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Urban Form and Social Exclusion: A Spatial Perspective on Residential Segregation in Czech Cities

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Abstract
Urban residential segregation, shaped by historical, economic, political, and cultural factors, varies in its spatial form, which varies across regions (Dadashpoor, 2024). Recent approaches by architects and planners explore links between the built environment and the inhabitant's socioeconomic traits, highlighting specific spatial features that can reinforce segregation (Vaughan et al., 2005; Knaap & Rey, 2024; Legeby, 2013). This study builds on these approaches and proposes a framework focused on spatial connectivity and accessibility in relation to socioeconomic deprivation in the Czech Republic. The focus is on access to amenities, public transportation, and urban connectivity. The research methodology is grounded in identifying localities with high concentrations of socially excluded residents, using available data on recipients of the subsistence allowance (Sýkora, 2015).

Keywords: Residential Segregation; Urban Form; Spatial Inequality; Urban Design

Introduction

Despite significant advances in research on urban segregation, the phenomenon continues to shape the social and spatial fabric of cities worldwide. Defined as the physical separation of socioeconomic or ethnic groups within urban areas (Musterd, 2020; Musterd et al., 2016; Massey & Denton, 1988), segregation not only reinforces inequalities but also limits opportunities for social mobility and integration (Musterd, 2023).

Socioeconomic inequalities in urban settings have garnered growing scholarly attention; however, the complexity of residential segregation, rooted in a combination of historical, economic, and spatial factors, necessitates a multidisciplinary approach (Vaughan & Arbaci, 2011). The concentration of disadvantaged groups in specific neighbourhoods has been linked to stigmatisation, discrimination, and reduced access to essential services, with profound consequences for both individual well-being and community cohesion (Musterd, 2023; Van Kempen & Bolt, 2012). Moreover, the spatial configuration of urban environments plays a significant role in shaping patterns of social inclusion and exclusion, underscoring the importance of spatial justice as a critical dimension in addressing urban inequalities (Lehman-Frisch, 2011; Massey, 1993; Van Kempen and Bolt, 2012).

While the adverse impacts of segregation, including unequal access to education, employment, and healthcare, are well documented (Yue et al., 2024), less attention has been paid to how spatial structures and urban morphology contribute to these patterns, particularly in post-socialist contexts. Current policy efforts, such as those by the European Union or SDG policy goals by the United Nations (Eurocities, 2023; United Nations, 2024), aim to address social exclusion and inequality, yet effectively integrating these goals into urban policies remains a significant challenge.

This study seeks to contribute to addressing this challenge by examining the spatial features of residential segregation in the Czech context, where socioeconomic exclusion can be traced through the concentration of people reliant on state welfare systems (Agentura pro sociální začleňování, 2024; Sýkora, 2023). By developing a theoretical framework that links spatial connectivity, accessibility, and residential segregation, this study aims to contribute to practical policy interventions.

Literature review

Conceptual Approaches to Studying Segregation

The exploration of urban segregation varies depending on the analytical perspective adopted. Musterd (2023)

identifies four dimensions of segregation based on sociodemographic characteristics. The first concerns class or social status (Sassen, 2001; Atkinson, 2006; Musterd, 2020). The second encompasses race and ethnicity, sometimes considered alongside religion and migration (Phillips, 2010). The third pertains to demographic attributes, such as age and life-cycle stage, while the fourth involves cultural distinctions, which may be reflected in differing lifestyles and educational levels. Although approaches to studying segregation may differ, this paper focuses specifically on the spatial aspects of socioeconomic segregation, following the assumption that spatial distance corresponds to social distance and that poverty often concentrates in particular areas and disadvantaged neighbourhoods (Musterd, 2020; Duncan and Duncan, 1955; Park, Burgess and McKenzie, 1925).

Within the discourse on residential segregation, scholars frequently distinguish between voluntary and involuntary forms of segregation (Dadashpoor, 2024; Musterd, 2020). Voluntary separation typically involves the self-selected separation of affluent groups into exclusive residential enclaves, such as gated communities. In contrast, involuntary segregation refers to the marginalisation of low-income populations, often manifesting in concentrated areas of poverty, such as ghettos or slums. However, the boundary between voluntary and involuntary segregation is not always clear-cut. What may appear as voluntary separation can, in some instances, be shaped by shared cultural or social characteristics or driven by a collective desire for security and cohesion (Dadashpoor, 2024; Toušek, 2007).

