

Mapping – Routing – Navigation for Cycling

Characteristics of cycle route networks, requirements of different user groups

Cycle route networks bear characteristics that are different from those of the classic road network. While the latter is interconnected and has a hierarchy that developed over time, the cycle route network is made up of many individual fragments in most European countries: car-free greenways, traffic-calmed streets, zones where speed limit is 30 km/h (18 mph), streets with a bike lane or cycle path, byways, etc. Often, interconnected routes become visible to users only by virtue of tools that help them find their way, e.g. direction signing, cycling maps, navigation system.

The requirements placed on a link – is the link direct, free of cars or located in a pleasant environment – vary depending on the cycling target groups. Commuters prefer the most timesaving route. They know their way around very well, but for their commute they also need roads that are suitable for everyday use (also after dark or in wet weather conditions). Recreational cyclists with children are not in a hurry; they look for routes that are free from motor traffic, easy to follow without tedious orientation and that are embedded in an attractive landscape, preferably. Sport cyclists using a racing bike require a smooth road surface.

Signage first emerged because users wanted to independently choose their own destinations and decide freely where to go and when. Signage was later followed

by cycling maps, cycling travel guides and not least also online route planners, as well as mobile applications that better serve the interests of the users.

Print media: cycling maps at a glance

Cycling maps as well as direction signing on cycle routes first appeared in Western and Central Europe around 1900, at a time when bicycles became a popu-

Cover images: A search result from a cycle route planner for the state of North Rhine-Westphalia (Germany).

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Berlin cycling map showing cycle streets (green-yellow), cycle facilities (yellow), cycling on bus lane (orange), calm streets (white), uncomfortable surface / very busy road (grey)
© Tilo Schütze, www.baerleinplan.de

lar means of transportation, when road maps were not primarily used for military purposes anymore and when motor-vehicle traffic was still a marginal phenomenon. The first road maps were designed mainly for cycling, and thus also showed an elevation profile. With the emergence of domestic tourism, the first cycling map was already published in the Netherlands in 1884 by the 'Algemene Nederlandse Wielrijdersbond', the then cycling association ANWB, which today is more of an automobile association.

From 1975 onwards, local cycling initiatives in Germany published 'byway maps' of cities. In doing so, they highlighted the demand for more cycle facilities. In 1982 there were already around 200 cycle route maps and cycling maps of cities in Germany.



Map showing part of Paris with 'Velib' bike rental stations.
© www.velib.fr

Apart from depicting cycle facilities, today's high-quality maps also illustrate recommended cycling routes and their quality. Equally, the maps display the main road network, car-free greenways, highlighting zones where speed limit is 30 km/h (18 mph) or provide information on the quality of the road surface. A special feature of the maps is that they highlight bicycle service and rental stations.

The development of bike rental systems also ushered in a new period for city cycling maps. These maps help users find the nearest bicycle rental station – with the main cycle route network as additional information. Bike rental stations are also increasingly depicted in network maps of urban bus- and tramlines. Regional cycle route maps and cycling travel guides supplement the recommendations for cycle routes at regional level with information on tourist attractions of the region. In some cases, information about trails, cycle routes as well as public transport services offered for weekends are integrated in one single map.

Digital media with geo-functions

The emergence of digital geo-media also radically changed cycle navigation. The term geo-media is often used as a collective term comprising all electronic media that integrate and articulate location-based data. Actually, geo-media refers to classic or new media/technologies that are equipped with additional geo-functions. Online route planners are only one example how cycling-related content can be merged with location-based information (e.g. weather forecast). Navigation software combined with a location-based search for accommodation or service areas can increase the visibility of such infrastructure and help cyclists to coordinate their interactions and take decision.

The interest of the hotel sector in enhancing its cycle-friendly profile has prompted the industry, among other things, to help set up the 'Bed+Bike' catalogue of the German Cyclists' Federation ADFC, a listing of bike friendly accommodation. This catalogue can be used in combination with the ADFC tour planner.

Online route planners and navigation tools

Until recently route planners were developed mainly for motorised transport. The increase in cycling also raised the demand for high-quality cycle route planners

Sources

BBBike (Berlin Brandenburg Bike route planner):
www.bbbike.de

Bike route planner of North Rhine-Westphalia (Germany):
www.radroutenplaner.nrw.de

Guymon, Shannon (2010): Biking directions added to Google Maps: www.googleblog.blogspot.com/2010/03/biking-directions-added-to-google-maps.html

Naviki: www.naviki.org

Open Street Map: www.openstreetmap.de

for both cycling tourism purposes and everyday cycling. These applications, contrary to the automotive navigation systems, are designed solely for non-motorised transport; hence they use different categories to better serve the needs of cyclists. Additional information about existing cycle paths, cycle-friendly roads, avoiding hilly terrain or type of surface are optional information offered by high-quality cycle route planners.

Cycle route planners vary depending on

- the source of the location-based data associated with the map, different providers (State Transport Ministries, research projects, private businesses)
- the purpose of the trip (tourist cycling on designated recreational routes or non-leisure, everyday cycling)
- the level of interactivity (including route selection, entering start point and destination as well as adding GPS track logs of routes travelled).

