

Pegadas: Perceptions and Experiences of Children's Mobility for the Development of Fairer and More Sustainable Public Policies

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Executive Summary

The PEGADAS project examines the relationship between children's mobility, territorial inequalities, and the quality of urban space across different municipalities in the Central Region of Portugal. Preliminary findings reveal a strong dependence on private cars for home-to-school journeys, limited use of active mobility, and significant challenges related to road safety and the quality of pedestrian infrastructure. Children particularly value green spaces, play areas, and safe environments; parents and guardians identify the lack of adequate sidewalks, excessive traffic, and road insecurity as the main barriers to children's autonomy. The municipal analysis highlights important territorial inequalities: municipalities with more integrated mobility and sustainability policies tend to provide better conditions for children's independent mobility. The policy brief presents recommendations aimed at municipalities, schools, and public decision-makers, emphasizing the need to invest in active mobility, traffic calming measures, high-quality public spaces, and children's participation in urban planning processes.

Recommendations

- Prioritize the creation and upgrading of safe, continuous, and accessible pedestrian infrastructure in the vicinity of schools and residential areas.
- Implement traffic calming measures in areas frequented by children, including 30 km/h zones, raised crosswalks, and restrictions on vehicle circulation near schools.
- Develop safe home-to-school routes for children living within 2 km of their school, encouraging both supervised and independent walking.
- Improve the quality and maintenance of public spaces, particularly pavements, street lighting, and urban cleanliness, in order to reduce perceptions of insecurity and discomfort.
- Strengthen the provision and enhancement of green spaces, parks, and playgrounds close to residential and school areas.
- Reduce children's exposure to excessive motor traffic around schools through the reorganization of traffic circulation and parking.
- Promote differentiated interventions for urban and rural contexts, recognizing territorial inequalities in children's mobility conditions.
- Encourage active mobility strategies tailored to the needs and perceptions of families, considering concerns related to safety, children's maturity, and travel distance.
- Integrate children's perspectives into urban and school planning through participatory methodologies that value their drawings, narratives, and everyday experiences.
- Strengthen collaboration between schools, municipalities, and local communities in identifying mobility problems and implementing concrete solutions.

Target audience of the policy brief

Municipalities of Coimbra, Condeixa-a-Nova, Montemor-o-Velho, Miranda do Corvo and Arganil; Intermunicipal Community of the Coimbra Region; Institute for Mobility and Transport (IMT); Portuguese Environment Agency (APA); Directorate-General for Territory (DGT); Centre Regional Coordination and Development Commission (CCDR Centre); participating school clusters and school boards; parents' associations and caregivers; municipal education and social action technicians; Directorate-General of Health (DGS); Local Health Units of the Centre Region; National Road Safety Authority (ANSR); UNICEF Portugal; research centres in mobility, urban planning and childhood studies; child-friendly cities networks and initiatives.

Introduction and Problem Statement

Mobility poverty has emerged as a growing concern in urban planning and mobility justice research, particularly due to its effects on children's well-being and equitable access to urban life (Lowans et al., 2021). Defined as the absence or limitation of mobility resulting from inaccessibility, lack of economic resources, or insufficient transport options (Mattioli et al., 2017), this condition compromises access to essential services and to social, educational, and economic opportunities, contributing to cycles of segregation and territorial exclusion, especially among the most vulnerable population groups. It is estimated that up to 90% of households may be affected by some form of mobility poverty (Lucas et al., 2016), demonstrating the structural and cross-cutting nature of this phenomenon.

Despite the growing emphasis on accessibility in urban planning, mobility poverty has only recently begun to be recognized as an autonomous form of social and territorial inequality. It is often associated with energy poverty, creating a condition of double vulnerability (Mattioli et al., 2017), in which families are forced to choose between basic needs, such as heating their homes or ensuring travel to school and work.

This issue is particularly concerning in the context of childhood. Due to their dependence on others, limited autonomy, and greater sensitivity to unsafe environments, children face additional barriers to mobility. Urban space plays a decisive role in the construction of children's autonomy, although the way it should be planned and organized remains controversial (Kytä, 2004). Broberg et al. (2013) operationalize this relationship based on two fundamental criteria: access to opportunities within the residential environment and children's independent mobility.

