Chapter 5
The Methodology

The methodology can be divided broadly into three parts. The first two deal with the requirements of addressing the first research objective, including the issues regarding the translation of source materials, classification methods and the construction and sourcing of a sample of maps. The third part deals with the second research objective. It is necessary to divide the first objective into two elements, due to the different methodological challenges posed by compiling a record of symbology out of its context and analysing it within the context of the map.

5.1 Compiling a Comprehensive Record of the Symbology of Soviet Military City Plans

5.1.1 Selection and Translation of Source Material

The first task required to achieve the research objectives is the compilation of a comprehensive record of the symbology of Soviet military city plans, as no such record exists in English. Even in the Russian language, the symbology of the series is derived from three separate documents which need to be sourced, translated and amalgamated in order to complete this segment of the research. It is intended that the resulting document will not only facilitate the achievement of the remainder of the above research objectives but that it will, in itself, provide a useful guide for those interpreting these maps. It will also provide a full record of the comprehensiveness of the series for the first time, thus providing a more complete picture of this aspect of Soviet and twentieth century history. As explained in Chap. 2, the three documents needed for this task are the *Conventional Signs for Topographic Maps of the USSR* (covering scales between 1:25,000 and 1:1,000,000), *Conventional Signs for Topographic Maps at 1:10,000* and a small supplement appended to the compilation manual for city plans [5: article 11].

M. Davis, *A Cartographic Analysis of Soviet Military City Plans*, Springer Theses,
https://doi.org/10.1007/978-3-030-84017-4_5

As the majority of known Soviet city plans were produced between 1970 and 1990 (due to a surge in production between 1970 and 1973, coinciding with the launch of Zenit-4MT), the symbology studied here will be that in effect in the early 1970s. Accordingly, the 1966, 1968 and 1978 editions of these three texts respectively are used here [4–6]. Original hard copies of both *Conventional Signs* books were sourced via online second-hand booksellers, while a copy of the 1978 city plan compilation manual is the only edition of this document available. Both editions of *Conventional Signs* were translated using an online translation tool and the *Oxford Essential Russian Dictionary* [15] where required. The translation was completed using the same method as both editions of *Conventional Signs*. After translation, these three texts were compiled into a single table which represents a snapshot of the complete Soviet city plan symbology in the early 1970s, albeit out of the context of the map.

5.1.2 Symbol Separation and Classification

Classification is the arrangement of data into 'taxonomic groups according to their observed similarities' [14] or, more specifically, the structuring of source data in order to reduce the complexity of information by eliminating unnecessary detail, thus facilitating appropriate visualisation and effective graphic communication [1: 134]. However, in the context of map symbologies, Kent [8: 157] highlights that a perfect classification is unlikely to be found, as there are often several methods of classifying the same data. Nonetheless, a classification of symbols which is workable in the context of this study is vital to the research objectives, as groupings of symbols by type will form a key element of the analysis of the symbology of Soviet city plans. Identifying classes with more symbols available may reveal something of the priorities of the map series. As Kent [8: 159] summarises, 'the more symbols used to describe a type of feature, the more significance that feature has, both on the map itself and to [the society which produced it].' In addition, the extent to which symbols appear on different maps may reveal discrepancies in the source data available for different locations, in addition to variations in social and physical landscapes.

More broadly, an analysis based on classes will also make key themes more apparent than one solely at the level of individual symbols. Additionally, as a reference resource, the data collected in the course of the analysis will be more easily interpreted by users if organised logically into feature classes. In constructing a card sorting method for map symbols, Roth et al. [16: 89] made similar observations:

> Organizing map symbols into broader categories improves the memorability of symbols by imposing a grouping rule, better delineates key themes within the map when the symbols are designed to reflect their higher-level category, and structures map legends for improved symbol reference.

The first major obstacle to be overcome in the creation of such a classification is the division of the symbology into discrete symbols in order that they might be homogenously quantified, as the method adopted by Roth et al. [16] relied on the presence of a set of discrete items (i.e. cards) as a starting point. Many symbols appear in the *Conventional Signs* books as discrete symbols and thus can be included in the new compilation in their original state. Others symbols, however are presented in groups, or as an annotated fictitious map (Fig. 5.1), in order to demonstrate their intended application in relation to other symbols. A similar issue encountered by Kent and Vujakovic [9: 182] led to their division of such 'clusters' into discrete symbols. Similarly, elements of the Soviet symbology presented in this way need to be separated in order to be included in this analysis, in order to avoid misleading symbol counts. In the Soviet specifications, the identification of discrete symbols within clusters or map extracts is typically aided by the inclusion of annotations (see Fig. 5.1). While some symbols can easily be separated into discrete units, others are dependent on context and their relationship with other symbols. In some cases, this means that a feature may be classified in more than one category. A level crossing, for example, is no more a feature of a railway than it is a feature of a road and could therefore be justifiably included in either of these categories, depending on the point of view of the user. In such instances, the category chosen is that which relates most closely to the category in which the feature appears in the relevant edition of *Conventional Signs.*

