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BOOK OF ABSTRACTS

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At the same time the workers prevent the trees from damages and diseases. The leaves used are the ones nearly ready to fall but are collected in a tree friendly manner.

Keywords: *Phoenix dactylifera*, crafts

ENHANCING THE ENVIRONMENTAL IMPACT OF ROUNDABOUTS AS A PART OF URBAN GREEN INFRASTRUCTURE: A CASE STUDY OF SKOPJE, NORTH MACEDONIA

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Urban green infrastructure plays a crucial role in enhancing the quality of urban life by incorporating diverse green areas. Roundabouts, as integral elements of urban landscapes, have gained global popularity in recent decades due to their traffic management benefits. However, their potential to improve environmental quality is now receiving increasing attention. This paper examines the environmental impact of six roundabouts in Skopje, North Macedonia, located across different parts of the city. It highlights the significance of these roundabouts as green spaces within the urban green infrastructure network and evaluates their landscape design and constituent elements. All six roundabouts studied are integrated into the urban green infrastructure network, contributing approximately 7000 m² of green area. While grass cover is present in all of them, three roundabouts incorporate low vegetation, and the remaining three feature a combination of low and high vegetation. However, the prevalent excessive use of unsustainable annual flowering plants poses economic challenges. In addition, inadequate maintenance practices and poor plant selection, lacking resistance to harmful automotive emissions, have resulted in suboptimal conditions for many plants. Recommendations are given to optimise the functionality,

sustainability, and biodiversity of roundabouts while maintaining aesthetic appeal. By adopting a strategic and holistic approach, urban planners can enhance the environmental impact of roundabouts, ensuring their integration into a cohesive and resilient urban green infrastructure network.

Keywords: roundabouts, urban green infrastructure, environmental impact, Skopje, North Macedonia

RESTORATION AND CONSERVATION OF THE TREE *QUERCUS ROBUR* L., SYN: *QUERCUS PEDUNCULATA* ERH. IN THE JOZIĆA KOLIBA SITE, SERBIA

**Suzana Mitrović, Milorad Veselinović, Goran Češljar, Zlatan
Radulović, Nevena Cule, Saša Eremija, Snežana Stajić**

Institute of Forestry, Belgrade, Serbia

Within the forest complex 'Obrenovacki Zabran' there is a nature reserve of the protection level III „Jozić koliba group of pedunculate oaks”. This area contains an oak tree that is over 200 years old and urgently needs measures to slow down its ageing and decay, and to preserve the attractiveness of this area. The aim of the tree's condition assessment is to analyse the state of health and the degree of damage, in order to define, on the basis of the results obtained, measures to rehabilitate the damage observed, caused by biotic and abiotic factors. The investigation included the recording of habitat-ecological conditions, dendrological parameters and the tree's state of health. Boot damage was determined on the basis of visual identification, taking samples from the boot surface and using a Presler drill inside the boot. The condition of the tree in the full cross-section area was analysed using sonic tomography. The vitality and ornamental value of the tree were determined using a modified visual tree assessment method. The examinations revealed that the tree is dying due to its age and that this process is accelerated by ecological and especially anthropogenic factors. All examinations of the tree revealed significant damage and voids spreading towards the centre of the tree. Examination of the tree by scanning using the prin-

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Enhancing the Environmental Impact of Roundabouts as a part of Urban Green Infrastructure: A Case Study of Skopje, North Macedonia

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INTRODUCTION

Urban green infrastructure plays a crucial role in enhancing the quality of urban life by incorporating diverse green areas. Roundabouts, as integral elements of urban landscapes, have gained global popularity in recent decades due to their traffic management benefits. However, their potential to improve environmental quality is now receiving increasing attention. The often-large areas occupied by this type of intersections require special attention on the use of ground and the preservation of the natural, environmental and architectural heritage (Ginelli *et al.*, 2014), therefore the landscape design style and its constituent elements are very important. The basic geometric elements of a roundabout include the central island of the roundabout, the splitter islands at the inlets, the circulatory roadway of the roundabout, inlets and outlets (Macioszek, 2022). The emphasis in this research is on the central islands of the roundabouts and their landscape design. Traditionally, the central island of roundabouts is designed and maintained as green areas, thus aligning with the goals of urban green infrastructure. The extent of their impact is contingent upon the landscape design style and the choice of constituent elements.

METHODOLOGY

This research aims to inventory and analyses vegetation, a part of landscape design elements of carefully selected roundabouts in the City of Skopje, North Macedonia. All field data were collected in June 2023 year. The analysis addresses several different aspects (inventory of vegetation in the field, plant species selection, plant condition, their aesthetic appeal and landscape design elements according to functionality, sustainability, and biodiversity). The current state of the central islands of the roundabouts is compared with the data obtained from companies responsible for the landscape design, planting greenery and maintenance of selected roundabouts.



