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PUBLIC TRANSPORT STOPS AND CRIME WITHIN THE CITY SPACE. THE CASE OF STARE BAŁUTY IN ŁÓDŹ

Przystanki transportu zbiorowego a przestępczość w przestrzeni miasta. Na przykładzie Starych Bałut w Łodzi

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Abstract: The goals of the study presented in the article draw attention to the role of public transport stops in the spatial distribution of crime in the Stare Bałuty estate in Łódź, Poland. Answers are provided to the questions of spatio-temporal structure of criminal acts committed within the estate, the influence zone of transport stops as well as the assessment and effects of environmental crime predictors in their vicinity.

Crime location quotient (LQC) was used to assess the intensity of crime and identify the influence zone that attracts certain categories of crimes to the vicinity of stops. The influence of environmental predictors on the level of threat was identified and assessed on the basis of B. Czarnecki's method. The variables used in the analysis initially spanned 739 crimes and 53 public transport stops evaluated with regard to 20 safety aspects and their impact on the pro-crime effects on the scale of location as well as various forms and functions of urban development.

A strong negative influence of public transport stops – attracting various categories of crime, mostly property theft – was discovered. The negative influence of stops on the concentration of crime within 200 metres is reinforced by the existence of environmental crime predictors.

The recommendations and discussions resulting from the findings should influence the policy of crime prevention on the level of object location, management and the maintenance of socio-spatial order in the vicinity.

Keywords: public transport stops, spatio-temporal distribution of crime, crime location quotient, evaluation of safety aspects, land use

Introduction

One of the basic rights of all residents is the option to move between their homes and places where they can fulfil their daily needs without being afraid of becoming a victim of a crime. Mobility is a crucial determinant of the quality of life in a city as it makes it possible to utilise various resources offered. The option of moving safely should encompass all types and elements of public transport, such as buses, streetcars, the underground network, trains, and others. Unfortunately, as shown by ample literature and empirical studies, public transport and the locations associated with it are not safe. Transit-related crime is a common, lasting phenomenon that – when on the increase – can be a serious source of fear for travellers in many different cities. The issue is especially serious from the perspective of those inhabitants who, for various reasons, are unable to use non-public transport, thus making public one their only option. Their activity in space forces them to use public transport, wait at stops or platforms, and change transportation at transfer points. Such objects and their surrounding areas are examples of places with a high concentration of crime; they can both attract crime and generate it (Brantingham, Brantingham, 1993). Destination and transfer stops or stations are characterised by a significant flow of passengers and pedestrians which, paradoxically, facilitates committing crimes: during specific times of day, crowded stops constitute the stage of pickpockets (Levine et al., 1986; Loukaitou-Sideris et al., 2001; Stucky, Smith, 2017). Numerous publications provide more and more in-depth descriptions of the relationship between the level of crime in such criminogenic locations and their vicinities (Smith, Clarke, 2000; Loukaitou-Sideris et al., 2002; Irvin-Erickson, La Vigne, 2015). The pro-criminal parameters of the neighbouring transport stops are increasingly better known, in terms of function and development form, as well as the quality of public spaces, their spatial order, and fittings. It is easier to predict the changeable structure of committed acts depending on the time and the size of passenger crowds. However, the works dedicated to the analysis of such locations in terms of various safety aspects in accordance with the concepts of shaping safe public spaces are few (Kooi, 2015).

The research presented largely aims to answer the questions: what spatial or temporal patterns of crime distribution are related to public transport stops and whether environmental crime predictors in the vicinity of such stops influence the level of crime threats? Therefore, there is a double purpose to this study. Firstly, to identify the spatial and temporal patterns of crime distribution in relation to the arrangement of public transport stops. Secondly, to determine

the influence of environmental crime predictors on the distribution of crime. The inventory of the research area has shown which objects and locations are potentially dangerous in the local context. In the majority of studies on the influence of land use on the distribution of crime, the location of objects in topographical geobases is used, without the analysis and interpretation of their direct neighbourhood and local situation. In this study, each public transport stop has been evaluated from an angle of its level of potential local environmental predictors.

The detailed research was conducted in the Stare Bałuty estate in Łódź, Poland. This estate is the northern part of the downtown, multi-functional urban development with 53 bus and streetcar public transport stops¹. The issues raised in the article will help understand the intensification of certain types of crimes committed at a specific time in the vicinity of public transport stops; the fulfilment of the safety conditions in these places will also be considered. Understanding the determinants of spatial crime patterns in the vicinity of transport stops may be of major significance to crime prevention and the improvement of the residents' quality of life.

1. Literature review

For decades, literature in the fields of the geography of crime and environmental criminology has been providing proofs of the influence of various types of land use on the distribution of crime (Ceccato, 2009; Andresen et al., 2009; Sypion-Dutkowska, 2014). The level of criminal activity in various areas depends on a specific combination of certain factors which make these locations favourable or unfavourable to crime. It was observed, that the level of criminal threat in a given location may be the result of the location itself, its typical development features, specific businesses located there or activities that occur in the area. There are numerous theories on the emergence of opportunities to commit crimes in specific circumstances. Clearly, they are unable to provide a full explanation of why some areas are more criminogenic than others, but successfully attempt to better understand criminal patterns, especially when it comes to crimes committed in cities.

Crime usually concentrates in cities, where it is not distributed randomly – there are certain patterns to its emergence. Some areas are more at risk than others. City centres, areas with diverse land development or transport hubs are frequently more criminogenic than residential areas (Sherman et al., 1989; Loukaitou-Sideris

¹ The term “public transport stops” used throughout the article denotes bus and streetcar stops.

et al., 2002; Ceccato et al., 2002; Ceccato, 2009; Mordwa, 2016). Moreover, the distribution of crime differs in time and space (Andresen, Malleson, 2013). For instance, around noon theft is more likely to occur in the vicinity of bus stops than elsewhere, although not all bus stops and their surroundings are equally criminogenic (Levine et al., 1986). Urban blocks in Prince George's County (Maryland, USA) with an abundance of school bus stops were associated with higher crime rates, although at various times of the day. C. G. Roman (2005) has proven that the presence of bus stops in a given street section is a strong criminal factor, especially during out-of-school time (after school and in the evenings). The indices of violent crimes rise with the increase of student presence at bus stops where a person has a higher chance to become their victim. Supporters of the theory of broken windows treat public space (a bus stop, an underground entrance, etc.) as more than merely a number of people gathered in a given place. They consider it a complex system of interactions, which, after crossing a given scale and frequency of these interactions, may become an impulse to disturb the state of safety – with the increase in the number of people at an arithmetic progression, the number of asocial behaviour increases exponentially (Wagers et al., 2017).

Modern transport systems generate areas and locations with major pedestrian flows and more susceptible to crime. A number of studies describe various signs of social pathologies (including crime) associated with the functioning of the public transport system (Loukaitou-Sideris, 1999; Church et al., 2000; Smith, Clarke, 2000; Liggett et al., 2001; Loukaitou-Sideris et al., 2001). The transportation system needs to be perceived as a multi-faceted arena consisting of numerous elements: means of transport (buses, streetcars, trains), objects (terminals, stations, stops, transfer points), and users (personnel, passengers). Spatial organisation and relationships between these elements may influence crime levels and people's sense of safety. The crime itself may be associated with the system itself (vandalism, charge evasion; Newton, Bowers, 2007), employees (especially ticket inspectors), and passengers especially at risk of pick-pockets or muggers (Smith, Clarke, 2000). In Leeds, UK, an innovative approach to researching the issue was taken. It combined the existence of crime hot spots with quick changes in the number of messages generated in social media via smartphones (Malleson, Andresen, 2015). Thus, through crowd-sourcing data, the size of passenger population at risk of violent crime was determined. Other studies focused on mid-journey threats to passengers (e.g. Loukaitou-Sideris, 2012), those who boarded, got off or waited at public transport stops (e.g. Levine et al., 1986). An interesting

study by A. Newton (2008) confirmed that the number of crimes committed on buses correlates with crimes in the area of a given bus route.