The literature demonstrates that factors such as parents' social networks, community cohesion, and perceptions of safety directly influence the degree of freedom granted to children, making them essential elements for public policies aimed at creating safe environments and networks of trust. The decline in children's mobility has been associated with problems such as obesity, deficits in physical and cognitive development, and lower spatial and environmental literacy (Rushovich et al., 2006; Whitzman et al., 2010).

The physical environment, often described through the "3Ds" - density, diversity, and design - significantly shapes children's active mobility (walking and cycling). Several studies have sought to relate characteristics of the built environment to patterns of children's mobility (De Meester et al., 2014; Monsur, 2011). A systematic review by Moghtaderi et al. (2012) confirms the benefits of independent mobility, while also highlighting the scarcity of quantitative studies directly linking urban space characteristics to measurable impacts, thereby hindering the design of effective public policies. These reviews reinforce the importance of context-sensitive analyses capable of integrating both objective and subjective dimensions of the urban experience. Currently, children's independent mobility is understood as a relational process, influenced by peer culture, parental concerns, technology, and community structures (Malone, 2013).

The PEGADAS project (Figure 1) seeks to understand and intervene in the relationship between children's mobility, social inequalities, and territorial morphology. The project adopts an interdisciplinary approach centered on children's experiences, combining qualitative, quantitative, and participatory methodologies.

Specific objectives

1. **To understand children's perceptions of their immediate urban environment** through the analysis of graphic representations and narratives produced by children aged 6 to 11. The aim is to identify how they perceive, experience, and represent the spaces they inhabit, particularly with regard to mobility, safety, nature, and infrastructure.
2. **To assess families' decisions and perceptions regarding children's mobility**, based on quantitative data collected through structured surveys directed at parents and guardians. This objective will enable the analysis of home-to-school and leisure mobility practices and constraints, considering socioeconomic and territorial variables.
3. **To combine objective and subjective data in order to characterize mobility poverty among children in different territories**, integrating perceptions of the urban environment, physical conditions of space, and the socioeconomic context of families. The goal is to develop a

multidimensional diagnosis reflecting inequalities in accessibility and children's freedom of movement.

4. **To relate empirical data to local public policies and the indicators of the Municipal Sustainability Index (ISM)**, evaluating the coherence between municipal strategies, political discourse, and territorial realities in the field of children's mobility and spatial justice.

5. **To promote the direct involvement of school communities and local stakeholders in the analysis of and response to mobility poverty**, through participatory methodologies adapted to age and context. This component aims to design, test, and implement a participatory tactical urbanism intervention, demonstrating the transformative potential of light, rapid, low-cost, and community co-created interventions.

Figure 1 – Structure and methodologies of the PEGADAS project.



Analysis / Key Findings

General data and family travel patterns

As of May 2026, data had been collected in four public primary schools: Casais do Campo, Taveiro, Condeixa, and São Martinho do Bispo.

To date, the study includes the participation of 239 children (101 female - 42.3% - and 138 male - 57.7%), aged between 6 and 11 years (mean age: 7.98 ± 1.2 years).

Most families own two motor vehicles (54.7%), while around 7% do not own any motorized vehicle. In contrast, ownership of non-motorized vehicles is relatively common (2 vehicles: 19.8%; 3 vehicles: 15.0%; 4 vehicles: 23.3%). The predominant residential zones

(Figure 2) were zones 2 and 3, representing 31.9% and 29.4% of participants, respectively.

