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THE PROMOTION OF BICYCLE ACCESS TO THE RAIL NETWORK AS A WAY OF MAKING BETTER USE OF THE EXISTING NETWORK AND REDUCING CAR DEPENDENCE

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The level of bike-rail integration (combining cycling with rail) in the UK presents an unrealised sustainable mobility potential: two per cent of rail passengers access the rail network by bicycle, contrasting with 40% in the Netherlands. Cycling on its own has distance limitations but in combination with rail it can substitute for longer car journeys and is one means of reducing car dependence.

This paper reports on the exploratory phase of a research project to understand existing bike-rail integration behaviour in the UK to inform the design, development and implementation of initiatives to increase its incidence. The data collection sites were the two busiest stations in the South West of England: Bristol Temple Meads and Bristol Parkway.

The exploratory phase included a face-to-face survey of 135 bike-rail integrators, which led to the findings that their main motivations were saving time and getting exercise. Two thirds were male, 40% in their thirties, 62% owned a car, and nearly all were employed and living in households with incomes of between £17,000 and £50,000. They had cycled on average 3.7 km to or from the station. The 44% who had a car available for that journey reported making an explicit choice to bike-rail integrate rather than use their cars for the whole journey.

The implications of these findings and the different types of interventions that could be implemented are discussed in the context of the current UK transport and rail policy context.

1. Introduction

The level of bike-rail integration (BRI) or combining cycling with rail in the UK presents an unrealised sustainable mobility potential: two per cent of rail passengers access the rail network by bicycle (DfT 2007a), contrasting with 40% in the Netherlands (NS 2008), where cycle access to the network is an integrated part of rail policy (Parkhurst, Kemp, Dijk, Sherwin, forthcoming).

This situation exists within an overall policy context in the UK of national objectives to reduce CO_2 emissions set out under the Climate Change Act 2008 and embedded in transport policy through the policy strategy document 'Low Carbon Transport: a Greener Future' (DfT 2009a).

An increase in BRI has the potential to reduce CO_2 emissions through substituting either car access journeys to the rail network, or complete car journeys, and depending on the extent to which there is vacant capacity on existing trains it would not result in any significant increase in overall CO_2 emissions from rail (ATOC 2007; Walsh, Jakeman, Moles & O'Reagan 2008; Bouman & Moll 2002). In particular, the trip distance band between 10 and 25 miles in the UK is responsible for over a third of all CO_2 emissions associated with commuting by car (DfT 2008) and represents a length of journey particularly suitable for substitution by a combination of cycling with rail.

BRI can provide a seamless journey to compete with a car in terms of speed and flexibility (Martens 2004) and in the longer term to offer an important extension of the more sustainable modes of walking and cycling which could enable more individuals to live without a car, or reduce their levels of car ownership (Clark, Lyons and Chatterjee 2009), possibly through moving to carfree developments which have been identified as particularly dependent on rail access (Melia, Barton, Parkhurst, 2010).

Cycle access to rail provides an opportunity to build physical activity into daily routines to counter the trend to obesity (Davis, Valsecchi & Fergusson 2007; Frank, Andresen and Schmid 2004). BRI increases the area around a station which can be accessed within a given journey time by between 10 and 15 times over walking (Countryside Agency 2004; Sherwin 2010). Moreover, as Martens (2007) has argued, access trips to the rail network by car and bus are often slow as a result of congestion and therefore the barriers for changing behaviour towards cycle access may be substantially lower than for trips in general.

2. The UK policy context for bike-rail integration

Behaviour change towards more sustainable modes has, until recently, rarely been explicitly mentioned in the context of BRI, and this is a surprise given that for the reasons identified in Section 1 it is a logically necessary element within a notional transport system which is both genuinely integrated and low carbon. As Buchan (2008) argues, it is only by providing a total package of modal options, including walking, cycling, BRI and public transport, that a reduction in car ownership and therefore use in the longer term might be possible.

A number of factors contribute to the low level of BRI in the UK, not least the marginality of cycling itself, with only one per cent of all trips cycled and two per cent of all trips of less than 3km (DfT 2007c). This compares with 37% of trips below 2.5 km in the Netherlands (Pucher & Buehler 2008). In the UK the provision of facilities to promote cycle access at railway stations - with a few

notable exceptions - has been a low priority. Forty-five per cent of the 2,500 UK stations do not even provide cycle parking (Green and Hall 2009).

