

# Analysis of Particular Design Methods for Aging Landscapes in Residential Areas

Xiangyun Wang<sup>1,2</sup>, Alamah Misni<sup>3\*</sup>, Siti Nor Afzan Buyadi<sup>4</sup>,  
Nur Hidayah Sobbri<sup>5</sup>

<sup>1</sup>Shandong Youth University of Political Science, Jingshi Dong Lu 31699, Jinan City, Shandong, China.

<sup>2</sup>Study of Postgraduate, College of Built Environment, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia.

<sup>3</sup>Study of Landscape Architecture, College of Built Environment, Universiti Teknologi MARA, 42300 Shah Alam, Selangor, Malaysia

<sup>4</sup>Unit Dasar, Bahagian Koordinasi TVET, Jabatan Pendidikan Politeknik & Kolej Komuniti, Aras 7, Galeria PjH, Jalan P4W, Persiaran Perdana, Presint 4, 62100 Putrajaya, Malaysia

<sup>5</sup>Arkitek Urbanisma Sdn. Bhd., No.8, Jalan USJ 9/5R, Subang Business Centre, 47620 UEP Subang Jaya, Selangor, Malaysia

---

## ARTICLE INFO

### Article history:

Received 15 May 2024

Revised 25 August 2024

Accepted 26 September 2024

Online first

Published 30 September 2024

---

### Keywords:

elderly population

global aging

landscape

residential area

special design

### DOI:

10.24191/bej.v21iSpecial

Issue.1550

---

## ABSTRACT

With the rapid improvement of economic and social medical security in recent years, the global aging situation has deepened. At the same time, the elderly groups' demand for the healthy use of landscape environment has increased. This study analysed the characteristics of the elderly population and the use needs of age-appropriate landscapes. Based on the theories of design, landscape architecture, sustainable design, and the critical points of age-appropriate landscape design, this paper applies unique design methods for designing and constructing aging landscapes in residential areas. The characteristics analysis of elderly landscape design includes vertical and drainage design, barrier-free design, garden road traffic planning, planting design, and landscape sustainability. The results and analysis stated that in combination with the design methods, a comfortable, safe, ecologically sustainable, and liveable aging landscape space is a suitable design for the residential area, and the local cultural design concept can enhance the sense of belonging of the elderly. The findings will provide theoretical and practical guidance for the design and construction of residential landscapes with suitable ecological environments for the elderly.

---

## INTRODUCTION

In the context of the gradual acceleration of the proportion of aging, the comprehensive physical functions of the elderly continue to deteriorate with the gradual increase in age (Li, 2019). The physical, mental, and pressure-bearing capacities of the elderly are gradually fragile, and other actual conditions and the actual use of age-appropriate garden landscapes in residential areas are constantly increasing (Zhang, 2020).

---

<sup>3\*</sup>Alamah Misni. Email address: [alamah884@uitm.edu.my](mailto:alamah884@uitm.edu.my)  
<https://doi.org/10.24191/bej.v21iSpecial.Issue.1550>

However, most residential landscape design currently aims to pursue economic benefits. It only pays attention to the appreciation needs of young audiences, resulting in excessive design and abnormal design, but ignoring the use of multi-layer age-appropriate garden space for healthy living activities of the elderly. According to the physical and mental characteristics of the elderly (Sweet, 2021), an aerobic garden space is designed for the companionship of children, daily relaxation, communication, and simple rehabilitation exercise for the elderly, providing a comfortable and liveable outdoor leisure and communication environment for the elderly's healthy home care. It is necessary for the physical and mental health of the elderly (Li & Huang, 2016; Zhu, 2020).

With the continuous increase in the proportion of aging in China and the continuous advancement of urbanization, the demand for outdoor activities of home-based elderly care groups is seriously out of balance with the current situation of age-appropriate landscape-supporting facilities in residential areas (Long, 2017). However, the state has launched and implemented age-appropriate landscape protection measures. However, most of them are limited to the construction of urban parks and professional institutions for the elderly, and there is a lack of attention to the aging landscape in residential areas. Thus, the study focuses on the actual use needs of age-appropriate landscapes for the elderly and the design and construction methods of age-appropriate landscapes (Wen & Zhao, 2018) for residential areas, including vertical and drainage design, barrier-free design, garden road traffic planning, landscape plant planting design and landscape sustainability.

### **Suitable for Aging Physical Demand**

With the increasing age of the elderly, their physiological perception ability, motor ability, and nervous system gradually decline (Field, 2019). The continuous degradation of physiological characteristics directly affects their ability to participate in daily behaviours and activities and the way of participation. In designing and constructing landscape architecture suitable for aging in residential areas, it is necessary to make up for the deficiencies of physiological characteristics of elderly groups as much as possible (Li et al., 2019). At the same time, with the physical decline of the elderly and the change of social roles, their psychological endurance and environmental sense of security are weakened, resulting in loss, inferiority, loneliness, emptiness, and other negative psychological emotions.

The unique design of landscape space suitable for aging should fully consider the changes in landscape space use needs caused by changes in the physiological and psychological characteristics of elderly groups. The daily behaviour and activity rules of the elderly group were summarized and analysed, and the landscape use needs of the elderly were analysed. The landscape use needs of the elderly involved comfort, sociability, safety, and consideration of physical health (Zhou & Liu, 2013). It includes a safe and accessible landscape space with a barrier-free design, an aging water landscape environment, a seating space for the elderly to rest and interact socially, and a multi-functional vegetation healing space with music and cultural elements. An ideal design should create an outdoor environment that is pleasant, accessible, and adaptable to different activities.

## **ANALYSIS ON SPECIAL DESIGN METHODS**

### **Vertical Design and Drainage Unique Design**

Based on the current mobility situation of the elderly group, the overall terrain of the landscape space suitable for aging in the residential area should be flat and open, and there should be no significant change in height difference. To facilitate the safe passage of the elderly group with assistance and care, the overall relief design should ensure that the road slope at all levels in the hospital conforms to the design norms for aging and barrier-free, and the overall terrain should not be changed too much (Zhu & Hu, 2020). The rolling micro-terrain combined with different types of plant planting designs can be used to form a

landscape space sequence of opening and closing changes, and the landscape visual effects of different scenery can enrich the activity space of elderly groups (Wang, 2018).

