What is the Cycle Network Model?

The Cycle Network Model (CNM) is a logical network model that has been designed to aid the capture and dissemination of cycling related information. The model describes both the physical path features as well as the information about the suitability of routes for cycling. The model has been created primarily to aid in the production of cycle journey planning software however the data created against this model could also be used for other purposes; for example, it could be used for asset management of a cycling infrastructure.

The CNM is built around the principles of the Digital National Framework (DNF). The objective of the DNF is to:

"… enables and promotes the integration and sharing of location-based information from multiple sources. It supports the objectives of the UK Location Strategy and the rollout of the UK Location Programme."

DNF provides a model enabling the incorporation of base reference datasets in the production of another. In many ways it is analogous to Lego "building blocks". Different datasets (whether they are from the same or different suppliers) are the "blocks" and the final dataset is created by combining these blocks. In the case of the CNM the building blocks are a reference road network, a path network, and reference attributes about the cycling infrastructure and routes. The model is designed to allow any road and path networks to be used as the base framework, provided these networks conform to the principles of DNF.

Transport Direct's implementation of the CNM utilises the roads and paths network from Ordnance Survey's OS MasterMap Integrated Transport Network Layer for its base reference network.

What is the CycleNetXChange format?

CycleNetXChange is the transfer format for data created against the Cycle Network Model. It is an application schema of Geography Markup Language (GML) and provides an XML based format to describe the network geometry and associated cycling attributes.

CycleNetXChange is supplied in a compressed format using GZip compression. All files have a .gz extension and when decompressed should be given a .gml extension.

How is the data compiled?

The CycleNetXChange is regularly exported from the Data Collation Service (DCS) of Transport Direct. The DCS provides a data management system enabling Transport Direct to collect, maintain, and export data conforming to the Cycle Network Model.

The DCS conflates data from three different sources to create the source database for both the Transport Direct Cycle Journey Planner and the exported CycleNetXChange data:

- **Roads and Paths Network** – Ordnance Survey's OS MasterMap Integrated Transport Network Layer is imported into the DCS database and provides the base road and path geometry
- **Survey Data –** This data is delivered using the CycleNetXChange format and adopts the Cycle Network Model. The survey data is primarily attributes about the conditions and suitability of infrastructure and routes for the purposes of cycling. In addition to these attributes the

- **Online Editor** – The DCS provides an Online Editor for Cycle Network Model data allowing the continued maintenance of the data contained within the system.

The DCS has a concept of "CNM Areas". As new data is imported into the system a "CNM Area" is created for, generally these areas are geographical. For example, there is a "CNM Area" called Peterborough which contains all the cycling information for the city of Peterborough.

When data is exported from the DCS as CycleNetXChange data it is done on an area by area basis. In order to get a complete National coverage of the dataset it will be necessary to download all of the available CNM Areas.

Guidance on each of the relevant sources of data

The Cycle Network Model is the logical data model for assigning cycling related attributes to national road databases that conform to the principles of the Digital National Framework model. The specification document is available from:
http://www.dft.gov.uk/cyclenetxchange/schema/doc/2007-12-05%20Cycle%20Data%20Specification%20v1.0x.zip

CycleNetXChange is an application schema of the OGC Geography Markup Language (GML) and is the transfer format of data conforming to the Cycle Network Model. The schemas necessary to interpret this data are available at:
http://www.dft.gov.uk/cyclenetxchange/schema/0.3a/CycleNetXChange-v0.3a.zip

The Cycle Network Model is built on the principles of the Digital National Framework and as such it uses Ordnance Survey's OS MasterMap Integrated Transport Network data model to provide the base reference network for the cycling data. Details of the OS MasterMap Integrated Transport Network product are available from:
http://www.ordnancesurvey.co.uk/oswebsite/products/os-mastermap/itn-layer/index.html

