



Research Article

Submission Date
09 / 05 / 2024
Admission Date
19 / 08 / 2024





How to Cite:



Integrating Multifunctional Street Design Concepts: A Case Study of Kayışdağı Street

Çok İşlevli Sokak Tasarımı Kavramlarının Bütünleştirilmesi: Kayışdağı Caddesi Örneği

Zerrin İnan¹ 
Orçun Mert Carlık² 

İnan, Z., Carlık, O.M. (2024). Integrating Multifunctional Street Design Concepts: A Case Study of Kayışdağı Street. *Journal of Environmental and Natural Studies*, 6 (2), 117-138. <https://doi.org/10.53472/jenas.1480696>

ABSTRACT:

Streets are a network of social, economic, and physical activities that contribute to the vitality of neighborhoods. Successful urban streets have multiple functions beyond simply moving people and goods from place to place. At least 20-30% of cities are made up of streets, a huge infrastructure that needs to be maintained and developed. They have the potential to help address today's urban challenges related to climate change, biodiversity loss, health problems, and well-being. Different street design strategies are presented as a response to these challenges, as they can fulfill this multitude of functions; they are not only transport infrastructures, but also lively and inclusive public spaces, carriers of economic development, ecological corridors supporting ecosystem services, and lines of technical infrastructure including street and traffic lighting, electrical power, signalization, etc. Complete Streets, Green Streets, Healthy Streets, and Place Making and Streets are all concepts and initiatives that have evolved to address issues related to the planning and design of street environments, each with its own focus and definitions. This article introduces the current approaches to street design and proposes to integrate principles from each of the four concepts into Kayışdağı Street in Istanbul. It is selected as a case study to improve existing university districts' services and build new neighborhoods as the population grows exponentially.

KEYWORDS: Complete street, street design, Kayışdağı Street, placemaking, healthy street, green street

Öz:

Caddeler; kentlerin yaşanabilirliğine katkıda bulunan bir sosyal, ekonomik ve fiziksel faaliyetler ağıdır. Başarılı kent caddeleri, insanları ve eşyaları bir yerden bir yere taşımanın ötesinde birçok işleve sahiptir. Şehirlerin en az %20-30'u, bakımı ve geliştirilmesi gereken devasa bir altyapı olan caddelerden oluşmaktadır. Bunun yanı sıra iklim değişikliği, biyoçeşitlilik kayıpları, sağlık sorunları ve toplulukların refahı ile ilgili çağdaş kentsel zorlukların üstesinden gelmeye katkıda bulunma potansiyeline sahiptirler. Günümüzde bu çok sayıda işlevi yerine getirebilmeleri için farklı cadde tasarım stratejileri ortaya konulmaktadır. Bu yenilikçi yaklaşımlar sadece trafik altyapıları değil aynı zamanda canlı ve kapsayıcı kamusal alanlar, ekonomik kalkınmayı teşvik, ekosistem hizmetlerini destekleyen ekolojik koridorlar ve sokak ve trafik aydınlatması, elektrik enerjisi, sinyalizasyon vb. dahil olmak üzere teknik altyapıları da kapsamaktadır. Bütünleşik caddeler, yeşil caddeler, sağlıklı caddeler ve caddeler için mekan yaratma hareketi gibi yaklaşımlar cadde planlaması ve tasarımı ile ilgili sorunları ele almak için geliştirilmiş kavramsal fikirler ve girişimlerdir ve her birinin kendi odak noktası ve tanımları bulunmaktadır. Bu makalede, dört farklı güncel cadde tasarımı yaklaşımları ele alınmakta ve hızla büyüyen bir üniversite bölgesi olma özelliğiyle çalışma alanı olarak seçilen Kayışdağı Caddesi'nde bu yaklaşımların temel ilkeleri örnek alınarak tasarım önerileri sunulmaktadır.

Anahtar Kelimeler: Bütünleşik cadde, cadde tasarımı, Kayışdağı Caddesi, mekan yaratma, sağlıklı cadde, yeşil cadde

¹ **Corresponding Author:** Yeditepe University Faculty of Architecture, zinan@yeditepe.edu.tr, 0000-0003-3217-4139

² Yeditepe University Faculty of Architecture, mert.carlik@yeditepe.edu.tr, 0009-0001-9380-9583

1. INTRODUCTION

Streets play a pivotal role in urban environments, serving as vital components of open spaces and public life. They form a communication network that connects families, friends, and businesses. However, there's a misconception regarding the definition of streets; the terms "road" and "street" have evolved into distinct concepts, with modern society emphasizing their differences. A road serves as a pathway for various modes of transportation, emphasizing movement between different places, while a street typically refers to a wider path within a town or village, often flanked by buildings.

In essence, a street can be seen as an enclosed, three-dimensional space bordered by adjacent buildings. Streets also fulfill a variety of needs, including access to education, entertainment, recreation, and relaxation. Unfortunately, many streets have been designed with a focus on automobiles, resulting in negative consequences for both people and the environment, such as impractical and impermeable surfaces that discourage pedestrian use.

Renowned architect Le Corbusier famously proclaimed that streets are outdated and should be replaced with something more efficient. While it's possible to agree with his assertion about the need to prioritize pedestrian safety without fully endorsing the elimination of streets, viewing cities solely through the lens of transportation functionality diminishes the significance and purpose of urban streets (Moughtin, 2003).

Traditional street planning, which often cuts through the heart of cities and neighborhoods, tends to fragment communities and causes air, noise, and visual pollution. Moreover, dense infrastructure construction in sensitive areas can heighten the risk of severe weather events like flooding and extreme temperatures. Transportation infrastructure can also introduce invasive plant species, disrupting natural ecosystems and reducing biodiversity, while rainwater runoff from impermeable surfaces leads to soil pollution and degraded water quality in nearby water bodies. Additionally, the prevalence of non-permeable surfaces exacerbates the urban heat island effect.

Nevertheless, recent advancements in street design have embraced sustainability, safety, social cohesion, and aesthetic appeal. Thoughtfully designed streets not only foster livable environments but also bolster local economies. Throughout history, successful urban streets have served various functions beyond mere transportation, offering economic, social, and environmental benefits.

The concept of sustainable transportation emphasizes safety, equity, flexibility, ecological sensitivity, and visual appeal while minimizing carbon emissions to combat climate change. Landscape architects and related professionals play a crucial role in promoting these principles in street design.

2. STREET DESIGN APPROACHES

Designing successful streets involves considering a variety of factors to ensure safe and comfortable use for all users, while also promoting economic, social, and environmental sustainability. In recent years, several conceptual approaches and initiatives have emerged to address street planning and design challenges that consider some key design parameters such as safety, inclusiveness, comfort and convenience, accessibility, sustainability, and public engagement. Each initiative and approach has evolved to address issues related to the planning and design of street environments. In this research, Complete Streets, Healthy Streets, Green Streets, and Place Making for streets were chosen for this research because they highlight different design parameters and have their own focus.

2.1. Complete Streets

Complete Streets are streets meticulously designed and managed to facilitate safe accessibility and mobility for all individuals, regardless of age or ability. This inclusive approach accommodates various modes of transportation, including driving, walking, biking, and public transit. Complete Street policies are established at different governmental levels—state, regional, and local—and are often reinforced by specific roadway design standards. These policies aim to enhance the safety and efficiency of the transportation network (U.S. Dept. of Transportation, 2015).

Complete Streets strategies encompass a diverse array of components, including sidewalks, bike lanes, dedicated bus lanes, public transit stops, pedestrian crossings, median islands, accessible signals, curb extensions, adjusted vehicle lanes, streetscape enhancements, and landscaping features shown at Figure 1. By integrating these elements, Complete Streets initiatives effectively mitigate motor vehicle accidents and pedestrian hazards, while also minimizing risks for cyclists, particularly when incorporating well-designed bicycle infrastructure (Reynolds et al., 2009). Moreover, these streets encourage walking and cycling by offering safer environments for physical activity during travel.

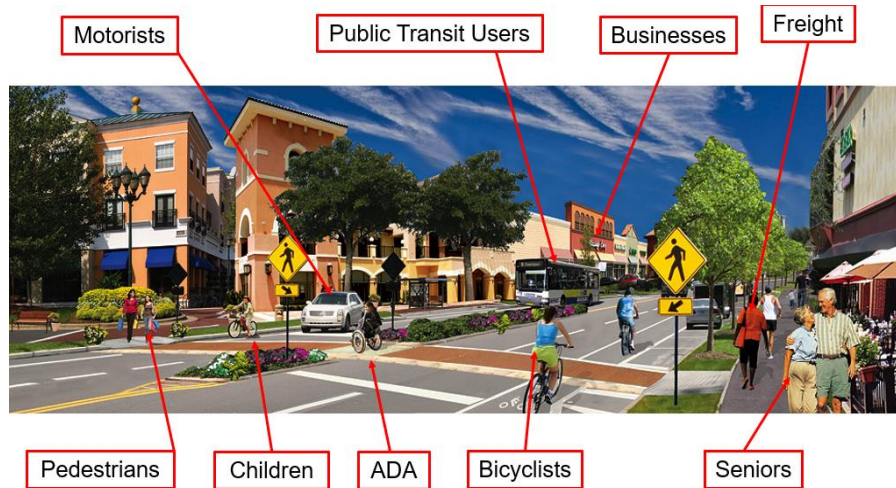


Figure 1. Diagram of a Complete Street (URL 1).

