Article

Developing an Evidence-Based Framework of Universal Design in the Context of Sustainable Urban Planning in Northern Nicosia

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Abstract: Sustainable urbanism involves a wide range of issues, starting with the building unit and leading up to the city scale under the discourse of sustainability, including the four main dimensions of environmental, economic, cultural, and social. Universal design (UD) can be suggested as one of the significant catalysts of urban design parameters, which are among the basic elements of social sustainability. UD is significant in terms of providing solutions that meet the common needs of all individuals in built environments. There is a strong relationship between social sustainability and UD. Thus, adopting the concept of UD in the planning of urban spaces is crucial. Within this framework, via the relevant theoretical evaluation, a conceptual framework is constructed in order to explain universal design as a concept within the context of urban design parameters and social sustainability. Alongside discussing universal design as a term, urban design parameters and social sustainability are also discussed in order to explain the development of the theoretical model. Later, in the methodology section of the study, northern Nicosia has been chosen as the study area. A qualitative evaluation regarding the seven dimensions of universal design and a quantitative assessment based on the TSI standards, prepared including European directives/regulations, were applied to the chosen nine urban space items on the avenue. Based on the findings at Şht. Kemal Ünal Avenue, it can be concluded that urban spaces in northern Nicosia do not achieve a convenient environment for all individuals to the greatest extent possible. Further, in the discussion section of the study, several suggestions are presented for the improvement of streets, taking into account UD principles. These suggestions refer to the stops, sidewalks, pedestrian crossings, urban furniture, and equipment on the avenue. In sum, it is expected that the qualitative and quantitative analyses undertaken and the literature review, including a theoretical model, will contribute to the existing knowledge on the terminology of universal design in the context of social sustainability.

Keywords: universal design; urban design parameters; social sustainability; qualitative and quantitative analysis; northern Nicosia

1. Introduction

Urbanization is occurring globally [1]. 2008 marked the first time that over half of the world’s population were urban dwellers, and these numbers are set to increase [2]. The world’s urban population is projected to increase further to 70% by 2050 [3]. As such, in enlarging cities, the variety of individuals is also increasing. Various individuals live together in urban environments, including those with disabilities.

Within this urbanization era, all four pillars of sustainability have been acknowledged in order to provide solutions to the challenges occurring at an accelerated rate. Thus, from the late 1950s onwards, sustainable urbanism emerged as a new discourse within the framework of sustainability and has been acknowledged as an urban development and planning concern, predominantly in developed countries [4].
Sustainable urbanism involves a wide range of issues, starting with the building unit and leading up to the city scale. The energy performance of buildings and energy-efficiency awareness are among the fundamental topics at the building level [5]. These headlines may increasingly vary as the scale expands, covering issues such as urban form, transportation, etc., under the discourse of sustainability, including the four main dimensions of environmental, economic, cultural, and social.

Social sustainability (SS) is one of these dimensions and involves a broad, open definition [6]. For instance, Eizenberg and Jabareen (2017) argue that social sustainability as a concept seeks to enhance the conservation of individuals, regardless of race, origin, culture, or socio-economic status, against peril by fostering the adaptation of just and equitable social, economic, and environmental policies. In addition, it can be suggested that social sustainability relates to how the environment influences the human quality of life from a humanistic perspective. Thus, it can be argued that a socially sustainable built environment should be created according to the requirements of a variety of its users. In other words, there is a strong relationship between universal design criteria and social sustainability. It is crucial to take into account the inclusion and advancement of persons who have been excluded from interacting in society for different reasons [7]. In this context, it is reasonable to adopt the concept of universal design, which aims to create designs for common use. This includes urban spaces, such as streets, squares, green spaces, parks, etc., for different user groups.

The common needs of all individuals who use urban spaces can be resolved by adopting the universal design concept. Universal design (UD) was described as “products and environments created to be usable by all individuals, to the greatest extent possible, without the need for adaptation or specialized design” by Mace in 1985 [8]. UD is highlighting the importance of recognizing and understanding that human beings will have different steps in their abilities throughout their life [9]. In the design and composition of an environment that can be accessed, understood, and used to the greatest extent possible by all individuals, the aim of UD is to promote equal rights and opportunities for all individuals [10]. It also contributes to the increase in the quality of urban life. It addresses barriers faced by people with disabilities, older adults, children, and other populations who the design process typically overlooks. UD reduces stigma and provides benefits for all users [11].

The existence of public spaces plays an important role in the context of urban planning and design. There are many types of urban spaces, such as green areas, parks, streets, squares, boulevards, and avenues. They provide spaces needed for recreation and create chances for interaction between individuals [12,13]. Thus, urban spaces must be designed conveniently for everyone’s use, including all ages and abilities. In other words, the strict link between human beings and the built environment is the reason why our cities and settlements need high-quality urban spaces, in order to enhance the social dimensions of everyday life [14]. Public spaces have the power to connect people and they could be a center for political, economic, and cultural activities [12,15,16]. In the broadest sense, humans as social beings produce their own life, their own consciousness, and their own world. ‘Nature’ itself, as apprehended in social life by the sense organs, has been modified, and therefore in a sense, produced [17]. Individuals have created the artificial environment by interfering with the natural environment according to their needs. In this case, urban spaces are one of the main domains of the urban fabric that are crucially required to serve all users to the greatest extent possible. The street is one of the main types of urban public space, built to relieve the basic requirements of individuals as social beings. The street has been valued as the most prevalent public space in a city by numerous empirical studies on urban space [18].

In line with these studies, the neighborhood of Taşkınköy, in the northeast of northern Nicosia, is selected as the study area. Although there are many related issues, such as regulations and standards to ensure UD principles, it is not possible to argue that urban spaces have the ability to achieve UD requirements in the city. In other words, it seems that northern Nicosia has an urgent need to improve its urban design dynamics and to
apply universal design principles within its urban design efforts. As a city, it has significant deficiencies with regards to the quality of urban environments, including urban spaces such as parks, squares, streets, and avenues. Therefore, this study aims to make an assessment and thorough analysis of a chosen avenue in the Taşkınköy neighborhood in terms of the seven universal design principles, both quantitatively and qualitatively.

It can be argued that this study has the potential to expand and embody knowledge on the evaluation and assessment of UD within urban planning and design studies from an international perspective while focusing on a local case. Hence, UD as an emerging interdisciplinary field of approach requires disparate research insights, and this study involves the benefit of contributing to the existing scientific discourse.

After the introduction, the next section summarizes the relevant literature on UD. Within the review of relevant theoretical evaluations, a conceptual framework is constructed in order to define universal design and explain its impact within the context of urban design parameters and social sustainability. Following this, the materials and methods applied in the selected neighborhood are explained, and analyses and evaluations of the study area are given. The final section contains a conclusion based on the literature review, analyses, evaluation, and suggestions.