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LOCATION



Figure 1. Location of selected roundabouts in the City of Skopje, North Macedonia. a) Roundabout Porta Vlae; b) Roundabout Catholic Cathedral Sacred Heart of Jesus; c) Roundabout Polyclinic Jane Sandanski; d) Roundabout Hotel Continental; e) Roundabout Avtokomanda and f) Roundabout Polyclinic Chair

RESULTS

Table 1. Area and coverage of selected roundabouts

	R. Porta Vlae	R. Catholic Cathedral Sacred Heart of Jesus	R. Polyclinic Jane Sandanski	R. Hotel Continental	R. Avtokomanda	R. Polyclinic Chair	Total (m ²)
Size							
Diameter (m)	37	38.5x33.5	30	40	60	18	
Area (m ²)	1074.67	890	706.5	1256	2826	254.34	7007.51
Grass cover (m ²)	894.67	760	646.5	1126	2775.76	254.34	6457.27
Paved surface (m ²)	/	50	/	70	/	/	120
Plant cover of perennials or woody creeping shrubs, hedges or plant borders of woody plants (m ²)	25	20	60	60	50.24	/	215.24
Plant cover of seasonal plants (m ²)	155	60	/	/	/	/	215

Table 2. Constituent elements, construction and reconstruction of roundabouts

Roundabout	Construction year	Constituent elements	Reconstruction
Porta Vlae	May, 2015	Grass cover and seasonal plants	2021 Grass cover, woody plants, perennials, and reduced number of seasonal plants
Catholic Cathedral Sacred Heart of Jesus	2007	Grass cover and seasonal plants	2013 Installation of monument, grass cover and reduced number of seasonal plants 2021 Monument, grass cover, hedge of woody plant, and reduced number of seasonal plants
Polyclinic Jane Sandanski	March, 2019	Grass cover and woody plants	/
Hotel Continental	2009	Grass cover and seasonal plants	2014 Installation of monument and border of woody plants
Avtokomanda	June, 2016	Grass cover and seasonal plants	2021 Grass cover, woody plants, perennials
Polyclinic Chair	2020	Grass cover and seasonal plants	2021 Grass cover, woody plants, perennials



Figure 2. Location of the Roundabout Porta Vlae, before and after construction



Figure 3. Location of the Roundabout Catholic Cathedral Sacred Heart of Jesus, before and after construction

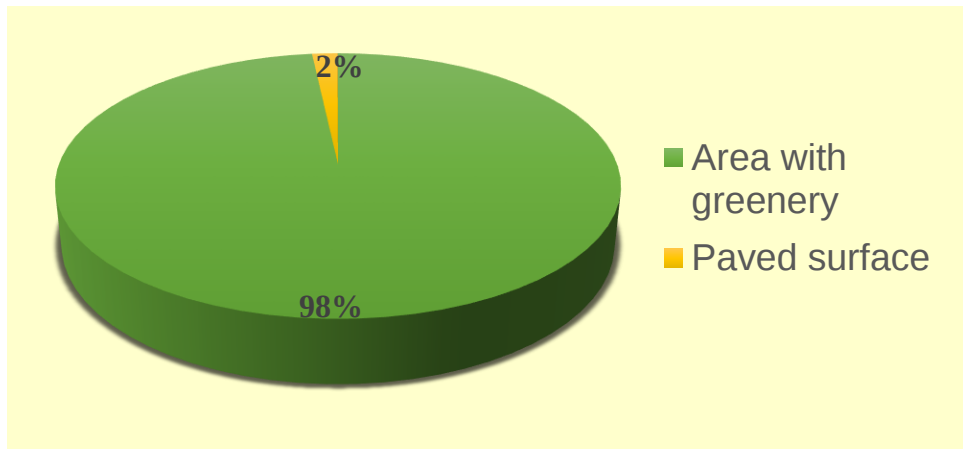


Figure 4. Area of all 6 roundabouts



Figure 6. Roundabout Porta Vlae. a) 2015 y., b) 2023 y.

Table 3. Types of vegetation on roundabouts

Only 3 roundabouts with HIGH VEGETATION		R. Porta Viae	R. Catholic Cathedral Sacred Heart of Jesus	R. Polyclinic Jare Sandanski	R. Hotel Continental	R. Avtokomanda	R. Polyclinic Chair	Total (pieces (p.); m²)
Low vegetation	Deciduous shrubs (p.)	/	/	10	/		3	13 p.
	Evergreen shrubs (p.)	/	50		/	125	293	468 p.
	Evergreen trees (p.)	/	/		/		3	3 p.
	Plant cover of perennials or woody creeping shrubs, hedges or plant borders of woody plants (m²)	25	20	60	60	50.24	/	215.24 m²
	Plant cover of seasonal plants (m²)	155	60	/	/	/	/	215 m²
High vegetation	Deciduous trees (p.)	59	/	15	/	30	/	104 p.
	Evergreen trees (p.)	64	/	10	/	15	/	89 p.



