

Paper Bike Lanes for a Fragmented City

Interrupted School Routes and Cycling Access in San Martin de Porres, Lima, Peru

Maria Fernanda Moreno Gariza | Pontificia Universidad Catolica del Peru | a20220492@pucp.edu.pe

20 km

approx. cycling network under analysis

800 m / 1 km

school-route influence areas

2

critical route sectors compared

2267 hab/ha

highest-density spatial unit observed

Core claim: fragmented bike lanes do not simply interrupt cycling mobility; they interrupt students' access to safe and sustainable school routes.

INTRODUCTION & AIM

Fragmented urban development in Lima has produced unequal access to safe and continuous cycling infrastructure, especially in peripheral districts such as San Martin de Porres. In school mobility, this fragmentation is expressed through discontinuous bike lanes, traffic congestion, accumulated waste, informal occupation, deteriorated pavement and weak separation from motorized traffic.

This research examines how these physical attributes affect students' cycling access to educational facilities, perceived safety and everyday travel experience.

METHOD

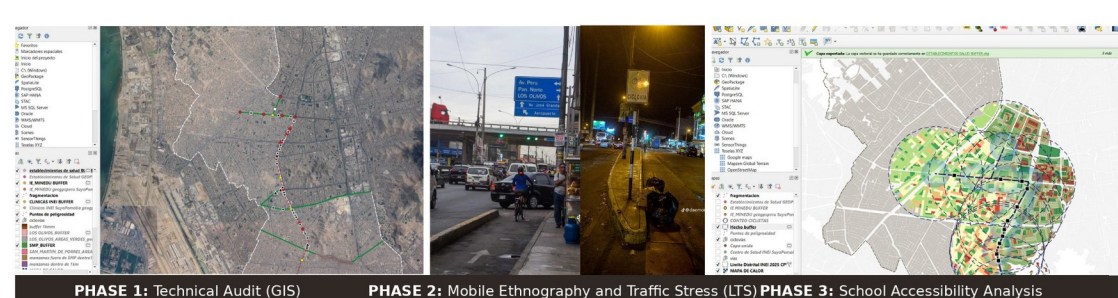


Figure 1. Research workflow: GIS audit, mobile ethnography and school-accessibility analysis.

Cartographic survey of existing cycling infrastructure and physical barriers.

GIS-based diagnosis using heat maps, buffers and urban-permeability variables.

Mobile ethnography during school entrance and exit hours to record conflicts, detours and perceived insecurity.

