

An Integrated GIS Approach to Sustainable Non-Motorized Transport Analysis in Gondar City Administration, Northwestern Ethiopia

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Abstract : Gondar City, a city in Ethiopia, is going through growth and increased use of motor vehicles, causing issues of traffic congestion, pollution, and limited mobility options. Despite the growing number of cars on the road, walking still accounts for 54% of all journeys. However, the city's transportation planning has mainly focused on accommodating vehicles, leading to a lack of infrastructure for non-motorized transportation (nmt). This study utilized GIS analysis and surveys involving residents to examine how aspects of the city impact motorized transport. The GIS analysis objectively evaluated built environment factors influencing nmt, such as infrastructure quality, land usage patterns, topography features, and environmental factors using a multi-criteria analysis method (mca). The survey gathered feedback from residents on these factors and analyzed them statistically. The GIS analysis pinpointed areas with potential for nmt, slopes ($<10.03^\circ$), mixed-use developments with 15% coverage, and high intersection densities ($> 4.2/100m$). On the hand, steep slopes ($>23.77^\circ$) and low intersection areas require interventions. The MCA analysis indicated that 66% of areas in Gondar City had limited nmt accessibility levels, while only 7% were considered accessible. According to survey findings, environmental characteristics such as building density differed throughout sub-cities and demographics, with 1-3 story townhouses dominating Azezo Teda compared to connected kebele housing in Arada, while agreeing topography has obstructed walking. Correlation analysis shows significant relationships like topographies' negative associations with connectivity (-0.373^{**}) and infrastructure (-0.391^{**}). Although, regression analysis found housing type (1.036), safety (-0.688), land use (0.933), connectedness (0.585), and infrastructure (0.889) with $p<0.05$ were among the determinants of transportation frequency. The integrated analysis uncovered disparities between survey analysis and GIS analysis. In Azezo Teda, the GIS score is 2.27, while the survey score is 2.89. However, there is a correlation ($\rho=0.56$, $p<0.01$) indicating the reliability of gis in assessing walkability. This research offers insights for enhancing nmt accessibility in Gondar City by promoting transportation planning that focuses on (nmt) and the needs of residents.

Keywords : non-motorized transportation, accessibility, built environment, infrastructure

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