Spatio-Temporal Analysis of Bicycle Commuting Behavior in the Greater Tokyo Area Using a Micro-Scale Persontrip Database

Konstantin GREGER[1], Yuji MURAYAMA[2]

[1] 筑波大学大学院 生命環境科学研究科 空間情報科学分野, [2] 筑波大学 生命環境科学研究科 空間情報科学分野

連絡先: <greger@geoenv.tsukuba.ac.jp>   Web: <http://www.konstantingreger.net/>

(1) Motivation: Within the realm of transportation research in Japan bicycle traffic is heavily underrepresented. This is especially true for the field of transport geography. Yet, the need for mobility under the constraints of highly urbanized areas, bicycles are an attractive alternative means of transportation, that deserve a closer inspection.

(2) Originality: The aforementioned scarcity of geographical research about bicycle traffic in Japan makes this study one of the first of its kind. In addition, the state-of-the-art analysis of the micro-scale persontrip database fits well the trend for the analysis of big data.

(3) Approach: Since this project has only been started recently we are still in an early stage of descriptive data analysis. To do this we employed the excellent Tokyo Persontrip Database (PFlow) by the Tokyo Metropolitan Area Transportation Planning Council (東京都市圏交通計画協議会) and the University of Tokyo Center for Spatial Information Science (CSIS, 東京大学空間情報科学研究センター). It contains detailed information about 587,340 individuals synthesized to 1-minute positions. This results in 845,769,600 point positions in total, which we converted into a PostgreSQL database.

(4) Results: 112,286 people in total used their bikes during the sample period (24 hours), that equals 19.1% of the total sample population of 587.334 people. They got on their bikes 272,897 times in total, 2.4 times each in average. Overall they used their bicycles for a total distance of 478,738 km. The average distance was 4.2 km per person.

We focused specifically on the morning rush hour period from 6:00am to 9:59am. Overall, 68,029 people used their bikes during those 4 hours, that equals 60.6% of the total cyclist population of 112,286 people. They got on their bikes 1.1 times in average. Overall they used bicycles for 154,279km, which results in an average distance of 2.3km per person.

A detailed analysis of the multi-modal use of various means of transportation during the morning rush hour also revealed interesting insights: Trips by bicycle during the morning rush hour go mostly (63%) all the way from home to the final destination. When integrated into a multi-modal trip, bicycles are mostly used on the "home"-end of the trip.

Finally, a spatio-temporal analysis showed that the usage of bicycles during the morning commute differs by greatly by location, depending on socio-demographic factors, urban structural function, special infrastructures. Figure 1 shows the number of bicycle subtrips ending within each OD zone (the areal unit used in the underlying data and also in our research). The relationship between the ends of bicycle subtrips and railway stations with large passenger volumes is easily noticeable. This relationship will be the main focus of our future research.
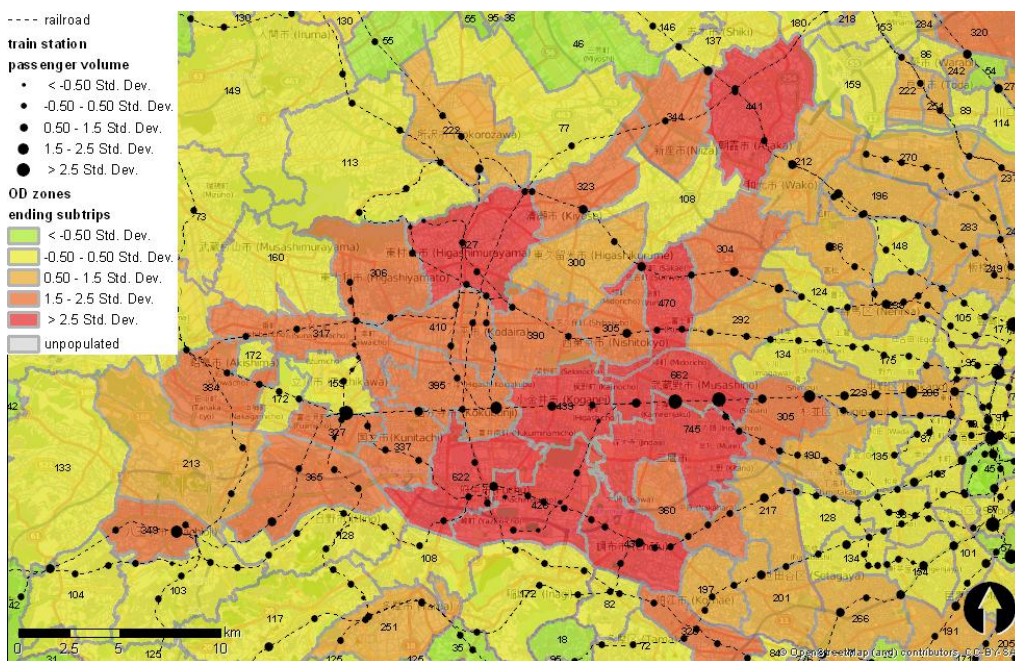

Figure 1: Absolute number of bicycle subtrips in the West of Tokyo, ending within each OD zone and their spatial relationship with train stations, symbolized by their daily passenger volume.