

Documentation
“National data scheme”
for cycling infrastructure geodata

as resolved by the committee “Digitales Radnetz Deutschland”
(Digital cycling network Germany) on 02/13/2023 (on behalf the Standards
working group)

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Note of changes

date	version	changes
1/6/2023	1.0	
5/8/2023	1.1	Chapter „Access via GDI-DE Registry“ Update link

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Introduction

Under the “Standards working group” (working group of the Digital cycling network steering group), the Radnetz Deutschland office in the Federal Office of Logistics and Mobility is collaborating actively with the German states and responsible service providers to develop a harmonized database of attributes on tourist or themed cycling network data, with the goal of providing high-quality information on the characteristics of cycling routes. The quality and type of cycling routes, such as their surfaces, accessibility, and other types of information are relevant. The purpose of the work to **harmonize available data attributes is to develop a national data scheme for the entire cycling network for thematically correlated cycling routes** (beyond D routes in the German cycling network, including main routes in the German states identified in the work to make the German cycling network more dense). This data will conform to the requirements of Delegated Regulation (EU) 2017/1926 and other European specifications (INSPIRE conformity).

The national data scheme and documentation were resolved by a majority of votes on behalf of the Standards working group in the “Germany digital cycling network” steering group in the meeting of February 13th, 2023.

The German cycling network consists of the network of cycling routes with national importance, and includes the twelve D routes, the Radweg Deutsche Einheit and the Iron Curtain Trail. The cycling network and its route guides are free and available for [download \(VeRa - Germany route planner \(radroutenplaner-deutschland.de\)\)](#) as a geodata set (GPS format / ESRI Shapefile). The route to the ICT is in coordination, so the data sets do not include the ICT. The German cycling network data set contains the geometry for the routes and route names as designations.

Purpose of the document

The document contains framework information for the national data scheme for cycling data, as well as available attributes and associated value ranges.

Access via GDI-DE Registry

The attributes and code lists are entered in the GDI-DE Registry at the following link:

<https://registry.gdi-de.org/codelist/de.bund.balm.radnetz>

Metadata

The final data model should contain the following metadata:

Reference scale:	1: 25,000
Georeferencing:	UTM Zone 32N (EPSG: 25832)
Data format:	GeoPackage (GPKG)
Scope of data:	Entire cycling network (thematically correlated routes)
Area covered:	Federal Republic of Germany
User language:	German
Usage conditions:	the geodata set is available for use free of charge according to the data license Germany – Zero – Version 2.0. Any use is permitted, without restrictions or conditions.
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Definition of terms

The national data scheme describes cycling data in the form of route guides for thematically correlated routes. National themed routes cross state borders to form D routes, which are part of the German cycling network.

The data model differentiates between the following content:

German cycling network: network of nationwide long-distance cycling routes of national interest.

Primary state routes:	primary state routes connect regions to the national cycling network, adding density to the German cycling network while also serving as attractive local transportation axes in many cities and other regions.
Geometry:	the spatial components of geographic data are represented in a GPS or geodata service using the geometry.
Geometry direction:	(digitization) direction of the geometry, starting from the first base point to the last base point (coordinate pair along an edge that defines its form)
Nodes:	Starting and ending point for a route, marks the change in attributes. The node (GM_Point) contains location attributes (coordination and unique node ID).
Edge:	a route, part of a route with uniform descriptive attributes that connects the nodes. Categorized into two classes (basic/optional) contains an edge attribute to describe the characteristics of the edge. The geometry curve runs on the center line of the cycling route. An edge (GM_Curve) or route section is part of the Features Route. Using MultiLineString is not permitted.
Route:	Routes are formed of thematically correlated route sections or curves. They have the same route ID or route name
Wayfinding:	Signs (nodes) on the cycling routes using an inherently consistent wayfinding system for cycling with wayfinding/signage stating the destination and/or route.
Feature:	A feature is a data set with self-referential characteristics (attributes) and externally referential characteristics (relations). Features with a spatial reference can be evaluated spatially and displayed in maps.
Field:	Header/title of an attribute in the attribute table
Attribute:	An attribute is a descriptive, self-referential characteristic of the feature
Code list:	A code list is a list of values (numbers or digits) and the descriptions of their individual meanings
Data type:	The data type describes the data format for the specific attribute. There are basic data types like integers, strings, booleans, date/time information, and complex data types like geometry or code lists (with pre-defined categories).
Primary key:	unique identifier for a data set