Please note that the Ordnance Survey data is licensed separately and is not exported as part of the CycleNetXChange export process. If you would like to make use of the ITN base network then you will need to source it separately. If you are a Government organisation then you are entitled to the data under the Public Services Mapping Agreement, further details can be found here:

http://www.ordnancesurvey.co.uk/oswebsite/public-sector/mapping-agreement/

As previously mentioned the Cycle Network Model has been designed using the principles of the Digital National Framework. Further details of what this is and how it can be used can be found at:
http://www.dnf.org

Using CycleNetXChange

The CycleNetXChange data can be used for a number of different applications. Currently it is used by Transport Direct in the online Cycle Journey Planner. However, it has potential for use in a range of other applications such as asset management, cycle time analysis, accessibility analysis, as well as many others.

The data supplied uses the road network from OS MasterMap Integrated Transport Network Layer and as such to gain the maximum benefit from use of this data it will be necessary to obtain the

relevant licence and dataset from Ordnance Survey. It is important to note that this data can be used without a licence for ITN but the amount of information that can be utilised will be reduced.

The source data is maintained daily with snapshots generated roughly on a monthly basis. It is important that any system relying on the accuracy of this data has in place a suitable update and maintenance regime in order to ensure the data is current.

Data Volumes

Due to the complex nature of this data file sizes can vary from area to area. Generally speaking the larger the area the larger the volume of data. The data is compressed using the GZip algorithm and as such is compressed at a ratio of approximately 20:1 – this means that the decompressed GML file can be up to twenty times larger than its compressed equivalent. Some systems will be able to use the data in its compressed form but some may require the data to be decompressed first.

The complexity of the geographic data also means that processing times can be long and will vary according to the power and memory of the system used. You should ensure that the system used to process and use this data has sufficient power and memory available.

What is a CNM Area?

In order to collect, maintain, and distribute a National cycling network dataset in an efficient and cost effective manner it is necessary to break the task into smaller more manageable chunks. Conceptually a CNM Area is approximately equivalent to a Local Authority's area of responsibility, though some large urban areas like London are sub-divided into smaller areas.

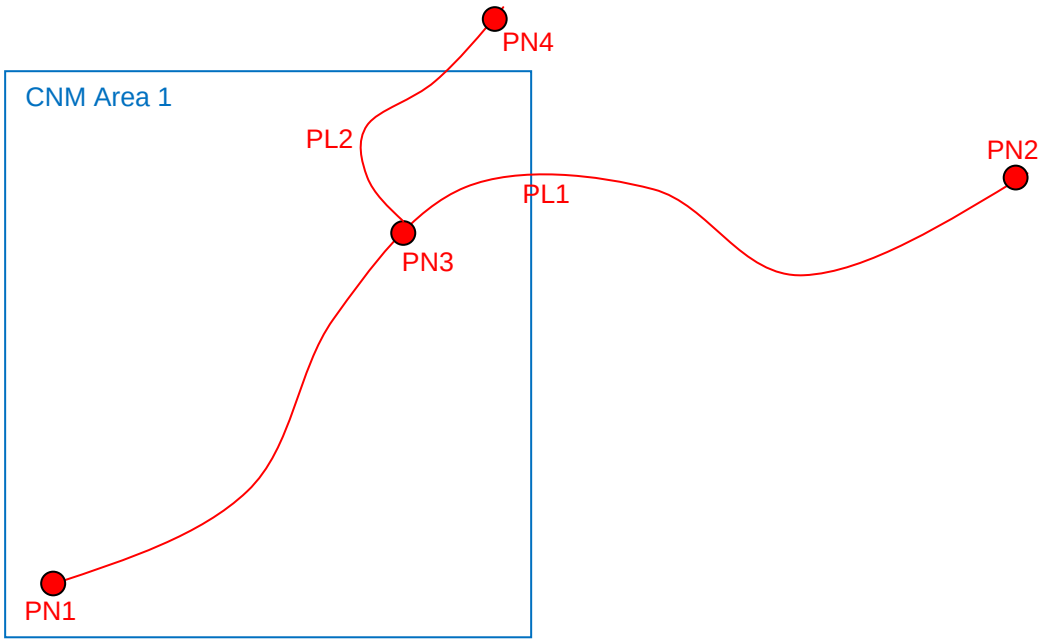
CNM Areas are determined by the area of coverage that is commissioned for a ground survey. When the source data is loaded into the DCS a Minimum Bounding Rectangle (MBR) calculation is made. The MBR is the minimum area necessary to encompass all of the data in the area. Consequently CNM Area definitions are very imprecise and there are instances where multiple CNM Areas may overlap.