2. Literature Review

2.1. Universal Design

Day by day the world is becoming more urbanized. The population in that industrialized world is now much more diverse. Disadvantaged individuals, who constitute 15% of the world’s population, are considered to be the largest minority in the world [2,19]. However, in many scientific fields, the definition of disability is defined in the “social” model rather than the “medical” model, and it is accepted that individuals are actually determined as disabled by society [2,19–21]. Accordingly, the concept of disability is an umbrella term used for physical disabilities, activity limitations, and refers to the negatives between the individual and contextual factors (environmental and personal factors) [19]. Since the 1980s, the concept has been considered as a social issue rather than a medical dimension. In this context, “disability” is the result of the interaction of individuals and their environment and is not related to individuals’ inadequacies [22].

On the other hand, there has been an increase in the number of elderly individuals due to the increase in the average life expectancy. The number of individuals with functional difficulties is also rising as the population gets older [23]. Thus, in the last few decade, several terms have been introduced to propose equal opportunities for all individuals living in urban environments. Accessible design, barrier-free design, adaptable design, usable design, inclusive design, design for all, and universal design are among these terms. Universal design is one of the most prominent approaches among these concepts. It is accepted as the most inclusive approach put forward as a solution to the problem of discrimination in design [24,25]. It can be used from product design to urban design.

Universal design as a new terminology was first used and promoted in the United States by Mace in 1985 to communicate a design approach that could be utilized by a wider range of users [26]. In a conference presentation, Mace (1998) [27] commented that he was often questioned about barrier-free design, universal design, and assistive technology. He then suggested that universal design’s focus is not specifically on people with disabilities, but all people. This approach is a philosophy of design that removes distinctions among varying abilities [28].

Pioneered by the Mace approach, a multidisciplinary group of experts at the Center for Universal Design at North Carolina State University wrote certain principles in 1997 to clarify the scope of UD, as it was perceived in the mid-1990s, and to provide guidance in both design and evaluation activities [11]. Accompanied by a set of guidelines for each principle, they were a valuable tool for clarifying universal design for early adopters and are still widely used today [29]. In the field of the built environment, the seven principles
of UD are designed to promote universal accessibility [30] and they have been accepted in design practice in many fields. Table 1 below displays these principles.

**Table 1. Principles of UD [31,32].**

| Principle                        | Description                                                                 | Design Details                                                                 |
|---------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| **Equitable use**               | The design is useful and marketable to individuals with diverse abilities.   | • Provide the same means of use for all users. Identical whenever possible,    |
|                                 | It aims to find solutions that are fair to everyone and are offered          | equivalent when not.                                                          |
|                                 | for equal use to everyone.                                                   | • Avoid segregating or stigmatizing any users.                                |
|                                 |                                                                            | • Make provisions for privacy, security, and safety equally available to all   |
|                                 |                                                                            | users.                                                                        |
|                                 |                                                                            | • Make the design appealing to all users.                                     |
| **Flexibility in use**          | The design accommodates a wide range of individual preferences and abilities.| • Provide choice in methods of use.                                          |
|                                 | This principle is about allowing users to select a suitable alternative for  | • Accommodate right- or left-handed access and use.                           |
|                                 | them.                                                                       | • Facilitate user accuracy and precision.                                     |
|                                 |                                                                            | • Provide adaptability to user pace.                                          |
| **Simple and intuitive use**    | Use of the design is easy to understand, regardless of the user’s experience| • Eliminate unnecessary complexity.                                          |
|                                 | , knowledge, language skills, or current concentration level. It ensures   | • Be consistent with user expectations and intuition.                         |
|                                 | that the designer makes the design understandable to all. This principle    | • Accommodate a wide range of literacy and language skills.                   |
|                                 | is providing simplicity in design, reducing unnecessary complexity, and     | • Arrange information consistent with its importance.                        |
|                                 | providing information in a consistent manner.                              | • Provide effective prompting and feedback during and after task completion.  |
| **Perceptible information**     | The design communicates necessary information effectively to the user,     | • Use different modes (pictorial, verbal, tactile) for redundant presentation |
|                                 | regardless of ambient conditions or the user’s sensory abilities.           | of essential information.                                                     |
|                                 |                                                                            | • Maximize “legibility” of essential information.                            |
|                                 |                                                                            | • Differentiate elements in ways that can be described (i.e., make it easy  |
|                                 |                                                                            | to give instructions or directions).                                         |
|                                 |                                                                            | • Provide compatibility with a variety of techniques or devices used by     |
|                                 |                                                                            | people with sensory limitations.                                             |
| **Tolerance for error**         | The design minimizes hazards and the adverse consequences of accidental    | • Arrange elements to minimize hazards and errors. Most used elements are    |
|                                 | or unintended actions. In other words, designs should be designed to       | most accessible, hazardous elements are eliminated, isolated, or shielded.   |
|                                 | minimize errors and accidents that may arise from user behavior.           | • Provide warnings of hazards and errors.                                     |
|                                 |                                                                            | • Provide fail-safe features.                                                 |
|                                 |                                                                            | • Discourage unconscious action in tasks that require vigilance.             |
| **Low physical effort**         | The design can be used efficiently and comfortably and with minimum        | • Allow user to maintain a neutral body position.                             |
|                                 | fatigue.                                                                    | • Use reasonable operating forces.                                            |
|                                 |                                                                            | • Minimize repetitive actions.                                                |
|                                 |                                                                            | • Minimize sustained physical effort.                                         |
| **Size and space for approach    | Principle of appropriate size and space is provided for approach, reach,    | • Provide a clear line of sight to important elements for any seated or      |
| and use**                       | manipulation, and use, regardless of user’s body size, posture, or         | standing user.                                                                |
|                                 | mobility.                                                                   | • Make reach to all components comfortable for any                            |
|                                 |                                                                            | seated or standing user.                                                      |
|                                 |                                                                            | • Accommodate variations in hand and grip size.                              |
|                                 |                                                                            | • Provide adequate space for the use of assistive devices or personal       |
|                                 |                                                                            | assistance.                                                                   |

In other words, UD is a strategy that has a core target to make the design and combination of disparate environments and products usable for everyone without the need for adaptation or specialized design solutions [33]. In addition, universal design should be comprehensive from origin to destination for the greatest possible range of potential users [34]. Therefore, it can be additionally argued that if the universal design is properly conceived and implemented, it is not noticeable because it simply works [35].
At this point it can further be argued that UD can be an influential tool for generating urban design parameters; in other words, universal design is a significant variable stimulating the parameters that are required for creating sustainable, livable urban environments. The mere application of universal design principles would not be sufficient to obtain sustainable urban environments, but it is suggested to be one of the significant catalysts of urban design parameters, which are among the basic elements of social sustainability.

