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Viabundus: Map of Premodern European Transport and Mobility

Social and Economic History

Bart Holterman | ORCID: 0000-0002-6414-4092

Institute for Regional History, Georg August University, Göttingen, Germany
bart.holterman@uni-goettingen.de

Maartje A.B. | ORCID: 0000-0002-8379-8585

Radboud Institute for Culture & History, Radboud University,
Nijmegen, The Netherlands
maartje.ab@ru.nl

Kasper H. Andersen | ORCID: 0000-0003-2069-4516

Moesgaard Museum, Højbjerg / Aarhus, Denmark
kan@moesgaardmuseum.dk

Maria C. Dengg | ORCID: 0000-0003-3614-9651

Department of History, Otto von Guericke University,
Magdeburg, Germany
maria.dengg@ovgu.de

Niels Petersen | ORCID: 0000-0003-3593-1932

Institute for Regional History, Georg August University,
Göttingen, Germany
niels.petersen@phil.uni-goettingen.de

Abstract

Viabundus is an open access online interactive map and database on roads and mobility in premodern northern and central Europe. The database covers the period 1350–1650. It is designed as a network model and includes digital reconstructions of long-distance land routes and inland waterways as well as a database with information about settlements, towns, toll stations, staple markets, fairs, bridges, ferries, harbours

and shipping locks. This makes it possible to use the dataset for advanced analyses with methods of GIS and network analysis. With the web application and downloadable dataset, the Viabundus project has created a tool for the analysis of premodern mobility for economic (transaction costs) and all other kinds of historical study involving movement of people and goods.

Keywords

pre-modern routes – GIS – economic history – urban history – transport – mobility – network– digital humanities

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- Related data set “Viabundus map of premodern European transport and mobility” with DOI [www.doi.org/10.5281/zenodo.6459474](https://doi.org/10.5281/zenodo.6459474) in repository “Zenodo”

1. Introduction

During the last decade, multiple projects have been launched that use digital GIS tools for the study of premodern travel and to estimate historical travel routes and times, pioneered by the *ORBIS* geospatial model of the Roman empire (2012).¹ Lacking so far was an integrated dataset that combines detailed reconstructions of the historical infrastructure network with an international scope in late medieval and early modern Europe, which is where the recently launched *Viabundus. Map of premodern European transport and mobility* comes in. The main goal of the dynamic Viabundus map and dataset is to provide scholars with a means to visualise and analyse all kinds of movement of people and goods bound to long-distance land routes and inland waterways

¹ <https://orbis.stanford.edu/orbis2012>. Other recent projects that depend on GIS for studies of premodern travel are, for example, Mercator-e (<https://fabricadesites.fcsh.unl.pt/mercator-e>) for the Iberian peninsula from Roman times to the 19th century; Viae Regiae (www.viaeregiae.org/) for the transport network of England and Wales in 1530–1680; the Cambridge Group for the History of Population and Social Structure's *Transport, urbanization and economic development in England and Wales, c.1670–1911* (www.campop.geog.cam.ac.uk/research/projects/transport); the Urban Occupations project (<https://urbanoccupations.ku.edu.tr>) for the Ottoman Empire, and the Atlas Fontium (www.atlasfontium.pl) of the Historical Institute of the Polish Academy of Sciences.

within the period 1350–1650 in northern and central Europe. As such, it features digital reconstructions of the road and waterway network, combined with a historical gazetteer of places along these routes. As a living dataset, it can be expanded to other regions and refined in the future.

The Viabundus dataset connects regional studies of the premodern infrastructure network for a large part of Europe and is a first step towards more reliable estimations of historical travel distances, times and transportation costs. These might provide a better understanding of relations between, for example, places, people, institutions and objects in the study of various kinds of mobility (O'Doherty & Schmieder, 2015; Zenobi, 2021). Physical travel and transportation are important factors in many fields, for example, in the study of migration and social mobility (Kuijpers, 2005), communication (Behringer, 2006; Lowagie, 2012), the history of ideas and knowledge (Jöns et al., 2017), pilgrimage and military history. However, Viabundus is in the first place designed from the perspective of economic historical research, where transport-related costs play an important role in the theory of transaction costs (Jenks, 2005). For this reason, data is included about toll stations, staple markets and fairs.

