

The influence of railways on spatial layouts of settlements in North-Eastern Poland

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ABSTRACT

The aim of the study was to analyse the transformation of spatial structures of towns in North-Eastern Poland, characterized by different origins and happening due to the construction of railway line. The region in question was in the past subject to different settlement processes taking place against the background of historical events such as, among others, the conquest of land by the Teutonic Knights and the political partition of Poland (the border between Prussia and Russia), thereby forming diverse urban systems, later influenced by the railway, which modified their spatial structures, as well as changed their existing importance in the region. As a result of aforementioned changes different forms of urban layouts were formed – line layouts within the historic towns and more complicated layouts within the new railway settlements. The entire analytical procedure was based mainly on archival cartographic materials and divided into three parts: conditions of settlements development, analyze the evolution of its spatial layouts and the typology of researched urban layouts. The chronological summary of the parts allowed for the comparison of the spatial structure of a given town and for its interpretation. In addition, field research necessary for the interpretation of the contemporary structures of chosen towns was carried out. The final result was a synthesis of research in the form of a typology of links between the original structure and the railway station, distinguishing between the different forms of settlements.

KEY WORDS: archival cartographic materials, railway settlements, railway station, urban space, street pattern

1. Introduction

Transformations of spatial structures of settlement units occur due to conditions that change in time and are period-specific. The aim of the study was to analyse the spatial structures of towns in North Eastern Poland, characterized by different origins, which have evolved under the influence of the railway line. The scope of the spatial analysis involved selected towns, among which several forms of settlements were distinguished, including: formal villages – *łowo-Osada (Illowo)*, *Prostki (Prostken)*, railway settlements – later towns *Korsze (Korschen)*, *Łapy*, location towns: *podlaskie – Grajewo* and towns of Teutonic genesis – *Działdowo (Soldau)*, *Ełk (Lyck)*. We have chosen locations that clearly show diversified types of spatial layouts resulting from the impact of railway transport. As a result of diverse settlement processes, a variety of different urban layout were formed and their spatial structures have been transformed by the construction of the

railway, which has also changed the rank of towns in the region. A station's location, therefore, became the impetus for the development of a village or town, and the impact on spatial arrangement could have taken two directions – radial or zone-oriented. In addition, the railway was a causative factor, both for the emergence of new urban space, as well as entire towns (MUMFORD, 1966; RODRIGUE ET AL., 2006; KRZYSZTOFIK ET AL., 2014).

In the subject literature, there are many theoretical models of urban space, but relatively few of them are devoted to forms created by the railway (MISZEWSKA & SZMYTKIE, 2006). A railway line, along with its accompanying system of streets, constitute elements of the spatial structure of a town with a different course, along which the development and arrangement of buildings progress (LYNCH, 2001). Attention to this phenomenon was attracted by KRZYSZTOFIK (2007) who, using the example of Polish town – Sosnowiec, made a detailed analysis demonstrating that the location of a train station influenced the development of a

triangular layout of the city. In contrast, WEJCHERT (1984) stated that any plan for a new town has elements crystallizing its structure, e.g. the main streets connecting the old city with development areas. Such a situation is present in the case of the location of cities of the Katowice conurbation (Southern Poland), in which linear systems connecting the old town with the railway station formed (KANTOR-PIETRAGA ET AL., 2011; DRAGAN, 2013). In addition, the same position of the railway station in relation to the city - tangentially or centrally affects the further development of the urban system (CZARNECKI, 1965; BRUISMAN ET AL., 2008). CZARNECKI (1970) distinguishes several systems of railway junctions, which diversely affect the town. These are junctions with one station in small and medium-sized towns, situated along the river or lake shore, or diametrical, cross, triangle, ring and mixed lines.

The analytical procedure is primarily based on chronologically summarized archival cartographic materials. Field research necessary for the interpretation of the relationship between the elements of the spatial structure was also carried out. And the final result was an attempt to design a model depiction of newly established urban structures, developing along transportation systems.

2. Formation of the settlement network in North-Eastern Poland

The study covered the area of the Podlaskie and Warmia-Masuria Voivodeships. In the past, these areas had different statehood history, which influenced the diverse nature of the settlement network of the two voivodeships. The historical background in the case of settlement processes of the study area played an important role due to the fact that specific historical events influenced the economic situation and the spatial layout of towns. These impacts were both destructive (the Teutonic-Lithuanian war, the "Swedish Deluge") and positive (the taking over of part of the area by the Teutonic Knights, the establishment of the Prussian-Russian border).

Initially, the study area was very little urbanized. The first settlements and urban centres were created in the first place on lands under the jurisdiction of the Teutonic Order. In the subject literature, there are three development stages of the Teutonic Knights settlement (from the fourteenth to the eighteenth century), which proceeded with the growth of the area subordinate to the Order from the north-west to south-east (KONDRACKI, 1972; KRZYSZTOFIK, 2000). The settlement policy of the Teutonic Order (i.e. a town and villages

located around it) led to the formation of an even distribution of town networks (KRZYSZTOFIK, 2000). Medieval Teutonic location towns, especially at the outset, had a market square and rectangular street pattern with compact development and a dominant feature of a church or a castle (KONDRACKI, 1972).

The settlement system in Podlasie was developed differently. Towns were created as a result of civic rights granted to settlements, and the major element of their structure was the location of the market, which was the case in Łomża, Augustów, Bielsk Podlaski, Grajewo. Towns were established in various ways - either by former castles, or pursuant to private locations, or entirely "from scratch" (MAROSZEK, 2010). In addition, urban settlements in Podlasie were quite unevenly spread and generally consisted of numerous small towns, which frequently had specific suburbs composed of surrounding villages (WYROBISZ, 1981; KRZYSZTOFIK, 2000).