2.2. Urban Design Parameters

Whyte (2000) [36] stated that a successful urban environment should be accessible, individuals should engage in different activities, the place should have a comfortable or good image and support social activities, and they should be friendly places where individuals can interact. It can be argued that universal design has a direct link with urban design parameters, which are required to create sustainable urban environments. In other words, it can be an efficient tool in terms of fulfilling the urban design parameters that target the requirements of human needs in urban environments.

As a broad issue, urban design parameters can be defined with various features. In other words, different scholars point out disparate elements for explaining these parameters. Hence, all these parameters are interrelated and broad within their own terminologies. In this study, it is suggested that the main features of the urban design parameters are accessibility, connectivity, walkability, safety, adaptability, legibility, and comfort; universal design has a direct positive impact on all of these items.

Accessibility refers to the extent to which streets enable all individuals to reach, enter, use, and walk around places they need or wish to visit, regardless of any physical, sensory, or mental impairment. In other words, accessibility is the encounter between the person’s or group’s functional capacity and the design of the physical environment [37]. This term can be discussed in different scales of the urban environment and a number of approaches can be used to assess accessibility [38]. In addition, according to several scholars, this term can also be used as sub-indicator of walkability. It is also closely related with connectivity. Connectivity is defined as the directness and availability of alternative routes from one point to another within a street network. Inter-sections per square mile of area and the ratio of straight-line distance of network distance are among the measures of this term [39]. Additionally, Moura et al., (2017) [40] define connectivity as the extent to which the pedestrian network links to key trip origins and destinations, as well as the extent of linkages between different routes on the network.

As another parameter, walkability is defined as “the extent to which the built environment supports and encourages walking through providing safety, and high level of accessibility and connectivity to destinations, and visual interest within a reasonable span of time” [41]. Walkability is essential for a sustainable city. An urban environment is walkable if the entire system of public corridors is walkable, and people can live without dependency on the automobile. Litman (2011) [42] further suggests that the term ‘walkability’ refers to the quality of walking conditions in an urban space, inclusive of comfort, safety, connectedness, and permeability (inclusiveness of neighborhood design). Pedestrian movements are one of the real systems that make up the city [43]. In addition, according to Henri Lefebvre, for the user who leaves her home and moves on foot, the area where the space/time relation is most suitable is the neighborhood [44]. Further, Owen et al., (2007) [45] argue that the standard elements of neighborhood walkability are street connectivity, land-use mix, proximity to destinations, and population density.
In addition, another significant parameter is the term ‘safety’. Safety is one of the determinants of an accessible and walkable environment. Good structure of street networks and clearly defined pedestrian districts can create better, more comfortable, and safer conditions for individuals [46]. Safety refers to the extent to which streets enable people to use, enjoy, and move around the outside environment without fear of endangerment. In this study, the term safety is used differently from the term ‘security’. Security is related to issues of crime, whereas safety is related to physical comport and ease conditions of the individual.

Further, as another parameter, adaptability offers the ability to change easily to social, technological, and economic conditions, creating conditions for development which support a city’s capacity to respond to changing circumstances [47]. In recent years, the importance of adaptability and resilience of public spaces against pressures has increased [48].

Legibility is another urban design parameter and can be defined as the ability to portray a clear image that is easy to understand and perceive. Recognizable routes, intersections, edges, and landmarks are among the measures of legibility. A legible environment is distinctive and ordered to help the resident orient himself, place parts of the city into coherent categories, and acquire a sense of security that he can relate to the surrounding urban world [49] (Sternberg, 2000). In addition, comfort is another parameter for the urban environment. In order to maximize user experience in urban spaces, it is important to provide comfortable conditions. It involves physiological, psychological, and physical measures.

In sum, urban design parameters have a direct influential link with the universal design concept, and they can be efficient factors used to boost the social dimension of sustainability in urban environments. Social sustainability involves various tangible and intangible features. These urban design parameters are among the tangible or physical items of social sustainability, alongside sustainable urban forms such as compactness, density, sustainable transportation, etc. [50]. Social sustainability also involves subjective qualities as non-physical indicators, such as equity, quality of life, social justice, etc.

2.3. Social Sustainability

Much emphasis has been given to environmental and economic aspects in the discussion of mainstream sustainability; however, social sustainability (SS) is equally important but has often been neglected [51]. SS relates to how the environment influences the human quality of life; thus, a socially sustainable built environment should be created through smart planning and design. It is related to issues including cultural identity, life quality, human health and safety, stability, justice, equity, and accessibility, as well as social justice, poverty, human rights, and gender equity topics.

Urban social sustainability is described as “the continuing ability of a city to act as a long term, the viable setting for peoples’ communication, interaction and cultural progress” [52]. Littig and Grießler argue that social sustainability approaches are not founded on theory but rather on the social implications of environmental political goals [53]. However, Polese and Stren offer a global definition of social sustainability with an emphasis on urban environments. They focused on the social (civil society, cultural diversity, and social integration) and economic dimensions of sustainability without forgetting the value of the physical context (e.g., public spaces, houses, design) within urban sustainability [54].

Further, as a broad concept, SS has tangible and intangible measures; it contains physical and nonphysical features, in other words. Involving a large spectrum of indicators, SS can even be handled at individual, relational, and institutional levels [55]. Among non-physical indicators, the main ones can be listed as equity, social justice, poverty, security, human rights, gender equality, quality of life, and topics such as sense of place, identity and culture, social capital, and cohesion [50,56–58]. In addition, among the physical indicators of social sustainability are sustainable urban design parameters and sustainable urban forms, including accessibility, safety, walkability, and sustainable urban forms that can be fulfilled with features such as compactness, density, sustainable transportation modes, mixed land uses, and ecological design [50,59–62]. At this point, it can be argued that universal design
has a direct link with the items of sustainable urban design parameters (which can be listed as physical indicators), and it can create an indirect link with sustainable urban forms and eventually with non-physical SS parameters. See Table 2.

Table 2. Social sustainability indicators including urban design parameters.

| Physical Indicators                          | Non-Physical Indicators             |
|---------------------------------------------|-------------------------------------|
| *Sustainable Urban Forms                    |                                     |
| Compactness                                 |                                     |
| Density                                     |                                     |
| Sustainable transportation                  | *Equity                             |
| Mixed land uses                             | *Security                           |
| Ecological design                           | *Poverty                            |
| *Sustainable Urban Design Parameters        | *Human Rights                       |
| Accessibility                               | *Social Justice                     |
| Connectivity                                | *Quality of Life                    |
| Walkability                                 | Sense of place                      |
| Safety                                      | Identity and culture                |
| Adaptability                                | Social capital                      |
| Legibility                                  | Social cohesion                     |
| Comfort                                     |                                     |

*"*" symbol defines main indicators of SS.

