EFFECTS OF URBAN TRAFFIC-FREE PATHS ON EVERYDAY CYCLING

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ABSTRACT

The UK National Cycle Network (NCN) developed by the transport organization, Sustrans, is a significant policy intervention aimed at encouraging cycling. Around half of the population is purported to live within one mile of the 20,000km Network. Traffic-free paths (separated from the public highway away from motor traffic) form about one third of the Network but account for around 80% of trips. The importance of NCN urban traffic-free paths in encouraging people to cycle is often assumed but despite large aggregate datasets characterising users, there is no research on the effects on the local communities which they serve. This paper presents completed Doctoral research which aimed to identify the contribution of a typical section of NCN urban traffic-free path in encouraging cycling for everyday travel amongst a community living adjacent to this type of intervention.

First, the paper outlines the characteristics of the NCN, the philosophy behind the development of urban traffic-free paths and the barriers to cycling which such interventions seek to overcome. Then findings of a controlled cross-sectional survey of two neighbourhoods in a medium size town in the English Midlands (which are demographically similar except that one is located adjacent to a section of NCN urban traffic-free cycle path intervention) are discussed.

In conclusion the paper will reveal that provision of NCN urban traffic-free cycle paths alone may be insufficient in encouraging a shift from car to cycling for everyday travel purposes. Furthermore, it will highlight unintended consequences of the development of urban traffic-free paths at the local level. The data from the study corroborates evidence that suggests that a wider co-ordinated multi-faceted approach to promoting cycling is required which combines social marketing with physical measures including; wider speed restrictions in urban areas, investment in high quality cycle facilities and general land use and transport policies that 'advantage cycling' and reduce the convenience of the car.

Keywords: cycling, National Cycle Network, traffic-free paths

1.0 INTRODUCTION

Visions of future low carbon sustainable transport routinely feature cycling. Replacement of short journeys by car with cycling in urban areas could help to reduce traffic congestion, improve the quality of the urban environment, benefit personal health and well-being and contribute towards a low carbon economy. However, rates of cycling for everyday travel in the UK have continued to decline as lifestyles have become more car dependent and cycling marginalised. Half of all car journeys in the UK are still less than five miles and around one third are less than two miles (DfT, 2007[a]). Targeting short trips by car that could potentially be replaced by cycling does not require a large investment by government (at least relative to other big infrastructure solutions) to make them an option for most people (Mackett, 2003). Research on consumer acceptance of sustainable transport by Defra (2007) has revealed that walking and cycling less than three miles is a more acceptable behavioural goal than that of purchasing more fuel efficient/low carbon cars and using public transport. This suggests that there is a large untapped potential to increase cycling (and walking) for short journeys in urban areas which could not only contribute to reducing traffic congestion, but also to reducing transport's contribution to global carbon emissions, improving the quality of the urban environment and improving the nation's health.

The UK National Cycle Network (NCN) is a significant policy intervention aimed at creating a cycling culture. The importance of urban traffic-free cycle paths in encouraging people to cycle is often assumed, but despite large aggregate datasets characterising users, there is no research on the effects of such interventions on the local communities which they serve. This paper reports on empirical research that used a controlled cross-sectional design to survey neighbourhoods in a medium size town in the English Midlands that are demographically similar but exhibit differing levels of access to NCN urban traffic-free cycle path interventions.

1.1 Background: The UK National Cycle Network

Sustrans, the organisation responsible for the development of the National Cycle Network (NCN), aims to encourage the public to 'change the way it thinks about transport' and to 'to travel in ways that actually benefited our health and the environment'. The organisation first started to develop what would be the first sections of the Network towards the end of the 1970s by creating a 5 mile traffic-free cycle path along the disused railway track between Bath and Bitton near Bristol in the south west region of England (Figure 1). By 1994 Sustrans had developed short sections of cycle route across the UK and started to promote the concept of a National Cycle Network. In 1995 the organisation was awarded £43.5 Millennium Lottery Grant towards the estimated £200M to develop this Network in its entirety. This sizeable allocation was significant in that it was second only to that awarded for the development of the high profile Millennium Dome in London.

Figure 1: The Bristol and Bath Railway Path prior to development into NCN Route 4 now carrying some 1.7 million journeys a year (photos courtesy of Sustrans).

In 2000 Sustrans successfully completed 5000 miles of the National Cycle Network and by 2005 the 10,000th mile was opened providing an estimated 30 million people with access to within two miles of their home. Most of the Network is comprised of a series of linked traffic-free paths (typically along river corridors or disused railway lines) and low trafficked roads many of which linked urban centres with the green belt and outlying countryside. The NCN is a composite of over a thousand local sections and each one is designed to be of benefit to local people (Cope *et al*., 2003).

The National Cycle Network is regarded by Sustrans and its partners as a major 'symbolic new start' for cycling. Local authorities and other partners support the project on the premise that is will bring benefits in terms of traffic reduction, improvements to health, improved economic prospects, inclusive transport opportunities and a safer travelling environment. The government continues to provide a supporting role and this in turn gives Sustrans a strong mandate to go forward and encourage further stakeholder support:

> We believe that by making it easier for people to walk and cycle safely for all types of local journey, the National Cycle Network is making a valuable contribution to the creation of a 'walking and cycling culture', where walking and cycling progressively become part of people's day-to-day lives. For that reason we are keen to support the continuing development of the Network, especially where this can provide improved access to schools, jobs, services and leisure.
>
> [DfT, 2004; p28]

