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Optimal parking solutions in a limited space: analysis for the area around the Rest House for Employees of Lublin University of Technology in Kazimierz Dolny

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Abstract: The study was aimed at selecting optimal parking solutions for the Rest House for Employees of Lublin University of Technology in Kazimierz Dolny, taking into account functional, ecological and aesthetic aspects. The location and surroundings of the facility required the design of a car park that would meet technical requirements and blend harmoniously with the surroundings. The site required improved aesthetics and functionality. This included creating more biologically active areas and separating the car park from the playground. The proposed changes included the use of appropriate surfacing materials to allow the car park space to blend into the natural landscape. The design concept included the addition of greenery to increase safety and comfort, as well as a shed with photovoltaic panels that could generate electricity. This design would optimise the functionality of the car park, influence the sustainability of the space and improve the aesthetics of the site.

Keywords: car park, landscape, parking surfaces

Introduction

Cars are an integral part of everyday life in modern society. A notable proportion of travellers opt for individual transport instead of public transport, valuing independence and comfort. With the development of tourism, there is an increasing demand for parking spaces, especially in attractive locations within close proximity to cultural and natural landmarks (Maršanic et al., 2021) the aim of this paper is, from the user's (n = 596).

Accommodation facilities should provide guests with convenient and safe access to car parks. However, intensively developing road infrastructure can disrupt spatial order. When designing car parks in places with high aesthetic value and a clear identity code, the traditional approach focusing on maximising the number of parking spaces should be rejected. Instead, a balance should be found between functionality and aesthetics and harmony with the surroundings (Sarna, 2010).

Purpose of the study

The objective of this study is to examine the available solutions for the optimal design of parking spaces at the Rest House for Employees of Lublin University of Technology in Kazimierz Dolny, with consideration of the functional, ecological and aesthetic aspects. It is essential that the car park meets the requisite technical conditions and complies with the stipulations set forth in the Local Spatial Development Plan. However, equal importance should be attached to ensuring that the design blends harmoniously with the distinctive aesthetic character of the city. Furthermore, when designing modern car parks, it is vital to minimise any adverse impact on the environment by incorporating available ecological solutions.

Characteristics of the study area

The subject of the study is the area around the Lublin University of Technology employees' hostel at 2B Kwaskowa Góra Street in Kazimierz Dolny. It is a facility with a hotel function, providing 15 beds in 10 rooms, a kitchen, a dining room and a conference room. Next to the facility there is a playground and a recreational area with a fireplace, the location of which within the study area positively influences the functional and tourist values of the facility (Fig. 2).

The study area is surrounded by rich vegetation and visually attractive buildings, often of a historical nature (Kopciowski, 2010). A definite advantage of the study area is its location. It is close to the city centre and the gorges (Fig.1). The picturesque landscape offers employees of the Lublin University of Technology and their families a chance to relax away from the hustle and bustle of the city. The rest house serves as a meeting place for meetings and scientific events organised by the university.

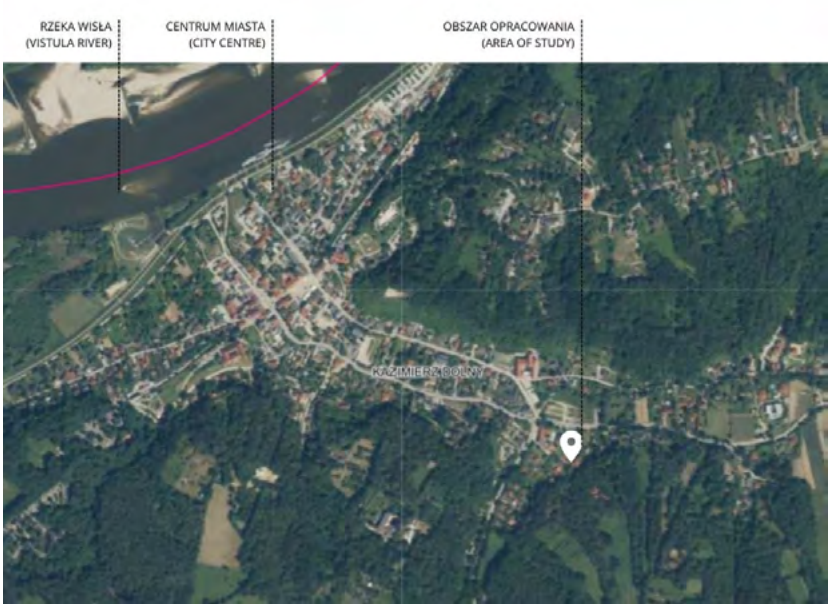

Fig. 1. Location of the work area in relation to the centre of Kazimierz Dolny. Source: Own compilation based on map from the geoportal.gov.pl