Landscape drainage is mainly based on landscape topography and is a comprehensive drainage method that combines pipeline and ditch drainage. The drainage method can be summarized into five primary forms: barrier, obstruction, storage, division, and guide (Wang & Gong, 2022). Permeable paving can be adopted in landscape roads and nodes to increase the infiltration of surface precipitation, and excess water can be stored for daily irrigation use through underground collection measures to form a sponge effect. Rainwater storage can also be carried out through the internal water landscape of the landscape. Drainage facilities should be as close to the landscape elements as possible. Based on the discharge of landscape sewage, it is possible to use pipes connected to the municipal pipe network for centralized drainage to reduce its pollution of local groundwater and ecological water sources and affect the average growth of landscape plants while providing a safe surface ecosystem, green and healthy environment for elderly to do passive and active recreational activities in these outdoor community areas (Chen, 2014) (Fig. 1).

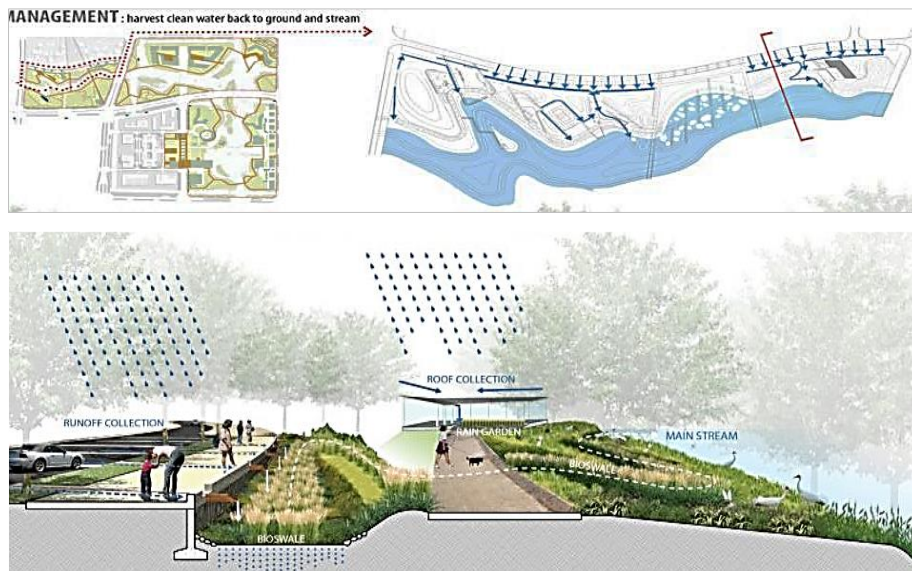


Fig. 1. Example of landscape drainage and water storage structure of Ningbo Ecological corridor, Ningbo, China: site plan (above) and section (below).

Source: ASLA (2013)

### Unique Design of Barrier-free Facilities

Based on the physical conditions of the elderly population, the landscape space, pathways, lighting layout, and service facilities in age-appropriate gardens should be systematically planned and designed by relevant national design standards (You, 2019). For areas with significant elevation changes and steps, double-layer handrails are essential to assist elderly individuals in navigating these spaces safely (Wang, 2019) (Fig. 3). Additionally, ergonomic rest seats should be strategically placed along pathways, considering the fatigue levels of elderly users. Selecting non-slip and flat pavement materials is crucial to minimize fall risks (Zhang & Zheng, 2014; Hao, 2019) (Fig. 2).

The design height of road signage and landscape features should be tailored to the upward viewing angle of elderly individuals, ensuring visibility and accessibility. Barrier-free public toilets must be incorporated at key boundary areas, with clear signage guiding users. Inside these facilities, barrier-free washing and side positions should be equipped to enhance usability (Hu et al., 2009) (Fig. 4). By prioritizing

these design elements, we can create inclusive and supportive environments that cater to the specific needs of elderly residents, promoting their safety and overall well-being.

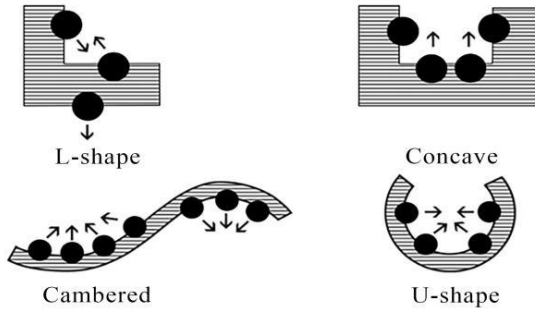


Fig. 2. Suitable shapes and forms for aging seat layout design

Source: Hao (2019)



Fig. 3. Design of multi-type barrier-free access (left) and double-layer handrail for the elderly community of Golden Key Happy Town in Thailand (right)

Source: Shma (2020)

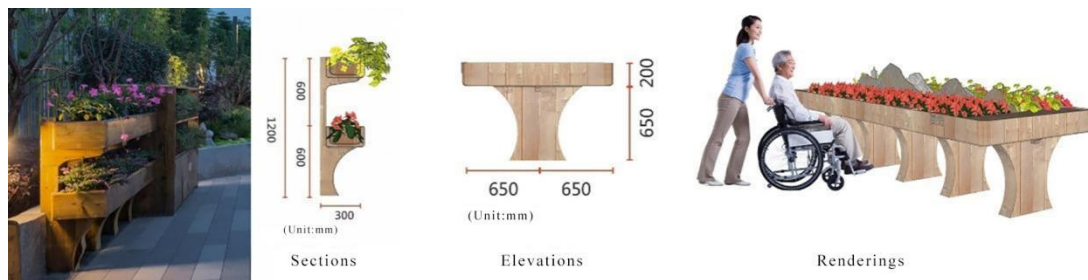


Fig. 4. Design of barrier-free planting pool in Chongqing Longhu Yian Elderly Apartment

Source: Zhang (2018)

