Producing bicycle network maps and cycling transport access guides

Purpose

This note provides advice to government agencies, councils, the private sector and community organisations on the making of maps and transport access guides for cyclists. It recommends techniques and procedures which are designed to improve wayfinding and route navigation for the community to help them to easily and efficiently use their bicycles for transport, tourism, recreation, fitness and fun.

Introduction

Cyclists were among the first mass-users of specialist road mapping which developed into the modern road maps and city street directories. Cycle maps are concentrated packages of information which can greatly help cyclists to find their way around an area, plan specific trips and navigate complex urban environments.

Unlike cycle route direction signage, which is limited to showing the way for a specific route, a well designed cycle map can show many things: alternative route possibilities; difficult riding conditions (such as steep hills); potential short cuts or detours; local services and facilities; tourist attractions; business centres; road traffic conditions; and, hazards such as difficult turnings and squeeze points. The widest possible use of the cycle network is promoted by the production and distribution of bicycle network maps. Sections of the maps can be used on static information display columns erected at key network junctions.

Aim

This series of notes aims to assist government agencies, local government and private/community organisations to provide for cycling in their local area.

Contents

Two examples of early road maps designed primarily for cyclists. Below left Figure 1: The cover panel of Joseph Pearson's Road Map of NSW published by HEC Robinson (c 1911). Below right Figure 2: Detail of a 1898 cyclists' map of the Macedon District, Victoria. Note the markings indicating the road condition.
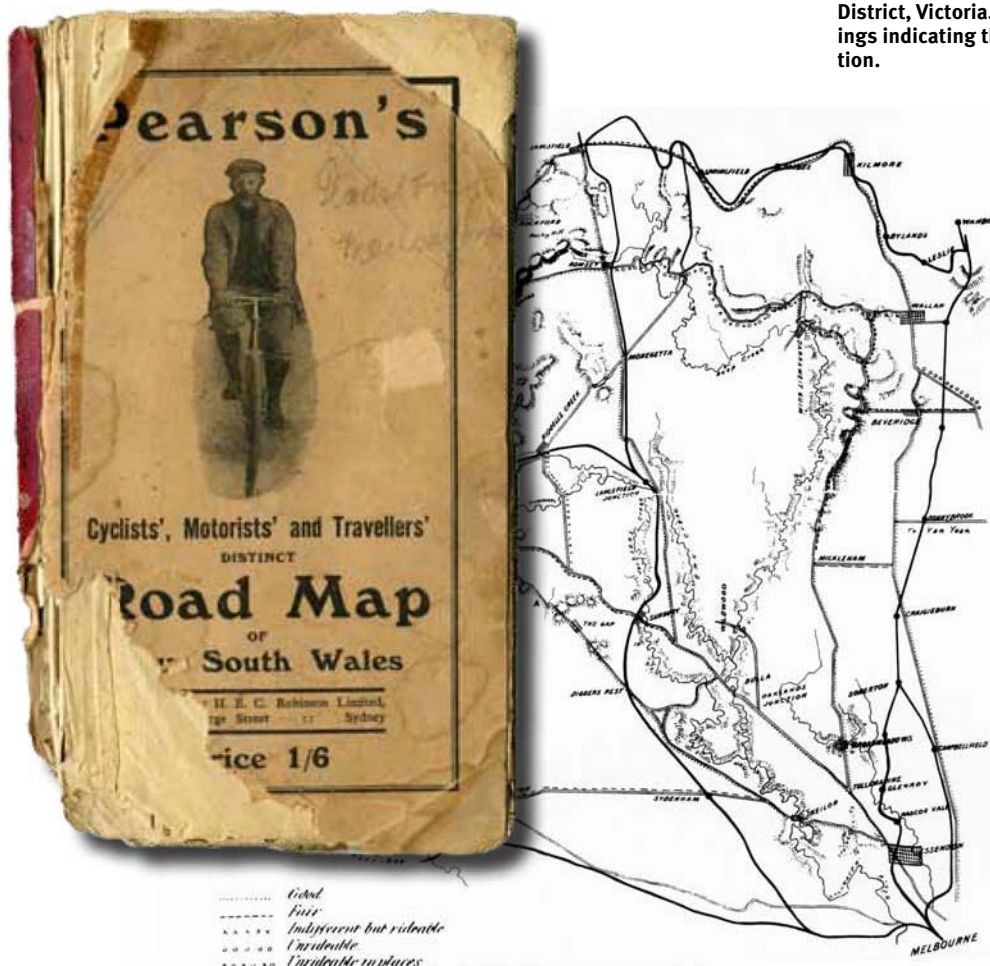
What is a map?