Fig. 2. View of the Rest House for Employees of Lublin University of Technology in Kazimierz Dolny. Source: Own photo

Criteria for assessing design solutions

The design of public spaces, including car parks, requires a number of considerations to ensure functionality and comfort while making them an integral part of their surroundings. Ergonomics is a priority, including the correct positioning of spaces and the safety of pedestrians and vehicles. Parking places have to meet strict standards for minimum dimensions and spacing, and should be adapted to people with disabilities to ensure safe and unhindered access to the vehicle (Bykowski and Krawczyńska, 2011).

Another important consideration is the choice of a proper surface. It should be safe and durable in all weather conditions and provide adequate grip in icy conditions (Bykowski and Krawczyńska, 2011). The environmental aspect is also important. The method of installation and the material properties of the chosen surfacing should ensure the natural run-off of rainwater and allow it to be absorbed into the ground (Burdziński, 2012).

When designing car parks in culturally and touristically important areas, consider the context. This means relating the materials and colours to the area. The car park blends in with the landscape, uses local materials and matches the style of nearby buildings, making the space an integral part of the area and reinforcing its identity (Burdziński, 2007).

Research methodology

A variety of research methods were employed in order to investigate optimal parking solutions, with the objective of developing the most efficient and compliant solutions possible.

A fundamental aspect of the design process is a detailed examination of the study area. This enables the identification of the issues that currently exist, the obstacles that must be overcome, and the potential for future development. Conducting such an analysis allows for a more precise understanding of the characteristics of the area, which in turn allows for more effective progression to subsequent stages of the project.

Throughout the entire analysis and design process, it is of the utmost importance to adhere to the guidelines set forth in the Local Development Plan (LDP), which serves as an indispensable document defining the rules of conduct in a given area with the aim of maintaining a coherent whole. The LDP specifies, inter alia, the permissible land use, the minimum biologically active area, the maximum surface area, the development intensity, and the minimum number of parking spaces (*Uchwała Nr XLIV/311/22 Rady Miejskiej w Kazimierzu*

Dolnym z Dnia 28 Września 2022 Roku w Sprawie Miejscowego Planu Zagospodarowania Przestrzennego Dla Części Obszaru Gminy Kazimierz Dolny, w Obrębach: Kazimierz Dolny, Mięćmierz-Okale, Cholewianka, 2022).

The subsequent phase of the investigation entails an examination of reference solutions and pertinent materials accessible on selected manufacturers. The analysis of assumptions enables the identification of optimal design practices in terms of functionality, integration with the surrounding environment, and innovative material solutions.

Results

Spatial analysis of the study area

Following a site visit to the study area and a detailed analysis, a number of important features were noted that affect the functionality and aesthetics of the current car park. One advantage of the existing condition is the large manoeuvring space, which facilitates convenient parking and movement of vehicles. Another characteristic feature is the formation of a roundabout in the form of a circular green in the centre of the site. This provides a smooth communication between the development area and the entrance to the property (Fig. 3).

Fig. 3. Existing condition of the car park. Source: Own photo

Fig. 4. Site plan with relevant measurements. Source: www.geoportal.gov.pl

At present, the car park has the capacity to accommodate a maximum of 11 vehicles (Fig. 4). The widening of the paved area on both the northern and southern sides would result in the creation of additional parking space, thereby enhancing the functionality of the facility, particularly in the context of increased traffic during events organised by the Lublin University of Technology and during the summer season.