Undoubtedly, an urbogenic factor in the case of Warmia, Masuria and Podlasie was the division by state borders between the State of the Teutonic Knights, the Polish Kingdom and the Grand Duchy of Lithuania. Then, on the border between the monastic lands, fortified cities emerged that would provide defence against raids. On the other hand, spatial layouts of cities of the north-east, due to their particular geographical and political conditions, were subject to constant internal modifications, especially cyclic renovation and reconstruction. This was related to, among others, numerous wars led by the Teutonic Order with the Grand Duchy of Lithuania and the Polish Kingdom, and also with the "Swedish Deluge" and local fires. All of these events led to changes in the urban and spatial system of the studied region.

In the sixteenth century there was the collapse of the Teutonic Order and the area came under the sovereignty of Prussia, from the eighteenth century - Eastern Prussia. Podlasie, on the other hand, has always been a borderland, where different directions of settlement and economy intermingled (WYROBISZ, 1981). In the nineteenth century, this region was divided between the Polish Kingdom and the Russian Empire, which - along with the development of railways - contributed to the urbanization of contemporary North-Eastern Poland. The first line of the north-east was the Main Warsaw-St. Petersburg railway (1862), which served as rapid transit from the Russian capital, St. Petersburg, to the western parts of the empire and the centre of the Polish Kingdom, as well as further to the west. A unique role in the economic life was played by the Brest - Grajewo line, built in 1873, which allowed for direct traffic from Odessa, through Kyiv, Białystok and Grajewo (frontier) to

Prussian Ełk (*Lyck*) and Kaliningrad (*Königsberg*) (DOBROŃSKI, 1979; TAYLOR, 2007; DOBROŃSKI, 2010). At the time, the railway, next to the frontier location, was the main urbogenic factor of Warmia-Masuria and Podlasie, and the lines and rail connections virtually reached all the cities of the Warmia and Masuria region. In the area of railway station suburbs with industrial and storage development emerged. The nineteenth century was also the beginning of development of railway settlements, although they did not acquire their municipal rights until the twentieth century (KRZYSZTOFIK, 2000).

3. Analysis of spatial systems of selected towns of North-Eastern Poland

The previously described evolutionary process of the settlement of the area revealed the diversity of urban systems in the towns of contemporary Warmia-Masuria and Podlasie Voivodeships. Moreover, with the development of the railway network, completely new spatial and functional structures emerged, or the existing ones were modified. In the towns of the feudal genesis, new urban systems developed that connected old towns with railway stations. On the other hand, completely new administrative units were formed, i.e. railway settlements, for which the railway was a key urbogenic factor. In order to present the various forms of new spatial layout, several towns of different genesis were selected within which these forms were most visible in their town structures.

The first example is the location of the town of Grajewo (1540). It was located on the border of the Duchy of Prussia and developed mainly due to its location at the crossroads of trade routes from Podlasie to Prussia and from Mazovia to Lithuania. The centre of the system was a rectangular town square, where the church was located and two streets developed with dozens of wooden houses. As a result of the "Swedish Deluge", Grajewo was almost completely deserted, while the competitive town of Szczuczyn developed (DOBROŃSKI, 2014).

A marked acceleration of the development of the town occurred with the creation of the railway station in the town's north-eastern outskirts at the time (Fig. 1A). The first and only line running through the town was the Brest - Grajewo line (1873), allowing for the transit of goods from Odessa through Brest to Ełk (*Lyck*) and further to Kaliningrad (*Königsberg*). The border location was also of great importance because the station was the last in the Russian Empire (the Polish Kingdom) with a representative building of the frontier station. The whole complex of the station

had ramps, warehouses, a number of stabling tracks, water towers, etc. As a result of the expansion of the railway infrastructure, also the urban development of the city occurred, and especially, with reference to the brick development along the railway line (Fig. 1B-C) as well as the creation of suburban areas, such as Wilczewo or Wiktorowo (DOBROŃSKI, 2014). In addition, the Holy Trinity brick church (1879) in the market square, a synagogue and an orthodox church were erected, as well as barracks for the Border Guards. Trade and industry developed dynamically (a glass-works, a conveyor belt factory, a distillery). Grajewo was a settlement, which, in the years 1867-1909, experienced the fastest population growth in the province of Łomża - 186% (DOBROŃSKI, 1979).

Towns of Teutonic origin have a very different genesis and spatial layout. This type of settlements includes Działdowo (*Soldau*), whose origins are associated with the construction of a castle, around which, a crafts settlement was established. The location of the town occurred in 1344 and then Działdowo (*Soldau*) was a fortified town on the Teutonic - Mazovian border. The castle protected the town from the south, but at the same time, it was a distinct part of the urban area (KORYCKA, 1966). The examined town underwent continuous damages as a result of Teutonic and Lithuanian, Teutonic and Polish, or Swedish wars, and as a result of fires plaguing the town in the eighteenth century. These events led to the transformation of architecture and urban layout, including a complete change of the market development and the extension of the square. With the development of the railway network, Działdowo (*Soldau*) gained the possibility of further, and much faster, urban and economic development. The first railway line constructed was the Malbork (*Mariaeburgum*) - Mława line (1878), initially used for freight, which connected Prussia Gdańsk (*Danzig*) with the Polish Kingdom (Warsaw). Another line in the direction of Brodnica (*Strasburg in Westpreußen*) was opened in 1887, and then in 1888 towards Olsztyn (*Allenstein*), which, in turn, provided the connection with Kaliningrad (*Königsberg*). The main task of these lines was to export products from the region, especially agricultural goods (KORYCKA, 1966). In the nineteenth and twentieth centuries, due to the location of the train station to the north-west of the existing town, a whole new part of the town evolved (Fig. 2A). The railway station, because of its distant location, had to be connected with the location town, which happened due to *Bahnhofstraße* (in the present day Jagiełły Street), along which new development progressed (Fig. 2B). The original

building of the train station was erected in 1878, together with accompanying buildings. At the beginning of the twentieth century, an engine house, a water tower, as well as hostels for railway workers and buildings for station masters were established ([www.tmzd.whshost.com/...](http://www.tmzd.whshost.com/) access 01.10.2015).