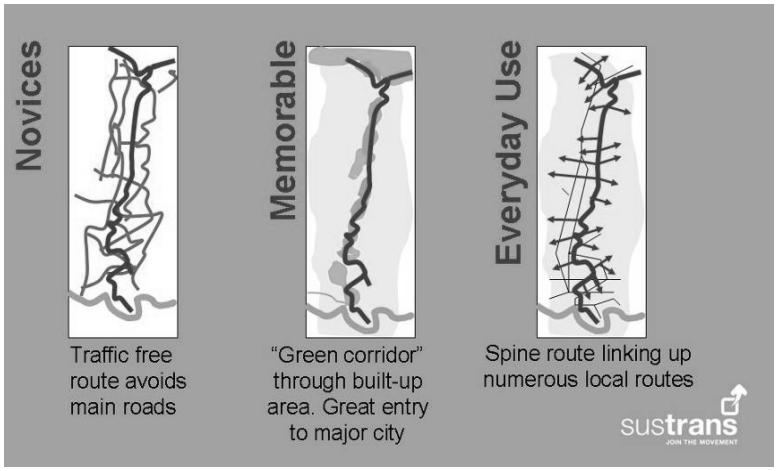
The intended role of traffic-free paths

One of the principle aims of the NCN is to encourage people to take up cycling for the first time or to start cycling again. One assumption is that NCN traffic-free routes provide the opportunity for less experienced cyclists to gain the confidence and experience necessary to enable them to cycle more.

> The novice cyclist stands to benefit the most by gaining confidence on the Network, its traffic-free, speed-calmed or lightly trafficked routes the perfect nursery slopes for acquiring the skills in relative safety. [Wickers, D., 2000; p44]

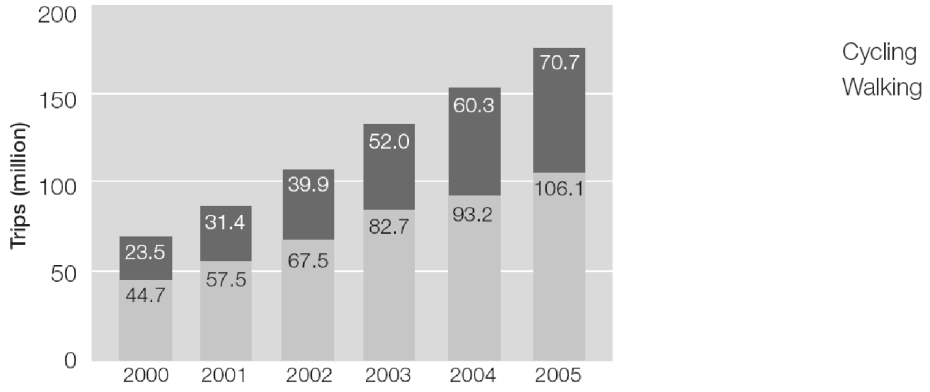
Sustrans philosophy is that by creating at least one high quality traffic-free cycle route in every urban area people could be persuaded to cycle again, enjoy the experience, and convince themselves that the bicycle was still a valuable and appropriate means of transport for everyday use (Figure 2).

Figure 2: Typical characteristics of traffic-free paths in urban areas (Source: Sustrans).



Sustrans annual Route User Monitoring Reports (RUMRs) provide evidence that there has been year-on-year growth of around 10% on the NCN (excluding new routes). Whilst actual route length has grown by 98% over the 5 years since 2000 usage rose by 135% (Figure 3) over the same period (Sustrans, 2006[a]). Sustrans states that traffic-free sections of the NCN in particular are crucial to the increased use of the Network. Traffic-free sections account for less than 20% of the Network but carry over 80% of all trips - around 193 million journeys in 2005. Around 60% of all trips by bicycle that take place on the Network are made on urban traffic-free routes (ibid).

Figure 3: Growth in walking and cycling on urban traffic-free sections of the National Cycle Network over the period 2000 to 2005



Since 1996 the ongoing National Travel Survey (NTS) has reported that the average distance travelled by bicycle has fallen by more than 10% overall and the number of cycling trips has also declined although this has stabilised in the last few years (DfT, 2006). It is important to note however that the NTS does not record cycling (and walking) trips that take place *off* the public highway and therefore does not include Sustrans' own reported growth in cycling along traffic-free sections of the NCN. This suggests that the nature of cycling is undergoing a transformation away from mixing with traffic towards traffic-free routes. Indeed, Sustrans continues to argue that these trips need to be recorded in official government statistics (Sustrans, 2006)[1] as this provides crucial evidence of the true picture of the demand for cycling in the UK.

Alternative discourse on the effects of traffic-free path interventions

> I've always seen it as critical to have a positive strategy to start people cycling again – and you don't start with the journey to work. The way into cycling, that first journey, will almost certainly be a leisure journey.
>
> [John Grimshaw, former Director of Sustrans, quoted in Sloman, (2006); p110]

Sustrans has, in the past, been criticised for focussing too much on traffic-free paths (that are mainly used for leisure journeys) and for adopting strategy that is doing little to lead more people to cycle competently and safely, wherever they wish to travel, and in a way that is sustainable and commands respect as an equal to others on the road. This criticism tends to be underlined by Forester's (2001) theory that 'bikeways' are the 'concrete expression of society's inferiority view of cycling' which proclaims motorists endanger cyclists and the way to protect cyclists is to build more bikeways (the so-called 'cyclist-inferiority phobia'). Pucher & Dijkstra (2000) acknowledge that this type of infrastructure is often more palatable and that motorists are less likely to object to off-road bike paths for recreational cycling because they do not interfere with the motor traffic on the roads. This may explain why local authorities and politicians have embraced the less controversial approach to traffic-free route path provision

[1] Sustrans continues to urge the government to include data from traffic-free routes of the National Cycle Network in order to achieve a much fairer assessment of the state of cycling in the UK.

promoted by Sustrans. However, Pucher (2001) also recommends accommodating the vehicular cycling on the public highway that Forester espouses but not to the exclusion of separate facilities. The author is critical of a sole focus on the 'vehicular cycling approach' which he regards as aimed at serving fast cycling and well-trained cyclists whilst ignoring the willingness, desire or need of people to cycle at lower speeds. The UK Department for Transport's position would appear to concur with this:

> 'Although we want people to be able to cycle safely on the roads, we recognise that high quality traffic free routes have a role to play in encouraging people to cycle more' (DfT, 2007[b]; p18).

