

INVESTIGATION OF SOME PARKING LOTS IN ÇANAKKALE CITY CENTER IN TERMS OF GREEN PARKING LOT DESIGN

Gökçe İzgier ^{1,a,*}, Prof. Dr. Abdullah Kelkit ^{2,b}

¹ Çanakkale Onsekiz Mart University School of Graduate Studies Master of Science Thesis in Landscape Architecture, Çanakkale, Turkey

² Çanakkale Onsekiz Mart University Architecture and Design Faculty Landscape Architecture Department, Çanakkale, Turkey

*Corresponding Author:
E-mail: gokceizgier@gmail.com

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a:  ORCID 0009-0000-7617-2632 b:  ORCID 0000-0002-5364-6425

ABSTRACT. Green parking is the standard for more sustainable and environmentally friendly parking design and features. Over the past few years, the parking and mobility industry has seen a surge in demand for green parking as businesses become smarter and more responsive to consumer preferences for sustainable products and services. Improving the livability of our cities is one of the challenges ahead. The benefits of green spaces have been proven beyond doubt by the scientific community. Not only parks and gardens, but also a tree-lined parking lot can help improve the urban microclimate. This study was conducted in Çanakkale city center. Barış Cafe, Public Garden and Çanakkale Municipality parking lots were selected as the study area. In this study, the compliance of three different parking lots in Çanakkale city center in terms of green parking standards was evaluated. The analysis of Barış Cafe, Public Garden and Çanakkale Municipality parking lots was conducted to determine to what extent the current situation is sufficient in terms of sustainable parking practices. Each parking lot was analyzed separately, and suggestions were made. As a result of the study, it was observed that the existing parking lots in Çanakkale city do not comply with green parking standards. This situation reveals the need to adopt more environmentally friendly and sustainable approaches in urban planning. Green parking lots not only ensure the sustainable use of parking areas, but also contribute to the general health of the urban environment.

Keywords: Çanakkale; city; parking lots; green parking lots

INTRODUCTION

The concept of a parking lot is defined in the literature as open or closed spaces where vehicles are left for a certain period in a way that is suitable for traffic (1). Today, the design of parking areas aims to facilitate vehicle movement, create maximum parking space, and provide ease of maintenance and service (2). After allocating space for these purposes, the remaining areas in parking lots should be designated as green spaces. However, in our country, the green areas allocated for parking lots are quite limited and insufficient. This negatively affects the visual aesthetic quality in cities.

It is observed that parking lot designs have many negative impacts on the environment. Some of these negative impacts include creating heat islands, affecting water reserves, stormwater management, water quality, local ecology and habitat, green spaces, air quality, and lighting (3).

Traditional parking lot designs use an impermeable, heat-absorbing material that collects rainwater on the hard surface and prevents it from seeping into the soil, thereby disrupting the natural water cycle. In traditional parking lots, rainwater is typically directed away from the area using gutters, sewers, and pipes. Consequently, traditional parking lots degrade water quality and consume large amounts of land and resources. Additionally, the materials used in the construction of parking lots have various impacts on air, water, and biodiversity throughout their lifecycle.

Green parking is a standard for more sustainable and environmentally friendly parking lot design and features. In the past few years, as businesses move to be smarter and more responsive to consumer preferences for sustainable products and services, the parking and mobility industry has seen a rise in green parking space demand (4)

From more efficient building materials to smart technologies, green parking lot design can be good for the environment and good for budgets. More efficient materials, technologies, and strategies for managing vehicles can reduce labor, energy, and building costs (4).

Especially in making green renovations to an existing structure, adding plants can be a smart and eco-friendly addition to any parking operation. They can contribute to reducing the heat island effect, too. Plants also absorb CO₂ emissions, prevent erosion and runoff, and add a welcoming, green appearance to your parking asset (4).

Many green infrastructure elements can be seamlessly integrated into parking lot designs. Permeable pavements can be installed in sections of a lot and rain gardens and bioswales can be included in medians and along the parking lot perimeter. When built into a parking lot, these elements also reduce the heat island effect and improve walkability in the area (5).

Another effective green parking technique is the use of alternative surfaces. Alternative surfaces include permeable surfaces and reduce stormwater discharges by increasing infiltration. They can include gravel, cobbles, wood mulch, brick, grass pavers, turf blocks, natural stone and permeable pavements. Permeable pavements include permeable pavers, pervious concrete and porous asphalt and can be effective substitutes for conventional asphalt and concrete, given their durability (5).