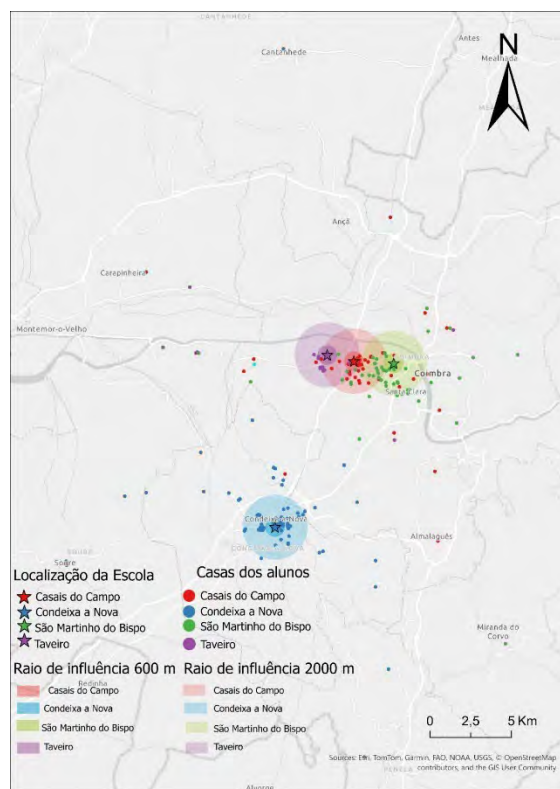
Figure 2 – Residential areas of participants.



The average distance between home and school is approximately 5 km, with around 45% of families living within 2 km of the school. However, in none of the schools analyzed did more than 25% of students live within 600

meters of the school (Figure 3). These data reflect the way urban areas have developed in recent decades, marked by strong investment in peripheral areas that has led to increasing urban sprawl.

Figure 3 – Spatial distribution of participants' residences and schools (data collected from the surveys).



Most parents and guardians (68.9%) reported never or rarely using active transport modes (i.e., walking or cycling) in their daily activities. The private car is the main mode of transport used for commuting to work (76.4%), while only 4.6% use public transport and 5.5% walk. Approximately 13% rely on multimodal solutions, combining two or more modes of transport.

Although 80.9% of participants have access to a public transport stop within 600 meters of their residence, the main reasons given for not using public transport relate to route inadequacy ("it does not go where I need to go") and schedules incompatible with daily needs. Reliability, safety, comfort, and ticket costs were less frequently mentioned.

As with adults, most children travel to school using individual motorized transport (74.4%). Only 18.5% use active mobility modes, exclusively walking, and no regular bicycle commuting was recorded. Among children who

walk to school, around 90% live within 2 km of the school. Approximately 7% use shared transport solutions, including public transport and school buses.

The main reasons identified by parents and guardians for not allowing walking mobility were "long distances" and the child's "age/lack of maturity." Other reasons included "inconvenience," "dangerous traffic," "fear of strangers," and "lack of adequate sidewalks or pedestrian crossings." No parent or guardian identified "the child's mobility difficulties" as the main reason.

Analysis of children's perceptions of urban space: comparing reality and drawings of their streets

The comparative analysis between the graphic representations produced by children (Figure 4) and the physical reality of their streets, supported by Artificial Intelligence tools (Gemini, Google), reveals significant findings regarding how children perceive and interpret public space.

The results show that spatial representation abilities improve significantly with age. While 26% of first-grade children did not represent the street in their drawings, this figure decreases to 12% among fourth-grade children. Regarding topography, 35% of children represented the street layout with a high degree of accuracy, ranging from 12% in first grade to 57% in fourth grade. However, representing scale remains challenging, with only 5% of children drawing proportions considered realistic and around 40% demonstrating significant distortions of reality.

In terms of realism, 57% of the drawings can be considered attentive cognitive maps consistent with observed reality, while 16% correspond to simplified representations of space and 27% depict predominantly imaginary scenarios.

Relevant omissions were identified in the representation of road infrastructure. Approximately 48% of children did not include sidewalks in their drawings, while 53% omitted existing traffic signs from their streets. Road safety features were also underrepresented: only 9% of children drew pedestrian crossings, despite these being present in approximately 33% of the observed streets.

The analysis of urban landmarks and functional uses reveals that children perceive space beyond the physical boundaries of their own street. Around 11% identified functional landmarks that did not exist on the represented street, and 3% included functional uses located in nearby areas. These findings suggest that children do not understand the street as an isolated unit, but rather as part of a broader and relational territory.