The distinction between what is sometimes termed "chosen" enclaves and "enforced" ghettos (Peach, 2005) highlights the complex interplay between individual agency and structural constraints. While ethnic concentration in specific neighbourhoods may initially offer certain advantages, such as social support networks and access to culturally familiar services, it can also create barriers to long-term integration and broader societal inclusion (Musterd, 2023). This phenomenon is particularly evident within the broader context of macroeconomic and political processes (Vaughan and Arbaci, 2011; Peach, 2005).

Musterd (2020) warns against the simplistic categorisation of segregation into 'good' and 'bad' forms. Such binary distinctions risk overlooking the nuanced and context-dependent nature of segregation. Although the emergence of gated communities represents a significant dimension of socio-spatial stratification, this study focuses specifically on exclusionary forms of segregation that affect marginalised populations.

The Multidimensional Nature of Exclusion

Spatial exclusion is the most visible manifestation of the broader phenomenon of social exclusion. Residential segregation forms part of the process that confines certain groups of people to specific regions, settlements, localities or buildings (Toušek et al., 2018). When these groups are defined by ascribed characteristics such as ethnicity, religion, nationality or similar attributes, the process can be understood as discrimination (Sýkora and Temelová, 2005).

However, social exclusion in its entirety does not necessarily equate to poverty, although it is often a contributing cause (Madanipour, 2011; Musterd, 2020). Exclusion can be understood at multiple levels and may take different forms depending on cultural, political and economic contexts. Madanipour (2011) argues that various forms of exclusion underpin all social relations. The division of life and activities into private and public spheres creates boundaries that are both temporal and spatial in nature. The author also conceptualises exclusion as an issue of access to places, activities, resources, information and other vital components of everyday life.

The Physicality of Urban Space: Influence on Social Life

Since the concept of the "right to the city" was introduced in the 1960s by the French philosopher and sociologist Henri Lefebvre, urban studies have increasingly grappled with space not only as a physical structure but also as the product of social ties, relations and dynamics. Lefebvre, followed later also by David Harvey, called for the democratisation of urban planning, arguing that all inhabitants have a stake in shaping their urban environments (Lefebvre, 1968; Harvey, 1973). Edward W. Soja builds on Lefebvre's work by arguing that our geographies, or lived spaces, are socially produced and not merely physical forms. According to Soja, justice and injustice are

embedded in the multi-scalar geographies we inhabit, from households to the global economy (Soja, 2010). At the same time, Soja rejects spatial determinism, warning that it would narrow the scope of the discussion. Instead, he advocates for a comprehensive approach that recognises the mutual influence of space and society for the reason that it is evident that some form of inequality will always exist.

There is ongoing debate in the literature regarding the extent to which the physical characteristics of a settlement influence the social ties among its residents (Vaughan and Arabaci, 2011). While some scholars argue that neighbourhood environments play a significant role in shaping individual behaviour and health outcomes (Galster et al., 2010), this relationship is complex and not always straightforward.

Space can be perceived as an expression of social relationships and, simultaneously, as a factor that influences them. When individuals face restrictions in their social opportunities, their spatial mobility is similarly constrained, and therefore, their personal experience of exclusion deepens (Madanipour, 2011). In turn, spatial inequalities tend to reinforce existing social inequalities (Vaughan, 2007; Madanipour, 2011).

The Role of Housing Policies and Spatial Planning

Regarding the approach to housing policy, Madanipour (2011) identifies two processes. First, the real estate market treats space as a commodity, creating socio-spatial segregation through residents' differential access to this commodity. This represents a purely market perspective. On the other hand, spatial and urban planning seeks to regulate and rationalise urban development and impose a form of order in the public interest. These two processes often contradict each other and produce what Madanipour calls the collectivisation of difference, meaning sharper social differences within smaller spatial units.

Following this idea in the context of post-socialist countries, Kovács (2020) refers to this urban transformation as mosaic-type urban development, where through the lens of administrative units, the population may be diverse, i.e. that people of different socioeconomic status live in the same neighbourhood, but in reality, they are small sharply segregated structures.

