

Sheet LVIII: 90 years of the municipal surveying and cartographic service  
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A cartographic and descriptive presentation of surveying and cartographic achievements of the geodetic administration body and geodetic service provider within the city's area in a nearly centennial period must take into account two basic aspects, i.e. the changes to the administrative city boundaries over the 90 years, which entailed modifications to the operative area of the municipal surveying service, and social, economic and, last but not least, political conditions being the factors directly affecting organisational and managerial rearrangements of the geodetic administration and services. In effect of this approach to the subject, this Sheet LVIII titled "90 years of the Municipal Surveying and Cartographic Service" comprises three maps:

- "Major surveying and cartographic achievements: 1918–1945";
- "Major surveying and cartographic achievements: 1945–1989";
- "Major surveying and cartographic achievements: 1989–2008";

which jointly encompass the period of 90 years of the Municipal Surveying and Cartographic Service's work.

The authors, however, decided that it is by all means necessary for a separate map that would precede this presentation to show the "roots of municipal surveying in Łódź", an early and very important surveying product and the first comprehensive surveying and cartographic work, i.e. the first detailed situation map of the entire area of the Łódź city at that time – Starzyński's map. Therefore the first map presented on this Sheet LVIII is titled "Major surveying and cartographic achievements: before 1918".

To present such a complex issue in an atlas of thematic maps intended for use by the broad reading public, it is necessary to bring to attention some further circumstances that affect the content of each map:

- the surveying principle 'from the general to the particular' – i.e. the principal importance of surveying matrixes that constitute a physical reflection in the field of the surveying coordinates configuration, without which no efficient spatial information system can exist, and
- continuity and consistency of surveying activities and the relative sustainability of their physical effects, i.e. the possible consistent enrichment of the national surveying and cartographic resource base,
- increased socio-economic expectations concerning the spatial information made available by the surveying and cartographic service, i.e. changes in the range and quality of the spatial information resource base,
- repercussions of technological advancements, including modernized surveying equipment and field survey results interpretation methods, i.e. the necessity of modernizing surveying and cartographic studies that, apparently, does not demonstrate itself through increased amount of physical effects of such changes,
- quantitative and qualitative changes in the surveying and cartographic materials required to be made available under new laws and regulations concerning the methods of acquiring, storing, processing, and supplying spatial information for socio-economic purposes, i.e. the underlying philosophy of building the national land information system.

The foregoing factors indisputably determined the content range of the four maps presented on this Sheet LVIII. Omitting secondary details, the maps only highlight the selected and most significant accomplishments of the surveying service in Łódź.

The municipal surveying and cartographic service should be understood here as the surveying administration, surveying service providers, and surveying supervisory bodies that take part in building the surveying and cartographic resource base concerning the city area.

Map 1. Major surveying and cartographic achievements before 1918

The first detailed surveys of Łódź were made in 1812–1819 by Franciszek Johnney, sworn geometer of the Duchy of Warsaw, and the geometer from the National Resources and Forestry Directorate, Plebanowski. In 1820, Łódź boasted 8.3 km<sup>2</sup> in area, 106 houses, and 767 inhabitants.

In 1821, when Łódź was granted the factory settlement rights, its area was extended to 10.2 km<sup>2</sup> by incorporating the "Stara Wieś Manor Farm and Wójtostwo Łódzkie which belonged to the governmental economic district of Łaznów". The regulatory plans of the newly-incorporated areas were made in 1823 by surveyor Filip de Viebig.

In 1825, Łódź was enlarged to 22.1 km<sup>2</sup> by incorporating "the village of Wólka, Wójtostwo Zakrzew (probably Zarzew), and a part of the state-owned forest belonging to the Forest Administration Region of Łaznów". The survey of the newly-incorporated areas and the situation map were prepared in 1827 by land surveyor Jan Leśniewski.

In 1840, the city area of Łódź was further enlarged to 27.4 km<sup>2</sup> by incorporating over 500 hectares of forest area belonging to the "Forest Administration Regions of Łaznów and Pabianiec". The plans of the newly-incorporated area were prepared by Rozwadowski, commissioner of the administrative department in the guberniya government.

