



Post-disaster Resettlement: Developing Permanent Housing Scenarios in Türkiye

Afet Sonrası Yeniden Yerleşim: Türkiye'de Kalıcı Konut Senaryolarının Geliştirilmesi

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Öz

Bu çalışma, 2023 Şubat Kahramanmaraş depremlerinin ardından Malatya'nın Yeşilyurt ilçesinde kalıcı konut tasarımına yönelik iki senaryonun geliştirilmesini incelemektedir. Araştırmanın temel amacı, yerel mimari mirasın korunması ile sürdürülebilir ve dirençli konut çözümlerinin geliştirilmesi arasında bir denge kurarak sosyal uyumu ve uzun vadeli iyileşmeyi desteklemektir. Karma yöntem yaklaşımı benimsenen çalışmada, yarı yapılandırılmış görüşmeler ve saha gözlemleri yoluyla kullanıcı ihtiyaçları ile konut tasarımı arasındaki temel temalar belirlenmiştir. Önerilen senaryolar; yerel malzeme kullanımı, enerji verimliliği yüksek tasarımlar ve uyurlanabilir planlama çözümleri ile sürdürülebilirliği önelemektedir. Tarımsal ve ortak kullanım alanlarının bütünlük biçimde tasarlanması ise topluluğun sosyo-ekonomik dokusunu güçlendirmeyi hedeflemektedir. Bulguların yerel bağlama özgü olması, genellebilirliğini sınırlasa da benzer afet sonrası konut projeleri için önemli çıkarımlar sunmaktadır. Bu araştırma, geleneksel mimariyi modern dayanıklılık stratejileriyle bütünlükten, kullanıcı odaklı ve kültürel hassasiyeti yüksek bir çerçeve sunarak, deprem riski taşıyan diğer bölgeler için de uygulanabilir bir model ortaya koymaktadır.

Anahtar Kelimeler: Afet sonrası kalıcı konut, Afet riskinin azaltılması, Kültürel mirasın korunması, Sürdürülebilir yeniden inşaa, Kullanıcı odaklı tasarım

ABSTRACT

This study examines the development of two permanent housing design scenarios in Malatya's Yeşilyurt district following the February 2023 Kahramanmaraş earthquakes. It aims to balance local architectural heritage preservation with sustainable, resilient housing solutions that promote social cohesion and long-term recovery. Using a mixed-methods approach, the study includes semi-structured interviews and field observations to identify key themes connecting user needs with housing design. The proposed scenarios emphasize sustainability through local materials, energy-efficient designs, and adaptable layouts. Agricultural and communal spaces are integrated to strengthen the community's socio-economic fabric. The study's context-specific findings may limit generalizability but provide valuable insights for similar post-disaster housing projects. This research offers a user-centered, culturally sensitive framework for integrating traditional architecture with modern resilience strategies, presenting a model for other earthquake-prone regions.

Keywords: Post-disaster permanent housing, Disaster risk reduction, Cultural heritage preservation, Sustainable reconstruction, User-centered design

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INTRODUCTION

Earthquakes are unpredictable events that result in significant loss of life, injuries, and both material and immaterial damage. Such disasters significantly impact the local housing market and quality of life in the affected regions (Boelhouwer & van der Heijden, 2018; Varolgüneş, 2021). Housing is considered one of the most valuable assets for individuals in developing countries. In sudden disasters, houses are often among the most damaged or completely lost elements, constituting a large part of the total disaster impact on the national economy (Lyons et al., 2010; Varolgüneş, 2021). Therefore, the success of resettlement and reconstruction processes is crucial for both the rapid recovery of earthquake victims and the mitigation of adverse effects on the national economy (Andersson & Shyr, 2024; Peacock et al., 2018). However, rapid interventions to meet urgent housing needs often lead to the neglect of cultural and local conditions. As a result, settlements that do not meet the needs and satisfaction of users may emerge (Johnson, 2007). Housing projects should not be seen merely as a solution to the need for shelter; rather, they should be considered as a process of creating a physical environment that responds to social, cultural, and economic needs (Limoncu & Bayülgen, 2005; Sev, 2009). Projects designed without spatial evaluations and without ensuring user participation in the process may lead to dissatisfaction among disaster victims over time and result in the abandonment of settlements (Ben Haman et al., 2021; Dikmen & Elias-Ozkan, 2016). In new settlements, establishing connections that provide social and economic benefits with the old settlement should be adopted as a planning criterion (Aysan & Oliver, 1987). The post-disaster reconstruction process presents a complex set of challenges (Shrader & Delaney, 2000). Among these challenges, the pressure to build housing as quickly as possible in a disrupted context so that displaced disaster victims can have a home again stands out. The reconstruction of large-scale permanent housing is generally a long process (Ahmed, 2011).

The earthquake centered in Maraş in 2023 had significant impacts on the urban fabric of the region and caused serious damage to the existing building stock. The areas most affected by the earthquake are those with old and traditional structures (Uzun & Somuncu, 2023). According to official damage assessment data reported in November 2023, a total of 178,987 buildings in Malatya were affected by the February 6, 2023 earthquakes, including 35,368 severely damaged buildings, 1,746 buildings requiring urgent demolition, and 554 collapsed structures, clearly demonstrating the scale and urgency of permanent housing needs in the region (Damcı et al, 2025). Resettlement processes following such disasters are often carried out under the pressure of rapid construction efforts and limited resources (Varolgüneş, 2025). This situation leads to a departure from local design and traditional construction technologies, resulting in new settlements filled with spatially and climatically inadequate, often reinforced concrete structures (Karki et al., 2022). To highlight these problems and propose solutions, a study was conducted in an area affected by the Maraş earthquakes on February 26, 2023. Malatya, one of the most heavily affected areas, was selected as the study site. Located in eastern Anatolia, Malatya is characterized by a continental climate with hot, dry summers and cold winters, as well as a strong tradition of courtyard-based housing and locally sourced building materials, factors that have historically shaped both its settlement patterns and architectural identity. Malatya, one of the most heavily affected areas, was selected as the study site. The research evaluated the region's traditional architecture, climatic and environmental features, and conducted semi-structured interviews with residents and local experts to understand user needs and socio-cultural dynamics. Findings highlight a reconstruction model that goes beyond the physical built environment preserving local values, fostering social continuity, and strengthening the sense of belonging. The proposed model is considered applicable not only to Malatya but also to other earthquake-affected regions (Kürüm Varolgüneş & Şeker). This study advocates for a sustainable, user-centered and locally attuned reconstruction approach. Through its literature review, methodology, findings, and conclusions, the article offers a renewed perspective on post-

disaster resettlement. By focusing on both physical rebuilding and the restoration of the social and cultural fabric, the study contributes to the development of culturally sensitive and sustainable housing models suitable for broader implementation.

Accordingly, the study is structured around the following research objectives:

- to explore how traditional architectural references and local spatial practices can inform the design of permanent post-disaster housing in the context of Malatya,
- to examine how user needs, expectations, and socio-cultural values identified through fieldwork and interviews can be reflected in architectural design decisions,
- to discuss the role of sustainability (considered through environmental, social, cultural, and economic dimensions) in shaping post-disaster housing scenarios,
- to present design scenarios developed for the Yeşilyurt district as context-sensitive examples that may offer insights for post-disaster reconstruction in similar settings. The overall research process and the relationship between the literature review, contextual analysis, user-centered data, and the proposed design scenarios are summarized in Figure 1.

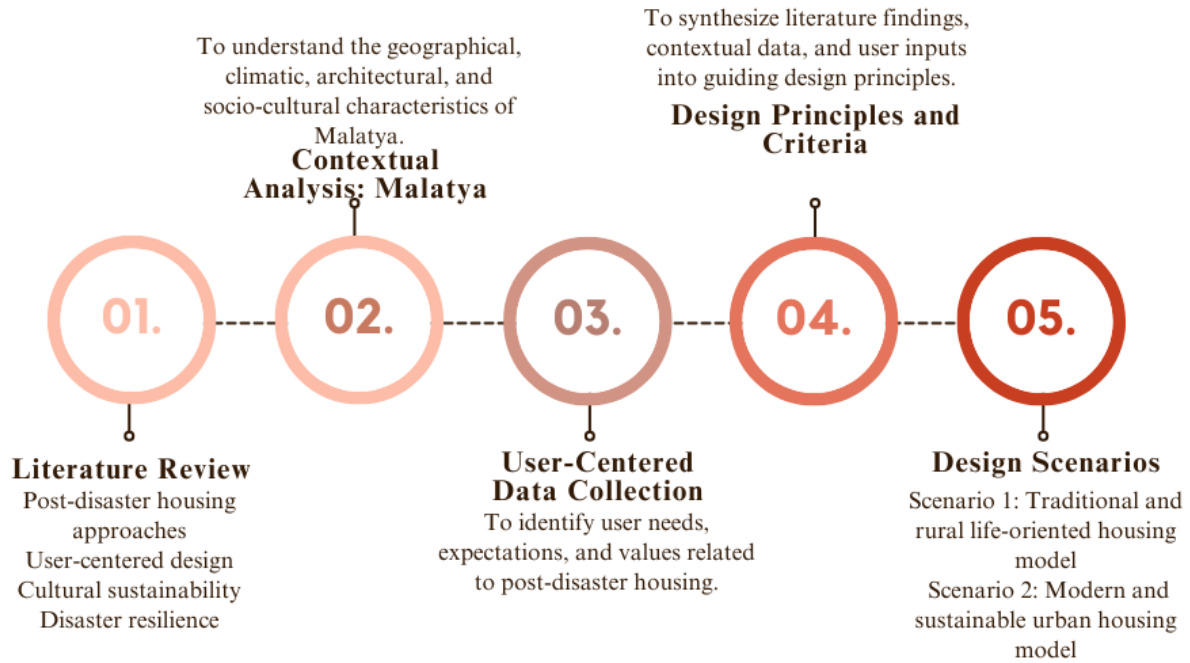


Figure 1. Conceptual Diagram of the Research Process for the Malatya Case

1. The conceptual framework

The healthy and effective management of post-earthquake resettlement processes depends on the proper management of economic conditions, disaster management systems, local land use decisions, and building practices (Tafti & Bashiri, 2022). At this point, architects and urban planners are among the most important actors in the process. When designing new living environments, it is essential to ensure that individuals can maintain their social lives healthily and feel a sense of belonging and security in the designed environment (Lagorio, 1990; Montalbano & Santi, 2023). Studies in global literature provide significant contributions to these reconstruction processes from various perspectives. Boelhouwer & van der Heijden (2018) comprehensively examined the impacts of earthquakes in Groningen, the Netherlands, on housing prices, quality of life, and settlement

