

CROWDSOURCING – A TOOL TO MEASURE AND IMPROVE WALKABILITY IN TBILISI (GEORGIA)?

G. Kankia¹; K. Gvelesiani²;

Email for correspondence: *gkankia@gmail.com*

Urban mobility system in Tbilisi (Georgia), like many other aspects of the established socio-economic system has experienced serious setbacks during the last couple of decades as the country entered the transition period from planned economy to free market system. As certain part of the society became wealthier, the urban travel behaviour significantly changed in favour of individual motorized mobility.

The urban public space has been gradually overtaken by private vehicles; sidewalks have been turning into car parking spaces thus considerably worsening the walking and safety conditions for pedestrians and creating barriers for people with reduced mobility and strollers. Additionally, construction sites have been swallowing the sidewalks all over the city, further limiting the space for pedestrian traffic.

In this paper, we use crowdsourcing approach from the university students and local residents (N=55) to identify major barriers pedestrians come across on their daily routes, locate and sort them in different qualitative categories. Most commonly used pedestrian routes have been identified using Geographic Information Systems (GIS) network and walkability conditions have been evaluated for each route based on the different barriers identified (N= 124) in the study area, the district of Vake (Tbilisi).

Results show that up to 80% of the barriers identified on the sidewalks are within 250 meter walking distance of a bus stop, creating significant obstacles for different groups of society and therefore, limiting easy access to affordable transit options, further encouraging the use of private car. Different types of interventions from the city authorities could considerably improve the walkability conditions and safety of pedestrians at selected locations. Regardless the limited extent of the research in this case study, the proposed methodology can be used as a useful tool for urban and transport planning purposes to improve walkability in urban areas.

KEYWORDS: Urban mobility, walkability, public transport, transport planning, sustainable transport

¹ University of Granada – gkankia@correo.ugr.es

² Iare Pekhit (Walk) – Pedestrian-rights organization – xatuna.gvelesiani@gmail.com

INTRODUCTION

Numerous studies in social and health sciences have underlined the importance of walkable, pedestrian-friendly environment in terms of sustainable urban mobility, as well as the wellbeing and safety of the residents (Delso, Martin, Ortega, & Otero, 2017; Gatrell, 2013; Quercia, Aiello, Schifanella, & Davies, 2015; Sundquist et al., 2011; Valenzuela, 2000).

Walking is considered to be one of the most efficient transportation options in dense urban settings for short-length trips, as it is an alternative to private car and therefore, reduces air and noise pollution, traffic congestion, dependency on oil products and decreasing greenhouse gas emissions. From the social point of view, walking can be seen as the most equitable mean of transportation, as it is cheap, and it needs only basic infrastructure. Other socio-economic benefits of walking include thrive of local businesses such as street shopping and tourism and, at a larger scale, public health savings, as it counts as a physical activity. Walking also provides accessibility to certain areas where no other transport options are available (Cambra, 2012).

The abovementioned aspects of walking represent the basic “foundations of a sustainable city” regardless of which pedestrian access has decreased steadily in most cities as a result of growing dependence on private vehicles (Forsyth & Southworth, 2008).

Even though walkability principles and pedestrian flow analyses had been considered in planning theories [in the form of compact neighbourhoods], as Clarence Perry proposed a “neighbourhood unit” in 1929, based on the Ebenezer Howard’s Garden City theory (19th – 20th centuries) (Moudon et al., 2006; Pushkarev, 1976), it was not until 1993 when Chris Bradshaw, a Canadian pedestrian rights advocate and Ottawa municipal planning official proposed the idea of “walkability index” that aimed to measure the quality called walkability. Bradshaw defines walkability as a set of characteristics that include the aspects of: 1) the built environment, 2) land use, origins and destinations; 3) weather conditions, and 4) local social culture and diversity. Human scale – lively streets, with barrier-free, wide sidewalks with easy access to diverse services and socializing options is crucial to consider a neighbourhood as a walkable unit. He proposes using different variables to calculate the index of walkability of a certain area based on quantifiable (density, public infrastructure in place, transit service accessibility, parking spaces, green spaces, etc.), as well as qualitative information, such as the feel of safety (for women and children), meeting someone while walking or “places of significance”(Bradshaw, 1993).

Hillier et al., (1993) underline the importance of urban grid configuration and whilst acknowledging the multiplier effect of attractors in the pedestrian flow generation, applying the space-syntax techniques in various case studies in London, they demonstrate the crucial role of the natural movement approach in the study and assessment of the urban environment.

