Readiness for Small-Sized Parking Policies: A Path to Sustainable Urban Mobility

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Abstract: Urban land use presents critical challenges for cities as they strive to balance stakeholder interests and needs. Several parking management policies have been implemented to optimise space, promoting more sustainable transport modes, such as electric vehicles, and meet specific needs of network users. This study explores the potential for European cities, especially those facing high density, heavy traffic, and limited urban space, to meet the demand for compact vehicles. By examining the European passenger car market, specifically sales of A-segment vehicles, this study establishes the readiness of national markets to adopt such policies. Findings reveal that countries like Malta and Italy, where urban congestion and spatial constraints pose challenges for urban planners, show a high adoption rate of small vehicles. This trend indicates an opportunity to improve urban space efficiency through targeted policies, potentially encouraging a shift towards more compact and fuel-efficient vehicles. By accommodating infrastructure for smaller vehicles, urban planners can support sustainable urban mobility, reduce environmental impacts, and improve accessibility in densely populated areas.

1 INTRODUCTION

Land use is one of the biggest challenges in urban planning, as different stakeholders attempt to promote and prioritise their own interests and needs. This issue becomes even more critical in mobility planning, where a complex ecosystem of actors creates contradictions from various perspectives. For example, while there is a push for soft mobility to address the climate crisis, the lack of investment in safe infrastructure influences modal choices (Sarker, Morimoto, Koike, & Ono, 2002) (Orozco-Fontalvo, Arévalo-Támara, Guerrero-Barbosa, & Gutiérrez-Torres) (Shen, Sakata, & Hashimoto, 2019). Additionally, the rise of shared mobility systems introduces different approaches to parking management (Jaber, Hamadneh, & Csonka, 2023) (Reck, Haitao, Guidon, & Axhau, 2021). All these factors affect how cities allocate urban land to their citizens.

However, there is a consensus that cities disproportionately allocate space to four-wheeled vehicles (Balsas, 2001). Several examples, particularly in North America, show how car-oriented development has led to extensive urban areas being repurposed for highways, which resulted in marginalisation and segregation under the dominance of car-culture (Archer, 2020) (Fielbaum & Jara-Díaz, 2021).

Nonetheless, in recent years, many cities have started adopting policies to reclaim urban space previously allocated to cars. It is now common to see low-traffic zones in different urban centres, especially in historic areas, with narrow streets, where shared spaces for different transport modes, including cars and pedestrians, can be challenging. These low traffic zones vary in flexibility, allowing only electric vehicles, imposing full bans, or applying restrictions only on defined days. Regardless of the specifics, the goal remains the same: to reduce congestion and air pollution, thereby improving citizen satisfaction and health outcomes (Azami, 2020).

Another aspect of urban policy involves parking management measures, such as implementing

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variable parking fees in high demand areas. By setting higher fees, cities attempt to discourage car use while encouraging more sustainable transport modes like public transit or micromobility (Ding & Zhang, 2017) (Cavadas & Antunes, 2018). This approach also extends to designating parking lots for more sustainable transport modes, such as electric vehicles (EVs). However, recent trends are not solely about adopting new power sources, like electric or hybrid vehicles, but also address vehicle size. In fact, in the European Union, it is estimated that 10% of vehicles fall under the A-segment, meaning they are under 4 metres in length (Statista, 2024).

Lastly, European projects have been advocating for smaller, compact vehicles. For example, ZEV-UP project is working on a prototype for a smaller, more affordable, and more efficient vehicle. This paper aims to explore the readiness of European countries to adopt parking policies that support small-sized vehicles and to assess how such changes could contribute to urban space reclamation and sustainability goals. It is structured as follows: an analysis of the policies for non-regular parking lots is presented as the theoretical background, followed by the methodology and its application using a European dataset. Finally, suggestions and conclusions are provided based on the results obtained

2 THE POLICIES FOR SPECIAL PARKING LOTS

City authorities have dealt with various strategies and policies related to parking management and parking lot allocation to optimise land use, tackle congestion and emissions, and encourage sustainable transport modes, such as EVs, by designating special parking lots equipped with charging infrastructure. These policies consider factors such as demand level, location, vehicle type, and so on.