This raises an important issue as to whether more weight has been given to initiatives that encourage recreational cycling (either as a support system to aid the transition into functional cycling or indeed as a resource in its own right) at the expense of (arguably more difficult) efforts to develop the infrastructure and support for everyday functional cycling. As Parkin *et al*. (2007) state, 'it cannot be assumed that use of the bicycle for recreational purposes will follow through into use for utilitarian purposes'.

The evidence gap

Considerable effort, time and money has been spent developing the National Cycle Network in the hope that the project will capture the imagination of the population generating a 'cultural response' to cycling whilst also acting as a stepping stone for new and returning cyclists. Councils have been busily allocating funds for cycling to develop (typically traffic-free) Sustrans routes within their authority boundaries. Critics of this approach would perhaps argue that this money would have been better spent elsewhere in promoting cycling, vehicular cycle training, improved conditions for cycling *on the highway*, and for measures that promote the treatment of cyclists as 'equals' to other road users.

Sustrans does not have substantive evidence that people using the NCN are converting to using cycles for everyday travel. Furthermore, Sustrans own route usage monitoring surveys are not detailed enough to allow closer interrogation of this theory. Cope *et al.* (2003) state that, 'figures [from the route monitoring programme] conceal the role of the NCN as a demonstration project that provides a safe try-out space for potential cyclists, who may eventually develop from recreational cyclists to utility cyclists'. The authors identify the need for a strategic assessment of the ways in which the NCN can assist in key policy areas; the need for improved mechanisms for information dissemination in terms of reaching target audiences, promoting the availability of the resource, communicating route alignment and brand recognition. From their analysis of existing route user data the authors conclude that there is a need to include *non-user populations* in future samples and to establish a *control exercise* to discern the magnitude of impacts related to initiatives (pp16&17).

Lawlor *et al*. (2003; pp96-101) have also pointed out that strategies that seek to change the environment to one that is supportive of regular commuting by bicycle (or on foot) have an important part to play in increasing population activity levels. They argue that there is an

urgent need to evaluate environmental interventions that are targeted at increasing levels of physical activity amongst the population such as the National Cycle Network - arguably the UK's largest such intervention. Although they acknowledge that evaluation is not straightforward they propose, 'combining evidence from network user surveys, routine transport surveys, and linking details of development of the network with routine surveys to compare modes of transport and levels of activity between areas close to and more distant from a network path' (p100). Similarly, Bauman (2005) has called for the prioritisation of natural experiments and the opportunistic evaluation of environmental improvements in order to improve the evidence base as to their effects on cycling (and walking) activity.

The next section reports on the research approach and methods used to develop a better understanding of the links between physical environmental interventions, namely Sustrans traffic-free paths in urban areas, and the current (and the future) role of cycling in the lives of residents at neighbourhoods served by those facilities.

2.0 RESEARCH APPROACH AND METHODS

A cross sectional research design was applied to a particular case study location for this study in order to generate concrete, practical and context dependent knowledge (Flyvbjerg, 2001; p70) of the effects of a section of Sustrans traffic-free cycle route. It was considered vital that the nature of the case study (e.g. whether it is typical in some way or other on a series of attributes) and the boundaries of the study population were clearly identifiable and kept in focus (Stake, 2000). This would enable the research to act as an exemplar of cycling behaviour within a specific context (i.e. traffic-free route providing direct access between residential areas and everyday facilities) to enable findings to be be generalised to theory (i.e. that this proximity encourages cycling for everyday travel).

In order to follow this logic, Stafford (Figure 4) a medium sized town in the English Midlands (population 111,500) was identified as a suitable case study. The town has average levels of cycling (3% journeys to work from Census 2001) and significant sections of traffic-free cycle route have been developed. The NCN through Staffordshire joins Stafford urban area via three mostly traffic-free routes that are highly visible on the ground and which all converge in the town centre (Figure 5). Each route provides the local population with the opportunity for traffic-free recreational access to the countryside as well as serving utility journeys to access the commercial centre as well as business parks and industrial estates along the routes.[2]. It can therefore be assumed that there are realistic opportunities of replacing short car journeys with cycling. One of the traffic-free cycle routes, The Isabel Trail, is 2.5 miles long and links the suburban area of Beaconside in north east Stafford with the town centre (

[2] Route 81 to Telford (also known as the Stafford Greenway); Route 5 (North) from Stone and Route 5 (South) from Lichfield providing access to Cannock Chase Forest Park Area of Outstanding Natural Beauty (AONB).

Figure 6 and

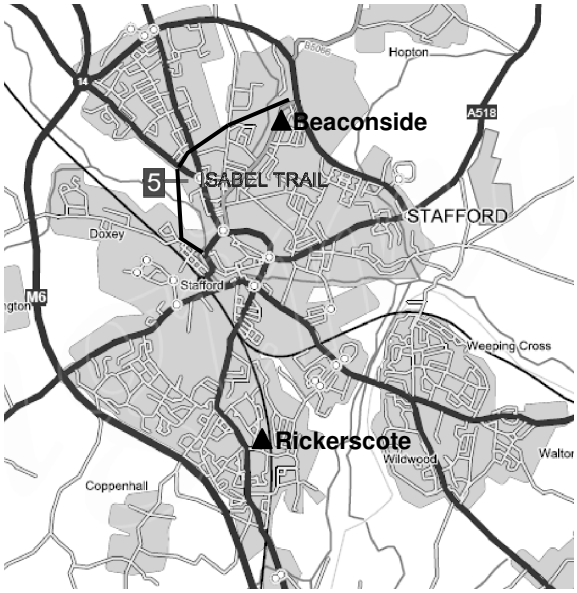
Figure 7). Completed in the autumn of 2005, The Isabel Trail forms part of Route 5 of the National Cycle Network and is regarded by the local authority as a 'flagship' route with high potential for replacing short journeys by car with cycling because it removes the danger of motor traffic and provides a direct connection to the town centre from outlying suburbs.