### Unique Design of Traffic Routes

Residential landscape parks mainly play the role of organizing space and guiding Tours. According to relevant laws and regulations, the overall proportion of residential landscape parks at all levels is generally controlled between 10%-20%. The beautiful road curve and rich paving forms can be closely integrated with the surrounding flowers, trees, buildings, rocks, water, and other landscapes, making the road a landscape of its own (Sun & Zhang, 2019). Based on the traffic capacity limitations of the elderly group, cut-type, and embankment-type garden roads can be set up to avoid irregular gravel paving, treading,

<https://doi.org/10.24191/bej.v21i1Special Issue.1550>

climbing, and other road types with poor safety factors. The geometric linear design of the garden road ensures the principles of safety, comfort, and convenience, and the structural design should meet the load and service life requirements under topographic and geological conditions (Zhai, 2016) (Fig. 5). Age-appropriate landscape road surface design is an essential factor affecting the outdoor activities of the elderly group. Materials should be smooth and non-slip, colours should be harmonious, patterns should have strong recognition and visual guidance, and a blind path should be added to meet the needs of special elderly groups (Pan et al., 2015) (Fig. 6). Garden roads usually bear the function of landscape drainage. To prevent the accumulation of water on the pavement on rainy days, a particular slope should be maintained on the transverse and longitudinal slopes in the design process of garden roads, and attention should be paid to the selection of water-permeable materials for surface and base paving (Wang et al., 2023).



Fig. 5. Characteristic of seats, pathways and planting design of Yunnan New Oupeng Education Town

Source: HAOFENG (2019)



Fig. 6. Characteristic of suitable pavement design with rough surface of materials for elderly in Taikang Home, Yanyuan, China

Source: SUNSHINE (2018)

### Planting With a Specific Design

The purpose of the planning and design of age-appropriate garden plant landscapes in residential areas is to build a quiet and comfortable, age-appropriate living environment. Plants have the functions of isolating noise, purifying air, dividing space, beautifying the environment, wind and shade, and plant landscaping (Li, 2021). Good plant landscape planning plays a vital role in shaping landscape space, optimizing activity space, and improving recuperation space (Xu & Si, 2020). The planning of age-appropriate landscape plants should follow the principles of age-appropriate, regional, and ecological, and can be divided into healing landscapes, inter-house gardens, open forest grassland, waterfront wetlands, aquatic plants, dense forest landscape, and other types according to spatial types (Li et al., 2010; Zhao, 2018; Lin, 2020) (Tables 1 and 3). The planning and design strategies mainly include creating a rehabilitative landscape environment space by purifying bactericidal and health care plants, creating an adequate landscape space for planting plants with different functions and creating a seasonal landscape

<https://doi.org/10.24191/bej.v21iSpecial Issue.1550>

space with four distinct seasons by planting plants with different types of colours (Zhang, 2020) (Tables 2 and 4). In the design process, appropriate tree species are selected and combined with various elements to build a healthy environment for aging landscape space in a suitable residential area (Du, 2016) (Table 5).

Table 1. Example of ecological functions of common plants in recreational areas

| Common Name          | Scientific name                | Ecological function   |
|----------------------|--------------------------------|---|
| Chinese scholar tree | <i>Styphnolobium japonicum</i> | It has the effect of windproof and sand-fixing, and strong resistance to sulphur dioxide, chlorine, and other toxic gases.  |
| Ligustrum            | <i>Ligustrum lucidum</i>       | Good cold resistance, resistance to water and moisture, resistance to pruning, but not barren. In addition to sulphur dioxide, hydrogen fluoride, etc., they have a strong resistance but also can resist higher dust and smoke pollution.  |
| Elm                  | <i>Ulmus parvifolia</i>        | Elm is a positive tree species, loves light, cold, barren resistance, and soil requirements are not high. Wind resistance and soil preservation ability are strong, with anti-pollution, page dust retention ability is strong.   |
| Cypress              | <i>Cupressus duclouxiana</i>   | The cypress canopy is dense, green, and elegant, and it absorbs toxic gases from the atmosphere.  |
| Masson pine          | <i>Pinus massoniana</i>        | Masson pine wood is exceptionally wet, the pine resin secreted by the needles and trunk is easily oxidized, and the emission of low concentrations of ozone can freshen the air; dustproof, suction ability is powerful, an adult pine can absorb tons of dust every year.  |
| Crape myrtle         | <i>Lagerstroemia chinensis</i> | Resistant to carbon dioxide, hydrogen chloride, chlorine, hydrogen fluoride, and other harmful gases.   |
| Tactile sense        | <i>Vernicia fordii</i>         | Camellia flower is a famous flower in China, with a strong absorption capacity, and it can absorb about 10 grams of sulphur per kilogram of dry leaves. It can resist the damage of harmful substances such as sulphur dioxide, hydrogen chloride, complex acid, and nitric acid smoke, and it purifies the atmosphere. |

Source: Zhao (2018)

Table 2. Common air-purifying plants

| Major pollutant   | Purification intensity | Trees species   | Shrubs, herbs, etc.                             |
|-------------------|------------------------|---|---|
| Physical particle | Stronger               | Sycamore, Chinese poplar, Magnolia, Privet                            | Large leaf boxwood, Cloves, etc.                |
|                   | Intermediate           | Chinese locust, Redbud, White wax, etc.                               | Rose, Lilac, etc.                               |
|                   | Strong                 | Palm, private, Bitter building, Chinese cedar, etc.                   | Buxus microphyllum, etc.                        |
| SQ2               | Stronger               | Albizia, Wisteria, Acacia, Paulownia, etc.                            | Bamboos   |
|                   | Sensitiveness          | Black pine, Metasequoia, Sycamore, Maple, etc.                        | Purple flower first Rubric, etc.                |
|                   | Strong                 | Privet, Conformation tree, Palm, Crape myrtle, etc.                   | Buxus microphyllum, etc.                        |
| Cl2               | Stronger               | Ailanthus, Mulberry, Jujube, etc.                                     | Buxus macrophylla, Forsythia, etc.              |
|                   | Sensitiveness          | Cedar, Pine, Juniper, etc.  | Marigolds, etc.                                 |
|                   | Strong                 | Ligustrum microphylla, Paulownia, Ailanthus sinensis, Ligustrum, etc. | Canna, etc.                                     |
| HF                | Stronger               | Albizia, Magnolia, Hibiscus, Eucommia, etc.                           | Shrubs, herbs, etc.                             |
|                   | Sensitiveness          | Apricot trees, Mountain peaches, Pear trees, etc.                     | Clearing heat and detoxifying, calming the mind |
| Gas tribute       | Stronger               | Mosquito mother, Magnolia, Melon seed boxwood, etc.                   | Shrubs, herbs, etc.                             |
| Fungi             | Stronger               | Cedar, Dragon cedar, Oleander, Metasequoia, etc.                      | Shrubs, herbs, etc.                             |

