Mapping out the future of cycling

A new resource will help transport planners identify routes with the greatest commuter cycling potential, writes **Dr Robin Lovelace**

Local authorities seeking to predict demand for cycling have had little in the way of tools for planning cycle routes. There has certainly been nothing widely accessible for councils seeking to measure future cycling demand.

All that is about to change with the launch of the Propensity to Cycle Tool (PCT) in July 2016. This is the culmination of work commissioned by the Department for Transport in early 2015 to identify "parts of [England] with the greatest propensity to cycle".

The tool overcomes a bottleneck in sustainable transport planning and visualises the results on a publicly available online mapping interface. By showing local health and emissions benefits, the PCT could also provide a powerful business case of investment in cycling.

Building the prototype

The PCT was a multi-university team effort between the Centre for Diet and Activity Research (CEDAR), University of Cambridge; University of Leeds; and the University of Westminster. At the time of writing, in May 2016, an early version of the PCT is available nationwide, publicly accessible at the project's website: pct.bike.

In Phase One of the project (January to June 2015, through a contract held by Brook Lyndhurst) we developed a prototype for three cities and carried out evidence reviews and data analysis. The resulting reports were published by the DfT as a resource for cycle planning (see gov.uk/government/publications/national-propensity-to-cycle-first-phase-development-study).

The document includes a study of evidence around infrastructure and cycling uptake, a systematic review of the impact of age and gender on cycle infrastructure preferences, and analysis comparing propensities to cycle in England and The Netherlands.

Following the success of Phase One we were commissioned to undertake Phase Two (through a contract held by Atkins), which primarily involved deploying the PCT nationwide. Future versions of the tool will involve more geographical detail and will incorporate a range of trips.

The PCT provides data at different levels: area; 'desire line'; route; and route network. It explores the local impacts of a range of scenarios such as: the Government Target – where the rate of cycling doubles; Gender Equality – where women cycle as much as men along each desire line); and Go Dutch – which illustrates what could happen if people in England cycled as much as people in the Netherlands for given distances and hilliness levels; and E-bikes – representing the potential for electric cycles to enable longer trips to be cycled, building on Go Dutch.

Visualising cycling patterns

The main aim of the PCT is to visualise and explore future demand for cycling. However, it is also a useful tool for exploring the geographical distribution of current cycling patterns. Understanding how the PCT visualises current levels of cycle commuting will help understand how it can be used to plan for the future, as each visualisation level is available for every scenario.

Area level data

At the area level, the PCT shows the number of people in each zone (with an average population of 8,000) who reported cycling as their main mode of travel to work in the 2011 Census. In West Yorkshire, for example, the PCT shows the north of Leeds to have the highest rate of cycling in the region.