Maps depict the places in which we live and travel. Modern aerial photographs can provide an accurate and visually detailed view of a locality, but maps do a lot more. Maps combine words and symbols to communicate a greater density of data and information than is possible in an equivalent photograph.

The symbolic language used in maps is space efficient and can pack large amounts of data into a relatively small space. To 'read' this information and fully understand the map, we need to decode its messages and place these within their proper context. The language of a map has to be understood by the people who are going to use it. If the symbolic language is too complicated, or difficult to understand, the map will be unreadable and therefore useless.

Map makers need to ensure that their maps are well designed and easily read. We all know that there are good maps and bad maps, the problem is defining which is which. The following principles are intended as a guide to mapmakers who need to decide what information to put in their maps and how to show it.

Principles of good map design

The following principles provide a useful guide to producing useful and easily understood maps.[1]

1. Concept before compilation

What is the map for? Who is its intended audience? What types of information do the users need? What level of competency do they possess? All these issues need to be addressed before the map can be produced.

Bicycles are superb short-range vehicles, and cyclists' needs can be intensely localised. Cyclists tend to use the whole street system for their trips – not just the major and secondary roads. Short cuts and safe crossing points on busy roads are important to them.

All recommended cycle routes in the network need to be indicated, not just those parts already completed – otherwise the map will be useless as a navigational aid. Maps showing only the completed 'bits' of cycle networks may be useful to governments to track cycle network development, but should not be issued to the public, as they do not show all the wayfinding possibilities.

Bicycle riders need to reach destinations at street addresses and town centres, so it is important that street names, community facilities (schools, universities, public buildings, shopping centres/streets etc) and prominent landmarks are shown and labelled.

Studies of human physiology have found that some people relate better to three-dimensional information rather than to conventional two-dimensional maps. A common response to this is to combine three dimensional diagrams of landmarks (buildings, sculpture, bridges and other structures) with a conventional map. This technique is often used in tourist guides where people are usually new to an area and more likely to recognise a landmark from its picture than its plan view shape.

Recommendation: *Maps for cyclists should be specifically designed to help them with their particular navigational problems and to show the kinds of things they want to know.*

1 British Cartographic Society Design Group 1999

Figure 3 (above): This German cyclists' map offers a unique way of mapping a dense urban environment (Berlin). The map doesn't show cycle network routes. Instead it shows the streets most suitable for cycling. Streets shown in a grey colour are unsuitable for cycling, streets shown in white are suitable but shared with cars and streets shown in yellow are most suitable and have marked bike lanes or off-road bike tracks (see major roads in top centre). This type of map can be useful for short local trips, but more difficult to use for longer cross-town trips.
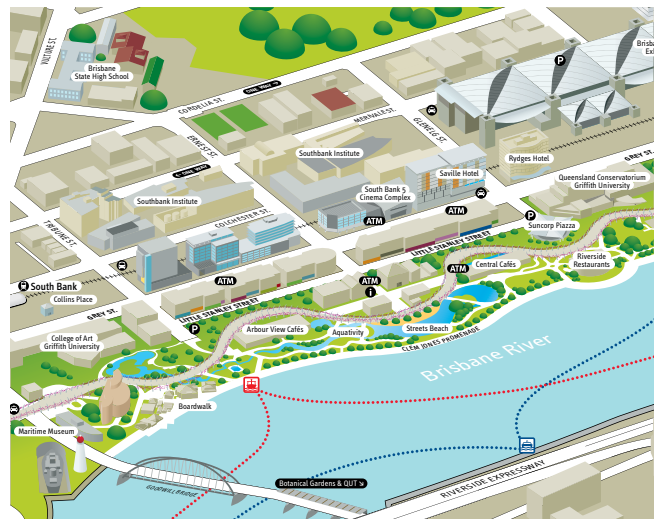

Figure 4 (above) and Figure 5 (below): These maps show details three dimensionally. This type of map is particularly useful for first time users such as tourists and newcomers. The map of Southbank Parklands (centre) provides a full 3D bird's-eye view of the area while the tourist map of the Italian town of Orvieto shows the major landmark buildings in 3D, and all other information in a more conventional 2D mapping style.

