

## **Investigation of Façade Arrangements in Rural Architecture of Diyarbakır Province Erimli Neighborhood**



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### **ABSTRACT**

As the archaeological remains indicate, adobe is one of the building materials that has been in existence since the earliest known period. Particularly in residential architecture, the inaccessibility of wood and stone materials, according to the characteristics of the region, necessitated the use of earthen materials. The use of earth-based adobe is common in rural architecture, especially in the mid-latitude region of the world, as it is easily available, does not require production facilities, and is economical and sustainable. The adobe architecture, which was used as a building material in the traditional architecture of the ancient Anatolian and Mesopotamian civilizations, still exists present day. Although adobe material differs in terms of its properties depending on the presence of water in the region, the type of earth, molding, and drying techniques, it is generally accepted as a common architectural and cultural heritage for thousands of years. Due to its cultural and architectural heritage, adobe architecture, which needs to be preserved and maintained, is in danger of losing its unique examples by being damaged due to the decrease in adobe mastery and abandonment due to migration from rural to urban areas, and neglect. In this context, the study aimed to draw attention to adobe architecture, adobe structures, which constitute the rural architecture of the Erimli Neighborhood of Diyarbakır province and are mostly composed of dwellings, were selected for examination. 13 unique dwellings selected in the Erimli Neighborhood have been examined in terms of façade arrangements. The positions of the dwellings to each other and the streets, the fullness and gap rates on the façade, the size, form, and location of the openings that composed the façade architecture were determined by photographs and drawings and grouped within themselves. The findings obtained aimed to draw attention to the place and importance of the rural architecture of the Erimli Neighborhood of Diyarbakır Province, built with adobe, in adobe architecture with its unique qualities. The necessity of preserving and maintaining the adobe architecture of the Erimli Neighborhood which has existed as a result of many years of experience and tradition has been tried to be revealed.

**KEYWORDS:** Adobe, local dwellings, rural architecture, traditional dwellings

### **INTRODUCTION**

The need for shelter is one of the basic needs that humanity has had to meet, and the increase in knowledge about agriculture has increased the necessity for well-designed shelters suitable for the physical environment. Temporary shelters, which are the habits of hunter-gatherer life, have left their place to the settled order with agricultural activities. The earliest examples of earthen shelters were built for use only in inclement weather conditions, often covered with mud for waterproofing, using shrubs and small pieces of wood. The development of adobe brick, which is a modular masonry unit made of sun-dried mud using molds, took place at higher civilization levels. [1].

One of the earth-based materials, adobe building material, has been widely used and developed in vernacular architecture with different forms, in almost every region of the world. The regions that use adobe building materials in the world are as follows: Mesopotamia, Nile Valley, North Africa, Mali, Morocco, Iraq, Iran, Yemen, Afghanistan, India, China, Sweden, Germany, Denmark, France, Spain, Portugal, England, South America, Mexico, and California (Fig. 1) [2].



**Figure 1.** Global map illustrating the use of the adobe building material.

Contrary to modern building technology, traditional applications are developed through trial and error rather than contemporary testing and application. Construction practices in vernacular architecture reflect the building materials, climatic conditions, social life, and skills available in a particular region. Considering all these criteria, it is still one of the most used building materials in vernacular architecture due to its local availability, low cost, waterproofing, thermal insulation, and sustainability [1,3]. Studies show that around 30% of the world's population lives in structures made of earth-based materials [4].

Although the constructions are now developed over reinforced concrete, adobe is still used in the vernacular architecture of Anatolia, especially in dwelling construction, with low cost and easy production methods. In Diyarbakır Erimli Neighborhood, which is located in the Southeast Anatolian Region, there are adobe dwellings that preserve their unique qualities despite the increasing number of reinforced concrete dwellings in the neighborhood. The study aims to draw attention to the unique dwellings by examining the façade arrangements of the adobe dwellings of the Erimli Neighborhood, which should be preserved and maintained.

## **1 PROPERTY OF ADOBE BUILDING MATERIAL**

The adobe building material is obtained by adding fibrous additives such as straw to clay-based soils that can bind the grains together, and turning them into a mortar with water. The resulting mortar is shaped with wooden molds, removed from the mold, and dried in the sun [5]. In its early days, adobe was used with the pouring technique on the stone wall, without the molds prepared beforehand. After this application, which took a long time, it is understood that the pre-shaped sun drying technique has become increasingly widespread [6]. Generally, adobe shows higher strength than rammed earth [7]. Correctly prepared and dried adobe can be used as a load-bearing wall material in buildings because it is homogeneous and compact [8].

Due to its porous structure, adobe quickly replaces the moisture in the air with the in its body. Thus, the microclimate in the environment is balanced in terms of humidity. Thanks to its heavy mass and porous structure, it has a high heat retention feature. It provides good bio-climatic comfort indoors both in summer and winter [9]. However, adobe is vulnerable to water due to the transport of fine clay particles to the surface in the presence of water. Since it is a building material whose heat retention and carrier properties decrease when wet, it requires compatible moisture insulation [7].

