PROCEEDINGS OF THE BIVEC/GIBET TRANSPORT RESEARCH DAYS 2019

Ghent

23-24 May 2019

Preface

Dear colleagues, Chers collègues,

A very warm welcome to all of you who attend the 2019 Transport Research Days (TRD) of BIVEC-GIBET, the Benelux Interuniversity Association of Transport Researchers, taking place on the 23th and 24th of May in Ghent (Belgium). The TRD are organized biannually and offer young and established scholars from the three Benelux Countries an opportunity to present their research findings to an informed audience of transport, mobility, and logistics researchers. It is already the 8th time that the TRD have been organized. Previous editions were held in Hasselt (2005), Rotterdam (2007), Brussels (2009), Namur (2011), Luxembourg (2013), Eindhoven (2015), and Liège (2017). And also the venue for the 9th TRD have been decided: Delft (2021).

This year the TRD were organized by the Social and Economic Geography (SEG) Research Group of the Geography Department of Ghent University (http://www.geoweb.ugent.be/research-units/seg). We are confident that we have put together a very interesting program that will bring forward transport, mobility and logistics research in the Benelux-countries quite significantly. This was made possible thanks to the active input of many of you who submitted high quality papers. We want to thank all participants, and all people who helped organizing the TRD. We want to say thanks to Helga Vermeulen (former secretary of the Geography Department) for taking care of the conference administrative tasks. Also thanks to Sofie De Winter, Paul Schapelynck, Karine Van Acker, and Steven De Vriese for their help.

In this conference proceedings book you will find the full papers and some extended abstracts that were submitted by the participants. Please note that all copyrights belong to the authors.

We hope you enjoy the 2019 Transport Research Days in Ghent.

The local organizing committee:

Prof. Frank Witlox (chair) – Prof. Ben Derudder – Prof. Veronique Van Acker – Dr. Long Cheng – Dr. Jonas De Vos – Dr. Tom Storme – Freke Caset, MSc – Yuting Chen, MSc – Leen De Paepe, MSc

BIVEC/GIBET

Promoting high quality research and education in the field of transport, within its region, is the main goal of the Benelux Interuniversity Association of Transport Economists - BIVEC-GIBET for short. Founded in 1978, the Association has evolved from a small group of transport economists into a solid and broad-based network of a diversity of transport experts. It presently unites both academic staff and professional people qualified in fields such as transport economics, logistics, regional economics, transport geography, transport engineering, transport policy, and transport law. BIVEC-GIBET already has 40 years of experience, and the organization is still going strong!

What are BIVEC-GIBET's main aims?

- **Transport Research Days**. A two-day conference where current research is being presented by junior and senior researchers in sessions preceded by senior researchers.
- **Joint BIVEC-BENELUX Policy day.** A one-day workshop on a topic that has a high policy relevance where in the morning the academics get the floor, and in the afternoon the policymakers. Topics such as cross-border mobility, traffic safety, road pricing have been addressed.
- **Piet Rietveld PhD Award.** This dissertation prize recognizes the best doctoral dissertation in the area of transport, mobility and/or logistics research (broadly defined) that was publicly defended and accepted for eligibility for a PhD degree at a Benelux University institution. The award entails a certificate, a three-year membership of BIVEC, and 2500 EUR.
- **One day research seminars**, organized by BIVEC members (e.g. on Chinese logistics, Eco Zones, …)
- **BIVEC-GIBET Transport Chair**. This Chair is awarded to an individual who has important scientific and/or social merits related to transport and mobility within Europe. The first recipient (in 2012) was professor David Banister (University of Oxford). The second recipient (in 2014) was professor Jonas Eliasson (Royal Institute of Technology, KTH). The third recipient (in 2016) was professor Alan C. McKinnon (Kuehne Logistics University, Hamburg), and the fourth recipient is professor Jos Delbeke (Florence European University Institute & KU Leuven).

