GUIDELINES FOR GIS-BASED TERRITORIAL ATLAS OF ROMAN ROUTES IN DANUBE REGION

Work Package Title	Mapping and promoting Roman network of routes and settlements
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Data preparation and identification of appropriate data

Content

The activity of mapping Roman routes and settlements network will build upon the results from WP T1 (Baseline screening and policy framework), providing an in-depth desk-research and field documentation for mapping Roman Routes and Settlements network. Each territorial partner will contribute to update the ISTER Catalogue on Roman routes & settlements along the Danube Region (Catalogue) with data from their local/regional/ state level., focusing mainly on the physical aspect of the Roman heritage legacy.

The GIS-based territorial Atlas of Roman routes legacy in Danube Region (Atlas) database will be constructed by merging data collected through the Catalogue delivered in WP T1 and enriched with additional data from WP T3, activity T3.1 (which will be constantly uploaded after collecting the Aerial photography documentation, as well as the field data and interpreting their results).

Therefore, the Atlas database will contain local and regional data on the Roman network of Routes and settlements, split into three basemap layers group of different GIS layers:

1. **Basemap layers**
   1.1 Open data and data with permission for public use
   - DARE map
   - Open street map
   1.2 Layers obtained (if obtained) from partners under the project framework
   - Topography and landscape (soil, vegetation, etc) and land-use;
   - Area physical accessibility and permeability;
2. **Atlas catalogue layers**
   - Features of Roman Routes and Settlements Network and peculiarities of hidden Roman Route assets and ancient landscapes;
   - Limits of protected monuments and areas;
   - Recommended limits for protection areas, divided into three main categories, differentiating between certain activities permitted within protection boundaries:
     1. non-touchable area or „sterilised" zones (where no activities should be permitted);
     2. buffer zone (providing a short-list of permitted activities with certain limitations) and
     3. surrounding territory (providing a list of permitted activities with certain limitations and activities which can be performed without any constraint).

Layers that will be included by default in Atlas od Roman routes are open data, for example Open street map, DARE map, etc. Appearance of layers, as *Topography, landscape (soil, vegetation, etc), land-use and area physical accessibility and permeability* will depend on obtaining data from territorial partners. Cross queries will be possible between catalogue layers only.

Roman routes atlas is basically a presentation and query tool for the Roman routes data organized in the underlying database according to the Catalogue. Additionally, to some of the existing solutions:

- https://orbis.stanford.edu/
- https://dh.gu.se/dare/
- http://umap.openstreetmap.fr/en/map/the-roman-roads-of-britain-atlas_94445
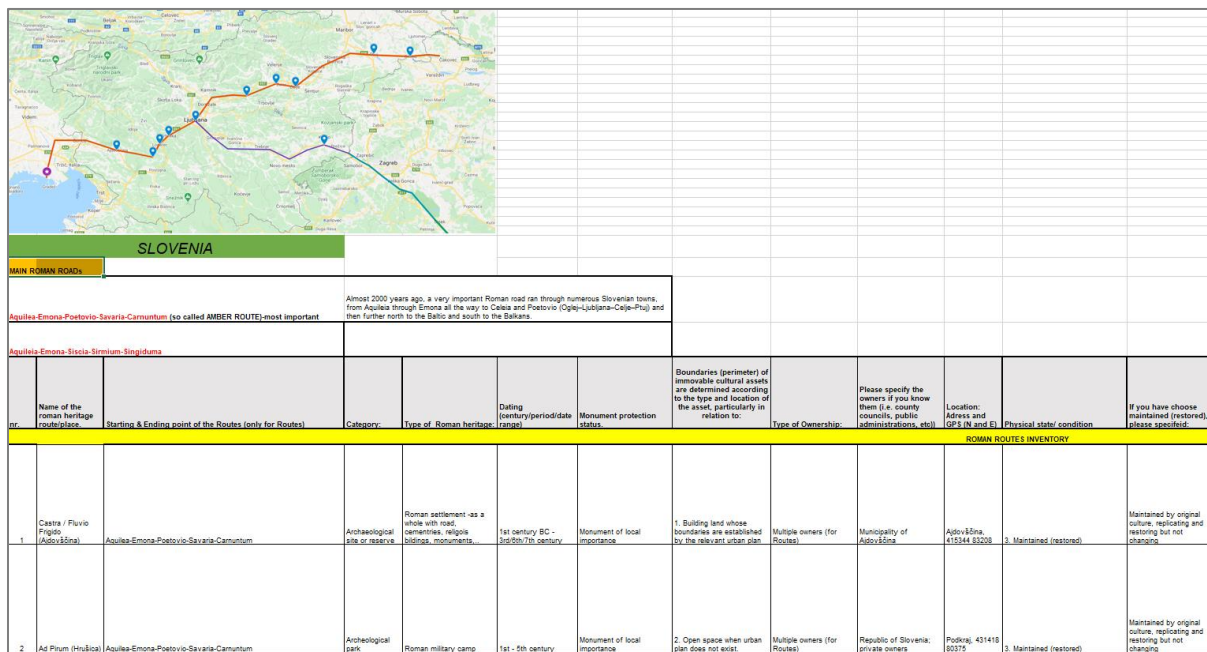- https://imperium.ahlfeldt.se/

The atlas will provide:

- Ability to add multimedia material for individual features (e.g. photos, articles, descriptions).
- API interface for sharing the data (machine access and download of the data).
- Query tool over database items.
- Overview of the database and associated media material.
- Possibility to share the predefined queries.
- Tool to organize predefined queries in the articles (possibility to add a description and publish query in an article gallery).
- Article gallery: a portal where users will be able to publish filtered Atlas data with custom explanatory text and media.
- Tool to combine the data between different layers (e.g. intersection between a protected areas layer and selected data layers).

