...::KENT AKADEMİSİ | URBAN ACADEMY

Volume: 16 Issue: 1 - 2023 | Cilt: 16 Sayı 1 - 2023

ARTICLE INFO | MAKALE KÜNYESİ
Research Article | Araştırma Makalesi
Submission Date | Gönderilme Tarihi: 11.08.2022
Admission Date | Kabul Tarihi: 24.02.2023

CITATION INFO | ATIF KÜNYESİ
Şatıroğlu, E. (2023). Urban Furniture in The Context of Sustainable Materials, *Kent Akademisi Dergisi*, *16*(1):566-576. https://doi.org/10.35674/kent.1160705

Urban Furniture in the Context of Sustainable Materials

Sürdürülebilir Malzemeler Bağlamında Kent Mobilyaları

Elif Şatıroğlu[1], Deryanur Dinçer[2], Bengi Korgavuş[3]

ABSTRACT

While the efforts to ensure the ecological balance for a sustainable and livable future have gained momentum in recent years, sustainable materials have become more needed in this context. Sustainable materials can be summarized as materials that consume less energy and do not harm the environment, nature, and human health, from the process of obtaining their raw materials to the processing stages, their use, maintenance, and repair, and the environmental conditions they are in during waste generation. In addition, they are local materials that respond to the culture they are in, are open to change, recyclable, non-toxic, and non-poisonous. Sustainable urban furniture can contribute to the future by minimizing environmental problems. Within the scope of this study, urban furniture such as seating elements, trash bins, lighting elements, pavement materials, playgrounds, and pergolas in the newly built or revised green areas in the center of Rize in the last five years, in the context of sustainable materials; Durability / Easy maintenance, Performance, Functionality, Space Relation, Economy, Recyclability, Aesthetics, and Ecological Materials were examined by considering criteria. By evaluating the results, evaluations were made on the materials used in urban furniture to create ecological and sustainable environments.

Keywords: Sustainable Design, Sustainable Materials, Urban Furniture

ÖZ

Sürdürülebilir ve yaşanabilir bir gelecek için ekolojik dengeyi sağlamaya yönelik çalışmalar son yıllarda çok fazla hız kazanırken bu bağlamda sürdürülebilir malzemelere daha çok ihtiyaç duyulmaya başlanmıştır. Sürdürülebilir malzemeler; kullanıldıkları süre boyunca, az enerji tüketen, hammaddelerinin elde edilmesi sürecinden, işlenme aşamalarına, kullanımlarından, bakım-onarımlarının yapılmasına ve atık oluşumları sırasında bulundukları çevre koşullarına, doğaya ve insan sağlığına zarar vermeyen, içinde bulunduğu kültüre yanıt veren, değişime açık, geri dönüştürülebilen, toksin ve zehirli olmayan yerel malzemeler olarak özetlenebilir. Sürdürülebilir kent mobilyaları, çevresel olumsuzlukları en aza indirip, geleceğe önemli katkılar sağlayabilir. Bu bağlamda çalışma kapsamında, Rize merkez çalışma alanı içerisinde son 5 yılda yeni yapılan veya yeniden revize edilen yeşil alanlar içerisinde ortak olarak bulunan; oturma elamanları, çöp kutuları, aydınlatma elemanları, zemin kaplamaları, çocuk oyun elemanları ve kamelyalar üzerinden 'sürdürülebilir malzeme' bağlamında; Sağlamlık/ Kolay bakım, Performans, İşlevsellik, Mekân İlişkisi, Ekonomiklik, Geri dönüştürüle bilirlik, Estetik ve Ekolojik malzeme kriterleri ele alınarak incelenmiştir. Sonuçlar değerlendirilerek ekolojik ve sürdürülebilir çevreler yaratmak için kent mobilyalarında kullanılan malzemeler üzerinden değerlendirmeler yapılmıştır.