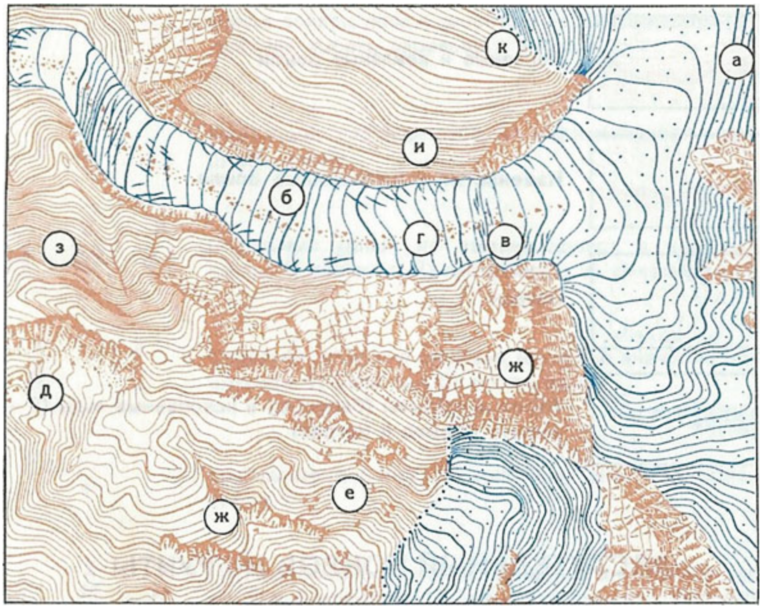

Fig. 5.1 A sample map from *Conventional Signs for Topographic Maps of the USSR* (General Staff [4]; no scale provided) demonstrating the depiction of various elements of relief as a 'cluster'. Many of the annotated features are not included elsewhere in the specification as discrete symbols (private collection)

As previously stated, dividing the classification of symbols into multiple levels, similar to the three levels adopted by Kent and Vujakovic [9: 183] (Fig. 5.2), will enable both the identification of general trends across the symbology, as well as patterns within more precisely defined groups of features. Whereas Kent and Vujakovic [9: 183] differentiated between Land Cover (Level I), General Land Use (Level II) and Specific Features (Level III), broad distinctions between 'natural' and 'human' landscape are less relevant here given the focus on a single symbology. Rather, the two-level system in this analysis (Fig. 5.3) is more akin to a twofold division of Kent and Vujakovic's [9] Level III typology into 13 and 35 classes respectively. This detailed level of analysis reflects the objective of identifying geographical variations in the mapping of specific features within the same map series, whereas Kent and Vujakovic's broader classes reflect their need to make broader distinctions between different symbologies. In addition, this method is similar to Kent and Vujakovic's in that each class, at both levels, is mutually exclusive.

Broadly, the classification of symbols adopted here is based on the classification of symbols in the editions of *Conventional Signs* used. However, as the categorisations of conventional signs at 1:25,000 and 1:10,000 differ from one another, a degree of compromise is required. Table 5.2 shows the First-Level classification used in both editions of *Conventional Signs* and the new classification devised for the purposes of this exercise. The most major change relates to the division of a markedly broad category used by both Soviet documents. Both texts incorporate a significant part of their symbology under the broad heading 'Industrial, agricultural and socio-cultural objects' (Промышленные, сельскохозяйственные и социально-культурные объекты), which includes an eclectic mixture of features, including a wooden windmill, a slagheap, an apiary, a bus stop and a mass grave. It was considered that this

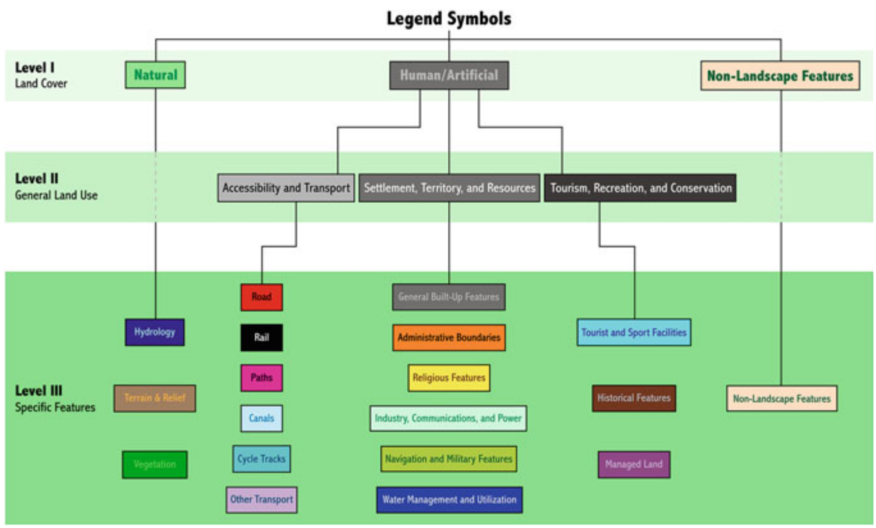

Fig. 5.2 The three-level classification adopted by Kent and Vujakovic [9]

