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Journal article

### **The Soviet mapping of Poland – a brief overview**

**Kent, A. J., Davis, M. and Davies, J.**

Kent, A., Davis, M. and Davies, J. (2019) The Soviet mapping of Poland – a brief overview. *Miscellanea Geographica*, Vol.23 (Issue 1), pp. 5-15.

<https://doi.org/10.2478/mgrsd-2018-0034>



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Kent, A. J., Davis, M. and Davies, J. (2019) The Soviet mapping of Poland - a brief overview. *Miscellanea Geographica*, 23 (1). pp. 1-11. ISSN 2084-6118.

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# The Soviet mapping of Poland – a brief overview

## Abstract

The Soviet military mapping project was the most comprehensive cartographic endeavour of the twentieth century. The resulting maps have been commercially available to the West since at least 1993, when a Latvian business first offered Soviet plans of Western cities for sale at the 16<sup>th</sup> International Cartographic Conference in Cologne, Germany. Covering the globe at a range of scales, Soviet military maps provide a fascinating – if disconcerting – view of familiar territory with a striking aesthetic. But they also provide a substantial untapped geospatial resource, often with an unparalleled level of topographic detail. This paper gives an overview of the Soviet global military mapping programme and its coverage of Poland, including the 1:25,000-scale city plan of Warsaw (printed in 1981). By illustrating the extensive topographic symbology employed at various scales of mapping, it suggests how these maps may offer scope for regional studies and how their cartographic language can provide some solutions for addressing the ongoing challenges of mapping the globe.

## Keywords

Soviet topographic maps • Cold War • geospatial intelligence • Warsaw • cartography

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Received: 7 November 2018  
Accepted: invited paper

## Introduction

During the Cold War, the Soviet Union secretly embarked on the most comprehensive and systematic global mapping project that had ever been undertaken. Detailed topographic maps and plans of foreign territories were produced at several scales (i.e. 1:5,000, 1:10,000, 1:15,000, 1:25,000, 1:50,000, 1:100,000, 1:200,000, 1:500,000 and 1:1,000,000) according to standard specifications by thousands of cartographers working within the Union of Soviet Socialist Republics (USSR) (Davies and Kent, 2017). Although the exact coverage of the globe is yet to be determined, Watt (2005) has estimated that over one million sheets are likely to exist, including detailed topographic maps of the USSR at several scales from 1:25,000, plus maps of the rest of the world at 1:200,000 and larger, with coverage of Europe, the Middle East, North and Central America, large areas of South America, the Indian subcontinent, south-east Asia, China, and the populated areas of Africa at 1:50,000 and/or 1:100,000 scales. Over 2,000 cities around the world are also known to have been mapped at larger scales, principally 1:10,000 or 1:25,000 (Davis and Kent, 2017). In addition, the mapping of some areas, such as Western Europe, was undertaken by military topographic organizations within Warsaw Pact countries (Cruickshank, 2007).

Although aspects of the Soviet military mapping programme were known outside the USSR before its collapse in 1991 (e.g. symbol explanation guides were produced by the US Department of the Army since at least 1958), their availability increased after Jāņa Sēta, a Latvian map shop based in Riga, began selling topographic maps and city plans at the 16<sup>th</sup> International Cartographic Conference in Cologne, Germany, in 1993. Today, digital copies of Soviet maps – including detailed city plans – may

be freely accessed from the websites of several national libraries around the world, such as the National Library of Australia (see Davis and Kent, 2017 for a comprehensive listing).

For many areas (particularly in Central Asia), Soviet maps remain the most accurate and comprehensive form of topographic information available. The improved availability of this huge geospatial resource invites fresh applications of Soviet military mapping to be explored and its potential to be realised. In this paper, we provide an overview of the Soviet global mapping programme and focus on the Soviet maps of Poland, including the 1:25,000-scale city plan of Warsaw (printed in 1981). Through illustrating maps at a variety of scales, we demonstrate how the cartographic language of Soviet military maps offers a versatile resource for studies at a full range of local, regional, national and international scales.

## Origins

The systematic mapping of Imperial Russia was focussed on its European territories. This included, for example, the series of ten-verst maps (1:420,000) produced by the Military Topographical Depot in 1821 (Postnikov, 1996). Aspirations for mapping beyond the vast territories that lay to the east were built on the pragmatism of a cartographic vision that originated from outside Russia. In 1891, German geomorphologist Albrecht Penck had proposed the idea of a 1:1,000,000-scale world map at the Fifth International Geographical Congress in Berne, Switzerland. The International Map of the World (IMW), as it was subsequently named, was a collaborative project that relied on the production of sheets by national mapping organizations. It

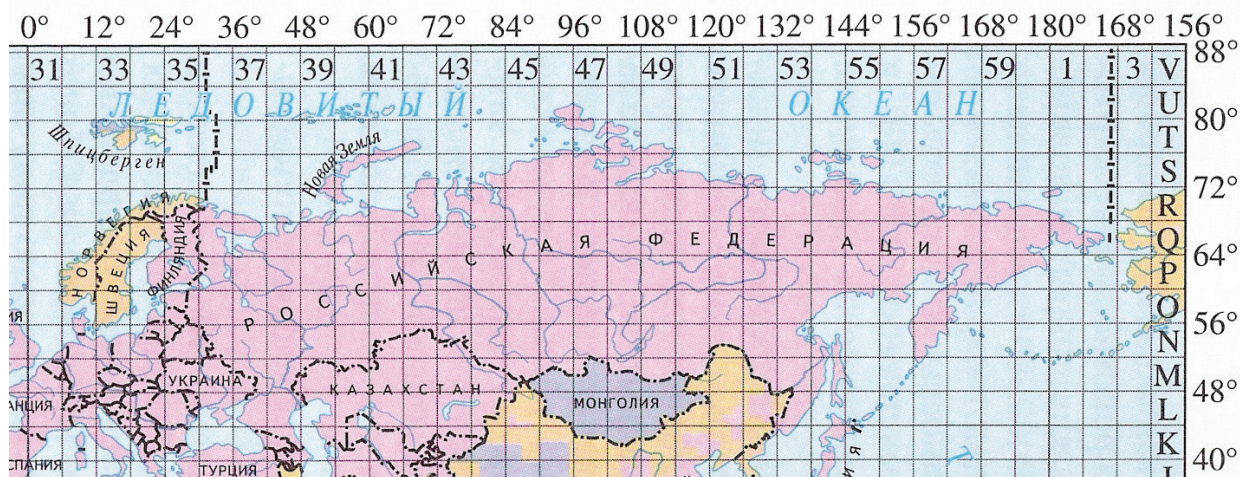


Figure 1. Extract from a map of the world indicating the coverage of topographic mapping and IMW nomenclature used by the Soviet Union (Vereshchaka, 2002)

was intended to challenge the confrontational nationalism and imperialism of the nineteenth century, allowing scientists and students alike to establish, meaningful worldwide comparisons for the first time (Pearson et al., 2006). The challenge in the new century would be to draw this information together for the good of all humanity (Heffernan, 2002: 209).