In addition to the ingredients of adobe material, molding, and drying techniques, its dimensions also differ from region to region. According to the Turkish Standard 2514, the most commonly used adobe components in Turkey are classified as 30-40 cm in length, 18, 19, 25, 30 cm in width,

and 12 cm in height. The large-sized adobe component is called " ana kerpiç", and the small-sized adobe component is called "kuzu kerpiç" (Table 1) [10].

**Table 1.** Classification table according to the dimensions of the adobe [11].

Category	Dimensions(cm)	Volume (dm <sup>3</sup> )	Approximate Weight (kg)	Name
I	12x19x40	9,12	10-12	Kuzu
II	12x30x40	14,40	15-25	Ana
III	12x18x30	6,4	7-11	Kuzu
IV	12x25x30	9,00	10-15	Ana

Adobe material is a material that stands out with criteria such as sustainability, energy efficiency, low emissions, use of natural materials, use of waste materials, and recycling, which are used in the environmental evaluation of building materials and construction methods [12].

## 2 FAÇADE ARRANGEMENTS OF RURAL ARCHITECTURE OF ERİMLİ NEIGHBORHOOD OF DİYARBAKIR PROVINCE

### 2.1 Environmental Characteristics of Erimli Neighborhood

The study area is in the Sur district of Diyarbakır province, located in the Tigris Section in the eastern half of the Southeastern Anatolia Region. The Erimli Neighborhood, which was selected for study, is located 21 km from Diyarbakır city center, on the edge of the Tigris River (Figure 2a). The neighborhood's area is 438 m<sup>2</sup>, and the residential is 660 meters above sea level [13].



**Figure 2.** a. The location of Erimli Neighborhood relative to the Tigris River [14]. b. Erimli Neighborhood slope view.

The Southeastern Anatolia Region has a continental climate with hot and dry summers and cold winters. The low relative humidity level causes dryness in the region. This situation has caused the settlements to be designed with passive strategies, especially according to the cooling period. In this context, Erimli Neighborhood benefits from the climatic advantages of the Tigris River, on which it is located. Located on the west-facing slope of a low-lying hill, Erimli Mahallesi provides optimum settlement conditions for hot-dry climate regions with its location and adobe structures (Figure 2b).

### 2.2 Settlement Characteristics of Erimli Neighborhood

The middle part of the settlement axis forms the center of the neighborhood. There is a coffee house, mosque, and condolence house used as a public area in the center. The buildings are not in a specific order but have an organic order developed in line with the needs. Houses arranged at close distances or adjacent to each other formed streets of various widths. These distances vary between 1 meter and 3 meters.

The traditional buildings made of adobe in the settlement are single storey. There are also two-storey examples of reinforced concrete structures built in recent years. Adobe houses can be classified as planned houses with and without a sofa. Adobe houses usually have a sofa, room, hall, kitchen, bathroom, toilet, and storage. In the garden areas, there are settlement, poultry and food warehouses. The construction technique of these places is the same as the houses and the building

material is mud brick. Although adobe houses are mostly built in rectangular and compact forms, there are also houses that cannot be defined as rectangular, depending on the later additions. The houses are generally oriented to the south and east.

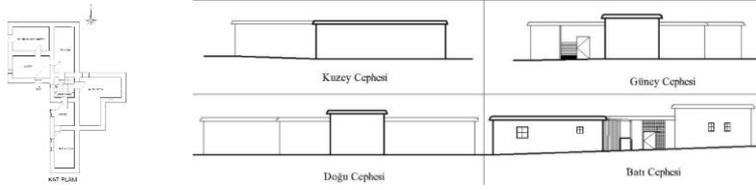
The walls that serve as carriers in the houses built with the masonry construction technique are made of adobe. The use of adobe building material on the walls increases the thermal performance of the spaces due to its heat-retaining feature and long time delay. The outer wall thickness of the buildings in the settlement is generally 80-85 cm, and the inner walls are approximately 55-60 cm thick. The upper cover of the buildings is made of an earthen roof with straw added. The roofing system consists of rafters with an average diameter of 5 cm, which are added in a vertical direction to the wooden rafters with an average diameter of 10 cm placed on the walls in the short direction of the spaces.

