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The world’s urban population growth and economic development have led to the reshaping of metropolitan space layout among residential, employment and shopping locations, generating growing mismatch between travel demand and transport services. Although a variety of public policies have been introduced to ease the situation of the transport network, the measures are still lagging behind the pace of urban growth. A reliable method to accurately analyze the current mobility demand and underlying transport network systems as well as to identify the areas with serious mismatch problems, is thus important in the assistance of designing more effective measures. With the wide deployment of GPS devices in vehicles in many cities today, we explore the possibility of using GPS data to develop such an approach.

Our exploration is composed of four major steps. First, city-wide mobility patterns are modeled based on GPS trajectories generated by vehicles. This model captures a set of key traffic characteristics between each pair of regions of the entire city network, including travel demand, travel speed, and route directness of travel paths. Upon this model, a set of indicators is then built to measure the road transport performance between the regions, and the areas with serious mismatch problems are subsequently pinpointed. Finally, the identified problematic regions are further examined and specific transport problems are analyzed.

By applying the proposed method to the Chinese city of Harbin using GPS data collected from all taxis operating in the city between July and September in 2013, the potentials and effectiveness of this technique are demonstrated. With more and more urban vehicles being installed with GPS devices, the designed method can be easily transferrable to the cities, thus paving a way for the development of a new, up-to-date and spatial-temporal sensitive road network analysis approach that supports the urban growth and transport system development into a sustainable future.