



Geospatial Data for the Medieval Road System in the Levant (Bilād al-Šām) from the Project 'VIA-TARIQ: Analysing the Long-Term Change and Persistency of the Roman Road System in the Levant'

DATA PAPERS

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 ubiquity press

ABSTRACT

The dataset represents the reconstructed Medieval (Early-Middle Islamic, ca. 650-1517 CE) road network with associated sites (settlements, road stations, forts, bridges, etc.) in the historical region of Levant/Bilād al-Šām. The data were compiled from selected Medieval Arabic geographic sources and published historical and archaeological evidence and previous attempts to reconstruct the Medieval road network in various periods and regions of the Levant. The roads and sites were identified and geolocated using modern and historical satellite imagery and georeferenced topographical maps. By integrating and digitising dispersed historical and archaeological data in a geospatial database the dataset will facilitate further research on the terrestrial transport networks in the Medieval Islamic world and will allow for a large-scale quantitative geospatial and network analyses.

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KEYWORDS:

Roads; Transport network; Near East; Bilād al-Šām; Settlements; Road stations; Bridges

TO CITE THIS ARTICLE:

Pažout A 2026 Geospatial Data for the Medieval Road System in the Levant (Bilād al-Šām) from the Project 'VIA-TARIQ: Analysing the Long-Term Change and Persistency of the Roman Road System in the Levant'. *Journal of Open Archaeology Data*, 14: 23, pp. 1–9. DOI: <https://doi.org/10.5334/joad.231>

(1) OVERVIEW

CONTEXT

The geospatial data for the Medieval road system in the Levant/Bilād al-Šām were collected in the context of the project 'VIA-TARIQ: Analysing the long-term change and persistency of the Roman road system in the Levant'. The goal of the project was to 1) analyse the long-term development of the terrestrial transport network from the Roman to the Medieval period, 2) analyse the persistency of the Roman transport infrastructure (roads, stations, etc.) in the Medieval period. Dalgaard et al [1] previously claimed that there is little continuity between the Roman and modern road network in the Middle East and North Africa (MENA) region, based on their analysis of Roman road network digitised from the Barrington Atlas [2, 3] and Medieval caravan routes. Knowing the deficiencies of the datasets that Dalgaard et al used in their large-scale continental-wide analysis (low resolution and accuracy of the geospatial data, biases in data collection and publication of the Barrington Atlas, low representativity of the caravan routes for the complete Medieval road system, etc.) it was decided to take their conclusions as a starting point and to test the hypothesis stating

there is low continuity between the Roman and the Medieval road network in the case of the Roman Near East. While the Roman road data were recently compiled and published, resulting in very high-resolution, spatially explicit and richly annotated dataset *Itiner-e* [4, 5], until now there did not exist a comparable digital and openly accessible dataset for the Medieval (Early-Middle Islamic) road system in the MENA region. An exception is the *al-Turayyā Project* [6, 7], a digital version of Cornu's atlas [8] of 'classical' Islamic sites and routes (9th–10th c. CE).

Therefore, in order to analyse the long-term development of the road network in the Near East and persistency of the Roman road network and its influence on the Medieval network this digital dataset was conceived. It was decided to apply similar methodology as was used to create *Itiner-e* by compiling available published historical (Medieval geographers, itineraries), epigraphic (milestones), and archaeological (settlements, road stations, bridges, forts, etc.) evidence to reconstruct the Medieval terrestrial transport network in Bilād al-Šām. This dataset is the first attempt to bring all this evidence together and reconstruct the Medieval road system in high spatial resolution and accuracy and to publish the geospatial data following FAIR and Open Science principles (Figure 1).