The subject of this article is public bus stops; they not only accumulate more crime than other neighbouring areas but also frequently invoke the sense of lacking personal safety. Apparently, fear of crime and the sense of safety are related to the real crime index, the characteristic features of transport objects, and the built environment (Ingalls et al., 1994; Liggett et al., 2001). Women in particular are likely to completely give up public transportation, according to the work by G. Valentine (1990). Her research conducted in Reading, UK, has shown that women predict risks in several specific types of places, including multi-storey car parks, train stations, bus stops, but also open spaces, narrow alleys, and underpasses (Valentine, 1990). For this reason, women more often drive their own vehicles or use taxis. The phenomenon of giving up public transport due to feeling unsafe can grow considerably which, in turn, will have its own, multi-faceted consequences (Ingalls et al., 1994; Iseki, Taylor, 2009; Sullivan et al., 2017). According to A. Loukaitou-Sideris (1999), ten bus stops with highest crime rates in Los Angeles were located at intersections of multi-lane roads in areas with a primary trade function. In her subsequent studies, the author broadened the set of factors that influence the level of fear and risk perception by those that are socio-psychological in nature (experience, previous victimisation, knowledge of the area, media coverage), socio-demographic (gender, ethnicity, age, income, disability, sexual orientation), environmental (location, social and spatial disorder informal social control, lightning), but also those related to the development and neighbourhood of bus stops. On the basis of research conducted in downtown Los Angeles, A. Loukaitou-Sideris deduced that higher crime rates are related to the utilisation of the neighbourhood of bus stops (off-licence stores, bars, pawnshops, intra-estate footpaths) and its physical condition (abandoned or ruined buildings, litter, graffiti). On the other hand, the presence of a shelter, open service facilities, good visibility and lighting as well as the presence of other passengers or pedestrians near the bus stop are variables that lower crime rates (Loukaitou-Sideris, 2012). Interestingly, the way this set of factors influences crime in the neighbourhood of train stations turned out to be largely different in another study (Liggett et al., 2001). A remarkable, complex review of current studies on the influence of the built environment, land use and environmental crime predictors on crime was made by A. R. Inlow (2021). She concluded that areas with lower crime rates are characterised by mixed-use areas and clear urban layout on a macro scale, while

on a local scale the issues of lighting, building conditions, servicing and maintenance of green areas are of utmost importance.

In reality, most transport-related crimes occur near a few transport stops. Various studies defined the features of such stops and their neighbourhoods. However, there is still an ongoing debate on the influence of such factors as: the option of natural supervision (informal social control), the proximity of trade districts, the presence of a greater number of passengers or the time of day (Roman, 2005; Ceccato, Uittenbogaard, 2014; Stucky, Smith 2017; Gerell, 2018;) on increased crime rates. The analyses conducted in Brisbane concluded that bus stops are high-risk locations, because of their properties that provide opportunities to commit crimes and attract potential offenders. Australian researchers analysed the potential influence of the presence of passengers and features of direct vicinities of bus stops on the occurrence of thefts and property damage in bus stops both at rush hours and outside of them. They concluded that the higher number of people waiting at bus stops signified a higher risk of theft. Moreover, it was proven that the influence of the same crime predictors at bus stops differs depending on the time of day (Zahnow, Corcoran, 2019).

One of the key criminological theories, the so-called crime pattern, treats public transport stops as crime generators (Brantingham, Brantingham, 1993). This stems from the major flows of people in such locations, generating many opportunities for crime. Since places with high crime rates attract other intentional criminals, public transport stops may also be treated as crime attractors. This has been confirmed by studies that saw stops and stations functioning as both crime generators and attractors, depending on the time of day, type of crime, and properties of the transport network itself (flows of passengers and pedestrians, possibility of control, and supervision).

Crime generators and attractors are some of many spatial features of residents' daily activities, where they fulfil their current needs. The spatio-temporal concentration of crime in cities largely results precisely from the daily flows of people from their homes to other city areas (for work, shopping or entertainment; Felson, Boivin, 2015). Some people decide to take criminal actions on a whim when the opportunity arises during their routine behaviours. In this case, a bus stop crime is a result of the offender's rational decision made while taking into account specific situational factors that provide such an opportunity and ensure a low risk of being caught. On the other hand, for passengers, a threat associated with simply moving through their living space may result in them changing their routes (Sullivan et al., 2017).

As a consequence of the studies that proved the relationships between the built environment and the distribution of crime, interesting concepts emerged that suggested the possibility of shaping public space in such a way, so as to reduce its crime-friendly properties. The research current dealing with the concepts emphasising the possibility of preventing crime by shaping space has mostly developed on the basis of early works by Jane Jacobs, Oscar Newman (*defensible space*), and Alice Coleman. In the following years, these works were modified and developed further by, for instance, R. Armitage and R. Atlas (*offensible space*), B. Hillier (*space syntax*), C. Jeffery (who was the first to coin the term *crime prevention through environmental design*, commonly used in the form of its abbreviation: CPTED), B. Poyner and B. Webb (*crime-free housing*), P. van Sommeren (*container concepts*), J. Wilson and G. Kelling (*broken windows*) – a comparative discussion of these solutions was provided by I. Colquhoun (2004) and B. Czarniecki (2011) in their books. The essence of these concepts consists in decreasing or eliminating the physical possibilities of committing a crime and increasing the probability of catching offenders. For this purpose, an increased or intensified supervision of the object is necessary as is convincing potential offenders they are constantly observed. Numerous programmes, including ones created by practitioners and local government activists, were created on the basis of the ideas of shaping safe public spaces. They contain specific recommendations and solutions; the most famous ones include the Dutch *Politiekeurmerk Veilig Wonen* (www.politiekeurmerk.nl), the British *Secured by Design* (www.securedbydesign.com), and the German *Beccaria-Standards* (www.beccaria.de).

2. Research material and methods. Research area

Data from Komenda Wojewódzka Policji (KWP – Voivodeship Police Headquarters) in Łódź was obtained to analyse the level and distribution of crime in Stare Bałuty. The tabular information included addresses, dates, types and nature of crimes registered in 2016. Unfortunately, in 19% of cases, the data was incomplete (lack of or incomplete addresses), which made geocoding impossible and excluded the data from further analyses (nevertheless, the 81% geocoding rate is an acceptable level; Ratcliffe, 2004). In the following steps, crimes committed that had no or weak association with the neighbourhood of public bus stops were removed from the database. Those were 156 acts in such categories as economic crimes, crimes against documents, against worker rights, against the justice system or against freedom, likely to be committed in offices, bureaus, enterprises or private

residences and not in public space. Therefore, the analyses of the distribution of crime were conducted on the basis of the collection of 739 punishable acts classified into six categories of crimes (Tab. 1). Kernel density estimation was used to identify places with highest risks of crime. The merit of this technique is that it makes it possible to work directly on address data and obtain clear, easily interpretable and quasi-continuous maps.