Dadashpoor (2024) identifies a potential driver of segregation in what is described as a form of invisible segregation, indirectly conditioned by the decisions of governing bodies and influenced by housing and social policies. As Luděk Sýkora et al. (2010) note, residential segregation also encompasses a spatial planning dimension. At various scales, spatial planning documents contain tools that can potentially contribute to desegregation. Furthermore, social segregation is acknowledged as a concern within national policy frameworks.

However, Musterd and Ostendorf (2009) caution that focusing solely on residential segregation may be insufficient to understand the social dynamics at playfully.

Research relying heavily on census data often emphasises segregation at the city-wide or neighbourhood scale, which can vary in conceptualisation. Moreover, everyday experiences of ethnic segregation may be more accurately reflected in other spatial settings such as streets, community centres, workplaces, parks, and other public spaces, and these sites may hold particular significance for vulnerable communities. For these groups, the spatial boundaries of social interaction differ from those captured by residential data (Phillips, 2007).

Moreover, architectural or urban form alone cannot be directly blamed for social problems. Bill Hillier (1996) emphasises the importance of analysing the spatial configuration of environments and how these influence patterns of movement and interaction. This approach provides a more nuanced understanding of the relationship between architecture and social behaviour (Hillier, 1996).

Detour to Post-Socialist Transition and Urban Transformation

In the twenty-first century, metropolitan Europe has become increasingly unequal, with a persistent and widening gap between high- and low-income populations observed across the continent (Musterd, 2017). To under-

stand the roots of segregation in Central Europe, particularly in the Czech Republic, it is essential to take a brief detour and examine the economic and urban transformations that have taken place over the past few decades.

The political changes following the collapse of the Soviet Union and the subsequent economic transformation brought dramatic shifts for all countries of the former Soviet bloc. The roots of the current patterns of segregation lie in this historical context.

Under state socialism, housing was considered a universal right, which in practice led to the mass construction of prefabricated housing estates and the expansion of the housing stock through the subdivision of expropriated apartments into multiple housing units (Kovács, 2020). However, this right was not distributed evenly. Socialist cities were characterised by a particular form of segregation based on allocated privileges, reflecting a marked stratification of society (Häussermann, 2008). Housing thus became, to some extent, a tool for distributing these privileges (Lux and Sunega, 2014).

The trajectories followed by individual republics in Central Europe after the fall of socialism differed considerably. For example, Tsenkova (2006) describes how the transition to a market economy, technological change, and industrialisation also transformed the urban environment.

Massive housing construction, housing allowances, expropriation, and rent regulation created a substantial publicly owned housing stock, which partially substituted for social housing. At the same time, there was no significant support for people in social need from other entities such as charities or churches. This absence contributed to a deepening of socio-spatial inequalities following the fall of the regime and large-scale privatisation (Lux and Sunega, 2014).

The privatisation of housing stock and the restructuring of the economy led to greater income diversification and the emergence of new socio-spatial inequalities (Kovács, 2020).

Another common feature across the former Soviet bloc countries is the high level of private ownership within the housing stock. Due to large-scale privatisation in the 1990s and 2000s, almost 90 per cent of the housing stock in the Czech Republic is now privately owned (Lux, 2014). Lux (2014) further notes that in the 1990s, nearly all housing stock was transferred to cities and municipalities, which became the largest owners of real estate. However, government limitations on their rights, combined with often outdated housing lacking repair funding, created difficulties. At a time of stagnant economic growth and some disillusionment with the economic transformation, privatisation emerged as a convenient tool to relieve municipalities of unwanted burdens and secure voter support. This process was also accompanied by widespread distrust of social housing, which, despite being built under favourable conditions in the 1990s, frequently ended up in private hands (Lux, 2014).

The lack of a sufficient public sector housing stock, combined the absence of governmental legislation on social housing, has led to the current situation of socioeconomically segregated neighbourhoods so-called excluded localities (Toušek, 2018). As the author notes, this term is rather challenging to grasp and lacks a clear definition. The Analysis of Socially Excluded Localities in the Czech Republic[1] (Čada et al., 2015) defines a socially excluded locality as "a space (house, street, neighbourhood) where there is a concentration of people who can be identified as having characteristics associated with social exclusion," further noting that such areas are negatively and symbolically labelled by the surrounding population. The spatial forms of socially excluded localities can vary in both size and structure; however, there are no clear implications for urban form that would allow for their consistent spatial identification.