Data usage

Geodata (geometry/attribute/relations) comes from the data delivered by the federal states, and is combined centrally by the German cycling network office of the Federal Office of Logistics and Mobility. Quality management includes reviewing the data to ensure it is consistent and free from gaps (topology check) and communicating potential areas of optimization. Map matching is conducted and geometries are connected in border areas to achieve the routing objective of the data set.

The data set is updated as needed. The up to date nature of the individual data sets is included as an attribute.

Data is published centrally via the national access point (Nationalen Zugangspunkt (NAP)). The technical infrastructure is provided via the landing page of the Germany cycling route planner.

Topology in the data model

*Wayfinding information is optional

The topology in the data scheme is described by a UML diagram (unified modeling language). The following UML diagram contains the features to be transformed (entities).

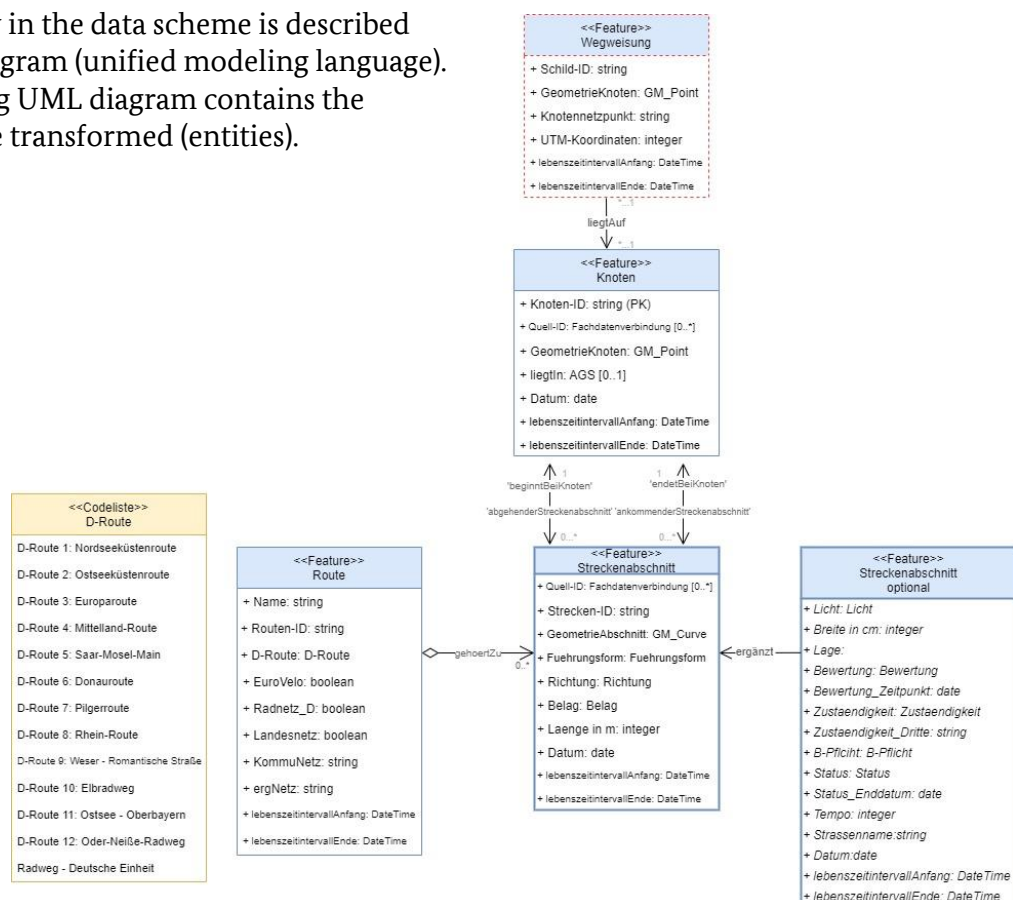


Figure 1 UML diagram "National data scheme" (Last updated: 10/25/2022)