preferences. Andersson & Shyr (2024) analyzed the socio-economic impacts of earthquakes and their reflections on urban planning in their article. The study evaluated the impacts of earthquakes on housing prices and their potential future effects through simulations. Tafti and Bashiri (2022) investigated how temporary housing after disasters is perceived, experienced, and used by disaster victims in low-income cities. Peacock et al. (2018) examined the impacts of post-disaster housing reconstruction policies on different beneficiary groups in their study. Montalbano & Santi (2023) investigated the sustainability of temporary housing and the environmental, economic, and social issues of these houses in their study. Ahmed (2011) provided a general evaluation of post-disaster permanent housing projects in developing countries and addressed the impacts of these projects in rural areas. Gomaa and Sakr (2015) identified several key factors contributing to the success of post-disaster settlements, including the promotion of social cohesion, the safeguarding of cultural identity and place attachment, the creation of secure living environments, and the reinforcement of socio-cultural values. In a similar vein, Dias et al. (2016) argued that effective reconstruction planning must go beyond physical infrastructure and environmental concerns, emphasizing the need for projects to support the socio-economic advancement of affected communities. Kennedy et al. (2008) further highlighted the importance of ensuring local community satisfaction during the rebuilding process, noting its critical role in achieving the long-term functionality and sustainability of resettlement initiatives. Supporting this perspective, Ophiyandri et al. (2016) pointed out that community-driven resettlement strategies significantly enhance resilience in disaster-affected populations (Ophiyandri et al., 2016).

Studies conducted in the context of Türkiye also support these themes. A post-disaster assessment by Enginöz (2004) revealed a disconnect between the design of the permanent dwellings built after the 1995 Dinar earthquake and both the environmental conditions and the expectations of the affected population. Limoncu and Bayülgen (2005) conducted a comparative assessment of post-earthquake sheltering practices in Türkiye by applying their three-phase model—comprising emergency, rehabilitation, and reconstruction stages—to six different case studies. Their findings revealed a lack of consistent strategic planning across all three phases, leading them to advocate for the development of a more sustainable and integrated sheltering framework. Similarly, İnal and Ünlü (2009) explored the role of flexibility in the design of permanent housing in the Gölyaka region of Düzce, emphasizing how adaptable spatial configurations can better accommodate the evolving needs of disaster-affected residents (İnal & Ünlü, 2009). Alaeddinoğlu et al. (2016) evaluated the socio-economic impacts of permanent housing built after the Van earthquake and assessed the long-term effects of these houses on the local population (Alaeddinoğlu et al., 2016). Kürüm Varolgüneş (2020, 2021) focused on user satisfaction and social sustainability parameters by evaluating the social sustainability performance of permanent housing built after the 2003 earthquake in Bingöl. In light of these studies in the literature, a reconstruction model centered on the traditional architecture and socio-cultural dynamics of Malatya should be proposed. These proposals, centered on Malatya's rural architecture, will form the basis of a sustainable construction model that will both preserve local identity and meet user needs. This model provides an applicable framework not only for Malatya but also for other earthquake regions.

In this study, sustainability is operationalized as a multi-dimensional construct comprising environmental, economic, social, and cultural dimensions. Rather than using sustainability as a normative umbrella term, each dimension is linked to explicit design decisions and evaluation indicators at the housing and neighborhood scales. Environmental sustainability is addressed through passive climatic strategies (orientation, natural ventilation, high-performance envelopes), renewable energy integration, and water-sensitive design. Economic sustainability is approached via lifecycle-oriented material choices, maintainability, and affordability considerations for construction and operation. Social sustainability is considered through spatial provisions that support privacy, safety,

and everyday social interaction (semi-private thresholds, courtyards, shared open spaces), while cultural sustainability is ensured by translating vernacular spatial logics (courtyard living, sofa/eyvan-like gathering patterns) and locally meaningful architectural elements into contemporary, code-compliant solutions.

To enhance traceability, Table 1 maps each sustainability dimension to (i) the associated design strategies adopted in Scenario 1 and Scenario 2 and (ii) the indicators used for qualitative assessment in this paper.

Table 1. Sustainability Dimensions and Design Decisions

Sustainability Dimension	Design Strategy	Design Decisions in the Proposed Scenarios	Evaluation / Evidence Used in the Study
Environmental Sustainability	Passive climatic design	Building orientation optimized according to prevailing wind directions and solar exposure; compact building form to reduce heat loss	Climate-responsive design principles derived from regional climate data and literature
	Energy efficiency	High-performance building envelopes natural ventilation strategies, shading elements, and roof-mounted photovoltaic panels	Qualitative assessment based on passive design logic and comparative references from post-disaster housing literature
	Water efficiency	Rainwater harvesting systems integrated into roof design and landscape use	Water-sensitive design principles and sustainable settlement approaches
Economic Sustainability	Use of local materials and labor	Preference for locally available materials (stone, wood, adobe-based components) to reduce transportation costs and support local economy	Cost-effectiveness and constructability discussed based on regional building practices
	Lifecycle affordability	Simple construction techniques, modular layout, and ease of maintenance	Qualitative lifecycle perspective focusing on long-term maintenance and adaptability
Social Sustainability	User-centered spatial organization	Housing layouts reflecting privacy gradients (public–semi-private–private), courtyards, and shared open spaces	Semi-structured interviews identifying user needs related to privacy, safety, and social interaction
	Community cohesion	Clustered housing units and shared neighborhood spaces encouraging everyday social interaction	Interview findings translated into spatial criteria and neighborhood-scale design decisions
Cultural Sustainability	Continuity of vernacular spatial patterns	Reinterpretation of traditional courtyard houses, sofa/eyvan-like gathering spaces, and spatial hierarchies	Architectural heritage analysis and user narratives emphasizing cultural continuity
	Material and architectural identity	Contemporary use of traditional materials and forms without literal replication	Contextual reading of local architecture combined with contemporary design principles

2. Methods

This study was conducted to evaluate permanent post-earthquake housing designs and to develop architectural scenarios that address diverse needs in the Yeşilyurt district of Malatya. The Yeşilyurt district was selected as the study area due to its combination of severe earthquake damage, strong historical and cultural continuity, rural–urban spatial characteristics, proximity to the city center, and

environmental features that allow the evaluation of context-sensitive and scalable post-disaster housing solutions. The research process centered on user-centered design principles and included comprehensive field studies, semi-structured interviews, focus group discussions with local experts, and an integrated architectural design process. Two distinct design scenarios were developed in detail based on the data collected. In the first phase of the research, 15 semi-structured interviews were conducted with earthquake-affected residents, architects and engineers (Table 2). These interviews aimed to gather detailed information on housing needs, design expectations, and social and cultural values.

Table 2. Demographic characteristics of the participants

Participants	Age	Gender	Occupation	Earthquake Impact	Household Status	Location
P1	48	Female	Housewife	Severe	Homeowner	Yeşilyurt
P2	32	Female	Housewife	Severe	Homeowner	Yeşilyurt
P3	50	Male	Civil Engineering	Severe	Tenant	Yeşilyurt
P4	43	Female	Teacher	Severe	Homeowner	Yeşilyurt
P5	35	Female	Architect	Severe	Homeowner	Yeşilyurt
P6	28	Female	Civil Engineering	Severe	Tenant	Yeşilyurt
P7	20	Female	Student	Severe	Tenant	Yeşilyurt
P8	23	Male	Small Business Owner	Severe	Tenant	Yeşilyurt
P9	24	Female	Teacher	Severe	Homeowner	Yeşilyurt
P10	38	Male	Small Business Owner	Severe	Tenant	Yeşilyurt
P11	41	Female	Housewife	Severe	Homeowner	Yeşilyurt
P12	52	Male	Small Business Owner	Severe	Homeowner	Yeşilyurt
P13	29	Female	Civil Engineering	Severe	Tenant	Yeşilyurt
P14	38	Male	Architect	Severe	Homeowner	Yeşilyurt
P15	23	Female	Student	Severe	Tenant	Yeşilyurt

Participants were asked questions under the categories of “housing needs”, “design expectations”, “social and cultural values”, “preservation of local architectural elements” and “modern living requirements” (Table 3).

The primary goal of these interviews was to gain an in-depth understanding of the region's social, cultural, and spatial needs. The focus group discussions provided valuable insights into how traditional architectural elements could be integrated into modern housing designs and how best to address user needs. These discussions also contributed to ensuring that post-earthquake housing designs were both safe and user-friendly.