Knowledge Gap: Urban Structure and Residential Segregation

Despite over a century of research on urban segregation, the settlement patterns of segregated populations remain insufficiently understood (Vaughan and Arbaci, 2011). Much of the comparative study to date has primar-

1 Translated by the author of this text from: Analýza sociálně vyloučených lokalit v ČR.

ily focused on capital cities, limiting broader generalisations about segregation across different urban contexts (Musterd et al., 2017).

Comparing levels of segregation and the approaches used to analyse them presents a range of methodological challenges. As Musterd (2023) notes, units of analysis can vary considerably depending on the research objective. Additionally, the spatial dimension of segregation can be studied using a variety of analytical methods, each influenced by the availability, type, and granularity of data employed.

While the causes and consequences of social exclusion have been widely studied, the traditional segregation measures often rely on predefined administrative boundaries, which can obscure the fluid and continuous nature of social and demographic distributions (O'Sullivan and Wong, 2007). O'Sullivan and Wong (2007) highlight that traditional segregation measures often rely on administrative boundaries. Because these units are arbitrary, the results can vary significantly depending on the size and shape of the areas chosen. This issue, where the scale or zoning of spatial units affects the analysis outcome, is known as the Modifiable Area Unit Problem (MAUP). This problem arises when discrete units show mixed populations, making it challenging to detect actual segregation patterns.

A notable challenge is addressed in the literature regarding the relationship between urban structure and residential segregation, a topic that has garnered growing scholarly attention in recent years (Vaughan et al., 2005; Legeby, 2013; Maffini and Maraschin, 2018; Knaap and Rey, 2024). A more comprehensive understanding of residential segregation necessitates analysing the spatial configuration of cities. This involves understanding the complex interrelationships between discrete urban elements and the city as a whole (Vaughan and Arbaci, 2011).

The presented analytical framework aims to contribute to this evolving field by addressing the issue at a broader spatial scale, with a specific focus on the built environment, particularly in terms of connectivity and accessibility. The objective is to develop a conceptual framework capable of examining multiple levels of spatial segregation, thus enabling a more nuanced understanding of how physical urban form shapes patterns of social division.

The contribution of this study to spatial planning practice lies in identifying the specific characteristics of segregated areas and the spatial factors that contribute to social exclusion. A data-driven approach offers the potential to apply these insights to other urban areas, providing an objective and quantitative perspective. This approach can support the formulation of more effective planning policies by identifying potential spatial factors that drive residential segregation.

Developing a Framework to Address the Spatial Dimensions of Residential Segregation

This study proposes a framework that emphasises connectivity and accessibility as spatial factors associated with residential segregation. By focusing on measurable spatial parameters commonly used in urban planning, it investigates how these elements correlate with the concentration of socioeconomically excluded populations. To bridge spatial analysis with practical planning, the research is scaled down to individual buildings and plots, which are the fundamental units used in neighbourhood and city-level masterplans.

The central research question is whether objective spatial patterns can be consistently identified in areas where segregated populations reside. A data-driven, quantitative approach ensures both replicability and applicability across different urban contexts. It aims to offer a methodological toolkit for assessing segregation at finer structural scales, supporting integration into urban design and planning practices.

The framework builds on extensive research into residential segregation in the Czech Republic, providing a robust foundation for broader comparative studies (Agentura pro sociální začleňování, 2024; Sýkora, 2010; Sýkora, 2023; Čada et al., 2015).

The study examines spatial features of segregation through the lens of accessibility to opportunities and the

permeability of the built environment. Segregation is analysed across three dimensions:

- Urban morphology, understood as the structural fabric that enables or constrains movement and access.
- Transportation and mobility.
- Access to public amenities.

Figure 1 illustrates each step of the proposed framework. In the next stage of the research, this framework will be applied to three Czech cities, selected as case studies based on their status as regional centres located in structurally deprived regions.

While recognising the importance of other factors, such as the quality of public space and patterns of social interaction, this research limits its focus to quantifiable spatial features at the building and plot levels in alignment with the tools and scales available to urban planners.

The following section will discuss each component of the framework, along with its theoretical and methodological foundations.