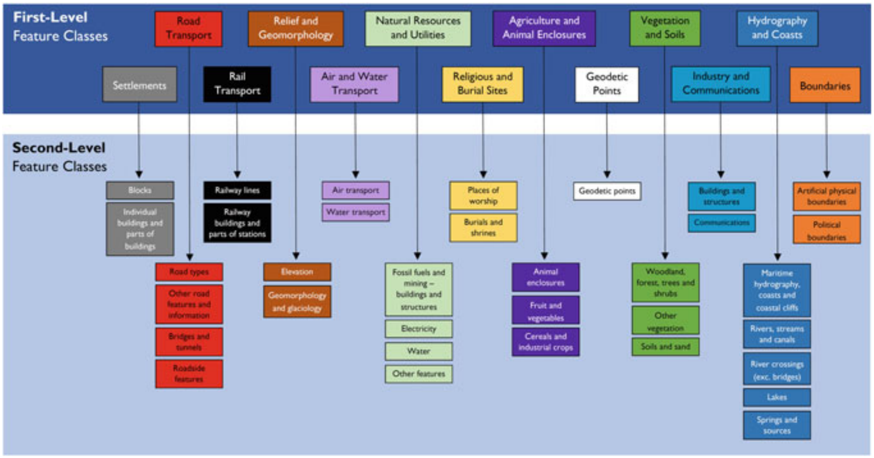

Fig. 5.3 The two-tier classification of feature classes used in the typology of Soviet military city plans

large category would be more usefully divided into five more specific categories (Table 5.1), facilitating more meaningful results. Across the symbology, several symbols were moved into other categories deemed more appropriate (the bus stop, for example, was moved to 'Road Transport'). Other categories were simply given names which more accurately describe their content. These issues are similar to those encountered by Roth et al. [16] who, on analysing the ANSI INCITS 415-2006 symbol standard, discovered overlaps between categories, categories missing altogether and individual symbols which had been misclassified, thus requiring the classification to be refined.

Within each of the new First-Level classes are a series of Second-Level classes which will enable a finer level of analysis and detection of any variance within the First-Level classes. Given the large quantity of symbols involved, these additional divisions will also aid navigation in the new record of symbology. The names and indicative scope of each of these Second-Level classes are presented in Table 5.2. The classification outlined in Table 5.2 does not include labels or any feature marked only by text. Although there is undoubtedly scope for a full analysis of these features and annotations in their own right, they have been excluded from this analysis as graphical symbology is the focus of the study (see Sect. 4.1).

5.1.3 Further Issues in Compiling a Comprehensive Symbology

Further complications arise in the case of graphically identical (or very similar) symbols which appear in both editions of *Conventional Signs*, but with slightly

Table 5.1 The First-Level classes used in both editions of *Conventional Signs* [4, 6] and the new classes devised for this study

***Conventional Signs for Topographic Maps of the USSR*(1966)** 'Conventional signs for maps at 1:25,000, 1:50,000 and 1:100,000' section	***Conventional Signs for Topographic Maps at 1:10,000*(1968)**	**New classes**
Settlements	*Settlements*	**Settlements**
Transport networks	*Highways, dirt roads and trails*	**Road transport**
	Railways and their facilities	**Rail transport**
Industrial, agricultural and socio-cultural objects	*Industrial, agricultural and socio-cultural objects*	**Air and water transport**
		Industry and communications
		Natural resources and utilities
		Religious and burial sites
		Agriculture and animal enclosures
Borders	*Borders and fences*	**Boundaries**
Geodetic points	*Geodetic points*	**Geodetic points**
Hydrography	*Hydrography*	**Hydrography and coasts**
Relief	*Relief*	**Relief and geomorphology**
Vegetation and soils	*Vegetation and soils*	**Vegetation and soils**

different descriptions. For example, a 'rocky outcrop' symbol at 1:25,000 is more specifically a 'large rocky outcrop' at 1:10,000. It is not possible to identify which meaning is intended when such a symbol is used on a map by its scale alone, as some symbols which only appear in the 1:25,000 specification appear on 1:10,000 maps and vice versa. In these cases, these symbols have been recorded separately each with its own description, despite their graphical likeness.

In a smaller number of cases, the reverse issue is manifested. Some phenomena are described identically in the two editions of *Conventional Signs*, but minor graphical differences exist between the two. These differences are often very slight and unlikely to reflect different real-world features and have thus been considered the same symbol in this study. An example of this is the 'palm tree' symbol, the trunk and leaves of which exhibit slightly different angles between the two scales (Fig. 5.4). The extent to which these differences are applied to maps at different scales will not be assessed here, as this will not contribute to the research objectives. Discrepancies in the sizes of symbols between the two documents will also not be considered here, as this may simply be a by-product of the different formatting of the books.