To assess the influence of crime predictors on the distribution of crime, the crime location quotient (LQC) was used (Sypion-Dutkowska, Leitner, 2017), modified on the basis of the PAI index (Chainey et al., 2008). Its formula is:

$$LQmC_i = \frac{NmC_i}{NmC} \frac{P}{P_i}$$

where: NmC_i – the number of events for m -type crimes within the buffer zone i from the public transport stop; NmC – the number of m -type crimes committed in the whole estate; P_i – the surface area of the i buffer zone from the public transport stop; P – estate area; l – four buffer zones: $i = 1-4$ (0–50; 51–100; 101–200; 200–300 m); M – total number of crimes, or the number of crimes in one of the six crime categories ($m = 1-6$).

The LQC quotients were calculated for the distance zones previously determined around the public transport stops, that is the multiple-ring buffers. The studies focused on the closest zone of influence of potentially dangerous places and locations, which is justified in light of the results obtained by other researchers (Sypion-Dutkowska, Leitner, 2017). Therefore, buffers were determined for four distance zones: up to 50, 50–100, 100–200, and 200–300 metres. The strength and direction of the influence of the location of public transport stops on the distribution of individual crime categories was determined with the use of the calculated LQC values. Value 1 signifies no influence or a balanced influence of a given place on the given category of crime. The higher the value, the stronger the relationship between the place and the crime category; values increasingly lower than 1 signify stronger and stronger crime-detering properties of the place.

To identify the stops with the highest risks of crimes occurring, the multiple-ring buffer layer (up to 200 m) was divided through Voronoi tessellations, constructed on the basis of all stops. The number of crimes and density of polygons created in this way

was calculated. Jenks optimisation method was used to determine that the highest crime density occurs in the neighbourhood of A and B stops, while the B, C, D, and E stops had the highest absolute number of punishable acts within 200 m (Fig. 1).

Studies on the influence of land use on the distribution of crime mainly use objects in topographic databases, without analysing or interpreting their local context. The advantage of such research is the inventory of the research area, during which the potential threat posed in the vicinity of public bus stops is identified in the local context. B. Czarnecki's method (2011), which directly corresponds to the solutions known from the British programme *Secured by Design*, was used to evaluate the safety risk. It is a fairly precise procedure, on the basis of which the evaluation of the threat posed by each transport stop was made; the evaluation occurred from the perspective of twenty various assessments, or safety aspects (the list of the researched safety aspects is presented in Fig. 2 later in the article). The evaluation was carried out on a scale of 1 to 5, where: 1 – means a certain lack of influence on safety; 2 – lack of influence; 3 – difficult to assess; 4 – potential influence; 5 – definitive influence. A more in-depth description of the evaluation of crime predictors that takes into account 20 safety conditions was presented in the article by S. Mordwa and P. Laskowska (2020).

Research was conducted in the Stare Bałuty estate (Łódź is divided into 56 SIM areas; SIM – Area of City Information System). The estate is located in the city centre, but north of the so-called historic urban core. Stare Bałuty is one of the areas in Łódź with the highest risk of crime (Mordwa, 2013). The criminal nature of the area and the stereotype shaped about it is clearly associated with its history.

Bałuty was incorporated into Łódź, which it bordered on the south, by the German authorities only in 1915. In 1884, it had 6.6 thousand inhabitants (it was still a village at this point), while in 1913, the number grew to 105 thousand. The result of such rapid development was a high demand for apartments. Therefore, any free plots of land were freely divided and developed; streets leading to the plots were created in a way that would suit the plot owners. The investments did not go hand in hand with the development of technical or social infrastructure. This exacerbated the spatial chaos, accompanied by low quality of buildings which fulfilled only the basic residential condition norms. The state was satisfactory only to the poorest. From the very beginning, a bad reputation hung over the Bałuty estate. It was believed that therein beat the heart of the Łódź crime (Badziak, 2017). Since Stare Bałuty was incorporated into Łódź, no spectacular city planning actions, social or spatial, were undertaken in

relation to the oldest development. In the 1960s and 1970s, block development was introduced north of the oldest, often sub-standard development of the area.

The current functional and spatial structure of Stare Bałuty (approx. 3.61 km²) has: southern historical multifunctional quarters (15% of surface area), multifunctional areas with no historical layout (30% of surface area; also in the south), north-eastern large residential complexes (43%, block development), service facilities in the centre (7%), and greeneries as well as single-family housing (Act No. LXIX/1753/18 of the Łódź City Council, 2018).

From the perspective of passenger flow, Stare Bałuty constitute both a transit area (with convenient transfer points) and a destination – not only for the residents, but also clients of various city institutions and, above all, the users of city-famous marketplaces: the Bałucki and Dolny markets. There are 53 public transport stops – for buses and streetcars – on the estate. This number includes 12 stops located directly by the estate border. In their case, the LQCs were

calculated on the basis of only those crimes committed within the estate (per the surface area of the specific buffer of the estate).

3. Result

3.1. The distribution of crime in Stare Bałuty

In 2016, the police recorded 739 acts committed potentially in association with the location of public transport stops. The majority were crimes against property (73%) or against the person (11%). Transport and communication-related crimes (approx. 6%), alcohol and drug-related crimes (4.5%), crimes against dignity and bodily integrity (4%), and sexual crimes (1.6%) were in a minority. 91% of all crimes were committed within 300 m of the transport stops on the estate.

On a crime density map (prepared with the *kernel density estimation* technique), three negative, clearly distinguishable areas with high values can be identified – all on the eastern side of the estate (Fig. 1). The