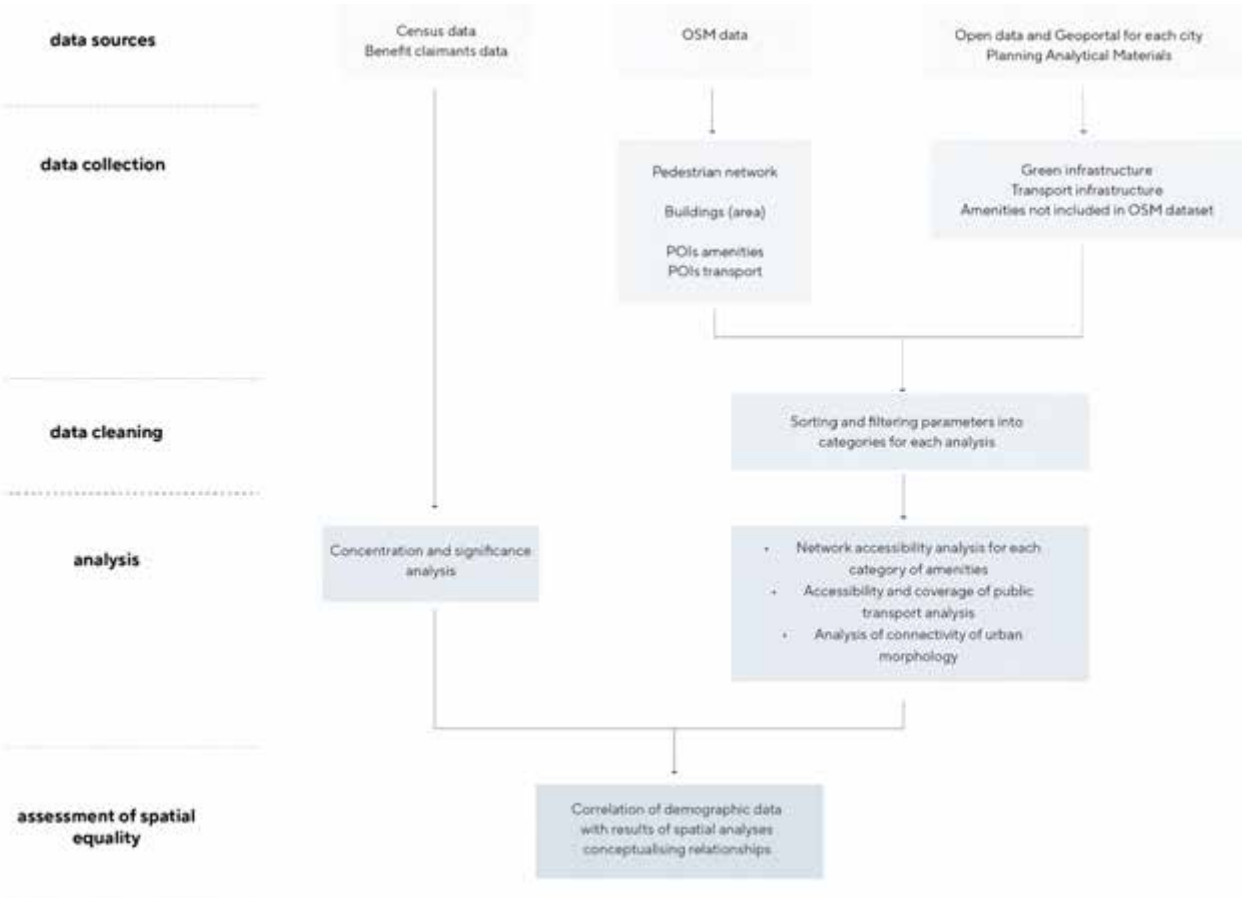

Figure 1: Proposed framework for assessing the spatial dimension of residential segregation.

Data

This study builds on existing analyses of residential segregation conducted within the Czech Republic. It draws on annually reported data based on the Methodology for the Identification of Localities of Residential Segrega-

tion[1](Sýkora, 2023). This data will be further refined to reflect specific residential structures by incorporating additional sources, including academic research and municipal reports on residential segregation in the surveyed cities.

The Methodology for the Identification and Evaluation of Segregation Sites identifies areas of segregation and assesses the suitability of social housing in preventing deeper exclusion. It assesses segregation at the level of primary settlement units (ZSJ) through three main steps: defining the target social group, identifying areas of concentration using statistical data, interviews, and discourse analysis, and evaluating findings with field verification to ensure that concentration reflects actual social exclusion (Sýkora, 2023).