Node system

A node is the starting or ending point of a route section (curve). When an attribute of a curve is changed, a node is set so that the curve has uniform attributes. Additional information is provided with the goal of making the attribute as clear as possible. It is possible to define attributes by majority principle for multiple, minor changes in attributes. The characteristic applicable to the greatest length of the route section is adopted. If stationing is used in the source model, then the sections with homogeneous attributes can be adopted in the same manner for transformation, if the node points (geocoordinates with country designation) are included for the start and end points (base points). Geoprocessing makes it possible to adopt the attributes according to the geoscheme.

Attribute catalog

Feature nodes

Attribute	Field name	Data type	Description	Values
Node ID	Node ID	string	Unique primary key (PK) from the first two places AGS (country designation) and combination of easting & northing: concat('AGS','easting', 'northing')	
GM_Point			Start/end point (geocoordinates with the elevation of a curve or route section) with homogeneous unique attributes A new node is required if attributes are changed or in case of a point of intersection with another curve.	
Source ID	Source ID	string	Original ID from data sources	
Date	Date	date	Autom. system date of the last change	

Base curve feature

The base curve feature (“route section”) contains the relevant minimum information, and is supplemented by the optional attribute of the optional curve feature (“optional_route section”). By dividing root & sub-categories, it is possible to adopt existing classes directly and to assign a sub-category, or if there is no sub-category or if the topic does not match well enough, to select the root category.

Attribute	Field name	Data type	Description	Values
Source ID	Source ID	string	Original ID from data sources	
Route ID	Route ID	string	Unique primary key (PK) from node ID (fromnodetonode)	
GM_Curve			The geometry representing the center line of the route section	
Guidance type	Guidance	key	Information on the guidance type based on the ERA 2010 (Recommendations for cycling infrastructure) (partially adjusted), aggregated by categories to transmit the level of detail of the information.	100=Cycling on roadway (mixed traffic with motor vehicles) 101=Bicycle path 102=Multi-purpose lanes 103= Protective strips 104=Cycling on roadway with street cars 105=Play street 200= Cycling lanes 300= Structurally separate cycling routes 301=Facility cycling paths 302=Bi-directional cycling paths

Attribute	Field name	Data type	Description	Values
				400= Route with pedestrian traffic 401= Joint walking and cycling path (StVO 240) 402= Route with pedestrian traffic, cycling permitted (StVO 239) 403= Pedestrian zone 404=Footpath (walk bicycle) 405=Footpath (cycling permitted) 500=Other paths 501=Agricultural road ¹ 502=Forestry road ² 503=Dirt road ³ 504=Dike path ⁴ 505=Service route on federal waterways 506=Stair 600= Mechanically operated connections 601=Ferry 602= Rail or cableway 900=Unknown
Direction of travel	Direction	key	Direction in which the cycling facilities can be traveled Derived from node ID (from/to) or node sequence	1= both directions 2= in geometry direction 3= against geometry direction 9= unknown
Surface type	Surface layer	key	Tye of surface based on ERA 2010 (recommendations for cycling infrastructure) and Based on RStO 12 (Guidelines for standardizing the surfaces of traffic areas 2012) (partially adjusted), aggregated by categories to transmit the level of detail of the information.	100 = paved surface 110 = asphalt top layer 120 = concrete top layer 130 = paving stones 131 = concrete pavers 132 = natural stone pavers 140 = panels 141 = concrete panels 142 = natural stone panels 143 = other panels 200 = water-bound surface 201 =fine crushed stone ⁵ 202 =coarse gravel ⁶ 300 = unpaved/natural surface 400 = wood 500 = metal 900 = unknown
Length	Length	integer	Length of the route section in meters	
Date	Date	date	Autom. system date of the last change	

¹ Agricultural roads that cannot be used by dual track, non all-terrain vehicles year-round (NWaldLG Sec. 25, 2) are used primarily to access and operate agricultural and forestry areas. Use of such roads by pedestrians and cyclists is permitted. Often, the route is paved with asphalt but may have potholes or other dangerous features.