This situation is exacerbated by the complex structure of a franchised rail industry, which exhibits both horizontal and vertical separation, making the implementation of any policy and investment to promote bike-rail integration (or indeed any transport integration) problematic. Currently each train operating company (TOC) has its own cycling policy and attitude to cycle facilities so that, for example, taking a bicycle on a train journey might involve travelling on trains run by three different operators, all with different rules regarding cycle carriage. The 'permanent way' infrastructure and some of the larger railway stations are the responsibility of Network Rail, whilst the running of the trains and smaller stations is typically the responsibility of a specific TOC. These governance and finance arrangements at the station level can act as a barrier to the provision of more cycle parking as car parking revenues accrue directly or indirectly to the station leaseholder, often a specific TOC, but any increased passenger revenue is divided between the operators using a particular station.

At the strategic level, in 2004, the (then) UK Government Countryside Agency in conjunction with the Department for Transport (DfT) published "Bike and Rail: A good practice guide" (2004). This stated that the DfT "sees an increase in Bike and Rail journeys as being an important element in the new strategy to increase numbers both of short trips by bike and of longer journeys involving Bike and Rail". Cycling policy advice and guidance was subsequently published for UK TOCs by the (then) Strategic Rail Authority (SRA) (2004), providing generic advice on a range of activities which could help to better integrate bike and rail journeys including: information provision, the carriage of bikes on trains, cycle parking, improved cycle access to stations, cycle hire and cycle centres. However, this initiative was formulated outside other aspects of rail policy: there were no binding TOC franchise clauses, few specific resources were identified (although £0.5 million was provided by the DfT for cycle parking facilities at around 200 stations), and there were no targets, no requirements for progress monitoring and no effective means of achieving a coherent approach across the rail sector.

Moreover, many measures that would facilitate cycle access to the railway go beyond the station forecourt, requiring the cooperation of other institutions, for example, a local authority with the power to create safe cycle routes to the station. This was recognised in the national government's white paper 'Building a Sustainable Railway' (DfT 2007b), which resulted in the creation of a 'Cycle Rail Taskforce' to facilitate the establishment of 24 Station Travel Plans (STPs) to provide an administrative mechanism for cross-organisational working to promote rail use and more sustainable access to the network including by bicycle (Association of Train Operating Companies 2009). Targets have also been considered: one independent review for government proposed a doubling of cycle access at particular stations over five years, with an overall national target of 5 per cent of passengers cycling to stations facilitated by the creation of 5,000 new cycle parking spaces each year (Green & Hall 2009). A

commitment to invest £14m in a package of measures to include 10,000 extra cycle parking facilities across the network was made in 2009 (DfT 2009b).

Though this does represent an increased commitment towards cycle access, the strong rail passenger growth of 40% over the last ten years (DfT 2007b) has prompted demands for increased car parking at railway stations though it is expensive and land extensive relative to the provision of cycle parking. Some argue that there is still an over emphasis on providing facilities for the 10% of rail passengers who currently access and park at a railway station, as seen in Table 1 below (Lingwood 2009, DfT 2007a).

Table 1 Mode of Access to the UK rail network

Mode of Access %	**Total %**
Walked	54
Bus/coach	10
Car (parked at or near the station)	10
Car (dropped off by someone)	7
Motorcycle	0
Bicycle	2
Taxi/minicab	3
Underground/Light Rail/Metros/Trams	14
Other	0

Source: ATOC personal communication using DfT National Rail Travel Survey data (DfT 2007a)

One of the barriers to further investment in the promotion of BRI in the UK has been the lack of research of existing bike-rail integrator behaviour and use of facilities. As has been explained, BRI has a low priority both at government and rail industry level and this paper reports on the findings within a three-year study of BRI (Sherwin, 2010) which illustrate the potential for the promotion of BRI as well as some of the factors that will need to be considered in the design of effective interventions. The next section outlines the methodologies used and the following three results sections illustrate the characteristics of existing bike-rail integrators, their motivations, their behaviour and its relationship to the facilities currently available.