One significant issue with the existing car park solution is the quality of the surface. The use of an openwork concrete slab presents a number of advantages. Firstly, it is a stable structure that is resistant to weather conditions. Secondly, it allows water to pass through, which is beneficial in certain contexts. In the particular case under discussion, however, it is evident that the solution has certain disadvantages. The material used is incongruous with the local materials used in the construction of the pavements in Kazimierz Dolny, the preservation of which was recommended in the concept for the protection of the town developed by Jerzy Żurawski (Szmygin, 2004). Furthermore, the car park is currently covered with a layer of sand, which acts as a barrier to the growth of vegetation, thereby reducing the ecological value of the space and impairing its aesthetic appeal (Fig. 5). Car parks, as prominent surface features, frequently exert an aesthetic influence on their surrounding

environment. Consequently, an essential objective in design is to integrate their form as seamlessly as possible into the surrounding landscape or architectural context (Burdziński, 2012).

Fig. 5. Existing surface of the car park. Source: Own photo

A significant issue inherent to the existing condition is the proximity to the playground, which presents a potential risk to children (Fig. 6). Presently, there is no demarcation between the car park and the recreational area situated in the western section of the property. It would be prudent for the project to either separate these spaces or relocate the playground. A further disadvantage of the study area is the limited availability of green space. Green areas constitute a fundamental component of the configuration of diverse public spaces, exerting a beneficial influence on the quality of life. The skilful design of greenery layouts and the selection of appropriate vegetation can significantly influence the perception of space by users, which is particularly important in the context of hotel and leisure facilities. Green areas have been shown to have a positive impact on the image of a given space and human health (Chojecka, 2014). An appropriate redesign of the green area around the Recreation House could enhance its aesthetic value, increase its functionality and facilitate the creation of a coherent composition within the wider development area.

Fig. 6. Location of the car park in relation to the playground. Source: Own photo

Analysis of the provisions of the Local Development Plan

The study area is situated within an area designated in the Local Spatial Development Plan as 10.UT (Fig. 5), which encompasses zones designated for commercial services development, including tourism and recreation services. The provisions of the Plan for this area stipulate the provision of a minimum of one parking space per dwelling unit and at least one space for every 30 m² of primary service area (*Uchwała Nr XLIV/311/22 Rady Miejskiej w Kazimierzu Dolnym z Dnia 28 Września 2022 Roku w Sprawie Miejscowego Planu Zagospodarowania Przestrzennego Dla Części Obszaru Gminy Kazimierz Dolny, w Obrębach: Kazimierz Dolny, Mięćmierz-Okale, Cholewianka*, 2022). Consequently, with 10 accommodation rooms offered by the Recreation House, there should be a minimum of 10 parking spaces in the development area, a condition that is currently met.

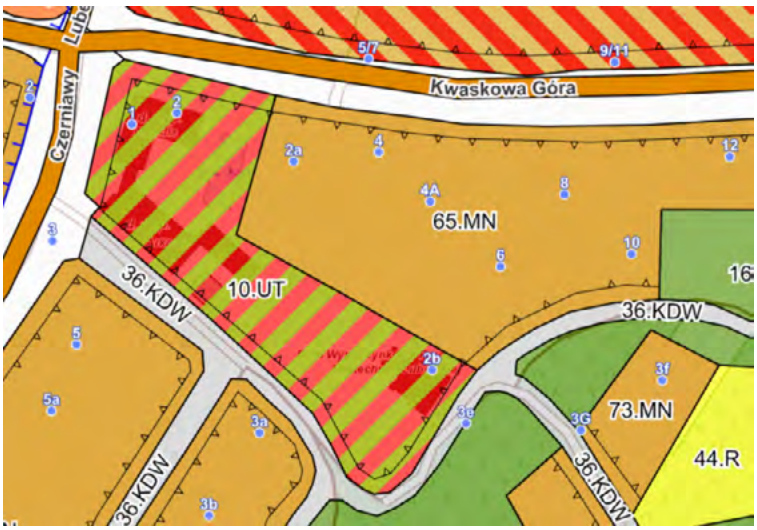

Fig. 7. Extract from the graphic annex of the Local Development Plan. Source: www.geoportal.gov.pl

Proposed design solutions

Proposed surfaces

In the process of designing the revitalisation of the car park at the Rest House for employees of the Lublin University of Technology, it is of particular importance to consider the choice of material. The surface should be selected with consideration to its durability, comfort in use, and consistency with the surrounding environment (Bykowski and Krawczyńska, 2011).