Anahtar Kelimeler: Sürdürülebilir Tasarım, Sürdürülebilir Malzeme, Kent Mobilyaları

[1] **Corresponding Author:** Recep Tayyip Erdoğan University, Landscape Architecture Department, elif.satiroglu@erdogan.edu.tr, 0000-0002-3891-3927

[2] Recep Tayyip Erdoğan University, Landscape Architecture Department, deryanur.dincer@erdogan.edu.tr, 0000-0002-1737-3124

[3] Yeditepe University, Urban Design and Landscape Architecture Department, bdemirkan@yeditepe.edu.tr, 0000-0002-2257-2902

INTRODUCTION

The world is on the brink of environmental disasters due to our past, present, and potential future actions. Examples such as the dramatic increase in population, uncontrollable consumption rates, and unplanned production decisions threaten to the environment. To raise awareness and to collect the general structure inside a domain, "sustainability" term has been discussed for decades (Temiz & Sağlık, 2021). This popular term decreases the negative impacts and creates a more maintainable production cycle and usage. Sustainability has been defined by many fields, and therefore its definition has undergone various changes over time. This term is multidimensional and includes social, cultural, and ecological factors. Alternative terms of sustainability include preservation, continuity, routinization, and resilience (Moore et al., 2017). It also covers the effort of transmitting the environment to future generations with conservation principles (Şatır, 2015).

Nowadays, most of the world's population lives in cities, and as a minor construction material, urban furniture has a critical role in assessing the cities' sustainable design measurements. A sustainable system must exist in entire landscape planning and design stages, such as plan decisions, material selection design, product development, and technology, to create a cozy environment for the next generations (Badeiy et al., 2015; Bolkaner et al., 2019).

1. SUSTAINABLE DESIGN

The sustainable design demonstrates that the product is environmentally, socially, and economically maintainable at different scales. McDonough (1992) defines sustainable design as "*the conception and realization of environmentally sensitive and responsible expression as a part of the evolving matrix of nature.*" Namely, the goal of sustainable designs is to be self-sufficient in the long term through contextual data such as climate, infrastructure, natural resources, technology, and local materials during the vernacular design process. In this stage, the vernacular design notion is critical to addressing sustainable material selection (Hergül, 2021).

1.1. Sustainable Materials

The importance of sustainable materials is demonstrated in many studies. Suitable material usage ensures the creation of designs that can be used for many years. The aim is to eliminate the short-lived and useless products that harm the environment and to create eco-friendly, long-lasting designs that meet the needs.

1.1.1. Wood and Stone

Wooden materials have been preferred by designers because of their many advantages, such as being environmentally friendly, flexible to design, and easy to implement. For suitable usage, wooden materials do not threaten the environment (Sayar et al., 2009). Therefore, wooden materials are included in recyclable and sustainable construction materials. Besides them, stone is one of the most ancient construction materials. These materials have appropriate features, such as being durable and recyclable and can be included in the sustainable materials category (Aydın & Lakot-Alemdağ, 2014).

1.1.2. Steel Material

Steel products are essentially reusable or recyclable. Even its scrap is economically valued (Aydın İpekçi et al., 2017; Sev, 2009). In the recycling of steel, it is stated that 74% of energy and 90% of raw materials are protected, water consumption is reduced by 40%, and mine wastes are reduced by 97% (Aydın İpekci et al., 2017). Various advanced and sustainable coating materials can be used for steel. When used in accordance with the recommended maintenance schedule, these coatings provide long-term

protection that reduces the environmental impact of steel. Rusting on the steel surface occurs when the humidity is above 60%. Metals should be kept away from oxide acid caused by corrosion. Coating copper on zinc reduces the damage caused by corrosion. Steel can be recycled indefinitely and without loss; steel quality can be improved during this process (Eren & Başarır, 2013).