² Unpaved road through the forest, can be accessed seasonally by heavy-duty transport

³ Unpaved connecting route through forest and field

⁴ A dike path is a path that is the top of a dike or a dike defense path if cycling is allowed.

⁵ Grain size < 32 mm

⁶ Grain size 32-63 mm

Route feature

Note: the base curve feature (“route section”) is supplemented by the “Route” feature, since a route section is part of a route. The feature has a 1:n relationship, since a route section can be associated with multiple routes.

Attribute	Field name	Data type	Description	Values
Name	Route name	String	Unique, full name of the route, multiple names possible (separated by “;”)	
Route ID	Route ID	Code list	Numerical route ID with country designation according to the first two places AGS (Ex.: AGS and source ID)	
D route	D route	Code list	Brief description of D route's affiliation with the Germany cycling route via external code list	
EuroVelo	EuroVelo	boolean	Boolean query of affiliation with a network	
Cyclingnetwork_D	Cyclingnetwork_D	boolean		
National network	National network	boolean		
Municipal network	MuniNet	string		100 = Municipal networks 101 = District network 102 = Municipal network
Other networks	supNets	String	Other networks that are relevant for the sources List of brief names	

Information on the route ID:

Designations or route identifiers as code list.

The country-specific code is placed before the country designation (AGS, first two numbers, similar to nodes) to ensure clarity on the federal level.

Example: AGS and source ID

Optional curve feature

Note: the optional curve feature (route_section_optional) is a supplement to the base curve feature (“route_section”), since the optional attributes are not entered from all sources.

Attribute	Field name	Data type	Description	Values
Lighting	Light	key	Lighting of cycling routes	0=non-illuminated 1=illuminated 2=retroreflective edge markers
Width	Width	integer	Paved minimum width ⁷ of a section in centimeters	
Location	Location	key	Description of the location Optional, only relevant if available	1= in urban area 2= in rural area
Evaluation	Evaluation	key	Evaluation of surface characteristics Observe indicators	1= like new/very good condition 2= good condition 3= average condition 4= poor condition/reason for monitoring/analysis 5= not rideable 9= not evaluated
Time of evaluation	Eval_1	date	System date of the evaluation, since the rating is a point-in-time rating	
Responsibility	Load-bearing capacity	key	Responsibility for maintaining load-bearing capacity	1=Federal government 2=State 3=District 4=Community 5=Third party 9=Unknown
Responsibility Third party	Structural load_3	string	Free field for entering responsibility, if third party	
Usage obligation	U obligation	boolean		
Status	Status	key	Definition of the category with a focus on rideability or the current status of the route section	10 = rideable 20 = under construction 30 = in planning 40 = blocked 41 = permanently blocked ⁸ 42 = seasonally blocked ⁹ 43 = blocked with end date
Seasonal status	Status_1	string	Time period that route is rideable in months with reference to source	
Status End date	Status_2	date	Date when blockage will be released	
Speed	Speed	integer	Maximum permitted motor vehicle speed	

⁷ The minimum width is the narrowest point of a section (in cm)

⁸ Sections that cannot be used for routing on a permanent basis. May be blocked by environmental influences (flood damage, falling rocks, etc.)

⁹ Sections that are rideable seasonally. Possibly due to ferry traffic, flood areas, seasonally used forestry/agricultural routes

Attribute	Field name	Data type	Description	Values
Street name	Str_name	string	Name of the street, if available	
Date	Date	date	Autom. system date of the last change	

Optional wayfinding feature

Note: the wayfinding feature (nodes) is optional, and is designed to provide cyclists more information on whether there are wayfinding signs on the route.