Source: Du (2016)

Table 3. Common aquatic plants

| Type                | Common name of species                 |
|---------------------|--|
| Emergent plant      | Lotus, Aquatic canna, Reed, Cattail    |
| Floating leaf plant | Water lily, King lily, Water lily      |
| Floating plant      | Giant algae, Water lilies              |
| Sleeping plant      | Bitter grass, Snapdragon, Water shield |

Source: Lin (2020)

Table 4. Common plant species that contribute to the health of old age people

| Common Name        | Scientific name               | Rehabilitation function  |
|--------------------|-------------------------------|--|
| Cinnamomum camphor | <i>Camphora officinarum</i>   | The whole plant has a camphor aroma, and the leaves have a camphor aroma, which can repel mosquitoes.    |
| Fragrant Tea Olive | <i>Osmanthus fragrans</i>     | Fragrant gas, phlegm, cough, produce fluid, stop toothache.  |
| Silver fruit       | <i>Ginkgo biloba</i>          | Leaves exude unique ginkgo ketone substances, prevent cancer, and moisten the lungs.                     |
| Wintersweet        | <i>Chimonanthus praecox</i>   | Relieve cough, itching, and asthma.  |
| Honeysuckle        | <i>Lonicera japonica</i>      | Pleasant fragrance, vertical green material.   |
| Magnolia           | <i>Magnolia grandis</i>       | Wet surface wind cold.   |
| Chinese thuja      | <i>Platycladus orientalis</i> | It contains volatile aromatic oils to reduce fatigue, inhibit excitement, and clear the mind.            |
| Chinese rose       | <i>Rosa chinensis</i>         | Floral solid or fruity scent relieves fatigue.   |
| Aspen              | <i>Populus adenopoda</i>      | Volatile substances can kill tuberculosis, cholera, dysentery, typhoid, diphtheria, and other pathogens. |
| Lotus              | <i>Nelumbo nucifera</i>       | The flowers are fragrant and refreshing.   |

Source: Du (2016)

Table 5. Common harmful plants

| Symptom                           | Type of plants | Plants common name                           |
|-----------------------------------|----------------|--|
| Skin inflammation                 | Herbaceous     | Trumpet and Primrose plants                  |
|                                   | Tree class     | Cotinus, Sumac, Tallow, etc.                 |
| Poisoned                          | Herbaceous     | Evergreen, Lily of the Valley, Lycoris, etc. |
|                                   | Tree class     | Heath, Oleander, Mandarin wood, Cuckoo, etc. |
| Accidental injury by acupuncture  | Herbaceous     | Anchovies, Chinese roses, etc.               |
|                                   | Tree class     | Bone structure, Fire spine, etc.             |
| Pollen allergy                    | Herbaceous     | Hogweed, Mugwort, Ryegrass, etc.             |
|                                   | Tree class     | Metasequoia, Cypress, Breadfruit, etc.       |
| Catkins allergy                   | Tree class     | French sycamore, Poplar, Willow, etc.        |
| Attract insects                   | Tree class     | Apples, Cherries, etc.                       |
| Shallow roots cause uneven ground | Tree class     | Linden, Willow, Beech, etc.                  |

Source: Du (2016)

## Unique Design of Logo and Lighting System

Based on the behavioural and activity needs of elderly groups, the landscape sign system can be classified into three main categories: guide signs, entry signs, and publicity and display signs (Yao & Gao, 2018; Liu, 2021). To enhance usability, the identification system should be designed with high visibility in

mind, utilizing specific colours and forms that cater to the visual adaptability of elderly users. This approach increases the overall identifiability of the elderly (Xu, 2014; Wang & Wang, 2022) (Fig. 7).

The height of signage should accommodate the visual range of both healthy elderly individuals and those using wheelchairs, ensuring accessibility for all. Adopting a design principle that Favors simplicity and clarity is essential, particularly for publicity and display signs, which should convey information effectively without unnecessary complexity (Du, 2016) (Table 6). By implementing these design strategies, we can create a more navigable and user-friendly environment that supports the independence and confidence of elderly residents in outdoor spaces.

Table 1. Colour setting degree sorting

| Background colour or image type | Red | Orange | Yellow | Green | Cyan | Purple | White | Gray | Black |
|---------------------------------|-----|--------|--------|-------|------|--------|-------|------|-------|
| Red                             | 0   | 40     | 46     | 25    | 26   | 28     | 41    | 30   | 33    |
| Orange                          | 39  | 0      | 38     | 34    | 41   | 39     | 36    | 37   | 42    |
| Yellow                          | 43  | 40     | 0      | 45    | 45   | 43     | 14    | 41   | 50    |
| Green                           | 28  | 35     | 42     | 0     | 34   | 32     | 46    | 29   | 37    |
| Cyan                            | 33  | 43     | 43     | 35    | 0    | 29     | 47    | 29   | 32    |
| Purple                          | 30  | 44     | 49     | 36    | 32   | 0      | 49    | 35   | 27    |
| White                           | 39  | 42     | 22     | 40    | 44   | 42     | 0     | 39   | 46    |
| Grey                            | 30  | 40     | 44     | 27    | 30   | 33     | 44    | 0    | 37    |

Source: Du (2016)

