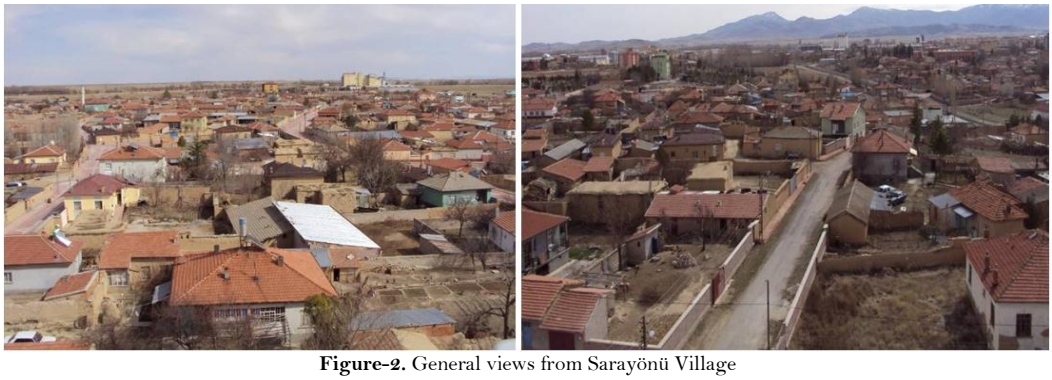


Figure-2. General views from Sarayönü Village

Table-1. Adobe material use in Sarayönü vernacular architecture

There is a future for adobe vernacular architecture in Sarayönü, because the majority of the architecture typology meet very well the actual requirements for these building typology. Only occasionally examples of spaces/constructions do not meet these requirements, in terms of quality of the spaces and/or structural safety. It's possible and viable the rehabilitation of these constructions, but also, adobe (mechanical and industrial produced material) can be adopted in

future new constructions. Essentially, the rehabilitation of this built heritage may contribute for the reduction of the resources consumptions associated with new edifications that frequently replace the adobe existing ones.

Vernacular architecture represents inherent, unwritten information for understanding the value of experiences related to sustainability. Thus, vernacular buildings and correspondingly settlements can be accepted as a knowledge source for sustainable building design ideas. Therefore, lessons learned from vernacular architecture can help in designing of environmentally friendly built environments.

3.2. Studio Practices with Adobe Material Context of Sustainability

Firstly students researched adobe material and sustainability for designing their project. For this reason a trip was organized to Sarayönü where used adobe as the primary construction material in houses. Students analyzed the traditional texture of Sarayönü and determined the traditional houses which used adobe (Figure 3). For this traditional texture project design area was given from Sarayönü (Figure 4).

Figure-3. Students exploring Sarayönü traditional houses

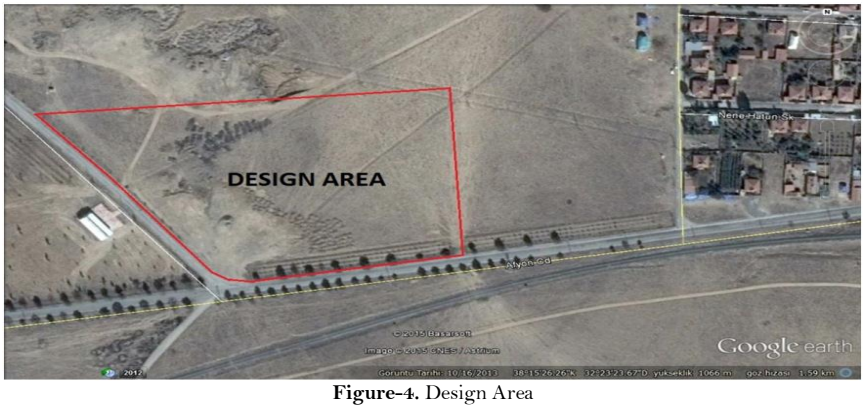


Figure-4. Design Area

After that they started to design their own projects. The preparation during the warm-up period, main idea and the first phase of design process was presented by the student pairs working