OVERALL DIAGNOSIS

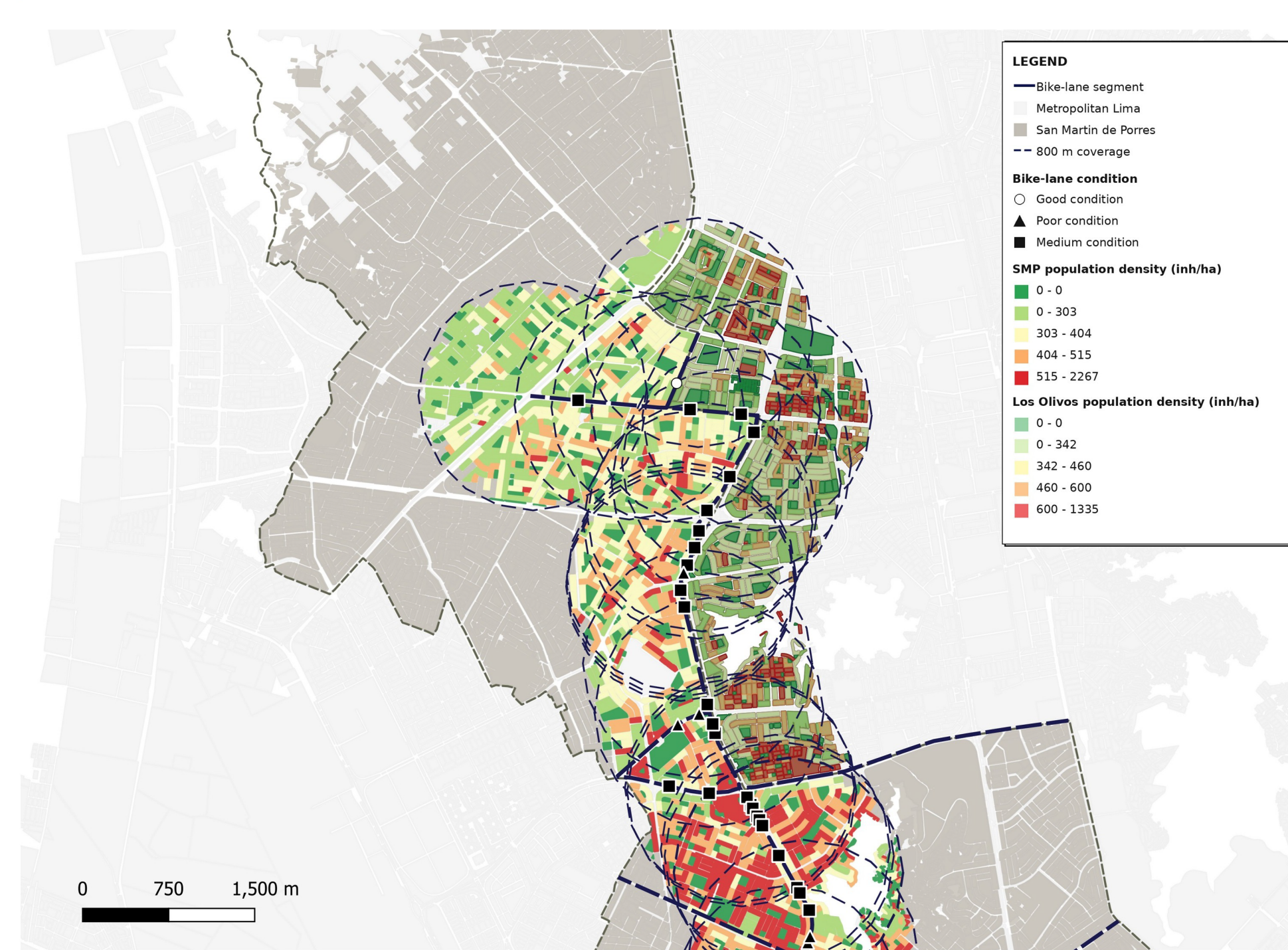


Figure 2. Population density, cycling coverage and school accessibility.

Finding 1

High-density sectors overlap with bike-lane segments in poor or medium condition, generating a structural disconnection in school cycling access.

Finding 2

Fragmentation is not isolated: within the 800 m and 1 km influence areas, discontinuity recurs at intersections where student flows and road conflicts converge.