Figure 4: Location of Stafford in the UK.

Figure 5: The National Cycle Network in Staffordshire.

Figure 6: Photos of The Isabel Trail traffic-free cycle route (NCN Route 5).

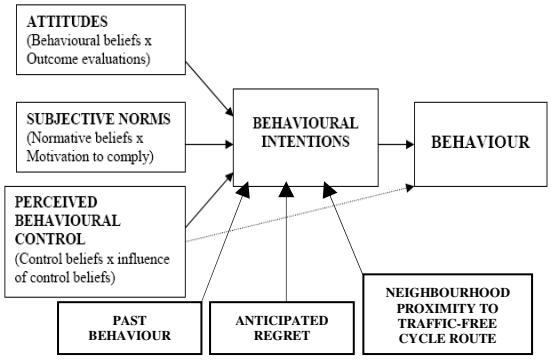
Figure 7: Alignment of The Isabel Trail (NCN Route 5) and location of surveyed neighbourhoods (Beaconside and Rickerscote).



A door-to-door drop and collect questionnaire survey was conducted in July 2006 amongst 250 households located across two neighbourhoods (known locally as Beaconside and Rickerscote) within Stafford Urban Area (Figure 7). The selected neighbourhoods differed in few respects other than the neighbourhood at Beaconside has direct access to The Isabel Trail traffic-free section whereas Rickerscote is located on the other side of town where the NCN traffic-free paths are least accessible. The National Classifications of the 2001 Census Output Area data (Vickers *et al.*, 2005) was initially used to explore demographic profiles of the population within Stafford urban area to select two comparable homogenous areas. Beaconside and Rickerscote, were suitable because they are both characterised by their 'averageness' by the National Classification and represent around 15% of the population of Stafford compared to 18% of the population of England. Each neighbourhood is predominantly suburban and located approximately 2 miles from the town centre (assumed to be a reasonable journey time by bicycle of around 15 minutes at an average speed of 8mph).

The questionnaire used for the survey focused on awareness of the available opportunities for traffic-free cycling in the town and use of traffic-free paths, the share of cycling for local travel for different journey purposes, attitudes to the role of cycling within society and for personal travel, and finally, future intentions to make practical everyday journeys by cycle. The Theory of Planned Behaviour (TPB) developed by Ajzen, (1985; 1991) was used as a theoretical framework to investigate the causal link between attitudes and behaviour to comprehend and predict people's intention to cycle. The model is based on the premise that individuals go through a systematic process of rationalisation before arriving at a behavioural decision (Figure 8). The more favourable the *attitude* (i.e. degree to which carrying out the behaviour by an individual is evaluated positively or negatively), *subjective norm* (i.e. the perceived social pressure to carry out the behaviour by 'significant others' such as family and friends) and *perceived behavioural control* (i.e. the individual's perception as to whether they have the ability to perform the behaviour) the stronger the *intention* to perform the behaviour. The model was also extended to include *past behaviour* (i.e. frequency of practical cycling in past month) and *anticipated regret* (i.e. if failed to make a practical journey by cycle within the next month) as well as *neighbourhood* (to determine whether proximity of traffic-free routes was significant in predicting intention to cycle).

Figure 8: The Theory of Planned Behaviour (Ajzen, 1991)



The survey drew a similar response rate across each neighbourhood of around 45% (n=205) of the adult population. The following section presents findings comparing awareness of traffic-free opportunities for cycling, use of traffic-free paths and perceived affect on cycling behaviour, and future intention to conduct practical journeys by cycle.

3.0 RESULTS

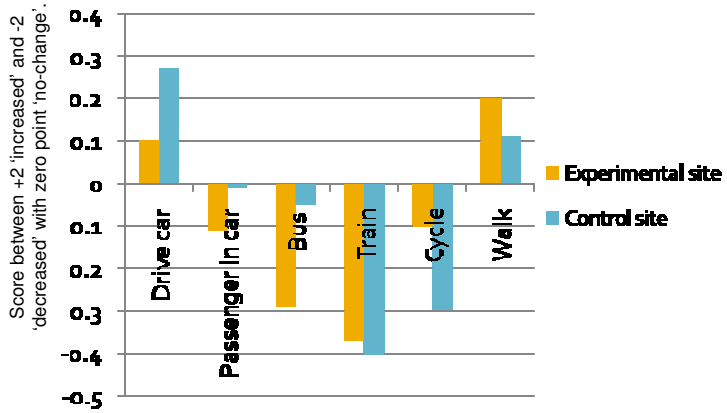
3.1 Levels of cycling

The survey results revealed that the level of cycling amongst survey respondents living adjacent to the traffic-free path intervention in the neighbourhood of Beaconside was higher than those respondents at the control neighbourhood (Rickerscote). The survey data revealed 6% mode share across *all* journey purposes for cycling at Beaconside and only 2% at Rickerscote (t=2.99, df=182, p=.003) (Table 1, column 1). Travel to work mode share from the 2001 Census also reveals that 7% of all journey to work were by cycle at Beaconside and only 2% at Rickerscote suggesting relatively little change in mode share of cycling (at least for the journey to work) since 2001 (Table 1, column 2). This was confirmed by asking respondents to indicate on a five point scale (i.e. +2 'increased' to -2 'decrease' with zero 'no change') how overall use of different modes used had changed over the previous 12 months (i.e. prior to the NCN traffic-free path being implemented). This indicated that levels of cycle use were perceived to have declined slightly across both neighbourhoods whilst walking and car driving had increased slightly (Figure 9). Overall this suggests that levels of cycling had not increased since the traffic-free intervention was completed in November 2005 (however, seasonal effects may have affected this result).