Despite initial enthusiasm, progress was slow (only around 20 sheets had been produced by 1913) and the IMW suffered inevitable problems of reaching international agreement on establishing cartographic conventions. Although Russia had signed up to the IMW, the Soviet Union later withdrew from the project. Nevertheless, the sheet lines of the IMW were adopted for the first detailed topographic mapping of the USSR (which began soon after the Bolshevik Revolution of 1917) and the first Soviet maps at 1:1,000,000 were completed in 1918.

A decree from Lenin in 1919 ensured that mapping activities fell under state supervision. This was followed in 1921 by the introduction of a standard specification for military topographic maps at a range of scales (1:10,000, 1:25,000, 1:50,000, 1:100,000, 1:200,000, 1:500,000, 1:1,000,000), with some sheets derived from photogrammetry by 1924 (Davies and Kent, 2017). From depicting regional geography to local terrain and street-level detail, all scales were based on a further implementation of the IMW sheet lines.

Following successive revisions, a specification was introduced in 1940 that included greater levels of topographic detail than those of other national mapping series, such as the types of forest and the widths of roads. Operation Barbarossa, the Nazi German invasion of the Soviet Union on 22<sup>nd</sup> June 1941, brought greater focus on the compilation of topographic material in support of military operations. In 1945, Stalin decreed that the priority for the USSR Military and Civil State Topographic Services was to produce a 1:100,000 map of the entire Soviet Union. This was achieved by 1954. Once this task was approaching completion, Moscow's attention shifted to the mapping of Soviet satellite states and of other parts of the world (Cruikshank, 2007: 24).

### Format

#### Topographic Maps

Soviet topographic maps or 'topos' are non-rectangular sheets whose sheet lines are defined by lines of latitude and longitude. They are numbered according to the nomenclature devised for

the International Map of the World (IMW). Topos were produced at seven scales that were regarded by the Soviet authorities as:

- Small-scale / general terrain evaluation: 1:1,000,000
- Small-scale / operational: 1:500,000
- Medium-scale / operational-tactical: 1:200,000
- Medium-scale / tactical: 1:100,000
- Large-scale / tactical: 1:50,000, 1:25,000, 1:10,000

The security classifications of the topographic maps in general are as follows:

- Small-scale maps (i.e. below 1:200,000) are unclassified;
- 1:200,000-scale maps are labelled Для Служебного Пользования (For Official Use);
- 1:100,000 and 1:50,000-scale maps of USSR territory are labelled Секретно (Secret);
- 1:100,000 and 1:50,000-scale maps of the rest of the world are labelled Для Служебного Пользования (For Official Use); and
- Larger-scale topos (i.e. above 1:50,000) and all military city plans are labelled Секретно (Secret).

The basic quadrangle is the 1:1,000,000 sheet, which spans four degrees latitude by six degrees longitude. The quadrangles are identified by lettered bands north from the Equator and by numbered zones east from longitude 180°. Figure 1 shows the layout of eastern Europe and the Russian Federation, north from band K (latitude 40 °) and east from zone 31 (longitude 0 °), from which it can be seen that Poland primarily appears on 1:1,000,000 maps M-33, M-34, N-33 and N-34. The pink areas on the figure indicate the territories that were mapped at the scale of 1:25,000 or smaller.

The bands used in IMW nomenclature adopt letters from the Roman rather than the Cyrillic alphabet, although Cyrillic is used for the sub-divisions into larger scales. Figure 2 illustrates the breakdown of each 1:1,000,000-scale sheet into four sheets at 1:500,000, 36 sheets at 1:200,000 and 144 sheets at 1:100,000. The maps themselves are labelled with both the Cyrillic code and with an all-numeric code, thus sheet M-34-B (seen in Figure 4) is also labelled '13-34-2'.

Figure 3 shows part of sheet M-34, dated 1989. This extract is of the north-eastern corner of the map, showing the small Polish town of Włodawa (Влодава), which lies about 220 km south-east



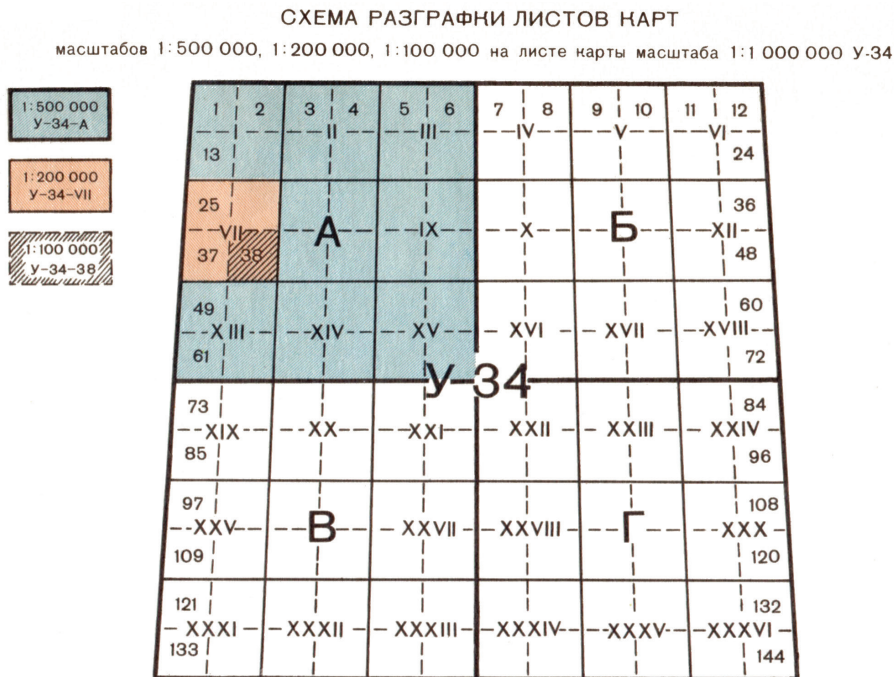


Figure 2. The basic division and sub-division of Soviet topographic map sheets according to IMW nomenclature, as derived from the 1:1,000,000 series (Soviet General Staff)