Format

Data collected through the Catalogue will represent the basis for the GIS-based territorial Atlas of Roman routes in Danube Region.

Main output of WP T1 ISTER Catalogue on Roman routes & settlements along the DR was prepared by WP T1 coordinator ERDF PP7 ZRS BISTRA PTUJ. The catalogue was prepared for the use of atlas in Excel table (Picture 1) which include data about Roman monuments, location of Roman Routes and archeological sites from all project partners. Entered data by territorial partners in excel table will be used in Atlas of Roman Routes combined with data entered in Google Maps Drive document (described below).

Picture 1 - ISTER Catalogue Excel table containing data for GIS Atlas of Roman Routes

The attributes for Atlas of Roman routes are provided in the of WP T1 ISTER Catalogue Excel file (Picture 2-1). To show them in the application (Picture 2-4) we have to know the geographical location, therefore a shared Google Maps Drive document (Picture 2-2) was established

(https://www.google.com/maps/d/u/0/edit?mid=1NbR_ztm3s2c6k_ZRXlg6R-hnfCUf-
IQq&ll=45.61796954529437%2C15.149272093750014&z=6). Its sole purpose is collecting
geographical locations of features whose attributes are already provided in WP T1 ISTER Catalogue
Excel file. Short instructions for adding features to Google Maps Drive document are prepared
(Annex 1)

The column "Name of the roman heritage route/place" in the Excel file will be linked with the field
"Name of the roman heritage route/place" in this Google Maps Drive document, therefore the value
in this field has to be **EXACTLY THE SAME** as the value in WP T1 ISTER Catalogue Excel file "Name of
the roman heritage route/place." column.

The merged data of this Google Maps Drive map (Picture 2-2) and WP T1 ISTER Catalogue (Picture 2-
1) is the basis for the initial filling of the "GIS-based territorial Atlas of Roman routes legacy in
DR" database (Picture 2-3).
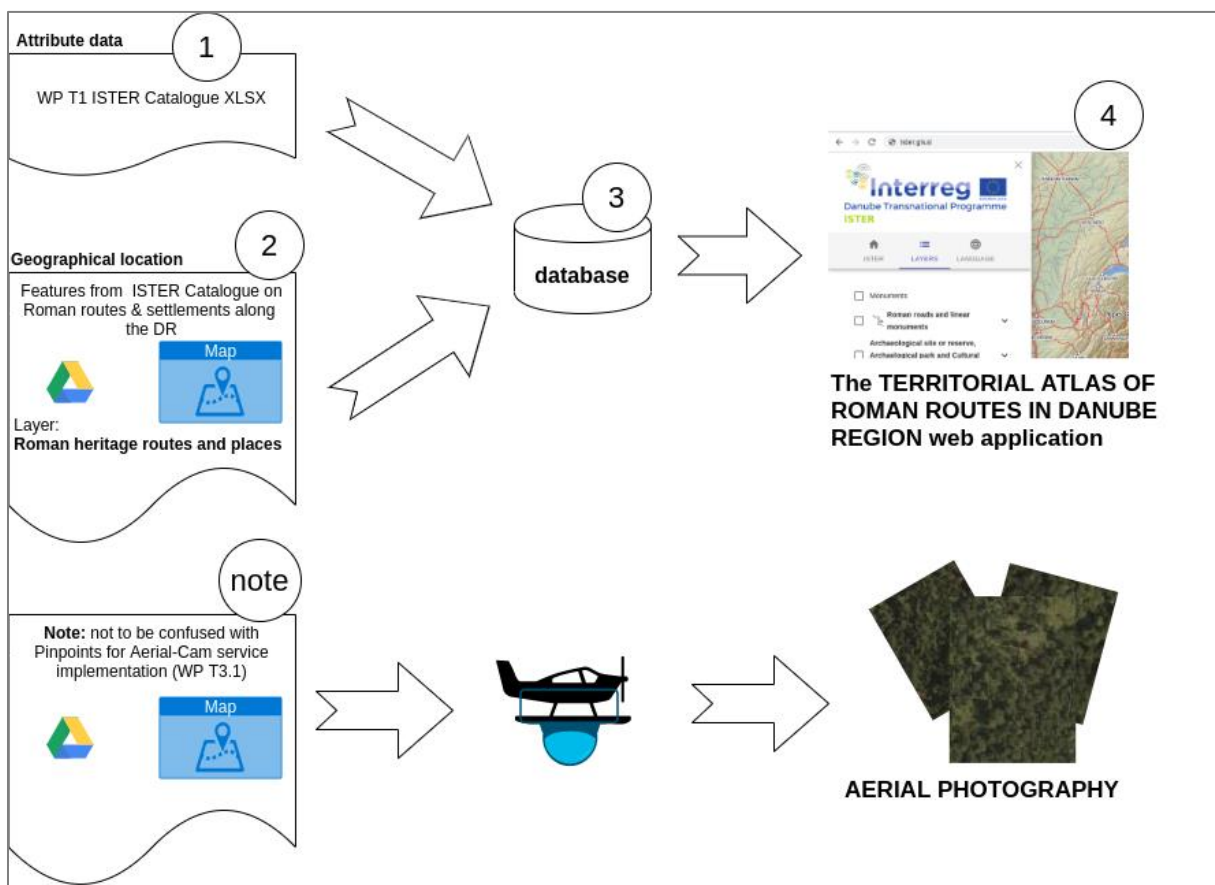
Picture 2 - Providing data for the Territorial Atlas of Roman Routes in Danube Region