In sum, it can be briefly suggested that UD (applied in different scales of the built environment with the help of seven main principles) has a positive impact on urban design parameters. The urban design parameters are among the physical components of social sustainability. As a comprehensive concept, alongside tangible components, social sustainability involves non-physical components. With the help of these indicators within these two main classifications, SS is one of the four main pillars of sustainable urban environments. The conceptual model of the study is displayed below as Figure 1.
Figure 1. Conceptual framework of the study representing the link between UD and sustainable urban environments.
3. Material and Methodology
3.1. Research Area

Cyprus is the 3rd largest island in the Mediterranean. It has an important strategic location in the world. The Greek and Turkish communities had lived together for many years in Cyprus. Following the inter-communal conflicts in the 1960s and the events of 1974, the island was divided into 2 parts as north and south Cyprus [63]. Northern Cyprus is divided into 6 districts (Nicosia, Famagusta, Kyrenia, Güzelyurt, İskele, Lefke). Nicosia, whose 2 sections are separated by a buffer zone, is the capital of both northern and southern Cyprus (Figure 2). It is also the central district of Northern Cyprus, with an area of approximately 502.19 km². The boundaries of the Nicosia district are Kyrenia in the north, the Greek Cypriot community in the south, Famagusta in the east, and the Morphou districts in the west [64].

Northern Cyprus has experienced rapid, unsustainable urban growth [65]. Urbanization started in the 1980s due to development in the economy, which prompted a demand in the mass-housing sector. This led to rapid construction of apartment blocks, detached, semi-detached, and terraced houses being built randomly across the country in both urban and suburban areas. This has led to poorly built urban environments lacking any political agenda for controlling urban planning, infrastructure, and physical quality [67]. Northern Nicosia, as the capital of Northern Cyprus, has suffered severely from this negative trend of urbanization, despite having a master plan for more than 30 years.
Northern Nicosia contains the administrative units (presidency, prime ministry, and other ministries) of the country. In addition, it is a city that has different intense financial and social activities. Furthermore, Nicosia includes private and public schools (from nursery to high school) and different university campuses involving a diversity of users.

Northern Nicosia includes many districts. The Taşkınköy neighborhood, selected for the study, is a developing region of northern Nicosia. It is one of the densely used neighborhoods. It has a large population. There are many urban spaces in the Taşkınköy neighborhood. In this study, Şht. Kemal Ünal Avenue, as one of the densely used urban spaces of the neighborhood, was examined and analyzed. See Figure 3.

**Figure 3.** Taşkınköy neighborhood and Şht. Kemal Ünal Avenue.

Şht. Kemal Ünal Avenue, a 2-lane road that was chosen as the research area, was inspected onsite. There are public car parking areas parallel to the road and 2 bus stops on this avenue. Furthermore, there are 2 traffic lights, each one located at 2 opposite points of the avenue. In addition, there are various pieces of urban furniture (lighting elements, garbage cans, signs, cash dispensers, flowerpots, etc.) items located at different points along the avenue. There are also pedestrian crossings at 2 different points. Speed limiter ramps are positioned for the pedestrian crossings. The onsite analysis was completed in May 2020. The details of this mapping can be seen in Figure 4.
3.2. Research Design

Within the scope of the research, Şht. Kemal Ünal Avenue, which is one of the densest mixed-use axes of the Taşkınköy neighborhood in Nicosia with a high population density and diversity, is examined. First, the current condition of the randomly selected 9 items in the selected urban space was evaluated in terms of material, size, and location in accordance with the 7 elements of universal design. Evaluated items were photographed and measurements were taken. Chosen urban space items were evaluated qualitatively for each of the 7 UD principles. The impact of these evaluated items on sustainable urban design parameters is further analyzed within this part of the research.

Additionally, as the quantitative part of the research, the chosen urban space items were assessed in terms of size properties according to the Turkish Standards Institution (TSI)

Figure 4. The details of the Şht. Kemal Ünal Avenue analysis in terms of road type, car parking, bus stops, pedestrian crossings, and traffic lights.
standards, prepared by taking into account international standards, including the European directives/regulations. Two disparate tables were created separately for qualitative and quantitative evaluation. Although there are no checklist or concrete standards for UD, there are several merits that designers use as a reference. In this research, alongside the qualitative evaluation, the Turkish Standards Institution (TSI) [68] (TSI, 2021) is referenced and an assessment in terms of size is completed for the evaluated urban space items. The items were assessed and displayed as appropriate (A) or inappropriate (I). TSI, as a standardization body, enables clients to gain access to the European and Gulf market by ensuring their products meet all CE mark requirements according to European directives/regulations and G mark requirements, according to GSO regulations. The assessed items were (Figure 5):

1. Garbage cans
2. Signs
3. Bus stops
4. Parking lots
5. Sidewalks/walking paths
6. Pedestrian crossing
7. Traffic lights
8. Flowerbox
9. Cash dispenser

Figure 5. The assessed urban space items on Şht. Kemal Ünal Avenue.

4. Findings

Based on the findings and according to the qualitative evaluation, it can be argued that evaluated urban space items including signs, parking lots, etc., mostly do not carry the properties of the UD principles. Pedestrian crossing widths are appropriate for the ‘size and space for approach and use’ principle of UD. Pedestrian crossings are also appropriate regarding the ‘tolerance for error’ principle, as there are ramps on two sides of the crossings.
decreasing the speed. In addition, bus stops seem appropriate according to the same UD principle as there is space left for wheelchair users or parents with strollers to stand at the bus stop. The signs slightly fulfill the ‘flexibility in use’ principle of UD as the board is written in two languages (Turkish and English), although visually impaired and illiterate individuals cannot understand the explanation. Furthermore, garbage cans also fulfill the ‘flexibility in use’ principle as they vary in material, size, and positioning. However, it is not easy to increase the positive comments about the qualitative evaluation. It can further be commented that the rest involves negative evaluation for the application of UD principles.

In the light of the quantitative assessment, nine chosen urban space items are measured in relation to TSI standards. Based on the quantitative assessment, it can be commented that only one evaluated item’s size is appropriate regarding the standards measured, the rest were assessed to be inappropriate. The data are given in the rubric as Tables 3 and 4.

According to the findings displayed in Tables 3 and 4 above, as also hypothesized by the study, it can be concluded that the avenue’s existing universal design features do not achieve a convenient, qualified environment for all individuals. Based on the qualitative evaluation, it can be argued that the evaluated urban space items, including signs, parking lots, etc., mostly do not carry the properties of the UD principles. Merely a few properties of the items match with the UD principles. In addition, based on the quantitative assessment made according to TSI standards and including European directives/regulations, it can be commented that only one evaluated item’s size is appropriate, and the rest were assessed to be inappropriate.

In Table 3 the impact of these items on sustainable urban design parameters is further investigated according to a score as positive (✓), negative (x) or none (o), alongside the evaluation of urban space elements in terms of universal design principles. Accordingly, it has been determined that this boulevard with its elements has a relatively low impact on urban design parameters to boost social sustainability. In sum, it is not possible to define northern Nicosia urban spaces as boosting urban design parameters or having the ability to achieve the required dynamics for everyone’s usage.