1.1.3. *Plastic Material*

Plastic materials are fossil fuel and bio-based organic materials. Plastic materials are derived from fossil raw materials such as oil, natural gas, and coal. Plastics have a very high usage area because they can be produced as durable, insulating, light, highly malleable, flexible, or rigid. Plastics can be molded and shaped in the desired form. Plastics are resistant to external influences and atmospheric effects. Some types are resistant to chemical interventions, do not disappear in nature, do not have electrical conductivity, have low thermal conductivity, are light, do not absorb moisture, and can be colored. Their colors can be changed at high temperatures, their thermal expansion rate is high, and they are partially combustible (Demirarslan, 2009). The costs of recycling methods of plastic materials are high. However, it is advantageous in terms of the sustainability of natural resources. There are methods applied in the recycling of plastic waste materials. First, plastic waste is collected at its source and separated by category (Sert, 2018).

1.2. Sustainability in the Scope of Urban Furniture

There are some criteria determined for urban furniture. Today, functional and sustainable features such as aesthetics, form, material, color, texture, perceptibility have been added to the criteria that urban furniture should have. (Karslı & Öztürk, 2019).

For a furniture to be sustainable, it must have features such as ecological material, durability, easy repair, performance, functionality, space-related, economical and recyclable material. (Kılıç & Sungurlu 2021). Sustainable urban furniture design indicators include energy and material use, natural environment, economy, applicability, social justice, development of society and employees, health, and product life cycle (Şatır, 2015).

1.2.1. ***Robustness/Easy maintenance:*** Urban furniture must resist natural conditions and accidents. The climatic conditions of the areas where they will be placed should be well known, and conscious materials should be chosen accordingly. They should be durable against small-scale accidents in the city and not easily damaged (Karslı & Öztürk, 2019).

1.2.2. ***Performance:*** Urban furniture in the urban space must work continuously and fulfill its functions correctly. The performances of the staff are directly related to the place they are in, and the functions expected from them (Yaylalı, 1998). The products designed with the least raw materials and get the highest efficiency are sustainable. From a design point of view, it is envisaged that the objects should be easy to be manufactured with a minimum number of parts and materials and that measures such as high efficiency should be spread (Şatır, 2015). One of the most important design measures that can be taken to ensure the sustainability of urban furniture is that the furniture can be easily disassembled and reassembled. The furniture's weakest and most problematic parts in terms of strength should be determined and designed to easily replace them with new ones (Kılıç & Sungurlu 2021).

1.2.3. ***Space Relationship:*** Urban furniture, at the design stage, of the places where they will be located, their characters, identities, and users, should be carefully studied and integrated with the place where they will be placed. During the design phase, layouts should also be considered.

1.2.4. ***Economy:*** Sustainable urban furniture is economical, readily available, easy to maintain, and long-lasting. Locally qualified materials positively affect lower energy costs and reduce air pollution depending on their transportation. The environmental characteristics of local materials, their economic benefits, and their supporting social development are important in terms of having positive effects on all these components that make up sustainability. It contributes to transportation and the economy in terms of ease of access to the construction site and sustainable development in terms of the environment, with the reduction of carbon emissions because of saving from toxic gases emitted during transportation (Güner et al., 2017).

1.2.5. ***Recyclability***: Environmental pollution concepts and recycling of solid wastes are important for a sustainable environment. Disposal of these domestic solid wastes leads to soil, ground, and water pollution. Since these wastes are stored in the fillings, they cause space loss (Bulhaz, 2020). These practices, which form the basis of sustainable development and cover issues such as energy and natural resource conservation and reducing waste, form the agenda of contemporary architecture. (İpekçi et al., 2017). Processing, packaging, and transporting of a building material or building a product from the extraction of its raw material; the process from use, maintenance, and repair to disposal and recycling (Çelebi & Aydın, 2001). As a result of renovation, repair, and demolition activities. The recovery potential of building materials/components such as concrete, metal, steel, wood, ceramics, plastic, and glass, which are produced because of building material production, construction, renovation, repair, and demolition activities of buildings, is relatively high. Recycling also preserves the total amount of energy that materials and products have from initial production. The amount of energy required for recycling can often be much less than that spent for initial production. For example, 10-20% of the initial production is used to recycle aluminum. Plastics, glass, and metals can be reshaped by applying heat (Sev, 2009).