Notice: This shared Google Maps Drive document is not to be confused with another one
(https://www.google.com/maps/d/u/0/edit?mid=1Ph11UHImW8Vt6YE81M5mpJB7huBQZWS1)
which is used for collecting Pinpoints for Aerial-Cam service implementation (WP T3.1)

Macros

The Atlas of Roman routes browser is used to view groups of object types or to view object catalog data. The purpose of creating a data layer browser is to establish a technological environment that will enable:

- spatial display of data with an appropriate cartographic basis for the entire layer
- tabular, cartographic query
- basic tools for navigating individual layers
- data storage
- displays for reporting purposes

The browser is designed as a web GIS tool with basic display functionalities and determining the properties of the displayed layers. It will be implemented as a standalone JavaScript client application, which will obtain the necessary data for operation via a single API point - with the same set of functionalities as will be used for data entry.

The browser communicates with the database via the program interface using the following commands:

- public / api / **layers** – the command returns a list of layers (object types) of the object catalog and their properties (eg icon and layer color)
- public / api / **code_list** – the command returns the code list (list of translations and any other features)

These calls are made when entering the browser, and the data they return allows the display of a structured object catalog.

To access the data of the selected object type / subtype, two more calls are made in the program interface:

- public / api / **geom** / {layer id} - return spatial data (points, lines or polygons) for the selected layer
- public / api / **attribute_values** / {layer id} - return attribute data for the selected layer

These calls are made when an individual object type or subtype is selected and allow the layer to be displayed in the browser.

Layer definition

The object catalog is an instruction for creating a database for Atlas of Roman routes. The latter means the selection of objects that will be included in the database, in what form they appear in nature and how they will be displayed in the database.

Point object type

Monuments				

Topological shape
point

OBJECT SUBTYPE	CODE	ATRIBUT	RANGE	DESCRIPTION
Roman monuments		1 Name		
		2 Dating		
		3 Type of Roman heritage	1 Roman settlement -as a whole with road, cemeteries, religious buildings, monuments,…	
			2 Roman road	
			3 Roman religious monument (one piece)	
			4 Roman cemeteries	
			5 Roman monuments	
			6 Roman religious buildings	
			7 Roman baths	
			8 Roman infrastructure (as bridge, aqueduct, garden,…)	
			9 Roman military camp	
			10 Other	
		4 Monument protection status	1 Monument of national importance	
			2 Monument of local importance	
			3 Only registered heritage	
			4 UNESCO site	
		5 Protective zone	1 Monument of national importance	*Protective zone (surface and boundaries/ distances*

	2 Monument of local importance	*defined in connection with the characteristics of the historical/ natural environment and terrain configuration)*
	3 Only registered heritage	
	4 UNESCO site	
6 Boundaries	1 Building land whose boundaries are established by the relevant urban plan	*Boundaries (perimeter) of immovable cultural assets are determined according to the type and location of the asset, particularly in relation to*
	2 Open space when urban plan does not exist	
	3 Configuration of terrain (e.g. landscape and archaeological reserve located on an inaccessible (wild) area)	
	4 Natural boundaries, roads, lakes, rivers etc	
	5 Interaction with its historical setting/ environment	
	6 Protective zones	
7 Type of ownership	1 Public	
	2 Private	
	3 Multiple owners (for Routes)	
	4 Stand-alone owner (particularly for buildings/ sites)	
	5 Other	
8 Owner		*Specify the owners if you know them (i.e. county councils, public administrations, etc)*
9 Location		*North and East coordinates*

	10 Physical state/condition	1 Abandoned (natural reclamation)	
		2 Maintained (restored)	
		3 Deteriorated or looted (decay stages)	
	11 Description		
	12 Picture		
	13 Link		
ISTER info monuments	1 Name		
	2 Location		
	3 Description		
	4 Picture		
	5 Link		

Linear object type

Roman roads and linear monuments			
Topological shape line			
OBJECT SUBTYPE	**CODE**	**ATRIBUT**	**RANGE**	**DESCRIPTION**

OBJECT SUBTYPE	CODE	ATRIBUT	RANGE	DESCRIPTION
Roman roads		1 Name		
		2 Dating		
		3 Type of Roman heritage	1 Roman settlement -as a whole with road, cemeteries, religious buildings, monuments,…	
			2 Roman road	
			3 Roman religious monument (one piece)	

	4 Roman cemeteries	
	5 Roman monuments	
	6 Roman religious buildings	
	7 Roman baths	
	8 Roman infrastructure (as bridge, aqueduct, garden,…)	
	9 Roman military camp	
	10 Other	
4 Monument protection status	1 Monument of national importance	
	2 Monument of local importance	
	3 Only registered heritage	
	4 UNESCO site	
5 Protective zone	1 Monument of national importance	*Protective zone (surface and boundaries/ distances defined in connection with the characteristics of the historical/ natural environment and terrain configuration)*
	2 Monument of local importance	
	3 Only registered heritage	
	4 UNESCO site	
6 Boundaries	1 Building land whose boundaries are established by the relevant urban plan	*Boundaries (perimeter) of immovable cultural assets are determined according to the type and location of the asset, particularly in relation to*
	2 Open space when urban plan does not exist	
	3 Configuration of terrain (e.g. landscape and archaeological reserve located on an inaccessible (wild) area)	
	4 Natural boundaries, roads, lakes, rivers etc	