3. Methodology for identifying existing bike-rail integration behaviour and the propensity of rail users to consider cycle access

A mixed-methods approach was applied to research at the two railway stations in Bristol (Bristol Temple Meads (BTM) and Bristol Parkway (BP), one of the ten largest urban areas in the UK. As cyclists are relatively rare at most UK stations, the research had to take place at locations where overall passenger flows would enable a sufficient sample of those accessing by bicycle to be identified. BTM and BP have the highest flows in South West England with over seven million and nearly two million annual journeys respectively (Office of the Rail Regulator, 2009). The stations each have substantial dedicated car parks and are served by a range of local bus services. BTM is on the fringe of the core Bristol central business district, but in walking range of a large number of potential destinations. BP is located in a context of modern medium-density residential development and low-density office and retail development, with many origins and destinations being beyond an attractive walk range for many travellers.

3.1 Survey of bike-rail integrators

During a three-week period in October 2007 135 or one-quarter[1] of the daily BRI population of bike-rail integrators were surveyed. Individuals with bicycles were opportunistically approached at various locations within the two stations (including in the vicinity of the cycle parking, in the concourse, at the entrance or exit, and on the platform). Surveys were conducted on various days, including weekends, and at different times of day.

As potential respondents were identified by them being in possession of a bicycle, the sample did not include those who had arrived at the stations by train, having parked a cycle at their origin station elsewhere or those who had parked a cycle nearby to BTM or BP but not in the designated parking facilities. The survey included closed-option questions to be analysed quantitatively and open-ended questions with prompts to be analysed qualitatively. Not all participants completed the open-ended question part in full, due to time constraints.

3.2 Internet survey to sample beyond Bristol stations

In collaboration with First Great Western Trains (FGW) an internet survey was placed on FGW's booking website targeting anyone planning or booking a rail journey to establish their attitudes towards, and levels of experience in experimenting with, alternative methods of access to the rail network. A specific motivation for the survey was to include those who do not currently use cycle access to the railway and to establish their propensity to trial this method. This yielded a sample of 975 returned questionnaires.

3.3 Monitoring of cycle parking acts

Cycle parking at BTM consisted of Sheffield-type stands located 'railside' under cover on Platform 3 with a capacity of 300 bicycles, monitored by CCTV and only accessible through the ticket barrier[2]. At BP there was a covered stand for 48 bicycles outside the station building. In order to ascertain the length of stay of the bicycles in the racks, laminated labels with unique numbers were attached to all the bicycles parked at BTM on a Wednesday in July 2007 at 06.45, and at BP at 07.30. The bicycles were counted at approximately four-hourly intervals over two weekdays and at three-hourly intervals on a Saturday and Sunday and any untagged new arrivals were tagged. A grid system was used mirroring the layout of the parking so that the location of the numbered bicycles could be checked to avoid double counting a bicycle that had been removed and subsequently returned at a later time with the tag still intact (i.e. as if it had not moved).

The tag and count system was laborious but was more applicable to high capacity cycle racks than alternative methodologies by earlier researchers. For example, the methodology used to monitor the UK government's programme of 'Cycling Demonstration Towns' was based on systems used to monitor car parking (Parkin 2007 personal communication). Under these procedures a cycle parking area was divided into 'beats' that were revisited at regular intervals to monitor movements. This is appropriate for cars, which have unique registration plates, but is not ideal for bicycles where accurate individual identification requires multiple characteristics such as wheel size, handlebar style, frame style and colour to be recorded and verified. Using CCTV footage was also considered, but in practice framing all the bikes that needed to be monitored in the video footage with sufficient clarity and resolution would not have been possible, and reviewing the footage would have been nearly as time intensive as undertaking direct observations. The tagging approach was chosen for its combination of rigour and practicability.

3.4 Monitoring of flow of bike-rail integrators

The layout of BTM and the greater flow of passengers with bicycles made it feasible to distinguish station parkers from those taking cycles on trains. Counts were undertaken at 15-minute intervals of those bringing fixed frame or folding bicycles in and out of the ticket control barriers at BTM between 07.00 and 10.00 and 16.00.and 19.00 on a Wednesday in October 2008. Four enumerators conducted the counts at the ticket barrier combined with a basic count (without duration tagging on this occasion) at the racks. These data analysed in combination with the parking counts enabled an approximation of the importance of the different methods of BRI to be established.