At the end of the 19th c., the population of Łódź was estimated at about 300,000. The area of the city within its administrative borders (marked on fragments of their course with boundary mounds) was still 27.4 km<sup>2</sup>. At that time, the first extensive cartographic study of this area was prepared with the first detailed situation map

„ПЛАНЪ ГОРОДА ЛОДЗИ ПЕТРОВСКОЙЪ ГУБЕРНИИ составленъ въ 1894, 1895 и 1896 годахъ землемеромъ 2го класса Владиславомъ Старжинскимъ” (fig. 1). On commission from the Łódź City Board (at that time there was no separate surveying department), the whole city was measured by Grade 2 sworn surveyor Władysław Starzyński. The survey was based on a horizontal surveying grid, not permanently stabilized, calculated in the local coordinates configuration in the Russian measurement system. Boundary mounds, street junctions, church towers, factory chimneys, and spires on domes were used as surveying reference points. Neither the surveying documents nor any technical reports or records of those works have remained until today. From the analysis of the available copies of this



Fig. 1. Fragment of sheet XIV of the 1897 map by Władysław Starzyński. The original at a scale 1:1 680 Source: National Archives in Łódź, dossier 1.

map it ensues that the surveying matrix was comprised of 193 "trigonometric" points, as they were named by the map's author. Out of this matrix, 7 reference points were taken into the city's later triangulation grids.

The result of the survey conducted 1894–1896 was presented by Starzyński on 54 section sheets at a scale of 1:1680. On the basis of additional measurements, taken in 1902–1904, Starzyński presented 523 hectares of the city's forest area on 20 further sheets of the same size.

Apart from the survey reference point locations and the description of their coordinates, Starzyński's map (fig. 2) contains the following: the city boundaries, land plot boundaries, boundary mounds, locations of brick, wooden, and iron buildings and structures with indicated housing buildings and churches, railways, roads, streets and squares, cemeteries, parks, gardens, orchards and lawns, arable fields, meadows and pastures, surface waters such as rivers, ponds, canals and ditches, wells, street lamps, electrical and telephone line poles, holes and excavations, thickets, single trees, and forests. The content of this situation map corresponds to the content of the current base map of the city. The locations of details were drawn in black ink, and the generic characteristics of surface details – in watercolour. The results of complementary surveys carried out between 1905–1906 within the previously surveyed areas were marked on the existing sheet in red ink. The accuracy of detail points' locations on the map in the central part of the city is estimated at about +/- 0.3 mm, which corresponds to +/- 0.5 m in the field. Regrettably, the map does not present any altimetric characteristics.



Fig. 2. Fragment of sheet XIV of the 1897 map by Władysław Starzyński. The original at a scale 1:1 680 Source: National Archives in Łódź, dossier 1.

An integral part of Władysław Starzyński's survey is a detailed measurement register including all land plots within the city area, save the City Treasury's forests, and their owners. The City Board received two original counterparts of that map and two register extracts. These maps and register extracts are now items of the Cartographic Collection, National Archive in Łódź.

The map "Major surveying and cartographic achievements before 1918" shows the horizontal surveying grid reference point locations and the range of all the survey sheets against the backdrop of the city limits at the time.

Map 2. Major surveying and cartographic achievements: 1918–1945

As a result of the 1906 incorporation, the area of Łódź largely increased. By incorporating "the village of Doly, Widzew, Dąbrówka, Dąbrówka Mała, Karolew, part of the village of Rokicie Stare, Rokicie Nowe, Brus and Zubardź", the area of Łódź was enlarged to 38.1 km<sup>2</sup>. Further incorporations (1915) of "the villages of Bałuty Nowe, Bałuty Stare, Bałuty-Colony, Widzew, Zarzew, Dąbrowa, part of the villages of Chojny, Rokicie Nowe, Rokicie Wójtostwo, Rokicie Stare, Zabieniec, Radogoszcz and Antoniew Stokowski" were the largest ever in the contemporary history of Łódź. At the time, the city area was enlarged to 58.8 km<sup>2</sup>. Only 47% of the city area within these new borders had been shown on the detailed map prepared by Władysław Starzyński.