		5 Interaction with its historical setting/ environment	
		6 Protective zones	
	7 Type of ownership	1 Public	
		2 Private	
		3 Multiple owners (for Routes)	
		4 Stand-alone owner (particularly for buildings/ sites)	
		5 Other	
	8 Owner		*Specify the owners if you know them (i.e. county councils, public administrations, etc)*
	9 Location		*North and East coordinates*
	10 Physical state/condition	1 Abandoned (natural reclamation)	
		2 Maintained (restored)	
		3 Deteriorated or looted (decay stages)	
	11 Description		
	12 Picture		
	13 Link		
Roman linear monuments	1 Name		
	2 Dating		
	3 Type of Roman heritage	1 Roman settlement -as a whole with road, cemeteries, religious buildings, monuments,…	
		2 Roman road	
		3 Roman religious monument (one piece)	

		4 Roman cemeteries	
		5 Roman monuments	
		6 Roman religious buildings	
		7 Roman baths	
		8 Roman infrastructure (as bridge, aqueduct, garden,…)	
		9 Roman military camp	
		10 Other	
	4 Monument protection status	1 Monument of national importance	
		2 Monument of local importance	
		3 Only registered heritage	
		4 UNESCO site	
	5 Protective zone	1 Monument of national importance	*Protective zone (surface and boundaries/ distances defined in connection with the characteristics of the historical/ natural environment and terrain configuration)*
		2 Monument of local importance	
		3 Only registered heritage	
		4 UNESCO site	
	6 Boundaries	1 Building land whose boundaries are established by the relevant urban plan	*Boundaries (perimeter) of immovable cultural assets are determined according to the type and location of the asset, particularly in relation to*
		2 Open space when urban plan does not exist	
		3 Configuration of terrain (e.g. landscape and archaeological reserve located on an inaccessible (wild) area)	
		4 Natural boundaries, roads, lakes, rivers etc	

	5 Interaction with its historical setting/ environment	
	6 Protective zones	
7 Type of ownership	1 Public	
	2 Private	
	3 Multiple owners (for Routes)	
	4 Stand-alone owner (particularly for buildings/ sites)	
	5 Other	
8 Owner		*Specify the owners if you know them (i.e. county councils, public administrations, etc)*
9 Location		*North and East coordinates*
10 Physical state/condition	1 Abandoned (natural reclamation)	
	2 Maintained (restored)	
	3 Deteriorated or looted (decay stages)	
11 Description		
12 Picture		
13 Link		

Planar object type

Archaeological site or reserve, Archaeological park, Cultural landscape and protection areas				
Topological shape plane				
OBJECT SUBTYPE	**CODE**	**ATRIBUT**	**RANGE**	**DESCRIPTION**
Archaeological site or reserve		1 Name		
		2 Dating		
		3 Type of Roman heritage	1 Roman settlement -as a whole with road, cemeteries, religious buildings, monuments,…	
			2 Roman road	
			3 Roman religious monument (one piece)	
			4 Roman cemeteries	
			5 Roman monuments	
			6 Roman religious buildings	
			7 Roman baths	
			8 Roman infrastructure (as bridge, aqueduct, garden,…)	
			9 Roman military camp	
			10 Other	
		4 Monument protection status	1 Monument of national importance	
			2 Monument of local importance	
			3 Only registered heritage	
			4 UNESCO site	
		5 Protective zone	1 Monument of national importance	*Protective zone (surface and boundaries/ distances defined in connection with the characteristics of the historical/ natural*
			2 Monument of local importance	

	3 Only registered heritage	*environment and terrain configuration)*
	4 UNESCO site	
6 Boundaries	1 Building land whose boundaries are established by the relevant urban plan	*Boundaries (perimeter) of immovable cultural assets are determined according to the type and location of the asset, particularly in relation to*
	2 Open space when urban plan does not exist	
	3 Configuration of terrain (e.g. landscape and archaeological reserve located on an inaccessible (wild) area)	
	4 Natural boundaries, roads, lakes, rivers etc	
	5 Interaction with its historical setting/ environment	
	6 Protective zones	
7 Type of ownership	1 Public	
	2 Private	
	3 Multiple owners (for Routes)	
	4 Stand-alone owner (particularly for buildings/ sites)	
	5 Other	
8 Owner		*Specify the owners if you know them (i.e. county councils, public administrations, etc)*
9 Location		*North and East coordinates*
10 Physical state/condition	1 Abandoned (natural reclamation)	
	2 Maintained (restored)	
	3 Deteriorated or looted (decay stages)	

	11 Description		
	12 Picture		
	13 Link		

Archaeological park	1 Name		
	2 Dating		
	3 Type of Roman heritage	1 Roman settlement -as a whole with road, cemeteries, religious buildings, monuments,…	
		2 Roman road	
		3 Roman religious monument (one piece)	
		4 Roman cemeteries	
		5 Roman monuments	
		6 Roman religious buildings	
		7 Roman baths	
		8 Roman infrastructure (as bridge, aqueduct, garden,…)	
		9 Roman military camp	
		10 Other	
	4 Monument protection status	1 Monument of national importance	
		2 Monument of local importance	
		3 Only registered heritage	
		4 UNESCO site	
	5 Protective zone	1 Monument of national importance	*Protective zone (surface and boundaries/ distances defined in connection with the characteristics of the historical/ natural*
		2 Monument of local importance	