4. Characteristics and motivations of bike-rail integrators as a way of identifying future bike-rail integrators

The results in this section are placed in the context of applying the information to the design of interventions to attract new bike-rail integrators. The face-to-

face survey showed that existing bike-rail integrators are mainly from a relatively clearly defined demographic group; males in their thirties. More specifically, 71% were male, which is a similar proportion to that within the cyclist population generally in the UK ($\chi^2 = 0.3$, df = 1, $p < 0.05$). However, the predominance of bike-rail integrators in their thirties is significantly different to the age breakdown amongst cyclists generally ($\chi^2 = 32.11$, df = 5, $p < 0.05$). The relatively few integrators identified over the age of 60 is likely to be a reflection of the fact that the vast majority of those undertaking BRI were employed; 72% full-time, 8% part-time and 9% in self-employment. Hence, in order to attract more integrators similar to existing integrators policy might target workplaces or rail season ticket databases. However, the findings also suggest that there may be particular barriers to other groups becoming integrators, which might be surmountable but need further investigation.

As was explained in the introduction, those who access the rail network by bicycle are a small group and are considered within the rail industry as a low priority (Lingwood 2009) and perceived to have less revenue generating potential. However, the survey showed that their levels of income were similar to those of rail travellers generally ($\chi^2 = 4.89$ df = 6, $p < 0.05$). Given the relatively modest cost of providing cycling facilities, this suggests integrators should perhaps be a priority group from the perspective of rail industry economic interests.

An open question was asked in the face-to-face survey of bike-rail integrators to understand the perceptions of the advantages and disadvantages of combining cycling with rail to identify possible promotional messages. Chart 1 below summarises a thematic analysis of the incidence of factors identified. Negative or ‘push factors’ were noted by some: high parking charges and traffic congestion; others articulated positive and affective reasons for bike-rail integration. Some enjoyed cycling or travelling by train and others disliked driving. The main motivations were saving time or money and taking exercise. The qualitative data collected highlighted a range of personal cycling ‘biographies’ and showed that the decision to bike-rail integrate was strongly influenced by the individual’s social and cultural context.

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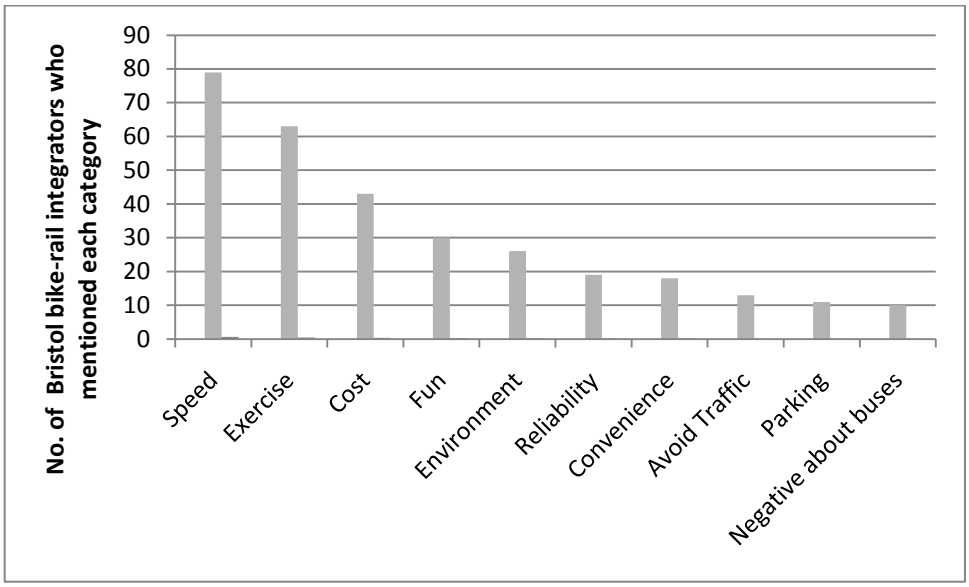
Chart 1 What bike-rail integrators considered were the advantages of their behaviour



Hence, the motivations were found to be diverse, illustrating a complex web of interactions amongst a number of influencing factors and in this case the congestion in the environs of both stations and the high occupancy of the (substantial) car parking facilities were deterrents to driving. The responses are likely to be station-context dependent and interventions will therefore need to be tailored to that particular context, but the results strongly suggest that the benefits of speed and exercise should be an important element in any promotional exercise.