Figure 6: This active-travel map uses the Brisway commercial street directory as its base. The street system is printed in a grey tone to make the public transport, cycling and walking information stand out. This map shows major commercial/community facilities and public places which are the destinations of many transport trips. Because this map aims to serve three transport user groups, it sacrifices some clarity and readability to present more information. As cycle routes overlap both walking routes and bus routes, a transparent style 'highlighter' line is used to show cycle routes.Reproduced from the map, *Active Travel Map 6 Brisbane South*, Brisbane City Council, 2006. Base map copyright Brisway Publishing Pty Ltd. Used with permission.

2. Hierarchy with harmony

Maps can contain many different sets of information with each displaying its own hierarchy. Striking a balance between the depiction of these different hierarchies and the overall legibility of the map is one of the map designer's biggest challenges.

One way the normal road hierarchy is depicted on street maps and directories is by line thickness. For example, major roads with heavy traffic are shown as thick lines, while secondary roads, residential streets and lanes are thinner lines, with colour often used to reinforce line thickness. On a map for cyclists, the most important information is the network of cycle routes (principal, local and tourist/recreational). Colour is recommended to indicate these cycle routes, with the base road network depicted in a neutral grey to differentiate it from the coloured cycle routes (see Figures 6 and 9).

Recommendation: *Important things must look important on the map. Information of lesser importance still needs to be readable, but only on closer inspection.*

3. Simplicity from sacrifice

The best way to avoid 'map clutter' and difficult to read maps is by limiting the range of route or facility types depicted. Usually there are three basic types of cycle routes: main or principal routes, local routes, and tourism and recreational routes. These three types can be simply shown using different line colours. Figure 7 shows many possible ways of showing route information using a combination of line colour and type. This level of complexity makes a map difficult to read. Figure 9 on the other hand, shows a cycle network map where only two types of routes are shown: principal routes shown in blue and local routes shown in green. This map has avoided complexity by limiting the depiction of cycle facilities to two line types: on-road (solid lines) and off-road facilities (broken lines). By sacrificing some level of detail the map becomes easier to read.

Using multiple colours and line shapes requires a careful application of contrasting colour and shape. When selecting line colours, avoid combinations which are hard to distinguish from each other. If cycle route conditions/facilities are to be shown, use a limited palette of line shapes to intuitively represent the facility. Whatever method is used to indicate information, it should be simple and easy to follow.

Recommendation: *Less is more. Good design tends*

Figure 7: Though it is possible to show route hierarchy, surface condition, type of facility etc using colour and line type, it is not advisable to show this level of detail. Limiting the number of symbols the user has to decode will make a map much easier to read.

Designation	Surface	Separation	Flow direction
Principal	Sealed	Physical (off-road path)	One-way off-road pairs
	Mixed (shared street)		
Local	Cobbled	Visual (bicycle lanes)	Two-way off-road one side
Tourist/recreational	Gravel	Mixed (shared path)	Contra-flow on-road

Figure 8: This cycle network map of Cambridge in the UK uses a mixture of colour and line shape to indicate routes and facilities. Solid yellow lines indicate the presence of cycle facilities and dashed yellow lines show routes without facilities (shared space). Blue lines indicate routes off-road and red lines indicate roads prohibited to cycling. Brown lines indicate shared bus lanes.

towards simplicity. The best, most useable maps are often distinguished by what they do not show rather than what they do show.

4. Maximum information at minimum cost

A good map is one which packs in a large amount of information, but at the same time is very easy to use. It is essential to carefully select the map content and symbols to avoid conflicting information, such as lines, lettering and colours. A good base map is essential, but if the base map is too strong in appearance the cycling information will be lost and the map will appear cluttered and confused.

When the background street network is shown in neutral grey (see Figures 6 and 9), coloured cycle routes and important buildings and services appear more prominent and can be more easily read on the map.

Recommendation: *Always try Include as much useful information on a map as is possible without making the map difficult to read and use.*

5. Engage emotion to improve understanding

A well-designed map needs to connect with users. For designers this means developing an emotional connection and empathy with the map users. Effective map design engages the map users' emotions and in this way are they receptive to the map's message. Although it is not its primary purpose, a good map which is loved by its users can be a work of art.