	3 Only registered heritage	*environment and terrain configuration)*
	4 UNESCO site	
6 Boundaries	1 Building land whose boundaries are established by the relevant urban plan	*Boundaries (perimeter) of immovable cultural assets are determined according to the type and location of the asset, particularly in relation to*
	2 Open space when urban plan does not exist	
	3 Configuration of terrain (e.g. landscape and archaeological reserve located on an inaccessible (wild) area)	
	4 Natural boundaries, roads, lakes, rivers etc	
	5 Interaction with its historical setting/ environment	
	6 Protective zones	
7 Type of ownership	1 Public	
	2 Private	
	3 Multiple owners (for Routes)	
	4 Stand-alone owner (particularly for buildings/ sites)	
	5 Other	
8 Owner		*Specify the owners if you know them (i.e. county councils, public administrations, etc)*
11 Location		*North and East coordinates*
12 Physical state/condition	1 Abandoned (natural reclamation)	
	2 Maintained (restored)	
	3 Deteriorated or looted (decay stages)	

	13 Description		
	12 Picture		
	13 Link		

Cultural landscape	1 Name		
	2 Dating		
	3 Type of Roman heritage	1 Roman settlement -as a whole with road, cemeteries, religious buildings, monuments,…	
		2 Roman road	
		3 Roman religious monument (one piece)	
		4 Roman cemeteries	
		5 Roman monuments	
		6 Roman religious buildings	
		7 Roman baths	
		8 Roman infrastructure (as bridge, aqueduct, garden,…)	
		9 Roman military camp	
		10 Other	
	4 Monument protection status	1 Monument of national importance	
		2 Monument of local importance	
		3 Only registered heritage	
		4 UNESCO site	
	5 Protective zone	1 Monument of national importance	*Protective zone (surface and boundaries/ distances defined in connection with the characteristics of the historical/ natural*
		2 Monument of local importance	

	3 Only registered heritage	*environment and terrain configuration)*
	4 UNESCO site	
6 Boundaries	1 Building land whose boundaries are established by the relevant urban plan	*Boundaries (perimeter) of immovable cultural assets are determined according to the type and location of the asset, particularly in relation to*
	2 Open space when urban plan does not exist	
	3 Configuration of terrain (e.g. landscape and archaeological reserve located on an inaccessible (wild) area)	
	4 Natural boundaries, roads, lakes, rivers etc	
	5 Interaction with its historical setting/ environment	
	6 Protective zones	
7 Type of ownership	1 Public	
	2 Private	
	3 Multiple owners (for Routes)	
	4 Stand-alone owner (particularly for buildings/ sites)	
	5 Other	
8 Owner		*Specify the owners if you know them (i.e. county councils, public administrations, etc)*
9 Location		*North and East coordinates*
10 Physical state/condition	1 Abandoned (natural reclamation)	
	2 Maintained (restored)	
	3 Deteriorated or looted (decay stages)	

	11 Description	
	12 Picture	
	13 Link	

| Protection areas	1 Recommended category for protection	1 Non-touchable area - „sterilised" zones (no activities should be permitted)
		2 Buffer zone (a short-list of permitted activities with certain limitations)
		3 Surrounding territory (permitted activities with certain limitations and activities which can be performed without any constraint)

GIS-based territorial Atlas of Roman routes legacy in DR - data visualisation

The application is designed to be user-friendly - very simple and manageable and the use is very intuitive. The main parts of the browser will be explained below, as well as the functionality of the application.

Browser functionalities

When you start the web application of the browser, an overview page with data is displayed, divided into four sections:

1. Interactive map.
2. Description of the project.
3. Filters.
4. Button to export data.
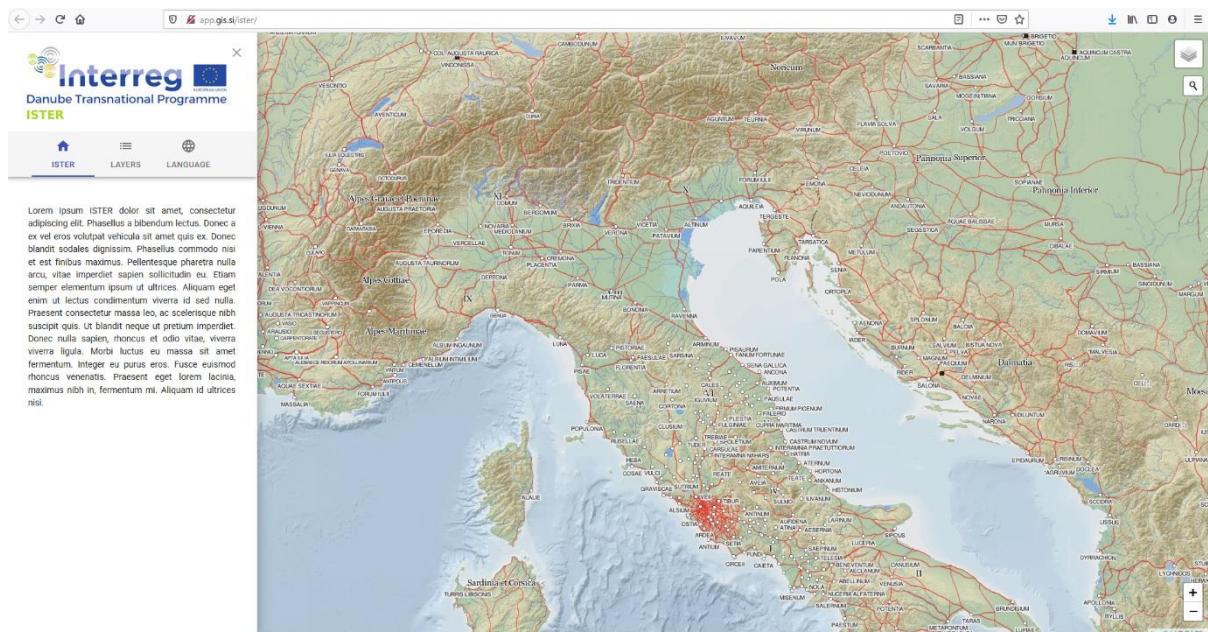
Picture 2- First page of the Atlas of Roman roads