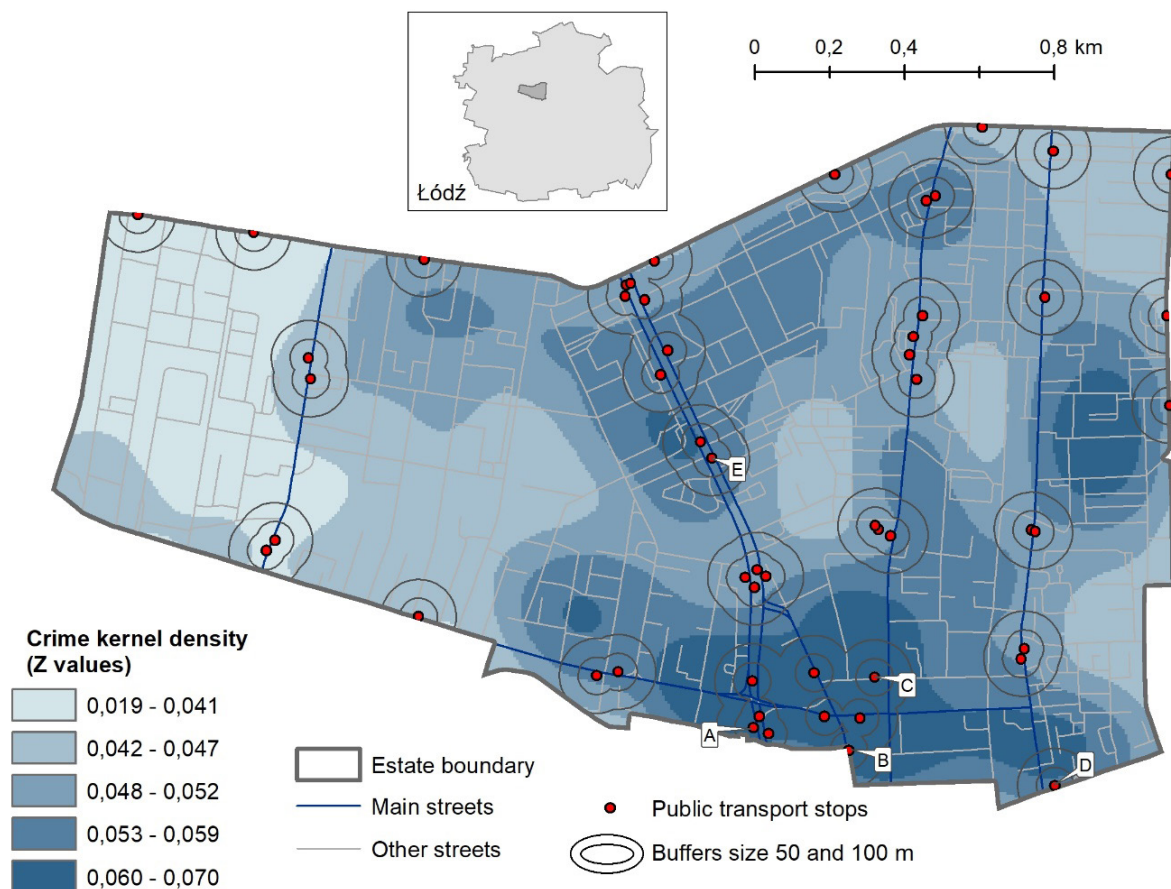


Fig. 1. Public transport stops and the density of crime in the Stare Bałuty estate in 2016.

Source: own elaboration based on the basis of KWP (Voivodeship Police Headquarters) in Łódź.

three areas are highly similar in terms of land use, with a dominant residential function supplemented by trade and services. In the southern area, residential buildings include mostly 19th-century tenements, among which are post-war four- and five-storey blocks. In the remaining two areas, residential blocks dominate (also those higher than eight storeys). Areas with the lowest crime density overlap with two forms of land use: greeneries or developed areas with industrial or storage functions.

Explicit statements cannot be issued on the basis of map of the areas with different levels of crime risks and the arrangement of public transport stops, since the stops (together with their potential influence zones) are located in areas with varying levels of crime risks.

3.2. The concentration of crime in Stare Bałuty – public transport stops as units attracting/deterring various types of crime

The LQC values, calculated for four distance zones, make it possible to determine the level and direction of the influence of the location of public transport stops on the distribution of individual categories of crime (Tab. 1). The values calculated for all types of crimes included in the study make it possible to claim that stops generally attract crime – the mean LQC values get lower as the distance to the zones increases. The closest vicinity of stops has up to 45%

more of punishable acts than the average of the entire investigated area (the two subsequent stop distance zones also have crime 'surpluses'). However, not all categories of crimes are attracted by stops as much as crimes against property, life and health or transport and communication-related crimes. In contrast to those crimes, higher LQC values for alcohol and drug-related crimes as well as sexual crimes were calculated for zones located further away from transport stops. Perhaps, in case of sexual crimes, from the perspective of an offender it can be easier to find a potential victim in the vicinity of a stop, but, due to its nature, it is inconvenient to commit the crime on the spot. That is why the victim is followed and attacked further away – this *modus operandi* would be concurrent with the stalker type characterised in the crime pattern theory (Brantingham, Brantingham, 1993). From the perspective of drug-related criminals, offering their 'products' in close vicinity of stops also does not seem like the best idea.

On the basis of the absolute values of the number of crimes within 50 m of public transport stops, the highest risk of crimes against property was assessed since thefts, burglaries as well as fraud and damage to property dominate in this zone. Moreover, road accidents (car crime) and negligent homicide (crime against the person) occur here often. In the zone of 50-100 m from transport stops, the most often occurring crimes are the same as in the zone closest to the stops: crimes against property (theft, burglary, fraud,

Tab. 1. The LQC values of crime categories by zones of distance from public transport stops in 2016.

Groups of crimes	Buffer zones (m)			
	0-50	50-100	100-200	200-300
Alcohol and drugs	1,17	1,33	1,33	0,40
Car	2,69	1,75	0,97	0,41
Against dignity and bodily integrity	1,66	1,01	1,50	0,28
Against property	1,34	1,21	1,12	0,64
Against the person	1,75	1,01	1,00	0,92
Sexual	0,00	1,04	1,63	0,73
The average value	1,45	1,30	1,12	0,62

Source: own elaboration based on the basis of KWP (Voivodeship Police Headquarters) in Łódź.

property damage) and crimes against the person (negligent homicide). Yet, here driving intoxicated (car crime), crimes against bodily integrity, and crimes falling under the act of counteracting drug addiction should also be feared.

In the next zone of 100-200 m from the stops, aside from crimes typical to the 50-100 m zone, appropriation (crime against property), sexual abuse of minors and rape (sexual crimes) as well as simple and light body injuries (crimes against the person) are also frequent. All the LQC indices calculated for the 200-300 m zone all have values lower than 1. Therefore, it can be assumed that the zone of the negative influence of public transport stops on the distribution of crime is approx. 200 m.

Five public transport stops in Stare Bałuty were identified as ones with the highest risk of crime. In Fig. 1 they are marked with letters A–E. The highest density of crime in the estate was observed at bus stop A (Zachodnia Street/Limanowskiego Street; stop number 1397). 16 crimes were committed in the zone of its potential influence. 14 of them were crimes against property (including 11 thefts). In the streetcar stop B zone (Zgierska Street/Bałucki market; 1429), 25 crimes were observed, including 15 against property (mostly thefts and burglaries) and 8 against the person (simple and light body injuries). The structure of crimes in the bus stop C zone (Bałucki market; 1869) is largely similar to that of stop B (also 25 crimes; including 17 against property and 5 against the person). The basic characteristic of bus stop D (Wojska Polskiego Street/

Franciszkańska Street; 1348) is the highest number of police records – 36. In 25 cases, those were crimes against property (12 thefts, 5 frauds, 4 burglaries), in 5 cases – against the person (3 negligent homicides), and in 4 cases – car crimes. There were 23 crimes committed in the zone of streetcar stop E (Zgierska Street/Adwokacka Street; 1433), including 19 against property (thefts and burglaries). In the whole estate, there were only four stops with no crimes registered within their zones of influence.

3.3. Changeability of crime over time in the zones of distance from the public transport

The number of crimes committed in Stare Bałuty shows little diversity within a year (the changeability index between months was 9%). Within a week, the growth tendency is observed from Monday to Friday, afterwards the numbers decrease until Sunday which is the safest day in this estate in Łódź. Yet the tendency is visibly diverse within a day (unfortunately, 15% of crimes recorded in police statistics do not have a time stamp). In 2016, in Stare Bałuty the safest times of day were the hours after midnight and mornings. Only 9% of crimes were committed in the first 8 of 24 hours; in the following 14 hours, as much as 86% of crimes were recorded. The time between 8 a.m. and 10 p.m. is the period of increased criminal activity, which is clearly related to the daily activities of the district residents.

Daily crime location quotients are presented in Tab. 2 (calculated for the number of all crimes

Tab. 2. LQC values for daily distribution of all crimes according to the zones of distance from the public transport stops in 2016.

4-hour time periods	Buffer zones (m)			
	0-50	50-100	100-200	200-300
02.00-05.59	1,29	1,46	1,30	0,29
06.00-09.59	0,84	2,05	1,00	0,36
10.00-13.59	1,33	1,42	1,20	0,54
14.00-17.59	1,65	1,06	1,04	0,74
18.00-21.59	1,28	1,28	1,09	0,69
22.00-01.59	1,72	1,67	0,98	0,44
average	1,38	1,38	1,10	0,59

Note: the calculations omitted 112 crimes with no time stamps.