For example, in recent years, it has become common to see parking areas equipped with charging stations designated exclusively for plug-in electric vehicles. These special lots may not necessarily differ significantly from standard parking spaces; however, their design and layout often include specific modifications to optimise space, facilitate charging, and improve user experience (Sanjay-Kumar, et al., 2022) (Faddel, Elsayed, & Mohammed, 2018). Other policies are related to dynamic pricing management, which adjusts parking fees based on time of day, and/or location, requiring special permits or fees for parking access (Maternini, Ferrari, & Guga, 2017).

Some policies are emission-driven, with many cities adopting measures to limit carbon emissions by banning internal combustion engine (ICE) vehicles and allowing only zero-emission vehicles in certain areas, such as city centres or crowded zones (Gonzales, Gomez, & Vassallo, 2022). Additionally, more specific policies target vehicle emissions through emission-based parking fees, where vehicles with lower emissions pay less to park, and vice versa. In these cases, parking management serves as an instrument to incentivise the adoption of cleaner vehicles (Krishnamurthy & Ngo, 2020).

Other policies boost the use of shared mobility options, such as carpooling and car sharing (Krishnamurthy & Ngo, 2020) (Mackowski, Bai, & Ouyang, 2015), allowing vehicles not owned by the user but that can be rented or used temporarily. These policies also impact parking management by giving priority or even dedicated lots to shared vehicles.

The dimensioning of special parking areas is another topic. On one hand, there is often a reduction in space allocated to two-wheelers to maximize availability, especially as these vehicles offer a dynamic and affordable alternative to passenger cars. On the other hand, some cities allocate larger parking spaces adapted for disabled users, as these spaces accommodate wheelchair access and manoeuvrability.

For passenger cars, parking management also extends to cargo vehicles. In commercial areas, designated parking spaces are available for small supply trucks, allowing loading and unloading during defined times and days according to local policies, normally aligning with market days or events. These policies also promote sustainable transport modes for cargo, banning ICE vehicles while allowing other greener engines, like EV, to reduce pollution rather than to optimize space.

Currently, the standard size for parking spaces in Europe varies by country, with dimensions typically ranging from 5 to 5.5 meters in length and 2 to 2.5 metres in width (Deutsches Institut für Normung, 2014), (Ayuntamiento Madrid , 2024), (AFNOR, 1994), (BME Faculty of Architectural Engineering, 2013), (Direction des Déplacements doux et de la Sécurité des aménagements de voiries, 2024), with exceptions for the special cases mentioned above. However, there is limited evidence of policies specifically aimed at designing parking spaces for small vehicles, despite the potential benefits these could bring to cities facing high traffic congestion and limited parking availability. Assessing the impact of such policies is, therefore, important.

3 METHODOLOGY

This study aims to assess the potential impact of implementing small-sized parking lots designed for compact vehicles by examining European passenger car sales data segmented by vehicle categories. Using Statista's dataset (Statista, 2024), it is possible to obtain detailed information on passenger car sales data. This data is classified under the ACEA categorization (ACEA, 2023), which divides passenger cars into various segments, with the smallest being minicars, also referred to in European Car segmentation as the A-segment.

To understand the practicality of small-sized parking lots, this methodology proposes examining A-segment sales data broken down by car manufacturer, allowing for the tracking of models within this segment available on the market, and thus their lengths. This analysis entails market research in each country, reviewing manufacturer websites and open sales markets.

Once the sales are allocated to car models in the A-segment category and therefore to a defined car length, an aggregation of sales data by threshold is proposed, with three thresholds defined:

- Vehicles under 3 meters in length;
- Vehicles under 3.5 meters in length;
- Vehicles under 4 meters in length.

The aggregated data from models allows for understanding the percentage of vehicles in the market under these three established thresholds, providing an overview of the readiness of national car markets to support the formulation of policies that incentivize smaller parking lots.

4 DATA SET ANALYSIS AND APPLICATION

By analysing the total passenger car market, it is possible to determine the share of A-segment in the European Market, which has shown a steady percentage variation since the 2015 update. Dividing Europe into macro regions, the following average percentages correspond to data from 2015 to 2023 (Statista, 2024):

- Eastern Europe: 5.5%;
- Northern Europe: 7.5%;
- Southern Europe: 8.2%;
- Central and West Europe: 6.1%

Figure 1 shows the average percentage of sales of A-segment vehicles over the last 10 years, highlighting the high presence of these vehicles in countries like Malta, Italy, the Netherlands, Denmark and Lithuania.