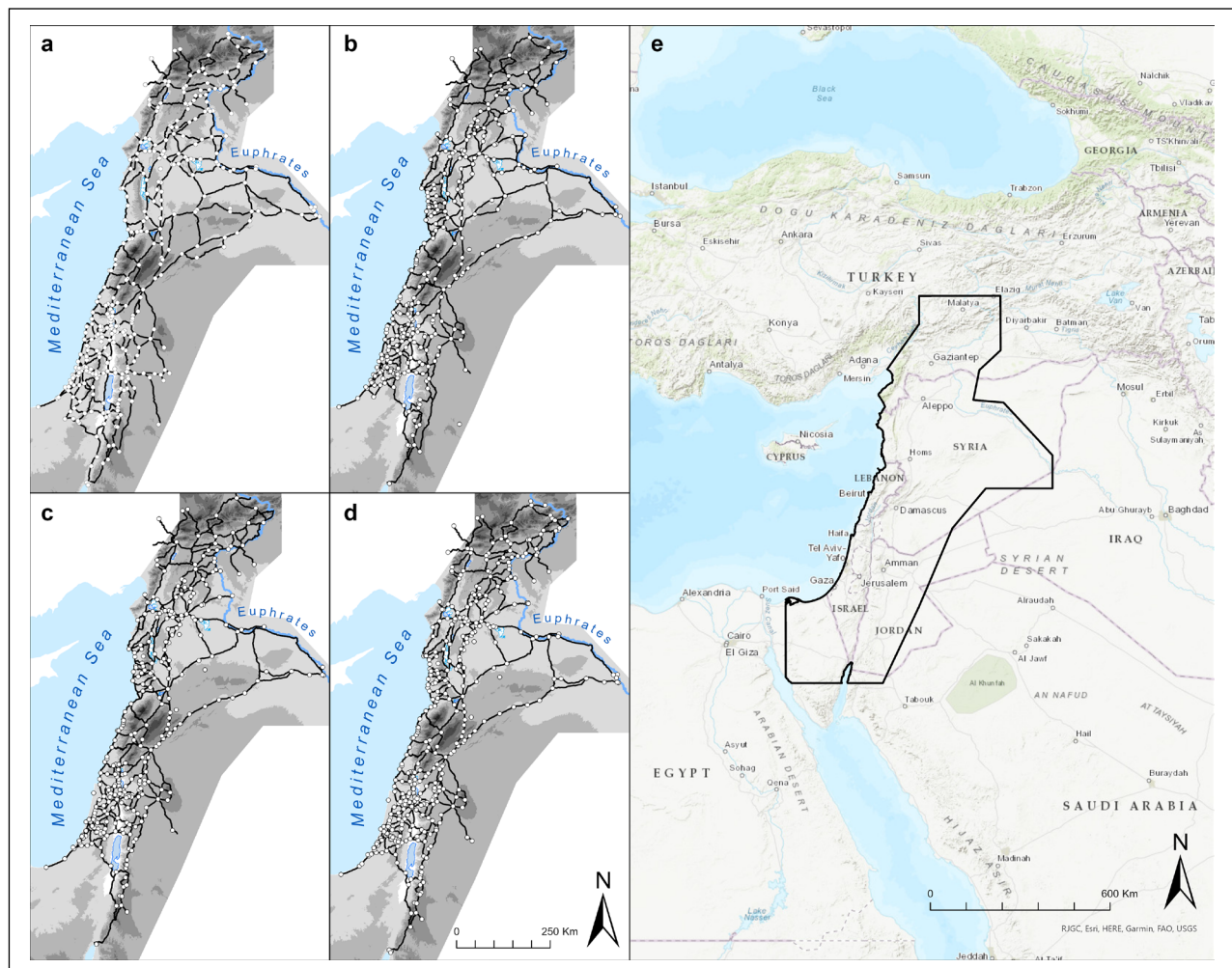


Figure 1 Map of the study region and digitised road networks. **a)** Early Islamic period, **b)** Middle Islamic period, **c)** Early Mamluk period, **d)** Late Mamluk period, **e)** Study region (marked in black outline) in its geographical context. © Adam Pažout.