In contrast, omissions of urban landmarks occurred in 13% of drawings and omissions of existing functional uses in 9%, indicating that certain elements of urban space lack practical or emotional relevance for some children, thereby becoming invisible within their mental maps.

The social and playful dimension emerged as one of the aspects most valued by children. Approximately 36% included people in their drawings, namely neighbors, relatives, and friends, with a higher incidence among younger students. The elements most frequently identified as positive were spaces for play and social interaction (parks, gardens, and football fields), contact with nature (flowers, trees, and bushes), and interactions with animals and neighbors.

The proximity of services and schools was also positively mentioned. However, only 2% of children represented bicycles in their drawings, despite cycling in the street emerging as the second most preferred activity related to the surrounding environment.

Regarding perceptions of urban hostility, the results showed no significant differences between age groups. Around 63% of children represented the street as a comfortable environment, while 20% characterized it as a restrictive and merely functional space.

This perception of discomfort is reinforced by the qualitative descriptions provided by the children regarding the aspects they least liked about their streets, particularly excessive traffic, noise, pollution, and urban degradation, including abandoned houses, deteriorated pavements, and insufficient public lighting.

The descriptions produced by the children converge with the perceptions of parents and guardians. When asked about the main obstacles to children's autonomy, participants identified the lack of adequate and safe sidewalks (45%), children's lack of maturity

(38%), and traffic danger (32%). Long distances to relevant destinations and fear of contact with strangers during journeys were also mentioned.

Regarding priority solutions, parents and guardians mainly advocated:

- the creation or upgrading of pedestrian networks (52%);
- the implementation of speed control measures, such as speed bumps, traffic lights, and speed cameras (28%);
- the creation of cycling lanes (22%).

Additional needs were also identified, namely increasing green and social spaces, strengthening police surveillance, and improving public lighting.

Results of the Municipal analysis

The results of the municipal analysis demonstrate that children's mobility poverty does not manifest uniformly across the territory and is strongly associated with the urban, environmental, and political characteristics of each municipality.

The comparison between Arganil, Coimbra, Condeixa-a-Nova, Miranda do Corvo, and Montemor-o-Velho highlights significant inequalities in mobility conditions, road safety, access to green spaces, and climate commitment.

More urban municipalities, such as Coimbra, present more structured and integrated policies, including sustainable mobility plans, electrification of the public fleet, and strategies promoting active mobility. In contrast, more rural territories tend to display fragmented and isolated interventions, limiting the creation of urban environments favorable to children's autonomy.

The analysis of the Municipal Sustainability Index indicators demonstrates that factors such as road safety, the quality of public space, accessibility to facilities, and the availability of pedestrian and cycling infrastructure directly influence children's independent mobility.

Although some municipalities show positive performance in areas such as education and certain environmental indicators, significant inequalities persist in the distribution of green spaces, the implementation of climate policies,

and urban safety conditions. These territorial differences condition children's opportunities for active and safe mobility, reinforcing patterns of car dependency and territorial exclusion.

The results also demonstrate that municipalities with more integrated policies tend to achieve better performance across the analyzed indicators, highlighting the importance of articulating mobility, urban planning, and climate action.

Combating children's mobility poverty therefore requires consistent local strategies adapted to territorial specificities and centered on the real needs of children and families. Promoting safer, more accessible, greener, and more inclusive cities is an essential condition for strengthening children's autonomy, improving well-being, and reducing socio-spatial inequalities.

Participatory action with children, families, teachers, and school decision-makers

The participatory component of the project is currently in the preparation and implementation phase. The first activities are scheduled for the period close to the school holidays at Taveiro School and will continue throughout the following academic year.