1.2.6. ***Aesthetics:*** An individual, who feels art in all the textures of the place he/she lives in, becomes more easily able to perceive his own identity and the identity of the place to which he/she belongs (Doğan, 2017). The aesthetic phenomenon that draws attention perceptually will also contribute to users' adoption of urban furniture and, thus, its protection.

1.2.7. ***Ecological Material:*** It is based on the principle that the materials used are not made with industrial construction materials containing toxic substances but with healthy materials suitable for human nature. Natural materials with no or minimal synthetic additives; are entirely recyclable, such as natural stone, wood or wood fiber, clay, straw, wicker, linen, and thatch. Some of the listed features of design products, such as being recyclable, containing less harmful materials to nature, and being able to produce with less energy, means that they are ecological. Being ecological has become a prerequisite for designing products.

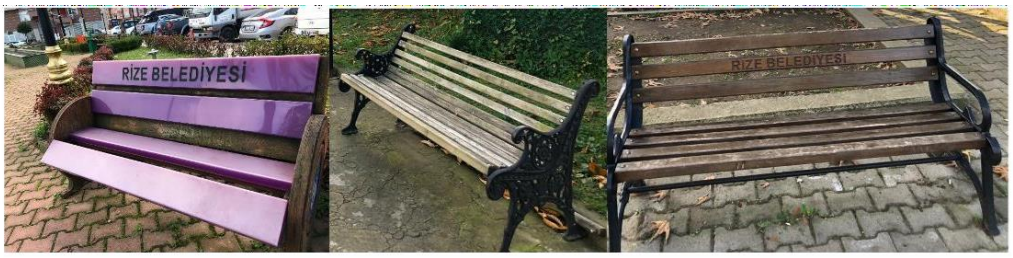
2. Material and Method

The study area consists of 17 urban green areas built or revised in the last five years, among the list of all green areas in the city center obtained from the final report of the project named "Inventory of Plant Species in the Parks and Gardens of Rize Province" by Rize Municipality and RTUE BAP Unit (Project No: FBA-2017-824) (Çorbacı et al., 2020). In the study area, five types of urban furniture, including seating elements, trash bins, lighting elements, pavement materials, playgrounds, and pergolas, were discussed in the green areas. Urban furniture has been examined in the context of 'sustainable materials', taking into account their durability and easy maintenance, efficiency features, functions they undertake, their relations with spaces, whether they are economical or not, their recyclability, aesthetic properties and criteria of being produced with ecological materials. Within the scope of the study, landscape research methods related to data collection, analysis and synthesis were used. The areas determined within the scope of the study were visited, the urban furniture was photographed, and then an identity card was created for each piece of furniture, and evaluations were made in line with the determined criteria.

The aim of this study, carried out in the case of the city of Rize, is to determine whether the urban furniture in the green areas organized in the city center in recent years is efficient in terms of sustainable material selection and to provide future suggestions.