SPATIAL COVERAGE

The spatial coverage of the dataset roughly corresponds to the traditional definition of Bilād al-Šām and ancient Greater Syria from Taurus Mountains in the north to the Red Sea in the south and between the Mediterranean Sea and the Euphrates. It covers contemporary Syria (west of the Euphrates), Lebanon, Jordan, Israel and Palestinian territories, and parts of south-eastern Turkey and Egypt's Sinai Peninsula.

Spatial extent (EPSG: 3395):

Northern boundary: 4 647 767.7 m

Southern boundary: 3 354 942.7 m

Eastern boundary: 4 564 089.6 m

Western boundary: 3 673 544.7 m

TEMPORAL COVERAGE

The dataset covers the Early and Middle Islamic periods in the Bilād al-Šām, ca. 650-1517 CE.

(2) METHODS

The dataset is based on available published historical, archaeological, and epigraphical evidence, and no field survey or field verification was conducted in data collection and compilation. The methodology closely follows the methodology employed in the creation of the *Itiner-e* dataset [4] as much as it could be followed and adapted to different material base and schemes of Islamic archaeology.

Compared to the Roman archaeology, there are considerable material, spatial, and temporal biases in addition to biases in intensity, spatial coverage, and focus of the archaeological investigations in the region of interest and on the Medieval road system. Road archaeology and transport networks are notably absent from the *Oxford Handbook of Islamic Archaeology* [9]. Milestones are confined to the Umayyad and Abbasid periods (7th–9th c. CE). Road stations (*khān*, *caravanserai*) appear late in the archaeological record (Ayyubid period, ca. 12th c. CE) and are often studied for their architecture and in the context of social and economic history. Attempts were made to reconstruct the road network based on locations of road stations, traveller's accounts, and itineraries [10–12]. Dussaud [13] and the *Tabula Imperii Byzantini* project [14] provide sweeping overview of the evidence but fail to capture the long-term development and their maps are a palimpsest of roads from the Roman to the Ottoman periods. Petersen [15] focused on the Syrian section of the Hajj route but is mostly preoccupied with road stations and does not deal with the actual course of the road in the landscape. Sauvaget reconstructed the network of the Mamluk *barīd* (postal and communication system) based on Mamluk sources and research on Syrian road stations [16–18]. Franz [19] recently reviewed the evidence for Ayyubid and Mamluk communication

system and provided a geospatial gazetteer of its identified stations. Bridges received some attention but generally are understudied, and there are difficulties with their dating [20, 21]. The study of Medieval roads in the Bilād al-Šām is therefore skewed either towards particular material evidence (road stations, bridges) or historical sources (Arabic geographers, merchant and pilgrim itineraries) and so biased towards the major communication and commercial routes. Only Major [22] attempts to reconstruct the regional road network in the 12th–13th c. CE northern Syrian coast drawing on wider archaeological evidence for settlement patterns and castles in addition to historical records.

This dataset, therefore, to a certain degree reflects these biases, as it was not always possible to avoid or 'correct' them without being too speculative in my reconstruction. There are no comprehensive historical-archaeological gazetteers of the Medieval Bilād al-Šām that would help to 'fill the gaps' using settlement contexts to establish the course of a road. The sites compiled in this dataset, then, are in no way representative of the totality of archaeological sites dated to the Medieval period in the study region. This dataset should be treated as preliminary and necessarily incomplete due to those biases and lack of research on many aspects of the road archaeology in the Medieval Bilād al-Šām. It is necessary first step in the future research on the roads and terrestrial transport networks of the Medieval MENA region.

