

Comprehensive Evaluation of Child-Friendly Public Spaces: The Zümrütevler Case as Istanbul's First Permanent Two-Stage Street Transformation

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Abstract

In rapidly urbanizing cities, creating child-friendly public spaces is essential for supporting children's independent mobility, safety, and well-being. Child-centred street transformations, often implemented through phased tactical urbanism approaches, aim to reconfigure vehicle-dominated areas into inclusive, pedestrian-friendly environments. This research critically evaluates the Zümrütevler Square transformation in Istanbul using a multi-scale framework covering process, neighbourhood context, and design details. The study broadens its scope by incorporating user behaviour analysis alongside design criteria, offering deeper insights into the lived experience of the space. Findings highlight successful participatory design and iterative adaptation but reveal limitations in sustaining child-friendly identity post-implementation, constrained child visibility, and institutional fragmentation. The study underscores the importance of integrating flexible, context-sensitive criteria and behavioural observations to enhance long-term child-friendly urban interventions in dense metropolitans.

Keywords: child-friendly; street transformation; public space; design guidelines; user behaviour

Introduction

In today's rapidly evolving urban landscapes, the well-being and development of children are increasingly central to city planning agendas. By 2030, it is estimated that 60% of the global population will be under the age of 18, highlighting the urgent need to consider children's needs in urban development. Urban environments play a pivotal role in shaping childhood experiences, and access to safe, engaging public spaces is essential for their physical, mental, and social well-being. As cities densify and open spaces become more limited, the question of where and how children can play and move safely gains critical importance. Contemporary shifts in neighbourhood dynamics have led to a reduction in outdoor spaces and limited children's independent interactions with their environment. While the value of child-friendly public spaces has long been recognised, creating and sustaining them in densely built environments has become increasingly challenging. For instance, the Welsh Assembly (2002) emphasises that play is fundamental for children's development and that communities should provide environments that support play opportunities.

The concept of a child-friendly city has gained significant attention, representing a broader movement toward creating urban spaces that are not only safe and accessible but also enriching for children's cognitive and social development. Urban designers, architects, and local governments are increasingly recognising children as essential urban actors, advocating for policies and designs that address their unique needs. Krysiak (2020) underlines that when children are ignored in the design process, they are effectively excluded from urban life, limiting their opportunities for growth and participation. One key strategy in advancing child-friendly urbanism is the transformation and pedestrianisation of streets—the very first public spaces children experience. These projects often begin with temporary interventions, using a phased or tactical urbanism approach. This allows cities to pilot changes, observe user reactions, and adapt plans before committing to permanent transformations. In this framework, streets are reimagined as accessible and stimulating spaces for children's daily activities, safe movement, and social interaction.

A prominent example of this strategy is the Zümrütevler Square transformation project in Istanbul, Türkiye. Implemented in two stages, this initiative converted a vehicle-dominated area into a pedestrian-friendly public square. It represents a pioneering case of phased child-friendly urban intervention in Türkiye, particularly significant given the city's high population density and limited open space. Such projects not only provide physical improvements but also aim to shift public perceptions, promote non-motorised mobility, and foster inclusivity, especially for vulnerable groups such as children, the elderly, and those with limited mobility. However, while

phased strategies offer flexibility and encourage public participation, they also present challenges in maintaining the integrity of the original design vision during the transition to permanent implementation. Revisions made for regulatory, political, or budgetary reasons may compromise the child-centred intent, raising questions about the sustainability and long-term effectiveness of such interventions. This study explores whether child-friendly environments created through phased street transformations retain their intended qualities once they are permanently implemented. The primary focus is on assessing both the child-friendliness and sustainability of these transformed spaces. The key research questions are:

- What methods and criteria can be used to measure child-friendliness at different scales?
- How do planning and design decisions at each stage affect the use and perception of space?
- Can spaces temporarily designed to be child-friendly retain their effectiveness after becoming permanent?
- How can sustainability be ensured in long-term child-centred street design?

This research centres on street transformations within metropolitan areas, with Istanbul as the main case context. It examines how car-dominated urban design limits children's mobility, safety, and access to social space, and how phased urban interventions can offer more inclusive alternatives. The study particularly investigates Zümrütevler Square, offering a detailed case analysis to evaluate the design and implementation process, as well as the space's current performance. The scope also includes a review of international urban design guides and case examples from other cities, which inform the evaluation framework used in the fieldwork. The study adopts a case study approach structured across three spatial levels:

- The transformation process (planning, decision-making, and implementation strategy)
- The neighbourhood scale (surrounding land use, accessibility, safety)
- The design detail scale (materials, play elements, inclusivity)

Evaluation criteria are synthesised from five international child-friendly street design guides and adapted to suit the local context. Fieldwork combines qualitative and quantitative methods, including document analysis, stakeholder interviews, field measurements, pedestrian counts, and behavioural mapping. This multiscale and interdisciplinary approach supports a comprehensive evaluation of both the child-friendliness and sustainability of the space, contributing a replicable framework for future urban design research and practice.

Children in Public Spaces

In modern societies, it is commonly believed that children today are more privileged than previous generations due to access to technology and a wide range of leisure activities available after school and on weekends (Freeman & Tranter, 2012). However, this perception raises a critical question: Are today's urban environments truly more beneficial for children, particularly regarding their ability to move freely and independently within the city, or are they still reliant on adult supervision? (Freeman & Tranter, 2012). Understanding how children interact with urban spaces begins with identifying the public environments they use outside the home. Public spaces—such as squares, boulevards, streets, playgrounds, and in-between areas—are more than physical locations; they are social and functional hubs that support daily life, infrastructure, and community interaction (UN-Habitat, 2020). Among these, streets are especially significant, forming the primary network for urban mobility and access, directly influencing how people navigate and connect within cities (GDCl, 2019).