Stonor et al., (2003) applied the same approach in order to study spatial integration of walking environment based on central London case and using the space syntax model developed a set of factors in terms of their importance according to first (footway accessibility, ground level activities, design of intersections, time of day), second (lighting, walking motives, sidewalk technical aspects, proximity to transport infrastructure, density on the sidewalk) and third (sidewalk quality, proximity to road traffic) order. However, they conclude that the only factors that had significant impact on pedestrian flow, were the footway accessibility and the ground level activity.

Mobile technologies and web platforms have become utterly helpful tools in the field of urban planning and the study of built environment as they allow to gather almost all kinds of “big data”

in a very short period of time, or even real time. In terms of walkability, a number of applications and web-platforms have been developed recently in order to collect different types of information³.

The main objective of the present paper is to evaluate the pedestrian experience in one of the most densely populated district of Tbilisi, Georgia – Vake based on different variables, such as safety, travel behaviour and infrastructure in place. In the next chapters the research context is outlined and the study area is described. Afterwards the methodology is explained and the results are discussed.

RESEARCH CONTEXT

A number of studies have focused on the topic of urban mobility in post-socialist countries with the majority of the research focused on the study of the newly-emerged phenomenon in urban transportation, so called “marshrutkas”, known as “dolmuş”, “matatu”, “bush taxi”, or “dollar van” in other parts of the world, dominantly in developing countries and countries in transition (Griškevi & Griškevi, 2003; Bratanova, 2009; Finn & Mulley, 2011). However, the focus on walkability has mostly been ignored, especially in the Georgian context.

Even though the rate of motorization in Tbilisi increased significantly – from 70 to 330 vehicles per capita in the last decade⁴, the share of walking in urban mobility still remains considerably high – at 27%, however, it falls behind driving or using public transportation, 30% and 39%, respectively⁵.

Study area

Located in the south – western part of the capital city of Georgia, Tbilisi (1.1 mln inhabitants)⁶, the Vake district accounts for up to 100 000 residents. With an abundance of academic institutions, public administration offices and business activities, the neighbourhood has attracted large numbers of residents over the years making it one of the densely populated district in the city with nearly 30 000 inhabitants per square kilometre in the urban core. According to the Tbilisi Metropolitan Area Transportation Household Survey (2015), Vake has one of the highest motorization rates in Tbilisi (avg. 0.51 cars per household), with 0.70 private vehicles per household on average.

METHODOLOGY

Walkability Questionnaire and Data Collection

To collect information on physical barriers and general walkability conditions in the district a special questionnaire was developed based on the Walkability Checklist questionnaire by the NHTSA⁷ which was adapted to local reality in terms of pedestrian and driver behaviour, built environment and infrastructure in place. The questionnaire included five questions (YES/NO) on different aspects of walkability and the participant was asked to evaluate each of them on a

³ As an example, Walkscore is a private company that allows individuals to share their walking experience and based on the data collected, evaluate the walkability of a certain area. A new feature also helps people look for real estate in the most pedestrian-friendly neighbourhoods.

⁴ Based on the data from the Ministry of Internal Affairs – 2014.

⁵ Tbilisi Metropolitan Area Transportation Household Survey – 2015.

⁶ 2014 Population census - GEOSTAT, 2016.

⁷ With the absence of universally adopted methodology to evaluate walkability, a checklist developed by the National Highway Traffic Safety Administration (USA) was taken as a basis for our questionnaire.

scale 1 (poor) to 6 (good) based on their personal experience. Each question had a follow-up sub question that should have been answered if the answer to the first question was negative.

It is noteworthy to mention that the questionnaires were designed to understand the general experience a pedestrian might have while walking through the neighbourhood.

At the end of the questionnaire, the pedestrian-friendliness of the neighbourhood is assessed based on the sum of the scores obtained from each question.

In addition to the questionnaire, the data collection process, which lasted for a month (November, 2016) also included mapping out the barriers that hindered walking along the everyday route of a pedestrian. This allowed to engage citizens (N = 55) in data collection process and evaluate the walking conditions based on the crowd sourced information. Next, identified barriers (N = 124) were sorted in four major categories: illegal parking on sidewalk, sidewalks taken over by private businesses, sidewalks blocked by construction sites and dangerous crosswalks with no special signalling or traffic lights.