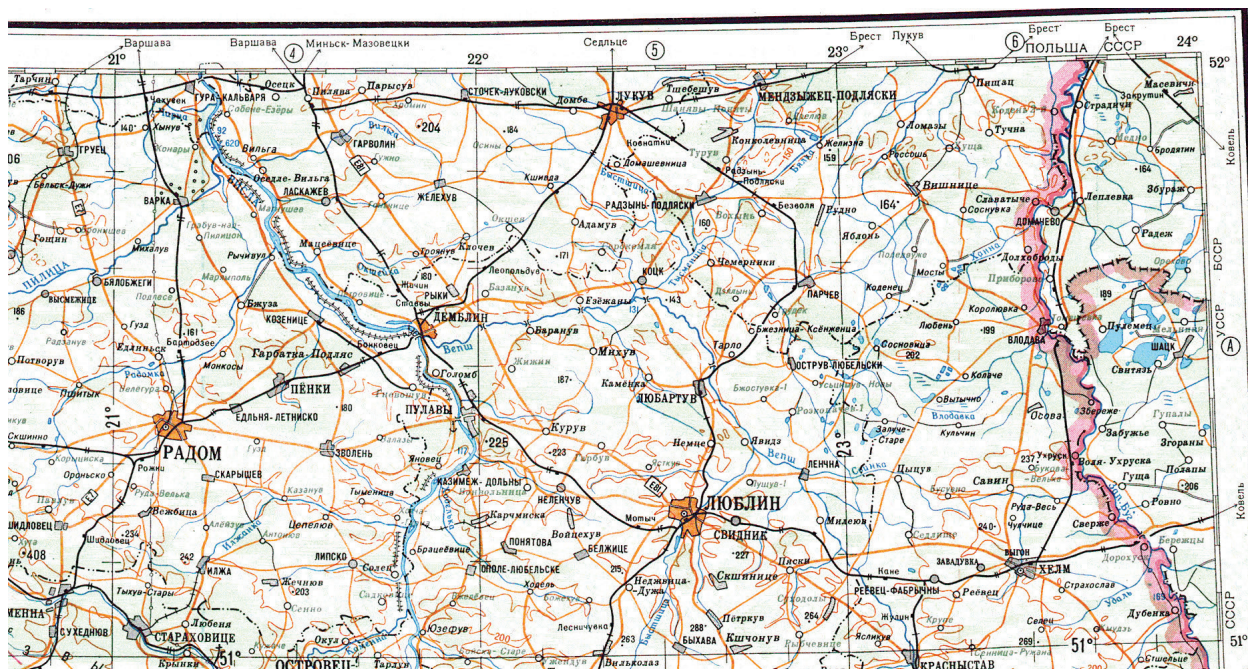


Figure 3. Extract from sheet M-34 (1:1,000,000), dated 1989, which covers the eastern part of Poland (Soviet General Staff).

of Warsaw on the River Bug, close to the borders of Belarus and Ukraine. This map is designed to give a quick visual impression of the terrain and the transit routes without including unnecessary detail. Contour lines are shown at 50-metre intervals, with land above 500 metres coloured pale brown (none on this extract) and woodlands in pale green. The extract in Figure 3 shows the inclusion of major roads, railways, rivers, towns and villages and the international border.

The map at the next larger scale, 1:500,000 sheet M-34-B (Figure 4), is also dated 1989. Maps at this scale provide more information, yet still manage to avoid confusing clutter. Smaller settlements and minor roads are included, more places are named (and also railway stations), and species of tree are distinguished by using different symbols.

The 1:200,000 sheet M-34-06, which is dated 1980 (Figure 5), introduces extensive annotation, much of it – but not all –





Figure 4. Extract from sheet M-34-B (1:500,000), dated 1989 (Soviet General Staff)



Figure 5. Extract from sheet M-34-06 (1:200,000), dated 1980 (Soviet General Staff)

overprinted in red. On the major roads, annotations indicate distance, width of carriageway, overall clearance and surface material (e.g. A = asphalt). Bridges are labelled with construction material, length, width and carrying capacity. In the forests, tree species are named, and the typical height, girth and clearance are stated, whilst in the river the speed of flow, width, depth and bed material are annotated. Contours are shown at 20-metre intervals and the low side of closed contours is marked with a tick. As with

other 1:200,000 maps, the reverse of the sheet includes a written description of the surface geology of the region, accompanied by a schematic map.

Figure 6 is an extract from 1:100,000 sheet M-34-024, dated 1988. Considerable detail of landforms is given at this scale and the depiction of urban morphology is sufficient to indicate the street layout in towns, as well as some individual buildings, overhead power cables, field boundaries and earthworks. The





Figure 6. Extract from sheet M-34-024 (1:100,000), dated 1988 (Soviet General Staff)

population of towns is shown below the place name. The extract in Figure 6 covers territory in all three countries (Poland, Belarus and Ukraine) and it is noteworthy that the same level of detail appears in all.

Each 1:100,000 sheet is broken down into four 1:50,000 sheets, labelled A, Б, В, Г (also 1, 2, 3, 4). For comparison, the 1:50,000 sheet shown in Figure 7 (which is an extract from sheet M-34-024-A, dated 1994), was produced by the Polish Army General Staff to the same specification as the Soviet maps, but with names appearing in Roman script. Other Warsaw Pact countries similarly produced localised versions of mapping for the benefit of non-Russian speaking users.