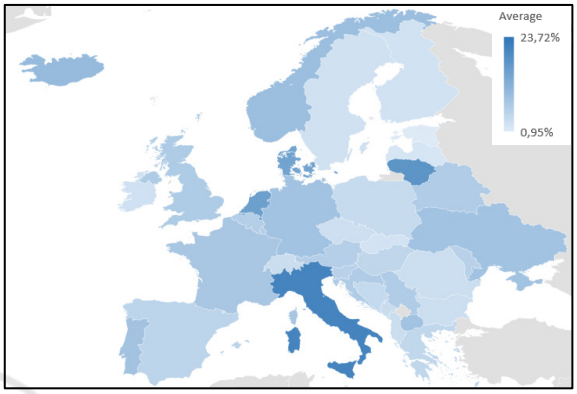

Figure 1: Map of European countries with the percentage of A-segment vehicles sold in the last 10 years.

The presence of small vehicles can be explained by diverse factors. In Italy and Malta, the high rate of car ownership (Eurostat, 2024) has led to significant congestion and limited parking space, making motorcycles and small vehicles attractive options due to their agility. In other cases, such as in the Netherlands or Denmark, the presence of small vehicle could be attributed to a combination of environmental policies and tax incentives, as small vehicles are typically more fuel-efficient and incur lower registration and annual taxes (Davies & Bastien, 2021). This trend may also be influenced by cycling culture and alternative transport, where small vehicles are seen as complementary modes. Additionally, economic factors contribute to this choice, as small vehicles tend to be more affordable in terms of purchase price and running costs.

In addition to A-segment vehicles' share in the overall passenger car market, Statista provides a breakdown of the A-segment by brand, allowing the tracking of models within the A-segment through manufacturers and their sales in Europe. Table 1 shows the A-segment models per brand and their respective lengths. This information helps establish the presence of these vehicles by length threshold.

Table 1: Brand and models sold in Europe belonging to the A-segment Category.

Brand and Model	Length (Approx.) (m)
Kia - Picanto	2.69
Mitsubishi - Space Star	2.87
Renault - Twingo	2.88
Aston Martin - Cygnet	2.90
Skoda - Citigo	3.07
Hyundai - i10	3.19
Abarth - 595	3.46
Daihatsu - Sirion	3.47
Peugeot - 108	3.47
Fiat - 500	3.50
Nissan - Micra	3.54
Fiat - Panda	3.56
Citroën - C1	3.57
Chevrolet - CH	3.60
SEAT - Mii	3.60
Suzuki - Alto	3.60
DR - DR Zero	3.61
Tazzari - Zero EM2	3.65
Smart - EQ Fortwo	3.66
Toyota - Aygo	3.67
Opel/Vauxhall - Karl	3.68
Volkswagen - up!	3.80
Mia - Vitale	3.85
Bolloré - M1	3.99

This information allows for the creation of length thresholds. In this study, three length thresholds were applied. Figure 2 shows how each brand and its models fall within these thresholds.

Figure 2: Average length of A-segment vehicles by model and brand sold in Europe.

By applying the thresholds to car sales data provided by Statista, it is possible to develop the following chart presented in Figure 3, which reflects the market shared of the A-segment by thresholds based on sales over the past 10 years.

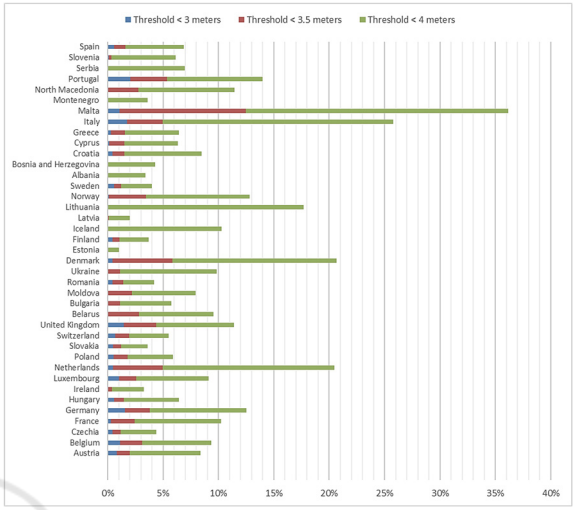

Figure 3: Percentage representation of thresholds per A-segment vehicle length in European countries.