The term "Child-Friendly Cities" was first introduced at the 1996 Habitat II Conference in Istanbul, which led UNICEF to launch the Child-Friendly Cities Initiative (CFCI) in the same year (UNICEF, n.d.). The initiative was designed to help local governments implement the UN Convention on the Rights of the Child by addressing children's needs at the municipal level. Over time, CFCI has evolved into a global platform involving not only local authorities but also NGOs, the private sector, academia, media, and children themselves, promoting collaborative efforts for more inclusive urban environments (UNICEF, n.d.). Although initially targeted at large urban centres, the initiative has extended its influence to smaller towns, encouraging the integration of children's rights into urban policies. The CFCI defines child-friendly cities as those that support children's rights across various domains—including

play, safety, green space, and access to services—many of which are directly linked to urban design (UNICEF, n.d.). Aligned with the UN Sustainable Development Goals, particularly Goal 11, CFCI promotes urban strategies that prioritize inclusivity, safety, and sustainability. Through the provision of playgrounds, green areas, and safe streets, the initiative contributes to making cities healthier and more accessible for children (UNICEF, n.d.).

Cities that provide safe environments, accessible amenities, and pedestrian-oriented infrastructure significantly reduce children's risk of injury. A child's ability to walk or play safely near home reflects a higher urban safety level and contributes to their physical, emotional, and cognitive well-being. Designing cities with children's needs in mind enhances inclusivity and benefits all residents. While inclusivity remains a major challenge in urban planning, prioritizing child-friendly environments—through safe streets, accessible green spaces, and improved public services—offers a promising approach. Thus, child-oriented design should ensure safe mobility, access to play and learning spaces, school routes, and inclusive public areas.

Child-Centred Street Transformation

With the rise of private vehicle use in the mid-20th century, urban residential design began to prioritize drivers' comfort over pedestrian needs (Krysiak, 2021). According to a report by the Gehl Institute and BvLF (2018), streets should not be limited to corridors of movement but reimagined as active public spaces, particularly for young children who often have limited mobility and rely on streets to access public life. Despite growing awareness of the long-term environmental, economic, and health drawbacks of car-centric planning, its impacts on children's daily experiences have only recently gained attention (Krysiak, 2021). The decline in street play has weakened children's relationship with public space, a contrast to previous generations. Moreover, increased car dependency exacerbates inequalities, as not all children have access to private transport or adult accompaniment, limiting their autonomy in traffic-heavy areas.

The restriction of Children's Independent Mobility (CIM), largely due to the dominance of vehicles on urban streets, not only increases the risk of traffic accidents but also reduces children's visibility in public spaces, heightening parental fears such as "stranger danger" (Freeman & Tranter, 2012). This aligns with Jane Jacobs' concept of "eyes on the street," where fewer people—especially children—lead to less natural surveillance and diminished street vitality. Limited street access prevents children from developing road safety skills and disconnects them from urban life. As a result, children miss out on the joys of walking, exploration, and forming a spatial connection with their neighbourhood, fostering a more isolated and sedentary lifestyle (O'Brien, 2003).

Designing streets with children in mind enhances mobility and inclusivity across age groups. Former Bogotá mayor Enrique Peñalosa emphasizes that the presence of children in public spaces is a key indicator of urban liveability, highlighting the importance of predictable and safe traffic environments (Gill, 2017). Transforming streets to allow safe walking and play opportunities empowers children, reduces parents' need to chauffeur them, and strengthens neighbourhood ties through increased social interactions. Krysiak (2021) urges planners and designers to reconsider why urban streets often prioritize vehicle efficiency over children's well-being. Promoting active mobility through thoughtful design not only benefits children but also supports a more cohesive and playful urban fabric by reinforcing community bonds and creating healthier public spaces.

Freeman and Tranter (2012) demonstrate that increased vehicle use over time has led to a decline in children's independent mobility (CIM), reducing opportunities for risk assessment and developmental growth through everyday routines like street crossing. Their findings also indicate a shift in travel modes, with a significant rise in private car use and a corresponding decline in walking and public transport among children (Freeman & Tranter, 2012, pp. 187–188).

The dominance of motor vehicles on urban streets significantly impacts traffic safety for all residents, especially children. Increased vehicle presence and fears of "stranger danger" have reduced children's independent mobility, a critical issue considering that road crashes are the second leading cause of death among children aged 5–14, emphasizing the need for integrating traffic safety into child-friendly urban design (Welle et al., 2015).

Traffic safety concerns extend beyond children, affecting vulnerable populations such as low-income groups, the elderly, and individuals with disabilities, due to insufficient infrastructure and limited mobility options (Welle et al., 2015). The reduction of pedestrians on streets decreases indirect supervision of children, further limiting their street use and independence. Neighbourhoods are generally defined as areas reachable within a 20-minute walk, a benchmark for liveability and equity in urban design (Gürdoğan, Gürdoğan & Thomsen, 2020). To promote pedestrian-friendly neighbourhoods, streets should be redesigned with a focus on walkability, especially in low-traffic areas, using cost-effective interventions (Gürdoğan et al., 2020). The ITDP's "Pedestrian First" project underscores walkability's benefits for equity, resilience, environment, health, economy, and social cohesion (Url-13). Short distances to facilities, notably schools, are vital for children's mobility; walking rates decline sharply beyond 0.5 km, with car use increasing past 1.6 km (Barker, 2006). Policies such as local speed limits and traffic calming can enhance children's independent mobility (Freeman & Tranter, 2012). The "Pedestrian First" initiative also recommends mixed-use development, improved public transport integration, smaller blocks for pedestrian permeability, and expanded car-free zones to support child-friendly neighbourhoods (Url-13). Child-focused street transformations, including temporary closures and permanent design changes, are emerging policy tools worldwide to promote child-friendly cities. Tactical urbanism, defined as low-cost, scalable, short-term interventions with long-term goals, facilitates such transformations by enabling community involvement and testing design possibilities before permanent implementation (Lydon et al., 2011; Yassin, 2019; Silva, 2016). This approach bridges bottom-up and top-down efforts, enhancing governmental and citizen collaboration for successful urban change (Yassin, 2019). Koçaş and Kısar Koramaz (2024), who examined the child-friendly approaches of different administrations, found that involving children and caregivers in the process is a common practice; however, their strategic approaches vary, and this diversity contributes to more inclusive urban designs.