Viabundus consists of both an online map application (see Figure 1) with tools for basic visualisation and analysis, as well as the underlying open source dataset, which can be downloaded for more advanced analyses with other applications. The present article presents the structure of the dataset and its sources rather than the web application itself. Also, a geospatial analysis of the data will have to be the topic of a future article. Moreover, it should be noted that due to the large scope of the dataset, it is impossible to discuss each element in detail in this article. For more detailed information about the dataset and the workings of the web application, the reader is advised to consult the extensive documentation files (Dengg, 2020; Holterman et al., 2021).²

2. Methods and Sources

The Viabundus dataset is primarily focused on long-distance routes, i.e. the connections between the main economic and cultural centres. Theoretically, routes are not identical to roads, which are the physical paths embedded within the landscape and defined by geographical conditions. Although one needs

2 The documentation for the Viabundus project consists of a general documentation file as well as separate documentation files for regional subprojects. They can be found on the project website as well as in the repository.

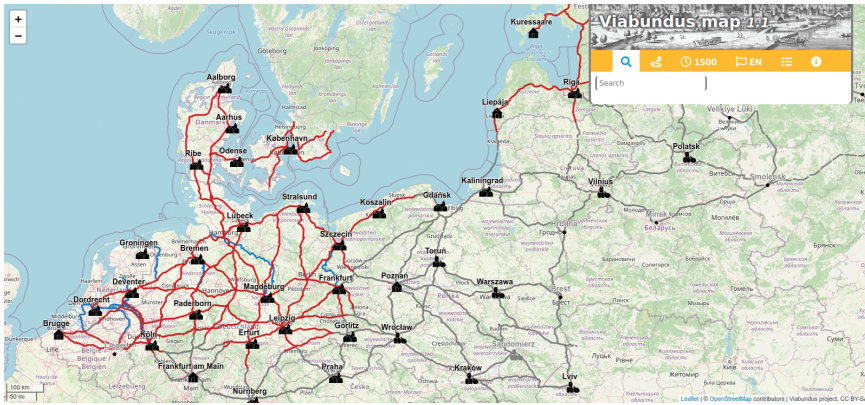


FIGURE 1 Screenshot of Viabundus 1.1

to necessarily follow a road in order to travel a route, the roads can change over time, or multiple alternative roads can exist within a route (Robert, 2009). Since Viabundus aims to map the course of historical roads most likely used by long-distance travellers as exactly as possible, in practice the dataset includes the roads that formed the routes. However, it has to be kept in mind that the displayed roads were not necessarily the only possible way to reach a certain place.

Viabundus is conceived as a network model, where points (called *nodes*, i.e. places of interest for travellers) are connected through lines (*edges*, i.e. the roads and waterways one used to travel from one node to another). All elements can be supplied with additional information. In doing so, Viabundus roughly follows the model designed by *ORBIS* (Scheidel et al., 2012). The Viabundus map is connected to a database with additional information relevant for various aspects of travelling, such as information about settlements and towns, tolls, staple markets, fairs, harbours, bridges, ferries and shipping locks.

As a first step, the road network from the study *Hansische Handelsstraßen* (Bruns & Weczerka, 1962, 1967) was digitised. It contains an atlas as well as elaborate descriptions of long-distance trade routes and places along them in the region of the main inland activity of the German Hanse, a community of merchants and towns with shared commercial interests. This approach also defines the initial geographical extent of the database, which reaches from Flanders in the west across the southern North Sea and Baltic Sea coasts and adjoining regions to the current-day Baltic states and Veliky Novgorod and Moscow in the east. These routes were roughly digitised according to the modern road network.