Recommendation: *Always aim to 'connect' with end user of the map and cater to their particular needs.*

The map making process

Developing a map is an excellent way of encouraging the community to ride more often. A cycling map can make people aware of new possibilities for travel in their local area. The following checklist outlines the important issues in the map making process.

Formulate the map concept

Maps can show many things from single routes to whole networks. Cycle maps can show people ways to get to a train or bus station or ferry wharf. They can also show local routes centred on universities, schools, TAFEs, large work places, shopping centres and other large trip attractors. Cycle network maps can show only routes within the network or, in the case of the map shown in Figure 3, cycling conditions on every street and road within an area. Maps can be used to show long distance tourism and recreational routes, or feature a single trunk route in an urban area to specifically promote this route to the local community.

The map concept will include a range of technical issues which, when settled, will feed directly into a brief for the map designer. Among these issues are:

- **Area covered by the map.** This also relates to the scale of the map. If the map is to cover a large area it may be necessary to break the map into pages or sections or even reduce the scale. Printed maps using large sheets of paper can be very difficult to use particularly over longer trips where the map has to be continually refolded. One of the reasons that street directories are popular is that they are reasonably compact and easier to use than a map printed on large sheets of paper.

- **Scale of the map.** Most street directories print maps in a scale of 1:20,000, with more detailed maps of the city centres at 1:10,000 and even 1:5,000. The smaller the number, the larger the scale – a 1:10,000 map of the same physical area will need a larger piece of paper to print on than a map in a scale of 1:20,000. Larger scale maps can fit in more information, but take up more space. Most people are familiar with the 1:20,000 street directory standard and it provides a good level of detail for urban environments. At 1:20,000, an A4 page will cover an area of 4.2 x 5.9 km. Increasing the scale increases the coverage, but to make the map readable some detail may have to be omitted.

- **Cycling information and how to show it.** There are many ways of showing cycling wayfinding information. A map can show a complete bicycle network of principal, local and recreational routes. It can also show recommended cycling routes using existing streets regardless of any specific cycling infrastructure provided. Cycling maps can show the facilities along designated routes or more broadly indicate the cycling conditions on all streets and roads within an urban area. Whichever approach is adopted, the map should clearly state in its legend box the way cycling information is represented on the map.

- **Good level of detail to show trip attractors.** This issue is related to the scale of the map. Cyclists are ordinary people who want to use their bikes in cities and towns for many different trip purposes. It is important that all the important community facilities (educational campuses, shopping areas/centres, commercial/business centres, government buildings and community facilities) are shown.