Each 1:50,000 sheet is subsequently divided into four 1:25,000 sheets, labelled a, б, в, г (also 1, 2, 3, 4). Figure 8 is an extract from 1:25,000 sheet W-18-31-A-a, dated 1974, depicting the Ural city of Sverdlovsk (now Ekaterinburg). This map is produced to a similar specification to the standard military editions but is from a series intended for use by civil authorities in the USSR, known as series SK-63. It lacks geographic coordinates and the name conceals the global location that normally would be indicated by the initial letter. A separate set of initial letters was devised with apparently random distribution across the Soviet Union. These maps were classified 'Secret'. The 1:25,000 sheets were further sub-divided into four 1:10,000 sheets, with coverage apparently limited to within the Soviet Union.

### City Plans

In addition to the comprehensive topographic series described above, a separate series of city plans was produced, typically at 1:25,000 or 1:10,000 scales, with plans of some cities at the scales of 1:20,000 (e.g. Tokyo, Japan), 1:15,000 (e.g. Sopot, Poland) and 1:5,000 (e.g. Milford Haven, UK). Although topographic maps were produced at the scales of 1:25,000 and 1:10,000, the city plan series differs in content and appearance, due in part to its more comprehensive symbology. According to a production manual produced by the Soviet General Staff (1978), plans were produced of cities and towns around the world with the aim of facilitating orientation, accurate measurement and detailed studies of urban areas and their surroundings. Although the earliest-known Soviet military city plans were produced in the 1940s, the vast majority were compiled during the 1970s and 1980s, reflecting the availability of Soviet satellite imagery collected especially for this purpose during this period. The plans are classified 'Secret'.

In total, over 2,000 such plans are known to exist. Unlike their topographic counterparts, the city plans do not provide continuous or systematic coverage across large areas according to a grid. Rather, city plan sheets are rectangular and centred on specific urban centres. Therefore, the name of the city provides the principal title of the plan, rather than IMW nomenclature, which is provided as a subtitle (and refers to the 1:100,000



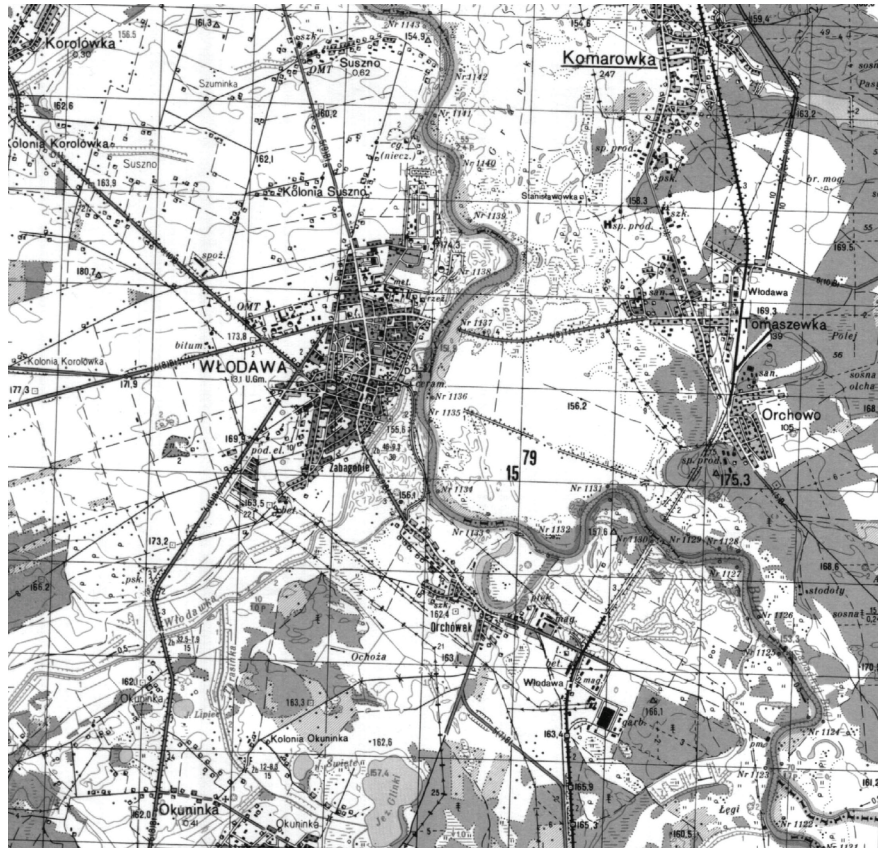


Figure 7. Extract from sheet M-34-024-A (1:50,000), dated 1994 (Polish Army General Staff)