Temporary street transformations gained increased attention during the COVID-19 pandemic, as reduced vehicle traffic and the heightened need for outdoor play spaces near residential areas encouraged the use of streets as playgrounds for children. Tactical urbanism methods facilitate low-cost, temporary street closures that activate public spaces and reprioritize street use. For example, Bristol's "Play Street" initiative exemplifies how such interventions can be implemented with minimal resources (Playing Out, 2014). The concept of play streets, however, dates back to the early 20th century, pioneered by Joseph Lee and gaining legislative support through the 1938 Street Playgrounds Act in the UK. This act permitted local authorities to temporarily close streets to traffic to provide safe play areas for children. Although popularity declined mid-century due to increased car usage and urban transformation, a resurgence has occurred since 2008, driven by community initiatives and government backing, highlighting the social and health benefits of play streets.

Permanent street transformations include the development of "home zones" or 'Woonerf,' a concept originating in the Netherlands and widely adopted in Europe. These shared streets balance the needs of pedestrians, cyclists, children, and drivers by incorporating traffic-calming measures such as reduced speed limits, signage, speed bumps, and street curvature to slow vehicle movement (Lydon, 2011). Woonerfs eliminate curbs to create multifunctional community spaces, with elements like trees and planters serving as natural barriers to maintain low vehicle speeds. Participatory approaches involving residents and children in design activities, such as the Sustrans DIY Streets project, foster greater community ownership and efficacy (Url-2). Signage marking shared zones helps inform drivers of the pedestrian priority (Url-3). A phased design strategy, or "transformation rehearsal," is another approach for permanent street changes that emphasizes gradual implementation and stakeholder involvement. This method allows residents, local authorities, and NGOs to collaboratively refine designs before major investments, facilitating data-driven decision-making and enhancing community participation (Gürdoğan et al., 2020).

Design guidelines serve as critical frameworks for achieving and evaluating child-friendly street designs, facilitating both the design process and the assessment of implemented spaces. Five distinct design guides, developed for various countries and global contexts, provide diverse perspectives on creating child-centred neighbourhoods and public areas. Among these, three guides were prepared with consultancy from the Bernard van Leer Foundation, which supports governments worldwide in enhancing wellbeing for young children and

their caregivers. Additionally, design guides from organizations such as UN-Habitat, ITDP, and WRI contribute further global and regional insights, enabling a comprehensive comparison of child-friendly urban design approaches.

Methodology

Five different child-friendly urban design guides were reviewed, with parameters from three guides selected for direct inclusion in the methodological framework due to their systematic structure and the clarity and measurability of their criteria. All three were developed under the consultancy of the Bernard van Leer Foundation, providing diverse perspectives across different scales, enabling a multi-scalar comparative evaluation. Although the other two guides were not directly included in the methodology, they contributed conceptually by offering complementary insights. The parameters from the three selected guides were compiled, systematically analysed, and grouped, consolidating overlapping or conceptually similar criteria into singular evaluation parameters, while unique parameters were retained individually. Criteria related to the decision-making process were mainly drawn from the NACTO & GDCI (2019) and the Government of India (2019) guides, as no transformation process criteria were found in the Government of Israel (2023) guide. Ultimately, seven key parameters, shown in Table 1, for the decision-making process in creating child-friendly spaces were identified and used as process evaluation criteria within the research methodology.

Table 1 Compilation of the parameters for the decision-making process from the child-centred design guidelines.

NACTO & GDCI (2019)	India (2019)	Israel (2023)	The Parameters for Evaluation
Prepare an action plan.	-	-	Prepare an action plan.
Collaborate with multiple stakeholders.	Collaborative efforts, alliances for public spaces, and self-directed initiatives	-	Fostering inclusive participation through partnerships and collective action
Involve children and caregivers in the process.	-	-	Involve children and caregivers in the process.
Experiment with various analysis and decision-making methods.	A combination of short-term, hands-on action, and long-term strategies	-	Adaptive planning, balancing experimental approaches
Showcase possibilities.	Quick trial-and-error solutions	-	Encourage experimentation through temporary interventions and showcase potential solutions
Temporarily open streets to children.		-	
-	Oversight and coordination of place	-	Oversight and coordination of place
-	Evaluation of expenses and advantages	-	Evaluation of expenses and advantages

Child-focused design guidelines outline parameters for developing child-friendly neighbourhoods, emphasizing both macro-scale elements such as accessibility and land use that address the needs of children and caregivers, as well as micro-scale details like façade treatments and vehicle restriction measures. Neighbourhood-scale criteria support inter-scale evaluation by integrating broader environmental factors—including the quantity and proximity of green spaces, playgrounds, and schools relative to the transformed street area—thereby facilitating

a comprehensive assessment of child-friendliness beyond isolated street interventions. Parameters from three child-focused design guides were compiled, as shown in Table 2, revealing thematic overlaps such as clustering to reduce travel distances and the presence of nearby child-friendly facilities. These overlapping criteria were consolidated into unified parameters, streamlining the evaluation framework and demonstrating how multiple design guides converge on similar priorities for creating child-friendly urban environments. Also, the parameters are categorized into groups such as land use and accessibility, vehicle and pedestrian traffic and activity analysis enabling organized evaluation of related details.