The name and bounding co-ordinates of each CNM Area are shown in a separate file.

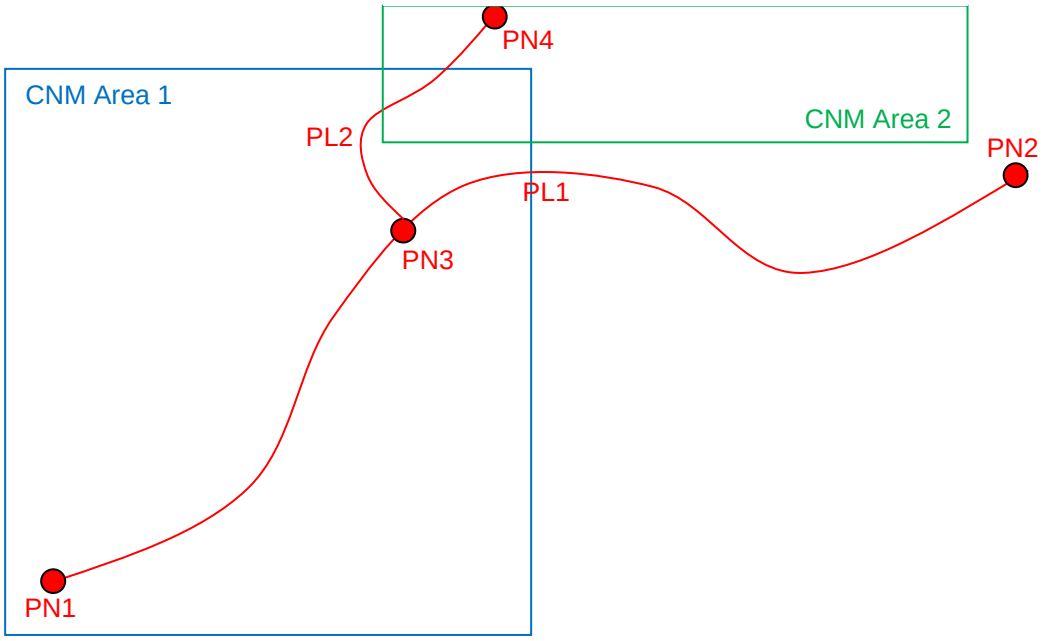
Overlapping CNM Areas

Due to the imprecise way in which CNM Areas are calculated there are occasions when areas will overlap other areas. Typically, areas of overlap occur at the boundaries of CNM Areas and will require careful handling in order to ensure data consistency and integrity.

The main issue in areas of overlap will be duplication of data. When data is exported from the DCS it is done on an area by area basis and the MBR of an area is used as the selection window for data to be exported. All data that intersects this selection window is exported in its entirety, that is to say the feature is not "chopped" to fit the selection window. Consider the following example:



In the example above CNM Area 1 is exported and the selection window means that the network links PL1 and PL2 are exported in their entirety. In order to maintain data integrity the node features PN1, PN2, PN3, and PN4 are also exported. Now consider an additional, overlapping CNM Area:



In this case the bottom-left corner of CNM Area 2 overlaps the top-right corner of CNM Area 1. As a consequence of this overlap both CNM Areas will contain the network link PL2 and the network nodes PN3 and PN4. If you were to take both CNM Area 1 and CNM Area 2 then you would receive two copies of these features, duplicates. You will need to take this into consideration when loading the data into your system, ensuring that you run a data de-duplication process when loading overlapping CNM Areas.