3. FINDINGS

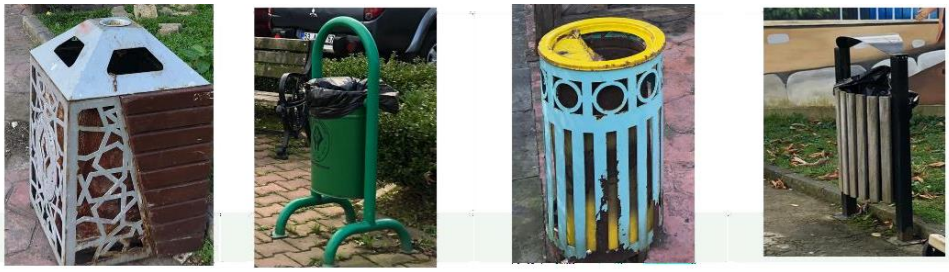
3.1. Seating Elements



STRENGTH/ Easy maintenance	The materials of the seating elements, which are used every day and exposed to external factors, are not selected according to climatic conditions..
Functionality	They are functionally and purposefully designed.
Space Relation	Seating elements positioned in the parking areas do not interfere with the flow of the road, their effects on the spaces are weak, and do not provide integrity with the space.
Affordability	The use of standard products, which are not unique and do not reflect the urban identity, have produced an economic result.
Recyclability	The wood material used can be recycled, although energy is not saved and the risk of pollution is not reduced by reusing an existing product.
Aesthetic	Seating elements of the same materials and standards were observed throughout the parks studied. There is no aesthetic understanding that provides meaning and integrity to the city and comes to the fore in the legibility and imagination of the city.
Ecological Material	Widespread use of wood has been observed as an energy-efficient material that causes the least damage to the environment and provides maximum performance.

Figure 1. Study showing the comparative features of seating units.

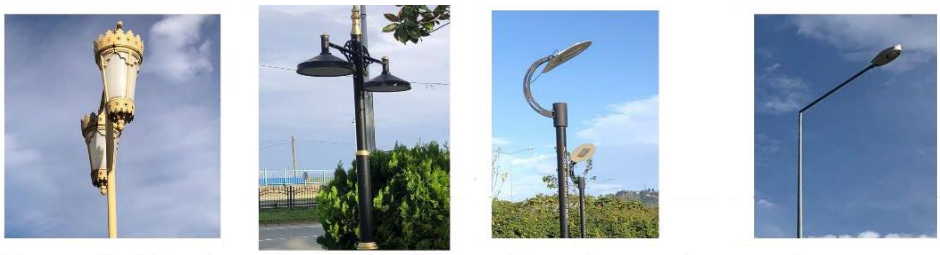
3.2. Trash Bins



STRENGTH/ Easy maintenance	It has been observed that the iron material used in general is rusted and not repaired..
Functionality	It has lost its function in most areas because it has not been maintained and repaired.
Space Relation	It has been determined that there are not enough litter boxes in the areas. No garbage bins compatible with the identity of the spaces were observed.
Affordability	The supply of standard products has made the cost cheaper.
Recyclability	In general, the metal material used in the reinforcement can be used for many years when it is not found in a corrosive environment and can be recycled at high rates. But the climatic conditions of the city are the opposite of this situation.
Aesthetic	There is no aesthetic situation that provides meaning and integrity to the city and contributes to the legibility and imagination of the city.
Ecological Material	Materials that are resistant to moisture, whose maintenance does not harm life and contribute to the improvement of air quality are not used.

Figure 2. Study showing comparative characteristics of trash cans.

3.3. Lighting Elements



STRENGTH/ Easy maintenance	Measures should be taken to increase the efficiency of the equipment and to ensure the replaceability of the deteriorated parts, and accordingly assembly and disassembly should be facilitated.
Functionality	They are functionally and purposefully designed.
Space Relation	Spacings within the areas are generally suitable. They are not considered as a whole with the areas in which they are placed. They lack a unique identity of domains.
Affordability	The supply of standard products has made the cost cheaper.
Recyclability	When the metal material used is not in a corrosive environment, it can be used for many years and can be recycled at high rates.
Aesthetic	The lighting elements in the areas are not in harmony with the other equipment. No original designs have been observed that are aesthetically compatible with the urban identity.
Ecological Material	Metals are a non-renewable resource and are used in production processes. ecologically, as they lead to high energy consumption. has negative features.

Figure 3. Table showing the comparative characteristics of lighting elements.