Table 5.2 The First-Level classes with Second-Level divisions and examples of features included in each class

First-Level classes	Second-Level classes	Examples of features included
1.0 Settlements	1.1 Blocks	Fire-resistant blocks, destroyed blocks, planned blocks
	1.2 Individual buildings and parts of buildings	Administrative, industrial or military buildings, ruins, yurts, tents, gazebos, cellars
2.0 Road transport	2.1 Road types	Motorways, highways, dirt roads, footpaths, roads under construction
	2.2 Other road features and information	Level crossings, steep section, road surface boundaries
	2.3 Bridges and tunnels	Road tunnels, metal bridges, wooden bridges, multi-level bridges, footbridges
	2.4 Roadside features	Embankments, cuttings, road signs, bus stops
3.0 Rail transport	3.1 Railway lines	Railways by number of tracks, electrification status, narrow gauge lines, monorails, funiculars
	3.2 Railway buildings and parts of stations	Stations, metro stations, parts of stations, depots
	3.3 Other railway features	Signals, dead ends, embankments, cuttings, lights, tunnels
4.0 Air and water transport	4.1 Air transport	Aerodromes, landing sites
	4.2 Water transport	Ferries, moorings, jetties, piers, buoys, lighthouses, breakwaters, groynes
5.0 Natural resources and utilities	5.1 Fossil fuels and mining—buildings and structures	Oil wells, coal mines, gas tanks, fuel stations, shafts, pipelines
	5.2 Electricity	Power stations, sub-stations, power lines, wind turbines
	5.3 Water	Aqueducts, water pipelines, wells, pumps
	5.4 Other features	Slag heaps, foresters' house
6.0 Religious and burial sites	6.1 Places of worship	Churches, mosques, Buddhist monasteries
	6.2 Burials and shrines	Cemeteries, graves, monuments, burial mounds

(continued)

Table 5.2 (continued)

First-Level classes	Second-Level classes	Examples of features included
7.0 Agriculture and animal enclosures	7.1 Animal enclosures	Paddocks, apiaries
	7.2 Fruit and vegetables	Orchards, vineyards, greenhouses
	7.3 Cereals and industrial crops	Rice fields, arable land
8.0 Boundaries	8.1 Artificial physical boundaries	Fences and walls
	8.2 Political boundaries	International, sub-national and local administrative boundaries
9.0 Geodetic points		Geodetic points, levelling marks astronomical points
10.0 Hydrography and coasts	10.1 Maritime hydrography, coasts and coastal cliffs	Coastal cliffs, mudflats, beaches, underwater stones, tidal directions, reefs
	10.2 Rivers, streams and canals	Rivers, canals, ditches, dykes, sluices, quays, waterfalls
	10.3 River crossings (exc. bridges)	Fords, river boats/ferries
	10.4 Lakes	Lakes, ponds, reservoirs, water holes
	10.5 Springs and sources	Springs, geysers, water fountains
11.0 Relief and geomorphology	11.1 Elevation	Contours, supporting contours
	11.2 Geomorphology and glaciology	Ravines, cliffs, craters, mounds, pits, caves, glaciers, firn fields, ice, snow
12.0 Vegetation and soils	12.1 Woodland, forest, trees and shrubs	Deciduous trees, coniferous trees, palm trees, clearings, scrub, bushes
	12.2 Other vegetation	Meadows, mosses, lichens, lawns and grasses, canes, reeds
	12.3 Soils and sand	Marshes, waterlogged ground, soil, sand, clay, gravel
13.0 Industry and communications (excluding natural resources)	13.1 Buildings and structures	Factory chimneys, towers, mills
	13.2 Communications	Radio and TV masts, broadcasting stations, telephone lines and exchanges

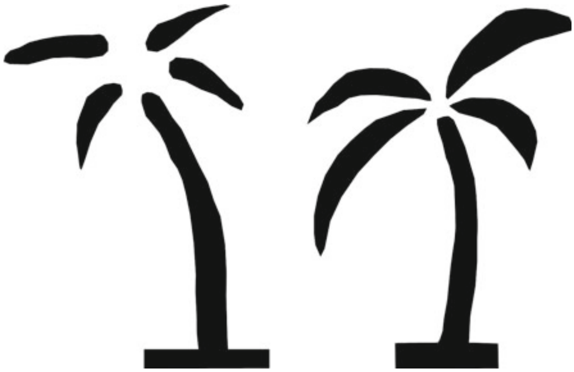

Fig. 5.4 Graphical differences between the 'palm tree' symbols in the 1968 1:10,000 (left) and 1966 1:25,000 (right) editions of *Conventional Signs* (derived from GUGK [6] and General Staff [4], redrawn and enlarged)

5.2 Designing an Analysis of Symbology in Context

5.2.1 Constructing a Sample of City Plans

The selection of city plans to be included in the study was designed to include as broad a range of cities as possible, within the confines of those mapped as part of the city plan series, as well as being approximately representative of the series as a whole, according to the information in Table 2.1. As the objectives of this study are concerned with the application of symbology in different socio-cultural and physical environments, ensuring that a diverse selection of locations is included must be the main priority of the sample, based on metrics which can be used to distinguish cities on these bases. In order to identify cities subject to diverse environmental conditions, the locations of the cities included in the city plan series were assigned to a Köppen-Geiger climate class, using a GIS overlay based on data compiled by Kottek et al. [10] (Fig. 5.5). This overlay was used to ensure that at least one city from each level one Köppen-Geiger climate class was included in the sample, in turn ensuring the inclusion of a range of physical environments.