Greening' the surface parking lot involves:

- planting trees.
- providing good quality soil and generous landscaped areas.
- enhancing pedestrian and cycling infrastructure.
- managing stormwater on-site.
- reducing the urban heat island effect; and
- using sustainable materials and Technologies (5).

Trees in parking lots help decrease pollutants and reduce temperature on the ground line (6).

Increasing our city's livability is one of the challenges that awaits us. The benefits generated by green areas have been demonstrated beyond any doubt by the scientific community. Not just parks and gardens, but also a tree lined parking lot can help in

ameliorating urban microclimate. So, it's also fundamental to spread the knowledge of trees' importance for livability in urban areas, to make trees in parking lots common in the asphalt jungle that our cities have become (6).

Green parking lots work to preserve the natural vegetation and open space of an area as much as possible, while also supporting local wildlife habits. When landscape architects design a parking area, they may use native trees and shrubs instead of non-native species, as they are more suited to the local climate and thus require less irrigation. Increasing the amount of green space within and around parking areas has benefits such as reducing CO₂ in the air, enhancing stormwater flow management, including water retention, and improving flood protection. Protecting or creating wetlands is particularly beneficial as they act as natural biological retention basins, which improve water quality, provide flood protection, and control erosion. Wetlands also serve as excellent habitats for local bird and fish species and are highly valuable for water storage; one acre of wetland can store over a million gallons of water (7).

Looking at green parking lot examples worldwide, many feature dense vegetation, permeable ground surfaces for rainwater absorption, and solar-powered shading systems. One such example is Toyota's green parking lot, implemented in 2013 for its new facilities in China, which includes dense vegetation, permeable hard surfaces, and a rooftop garden (Fig.1).



Fig. 1. Toyota's green parking lot implementation (8)

At Hotel Marcel in New Haven, solar-powered canopies are used. Additionally, the parking lot includes 12 electric vehicle charging stations (Fig. 2) (9).

The aim of this research is to provide a general definition of green parking lots and highlight the design features that need attention. Additionally, it seeks to conduct studies on designated parking areas in the city of Çanakkale within the scope of green parking lot criteria.



Fig. 2. Hotel Marcel Parking Lot (9)

MATERIALS AND METHODS

This study was conducted in the city center of Çanakkale. The selected study areas are the Barış Café, Halk Garden, and Çanakkale Municipality parking lots (Fig. 3). The primary reason for selecting these parking lots is that they are the most heavily used in Çanakkale's city center. These parking lots are arranged in order from highest to lowest plant density. A literature review on the subject was carried out, followed by observations and analyses in the research areas, which were documented with photographs and used as supplementary material.



Fig. 3. Location of Study Areas in Çanakkale City Center. 1.Barış Cafe Parking Lot 2. Halk Garden Parking Lot 3. Çanakkale Municipality Parking Lot (modified from Google Earth).

The study method consists of several stages: collecting data obtained from a review of national and international literature on green parking lots; gathering information, documents, maps, etc., about the study area; conducting field observations; analyzing all information; and developing recommendations specific to the study area.

RESULTS AND DISCUSSION

Çanakkale is in northwestern Turkey, on the Gallipoli Peninsula and the Biga Peninsula, which extends from Anatolia. It is the second province in Turkey with territories in both Asia and Europe. Covering an area of 9,737 km², its coordinates range between 25° 35' and 27° 45' E longitude and 39° 30' and 40° 42' N latitude (10). Çanakkale experiences a transitional climate between the Mediterranean and Black Sea climates. During the tourist season, air temperatures are generally high, and sea temperatures peak in July and August. Daily air temperatures during the season range between a maximum of 35°C and a minimum of 25°C (10).

The city's economy is primarily based on agriculture, with various agricultural activities carried out, and livestock farming is also a significant source of income. The population of the city is 570,499 (11). The number of registered vehicles is 288,120 (12). Due to the high number of vehicles relative to the population, the number of parking lots in the city center is insufficient.

Selected Parking Lots in Çanakkale City Center

Bariş Cafe Parking Lot

Located in Barbaros Neighborhood, this parking lot is situated in one of Çanakkale's busiest areas, surrounded by shopping centers, the coastal strip, and various cafes (Figures 4 and 5). It served as the Tekel Wine and Brandy Factory for many years, but in 2020, it was repurposed by the municipality and has since been used as a cafe and parking lot.

