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EDITORS:
Vladan Djokić
Aleksandra Djordjević
Milica Milojević
Aleksandra Milovanović
Mladen Pešić

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TABLE OF CONTENTS

Rural linear settlement structures as a typological response to distinct settlement factors: climate, topography, landform, social structure and demography. A discussion based on the analysis of the Pannonian Basin

Daniel Löschenbrand[1], Susanne Tobisch[2], Angelika Psenner[3]

[1] Institute for Urban Design and Landscape Architecture, Faculty of Architecture and Planning, TU Wien), Austria, daniel.loeschenbrand@tuwien.ac.at

[2] Institute for Urban Design and Landscape Architecture, Faculty of Architecture and Planning, TU Wien), Austria, susanne.tobisch@tuwien.ac.at

[3] Institute for Urban Design and Landscape Architecture, Faculty of Architecture and Planning, TU Wien), Austria, angelika.psenner@tuwien.ac.at

ABSTRACT

Linear settlements are present in many rural regions in Europe: from England in the North to Italy in the South, from France in the West to Ukraine in the East. Although the villages vary widely in form and age, as well as in circumstances of their development - from historically grown to planned settlements - the distribution of linear settlements in their general area of distribution area suggests that there are specific conditions that favour their occurrence.

While there are linear settlements alongside canals or streams, as well as villages arranged along features such as village greens (Dorfanger), the most basic form of linear settlement is the street village (Straßendorf). It has a uniform urban parterre structure that serves all essential settlement tasks, such as dwelling, working, supply, recreation, worship, and traffic.

To date, there is a lack of comprehensive research regarding the preconditions for the development and spread of those linear settlements. Through a morphological analysis of relevant urban design factors our research will fill this knowledge gap. To start with, this paper offers first results and insights into analyses of linear settlements in areas of Austria, Slovakia and Hungary. The study is embedded in a recently initiated larger research project concerning the transformative potentials of linear settlement structures in the European area. Besides results, that are to be understood as first approximations, a short historical overview on the most important milestones of local settlement development in the study area is given. Furthermore, morphological analysis of relevant factors, local typologies and patterns of buildings and settlement structures as well as specific spatial qualities of villages are addressed with regard to the genesis of the investigated linear settlements.

Keywords: Linear Settlements, Pannonian Basin, Morphology, Regional Planning

INTRODUCTION

The paper is intended as a starting point for a cross-border systematic consideration of linear settlement patterns in the Austria-Slovakia-Hungary border area. Initial research results and discussions on the topic are presented here, as well as fields of interests and ongoing research activities. After the overall study is completed, final evaluations and the expected in-depth research findings will be published.

For this initial approach, a research area was first defined within the field spanned by the location of the cities of Vienna, Bratislava, Gyor, Sopron and Wiener Neustadt. The majority of the research region is located in Austria and Hungary, which have so far been the main focus of the evaluation. Currently the topic of linear settlement structures is often considered from a local building heritage perspective, with the aim of presenting regional and historical architectural and settlement aspects; while the focus of our approach clearly lies in a morphological development analysis.

To our knowledge there is little recent literature to this specific topic of linear settlement structures from an urban planning perspective. In the course of this, it must also be mentioned that the following work is primarily influenced by German-language literature. The inclusion of Hungarian und Slovak-literature is formulated as a following milestone in the upcoming steps of the research project.

The German-speaking respectively Austrian perspective on the topic of linear settlements is shaped among others, by the work of the architect Adalbert Klaar. For the creation of his maps–the "Siedlungsformenkarten" - he formulated very detailed and specific definitions of the single types of settlements, including the linear settlement types (Klaar, 1942). Due to further definitions, different subtypes, regional differences in interpretation in individual countries and the fact that the settlements studied have meanwhile been expanded and individual buildings partially converted, the present study–in order to create clarity and to focus on the morpho-analysis attempted here–henceforth uses a highly simplified categorization of the different linear settlement types:

- Corridor: a main street with rows of houses on both sides (no distinction between open or closed street front), no classifying width of the central main street an no central public space (Anger). Multi-row linear settlements are also categorized as Corridor.
- Anger: in contrast to the Corridor type, the Anger type has an additional public open or green space in the street space; this zone can also be partially built on.
- Hybrid: when both types–Corridor and Anger–occur side by side in a village/city, or when one of the two mentioned is combined with another special type within the settlement structure.