RESULTS & DISCUSSION

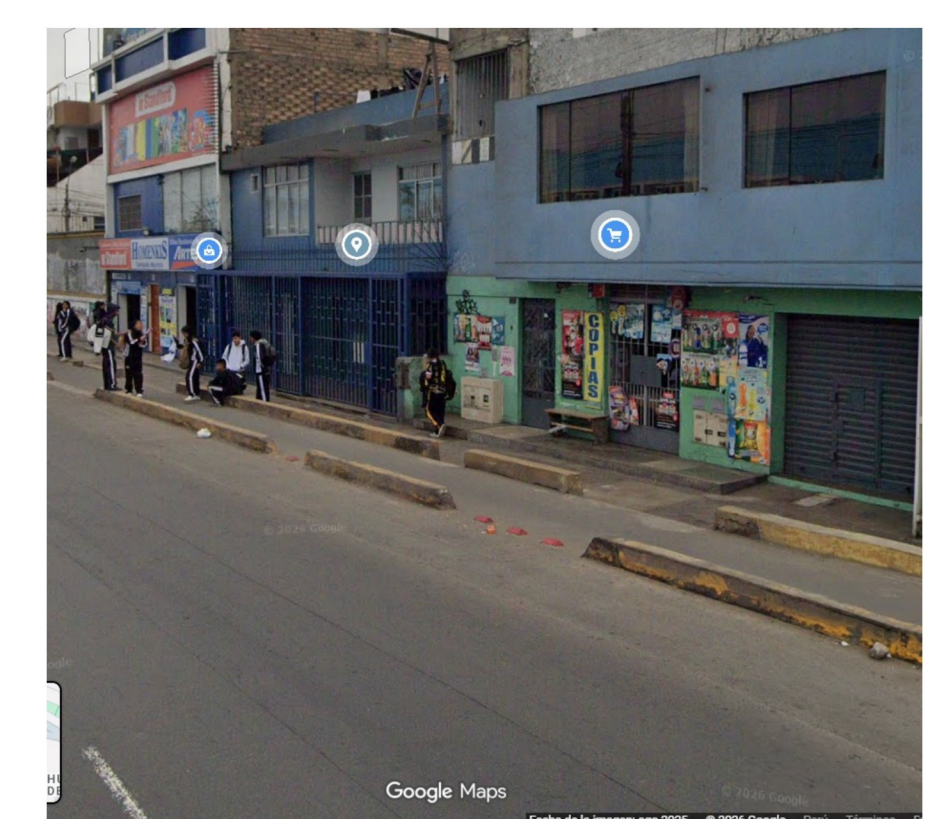


Figure 3. Students near fragmented cycling infrastructure.

Traffic stress

Mobile ethnography identifies a combined physical and psychological pressure: proximity to vehicles, fragmented paths, unsafe crossings and repeated obstacles along the route.

Policy issue

The problem is not only the number of bike-lane kilometers, but whether the existing network works as a safe, continuous and accessible school-mobility system.

Design implication

Repairing continuity, crossings, pavement quality and physical separation should precede further network expansion in peripheral districts.