For 44% of the bike-rail integrators surveyed, a car was available for their use to access the railway station. A supplementary question was asked; 'Why didn't you use your car to get to the station?' Some gave positive reasons as to why they had cycled, others negative reasons, for example, that they did not want to pay for car parking, and in some cases both positive and negative responses. The push factors were a dislike of traffic, the hassle, the cost and lack of availability of parking. Several answered "*it wouldn't make sense to drive to the station"* or *"I wouldn't consider it"*. Fewer, 17% said that they would consider using the car for the whole journey but had chosen to bike-rail integrate because they had a preference for train travel. The box below highlights some of the responses given for not using the car for the whole journey.

"I can work on the train, driving is exhausting"

"M5 commute is unpleasant"

"*M4 and fatigue*".

"don't like driving and there is a viable alternative"

"*so much more pleasurable, a proper outing, exploring"*

"time to read and relax"

"*a train season [ticket] is £608 and parking would be £1400 in Bristol".*

"used to drive, started to bike-rail two years ago for fitness, pleasantly surprised"

"I would need a second car, hate traffic jams, the cost and bad for the environment"

On average the Bristol bike-rail integrators had cycled a distance of 3.7km to the station, a distance which few would consider walking. Table 2 below illustrates the potential increase in catchment area over walking if the promotion of cycle access was more vigorously promoted[3]. The size of the expansion in catchment area of any station would depend on cycling speeds and for the purposes of this research a 15kmh speed has been used, resulting in a tenfold increase in catchment area over walking.

Table 2 Station Catchment area for walking and cycling

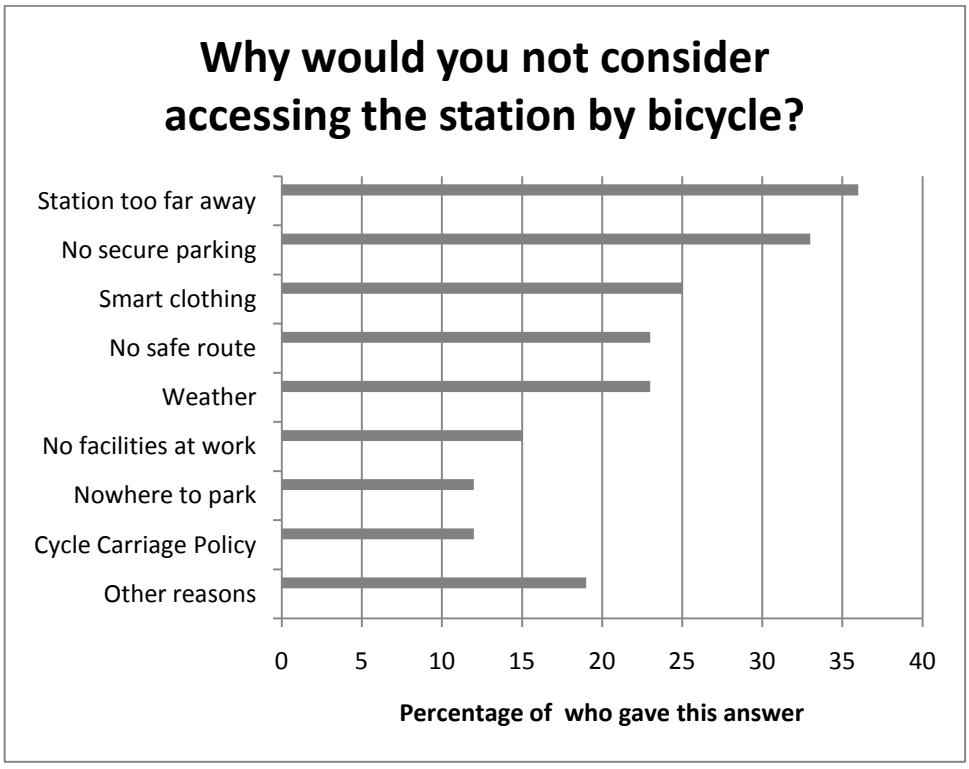
	Average speed	**Distance Covered in 10 minutes**	**Catchment area**
Walking	5 km per hour	0.8 km	2 kms^2
Cycling	15 km per hour	2.5 km	20 kms^2

Interventions to promote BRI could initially target two groups; existing rail users who do not currently access by bicycle and those that live within a particular cycling distance band of a railway station, a distance that is perhaps perceived to be too far to walk but not far enough to warrant using a car or public transport e.g. between 0.8 and 2.5 km.