In order to explicitly incorporate the uncertainty introduced by these biases in the dataset, several data descriptors are used. 1) *Segment certainty* refers to the spatial accuracy of the digitisation of the road segment. 2) *Road certainty* refers to certainty of the presence of a road in a given period, based on the available sources. *Segment certainty* has three values: 'certain', 'conjectured', and 'hypothetical'. 'Certain' refers to road segments that were identified through archaeological investigations, or it was possible to locate them with high spatial accuracy based on the archaeological and historical evidence within +/- 50 m in mountain terrain (typically mountain passes) and +/- 200 m in flat or moderate topography. 'Conjectured' denotes road segments whose spatial accuracy is lower due to insufficient evidence. 'Hypothetical' denotes road segments with very low spatial accuracy or roads without a fixed course where multiple layouts could have been used at the same time (such as desert roads), a digitized line then represents one of potential road layouts. *Road certainty* has three values: 'high', 'medium', and 'low'. 'High' signifies that the presence of a road segment is signalled by both primary (historical) sources, such as itineraries, and by secondary archaeological and historical-geographical sources. 'Medium' denotes road segments for which we lack primary historical sources but there exist secondary sources on them. Finally, 'low' denotes road segments for which we lack both primary and secondary sources and their digitisation is therefore

EARLY ISLAMIC			MIDDLE ISLAMIC		EARLY MAMLUK		LATE MAMLUK	
SEGMENT CERTAINTY								
	LENGTH (km)	PERCENTAGE	LENGTH (km)	PERCENTAGE	LENGTH (km)	PERCENTAGE	LENGTH (km)	PERCENTAGE
Certain	1,622.8	13.2%	1,331.9	11.3%	1,339.3	11.6%	1,333.6	11.5%
Conjectured	8,412.5	68.4%	9,417.8	79.7%	9,436.4	82.1%	9,614.5	82.6%
Hypothetical	2,227.2	18.4%	1,065.2	9%	716.1	6.3%	685.4	5.9%
ROAD CERTAINTY								
	LENGTH (km)	PERCENTAGE	LENGTH (km)	PERCENTAGE	LENGTH (km)	PERCENTAGE	LENGTH (km)	PERCENTAGE
High	7,656.4	62.3%	7,515.9	63.6%	7,957.5	69.2%	8,104.1	69.7%
Medium	1,650.1	24.3%	4,197.7	35.5%	3,500.4	30.5%	3,495.5	30%
Low	4,441.5	13.4%	101.3	0.9%	33.8	0.3%	33.8	0.3%

Table 1 Summary statistics of Segment certainty and Road certainty categories of the road dataset by periods.

PERIODISATION USED	DATING	DYNASTY/OTHER TERMINOLOGY
Early Islamic	650–950 CE	Umayyad, Abbasid
Middle Islamic	950–1250 CE	Fatimid, Middle Byzantine, Seljuk, Crusader, Ayyubid
Early Mamluk	1250–1350 CE	Mamluk, Middle Islamic
Late Mamluk	1350–1517 CE	Mamluk, Middle Islamic

Table 2 Periodisation and terminology used in the dataset.

based mainly on the settlement context and judgment of the author of the digitisation. The summary statistics of the *Segment certainty* and *Road certainty* categories by periods are shown in Table 1.

The road dataset is divided into sub-periods that reflect different historical and material sources available for each period and to better understand and analyse the long-term development and change of the road system (Table 2). The periodisation combines a revised archaeological and historical/dynastic scheme applicable to the region [23–26].

Early/Late Mamluk distinction reflects small changes in the *barīd* network that took place before ca. 1350 CE and the construction of several new road stations during the second half of the 14th c. and 15th c.

Medieval and modern Arabic and Turkish toponyms are used with simplified English transcription (without punctuations and special symbols). Common English names (Damascus, Jerusalem, etc.) are used in certain places.

STEPS

The road digitisation was made in three steps: a) road identification, b) road localization, c) road digitisation. Concurrently, sites associated with the road system (start and end points, road stations, bridges, forts, sanctuaries, settlements, and cities) were digitised using the same sequence of a) identification, b) localisation, c) digitisation.

