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Using Google Distance Matrix Application Programming Interface to Reveal and Handle Urban Road Congestion Hot Spots: A Case Study from Budapest

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Abstract : In recent years, a growing body of literature emphasizes the increasingly negative impacts of urban road congestion in the everyday life of citizens. Although there are different responses from the public sector to decrease traffic congestion in urban regions, the most effective public intervention is using congestion charges. Because travel is an economic asset, its consumption can be controlled by extra taxes or prices effectively, but this demand-side intervention is often unpopular. Measuring traffic flows with the help of different methods has a long history in transport sciences, but until recently, there was not enough sufficient data for evaluating road traffic flow patterns on the scale of an entire road system of a larger urban area. European cities (e.g., London, Stockholm, Milan), in which congestion charges have already been introduced, designated a particular zone in their downtown for paying, but it protects only the users and inhabitants of the CBD (Central Business District) area. Through the use of Google Maps data as a resource for revealing urban road traffic flow patterns, this paper aims to provide a solution for a fairer and smarter congestion pricing method in cities. The case study area of the research contains three bordering districts of Budapest which are linked by one main road. The first district (5th) is the original downtown that is affected by the congestion charge plans of the city. The second district (13th) lies in the transition zone, and it has recently been transformed into a new CBD containing the biggest office zone in Budapest. The third district (4th) is a mainly residential type of area on the outskirts of the city. The raw data of the research was collected with the help of Google's Distance Matrix API (Application Programming Interface) which provides future estimated traffic data via travel times between freely fixed coordinate pairs. From the difference of free flow and congested travel time data, the daily congestion patterns and hot spots are detectable in all measured roads within the area. The results suggest that the distribution of congestion peak times and hot spots are uneven in the examined area; however, there are frequently congested areas which lie outside the downtown and their inhabitants also need some protection. The conclusion of this case study is that cities can develop a real-time and place-based congestion charge system that forces car users to avoid frequently congested roads by changing their routes or travel modes. This would be a fairer solution for decreasing the negative environmental effects of the urban road transportation instead of protecting a very limited downtown area.

Keywords : Budapest, congestion charge, distance matrix API, application programming interface, pilot study
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