Source: own elaboration based on the basis of KWP (Voivodeship Police Headquarters) in Łódź.

committed in 4-hour time periods, and not – like in Tab. 1 – for the number of crimes in a category). The high values are noticeable in two zones within 100 m of the researched public transport stops and one 100–200 m zone – but solely during night hours. Therefore, it has been observed that “excessive” crimes are committed in the vicinity of public transport stops at all times of day. Within 100 m of stops there is, on average, a 40% higher risk of crime at any time of day, taking into account all types of crime included in the study. Between 2 a.m. and 5.59 a.m. the zone of increased risk extends to 200 m.

Public transport stops considered here most at risk (A–E in Fig. 1), had a different daily distribution of crime. In the A and C zones, more than 60% of crimes were committed between 10 a.m. and 4 p.m., while in the B zone, the peak criminal activity was between 4 p.m. and 10 p.m. (with 44% of crimes committed). The longest danger period occurred in zones D (9 a.m. to 11.59 p.m.; 69% of crimes) and E (10 a.m. to 11 p.m.; 74% of crimes).

3.4. Assessment of safety conditions in vicinities of public transport stops

Each of the 53 public transport stops was assessed, in its local context, based on 20 safety aspects. Mean values are presented in Fig. 2. The majority of assessments indicated no risk to safety conditions (value 1 was absent, while value 2 amounted to 53% of all values). The percentage of value 4, indicating potentially negative influence of stops, was 23%, and 5 – only 4.5%. The mean of the value of all researched locations was 2.75, while all values fell into the 2.40–3.30 range in the B stop, earlier counted as one of the most threatened by crime (on the basis of the number and density of crimes). The remaining stops with highest risks of crime (with means from 20 values falling between 3.25 and 3.10) were among the 13 places with worst assessments.

Only several of the 20 analysed aspects of the fulfilment of safety conditions played a major role in the assessment of individual public transport stops (Fig. 2). Those were: *the sense of anonymity*, *territoriality* (or the absence of its signs in places that facilitate crime), *presence of third persons*, *attractiveness of place* (its vitality, diversity of functions, activity factors at different points of day), and *the presence of risk groups*. All stops with the highest risks of crime (marked A–E) obtained the assessment in the value of 4 in terms of

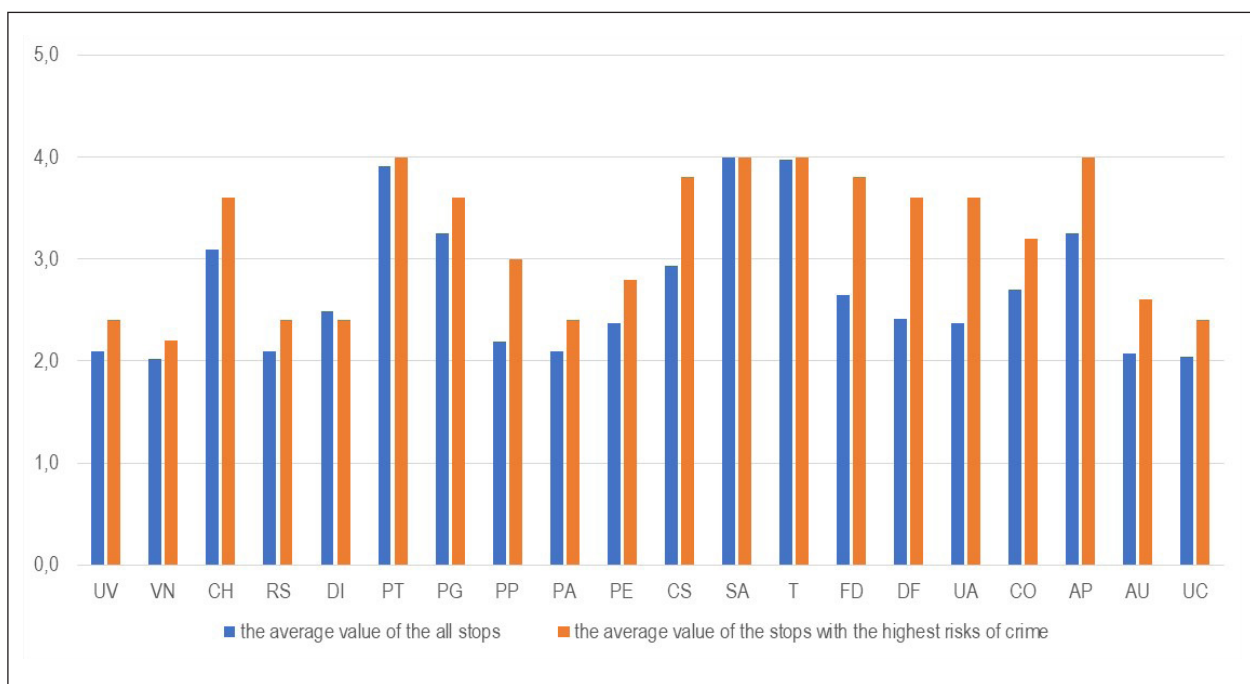


Fig. 2. Assessment of safety conditions in public transport stops.

Abbreviations: UV – user’s visibility; VN – visibility from the neighbourhood; CH – conditions for obtaining help; RS – possibility of route selection; DI – degree of isolation; PT – presence of third persons; PG – presence of risk groups; PP – proof of perpetrator’s presence; PA – perpetrators advantage; PE – possibility of escape or hiding; CS – conditions for supervision; SA – sense of anonymity; T – territoriality; FD – feeling of disorganisation; DF – durability of materials and function; UA – unlawful applications; CO – conditions for maintaining order; AP – attractiveness of place; AU – appropriate usage; UC – usage conflicts.

Source: own elaboration.

the enumerated aspects of safety conditions. Moreover, these five stops were negatively assessed also in the following aspects: *supervisory conditions* (social control, presence of “social eyes”); *feeling of disorganisation* (the consent effect); *durability of materials and function*, and susceptibility to *unlawful applications* (e.g. graffiti).

In the vicinity of stop A, four crime predictors that influence the criminogenic predispositions of the place were identified: two other public transport stops, a tree-covered natural wasteland, and a store that sells alcohol (the set of crime predictors was adopted after B. Czarnecki, 2011). The effects of the influence of these spatial factors include the following: transit movement, flow of people (including strangers), consent conditions: insufficiently maintained greeneries, disorganisation, litter, limited visibility and field of vision, no supervision, annoying function of the store, frequent presence of people from pathological environments.

In the vicinity of stop B, eight crime predictors were identified: two other public transport stops, a tree-covered square, a degraded area, a natural wasteland, unguarded garages, areas unfavourable to user presence, and a supermarket. There, the following effects of the influence of crime predictors were determined: transit movement, major flows of people (potential offenders or victims), limited visibility, limited conditions for supervision and sense of direction, conditions favourable to the consent effect and marginalisation, graffiti, parking outside designated parking spaces.

Seven crime predictors were identified in the vicinity of stop C: two other public transport stops, a city marketplace, a bar that sells alcohol, an abandoned building (in ruins), an unguarded car park, and a tree-covered natural wasteland. The criminogenic effects arising due to such neighbourhood include: transit movement, flow of people (including strangers), consent conditions: bad condition of greeneries, hindered sense of direction, presence of potential victims and offenders, no possibility of supervision or social control, possibility of surprising the victim, hindered conditions for asking for help, offender’s advantage and possibility of the offender escaping and hiding, litter, answering “the call of nature”.