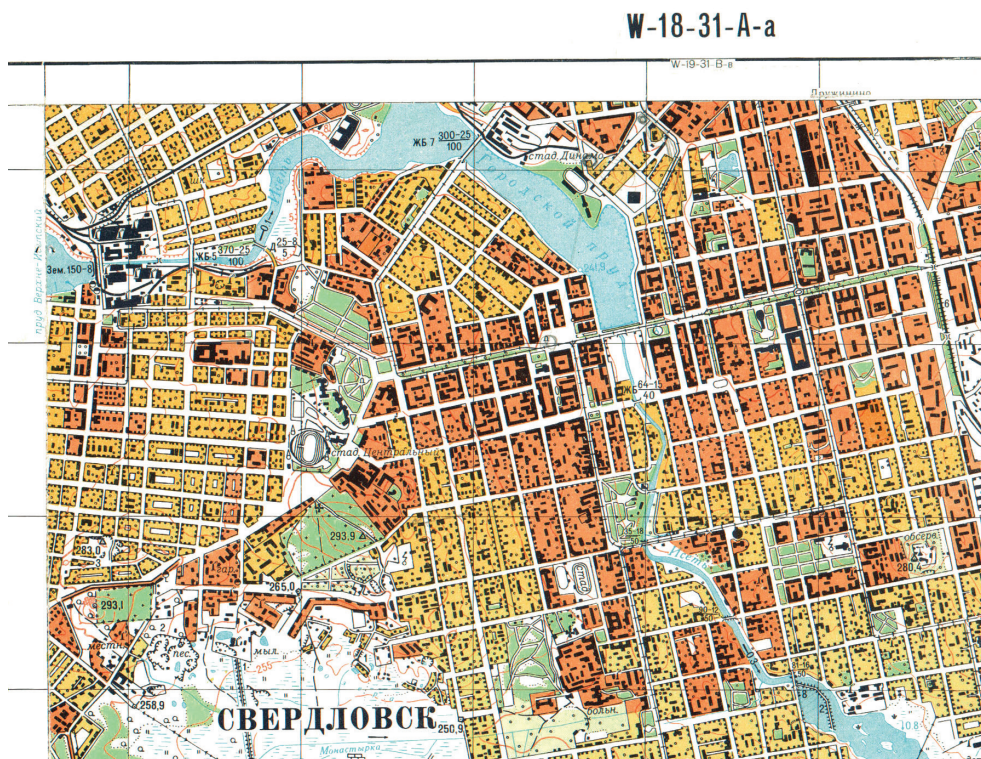


Figure 8. Extract from sheet W-18-31-A-a (1:25,000), dated 1974 (Soviet General Staff)



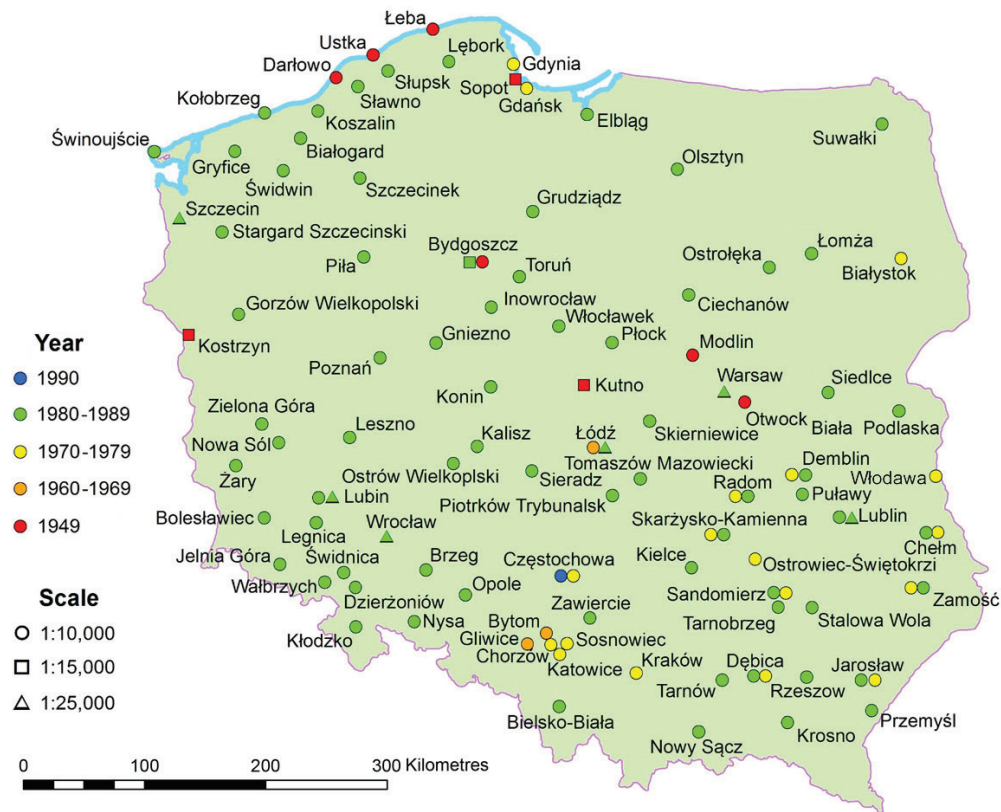


Figure 9. Map showing the years of production and scales of Soviet city plans covering Poland, 1949–1990 (map created by John Hills)

sheet/s on which the city is located). City plans universally adopt the Soviet variation of the Gauss-Krüger projection and the Pulkovo 1942 Coordinate System and datum. Smaller cities and their immediate surroundings are usually presented on a single sheet, while larger cities often span multiple sheets. The largest plan known to date is that of Los Angeles (USA), which is spread across twelve sheets.

Based on current political boundaries, the city plan series covers towns and cities in over 130 countries, with notable concentrations in Europe, North America and the Far East. While many of the world's largest cities are included, such as Shanghai (China), Tokyo (Japan), London (UK), New York (USA), Paris (France), Istanbul (Turkey) and Cairo (Egypt), there are several large cities of which no Soviet plan is currently known, such as Rio de Janeiro (Brazil), Bogotá (Colombia), Melbourne (Australia) and Lagos (Nigeria). Concurrently, some remarkably small settlements have not been overlooked, presumably because of their local administrative importance, military function, or proximity to international borders. Examples of such towns are Hamilton (Bermuda), Demblin (Poland) and Vardø (Norway), which have a combined population of approximately 6,000.

The most visually distinctive aspect of the Soviet military city plans is their colour-coding of important objects. These are numbered and correspond to a listing at the edge of the plan, or, occasionally, on a separate sheet or in a booklet. The objects are colour-coded according to their function. Black is used for buildings with an industrial purpose, green denotes a military/communications function, whereas purple is reserved for administrative or governmental buildings. Other types of building are coloured brown. The city plans are also notable for their rich hydrographic information and their inclusion of fine detail which

would not usually be expected on an urban plan, such as the width of streets, the load capacity of bridges and the flow direction of rivers. Each plan is also accompanied by a descriptive text, or 'spravka', which introduces the physical geography of the city and its surroundings in addition to providing an overview of its economic and political functions.

The specifications of the plans evolved in stages, each offering a more sophisticated representation of the urban landscape and, in particular, a more detailed classification of strategically important buildings (Davies and Kent, 2017). Earlier plans employed fewer colours (i.e. light brown, dark brown, blue, and green), with important buildings shown in dark brown overprinted with blue to make them appear black and therefore visually more prominent.

