Measuring the Impacts of Sidewalks on Public Transit First Mile/Last Mile Accessibility and their Association with Social and Demographic Factors

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ABSTRACT:

In integrated transit planning, first-mile last-mile (FMLM) accessibility carries profound importance to ensure the benefit of transit to the users. The presence of sidewalk around the bus stops can become a vital factor in FMLM accessibility, especially for sidewalk-reliant groups (e.g., people with disabilities, older people, children). Many cities, particularly in the United States, have incomplete sidewalk coverage of their street networks. Analyzing the impacts of the distribution of sidewalks and its effect on FMLM accessibility can improve the understanding of equitable accessibility and mobility. In this research, we develop and apply four comparative accessibility measures that can compare the FMLM accessibility based on sidewalks with that based on the road network. These four measures are: i) the reachable space from transit stops afforded by the sidewalk network versus the street network; ii) the total building area reachable from stops using both networks; ii) the number of groceries reachable using both networks, and; iv) the reachable number of healthcare providers. We also measure the degree of sidewalk completeness to reflect the proportion of the existing length of sidewalks and ideal length of sidewalks around the bus stop. We apply these measures to an analysis of FMLM public transit accessibility in Columbus, Ohio, USA, a city that has a substantial degree of incomplete sidewalks and sidewalk network gaps. Results confirm the impact of incomplete sidewalks on FMLM accessibility. Our study also analyzes the sociodemographic factors that associate with reduced FMLM accessibility due to incomplete sidewalks. We identify four clusters of neighborhood types using nine sociodemographic variables related to income, race, education, vehicle ownership, and commuting mode. The result indicates that low-income inner city neighborhoods have the highest FMLM accessibility, followed by neighborhoods dominated by student and young professionals, affluent suburban neighborhoods and finally middle class neighborhoods on the periphery of the inner city. We also find that the student community has the highest grocery accessibility and the lowest healthcare accessibility among the other three clusters. Building upon a directly comparable accessibility measure, this research reveals a non-linear equity implication with respect to sociodemographic class, contradicting the common intuition that people in less affluent neighborhoods suffer the most from reduced accessibility due to lack of sidewalks. Also, our measures and analysis enable policy makers and researchers to identify areas with need of sidewalk network improvement.

KEYWORDS: *sidewalk networks, first mile last mile accessibility, public transit, equity*

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