The effectiveness of building spurs into linear cycling routes

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1 Executive Summary

This paper presents the case for the effectiveness of building spurs and cycling networks, as opposed to linear cycling routes.

This approach is supported and demonstrated by several public sector guidance papers and academic studies. This effectiveness is demonstrated through increased usage, increased modal share, higher time and distance efficiency and in the reduced safety risk of cycling; compared to the provision of both non-dedicated cycle infrastructure and one-off linear cycling routes.

The case of Seville is a strong example of the importance of strategically building a cycling network and the characteristics this requires. From 2006 to 2011, the municipal government embarked on a programme to rapidly expand the city's cycle network to create 164km of bi-directional segregated cycle tracks and shared paths. This resulted in a significant increase in cycling modal share (+6 percentage points) and a 56% decrease in bicycle accidents. Over the same time period in Greater London, the mode share for cycling increased by 0.2 percentage points (Transport for London, 2017). The success of the programme was, in part, attributed to the approach of rapidly building a complete cycle network, as opposed to one-off linear routes.

The paper concludes that the effectiveness of building spurs into linear cycling routes can be seen in the increased usage, efficiency and reduced risk of cycling networks, as seen in London and internationally.

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2 Introduction

This paper presents a case for building spurs into linear cycling routes. Due to a lack of research on the effectiveness of spurs off linear routes in particular, this paper draws from evidence and case studies of cycling networks, with the assumption that the network approach can be applied to spurs.

Firstly, several terms are defined, key to understanding the argument of this paper. Then, coherence and mesh density, key measures of the characteristics and effectiveness of cycle networks are outlined. Following this, the benefits of a network and spur approach are discussed, and then the case of Seville is presented.

3 Definitions

Network

A series of different forms of connected cycling infrastructure, which can include cycle tracks (including route spines and spurs), wayfinding, cycle parking and streets designed for cyclists, which work together to allow more direct, comfortable and safe cycle journeys serving multiple destinations.

The term ‘cycle network’ has been used throughout this document. Although this is a different form of infrastructure to spurs off a linear cycling route, we can still learn from the characteristics and case studies of cycle networks in understanding the effectiveness of spurs.