In order to include the socio-cultural element of the first research objective, a measure of social diversity was incorporated by assigning a 2016 Human Development Index (HDI) value to each city plan. These data are only available at nation-state level, based on current political boundaries. Therefore, in cases in which a city is currently located in a different country than the one in which it was located at the time of the production of the relevant Soviet plan, the HDI value for the modern country has been used. In the construction of the sample, it was ensued that at least one city was included from a country with a HDI value in each decile between 0.4 (low human development) and 0.9 (very high human development). In order to increase the number of HDI values represented, no more than one plan was included from any one country. This also removes the need to differentiate the human development of multiple cities within a single country, as standardised data which could be used for this purpose across the globe is not available. The use of nation-state-level human development data to differentiate cities is not problematic in this analysis, as a precise and detailed measure of development is not required in order to meet its objective of broadly differentiating a small number of cities across the globe. If the symbology of a larger sample, or the whole series, of Soviet city plans were to be analysed in relation to human development, it may be necessary to investigate options for the compilation of more precise, sub-national metrics for this purpose. In such a situation, it should be considered that city-level data would also be aggregated and generalised to an extent, therefore overlooking diversity at larger, sub-city scales. Ivanov and Peleah [7: 6] highlight the potential benefits of geographically disaggregating HDI data but also identify elements of the index's constituent data which are unavailable at various sub-national scales. In any case, the balance between data precision and fitness for purpose must be struck in accordance with the requirements of the analysis being undertaken.

As the development of cities is not the focus of this analysis and the sample of cities incorporated is small, HDI data are not unduly coarse in this context. Conversely, its international standardisation renders it appropriate for a global analysis such as this.

In addition to these considerations, as far as possible, a range of population sizes were included. Given the restrictive effect of the above conditions, the consideration of population could not have a rigorous quantitative basis but instead has been applied approximately. Given that the available population data are subject to local methods of boundary delineation, were compiled considerably more recently than Soviet city plans and, in some parts of the world, are solely based on estimates, any consideration of population in these circumstances can only be approximate. Given the evolving

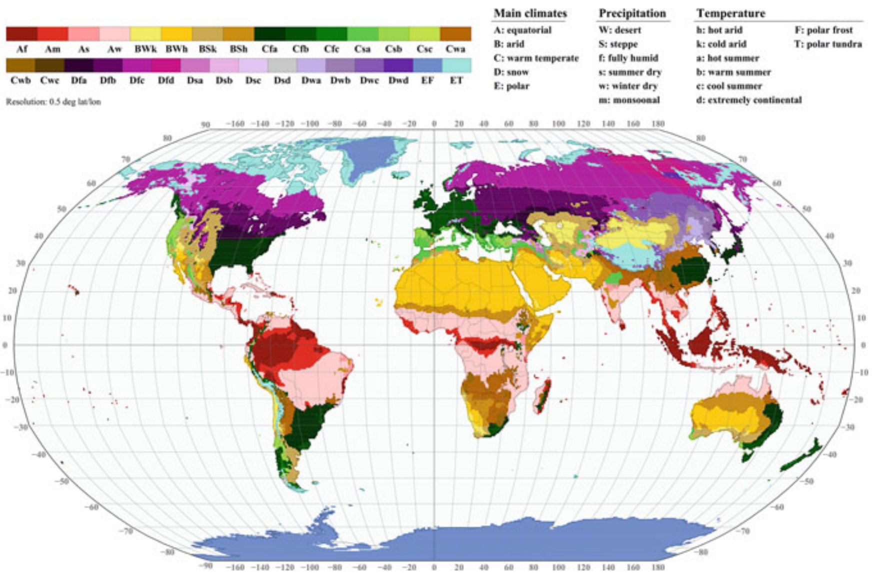

Fig. 5.5 Updated Köppen-Geiger Climate Classification used in the sample selection, adapted from Kottek et al. [10]

styles of Soviet city plans outlined in Chap. 2, it is natural to consider that the application of symbology may also evolve over time. It was therefore considered necessary to ensure a temporal spread within the sample. Specifically, this resulted in the stipulation that at least one plan be included from each rolling three-year period between the introduction of the new compilation manual for city plans in 1972 and the dissolution of the USSR in 1991. This period represents the peak of city plan production, as understood in Fig. 2.4. City plans are here identified based on their edition date, rather than any compilation or printing dates, given the issues associated with identifying plans based on the latter [2, 3].

Another consideration is the number of plans to be included. Given the labour-intensive nature of compiling a comprehensive record of symbols used on topographic maps, the practicalities of undertaking this confine the study to a relatively small number of city plans. Of the 1,899 city plans known to exist, 19 were selected for inclusion; 1% of the total. The nature of the 19 plans selected proportionately reflects the characteristics of the entire series. Of the 1,899 city plans, 1,545 (85%) are at 1:10,000, dictating that 15 plans in the sample should be at this scale. Likewise, there are 324 known plans at 1:25,000, dictating a 17% share of the sample – rounded to the remaining four plans. In addition, all known documents dealing with large-scale Soviet symbologies expressly address 1:25,000 and 1:10,000 maps, making the compilation of comprehensive records of symbology at other scales problematic. It is also acknowledged that further stipulations could have been made with regard to the proportion of plans with a particular number of sheets at each scale. However, these additional conditions would have made the construction of a sample virtually impossible, once all of the other considerations have been made.