The internet survey showed that, of those planning or booking a rail journey anywhere on the UK rail network (N=975), 61% owned a bicycle. These individuals were asked if they would ever consider accessing the station by bicycle and over half replied in the affirmative. Hypothetical questions need to be treated with caution but it does suggest that a reasonable proportion are at least willing to entertain the idea of using their bicycles and this in turn suggests there may not be a distance barrier.

A further question was asked of those respondents who owned a bicycle but had said they would not consider using it (N=209), Why would you not consider accessing the station by bicycle?" and the percentage of individuals who gave a particular answer is shown in Chart 2 below. Distance was mentioned most but only slightly less often mentioned was "not safe to leave a bicycle at the station", which was the actual description in the questionnaire (labelled as "no secure parking" for ease of representation in the Chart 2 below).

Chart 2 Reasons for not considering accessing by bicycle (N=209)

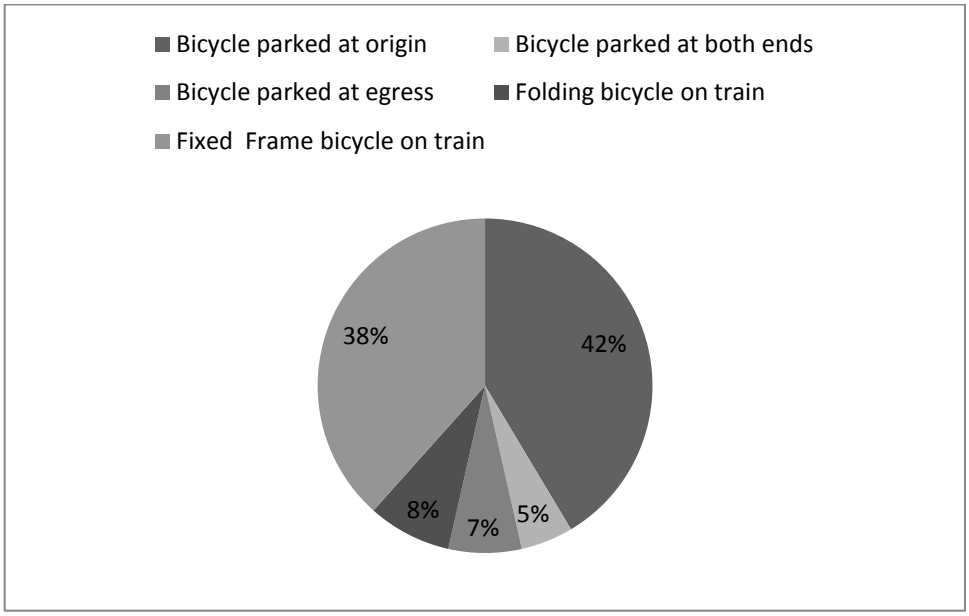


As the introduction pointed out there are many railway stations in the UK that do not have any cycle parking. An obvious first step to promote bike-rail integration would be to address this barrier and provide secure cycle parking but as the next two sections illustrate it is not that straightforward to establish the potential demand or whether the provision of parking is the best solution for all those individuals who might wish to bike-rail integrate.

5. The choice of method of bike-rail integration

There are several different potential methods of BRI and five different had been deployed by the survey participants in Bristol as shown in Chart 3.

Chart 3 Method of bike-rail integration



What became clear through the face-to-face survey was that individuals were using more than one method depending on the journey purpose and frequency and considerable experimentation had taken place to find the most satisfactory method. The decision was influenced by a number of factors:-

- the security of bike parking, with security at both ends being important for individuals to feel comfortable with storing a bicycle at both ends.
- the ease or difficulty of taking a bicycle on the train which depended on the route, the carrier, the time of day and the flexibility of the staff.
- the distance at either end of the rail journey.
- The journey frequency - it would not be worth investing in a second bike parked at the destination station if the journey is infrequent.
- Safe or perceived to be safe routes to stations.