Four crime predictors were identified in the vicinity of stop D: intra-estate space, hindering the sense of direction, tree-covered natural wasteland with informal footpaths, unguarded garages, and a degraded area. The criminogenic effects arising due to such neighbourhood include: no supervisory factors, anonymity, consent conditions, graffiti, unclear place status, hindered sense of direction, objects that hinder visibility, offender’s advantage, easier access

to sensitive areas (garages), transit point, presence of strangers, creation of isolated spaces.

In the vicinity of stop E, five crime predictors were identified: a degraded area, a supermarket, two unguarded garages, and inconsistent elements of intra-estate space structure. There, the following effects of the influence of crime predictors were determined: flow of people (including strangers), consent conditions: bad condition of greenery, litter, hindered sense of direction, presence of potential victims and offenders, no possibility of supervision or social control, objects that hinder visibility, offender’s advantage, easier access to sensitive areas (garages), possibility of surprising the victim, parking outside designated parking spaces, isolated areas, anonymity.

4. Discussion

The results presented in the article show that crime registered by the police has a tendency to concentrate around public transport stops and there are patterns to its distribution in time. Obviously, public transport stops are not isolated in urban space, but are a part of a complex system of various forms and functions of land use. Learning the relationships and patterns between the studied stops and the spatial properties of their surroundings improved our understanding of how crime is non-randomly distributed through city space. The observed correlation between the concentration of crime and the typical features of stops confirms earlier findings of numerous authors (Liggett et al., 2001; Newton, Bowers, 2007; Loukaitou-Sideris, 2012; Bowers, 2013; Sypion-Dutkowska, 2014; Phillips, Sandler, 2015; Hart, Miethe, 2015; Zahnow, Corcoran, 2019).

In general, public transport stops in the Stare Bałuty estate in Łódź are places with a higher than average risk of crime. Crime attracting properties of stops have been confirmed through the values of location quotients. It was proven that the zone at higher risk of crime has a radius of approx. 200 m. In similar analyses conducted in Szczecin, public transport stops were among the development functions at highest risk – out of 30 functions analysed, stops took the sixth place (after alcohol distribution points, clubs, cultural buildings, residential buildings as well as trade and service buildings). In Szczecin, stops attract crime to a degree even higher than in this study, although their influence zone was also 200 m (Sypion-Dutkowska, 2014). The structure of crimes attracted by Szczecin public transport stops was similar to the one observed in Stare Bałuty. They included muggings, drug-related crimes, trade-related crimes, thefts, burglaries and property damage (minor differences may stem from a different classification of

crimes adopted by the researcher). In the USA, underground stations in Philadelphia attracted muggings the most (McCord, Ratcliffe, 2009), while the vicinities of school bus stops attracted force-based crimes (Roman, 2005), which partially overlaps with the Polish studies.

Opportunities to commit crimes may appear in various places within the city space. According to the research presented, public transport stops turned out to be especially capable of attracting offenders. On the basis of the case of Stare Bałuty in Łódź, a certain pattern of concentration of criminal activities around stops was shown. It has been observed that, according to Zipf's law (in criminology known as *crime distance decay*; Hammond, Youngs, 2011), the highest number of criminal acts occurs in the closest vicinity of public transport stops. Until the 200-metre mark, the number of crimes slowly decreases, and, later on decreases rapidly. Unfortunately, the studies conducted in Łódź did not determine whether the analysed stops attract crime as crime attractors or crime generators – this matter may be resolved through further studies. For instance, K. Bowers (2013), initially determined that thefts are attracted by various functions of the built environment (including stops) and, moreover, that the analysed objects act as crime generators. Despite that, this article expands the Polish literature on the subject of crime distribution within districts by analysing the until now insufficiently described influence of public transport stops. The research conducted in Łódź identifies the range of the increased crime zone as only within 200 m of such stops.

In recent years, the interest in studying the interactions between the built environment and crime rates has visibly risen (Felson, Boivin, 2015). With the evolution of urban spaces, adapted to meet the new challenges (climate change, technological progress, population increase, changes in needs and social aspirations, etc.), there exists a real need to understand how to plan and develop cities and specific places that would facilitate social interactions, simultaneously limiting the possibility of the emergence of any signs of social disorder (including crime). Transport stops are one of the key elements of the urban environment; their design can facilitate or hinder crime or other violations. The works of A. Loukaitou-Sideris (1999) and R. Liggett (with a team, 2001) studied the relationship between criminal activities in the neighbourhood of bus stops and environmental crime predictors. It was observed that high crime rates in bus stops correlate with a high number of negative environmental factors within 300 ft (slightly more than 90 m) of the stop. These factors included objects such as off-licence stores, bars, undeveloped plots, vacant buildings, and adult bookstores/movie theatres. The authors

concluded that the most important crime factor at bus stops is their location in the local, spatially-conditioned context. Furthermore, studies conducted in Brisbane, Australia, indicated that if there are other stops, car parks, stores, bars, schools or undeveloped areas within 400 m of the transport stops, their neighbourhood will have a criminal influence (Zahnow, Corcoran, 2019). The analysis of the closest neighbourhoods of the stops in Stare Bałuty with the highest risk of crime confirmed the existence of the same environmental crime predictors (with few exceptions). Therefore, it can be assumed that the presence of specific environmental factors (or the built environment functions) in a certain local context can help predict crime rates in this location.

There are specific patterns to the changes in crime threat levels at specific times of day and week. Criminals are most active during workdays and at rush hours (when people are on the move in accordance with their daily routines; Levine et al., 1986). Two conclusions can be drawn on the daily changeability in crime intensity near public transport stops. Firstly, public transport stops attracting crime. At any time of day, there is a higher risk of crime within 200 m of all stops than in the entire estate studied. Secondly, the analysis of specific stops, which took into account their local environmental conditions, has shown a temporal changeability of crime intensity in their neighbourhood. In this case, the generalisation of individual temporal properties of individual stops leads to an important, although seemingly contradictory, conclusion: crime at public transport stops is dependent on time, but depending on the method of the built environment – in some places the activeness of offenders occurs during rush hours, while in others it intensifies outside of them. Other studies have shown that outside of rush hours it is the other physical aspects of the environment that play a more important role in predicting the number of crimes at stops (Zahnow, Corcoran, 2019). This can be explained not only by issues related to land use and its functions. Studies conducted in Los Angeles have shown that eight out of ten bus stops with the highest crime rates had no proper street lighting (Loukaitou-Sideris, 1999).

Another interesting issue was investigated in Washington, DC, related to the analysis of crime at transport stops in relation to time. The study has shown spatial and temporal side effects of temporary exclusion of certain train stations or whole train lines from use. In such cases, crime rates visibly dropped when a stop was closed. Moreover, the risk of crime decreased even at neighbouring, still-functioning stations (Phillips, Sandler, 2015). In this context, it should be emphasised that studies on crime and transport should also take into account the cases in which the scope and working

time of the transport system change. Furthermore, to better understand crime at stops of various means of transport, it should be tested whether the temporary increases in the number of passengers using city transport provide additional criminal opportunities (more potential victims) or hinder crime (more social eyes, potential watchmen). This is a complex issue, related also to the category of acts analysed. On the one hand, a greater number of people waiting at bus stops in Brisbane was positively related to a higher risk of thefts, since it provided more real targets (opportunities to commit a crime) and greater possibilities. On the other hand, the relation between property damage and the number of passengers was not proven (Zahnow, Corcoran, 2019). The analysis of the influence of the increase in passenger number on crime rates in a "major city in Eastern Canada" has shown that criminal activity diminishes when the number of passengers reaches a high level. Therefore, there is a possibility of the existence of a curvilinear relationship between the size of the flow of people and crime (Felson, Boivin, 2015).