3.4. Pavement Materials

					
STRENGTH/ maintenance	Easy	The flooring materials chosen without considering the climatic conditions of the city have undergone deformation over time. It has been observed that there are problems in maintenance and repairs.			
Functionality		In some places, due to the fact that the sub-floor is not sufficiently strong, the collapse of the floors over time and ponding after the rain due to the lack of suitable drainage solutions are encountered.			
Space Relation		The integrity of the flooring is deteriorated, and as a result, they remain as unusable and broken-looking spaces within the pedestrian zone.			
Affordability		The supply of standard products has made the cost cheaper.			
Recyclability		Surfaces covered with natural stone are much more durable and economical than other alternative materials.			
Aesthetic		Materials and colors that do not reflect the identity of the areas and do not form integrity with the equipment are used.			
Ecological Material		The stone floor coverings used in the areas have the characteristics of ecological materials.			

Figure 4. Table showing the comparative characteristics of pavement materials.

3.5. Pergolas

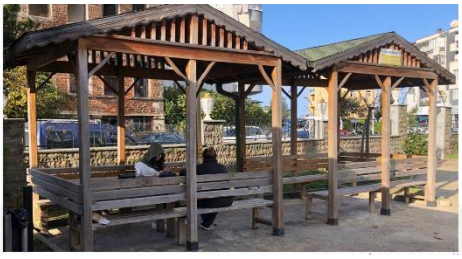
			
STRENGTH/ maintenance	Easy	It has been observed that the wooden material chosen without considering the climatic conditions of the city has undergone deformation over time. In addition, it has been observed that there are problems in maintenance and repairs.	
Functionality		They are functionally and purposefully designed.	
Space Relation		It has been observed that, in addition to their location in the space, their compatibility with the landscape lines and the ground on which they are placed do not have the qualities that can support the function.	
Affordability		The supply of standard products has made the cost cheaper.	
Recyclability		By processing in wood waste recycling facilities and providing material recycling, resources are protected by using them in the production of wooden goods again.	
Aesthetic		The reinforcement, which can be a plastic element even when not in use, has been placed in the same type in all selected areas.	
Ecological Material		Wood is a sustainable and ecological material when used consciously.	

Figure 5. Table showing the comparative characteristics of pergolas.

3.6. Playgrounds

STRENGTH/ Easy maintenance	Equipment is relatively safe, meets current standards, and is maintained. All equipment is fixed to the surface.
Functionality	Playground equipment is available in interesting, different colors, designs and Conventional equipment is functional, although they are expected to be usable for different purposes.
Space Relation	Integrated areas with natural reinforcements (such as grass, water, sand, trees) have not been created.
Affordability	The supply of standard products has made the cost cheaper.
Recyclability	Plastic material used throughout the areas
Aesthetic	Play equipment that is not separated according to different age groups did not support the physical and mental development of children with creative games, and standard installations created ordinary playgrounds.
Ecological Material	The plastic material used in the equipment harms the environment during the production and usage process..

Figure 6. Table showing the comparative characteristics of playgrounds.

4. DISCUSSION

Commonly located in the green areas newly built or revised in the last five years within the Rize central working area when urban furniture is examined in the context of 'sustainable materials' over seating elements, trash bins, lighting elements, pavement materials, playgrounds, and pergolas. Since the maintenance and repairs of the reinforcement materials selected for the region that receives heavy rainfall are not carried out regularly, the resulting image has become far from aesthetics and functionality. It was observed that the climatic conditions of the city were not considered. The accessories are not associated with the places where they are used. All the observed urban furniture common in the study area is used in similar materials, forms, and forms. Accessories are economical because they are standard production catalog models, not a unique production design, which is not associated with the city's identity. Equipment that does not form integrity with each other in terms of aesthetics is placed in the designated areas. Today, the ecological feature of the equipment has become a prerequisite for designing products. Materials that are recyclable, contain less harmful materials to nature, can produce with less energy, and improve air quality are the primary reasons for preference. In material selection, materials that are recyclable, do not contain harmful materials, can produce with less energy, and improve air quality should be the primary reason for preference. It has been observed that these properties are not considered in the material selection of the rebars examined in the study area. Materials that are resistant to moisture and contribute to improving air quality are not selected. The reason for choosing urban furniture, which is in open green spaces, which has been organized recently; While it is expected that environmentally friendly approaches will be adopted with current technologies, within the framework of the new age's perception of sustainability, the result obtained from the study data has shown the opposite of the situation.

