

Interreg



Co-funded by
the European Union

Italy – Croatia



INTERREG ITALY-CROATIA PROGRAMME 2021–2027

D.2.1.2. Developing and upgrading
technological and ICT tools

Interreg



Co-funded by
the European Union

Italy – Croatia



CYROS

Implementation, in the Programme area, of the EUSAIR flagship and crosspillar project idea Adriatic Ionian CYcle ROute for Sustainable tourism

WP number	WP2
Activity number	Activity 2.1. Exploiting ICT technologies and tools to develop new joint models of a sustainable mobility, supporting a sustainable tourism
Deliverable number	D.2.1.2
PP in charge	PP5-ITL
Version	1
Date	03/2026
Availability	Public
PP contributors	Denis Grasso, Giacomo Nonino





Summary

- 1. Introduction 1
- 2. Standards for data collection 1
 - 2.1. Data standards for cycling infrastructures 2
 - 2.2. The CYROS data model for cycling infrastructure 4
 - 2.3. Data standards for tourist POIs/AOIs 5
 - 2.4. The CYROS data model for POIs/AOIs 6
 - 2.5. Data standard for services for the cyclist 7
 - 2.6. The CYROS data model for services for the cyclist 7
- 3. Cyros WebGis 8
- 4. Final considerations and future developments 10
- 5. Annex: additional resources 10



1. Introduction

This report describes the actions that were taken and the results that were obtained in the development of maps/online ICT tools for the data provision (especially D.2.1.1 and D.1.1.1 data) to cyclists and stakeholders involved in management and planning. The resulting ICT tool, a WebGIS portal, will support joint monitoring and dialogue in the Program Area.

2. Standards for data collection

Since data on cyclist infrastructure and services will be displayed in a WebGIS portal, it must be georeferenced and shared in a proper data format; to that end, the ESRI Shapefile (SHP file from this point forward) data format was chosen as the official format for data sharing among consortium partners. A SHP file is comprised of a “geographical” part, that describes where data is located in the world and its shape (a point, a line or a polygon) and a “tabular” part called “attribute table”, that describes characteristics/attributes (stored as columns/fields) of geometries (rows). Therefore, a data model for a SHP file is composed of:

- A type of geometry;
- A series of data fields/columns, each with a specific datatype (string, integer, Boolean, date) and length.

Since SHP cannot store data of different geometries, it was necessary to design a data model for cycling infrastructures (lines) and a separate model for Points of Interest (POIs) / Services (points). In addition, the point model was divided into two separate models since the important characteristics of POIs are different from the important characteristics of Services, resulting in different attribute tables. Finally, some POIs cannot be described properly as points due to their massive spatial extension, such as natural parks and large UNESCO sites; therefore, an additional polygonal model was designed for so-called Areas Of Interest (AOIs).

As result, 4 distinct data models were designed, each focused on a different type of information/geometry:

1. Cycling infrastructures
2. Tourist Points Of Interest (POIs)
3. Tourist Areas Of Interest (AOIs)
4. Services for the cyclist



These models were designed as “data-sharing models”: since the WebGIS portal retrieves data from a relational database, which is a rigid data structure that can house only specific datatypes once it has been developed, Partners were required to modify and convert their dataset to align them to the models, so that data can be seamlessly integrated inside the database and visualized in the WebGIS portal.

While setting the geographical part of the model is straightforward, designing the tabular part of the model is a more involved process. It consists in selecting which characteristics are important for said geometry, that is which data fields will become part of the attribute table. To enhance the interoperability of the models and build upon previous efforts carried out at the EU level, a research phase was carried out to find previous or ongoing projects that have dealt with the issue at hand and whether there were unified data models for this kind of data in the EU landscape.

2.1. EU data standards for cycling infrastructures

At the moment, there isn't a standard for data on cycling infrastructure which is adopted throughout the European Union.

The European Cyclists' Federation (ECF)¹ highlights that there is great demand for data on cycling infrastructure; however, at the moment, no official source provides this kind of information on a European scale, and therefore a unified standard has not been developed.

The European Declaration on Cycling², officially adopted in April 2024, states that “cycling data is not collected consistently in the EU. This affects the optimal choice of transport investments and the evaluation of the effectiveness of measures already taken”.