Every Complete Streets design is tailored to suit its specific community context, yet adheres to fundamental design principles. These principles typically entail incorporating comfortable sidewalks or generously sized paved shoulders, ensuring accessible and thoughtfully designed public transportation stops, providing designated lanes for bicycles and/or electric scooters, offering frequent and secure crossing points, installing easily reachable pedestrian signals, implementing high-quality lighting, and employing narrower travel lanes for motor vehicles compared to standard widths (Smart Growth America, 2012).

Designing a Complete Street enhances the efficiency of the current road network by accommodating a greater number of users within the same space, which includes considering the spatial requirements for buses (Litman, 2016). In terms of safety, research conducted by King et al. (2003) demonstrated that implementing pedestrian-friendly features decreased pedestrian risk by 28%. Consequently, public health experts have emphasized the significance of constructing additional sidewalks, enhancing public transportation services, and establishing bicycle routes to encourage physical activity. They have suggested reallocating funds designated for highway construction to prioritize accommodating more diverse users and functions.



Figure 2. Transit Riders Boarding and Exiting the First Bus Rapid Transit Line in Indianapolis at Top (URL 2). Separated Bike Lanes on Guadalupe Street in Austin, Texas (Bottom Left), (URL 3). Michigan City Curb Extensions, USA (Bottom Right), (URL 4).

Another study discovered that 43 percent of individuals residing within a 10-minute walking distance of safe locations adhered to daily activity recommendations outlined by experts. However, for those lacking accessible walking areas nearby, this compliance rate dropped to 27 percent (Powell et al., 2003). Moreover, users are 65 percent more inclined to walk in neighborhoods equipped with sidewalks. However, a drawback of the Complete Street concept is its lack of focus on ecological considerations and aesthetic preferences that users and visitors may prioritize.

2.2. Green Streets

According to the Environmental Protection Agency (EPA), a green street is a stormwater management approach that integrates vegetation (such as perennials, shrubs, and trees), soil, and engineered systems (like permeable pavements) to decelerate, filter, and purify stormwater runoff originating from impermeable surfaces such as streets and sidewalks (EPA, 2021).

Green streets employ a design methodology aimed at reducing environmental footprint by prioritizing strategies to manage rainwater at its origin, during its journey, and in its drainage, utilizing green infrastructure techniques. By incorporating green infrastructure applications, green streets sustain the water cycle and mimic natural hydrological processes within urban areas, effectively enhancing water quality and mitigating surface runoff rates (Noaca, 2019).



Figure 3. Examples of Green Streets from Various Locations: Curb Extension and Arterial Swales in Vermont (Top Left & Right) (URL 5)

Median with Bioretention Planters in Philadelphia (Bottom Left), (url 6). Infiltrated Planters in Portland (Bottom Right), (URL 7).

Green streets utilize a diverse range of design elements, including permeable pavement materials, street trees, infiltrated or flow-through planters, vegetated swales, green gutters, and curb extensions. The effective incorporation of green techniques and landscaping fosters interaction between soil and vegetation, promoting stormwater infiltration and retention.

While the design and aesthetics of green streets may vary, they share common functional objectives:

- Providing stormwater management at its source, encompassing volume reduction, infiltration, capture, storage, and enhancement of water quality (Im, 2019).
- Creating roadways that contribute to environmental protection and local water quality preservation (EPA, 2021).
- Upholding and reinstating natural processes (EPA, 2021).
- Cultivating distinctive and appealing streetscapes to enhance social well-being (Im, 2019).
- Encouraging diverse curbside uses, including parking for private automobiles to ensure pedestrian and cyclist safety, on-street bicycle parking, parklets, bus lanes, and other public amenities (Noaca, 2019).

Green Streets should prioritize cost-effectiveness, which can be achieved by utilizing local materials and native plants. Additionally, they should safeguard existing wildlife corridors, prevent fragmentation of wildlife habitats, and respect various aspects of local ecology and hydrology. Green Streets must incorporate stormwater management strategies right from the early planning stages (Jiang, 2016).

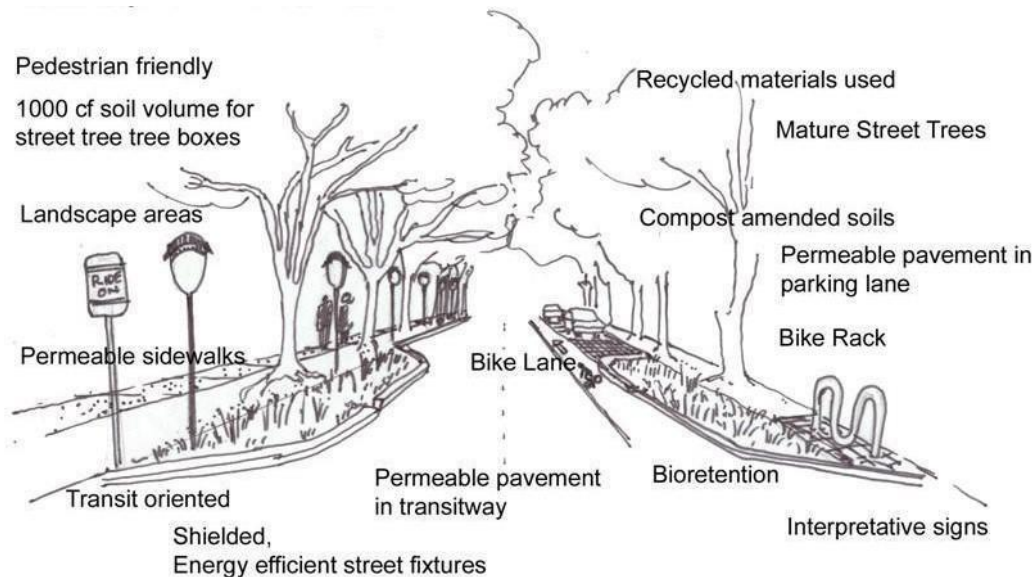


Figure 4. Titled "Anatomy of a Green Street," Presents a Design Graphic that Provides Details of Green Street Elements Comprising a Green Street (URL 8).

Prior research has shown that vegetation in streetscapes provides various ecosystem services, including positive social and health benefits (De Vries et al., 2013, Mullaney et al., 2015 and Säumel et al., 2016), and green corridors rather than defined parks were more preferred for recreation and commuting purposes (Honold et al., 2016).

Green Streets prioritize environmental enhancement with features like permeable pavements, vegetated bioswales, and bio-retention devices that absorb and filter stormwater, reducing flooding and water pollution and stormwater runoff (Selbig et al., 2021). Street trees are planted with sufficient space for their roots, ensuring long-term health. Using renewable local materials lowers the carbon footprint and supports local businesses. Additionally, well-chosen and placed vegetation enhances biodiversity and reduces air pollution (Jiang, 2016).

While Green Streets significantly contribute to sustainability efforts, there is a limited intersection between the Green Street concept and place-making principles. Additionally, there's limited discussion on how these streets interact with other transportation modes and address safety concerns. This highlights a potential area for further exploration and integration within the broader urban planning framework.

2.3. Healthy Streets

The concept of Healthy Streets, along with its top 10 Indicators shown at figure 5, originated in Transport for London policy in 2014. The program was formulated by Lucy Saunders, an expert in public health and transportation, and was officially endorsed by London Mayor Sadiq Khan in October 2016. Healthy Streets is an urban development approach that prioritizes streets designed to encourage active pedestrian and public transport travel, maintain clean air, and enhance safety (Transport for London, 2020).

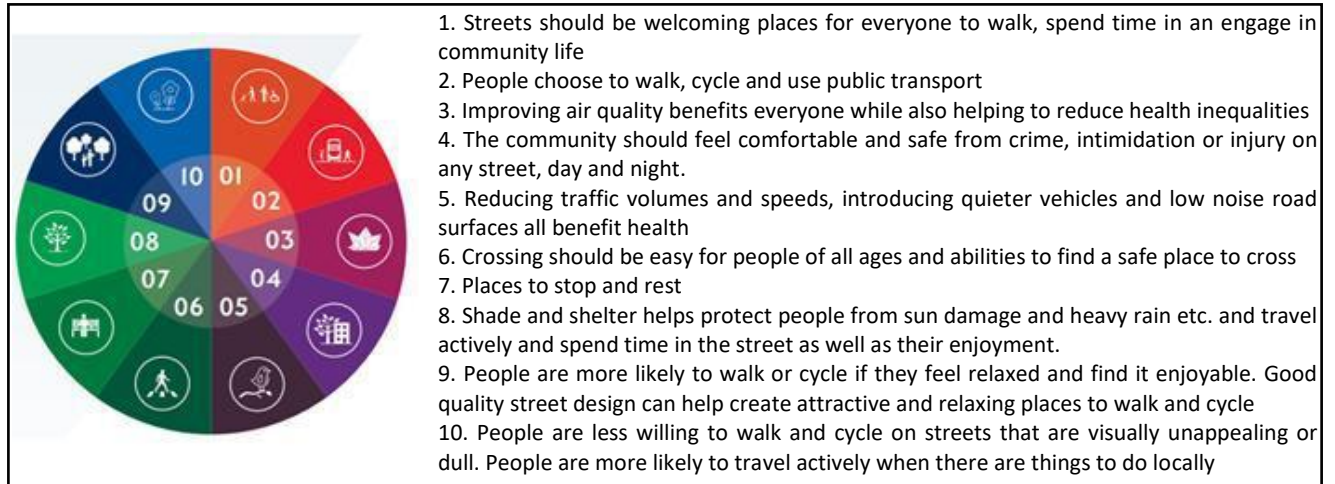


Figure 5. Healthy Street Indicators (URL 9).