CRITICAL SECTOR 1: OVALO JOSE GRANDA / AV. UNIVERSITARIA

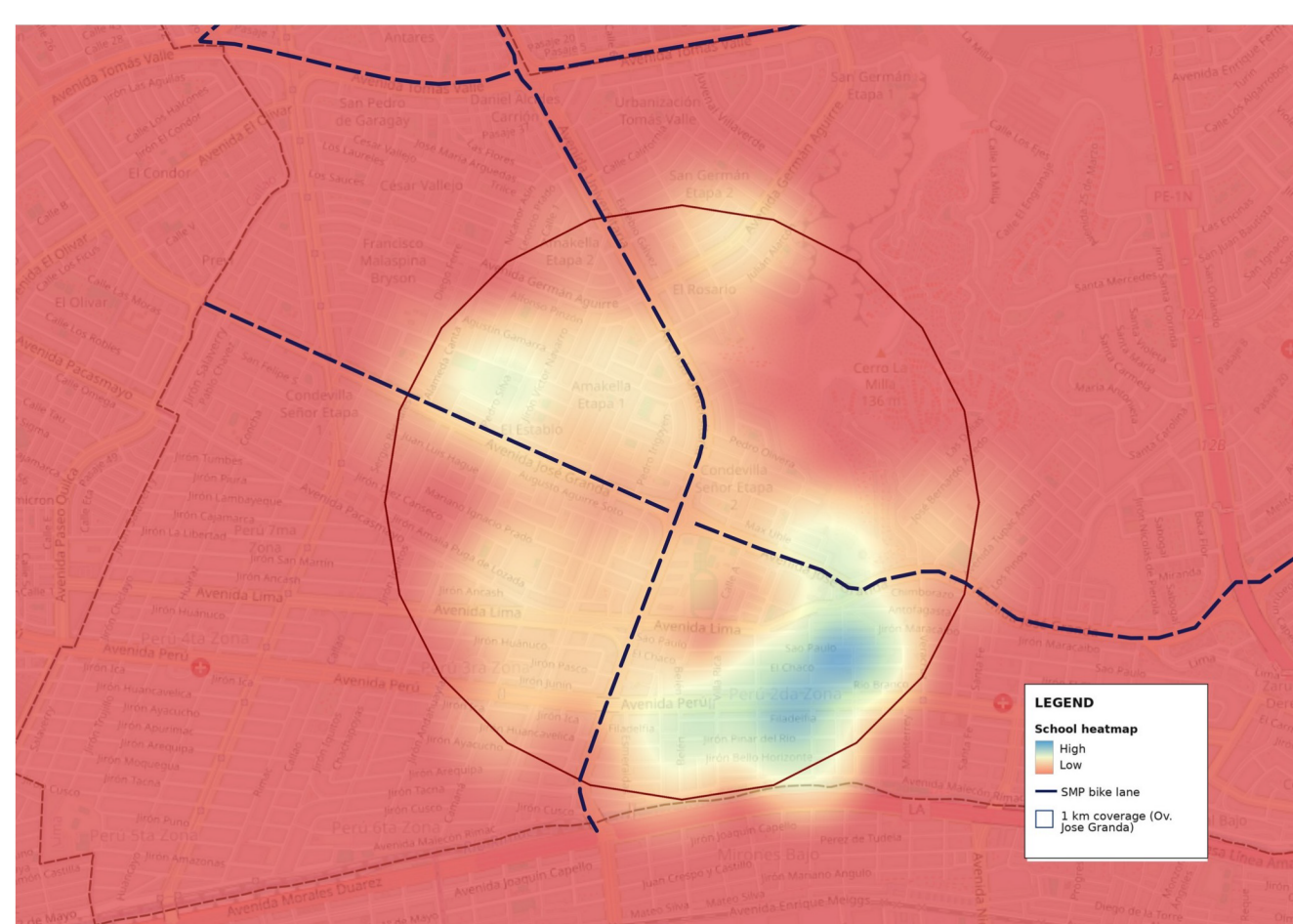


Figure 4. Heat map: school-related pressure around Ovalo Jose Granda.