Display content and use the map

In the initial view, the map shows the area of the whole Danube Region. A look at the map is possible to change arbitrarily. With the middle wheel on the mouse it is possible to adjust the scale - the scale can be increased or decreased. You can move the position of the maps to the current scale in any direction by clicking on the map, holding the click and dragging in any direction. After dragging, release the mouse button.

The following cartographic display management functionalities were performed in the browser:

1. Sidebar content menu.
2. Tree menu.

3. Merge layers into groups of object subtypes.
4. Open and close groups of data layers.
5. Possibility to open / close the whole group of selected layers.
6. Standard controls (navigation, zoom).
7. Display of the number of records (objects) on an individual layer.
8. Display of the attribute table of the selected layer.
9. Store data in GEOJSON format.
10. Data loading indicator.
11. Display of data of the selected object (descriptive and image content).
12. Selection of basic bases: digital orthophotos and Open street map physical map.
13. Selection of underlying layers.
14. Search by places.

Basic content functionalities of the browser:

1. Selection of roman legacy group.
2. Selection of object type for selected roman legacy group.
3. Display of selected layers.
4. Management of individual layer.
5. Display of attribute table (possibility of filtering and searching by columns).
6. Show / hide layer on map.
7. Remove layer from the list of selected layers.

The captured database data is displayed in the graphical interface. The data is shown by location with symbols from the legend. All the layers are activated, which are activated in the legendary part with a tick in the square box. The layers can be activated or deactivated at will. The data are graphically visualized with characters created for editing cartographic representations. The characters are written in SVG (Scalable Vector Graphic) format, i.e. vector format, which always provides the same appearance regardless of the degree of magnification or reduction of the displayed content in a web browser. An explanation of the meaning of the characters is on the left side of the web browser. In the first row, there are fields where by clicking we activate the check mark and thus mark the activity of the layer by type, and then within the type we activate the contents of the layer with a tick. There are described the meanings of the characters for each layer, geometric building blocks - linear, planar or point. On the right side of the interpretation of the character is a numerical printout of how many individual data records are linked to the data layer or the character in question.

Underlying and auxiliary layers

By clicking on the icon located on the bottom right of the map, we open the menu to display underlying or auxiliary layers.

The OpenStreetMap map, Digital Atlas of the Roman Empire (DARE) and the DOF-dimensional orthographic surface aerial photography layer are available as underlaying layers. The OpenStreetMap map shows the main topographic elements in the space (geographical names, roads, railways, rivers, land use) and allows navigation on the map. Digital Atlas of the Roman Empire (DARE) is a map that shows
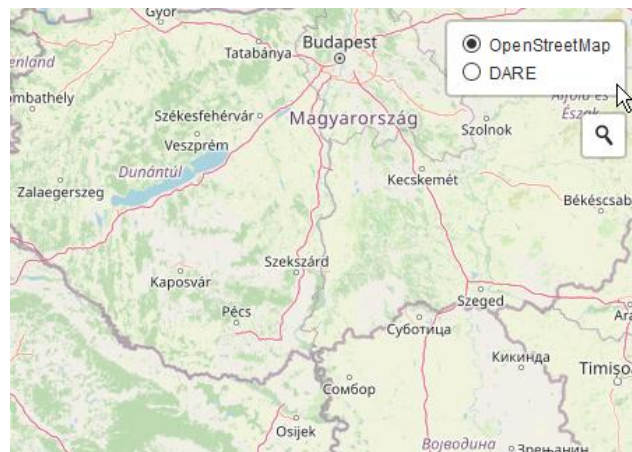

Picture 3 - Choice of underlaying layers

roman forts, roads, limes, Roman names of cities etc. The DOF display allows a realistic view of the area from the air, at the time of capturing the photos (actually the status may deviate from the displayed one due to out-of-date photos).