Individuals were found to be altering departure time to increase the probability of finding an available bike space on the train; using different rail routes or choosing a specific TOC where a route was served by more than one, according to the varying capacity on different types of rolling stock and regulations on bicycle carriage; buying a folding bike or a second bicycle for the destination station.

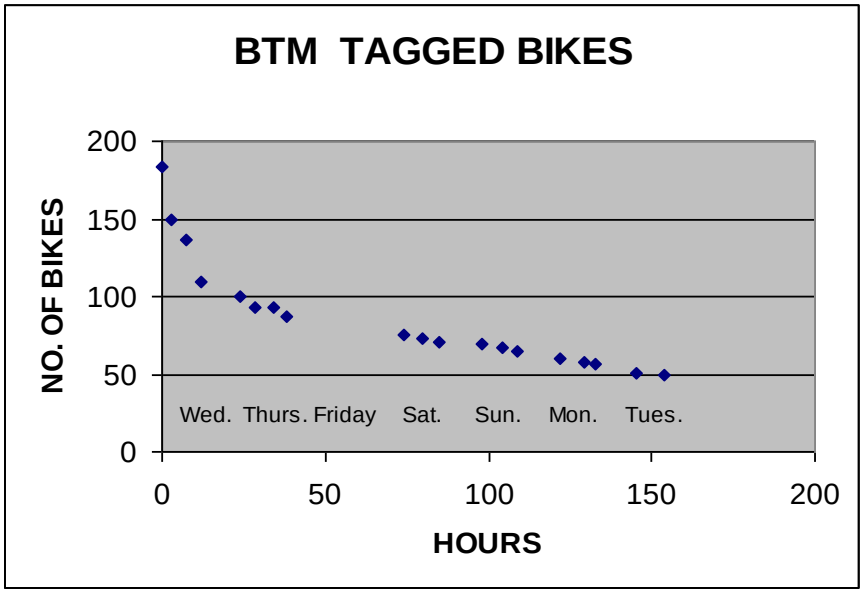
The security of parked cycles at stations was frequently introduced by participants unprompted and in the context of questions on other topics. Nineteen per cent of the quantitative sample had had a bicycle stolen from or

vandalised at a railway station. This actual experience of theft as well as the perception of poor security was influencing decision making: in some cases a bicycle was being taken onto a train rather than parked at a station simply to avoid it being left unattended. The internet survey result suggested that as many as one in ten of those taking bicycles on trains are doing so for fear of leaving their bicycles at a station.

6. Journey frequency and use of facilities

As mentioned above, journey frequency was a consideration in the choice of bike-rail integration method so, for example, for an infrequent journey an individual might not invest in two bicycles for either end of the journey or a folding bicycle. The survey at Bristol found that 38% of the sample were commuting every weekday but a similar percentage, 37%, were either making a first-time journey or another pattern of infrequent journeys. This is a similar frequency pattern to rail travellers generally ($\chi^2 = 4.94$, df = 5, $p < 0.05$). This was supported by the detailed cycle parking counts which showed that not all the parked bicycles were used every day. Chart 4 below shows how long it took the 184 bicycles found already parked at 06.45 on a July morning in 2007 to be removed from the racks.

Chart 4 Decay of bicycle parking acts at Bristol Temple Meads



After two peak rail travel weekdays, a Wednesday and a Thursday, 87 out of the original 184 bikes had not moved and 49 had not moved after a week and 29 did not move for a further six weeks and were removed by FGW as abandoned. The other 20 bicycles that did not move in a week but were 'in use' suggested that either their owners were on holiday, or they were working elsewhere or they used their bicycles very infrequently. This exercise was repeated at Bristol Parkway with similar results. Overall 10% of the bicycles at

both stations could be considered abandoned; illustrating that better management could release capacity, although also confirming that a 90% of bikes were in active use, even if not frequently in some cases.