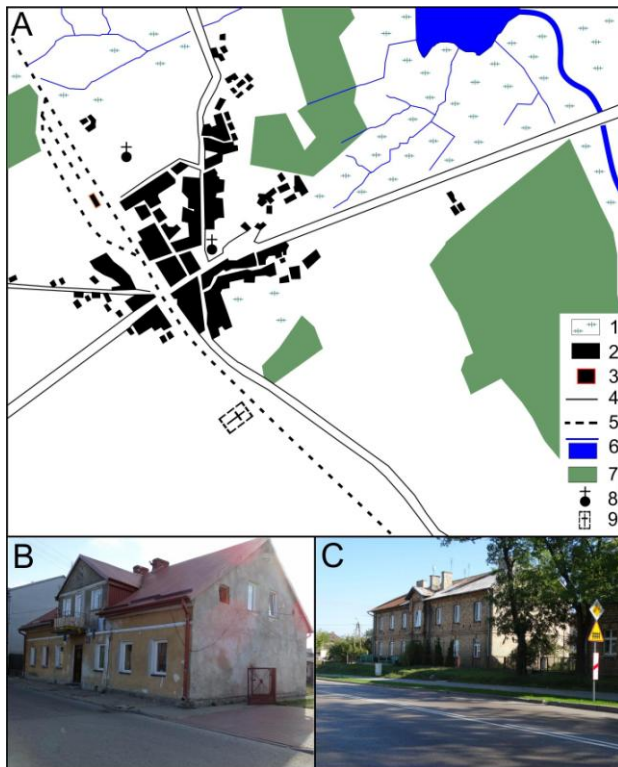


Fig. 1. Spatial layout of Grajewo in the beginning of the 20th century (A) and buildings alongside the railway line (B-C) (Source: author's own study based on Новая Топографическая Карта..., 1916 (A); photo by author (B-C)

- 1 - wetlands, 2 - buildings, 3 - railway station, 4 - streets,
- 5 - railway line, 6 - rivers and lakes, 7 - forest area, 8 - church,
- 9 - cemetery

Another Teutonic town, but with a slightly different spatial arrangement is Ełk (*Lyck*). Practically, from the very beginning, the urban layout of the town was greatly determined by natural conditions. The Teutonic castle was situated on an island on the Ełk Lake, on the site of the former castle. On the eastern side of the lake, a fishing village developed that gained municipal rights in 1425. The town was located on the upland and developed on the basis of streets running parallel to the shoreline of the lake. The town development underwent systematic exchange due to frequent fires, and therefore contemporary Ełk (*Lyck*) is characterized by relatively new construction dating from the late nineteenth and early twentieth centuries (KOWECKI & ROMAN, 1970) and the post war period.

The economic and urban revival of the examined town was only brought about through

In addition, on the west side of the railway line a housing estate for railway workers was established (Fig. 2C). Currently, the urban layout created as a result of the railway established in Działdowo (*Soldau*) in the nineteenth century is still visible in the spatial structure of the town.

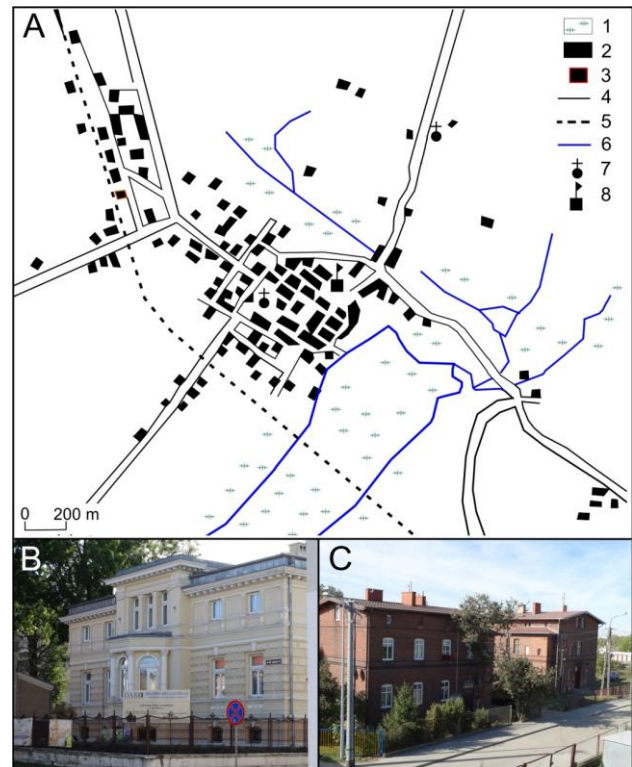


Fig. 2. Spatial layout of Działdowo (*Soldau*) in the 1930s (A), villa in the present day Jagiełły Street (formerly *Bahnhofstraße*) (B) and housing estate for railway employees (C) (Source: author's own study based on Topographische Karte..., 1938c (A); photo by author (B-C)

- 1 - wetlands, 2 - buildings, 3 - railway station, 4 - streets,
- 5 - railway line, 6 - rivers, 7 - church, 8 - castle

the creation of the railway line. Then, Ełk (*Lyck*) became an important frontier railway junction since the lines here converged from as many as five directions (LEKSYKON MIAST POLSKICH, 1998). In 1868, the Korsze (*Korschen*) - Kaliningrad (*Königsberg*) line was opened, and in the 1970s - to Białystok through Grajewo, and towards Gołdap (*Goldap*). Another railway line built in 1885 led to Olsztyn (*Allenstein*) through Szczytno (*Ortelsburg*), and the complement of the junction was the line in the direction of Czerwonka through Orzysz (*Arysz*), but it was open quite late (1915). The railway station, according to the Prussian practice, was located outside the town on its eastern outskirts (Fig. 3A). Between the original town and the railway station the new centre of Ełk (*Lyck*) developed, with buildings from the nineteenth and early twentieth centuries. The main street of the new town became the current Armii Krajowej Street

(former *Bahnhofstraße*), which, in a straight line, connected the railway station with the former Protestant church (now Catholic). Representative tenement houses were erected along it (Fig. 3B), as well as a post office (Fig. 3C) and a gym. Furthermore, within the so-called new centre, the town hall (1912), the building of the music school and baptist church were also built. The development of railways was accompanied by the dynamic development of industry.