A variety of options

The different options provided by online route planners sets them apart from others in terms of quality. For instance, do they give recommendations for cycle tours, or suggest special recreational routes? Are enter options for 'start point' and 'destination' limited to an address or do they also integrate stops in the local public transport network and attractions? Can users plan a multi-day trip (stopover option)? Can additional information about the roads be accessed in the database, such as 'suitable for racing bikes', 'traffic-calmed' or 'gradient'? Can users only print out the search results or can they download it as a GPS track? Can users toggle between various map layers, rendering information about the route such as attractions, restaurants, accommodation and shopping areas as well as other points of interest (hospitals, cash terminals, supermarkets, etc.)? Is the route network used by the planner detailed enough to allow route planning, etc.?

After recording tour routes using a GPS tracking device, can users upload the tracks to share them with other users? Can users record tour routes to pass them on later (as a GPS track)? Are there additional options for users to rate the routes, or even the restaurants or accommodation they selected? Can users share relevant knowledge and thus help make the planner more attractive and informative?

Examples of providers

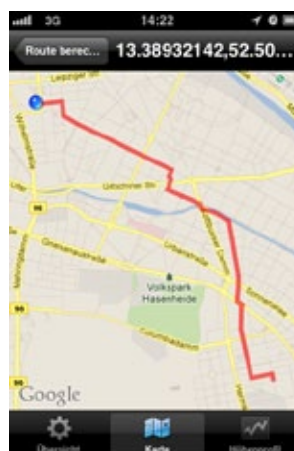
The different providers of interactive route planners set different priorities. The Länder, for example, focus primarily on tourism, whereas community-generated orientation systems aim at mapping the road network for every-day use. Additional information (highlighting e.g. 'pedestrian zone', 'cycling permitted', 'sett-paved cobblestone road', 'no street lighting') for cycle route sections in Berlin and Brandenburg is provided on the website www.BBBike.de, the result of a diploma thesis at the Technical University of Berlin. The information on the website is presented in the form of a map and offers a detailed description of routes along with comments about the road conditions.

The hilly city of Stuttgart has designed a cycle route planner that does not only allow users to plan their own routes depending on their own preferences, but also advises cyclists to use public transport to take them and their bikes over steep sections in the city. Furthermore, the cycle route planner integrates the public transport journey planner into the route planner. To set up its route planner, the city of Stuttgart sought the cooperation with the regional public transport authorities.

Since 2010 'Google Maps' has been offering numerous maps detailing networks of cycle facilities, mainly for North American cities. The quality for individual route planning varies depending on the data, which is mainly provided by the cities.

Orientation – online and mobile

Mobile phones can serve as navigation systems if they are equipped with the necessary software and Internet connection. Some of the German states (Hesse, North Rhine-Westphalia) and the German Cyclists' Federation ADFC offer applications for smartphones, also known as 'apps', which have come to complement the successful online route planner. People going on a cycling tour can carry their own naviga-



Screenshot of the free Naviki app for smartphones.

Twitter account NYC Bridge Report:
<http://twitter.com/nycbridgereport>

tion systems along and that way be guided to their destination in real time. However, there are still challenges for the mobile applications, for example when it comes to downloading map information for continuous positioning, which does not only use up a lot of battery energy, but also varies depending on the speed of the internet connection and the working memory of the devices. Meanwhile, mobile applications that store maps offline on the device have proven to be much more stable. However, in that case there are licensing issues unless the application – such as Naviki – works with OSM (OpenStreetMap) systems.

Further requirements are placed on the navigation system when people use it on a cycling tour: Will the route be recalculated if, for whatever reason, the cyclist follows a different path? Does the information on the display include places of interest, restaurants or other infrastructure (including contact details)?

Social resources for map and data generation

‘OpenStreetMap’ (OSM) is the most important example of maps that are created by users and released with a free license. These maps provide a base for the cycle route planner Naviki. Additionally, its users can upload their own routes as GPS tracks, which can be included in its routing, thus producing high-quality and detailed route maps also showing local short cuts and alternative traffic-calmed routes off the familiar road network. The service uses a database providing geospatial data for users to edit, which is why license costs can be avoided so that map data can be used on websites and printed material without additional costs. The website also allows users to give feedback on the mobile applications.

The knowledge users provide on the Internet can be utilised for cycling purposes in multiple ways. In that spirit, a cyclists’ organisation in New York set up the twitter account ‘nycbridgereport’ that is fed by cyclists mainly to give and exchange information about the conditions of cycle paths on New York’s bridges in snowy weather, but is also a useful and practical tool to warn of road



Screenshot of the Twitter account “nycbridgereport”.

works and traffic re-routing.

This form of self-organisation among users/cyclists is also an important resource for public administration. The Land of Hesse, for example, allows users of the online cycling information platform ‘Meldeplattform Radverkehr’ to report road damage directly to the local authorities.

Conclusion

Building a complete and coherent map of a cycle route network is a tremendous challenge and depends on user interest. Numerous cycling travel guides as well as cycle route maps have been produced to provide cyclists with comprehensive information about their options. Digital media increasingly offer geo-functions that can be used both on a home computer or a smartphone. The benefit these tools offer to cyclists is increased substantially with ever more accurate routes and the possibility to toggle between multiple map layers showing, for example, different points of interest (POIs). These layers also shape users’ decisions regarding the choice of their cycling route, which is why it is so important for local businesses to get their business on the route planners. However, also the users become more and more involved – they help create maps, evaluate routes, add recommendations for routes, inform other users about cycle network damage or report the damage directly to the public authorities responsible for road building and maintenance by using their platforms.



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More information on cycling and orientation can be found in CyE I-11 Signposting to Establish Cycle Routes — In Germany, regulations determine standards for coherent and visible direction signing as well as consistency in signing of destinations.

“Cycling Expertise“ is available online:
www.nrvp.de/en/transferstelle

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