The previous graph shows a significant opportunity for countries like Malta and Italy to adopt policies promoting smaller parking areas within their parking infrastructure. This approach would particularly benefit drivers whose choice of vehicle size is influenced by externalities such as limited urban space or high traffic conditions.

4.1 Policy Challenges

Introducing policies to designate parking spaces specifically for small vehicles could encourage the adoption of more sustainable and compact vehicles, improving urban mobility and reducing congestion. However, implementing such policies presents unique challenges that must be addressed to ensure their effectiveness and user acceptance.

A primary challenge is the lack of standardization around the concept of a “small vehicle.” Despite other types of designated parking spaces, such as those for EVs, disabled users, or loading zones, there is no standardized definition for small vehicles. This ambiguity can lead to confusion among users about which vehicles qualify for compact parking spaces, potentially reducing compliance and undermining the policy’s effectiveness.

Additionally, vehicle segmentation alone may not be sufficient to clearly define eligibility for small vehicle parking spaces. An example of standardisation

could be the one given by the EU related to A-segmentation; however, this classification alone may not be enough, as the policy could consider other thresholds depending on vehicle length.

To address these challenges, more descriptive instructions should accompany the policy. Signage and markings could provide clear criteria, such as vehicle size limits or specific models that are eligible for these spaces. Moreover, these measures should be reinforced with educational campaigns to inform the public about the advantages of small vehicle parking spaces and the qualifications for using them. Such campaigns could emphasize the benefits of compact vehicle use in urban areas, like reduced environmental impact, ease of parking, and support for sustainable urban development.

The success of small parking policies may also depend on broader urban planning and enforcement mechanisms. Without clear, visible enforcement, drivers of larger vehicles may occupy compact parking spaces, negating the policy's benefits. Policymakers may need to consider additional enforcement measures, such as digital monitoring, fines, or parking attendants, to ensure compliance.

Finally, integrating small vehicle parking policies with other urban mobility initiatives can help overcome potential public resistance. To build support, cities could demonstrate the policy's positive impact through pilot programs, highlighting how prioritizing small vehicles can benefit densely populated urban areas.

5 CONCLUSIONS

Implementing policies for smaller parking spaces could lead to a more efficient use of available land, especially in densely populated or historically compact urban areas where space is limited. For example, reducing the standard size of parking spots could increase parking capacity in busy areas, accommodating the needs of A-segment vehicle owners without requiring significant infrastructure expansion.

Additionally, these policies could promote the adoption of compact vehicles by offering economic incentives for small car owners, such as lower parking fees or prioritized access in crowded zones. This aligns with broader urban mobility goals to reduce emissions, decrease congestion, and make cities more pedestrian-friendly. However, successful implementation may depend on a clear, standardized definition of a "small vehicle" to avoid ambiguity and ensure compliance. Unlike other specialized parking designations, the concept of a small vehicle lacks universal understanding, making additional clarity through signage and consistent guidelines essential.

Educational campaigns and public engagement will also play a crucial role in helping residents understand and support these changes. By making smaller vehicles more practical and advantageous for urban drivers, city planners in countries like Malta and Italy can advance sustainable mobility solutions while addressing the unique challenges of their urban landscapes.

In the long term, fostering an ecosystem that supports smaller vehicles could shifts consumer behaviour toward compact and energy-efficient vehicles. Enhanced enforcement mechanisms, such as digital monitoring or fines, may also be necessary to maintain the integrity of these spaces and encourage proper usage. This could reduce some of the pressure on public transit systems and lessen the environmental impact of urban transportation networks. Overall, adapting parking infrastructure to better accommodate small vehicles aligns with sustainable urban development and can contribute to creating cities that prioritize accessible, low-impact mobility solutions.

6 LIMITATIONS AND FUTURE RESEARCH

The study does not account for market evolution in the coming years, as vehicle dimensions may change in response to numerous factors, such as consumer preferences, regulatory impacts, and technological advances. Additionally, ultra-compact vehicle categories like L6 and L7 are not included in the analysis due to a lack of related data. These vehicles, which are even smaller than the A-segment, could significantly impact urban parking needs and infrastructure if widely adopted. Future research could explore these evolving dynamics and assess their implications for sustainable parking policies and urban planning, exploring not only Europe but other regions and continents.

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