Sustainable Active Transportation Infrastructure for Urban Heat Adaptation and Mitigation: A Systematic Literature Review

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Abstract Cities around the world are increasingly confronting the challenges posed by rising temperatures and the intensification of Urban Heat Islands (UHIs), which threaten public health, reduce outdoor comfort, and diminish the overall livability of urban environments. As global temperatures rise and heatwaves become more frequent, there is an urgent need for integrated urban strategies that can simultaneously address climate adaptation and support sustainable mobility. Active transportation infrastructure, comprising walkable and bikeable street networks, shaded pedestrian corridors, greenways, and interconnected public spaces, has gained prominence in recent years; however, its interface with heat resilience, mitigation, and adaptation has not been studied sufficiently.

This systematic literature review (SLR) explores the intersection of sustainable active transportation and urban heat resilience by analyzing a curated set of 180 peer-reviewed journal articles. The review follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Through a combination of bibliometric analysis and detailed thematic content analysis, the study examines how active transport infrastructure can serve both as an adaptation mechanism and a mitigation strategy in response to urban heat. The review identifies critical characteristics and design elements of infrastructure that contribute to cooling effects, and integrated microclimate-sensitive urban design. In addition, the review delves into analysing enablers and barriers that influence the implementation and success of such interventions. A diverse set of case studies and pilot projects, ranging from large-scale green corridor planning to small-scale neighborhood interventions, are reviewed to extract lessons on successful implementation, public acceptance, and policy integration. Furthermore, it examines the co-benefits of such infrastructure, which include improved thermal comfort, increased physical activity, social cohesion, and equitable access to public space. Trade-offs are also discussed, such as land use constraints, upfront costs, and potential gentrification effects.

The findings of this review underscore the potential for sustainable active transportation infrastructure to act as a nexus between urban climate adaptation and sustainable mobility planning. By integrating environmental, social, and technical dimensions, this research provides a comprehensive synthesis of the state of knowledge and highlights practical pathways for embedding heat-resilient active mobility systems into urban planning frameworks. The insights generated are intended to support urban planners, policymakers, and researchers seeking to design inclusive,

climate-responsive cities that prioritize both human well-being and ecological resilience.