Table 3. Questions asked to participants

Category	Question	Relevant References
Housing needs (Physical needs social and cultural needs economic needs psychological and emotional needs)	What is the current housing condition of the participant?	Marcillia & Ohno, 2012
	What are your housing needs after the earthquake?	Enginöz & Ünlü, 2010
	What do you think about temporary housing solutions?	Prasetyo et al., 2018
	What are your expectations regarding the size and number of rooms of the house?	Shehab, 2018
	What do you think about the structural safety and earthquake resistance of the house?	Aliyu, 2015
	What are your expectations regarding the heating, cooling, and insulation features of the house?	Prasetyo et al., 2018
	Should there be spaces for social and cultural activities in the neighborhood?	Cajilig, 2017
Design expectations	How important are neighborly relations and neighborhood culture to you?	Memmott & Keys, 2015
	What are your expectations regarding the cost and payment conditions of the house?	Memmott & Keys, 2015
	What do you think about the security and privacy features of the house?	Indrawan et al., 2021
Social and cultural values	What features are important to you in the design of new housing?	Indrawan et al., 2021
	What do you think about earthquake-resistant building design?	Cao, 2018
	What elements would you like to see in the interior and exterior design of houses?	Marcillia & Ohno, 2012
Preservation of local architectural elements	What social and cultural values should be preserved in housing design?	Cajilig, 2017
	How important are neighborhood culture and neighborly relations to you?	Marcillia & Ohno, 2012
Modern living requirements	What do you think about the integration of traditional architectural elements with modern designs?	Prasetyo et al., 2018
	How important is the preservation of local architectural elements to you?	Shehab, 2018
	What do you think about the use of traditional building materials?	Aliyu, 2015; Varolgunes, 2021
Modern living requirements	How can modern living needs be integrated with local architectural elements?	Prasetyo et al., 2018
	What modern living needs should be met in new housing?	Prasetyo et al., 2018
	What do you think about technological infrastructure and smart home systems?	Cao, 2018
	What are your expectations regarding energy efficiency and sustainability?	Indrawan et al., 2021

The collected data were analyzed and visualized through a relationship diagram illustrating connections between participants and thematic categories. These findings informed the development of design criteria to enhance user satisfaction, while housing designs were optimized to meet safety and durability standards, ensuring long-term resilience. Yeşilyurt district was selected as the study area for its unique combination of rural and urban characteristics, offering an ideal context for scalable housing design. Its dual function preserving cultural heritage and accommodating modern living positioned it as a focal point in post-earthquake reconstruction efforts. Within this framework, two design scenarios were developed to integrate traditional architectural elements with contemporary needs. The methodology supports user-centered permanent housing solutions by

fusing vernacular and modern architecture. By embedding architectural design within the research process, the study provides original and impactful contributions to post-disaster housing design.

3. RESULTS AND DISCUSSION

3.1 A Special Context for Post-Earthquake Reconstruction: Malatya

Located in the Eastern Anatolia Region, Malatya (Figure 2) has hosted many communities and nations due to its geographical location.



Figure 2. The location of Malatya and Yeşilyurt district on the map.

Malatya has maintained its status as an important settlement center since prehistoric times and has preserved this position to the present day. Throughout its rich historical past, Malatya, shaped under the influence of different civilizations, has been a center of attention not only politically and economically but also socially and culturally. The region, under the rule of various civilizations such as the Hittites, Urartians, Persians, Romans, and Byzantines, has increased its social and cultural wealth in every period, and these riches have been among the fundamental elements shaping the city's identity (Atıcı & Yaşar, 2019). Malatya's traditional settlement pattern has emerged as a product of this multi-layered historical process. Settlement plans that adapt to the geographical and climatic conditions of the region, the use of local materials, and unique architectural forms make Malatya's traditional architecture distinctive. The extensive use of local materials such as adobe, stone, and wood has played an important role both aesthetically and functionally, enhancing the durability of the region-specific structures (Şahin & Eroğlu, 2020; Şahin, 2020). Additionally, the inward-oriented courtyard layout of traditional houses is noteworthy for its spatial organization that promotes social interaction and preserves privacy (Akyıldız, 2021). Social practices and local cultural dynamics have been decisive in shaping this traditional fabric. Malatya's traditional settlement structures have not only met the need for shelter but also served as social spaces that strengthen communal belonging. The strong presence of neighborhood culture, neighborly relations, and communal living practices in the urban fabric has ensured the social sustainability of these settlements.

In conclusion, Malatya's traditional settlement fabric, as a reflection of the social, economic, and cultural dynamics that have developed throughout history, is an important element that carries the region's identity and cultural heritage to the present day. This rich heritage has the potential to inspire modern housing design and offers a significant model for preserving local identity and creating sustainable settlements (Tuncer, 2007). The chronological history of the city of Malatya is presented in Figure 3.

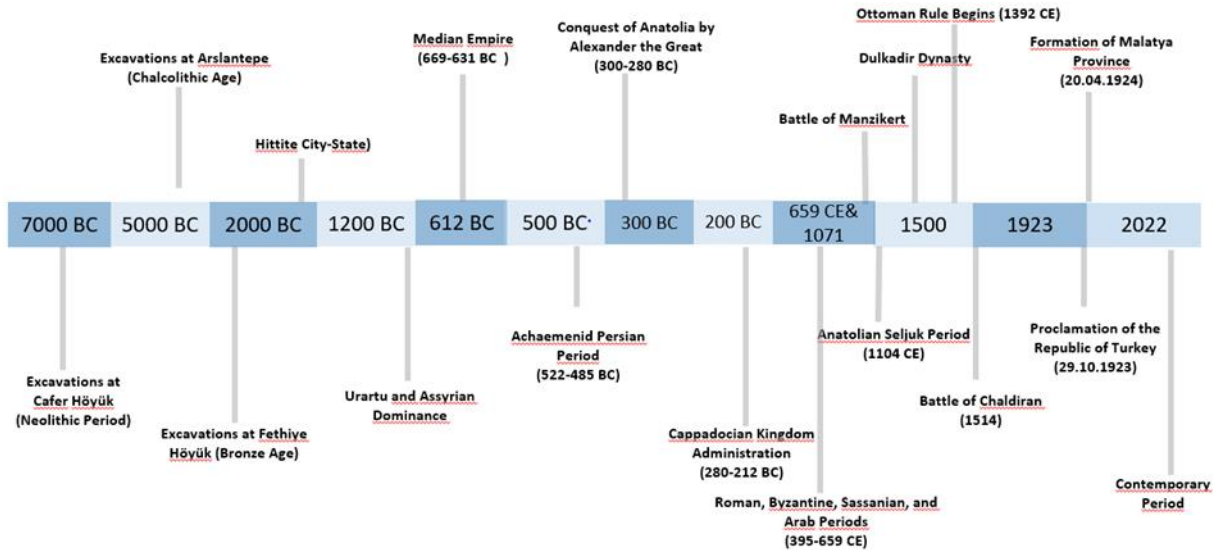


Figure 3. Chronological History of the city of Malatya (produced by the authors based on the literature review)

Due to its geographical location and elevation, Malatya is significantly influenced by a harsh continental climate. However, being considered a transition zone between the continental and Mediterranean climates reveals the region's microclimatic diversity. This situation leads to local climate conditions occasionally resembling those typical of Eastern, Southeastern, and Central Anatolia. While the winter season is long, cold, and harsh, the summer season is characterized by hot and dry conditions. The region's distance from the sea and high altitude further accentuates these climatic features. In Malatya, the majority of the annual precipitation occurs in the winter, spring, and autumn months, constituting approximately 95% of the yearly total (Figure 4). In contrast, summer precipitation is quite limited, indicating the region's susceptibility to drought. These climatic dynamics directly affect settlement planning, agricultural activities, and housing designs in the region. Particularly, the adoption of passive climate control strategies is crucial in the construction of energy-efficient and climate-friendly buildings. In this context, Malatya's climatic characteristics are a critical factor to consider in both shaping local architecture and designing post-disaster housing. Climate-sensitive design approaches play a key role in enhancing the quality of life in the region and creating sustainable settlements (Boyras & Budak, 2017).

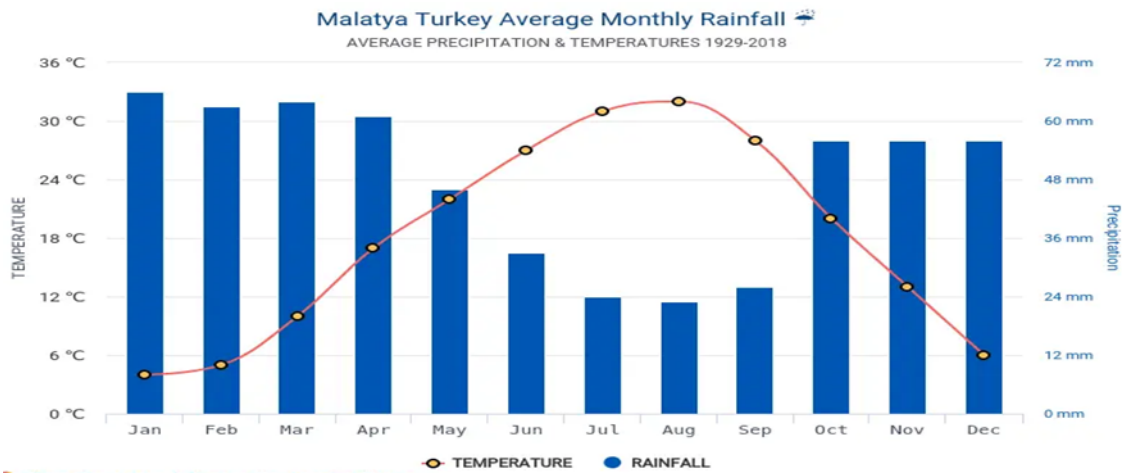


Figure 4. Climate data for the city of Malatya (Url-1).