Table 1: reported cycling mode share compared to Census 2001 Travel To Work (TTW)

	Proportion cycling mode share across all journey purposes	2001 Census Travel To Work mode proportion
England and Wales	-	2.76
Stafford	-	3.15
Beaconside (access to traffic-free routes)	6	7
Rickerscote (limited access to traffic-free routes)	2	2
	T=2.99. df=182, p=.003	

Figure 9: Perceived changes in travel behaviour over last 12 months.



3.2 Familiarity with opportunities for traffic-free cycling

Familiarity with the availability of the NCN Route 5 Isabel Trail traffic-free path was investigated. There was a significant difference between sites with 59% of respondents at Beaconside familiar with this facility compared with only 6% at Rickerscote (X^2=71.1,df=2,p<.001). This would suggest that proximity to traffic-free facilities appears to increase awareness of opportunities for traffic-free cycling. However, the comments of one respondent at Beaconside revealed the potential lack of awareness of other opportunities for traffic-free cycling across Stafford: *"I use the Isabel Trail a lot but was surprised to find out there was two others [traffic-free routes] in Stafford. Maybe these would be used more if better publicized?"* (Male, 41, living adjacent to Isabel Trail). Furthermore, there was evidence of a very low level of familiarity across both neighbourhoods with the organisation behind the development of the traffic-free routes in the town with around 90% of respondents (X^2=1.34,df=1,p<.25) never having heard of Sustrans. Although familiarity with the National Cycle Network was higher (30% at Beaconside and 18% at Rickerscote) there was not a statistically significant difference between neighbourhoods (X^2=3.14, df=1,p=.08). This suggests that proximity to NCN facilities does not guarantee increased awareness of 'the Sustrans mission' (i.e. to encourage a mode shift from car use to walking and cycling). It would appear, therefore, that increased effort is required at the local level to disseminate promotional messages about the availability of the National Cycle Network and the opportunities it provides to replace short car journeys with cycling (and walking).

3.3 Actual use of traffic-free routes and perceived affect on level and type of cycling

When comparing use of traffic-free routes for cycling between neighbourhoods (Figure 10), 1 in 5 respondents at the Beaconside neighbourhood reported using traffic-free routes in Stafford at least once a month compared to only 1 in 20 at the control site (X^2=14.75,df=3,p=.002). This result is statistically significant and seems to suggest that the availability of a nearby traffic-free cycling route is encouraging cycling. However, when respondents at the Beaconside site were asked about the purpose for which the traffic-free route is used it becomes clear that this is overwhelmingly for the purposes of recreation. Indeed, almost all respondents who reporting having used the route did so mainly for recreation whereas only around one third used the route for the journey to work or other practical journey purposes such as shopping (Table 2). This suggests that the provision of the traffic-free facility has provided an important near-to-home recreational cycling facility (for at least one fifth of the population of Beaconside) but that the facility is less significant in supporting everyday practical journeys by cycle. It is also unclear whether these are *additional* recreational journeys or whether they are replacing recreational journeys that would have otherwise been made by car.

Figure 10: Frequency of use of traffic-free cycle routes in Stafford.

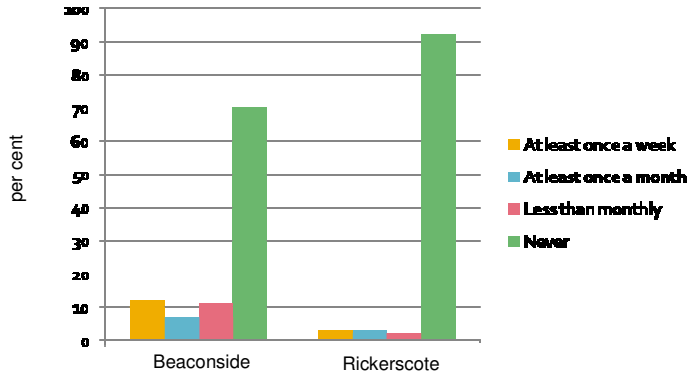
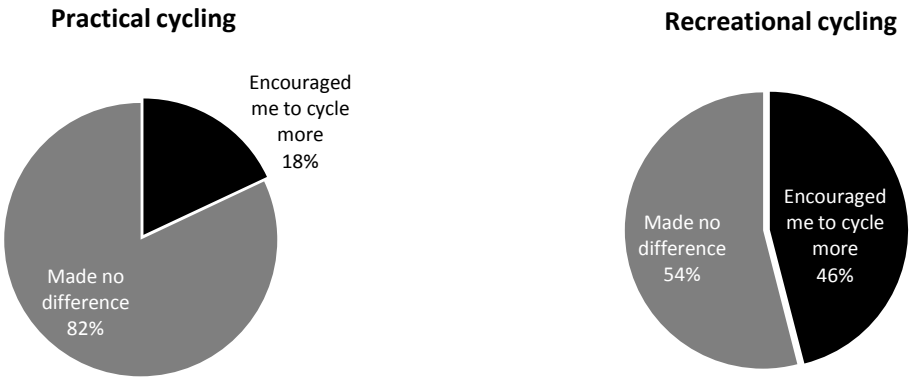


Table 2 Purposes for which residents of Beaconside use the Isabel Trail traffic-free route.

Reported use of traffic-free path for…	Per cent
Journey to work	32
Light grocery shopping	32
Heavy food shopping	4
Travel to (Stafford) High Street	20
Visiting friends and relatives	24
Local recreational journeys	96
Journey to school	16

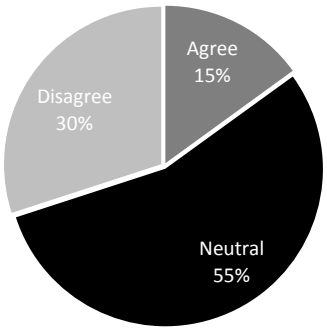
Respondents at the Beaconside site were asked to report the perceived effect of the availability of the Isabel Trail traffic-free route on their level and type of cycling. 30% of sampled population (n=33) reported having ever used the route for cycling, and of those people,18% stated that they had been encouraged to cycle more for practical journeys and 46% for recreational journeys, again confirming the importance of the facility as a local recreational offering (Figure 11). When considering this as a proportion of the total population at the Beaconside neighbourhood (i.e. including those that reported never having used the facility), less than 5% of the total sample population report having been encouraged to cycle more for practical purposes and 14% for leisure as a result of availability of the traffic-free path.