Background

The selected research area circumscribes a settlement area historically strongly influenced by the Austrian Habsburg monarchy and the Hungarian Aristocracy.

Prior to this, in the early Middle Ages from the end of 8th till the 10th century, the area was shaped among other things, by a colonizing German settlement process under Carolingian Influence as well as by the sedentary settlement of the Magyars in the Basin (Ernst, 1987: 22ff). With regard to linear settlement components in this area, the 11th century probably marks a decisive phase. In this period, further planned colonization with German settlers took place in areas of present-day province of Burgenland (Schickhofer, Schoberwalter and Kaufmann, 1987: 7) and Hungary (Ernst, 1987: 27). Parallel

to this, in the 11th and 12th centuries, a spreading of linear settlements in the province of Lower Austria (neighboring Burgenland and Hungary) is described, whereby these were all laid out in a concerted planned manner as part of colonisation (Miller, 1950: 46, 47). Also for the Burgenland, the use of linear settlement structures in the course of colonization is noted (Schickhofer, Schoberwalter and Kaufmann, 1987: 8). In the 12th and 13th centuries the emergence and development of the "Angerdorf" in Burgenland is depicted (Schickhofer, Schoberwalter and Kaufmann, 1987: 11). For military reasons of defence, the buildings in the villages, for example in northern Burgenland, were built close together and the Corridor and Anger Type prevailed (Schmeller, 1974: 43). Both types were built with clear planning principles. After the regions studied here were affected by heavy destructions during the Turkish Wars in the 16th and 17th century, the villages and linear settlements were rebuilt. In this phase a specific type of linear settlement emerged, the so-called engineer-village, "Ingenieurdorf" (Schmeller, 1974: 44).

From the end of the 18th to the middle of the 19th century a general colonization- and settlement policy took place in the central Danube valley, "Donautal", by the Habsburgs, which particularly affected certain areas of the Pannonian Basin. Villages were founded by the state and private businesses; both favored the linear settlement structure, which then subsequently formed the basis for multi-line settlements or other more complex types. The planning guidelines determined the size of settlement and population, as well as the distribution of fields and the type of cultivation (Miller, 1950: 63, 64). In the Habsburg Empire, a kind of genesis of settlement planning developed during this period, with different design guidelines and parameters (Miller, 1950: 66, 67). There were a variety of regulations, for instance the Hungarian State Chancellery in Vienna, which was also responsible for the already mentioned Burgenland, prescribed the planting of trees to prevent fire flashovers. (Bauer, 2023: 162). Since the second half of the 19th century, as the non-farming population increased, small buildings and settlement structures were built compactly next to the existing farm houses in the same but smaller scheme (Kleemaier-Weltl, 2023: 156); thus representing the first settlement extensions that did not reflect the main agricultural sense.

It can be argued that the chronology of the village structures, which is very abbreviated and not fully outlined here, ultimately led in the end to very homogeneous settlement patterns in large parts of the empire, with the associated linear settlements being rather defining and formative for the landscape. The widespread typological components for the linear settlement structures in the study area and beyond were, on the one hand, long lots combined with open-field and three field farming and, on the other hand, narrow but deep plots along the main road/"Anger" with the typical rural buildings on them: "Streckhof", "Zwerchhof" or "Dreiseithof" respectively „Doppelhakenhof".

With regard to the research area, two very different settlement developments can be observed in Austria and Hungary in the phase after the second World War:

Austria was marked by a phase of reconstruction and economic upswing, which ultimately led to major transformations in the linear settlements. Triggered by significant changes in agriculture, such as the extensive decline in livestock farming, meadows that were no longer needed near settlements were often redesignated as building land and filled in with settlement extensions, mostly in a grid structure. This is associated with the development of single-family-houses and the beginning of the urban sprawl, that continues to this day. A further significant transformation occured in the settlement core, where the old farmhouses were frequently expanded by an additional storey (Kleemaier-Weltl, 2023: 158, 159).

In the same time was a completely different development in Hungary, where agriculture was collectivized: farmhouses no longer needed their own farm buildings or barns, so that these increasingly disappeared from the village landscape. At the same time, with the cube house "Kádár Kubus" a uniform house type was created for settlement expansion and transformation. These new houses were integrated into the existing long parcel system; a new linear settlement type was realised by connecting these buildings with new access roads (Kleemaier-Weltl, 2023: 159). This pattern characterises the rural areas of Hungary even beyond the research area.