3.2 Architectural Features and Spatial Organization of Traditional Malatya Houses

With its architectural and cultural accumulation spanning centuries, Malatya has great potential for adapting traditional construction techniques to modern structures. Traditional Malatya houses are notable for their climate-adaptive design features, use of natural materials, and solutions that meet local socio-cultural needs (Şahin & Eroğlu, 2020). In these houses, courtyards, structural elements made of local materials such as stone and wood, and open spaces that promote communal life stand out. Emulating these features in post-earthquake construction is crucial for preserving the region's cultural identity and creating resilient living spaces with high user satisfaction. Malatya's traditional residential architecture, shaped by region-specific elements such as adobe houses, stone walls, inner courtyards, and gardens, offers a construction culture that supports not only functionality but also social cohesion and interaction (Atıcı & Yaşar, 2019). The materials and design elements used in these houses adapt to the geographical and climatic conditions of the region while also reflecting the characteristics of Ottoman civil architecture. Typically dating back to the late 19th century, Malatya houses are distinguished by their two-story arrangements, with some mansions featuring a “köşk oda (cihannüma)” as a third elevated room (Şahin & Eroğlu, 2020) (Figure 5). Entrances directly connected to the street and open spaces such as courtyards or gardens provided a link between the houses and the outdoors; these areas were used as functional spaces for daily life and social interactions (Özyılmaz & Aluçlu, 2009) (Özyılmaz and Aluçlu, 2009).



Figure 5. Entrance facade of the traditional Malatya house

In the traditional houses of Malatya, doors are significant architectural elements due to their functionality and aesthetic details. Typically made from durable wood such as oak or walnut, these doors are simple and sturdy to ensure privacy. The surfaces of the doors are adorned with geometric patterns and floral motifs, while the knockers and hinges, made of wrought iron, provide both functional and aesthetic contributions. Double-winged main entrance doors, especially in large mansions, offer wide openings for ease of use, whereas interior doors are designed with finer craftsmanship. The doors are framed with arched entrances that harmonize with stone or adobe walls, often reflecting the social and economic status of the homeowner (Figure 6). Traditional

Malatya doors are an important source of inspiration for both past and modern designs, contributing to social life and reflecting cultural identity.

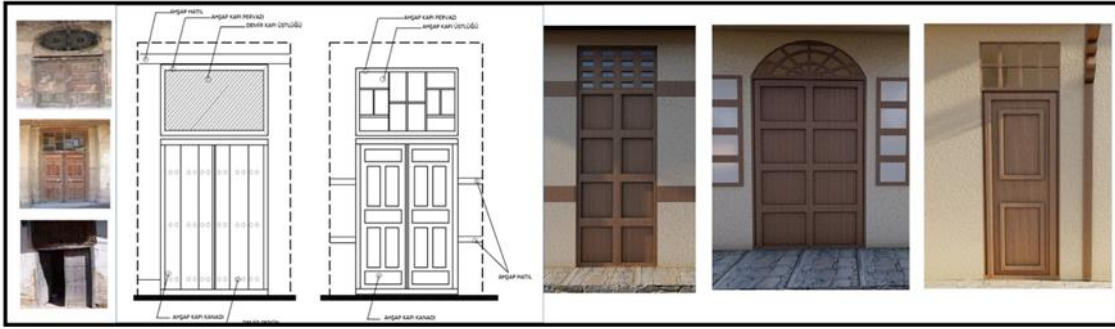


Figure 6. Door examples from the traditional Malatya house

In the interior design, architectural elements such as the *seki*, *yüklük*, cupboard, and *taka*, which bear traces of the Central Asian Turkish tent culture, offer both functional and cultural continuity. The sofas have held an important place in the spatial organization as the central gathering area of the houses, while the *eyvans* were frequently used spaces during the hot summer months (Şahin, 2020). Local materials such as stone, adobe, and wood were preferred in the constructions. Although the use of materials varied by region, traditional construction techniques such as the masonry system, *bağdadi*, and *hımış* were widely applied. In facade designs, the principle of privacy was emphasized, with a closed layout preferred on the ground floors, while the upper floors were enlivened with larger and more numerous windows (Figure 7). Additionally, wooden decorations were enriched with geometric and floral motifs; unique details such as the "gantamarlı oymalı" arch gave Malatya houses a characteristic aesthetic (Şahin & Eroğlu, 2020).

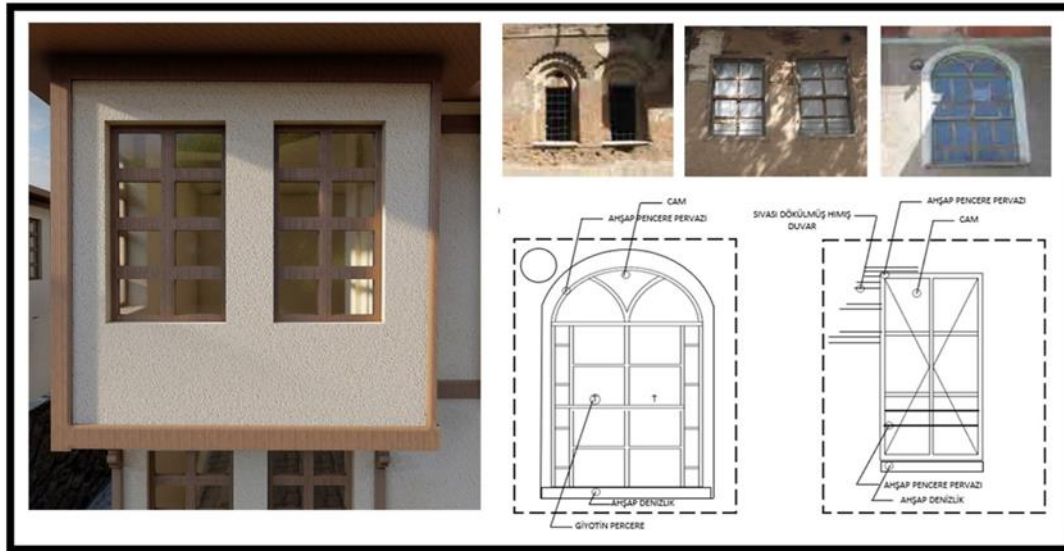


Figure 7. Window examples from the traditional Malatya house

The earthquake that occurred on February 6, 2023, caused damage to some of these traditional structures. This situation highlights the necessity of repairing existing buildings to preserve Malatya's cultural heritage and constructing new modern buildings that are respectful of the traditional fabric, meet safety standards, and are durable and sustainable. The spatial and aesthetic values of traditional architecture are qualities that can inspire contemporary housing projects and form the basis of an approach that can sustain the region's identity. Examples of traditional architectural plans are presented in Figures 8 and 9.

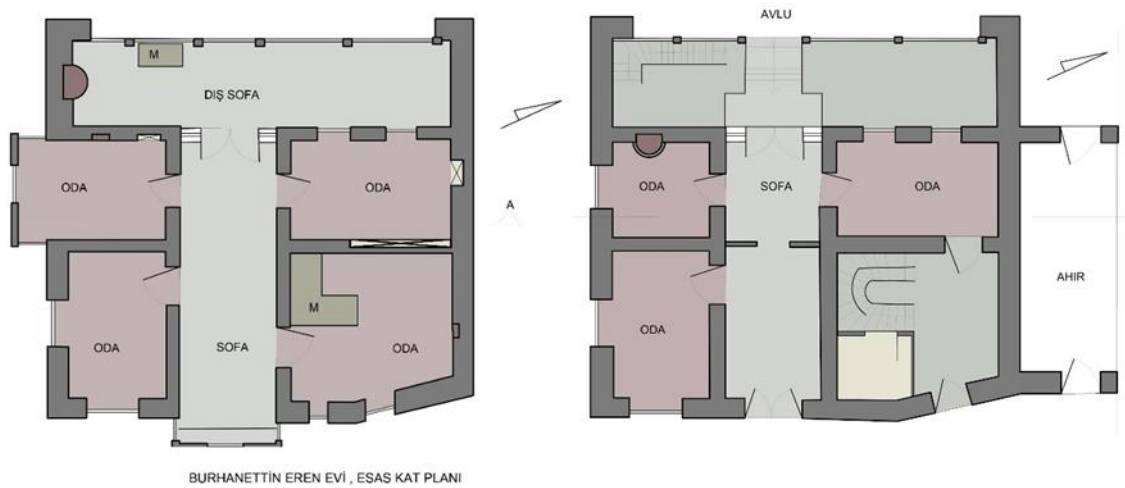


Figure 8. Plan of the Burhanettin Eren House (Adapted by the authors based on the drawings of (Temiz, 1990)



Figure 9. Plan of the Hanifi Tanbey House (Adapted by the authors based on the drawings of Temiz, 1990)

3.3 A User-centered approach for permanent housing in Malatya post-disaster

The earthquakes centered in Kahramanmaraş on February 6, 2023, dealt a severe blow to Malatya's physical infrastructure and social fabric (Figure 10). The study area, located in the Yeşilyurt district where traditional Malatya houses are concentrated, also suffered significant damage in the earthquake. The destructions, particularly in the Mollakasım neighborhood, have greatly affected the traditional fabric. To revitalize the city, the pattern formed by the traditional fabric will be modernized and continued in the new city, which will be designed according to the region's culture, lifestyle, and environmental factors such as climate and topography. Malatya's socio-cultural structure is based on traditions where family ties are strong, and neighborhood relations are prominent. The reconstruction process needs to be designed in a way that not only preserves but strengthens this social fabric. This can be achieved through a design process that prioritizes user needs and values. In the construction of permanent housing post-disaster, appropriate site selection is a critical phase for a safe and user-centered reconstruction process. The literature emphasizes that site selection should consider not only physical safety but also socio-cultural, economic, and environmental factors (Aysan & Oliver, 1987; Coburn & Spence, 2002). Environmental criteria such as climate conditions, access to water resources, and the preservation of agricultural lands are among the key elements determining the success of site selection (Aysan, 1985; UNDRO, 2018).