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Bariş Cafe Parking Lot

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Fig. 4. Plan View of Bariş Cafe Parking Lot (sourced from Google Earth)



Fig. 5. *General View of Barış Cafe Parking Lot*

The parking lot covers an area of 3,160 m² and has a capacity for 133 vehicles, including 2 spaces designated for disabled parking; however, there is no area allocated for bicycles. Interlocking pavers are used for the hard surface (Fig. 6). Unlike green parking lots, the surface is impermeable and not suitable for rainwater collection, which can be a disadvantage in terms of environmental sustainability and effective water management.



Fig. 6. *Interlocking Pavers*

Unlike the other two parking lots, this design incorporates vegetation (Fig. 7). The plants found in the parking lot include *Buxus sempervirens* (Boxwood), *Phoenix dactylifera* (Date Palm), *Thuja occidentalis* (Western Arborvitae), *Ligustrum ovalifolium* (Privet), *Cupressus sempervirens* (Mediterranean Cypress), and *Jasminum sambac* (Arabian Jasmine). The presence of plant diversity in the parking lot reflects an eco-friendly approach while also providing a visually pleasant appearance.

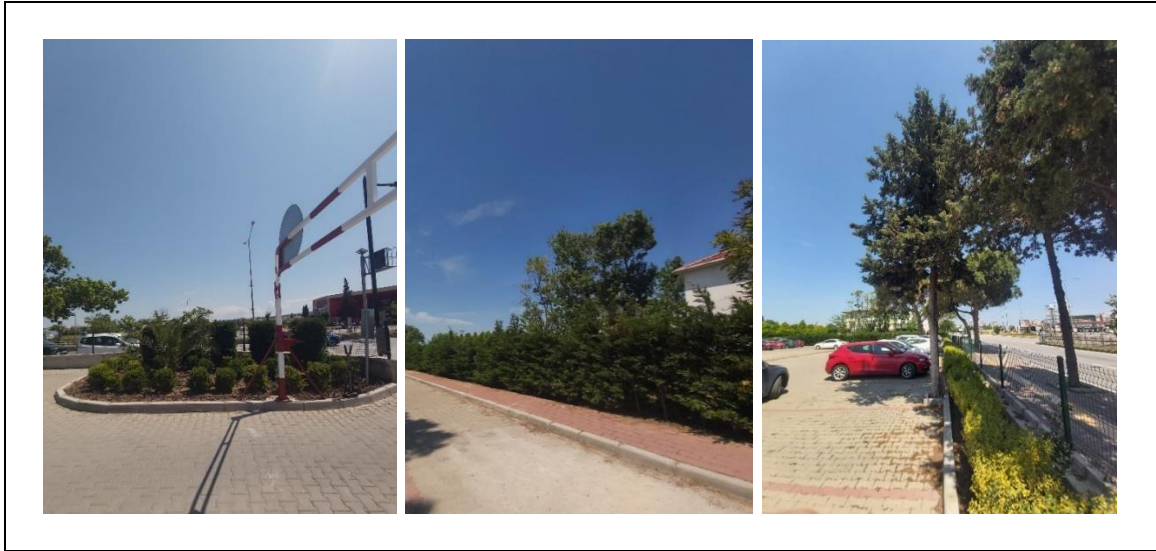


Fig. 7. *Vegetation at Barış Cafe Parking Lot*

Halk Garden Parking Lot

Located in Cevat Paşa Neighborhood, this parking lot is very close to the city's busiest area, the Dock Square. It is also situated on the rear side street of Halk Garden and, unlike the other two parking lots, it is a paid parking lot (Fig. 8).



Fig. 8. *Plan View of Halk Garden Parking Lot (sourced from Google Earth)*

The old girls' vocational high school located next to the parking lot is currently in a demolished state and is being used as a temporary parking area. The parking lot covers an area of 1,333 m² and is 512 meters long, with a capacity for 81 vehicles. There is no designated space for disabled parking, but a bicycle area is available. The parking lot is open to vehicle traffic, has a dual-direction flow, and is positioned directly on the central median (Fig. 9). Due to its location, it is a frequently used parking area.



Fig. 9. *General View of Halk Garden Parking Lot*

The hard surface is made of interlocking pavers and concrete materials (Fig. 10). However, the materials used for the hard surface are not suitable for green parking lots.