It should also be noted that the above conditions for the selection of city plans could not be applied to all 1,899 known city plans, but were instead restricted to those available in the course of this research (i.e. held in accessible institutions). This presents the issue that collections in Europe and North America (which constitute the majority of holdings of Soviet city plans) have a tendency to focus, with some exceptions, the geographic coverage of their collections on these areas. Nonetheless, it was possible to satisfy all of the above-outlined conditions despite this trend, resulting in the final sample in Table 5.3 (Fig. 5.6).

5.2.2 Obtaining the Map Sample

Of the 19 city plans in the sample, ten were already held in digital form by Canterbury Christ Church University and were analysed on-screen (Cairo, Freetown, Port-au-Prince, Frankfurt-am-Main, Gloucester, Tromsø, Boulogne-Sur-Mer, Miami, Halifax/Dartmouth and Canberra). In addition, the plans of Damascus and Sidon are available in the online collections of the National Library of Australia, while the plans of La Paz and Zaragoza are available in the online collections of the Cartographic and Geological Institute of Catalonia. Consequently, these four plans were also analysed on-screen using these repositories. The remaining plans in the sample

Table 5.3 The sample of 1:10,000 and 1:25,000 Soviet military city plans analysed in this study (ordered by scale then population)

Plan title	Edition	Scale	No. of sheets	Primary country covered	Population	HDI (2016) and rank (of 188)	Climate
Cairo	1972	1:10,000	4	Egypt	7,772,000	0.691 (111)	BWh
Damascus	1987	1:10,000	2	Syria	1,711,000	0.536 (149)	BSk
Amritsar	1979	1:10,000	1	India	1,133,000	0.624 (131)	Cwa
La Paz	1977	1:10,000	1	Bolivia	789,585	0.674 (118)	ET
Freetown	1984	1:10,000	1	Sierra Leone	772,873	0.420 (179)	Am
Liaoyang	1974	1:10,000	1	China	728,492	0.738 (90)	Dwa
Port-au-Prince	1983	1:10,000	1	Haiti	704,776	0.493 (163)	Aw
Frankfurt am Main	1983	1:10,000	4	Germany (West)	691,518	0.926 (4)	Cfb
Zaragoza	1990	1:10,000	1	Spain	679,624	0.884 (27)	BSk
Namangan	1976	1:10,000	2	Uzbekistan (USSR)	391,297	0.701 (105)	BSk
Gloucester	1989	1:10,000	2	United Kingdom	123,205	0.909 (16)	Cfb
Sidon	1983	1:10,000	1	Lebanon	80,000	0.763 (76)	Csa
Tromsø	1975	1:10,000	1	Norway	71,590	0.949 (1)	Dfc
Boulogne-sur-Mer	1981	1:10,000 ara>	1	France	43,310	0.897 (21)	Cfb
Topar	1980	1:10,000	1	Kazakhstan (USSR)	9,314	0.794 (56)	Dfb
Johannesburg	1972	1:25,000	2	South Africa	752,349	0.666 (119)	Cwb
Miami	1984	1:25,000	2	United States of America	417,650	0.920 (=10)	Am
Halifax/Dartmouth	1974	1:25,000	1	Canada	390,096	0.920 (=10)	Dfb

(continued)

Table 5.3 (continued)

Plan title	Edition	Scale	No. of sheets	Primary country covered	Population	HDI (2016) and rank (of 188)	Climate
Canberra	1981	1:25,000	1	Australia	358,222	0.939 (2)	Cfb

Fig. 5.6 The sample of Soviet military city plans analysed in this study

are not held by Canterbury Christ Church University, nor are they known to be available via any online collection. As a result, hard-copy plans of Amritsar, Namangan and Topar were analysed in the Maps Reading Room of the British Library, London (UK) and plans of Liaoyang and Johannesburg were analysed in the Geography and Map Division of the Library of Congress, Washington, D.C. (USA). The collection of some data on-screen and others from paper maps is not expected to influence the results of the exercise in any way as the only differences between these two methods are those relating to colour, resolution and the scale at which the map is displayed. As these differences are likely to be slight and only the symbols in use on each map are being counted, such discrepancies will be inconsequential.

5.2.3 Data Collection Process

Beginning at the top-left corner of each plan, each grid square was inspected and each element of the symbology used was marked on a hardcopy sheet of the entire symbology at both 1:10,000 and 1:25,000. An analogue method using pencil and paper was used in order to meet the requirements of the reading rooms in which some of the data collection took place. Although the same restrictions did not apply when data were collected from online maps, the same method was used for consistency. Once a symbol had been marked on the sheet for a particular plan once, it was ignored if used again subsequently on the same plan. In the event of a symbol appearing on a map but not on the symbology list, a description was noted separately along with any additional information from the legend, if available. In cases where an identical symbol appears in the specifications for both scales, the version marked was that which corresponded with the scale of the plan. Where a symbol only appears in the specification at one scale, it was marked, if present, regardless of the scale of the plan under scrutiny. The process accelerated throughout the analysis of each plan, as repeated symbols became more common. The data on the symbology sheets were subsequently transferred to a spreadsheet prior to analysis.