Limitations of the Study

The study aimed to make an assessment and thorough analysis of a chosen avenue in the Taşkınköy neighborhood in terms of the seven universal design principles, both quantitatively and qualitatively. As a limitation of the research, the type and quantity of urban spaces for assessment can be increased. Scientific work can further be conducted in different urban spaces of different neighborhoods of the city in order to better evaluate the universal design principles in northern Nicosia. Furthermore, more theoretical models are needed to investigate the link between UD, universal design parameters, and sustainable urban environments.
Table 3. Evaluation in terms of UD principles.

| Evaluated Item | Visual (S) | UD Principles | Evaluation | Sufficient (S)/Insufficient (I) |
|----------------|------------|---------------|------------|---------------------------------|
| Garbage Cans   |            | Equitable use | Garbage cans can be used by different profiles of users, including disabled ones. | S |
|                |            | Flexibility in use | They vary in material, size, and location. For this reason, it offers users opportunities for different needs. | S |
|                |            | Simple and intuitive use | Its function is easily understood by everyone. | S |
|                |            | Perceptible information | It is made of material with a contrasting color to its surroundings, increasing its perceptibility. | S |
|                |            | Tolerance for error | Users may have instant accidents because of the location. | I |
|                |            | Low physical effort | Short individuals or children cannot reach easily. | I |
|                |            | Size and space for approach and use | They are not suitable for the approach and use of children, short individuals, or wheelchair users. | I |

| Sustainable Urban Design Parameters | Accessibility | Connectivity | Walkability | Safety | Adaptability | Legibility | Comfort |
|-------------------------------------|---------------|--------------|-------------|--------|--------------|------------|---------|
| Score                               | ✓ Positive    | x            | x           | x      | o            | o          | o       |
| x                                   | Negative      | o            | x           | x      | o            | o          | o       |
| o                                   | None          | o            | x           | x      | o            | o          | o       |
### Table 3. Cont.

#### Urban Space Evaluation Form

| Evaluated Item | Visual (S) | UD Principles | Evaluation | Sufficient (S)/Insufficient (I) |
|----------------|------------|---------------|------------|---------------------------------|
| Signs          |            | Equitable use | They cannot be used by illiterate and visually impaired individuals. | I |
|                |            | Flexibility in use | Since the information board is written in two languages (Turkish and English), individuals can choose the one that suits them. However, visually impaired and illiterate individuals cannot understand the explanation. | I |
|                |            | Simple and intuitive use | The signs and keys on the device are self-explanatory. However, there is no explanatory tool for the visually impaired. | I |
|                |            | Perceptible information | Information is not perceivable by all individuals. | I |
|                |            | Tolerance for error | Due to its location on the pavement, it is dangerous for people who walk distractedly or have poor eyesight. | I |
|                |            | Low physical effort | It is sufficient to press the keys for use easily. | S |
|                |            | Size and space for approach and use. | It is suitable for the approach and use of various users. | S |

#### Sustainable Urban Design Parameters

| Sustainable Urban Design Parameters | Accessibility | Connectivity | Walkability | Safety | Adaptability | Legibility | Comfort |
|-------------------------------------|---------------|--------------|-------------|--------|--------------|------------|---------|
| Score                               | ✓ Positive    | x Negative   | o None      | x      | ✓            | o          | ✓       |
### Table 3. Cont.

| Evaluated Item | Visual (S) | UD Principles | Evaluation | Sufficient(S)/Insufficient (I) |
|----------------|------------|---------------|------------|-------------------------------|
| Bus Stop       |            | Equitable use | There is only one type of seating element. (h:50cm. w: 122cm. d: 40 cm.) | I |
|                |            | Flexibility in use | A pavement ramp is not considered to overcome the level difference in order to reach the bus stops. | I |
|                |            | Simple and intuitive use | Necessary markings and directions have not been made so that the stops can be seen from a distance. | I |
|                |            | Perceptible information | There is no information board at the bus stops. | I |
|                |            | Tolerance for error | Since transparent material is used, it poses a danger to users visually impaired. | I |
|                |            | Low physical effort | Bus stops cannot be accessed without physical effort by users with wheelchairs. There is no ramp and textured surface. | I |
|                |            | Size and space for approach and use | Sufficient space has been left for wheelchair users or parents with strollers to stand. | S |

| Sustainable Urban Design Parameters | Accessibility | Connectivity | Walkability | Safety | Adaptability | Legibility | Comfort |
|-------------------------------------|---------------|--------------|-------------|--------|--------------|------------|---------|
| Score                               | ✓ Positive    | x Negative   | ✓           | x      | x            | ✓          | x       |
### Table 3. Cont.

| Evaluated Item | Visual (S) | UD Principles | Evaluation | Sufficient (S)/Insufficient (I) |
|----------------|------------|---------------|------------|----------------------------------|
| Parking Areas  |            | Equitable use | Parking spaces parallel to the road do not offer equal usage for all individuals. There is no car parking area for disabled users. | I                      |
|                |            | Flexibility in use | Disabled parking space has not been arranged considering different types of users. | I                      |
|                |            | Simple and intuitive use | The parking lots along the street are not clearly distinguishable and understandable in terms of materials and design. | I                      |
|                |            | Perceptible information | There are information signs and payment points about parking times and pricing on the street. | S                      |
|                |            | Tolerance for error | The floor covering is deformed. It is dangerous for users. | I                      |
|                |            | Low physical effort | A curb ramp is not considered for access from the parking lot to the sidewalk. | I                      |
|                |            | Size and space for approach and use | Except for the manoeuvring area, it does not comply with the parking dimensions (250/500 cm.) determined for the vehicle. | I                      |

| Sustainable Urban Design Parameters | Accessibility | Connectivity | Walkability | Safety | Adaptability | Legibility | Comfort |
|------------------------------------|---------------|--------------|-------------|--------|--------------|------------|---------|
| Score                              | ✓ Positive    |              | ✓           |        | x            | o          |         |
### Table 3. Cont.