The browser is set up in line with the majority of web mapping application design trends so that its use is easy and understandable. In general, usage is based on the following order:

Selecting a layer from the menu

- icon ✅ indicates an included layer or group

- icon ⌄ indicates a submenu that can be opened

- icon ⌃ indicates an open submenu that can be closed
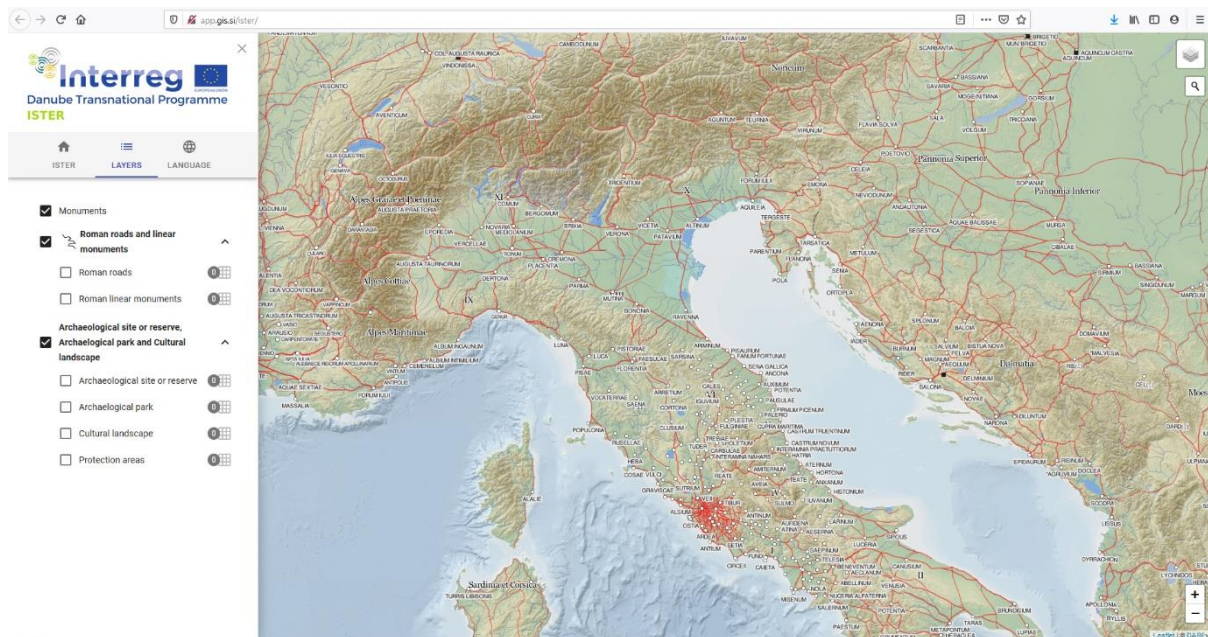
Picture 4 - Layers

Accessibility and availability

The Atlas of the Roman routes will be freely accessible to everyone. The TERRITORIAL ATLAS OF ROMAN ROUTES IN DANUBE REGION web application will be available at https://ister.gis.si.

The mobile application contains an interactive map, photographs and recordings of archaeological sites, and offers as rich descriptions and visual representations of Roman roads and monuments that are shown in application.

Localizing app helps make it relevant to a variety of cultures and languages, and provides opportunity to be accessible to a wider circle of people. Users can select their preferred language in app just by clicking on icon, making it easy for multilingual user to switch between languages in app.
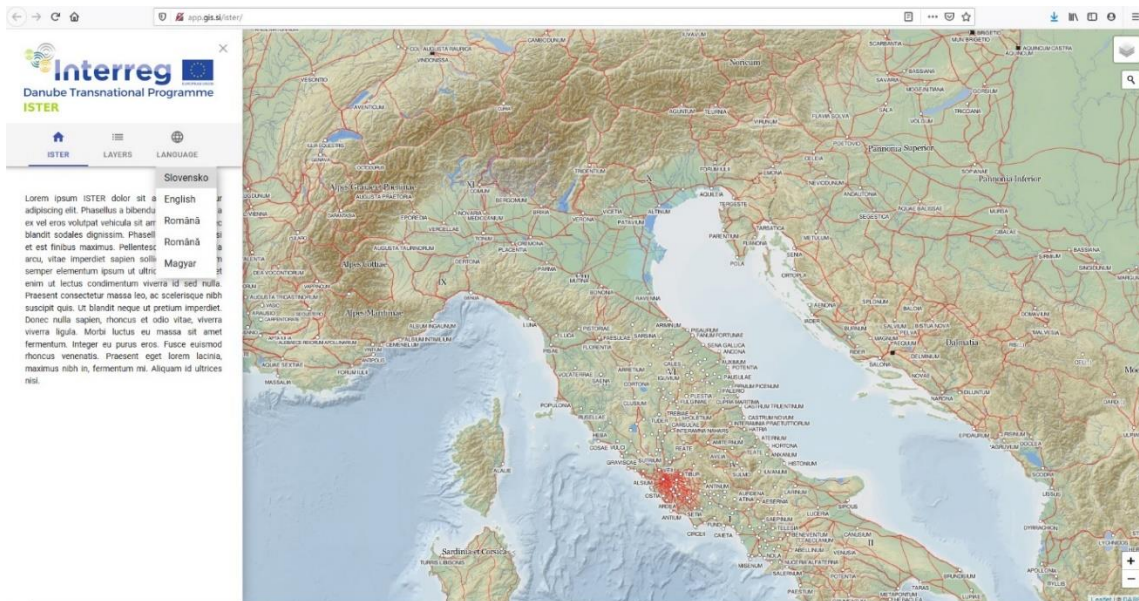
Picture 5- Selection between languages

Data sharing and disseminations

Data or image export through charts, maps, infographics, active links

Application offers an option to download data from database. The procedure for how to download files will be explained below.