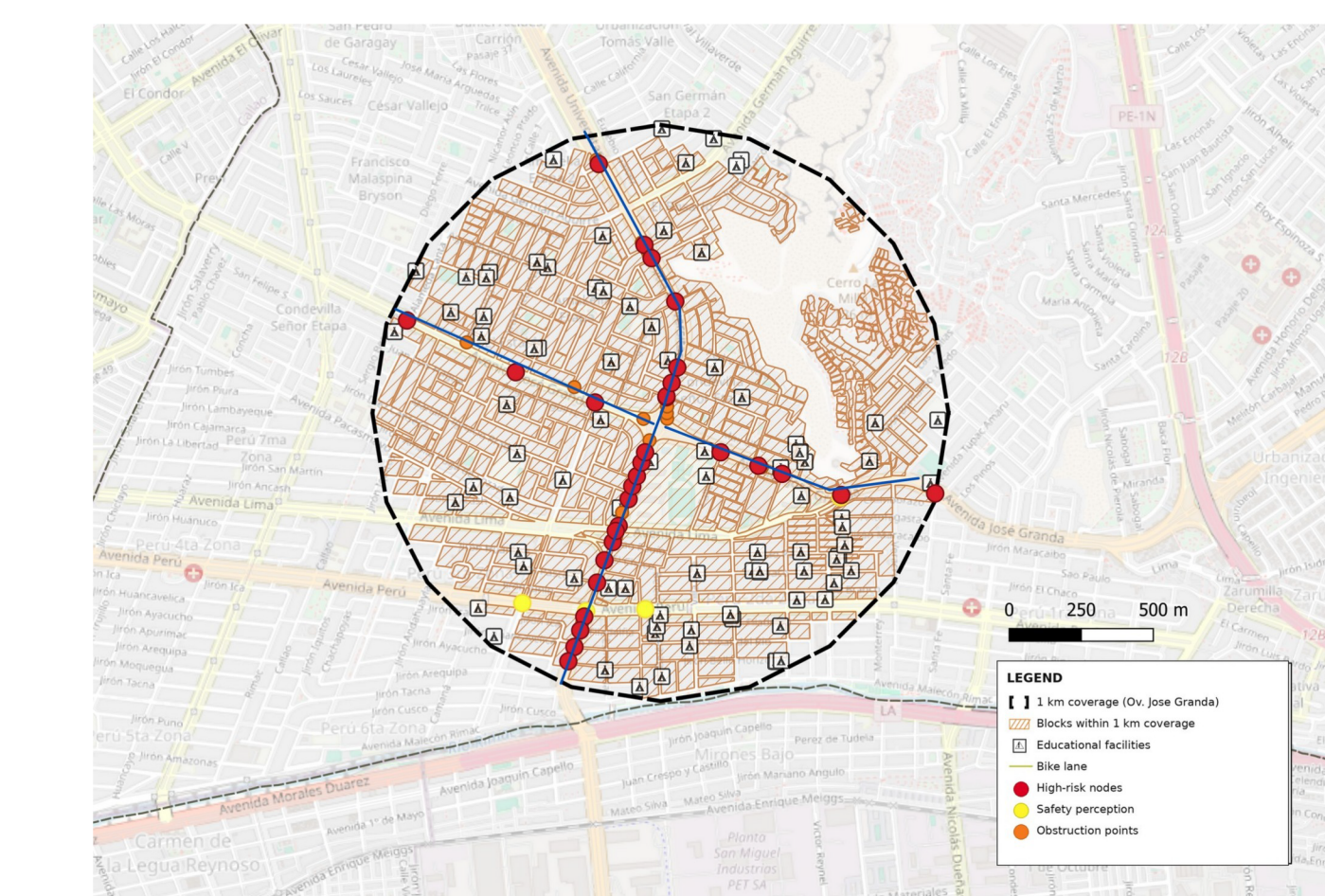


Figure 5. Conflict diagnosis: risk nodes and obstructions.

The heat map shows a strong concentration of educational facilities around the oval, while the diagnosis map locates high-risk nodes at the very points where cycling continuity breaks. Students are forced into mixed traffic under congested and unsafe conditions.

CRITICAL SECTOR 2: ANTUNEZ DE MAYOLO / AV. UNIVERSITARIA



Figure 6. Heat map: concentration of students and access pressure.