### 2.3 Façade Arrangements of Erimli Neighborhood

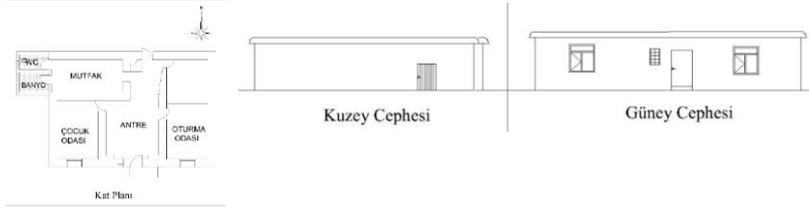
In the study, 20 adobe houses in Erimli Neighborhood were examined in terms of their façade arrangements. The examination was made by classifying them according to the elements that constitute the façade. The plan drawings, façade drawings, and images of the examined houses are presented in Figure 3. The entrance arrangements, walls, openings, and roof coverings that constitute the façades of the adobe houses in the settlement are designed simply and without ornaments. There are no moldings, cartridges, or consoles in the façade arrangements where functionality is prominent. The number of floors of the adobe houses, which were mostly designed as one-storey in the settlement, later increased to two with brick material. There are also examples where additions were made with brick material. Despite the existence of houses with balconies on the façades, balconies are not a common element in the settlement. Although the occupancy-space ratio and symmetry concerns are not observed on the façades, sharp lines are often not encountered as a feature of adobe material.

House No.	Plans	Façades	Images
1	<p>ZEMİN KAT BİRİNCİ KAT</p>	<p>Güney Cephesi Batı Cephesi Doğu Cephesi</p>	
2	<p>KAT PLANI</p>	<p>Kuzey Cephesi Doğu Cephesi Güney Cephesi Batı Cephesi</p>	

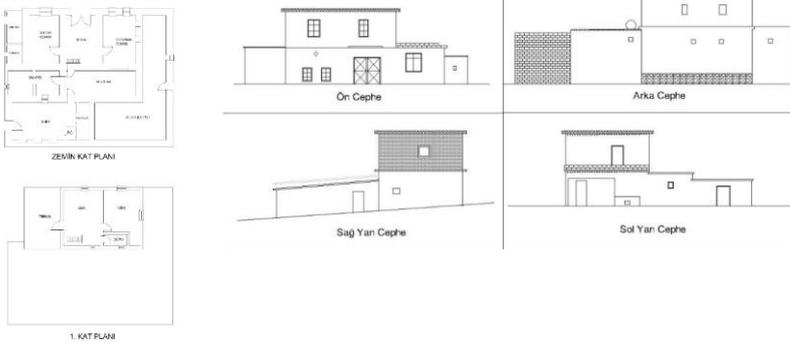
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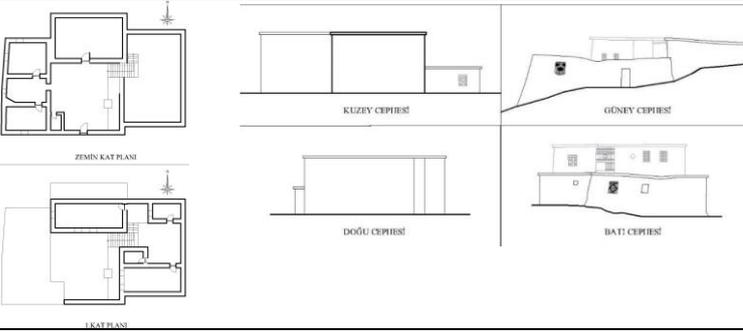
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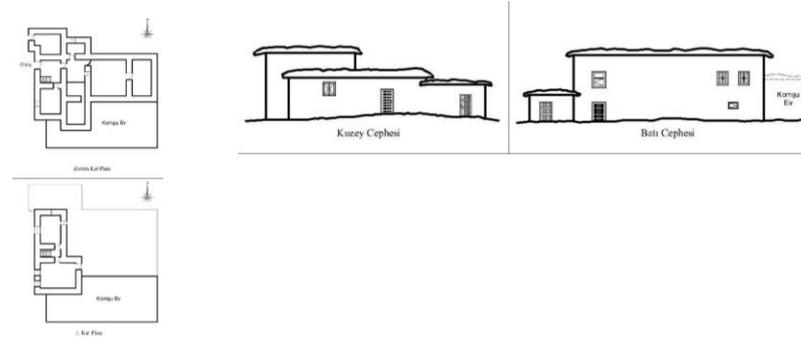
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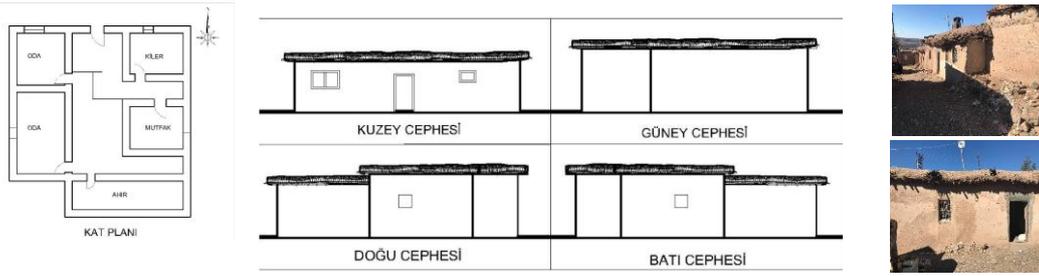


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**Figure 3.** Plan, façade drawings and images of adobe houses in Erimli Neighborhood.