METHODOLOGY

Frame

The area spanned by the cities of Vienna, Bratislava, Gyor, Sopron and Wiener Neustadt forms the research area and includes settlements from 13 counties and 4 federal provinces: Niederösterreich (AUT), Burgenland (AUT), Bratislava (SVK) und Gyor-Moson-Sopron (HUN).

With focus on the rural aspect, all villages and towns are considered and only the district capitals are excluded. In order to analyse the individual aspects and qualities, three Phases with different scale levels were defined. On a large-scale level phase 1 describes a first approximation and recording of all settlements that still exhibit a historically linear settlement structure. In phase 2, a selection of surveyed villages is analysed for single spatial parameters and urban patterns are presented. In phase 3, selected settlements are examined in more detail and urban qualities are addressed.

Phase 1

Based on the approach of Klaar's "Siedlungsformenkarte", the linking of categorization and mapping of settlement-types, a new settlement-based mapping is developed, which focuses on the geographical orientation of the historical linear settlement centre.

In order to achieve the most efficient management of the land, historical linear settlement layouts paid particular attention to geographical features. Thus, landscape and topographic components such as hills, forests, canals or streams as well as soil conditions were decisive. In addition, wind and other climatic influences also played a role in the alignment (Miller, 1950: 64, 65).

In phase 1 over 270 settlements were considered, and in around 65% of them historical and actual qualities of linear settlements structures could be identified according to the three types: Corridor, Anger or Hybrid. Both, Klaar's "Siedlungsformenkarte" and the Arcanum web portal (Arcanum: Franziszeische Landesaufnahme) are used as data basis for this historical consideration.

The Classification of orientation is north/south, west/east, northwest/southeast, southwest/northeast as well as north/south–west/east. The last category can arise if, for example, two settlement cores are found within a village or town.

Phase 2

Based on the 176 linear settlements surveyed in phase 1, a representative cross section of 20 villages is identified, whereby at least one settlement per district (within the study area) must be represented in

each case. Further selection criteria are the proper representation of the three types (Corridor, Anger and Hybrid) and the geographical orientation as well as the urban structure of the settlement itself.

The aim is to identify urban development patterns, and subsequently to derive different parameters and qualities of individual types and possible cultural and regional imprints. Various parameters are examined here: quantitative aspects such as distances to water bodies or higher-level road networks, number of inhabitants, the dimensions of the local centre as well as further points of interest–those points of interest are seen as indicators of the frequency of activity (residents and tourists) by capturing the number of shops, restaurants, banks, hotels, etc.

An attempt is also made to determine the type and scale of the settlement expansion in comparison to the settlement centre. Furthermore, the relationship between the linear settlement and the road system is examined, as well as whether the ancient major road still holds the highest significance within the neighbourhood street system. Additionally, it is examined to see if distinctive topographies can be found nearby or if unique structures like industries or castles had an impact on the growth of the settlement.

Table 1. *Profile recorded for each linear settlement*

Collected Data: Metropolitan Region Wien - Bratislava - Györ - Sopron - Wiener Neustadt

Geography	Geographical Orientation of the historic linear settlement	North/South	West/East	North-South/ West-East	Northwest/ Southeast	Southwest/ Northeast
	Distance to water	0 - 2km	2km - 4km	4km - 6km	6km - 8km	> 8km
	Characteristic topography	Yes	No			
Spatial Structures	Length of the local center of the linear settlement	0- 400m	400m- 600m	600m- 800m	800m- 1.000m	> 1.000m
	Extensions of the linear settlement	Linear structures	Grid structures	Both		
	Number of Points of Interest (Gastronomy, Shops,…)	0- 5	6- 10	11- 20	21- 30	> 30
	Characteristic special objects (Castles, Factories, Others)	Yes	No			
Mobility	Distance to current superordinate road network	0- 2km	2km- 4km	4km- 6km	6km- 8km	> 8km
	Connection of the settlement (local center) to the road network	Central	Parallel	Across	Other	
Society	Population	0- 1.000	1.000- 2.000	2.000- 4.000	4.000- 6.000	> 6.000

Phase 3

With one village from Hungary and one from Austria, the objective is to demonstrate morphological distinctions and various qualities in phase 3, which will focus on two settlements chosen out of phase 2. In addition, a third linear settlement is included as a comparison object, a special form of Anger settlement - the geometrically precisely laid out "engineer village". The aim is to convey an understanding of how the settlement layout works and what spatial qualities are associated with it.