The European Transport Safety Council, although it publishes reports and aggregated data on the state of walking and cycling across EU countries, has not designed a standard for this type of data.

¹ The ECF is a Brussels-based independent non-profit association dedicated to achieving more and better cycling for all in Europe. Comprised of more than 70 organizations, it is responsible for the development and coordination of the EuroVelo project.

² https://pro.eurovelo.com/news/2024-04-18_european-declaration-on-cycling-what-impact-for-cycling-tourism-and-cycle-route-networks



However, a number of key players at the EU level are taking steps in their respective fields to improve the state of data on cycling infrastructure in Europe.

ECF created a data portal/dashboard called Cycling Infrastructure Tracker³, which summaries the state of cycling infrastructures across Europe. These analyses are based on OpenStreetMap data, which, according to ECF, has been found to be more detailed and up-to-date than official municipal data in certain contexts. Data from OSM is not used as it is, but is refined and simplified by ECF, combining certain fields and omitting others; the result is a data model with great potential, since data structured accordingly can be used to update OSM data and in turn the accuracy of the ECF database. In addition, data collected and refined by ECF is freely available from their portal, therefore can have a major impact on projects and efforts by public administrations.

In addition, ECF has designed a guide to assess the quality of a cycling route and, if the route is already classified as Eurovelo, to certify its compliance to the best standards; the guide is the European Certification Standard (ECS)⁴, published in December 2021. While some of the characteristics that are considered in the evaluation could be useful attributes of geographic data describing cycling infrastructure, the assessment must be made on the field by certified individuals. The evaluators can use external data, such as data that will be available via the CYROS project or public datasets, only if it cannot be gathered through field work; therefore, adding this data to the data standard of this project will have no impact in this regard. Nevertheless, some of these attributes could be useful for the average cycling tourist and can be integrated into the data standard.

On 27 September 2024, the United Nations Economic Commission for Europe (UNECE) adopted the “Guide for Designating Cycle Route Networks”, which is the result of two years of work by the “Group of Experts on Cycling Infrastructure”, of which the European Cyclists' Federation (ECF) is an active member. The document classifies the various types of cycling infrastructures and describes a set of steps to follow in an iterative way to put in place networks that will serve well their intended functions.

Moreover, in 2025 April NAPCORE⁵ published the report ‘Recommendations for cycling data standardization’⁶ targeted to the European Commission Directorate-general MOVE (EC DG MOVE), which is responsible for EU policy

³ <https://www.ecf.com/en/resources/ecfs-cycling-infrastructure-tracker/#:~:text=Disclaimer,made%20with>

⁴ <https://pro.eurovelo.com/projects/european-certification-standard>

⁵ NAPCORE (National Access Point Coordination Organisation for Europe) is the name of the formed organisation to coordinate and harmonise more than 30 mobility data platforms across Europe (NAPs).

⁶ <https://www.interregnorthsea.eu/megabits/news/megabits-contributed-to-european-cycling-data-standardisation-recommendations>



on mobility and transport. In addition to analyzing the state of cycling data across Europe, the report contains a series of recommendations and middle-to-long term actions to be taken.

In particular, the following points are of particular interest for CYROS efforts:

- Cycling infrastructure data must contain, at the very minimum, the type of infrastructure, its surface and its width;
- The recommended types of infrastructures are those defined in the final report of the UNECE Group of Experts on cycling infrastructure;
- Develop or adapt an existing conversion method between the common standards and OpenStreetMap representation of the cycling infrastructure.

Finally, at the regional level, the Italian region of Emilia-Romagna has designed a new data model to assess its cycling infrastructure that is partially inspired by the latest developments by UNECE and ECF, although it lacks some key attributes.