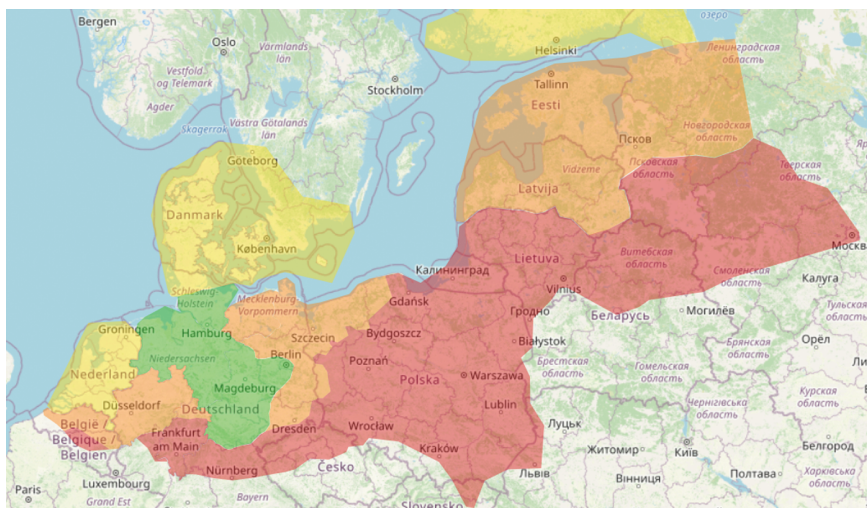
In a next step, the transportation network was refined and elaborated for selected regions, to move away from a Hanseatic perspective and to make the map and database applicable to research on other topics. This was done according to the following four guidelines:

- 1) More precise and historically accurate mapping of the historical roads. This is primarily based on the results of previous regional research on historical roads (*Altstraßenforschung*) (e.g., Denecke 1969, 1979; Fütterer, 2016) or already existing datasets such as the [Kaart van de verstedelijking of the Rijksdienst voor Cultureel Erfgoed](#) (Kosian et al., 2016, largely based on Horsten, 2005). In regions where such studies were not available, we turned to contemporary historical sources such as itineraries (e.g., Schwarzwälder & Schwarzwälder, 1987) and historical maps from the 16th and 17th century (e.g., Blaeu, 1664–1665). However, because these are often not detailed enough for accurate reconstructions of historical roads, they provided the waypoints, whereas the reconstruction of the course of the roads was based on the first detailed triangulated maps from the 18th and early 19th century (e.g., Arnoldt et al., 2006; Wiebeking, 1961–1969). Given the large number of sources used in this process, we only mention a few examples here; a full list can be found in the documentation files.
- 2) Inclusion of all towns within the selected regions and the connections between them. Towns are considered important political and commercial centres within the regional road systems in the period under discussion. They were included according to regional repertoires of historical towns (Cox, 2012; Keyser, 1939–1974; Kristensen & Poulsen, 2016).
- 3) Inclusion of navigable inland waterways, which provided an important alternative transportation system to the land routes in many regions. Included were only those natural waterways that are attested as transportation routes between settlements between 1350 and 1650 (e.g., Eckoldt, 1998; Peters, 1913) and (barge) canals constructed before 1650 (e.g., De Vries, 1981; Müller, 1989). Not included as navigable waterways are those rivers and canals that only served the transport of raw materials such as (floated) timber and peat from the point of their extraction to the nearest distribution point (harbour). The maps used for the reconstruction of the course of the rivers are largely the same as those for the land roads.
- 4) Inclusion of information about toll stations, fairs, staple markets, bridges, harbours, ferries and shipping locks in the selected regions with the help of additional secondary literature.