In this phase, the morpho-analytical UPM-method (Urban Parterre Modelling) developed by Angelika Psenner, is applied in an adapted and highly simplified way. The idea of the UPM-method is to represent the functioning of the urban parterre system, consisting of the street space, the ground floor zone and the courtyards. A holistic application of the method, with the collection of historic data on streets and buildings in archives, the representation and comparison of historical and current uses in the ground floor zone, the three-dimensional modelling of the buildings and the street space, etc. is also considered as an outstanding milestone. For the current time a mapping of the present uses, affecting the ground floor zone, was carried out (the online mapping services Google Maps and Openstreetmap were used as data basis). Furthermore, schematic street sections were created, to illustrate local urban qualities and relations between street space, buildings and courtyards.

RESULTS AND DISCUSSIONS

Phase 1: The results of phase 1 with 176 evaluated structures show that there is no generally applicable preference with regard to the geographical orientation of the linear settlements: 29% northwest/ southeast, 23% southwest/northeast, 23% north/south, 17% east/west und 8% north/south–west/ east. Geographical connections as well as important road systems were probably decisive for the lo-

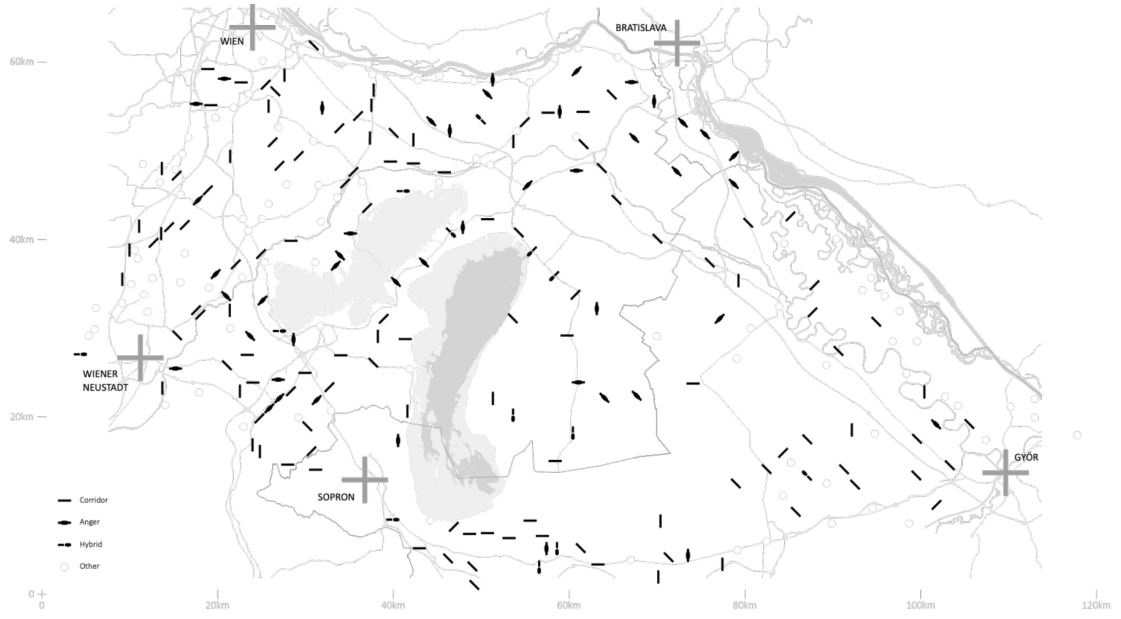

Figure 1. *A settlement-based map, with focus on the geographical orientation of the historical linear settlement centre, © Loeschenbrand/ Tobisch/ Psenner (Datasource for map basis: OpenStreetMap, ODbL)*

cation and orientation. A corresponding spatial pattern can be seen along the river "Leitha", where almost all linear settlements run parallel to the river. If the superordinate parameters did not clearly determine the layout of the linear settlement, factors such as wind could be determinant. In this sense the northwest/southeast orientation, i.e. the category with the largest proportion, corresponds to one of the main wind directions in parts of the research area.