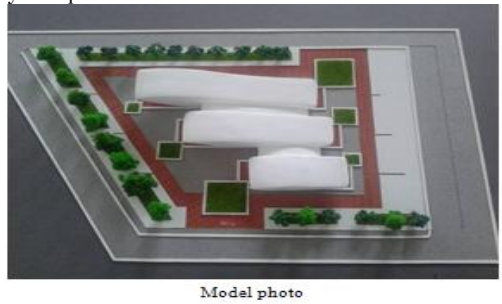
together on each project. In the first jury, students received comments and critique on their proposed 'carpet factory' with sustainable material adobe arrangement and evaluation of all efforts during.

In the second jury, carpet factory projects were evaluated with respect to their sensitivity to sustainability and a second jury grade was awarded. In the final jury, all decisions regarding about sustainable carpet factory with adobe, construction details and the architectural draft were evaluated. Some students alone, some students in groups of two designed a project. In following tables, there are student final projects (Table 2-6).

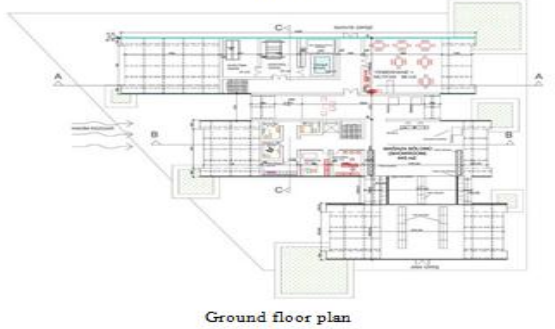
This study is significant in terms of giving opportunity to practice sustainable design within adobe in the architectural education as well. The relationship between architectural design practice and sustainable design with adobe were evaluated with all positive and negative aspects within the context of students projects.

Table-2. Final project designed by Аскар НУРТАЗЕНОВ

Layout plan

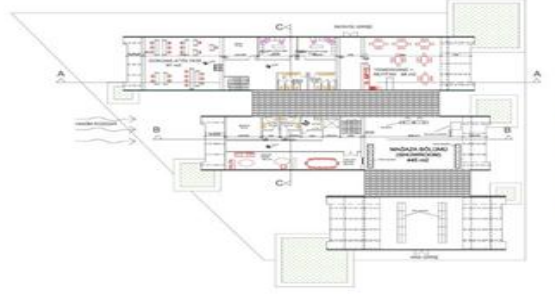


Model photo



Ground floor plan

Model photo



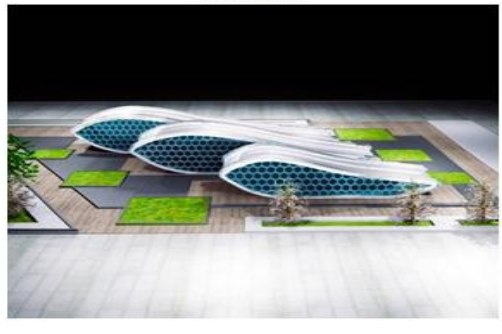
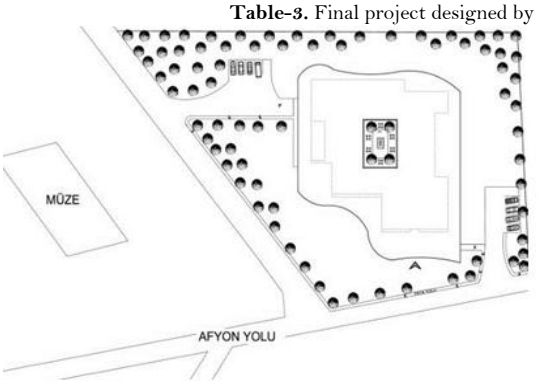
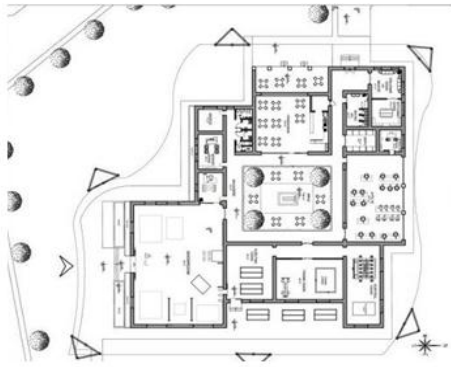


