

## **Web-based Geospatial Information and the Practise of Cycle Route Management**

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### **ABSTRACT**

The London Cycle Network Plus (LCN+) project is broadly utilizing web-based Geospatial technology to the practice of cycle route alignment, project management and programme development.

The LCN Webmap [www.londoncyclenetwork.org.uk](http://www.londoncyclenetwork.org.uk) also serves as a vehicle for communicating route alignment, collision stats, cycle volumes and scheme information to the public and specific project stakeholders.

This paper presents the unique approaches, advances and challenges of initiating and evolving this innovative tool in London's street planning environment. LCN+ project stakeholders include Transport for London, the 33 London Boroughs, the London Borough of Camden and cycle user groups.

The LCN+ is a planned 900-kilometre network of well-designed cycle routes covering all of London. Completion is expected for 2009/10 with a budget of approximately £140m and will serve to under-pin the 200% increase in cycle volume sought by the London Cycling Action Plan.

### **INTRODUCTION**

A Geographical Information System (GIS) provides a foundation for the information necessary to project manage delivery of the 900km / £140m London Cycle Network Plus (LCN+). In order to effectively project manage the project, a variety of data types from an array of sources need to be organised, shared and analysed throughout the programme year.

The LCN+ spans 51.7km east/west and 42.6km north/south and is comprised of orbital and radial routes with Charing Cross generally considered the map centre. In 2001, due to business planning rationalisations, the original LCN network was reconceptualised to the LCN+, a strategic network of 900km providing 'fast, safe, and comfortable' conditions for cyclists.

As project managers of the LCN+, GIS information enters into many of the roles and responsibilities. The most significant is custodian of what is known as the Link Map and Street Name Schedule. The Link Map consists of over 285 Links, which span the highways of London. Links represent sections of cycle route that are unique to a borough. They are therefore, useful unique identifiers that assist project management of the LCN+.

GIS lends itself to relating types of data together through specific geographical location or coordinates (in the UK context this is the British National Grid.) It is these geo-references which ultimately under-pin the information analysis of:

- a. the network
- b. route alignment or link management and
- c. the location of specific segments/schemes.

As an activity to better manage communication of the Link Map and to overcome information sharing barriers, a map-based website tool [www.londoncyclenetwork.org.uk/webmap](http://www.londoncyclenetwork.org.uk/webmap) was developed as a service to simplify record sharing whilst enabling a broader range and increased number of cycle practitioners access to centralised resources.

## **DATA MANAGEMENT**

### **Network Level**

The LCN+ is most divided among the 33 London Boroughs; they are then grouped into five sectors (NE, NW, Central, SE, SW) with the Thames River dividing north and south. It is also important to distinguish the Highway Authority responsible for the roads. The most relevant are the Borough Primary Road Network (BPRN), where the Borough has authority. The other Authority in London is Transport for London (TfL). They manage the Transport for London Road Network (TLRN), which accounts for just 5% of London's road length but carry 1/3 of the Capital's traffic. TfL manage these roads with a view to reducing congestion and enabling more sustainable modes such as walking and cycling and also works closely with the 33 boroughs that manage the remaining 13,000km of London roads.

The management and development of the Link Map and Street Name Schedule form a major part of network development. Paper copies of the Link Map are issued to the boroughs every six months as the network is continually developing. Updates are made accordingly. The procedures for data collection, maintenance and map storage are routinely reviewed and updated as necessary.

At the network level it is important that observations on directness across the sector and borough boundaries can be identified and addressed. Examples include:

- One Borough proposed an alignment from the town centre westward along the Thames, however the adjoining borough was land-locked by private / commercial ownership and would be unable to progress any riverside cycle schemes. Once the situation was deemed insurmountable, the short Link or 'spur' was removed from the network, focussing attention to where it is more suited.

- Continuity must also be addressed across geological features such as the meandering river Thames. Although the Thames frontage is clearly the most ideal recreational route, it is not always the most direct for the commuter.

Future development projects such as the Thames Gateway Bridge and the 2012 Olympic complexes at Stratford also impact the shape of network. As do town centre developments such as Croydon and increased movements to historical town centres such as Kingston Upon Thames.

## **Link Level**

Links represent sections of the network that are unique to a borough, generally they run from borough boundary to borough boundary. Links have been numbered 1 to 285 as a means of uniquely identifying the cycle routes within each borough. It should be noted that Link numbers are purely a project management tool and do not directly correspond to the LCN route signing found on the network. The webmap provides both Link number and route number information to address any confusion.