In the first step, roads and sites were identified based on historical sources, previously published atlases,

regional summaries, milestones, archaeological surveys, and excavations. The project principally relied on Dussaud [13] and *Tabula Imperii Byzantini* [14] for Syria and Northern Syria, Cornu's atlas for the Early Islamic period [8], and *Archaeological Survey of Israel* and *MEGA Jordan* databases for the southern Levant (Israel/Palestine, Jordan). Umayyad and Abbasid milestones are known only from several roads south of Damascus, and most were published by Sharon in *Corpus Inscriptionum Arabicarum Palaestinae* (CIAP) [27, 28], which also includes building inscriptions of *khāns*. Road stations were collected first by Sauvaget [16, 17], and more recently by Cytryn-Silverman in Israel and Tavernari in all of Bilād al-Šām, who also provides a reconstruction of the road network in the Ayyubid-Mamluk period [10, 11]. Historical sources used cover mainly Early Islamic geographers in *Bibliotheca Geographorum Arabicorum* (ibn Khurdhadhbih, Qudamah ibn Jafar, al-Maqdisi, ibn Hawqal, al-Istakhri) [29–32], Naser-e Khosraw for Middle Islamic period [33], and al-Umari and al-Qalqashandi for the Mamluk *barīd* [19, 34]. The selection of historical sources was limited by availability of the primary editions and works in translation. For the complete bibliography used for road and site identification, see the *bibliography.md* file in the dataset.

In the second step, the identified roads and sites were spatially located. This proved to be the most sensitive issue in the case of road localisation, as most of the sources used in step one are less concerned with recovering the actual course of the road in the landscape and focus more on routes (itineraries) without specifying topographic details of the road. Where

possible, additional archaeological data were collected from archaeological and survey reports and databases such as the *Archaeological Survey of Israel* and *MEGA Jordan* to recover regional settlement patterns and propose the course of a road using settlement context. The information obtained from sources in step one was subsequently compared to various planimetric sources, such as modern and historical satellite imagery [35, 36] and topographical maps, e.g., *Survey of Western Palestine* [37], *Carte du Liban* [38], *Karte des Ostjordanlandes* [39], *Karte von Kleinasien* [40], French and British maps in 1:50,000, 1:100,000, and 1:200,000 scale [41–43], and 1:100,000 maps of Turkey [44].

In step three, each road segment and site were manually digitised following spatial localisation suggested or recovered in step two in a Geographic Information Systems (GIS) platform and stored as a single data record in a vector layer with an associated attribute table. The digitised road sections follow a line connecting known sites associated with a route (settlements, milestones, bridges, road stations, etc.). The digitised paths of such segments are refined by comparing them to existing contemporary and historical roads on georeferenced topographic maps and satellite imagery. The digitised reconstructed segment aims to consider local topography and conform its course to local obstacles (wetlands, rugged terrain, etc.). In many cases, thus ‘conjectured’ road follows a modern or historical road where additional archaeological and historical data are missing. As a rule, if the start and end points of a road remain the same between periods and no other variables are known to influence the course of the road, the road segments are not changed between the periods. This method was applied to the Early Islamic period using the *Itiner-e* dataset and subsequently to the following periods (i.e., Early Islamic to Middle Islamic etc.). Summary statistics of the total road length and number of sites is in Table 3.

Geodesic length of each road segment in meters was calculated using the WGS84/World Mercator (EPSG: 3395) coordinate system and stored as an attribute.

QUALITY CONTROL

Topological consistency of the road segments was checked to ensure that: a) the lines do not self-intersect, b) do not self-overlap, c) all road segments are split at intersections with other road segments or where they intersect with points in *_sites* datasets.

PERIOD	ROAD LENGTH (km)	NUMBER OF SITES
Early Islamic	12,262.5	361
Middle Islamic	11,814.9	409
Early Mamluk	11,491.8	429
Late Mamluk	11,633.5	443

Table 3 Summary statistics of the dataset.