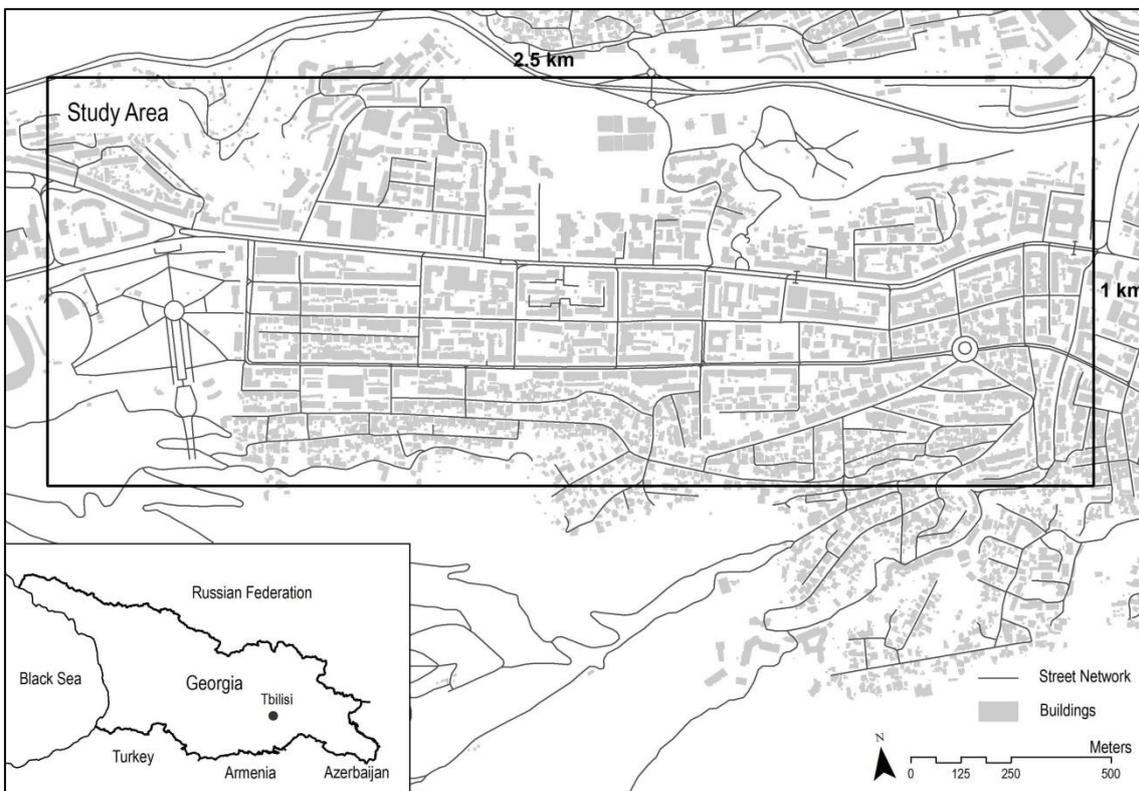


Figure 1: Location map of the study area

Spatial Analysis and Identification of Most Problematic Pedestrian Corridors

GIS network datasets were created in order to conduct spatial analysis. Street network of the district was built based on the OSM data and categorized as street axis and sidewalks. The information on walking barriers was added in the analysis as point features. Barriers found during walk were placed on sidewalks, while dangerous crosswalks were located on the street axis.

In order to identify most problematic pedestrian routes, a point kernel density analysis is performed. The kernel density is calculated with the ArcGIS 10.2 kernel density tool, with barriers as input data and creates a final raster layer with continuous surface with density values,

which are later attributed to the street network within the corresponding density area and is categorized into three classes, using Jenks Natural Break Method, to identify sidewalks with higher barrier density rates. Network features with higher values are identified as the most problematic pedestrian corridors.

To assess the relationship between walkability and transit accessibility in the district, a network analysis was performed using the same street network and bus stop and route data, obtained from the municipal transport authority⁸ and an open source database,⁹ respectively. Bus catchment areas within 250 and 500 meters walking distance of bus stops have been identified using ArcGIS 10.2 network analyst tool.

Additionally, an observational approach was chosen to assess the built environment and identify streets with sidewalk and with no sidewalk.¹⁰

RESULTS

Street Typology and Walking Conditions

Almost 50% of the streets in the study area have no sidewalk on one or either side of the roadway, and coincide mostly with the residential use of the street (Figure 2a). The total length of the sidewalks in the study area is 25 km.

As the results of the kernel density analysis of the identified barriers and bus service catchment areas show (Figure 2b), 78% of the walking obstacles are within a 250-meter service area of public transit, and the remaining 22% within the next 250 meters. Therefore, 100% of the pedestrian barriers are located within 500 meters of the access point to the public transport, making it difficult for people, especially those with special needs to have an affordable mobility option in walking distance.

Figure 2 – Street Typology and Sidewalk Walkability



⁸ Tbilisi Transport Company is the municipal operator for public buses. Minibus routes have been ignored in the analysis due to insufficient data.

⁹ Bus routes have been obtained from the open source database - Jumpstart Georgia.