Figure 10. The Impact of the February 6 earthquakes on Malatya (Author's Personal Archive, 2023)

The Yeşilyurt district of Malatya, with its geographical location, historical background, and existing settlement characteristics, serves as a notable example for post-disaster settlement. The region has a rich historical and cultural heritage, with a settlement history dating back to the 4th-7th centuries CE (Common Era) usage by Turks since the Dulkadiroğlu Beylik period (Temiz, 1990). This historical continuity provides a significant foundation for Yeşilyurt's current socio-cultural structure. Yeşilyurt is located approximately 15 km from Malatya city centre, extending along the Beylerderesi Valley and situated in a 3 km green topography (Şahin & Eroğlu, 2020). This natural structure of the region offers an aesthetically pleasing and sheltered settlement area from a topographical perspective. Low-slope areas and valleys have suitable ground conditions for construction but must be carefully evaluated against potential disaster risks such as floods and landslides. Yeşilyurt offers significant advantages in terms of environmental sustainability. The green areas and water resources in the region stand out as natural elements that enhance the quality of life. However, as noted in the literature (Aysan, 1985), new settlement areas should be designed to protect valuable agricultural lands.

Since Yeşilyurt is a region with abundant agricultural lands, it is important to plan settlements in a way that does not harm these areas. The historical and cultural heritage of Yeşilyurt increases the importance of socio-cultural harmony in new settlement areas. The settlement history of the region offers an opportunity to combine traditional architecture and social structure with contemporary needs. The literature emphasizes that settlements not aligned with the cultural habits of users can lead to long-term dissatisfaction and abandonment of the settlements (Coburn & Spence, 2002). In this context, the houses to be built in Yeşilyurt should be designed with an approach that blends the traditional civil architectural elements of the region with modern designs. The proximity of Yeşilyurt to Malatya city centre is a significant advantage in terms of site selection. This distance facilitates daily commuting while providing access to economic and social opportunities in the centre. The literature highlights the importance of integrating post-disaster resettlement areas with the centre in terms of infrastructure and transportation (UNDRO, 2018). Therefore, the settlements to be built in Yeşilyurt should be compatible with existing infrastructure networks and offer advanced transportation connections.

3.4 Land evaluation and analysis

In this study, post-earthquake interviews and field studies were conducted in the Yeşilyurt district of Malatya, particularly around Mollakasım Neighborhood and Adıyaman Street. In this context, planning proposals for permanent disaster housing were developed by considering the current land use, zoning plans, and cultural heritage elements that need to be preserved. The existing land analyses and zoning status clearly reveal the commercial and social focal points in the region. Adıyaman Street stands out as an area where traditional houses are concentrated, and the historical texture is felt; maintaining the conservation status of this street will contribute to preserving the historical identity of the region. Periodic settlement analyses are of great importance for

understanding the historical development and urbanization process of Yeşilyurt. It is observed that the initial settlements were located close to water sources and that urbanization accelerated in the 19th century. This process necessitates that new disaster housing respects the existing historical texture. The conservation areas map shows the areas where cultural and historical heritage is concentrated in the Yeşilyurt district. The registered buildings concentrated along Adıyaman Street should be preserved and maintained in urban transformation projects. Preserving these structures is important not only for the continuity of the urban fabric but also for strengthening social memory. During the design of permanent disaster housing, it should be ensured that these areas are preserved and that new buildings are in harmony with the existing texture. In the planning studies for permanent disaster housing, factors such as land use, preservation of cultural heritage, transportation and infrastructure integration, and sustainability should be considered. Planning should be done in a way that integrates with the commercial and social centers around Mollakasım and Adıyaman Streets.

The construction of houses compatible with the registered buildings and protected areas in the region will be possible by combining traditional architectural elements with modern building technologies. The integration of new housing projects with the existing transportation network and infrastructure of the region should be ensured, and solutions should be developed to regulate traffic on the main axes of Mollakasım and Adıyaman Streets. In addition, within the framework of sustainability principles, priority should be given to elements such as energy efficiency, green spaces, and water conservation. Yeşilyurt district is an important settlement area of Malatya with its historical and cultural values. In the post-earthquake reconstruction process, preserving these values and ensuring urban development suitable for the requirements of modern life will both sustain the historical identity of the region and enhance the quality of social life. In this context, permanent disaster housing should be designed to preserve the cultural heritage of the region while meeting contemporary urban needs. In conclusion, Mollakasım and Adıyaman Streets in the Yeşilyurt district of Malatya play an important role in terms of urban history and cultural continuity. Any urban interventions and housing projects to be carried out in this region should support the goal of creating a sustainable and resilient city by preserving the local identity and texture. Contributing to the specified analyses and proposals or expanding the scope of the study with additional data is of great importance for the future of regional planning. Examples of traditional houses located on Adıyaman Street in Yeşilyurt, Malatya, are presented in Figure 11, while the analyses related to the study area are provided in Figures 12 and 13a, b.



Figure 11. Traditional Malatya houses located on Adıyaman street (Author's Personal Archive , 2022)