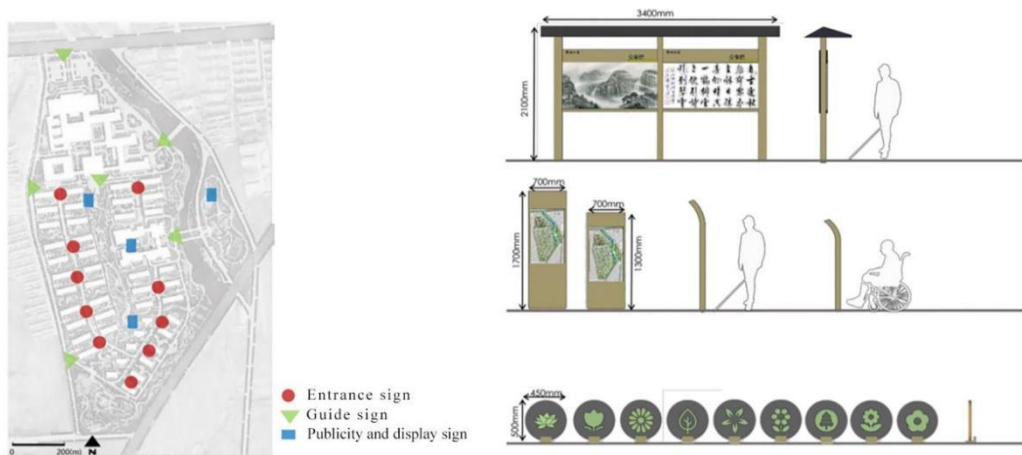


Fig. 7. Design of age-appropriate identification system

Source: Wen (2021)

Due to the decline in visual abilities among the elderly, the night lighting system in aging landscapes must be designed to enhance illumination standards according to different spatial types. For instance, the illumination level in leisure activity areas should be increased to twice the usual standard, while lighting at road traffic locations should be elevated by three times (Zhang & Yuan, 2023). However, it is crucial to balance increased illumination with the potential for light pollution, which can detract from the landscape's appeal and adversely affect the well-being of users.





Fig. 8. Suitable for aging landscape lighting design

Source: Lin (2020)

In addition to improving spatial illumination standards, thoughtful design of lighting forms is essential. Utilizing downward-facing fixtures and hidden light sources can help minimize glare and reduce light pollution, creating a more comfortable environment for elderly users (Liu et al., 2015; Lin, 2020) (Fig. 8). This approach not only enhances visibility and safety but also contributes to a tranquil atmosphere, promoting overall well-being in outdoor spaces. By integrating these strategies, we can create nightscapes that are both functional and aesthetically pleasing, ensuring that elderly residents feel secure and comfortable while navigating their surroundings after dark.

Table 7. Recommended table for aging landscape lighting

| Place classification     | Application scenario               | Illumination range (xl) | Installation height (m) | Remark   |
|--------------------------|------------------------------------|-------------------------|-------------------------|--|
| Decorative lighting      | Green plant sculpture              | 150-300<br>150-500      |                         | Low lighting, using side light, and flood light effects are best. The colour variety should not be too much. Avoid entering the house when using a floodlight. |
|                          | identification                     | 200-300                 |                         |  |
| Social venue lighting    | Central active area                | 50-100                  | 2.5-4                   | Use warm light to avoid glare  |
|                          | passageway                         | 50-70                   | 0.5 1.2                 |  |
| Road lighting            | Primary and secondary roads        | 10-20                   | 4-6                     | Avoid intense light and use low lighting for sidewalks and barrier-free access.  |
|                          | Around the parking space           | 10-30                   | 2.5-4                   |  |
|                          | footpath                           | 10-20                   | 0.6 1.2                 |  |
| Outdoor fitness venue    | Barrier-free access                | 10-30                   | 0.3 1.2                 | Downward illumination  |
|                          | Outdoor fitness venue              | 150-300                 | 2.5-4                   |  |
| Safety lighting          | Escape hatch                       | 50-70                   | Escape hatch top        | It should be in the form of an autonomous power supply, the position of the lamp should be eye-catching, and it should be set against the wall.                |
|                          | intersection                       | 50-70                   |                         |  |
|                          | Cell gate                          | 50-70                   | Above unit door         |  |
| Boundary lighting        | Escape route                       | 50-100                  | Smaller than 1          | Use a warm colour light source.  |
|                          | intersection                       | 30-50                   | Smaller than 1          |  |
| Recreation area lighting | Waterbody perimeter                | 30-50                   |                         | Suitable for low lighting, warm colour light source  |
|                          | Central area recreation facilities | 50-100                  |                         |  |
|                          | Sidewalk rest facilities           | 10-30                   |                         |  |

Source: Wang (2021)



Fig. 9. Route guide lighting design

Source: Expolight (2023)

The colour, light, and shading design of landscape lighting systems must complement the overall style of the site and its architectural features. Proper lighting enhances both aesthetic and functional aspects, creating a cohesive environment. Lighting facilities should be distributed across gardens, open spaces, and plazas, with thoughtful planning for different levels of the landscape. It is essential to consider the needs of the elderly population when selecting light sources. Large lamps, typically 4 to 6 meters high, should be spaced 16 to 20 meters apart, and use designs that direct light upward or with a hood to avoid glare issues for seniors (Zhu & Hu, 2020). Additionally, smaller lighting fixtures, ranging from 0.6 to 1.2 meters in height, should provide soft, guided illumination to enhance nighttime visibility and safety for elderly individuals (Wang, 2021). The combination of aesthetics and functionality ensures that landscape lighting not only beautifies the area but also accommodates the needs of various age groups, especially seniors (Zou & Zhao, 2018).

### The Unique Design of Landscape Sketch

In the process of design, landscape sketches should meet the requirements of function and have individual characteristics, ecological principles, and the construction principles of emotional destination. According to the types of landscape sketches can be divided into artistic sketches, functional sketches, and other types of landscape sketches (Wang, 2019). Artistic works can be divided into sculpture and installation art. Different types of theme sculptures and landscape space installations can be set according to regional culture to improve the theme positioning of landscape culture (Wang, 2013; Dragon, 2014). Functional skits refer to the characteristic design of landscape seats, signboards, lamp types, garbage bins, etc., which are integrated with landscape space elements. Other types of skits include the design of landscape Bridges, fitness and recreation facilities, and the echo of landscape elements of building doors and window holes (Song, 2020). The design of all kinds of landscape pieces should fully integrate into the regional culture, conform to the landscape theme, meet the aesthetic needs of the elderly groups, and comply with the principles of functional satisfaction, personality characteristics, ecology, and emotional destination (Zou & Zhao, 2018).