Studies have consistently shown support for the positive health effects of active travel, even over longer distances, with some evidence suggesting that active travel may reduce the risk of diabetes and obesity (Saunders et al., 2013). The Healthy Streets Approach emphasizes the creation of streets that are pleasant, safe, and attractive, where factors such as noise, air pollution, accessibility, and insufficient seating and shelter do not serve as barriers preventing people, especially the most vulnerable, from engaging in outdoor activities.



Figure 6. Examples of Healthy Street implementations: Street Closures During School Run Times in Camden (top left), (URL 10). Park(ing) Day in London, Where Parking Spaces are Temporarily Transformed into Vibrant Public Spaces (Top Right), (URL 11). Places to Stop and Rest in Campbelltown, Australia, and London (Bottom Left and Right), (URL 12).

Healthy Streets design principles prioritize streets as inclusive spaces for everyone to walk, socialize, and linger in and around. A well-designed street system offers increased opportunities for walking and cycling to a broader range of people. Enhancing air quality and minimizing noise pollution yields health benefits for all users. It's essential for the entire community to feel comfortable and safe on the streets at all times. Simplifying street crossings encourages more walking and fosters connections between communities. Installing resting spots, shade structures, and shelters ensures that everyone can utilize the streets regardless of weather conditions.

Additionally, incorporating attractive views, well-designed buildings, greenery, and street art enhances the overall experience for street users. Figure 7. illustrates the physical changes made to Holborn Circus in London, which aimed to enhance pedestrian crossings, provide seating, shade, and increase greenery, while also improving safety for cyclists. However, these changes did not lead to significant improvements in air quality and noise levels, as these factors were heavily influenced by the location of the junction and the surrounding buildings.

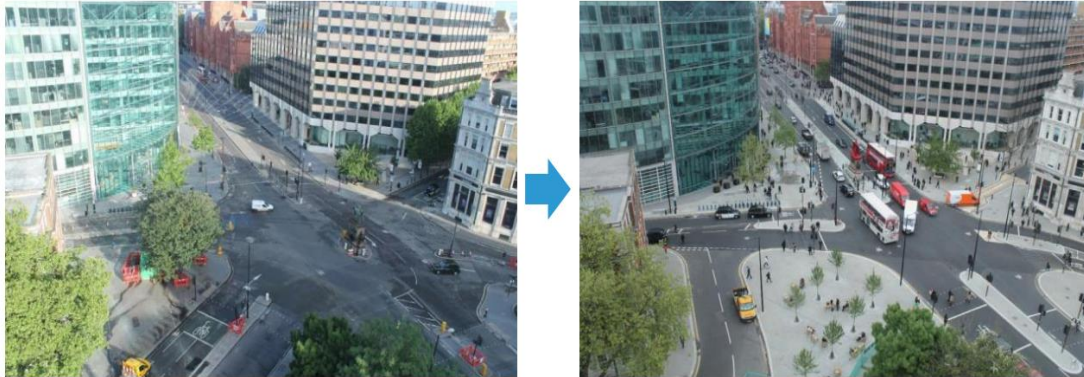


Figure 7. Changes of Holborn Circus in London after Design Implementation (URL 13).

2.4. Placemaking for Streets

Placemaking is a multifaceted approach to the planning, design, and management of public spaces, with the aim of inspiring people to collectively reimagine and reinvent these spaces as the focal point of every community. It seeks to create public spaces that enhance people's quality of life and take into account the unique assets, features, and potential of each local community. Placemaking is characterized by its sociable, adaptable, and context-specific nature (PPS, 2015).

Placemaking is a collaborative process for shaping our public realm to maximize shared value. More than just promoting better urban design, Placemaking facilitates creative land-use patterns, paying particular attention to the physical, cultural, and social identities that define a place and support its ongoing evolution (Ellery & Ellery, 2019).

According to the Project for Public Spaces (PPS), more than 80% of all public areas in cities consist of streets. This highlights the importance of going beyond designing streets solely for vehicular circulation and instead leveraging streets to facilitate a variety of activities and interactions. For instance, Main Streets should be designed as vibrant community hubs that support retail sales, services, events, and casual social interactions, among other uses. Due to their diverse mix of activities, streets can serve as significant locations where memories are created and a sense of place is fostered. Through the process of placemaking, a street can be transformed into a well-utilized and beloved public space with great success.

PPS conducted evaluations of numerous public spaces across continents and identified common qualities among successful places. These include:

- **Accessibility:** Successful places are easily reachable and open to everyone.
- **Diversity of Activities:** They offer a variety of activities, catering to different interests and preferences.
- **Comfort and Positive Image:** They provide comfort and have a positive aesthetic appeal.
- **Sociability:** They serve as sociable spaces where people come together and are inviting to visitors.

In adapting placemaking principles for streets, eight key principles were identified to attract people to a street environment. These principles : 1) Great Activities & Destinations, 2) Safe, 3) Inviting and Rich in Detail, 4) Designed for Lingerin, 5) Interactive and Social, 6) Unique, 7) Accessible, 8) Flexible (PPS, 2015).

Placemaking seeks to create and improve community-centered public spaces, with the widespread adoption of its principles potentially leading to enhanced health, happiness, and overall well-being among people. Ideally, Placemaking recognizes and values the existing strengths and future potential of local communities, while also embracing the creative ideas of designers and the grassroots involvement of community members. However, Placemaking's emphasis on the social functions of public spaces has meant that it has often overlooked environmental benefits and the promotion of diverse transportation options (Jiang, 2016).



Figure 8. Examples of Strategies for Transforming Streets into Vibrant Public Spaces:

Street markets in Utah, feature programming during different times of the day, week, and year (top left),(URL 14).

Narrow vehicle lanes, low vehicle speeds, and buffers between pedestrians and vehicular traffic in Mexico City (top right), (URL 15).

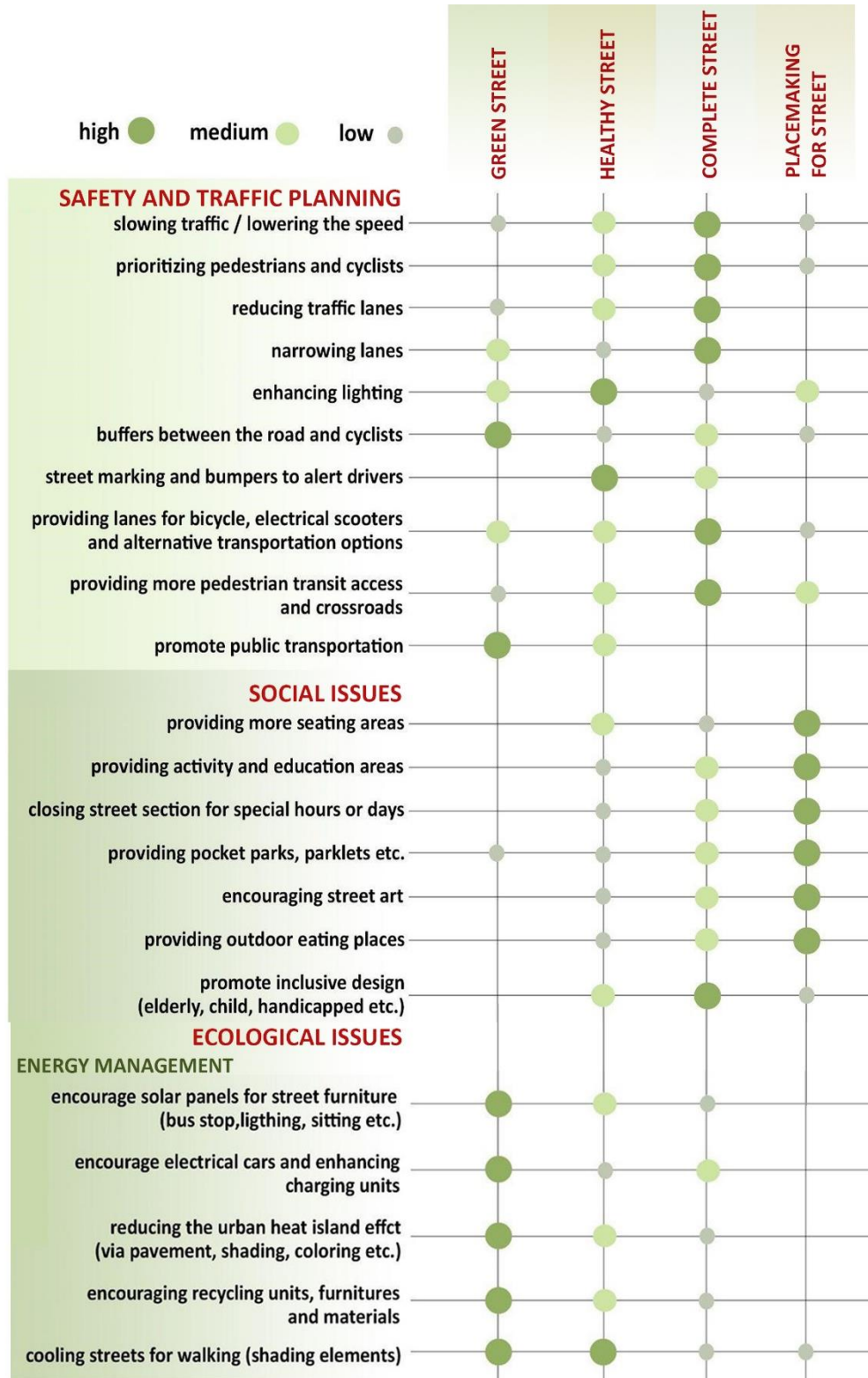
Active ground floor uses, interesting shop window displays, and human-scaled signage in New York City (bottom left), (URL 16).