Figure 11: Effect of traffic-free path on cycle users at Beaconside on practical and recreational cycling



It was highlighted earlier that one assumption is that NCN traffic-free routes provide the opportunity for less experienced cyclists to gain the confidence and experience necessary to enable them to cycle more. This was tested by asking respondents living adjacent to the NCN at Beaconside their level of agreement or disagreement with the statement, *'Using the traffic-free cycle path has given me the skills and confidence to cycle in a variety of different contexts including riding on the road mixing with traffic'.* Again, of the 33 people who reported ever having used the route, only 5 agreed with this statement (Figure 12). This represents less than 5% of the total sample population at Beaconside and suggests that there is little evidence that providing near-to-home traffic-free free cycling opportunities encourages cycling in different environmental contexts such as on the road mixing with general traffic.

Figure 12: Level of agreement with statement, *"Using the traffic-free cycle path has given me the skills and confidence to cycle in a variety of different contexts including riding on the road mixing with traffic..."*



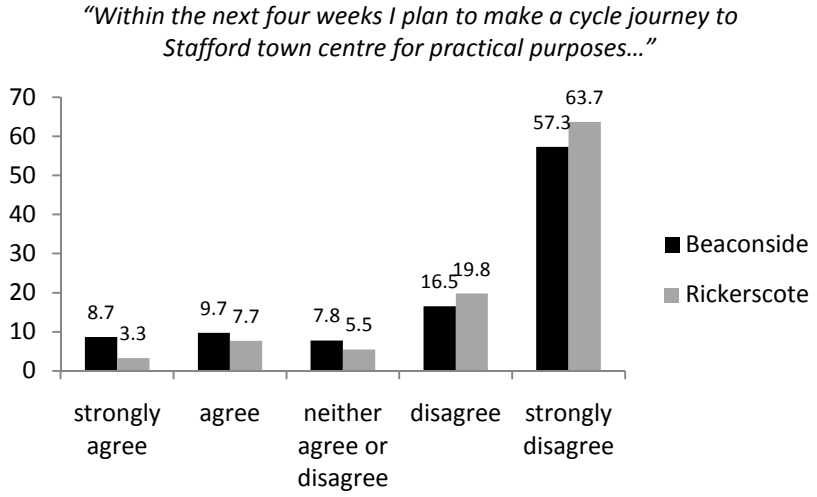
3.4 Effect on future intention to cycle for short practical journeys

The Theory of Planned Behaviour (Ajzen, 1985; 1991) was used to explore attitudes to cycling and predict respondents' intention to cycle with the relevant components of the theoretical model (see Figure 8 earlier). The Theory of Planned Behaviour suggests that to explore the attitude-behaviour connection an explicit target behaviour should be identified and that this should be defined in terms of target, action, context and time (TACT) (Ajzen, 2002; Francis *et al.*, 2004). To satisfy this condition, when completing the survey questionnaire section on planned behaviour, respondents across both neighbourhoods were provided with the following instruction before answering statements relating to components of the TPB model, *'I want you to seriously consider making a journey by cycle from your home to Stafford Town Centre (a distance of approximately 2 miles) on a dry sunny day for practical purposes (e.g. going to a shop) within the next 4 weeks.'*

Figure 13 below shows the level of agreement and disagreement with the statement, *"Within the next four weeks I plan to make a cycle journey to Stafford town centre for practical purposes…",* and demonstrates the low level of intention to cycle for practical purposes at both neighbourhoods. Around 80% of respondents at Beaconside and 90% of respondents at Rickerscote stated that they did *not* intend to make a practical journey by cycle to Stafford

town centre during the following four weeks and the difference between these values was not statistically significant (t=1.76, df=190, p<.08).

Figure 13: Intention to make a practical cycle journey to Stafford town centre.



The question of whether neighbourhood proximity is able to predict intention to cycle along with independent variables from the Theory of Planned Behaviour model was tested using a multinomial logistic regression model. Multinomial logistic regression is similar to multiple regression but does not assume that the relationship between the independent variables and the dependent variable is a linear one or that the dependent variable or residuals are distributed normally and is more robust when these assumptions are not met (Hair *et al*., 1984; p276). Multinomial logistic regression is also used where there are three or more categorical outcome variables. In preparation for multinomial logistic analysis the 7-point intention variable was split into three categories representing 'no intention' (previous score = 1), 'low-intention' (previously score = 2 or 3) and 'moderate to high intention' (previous score = 4-7) for all respondents across sites as shown in Table 3.

Table 3: Case summaries for 3 category dependent variable (intention) used in multinomial logistic regression analysis

Intention to make a practical cycle journey from home to town centre (approx 2 miles) within next 4 weeks.	N	Marginal Percentage
No intention	117	60.3
Low intention	35	18.0
Moderate to high intention	42	21.6
Beaconside (direct access to traffic-free route)	103	53.1
Rickerscote (no direct access to traffic-free route)	91	46.9
Valid	194	100
Missing	11	
Total	205	

Due to low sample size the analysis was performed on aggregated data for all respondents (n=205) with each neighbourhood included as an independent variable. The 'low intention' category was chosen as the reference group when performing the analysis so that the regression was able to demonstrate which variables are significantly predictive of being in

either of the extreme categories (i.e. 'no-intention' and 'moderate/high intention') compared with the middle category of 'low-intention'. Several models were tested but the best model fit specification included all of the independent variables including *neighbourhood*. Table 4 shows that the final model outperforms the intercept only (null) model and is statistically significant (χ^2 = 121.598; df=18; p<.001). The existence of a relationship between the independent variables and the dependent variable was therefore supported (i.e. the null hypothesis that there was no difference between the model without independent variables and the model with independent variables was rejected). Table 5 shows that the model provides better predictive ability for 'no-intention' and 'moderate/high intention'.