Interested and/or convinced to become a member? No problem, just go to our website: ***http://www.bivec-gibet.eu*** *and fill in the application form. An annual individual membership costs 50 EUR and gives you free or strongly reduced registration fees to all our activities.*

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Predicting Pedestrian Traffic at Street Level using Data from the 'Straatvinken' Citizen Science Project

Thomas Vanoutrive[1]
Huib Huyse[2]

Abstract: *The analysis reported in this paper estimated the number of pedestrians in street segments in the Antwerp region. Data on the number of pedestrians were obtained from the citizen science project 'Straatvinken'. As expected, the number of pedestrians is correlated with population density and job density. The position of a street segment in the road network is also a relevant factor and was measured using betweenness centrality. We conclude that traffic data collected by citizens may offer a valuable source of information, and that the act of counting has the potential to increase participation in traffic and transport planning processes.*

Keywords*:* pedestrian traffic, walking, Straatvinken, citizen science, Antwerp.

1. Introduction

Pedestrian traffic is often treated as a taken for granted way of travelling by both researchers and policy makers. However, recent studies have highlighted that walking deserves more attention arguing that (1) walking is a sustainable mode of travel which allows persons to reach a variety of destinations (Saghapour et al., forthcoming), (2) barriers such as roads with heavy traffic can significantly reduce the accessibility of persons for whom walking is an important mode of travel ('community severance'; Anciaes et al., 2016), (3) walking is promoted for health reasons since it is an everyday activity which can be carried out by a large majority of the population, and (4) the presence of pedestrians in streets contributes to the liveability of neighbourhoods, and meetings with relatives and strangers are seen as an essential part of social life (Gehl, 2011).

The literature that focuses on mode choice investigates why people choose to travel by car, train, bike or another travel mode (Abdul Aziz et al., 2018). In this literature, walking is often seen as a residual category since this travel mode has a marginal position in the commuting modal split. However, as has been outlined above, walking remains a relevant mode when seen from a street perspective. Related to the mode choice literature are studies that measure the modal split of larger geographical units such as cities (Vanoutrive, 2015). However, the level of abstraction and measurement issues make that there is a significant distance between the traffic conditions that people experience in their daily lives and aggregated indicators. A focus on streets has the potential to disentangle the modal split of a city or region.

Recent contributions have used a variety of quantitative and qualitative methods to measure and better understand barriers to walking, and the presence of walking in urban as well as suburban locations (Geddes and Vaughan, 2014). This includes investigations of crossing facilities (Anciaes and Jones, 2018), stated preference studies and Geographical Information System (GIS)-based applications (Dhanani et al., 2017). However, a considerable part of the research is carried out in the UK, a setting which shows relevant differences with, for instance, the region of Flanders in terms of street design, modal split and travel behaviour. The aim of this research is to better understand the spatial distribution of pedestrian traffic.

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2. Method and data

The present paper reports the first results of a quantitative analysis of pedestrian traffic that makes use of traffic counts collected by citizens within the framework of the 'Straatvinken' citizen science project. A regression model was estimated with the absolute number of pedestrians in a street segment as dependent variable. According to the literature, following variables have considerable explanatory power (Geddes and Vaughan, 2014): (1) population density, (2) the presence of non-residential activities such as jobs and retail, (3) sociodemographic variables such as age composition and median income of a neighbourhood, (4) the position of a street segment in the street network, which can for example be measured using space syntax methods, and (5) street layout characteristics.
For the dependent variable, the data stems from the 'straatvinken' project (www.straatvinken.be). In the framework of this project, more than 1,500 citizens simultaneously counted traffic during one hour in the May 2018 pilot. One of the distinctive features of the 'straatvinken' project is that all modes of transport are counted, including pedestrians, vans, cars and bicycles (6 categories in total), and all of that at street level. The study area corresponds to the 33 municipalities of the Antwerp region. Figure 1 shows a map of the region and the locations of the traffic counts selected for the analysis.