Attribute	Field name	Data type	Description	Values
Sign ID	Sign ID	string	Source ID from land registry	
Node network point	Node network ID	string	ID from land registry	

Indicators for classifying “Evaluation” attribute

The “Evaluation” attribute provides information on the quality of the surface, and on whether the surface of the route section can be ridden on. The evaluation is a point-in-time evaluation, so the time stamp of the evaluation is relevant.

The evaluation of surface quality requires methodologically clear indicators for the purpose of classification. Since there is no standardized and certified process for evaluating the condition of cycling routes, a qualitative assessment should be provided.

The qualitative assessment, which is not a standardized process, does offer a point of orientation describing the condition of the surface of the cycling route. This, in turn, can be used to determine if action may be required, such as renovations (due to the structural condition), if defects were included and documented in the quality assessment.

Commonly, five assessment classes in descending order are used to evaluate the quality of the surface. The method for evaluating the surface in the FGSV regulation “Additional technical contractual conditions and guidelines for road condition assessment and evaluation” – ZTV ZEB-StB for short - ([FGSV, 2006](#)) for motorized road traffic is used, similar to evaluating roads for motorized traffic. It can only be used to determine indirect information on the status of the cycling route. Status classes from common contracts for assessing and evaluating the status of cycling routes are determined based on statistical variables, using photogrammetric acquisition. Status classes are identified and the section is evaluated depending on its specific design and surface type.

Frequently asked questions (FAQ)

The following basic information is provided to clarify questions regarding the transformation:

1. There is no data for certain fields/attributes. Why is this?

- The attributes can only be filled in if data is available. If no data is available for an attribute, the field remains empty (“ZERO”). If individual pieces of data are missing, it is entered as unknown (Attribute: “Responsibility,” “Evaluation,” “Surface type,” “Direction of travel,” “Guidance type”).

2. Node ID – how is the node ID formed?

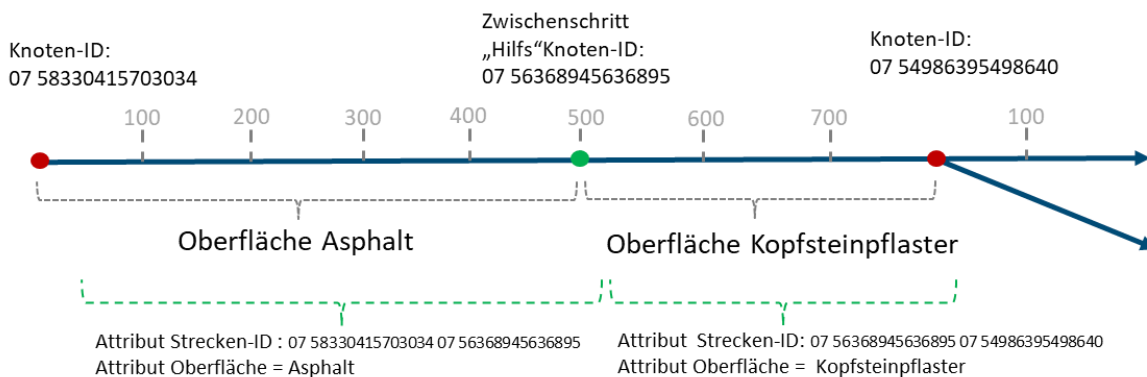
- The unique primary key (PK) is formed from the country designation (first two first digits of the general settlement key) and combination of easting and northing).

Notes:

- Function: concat('AGS','easting','northing')
- No elevation information should be included for the node.
- Geometric resolution = 1m

3. Node ID: how do I represent stationing along the curve?

- After forming homogeneous sections (same attributes), the positions of the stationing information can be used as nodes. The following image provides an explanation of this:



4. Sides with different attributes – what if the opposing guidance types that can be ridden on by cyclists have different attributes?

- Guidance of separate (or parallel) geometries with corresponding attributes

5. Minor attribute change: how do I handle minor attribute changes?

- Due to the majority principle, the values/categories for the optional attributes can be combined into one value, so that the values/characteristics applicable to the longest area or majority of the route can be used to prevent creating excessive nodes.