Fig. 10. *Hard Surface Material Used*

Only 16 *Pinus pinea* (Stone Pine) trees are used as vegetation (Fig. 11). This limited selection may reflect a constrained approach in terms of environmental sustainability and visual diversity.



Fig.11. *Pinus pinea* (Stone Pine)

Çanakkale Municipality Parking Lot

Located in İsmetpaşa Neighborhood, this parking lot was previously used as a business center. However, since last year, it has been serving as a parking lot for the municipality (Fig. 12).



Fig. 12. Plan View of Çanakkale Municipality Parking Lot (sourced from Google Earth)

The parking lot covers an area of 6,231 m² and has a capacity for 190 vehicles (Fig. 13).



Fig. 13. *General View of Çanakkale Municipality Parking Lot*

The hard surface is made of white gravel (Fig. 14). However, the material used for the hard surface is not suitable for green parking lots.



Fig. 14. *Hard Surface Material Used*

Unlike the other parking lots examined, this area includes a separate space for bicycles and an area for electric scooters (Fig. 15).



Fig. 15. *Bicycle Parking and Electric Scooter Area*

The boundary wall in the area is poorly maintained and creates an unattractive appearance (Fig. 16). There is no vegetation within the parking lot, indicating that it is an area that needs improvement in terms of environmental aesthetics and user experience.



Fig. 16. *Boundary Wall of the Area*

CONCLUSION AND RECOMMENDATIONS

The increasing population and number of vehicles in cities have led to higher traffic congestion, resulting in the growing need for more parking spaces. In response to this demand, traditional parking lots are designed. However, these approaches are often vehicle-centric, which encourages the use of motorized vehicles and exacerbates issues such as traffic jams, air pollution, noise, and environmental degradation. Additionally, traditional parking designs can lead to problems like the creation of heat islands and the use of impermeable surfaces.

Green parking lots offer an effective solution to counteract these negative impacts. With their pedestrian- and environmentally friendly, sustainable designs, green parking lots also encourage bicycle use. A guide published by the city of Toronto states that the city's sustainable growth and development can, in part, be achieved by reducing dependence on automobiles and supporting alternative transportation methods (13).

In this study, the suitability of three different parking lots in the center of Çanakkale was assessed in terms of green parking lot standards. The analysis of Barış Kafe, Halk Bahçesi, and Çanakkale Municipality parking lots was conducted to determine how adequate the current situation is in terms of sustainable parking practices. Each parking lot was analyzed individually, and recommendations were provided.

Barış Kafe Parking Lot

Surface Permeability: The use of interlocking paving stones in Barış Kafe Parking Lot prevents rainwater from interacting with the soil, disrupting the natural water cycle. This material, with low surface permeability, poses a disadvantage in terms of water management and environmental sustainability. Therefore, permeable stones or concrete blocks should be used as surface materials. Additionally, natural channels should be created to direct the flow of water, allowing rainwater to meet the soil.

Vegetation: The parking lot has some vegetation, reflecting an eco-friendly approach. However, to fully comply with green parking lot standards, the amount of vegetation should be increased, and a more diverse range of plant species should be incorporated.

Halk Bahçesi Parking Lot

Surface Materials: The use of interlocking paving stones and concrete in Halk Bahçesi Parking Lot is not in line with green parking lot criteria. These materials hinder rainwater from reaching the soil, negatively impacting water management. Therefore, permeable surface materials should be used. To support water management, natural channels or water-permeable areas should be created to direct the flow of water.

Plant Diversity: The parking lot has only 16 *Pinus pinea* (Stone Pine) trees, which reflects a limited approach in terms of environmental sustainability and visual diversity. A greater variety of plant species is needed to meet green parking lot standards.

Çanakkale Municipality Parking Lot

Surface Materials: The white gravel used in Çanakkale Municipality Parking Lot is also unsuitable for green parking lot standards. Permeable surface materials should be preferred. Additionally, measures should be taken to ensure rainwater reaches the soil, using local materials.

Bicycle and Electric Scooter Areas: While the inclusion of bicycle and electric scooter areas is a positive feature, it is insufficient in terms of overall environmental sustainability.

Vegetation: The parking lot lacks any vegetation, which negatively impacts environmental aesthetics and user experience.

The study shows that the existing parking lots in Çanakkale do not meet the standards of green parking lots. This highlights the need for more environmentally friendly and sustainable approaches in urban planning. Green parking lots not only ensure the sustainable use of parking spaces but also contribute to the overall health of the urban environment.

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