Facing the tasks of introducing spatial order, building the municipal water supply and sewerage systems, and organising the land management, in January of 1918 the City Council passed a resolution on establishing the Municipal Surveying Division as part of the Construction Department, Łódź City Council. It was the first surveying authority in the city. On 1 July, 1918, Franciszek Walicki, a land surveyor from Vilnius, was appointed head of the division. The key responsibility of the Surveying Division was to provide the city administration with detailed documentation necessary for spatial planning and arranging projecting municipal investments. For this purpose, at the Municipal Surveying Division the Surveying Bureau was set up as an executive body. In line with the principle "from the general to the particular", it started out by designing and preparing the master surveying grid.

In 1918–1921, a local triangulation network was established in the form of a central system consisting of eight triangles with a union apex being the base of the cross on the tower of the church of the Elevation of the Holy Cross. The triangulation base, whose length, already provided in the metric system, determined the accuracy of the map projection, was set along Zagajnikowa St. (today Kopcińskiego St.). The grid was oriented parallel to the geographic meridian based on astronomical measurements conducted by Professor Tadeusz Banachiewicz from Krakow. The basic triangulation grid was enhanced with benchmarks on tall and well visible buildings or other structures. This first triangulation grid of Łódź from the years 1918–1921 comprised an overall of 31 reference points.

After the field triangulation was finished, commenced were the works to set up a polygonal grid, permanently stabilised and referenced to the triangulation grid. The polygonal grid, which provided the direct basis for measurements of situation details, consisted of approximately 2000 reference points.

The works to establish an accurate altimetric levelling grid began in 1919. The starting point was the benchmark placed on the foundations of the church of the Elevation of the Holy Cross. From this benchmark four levelling draws ran in four directions being connected to each other by external circumferential draws (on the city borders) and internal draws in densely urbanized areas. In this way 17 closed polygons were formed, which made it possible to accurately calculate the height of 30 nodal and intermediate benchmarks, and to easily connect new technical levelling benchmarks in the future. By the outbreak of World War II, 1467 benchmarks had been established and their heights measured. Almost at the same time when the polygonal grid was being developed, commenced were the measurements of situation details and the works to develop the situation map. Situation details were

measured applying the rectangular measurement method to the detail point from the measurement lines based on the polygonal grid points. Simultaneously, measured were the lengths of the front borders of land plots, as well as the dimensions of buildings and certain structures. The results of the field measurements were transferred onto drawing paper at an appropriate scale. In this way individual situation maps were made for each street quarter (so called "block"), with ground measurements included in the situation drawings. This rare cartographic illustration of the measurement results enabled fast copying of the map at the block scale, as well as drawing customised maps at various scales.

For the central parts of the city the blocks were made at a scale of 1:250, for areas with a smaller concentration of buildings – at a scale of 1:500, and for farming and forested areas – at a scale of 1:1000. The blocks were situation maps without the height characteristics of the area. Each block was coloured with watercolours in the colour convention referencing to the old map of Łódź developed by Starzyński. All these works were done by the Surveying Bureau. Other surveying works in the city were done by sworn surveyors' practices utilising the city surveying grid.

In 1932, on the initiative of the regional authorities a project was launched to link the triangulation grid of Łódź with those of the neighbouring towns into one local reference system called "the surveying base of the 'Small Region of Łódź – Mały Region Łódzki'". New measurements and calculations for the whole grid made by the practice of the sworn land surveyor Szymon Grygoczuk from Brześć-on-Bug, were completed in 1935. As a result, the shape of the triangulation grid and the scale of the coordinate system slightly changed. The new coordinate system assumed at the time, following some later alterations, is still in place today. The change in the shape of the city triangulation grid rendered it necessary to partially rearrange the referenced polygonal grid, as well as to re-calculate the coordinate points of that grid.