3. Consistency and Reliability of the Data

Viabundus was designed as a “living” dataset, in which data can be refined or to which new data can be added. Changes will be released as regular updates to the dataset, whereas older versions will remain available for download. This allows a regional approach in which information for well-researched regions is already made available to users while research on other regions is still being carried out. Moreover, it provides the opportunity to incorporate the feedback of users of the database, such as local experts.

This also means that the quality and density of the dataset differs from region to region. The current version 1.1, released on 6 December 2021, contains the roughly digitized street network from *Hansische Handelsstraßen*. The regions of the modern German states of Lower Saxony, Saxony-Anhalt, Thuringia and parts of Brandenburg can be considered complete according to the guidelines described above. Moreover, the street networks of northern Germany, the Polish West Pomeranian voivodeship, Denmark, the Netherlands, Estonia, Latvia and the Russian region around Veliky Novgorod have been corrected for historical accuracy and extended, whereas work on the Netherlands and Denmark is still being undertaken (see Figure 2). A subproject that reconstructs the Finnish transport network has recently started (see <https://projects.tuni.fi/viabundus-finland>).



Note: Green: ready; yellow: extended research in progress; orange: road network reconstructed with historical maps, no further research planned yet; red: rough digitization of the road network with modern maps, no further research planned yet.

FIGURE 2 The state of research in the regions covered by Viabundus 1.1

Of course, the regional variation in the data has practical consequences, because reliable spatial analysis requires consistent data. Therefore, care has been taken to indicate the state of research in the database for the user. A clear distinction is made between the edges that are only roughly digitised from *Hansische Handelsstraßen* and those that have been refined for historical accuracy. For the nodes, a “ready” field is marked when the data for the node can be considered complete and reliable according to the guidelines. The distinction between these elements is clearly displayed in the Viabundus web application with a green checkmark (see Figure 3) and different colours (see Figure 1). Moreover, the state of research for each region (see Figure 2) will be displayed as a layer on the web map in future versions.

Even within the regions considered complete according to the guidelines above, a number of challenges influence the consistency of the data: historical uncertainties, gaps in the sources and changes over time, as well as lacunae in research and the uneven character of the source material between regions. In order to deal with these inevitable challenges, every element in the database contains a description field and can be dated by supplying the years between which the element existed. Moreover, source references are supplied for the nodes and edges, which allows users to find more information about single elements and to identify the lacunae in the dataset.

4. The Dataset

- **Viabundus map of premodern European transport and mobility deposited at Zenodo** – DOI: www.doi.org/10.5281/zenodo.6459474
- **Temporal coverage: 1350–1650**

Viabundus consists of a database as well as a web application. The user interface of the web application is displayed as an interactive map, which can be used to explore the data (see Figure 3). Moreover, the web map includes basic tools for analysis, such as a simple route planner with estimations of travel times for various modes of travel, and a calendar of fairs for a chosen year and region. Both tools are still in a beta version and will be improved in future versions. Due to the scope of this article, their exact workings will not be elaborated here, but these are described in the documentation.

The dataset used for generating the web map is stored as a relational SQL database, which can be downloaded in the csv or GeoJSON formats. Because of the network model described above, the database is built up around two main tables containing the nodes and edges (see Figure 4).