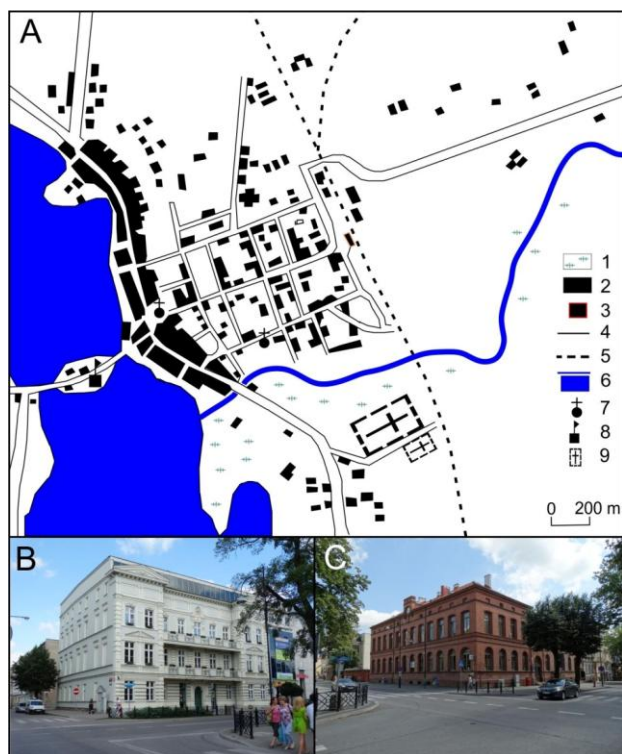


Fig. 3. Spatial layout of Ełk (*Lyck*) in the 1930s (A), tenement house in the present day Armii Krajowej Street (formerly *Bahnhofstraße*) (B) and post office (C)
(Source: author's own study based on Topographische Karte..., 1937 (A); photo by author (B-C)
1 – wetlands, 2 – buildings, 3 – railway station, 4 – streets, 5 – railway line, 6 – rivers and lakes, 7 – church, 8 – castle, 9 – cemetery

Together, with the development of railways in the nineteenth century, new forms of settlement developed in North-Eastern Poland, i.e. railway villages. One of these is Łapy, whose genesis was related to the creation of the Warsaw – St. Petersburg railway line. The station was established in the then backwater Łapy – Barwiki in 1862 and at the same time on the border of the Russian Empire and Polish Kingdom (MIASTA W TYSIĄCLECIU, 1967). In the same year, repair workshops for locomotives and carriages were established, and the development of building proceeded within other Łapy backwaters (Bociany, Leśniki, Goździki) (Fig. 4A). In 1893, Łapy - Barwiki became a railway junction due to the creation of a railway

line from Łapy, through Ostrołęka to Małkinia in the so-called Narew Railway (Kolej Nadnarwiańska) (SZUMSKI, 1997). Since the construction of the railway station, systematic urban and economic development of the railway village Łapy – Barwiki proceeded, but its transformation into the settlement of Łapy took place only in 1903. The new residential and service development, mainly wooden and multi-family, was built in the immediate vicinity of the railway station (Fig. 4B). The main focal point of the created settlement was a presentable railway station, which, in addition to the zone intended for travellers, also had housing and service premises, i.e. a post office, a pharmacy, a barber shop and a restaurant. The size of the building resulted from the rank of the station which, due to its border location, was one of the most important along the Warsaw - Petersburg railway line (SOBIESZCZAK, 2013). The studied settlement received municipal rights only in 1925. And a primary factor in the development of Łapy and the principal workplace of the local population still remained the railways and the Railway Repair Plant. In the inter-war period, there also appeared new railway employees buildings, including Łapy – Osse and “Wygwizdowo” (Fig. 4C).

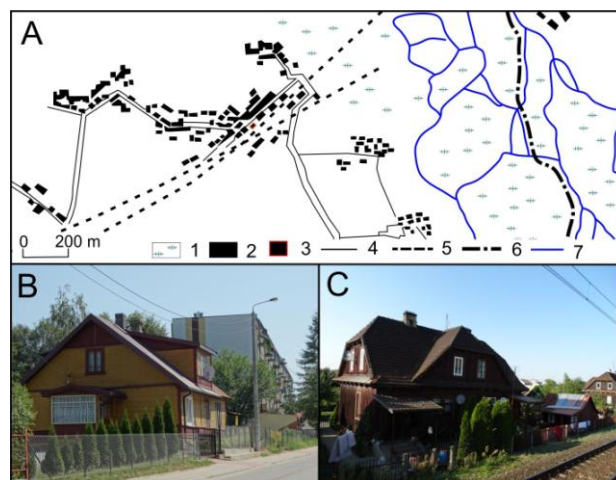


Fig. 4. Spatial layout of Łapy in the beginning of the 20th century (A), buildings from the 19th century (B) and buildings the Wigwizdowo colony (C)
(Source: author's own study based on Новая Топографическая Карта..., 1912 (A); photo by author (B-C)
1 – wetlands, 2 – buildings, 3 – railway station, 4 – streets, 5 – railway line, 6 – boundary, 7 – river