CONSTRAINTS

The main constraints of the dataset are related to the accuracy and spatial resolution of the location of roads and road related sites in the archaeological literature. *Archaeological Survey of Israel* and *MEGA Jordan* are geospatial databases, and the accuracy of the representative points of archaeological sites is usually good. In other instances, the information obtained from publications was cross-checked with available satellite imagery and topographic maps to locate the reported archaeological remains. *Segment certainty* field is used to store information about the spatial accuracy of the road data.

Chronological information is often missing in the *_sites* datasets, as it was not always possible to establish approximate start and end dates of each site based on the available literature, besides general attribution to a certain period. Missing values are recorded as ‘9999’ in the database.

(3) DATASET DESCRIPTION

OBJECT NAME

The dataset consists of separate road and site files for each sub-period following the chronological scheme defined above in (2) *Methods* section using this naming convention: *period_name_roads* or *period_name_sites*. *bibliography.md* file contains the complete bibliography used for creation of the dataset. *readme.md* file contains a brief summary and description of the dataset.

DATA TYPE

Digitised roads are stored as vector polylines (ESRI Shapefile) or as a FeatureCollection with LineString geometries (GeoJSON). Digitised sites are represented as points and stored as vector points (ESRI Shapefile) or as a FeatureCollection with Point geometries (GeoJSON). All geospatial data is in the projected coordinate system WGS84/World Mercator (EPSG: 3395).

Each road segment and site is treated as a single record (row in the database) in the geospatial database with associated variables stored in the attribute table. The attribute table is structured to hold basic descriptors of each road segment and site, such as unique identifiers, typology, information related to spatial accuracy and certainty, chronological, historical, and bibliographical information, and creator of each record.

Data structure of *_roads* files is described in Table 4. Data structure of *_sites* files is described in Table 5.

bibliography.md (Markdown file) is divided into sections “Sources”, “Roads”, “Sites”, and “Other” (i.e., publications consulted during the creation of the dataset but not directly used in data collection and compilation).

readme.md (Markdown file) contains information about the creator, license, and data structure with a brief summary of the dataset.

FIELD NAME	MEANING	TYPE	DESCRIPTION
Id	Id	integer (Long Integer)	Unique numerical identifier
name	name	string (text)	Name of the road segment, typically in the form 'Start point-End point' using Medieval or modern names depending on whether the Medieval name is known. Arabic forms are preferred, English forms that are commonly used (Jerusalem, Damascus, etc.) are employed
type	type	string (text)	Type of the road segment, values: 'Main Road' and 'Secondary Road'
typeCode	type code	integer (Long Integer)	Road type numerical code, values: 2 = 'Main Road' and 1 = 'Secondary Road'
itinerary	itinerary	string (text)	Name of the known itinerary associated with the road segment, e.g., 'Hajj Route', 'Barid' etc.
source	source	string (text)	Medieval source that (probably) references the road segment, short reference in the form 'Name Page Number' of the standard primary edition or translation (see bibliography.md file for the full reference)
biblio	bibliography	string (text)	Reference to a secondary literature that was used to identify, localise, and digitise the road segment. Short reference in the form 'Name Year' (see bibliography.md file for full reference)
segmentCer	segment certainty	string (text)	Spatial accuracy of the digitisation of the road segment. Values: 'Certain' (+/- 50 m in mountainous terrain, +/-200 in flat terrain), 'Conjectured', 'Hypothetical' (mostly unfixed desert routes)
roadCer	road certainty	string (text)	Certainty of the existence of the road segment based on the available primary and secondary sources. Values: 'High' (primary and secondary sources, or good archaeological/historical-geographical secondary literature), 'Medium' (based on archaeological and historical-geographical secondary literature), 'Low' (based only on settlement context or archaeological secondary literature)
geoLength	geodesic length	integer (32-bit Float)	Geodesic length of the road segment in meters
citation	citation	string (text)	Author of the digitisation

Table 4 Data structure of the *_roads* files.