5. CONCLUSION

It is of great importance that urban furniture, which can be considered as the smallest component of the environment we live in, is designed by evaluating it within the scope of sustainable design criteria. For urban furniture to be sustainable, it should be made from natural, recycled, or recyclable materials obtained from local sources. The production techniques of urban furniture should be such that they do not destroy the delicate balance we have established with nature Material properties of urban furniture; It should have designs suitable for the socio-cultural structure of the city users by producing recyclable energy, which keeps energy consumption at a minimum level in the ecosystem, and by making production from natural waste materials. In the century we live in when we are faced with environmental problems, it will contribute to our future by designing products that are sensitive to the environment, keep sustainable approaches in the foreground and meet the needs. The widespread use of recycled building materials will contribute positively to resource conservation and alleviate the environmental and economic burden of waste and sustainability.

Suggestions for the establishment of a sustainable urban environment can be listed as the creation of standards that will inform and guide designers on sustainable design, as well as government agencies and especially local administrations to include sustainable urban furniture that will strengthen the urban identity, raise awareness, and motivate citizens about sustainability, and create legal procedures. Production of urban furniture resistant to environmental and vandalism conditions, with easy maintenance and repair processes, and extends its useful life thanks to materials and construction techniques and presents the furniture as an aesthetic value to its users while providing all these can be listed as other suggestions for the creation of a successful sustainable urban environment.

Compliance with Ethical Standard

Conflict of Interests: The authors declare that for this article they have no actual, potential, or perceived conflict of interests.

Ethics Committee Approval: Ethics committee approval is not required for this study.

Funding Disclosure: No financial support was required in this study.

REFERENCES

Aydın, Ö., Lakot Alemdağ, E. (2014). Karadeniz Geleneksel Mimarisinde Sürdürülebilir Malzemeler; Ahşap ve Taş, Journal of International Social Research, Cilt: 7 Sayı: 35 Volume: 7 Issue: 35.

Aydın İpekçi, C., Coşgun, N. & Tıkansak Karadayı, T. (2017). İnşaat Sektöründe Geri Kazanılmış Malzeme Kullanımının Sürdürülebilirlik Açısından Önemi. TÜBAV Bilim Dergisi, 10 (2), 43-50.

Badeıy, L. , Nakhaeı, M. , Babaoghly, F. & Abharı, N. (2015). Some approaches in design of urban furniture with emphasis on green space use and sustainable urban landscape . Cumhuriyet Üniversitesi Fen Edebiyat Fakültesi Fen Bilimleri Dergisi , 36 (3) , 3782-3790 . Retrieved from https://dergipark.org.tr/tr/pub/cumuscij/issue/45132/564722

Bolkaner, M. K., İnançoğlu, S., & Asilsoy, B. (2019). A Study on Urban Furniture: Nicosia Old City. European Journal of Sustainable Development, 8(2), 1. https://doi.org/10.14207/ejsd.2019.v8n2p1

Bulhaz, D. Ö. (2020). Sürdürülebilirlik Kavramının İç Mimarlık Açısından Değerlendirmesi. Online Journal of Art and Design, Volume 8, Issue 3, 272-285.

Çelebi, G., Aydin, B. (2001). "Sürdürülebilir Mimarlık Yaklaşımında Yapı Malzemelerinin İrdelenmesi", IV. Ulusal Ekoloji ve Çevre Kongresi, Bildiriler Kitabı, ss. 457–464.