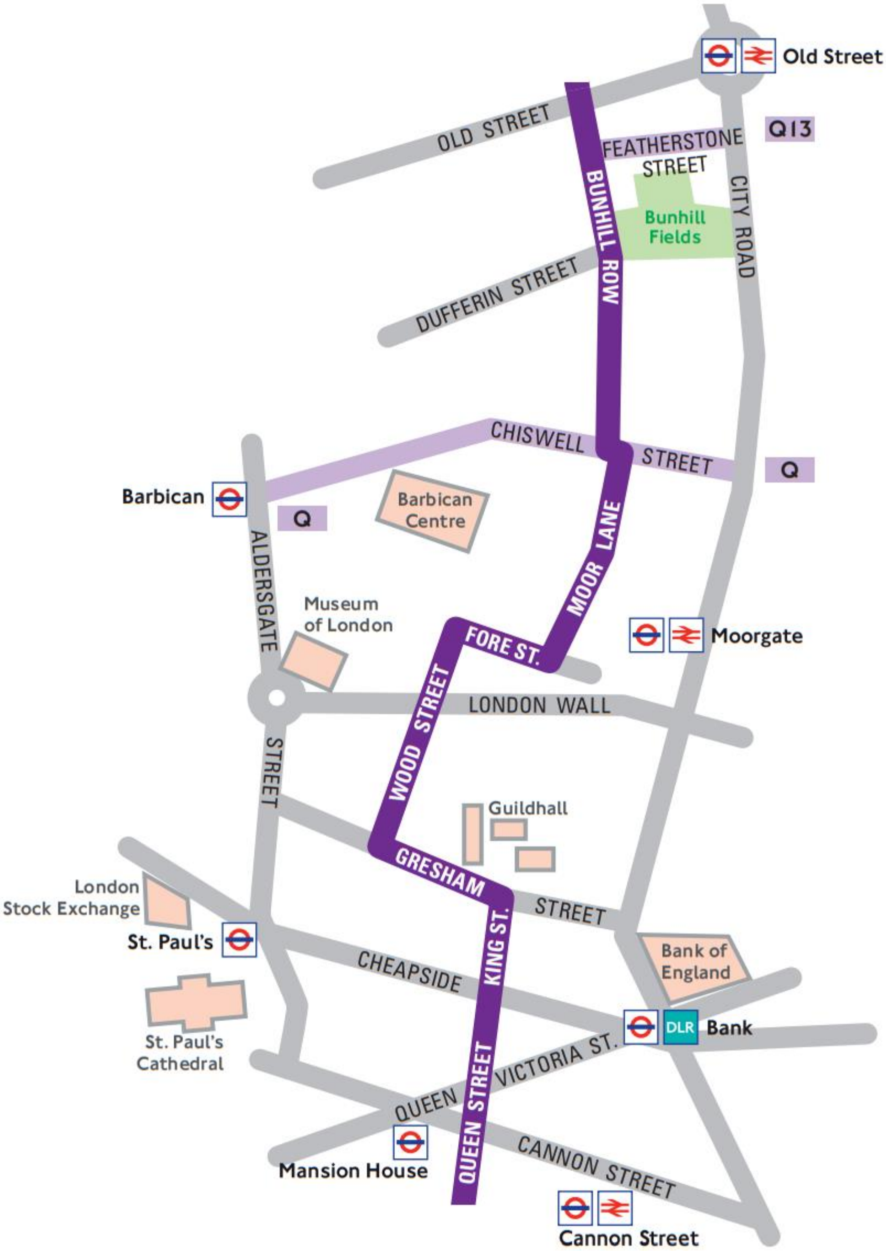
A Quietway is part of cycle network, composed of cycle tracks, signage and re-designed public realm to encourage cycling (J Bewley/Sustrans, 2016)

Spine

A linear cycling route. This usually links key destinations and points of origin e.g. town centres. In the example below, a Quietway runs North-South, indicated in dark purple. Shorter routes can offshoot from a spine, known as ‘spurs’.

Spur

A linear cycling route which offshoots or intersects a spine. In the example below, a spur running along Chiswell Street (indicated in light purple) intersects the North-South spinal route. Spurs are usually built to provide better access for cyclists to/from key destinations/points of origin which cannot be directly accessed by the spinal route.



Route map of Transport for London's Quietway 11 (Transport for London, 2017)

4 Coherence

One of the key principles that should be taken into account when designing a cycle route is coherence. This is strongly supported by several guidance papers and reports produced by the EU, Department for Transport, Transport for London (TfL) and Sustrans, as well as academic research (cited in this document). These papers outline the importance of linking all ‘significant trip generators and attractors - schools and colleges, retail areas, primary healthcare and hospitals […] – with residential areas’. This includes maximising links to the surrounding area by connecting all potential origins with destinations and providing a mixture of route options for different types of trips, all of which are key to achieving high usage of a cycle route, improving efficiency and reducing risk.

TfL’s London Cycle Design Standards scores coherence highly (as part of its Cycling Level of Service assessment) where:

- Cyclists are provided with dedicated connections to other routes
- There is a network mesh density less than 250m (see 5. Mesh Density)
- Good quality wayfinding which is consistent and allows cyclists to find a range of routes and destinations.

Internationally, there is consensus of the importance of coherence. The U.S. Federal Highway Administration’s Strategic Agenda for Pedestrian and Bicycle Transportation (2016) establishes the case for ‘connected networks’ which are safe, accessible and comfortable as a cornerstone goal, in order to reduce motor vehicle usage and increase levels of cycling and walking. The agenda also outlines the fundamental importance of this goal in achieving other goals within the agenda, such as improved safety, activity and equity.