FIELD NAME	MEANING	TYPE	DESCRIPTION
Id	Id	integer (Long Integer)	Unique numerical identifier
name	name	string (text)	Medieval name of the site. Arabic forms are preferred, in some cases Frankish/Latin names are used
modernName	modern name	string (text)	Modern name of the site
type	type	string (text)	Type of the site. Values: 'city', 'settlement', 'station', 'fort', 'place', 'sanctuary', 'bridge'
minDate	minimum date	string (text)	Earliest date the site can be dated to. For unknown 9999 is used
maxDate	maximum date	string (text)	Date of the destruction/abandonment of the site. For unknown or continuous activity until the present 9999 is used
umayyad	Umayyad period	string (text)	Whether site exists in given period. Value: 'yes', 'no', 'unknown', 'possible'
abbasid	Abbasid period	string (text)	Whether site exists in given period. Value: 'yes', 'no', 'unknown', 'possible'
fatimid	Fatimid/Middle Byzantine period	string (text)	Whether site exists in given period. Value: 'yes', 'no', 'unknown', 'possible'
ayyubidCru	Ayyubid-Crusader period	string (text)	Whether site exists in given period. Value: 'yes', 'no', 'unknown', 'possible'
mamluk	Mamluk period	string (text)	Whether site exists in given period. Value: 'yes', 'no', 'unknown', 'possible'
citation	citation	string (text)	Author of the digitisation
biblio	bibliography	string (text)	Reference to a secondary literature that was used to identify, localise, and digitise the site. Short reference in the form 'Name Year' (see bibliography.md file for the full reference)

Table 5 Data structure of the *_sites* files.

FORMAT NAMES AND VERSIONS

.shp; .geojson; .md

CREATION DATES

Between September 2025 and June 2026.

DATASET CREATORS

Adam Pažout designed the database and collected the data.

LANGUAGE

English

LICENSE

CC-BY 4.0 International

REPOSITORY LOCATION

<https://doi.org/10.5281/zenodo.21904951>

PUBLICATION DATE

12/08/2026

(4) REUSE POTENTIAL

This dataset for the first time integrates historical and archaeological data related to the Medieval road and transport network in the Levant/Bilād al-Šām into a geospatial database. By making this data FAIR it fosters interdisciplinary engagement between archaeology, history, geography and economy. It can be reused as a reference point for further studies on the Medieval road system and terrestrial transport network in the region and for large-scale quantitative geospatial, network, and econometric analyses and comparison with road systems in other parts of the world and periods. Additional historical-archaeological validation of parts or of the whole dataset might be performed. It can be reproduced for educational and dissemination activities that focus on the Medieval history and Islamic archaeology. The dataset is relevant for studies on economic, social and political history, Islamic archaeology, development of transportation network and technology, and comparative history.

ACKNOWLEDGEMENTS

I would like to thank Pau de Soto (Universitat Autònoma de Barcelona) for his support throughout the project.

FUNDING STATEMENT

The project 'VIA-TARIQ: Analysing the long-term change and persistency of the Roman road system in the Levant' has received funding from the European Union's Horizon

Europe research and innovation programme under the Marie Skłodowska-Curie grant agreement No 101151931.

COMPETING INTERESTS

The author has no competing interests to declare.

AUTHOR CONTRIBUTIONS

Adam Pažout wrote the manuscript and prepared the figures and tables.

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TO CITE THIS ARTICLE:

Pažout A 2026 Geospatial Data for the Medieval Road System in the Levant (Bilād al-Šām) from the Project 'VIA-TARIQ: Analysing the Long-Term Change and Persistency of the Roman Road System in the Levant'. *Journal of Open Archaeology Data*, 14: 23, pp. 1–9. DOI: <https://doi.org/10.5334/joad.231>

Submitted: 17 August 2026 **Accepted:** 07 October 2026 **Published:** 21 October 2026

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Journal of Open Archaeology Data is a peer-reviewed open access journal published by Ubiquity Press.