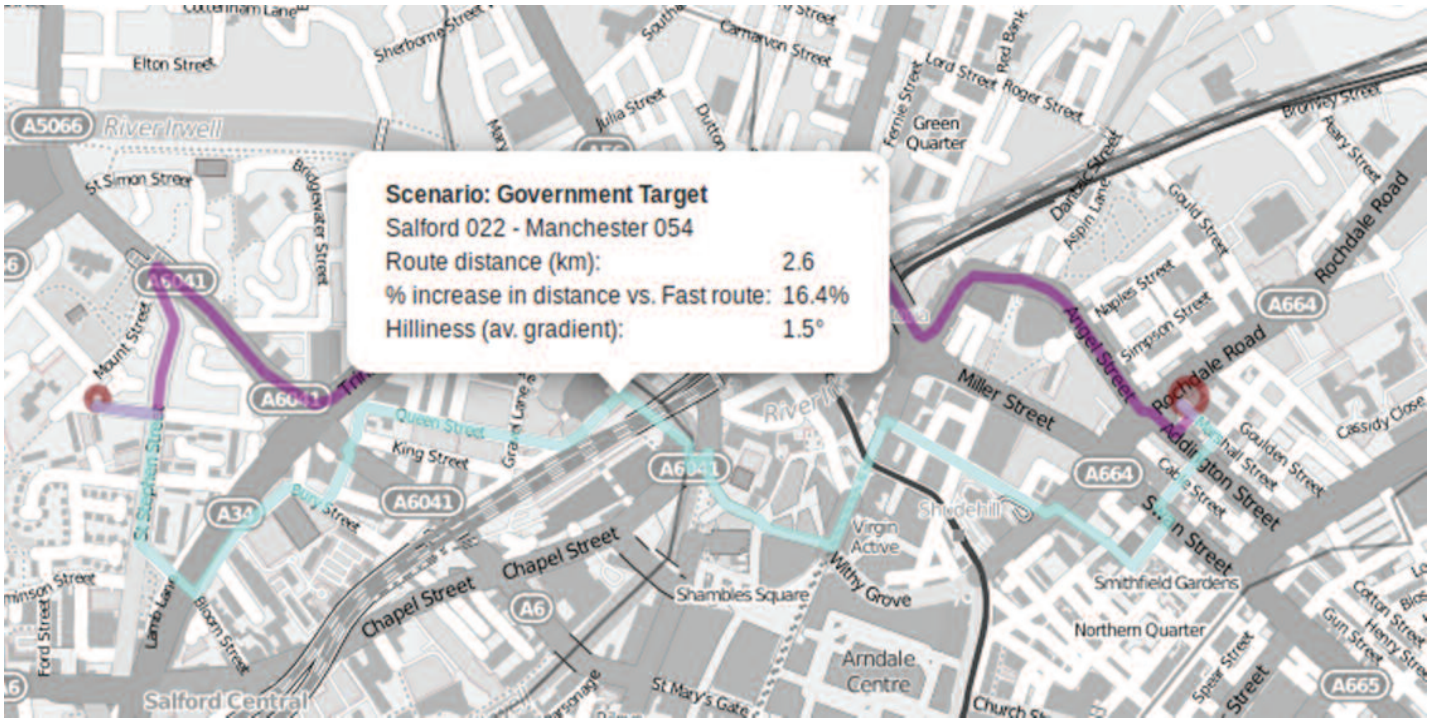

Figure 1: Route allocated flows in Manchester showing the large discrepancy between 'fastest' and 'quietest' routes

The PCT does something exciting and new; it provides a quantitative vision of ambitious cycling scenarios that is geographically specific, down to the level of roads

Dr Robin Lovelace

Cycling 'desire lines'

'Desire lines' are straight lines connecting where people live to where they want to travel. In the context of the travel to work 'flow data' used by the PCT, this means lines connecting home and work locations. By showing the desire lines with the highest rates of cycling, the PCT can illustrate where there is the highest demand for cycling flows.

Route allocated flows

A key feature of the PCT is its ability to allocate cycling desire lines to the route network. This was done thanks to CycleStreets.net, a not-for-profit journey planner 'by cyclists, for cyclists'. For each origin-destination pair the PCT can show both the fastest and the quietest routes, as defined by CycleStreets. This distinction can be useful for planning new routes.

To get from MSOA [middle super output area] Salford 022 to Manchester 054, for example, one must either navigate the busy Trinity Way or take a circuitous route through various side streets. The extra 300m needed to go via the 'quiet' route is represented on the map in the pop-ups associated with these route allocated flows. This is illustrated in *Figure 1* (left).

The route network

While route allocated flows links an origin and destination, the route network layer goes a stage further. It is the result of aggregating all overlapping route-allocated desire lines.

The route network layer is crucial for envisioning cycling scenarios because it provides an estimate of how many cycle commuters could use specific road segments and therefore plan for the appropriate width and capacity of new infrastructure (*see Figure 2 overleaf*). The PCT uses the fastest routes as the basis of the route network because evidence shows that cyclists, especially women and the elderly, have a strong preference for direct routes.

Cycling's changing geography

Each of the layers described above is useful in understanding the spatial distribution of cyclists and their likely routes to work (more trip purposes will be added to the PCT in due course), based on the 2011 census. But if cycling grows substantially, as many transport planners expect, the geographical distribution of demand for cycling demand is likely to change. In other words, current data shows where to build for yesterday, not tomorrow. To address this issue the PCT uses a range of scenarios to show the areas, desire lines and routes with the greatest potential for growth in cycling.

The scenarios range from short-term to long-term. All imply the removal of infrastructural, policy and cultural barriers to cycling. The scenarios are:

- Government target (govtarget), a doubling of the number of cycling trips in England. Although this is a substantial increase in relative terms, cycle use still remains low in this scenario compared with countries such as the Netherlands, rising from 3% to 6% of commutes.
- Gender Equality (gendereq). This scenario illustrates the increase in cycling that would result if women were as likely as men to cycle a given trip. Specifically, the scenario sets the proportion of female cycle commuters to be equal to the current proportion of males.
- Go Dutch (godutch). While govtarget and gendereq build on current cycling behaviour, 'Go Dutch' focuses on long-term potential. godutch represents what would happen if people in England were as likely as people in the Netherlands to cycle a trip of a given distance and level of hilliness.
- E-bikes (ebikes). This scenario models the additional increase in cycle use that would be achieved through the widespread uptake of electric cycles ('E-bikes').