5 Mesh Density

TfL’s London Cycling Design Standards (2014) outlines ‘mesh density’ as a factor in its Cycling Level of Service. Mesh density is an indicator of whether the grid formed by several cycle routes within a network is tighter (more routes per unit area) or looser (fewer routes per unit area). Therefore, greater mesh density leads to a higher score in the Cycling Level of Service. In central London’s case, the London Cycle Design Standards state that cyclists ‘should not have to travel more than 400m to get to a parallel route of similar quality’. This achieves a basic Cycling Level of Service, scoring zero points. Urban density must be taken into account when considering the mesh density required for an area. Area-wide infrastructure is generally more appropriate in more dense urban areas (e.g. central London and outer London town centres), where there is a higher potential of cycle journeys.

Increasing mesh density through the strategic location of cycle tracks and wayfinding increases the mobility of cyclists, as it provides better access to origins and destinations on high quality purpose built infrastructure (Sustrans, 2015). Conversely, fragmented ‘one-off’ projects negatively impact on a cyclist’s mobility opportunities (Schoner and Levinson, 2014). Therefore, ensuring routes are connected, through spurs or intersections, provides greater service and utility of existing infrastructure.

6 The case for spurs and networks

The following section outlines the advantages of building route spurs and networks and the rationale behind these. Whilst there is a lack of research demonstrating the effectiveness of spurs in particular, evidence demonstrating the outcomes of cycle networks exists. This can be applied to building an understanding of the effectiveness and required characteristics of route spurs.

6.1 Usage

A general consensus exists with regards to the effectiveness of cycle routes and wider networks in increasing usage. An exemplary case study for this is Seville, Spain, having experienced a modal share jump from negligible figures to 6% of all traffic (see Section 7). Similarly, Vancouver's cycle modal share increased from 4% in 2011 to 10% in 2015 following its programme to build a network of protected cycle tracks in the downtown area (Boldry et al., 2017).

In London, a mixture of infrastructure programmes and policies has driven an increase from 380,000 in 2004 to 610,000 in 2014. Cycle Superhighways, high-capacity routes running into and across London, saw a 46% and 83% increase in usage during the first year on the pilot routes (CS7 and CS3 respectively) (Haojie et al., 2017).

An increase in usage has also been observed on Quietway 1, the pilot route of the Quietways programme. This delivers radial and orbital low-traffic routes running through backstreets and green spaces. Baseline and after-implementation monitoring surveys indicated modal shift towards cycling, with 7% of respondents saying they used to drive their trip, and amongst respondents who started cycling, 23% reported using a bicycle for their journey all the time.

Whilst the increases in usage of routes in London have been monitored in response to the outcomes of spinal routes, both Cycle Superhighways and Quietways, together with Mini-Holland schemes, form part of the Mayor of London's cycling programme to deliver a comprehensive network of cycle routes across London (Transport for London, 2018). These also contribute to delivering a network with greater cohesion and mesh density. Considering the significant increase in cycling (two fold increase since 2000) (London Assembly Transport Committee, 2018), this demonstrates, in part, the effectiveness of a 'network' rather than individual linear route approach.

6.2 Journey time efficiency

The Department for Transport's Local Transport Note, Cycle Infrastructure Design (October 2008), presents the case for making cycling a more time efficient mode of transport by improving the directness and accessibility of routes. Greater efficiency can be provided by creating 'fine grain' networks by building links off a spine, 'based around the principle of providing small connected blocks of development so that walking and cycling distances are minimised'.

In addition, research by Handy and Xing (2011) in six small US cities demonstrates that bicycle commuters are highly sensitive to distance, and therefore 'building a network that provides direct connections with minimal detour is important'. Building a spine with spurs addresses this sensitivity by reducing the distance of a detour required to adjoin a cycle track.