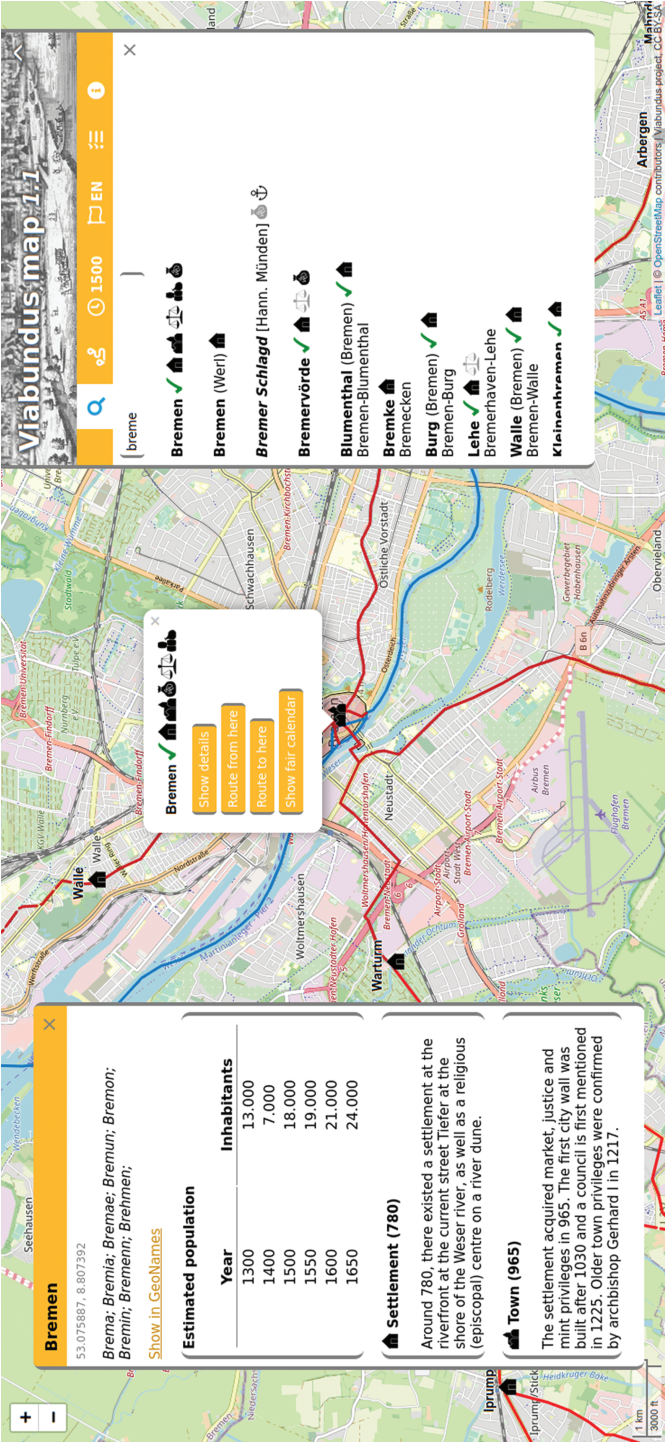
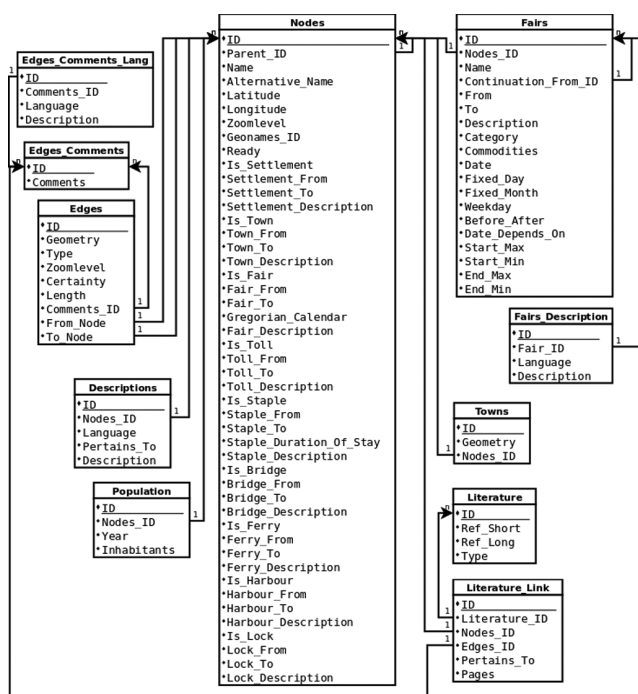


FIGURE 3 Screenshot of the Viabundus web application, version 1.1



Note: Descriptions of the tables and fields can be found in the documentation.