2.2. The CYROS data model for cycling infrastructure

Due to the findings summarized in the previous paragraph, the CYROS data model for the cycling infrastructure has been designed according to the following principles:

- The starting point is the new Emilia-Romagna Region model, which features attributes pertaining to:
 - State of implementation of the infrastructure;
 - Infrastructure type (cycle track, cycle lane, greenway etc.), which are mostly in line with the UNECE classification;
 - Limitations to traffic;
 - Direction of travel for cyclists.
- In line with NAPCORE recommendations, the surface type and the lane/track width are added;
 - Surface types are derived from the ECF work on OpenStreetMap data and relate to the ECS types;
- In line with the ECS, an optional field regarding traffic intensity is added;



- An additional field describing if the cycling segment is elevated or an underpass is added;
- Additional fields are added to track the date and author of updates to the database, the date of validity of said update, the source of geometry data;
- In line with NAPCORE recommendations and with the efforts of ECF, the data model is structured so that conversion to the OpenStreetMap data model will be easy.

The cycle routes network is represented as linear geometries instead of polygonal geometries.

2.3. EU data standards for tourist POIs/AOIs

As for the data model on cycling infrastructure, at the moment, there isn't a standard for data on touristic points of interest (POI) which is adopted throughout the European Union. However, at the national level, some countries are taking steps toward the definition of ontologies in order to create a centralized national portal on tourism.

In July 2017, the French public administration launched DATAtourisme⁷, a web portal to aggregate, standardize and facilitate the dissemination of open tourism data, which was scattered across more than 40 local databases. The ontologies designed for DATAtourisme are the most comprehensive in the European information science landscape at the moment.

At the Italian level, Ontopia⁸, that is the "official repository of ontologies and controlled vocabulary developed as part of the three-year program for the digitalization of the Public Administration", contains a series of vocabularies pertaining to the topic of tourism. Moreover, a key action of the national recovery plan "Piano Nazionale di Ripresa e Resilienza" (PNRR), founded by the Next Generation EU economic recovery package, is the development of the Tourism Digital Hub (TDH)⁹, a web platform to aggregate and promote the tourist offer of the country. In the development of the ontologies for the Tourism Digital Hub platform, the controlled vocabularies of Ontopia and the existing ontologies of DATAtourisme were taken as a starting point.

⁷ <https://www.datatourisme.fr/>

⁸ <https://github.com/italia/dati-semantic-assets/wiki>

⁹ <https://www.italiadomani.gov.it/en/Interventi/investimenti/hub-del-turismo-digitale.html>



Finally, at the Italian regional level, the Emilia-Romagna Tourism portal¹⁰ developed a series of ontologies and taxonomies in line with the design of the Tourism Digital Hub to classify the tourism datasets of the region.

2.4. The CYROS data model for POIs/AOIs

Due to the findings summarized in the previous paragraph, the data model for the POIs has been designed according to the following principles:

- The data model is designed to have fields to collect the requested key characteristics as requested for the deliverable D.2.1.1.
 - Name and general info;
 - Geographical localization of the POI;
 - Thematic description of the POI, that it, if the POI belongs to a cultural/natural macroscopic area/destination/route;
 - Contact information;
 - Data procurement and validity;
- In particular, regarding the classification of the Points of Interests (POI) a two fields/levels system was adopted, mirroring the ontologies of DATAtourisme and allowing a precise characterization of the POI:
 - Theme: generic characterization of the POI, such as “cultural”, “entertainment”, “natural” etc.
 - The controlled vocabulary is custom made on the basis of the previous ontologies.
 - Sub-theme: precise characterization of the POI, following its theme [e.g.: theme = 1 (entertainment) | sub-theme = 105 (cinema)].
 - The controlled vocabulary is a subset of the subclasses of the DATAtourisme ontologies.
- Finally, an additional field called “rank” controls how much a POI should be highlighted in the WebGIS on a scale from 1 to 5, scaling down or scaling up the dimensions of the icon.

¹⁰ <https://emiliaromagnaturismo.it/it>



Data is represented as points (POIs) with the exception of natural parks and UNESCO sites that extends over long distances; this kind of data is represented as polygons (AOIs) in the WebGIS and has an attribute table with the same fields as the POI with the exception of the field “rank” which is missing.

2.5. EU data standard for services for the cyclist

As for the previous data models, at the moment there isn't a standard for data on touristic points of interests (POI) which is adopted throughout the European Union. In addition, there are no initiatives at the national or regional level to create a standardised model.