Conclusion

The results of the presented research have a number of limitations. One of them was, for instance, the selection of a single Łódź estate as a research area. The intention was to conduct detailed studies encompassing the local context of environmental crime predictors in vicinities of public transport stops and, further on, to assess the threat from the perspective of 20 safety aspects. The labour intensity of the research permitted the surface area selected. Therefore, it is likely that the results and conclusions drawn may not be adapted to other urban contexts, other large cities or even Łódź itself. Moreover, the analyses presented did not encompass all co-variables of urban structure and were limited to relatively short periods (the data was collected from one year only). These issues are possible to be eliminated, although in larger-scale studies. Problems that may be hard to overcome include the quality of data received from the police, since cases are recorded by address. Since public transport stops do not have an address, they are registered by the address of the nearest object. Therefore, until the police begin to fully utilise GPS coordinates, all similar studies will still have a margin of error due to only approximate locations of crimes.

The results of the research presented contribute to the understanding of the patterns of crime distribution in cities in three ways: a) the spatial concentration of crimes can be explained by the location of public transport stops; b) studies on crimes in cities should analyse the distance between the environmental crime

predictors and public transport stops; c) the location of stops in relation to the neighbouring spatial crime predictors is related to the arrangement of the hot spots of crime.

The article provides ample contribution to further discussions. Firstly, if there is a connection between public transport stops and the emergence of hot spots of crime, their location should be a major factor in determining police patrol routes (see: Kooi, 2015; Ariel, Partridge, 2017); other factors to be taken into consideration include the arrangement of other spatial factors (e.g. the functions of the built environment, abandoned buildings, degraded areas, lighting and many others), and the socio-demographic conditions of surroundings (e.g. age, gender, education, income), or the distribution of other signs of social pathologies (e.g. alcoholism, prostitution, youth gangs and risk groups, unemployment). Studying the relationships between the hot spots of crime and the locations of stops may be valuable both from a theoretic standpoint and in order to practically shape the policies of crime prevention (McCord, Ratcliffe, 2009). It has been proven that public transport stops influence their surroundings by, to some extent, transferring the danger created outside (to the streets and areas with different applications). Therefore, it seems that the integration of the studies on crime associated with public transport stops with the works mentioning the implications of the threat levels created by various functions of the built environment found in their vicinity may expand the current knowledge on the theoretical, conceptual and empirical levels.

The spatio-temporal patterns of the distribution of crime hot spots and public transport stops presented here can be used to measure distance from police stations, in order to optimise the assignment of police resources on the scale of the whole city. Since crimes are more likely to be committed at a distance from police stations (which have crime-detering properties; Sypion-Dutkowska, 2014), the reaction period to police arrival is likely to be longer. For this reason, numerous victims of, for example, crimes against property, decide not to file police reports (Mordwa, 2012; Guedes et al., 2014). On the basis of the spatial and temporal crime patterns centred around public transport stops and revealed in the article, the following can be suggested: 1) the purposefulness of police resource management that would be incident-oriented; 2) routine patrol activities in the vicinity of public transport stops, since they can help decrease the level of crime risk and increase the inhabitants' sense of safety.

Thirdly, actions regarding the rational placement of CCTV devices, mostly due to the crime-attracting influence of public transport stops that attracts crime.

The rate of common crimes (especially ones against property) in the zones located further away from police stations could be balanced out by an effective CCTV system. In some Polish cities (including Łódź), studies determining the usefulness of installing industrial cameras to improve public safety were conducted (Waszkiewicz, 2012; Matczak et al., 2021). Although it was expected that the CCTV cameras would reduce crime rates by “expanding” the police supervision of critical locations, the results were not optimistic. Analyses show that the influence of CCTV cameras installed in Polish cities on the level of crime was noticeable, although ambiguous and determined by the category of crime. Since the conclusion was that CCTV’s influence on the decrease of crime rates in Poland is doubtful, it is even more necessary to take action on the academic and practical levels, in order to distribute and use this system of crime prevention and reduction in a more effective way.

Studying the crime hot spots in relation to the distribution of public transport stops may be highly useful for the public order and safety, since it can facilitate the creation of specific strategies that would prevent and repel crime: identifying the range of police stations and district beats, the planning of patrol actions (on foot, on horseback or motorised), the arrangement of CCTV devices as well as matters of shaping safe spaces (CPTED strategies). In conclusion, the assessment of the level of criminal threat in the neighbourhood of public transport stops should consider their spatial influence or the complex influence of environmental predictors located in their vicinity. In particular, when it is applicable to the effective strategies of crime prevention aimed at a specific goal.

References

- Andresen M., Brantingham P. J., Kinney B., 2009, *Classics in environmental criminology*, Taylor & Francis, Boca Raton.
- Andresen M. A., Malleson N., 2013, Crime seasonality and its variations across space, *Applied Geography*, 43, 25-35.
- Ariel B., Partridge H., 2017, Predictable Policing: Measuring the Crime Control Benefits of Hotspots Policing at Bus Stops, *Journal of Quantitative Criminology*, 33, 809-833.
- Badziak K., 2017, Historyczne Bałuty do wybuchu I wojny światowej, [in:] M. J. Szymański, D. Staniszevska, T. Kochelski (eds.), *Bałuty – legenda i rzeczywistość*, Muzeum Miasta Łodzi, Łódź, 7-50.
- Bowers K., 2013, Risky facilities: crime radiators or crime absorbers? A comparison of internal and external levels of theft, *Journal of Quantitative Criminology*, 30(3), 389-414.
- Brantingham P. J., Brantingham P. L., 1993, Environment, routine and situation: Toward a pattern theory of crime, *Advances in Criminological Theory*, 5, 259-294.
- Ceccato V., 2009, Crime in a city in transition: the case of Tallinn, Estonia, *Urban Studies*, 46(8), 1611-1638.
- Ceccato V., Haining R., Signoretta P., 2002, Exploring crime statistics in Stockholm using spatial analysis tools, *Annals of the Association of American Geographers*, 92(1), 29-51.
- Ceccato V., Uittenbogaard A. C., 2014, Space-time dynamics of crime in transport nodes, *Annals of the Association of American Geographers*, 104, 131-150.
- Chainey S., Thompson L., Uhlig S., 2008, The utility of hot-spot mapping for predicting spatial patterns, *Security Journal*, 21(1-2), 2-28.
- Church A., Frost M., Sullivan K., 2000, Transport and social exclusion in London, *Transport Policy*, 7(3), 195-205.
- Colquhoun I., 2004, *Design Out Crime: Creating safe and sustainable communities*, Architectural Press, Burlington.
- Czarnecki B., 2011, *Przestrzenne aspekty przestępczości. Metoda identyfikacji czynników zagrożeń w przestrzeni miejskiej*, Oficyna Wydawnicza Politechniki Białostockiej, Białystok.
- Felson M., Boivin R., 2015, Daily crime flows within a city, *Crime Science*, 4(31), 1-10.
- Gerell M., 2018, Bus stops and violence, are risky places really risky?, *European Journal on Criminal Policy and Research*, 24, 351-371.
- Guedes R., Furtado V., Pequeno T., 2014, Multiagent models for police resource allocation and dispatch, *2014 IEEE Joint Intelligence and Security Informatics Conference*, IEEE Publishing, 288-291.
- Hammond L., Youngs, D., 2011, Decay functions and criminal spatial processes: Geographical offender profiling of volume crime, *Journal of Investigative Psychology and Offender Profiling*, 8(1), 90-102.
- Hart T. C., Miethe T. D., 2015, Public bus stops and the meso environment: understanding the situational context of street robberies, [in:] V. Ceccato, A. Newton (eds.), *Safety and Security in Transit Environments: An Interdisciplinary Approach*, Palgrave Macmillan, London, 196-212.
- Ingalls G. L., Hartgen D. T., Owens T. W., 1994, Public fear of crime and its role in bus transit use, *Transportation Research Record*, 1433, 201-211.
- Inlow A. R., 2021, A comprehensive review of quantitative research on crime, the built environment, land use, and physical geography, *Sociology Compass*, 15(7), 1-18.
- Irvin-Erickson Y., La Vigne N., 2015, A spatio-temporal analysis of crime at Washington, D.C. metro rail: Stations’ crime-generating and crime-attracting characteristics as transportation nodes and places, *Crime Science*, 4(14), 1-13.
- Iseki H., Taylor B. D., 2009, Not all transfers are created equal: towards a framework relating transfer connectivity to travel behaviour, *Transport Reviews*, 29(6), 777-800.
- Kooi B., 2015, Security Concerns at Hot-Spot Bus Stop Locations, *Journal of Applied Security Research*, 10(3), 277-307.
- Levine N., Wachs M., Shirazi E., 1986, Crime at bus stops: a study of environmental factors, *Journal of Architectural and Planning Research*, 3, 339-361.