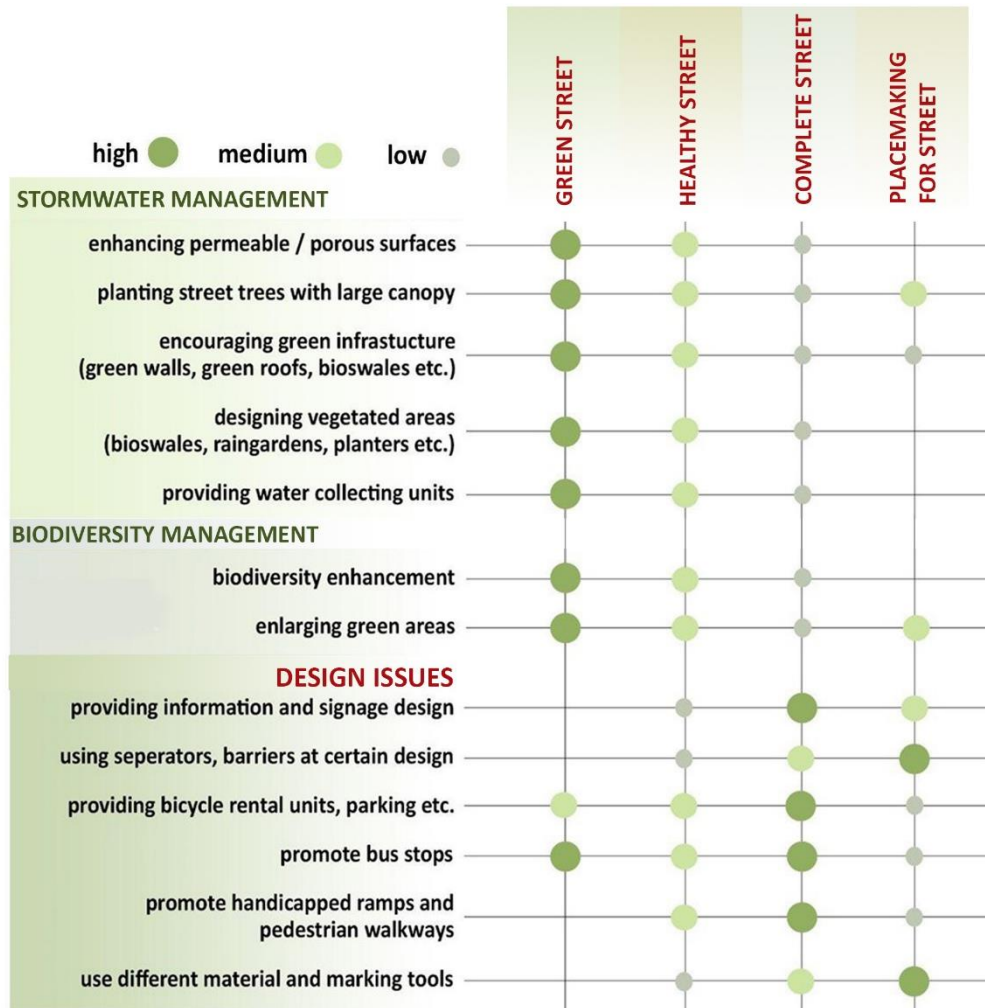
Outdoor cafés, trees for shade, and wide sidewalks along Champs-Élysées in Paris, France. (URL 17)

In summary, the basic principles of different street design approaches are summarized as the use of alternative transportation options, such as walking, cycling, and/or public transport, for all; use of environmentally preferred permeable surface materials; the presence of planted areas and preferably the use of large-topped trees; providing effective stormwater control and green parking alternatives; and providing socially active spaces and functions through streets.

For this study, an evaluation table was formed comprising safety, traffic planning, social, ecological and design criteria (Table 1). The aim was to compare various street design strategies to each other and tailor them to the specific characteristics of the study area. The table shows the relationship between the basic principles and contemporary street design relatively.

Table 1. Comparison Table of Selected Street Design Strategies (by Authors)





3. KAYIŞDAĞI STREET AS A CASE

This study provides an overview of current Street design approaches and proposes to combine principles from each of the four concepts into the selected Street. Kayışdağı Street is selected as a case study site in İstanbul to improve services in existing University Districts and to build new neighborhoods as the population grows exponentially to integrate current design principles and four concepts explained into it.

3.1. Introduction of Area

The project area encompasses a specific stretch of Kayışdağı Street, spanning from the intersection near İçerenköy Metro Station to Yeditepe University. This area holds significant development potential due to its strategic location, featuring moderately large street sections and buildings that are more in tune with human scale compared to other parts of Ataşehir. Additionally, the region boasts adequate infrastructure and underutilized pedestrian lanes within its current layout.

Noteworthy landmarks in the vicinity include Darülazece, a charitable foundation care for elderly, and Yeditepe University Campus, which offer both wildlife habitats and opportunities for human activities. By collaborating with architects and landscape architects who are attuned to the social needs of users, ecological considerations, and environmental concerns, Kayışdağı Street can undergo a transformation into an environmentally conscious and socially appealing hub where users can truly enjoy their time. Kayışdağı Street stretches between two neighborhoods: Kayışdağı and İnönü. The former, Kayışdağı neighborhood, derives its name from Kayışdağı Hill. This neighborhood extends from the base of the hill towards the northeast. The vegetation cover differs between the north and south of Kayışdağı. In terms of floristic composition, there is a transition area between two different vegetation types.

The area to the north of Kayışdağı is characterized by humid forests and sometimes Mediterranean plant communities, whereas the area to the south is dominated by arid oak species. There is a plantation forest consisting of pine trees on the border of the study area. Originally, the area served as grazing land for shepherds, with sloping areas covered in forests consisting of oak, ash, and pine trees, primarily used for firewood production by the local government. Before and during the construction of Yeditepe University, the 26 August settlement, and the İstanbul Metropolitan Municipality (İBB) Kayışdağı Darülaceze facilities in 1998, established beneath Kayışdağı Hill in 1996, the plantation forest suffered extensive damage and its landscape underwent significant alteration. (Kahraman, 2016).



Figure 8. Location of Kayışdağı Street and Surrounding Neighborhoods (by Authors).

İnönü and Kayışdağı are two neighborhoods located within the jurisdiction of the Ataşehir Municipality, which was newly established in 2008. İnönü Neighborhood was separated from Kadıköy in 2009 and became part of the newly formed Ataşehir district. According to current population data, the neighborhood is home to 28,188 people and shares borders with Maltepe. In 2009, Kayışdağı Neighborhood, also separated from Kadıköy and incorporated into the Ataşehir district, takes its name from Kayışdağı, which rises 438 meters high and is the third highest point in İstanbul province. As of 2022, the neighborhood's population stands at 42,462 (Ataşehir Municipality, 2024).

3.2. Methodology

The design process was broken down into four main steps. Firstly, the site inventory has been conducted along Kayışdağı Street. This involved documenting the current demographics, housing, transportation patterns, and types of businesses. Secondly, the existing street spaces and streetscapes were analyzed to identify constraints and opportunities. Thirdly, the street's facilities, appearance, and sustainability to establish the project's parameters were assessed. Finally, plans and designs aimed at transforming Kayışdağı Street into a more comprehensive and integrated thoroughfare have been developed and the approaches discussed in the literature were used in combination.

3.3. Site Inventory and Analysis

Parking and Inefficient Use of Spaces

Parking lots are inadequate, particularly during the opening hours of Yeditepe University, resulting in heavy and irregular parking in front of auto gallery shops, restaurants, and cafes. Pedestrian paths along the streets are inconsistently extended and narrowed, rendering them non-functional. A heavy concentration of auto service shops and other light industrial concerns amplifies the problems caused by large, impermeable parking lots. Massive spaces occupied by parking cars can't treat rainwater but might cause further pollution and heat increase.