On the other hand, in the area of East Prussia, practically in its geometric centre, a railway junction station was established in a grange called Korsze (*Korschen*). The line from Kaliningrad (*Königsberg*) (1867) to Ełk (*Lyck*) (1868) was run through the settlement, together with a second line connecting Korsze (*Korschen*) with Černâhovsk (*Insterburg*) and in the opposite direction with Olsztyn

(Allenstein) (1971), Toruń (*Thorn*) (1874) and continuing through to Berlin. In this way, a railway junction was formed, and parallel to it, the road junction, additionally stimulating the development of the settlement (SIKORSKI, 2012, access: 01.10.2015). Development proceeded on the southern side of the railway line, along the parallel street as well as in the immediate vicinity of the railway crossing on the northern side of the junction station (Fig. 5A). Next to the buildings necessary for the operation of the station (a tower, an engine house, warehouses), housing for railway employees was built (Fig. 5B-C). The railway infrastructure was a dominant feature in the spatial structure of Korsze (*Korschen*), and the existence of two separate stations (separate stations for private and public railways) evidenced the rank of the junction (SIKORSKI, 2012, access: 01.10.2015).

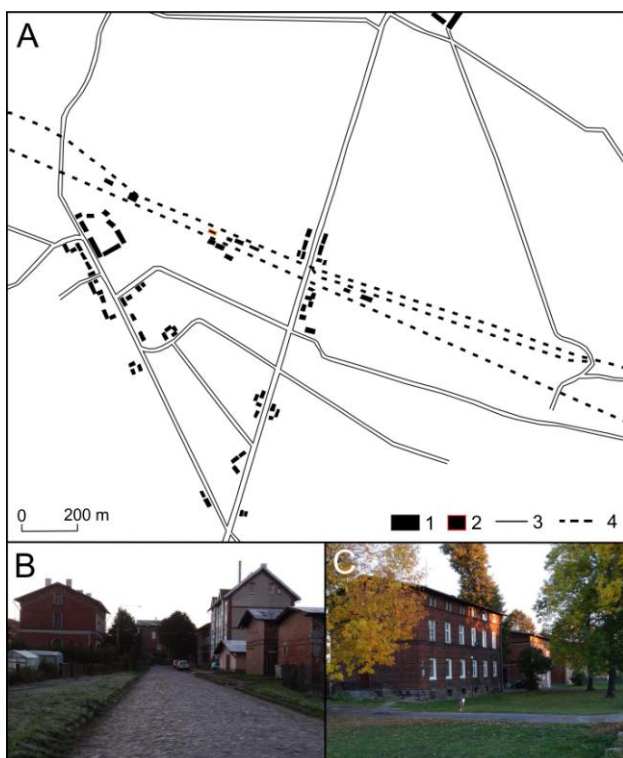


Fig. 5. Spatial layout of Korsze (*Korschen*) in the 19th century (A), buildings for railway employees (B-C).
(Source: author's own study based on *Agronomische Bohnrungen 1897* (A); photo by author (B-C))
1 - buildings, 2 - railway station, 3 - streets, 4 - railway line

At the beginning of the twentieth century, the residential development, services and industrial buildings still proceeded. There was a post office, hotels, a station restaurant, a slaughterhouse, and Protestant and Catholic churches. Korsze (*Korschen*) was already an important settlement in the region, a commuting centre for the residents of the surrounding area. The development in the north of the railway station, along the street

perpendicular to the main axis of the road took place later, in connection with the acquisition of new land for development in this part of the settlement (TOPOGRAPHISCHE KARTE..., 1936c). Further housing development happened in the inter-war period and Korsze (*Korschen*) was given its town status only after the Second World War - in 1962 (LEKSYKON MIAST POLSKICH, 1998).

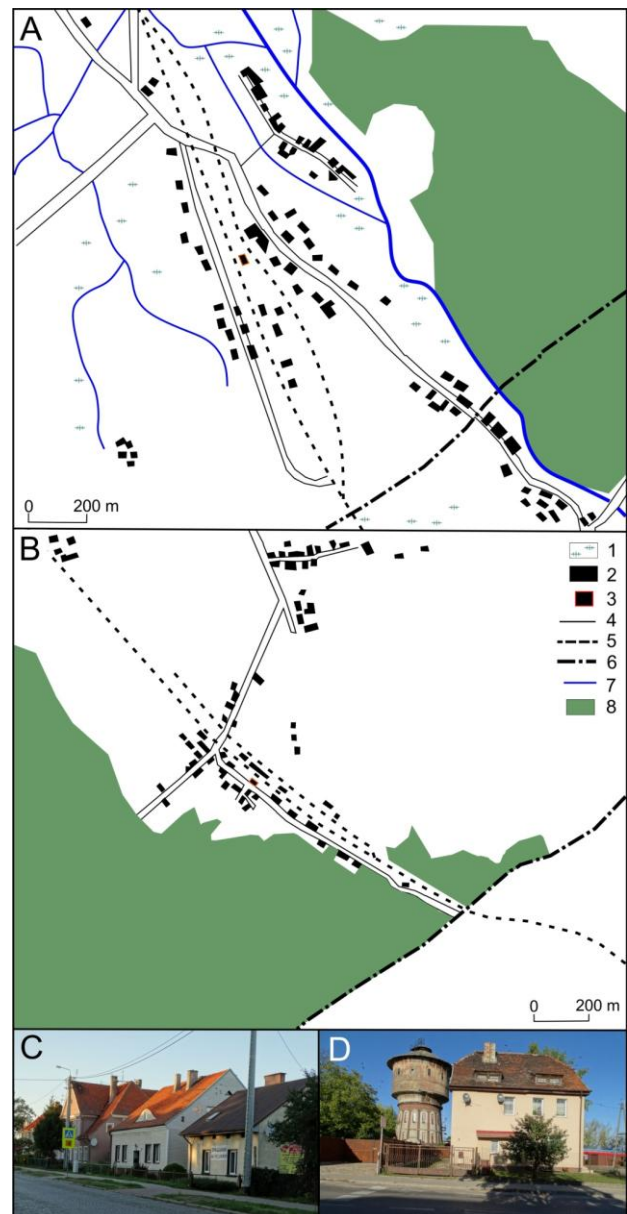


Fig. 6. Spatial layout of Prostki (*Prostken*) in the 1940s (A) and Howo-Osada (*Illowo*) in the 1930s (B), residential buildings of Prostki (*Prostken*) (C) and Howo-Osada (*Illowo*) (D)
(Source: author's own study based on *Topographische Karte...*, 1944 (A) *Topographische Karte...* 1938b (B); photo by author (C-D))
1 - wetlands, 2 - buildings, 3 - railway station, 4 - streets, 5 - railway line, 6 - boundary, 7 - river, 8 - forest area