A strategic feasibility process (in London this is called a “CRISP” for Cycle Route Implementation Stakeholder Plan) forms the basis for development along a Link. This results in a series of recommendations to ensure a Link offers the cyclist fast, safe, and comfortable conditions for travel. Cycle facilities or alignment variations, suggested additions (possibly spurs to rail stations) and night-time alternatives may emerge as recommendations from the study. These are captured and mapped and once any changes to the alignment are formally agreed the Link Map is altered to accommodate this.

Links form the basis for financial allocation, as funding of schemes is most commonly agreed on the development of a Link according to recommendations from the strategic feasibility study. At the end of each year, the percentage (%) of Link completion informs the future business planning decisions and is being developed as a management reference.

## **Segment/Scheme Level**

In an increasing way, segments are forming the building blocks of the project. Following a feasibility study, sections of a Link are identified as requiring or not requiring work. The recommendations of the study correspond to the segments by the length prescribed in the report. If a segment does not require improvement or once the improvement has been carried out the segment is then considered adopted to the LCN+ and that section of the Link completed.

Geospatially, segments are based on the Ordnance Survey's Road Centre Line or OSCAR data. This data includes the characteristics: street name, road type, length and OSODR code. We have added borough, segment number, Link number, CRISP name, datasheet number, recommendation number, programme year, estimated and actual cost, description, type of existing facility, LCN route number and TLRN interface and TLRN code.

For mapping purposes, cycle facilities are classified into features along a Link to include length segments such as cycle lanes, tracks, or the most suitable traffic calmed equivalent, as well as point data such as traffic controlled crossings (pedestrian, toucan, pelican etc). Link analysis and reporting can be gathered as required and data capture allows a percentage requiring works / no works required

ratio to be calculated against a Link. Estimated future funding can also be derived following the recommendation classification into a database.

## WEBSITE AND WEBMAP DEVELOPMENT

The LCN+ webmap has been developed and operational over the last two years with over 7, 000 registered users. The web application consists of a range of tools found on the tool bar, directional (panning) and zoom features, query options and a dynamic legend where layers (can be identified by colour and added or removed).

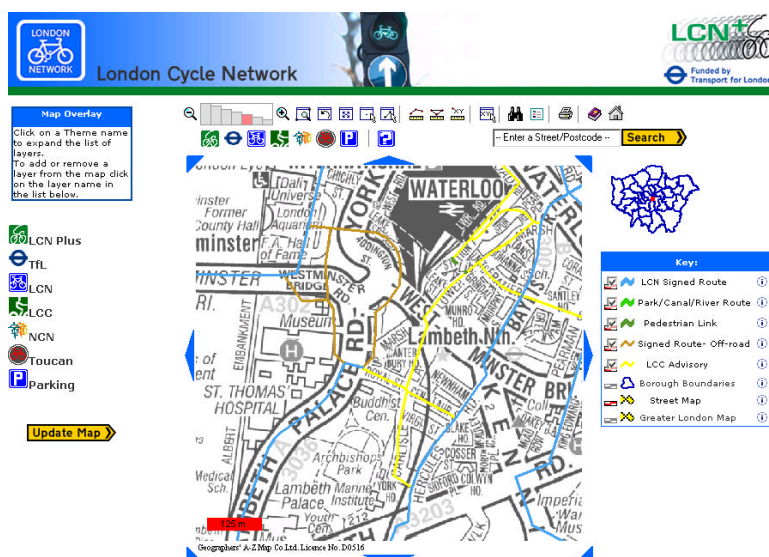


Figure 1. Public Level Webmap interface.

Users are able to export datasets into MS Excel and basic thematic mapping is available. The system resembles many comparable industry desktop GIS viewers, and we created an additional tool bar using the known London Cycle signs and added partner logos as buttons to 'add' and 'remove' layers corresponding to their data.

On entering the site, the initial map view loads pre-populated with London Cycle Guide data developed by TfL's Cycling Centre of Excellence (CCE) and the London Cycle Campaign (LCC). These are available as paper maps and have proved a substantial promotional success and are freely available throughout London via [cycling@streetmanagement.org.uk](mailto:cycling@streetmanagement.org.uk). The information has a broader impact being in paper format as well as available through the web,.

The delineation of the LCN+ can be overlaid on the base-mapping and the London Cycle Guide data. The ease and speed of information retrieval is one of the most notable benefits of the webmap and delivery performance is being further enhanced through the acquisition of a high specification dedicated web server.