- **Delivery formats and mechanisms.** The way a map will be delivered to potential cyclists is an important part of the map making process. Traditional printed paper maps can be made in many shapes and
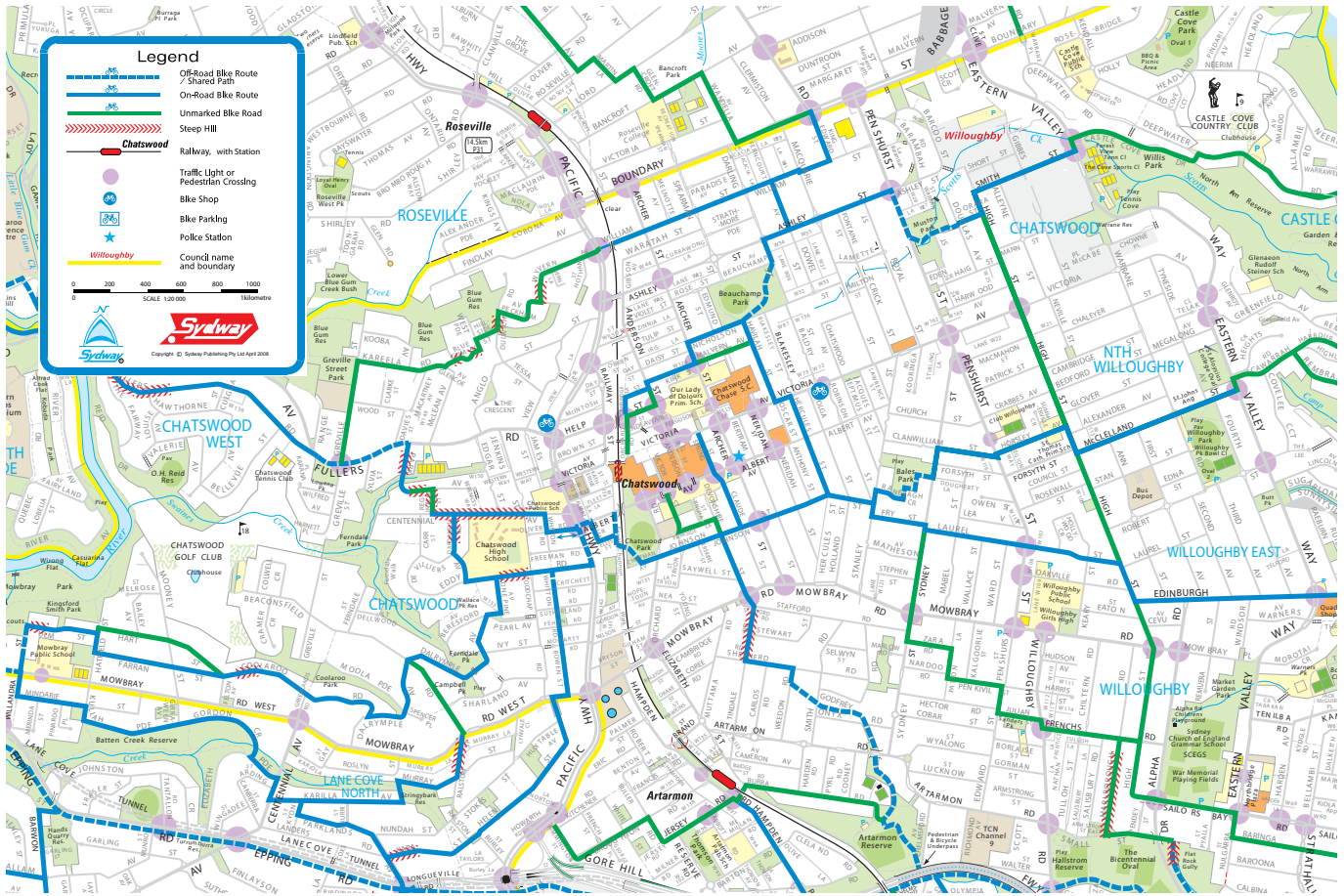
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Figure 9 (above): This cycle network map uses a similar street directory base map as Figure 6. Routes with facilities are blue. Unmarked routes are green. Reproduced from *Commuting to Chatswood by Bicycle*, Willoughby Council, 2008. Base map copyright Sydway Publishing Pty Ltd. Used with permission.

sizes. Local transport access guides showing a localised cycle network feeding to a major transport interchange can be printed as a foldable pocket map. Larger maps of regional and town bicycle networks may need to be printed on larger sheets of paper folded to a more portable size. Though the technology exists to print maps on waterproof plastic, this is not recommended as maps quickly go out of date and paper better suits the map lifecycle. Printing of paper maps needs a well formulated distribution and communications strategy. Cycle shops are good distribution points as their customers are always wanting cycling information. Government and tourism customer service centres and other places with high public visitation should be included in the distribution strategy. Letterboxing residents along a major cycle route corridor with a simple inexpensively produced map leaflet is a good way of raising local awareness.

The advent of the Internet has introduced a number of new ways of distributing and delivering maps to cyclists. Maps created in vector file format are very space efficient and can be easily scaled (enlarged and reduced) for on-screen viewing. These maps are very suitable for Internet distribution as PDF files and can be printed as needed. The Department of Transport and Main Roads's website features a point-and-click map where cyclists can download cycle network maps from a number of Queensland local and regional councils. A growing number of Council websites allow for direct downloading of cycle route and network maps.