The methodology utilises the abbreviation SPO PNZ, i.e. "co-assessed persons for the provision of a subsistence allowance". These are the populations at risk of poverty. The provision of the allowance is linked to the household and encompasses a wide range of individuals in varying social positions. Information on the location of public infrastructure will be sourced from open data platforms and mapping services provided by individual municipalities. Data on the street network and built environment will be obtained from OpenStreetMap (OSM), and these datasets will be further tailored and processed to meet the requirements of spatial analysis.

Urban Morphology and Spatial Configuration

Studies of urban morphology provide a framework for analysing the physical structure of cities. Configurational approaches focus on the spatial arrangement and interconnectivity of fundamental urban elements such as plots, buildings, and streets. These structural relationships shape how cities function, influencing movement patterns, social interactions, and access to resources (Hillier and Hanson, 1984; Hillier, 1996).

Research using configurational theory has explored the links between urban form and social deprivation, highlighting how spatial configurations may contribute to the concentration of disadvantaged populations (Vaughan et al., 2005; Legeby, 2013; Maffini and Maraschin, 2018; Knaap and Rey, 2024). Recent studies suggest that analysing and classifying distinct urban forms can help identify which spatial patterns are more susceptible to socioeconomic exclusion (Venerandi et al., 2024).

Evaluating Urban Morphology: Urban Morphometrics

Advancements in geographic data analysis and the growing availability of geospatial data have given rise to a data-driven branch of urban morphology known as 'urban morphometrics' (Araldi and Fusco, 2019; Fleischmann et al., 2021; Porta et al., 2022). This approach typically involves quantifying urban form across numerous metrics at the building level, using clustering techniques to define morphological regions or urban types, and profiling them for comparative analysis (Venerandi et al., 2024).

Drawing on digital mapping sources such as street networks, building footprints, and morphological tessellations, these methods enable the classification of homogeneous urban tissue types. This systematic approach supports comparative studies of urban form, facilitating a deeper exploration of how spatial patterns relate to broader issues, such as environmental quality, public health, and social inclusion. This study builds on established methods in urban morphology (Fleischmann et al., 2021), selecting a set of spatial characteristics to guide the analysis of urban form, as shown in Table 2. The chosen variables are aligned with the research objective of examining connectivity, accessibility, and permeability within the built environment.

This approach will generate a dataset that can be correlated with the distribution of socioeconomically excluded individuals to gain an understanding of the variables associated with segregation.

2 The title translated by the author of this text from: Metodika identifikace a hodnocení lokalit segregace.

Table 2 Primary morphometric characters from the Methodological foundation of a numerical taxonomy of urban form, sorted by "element" (Fleischmann et al., 2021).

Element	Set of parameters	Data Source
building	Area of building Height of a building Volume of the building Perimeter of a building Courtyard area of a building Circular compactness of a building Corners of a building Squareness of a building Equivalent rectangular index of a building Elongation of a building Centroid - corner distance deviation of a building Centroid - corner mean distance of a building Solar orientation of a building Street alignment of a building Cell alignment of a building	OSM data
tessellation cell	Longest axis length of a tessellation cell Area of a tessellation cell Circular compactness of a tessellation cell Equivalent rectangular index of a tessellation cell Solar orientation of a tessellation cell Street alignment of a building Coverage area ratio of a tessellation cell Floor area ratio of a tessellation cell	OSM data
street segment	Length of a street segment Width of a street profile Height of a street profile Height to width ratio of a street profile Openness of a street profile Width deviation of a street profile Height deviation of a street profile Linearity of a street segment Area covered by a street segment Buildings per meter of a street segment	OSM data
street node	Area covered by a street node	OSM data

adjacent buildings	Shared walls ratio of adjacent buildings Number of courtyards of adjacent buildings Perimeter wall length of adjacent buildings	OSM data
neighbouring buildings	Alignment of neighbouring buildings Mean distance to neighbouring buildings Mean inter-building distance between neighbouring buildings Building adjacency of neighbouring buildings	OSM data
neighbouring cell	Weighted neighbours of a tessellation cell Area covered by neighbouring cells Mean distance to neighbouring buildings	OSM data
neighbouring segments	Reached cells by neighbouring segments Reached area by neighbouring segments	OSM data
neighbouring nodes	Degree of a street node Mean distance to neighbouring nodes from a street node Reached cells by neighbouring nodes Reached area by neighbouring nodes	OSM data
neighbouring tessellation cell	Gross floor area ratio of neighbouring tessellation cells	OSM data
block	Weighted reached blocks of neighbouring tessellation cells Area of a block Perimeter of a block Circular compactness of a block Equivalent rectangular index of a block Compactness-weighted axis of a block Solar orientation of a block Weighted neighbours of a block Weighted cells of a block	OSM data
street network	Local meshedness of a street network Mean segment length of a street network Cul-de-sac length of a street network Reached cells by street network segments Node density of a street network Reached cells by street network nodes Reached area by street network nodes Proportion of cul-de-sacs within a street network Proportion of 3-way intersections within a street network Proportion of 4-way intersections within a street network Weighted node density of a street network Local closeness centrality of a street network Square clustering of a street network	OSM data