However, as some types of services can be classified as general tourist services, they are somewhat represented in the DATAtourisme ontologies. In addition, while there aren't data standards at the national or regional level, OpenStreetMap (OSM) offers two rendering layers tailored to cyclist, OpenCycleMap and CycloSM, which are used by a large number of cyclists. New classes were designed based on data shown on the OSM rendering layers and enriched with the relevant subclasses from the DATAtourisme ontologies.

2.6. The CYROS data model for services for the cyclist

Due to the findings summarized in the previous paragraph, the data model for services has been designed according to the following principles:

- The data model is designed to have fields to collect the requested key characteristics as requested for the deliverable D.2.1.1.
 - Name and general info;
 - Geographical localization of the service;
 - Contact information;
 - Opening hours and type of access;
 - Data procurement and validity.
- In particular, regarding the classification of the services a two fields/levels system was adopted, mirroring the ontologies of DATAtourisme:
 - Type: generic characterization of the service, such as “accomodation”, “medical”, etc.



- The controlled vocabulary is custom made on the basis of OpenCycleMap and CycLOSM.
 - Sub-type: precise characterization of the POI, following its theme [e.g.: theme = 1 (accommodation) | sub-type = 104 (bike-friendly hotels)].
- The controlled vocabulary is a mix of and new classes based on data shown on OpenCycleMap and CycLOSM and a subset of the DATAtourisme ontology.

Data is represented as points.

3. The CYROS WebGIS

The CYROS WebGIS portal that was designed for the EU project by the Institute for Transport and Logistics (ITL) is both a visualization tool for the cyclist end-user, a data sharing tool and a data update tool for the stakeholders involved in the promotion and development of the Adriatic Cycling Route. The WebGIS is based on PostgreSQL, a free and open-source relational database management system (RDBMS) which supports the storage of geographic objects thanks to the open-source extension PostGIS.

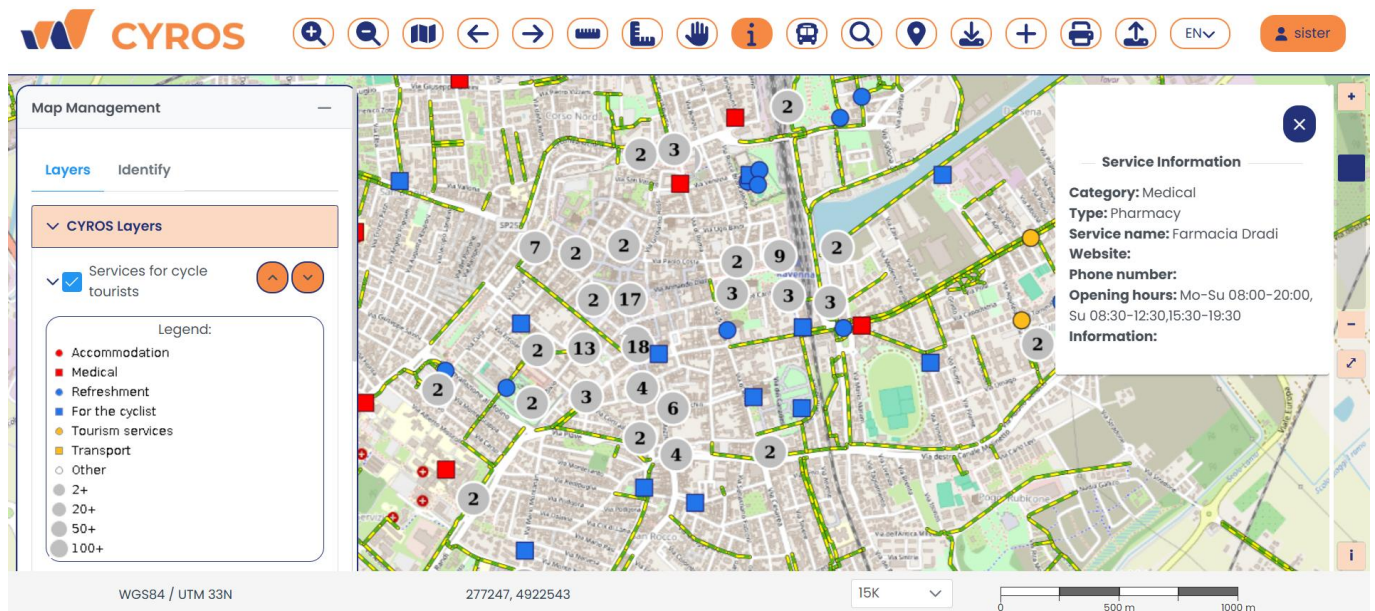


FIGURE 1. CYROS WEBGIS INTERFACE



A multilingual portal, available in English, Italian and Croatian, it offers all the standard features of a WebGIS to navigate datasets:

- Changing the visualization scale and panning the view;
- Centering the view on the user coordinates;
- Centering the view on a provided street address;
- Changing how data layers stored in the database behind the portal are displayed (opacity and order);
- Identification of the attributes of geometries displayed (extracts records of the attribute tables);
- Measurement of distances and areas;
- Upload of temporary data:
 - Stored locally on the user computer, by uploading data in GeoPackage (GPKG) or Shapefile (SHP) formats;
 - Available online by connecting a Web Map Service (WMS), which is a standard protocol developed by the Open Geospatial Consortium;
- Download of datasets stored on the database, both in their entirety or a selection of their geometries/records.

In addition, the portal allows for:

- The interrogation of public transportation data (bus stops and bus lines);
- The update of datasets by uploading data in GeoPackage (GPKG) or Shapefile (SHP) formats directly to the database.
 - This feature is not available to the cyclist end-user, but only to the users that belongs to partners involved in the project;
 - Data must be uploaded with attributes tables and geometry types that are in line with the data models that have been described in the previous chapters;
 - Users can update data of geometries already in the database by uploading geometries with the same “id” (check the Excel spreadsheets) or add new geometries by uploading geometries with NULL values in the “id” field.



4. Final considerations and future developments

The CYROS WebGIS portal will allow the project partners to update data for the management and promotion of the Adriatic Cycling Route, acting as a unified data repository and update portal in addition to the standard usage case of a basic WebGIS portal.

In order to act as an update tool, however, it is imperative that datasets are converted to the data models that have been designed, that is in SHP file formats, with specific geometry types and specific data fields as showcased in the Excel spreadsheets.

A major obstacle that was encountered during the project was the lack of technological know-how about working with geospatial data and the SHP file format by some partners, which prevented them from sharing data in the proper form. As a result, some areas in Italy and Croatia lack data about POIs/AOIs and services and datasets regarding the cycling infrastructure are not as informative as their attribute table would allow them to be. Further efforts have to be made by the end of the project to complete the CYROS data repository. Nevertheless, the open-source approach and the possibility for all to access the data for free can allow the possibility for all the interested stakeholders at EU level to use these data in other applications and/or studies. This CYROS WebGIS is a starting point more than an end for a more sustainable and interconnected Ital-Croatia area.

5. Annex. Additional resources

In addition to this document, a series of Excel spreadsheets are provided, which illustrate the structure of the attribute table of the various data models and can guide the users in the conversion of their datasets.

SHP files with attribute tables aligned to the data models are provided as well to serve as a starting point for future updates by the project partners.

To help users navigate the WebGIS and to showcase its features, a short series of 4 videos was recorded in English. The videos are available on YouTube at the following links:

- **CYROS WebGIS. Lesson 1. Introduction**
<https://youtu.be/mBw5w7Te-ow>
- **CYROS WebGIS. Lesson 2. Upload temporary data**
<https://youtu.be/mVwURbEfnQ>





- **CYROS WebGIS. Lesson 3. Cycling thematic layers**
<https://youtu.be/cNjqznsIB6w>
- **CYROS WebGIS. Lesson 4. Export data and upload data**
<https://youtu.be/wnR3369wnCw>

An online training event on the CYROS WebGis was held online on 11/03/2026. The event was recorded and it is available at the following links:

- **CYROS WebGIS Webinar. Part 1. Data models for cycling data**
<https://youtu.be/IQDmXvqmJJU>
- **CYROS WebGIS Webinar. Part 2. Transforming data according to the data models**
<https://youtu.be/9NfZWAR7ygo>
- **CYROS WebGIS Webinar. Part 3. How to use the CYROS WebGis**
<https://youtu.be/0fM5V76n1hc>