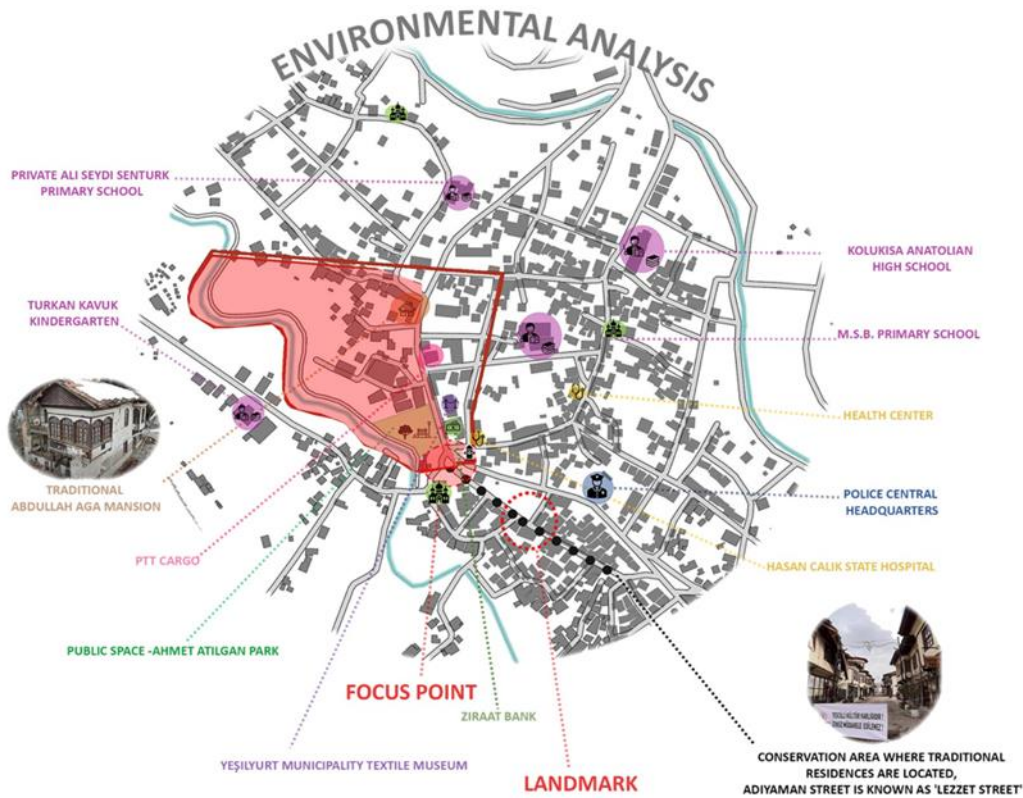


Figure 12. Study area and conducted analyses

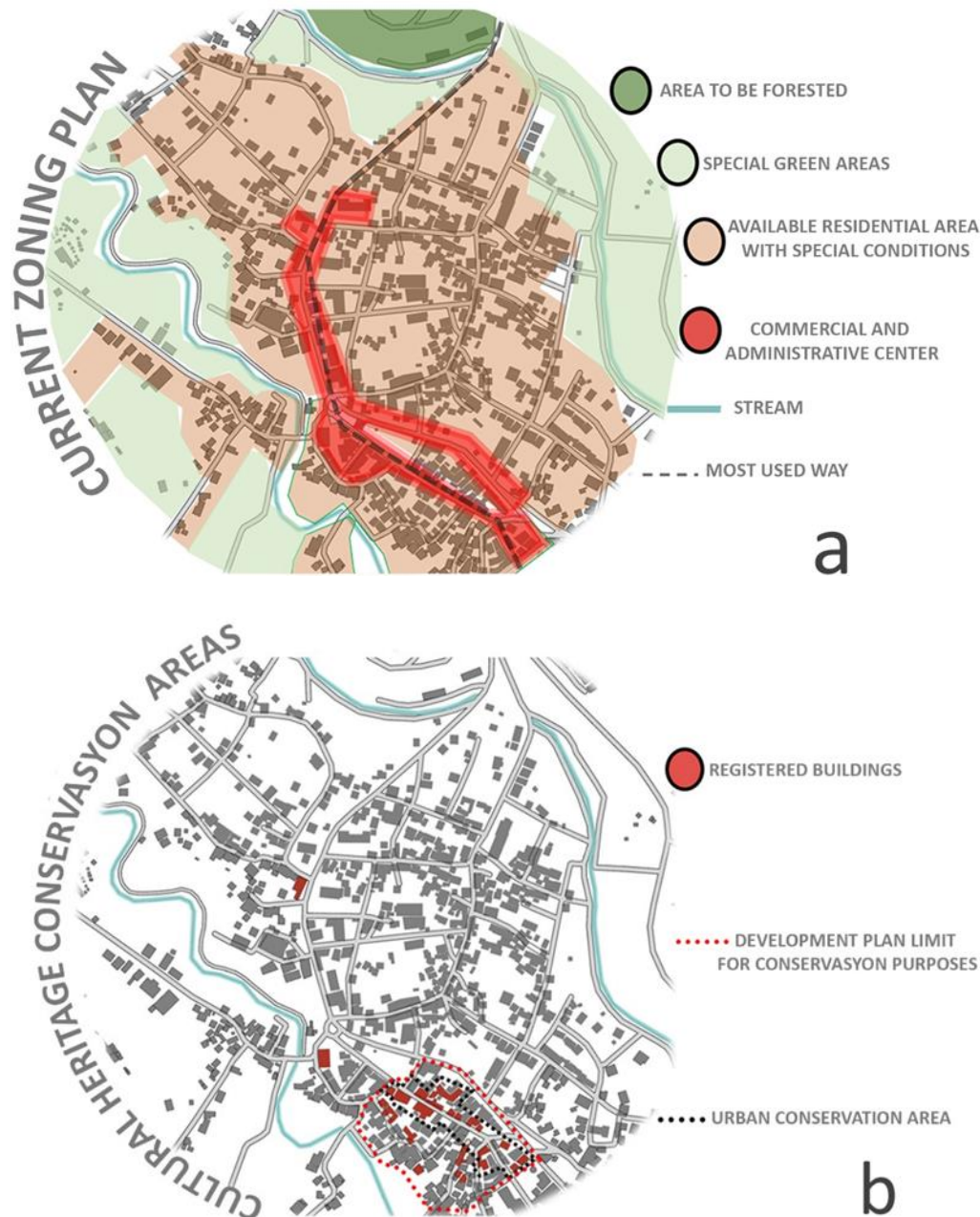


Figure 13 (a,b). Study area and conducted analyses

3.5 Delivering on user requirements

Adopting a design approach that addresses user needs in the production of post-disaster permanent housing in Malatya is of critical importance to ensuring the long-term functionality and sustainability of the housing. As highlighted in the literature, the design of permanent housing should consider users' livelihoods and working conditions (Oliver-Smith, 1991). In an area like Malatya, where agricultural activities are prominent, new settlement areas must be planned without damaging agricultural lands and in a way that enables users to continue their agricultural production. Additionally, preserving traditional lifestyles and addressing the unique needs of rural living play a critical role in facilitating users' adaptation to new housing (Enginöz, 2004; Enginöz & Ünlü, 2010).

The diagram presented in Figure 14 illustrates the connections between participants and various categories of needs, as well as the intensity of these connections, offering significant insights into post-disaster housing expectations. Overall, the Physical Needs and Economic Needs categories show

stronger connections compared to others. This highlights participants' focus on fundamental issues such as structural safety, housing costs, and energy efficiency after the disaster. The Physical Needs category reveals significant interest in housing size, room layout, structural safety, and earthquake resistance. The Economic Needs category emphasizes priorities like housing costs, payment conditions, and energy efficiency. Meanwhile, Psychological Needs underline the importance of security, privacy, and environmental psychological effects that support the well-being of individuals.

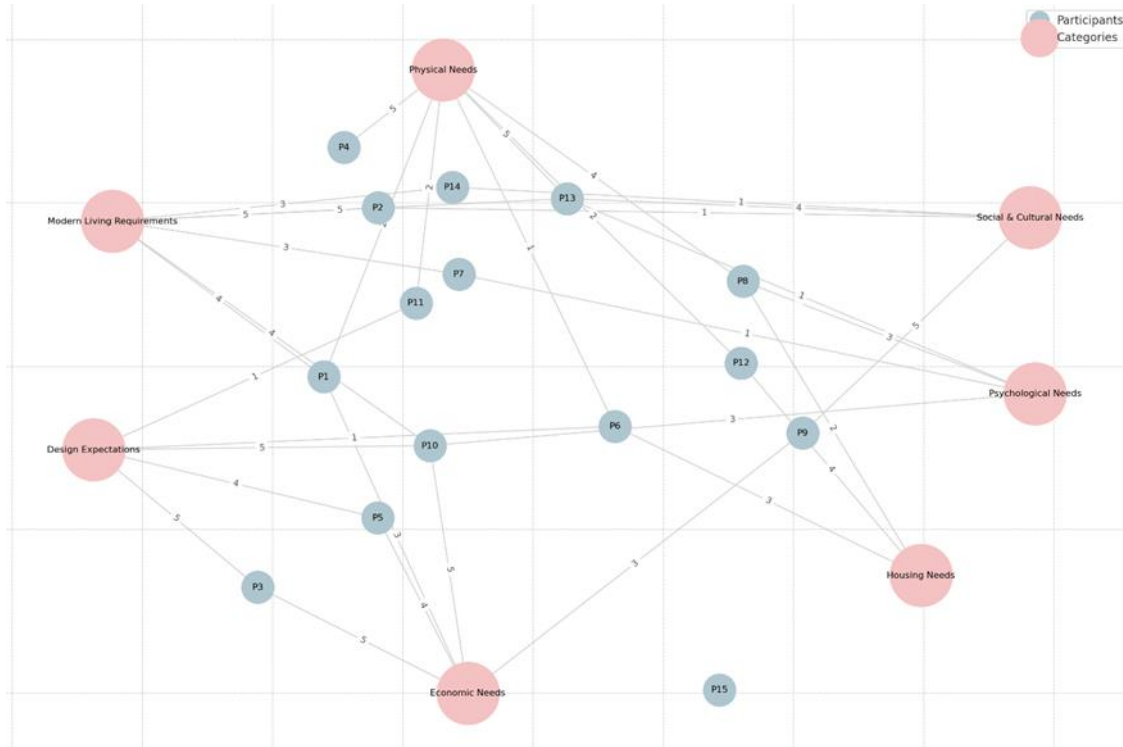


Figure 14. Participants-categories relationship diagram

Likewise, the Social and Cultural Needs category also emerges as a crucial area. Participants expressed expectations regarding the preservation of neighborhood culture, social harmony, and traditional architectural elements. Additionally, the large family structures prevalent in Malatya's rural areas should be taken into account. These structures, where extended families live together, underline the necessity for spatial flexibility and shared living spaces (İnal & Ünlü, 2009). Semi-structured interviews conducted with Malatya residents directly affected by the earthquake have revealed user needs, cultural values, and technical requirements, leading to the identification of the following key themes:

- Cultural continuity: Preservation of communal spaces that support social interaction and reflect Malatya's cultural identity.
- Sustainability: Use of local materials and implementation of energy-efficient design strategies.
- Flexibility: Plans that adapt to changing family structures and future needs.
- Community integration: Settlement clusters that promote community interaction while ensuring privacy and security.
- Resilience and safety: Construction of earthquake-resistant buildings that meet modern safety standards.

Based on these findings, a sustainable reconstruction model is proposed, integrating Malatya's architectural and cultural heritage with modern construction technologies and emphasizing user participation. The proposed model is structured around two distinct scenarios: Rural and traditional life preservation model and modern and sustainable urban model. The first scenario focuses on solutions suitable for rural areas, supporting extended family structures and agricultural production. In contrast, the second scenario targets denser population areas, emphasizing modern living needs and advanced technological infrastructure.

3.6 Housing design

In the design of permanent housing post-disaster, it is crucial to plan the houses in a way that aligns with the region's socio-cultural structure, economic conditions, and climatic characteristics to enhance user satisfaction and create sustainable living areas (Perera et al., 2012; Steinberg, 2007). The design scenarios developed specifically for Malatya are based on both preserving traditional architectural elements and meeting the requirements of modern life. In this context, houses that preserve and reflect the existing texture are designed for the inner parts of the Yeşilyurt neighbourhood, which still retains the characteristic features of Malatya houses. Meanwhile, for the neighbourhoods in Yeşilyurt district that house the city's dense population and are constantly changing and developing, an exemplary design has been developed for housing and its surroundings with more modern plan types, enriched with commercial and social amenities. In both scenarios, the flexibility of the housing design aims to respond to the changing needs of users and strengthen social belonging through the participation of disaster victims in the processes. Additionally, ensuring that the buildings are compatible with the region's identity in terms of safety, durability, and aesthetics has been determined as the primary design criterion.