Mobility and Connectivity

Residential segregation can also be understood as a consequence of limited interactions and co-presence in public space (Legeby, 2013). As argued by Rokem and Vaughan (2018), segregation is shaped and potentially reshaped by patterns of mobility. Connectivity, defined as the opportunity for encounters between different population groups, is, therefore, a key consideration in addressing issues of social and spatial justice. A potential tool for assessing the intensity of flows and potential interactions in public space, as highlighted in the research mentioned above is the Space Syntax method. Developed in the 1970s by Bill Hillier, Julienne Hanson, and colleagues at The Bartlett, University College London, the Space Syntax method established a foundational link between spatial configuration and social phenomena in urban environments (Hillier and Hanson, 1984; Hillier, 1996). Their research demonstrated that the layout of spaces influences pedestrian movement, the distribution of safety, and the vibrancy of public life. Today, Space Syntax represents a broad interdisciplinary field encompassing diverse analytical tools and methodologies for quantitative spatial analysis across multiple scales.

Mobility patterns expressed not only through walkability but also via the coverage of public transportation systems, play a crucial role in urban planning, as transport infrastructure has the potential to either bridge or deepen social divides (Rokem and Vaughan, 2018). By shifting focus from where people live to where they travel in their daily lives, a more nuanced understanding of urban social dynamics can be achieved (Kolkowski et al., 2023). Focused interventions, such as the introduction of new public transport lines, have been shown to significantly improve access to essential services (Lee and Miller, 2018).

Evaluating mobility

This framework addresses both structural and service-related aspects of urban accessibility. The street network is analysed using the Space Syntax method, and public transport coverage is assessed using data from local municipalities, including connection frequencies; both analyses are linked to individual buildings. This approach aims to capture the actual daily mobility opportunities available to residents in different parts of the city.

Table 2 Accessibility standards for public Infrastructure, selected categories translated by the author of this text (Maier et al., 2020).

Type of Public Infrastructure	Description / Reference Point for Accessibility: Starting / Destination	Accessibility Standard	Data Source
Public Transport Stop	Building entrance / Platform centre	500 m (300 m) 600–700 m	OSM data / Open City Data

Accessibility in the Urban Environment

Accessibility in urban environments is commonly defined as the degree to which residents can efficiently reach essential services and destinations (Hansen, 1959; Nicoletti, Sirenko and Verma, 2023). Despite its importance, travel remains constrained by existing infrastructure and various physical or invisible barriers. Ensuring equitable access to urban services, institutions, and economic opportunities is widely recognised as a key component of sustainable development and improved quality of life (Weiss et al., 2018).

However, access to public infrastructure often reflects underlying socioeconomic disparities. Research shows that socioeconomically disadvantaged populations are frequently underserved by public amenities, experiencing limited access to services such as healthcare, education, and community infrastructure (Nicoletti, 2022; Ashik, Mim and Neema, 2020; Lee, Jeong and Go, 2024; Weiss et al., 2018; Hosseini et al., 2022). While some communities benefit from a diverse range of accessible facilities, marginalised and spatially segregated populations face

persistent obstacles in reaching these services (Van Wee and Geurs, 2011). In response, urban planners have increasingly advocated for a more equitable distribution of resources (Hosseini, 2021).

Evaluating Spatial Accessibility

There is an ongoing debate about the best approaches for evaluating spatial accessibility. Many scholars argue that analyses should extend beyond simple walking distance to incorporate travel time, demand, and service capacity (Ashik, Mim and Neema, 2020). Building on these insights, this study focuses on assessing the accessibility of key urban amenities, as defined by methodology issued by the Czech government: Accessibility standards for public amenities[2] (Maier et al., 2020). Walking distance is calculated from individual buildings to the nearest type of public amenity based on the categories shown in Table 1. These measures will later be correlated with the spatial concentration of socially excluded residents to better understand inequalities in urban service provision.