The last type of towns of the genesis associated with the railway are settlements, which to this day have no civic rights, and formally are villages

– Prostki (*Prostken*) oraz Iłowo-Osada (*Iłowo*). Prostki (*Prostken*) is located on the line from Ełk (*Lyck*) (via Grajewo and Brześć) to Odessa, and Iłowo-Osada (*Iłowo*) was a transshipment border station for the Malbork (*Marienburg*) – Mława Railway (1877), which connected with the broad gauge Narew Railway (Kolej Nadnarwiańska). The development of villages occurred as a result of the location of the border station between East Prussia and the Polish Kingdom (Russian Empire). The coincidence of two factors provided a range of new possibilities for the urban and economic development of both examined villages (Fig. 6A-D). They constituted border trans-shipment stations between broad and standard gauge railway, thanks to which trade and freight shipping developed. Marine Associations also had their buildings there, recruiting immigrants going abroad, especially to America. This resulted in the dynamic development of housing and services (post offices, chambers of the customs offices, schools, churches). In addition, both Prostki (*Prostken*) and Iłowo-Osada (*Iłowo*) had a disproportionately large number of railway station complexes for the size of towns (Fig. 6 A), which were divided into two parts: the Prussian (standard gauge railways) and Russian (broad gauge railways). Within the stations, there were numerous warehouses with reloading ramps, engine houses, pressure towers and train station buildings. The area of the station, together with the complex of railway development in both examined cases, was greater than the residential and service areas. The location of the stations was moreover urbogenic, as the originally small villages took on the characteristics of small towns.

4. Typology of the post-railway urban layout

The towns characterized above may be divided into two groups: feudal towns and the settlements formed in the nineteenth century. The origins of towns are so important that the railway, as an urbogenic factor, led to the creation of entirely new spaces, which either became the new core of the existing town, or were the “core” of new towns.

In the first case, new urban districts emerged. This resulted from the tradition (above all Prussian) of locating the railway station on the outskirts of urban areas, due to the need to devote significant space to the construction of the station, as well as due to ensuring fire safety in the – often wooden at the time – buildings of the town. This area became a magnet for shippers, rail-road workers, merchants, restaurant and hotel owners (MISZEWSKA & SZMYTKIE, 2006). Then, a need arose to connect the railway station (and the adjoining new part of

town) with the market (the older part of the town), which often led to the formation of linear systems. The axis of such systems was the street connecting the old and the new space, which became the most representative part of the town with commercial functions and characterized by architecturally impressive development (KANTOR-PIETRAGA ET AL., 2011). Towns that were characterized by a functional and spatial stagnation, thanks to the railway, were given a chance for their dynamic development. Działdowo (*Soldau*) was one of the centres with a typically linear system. In this case, the station was located west of the location town and the castle of the Teutonic Knights. Then, a new “railway station” space emerged, which was then directly connected with the market by the *Bahnhofstraße* (in the present day Armii Krajowej Street), designed in the second half of the nineteenth century (<http://tmzd.whshost.com/index.php?poz=2>, access: 1.10.2015) (Fig. 7A). Along its course, representative buildings were located, i.e. magnificent tenement houses and villas from the nineteenth century, as well as new services (including a synagogue, a school, a court house, hotels, printing workshops, and restaurants). The newly created structure took over a large part of major services, becoming a new functional centre of town. The linear system developed similarly in Ełk (*Lyck*), but street character of the development along the banks of the river and the lake was devoid of the market. In this case, the *Bahnhofstraße* (in the present day Armii Krajowej Street) originated at the station square, located on the eastern outskirts of the original town, and ran towards the square by the church towards the bridge leading to the monastic castle. This street connects the castle and the location town with the railway station practically in a straight line because after eliminating the differences of level, the railway station buildings could be seen from the square in front of the church (Fig. 7B). Also in this case, the street became a major representative axis of the new centre, where a number of architecturally valuable buildings and villas were located. In addition, along its course, new service functions were established – a post office, a Protestant church, and a sports hall. The spatial arrangement of Grajewo developed in a slightly different way, where a new representative space developed on the streets running parallel to the railway line (Fig. 7C). However, also in this case, the new service centre was located in the vicinity of the railway station. The combination of the location system with the new urban space and the further development of Grajewo resulted from the short streets perpendicular to the north and south to the main axis along the tracks.