Table 2 Compilation of neighbourhood scale criteria obtained from three different child-centred design guides.

NACTO & GDCI (2019)	India (2019)	Israel (2023)	The Parameters for Evaluation
Reduce trip journey by clusters	Minimum 300 m to existing open spaces	Near child-friendly facilities	Reduce trip journey with keeping the distances (minimum 300 m to open spaces, nursery school, health facilities, and minimum 600 m to primary school)
	Minimum 300 m to nursery school		
	Minimum 600 m to primary school	Open spaces for play near home	
	Minimum 300 m to existing health facilities		
Local mobility parks	-	-	Local mobility parks
Low speed regions in child-densed areas	Set speed limits	Traffic-calming measures	Traffic-calming measures
Pedestrian-first or car-free zones in pedestrian densely areas	Prevent unnecessary traffic	Encourage walking	Pedestrian-first zones to encourage walking
Low-emission zones	-	-	Low-emission zones
	Active facades	-	Active facades
	Windows and main doorways	-	Windows and main doorways

Three distinct design guidelines centred on children and their caregivers provide detailed parameters for creating child-friendly streets. These parameters, synthesized and simplified in this section, culminate in a consolidated list of 36 criteria essential for child-friendly street design, as shown in Table 3. The 36 detailed parameters from child-focused design guides encompass elements like floor materials, borders, and dimensions. These parameters are categorized into groups such as pedestrian crossings, walk paths, urban furniture, play opportunities, green spaces, and design materials, enabling organized evaluation of related details. The analysis reveals that certain details appear across multiple categories; for instance, obstacles are addressed both in pedestrian crossing parameters and in considerations impacting sidewalk comfort and accessibility for disabled users. Furthermore, the guidelines include precise measurements related to seating elements, emphasizing their spatial relationships with surrounding features such as trees and playgrounds. This comprehensive detailing ensures that design elements are evaluated holistically, accounting for their multifunctional impacts within the urban environment. By integrating overlapping criteria, the consolidated parameter list provides a structured framework for assessing and guiding child-friendly street design across multiple facets.

Table 3 Compilation of design scale criteria obtained from three different child-centred design guides.

NACTO & GDCI (2019)	India (2019)	Israel (2023)	The Parameters for Evaluation
Short crossings at least 1.8 m wide, and ideally 2.4 m wide)	-	-	Short crossings at least 1.8 m wide, and ideally 2.4 m wide)
Frequency of crossings (every 50 to 100 m, no more than 200 m)	Crossings with regular intervals	Street-height crosswalks (every 50-100 m)	Pedestrian crossings every 50 to 100 m
Legible crossings (markings should be at least 3 m wide)	Visible and bright colored crossings	-	Visible, wide and bright crossings
At-grade crossings (a rised to match the sidewalk level)	-	Raised crosswalks	Raised crosswalks
Visibility of crossings (No parking within 6 to 8 m of intersections, stop bars at least 3 m from crossings, and minimize visual obstructions within 3 to 5 m of crossings)	No obstruct on crossings	Accessible crosswalks	No parking within 6 to 8 m of intersections, stop bars at least 3 m from crossings, and minimize visual obstructions within 3 to 5 m of crossings
	Parked cars far away		
-	Visible corners	Expanded street corners	Visible corners
Clear walkpath (at least 1.8-2.4 m wide in residential settings, 2.4-4.5 m wide in downtowns, school zones, or commercial areas)	-	Continuous, accessible and obstruct-free pathways	Continuous, accessible and obstruct-free pathways (at least 1.8-2.4 m wide in residential settings, 2.4-4.5 m wide in downtowns, school zones, or commercial areas)
Pedestrian ramps (maximum slope of 10%, ideally 8%)	Inclination ramps	-	Ideal pedestrian ramps (maximum slope of 10%, ideally 8%)
-	Chicanes	-	Chicanes
Street furniture zone on sidewalks	-	Recreational and street furniture zones	Street furniture zones
Appropriate seating dimensions	Bench types, seating with free space at least 1.8 meters	-	Appropriate seating dimensions
Variation of seating materials		-	
Enough seatings (every 50 to 100 m)	-	-	Enough seatings (every 50 to 100 m)
Seating in various locations	-	-	Seating in various locations
-	Seating with shading	-	Seating with shading
-	Seating with shelter and protection	-	Seating with shelter and protection
Street lighting	Low-level lighting	-	Appropriate lighting
	Lighting with regular interval (at least every 30 m)	-	
	No shadow zones	-	

Wayfinding	Eye level of 95 cm	-	Child-friendly wayfinding solutions
	Bright and recognizable objects with interval	-	
	Landmarks	-	
Trash cans	-	-	Trash cans
Public toilets	-	-	Public toilets
Drinking fountains	-	-	Drinking fountains
Wi-fi and charging	-	-	Wi-fi and charging
-	Shading and cooling elements	-	Shading and cooling elements
Incorporate art and play with seatings	-	-	Incorporate art and play with seatings
Different types of learning	-	-	Different types of learning
Creative play opportunities	Playful furniture	Play elements	Creative play opportunities
	Pop-up playing	Steps for play and rest	
Buffer zone at sidewalks	Various plant zones	-	Plant zones in different places
Plant more trees		-	
Co-locate nature		-	
Consider children's height for connection with nature	Different height trees	-	Different height trees for kids to enjoy
Kids engaging with nature		-	
Plant species for kids		-	
Room for insects and spiders	-	-	Room for insects and spiders
-	Indigenous and local species	-	Indigenous and local species
-	Retain existing trees	-	Retain existing trees
Engaging surfaces on sidewalks	Colorful patterns	-	Engaging colorful, different patterns on sidewalks
	Different types of patterns	-	
	Sidewalk games	-	
-	Avoid uneven ground cover materials	-	Child-friendly ground cover materials
-	Child-friendly materials	Anti-slip materials for strollers	
-	No obstruct in public realm	-	No obstruct in public realm
-	Obstacles between different pavements	-	Obstacles between different pavements
-	Low fences	-	Low fences
-	Boulders with min 1.2 m spacing	-	Boulders with min 1.2 m spacing

