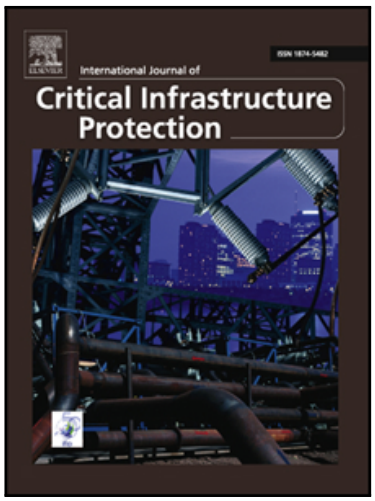

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Enhanced connectivity index – A new measure for identifying critical points in urban public transportation networks

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Abstract

This paper describes a novel methodology for identifying the critical nodes in urban public transportation networks. The methodology, which is based on graph theory, transportation and urban planning, seeks to optimize the use of city resources. The term "criticality" is defined in terms of the connectivity and activity density of a transportation node over time. The connectivity of a node is defined by the operational characteristics of the system (e.g., vehicle capacity, velocity, distance and frequency) whereas the urban activity density is based on urban planning indicators (e.g., population density, land use and urban form) along with the time factor. These two components are used to create the enhanced connectivity index that reflects the interaction between a transportation network and an urban environment. Detecting critical nodes in a transportation network over time is important because knowledge about the nodes that are likely to be more occupied supports strategy development, public resource management and funding prioritization. Moreover, the enhanced connectivity index can be used to enhance the intelligence of existing transportation systems. The application of the methodology to the bus system of a medium-sized city provides valuable insights into the spatial and temporal distributions of critical nodes. The results demonstrate that node criticality fluctuates considerably over time, because nodes with high activity during the morning hours are less critical during the evening hours, and vice

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