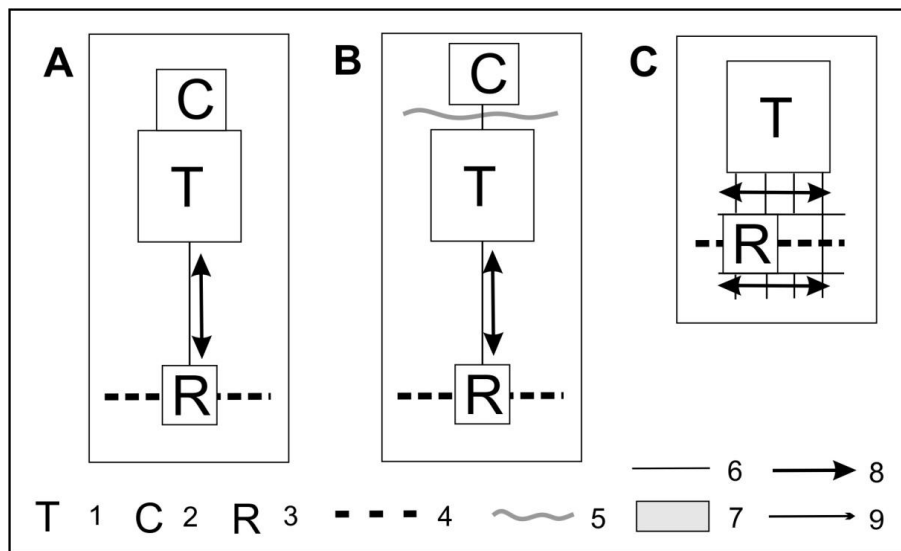


Fig. 7. Urban layout model of location towns and direction of their development: A – Działdowo (*Soldau*), B – Ełk (*Lyck*), C – Grajewo (Source: author's own study)
 1 – location town, 2 – Teutonic castle, 3 – railway station with its buildings, 4 – railway line, 5 – lakeshore, 6 – street layout, 7 – built-up area, urban development intensity: 8 – strong, 9 – weak

In the area of the current Warmia-Masuria and Podlaskie Voivodeships, as a result of the construction of railway lines, many linear systems have developed, which are more or less visible in the contemporary urban structure. In the case of location towns of Podlasie, the station's area was connected with the old town through the main street. Such a situation occurred in the case of Bielsk Podlaski (*НОВАЯ ТОПОГРАФИЧЕСКАЯ КАРТА...*, 1915b) and Białystok (*НОВАЯ ТОПОГРАФИЧЕСКАЯ КАРТА...*, 1915a), where the street ran from the train station in the direction of the market, but not always in a straight line. It was similar in the case of location towns of the Teutonic Knights, where the old location towns around the castle had a connection with the railway station, remote by even a few kilometres. The model system is observed in Nidzica (*Neidenburg*), where the street coming out of the south-west corner of the market square leads directly to the station (*ТОПОГРАФИЧЕСКАЯ КАРТА...*, 1934). The same is the case of Olecko (*Oletzko*), where the street leading to the station starts its course from one corner of the market square, but it does not lead to the station square, but the station itself in an exact straight line (*ТОПОГРАФИЧЕСКАЯ КАРТА...*, 1940). This is also the case in Biała Piska (*Bialla*) and Pisz (*Johannisburg*) (*ТОПОГРАФИЧЕСКАЯ КАРТА...*, 1927; 1938a). Olsztynek (*Hohenstein*) also has a quite clear linear system, despite the fact that the street in question does not come out of station square and does not end up on the market (*ТОПОГРАФИЧЕСКАЯ КАРТА...*, 1933). The existence of several streets coming out of the station and extending towards the old town is characteristic to Bartoszyce (*Bartenstein*) and Giżycko (*Lötzen*)

(*ТОПОГРАФИЧЕСКАЯ КАРТА...*, 1926, 1936a). A slightly different course of the connecting street is in Kętrzyn (*Rastenburg*), because its course is parallel to the railway line starting at the station and connecting to the old town in the area of the castle of the Teutonic Knights (*ТОПОГРАФИЧЕСКАЯ КАРТА...*, 1936c).

In the second of the examined cases the urban process was marked by similar origins, in the form of the location of the railway station in the weakly urbanized area, but the difference was the final result. The train station became the new core and also the centre of the new form of settlement, i.e. the railway station village. Undoubtedly, the newly created urban structures, developing around the station, took on forms similar to the radial ones. In the immediate vicinity of the station, the most important economic activities and residential areas for railway workers were located. In all cases of shaping the railway settlements, the development proceeded along main streets. The result of each transportation solutions was the development of different forms of urban quasi-concentric systems, i.e. derivatives of circle. In all four cases of railway settlements, the railway station was located in the centre of the place and determined the functional and spatial development of the whole village. New development concentrated around the train station and streets in its immediate vicinity. These axes determined the direction of expansion of spatial development, which in consequence, led to the formation of various urban systems. Łapy adopted the form most similar to the concentric one (Fig. 8A), where the railway line cut through two Łapy backwaters, leading to urban development in their area. It proceeded to the north

and south of the station, however, it took on a different intensity: in the immediate vicinity of the railway, the development occurred much faster along the main street (in the present day Kolejowa Street) and short streets leading from it, than in the southern part of the settlement with the more irregular transportation system (Fig. 8A). And in Prussian Korsze (*Korschen*), the whole spatial structure of the settlement developed in a more complicated way. In this case, urban expansion was determined by the established system of roads. The main street crosses the railway line from the north-east to the south-west, and in its southern parts smaller streets connect to it. The entire cross system created by the roads and a railway line divided the settlement into four parts, of which development took place only in two zones, which is noticeable even at present (Fig. 8B). The urban layout took the form of a bow of which the south-western part grew much faster, and the north-eastern slower. This was related to private property not purchased until the beginning of the twentieth century, when a new housing development happened in the settlement. The centre of Korsze (*Korschen*) was formed not in the immediate vicinity of the railway station, with its island position (between

the tracks), but in the region of a nearby railway crossing (Fig. 8B). Yet another model of urban development can be observed in Iłowo-Osada (Iłowo-Dworzec). In this case, a distinctive feature of the landscape was the border station for the broad and standard gauge railway. Most of the residential and commercial buildings were located on the south-western side of the railway line, and only some of them on the north-eastern, along the street running in the direction of the original village of Iłowo (Fig. 8C). The centre was also shaped by the train crossings and the development was located along the streets running perpendicular and parallel to the tracks. The urbanized area was developed nearby the forking streets, forming a semicircle. The village of Prostki (*Prostken*) developed quite differently from other settlements. The railway station here was located in the centre of the village, inside a triangle formed by two streets (Kolejowa and Główna) (Fig. 8D). The development of residential and service buildings progressed along the described transportation strings, which gave the former village the character of a small-town. In turn, the space between the two main streets developed strictly for railway purposes, housed a railway station, a post office and a customs hall (BAHNHOF PROSTKEN, 1883).