A fundamental finding of this phase 1 is the fact that, from a morphological point of view, geographical und climatic design principles were often decisive for the functioning of linear settlements.

Phase 2: From the current state of analysis and the evaluation of the collected data so far from the 20 selected linear settlements, it was possible to define an archetypical linear settlement of the research area: a Corridor type with northwest/southeast orientation and a population between 2.000 and 4.000. The distance to a water body is less than 2km, a characteristic topography is not given. The centre of the linear settlement is between 600m and 800m, the most important and busiest road is still the central main street of the settlement and the distance to a superordinate road network is under 2km. The settlement expansion consists of linear and grid structures development. Special objects are not identifiable and the number of points of interests is between 6 and 10.

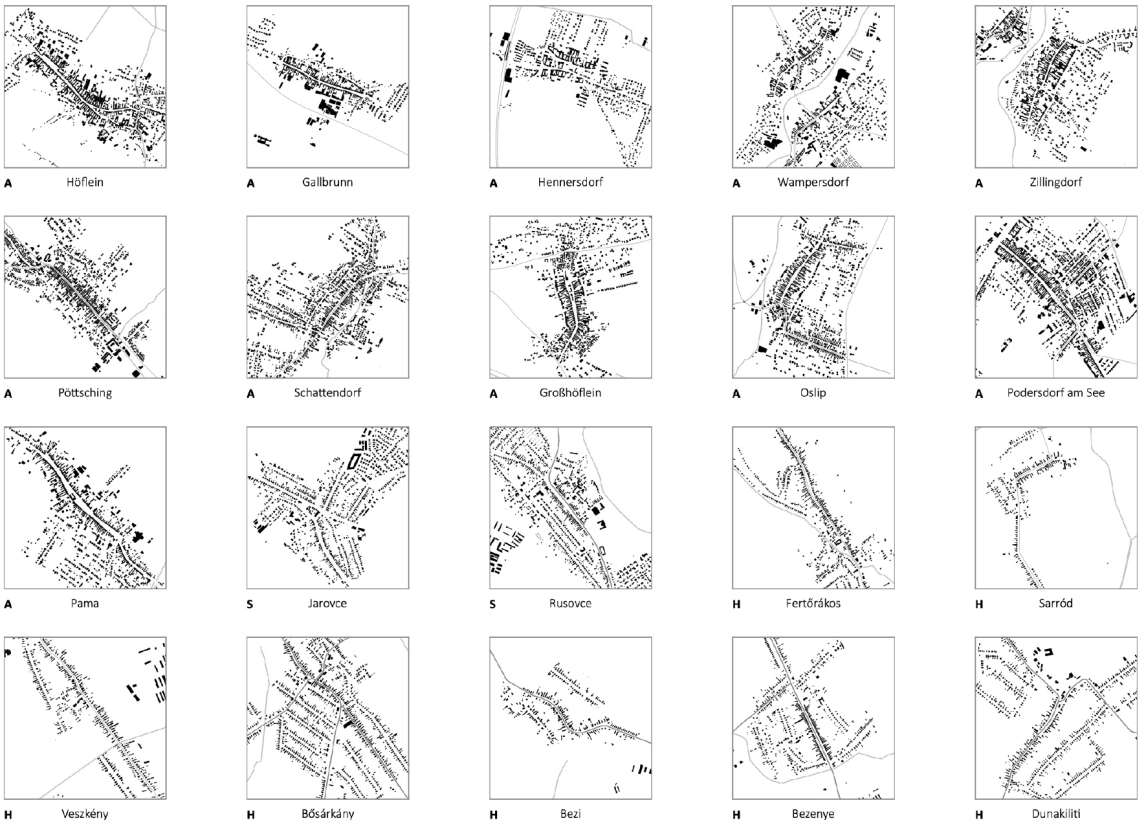

Figure 2. *Structural plans of the selected linear settlements (Phase 2), © Loeschenbrand/ Tobisch/ Psenner (Datasource: OpenStreetMap, ODbL)*

The distinction between the linear settlements from Hungary and Austria in terms of settlement expansions and density levels is clear when looking at the existing structural designs of the chosen communities (Figure 2).

The various developments in the second half of the 20th century, which have already been discussed under the heading “Background” may have played a key role. The villages studied in Slovakia, all of which correspond to the Anger type, show similarities to Hungarian settlements in terms of density and are more comparable to line settlements from Austria in terms of settlement extent.