Çorbacı, Ö. L., Abay, G., Oğuztürk, T., & Üçok, M., (2020). Kentsel Rekreasyonel Alanlardaki Bitki Varlığı; Rize Örneği Plant Existence in Urban Recreational Areas; Rize Example. Düzce Üniversitesi Orman Fakültesi Ormancılık Dergisi (DÜOD) , vol.16, no.2, 16-44.

Demirarslan, S. (2009). Plastik Malzemenin Özellikleri ve İnşaat Sektöründeki Kullanım Yerleri. *KOÜ–Kocaeli Meslek Yüksek Okulu Ders Notu*.

Doğan, C. (2015). Çağdaş Kent Mobilyası Üzerine Bir İnceleme Örnekler ve Değerlendirmeler. Mimarist Mimarlık Kültür Dergisi, (54), 17-21.

Eren, Ö. & Başarır, B. (2013). Çelik Strüktürlerin Yaşam Döngüsü İçinde Sürdürülebilirliğinin Değerlendirilmesi. Engineering Sciences, 8 (2), 120-135.

Güner, C., Gökşen, F. & Koçhan, A. (2017). Sürdürülebilir Kalkınma Modeli için Çevre Duyarlı Yapılarda Malzeme Seçiminin İncelenmesi. Akademia Disiplinlerarası Bilimsel Araştırmalar Dergisi, 3 (2), 1-14.

Hergül, Ö. C. (2021). Sürdürülebilir Kampüs için Kent Mobilyası Tasarımı: Bir Stüdyo Deneyimi. Avrupa Bilim ve Teknoloji Dergisi, Ejosat 2021 Ocak, 374-380. https://doi.org/10.31590/ejosat.841443

Karslı, U., Öztürk, Ö. (2019). Sürdürülebilir Çevrede Kent Mobilyaları. Mimarlık Tasarım Kültür Sanat Dergisi.

Kılıç, M., Sungurlu, A. (2021). Sürdürülebilir Kent Mobilyaları. *Online Journal of Art and Design*, *9*(2).

McDonough, W. (1992). Hannover Principles: Design for Sustainability: Prepared for EXPO 2000 The World's Fair Hannover. Publisher: W. McDonough Architects.

Moore, J.E., Mascarenhas, A., Bain, J. et al. (2017). Developing A Comprehensive Definition of Sustainability. Implementation Sci 12, 110 (2017). https://doi.org/10.1186/s13012-017-0637-1

Sert, N. (2018). *Plastik Geri Dönüşüm Tesisinde Atık Yönetimi.* (Yüksek Lisans Tezi) Niğde Ömer Halisdemir Üniversitesi, Fen Bilimleri Enstitüsü, Niğde.

Sev, A. (2009). *Sürdürülebilir Mimarlık*. YEM Yayınları.

Şatır, S. (2015). Sürdürülebilir Kentsel Mekânlar ve Kent Mobilyaları. *Tasarım+ Kuram*, *11*(19), 1-18.

Sayar, Z., Gültekin N, A., Dikmen, B., Bilgin, Ç. (2009). "Sürdürülebilir Mimarlık Kapsamında Ahşap ve PVC Doğramaların Değerlendirilmesi", 5. Uluslararası İleri Teknolojiler Sempozyumu (İATS'09), 2067-2072.

Temiz, M., Sağlık, A. (2021). Sürdürülebilir Kentler: Yeşil İş Parkları. *Türkiye Peyzaj Araştırmaları Dergisi*, *4*(1). https://doi.org/10.51552/peyad.786432

Toker, F. R. (2020). Sürdürülebilir Mimarlık ve Akıllı Malzemeler. Sürdürülebilir Mühendislik Uygulamaları ve Teknolojik Gelişmeler Dergisi, 3 (2), 77-80 .

Yaylalı, S. (1998). *Kent Mobilyaları Tasarımında Kullanılabilecek Kavramsal Bir Model* (Yüksek Lisans Tezi) İstanbul Teknik Üniversitesi, Fen Bilimleri Enstitüsü, İstanbul.