¹⁰ Streets with too narrow sidewalks, where it is impossible to walk for even a single adult have been considered as streets with no sidewalk at all, as they don't serve the sole purpose of walking freely and safely.

The kernel density analysis shows that 7 km (28%) of the total length of the sidewalks present unpleasant conditions for walking, making it hard for a pedestrian to navigate freely and safely, while 11 km (44%) of the sidewalks present moderate walking conditions and only one fifth (5 km – 20%) of the total walking network is mostly free of barriers and present acceptable walking conditions for a pedestrian. Due to insufficient barrier data, it has not been possible to evaluate the conditions on the remaining 2 km (12%) of the total length of the sidewalks.

Critical points

With a total of 124 barriers and 55 questionnaire responses recorded during the study period, the principle reasons for poor walkability can be divided into two major categories: the infrastructure and built environment, which are not adapted to the needs of pedestrians as 26% of identified barriers included dangerous crosswalks; and the inefficient law enforcement, resulting in the illegal takeover of walking spaces for parking (53%), private businesses (6%) or construction sites (15%), as well as the dangerous and irresponsible behaviour of drivers towards pedestrians (Table 1).

Table 1 – Summary of walkability audit questionnaire responses

Did you have room to walk? (%)		Was it easy to cross the street? (%)		Did the drivers behave well? (%)		Was it easy to follow traffic rules? (%)			Was your walk pleasant? (%)		
YES	NO	YES	NO	YES	NO	YES	NO	NA	YES	NO	
8	92	12	88	8	92	37	63		8	92	
Reasons (%)		Reasons (%)		Describe the behavior (%)		Could you? (%)	Y	N	NA	Reasons (%)	
Paths stopped	38	Road too wide	21	Turned carelessly	56	Cross at crosswalks	53	43	4	Scarce greening	55
Cracked sidewalks	40	Long waiting at traffic light	49	Did not yield while crossing	80	Cross while see and being seen by drivers	51	43	6	Scary dogs	6
Blocked sidewalks	82	No crosswalk/ traffic light	47	Did not yield while turning on light	55	Walk on sidewalks *	39	47	14	Scary people	10
No sidewalks	17	Parked cars blocked the view	39	Drove too fast	49	Cross at traffic lights	66	27	7	Poor street lighting	20
-	-	No ramps/ Repair needed	17	Drove through traffic lights	57	-	-	-	-	Lots of trash	25
Score		Score		Score		Score			Score		
1 (poor)	2.1	1 (poor)	2.5	1 (poor)	2.1	1 (poor)	3.2			1 (poor)	2.9
6 (good)		6 (good)		6 (good)		6 (good)				6 (good)	

* NO means the pedestrian had to walk through traffic

DISCUSSION AND CONCLUSIONS

This paper is a case study analysing the walking conditions in one of the most densely populated district of Tbilisi (Georgia), Vake. The study of walkability is a relatively new approach in the field of urban mobility and several authors from urban planning, as well as other social and medical science fields propose different visions on how to assess the pedestrian-friendliness of a place and its impact on human wellbeing. The paper offers a methodology, which based on quantitative and qualitative information gathered through crowdsourcing, the pedestrian experience of local residents and everyday visitors, intends to analyse how walkable the district in question is. While the methodology presented in this paper is relatively simple and may have certain limitations and lack of accuracy, as it uses quite limited amount of information, it is first

such attempt to evaluate walkability based on crowd sourced information in local context, and could be significantly improved as more quantitative and representative information is available.

Regardless its limitations, based on the barrier data, sidewalks with different levels of walking difficulty have been identified and categorized, with the absolute majority of obstacles located within 500-meter service areas of public transit, therefore, making collective transport less accessible, attractive and inclusive.

Taking into consideration the high density and compactness of the neighbourhood, the absolute majority of the inhabitants are directly affected by poor walking conditions, further increasing their risks of cardiovascular diseases and mental illness of the residents, as walking has already been proved to be one of the healthiest and important physical activity, not to mention its positive impact on environment. It also directly contributes to higher use of private vehicle, thus adding up to the congestion, especially during rush hours.

As Jan Gehl puts it: “being friendly towards pedestrians is the cheapest approach” the authorities can choose in the process of elaborating the vision of city’s strategic development (Dalsgaard, 2013).

In order to make positive use of the already existing high density and physical compactness of the built environment in Vake district, simple solutions, such as stricter law enforcement, regulating the private businesses or creating safer crosswalks at the most dangerous intersections (Figure 2a and 2b) could bring several positive results at once, as numerous examples around the world shows. Pedestrian-friendly areas are profitable for private sectors, create interaction on local level, decrease congestion thus, are more environmentally-friendly and contribute to the physical and mental wellbeing of its residents.

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