In the same year, launched were the works to establish a new and homogenous for the entire city situation and altimetry map. The map was sectioned, made at a scale of 1:1000, and drawn on 500 x 620 mm aluminium sheets. The sheets reflected the situation on the basis of the measurements included in the city blocks and supplementary measurements conducted specifically for this purpose (revision of old measurements). The altimetry characteristics of the area were presented by contour lines and pickets on the basis of tachometric measurements.

According to a handwritten note made by the head of the Surveying Division, Waclaw Bobrowski, the works completed at the time when the Surveying Bureau was taken over by the German occupational authorities in 1939 included the triangulation grid for the "Small Region of Łódź" consisting of 198 reference points, the polygonal grid with 2480 points, 1284 of which had coordinates in the new reference system, and the accurate levelling grid of Łódź consisting of 1467 benchmarks. The whole city area of 5875 hectares had undergone "essential detailed surveying", and supplementary measurements were taken on 1575 hectares. Moreover, tachometric measurements had been taken on 4820 hectares. On the new master map, 1180 hectares were charted at a scale of 1:1000. The note also mentioned preparations for establishing a detailed land register.

The range of the surveying work done during the German occupation has not been fully identified to date.

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Map 3. Major surveying and cartographic achievements: 1945–1989

Łódź's liberation from the German occupation on 19 January, 1945 was the beginning of huge changes in the city, including the surveying service. In December of 1945, the city boundaries were extended again by the formal incorporation of the city of Ruda Pabianicka, the boroughs of Chojny and Radogoszcz, and parts of seven other local boroughs. The area within the city's administrative borders nearly quadrupled to 214.4 km<sup>2</sup>.

Soon after the liberation, the City Board in Łódź reactivated the Surveying Division and its executive body – the Surveying Bureau. Their task was to continue the works initiated before the war on the now much larger area. However, the state's political system had changed radically, which resulted in considerable changes in the organization of the surveying service.

Already in 1945, the National Surveying Office (later re-named the National Surveying and Cartography Office) was established as the state administration body for coordination and supervision of all surveying works, also delivered by other departments, such as the Ministry of Agriculture and the Ministry of Municipal Economy. In 1947, established was the National Surveying and Cartographic Resource Centre, still in place. From then on, it was obligatory for all geodetic and cartographic materials maintained by sworn surveyors' practices to be transferred to local surveying repositories. Also, any intention to do surveying work had to be reported to the competent authorities, and the results of such works were also required to be transferred to the repository. This decision facilitated the process of preparing and producing the detailed map of the city. In the same year passed was a decree concerning land and building cadastre, the maintenance of which was vested in the local authorities.

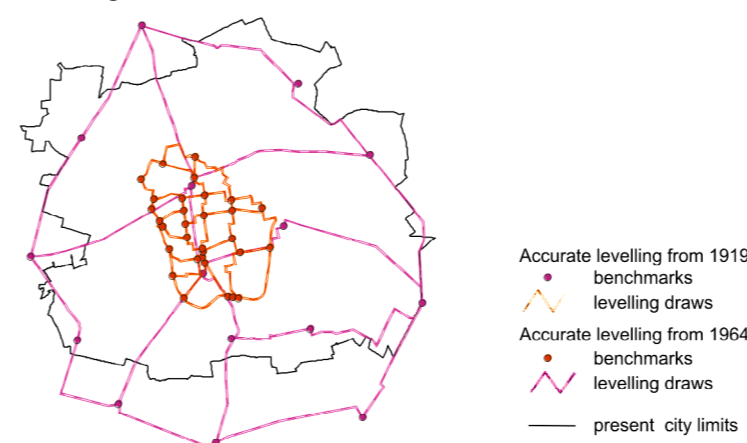


Fig. 3. The development of an accurate levelling grid Source: own compilation based on data from MODGiK in Łódź

As of 1949, the institution of an independent sworn surveyor was eliminated and replaced by state surveying companies. In Łódź, the first state surveying company was initiated by a surveying team from the State Surveying Enterprise, Kielce Division that came to Łódź in May of 1949. The team later expanded to become the Regional Surveying Enterprise of Łódź, currently the Łódź Regional Surveying Company, Ltd.