- A - Darülaceze (looking at east)
- B - Darülaceze (looking at west)
- C - Celal Yardımcı Primary school
- D - IETT Garage
- E - Cityloft Hotel
- F - Mosque
- G - Large intersection close to the university
- H - Main entrance of Yeditepe University

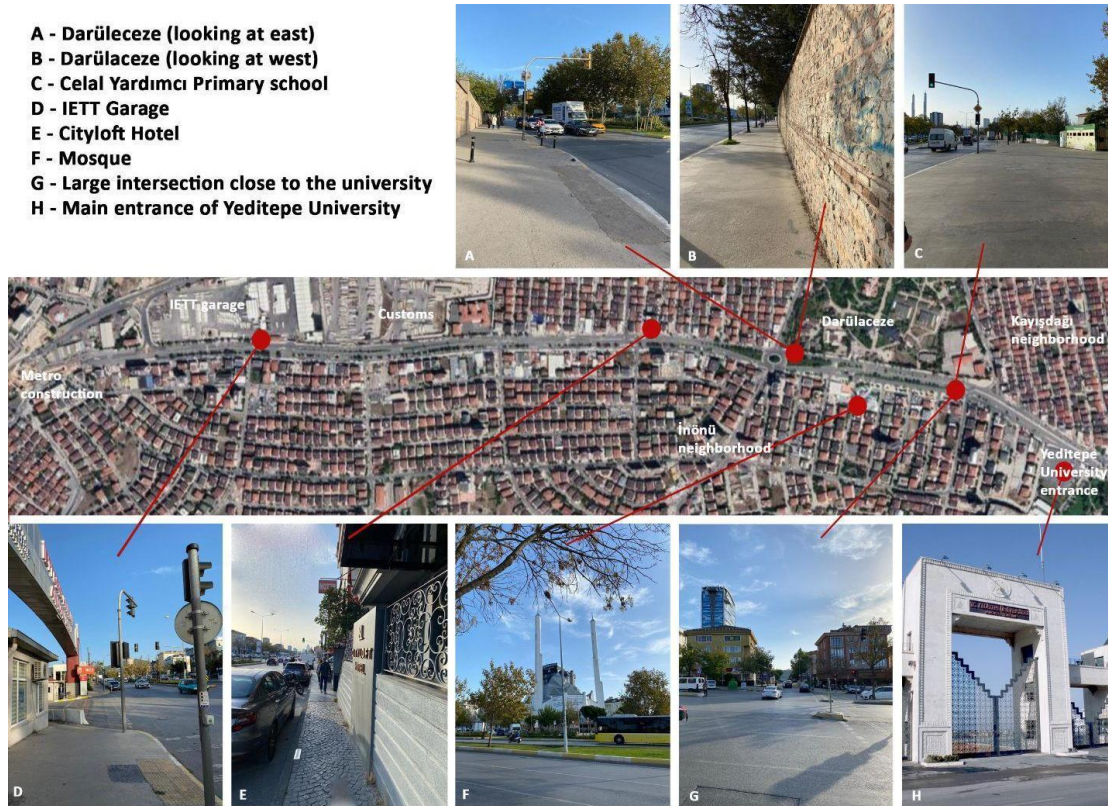


Figure 9: Photos Taken from Different Points of Kayışdağı Street (by Authors).

Topography

The overall slope along Kayışdağı Street remains almost 3% in the east-west direction. The lowest point is found at the İçerenköy metro station, measuring 111 meters above sea level, while the highest point is at the intersection near the main entrance of Yeditepe University, reaching an elevation of 190 meters (Ataşehir Development Plan, 2021).

Street and Building Layout Types

Within the project boundary, Kayışdağı Street is equipped with 3 lanes for outbound and inbound traffic. Additionally, in certain areas, a 4th lane has been created through side roads. The side roads are interconnected with the main Kayışdağı Street, and the arrangement of buildings follows a grid system. Narrow streets are designed for one-way traffic, while wider streets allow for two-way travel, sometimes with an additional lane designated for parking. All streets and roads are surfaced with asphalt material, minimizing the presence of green, permeable surfaces.

Street Users

The majority of ground floors along Kayışdağı Street are dedicated to commercial purposes, including restaurants, shops, and cafes. Certain key locations on the street, like Yeditepe University, exhibit a higher concentration of commercial activity compared to other areas. Meanwhile, some sections experience less commercial activity. Parents regularly traverse the street during school hours to drop off or pick up their children from Celal Yardımcı Primary School. Additionally, students from the university are actively present in the upper parts of the street and smaller roads around the main entrance of Yeditepe University. This area sees significant activity during both daytime and nighttime.

Street Design Elements

Typically, the wide, three-lane roads feature expansive sidewalks, although their design leaves much to be desired. At times, these pedestrian zones are as spacious as the vehicle lanes, rendering them impractical for residents. Additionally, there's a lack of shading trees or barriers separating pedestrians from vehicle traffic. However, there are essential pedestrian crossings equipped with traffic lights placed strategically, along with covered bus stops offering moderate protection from cold, heat, and rainfall. Sidewalk paving materials are inconsistent between blocks and lack of seating or waiting spaces and urban furniture between blocks. Raised curbs might disturb disabled pedestrians and elderly close to the Darülaceze, the signs have no uniformity of style along the street.

Current Building Types/Usage

It has been noted that 98.4% of the buildings in the Kayışdağı and İnönü neighborhoods are constructed using reinforced concrete. Additionally, there are 40 prefabricated units included in the area. The remaining structures, totaling 33, are made of masonry.

The majority of the project area is designated for residential use, comprising 67.18% of the total area. Residential and commercial functions combined cover 12.22% of the area. Official institutions occupy 8.93% of the planning area, with the largest function within this category being social cultural facilities, notably Darülaceze, accounting for 4.52% of the total area. Municipal services, represented by IETT (İstanbul Electricity Tramway and Tunnel Establishments) Public Bus Garage, make up 2.25% of the area, while parking spaces constitute 1.18%. Functions occupying less than 1% of the total area within the study area include primary and secondary education facilities, religious establishments, tourism facilities, storage areas, maintenance and fuel stations, health facilities, and private healthcare facilities (Ataşehir Development Plan, 2021).

As shown in Figure 10, it can be observed that the average height of buildings within the project boundaries of Kayışdağı Street is approximately 5 floors. In the Kayışdağı neighborhood, most buildings typically have three stories, while in the İnönü neighborhood, buildings are taller, reaching up to 15 storeys in height. However, it's worth noting that only six buildings reach the height of 15 storeys, with the majority having between 5 to 7 storeys.

One could argue that green spaces are notably lacking, aside from the expansive median in front of Darülaceze. While this area boasts large Plane trees (*Platanus occidentalis* and *Platanus orientalis*) and Phormiums (*Phormium tenax*), creating a lush green environment, the drawback is its limited usability for people. Moreover, these sizable trees only provide shade to already green areas that don't necessarily require additional cooling shade. Although sidewalks are generally spacious and adequate, they suffer from poor design and a lack of buffers separating them from the vehicle road, leading to instances of cars being parked in these pedestrian zones. As for the buildings, they resemble typical residential structures found throughout Istanbul: unspecified, lacking in authenticity, and average in appearance. They are predominantly covered with simple plaster facades and common PVC windows.

Current Street Trees

The green areas on Kayışdağı Street are mostly composed of trees planted on the median and sidewalks. The trees on Kayışdağı Street are generally planted as an allee, but there is no consistent linear harmony and they are interrupted from time to time. Even trees of the same species vary in height and volume due to different planting times.

Some of the trees in the refuges and sidewalks are planted too close to the street, causing maintenance and health problems. Kayışdağı Street has deciduous trees with small, medium and large crowns. The most common tree species are *Fraxinus ornus*, *Fraxinus excelsior*, *Fraxinus angustifolia* (Ash), *Platanus occidentalis* and *Platanus orientalis* (Plane tree). Due to pruning errors and over-pruning, there are often asymmetrical tree forms with crown widths that vary with the direction of view.

Public Transportation

In the project area of Kayışdağı Street, there are a total of nine bus stops/stations serving buses traveling to and from ten different locations. Additionally, three minibus lines connect to nearby centers.