6.3 Reduced risk

Within the cycling community there is a general consensus that with increased cycling facilities; lanes and tracks being the most common, the injury risk associated with cycling is reduced. The implementation of high quality facilities also is associated with an increase in the number of cyclists thereby further reducing the risks as outlined in the 'Safety in numbers' argument (Jacobsen, 2003). However, Wegman, et al. (2012) contend that higher cycling numbers alone are not responsible for reduced risk, as higher numbers of cyclists are associated with high densities of bicycle facilities and infrastructure found where there is greater mesh density.

7 Case study: Seville

Seville, Spain, provides an interesting and convincing case study for the effectiveness of networks, as opposed to stand-alone linear routes. From 2006 to 2011 Seville's municipal government rapidly expanded the city's provision of cycle tracks from 19km, to a network of 164km bi-directional segregated cycle tracks and shared paths. Seville experienced a jump in modal share from negligible values to 6% of all trips.

Map of Seville's cycle network in 2010 (Marqués et al., 2015)

Segregated bi-directional cycle lanes in Seville (London Cycling Campaign)

The new and expanded cycle network was the result of The Urban City Masterplan, which included a segregated bike network as part of the new city mobility system. The design of the network was first proposed through a ‘theoretical network’ which connected major trip attractors (e.g. intermodal centres) and relational spaces (e.g. squares, high streets). Next, taking into account on-street space constraints, the theoretical network was adjusted by optimising routes to trip attractors. The network was then proposed with 200 trip attractors located within 300m of the cycle network.

The proposal included specifications on cycle infrastructure typology. This mostly consisted of bi-directional segregated cycle tracks, built over previous parking lanes, either at the same level as the pavement or separated with bollards if at the same level as the road (Marques et al., 2015).

(London Cycling Campaign)

The main characteristics of the resulting network are:

- **Continuity and connectivity:** the network was designed with the aim of connecting, through a continuum of bike paths, the main trip-attractors and main residential areas of the city.
- **Cohesion and homogeneity:** the design of bike paths is very similar throughout the whole network, so that cyclists can easily follow it. This was achieved by using green pavement all through the network, as well as a uniform morphology, which is described below.
- **Directness and visibility:** as the network follows the main streets of the city it is quite visible. Moreover, as a general rule, detours and multiple street crossings were avoided.
- **Comfort:** The whole network should be comfortable for everyday cycling, with parking facilities and uniform pavement, without unexpected steps at intersections, etc.
- **Quick building:** The basic network (77 km) was built in less than two years (2006 and 2007).

(Extract from Ayuntamiento de Sevilla, 2005, 2006, 2007)

Some of the most notable and significant research into the effectiveness and impacts of Seville's new cycle network has been carried out by Marqués, Hernández-Herrador, Calvo-Salazar and others in 2015 and 2017. This demonstrated a large reduction in risk from before to after the network was built (2000 vs 2013). This saw a reduction in the number of recorded traffic collisions involving cyclists by a) kilometres of cycle track and b) numbers of cycle trips undertaken. From 2000 to 2013, the number of bicycle incidents per million trips decreased from 17.7 to 7.7 (56% reduction) and the number of cyclists killed or seriously injured (KSI) per million trips decreased from 1.31 to 0.36 per million trips (72% reduction).

The research concluded by discussing the importance of creating 'a complete network of bikeways covering the whole city instead of just continue making isolated bikeways' (Marqués and Hernández-Herrador, 2017). Together with the significant increase in cycling modal share and reduced risks to cyclists, Seville makes a strong case for the effectiveness of cycle networks. From this, we can learn lessons on the approach and characteristics which might be useful when considering the necessity, effectiveness and impacts of building spurs into linear routes.

8 Conclusions

Research from a range of sources supports the case that building cycle routes as part of a connected and cohesive network leads to greater usage, more efficient cycle journeys and reduced injury risk for cyclists.

Given the interaction between a linear route and spurs, and how this is replicated in a cycle network to form the end structure, we can assume that the effectiveness of cycle networks can be somewhat replicated in spurs off a linear route.

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