Table-3. Final project designed by Güneş YORNUK & Emre ÖZALP



Layout plan



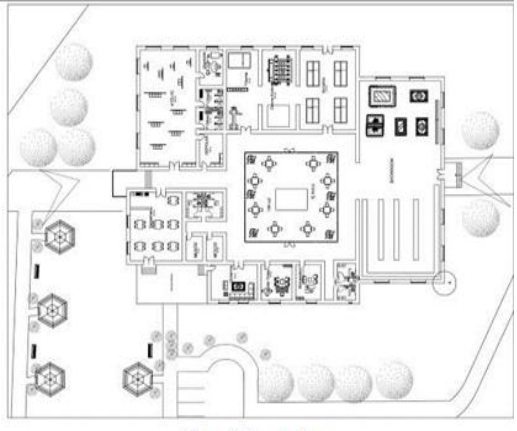
Ground floor plan

Model photo

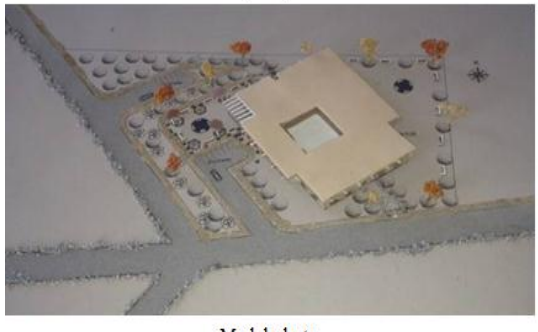
Model photo

Table-4. Final project designed by Ayşe DEMİR

Layout plan



Ground floor plan



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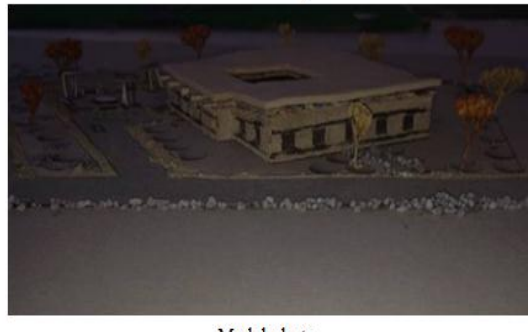

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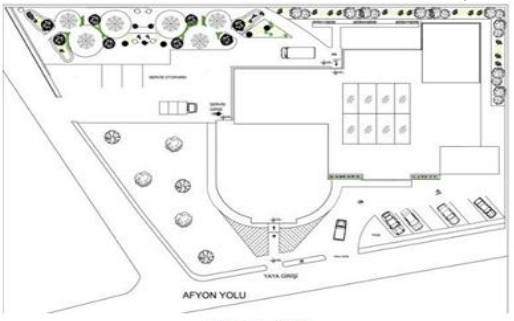
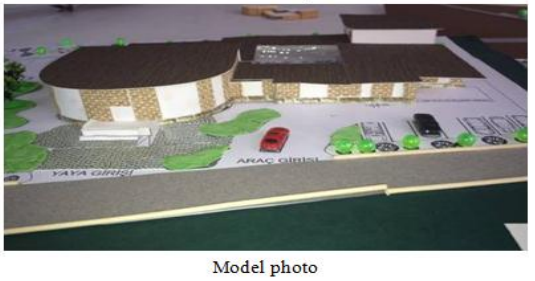
Table-5. Final project designed by Nurefşan BALTA