The study establishes two main objectives: identifying parameters for assessing the processes and design details of child-friendly street transformations, and defining methods for measuring these parameters. The literature review provides a foundation by examining the concepts of child-friendly cities and streets, incorporating various design guidelines focused on children. Methodologically, evaluation criteria are derived by synthesizing common and unique elements from multiple child-centred design guides, despite differences in scale, to suit the research focus. The evaluation approach encompasses three spatial scales: the decision-making process, neighbourhood context, and detailed design implementation. Process evaluation parameters, developed from three design guides, assess the sustainability of the transformation's child-friendly identity, with data gathered via interviews and document analysis. Neighbourhood-scale evaluation considers environmental factors such as green spaces and facilities to contextualize the transformation within a broader child-friendly setting, utilizing land use and accessibility analyses. Design detail evaluation employs 36 criteria grouped into categories like pedestrian crossings and urban furniture, measured through field observations and spatial analysis. Scoring systems are applied across all scales to quantify success, integrating qualitative and quantitative data to comprehensively evaluate the Zümrütevler child-friendly street transformation. In addition to these quantitative measurements and evaluations, a more comprehensive investigation was conducted by incorporating user observations, which provided critical insights into how the design elements function in practice. On January 13, 2025, user behaviour was monitored for 15 minutes between 14:35 and 14:50, followed by a pedestrian flow analysis conducted from 15:00 to 15:15. This period was intentionally selected to coincide with the time students leave school and return home. Data collection methods for this phase included measurement, pedestrian counting, photography, and detailed field notes, enriching the analysis of the design components with direct user interaction data.

Results

The Pedestrian Safety Transformation Trial (Yaya Güvenliği Dönüşüm Provası) was implemented by Maltepe Municipality in partnership with IMM and Superpool, under the guidance of NACTO-GDCI, as part of the Urban95 initiative led by BvLF (Superpool, 2020). This program encourages urban planners and community leaders to reconsider city environments from the viewpoint of a three-year-old child, approximately 95 centimetres tall (BvLF, 2021). The transformation of a chaotic intersection into Zümrütevler Square, a pedestrian-friendly public space, was documented in the report "Zümrütevler Square (2020)." The pilot area was selected due to limited park and open space availability, and the project prioritized redesigning pedestrian crossings and intersections along children's daily routes to school, emphasizing child-centric and pedestrian-friendly design (Superpool, 2020).



Figure 1 Child-friendly street transformation processes in Zümrütevler Neighbourhood: pre-project, rehearsal phase, post-permanent implementation (Superpool, 2022).

The project unfolded in two stages: an interim phase involving temporary measures such as asphalt painting and movable street furniture to allow assessment before permanent interventions, and a final phase with lasting modifications completed in August 2020. The interim implementation began on October 18, 2019, and lasted approximately six months. Differences were observed between pedestrian crossing layouts in the interim and permanent phases, with the total number of crossings reduced from eight to four in the final design (Superpool, 2020).



Figure 2 Comparison of pedestrian crossings after rehearsal and permanent implementation (Superpool, 2020).

Post-transformation data indicated that 1,075 m² of vehicle lanes were converted into pedestrian paths, with 550 m² becoming public spaces. The area gained green spaces and transitioned from a traffic junction to a fully accessible square. Usage increased significantly: the number of people in the square rose by 72%, babies and young children increased by 3.5 times, children aged 5-12 doubled, and the elderly population grew tenfold. Pedestrian crossings increased by 21%, sidewalk use by 30%, and children's independent mobility improved by 43%, with 89% of this occurring in safe zones (Superpool, 2020).

According to the data obtained from open sources and interviews with project coordinators that include detailed explanations of the project process, the transformation process was evaluated according to the parameters determined in the research methodology section. With the two-phased design approach implemented in the Zümrütevler neighbourhood, the street transformation application was one of the actions of a higher scale decision. The decision to transform this area was taken in line with the need and it became the first square of the neighbourhood. When the whole process, including the rehearsal process and the current situation, is considered, the data obtained from open sources and the interviews with the institutions show that other parameters were provided for the transformation process.

A cross-scale evaluation of the neighbourhood surrounding the child-friendly street transformation in Zümrütevler was conducted to assess land use, accessibility, traffic calming measures, and street activity. The land use and accessibility analysis revealed that although the case study area is within walking distance to certain child-related facilities such as open spaces and nurseries, large portions of the neighbourhood lack adequate pedestrian access to kindergartens, health facilities, and open spaces within recommended distances. Primary schools have better coverage due to wider accessibility ranges, but overall, the neighbourhood fails to meet accessibility criteria and does not include local mobility parks or similar child-oriented spaces, resulting in a zero score in the accessibility evaluation.

Traffic calming measures were found to be limited primarily to the immediate vicinity of Zümrütevler Square, with speed limits mostly adhering to the general 50 km/h standard elsewhere. Pavement treatments aimed at increasing driver awareness are scarce, and no additional pedestrian-priority or low-emission zones exist within a 250-meter radius. These findings indicate that traffic interventions are insufficient to support a child-friendly environment beyond the square itself. Conversely, the analysis of street activity indicated a predominance of active frontages supported by mixed-use land and pedestrian presence, fulfilling vitality criteria. Although some residential streets with high garden walls reduce child-friendliness, this issue is limited in extent. Overall, vitality parameters are satisfied. However, when combined, the evaluations demonstrate that the neighbourhood largely fails to meet the comprehensive criteria for a child-friendly environment, with deficiencies in accessibility and traffic calming measures being the main limitations.