Tomorrow's best routes

Because the PCT offers several options for exploring and visualising local cycling patterns, it can be used in a multitude of ways. Perhaps most importantly for local transport planners is its ability to identify roads on which there is very high cycling potential but low current numbers of cyclists using it. Such roads might not be currently seen as good candidates for investment but could, were conditions different, attract high numbers of cycle commuters. York Road in Leeds is a good example of this; the PCT shows that it is currently used by fewer than 100 commuter cyclists yet under the Go Dutch scenario it is used by over 1,000!

The area level results are also interesting for each scenario; in Leeds the PCT shows that Go Dutch represents a tenfold increase in cycling and a substantial shift in the spatial distribution of cycling flows to the south and east of the city, suggesting where a new 'core network' of cycle paths should be constructed.

What does 'propensity to cycle' mean?

Robin Lovelace offers his definition of the term 'propensity to cycle'

Propensity to cycle refers to the modelled uptake of cycling at area, desire line and route network levels under different scenarios of the future. Policy relevant scenarios include meeting national or local targets, the potential uptake if people in the study area cycled as much as the Dutch do or the impact of electric bikes on people's willingness to cycle longer distances. Propensity can include estimates of the impact of socio-demographics on the likelihood of cycling uptake, but in in the National Propensity to Cycle Tool for England (Version 1) we assume everyone is equally able to cycle, building on evidence that higher levels of cycling are associated with greater age and gender equity in cycling.

The shifting distribution of cycling flows is shown in *Figure 2* (right) from the 2011 baseline scenario (above) to the Go Dutch scenario (below) in Leeds.

Various options are available to assist the transport planning process in conjunction with the PCT. The ability to turn zone transparency on and off, for example, will enable planners to explore how cycling potential relates to the urban environment. Changing the basemap can show how latent demand for cycling relates to current cycle infrastructure (with the OpenCycleMap basemap), levels of deprivation (with the 'IMD' layer) and road width for space re-allocation for cycle and walking paths (with the satellite basemap).

Free and easily accessible

The PCT is available for free online for anyone to use. This is an important aspect of its design, which aims to make evidence for transport planning as accessible as possible and inform the debate about transport futures. We believe this will support collaborative planning around shared goals and visions of the future.

The PCT is not designed to replace but rather complement local knowledge. The data is not complete because it is based on commuter data from 2011. It is also designed to augment rather than replace existing tools for planning cycling infrastructure such as that described in a previous issue of GBC (see Payne 2014). Rather, the PCT does something exciting and new; it provides a quantitative vision of ambitious cycling scenarios that is geographically specific, down to the level of roads.

Unlike many tools for transport planning, the Propensity to Cycle Tool is open source (see the code at github.com/npct). This raises the possibiity of transport planners and others creating modified versions of their own needs and to answer specific questions. For instance,'what will cycling look like in Bristol when we reach the 20% target mode share for cycling?'

As with any technology, the PCT cannot answer all questions. But feedback from transport planners and campaigners to date suggests it can provide a powerful supplement to the local planner's toolbox.

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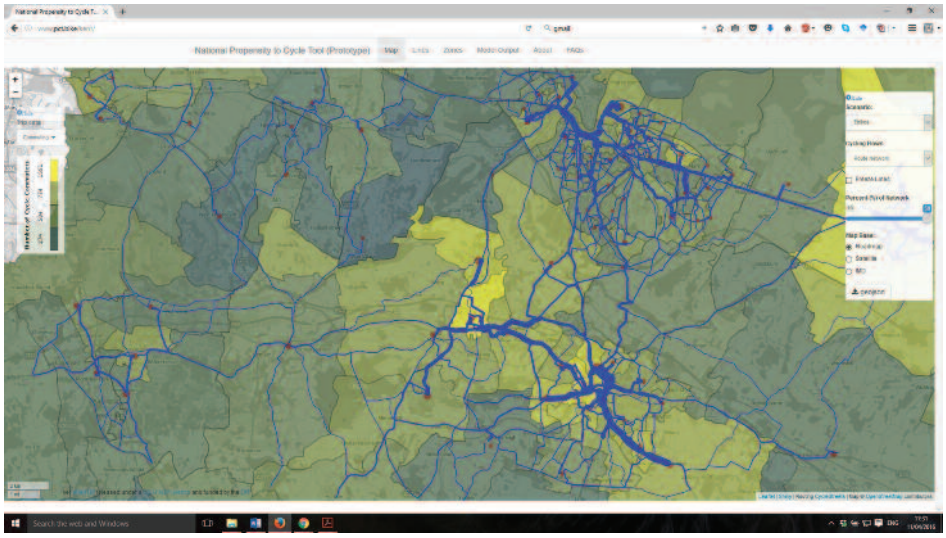
Figure 2: Comparison of cycling flows between the 2011 baseline scenario (above) and the Go Dutch scenario (below)



The PCT pinpointed which routes in Kent were likely to have the highest cycling commuter demand

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