5.3 Comparison with *OpenStreetMap*

The second research objective necessitates a comparison of the Soviet military city plan symbology and the symbology of *OpenStreetMap* (OSM) in order to highlight elements of one which may inform the other. The comparison of the Soviet city plan symbology with the OSM symbology will be undertaken separately, after the collection of data from the Soviet city plans has taken place. This will enable the comparison of OSM data with the Soviet city plan with the highest total symbol count. This has been done in order that the largest possible proportion of the Soviet symbology may be included in this part of the analysis, while still being based on map symbols in context, rather than legends and specifications alone. To this end, an area of OSM data is required which corresponds to the geographical extent of the Soviet plan of Frankfurt am Main, Germany (1983, 1:10,000). The symbology of these data can then be directly classified using the feature classes in Fig. 5.3 and directly compared with the Soviet symbology data for Frankfurt am Main. The full OSM and Soviet symbol specifications can also be compared.

There are several technical discrepancies between OSM and a Soviet city plan which should be considered during this process. Firstly, as Soviet city plans are static, printed maps, the comparison will need to take place with only one zoom level of OSM data, of a total of 19 available zoom levels (Table 5.4).

As no OSM zoom level is equivalent to 1:10,000 (or 1:25,000), zoom level 16 will be used in this comparison (approximately 1:8,000) as the closest available scale to the plan of Frankfurt am Main (Fig. 5.7). As a result, direct comparisons of symbol counts are likely to be less useful than a more holistic comparison of the relative proportions of the symbology in each First and Second-Level feature class, due to the resulting discrepancy in generalisation. OSM also offers several ‘tile layers’ which display OSM data according to different style sheets. Although users can create custom style sheets, there are four ‘featured tile layers’ which are available in

Table 5.4 Comparison of *OpenStreetMap* (OSM) zoom levels with approximate scale and global tile count [11]

Zoom level	Approximate scale	Total number of tiles
0	1:500,000,000	1
1	1:250,000,000	4
2	1:150,000,000	16
3	1:70,000,000	64
4	1:35,000,000	256
5	1:15,000,000	1,024
6	1:10,000,000	4,096
7	1:4,000,000	16,384
8	1:2,000,000	65,536
9	1:1,000,000	262,144
10	1:500,000	1,048,576
11	1:250,000	4,194,304
12	1:150,000	16,777,216
13	1:70,000	67,108,864
14	1:35,000	268,435,456
15	1:15,000	1,073,741,824
16	1:8,000	4,294,967,296
17	1:4,000	17,179,869,184
18	1:2,000	68,719,476,736
19	1:1,000	274,877,906,944

the main OSM interface: Standard, Cycle Map, Transport Map and Humanitarian. The Humanitarian layer is intended to be used in emergency situations, such as in the aftermath of a natural disaster, and uses pale colours to facilitate printing annotation in the field, while maintaining legibility [12]. It also highlights features which may be particularly useful in such situations, such as wells, pumps, fire hydrants, light sources and public buildings (ibid.). As the Soviet city plan series has no explicit thematic focus, mapping data according to availability rather than any particular theme, the Standard tile layer will be used in this analysis as it is similar in this respect.

The OSM symbology data collection will take place online using the standard OSM interface. Symbology will be recorded manually, similar to the data collection from the Soviet city plans. The Soviet plan of Frankfurt am Main will be to hand during this process, for the identification of the sheet extent. As the tile servers of OSM are not open source, as OSM data are [13], a live, online version of OSM will be used. Consequently, the data collection will be carried out on the same day, to minimise the effect of updates during the process, which take place within a few minutes of user edits. As data for only one city will be collected, this is a feasible timescale. A further complication is that the classification devised for the Soviet city plan symbology is not adequate for application to the OSM standard layer. To