In May of 1950, the existing Measurement Bureau was transformed into the Municipal Measurement Bureau, currently the Municipal Surveying Company in Łódź, Ltd. As of 1952, the surveying administration, being part of the appropriate and frequently changing Departments of the Presidium of the Łódź City National Council, focused on defining the types and ranges of surveying and cartographic works necessary to satisfy the needs of the city's authorities and their subordinate services.

The most urgent task was to prepare a consolidated detailed situation and altimetric map of the entire city at a scale of 1:1000, called the master map. The next task was to prepare a street map with a surveying inventory of the surface and underground infrastructural system. Łódź was one of the first Polish cities to take regular measurements of the infrastructural system, starting from 1964.

Within the framework of the countryside project to establish a consolidated modern surveying grid, appropriate measurements were also taken in the area of Łódź. In the accurate levelling grid, the basis for further development of the technical levelling grid, established were 390 benchmarks which in the central part of the city included many of the existing reference points of the old altimetric grid. The measurements were completed in 1964. How the accurate levelling grid of Łódź developed is illustrated in fig. 3.

The following year brought the launch of new measurements of the modified and considerably enlarged triangulation grid of the city, now being an integral part of the national surveying grid. The

new triangulation grid in the central part of the city partly coincided with the grid of the "Small Region of Łódź". As a result of taking new measurements, the reference point coordinates in the old grid were given new values, slightly different from the previous ones. Therefore, the new coordinate system of the triangulation grid became known as the 'LAM System'. This local coordinate system was valid only for surveying works within the city area. Outside its administrative borders, any and all surveying works were governed by the national '1965 coordinate system' introduced in 1968. The spatial development of the triangulation grid in the region of Łódź is shown in figure 4

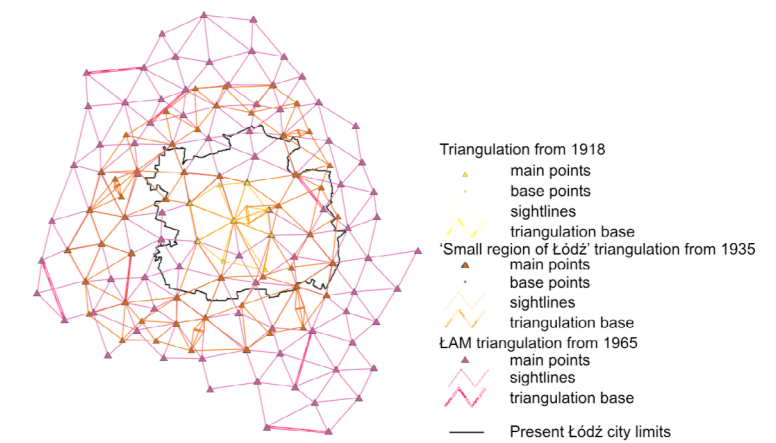


Fig. 4. Triangulation grid development Source: own compilation based on data from MODGiK in Łódź

Based on the new triangulation, a new polygonal grid was established in the city area, consisting of 4243 reference points marked on the ground. The measurements and calculations were completed in 1968. In line with the principle of preserving the surveying continuity in the city area, many reference points of the old grid, both horizontal (triangulation and polygonisation) and altimetric (levelling), were included into the new grids. The quantitative development of the city's detailed surveying grids in comparison to the interwar period is shown in figure 5.