### Poland

The Soviet military mapping of Poland was comprehensive. The country was covered by all topographic scales from at least 1:50,000 or larger; several hundred 1:25,000 topographic sheets are alleged to exist (Map Archive of Wojskowy Instytut Geograficzny 1919–1939, 2013), although exact coverage at this scale is yet to be determined. Poland was also very comprehensively covered by the city plan series, with around 100 settlements mapped in street-level detail by the Soviet General Staff (Figure 9). Although it is not surprising that the larger cities of Warsaw, Kraków, Łódź, Wrocław and Poznań are included, Łeba, Sławno, Włodawa and Darłowo may be less familiar to a non-domestic audience. After an initial group of nine small Polish towns was mapped in 1949, followed by a further three in the 1960s (this time including the much larger city of Łódź), most of the plans were produced between 1973 and 1990, which reflects the availability



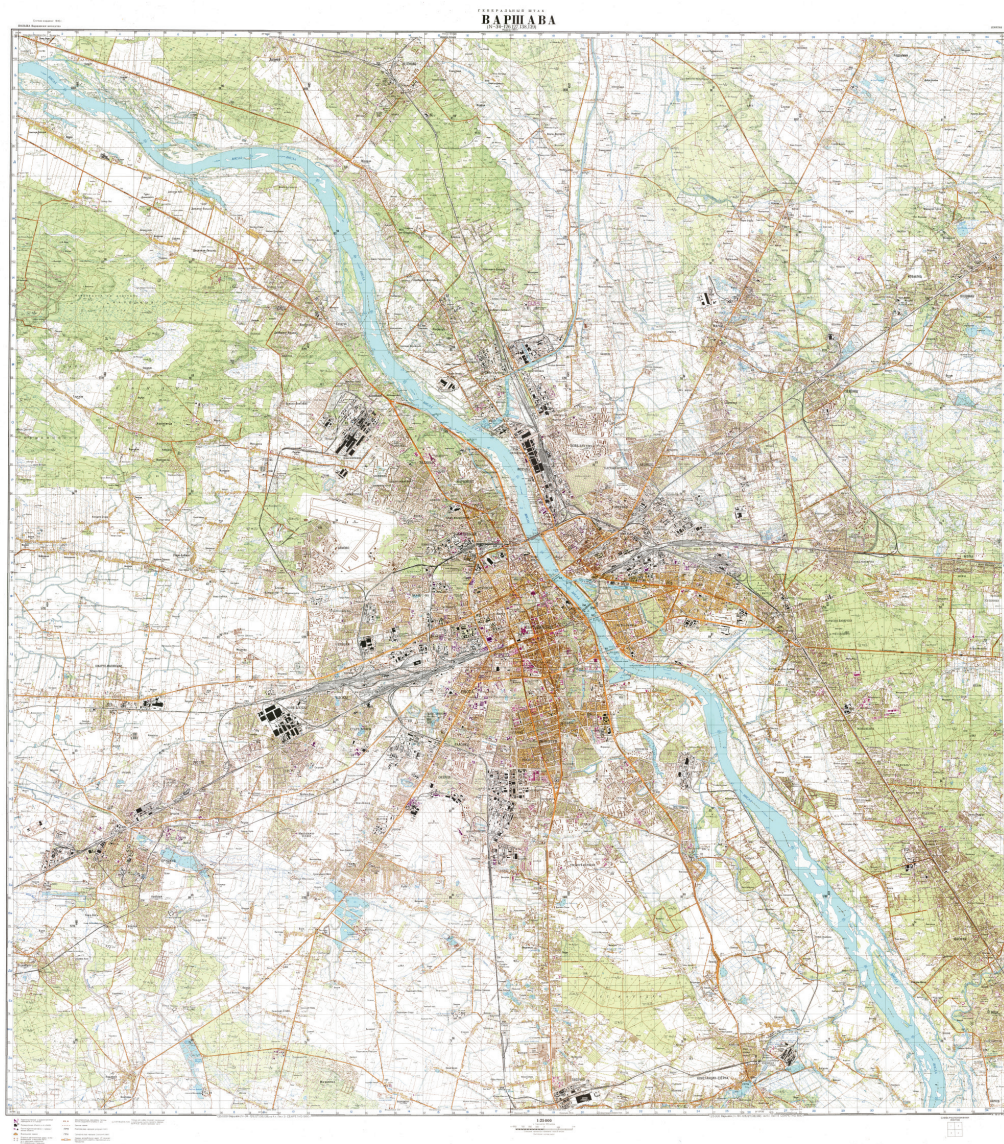


Figure 10. Soviet 1:25,000 military city plan of Warsaw (*Bapwasa*), printed in 1981. The inner margins have been removed to create a mosaic of the four sheets (Soviet General Staff)

of high-quality satellite imagery and follows the wider trend of international coverage.

The vast majority of Polish towns and cities were mapped at 1:10,000. Some earlier plans use a scale of 1:15,000, which was phased out by the 1970s, and only the larger cities of Warsaw, Wrocław, Szczecin, Lublin and Łódź utilise the smaller scale of 1:25,000, due to their size. The inclusion of many smaller Polish towns and villages is reflected by the fact that approximately 80% of the plans are printed on a single sheet. No plan of a Polish city exceeds four sheets (i.e. Warsaw, Łódź, Poznań and Gdańsk) although, inconveniently, the sheet boundaries tend to fall across the central areas of the city. For cities in countries where there was no Soviet topographic coverage at the time of the plan's production, the Soviet plan includes a small-scale topographic inset map that shows the region surrounding the city. As Poland was also comprehensively covered by Soviet topographic maps at various scales, these inset maps therefore do not appear on the plans of Polish cities.

The four-sheet Soviet military city plan of Warsaw (Figure 10) was printed in June 1981 in the Dunayev Cartographic Factory in Moscow (indicated by the print code that is placed in the margin of each sheet). As is typical for the city plan series, the sheet is classified 'Secret'. The codes under the title refer to the four corresponding 1:100,000 topographic sheets (N-34-126, 127, 138 and 139), on which the city may be found. The city and its environs are covered by four 1:25,000 sheets, but removing the inner margins reveals the unified composition (Figure 10) that is centred on the city. The *spravka*, street index, and list of buildings of strategic importance do not appear on any of the four sheets and are included in a separate booklet. This is a characteristic of the largest cities covered by the city plans (e.g. London, UK), where the number of important objects runs into several hundred.