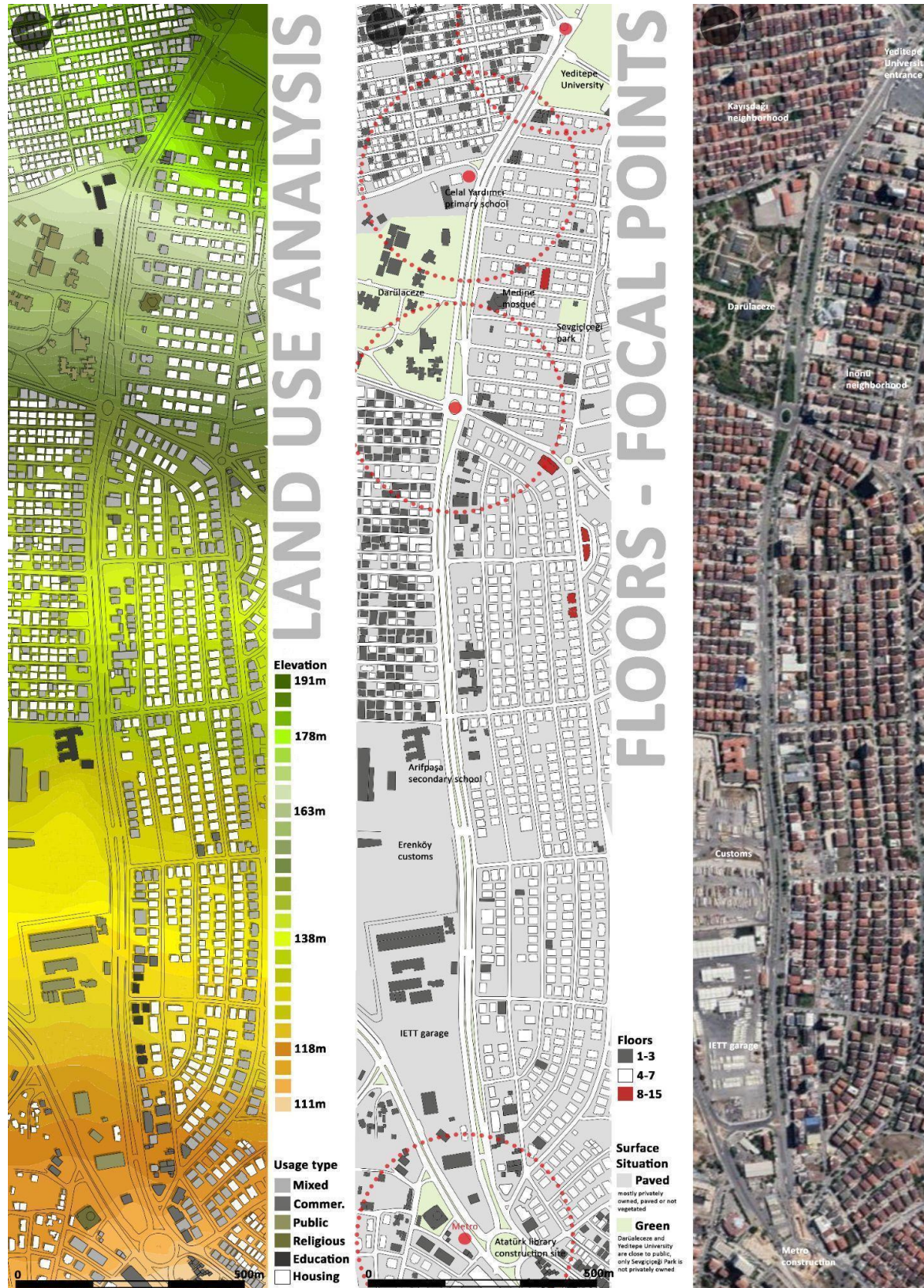


Figure 9: General Analysis of Kayışdağı Street from the Lowest to the Highest Point (by Authors).

4. DESIGN APPROACHES FOR KAYIŞDAĞI STREET

Kayışdağı Street was redesigned based on the following principles.

Prioritizing the Connection Between Nature and Urban Fabric: Kayışdağı Street has emerged as a vital transportation artery in the rapidly expanding eastern district of Ataşehir. This prominent thoroughfare must harmonize with the natural environment by incorporating more green spaces, reducing the number of car lanes, and featuring visually appealing vegetation.

Climate Compatibility: Minimize the damage caused by climate impacts while maximizing the many opportunities for human development offered by a low-emissions, more resilient future is important for sustainability. Encouraging growth and social development while building climate resilience, reducing or keeping emissions low by increasing carbon-storing trees, permeable materials, etc. is a priority.

Pedestrianization: In planning for user recreation needs, particularly for the elderly from Darülaceze, it is imperative to extend and redesign pedestrian areas along Kayışdağı Street according to contemporary street design approaches. Additionally, since a significant portion of users commute short distances on Kayışdağı Street daily, it is essential to provide a comfortable walking system throughout the entirety of the street for their convenience.

Safer Environment: Separating high-speed traffic from pedestrians is crucial to create a safer environment for everyone. Implementing markings on driving lanes to guide pedestrians to designated points while also alerting drivers to slow down and remain vigilant is a critical decision for the redesign process.

Mitigating the Periodically Empty Spaces: The large curb area in front of Celal Yardımcı Primary School remains vacant after school hours and during holidays. To address this issue and discourage the area from being periodically empty, pop-up playgrounds should be designed. These pop-up playgrounds will attract younger groups of users, ensuring the space is utilized effectively and remains lively even outside of school hours.

Giving importance to the Bikeways: To promote the use of bicycles as a mode of transportation, benefiting both human health and the environment, bikeways should be incorporated onto the street. Additionally, bike stops should be included in the design to facilitate the convenient usage of bicycles as a means of transportation.

Encouraging Users to Walk as a Way of Transportation: As mentioned in the policies of Street Design approaches, the project aimed to support people to walk and cycle particularly around schools and parks in neighborhoods of greatest need. To enhance human health and well-being, it's crucial to incorporate rest areas, seating areas, and similar amenities like bike lanes along with the planting of tall trees to provide shade and create a comfortable walking environment. However, the bike lane shall be constructed within an enlarged sidewalk on the southern side of the street. The rental points, footrests on crossings and altered colored pavements will be added to the design. Additionally, to increase the pedestrian traffic some points will be emphasized with markings on the surface as shown in Figure 10, especially on commonly used crossings such as areas in front of Yeditepe University and Celal Yardımcı Primary School.

Making Crossings Easier: To promote walking as a mode of transportation, it's essential to consider not only the design of the walkways but also the crossings as a cohesive unit. The design should incorporate short and frequently positioned crossings that are easily accessible for users. Furthermore, the vehicle road should be narrowed and lined with plantings to encourage slower vehicle speeds, thus enhancing safety for pedestrians. Also, to create a safer environment, markings on the pavement and different patterns that indicate the type of users are added. (Shown in Figure 10. and 12.)

Creating an Active Environment: Creating an active and visually appealing environment is essential to encourage people to use the street more actively for walking and biking or just for recreational needs. Incorporating amenities such as buffets, resting areas, seating areas, pop-up playgrounds, planting areas, and shops can enhance the overall appeal and activity level of the street, thereby promoting increased pedestrian and cyclist engagement. Especially the space in front of Celal Yardımcı primary school and the other side of the road are meticulously redesigned to create appropriate areas for all these activities. (Figure 12. and Figure 13.)

Respecting Diversity: It is imperative that all the items and designs mentioned take into account the diversity of users in terms of age, gender, and other factors. Designs should be inclusive, ensuring that they accommodate elderly individuals at every point. Special attention should be given to their health and ensuring comfortable use. By incorporating inclusive designs, we can create environments that are accessible and welcoming to all members of the community. Especially for the group of people that are older than the average user because of the presence of Darülaceze where hosts them in the study area.

5. DESIGN ALTERNATIVES AND SUGGESTIONS TO THE SELECTED STREET

Increase of Pedestrian Lanes and Adding Bikeways

The redesign proposal for the design area will maximize its potential by prioritizing walkable pedestrianized lanes over vehicle lanes. These new pedestrian lanes will feature native, large canopied trees to provide shade during the summer months and act as barriers against strong winds originating from higher points of Kayışdağı hill. The dense vegetation will enhance visual aesthetics year-round. Pedestrian lanes will be redesigned with contemporary anthropogenic measurements in mind, ensuring a minimum width of 120 centimeters for comfortable use.

Additionally, seating areas will be strategically included to cater to elderly users from Darülaceze, encouraging them to venture out onto Kayışdağı Street. Bikeways will be situated on the side facing İnönü neighborhood, establishing a continuous lane that links İçerenköy subway station to Yeditepe University. This uninterrupted route will provide an alternative transportation option for users traveling to the university and passing through various nodes. Bike rental points will be integrated along the bikeway to promote bicycle usage. Furthermore, the bikeway lanes will have a minimum width of 190 centimeters to ensure a safe biking environment.