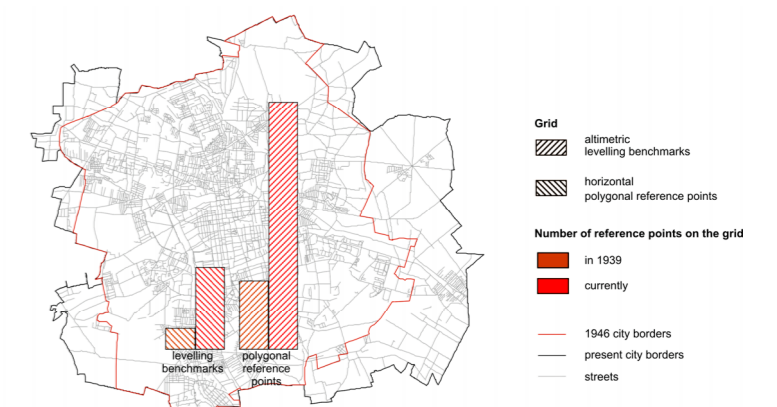


Fig. 5. Detailed horizontal grid development Source: own compilation based on data from MODGiK in Łódź

The development of the surveying grid is not proportional to the growing size of the city's area due to the fact that apart from the town of Ruda Pabianicka, the areas incorporated into Łódź were farming lands or fores.

Simultaneously with the establishment of the surveying grid the entire index of all detailed city maps was catalogued, analysed, and evaluated section by section. The evaluation results with regard to each city district are presented in figure 6. An analogous evaluation was made for the existing street maps, respectively.

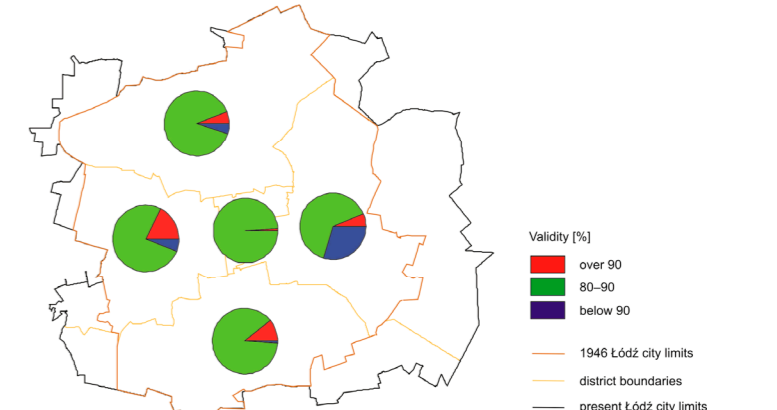


Fig. 6. Validity of large-scale maps in city districts in 1967. Source: own compilation based on data from MODGiK in Łódź

The new surveying grid, the quality evaluation of the existing collection of the variously scaled maps maintained for the urban areas, and the city's specific needs were the basis for a decision to prepare a new consolidated situation and altimetric map at a scale of 1:500 on new-size sheets with section dimensions of 500x800 mm.

In 1958–1966, a new land and building register was established, now known as "the old register". Each district was then a separate registration unit divided into surveying districts. The city area was divided into 930 registration surveying districts (Bałuty – 239 surveying districts, Góra – 211, Polesie – 161, Śródmieście (city centre) – 42, Widzew – 227). For each surveying district established were "as is" land registration records consisting of a cartographic part, i.e. the registration map and its matrix, and a descriptive part including essential documents, such as the land and landowners register, as well as supplementary documents, e.g. registration certificates and files.

In the period 1971–1981, a new land and buildings register was created in accordance with the directives passed in 1969 by the Ministers of Agriculture and Municipal Economy. The existing registration units – city districts – were retained, but a new subdivision into registration surveying districts was introduced. In total, 188 surveying districts were formed, of which in Bałuty – 54, Góra – 52, Polesie – 36, Śródmieście (city centre) – 9, and in Widzew – 37. The registration map was developed in analogue form, at a scale of 1:1000 and arranged as per the surveying districts. The land register and other directories were hand-written. Later on, their maintenance was computer supported.

As of 1970, the municipal surveyors have been providing services to the Project Documentation Harmonisation Division (ZUDP). As part of these services, the municipal surveyors provide the surveying component of the project documentation for the purpose of reconciling the prospective projects and maintain the standard map of the city.