The system aggregates data from a variety of sources that have been proven most useful to cycle planners and practitioners. The feature that sets Webmap apart from many other regular Internet map interfaces is that metadata associated with data sets is stored in a data warehouse. This information is accessible through the interactive map display or through search and query menus. In order to select and isolate specific information queries can be performed, these queries are aided by the use of dropdown menus. By way of an example, a planner may be able to find collision

statistics and parking facilities for one or more links within a borough. The results of the query can be displayed in a table format or on the map display. Once selected a particular set of information can be saved, this will enable the user to return to a specific work point, or the data can be exported to Excel or the maps can be printed.

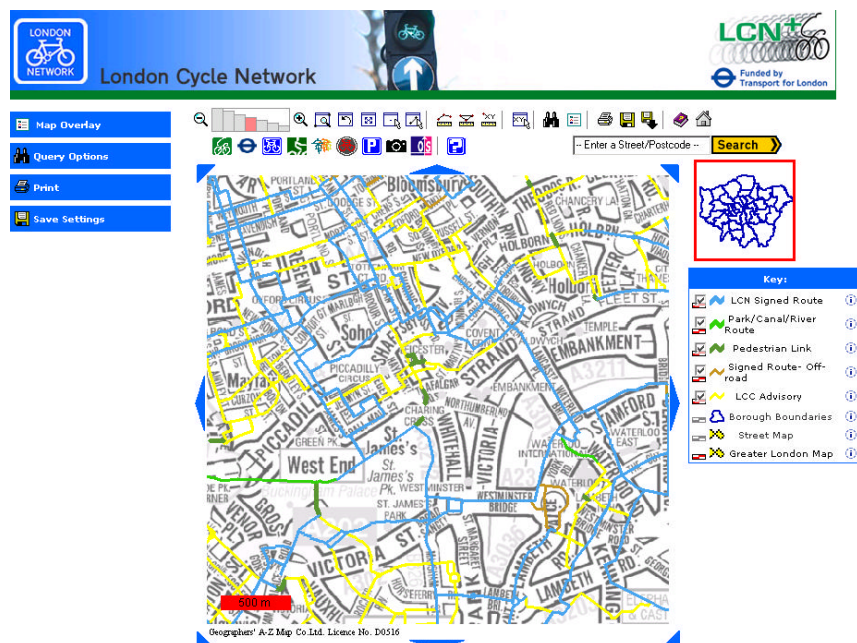


Figure 2. Planners' view of Webmap

The integrity and value of the Webmap is based on the quality of the available data. LCN+ plays an important role in data acquisition, collation and maintenance. Data is gathered from a number of sources. Base data is sources from data vendors, 'A to Z' and OS Mastermap provide the background maps, OSCAR and Aerial Photography are additional sources of reference. Cycle facilities and route alignments are captured and digitised according to the base data.

Data collection and information gathering takes place on a continual basis. During the feasibility process and design phases data is collected and assimilated. As information is collected and updated so the information supplied to the Webmap is correspondingly updated. The updated website provides a central warehouse for route alignments, cycle collision data, cycle volume (TfL Automatic cycle counters & DfT cycle counts) key trip generators.

The addition of bus lane and bus route, traffic volume and speed information is also providing more options for borough cycle officers and consultants to perform a variety background and on-going investigations/tasks necessary for audit and monitoring considerations.

Management of the Webmap involves managing data as well as the management of registered users. Website users are required to register, and once registered an administrator can assign higher levels of data access. In order to ensure data security both data and users are managed in a hierarchy structure according to needs (Table 1.)



	London Cycle Network+	Project Information	Planners Information	Administrator
Public	X			
Public – High	X	X		
Internal – Low	X	X	X	
Internal – Med	X	X	X	
Internal – High	X	X	X	
Administrator	X	X	X	X

Table 1. Hierarchy of data access

#### Dataset 1. London Cycle Network Plus

The LCN+ dataset makes up the major portion of the presented map layers. Upon registering members of the public are free to access this information. Within this data, maps of the National Cycle Network, London Cycle Network and LCN+ are represented. In order to assist cyclists in route planning, toucans, signalised crossings and advanced stop lines (ASL's) can be added to the network display. At this level of access users are able to view the cycle facilities implemented in 2003/04 and in 2004/05.

#### Dataset 2. Project Information

Feasibility studies provide the foundation for the development of cycling facilities and the improvement and safety of cycle routes. Public-Higher access level will enable cycle clubs and interest groups to view the histories, progress and future development of feasibility studies.