When you select a data layer and click on the display of attributes of the selected layer, the attribute table opens, which has an icon on the right side for saving or exporting data to a computer. By clicking on the icon, the data can be exported in the form of a GEOJSON file. All data for the selected layer is exported. The GEOJSON file is mainly used in GIS environments, e.g. for the purposes of further GIS analysis.

Information of the process of the user requirements' collection

The goal was to use all the potential of modern technology to promote Roman heritage in Danube region and to sensitize the population to its value and to create product that will offer users additional content and provide them to get to know the cultural heritage. Furthermore, application is giving everyone an ability to share valuable information on Roman heritage (adding photos, articles etc.) as well as a possibility to download data from application.

Tool for setting the recommended protection limits applicable to both Roman Settlements and Roads Network
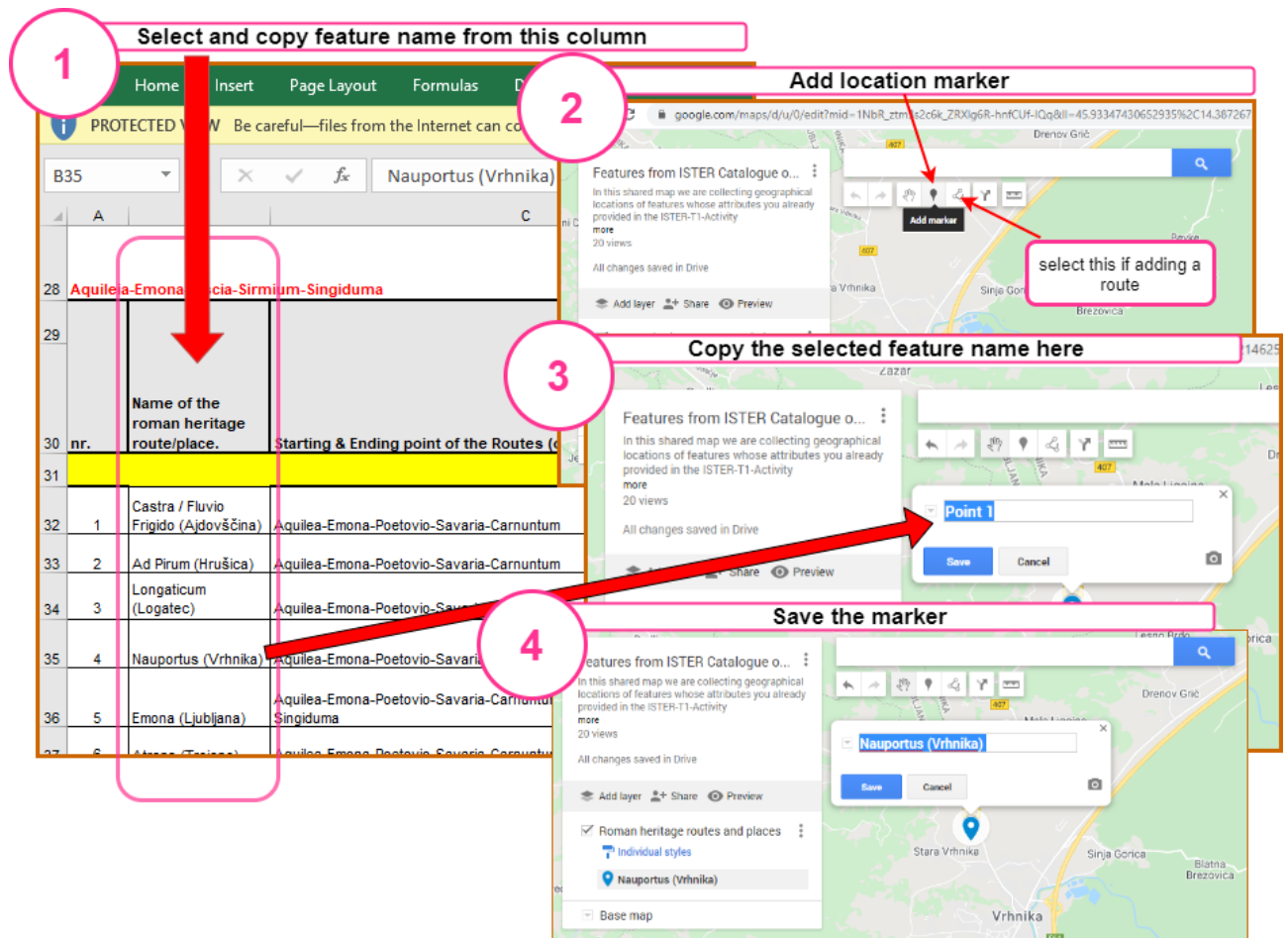
GIS-based territorial Atlas will provide a spatial representation of the open inventory of Roman routes legacy in DR and relevant information regarding protection limits applicable to both Roman Settlements and Roads Network, retracing the history of the Roman Empire (through Roman Roads Network in DR) and its relation with the natural environment.

A dedicated layer in the Atlas will differentiate recommendations for protection areas into three main categories:

1. Non-touchable area or„sterilised" zones (where no activities should be permitted);
2. buffer zone (providing a short-list of permitted activities with certain limitations) and
3. surrounding territory (providing a list of permitted activities with certain limitations and activities which can be performed without any constraint).

Each territorial partner will determine protection areas for its respective territory.

Annex1: Instructions for adding features to Google Maps Drive document