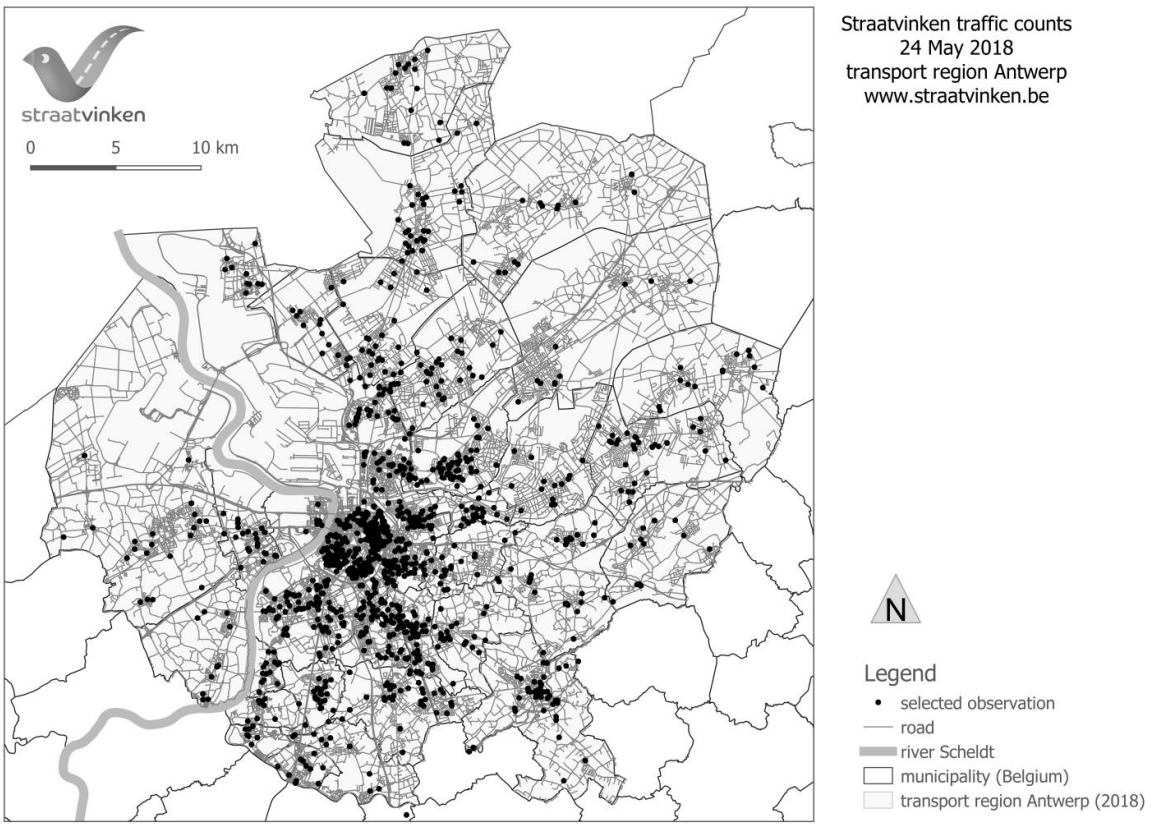


Figure 35 : Map of the study region

After data cleaning, 1,199 observations were retained, and the number of pedestrians was extrapolated to values for 1 hour (24 May 2018, 17h-18h). Somewhat less than half of the traffic counts are based on paper and pencil registration (n_{paper} = 537), while for the other observations, participants made use of a smartphone application developed for the Straatvinken project (n_{app} = 662). The observations were attributed to street segments as defined by the regional GIS agency (road centre line, file: Wvb.shp, version 10-04-2018) using GPS location (app-based data) or geocoded address data (paper and pencil). Table 1 gives some descriptive statistics of the dependent variable, and it is clear from the table that this variable is not normally distributed. The logarithm was taken which reduced the skewness to -0.2 and the kurtosis to -0.5.

Table 12 : Descriptive statistics of the number of pedestrians (1h values; 24 May 2018, 17h-18h)

variable	value
number of observed street segments	1,199
total number of pedestrians	59,529
average pedestrians/street	49.7
median pedestrians/street	22
standard deviation	75.7
skewness	3.5
kurtosis	17.4

Figure 2 shows the relationship between the number of pedestrians and the distance from the city centre of Antwerp. A clear distance decay pattern can be observed. In order to explain this pattern, we selected some variables to be included in a regression model.