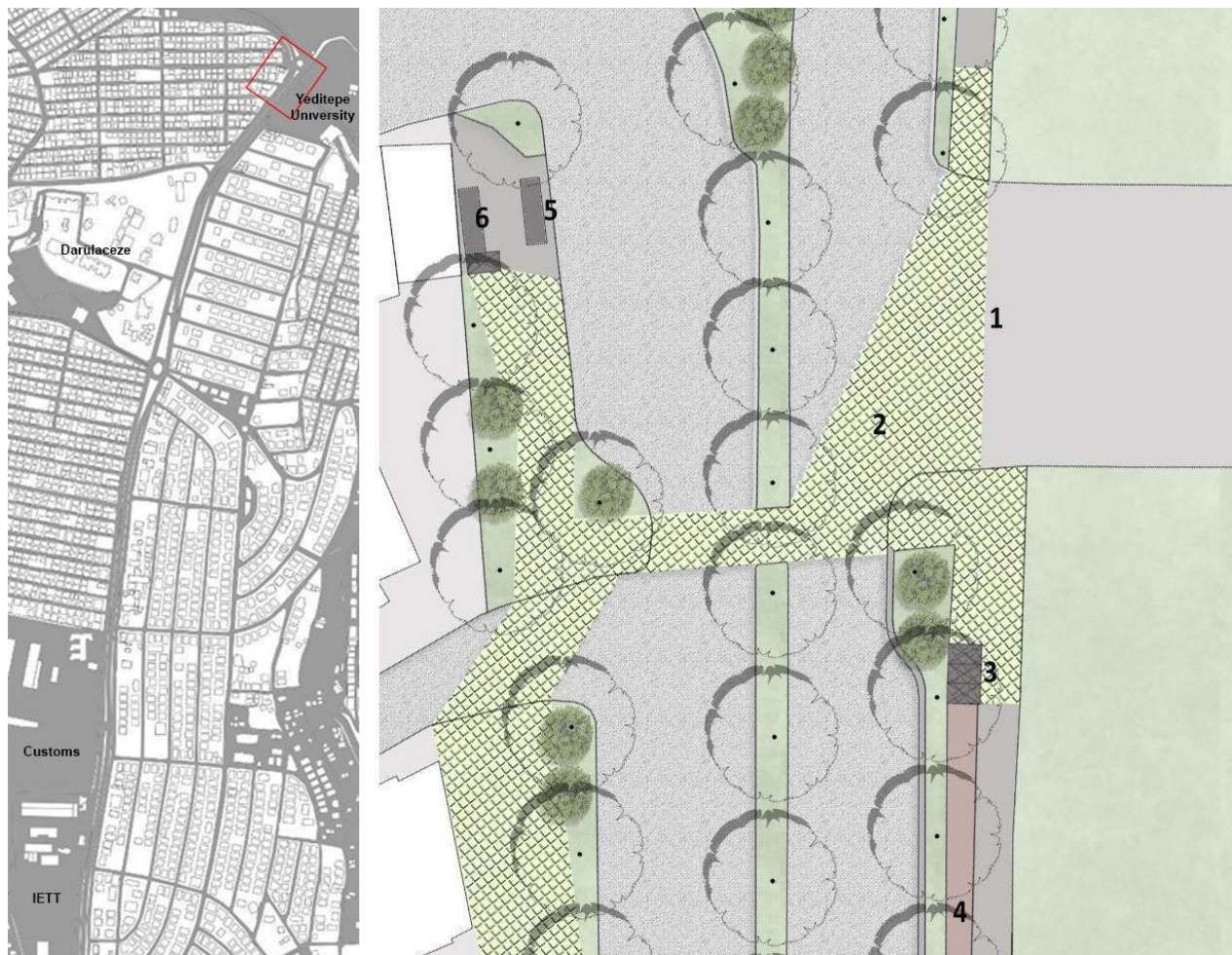


Figure 10. Proposal of the Surrounding of the Gate of Yeditepe University 1. Entrance of the University, 2. Markings on the Pavement, 3. Bike Rental Point, 4. Bikeway, 5. Enlarged Bus Stop, 6. ATMs and Simit Buffet (by Authors).

Visual Emphasis of Crossroads

Given that Kayışdağı Street serves as a major thoroughfare for heavy vehicles between the IETT (İstanbul Electricity Tramway and Tunnel Establishments) Public Bus Garage, customs, and the freeway; pedestrian safety at crossroads and junctions is a significant concern. To address this, the project includes markings on the street surface and pedestrian lanes. These markings will guide pedestrians to designated points, particularly around areas like Yeditepe University, and also serve as warnings to drivers to reduce speed when approaching crossroads. Additionally, the new surface features will enhance the visual appeal of the street and help alleviate the gray atmosphere.

Planting Design

Selecting native plants is the main concern of creating the whole planting design. Plane trees (*Platanus orientalis*), Oak trees (*Quercus frainetto*), Willow trees (*Salix alba*) and Pine trees (*Pinus brutia*) are selected as large canopy trees while Viburnums (*Viburnum tinus*), Strawberry trees (*Arbutus unedo*) are in the selected group of shrubs. Within all these species, various types of grassy plants and semi hydrophilic herbaceous plants will be used to create a self-maintaining vegetation under the climatic conditions of Kayışdağı.

Stormwater Management

In the design proposal, green gutters, bioswales, and green buffers take center stage as crucial elements. Depending on the street's width, bioswales will serve as green gutters, naturally collecting stormwater. This approach addresses issues related to infiltration and stormwater storage. Additionally, permeable pavement materials will be utilized to minimize the amount of runoff entering sewage systems. This strategy not only tackles stormwater management but also helps reduce the urban heat island effect, thereby contributing to a more sustainable urban environment.

Permeability of pavements where only pedestrians use is one of the main issues to sustain this topic. As shown in Figure 11, sidewalks are thinner and more permeable than vehicle lanes.

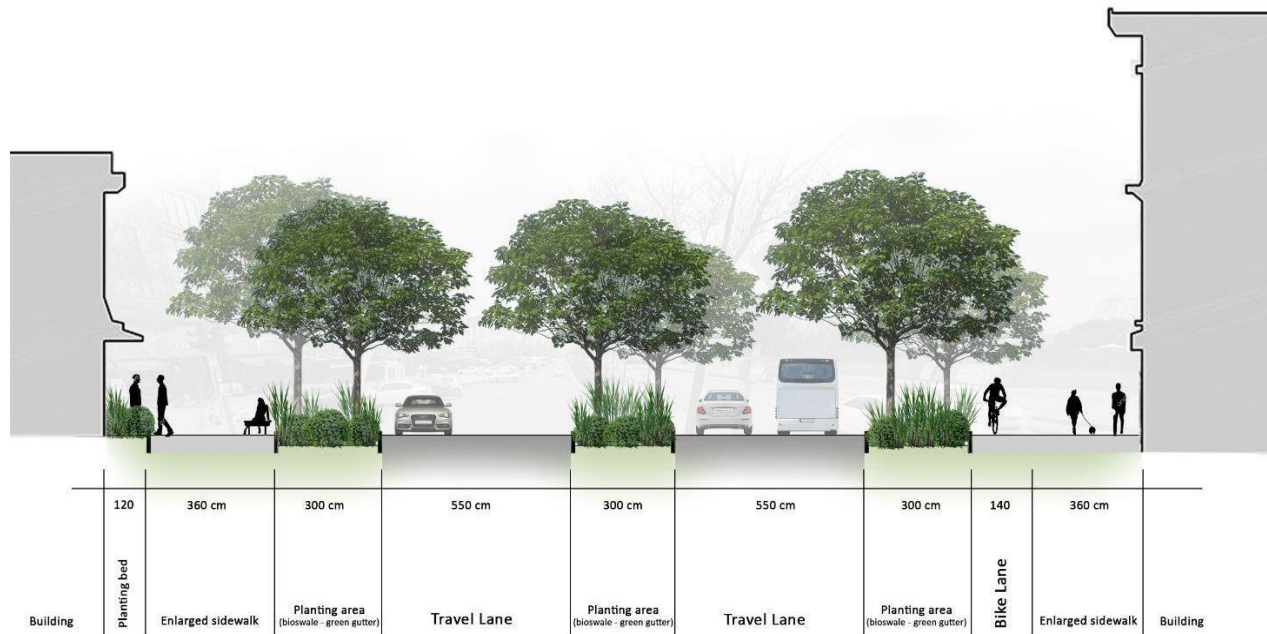


Figure 11. Proposed General Section of Where The Street is Approximately 30 Meters’ Diameter (by Authors).

Interaction between Users from Different Ages

It is expected that both the permanent arrangements implemented in this area and the temporary arrangements during parking days will be beneficial for older users residing in Darülaceze, which is situated nearby. The goal is to enhance interaction between

children and elderly users, thereby fostering a sense of community and social connection. These initiatives are anticipated to have a positive impact on the well-being and overall quality of life for residents of all ages in the surrounding area.

Redesign of the Area in front of Celal Yardımcı Primary School

In accordance with the principles of Healthy Streets and Placemaking, the area in front of Celal Yardımcı Primary School has been given priority, with a focus on creating a safer and more inviting environment for pedestrians, parents, and students. A buffer zone has been established, extending approximately 1 meter from the roadway to the pavement. Within this zone, a 2-meter-wide strip has been designated for planting areas, while the remaining 3 meters serve as pedestrian passageways. Beyond the plant buffer zone lies what is referred to as the "clean zone," as outlined in the Healthy Streets guidelines. This space has been enhanced with seating areas, particularly addressing the need for waiting areas for parents. Additionally, tall trees have been planted in this area to ensure that pedestrians can utilize the street comfortably and sustainably over the long term.



Figure 12. Proposal for the Large Curb in front of Celal Yardımcı Primary School - 1; Area for Pop-up Playgrounds, 2; Markings on the Pavement, 3; The Area that is Being Used by Cafes, 4; Bikeway. (by Authors)

Parking Day and Pop-up Playgrounds

The width and location of this area lend themselves well to the idea of hosting a "parking day," during which the road within this space can be temporarily closed to traffic, particularly on Sundays. During such events, pop-up playgrounds located within the

secure area of the school can be relocated and utilized within this space. This initiative aims to provide pedestrian users, especially children, with the opportunity to spend time on the street in a healthy and leisurely manner, free from vehicle traffic.

The presence of plants and seating areas, strategically planted for shade and aesthetic purposes, further enhances the experience. Ultimately, this approach aligns with the concept of Healthy Streets, fostering a livelier and more vibrant street environment.

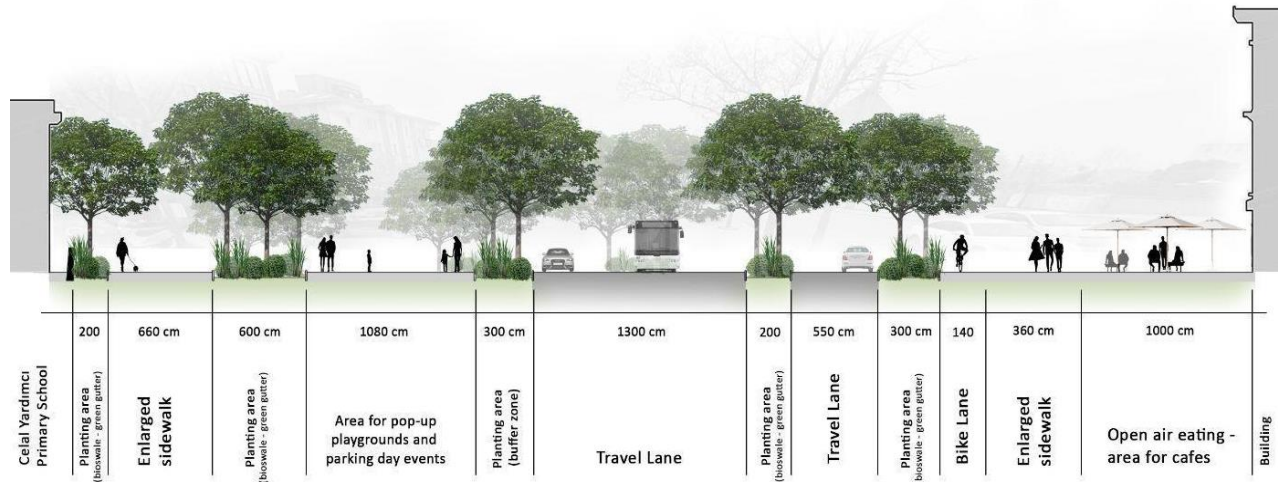


Figure 13. The Proposed Section of the Designated Area of Pop-up Playground for Celal Yardımcı Primary School and the General Street (General Section of Where the Street is Approximately 50 Meters' Diameter and More), (by Authors)

6. CONCLUSION

Kayışdağı Street holds significant potential and could emerge as a prominent focal point in Istanbul for social, cultural, educational, and entertainment activities. By exploring various street design options that take into account its current location, natural surroundings, road layout, and user needs, we can unlock this potential and enhance its appeal.