Table 4: Overall Model Fit for TPB including neighbourhood.

Model Fitting Information				
Model	-2 log likelihood	Chi-square	Df	Sig.
Intercept only	366.742			
Final	245.144	121.598	18	.001

Table 5: Classification table showing ability of model to predict group membership.

	Predicted			
Observed	No intention	Low intention	Moderate/High Intention	Percent correct
No intention	108	3	6	92.3
Low intention	15	12	8	34.3
Medium/High Intention	2	10	20	47.6
Overall Percentage	69.6%	12.9%	17.5%	72.2%

The strength of the relationship indicated by the Pseudo R^2 (Nagelkerke) value was .549 which suggests that the proportion of variation being explained by the model is 55%. The overall likelihood ratio test revealed that there is a statistically significant relationship between the dependent variable intention to cycle for a short practical journey and subjective norm ($\chi 2$=6.18, df=2, p<.05), self-efficacy/controllability ($\chi 2$=7.21, df=2, p<.05), past behaviour ($\chi 2$= 8.48, df=2, p<.05) and also anticipated regret ($\chi 2$=23.25, df=2, p<.001). Neighbourhood, however, was *not* a significant predictor of intention to cycle.

The model summary reproduced in Table 6 below demonstrates that anticipated regret is significant in distinguishing the 'no-intention' category of the dependent variable from the 'low intention' category of the dependent variable (Wald=19.83, df=2, p<.001). Self-efficacy/controllability is also significant in distinguishing the 'no-intention' category of the dependent variable from the 'low intention' category of the dependent variable (Wald=4.93, df=2, p<.05) and also descriptive norm (Wald=3.94, df=2, p=.05). None of the independent variables in the model including site were significant in distinguishing the 'moderate-high' intention category from the 'low intention' category. Whilst, past behaviour came closest this was not sufficiently significant at the 95% level of confidence (p=.06).

The Exp(B) statistic in Table 6 is an indicator of the change in odds resulting from a unit change in the predictor variable. If the value is greater than 1, then as the predictor increases, the odds of the outcome occurring increases. Conversely, a value less than one indicates that, as the predictor increases, the odds of the outcome occurring decrease. This suggests the following:

1. For each unit *increase* in *self-efficacy/controllability* the odds of being in the group of survey respondents who indicated that they had *no intention* of making a practical journey from home to the town centre by bicycle *decreases* by 36.5% (i.e. 0.635 – 1).

2. For each unit *increase* in *anticipated regret* the odds of being in the group of survey respondents who indicated that they had *no intention* of making a practical journey from home to the town centre by bicycle *decreases* by 48.8% (i.e. 0.512 – 1).

3. For each *unit increase* in *descriptive norm* the odds of being in the group of survey respondents who indicated that they had *no intention* of making a practical journey from home to the town centre by bicycle *decreases* by 74.5% (i.e. 0.255 – 1).

Table 6: Results of Multinomial Logistic Regression for the final model showing significant effects on respondents' intention to make a short practical journey from home to the town centre.

Intention to make a practical journey by cycle from home to the town centre within the next four weeks.		B Estimate	SE	Wald	Df	p (Sig)	Exp (B)	95% Confidence Interval Exp(B) Lower bound	Upper bound
NO INTENTION	Intercept	6.248	1.251	24.957	1	.001	-	-	-
	attitude (beliefs)	-.192	.184	1.081	1	.298	.826	.575	1.185
	attitude (evaluative)	.034	.065	.278	1	.598	1.035	.911	1.176
	subjective norm (beliefs)	-.070	.056	1.552	1	.213	.933	.836	1.041
	descriptive norm	-1.366	.697	3.939	1	.050	.255	.065	1.000
	perceived behavioural control (beliefs)	.039	.042	.873	1	.350	1.040	.958	1.129
	self-efficacy controllability	-.408	.184	4.928	1	.026	.665	.464	.953
	anticipated regret	-.732	.164	19.831	1	.001	.481	.348	.664
	past (cycling) behaviour	-3.341	4.830	.478	1	.489	.035	2.74E-006	457.656
	neighbourhood= Beaconside/Rickerscote	.444	.522	.725	1	.394	1.560	.561	4.337
MODERATE TO HIGH INTENTION	intercept	.437	1.325	.109	1	.741	-	-	-
	attitude (beliefs)	.056	.072	.603	1	.437	1.058	.918	1.219
	attitude (evaluative)	-.074	.202	.135	1	.714	.929	.626	1.379
	subjective norm (beliefs)	.060	.056	1.160	1	.281	1.062	.952	1.186
	descriptive norm	-.509	.600	.718	1	.397	.601	.185	1.950
	perceived behavioural control (beliefs)	-.014	.045	.098	1	.754	.986	.904	1.076
	self-efficacy/controllability	-.025	.209	.015	1	.903	.975	.647	1.469
	anticipated regret	-.189	.155	1.483	1	.223	.828	.611	1.122
	past (cycling) behaviour	6.326	3.379	3.505	1	.061	558.767	.743	420111.205
	neighbourhood= Beaconside/Rickerscote	.314	.538	.340	1	.560	1.369	.477	3.928

N=194 (Non-intention = 117; low intention = 35; medium to high intention = 42)
Model Chi-square = 121.598; df=18; p<.001; -2 log likelihood = 245.144; Pseudo R^2 (Nagelkerke) = .55.
Reference category = 'Low intention'.