Scenario 1: Design based on traditional architecture

The design developed for Scenario 1 in Malatya's Yeşilyurt region exemplifies the integration of local architectural heritage with contemporary post-earthquake reconstruction needs. The approach prioritizes not only physical housing requirements but also social sustainability by drawing upon the region's rich historical and cultural identity. Traditional materials such as adobe, stone, and wood are employed in alignment with modern standards to strike a balance between durability, aesthetics, and environmental friendliness. Adobe offers natural insulation for energy efficiency, stone contributes to structural stability when integrated with contemporary seismic-resistant systems and wood adds warmth and character to the structures. Floor plans reference traditional Malatya houses, adapted for modern use. While historical elements like the tandoor have been replaced by contemporary kitchens, the multifunctionality of spaces has been preserved (Figure 15-17). The ground floors accommodate communal areas such as living rooms and kitchens, while the upper floors are dedicated to bedrooms. The inclusion of the Cihannüma, a panoramic upper-level space, further merges aesthetic and practical design. A flexible planning approach supports the needs of extended families, incorporating modular layouts that allow spatial adaptation over time. For instance, living rooms can serve as guest quarters or workspaces. This design adaptability is particularly significant in the unpredictable context of post-disaster living. The project also integrates provisions for local economic activities, acknowledging Yeşilyurt's rural character. Gardens designed for small-scale agriculture and livestock contribute to the self-sufficiency and cultural continuity of the community. Structural resilience was a central concern, with traditional materials combined with contemporary techniques to meet seismic safety standards. Energy-efficient insulation, natural ventilation, solar panels, and rainwater harvesting systems were incorporated to promote environmental sustainability. A key strength of the project lies in its cultural and social sensitivity. The design

supports neighborhood cohesion through shared spaces such as courtyards and verandas, echoing traditional Malatya homes and encouraging community interaction— especially vital features in the recovery phase following a disaster. In conclusion, the housing model in Scenario 1 offers a compelling case of harmonizing tradition with modernity. It delivers resilient, adaptable, and culturally attuned housing that not only preserves local identity but also provides sustainable and secure living environments (Figure 17a, b). This model presents a scalable approach for post-disaster reconstruction in similarly contextualized regions.



Figure 15. Site plan for Scenario 1

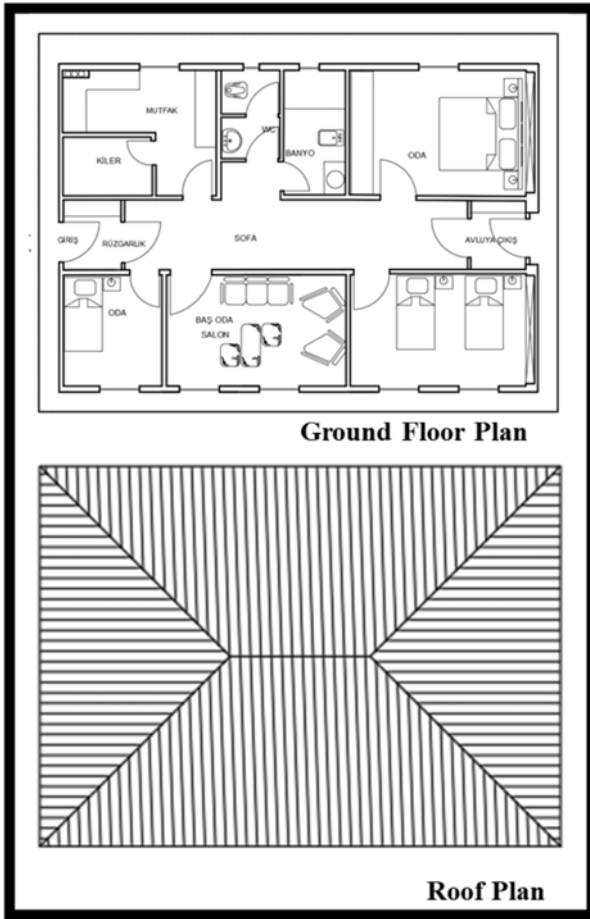


Figure 16. Single-story housing plan designed for Scenario 1

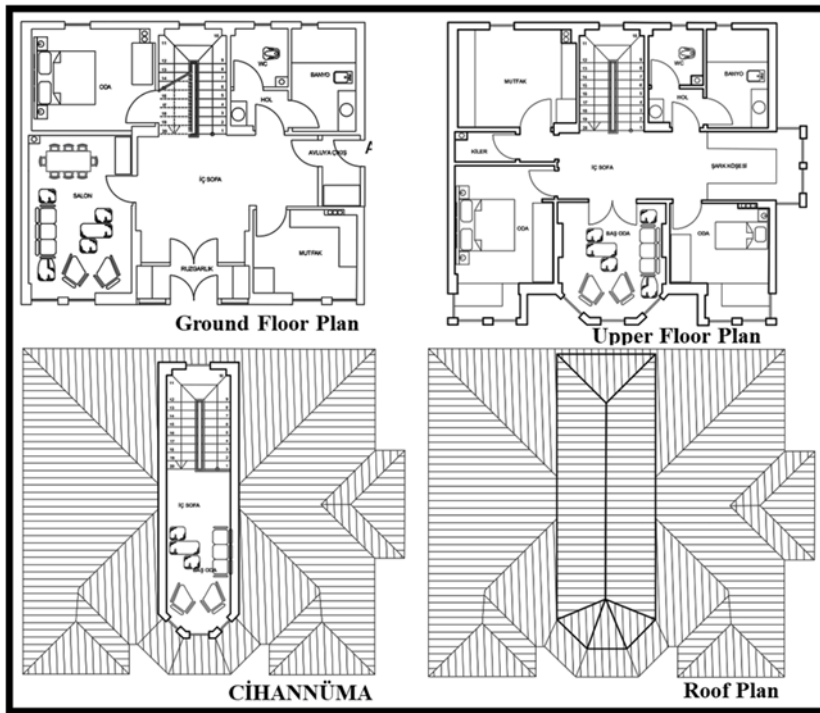


Figure 17. Two-story housing plan designed for Scenario 1



Figure 18. General view of Scenario 1

Scenario 2: Urban-scale design with modern plan types

The proposed design for Mollakasım Neighborhood in Malatya's Yeşilyurt district has been developed with an approach that aims to meet the needs of modern urban life while preserving local identity. The project is conceived as a multifaceted living center that includes residential settlements supported by commercial and social amenities. The fundamental principle of the design is to create a living space that combines sustainability and aesthetic understanding in high-density settlements, while strengthening social bonds. The general view of the project for Scenario 2 is presented in Figure 18, examples of different plan types produced are shown in Figure 19, and the urban-scale silhouette is provided in Figures 20,21.



Figure 19. General view of Scenario 2

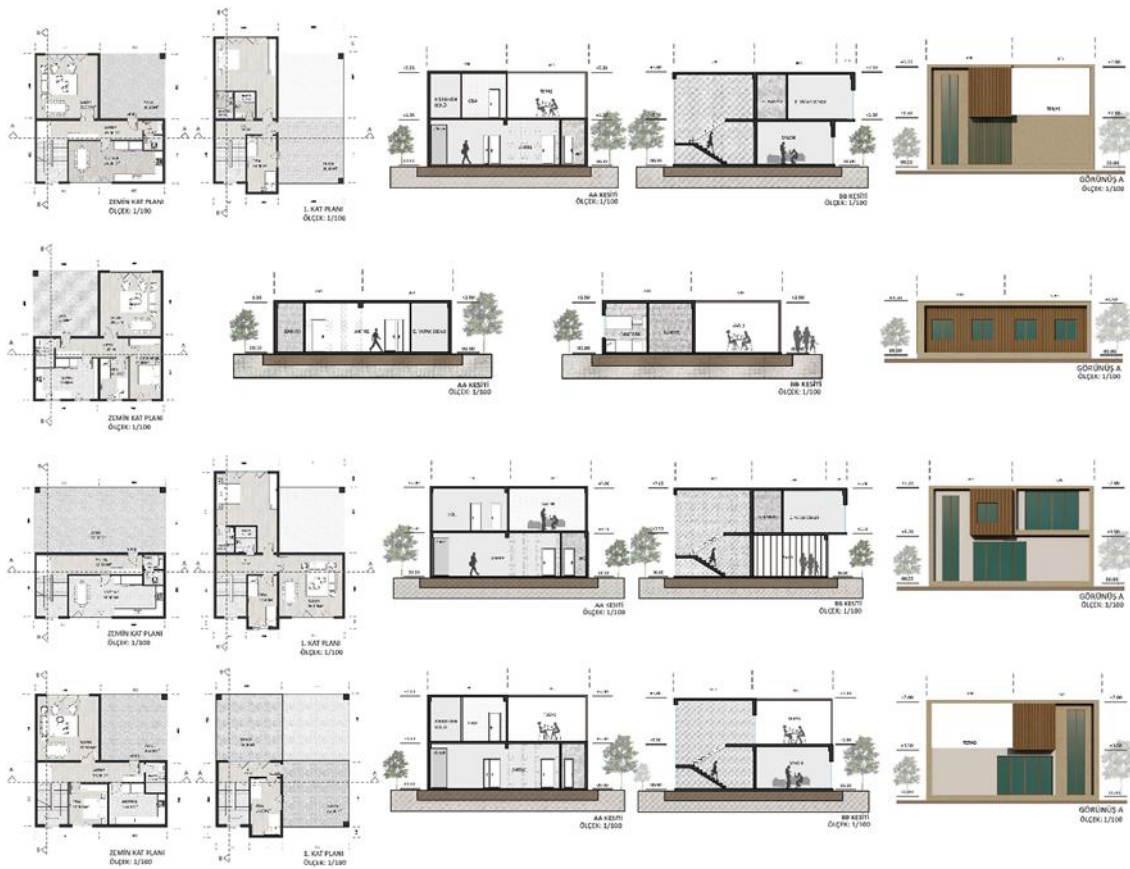


Figure 20. Housing typology plans designed for Scenario 2



Figure 21. Urban-scale silhouette for Scenario 2

The project's spatial organization is grounded in a development model that merges local architectural identity with contemporary design principles. Housing units utilize a reinforced concrete frame system to ensure structural safety, while façade treatments with natural stone and wood-like

cladding reference the region's traditional texture, offering aesthetic unity between modern and vernacular styles. The project adopts a detached settlement layout. Pedestrian pathways and wide streets, as seen in the visual materials, promote intra-neighborhood mobility and ensure access to public transport. As emphasized by Taş et al. (2007) and Taş & Taşkın (2024), such configurations enhance quality of life by encouraging walking and cycling within urban environments (Tas et al., 2007; Tas & Taşkın, 2024). Beyond residential needs, the design integrates social infrastructure such as playgrounds, sports areas, educational facilities, and healthcare units to foster social interaction and neighborhood cohesion. Strategically placed green and public spaces support daily interaction with nature, reinforcing community wellbeing. Sustainability is a core pillar of the project. Rooftop solar panels and the use of high-insulation materials contribute to energy efficiency by lowering heating and cooling demands. Rainwater harvesting systems provide environmental and economic advantages, promoting sustainable water use and conserving regional resources.