#### Urban Space Evaluation Form

| Evaluated Item            | Visual (S) | UD Principles                                                                 | Evaluation                                                                 | Sufficient (S)/Insufficient (I) |
|---------------------------|------------|--------------------------------------------------------------------------------|----------------------------------------------------------------------------|---------------------------------|
| Sidewalk/Walkway          |            | Equitable use                                                                  | User diversity has been neglected. Sidewalk ramps have not been created and textured surfaces have not been used. The pavement surfaces are partially destroyed. | I                               |
| Flexibility in use        |            | Flexibility in use                                                             | Sidewalks along the street differ in terms of material size. Different users have not been taken into account, design has not been made according to user needs, such as pavement. | I                               |
| Simple and intuitive use  |            | Simple and intuitive use                                                       | Pavement areas are distinguished.                                         | S                               |
| Perceptible information   |            | Perceptible information                                                        | The property area, pedestrian area, and safety lane have not been determined separately. | I                               |
| Tolerance for error       |            | Tolerance for error                                                            | Different elements, such as lighting in the pavement, cover the walking area and can cause an accident. | I                               |
| Low physical effort       |            | Low physical effort                                                            | There are no sidewalk ramps that help to ensure the continuity of the sidewalks. | I                               |
| Size and space for approach and use |    | Size and space for approach and use                                             | Although the user density is the same, the sidewalk widths vary along the street. | I                               |

#### Sustainable Urban Design Parameters

| Score | Sustainable Urban Design Parameters | Accessibility | Connectivity | Walkability | Safety | Adaptability | Legibility | Comfort |
|-------|-------------------------------------|---------------|--------------|-------------|--------|--------------|------------|---------|
| ✓     | Accessibility                       | x             | x            | x           | x      | x            | o          | x       |
| x     | Negative                            |               |              |             |        |              |            |         |
| o     | None                                |               |              |             |        |              |            |         |
**Table 3. Cont.**

**Urban Space Evaluation Form**

| Evaluated Item | Visual (S) | UD Principles | Evaluation | Sufficient (S)/Insufficient (I) |
|----------------|------------|---------------|------------|----------------------------------|
| **Pedestrian Crossing** |            |               |            |                                  |
| Equitable use |            |               | It cannot be used equally by all users due to deficiencies and errors in physical arrangements. | I |
| Flexibility in use |            |               | User diversity is not taken into account. | I |
| Simple and intuitive use |            |               | It can be easily perceived from a certain distance because of the warning lines drawn on the floor. In addition, there are speed limiter ramps for vehicles located close to the pedestrian crossing. In order to be perceived at night, flashing warning lights have been considered, despite their location being inside the pedestrian crossing. | S |
| Perceptible information |            |               | There are no guide tracks for visually impaired individuals. | I |
| Tolerance for error |            |               | It may cause accidents due to its damaged ground. In addition, accidents may occur in terms of the location of the flashing warning lights. Positively, there are ramps on two sides of the crossing decreasing the driver speed. | I |
| Low physical effort |            |               | The junction of the sidewalk and the pedestrian crossing is not at the same level and a ramp is not considered. | I |
| Size and space for approach and use |            |               | It is suitable for all users in terms of its size. (w = 400 cm) | S |

**Sustainable Urban Design Parameters**

| Accessibility | Connectivity | Walkability | Safety | Adaptability | Legibility | Comfort |
|---------------|--------------|-------------|--------|--------------|------------|---------|
| x             | ✔            | ✔           | x      | x            | o          | o       |

**Score**

- ✔ Positive
- x Negative
- o None
Table 3. Cont.

| Evaluated Item | Visual (S) | UD Principles | Evaluation | Sufficient (S)/Insufficient (I) |
|----------------|------------|---------------|------------|-------------------------------|
| Traffic Lights |            | Equitable use | It is positioned to control vehicle traffic. Pedestrians using the street are not considered. | I |
|                |            | Flexibility in use | There are no warning systems suitable for user diversity. | I |
|                |            | Simple and intuitive use | The colors of the lights have international validity. It is understood equally by all individuals. | S |
|                |            | Perceptible information | When approaching the traffic lights, there is no information sign stating that there is a traffic light at a certain distance. | I |
|                |            | Tolerance for error | Red light duration is arranged so that vehicles coming from different directions do not intersect. | S |
|                |            | Low physical effort | As it is automated, it does not require any physical power. | S |
|                |            | Size and space for approach and use | Light heights have dimensions that can be seen by users in the vehicle from a certain distance. (h = 346 cm.) | S |

| Sustainable Urban Design Parameters | Accessibility | Connectivity | Walkability | Safety | Adaptability | Legibility | Comfort |
|------------------------------------|---------------|--------------|-------------|--------|--------------|------------|---------|
| Score                              | ✓ Positive    |              | ✓           | o      | ✓            | o          | o       | o       |
Table 3. Cont.

| Evaluated Item | Visual (S) | UD Principles | Evaluation | Sufficient (S)/Insufficient (I) |
|----------------|------------|---------------|------------|---------------------------------|
| Flowerbox      |            | Equitable use | Since the flowerboxes cover the walking area on sidewalks, it is not suitable for visually impaired individuals or for individuals walking side by side as a group. | I |
|                |            | Flexibility in use | Flowerboxes can be used as a divider and surrounding element by positioning the long side of them parallel to the road. | I |
|                |            | Simple and intuitive use | Because of the positions of the flowerbeds, the connection points of the vehicle road and the sidewalks are controlled and can be distinguished. | S |
|                |            | Perceptible information | It is not designed in a contrasting color with the environment. For this reason, its detectability is low. | I |
|                |            | Tolerance for error | Location of the flowerboxes in the pavement cover the walking area, and they can cause an accident. | I |
|                |            | Low physical effort | Since it covers the walking area, it causes changes in direction when walking. It is not suitable in terms of low physical effort. | I |
|                |            | Size and space for approach and use | Its height is not sufficient to be perceived by individuals. (h: 42 cm) | I |

Sustainable Urban Design Parameters

| Accessibility | Connectivity | Walkability | Safety | Adaptability | Legibility | Comfort |
|---------------|--------------|-------------|--------|--------------|------------|---------|
| o             | ✓            | x           | x      | o            | o          | o       |
Table 3. Cont.

| Evaluated Item | Visual (S) | UD Principles                          | Evaluation | Sufficient (S)/Insufficient (I) |
|----------------|------------|----------------------------------------|------------|-------------------------------|
| Cash Dispenser |            | Equitable use                          | Due to its dimensions and the level difference between the pavement, it cannot be said to be of equal use. | I               |
|                |            | Flexibility in use                     | The user is not offered a choice in terms of dimensions for using machine. The principle of flexible use has been neglected. | I               |
|                |            | Simple and intuitive use               | Although the operation screen and keys are suitable for simple and intuitive use for different profile of users, illiterate individuals and/or visually impaired cannot use it. | I               |
|                |            | Perceptible information                | Information for using is not perceptible for illiterate individuals or the visually impaired. | I               |
|                |            | Tolerance for error                    | The level difference between the pavement and the access platform to the device can cause accidents. | I               |
|                |            | Low physical effort                    | The level difference for accessing the device indicates that it is not suitable for the low physical effort principle. | I               |
|                |            | Size and space for approach and use    | Due to its size and the access platform, it is not suitable for all individuals in terms of approach and use. | I               |

| Sustainable Urban Design Parameters | Accessibility | Connectivity | Walkability | Safety | Adaptability | Legibility | Comfort |
|-------------------------------------|---------------|--------------|-------------|--------|--------------|------------|---------|
| Score                               | ✓             | x            | o           | x      | x            | o          | o       |
|                                    | x             | o            | o           | x      | x            | o          | o       |
|                                    | o             | None         |             |        |              |            |         |
Table 4. Assessment of the urban space items according to TSI standards. [APPROPRIATE (A)/INAPPROPRIATE (I)].