The final parking beats of the survey days at BTM recorded on average 214 bicycles still parked suggesting that two thirds of the cycle parking spaces were occupied overnight. The simultaneous parking and barrier counts at BTM tracked the movements of bike-rail integrators in and out of the barriers showing that there were two groups using the cycle parking facilities: those who lived outside Bristol and parked overnight, and those that lived in Bristol and parking during the day, who represented the larger group. It was also interesting to note that only 10% of those presumably living in Bristol coming through the barriers into the station in the morning had folding bicycles whereas the proportion was higher at 25% of those exiting the station in the mornings. This could be partly explained by the fact that those living outside Bristol who had parked their bicycle at their origin station could not be identified through the sampling method used.

These proportions will vary according to the facilities and context in which bike-rail integrators are operating. In areas of the network with bicycle carriage constraints a greater proportion may invest in a folding bicycle. Not all stations will be catering for two groups (daytrippers and overnight parkers); it is unlikely at a suburban London commuter station that there will be much demand for overnight cycle parking. In the case of Bristol, the level of detail of 15 minute interval counts illustrated that the times of travel of the two groups did not coincide and between 07.30 and 08.30 there was a mismatch between supply and demand, with some of those arriving on a bicycle at BTM from Bristol not being able to find a space because those living outside Bristol arrived at the station later to remove their bicycles from the racks for the onward journey within Bristol to create space. This was exacerbated by the infrequent journey patterns. So, for example, on the day of the simultaneous count, of the 200 bicycles parked overnight, less than 50 were removed in the morning by those living outside Bristol, leaving a capacity of 150 spaces for those living in Bristol.

Within the racks at BTM there were some bicycles that moved once a week, others that moved every day and at different times. Underlying these quantitative data are complex behaviour patterns revealed through the qualitative data; e.g. a female integrater who lived in Cumbria and worked in Bristol 4 days a week; train driver working shifts parking at many different times of day; female who parks her bicycle at BTM for work during the week but takes it on the train at the end of the week for use at home at weekends.

Conclusion

The study reported in this paper suggests that existing bike-rail integrators have invested considerable time in developing effective, beneficial mobility practices. The development of bike-rail integration in the specific case-study of Bristol appears to be limited by supply constraints set by the current level of

facilities. The level of suppressed demand has not been measured nor the extent to which other individuals have tried bicycle access, or for that matter rail travel itself, and whose experience has led them to discard it as an option. The relatively restricted demographic group observed exhibits a level of commitment and determination to combine cycling with rail in spite of, not because of, the quality and quantity of facilities and institutional support which have been provided.

However, as outlined in the introduction, there is potential to increase the level of bike-rail integration but in order to do so policy and practice will need to consider different kinds of traveller and demographic groups and focus on a significant reduction in the different practical barriers which variously affect different kinds of user. At Bristol it was shown that 10% of new parking capacity would be created just by better management of the existing facilities and the results of the internet survey suggest that bicycle carriage capacity would also be released with the provision of more secure bicycle parking.

The provision of increased secure cycle parking is an obvious first step in the promotion of bike-rail integration but it is not as straightforward as it might first appear. An important pre-requisite for any intervention has been shown to be an understanding of the likely pattern of demand at any given station. In the case of BTM, providing an increased supply of cycle parking may release suppressed demand, but in both the current user groups which may not solve the parking demand conflict issues. It also raises the question as to whether it is an efficient use of station space to encourage individuals to keep a bicycle in a station rack for seven days only to be used once a week. A better solution might be to provide bicycles for hire for infrequent users (Sherwin 2010). In addition, the availability of hire bikes would enable easier trialling and experimentation of bike-rail integration as well as providing a service for tourists and visitors to access Bristol by train and make their journeys within Bristol on a bicycle.

Apart from the facilities there are clear promotional messages suggested by the data; the speed and exercise benefits as well as the ability to work or relax on the train. There are relatively easy to reach target groups within existing rail travellers: rail users who own bicycles but do not access the station by bicycles and season ticket or car parking permit (regular commuters) holders who live within cycling distance of a railway station.

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NOTES

[1] Based on the national ticket sales database and the TOC's automatic barrier counts

[2] A minority of bicycles were also parked formally or informally outside BTM and in a neighbouring development but these were not included in the study

[3] If a constant housing density is assumed and does not consider the effort and time costs of cycling which in practice will of course increasingly deter integration via the railway station at the centre of the area then the potential number of bike-rail integrators will increase according to circle theorem: each unit distance of radius will include a proportionately greater surface area and cyclist population.