Interactive web-based mapping

The Internet has created exciting possibilities for interactive mapping. There are two main types: static mapping and route-finding mapping. Static mapping websites invite cyclists to plot their favourite commuting or recreational routes onto an internet map base such as

Figure 10 (below): The Department of Transport and Main Roads website has an interactive map to allow cyclists to download local cycle network maps in electronic format. These maps can be enlarged on screen or printed on demand.
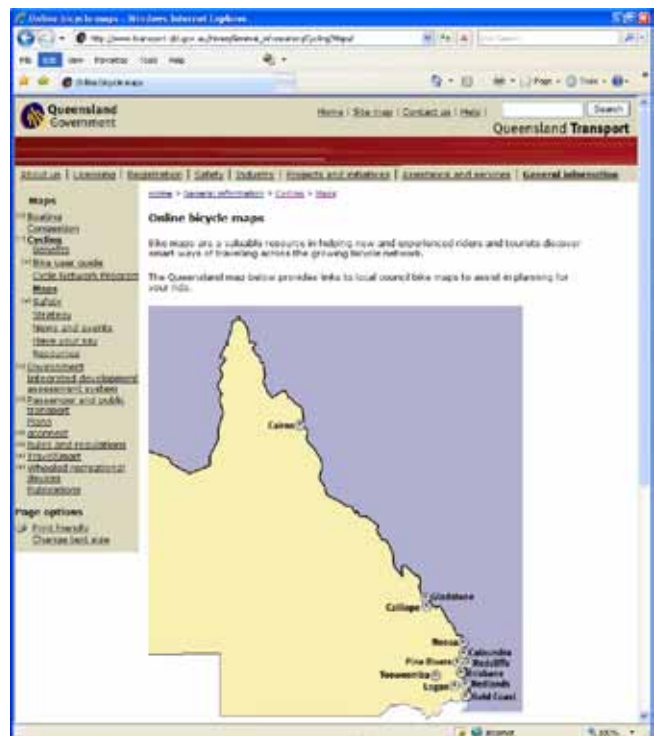
Google Maps. These maps can then be viewed by other riders. On-demand wayfinding mapping allows riders to enter actual trip details (start, via and to streets) into a pre-programmed database which then suggests a suitable route based on a number of additional criteria entered by the user (type of roads, speed of travel, terrain/gradient etc).

There are a number of static cycle mapping websites. Bikely.com has a large number of Australian routes from short distance CBD based cycle commuting trips to longer training ride loops and cycle touring journeys. Static route websites offer cyclists the opportunity to share their favourite routes with others who may benefit from this information. Some systems allow for notations to be added to the route at specific locations to advise other users of difficult turnings/crossings and points of interest.

In Europe on-demand wayfinding websites are now available for cyclists in Berlin, Munich and many other cities. These sites are powered by a database of route suitability information for streets and roads within the covered area. Cyclists wanting to find a suitable cycle route enter their street of origin, an optional mid point and a destination street. Streets are selected from pull-down fields which ensure correct computer input. After selecting from additional criteria (type of roads – main, secondary, bikelanes/tracks only, no cobblestones etc) cyclists can produce a map for printing along with a turn by turn description of the recommended route. Data can be produced for use in Palm Pilots and portable Global Positioning System (GPS) devices, such as mobile phones and cycle mounted GPS units.

The Berlin system (bbbike.de) is available in an English version. The BBBike system is being developed in 30 German cities and over 50 other European and North American cities.

Making maps from GIS systems

The advent of computer-based geographical information systems has enabled council and government agencies to store information and produce this data as maps. GIS mapping is a useful tool for governments to manage developing bicycle networks as these systems are able to store a range of details on cycle facilities and signage etc. Though in recent years these systems have improved the graphical presentation of their maps, they are usually

not recommended for public use because they lack the wealth of additional information which makes a map useful to a cyclist in the community. GIS maps require additional graphical design input and can be useful to designers in the developmental phase of map making.

GPS cycle route mapping

Geographical positioning systems are becoming increasingly affordable and are now being installed into motor vehicles. Though cycle mounted GPS devices are available these systems currently lack the specific cycle route data to enable cyclists to plot their journeys based on specific bicycle route information. Cycle-based GPS devices are particularly useful for rural bicycle touring applications and, along with urban route finding, should improve in years to come as cycle route data is included in existing motoring-based systems.

Figure 12 shows output from the BBBike on-line route finding system for Berlin, Germany. This web site produces a wayfinding street list and map in printable format in response to information entered by users. The BBBike system will also download route data for use in a cycle mounted GPS device.

Figure 11 (below): Bikely is an interactive website which allows cyclists to plot favourite routes which are then available on the Internet. Bikely allows for notes to be added at points along the route to add further detail and assist navigation.