### Universal Design

The universal design of age-appropriate landscape spaces refers to principles that can be applied across various contexts and purposes. This comprehensive design approach aims to provide a convenient, safe, and comfortable outdoor environment for the elderly, creating spaces that are not only aesthetically pleasing but also practical, sustainable, and adaptable to diverse needs (Gan, 2007).

Central to universal design is the emphasis on accessibility, which involves implementing barrier-free features that facilitate comfortable and safe use. This includes flat paths, barrier-free ramps, tactile guidance for the visually impaired, handrails, and easy-to-identify signage to enhance overall accessibility (Wang,

2019) (Fig. 10). Furthermore, integrating ecological design principles is essential; strategies such as effective water resource management, the sponge city concept, thoughtful vegetation selection, and promoting biodiversity are crucial for reducing environmental impact and enhancing the sustainability of the landscape (Zhao, 2018) (Table 8). By harmonizing these elements, universal design can effectively meet the varied needs of elderly users while fostering an inclusive and resilient outdoor environment.

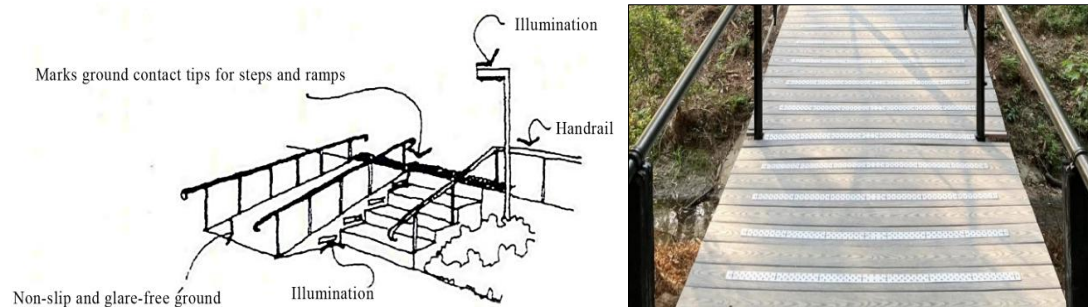


Fig. 1. Steps, handrails, ramp design characteristic/condition suitable for elderly (left), and example of non-slip material of ramp - handi treads deck and ramp treads (proper).

Source: Marcus (2001) (left), Clearly (2023) (right)

The universal landscape design should also thoroughly consider the local cultural and social background and integrate these elements into the design to create a landscape with local characteristics and social significance (Wang, 2019). Safety is also an essential consideration in the design of universal design, including appropriate lighting, non-slip surfaces, safety railings, etc., to ensure the safety of users in the space, and the overall landscape should be equipped with emergency rescue equipment and rescue accessibility in the necessary areas to provide rescue support in emergencies (Geh, 2010). The unique design of the general landscape should consider the landscape use needs of different groups and create garden Spaces that adapt to diverse uses (Vivi, 2019). This requires a combination of aesthetic, functional, sustainability, and social considerations to create a balanced and vibrant outdoor landscape environment (Kaplan, 1989).

Table 8. Suitable for aging seat size design requirements

| Position     | Scale and standard  |
|--------------|---|
| Altitude     | The overall height of the seat is higher than the general seat, in the range of 450-500mm.  |
| Profundity   | The seat depth should be relatively shallow, in the range of 400-500mm.   |
| Handrail     | The seat should be equipped with a strong armrest and a position of 200-250mm on the chair surface, extending out of the seat edge.   |
| Backrest     | The backrest is necessary and should be integrated into the seat design consideration.  |
| Heel space   | You need at least 75mm of headroom to swing your feet when getting up from the seat.  |
| Load         | The load-bearing capacity of a single seat should be changed to more than 115kg, and the multi-seat bench should be superimposed according to the design seat amount.             |
| Stable       | Tables and chairs must be made of stable and durable materials and stable structures and play an important supporting role for elderly people with limited strength and mobility. |
| Table height | It is accessible to wheelchair users, and the height is within the range of 700-750mm.  |
| Headroom     | Considering the needs of wheelchair users, there should be at least 900mm of headroom width.  |

Source: Zhao (2018)

## CONCLUSION

This study primarily focuses on the design and research of specialized methods for creating age-appropriate landscapes in residential areas. It conducts a comprehensive analysis of various landscape functional zones and their specific design methodologies (Li, 2019). A critical examination reveals that

understanding the existing site conditions and effectively addressing the landscape usage needs of elderly residents are fundamental prerequisites for developing age-friendly landscape designs.

The research is grounded in principles and strategies tailored explicitly for age-appropriate landscape design in residential environments (Wang, 2018). By integrating theories from design, landscape architecture, sustainable design, and human-centred design, this paper explores specialized design methods across seven dimensions: vertical and drainage design, barrier-free design, garden road traffic planning, planting design, and general design (Zhang, 2019).

In the realm of vertical and drainage design, it is essential to analyse terrain characteristics to ensure a comprehensive and functional layout of drainage systems. However, this study emphasizes that mere adherence to technical requirements is insufficient; there must be a thoughtful consideration of how these systems impact overall user experience. The designs for garden roads and barrier-free access must not only facilitate pedestrian traffic but also enhance aesthetic and sensory experiences, optimizing pavement, lighting, and safety features to foster a welcoming environment.

The application of planting design should extend beyond mere spatial division; it should integrate therapeutic horticulture principles that promote rehabilitation and well-being for the elderly. Moreover, while ensuring ecological sustainability, it is vital to incorporate humanistic elements that resonate with the cultural context of the residents, thereby enhancing their sense of belonging and community.

Ultimately, this study advocates for a holistic approach that combines functionality with empathy, creating a comfortable, safe, and ecologically viable landscape that caters to the needs of aging populations. Such an approach is not only a design challenge but also a social imperative, reflecting a broader commitment to inclusivity and the well-being of all community members. By integrating these critical perspectives, the proposed landscape spaces can genuinely become vibrant, liveable environments for the elderly.