The utilisation of geogrid paving represents an ecological and functional solution that will impart a greater degree of lightness to the site. The geogrid allows for the planting of low-growing vegetation between the individual grids and facilitates the absorption of rainwater. The geogrid is durable, straightforward to install and can be cut to any shape. However, it is important to consider the preparation of the surface and the selection of a grass species that is resistant to harsh weather conditions and mechanical damage (Burdziński, 2012).

Fig. 8. Example of geogrid usage . Source: www.geoproduct.pl

Fig. 9. Concrete openwork panels. Source: www.muratordom.pl

The use of concrete block paving with green joints left in place represents a potential solution that could integrate harmoniously with the existing character of the site while simultaneously providing a stable and durable substrate. The retention of the joints ensures water permeability, while also offering an environmentally conscious alternative (Siedlecka and Suchocka, 2017).

Fig. 10. Openwork paving with green joints. Source: www.pater.pl/

Fig. 11. Stone paving with granite blocks. Source: www.elewacjekamienne.com.pl

A visit to Kazimierz Dolny reveals numerous locations where natural stone has been chosen as the pavement material (Szmygin, 2004). This choice of material blends harmoniously with the architectural style of the city, evoking the Renaissance and Baroque townhouses. Stone pavements are characterised by good durability and resistance to external factors, making them a durable and resilient choice for pedestrian areas (Strzałkowski, 2018).

Proposed changes to the car park layout

The initial proposal for modification to the car park configuration places primary emphasis on the expansion of biologically active zones, with the objective of enhancing the visual appeal and incorporating a greater degree of natural elements. As part of the design, the parking bays are delineated by green belts. This configuration results in a regular yet less obtrusive character to the space, which has a positive impact on visitors' perception of the area.

The introduction of tall greenery is an important element in this design, as it provides shade, enhancing comfort, particularly in summer. The trees also fulfil the function of a visual shield, covering the cars that were previously visible from the terraces of the accommodation rooms. This adds a sense of privacy and reduces the negative impact of road infrastructure elements on the picturesque landscape of Kazimierz Dolny (Burdziński, 2007).

In addition, it has been suggested that an important element in ensuring children's safety is the introduction of screening to separate the car park from the play area. Such separation could be provided by dense shrubs or trees (Burdziński, 2012).

Introducing more biologically active areas into the design of car parks also helps to improve air quality and retain rainwater in the area, responding to contemporary environmental needs and the sustainability of public spaces (Burdziński, 2012).

Fig. 12. First variant of car park layout. Source: own study

A second proposal to enhance the operational efficacy of the parking facility at the Rest House of the Lublin University of Technology in Kazimierz Dolny is the use of a carport, which is a progressively prevalent solution in the context of contemporary ecological imperatives and the sustainable development of public spaces.

The function of carports is to provide protection for vehicles from inclement weather conditions, such as precipitation, snow, and excessive sunlight.

A significant advantage of carports is their ability to generate electricity through photovoltaic panels mounted on the roof of the structure. The energy produced could be used to power the infrastructure of the leisure facility or to charge electric cars (Małek & Kowalczyk, 2016). In order not to disrupt the architectural order of the development, the carport could be made of wood. (Fig.13)

Fig. 13. Proposal for a wooden carport. Source: https://www.backyarddiscovery.com/products/24x12-arcadia-sloped-roof-gazebo

Fig. 14. Second variant of car park layout. Source: own study

Summary

The objective of the study presented in this paper was to identify optimal parking solutions within the constrained space of the Rest House for Employees of Lublin University of Technology in Kazimierz Dolny. The analysis of the site revealed that the current car park requires enhancements in terms of paving and integration with the surrounding area, particularly through the introduction of more greenery and the separation of the car park space from the playground. The proposed material solutions include the use of surfaces such as openwork paving blocks, natural stone, and geogrid. Additionally, the introduction of tall greenery and plant isolation is recommended to enhance the aesthetic appeal and safety of the area. Another proposal is the utilisation of carports to shield vehicles from inclement weather and to generate electricity. These recommendations aim to enhance the quality of the parking space and align it with the ecological and aesthetic standards of the region.

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