The level of topographic detail on the city plan is comprehensive. For example, the contour interval is five metres and annotations provide further information regarding the type, girth and spacing of trees, the depth, speed and flow



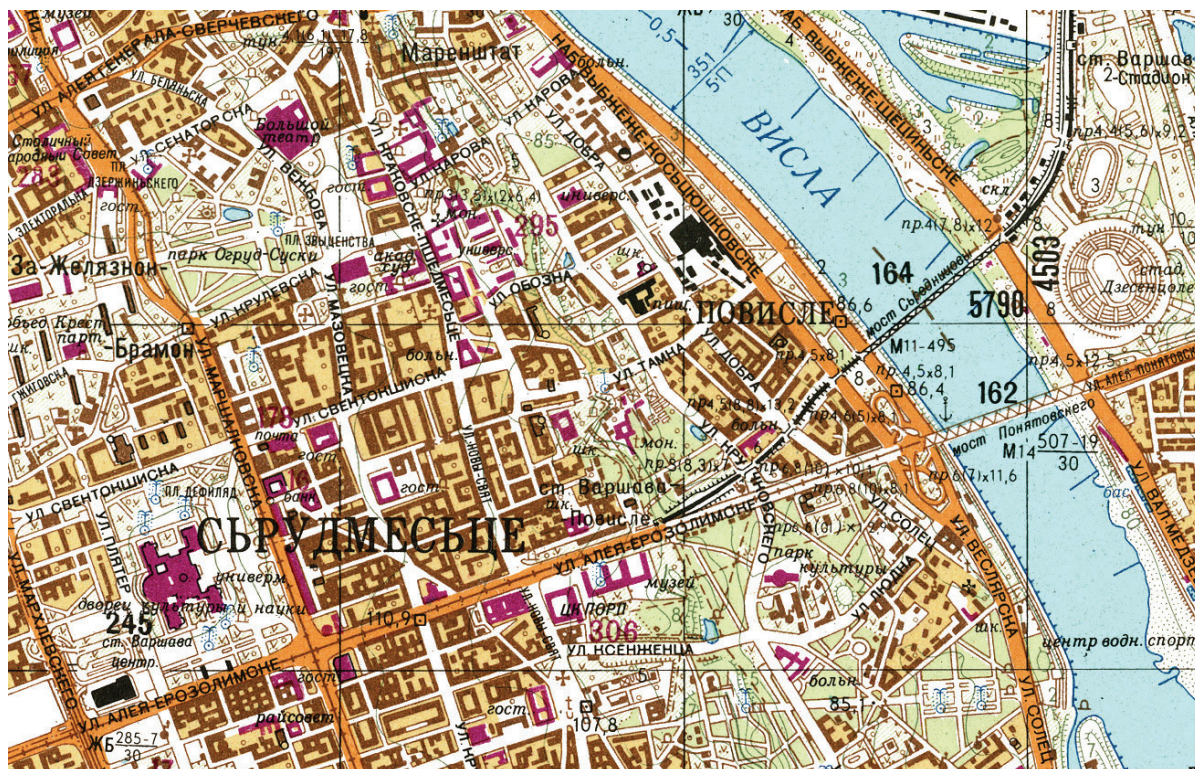


Figure 11. Detail of the Soviet 1:25,000 military city plan of Warsaw printed in 1981, which includes the Poniatowski Bridge to the right and the Palace of Culture and Science on the left (Soviet General Staff)

direction of the River Vistula. The annotation accompanying the Poniatowski Bridge (see Figure 11) indicates that the construction material is metal; that the height of the truss is 14 metres above water; that the carriageway is 509 metres long by 19 metres wide; and that its carrying capacity is 30 tonnes. Similar annotations on the plan may be found placed beside bridges all over the city. Although no buildings have been coloured in green on the plan (which would denote strategically important objects with a military/communications function), there are many buildings coloured purple, indicating their administrative use. For example, on Figure 11 these include the Palace of Culture and Science (numbered 245 and surrounded by fountains – see bottom left) and the Grand Theatre (labelled as the Bolshoi Theatre and unnumbered – top).

In contrast to Warsaw, the Soviet military city plan of Łódź, is covered by just one 1:25,000 sheet (Figure 12). Although an earlier four-sheet plan of the city was made in 1962, this one-sheet edition was printed in 1987 at the factory in Sverdlovsk (Ekaterinburg). It incorporates a *spravka* and an alphabetical index of sheets, and lists 201 strategically important buildings, including the large textile factories that dominated the city's industry. Most Soviet military city plans adopt this format and layout, with the supplementary information included on the sheets themselves for easy reference. Annotations on the plan indicate in full detail the construction material (e.g. reinforced concrete) and dimensions of bridges on approach to the city.

### Applications

The level of secrecy of the maps discussed here meant that the West was unaware of the full extent of the Soviet cartographic programme that was taking place throughout the Cold War. In 1993, Aivars Zvirbulis, an orienteer, established a small map printing press in Riga, the capital of the newly independent

Latvian republic. Having closed in 1992, the military topographic depot in the town of Cēsis, 100 km from Riga, was due to dispose of its stock as waste paper. Zvirbulis managed to salvage a small proportion of the sheets and advertised them for sale on a flyer at the 16th International Cartographic Conference in Cologne, Germany, in 1993. The maps were purchased by individuals and libraries across the world, of which the US Library of Congress has accumulated the most sizeable collection to date. At the time of writing, the Jāņa Sēta map store in Riga, which subsequently obtained more stock from another defunct topographic depot in Jelgava, continues to sell some remaining maps.