### 2.3.1 Entry Arrangements

The locations of the entrances to the adobe houses in the settlement were determined by the parceling features and the garden areas. Houses with a garden can be accessed from the garden area, and houses without a garden can be accessed from the street. Entries are usually opened at ground level or, in some cases, from sills 10-15 cm high. In most garden areas, there are units such as coops, barns, and warehouses which are made of adobe. In the settlement, tandoor sections with separate entrances are also seen, which are planned independently of the houses not to increase the room temperatures. The entrance doors are protected by the 50-centimeter eaves of the top cover, and there is no independent entrance marquee on the façade. Although the dimensions of the entrance doors vary, the doors are 80-100 cm wide and 130-200 cm high on average. The doors of the barn unit, which are reflected on the façade, vary between 80-100 cm in width and 140-170 cm in height. The entrance doors of the units used as food warehouses are approximately 70x140 cm in size. While the material of the entrance doors of the houses is metal, the entrance doors of the coop, barn, and warehouse units are made of wood. There are no ornaments on the iron or wooden doors.

### 2.3.2 Windows

Despite the proximity of the settlement to the Tigris River, the orientation of the buildings did not develop towards the west where the river is located. However, the arrangement of the houses in the settlement in a closely spaced or adjacent order necessitated the orientation of a few in number and small in size windows to the west. While the buildings are generally positioned with their long façades facing south, it is also possible to see examples oriented to the east. Opening a window in the south direction reduces the heat gain by blocking the solar radiation coming from the east-west direction. In this way, indoor temperatures can be balanced during the summer months when the outdoor temperature reaches high degrees. Although there is no standard ratio of the windows of adobe houses, it can be said that the room windows are in the range of 70-110 cm in width and 100-140 cm in height. There are also near-square windows in the range of 60-80 cm. In wet areas, barns and warehouses, there are windows with an average width of 15-50 cm and a height of 35-50 cm. The fact that the window profile made of wood is usually on the inner surfaces of the walls, protects from solar radiation. There are also examples where wooden joinery was later replaced with PVC profile. Metal railings are mostly used on the windows. There are wire mosquito nets and cloth covers on metal railings on the windows of some houses in the settlement. In the wet areas of adobe houses, there are window openings of 30-40 cm width, without profile, in the north or west direction. Cartridges or shutters were not found on the plain and unadorned windows.

### 2.3.3 Top Covers

The upper cover of the adobe houses is an earthen roof with wooden beams. Wooden rafters with an average diameter of 10 cm in the short direction of the space and rafters with a diameter of about 5 cm in the long direction were placed on the wall. After the rafters are covered with materials such as wood and bushes, soil with the addition of straw is laid. Soil is poured into the middle parts of the cover at a higher level than at the edges. With this method, precipitation waters discharge by creating a slope towards the edges. The eaves arrange at an average thickness of 50

cm. The roof systems of adobe barns, poultry houses, and storage units were built with the method used in the houses. The chimneys in adobe houses are generally made of adobe, in a simple form that narrows towards the upper part. There are also brick chimneys added to the houses later. The top cover of the tandoori section has a small skylight that functions as a chimney [15].

### 3 RESULTS

In this study, the façade arrangements of rural architectural examples made of adobe in the Erimli Neighborhood of Diyarbakır province were examined. The entrance arrangements, windows, and roof coverings that make up the façade elements of 13 adobe houses selected for examination in the settlement are discussed under separate headings. The plan and façade drawings and visuals of 13 houses determined by fieldwork are presented in Figure 3. The façades of the adobe houses, which were examined according to the findings, were designed according to the climatic and topographic characteristics of the settlement, rather than an aesthetic concern, and they have the characteristics of the rural architecture to adapt to the physical environment. The entrance arrangements as an element of the façade elements are oriented according to the parcelling features, and the window openings are oriented according to the thermal performance. The number and dimensions of the openings were also designed by considering the climatic features. There aren't any ornaments on the doors, windows, or walls of the façade elements, and functionality is at the forefront. This simplicity observed in the façades of adobe houses allows them to adapt to the basic conditions of the environment in various climates and topographies. The façades of the adobe houses in the settlement, which were designed without façade movements such as molding, cartridge, cantilever, pillar, and ornament, created unity and added a characteristic feature to the settlement. In this context, adobe houses built with building materials and construction techniques suitable for the region in Erimli Neighborhood, which is facing the danger of concretization, are structures that should be preserved with their original qualities and handed down to future generations.

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