The study on the parameters of the selected linear settlements represents a first approximation and an preliminary status. The anticipated more in-depth investigation and evaluation should yield more intriguing results that will help us understand how villages work and the typological characteristics of linear settlements both historically and geographically.

Phase 3: With regard to spatial qualities, it is planned to apply further principles of the UPM method to the selected settlements of phase 3, such as the comparison of historical and current use or the three-dimensional modelling of the main street and the buildings.

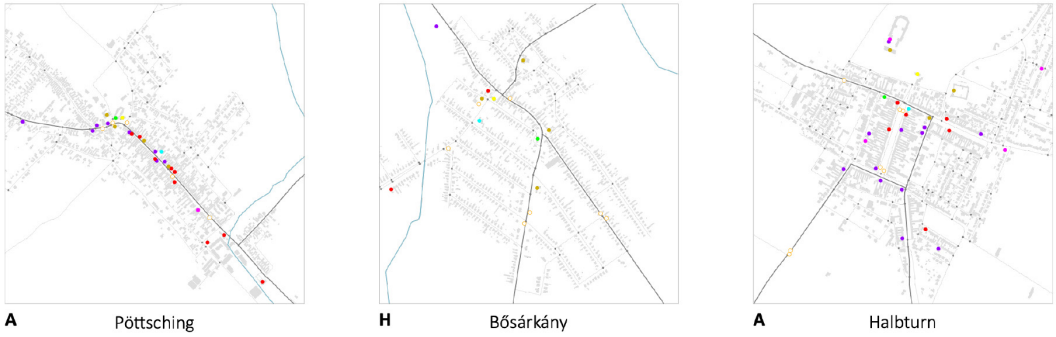

Figure 3. *Mapping process of ground floor uses (Phase 3), © Loeschenbrand/ Tobisch/ Psenner (Datasource for map basis: OpenStreetMap, ODbL)*

However, the applied method of mapping and the representation of qualities in the sections, already allow for making first statements on various qualities:

It can be seen, that linear settlements with a more compact and denser settlement core, as can also be found in isolated cases in Hungary, the points of attraction tend to be located on the main street and thus strengthen its linear core and show more urbanity. Moreover, in the dense agglomerations with connected street fronts, the permeability of the facades – i.e. how entrance doors and gates influence the Stadtparterre experience (Psenner, 2023) – is clearly different from settlements with a looser density, where driveway gates are characteristic. This also results in a different approach to parking in public space. Another interesting field is the transformation of the old farmhouses and original building typologies, some of which have changed considerably in the second half of the 20th century.

All these theses, themes and topics are to be addressed in ongoing research process.

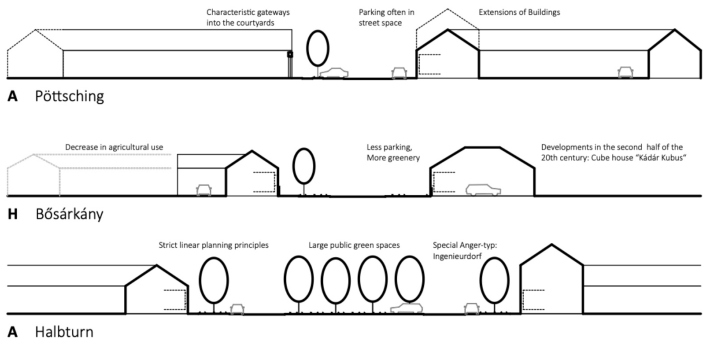

Figure 4. *Sections of the selected linear settlements (Phase 3), © Loeschenbrand/ Tobisch/ Psenner*

CONCLUSIONS

The consideration of the linear settlements in this selected research area already reveals the importance and diversity of potentials for further research in this typology. This is not only about understanding an urban historical heritage, but much more about questions of whether and how we can possibly counter the urban sprawl in rural areas with appropriately infrastructurally equipped and compact village structures. This requires in particular a morphological and systematic knowledge of the existing components and structures.

The network of the linear settlement structures in the selected research area also shows the aspect of distances and connections to higher-level structures. Connected to this is an important facet of the topic that has not yet found space in the research project, but is elementarily important for the structure and design of linear settlements, namely mobility and traffic.

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