Figure 5. Roundabout Polyclinic Chair. a) 2020 y., b) 2023 y.



Figure 7. Roundabout Catholic Cathedral Sacred Heart of Jesus. a) 2007 y., b) 2023 y.

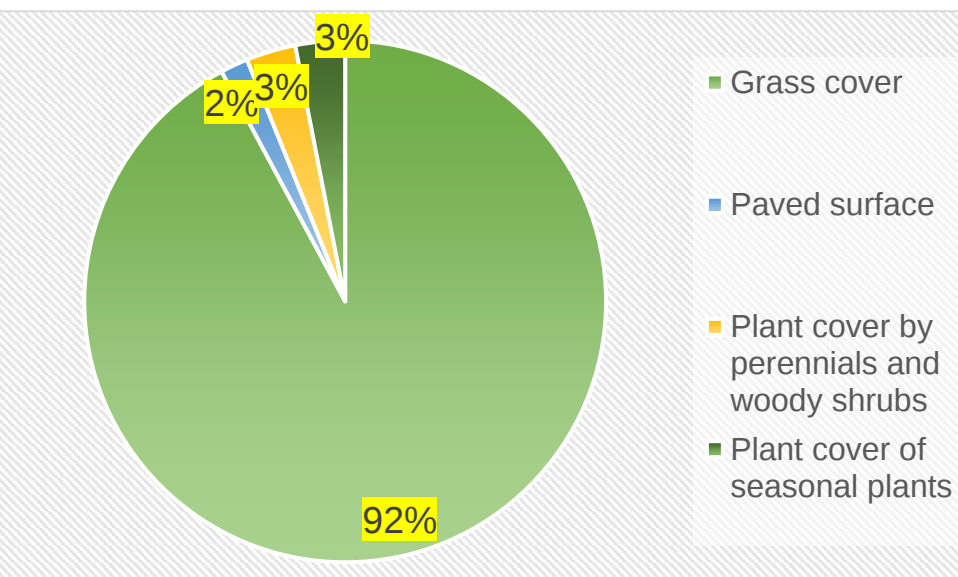


Figure 8. Coverage of the roundabouts

IMPROPER PLANT SELECTION

IMPROPER LANDSCAPE DESIGN

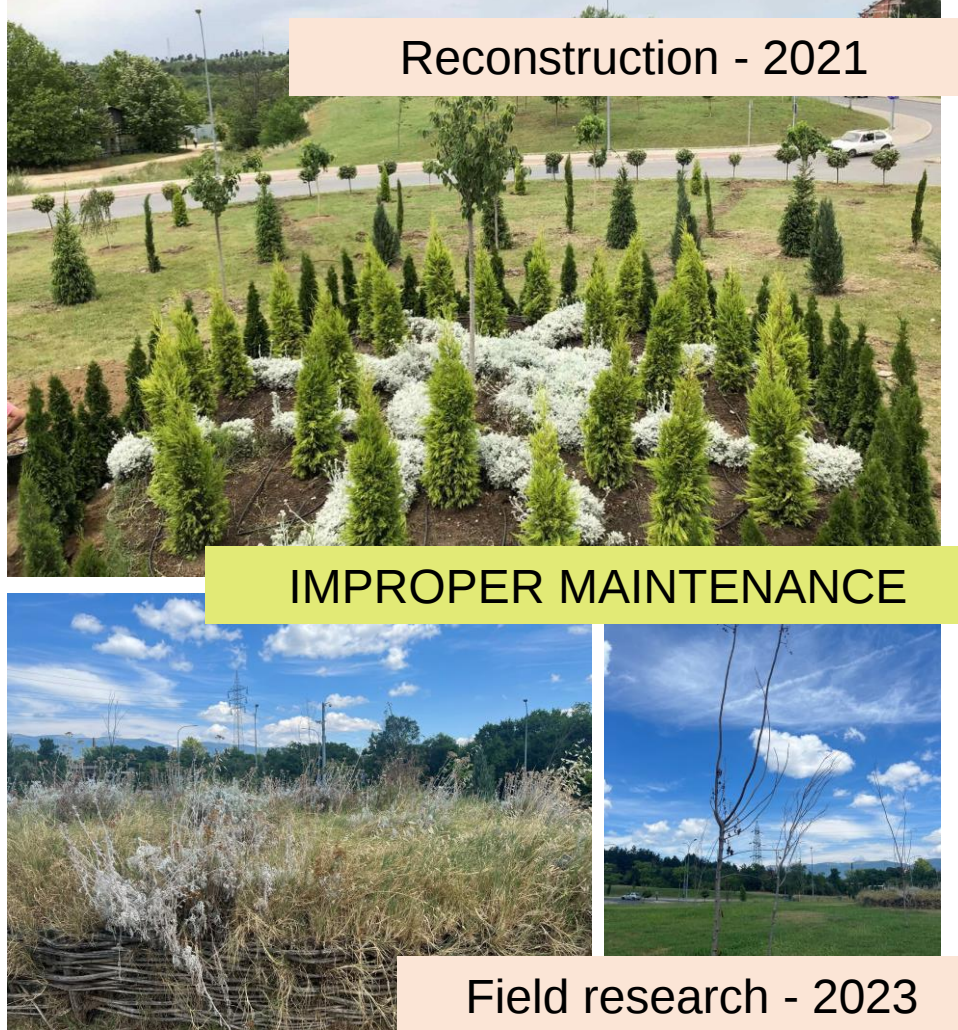


Figure 9. Roundabout Avtokomanda

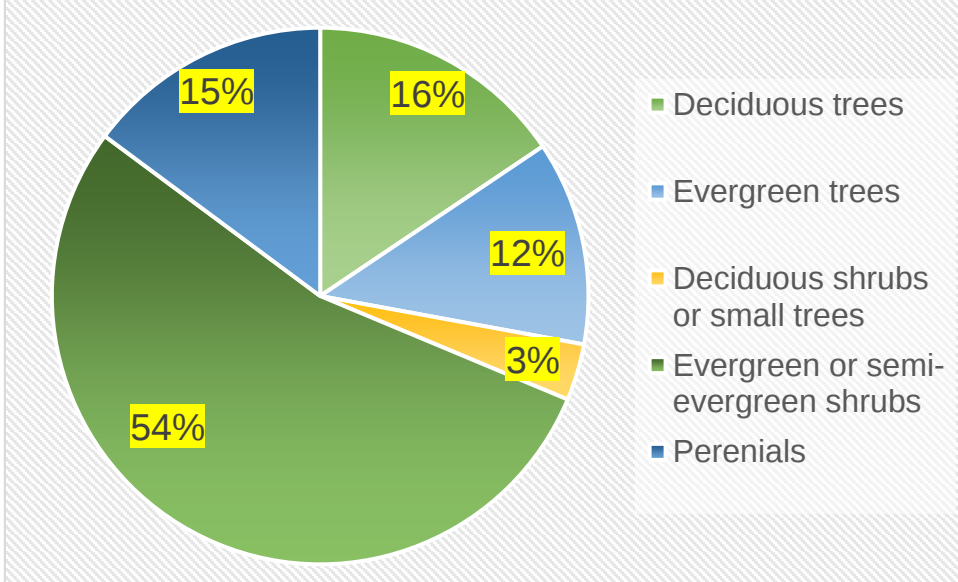


Figure 10. Types of plants, planted individually on a grass cover

MAIN CONCLUSIONS AND RECOMMENDATIONS

- All six roundabouts studied are integrated into the urban green infrastructure network, contributing approximately 7000 m² of green area. **POSITIVE**
- While grass cover is present in all of them, three roundabouts incorporate low vegetation, and the remaining three feature a combination of low and high vegetation.
- The prevalent excessive use of unsustainable annual flowering plants poses economic challenges. **NEGATIVE**
- With the reconstruction of 4 roundabouts (Porta Vlae, Catholic Cathedral Sacred Heart of Jesus, Avtokomanda and Polyclinic Chair) in 2021, the landscape design has been changed and the use of seasonal plants has been reduced or excluded. **POSITIVE**
- Inadequate maintenance practices and poor plant selection, lacking resistance to harmful automotive emissions, have resulted in suboptimal conditions for many plants (most striking example – Roundabout Avtokomanda). **NEGATIVE**
- The inventory of the urban dendroflora of all six roundabouts shows 30 different taxons, and the most of them (54%) are evergreen or semi-evergreen shrubs.
- Recommendations are given to optimize the functionality, sustainability, and biodiversity of roundabouts while maintaining aesthetic appeal (landscape designing with the use of rain garden model and xeriscaping).
- By adopting a strategic and holistic approach, urban planners and landscape designers can enhance the environmental impact of roundabouts, ensuring their integration into a cohesive and resilient urban green infrastructure network.

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References

Ginelli, E., Mussone, L., Riva, G. D., & Trabucchi, M. (2014). Landscape and Environmental Impact Evaluation of Roundabouts. *International Journal of Architecture, Engineering and Construction*, 3(4), 247-261.
Macioszek, E. (2022). Roundabouts as aesthetic road solutions for organizing landscapes. *Zeszyty Naukowe. Transport/Politechnika Śląska*.



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