The extended TPB model is demonstrated to be a useful predictor of intention to make practical journeys by cycle. In summary, the odds of a respondent making a practical journey by bicycle increases if other family members cycle, and if there would be a feeling regret if the journey was not made by cycle; and when, on balance, there is a belief in personal ability to make a practical journey by cycle (self-efficacy) and/or a perception that this journey is both possible and easy (controllability). The regression analysis revealed that neighbourhood proximity to traffic-free routes did *not* add to the predictive ability of the model and its contribution is therefore *not* significant. This suggests that householders with direct access to traffic-free cycle facilities outside their homes are no more likely to make practical journeys by cycle than those householders without direct access to such facilities.

4.0 DISCUSSION

The focus of this paper has been a significant policy intervention aimed at increasing levels of cycling in the UK and generating a cycling culture. The National Cycle Network developed by Sustrans is supported by national government and local authorities on the premise that it will bring benefits in terms of traffic reduction, improvements to health, improved economic prospects, inclusive travel opportunities and a safer travelling environment. The proposition by Sustrans that providing at least one high quality traffic-free route in every urban area can persuade people to cycle again, and in doing so, convince them that cycling is a valuable and appropriate means of transport for short journeys was tested.

Evidence produced by Sustrans reveals that around two-thirds of all trips by bicycle on the Network take place on traffic-free routes and that these sections have witnessed the most growth. However, this paper highlighted that the evidence base is characterised by large aggregate datasets and that there is a paucity of evidence of the impacts of localised traffic-free path interventions on the communities they serve. By focusing on a single case study location where such interventions have been implemented (and where significant perceived barriers to cycling such as difficult topography and traffic danger either do not exist or have been removed) this study was able to identify whether the provision of a good length of flat traffic-free cycle route, linking the urban centre to the suburbs (a distance of around 2 miles), has generated a 'cultural response' to cycling and promoted more sustainable travel behaviour.

The key finding is that provision of National Cycle Network urban traffic-free cycle routes alone would appear to be insufficient in encouraging a shift from car travel to cycling for everyday practical journeys. Although it was revealed that there is a higher rate of cycling across all journey purposes at Beaconside where the traffic-free intervention has been implemented, there was little evidence that the availability of the traffic-free path was the main causal factor. It is more likely that this was the result of the complex interaction of other environmental and social-psychological variables (e.g. proximity of journey attractors, individual cycling experience and desirability of cycling amongst household members) that would need to be established through further study.

Whilst residential proximity to an urban traffic-free routes does not necessarily increase levels of cycling for everyday travel there is strong evidence that it can help to facilitate near-to-home recreational opportunities. A significant proportion of the population (circa 30%) living adjacent to the traffic-free route at Beaconside used the Isabel trail for recreational cycling. In this respect, neighbourhoods with good access to Sustrans type traffic-free routes are best placed to take advantage of demand for near-home recreational opportunities. However, it should be noted that, proximity to a section of National Cycle Network urban traffic-free trail does not automatically increase levels of awareness of the either the NCN concept or of the Sustrans 'brand'. Indeed, awareness of Sustrans and the National Cycle Network was very low even amongst residents living adjacent to the NCN. This suggests that there is plenty of scope to market the benefits that NCN traffic-free facilities have to offer amongst UK households served directly by such facilities.

There is a paucity of evidence which demonstrates that developing or altering transport infrastructure or other aspects of the built environment have led to an increase in walking or cycling or a modal shift away from car use. Badland *et al.* (2005; p192) have noted in a meta-analysis of existing studies, that the majority of existing research on the association between the built environment and physical activity behaviour is based on *'country-specific, self-report cross-sectional designs, which have led to inherent flaws and no establishment of causality'.* This research falls into that trap - although the focus of this study was the effect of an environmental intervention on *travel behaviour*. Therefore, it is difficult to attribute causality - that the traffic-free routes *causes* more people to cycle that otherwise would not have cycled.

There is a general difficulty in applying robust study designs to the evaluation of complex infrastructural interventions. As well as availability of cycling infrastructure such as traffic-free trails, other objective environmental variables such as connectivity, land use mix and transport system characteristics could be important factors affecting whether the population chooses to cycle, not to mention psychological, social and cultural factors. There is a need, therefore, to develop more sophisticated 'ecological' models of behaviour which take into consideration a host of possible explanatory variables covering the physical environment and the psycho-socio-cultural milieu of the individual (Saelens et al., 2003).

Ideally, this research could have used a test re-test experimental research design to measure travel behaviour at Beaconside (the intervention neighbourhood) and at Rickerscote (the control neighbourhood) prior to intervention and again after intervention to measure any effect. Future studies should aim to use a classic pre-test post-test experimental design to obtain more reliable evidence of the effects of environmental interventions targeted at encouraging everyday cycling[3]. Longitudinal surveys of communities served by new interventions targeted at encouraging cycling can also be used to monitor awareness and changes in attitudes and behaviour using more in-depth qualitative techniques at the household level.

[3] The iConnect study is adopting precisely this strategy to evaluate the Connect2 project, an ambitious UK-wide project also led by Sustrans, to transform local travel in 79 communities and provide people with easier access to everyday activities by constructing new crossings and bridges to overcome major obstacles to walking and cycling. More information available from http://www.iconnect.ac.uk/

5.0 CONCLUSION

This study discussed in this paper set out to understand the localised effects of typical Sustrans style traffic-free path interventions on cycling for everyday travel. The key finding is that, provision of significant lengths of National Cycle Network urban traffic-free cycle routes alone, appear to be insufficient in encouraging a shift from car travel to cycling for everyday practical journeys. Urban traffic-free paths were found to be significant, however, in facilitating near-to-home recreational cycling. This suggests that a wider co-ordinated multi-faceted approach to promoting cycling is required which combines social marketing with physical measures including wider speed restrictions in urban areas, investment in high quality cycle facilities across the urban transport network and general land use and transport policies that 'advantage cycling' and reduce the convenience of the car.

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