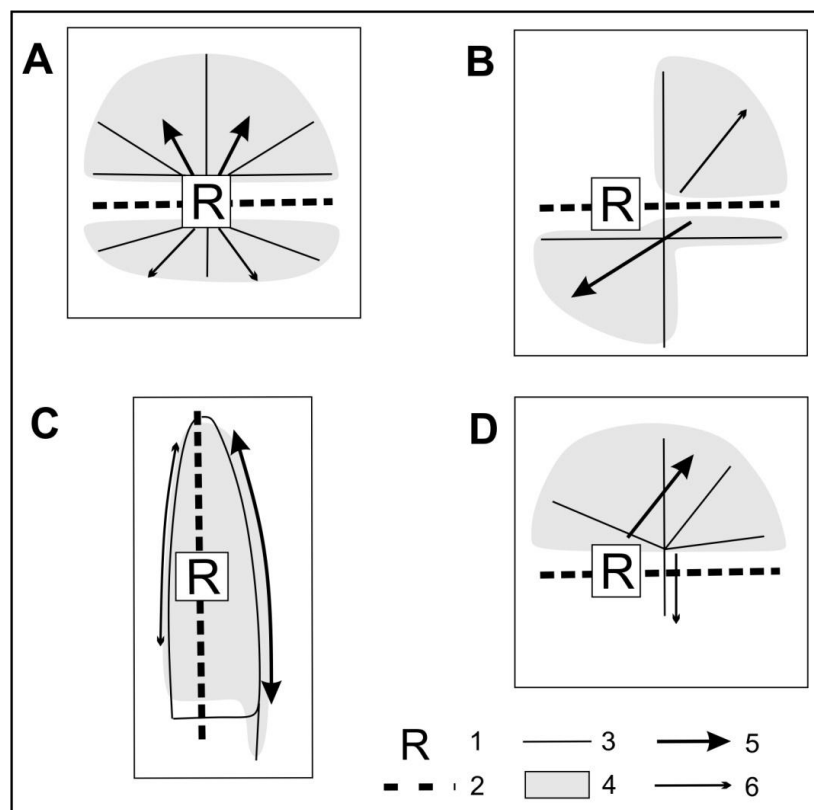


Fig. 8. Urban layout model of railway settlements and direction of their development: A – Łapy, B – Korsze (*Korschen*), C – Prostki (*Prostken*), D – Iłowo-Osada (*Iłowo*) (Source: author's own study)
 1 – railway station with its buildings, 2 – railway line, 3 – street layout, 4 – built-up area, urban development intensity: 5 – strong, 6 – weak

The discussed cases of railway settlement urban structure are not the only ones in the studied region. On the basis of archival topographical maps, it may be concluded that similar forms of concentric or semicircular zones of spatial impact formed around railway stations in other settlements. This group of towns includes the former village of Starosielce, now one of the districts of Białystok. It developed on both sides of the railway station, parallel to the Grajewo – Brest railway tracks (НОВАЯ ТОПОГРАФИЧЕСКАЯ КАРТА..., 1930). The settlement of Szepietowo (municipal rights since 2010) developed adversely, since its spatial expansion progressed from the Warsaw – Petersburg line in one direction, i.e. in the south-east (НОВАЯ ТОПОГРАФИЧЕСКАЯ КАРТА..., 1914; JACYNIEWICZ, 2000).

5. Conclusion

The final result of the research on spatial structures of towns and villages of North-Eastern Poland was an attempt to translate the interpretation of the actual urban system into its model approach. This allowed to form conclusions and to make some generalizations on the urban systems, which may be used in further research on other Polish settlement centres. The geographical approach gave the research a spatial and analytical dimension with regards to the interpretation of relations between different elements of the system. A detailed analysis of the transformations of spatial structures was based on cartographical archives, which made it possible to trace the trends of the spatial transportation system and development. On the other hand, fieldwork provided valuable information on the architectural form and sequence of spatial development in the settlements, as well as the contemporary relationships between different elements of the structure.

The towns of the Warmia-Masuria and Podlaskie Voivodeships had different origins and consequently various urban forms were formed there. These structures were modified in the nineteenth century as a result of building railway lines in the area of the examined towns. In the surroundings of the railway station, new town core developed, around which further functional and spatial development of settlements included in the study proceeded. There arose the need to connect the railway station with the old town, and this is how linear systems evolved. They are created on one axis connecting the railway station area with the location town - Ełk (*Lyck*), Olsztynek (*Hohenstein*), Kętrzyn (*Rastenburg*), or the market square - Działdowo (*Soldau*), Nidzica (*Neidenburg*), Białystok. These systems may also take on more complex

forms consisting of several smaller streets that run out of the railway line towards the town - Grajewo, Giżycko (*Lötzen*). Also in the case of railway settlements, the transportation axes have become a “backbone” for the expansion of the development. The development progressed along the streets that went from the train station in different directions, creating the radial form (Łapy, Starosielce). It could also take on the form of a circle segment, i.e. a form similar to a semicircle - Łowo-Osada (*Illowo*), Szepietowo, a triangle - Prostki (*Prostken*), or crossing in the area of the railway station, as is the case in Korsze (*Korschen*).

The emergence and development of railways have contributed to the economic and spatial development of many towns, but the biggest impetus was given to these centres, in which the synergy of two factors happened – the railway and the border, or transportation junction. Railway transport became clearly an urbogenic factor for the examined places since the location towns gained a “second life” and economic recovery, while small villages and settlements gained urban character, and in consequence, some of them were granted town status in the following years.

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