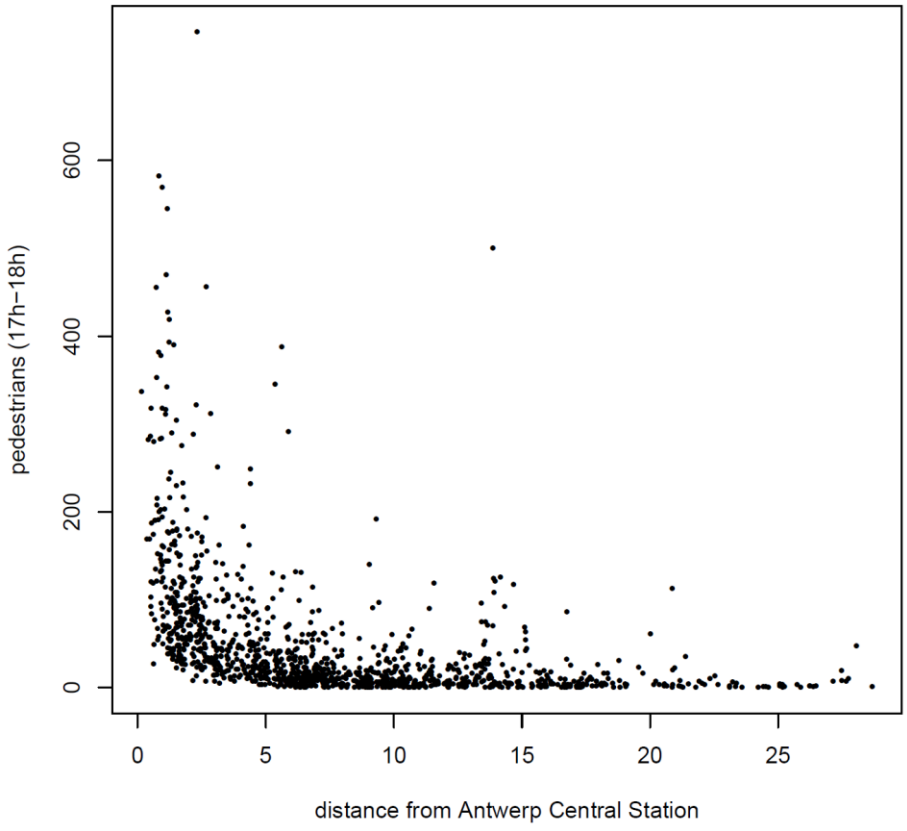


Figure 2: Pedestrians and distance from the city centre of Antwerp

As for the independent variables, 500m, 1,000m and 1,500m circular buffer zones were drawn around the measurement locations. Subsequently, the share of the area of each statistical ward that lies within the buffer zone was computed and jobs and population were attributed to the zones assuming a homogeneous spatial distribution. Job data stems from Belgium's Census 2011 (file TU_GEO_LPW_SECTOR.mdb), and the same holds for the population data (table S_00.04). Three age categories were used: 0-19 year, 20-64 year, and >64. In order to take into account the position of a street segment in the road network, the betweenness centrality was computed using the R package *igraph*. The transformation of the shapefile containing the road center lines into a network graph was done using the package *shp2graph*, but first motorways were removed since pedestrians cannot make use of these infrastructures. Correlation coefficients as well as a stepwise regression indicated that using the 500m range outperformed the application of other buffer radii. The logarithm is used for job data and betweenness centrality, and population data are measured in 1,000 residents.

3. Results

Table 2 shows the results of an OLS regression with the logarithm of the number of pedestrians in a street segment as dependent variable. The results confirm that the amount of pedestrian traffic can be estimated at the street level with a reasonable level of accuracy (adjusted R^2: 0.65). The density of the area where a street segment is located and its centrality in the street network are major determinants which are associated with higher numbers of pedestrians. Only for the age category 20-64 the estimate is not significant at the 5% level.

Table 2 : Results of OLS regression

Variable	Estimate	St. error	t value
Intercept	-0.60	0.075	-8.02
log(Jobs)	0.39	0.032	12.46
Age 0-19	0.086	0.033	2.64
Age 20-64	0.020	0.019	1.09
Age $\geq$65	0.18	0.043	4.14
Betweenness centrality	0.23	0.024	9.40
adjusted R^2	0.65		

4. Discussion and Conclusion

The results of this preliminary research confirm that density and the position of a street segment in a road network are positively associated with the number of pedestrians in a street. The data on pedestrians was generated in a citizen science project, Straatvinken, and these results indicate that this can be considered a useful data source, in particular since walking receives relatively less attention in transport research and policy when compared to motorized traffic and, to a lesser extent, bicycle traffic. Knowledge on the spatial distribution and other characteristics of walking might be used by urban designers, citizen groups and policymakers to create more walkable neighbourhoods and to detect physical as well as other barriers to walking. Collecting traffic data with citizens not only generates a useful source of information, it has also the potential to increase levels of participation in analysis and design.

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