User participation in the design process is another critical strength. As noted by Perera et al. (2012), involving residents enhances their sense of ownership and long-term satisfaction. Flexible interior layouts allow adaptation to evolving household needs, supporting a dynamic and user-centered living environment. Social and cultural spaces are designed to promote modern interpretations of neighborhood relationships. The project thus supports communal life while aligning with contemporary urban dynamics.

In this respect, the design decisions in Scenario 2 were directly informed by the empirical themes identified through interviews and field observations. The participants' emphasis on safety and long-term security was translated into the use of a contemporary reinforced concrete frame system and infrastructure-supported urban planning. The need for social interaction and the continuity of neighborhood culture informed the inclusion of pedestrian routes, public green areas, playgrounds, and shared social facilities. Similarly, expectations regarding flexibility and changing household structures were reflected in adaptable apartment typologies, while economic and environmental concerns were addressed through durable construction systems, energy-efficient envelopes, rooftop solar panels, and rainwater harvesting. Cultural continuity was not pursued through the literal reproduction of traditional houses, but through the reinterpretation of local identity in façade materials, settlement character, and the relationship between housing units and shared open spaces.

In conclusion, the design offers a livable and sustainable urban model that harmonizes local identity with modern functionality through social amenities, environmental sensitivity, and participatory planning. To make the analytical link between the empirical findings and the proposed design outcomes more explicit, Table 4 maps the main themes derived from the interviews and field observations to the corresponding design criteria and spatial decisions in Scenario 1 and Scenario 2. Rather than providing only a comparison between the two scenarios, the table clarifies how user needs, socio-cultural values, economic considerations, and sustainability concerns were translated into concrete architectural and planning strategies.

Table 4. Mapping empirical findings to the proposed housing scenarios

Empirical finding/user need	Design criterion	Scenario 1: Traditional Oriented Model	Scenario 2: Modern Urban Model
Need for privacy and security	Creating a gradual transition between public, semi private and private spaces	Inward-oriented courtyard layout, controlled entrances, semi private gardens and verandas	Clear separation of public, communal and residential areas; controlled access to housing units
Continuity of neighborhood culture and social interaction	Supporting everyday encounters and community cohesion	Shared courtyards, gardens and semi private outdoor spaces supporting neighborly relations	Public green areas, playgrounds, pedestrian paths and social facilities supporting urban-scale interaction
Extended family structure and changing household needs	Providing flexible and adaptable spatial organization	Flexible housing layouts, multifunctional rooms and courtyard based domestic life	Standardized but adaptable apartment typologies for nuclear families and changing urban households
Cultural continuity and local architectural identity	Reinterpreting vernacular architectural references	Local materials such as stone, wood and Adobe based components, courtyard centered plan logic	Reinforced concrete structure with stone and wood-like façade treatments referencing local identity
Economic concerns and livelihood continuity	Reducing construction/maintenance burden and supporting local practices	Use of local materials and labor; gardens allowing small-scale agricultural production	Durable construction systems, energy efficient infrastructure and access to commercial/social amenities
Climate adaptation and environmental sustainability	Improving energy performance and environmental responsiveness	Passive climatic design, natural ventilation, shaded outdoor spaces and small scale renewable energy solutions	High-performance envelopes, rooftop solar panels, rainwater harvesting and planned green infrastructure
Earthquake safety and long term resilience	Combining user centered design with contemporary seismic safety	Traditional spatial references integrated with contemporary seismic-resistant systems	Reinforced concrete frame system and infrastructure supported urban planning

CONCLUSIONS

The conclusions presented in this section build on key findings related to privacy, social interaction, climate adaptation, and spatial flexibility identified throughout the study. This study developed two different scenarios for the design of permanent housing in the Yeşilyurt district of Malatya, which was affected by the earthquakes centred in Kahramanmaraş on February 6, 2023, offering solutions that meet the socio-cultural, economic, and environmental needs of the region. The main objective of the study was to create sustainable housing models that preserve local identity by combining the unique elements of traditional Malatya architecture with modern construction techniques and contemporary living requirements. The findings not only improved the quality of life for the local population but also provided significant insights that could guide similar post-disaster housing projects in Türkiye and worldwide. The housing designs developed in Yeşilyurt present a remarkable example of sensitivity to the region's traditional architecture and lifestyle. The rural housing design based on traditional architecture offers a model that supports social belonging through the use of local materials such as adobe and stone and flexible spatial organizations. This design ensures the sustainability of rural life by incorporating social and functional spaces that can meet the daily needs of users. Additionally, flexible floor plans with modular spatial arrangements suitable for extended family structures are designed to respond to the changing needs of users. The second design scenario

developed at the modern urban scale offers a housing model enriched with commercial and social amenities, suitable for the requirements of modern life. Access to public transportation networks, wide pedestrian paths, recreational areas, and educational centers are included in the design as important components that enhance the quality of life. In this design, flexibility is adopted not only in the modularity of the spaces within the houses but also in the planning decisions at the urban scale. Social and cultural spaces are designed at the neighborhood scale, with the aim of ensuring strong social belonging through pedestrian paths and common areas that encourage social interaction.

This study presents a significant model for permanent housing projects in earthquake-prone regions of Türkiye. The integration of traditional architecture with modern construction techniques emerges as a key factor for the success of post-disaster housing. This combination not only ensures aesthetic and cultural coherence but also helps meet the functional needs of local communities. In contrast to conventional post-disaster resettlement practices in Türkiye, which often prioritize physical reconstruction, this study emphasizes an approach centered on social, cultural, and psychological needs. The importance of user participation in the design process is also highlighted, as it fosters a sense of ownership and increases long-term satisfaction. The participatory design approach can serve as a valuable guide for similar projects across different regions. Incorporating local knowledge and experiences accelerates recovery and promotes social cohesion. Flexible spatial configurations allow adaptation to evolving conditions, reducing post-disaster dissatisfaction and potential migration. The study offers key insights for global post-disaster housing strategies. As emphasized in the literature (Hayles, 2010; Oliver-Smith, 1991), success in such projects is strongly tied to sensitivity toward local architectural and cultural contexts. The housing designs in the Malatya case provide a replicable model for preserving local values while enhancing user satisfaction. Accordingly, post-disaster housing should move beyond basic shelter to address broader dimensions of social, economic, and cultural sustainability. A balanced use of traditional and modern design not only improves user satisfaction but also bolsters community resilience. This globally relevant model shows that integrating local architectural identity with contemporary principles significantly contributes to the success of reconstruction projects. The findings offer practical guidance for future applications in other earthquake-prone areas of Türkiye. Further studies may explore the model's adaptability across various climates, cultures, and economic conditions. Moreover, as part of pre-disaster planning, housing types that reflect user needs and are tailored to local climate, geology, and social dynamics should be developed.

Limitations of the Study:

This research was conducted exclusively in the Yeşilyurt district of Malatya, and the context-specific nature of the findings limits their generalizability. The relatively small number of participants and the predominantly qualitative methodology constrain the representativeness of the results. Moreover, the proposed design scenarios have not been implemented, and therefore, no user-based evaluations could be conducted. The study primarily relied on thematic analysis rather than statistical methods, which restricts the ability to test the findings against objective metrics. In light of these limitations, future research should explore the applicability and sustainability of the proposed model through comparative studies conducted in diverse geographical and cultural contexts.

Future Research:

This study highlights the potential of culturally sensitive and user-centered design models in post-disaster housing; however, several avenues remain open for further investigation. First, future research should empirically test the effectiveness of the proposed design scenarios through pilot implementations and post-occupancy evaluations to measure user satisfaction, socio-spatial integration, and long-term adaptability. Second, quantitative analyses involving larger sample sizes

across different regions are necessary to enhance the external validity of the findings. Comparative studies in other disaster-affected areas with distinct socio-cultural and climatic conditions could offer valuable insights into the model's scalability and transferability. Additionally, future research may explore the integration of digital design tools and participatory technologies—such as virtual reality simulations or digital twin environments—to support collaborative decision-making in post-disaster reconstruction. Longitudinal studies tracking the evolution of community well-being and housing performance over time would also contribute to the refinement of sustainable and resilient reconstruction frameworks.

Compliance with Ethical Standards

1. Conflict of Interest

The author(s) declare that there is no conflict of interest with themselves or with any potential third parties before or after the publication of this study.

2. Ethics Committee Approval

This study was approved by the Bingöl University Science and Engineering Sciences Scientific Research and Publication Ethics Board with the decision letter reference number E.88378. Verbal informed consent was obtained from all subjects before the study.

3. Generative Artificial Intelligence (GAI) Usage Statement

Artificial intelligence has not been used in any phase of the article.

4. Financial Support

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