| Urban Space Items      | Size                        | TSI Standards                  | A/I |
|------------------------|-----------------------------|--------------------------------|-----|
| Garbage Cans           | height: 130 cm              | height: 90–120 cm              | I   |
| Signs                  | height: 200 cm              | starting point height: 105 cm  | I   |
|                        |                             | end point height: 195 cm       |     |
| Bus Stops              | sitting element height: 50 cm| sitting element height: 41–46 cm| I   |
|                        | thick, non-matte, colored, reflective strips: not available | thick, non-matte, colored, reflective strips height: 100–140 cm| I   |
| Parking Lots           | width: 202 cm               | width: 250 cm                  | I   |
|                        | length: 472 cm              | length: 500 cm                 |     |
| Sidewalks/Walkway      | width: 145–856 cm (variable)| width: at least 150 cm         | I   |
| Pedestrian Crossing    | width: 400 cm               | width: min. 300 cm             | A   |
| Traffic Lights         | Height: 346 cm              | height: 450 cm                 | I   |
| Flowerbox              | height: 42 cm               | height: 70 cm                  | I   |
| Cash Dispenser         | card point height: 121 cm   | max. card point height: 110 cm | I   |
|                        | cash point height: 100 cm   | max. cash point height: 80 cm  |     |

5. Discussion

According to the analyses and evaluations, it can be concluded that Şht. Kemal Ünal Avenue’s existing UD features, examined within seven dimensions and TSI standards, do not achieve support to create a qualified environment for all individuals. Therefore, several suggestions are presented here for the improvement of the streets taking into account the UD principles. These suggestions are about the stops, sidewalks, pedestrian crossings, urban furniture, and equipment on the avenue.

With respect to the laws and legislations of many countries, all individuals have equal rights in society. This equality should also manifest itself in urban spaces. Although there are no specific checklists, there are some standards or rules that the designer applies when making designs for all users. Although these regulations may differ between countries, in general, they have the same aim guiding designers to create suitable environments and spaces for everyone, including the disabled. For example, there is Accessibility for the Disabled—A Design Manual for a Barrier-Free Environment by the United Nations. There are also standards from the ‘TS 12576 Urban Roads- Structural Preventive and Sign Design Criteria on Accessibility in Sidewalks and Pedestrian Crossings’ in Turkey and in addition there is a regulation titled “Chapter 96 (Fasıl 96)” in Northern Cyprus. They involve data regarding application measures and techniques for cities. When these three standards are examined, it is seen that they contain measures close to each other and have similar application techniques. Accordingly, some suggestions for northern Nicosia streets are presented below and these suggestions are supported by visuals.

5.1. The Stops

The stops are the places that have been designed to stop vehicles to transport passengers of different abilities and characteristic values (tall, short, young, elderly, etc.). Although public transportation vehicles are not widely used in Northern Cyprus, there are public transportation vehicles in the urban circulation network. There are stops at two different points of the avenue. There are some suggestions below for making these stops more suitable for users.

- Necessary markings and directions should be made so that they can be easily found and seen from a distance.
- The stops are located inside the pavement at present. They should be positioned outside the pavement width and should not block the walking area.
• Since transparent material is used, two 15 cm thick non-matte, colored, reflective strips should be attached 100–140 cm above the surface in order to not pose a danger to users with vision problems.
• At each stop, there should be a legible and illuminated information sign stating which public transport vehicle the stop belongs to, the route number of the vehicle, the route and the name of the stop.
• The height of this plate from the ground must be at least 220 cm. Informative boards at the stops should be at a maximum height of 110–130 cm. On these boards, the route plan of the public transportation vehicles that will come to that stop, the closest taxi stand to that stop, and important telephone numbers such as emergency health should be listed. The location of the stop should be indicated by an arrow on the route plan, and other public transport routes on the route and, if any, transferable stops should be highlighted. There should be a city map, divided into zones by color, showing important public buildings and main streets. The information on the board should be designed taking into account the visually impaired, by using letters with large buttons, embossed city maps and route plan, and if necessary, voice notification mechanisms should be used.
• Necessary markings and directions should be made so that the stops can be easily found and seen from a distance.
• If transparent material is used at the stops, two 15 cm thick glossy, colored, reflective strips should be attached 100–140 cm above the ground on these surfaces in order to not pose a danger to visually impaired pedestrians.
• The sitting element height of the bus stop should be 41–46 cm.

5.2. Sidewalks/Walkway

There are sidewalks on both sides of the road along the avenue. The widths of these sidewalks are not equal along the avenue, and they do not comply with the safety strip, sidewalk walking area and property area regulations given in the laws and regulations examined. In addition, paving materials are often not found on the pavements. Where it is found, it is damaged. There are some suggestions below for these sidewalks to be more convenient for users.
• They must be designed with the safety strip, sidewalk walking area and property area regulations given in the laws and regulations examined (Figure 6).
• The urban furniture (signs, flowerpots, trash cans, lighting elements, etc.) should be located within the safety strip area seen in the sidewalk section given in Figure 6.
• Damage to the sidewalk surface must be repaired and they should be covered with non-slip flooring materials without gaps.

![Figure 6. Sidewalk section [69].](image-url)
• In the walking area of the sidewalk given in Figure 6, tactile surfaces should be made so that the visually impaired can move forward safely. These surfaces should be in contrast with their surroundings and in a noticeable tone.
• There should be no elements, such as overhanging branches, thorny plants, or signboards, which are below the head recovery distance affecting (less than 220 cm height) the walking area on the sidewalk area.
• Ramps should be built to ensure transition and continuity between pavements. Ramps should be at a suitable slope with sufficient width to ensure safety and continuity so that all pedestrians, including persons with reduced mobility, can move freely.
• There should be no obstacles on the pavement so that all pedestrians, including those with limited mobility, can use the pavements safely and comfortably. All reinforcements that may create horizontal and vertical obstacles should be located in the pedestrian safety strip on the pavement.
• The width of the walking area on the sidewalk should be at least 150 cm so that all pedestrians, including those with limited mobility, can move freely. Minimum safety strip, walking area, and property strip widths on the sidewalk vary according to the pedestrian density.

5.3. Parking Areas

There are parking areas on the avenue parallel to the road. There are no areas reserved for disabled users in these car parks. In addition, even if one of the existing car parks is changed to accommodate disabled users, there is no ramp despite the level difference at the connection point with the pavement. There are some suggestions below for making these car parking areas more suitable for users.