## ACKNOWLEDGEMENTS/FUNDING

The author appreciates the platform given of College of Built Environment, Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia for doing this research and publication.

## CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits or commercial or financial conflicts and declare the absence of conflicting interests with the funders.

## AUTHORS' CONTRIBUTIONS

Xiangyun Wang designed and carried out the research, wrote and revised the article. Alamah Misni conceptualized the central research idea and revised the article. Alamah Misni supervised the research progress, anchored the review and revisions, and approved the article submission.

## REFERENCES

- ASLA. (2013). *Ningbo Eco-Corridor - 3.3 km Living Filter Ningbo, China*. Analysis and Planning. SWA Group, Sausalito, CA Client: Ningbo Planning Bureau – East New Town Development Committee. <https://www.asla.org/2013awards/253.html>
- Chen, S. M. (2014). Analysis of technical critical points of water supply and drainage construction in garden construction. *Jiangxi Building Materials* 64 (24), 225.

- Clearly, M. (2023). The Importance of Making Outdoor Ramps Non-Slip. <https://handitreads.com/making-outdoor-ramps-non-slip/>.
- Dragon, K. A. (2014). *The policy of "active aging" system research in national regions*. Master's Degree Thesis, Central South University for Nationalities, China.
- Du, J. (2016). *The elderly community outdoor landscape design*. Master's Degree Thesis, Nanjing Agricultural University, China.
- Field. (2019). *Local elements in the application of rural landscape construction research*. Master's Degree Thesis, Zhejiang Forestry University, China.
- Gan, W. Q. (2007). *Ecological residential green space landscape planning studies*. Master's Degree Thesis, Northwest Agriculture and Forestry University of Science and Technology, China.
- Gehl, J. (2010). *Cities for People*. Island Press. Gehl emphasizes the need to design public spaces that cater to diverse community needs while ensuring safety and accessibility.
- Hao, D. (2019). *Research on Landscape Design of Urban Elderly Park based on Health Concept*. Master's Degree Thesis, Xi'an University of Technology, China.
- HAOFENG. (2019). *Yunnan new Oupeng0 education town landscape design, China*. Analysis and Planning. Haofeng Planning and Design Group Client: Yuzhou • New Oupeng Education Industry (Group) Co., LTD. <http://www.landscape.cn/landscape/10881.html>
- Hu, L., Li, S. & Wu, F. (2009). Survey on barrier-free facilities in gardens: A case study of Beijing. *Chinese Gardens* 25(05), 91-95.
- Kaplan, R., & Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective*. Cambridge University Press.
- Li, C., Yu, M., & Li, C. (2019). A study on the aging landscape renewal of old residential district in Shenyang based on comfort optimization: A case study of Xiushan Residential District. *Chinese Garden* 35(01), 23-28.
- Li, J. (2019). *Design strategies for age-friendly landscapes in residential areas*. Journal of Urban Planning and Development, 145(4), 04019032. [https://doi.org/10.1061/\(ASCE\)UP.1943-5444.0000532](https://doi.org/10.1061/(ASCE)UP.1943-5444.0000532)
- Li, W. & Huang, W. (2016). Aging suitable design of outdoor interaction space in residential areas. *Urban Housing* 23(07), 30–32.
- Li, X., An, X., Jin, Z. L., Pan, H. & Zhang, Q. X. (2010). Research progress on the effects of plant color on human physiology and psychology. *Hubei agricultural science* 49(07), 1730-1733. <https://doi.org/10.14088/j.cnki.issn0439-8114.2010.07.013>
- Li, Y. (2019a). *Based on the old behavior and psychological characteristics of urban residential areas, optimum aging landscape design research is needed*. Master's Degree Thesis, Lu Xun Academy of Fine Arts, China.
- Li, Y. (2019b). *Regular exercise for the elderly nursing home research on the effects of quality of life*. Master's Degree Thesis, Tianjin Sports College, China.
- Li. (2021). *Based on the concept of optimum aging design research center for senior citizens*. Master's Degree Thesis, Henan Normal University, China.

- Lin, Y. (2020). Living mode of endowment town landscape design research. Master's Degree Thesis, University of Jilin Architecture, China.
- Liu, D. (2021). *Zhuozhou's high-speed new town residential area's optimum aging facilities have improved research*. Master's Degree Thesis, Guilin University of Technology, China.
- Liu, D., Jia, L. & Wang, S. (2015). Research on the general design of residential aging under the home care model. *Architectural Journal* 561(06), 1-8.
- Long, B. (2017). *Research on River ecological landscape design based on Sponge City*. Doctoral dissertation, Agricultural University of Hebei, China.
- Marcus, C. C. (2001). *Human Places: Guidelines for Urban Open Space Design*. Second edition. China: Building Industry Press.
- Pan, Y., Che, D. & Lin, Z. (2015). Design of Blind Park. *Journal of Shandong Agricultural University (Natural Science Edition)* 46(02), 297–302.
- Shma. (2020). *Thailand Golden Key Happy Town Retirement Community Landscape Design Pathum Thani Province, Thailand*. Analysis and Planning. Shma Client: Thonburi Healthcare Group. <http://www.landscape.cn/landscape/11691.html>
- Song, C. (2020). *Handan rural outdoor public space optimum described research*. Master's Degree Thesis, Hebei University of Engineering, China.
- Sun, G. & Zhang, Z. H. (2019). Application design of barrier-free facilities based on aging society. *Packaging Engineering* 40(18), 108-111. <https://doi.org/10.19554/j.cnki.1001-3563.2019.18.016>
- SUNSHINE. (2013). *Taikang Home · Yan Garden landscape design, China*. Analysis and Planning. Beijing Shunjing Garden Co., LTD Group Client: Beijing Changping Taikang Community. <http://www.landscape.cn/landscape/11528.html>
- Sweet. (2021). *Based on the activities of the elderly community landscape design*. Master's Degree Thesis, Beijing Forestry University, China.
- Vivi. (2019). *A concave terrain space mountain city park plant landscape design to explore*. Master's Degree Thesis, Southwest University, China.
- Wang, G. (2018). *Guangzhou city center park barrier-free facilities research*. Master's Degree Thesis, Zhongkai Agricultural Engineering College, China.
- Wang, H. (2019a). *Residential area optimum aging rehabilitative landscape design research*. Master's Degree Thesis, Changan University, China.
- Wang, L. R. (2013). *Based on the regional culture landscape sketch design research*. Master's Degree Thesis, Nanjing Forestry University, China.
- Wang, R. R. (2021). *The Sunshine Square Home elderly apartment park landscape design research*. Master's Degree Thesis, Qufu Normal University, China.
- Wang, S. (2018). *Principles of designing age-appropriate landscapes: A focus on residential environments*. *Landscape Research*, 43(7), 842–857. <https://doi.org/10.1080/01426397.2018.1437346>
- Wang, W. & Gong, L. (2022). Characteristics and construction technology of garden water supply and drainage engineering. *Water Supply and Drainage* 58(S1), 775-779. <https://doi.org/10.13789/j.carol.carroll.nki.wwe1964.2021.09.08.0004>