Residents from various districts and neighborhoods could utilize the street more effectively. Enhancing safety and convenience for pedestrians would generate interest in the area, encouraging people to spend more time here. This, in turn, could lead to an uptick in economic activity, benefiting businesses and other sectors operating in the vicinity.

To achieve these goals, the redesign process should prioritize ecological features and aim to make the area more natural. Given Istanbul's rapid urban expansion, maximizing green spaces is crucial. Despite Kayışdağı Street being wider than other major thoroughfares, efforts should be made to increase its greenery and enhance its appeal to residents and visitors alike.

However, cities should prioritize the safety and well-being of all users, including the most vulnerable, regardless of their skill level, age, or income. This can be achieved by ensuring safe and equitable access for everyone. A city fulfills its duty to its citizens by implementing street designs that enhance access to employment and education, promote personal health, improve public well-being, and foster cohesive communities.

Also, in light of the widespread impact of climate change, street projects present opportunities for local initiatives to enhance the environmental sustainability and resilience of a city. By promoting sustainable transportation through thoughtfully designed streets, cities can mitigate carbon emissions and enhance air quality. Implementing well-designed landscaping features and incorporating road trees can contribute to better water management, enhance biodiversity, and strengthen people's connection with the natural environment. Additionally, reducing the number of vehicles and establishing alternative parking solutions can effectively minimize soil pollution.

To conclude, the safety, comfort, efficiency, and vibrancy of a city's streets greatly influence its livability and residents' sense of connection to their urban environment. Streets play a crucial role in fostering social interaction, and well-designed streets contribute to the development of stronger and safer communities. The design of urban spaces goes beyond mere architecture; it embodies the collective contribution of people to their environment and natural surroundings. Kayışdağı Street stands as one of the promising areas where such contributions can be made.

ETHICAL STANDARDS:

Conflict of Interest: There are no potential conflicts of interest with the authors or third parties in this article.

Ethics Committee Permission: This article does not require ethics committee approval.

Financial Support: No financial support was received for this article.

REFERENCES:

Ataşehir Master Development Plan. (2021). *1/5000 scale Ataşehir District Kayışdağı and İnönü neighborhoods revision*. https://sehirplanlama.ibb.istanbul/wp-content/uploads/2021/07/PR_78531.pdf

De Vries, S. M. E., Van Dillen, P. P., & Groenewegen, P. (2013). Streetscape greenery and health: Stress, social cohesion and physical activity as mediators. *Social Science and Medicine*, *94*(1), 26-33.

EPA. (2021). *United States Environmental Protection Agency*. <https://www.epa.gov/G3/learn-about-green-streets>

Ellery, P. J., & Ellery, J. (2019). Strengthening community sense of place through placemaking. *Urban Planning*, *4*(2), 237-248. <https://doi.org/10.17645/up.v4i2.2004>

Healthy Streets. (2024). <https://www.healthystreets.com/>

Im, J. (2019). Green streets to serve urban sustainability: Benefits and typology. *Sustainability*, *11*(22), 6483-6505. <https://doi.org/10.3390/su11226483>

Jiang, J. (2016). *A more complete street, a street for everyone to enjoy, North East Street, Frederick, Maryland* [Master's thesis], University of Maryland.

Honold, J., Lakes, T., Beyer, R., & Van der Meer, E. (2016). Restoration in urban spaces: Nature views from home, greenways, and public parks. *Environment and Behavior*, *48*(6), 796-825.

Kahraman, U. Ç. (2016). *Kayışdağı yöresindeki ağaçlandırmaların silvikültürel olarak değerlendirilmesi / Silvicultural evaluation of plantation in the Kayışdağı region* [Master's thesis, İstanbul Üniversitesi]. YÖK Tez Merkezi.

King, M. R., Carnegie, C., & Ewing, R. (2003). Pedestrian safety through a raised median and redesigned intersections. *Transportation Research Record Journal of the Transportation Research Board*, *1828*(1), 56-66.

Litman, T. (2016). *Economics of highway spending and traffic congestion*. Victoria Transport Policy Institute.

Moughtin, C. (2003). *Urban design: Street and square* (3rd ed.). Oxford: Architecture Press.

Mullaney, T., Lucke, J., & Trueman, S. J. (2015). A review of benefits and challenges in growing street trees in paved urban environments. *Landscape and Urban Planning*, *134*, 157-166.

Noaca. (2019). *Complete and green streets policy*, Noaca Policy Committee. <https://www.noaca.org>

Powell, K. E., Martin, L., & Chowdhury, P. P. (2003). Places to walk: Convenience and regular physical activity. *American Journal of Public Health*, *93*, 1519-1521.

PPS. (2015). *Project for Public Spaces*. <https://www.pps.org>

Reynolds, C. C., Harris, M. A., Teschke, K., Cipton, P. A., & Winters, M. (2009). The impact of transportation infrastructure on bicycling injuries and crashes: A review of the literature. *Environmental Health*, 8, 47.

Säumel, I., Weber, F., & Kowarik, I. (2016). Toward livable and healthy urban streets: Roadside vegetation provides ecosystem services where people live and move. *Environmental Science & Policy*, 62, 24-33.

Saunders, L., Green, J., Petticrew, M., Steinbach, R., & Roberts, H. (2013). What are the health benefits of active travel? A systematic review of trials and cohort studies. *PLOS ONE*, 8(8).

Selbig, W. R., Loheide, S. P., Shuster, W., Scharenbroch, B. C., Coville, R. C., Kruegler, J., Avery, W., Haefner, R., & Nowak, D. (2021). Quantifying the stormwater runoff volume reduction benefits of urban street tree canopy. <https://doi.org/10.1016/j.scitotenv.2021.151296>.

Smart Growth America. (2012). *National Coalition for Complete Streets*. <https://smartgrowthamerica.org/program/national-complete-streets-coalition/>

Transport for London. (2016). *How green infrastructure contributes to the healthy street approach*. <https://content.tfl.gov.uk/contributions-of-gi-to-healthy-streets-approach.pdf>

Transport for London. (2020). *Small change, big impact: A practical guide to changing London's public spaces*. <https://content.tfl.gov.uk/small-change-big-impact.pdf>

U.S. Department of Transportation. (2015). <https://www.transportation.gov/mission/health/complete-streets#:~:text=Complete%20Streets%20are%20streets%20designed,bicyclists%2C%20or%20public%20transportation%20riders.>

Photo credits:

URL 1. <https://smartgrowthamerica.org>

URL 2. <https://benefits.completestreets.org/how-it-works/>

URL 3. <https://www.planetizen.com/node/73723/celebrating-best-complete-streets-policies-2014>

URL 4. <https://smartgrowthamerica.org/what-are-complete-streets/>

URL 5. <https://www.epa.gov/>

URL 6. <https://www.hawkinspartners.com/>

URL 7. <https://www.portland.gov/bes>

URL 8. <https://www.epa.gov/>

URL 9. <https://www.healthystreets.com/what-is-healthy-streets>

URL 10. <https://www.bbc.com/news/av/uk-england-london-38901536>

URL 11. <https://tfl.gov.uk/>

URL 12. <https://www.healthystreets.com/>

URL 13. <https://jbriney.co.uk/case-studies/holborn-circus-remodelling-scheme/>

URL 14. <https://ogdendowntown.com/historic25th/>

URL 15. <https://mexico.itdp.org/>

URL 16. <https://www.flickr.com/people/marionzetta/>

URL 17. <https://www.pps.org/>

External references:

Complete Streets Design Guide. <http://atpolicy.org/resources/design-guides/complete-streets-complete-networks-design-guide/>

Green Streets Handbook. https://www.epa.gov/sites/default/files/2021-04/documents/green_streets_design_manual_feb_2021_web_res_small_508.pdf

NACTO. (2016). *Global street design guide*. The National Association of City Transportation Officials Global Designing Cities Initiative, Island Press.

Project for Public Spaces Placemaking Program. <https://www.pps.org/placemaking>

Transport for London - Healthy Streets Explained. <https://content.tfl.gov.uk/healthy-streets-explained.pdf>

City of Hartford. (2020). *Complete Street Plan.* <https://www.hartfordct.gov/public/cs-projects>

O'Connor, M. (Ed.). (2021). *Managing curb space in the Boston region: A guidebook.* Boston Region Metropolitan Planning Organization (MPO).