• Parking spaces equal to 5% of the total number of parking lots should be arranged for disabled users [69].
• Markings should be made on the floor and on the vertically positioned plate in the parking spaces arranged for disabled users.
• Since the parking lot to be arranged is a parking lot parallel to the road, the required distance should be left for maneuvering and movement on the side and back of the parking space arranged for disabled users. Including these distances, parking spaces designed disabled users for one vehicle should be 700 cm/400 cm.
• The connection point from the parking lot to the pavement must be made with a ramp.
• Other parking spaces should be arranged in suitable dimensions for vehicles (250 cm/500 cm). They should be divided by lines on the floor.
• Disabled parking area dimensions (parallel to the road): width: 400 cm, length: 700 cm
• Standard parking area dimensions (parallel to the road): width: 250 cm, length: 500 cm [69].

5.4. Pedestrian Crossings

There are pedestrian crossings at two points on the avenue. There are some suggestions below for making these pedestrian crossings more suitable for users.

• The junction of the sidewalk and the pedestrian crossing is damaged. This damage must be repaired. The level difference between them must be overcome with a ramp. The material used for this ramp must be non-slip. The ramp width should be equal to the width of the pedestrian crossing.
• A warning surface should be laid at the beginning and end of the pedestrian crossing to ensure the safety of the visually impaired. In addition, there should be a guide mark on the ground along the pedestrian crossing.
• In order to be perceived at night in the current situation, the flashing warning lamps located inside the pedestrian crossing should be moved before and after the pedestrian crossing. Thus, drivers can be aware of the pedestrian crossing when approaching. Furthermore, the risk of hitting this element in moments of carelessness of the users within the net usable area of the pedestrian crossing will be eliminated.
• At pedestrian crossings without light control, drivers must be warned with a pedestrian crossing sign at least 20 m before the pedestrian crossing.
• Pedestrian crossings should be well lit from above, this lighting should be separate and brighter in a distinguishable change from road lighting.
• Pedestrian crossings should be well marked with landmarks.
• Pedestrian crossings on vehicle roads and intersections should not be cut with curbstones. Three-way inclined ramps should be built to the pedestrian path as wide as the width of the pedestrian crossing up to the vehicle road level. The ramp (slope 8%) should not overflow into the carriageway.
• In order to ensure the safe passage of visually impaired pedestrians, guide tracks and warning surfaces should be created in the surface texture of the level pedestrian crossings. The minimum width of the pedestrian crossing must be 300 cm.

5.5. Urban Furniture and Equipment

There are different type of urban furniture and equipment along the avenue. Some of them are garbage cans, signs, lighting elements, flowerboxes, and traffic lights. Below are some suggestions regarding these items for increased accessibility, walkability, and safety in this avenue.
• Urban furniture must be located within the safety strip and/or property strip specified on the pavement. They should not be positioned in the walking area.
• They should be in sizes suitable for everyone, including wheelchair users, short individuals, children, or they should be designed in different sizes and/or features to offer options to the user.
• Information signs and/or digital devices (such as parking area payment points) should be supported with the Braille alphabet, audio warning systems, and/or visual content, taking into account visually impaired and illiterate individuals.
• Lighting elements should have features to illuminate both the pavement and the vehicle road along the street.

The garbage cans are evaluated in Table 2. They should be chosen from materials that will not cause injuries, should be in a contrasting color, have a lid that can be used with one hand, and should be placed on the pedestrian safety strip. The height of them should be 90–120 cm.
• Signs are evaluated in Table 2. Information signs are texts and symbols used to convey information through sight, hearing, and touch. The height from the ground of the information on the signs should be arranged in such a way that there is a clear line of sight for the tall/short stature and the persons in between. (Starting height: nearly 105 cm.—Finish height: nearly 195 cm.) [69].

Traffic lights are interpreted in Table 2. At traffic lights with pedestrian control, traffic sign buttons should be placed at a height of 90–120 cm so that they can be used by disabled individuals. These buttons should be illuminated, audible, and vibrating so that visually and hearing-impaired pedestrians can use them. There should be embossed arrows on the buttons indicating the direction of the intersection. The height of the traffic lights from the ground must be at least 4.5 m.

In addition, the cash dispenser must have features suitable for the approach and use of wheelchair users (Figure 7). It should be suitable for a variety of users with its dimensions, audible warning systems, and tactile keys.
As the world is becoming more and more urbanized, the significance of universal design is increasing both in developed and developing countries. Recently, there has been a rising focus on providing equal opportunities for all people, including those with disabilities, in order for everyone to participate in social and communal life. There has been remarkable progress since the terminology of universal design was first proposed, and the emergence of universal design thinking can be witnessed in nations and regions throughout the world, including but not limited to Australia, Brazil, Canada, France, Germany, India, Ireland, Israel, Italy, the Netherlands, Norway, Southeast Asia, and Switzerland. However, such a paradigm shift has not dominated existing conventional mainstream design [71]; Northern Cyprus also involves additional regulative, administrative deficiencies, etc., and there are still challenges even in developed countries with legislative, institutional, and scientific backgrounds for this terminology. Therefore, for the total fulfillment of the required transformation, there is a need to continue focusing on the development of this term.

This study first develops a conceptual framework in order to explain how UD can be operated as a catalyst for creating sustainable urban environments. According to this theoretical model, UD, with the help of its seven principles, stimulates urban design principles as one of the two physical components of social sustainability. With the addition of sustainable urban form features (compactness, density, sustainable transportation, mixed land uses, ecological design) as physical components, and also non-physical items (equity, security, poverty, human rights, social justice, and quality of life), the social dimension of sustainability can be fulfilled. By constructing such a framework, this study hoped to obtain a holistic approach to determine the link between universal design and sustainable urban environments.

In the methodology part of the study, Taşkınköy in northern Nicosia, was chosen as the study area. A qualitative evaluation regarding the seven dimensions of universal design and a quantitative assessment based on TSI standards, prepared including European directives/regulations, were applied to the chosen nine urban space items of the avenue. Based on the findings, it can be concluded that northern Nicosia urban spaces do not achieve a convenient environment for all individuals to the greatest extent possible. As such Figure 8 displays the ratio of the findings for each evaluated item (garbage can, sign, bus stop, parking area, sidewalk, pedestrian crossing, traffic light, flowerbox, and cash dispenser) as sufficient or insufficient in terms of seven principles of UD. It can be commented that the adequacy of the items is relatively weak. Furthermore, it has been determined that this boulevard with its elements has a relatively weak impact on urban design parameters to boost social sustainability.

Figure 7. Cash dispenser example [70].

6. Conclusions
Figure 8. The ratio of the findings as sufficient or insufficient in terms of the seven principles of UD for each evaluated item in Şht. Kemal Ünal Avenue.

In sum, the authors hope that alongside theoretical evaluation, field work involving qualitative and quantitative analysis can expand the existing scientific knowledge of UD. Briefly, this study has focused on the importance of considering the concept of universal design for urban spaces. It is expected that the qualitative and quantitative analyses made and the literature review, including a theoretical model, will contribute to the existing knowledge on the terminology of universal design in the context of social sustainability.

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