- Liggett R., Loukaitou-Sideris A., Iseki H., 2001, The bus stop – environment connection: Do characteristics of the built environment correlate with bus stop crime?, *Transportation Research Record*, 1760, 20-27.
- Loukaitou-Sideris A., 1999, Hot spots of bus stop crime: The importance of environmental attributes, *Journal of the American Planning Association*, 65(4), 395-411.
- Loukaitou-Sideris A., 2012, Safe on the Move: The Importance of the Built Environment, [in:] V. Ceccato (red.), *The Urban Fabric of Crime and Fear*, Springer, Dordrecht, 85-110.
- Loukaitou-Sideris A., Liggett R., Iseki H., 2002, The geography of transit crime: Documentation and evaluation of crime incidence on and around green line stations in Los Angeles, *Journal of Planning Education and Research*, 22(2), 135-151.
- Loukaitou-Sideris A., Liggett R., Iseki H., Thurlow W., 2001, Measuring the effects of built environment on bus stop crime, *Environment and Planning B*, 28(2), 255-280.
- Malleson N., Andresen M. A., 2015, The impact of using social media data in crime rate calculations: shifting hot spots and changing spatial patterns, *Cartography and Geographic Information Science*, 42(2), 112-121.
- Matczak P., Wójtowicz A., Dąbrowski A., Leitner M., Syption-Dutkowska N., 2021, Effectiveness of CCTV systems as a crime preventive tool: evidence from eight Polish cities, *International Journal of Comparative and Applied Criminal Justice*, 45, 1-20, DOI: 10.1080/01924036.2021.1976237.
- McCord E. S., Ratcliffe J.H., 2009, Intensity value analysis and the criminogenic effects of land use features on local crime problems, *Crime Patterns and Analysis*, 2(1), 17-30.
- Mordwa S., 2012, Ciemna liczba przestępstw. Przykład badań wiktyimizacyjnych mieszkańców wybranych obszarów w Łodzi, *Space–Society–Economy*, 11, 145-155.
- Mordwa S., 2013, *Przestępczość i poczucie bezpieczeństwa w przestrzeni miasta. Przykład Łodzi*, Wydawnictwo Uniwersytetu Łódzkiego, Łódź.
- Mordwa S., 2016, The geography of crime in Poland and its interrelationship with other fields of study, *Geographia Polonica*, 89(2), 187-202, DOI: 10.7163/GPol.0053.
- Mordwa S., Laskowska P., 2020, Czynniki zagrożeń przestępczością w przestrzeni miasta, *Archiwum Kryminologii*, XLII(2), 67-98, DOI: 10.7420/AK2020R.
- Newton A., 2008, A study of bus route crime risk in urban areas: the changing environs of a bus journey, *Built Environment*, 34(1), 88-103.
- Newton A., Bowers K., 2007, The geography of bus shelter damage: The influence of crime, neighbourhood characteristics and land-use, *Internet Journal of Criminology*, 20, 1-20.
- Phillips D. C., Sandler D., 2015, Does public transit spread crime? Evidence from temporary rail station closures, *Regional Science and Urban Economics*, 52(C), 13-26.
- Ratcliffe J. H., 2004, Geocoding crime and a first estimate of a minimum acceptable hit rate, *International Journal of Geographical Information Science*, 18(1), 61-72.
- Roman C. G., 2005, Routine activities of youth and neighborhood violence: Spatial modeling of place, time, and crime, [in:] F. Wang (ed.), *Geographic information systems and crime analysis*, Idea Group Publishing, Hershey, London, 293-310.
- Sherman L. W., Gartin P. R., Buerger M. E., 1989, Hot spots of predatory crime: Routine activities and the criminology of place, *Criminology*, 27(1), 27-56.
- Smith M. J., Clarke R. V., 2000, Crime and public transport, *Crime and Justice*, 27, 169-233.
- Stucky T. D., Smith S. L., 2017, Exploring the conditional effects of bus stops on crime, *Security Journal*, 30, 290-309.
- Sullivan D., Caminha C., Melo H. P. M., Furtado V., 2017, Towards Understanding the Impact of Crime on the Choice of Route by a Bus Passenger, *Progress in Artificial Intelligence*, 10423, 1-41.
- Sypion-Dutkowska N., 2014, Uwarunkowania przestrzenne przestępczości w wielkim mieście w ujęciu GIS (na przykładzie Szczecina), *Studia KPZK PAN*, 159, 2-122.
- Sypion-Dutkowska N., Leitner M., 2017, Land Use Influencing the Spatial Distribution of Urban Crime: A Case Study of Szczecin, Poland, *ISPRS International Journal of Geo-Information*, 6 (3), 1-74.
- Valentine G., 1990, Women's fear and the design of public space, *Built Environment*, 16(4), 288-303.
- Wagers M., Sousa W., Kelling G., 2017, Broken Windows, [in:] R. Wortley, M. Townsey (eds.), *Environmental Criminology and Crime Analysis*, Routledge, London, 334-350.
- Waszkiewicz P., 2012, Monitoring wizyjny miejsc publicznych w dużym mieście na przykładzie Warszawy. Próba analizy kosztów i zysków, *Archiwum Kryminologii*, 34, 253-274.
- Zahnw R., Corcoran J., 2019, Crime and bus stops: An examination using transit smart card and crime data, *Environment and Planning B: Urban Analytics and City Science*, 48(4), 706-723.

Internet sites

- Beccaria – Programm: Qualität durch Kompetenz, <https://www.beccaria.de> [access: 16.08.2022].
- Secured by Design (SBD), <https://www.securedbydesign.com> [access: 16.08.2022].
- Veilig wonen in Nederland met het Politiekeurmerk, <https://www.politiekeurmerk.nl> [access: 16.08.2022].



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