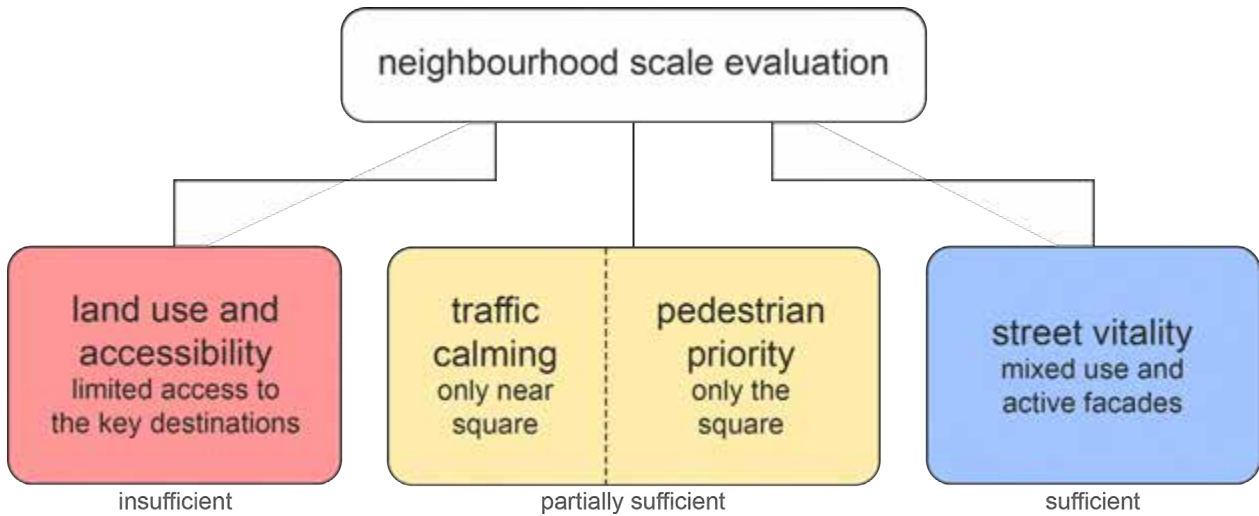


Figure 3 Diagram showing the outcomes of the neighborhood-scale evaluation

The detailed assessment of design elements in the Zümrütevler Square transformation area reveals variable adherence to established child-friendly design standards. Pedestrian crossings comply with minimum width requirements and are adequately spaced within the transformed zone. However, their diminished visibility due to fading and limited presence beyond this immediate area negatively impact pedestrian safety and accessibility. Field observations demonstrate a preference among pedestrians for crossing at informal locations rather than designated crosswalks, exposing a disconnect between intended design and actual user behaviour.

Sidewalks generally offer sufficient width and are mostly unobstructed, with ramp slopes aligning with accessibility norms. Nonetheless, the presence of bollards on ramps hinders ease of use for disabled individuals, marginally reducing overall sidewalk effectiveness. Urban furniture, though limited in quantity, serves its purpose by fostering social interaction through strategically arranged seating. Play opportunities, integrated alongside seating areas and including artistic features, meet all relevant design criteria; however, child usage of these spaces was notably scarce, potentially attributable to parked vehicles affecting perceptions of safety and spatial quality. Green elements demonstrate diversity in plant species and buffer zones. Regarding design materials, bollard placement conforms to standards, yet surface treatments lack child-friendly qualities and do not provide sufficient textural differentiation, fulfilling only half of the evaluated material parameters.

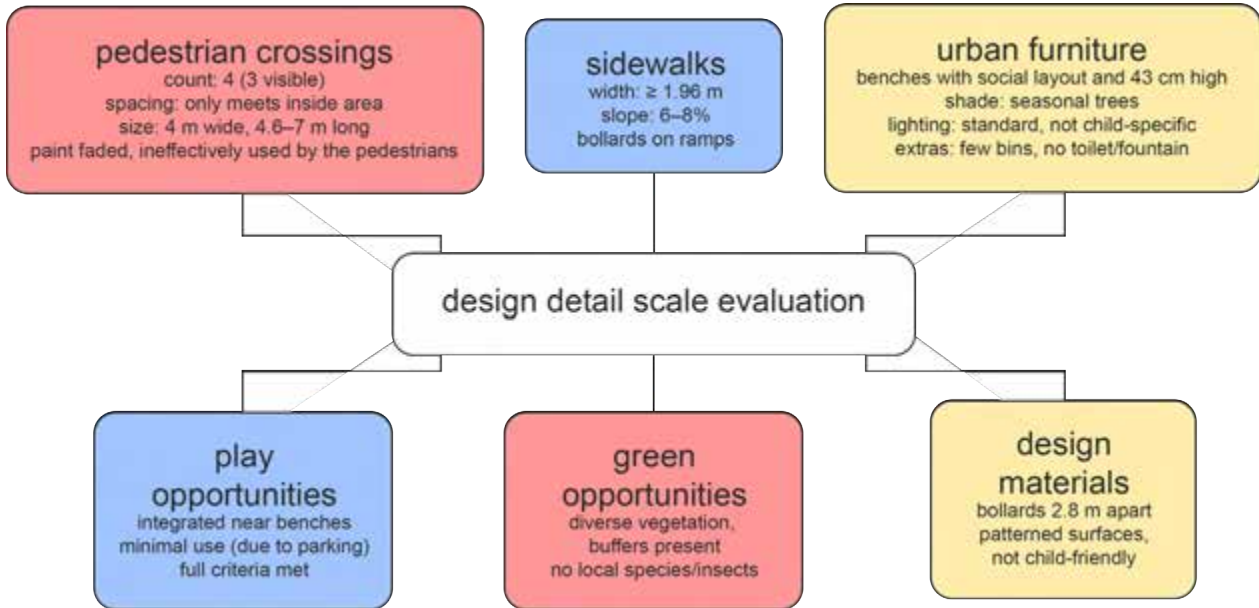


Figure 4 Diagram showing the outcomes of the design detail evaluation

Overall, while the transformation reflects commitment to several child-friendly design principles, significant shortcomings remain in accessibility, material selection, and user-centric functionality. The adequacy of applying all child-friendly parameters universally within the area merits reconsideration, especially considering user behaviour patterns. Although foundational progress toward a child-friendly environment is evident, further enhancements are necessary to fully support independent and safe mobility for children.