In the academic community, the maps received mention in the ensuing years (e.g. Collier et al., 1996) but more thorough study or application of this 'new' geospatial data has been slow to appear and not emerging until the mid-2000s (e.g. Davies, 2005a; 2005b; 2006; 2010; Watt, 2005; Cruickshank, 2007; 2008; 2012; Kent and Davies, 2013; Davies and Kent, 2017). More recently, the maps have become commercially available in digital formats, notably from two firms based in the USA: East View Geospatial and LandInfo. Both have highlighted the potential for Soviet spatial data to be used for a variety of contemporary applications, particularly environmental impact assessments and the construction of Digital Elevation Models (DEMs) (Lee, 2003). Rondelli et al. (2013) have utilised 1:10,000 Soviet topographic coverage from the 1950s of Samarkand, now Uzbekistan, alongside modern satellite imagery to locate archaeological remains with a view to supporting the management of such sites. Davies and Kent (2017: 134-137) recount examples from military and UN personnel who used Soviet mapping on operation in Afghanistan and Iraq, as the maps constituted some of the most detailed terrain information available. The maps have also found new life in resource management. The detailed symbology of the maps has proved vital for the identification of artesian wells during water



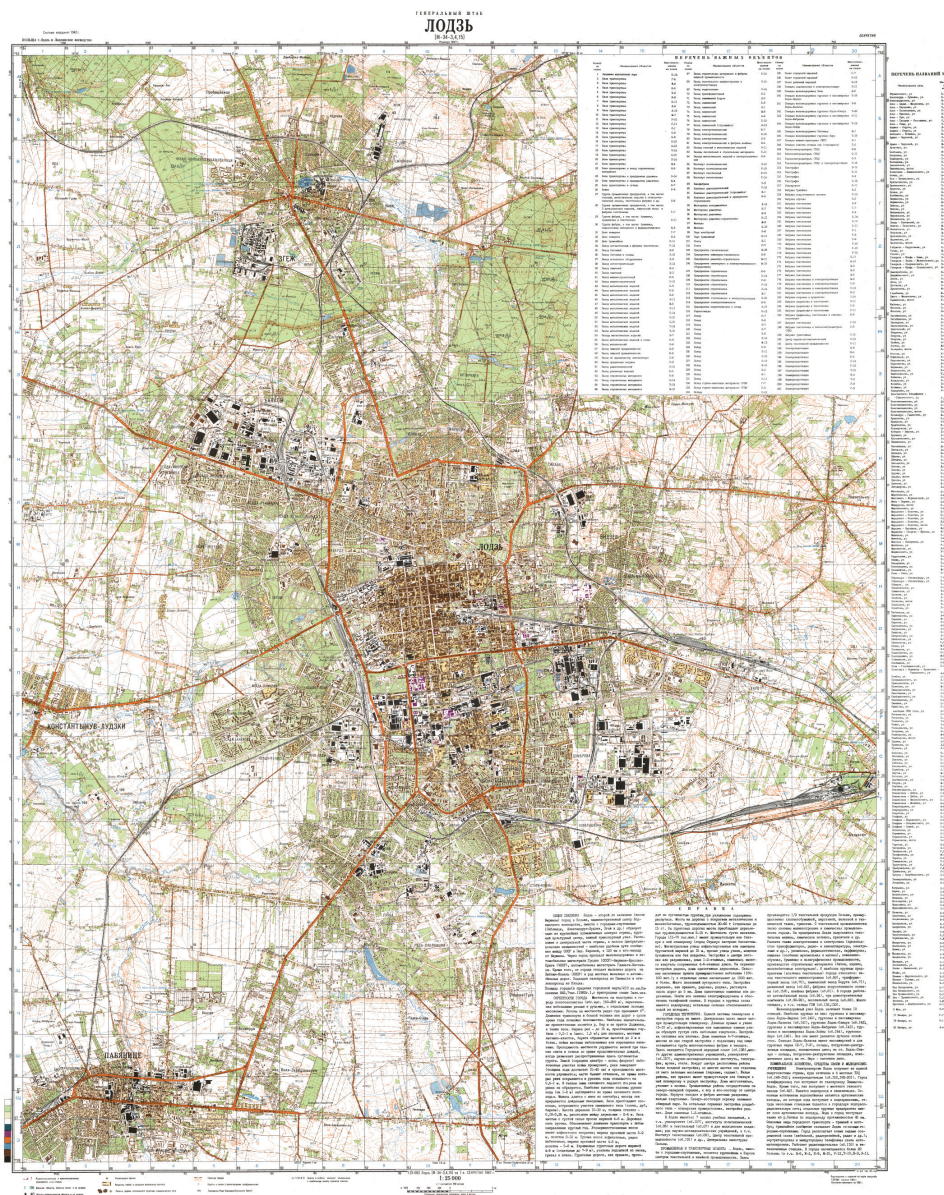


Figure 12. Soviet 1:25,000 military city plan of Łódź (Лодзь), printed in 1987 (Soviet General Staff)

management projects in the Ararat Valley, Armenia (*ibid.*: 135). Soviet topographic sheets have also functioned well as records of land use, aiding the oil exploration process (*ibid.*: 135), while gold, copper, mercury and iron deposits near Herat, Afghanistan have been rediscovered by the US Geological Survey (USGS) using Soviet geological maps (USGS, 2015). The USGS has also digitised and re-indexed Soviet topographic sheets covering Afghanistan in a project in conjunction with the United States Agency for International Development (USAID) (USGS, 2014). Nevertheless, such applications are relatively rare and there remains vast scope for applications of Soviet maps and their data.

### Conclusion

During the Cold War, the Soviet Union secretly produced the most comprehensive multi-scale topographic mapping

of the globe. This included detailed street-level plans of over 2,000 towns and cities beyond the borders of the former USSR. There is more to Soviet maps, however, than Cold War history. If cartography is regarded as a visual language for expressing and communicating spatial relationships and the meanings associated with places (Kent and Vujakovic, 2011), the symbology of Soviet maps offers a versatile and rich vocabulary for articulating the environmental and cultural diversity of the globe. Languages live through their use, and the language of maps is continually restored and reimagined as it is read and experienced. Therefore, instead of regarding Soviet maps as relics of the Cold War that can only offer a bygone utopian vision, we suggest that they have enormous potential to bring relevant insights for mapping programmes today. Indeed, the challenge of simultaneously presenting a wide variety of geographical themes – some of

which do not appear on state topographic maps – may offer a range of solutions for overcoming problems in the cartographic design of multi-scale digital topographic databases.

### Acknowledgements

The authors are grateful to John Hills for creating the map of Soviet plans of cities in Poland for this paper.

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