Layout plan

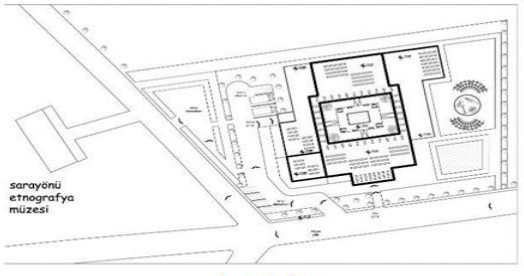
Ground floor plan

Model photo

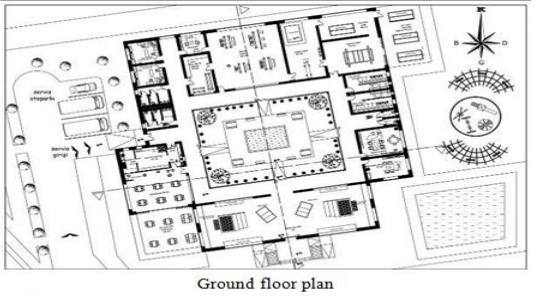


Model photo

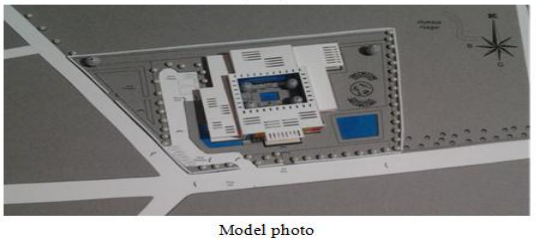
Table-6. Final project designed by Sümeyye ULUDAĞ & Betül ARSLAN



Layout plan



Ground floor plan



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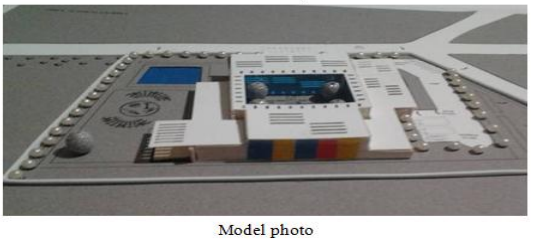

Model photo

4. DISCUSSION AND CONCLUSIONS

As a matter of fact, architecture is by its own definition the product of a creative process, which measures its success by its capacity to provide an answer to economic, aesthetic, ethical, socio-cultural and physio-psychological human needs. To promote sustainable design in the built environment, architecture must therefore assume a further dimension, conscientiously responding to the context where it is built and to the environment as a whole [4]. Sustainable environmental design should be professed as a core architectural skill with the potential to deliver low carbon emitting/energy consuming buildings, while encompassing the aesthetic, economic, social and cultural values inherent in a responsible design process.

Taking into consideration that traditional materials are closely related to local conditions and have significantly less environmental impacts and embodied energy than current construction materials, their use means a potential to reduce impacts throughout the life-cycle of buildings, in a "cradle-to-grave" approach. Thus, to achieve sustainability, architecture should seek integration between tradition and modernity, using the best of both in technologies and materials. Beyond the environmental issues, promoting the use of local materials like adobe have a positive impact on local social and economical developments.

Contrary to cliches, adobe is perfectly adaptable for use in cold, wet climates as well as hot and dry ones, and for areas prone to earthquakes. With its efficient use of energy, natural resources for construction, and minimal effort for long-term maintenance, it's clear that the adobe is an ideal option for constructing eco-friendly structures throughout the world.

The studies briefly presented contribute for the discussion and awareness of the need for preservation of adobe vernacular architecture, as well as to the opportunity of using adobe as a building material for new constructions. It is important to engender a 'sustainable' architectural consciousness in the students who will be the next generation architects. In architectural education, design decisions taken during the early phases of the design process play an important role in ensuring concern for the sustainability issue. When these young designers become professionals, it will be observed how successful this studio was by following their architectural products. This article detailed the specific teaching/learning experience for sustainability in architecture design studio as a methodology.

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