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Optimal and Critical Path Analysis of State Transportation Network Using Neo4J

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Abstract : A transportation network is a realization of a spatial network, describing a structure which permits either vehicular movement or flow of some commodity. Examples include road networks, railways, air routes, pipelines, and many more. The transportation network plays a vital role in maintaining the vigor of the nation’s economy. Hence, ensuring the network stays resilient all the time, especially in the face of challenges such as heavy traffic loads and large scale natural disasters, is of utmost importance. In this paper, we used the Neo4j application to develop the graph. Neo4j is the world's leading open-source, NoSQL, a native graph database that implements an ACID-compliant transactional backend to applications. The Southern California network model is developed using the Neo4j application and obtained the most critical and optimal nodes and paths in the network using centrality algorithms. The edge betweenness centrality algorithm calculates the critical or optimal paths using Yen's k-shortest paths algorithm, and the node betweenness centrality algorithm calculates the amount of influence a node has over the network. The preliminary study results confirm that the Neo4j application can be a suitable tool to study the important nodes and the critical paths for the major congested metropolitan area.

Keywords : critical path, transportation network, connectivity reliability, network model, Neo4j application, edge betweenness centrality index
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