#### Dataset 3. Planner Information

Borough officers and planners have the benefit of being able to access data which is required for feasibility studies and planning required for the implementation of new cycle facilities (these are part of the feasibility process), this include access to OS Mastermap (street level mapping at a scale of 1: 2500) and photographs of existing faults and sites requiring upgrading or repair. Consideration of cycle flow and cycle collisions are important components of the feasibility process and planners are able to access this data from Webmap. Future consideration is given to include 'As Built' drawings of delivered schemes as well as fault photo records. These would appear as embedded images on the OS background.



Figure 3. Aerial Photo detail

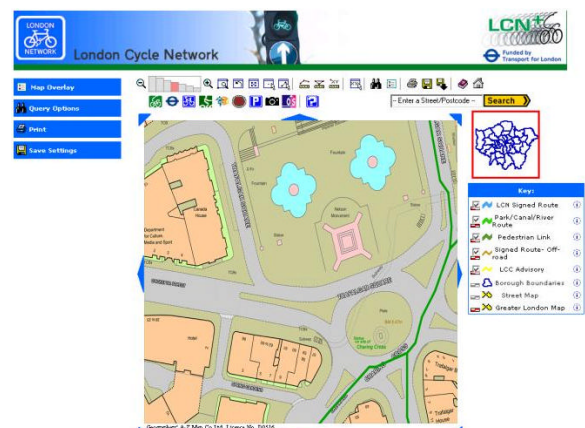


Figure 4. OS Mastermap detail

## Administration

Administrators have read and write access rights to the database that stores all of the mapping data. From a central database all aspects of map display and site functioning are managed, administrators can manipulate and control the typology and symbology of all the viewable data. Administrators manage the database of registered users assigning appropriate accessibility to mapping information. This and other 'back end' data management features are controlled through Mapping Service Administration Tools.

**LCN+ Mapping Service Administration Tools**

[Administration Home](#)  
▣ **Site Management**  
▣ **User Management:**  
▣ **Data Management:**  
    [Address Alias](#)  
    [Area Types](#)  
    [Themes](#)  
    [Suppliers](#)  
    [Products](#)  
    [Layers](#)  
    [Connections](#)  
    [Check For New Data](#)  
▣ **Service Management:**  
▣ **System Information:**  
▣ **Help:**

### Edit Layer

The page below allows you to edit a layer.

The form below allows you to edit a layer. Please note that the site code uses layers in all map displays. Changes to this layer will have an **immediate** effect on your web site.

To edit a layers map display properties select the display properties button below. To define the layers default thematic display properties then select the thematic properties button. To edit the metadata for the attributes of this layer select the attributes button.

No tool is provided here to remove layers. To remove please use your database administration tool or the desktop metadata editor. Alternatively to ensure that this layer is not visible in the web site you can move it to the "unknown" theme. This themes contents never appear in the web site.

**Public Name:** Signed Route- Off-road  
**Theme:** LCN  
**Short Description:** Signed route- separate from traffic  
**Description:** Routes signed for cyclists separate from traffic. Usually si  
**Data Product:** - No Product -  
**Security Level:** Public  
**Area Type:** - No Area Type -  
**Enable Map Overlay:** True  
**Filter:**  
**Data Updated Date:** 06 July 2005 18:25:24  
**Private Name:** Off\_Carriage  
**Connection Name:** LCNLive  
**Geometry Type:** LINE  
**Metadata Updated Date:** 19 August 2005 18:18:33  
**Metadata Created Date:** 06 July 2005 18:25:24  
**Update Layer**

The following buttons provide access to further layer metadata settings:  
**Display Properties** **Thematic Properties** **Attributes**

You can create a copy this layer's metadata by clicking the copy layer button below:  
**Copy Layer**

[Return to Layers](#) | [Top](#)

Figure 5. Mapping Service Administration Tools

## CONCLUSION

The LCN+ Project Management Team utilise GIS on a continual basis as a part of its assessment, analysis and reporting on the progress of the development of the network. GIS forms the basis in evaluating the progress towards network completion and is proving an invaluable tool to connect a range and variety of information and data types with the practitioners who need to utilise it. The development of Webmap provides a central data warehouse that allows a great number of users an access point for relevant information. As administrators, the Project Management Team monitors the use and accessibility of data and ensures it is current and relevant.

LCN+ Webmap is compliant with government requirements of IEG (Implementing Electronic Government) of Local Authority digital information sharing and provides open access to all the work and data collected and utilised in the project

management of the LCN+. The free access to data establishes an environment in which every person or stakeholder involved has greater resources and capabilities at their disposal and is more accountable for each part of a coordinated delivery.

## **REFERENCES**

TfL, A Business Case and Evaluation of the Impacts of Cycling in London, 2004

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TfL, Monitoring Local Transport in London, Advice on Causal Chains, 2004