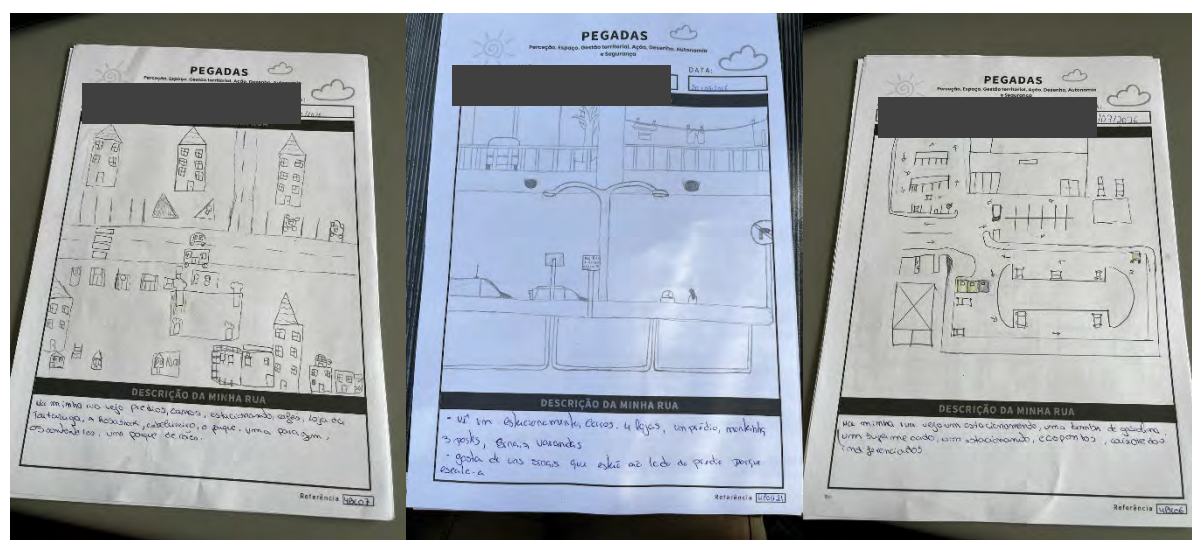
Data collection is also ongoing. Following the completion of activities in the Oliveira do Hospital School Cluster (5 schools) in May 2026, new data collection and participatory activities are already scheduled for September 2026 in schools located in Vila Nova de Poiares, Cantanhede, and Figueira da Foz.

This phase of the project will include participatory workshops involving children, parents and guardians, teachers, and institutional representatives, with the objectives of:

- identifying concrete mobility and safety problems;
- co-creating solutions adapted to the local context;
- testing temporary tactical urbanism interventions;
- strengthening children's participation in urban planning processes.

Planned activities include participatory mapping exercises, exploratory walks, collaborative drawing sessions, and the experimental implementation of traffic calming measures and public space improvements.

Figure 4 – Examples of drawings and descriptions produced by the children.



Policy Options and Recommendations

The evidence produced by the PEGADAS project highlights the need for integrated and

territorially sensitive strategies to combat children's mobility poverty. The findings show that factors such as road safety, the quality of

pedestrian infrastructure, access to green spaces, and the organization of urban space directly influence children's autonomy and well-being.

The recommendations (Figure 5) translate the project's main findings into action proposals directed at municipalities, schools, and public entities, promoting an approach centered on children, active mobility, and spatial justice.

Figure 5 – Policy options and recommendations to promote active mobility in childhood.



Conclusion

The preliminary findings of the PEGADAS project demonstrate that children's mobility poverty is a multidimensional phenomenon, strongly conditioned by the characteristics of urban space, territorial inequalities, and family mobility practices.

The high dependence on private cars, the lack of safe pedestrian infrastructure, and perceptions of insecurity significantly limit children's autonomy and their equitable access to the city. At the same time, the representations produced by the children themselves highlight the importance of social spaces, nature, and safety in shaping children's urban experiences.

The data reinforce the need for integrated public policies capable of articulating mobility, urban planning, environmental action, and citizen participation. Strategies centered on active mobility, road safety, and the improvement of public space can contribute to more inclusive, healthy, and sustainable cities.

In this context, the PEGADAS project demonstrates the potential of participatory methodologies and tactical urbanism to engage school communities and local stakeholders in the development of solutions adapted to the real needs of children and families

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