In addition to the design criteria evaluations, the interaction between design elements and actual users was examined through field observations. User movement patterns and preferred directions within the area were recorded, with results illustrated in Figure 5, showing frequently used pedestrian routes during the observation period. The majority of users passing through the space were caregivers accompanied by children and individuals returning from shopping. The timing of the observation supports the conclusion that children and their caregivers primarily use the area as a transit route.



Figure 5 User flow map

Although Figure 5 suggests broad usage of the square, the presence of parked vehicles significantly obstructs pedestrian circulation and undermines the space's child-friendly qualities. As depicted in Figure 6, pedestrians must navigate around parked cars when crossing streets to access the square, reducing comfort and safety.



Figure 6 Users cannot use the area comfortably due to the parked cars

Further photographic evidence gathered outside observation periods indicated that some pedestrians, including those with children, chose to walk along vehicular roads instead of using the open square, as shown in Figure 7. Improper pedestrian crossing behaviours were also documented, highlighting non-compliance with intended pedestrian pathways.



Figure 7 Pedestrians not using the pedestrian crossings

A behavioural map (Figure 8) representing sitting and standing activities during the observation period shows standing users predominantly engaged in socializing near seating elements. These social interactions were primarily carried out by older male individuals, as documented in Figure 9. Notably, these frequent users were not caregivers accompanying children, the primary target group of the child-friendly design.

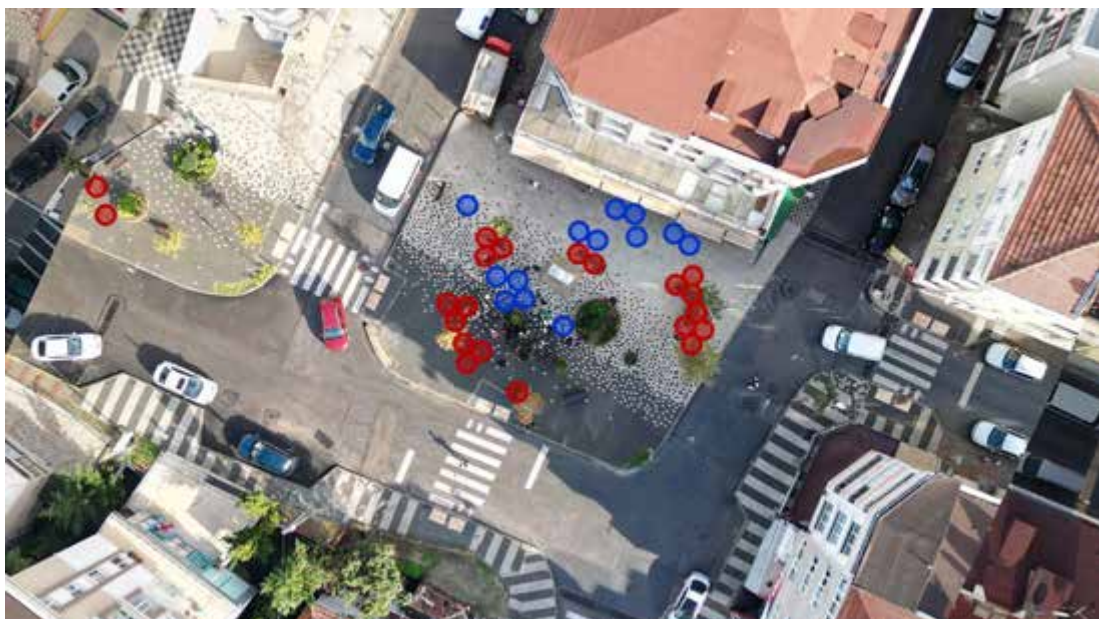


Figure 8 User behaviour map



Figure 9 Elderly people using the area for rest and chatting

Evaluation of the transformed area from the perspective of children and caregivers revealed that the space functioned almost exclusively as a passageway, as confirmed by measurements and photographic records (Figure 10).



Figure 10 Photographing the use of a passageway by children and caregivers

The combined findings from behavioural observation and pedestrian flow analysis reveal a significant gap between the intended child-friendly design objectives and actual usage patterns. Despite being designed to facilitate stationary, interactive activities for children and caregivers, the space predominantly serves as a transit corridor. Persistent vehicle presence and pedestrian pathway misuse further detract from the space's functionality as a child-friendly public environment. These results indicate a need for additional design interventions to better support and encourage the intended user groups.

Discussion

The child-friendly street transformation in Zümrütevler Neighbourhood was critically examined through a multi-scale lens encompassing the process, neighbourhood context, and detailed design elements, following the evaluation framework outlined in the methodology. The analysis reveals that while the project demonstrated sensitivity to local context and engaged stakeholders actively at the project level, it failed to establish meaningful connections with broader neighbourhood infrastructure and urban policy agendas.