FIGURE 4 Database schema of the Viabundus dataset

Nodes are defined as any place along the route where something happens or that could require an action of the traveller: reach a destination, change the road, pay a fee, change means of transportation, and so forth. All nodes are supplied with coordinates. Optionally, the node has a name according to the modern official name in its national language, alternative names (either modern variants or historical names and spellings), the ID number of the place in the [Geonames database](#), and a ready checkmark to indicate the state of research for the selected node.

In its basic form, a node is a mere junction. In order to provide more information about the character of a node, it can be supplied with one or more attributes. Each of the nine attributes contains information on the period of the existence of this attribute and possible additional information in a full-text description.

The *settlement* and *town* attributes describe the basic character of the node as places inhabited by humans. This usually indicates a village, but monasteries, farms, inns, watchtowers, and so forth are considered settlements as well. For towns, a short description of the reasons for qualifying a settlement as town (usually the granting of town rights) is provided.

The *toll*, *staple* and *fair* attributes are included because they describe important factors for commercial travel. Tolls have been defined as any kind of transit fee that travellers had to pay while on the road, i.e. road tolls, customs, fees for safe conduct (*Geleit*), and so forth (Pfeiffer, 1997; Straube, 2015). Settlements with staple rights significantly influenced traffic flows, as they could prohibit commercial travellers to use roads that circumvented the staple market and force merchants to offer their commodities on the local market for a certain number of days (Gönnenwein, 1939).

Fairs were the primary venues of long-distance trade in the Middle Ages and early modern period, and also have a strong temporal component because they took place at certain times of the year (Irsigler & Pauly, 2007). For this reason, nodes with the fair attribute are connected to a separate table that contains information about individual fairs that took place within the selected settlement.

Harbours have been defined as places where it was possible to change between land and water ways. *Bridges* and *ferries* provide important points where land ways had to cross bodies of water. Finally, *locks* were constructed to increase the navigability of a waterway, but were also barriers that often forced vessels to halt for a certain amount of time.

Edges are geospatial representations of the land roads and waterways that connect the nodes. They are divided into three types: land, water and ferry routes (the latter correspond to the ferry attribute of the connected nodes). Next to the actual geometry, each edge is supplied with additional information such as length and the accuracy of the reconstruction. Edges for which the historical course is uncertain are displayed with a dashed line on the Viabundus web map; this goes among others for all initially digitised roads from *Hansische Handelsstraßen* that were not corrected for historical accuracy, which are furthermore displayed in a different colour (see Figure 1).

5. Concluding Remarks

With the online map and dataset, the Viabundus project provides researchers with a digital tool for the study of mobility in large parts of premodern Europe, which would be of use for purposes of visualisation and analysis in many different research fields. Monastic landscapes, individual movement such as pilgrimage, economic data such as credit networks or various kinds of communication are topics that promise additional insight when combined with the Viabundus map. Additionally, the open access downloadable dataset makes it possible for those acquainted with GIS and network analysis techniques to

use the data to perform more advanced structural studies of the premodern European transportation network.

Reliable spatial analysis is limited to the well-researched regions, but the usefulness of the dataset will continue to grow as the dataset and web application evolves. The primary goal of future versions of Viabundus will therefore be the improvement of the data for regions already covered by the dataset and the extension to regions not yet included. This also includes the mapping of sea routes as a crucial element in long-distance transportation in coastal areas. On a technical level, an important task will be linking the dataset with the Semantic Web, such as Wikidata and the [World Historical Gazetteer](#), to allow exchange with other datasets. With regards to the web application, the development of a more advanced routing algorithm, which includes, for example, parameters on seasonality or ruggedness, will be of benefit for researchers working with methods of network analysis.

Questions, suggestions and collaboration possibilities are most welcome at info@viabundus.eu.

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