Table 1 Accessibility standards for public amenities, selected categories translated by the author of this text (Maier et al., 2020).

Type of public amenities	Description / Reference Point for Accessibility: Starting / Destination	Accessibility Standard	Data Source
Education			
Kindergarten	Residential building / Kindergarten	600 m (400 m)	OSM data / Local Geoportal of Planning Analytical Materials
Primary School	Residential building / Primary School	600 m	OSM data / Local Geoportal of Planning Analytical Materials
Social services:			
Day Service Center and Day Care Center	Residential building / Social Care Facility	600 m	OSM data / Local Geoportal of Planning Analytical Materials
Facility for children and youth, weekly care centre, intervention centre	Residential building / Social Care Facility	Location in the municipality	OSM data / Local Geoportal of Planning Analytical Materials
Healthcare			
General practitioner, paediatrician, dentist, gynaecology and obstetrics, pharmacy	Residential building / Doctor's office, Pharmacy	600 m	OSM data / Local Geoportal of Planning Analytical Materials
Culture:			
Library	Residential building / Library	15 min walk or travel	OSM data / Local Geoportal of Planning Analytical Materials
Community Centre	Residential building / Community Centre	600 m (depending on the position in the municipality)	OSM data / Local Geoportal of Planning Analytical Materials
Multipurpose Hall	Residential building / Multipurpose Hall	Location in the municipality	OSM data / Local Geoportal of Planning Analytical Materials
Public Administration			

3 The title translated by the author of this text from: Standardy dostupnosti veřejné infrastruktury

Post Office / Postal Counter	Residential building / Post Office	Location in the municipality	OSM data / Local Geoportal of Planning Analytical Materials
Civil Protection			
Volunteer Fire Station	Residential building / Fire Station	1 000 m	OSM data / Local Geoportal of Planning Analytical Materials
Fire Station	Fire Station / Any location	According to the legal definition	OSM data / Local Geoportal of Planning Analytical Materials
Permanent Shelter for Residents	Residential concentration areas / Permanent Shelter	500 m	OSM data / Local Geoportal of Planning Analytical Materials
Playgrounds:			
Playground for Preschool Children	Residential building / Playground	200 m	OSM data / Local Geoportal of Planning Analytical Materials
Playground for Younger School Children	Residential building / Playground	500 m	OSM data / Local Geoportal of Planning Analytical Materials
Playground for Youth and Adults	Residential building / Playground	500 m (1 000 m)	OSM data / Local Geoportal of Planning Analytical Materials

Discussion and conclusion

This study presents a framework for identifying potential spatial factors contributing to residential segregation by linking them with data on the location of segregated residents, as identified in previous comprehensive studies on segregation in the Czech Republic (e.g. Sýkora, 2023; Čada et al., 2015). The analysis is conducted at a scale relevant to urban planning practice.

By refining the spatial scale to the level of individual buildings and plots, the study aims to bridge academic research with practical urban planning, providing concrete insights that can inform planning decisions.

The analytical framework integrates multiple methodologies to investigate three dimensions of spatial segregation. First, it examines urban form as a structural barrier and a defining feature of settlement patterns. Second, it considers mobility, focusing on the walkable street network and the extent of public transport coverage. Third, it assesses accessibility to public amenities and services as a measure of spatial equity. Each dimension will be analysed for every building in the selected cities, and the results will be correlated with data on the concentration of socially segregated populations. Findings within the proposed research framework could provide deeper insights into the underlying patterns of spatial segregation and enhance existing research on segregation, particularly in the context of spatial planning and urban design.

This research project does not address a broader temporal scope or investigate the dynamic processes underlying social exclusion. Incorporating a longitudinal perspective and analysing patterns at the scale of individual buildings could yield a more comprehensive understanding of the migration trajectories of socially excluded populations, particularly when situated within broader regional trends. Such an approach would benefit from a qualitative analysis of spatial planning documents and policies, tracing the arguments and. A historical examination of planning paradigms would provide essential context for understanding how approaches to segregation have evolved in response to shifting political, economic, and social conditions.

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