At the process scale, the initiative employed a phased, inclusive, and flexible design strategy that leveraged data insights and fostered collaboration among institutions. Although there was no overarching higher-level planning directive guiding the intervention, the project successfully coordinated diverse stakeholders and ensured the participation of children and caregivers in shaping the outcome. The iterative rehearsal phase was particularly influential, facilitating design adjustments and enhancing community buy-in—highlighting the practical benefits of tactical urbanism approaches in child-focused urban interventions.

In contrast, the neighbourhood-level evaluation exposes significant gaps. Accessibility assessments indicate that most residential areas remain beyond a reasonable walking distance to key child-oriented facilities, while traffic calming measures are confined to the immediate project boundaries. Nonetheless, the presence of relatively active street frontages offers some support for children's independent movement. This juxtaposition reflects a critical disconnect between targeted site-specific improvements and the absence of integrated, systemic planning at the neighbourhood scale.

Regarding design details, the spatial elements only partially meet child-friendly urban design benchmarks.

Although infrastructural components such as sidewalks, ramps, crossings, and urban furniture generally adhere to established technical criteria, observed user behaviour reveals a misalignment between intended design purposes and actual use patterns. The space predominantly functions as a thoroughfare for children and caregivers rather than a place for gathering or play, with frequent informal crossing indicating concerns related to safety and usability. Moreover, the pervasive presence of vehicles and scarcity of playful amenities further restrict children's autonomous engagement. These observations emphasize that adherence to technical standards alone is inadequate; successful child-friendly environments require design approaches that respond meaningfully to lived experience. Ultimately, the findings suggest that enhancing spatial quality must be complemented by coordinated, cross-scale strategies that harmonize physical interventions with everyday behaviours to truly realize child-friendly urban spaces.

Conclusion

The concept of child-friendly cities encompasses multifaceted dimensions and requires comprehensive approaches to effectively promote children's independent mobility and well-being in urban environments. Local governments increasingly pursue child-friendly street transformation projects, underpinned by the prevailing conviction that creating safe, accessible, and health-promoting urban spaces for children contributes to the formation of healthier societies. However, the complexity of sustaining the child-friendly identity beyond initial design stages remains a significant challenge, necessitating critical examination of relevant parameters and practical obstacles throughout the transformation process.

This study contributes to this discourse by conducting a rigorous, multi-scale evaluation of the child-friendly street transformation in Zümrütevler Square, selected as a case study. The research framework incorporated assessment at three interconnected scales: the process level, the neighbourhood context, and the detailed design components. This layered analytical approach not only advances the understanding of child-friendly urban interventions but also foregrounds the necessity of examining interactions across scales to reveal systemic strengths and weaknesses. The development of an original, criteria-based evaluation tool derived from existing design guidelines enabled a nuanced analysis of spatial and procedural aspects of the transformation, while direct incorporation of user behaviour observations ensured that the evaluation extended beyond normative design standards to include lived experience.

A key finding relates to the applicability and relevance of child-friendly design parameters across all scales and contexts. While many criteria are well-established within the literature and provide essential benchmarks, the Zümrütevler case exposes critical tensions regarding their universal applicability. Several parameters, though theoretically sound, proved difficult to implement or maintain consistently throughout the transformation phases, raising important questions about their flexibility and contextual suitability. This insight suggests that future frameworks should incorporate adaptive, context-sensitive criteria that account for diverse urban realities and evolving user behaviours, rather than relying solely on rigid, one-size-fits-all standards.

Regarding the visibility and presence of children within the transformed space, observations revealed a notable deficiency. Despite the project's explicit child-focused intentions, actual child presence and engagement in the area remained limited. The square was predominantly used as a transitional passage by children and caregivers rather than as an interactive, playful environment. This gap between design intention and on-the-ground reality signals a need to critically reconsider not only physical design elements but also socio-environmental factors that influence children's visibility and autonomy in public spaces. Issues such as vehicular dominance, perceived safety concerns, and spatial constraints emerged as significant deterrents to sustained child use, underscoring that child-friendliness must encompass both physical and behavioural dimensions to be truly effective.

The process evaluation further highlighted institutional and procedural complexities that influence project outcomes. The involvement of multiple authorities with overlapping jurisdiction over the site created challenges in coordination, leading to compromises in design cohesion and implementation consistency. This institutional fragmentation underscores the importance of establishing clear governance frameworks and collaborative

mechanisms to streamline decision-making and maintain the integrity of child-friendly objectives. Moreover, the phased approach, which included a rehearsal stage applying tactical urbanism principles, was instrumental in refining the design and fostering public acceptance. However, the research identified a missed opportunity in not conducting a second rehearsal phase, which could have allowed for iterative testing and incorporation of feedback based on revised design alternatives. Evaluating rehearsal phases explicitly within the criteria framework emerges as a critical area for future research and practice, as it holds potential to significantly enhance the adaptability and success of child-friendly transformations.

In sum, this study affirms that multi-scale, integrated evaluations are essential for a holistic understanding of child-friendly urban interventions. Evaluations that combine technical design criteria with empirical user behaviour analysis provide richer insights and more actionable knowledge than those relying solely on normative standards. Furthermore, the findings underscore the necessity to critically assess the feasibility and relevance of design parameters in varied contexts and to maintain child visibility and engagement as central goals. The role of institutional coordination and iterative, participatory design processes—particularly the rehearsal phases—must be emphasized in both research and practice to support sustainable child-friendly environments.

Finally, the transformation of Zümrütevler Square, as one of Turkey's pioneering projects integrating tactical urbanism with permanent implementation in a dense metropolitan context, offers valuable lessons for urban policy and design. It highlights that successful child-friendly street transformations require long-term commitment, cross-sectoral collaboration, and a continuous feedback loop that integrates design adaptation with lived realities. Future studies should expand on the rehearsal phase's role and explore adaptive criteria frameworks to enhance applicability across contexts. Such comprehensive approaches are imperative to advancing child-friendly urbanism and fostering inclusive, healthy cities for all generations.

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