- Wang, W. (2019b). In the city square trails landscape design research. Master's Degree Thesis, Shandong Construction University, China.
- Wang, X., & Wang, F. (2022). The Influence of the Characteristics of the Elderly on the Landscape Design of Residential Areas Suitable for Aging. *Proceedings of the International Conference on Green Building, Civil Engineering and Smart City* 211(pp. 1170-1178). Singapore: Springer Nature Singapore. [https://doi.org/10.1007/978-981-19-5217-3\\_120](https://doi.org/10.1007/978-981-19-5217-3_120)
- Wang, X., Misni, A., & Wang, F. (2023). Influence Factors Analysis of Aging Landscape Based on the Characteristics of the Elderly Human Body. *Proceedings of the International Conference on Green Building, Civil Engineering and Smart City* 328(pp. 949-959). Singapore: Springer Nature Singapore. [https://doi.org/10.1007/978-981-99-9947-7\\_93](https://doi.org/10.1007/978-981-99-9947-7_93)
- Wang, Z. H. (2019). *The old residential area optimum aging landscape design research*. Master's Degree Thesis, Hebei University of Technology, China.
- Wen, Q. & Zhao, L. (2018). Discussion on landscape design methods of community parks focusing on the elderly: A case study of Huanghai Road Park in Laiyang City, Shandong Province. *Design* 133(01), 34–36.
- Xu, H. (2014). *The characteristics of residential landscape construction research*. Master's Degree Thesis, Nanjing Agricultural University, China.
- Xu, Z. D. & Si, W. (2020). Research on landscape allocation of age-appropriate plants under horticultural therapy. *Western Leather* 42(02), 105.
- Yao, X. & Gao, L. (2018). The significance of landscape design in urban planning. *Modern Gardening* 289(20), 75. <https://doi.org/10.14051/j.carol.carroll.nki.xdyy.2018.20.064>.
- You, P. F. (2019). *In Hefei old apartment outdoor landscape design research*. Master's Degree Thesis, Harbin University of Science and Technology, China.
- Yuan. (2023). *Ling home beach national archaeological site park landscape sketch design*. Master's Degree Thesis, Anhui University of Engineering, China.
- Zhai, Y. (2016). Research on urban park design features to promote walking behaviour of the elderly based on content analysis. *Landscape Architecture* 81(07), 121-128.
- Zhang W. & Zheng, C. L. (2014). Research on the application of ground paving materials in modern residential areas in China. *Journal of Yangtze University (Science Edition)* 11(29),19-22. <https://doi.org/10.16772/j.cnki.1673-1409.2014.29.012>
- Zhang, D. (2020). *Evaluation of Elderly people's satisfaction with outdoor activity Space in Residential areas of Changsha City*. Master's Degree Thesis, Hunan University, China.
- Zhang, D. (2020). *In Changsha city residential outdoor space, the elderly satisfaction evaluation studies*. Master's Degree Thesis, Hunan University, China.
- Zhang, J. (2020). *William Garden residential area in Kunming, optimal aging landscape design*. Master's Degree Thesis, Kunming University of Science and Technology, China.
- Zhang, L. & Yan, Y. (2023). Research progress of aging lighting for walking space. *Journal of Lighting Engineering* 34(04), 114-120.
- Zhang, L. (2018). *Chongqing Longhu Yinian apartment rehabilitation garden landscape design, China*. Analysis and Planning. GVL Yijing International Design Group Client: Chongqing Longhu Hengzhuo

Real Estate Development Co., LTD. <http://www.landscape.cn/landscape/10168.html>

Zhang, S. & Zhang, X. (2020). Exploration on the design of aging landscape renewal in Hongmei New Village in Changzhou from the perspective of healing. *Gardens and Gardens* 336(04), 69-75.

Zhang, Y. (2020). *Innovative design methods for creating sustainable and human-centered landscapes for the elderly*. International Journal of Environmental Research and Public Health, 17(15), 5505. <https://doi.org/10.3390/ijerph17155505>

Zhao, L. (2018). *Pay attention to the elderly in the community park landscape design methods*. Master's Degree Thesis, East China University of Science and Technology, China.

Zhou, Y. M. & Liu, J. Y. (2013). Aging adaptive design of outdoor environment in residential areas. *Architectural Journal* 535(03), 60-64.

Zhu, H. & Hu, W. (2020). Application of environmental psychology theory in the landscape design of residential areas suitable for aging. *Architecture and Culture* 199(06), 206-207.

Zhu. (2020). *Based on the modern emergency rescue of all-terrain truck design research*. Master's Degree Thesis, Dalian University of Technology, China.

Zou, Y. & Zhao, Y. (2018). *Chizhou moat site Park landscape and sponge design, China*. Analysis and Planning. UP+S Group, Beijing, China Client: Chizhou city urban construction key project management office. <http://chla.com.cn/htm/2020/0622/275770.html>



© 2024 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY-NC-ND 4.0) license (<http://creativecommons.org/licenses/by-nc-nd/4.0/deed.en>).