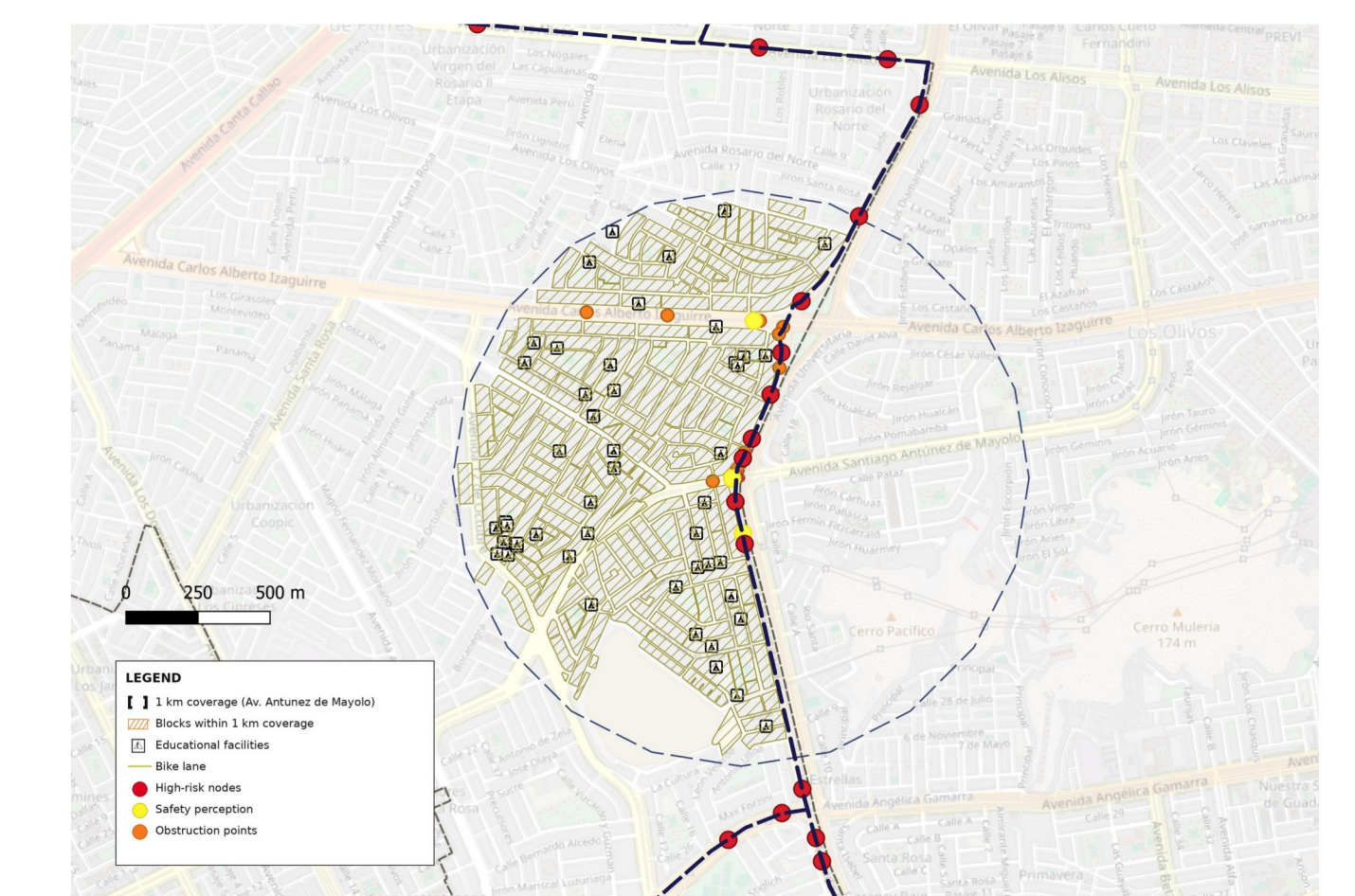


Figure 7. Conflict diagnosis: obstructed access.

In Antunez de Mayolo, waste accumulation, illegal parking, weak crossing conditions and low perceived safety interrupt access to the main cycling corridor. A potential connector becomes a physical barrier for active school mobility.

CONCLUSION

Cycling infrastructure in San Martin de Porres fails to operate as a safe and continuous mobility system for students. In the analyzed school routes, bike lanes become fragmented and contested corridors that add risk to educational access instead of protecting it.

RECOMMENDATIONS

- Repair existing discontinuities before expanding the network.
- Prioritize safe crossings at school-access intersections.
- Remove recurrent obstructions and improve pavement quality.
- Strengthen physical separation from motorized traffic.

CONFLICT OF INTEREST / ACKNOWLEDGMENTS

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REFERENCES

- Van der Meer, L., Werner, C., & Loidl, M. (2024). Assessment of bicycle accessibility to mobility hubs. *AGILE: GIScience Series*, 5, 48.
- Villar-Urbe, J. R., Demoraes, F., & Penagos-Avila, L. V. (2024). Sustainable mobility practices in peripheral urban areas. *Territorios*, 51, 1-36.
- Rosas-Satizabal, D., Guzman, L. A., & Oviedo, D. (2024). Cycling diversity, accessibility, and equality in Bogota. *Journal of Sustainable Transportation*, 14(3), 45-68.