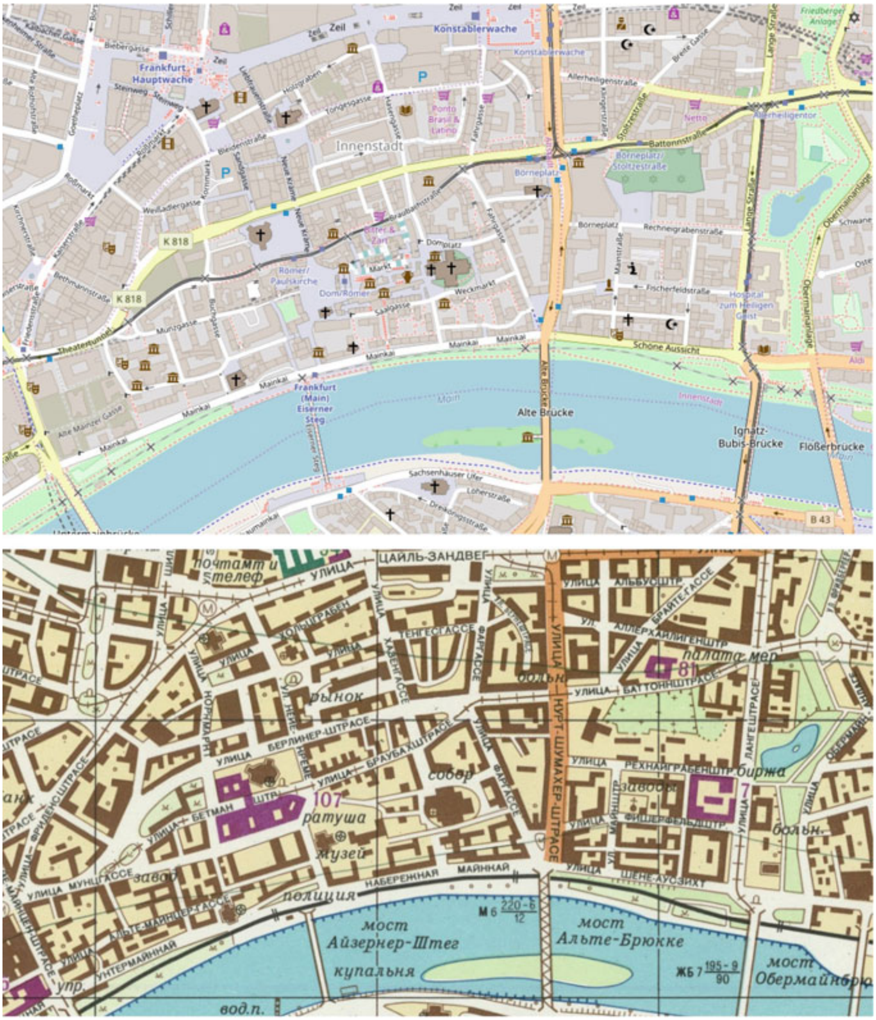

Fig. 5.7 Central part of Frankfurt am Main, Germany on OSM zoom level 16 (approximately 1:8,000) using the Standard tile layer (22nd January 2018) (top) (© OpenStreetMap contributors) and the Soviet plan of Frankfurt am Main (1983, 1:10,000) (bottom) (private collection)

this end, two additional First-Level feature classes will be added to this part of the study; ‘Retail and Restaurants’ and ‘Leisure, Tourism and Public Services’. Within the Soviet city plan symbology, there are no symbols which would be better placed in either of these new classes than the class in which they have already been placed. Although a limited selection of public buildings are marked on the city plans, this is generally done by labelling rather than the use of a specific graphical symbol. As a result, the Soviet symbology data have not been reclassified for this part of the analysis. Beyond these two new classes, the OSM symbology is classified according to the 13 classes used for the Soviet symbology. Given the discrepancies in scale and age between the Soviet city plans and OSM, the finer level of analysis provided by the Second-Level feature classes is unsuitable for this part of the analysis. Chapter 6 outlines the results of the data collection processes explained in this chapter, dealing with the Soviet city plans and OSM in turn.

References

1. Anson RW, Ormeling FJ (2002) Basic cartography, vol 2, 2nd edn. Butterworth-Heinemann, Oxford
2. Davis M, Kent AJ (2017) Improving user access to Soviet military mapping: current issues in libraries and collections around the globe. J Map Geogr Libr 13(2):246–260
3. Davis M, Kent AJ (2018) Identifying metadata on Soviet military maps: an illustrated guide. In: Altić M, Demhardt IJ, Vervust S (eds) Dissemination of cartographic knowledge. Springer International, Cham, pp 301–314
4. General Staff (1966) Условные знаки, топографических карт СССР [Conventional signs for topographic maps of the USSR]. Military Topographic Service, Moscow
5. General Staff (1978) Руководство по картографическим и картоиздательским работам: часть 4 – составление и подготовка к изданию планов городов [Manual for cartography and cartographic reproduction works. Part 4—Compilation and preparation for printing of city plans]. Military Topographic Service, Moscow
6. GUGK (1968) Условные знаки для топографических карт масштаба 1:10,000 [Conventional signs for topographic maps, scale 1:10,000]. Main Administration of Geodesy and Cartography, Moscow
7. Ivanov A, Peleah M (2011) Disaggregating the human development index: opportunities and challenges for local level policy-making. United Nations Development Programme, Bratislava
8. Kent AJ (2007) An analysis of the cartographic language of European state topographic maps: aesthetics, style, and identity. PhD thesis, University of Kent/Canterbury Christ Church University
9. Kent AJ, Vujakovic P (2009) Stylistic diversity in European state 1:50,000 topographic maps. Cartogr J 46(3):179–213
10. Kottek M, Grieser J, Beck C, Rudolf B, Rubel F (2006) World Map of the Köppen-Geiger climate classification updated. Meteorol Z 15(3):259–263
11. OpenStreetMap (2017) Zoom levels. Available at: https://wiki.openstreetmap.org/wiki/zoom_levels. Accessed 22 Jan 2018
12. OpenStreetMap (2017) Humanitarian map style. Available at: https://wiki.openstreetmap.org/wiki/humanitarian_map_style. Accessed 22 Jan 2018
13. OpenStreetMap (2017) Tile usage policy. Available at: https://operations.osmfoundation.org/policies/tiles/. Accessed 22 Jan 2018
14. Oxford English Dictionary (2018) Classification. Available at: https://en.oxforddictionaries.com/definition/classification. Accessed 10 Jan 2018
15. Oxford Essential Russian Dictionary (2010) Oxford University Press, Oxford
16. Roth RE, Finch BG, Blanford AK, Robinson AC, MacEachren AM (2011) Card sorting for cartographic research and practice. Cartogr Geogr Inf Sci 38(1):89–99