

Barriers to Passenger Rail Use: A Review of the Evidence

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ABSTRACT *Research has shown that even when rail travel is the most cost-effective mode of transport for a particular journey, many travellers will still choose other modes. This indicates the existence of non-financial barriers to rail use, and this paper reviews the evidence on the importance of such barriers, focusing particularly on the UK but also considering research from other countries. A total of 37 distinct barriers were identified, and these can be divided into “hard”, “soft” and “complementary” factors. Travellers are unlikely to consider these barriers individually, viewing them instead as a package, which can make it difficult to identify which barriers are most significant. In many cases, all barriers which exist for a particular traveller will need to be addressed before mode shift occurs. After considering the relative importance of the different barriers, the paper concludes by making some suggestions as to the most effective ways in which these barriers can be overcome and mode shift to rail achieved. This has key implications for transport policy, as it can inform the targeting of the limited funds available to influence travel behaviour and increase the sustainability of travel patterns.*

Keywords: rail travel; mode shift; perceptions; policy packages; car dependence

1. Introduction and Scope

The aim of this research was to review the evidence relating to barriers to mode shift to rail by passengers from other modes, to assist the UK rail industry in prioritizing efforts to tackle these barriers. The review considered over 100 studies relating to barriers to mode shift, including a large quantity of “grey” literature where much of the evidence on this topic is described. While the research focused particularly on evidence from and relevance to the UK, papers from elsewhere also contributed important evidence, and the majority of the barriers identified are common to most rail systems in the developed world. Barriers to mode shift can be defined as factors which mean that the temporal, financial, physical, mental (cognitive) and/or emotional (affective) effort required to use rail for a particular journey are greater than the effort required to use an alternative mode (Accent, 2009a) or undertake an alternative activity which achieves equivalent

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results. For travel behaviour to change, an individual will need both the motivation to change (wish) and the means to facilitate such change (ability) by overcoming the barriers that exist (DfT, 2002). They will also need to perceive some change in conditions, with the new behaviour seeming more advantageous (improving their cost–benefit balance), more “me” (better fitting their perceptions of and/or aspirations for themselves), more prevalent, or easier to accomplish, or conversely their current behaviour performing less well with regard to these criteria (DfT, 2011a).

The term “barriers to rail use” describes two related issues. The first describes journeys where rail offers a superior option to other modes by “traditional” measures such as travel time or cost, but where people do not choose rail because of the intervention of other factors which reduce rail’s perceived utility relative to alternative modes. For example, while car travel was shown on average to be 7–22% more expensive than unrestricted rail travel for business trips in 2010 (Blainey & Preston, 2010), only 8% of business trips were made by rail in the same year, compared to 69% by car (DfT, 2011b). The second issue describes journeys where rail is slower or more expensive than alternative modes, but where there are advantages to wider society in people using rail. To achieve mode shift in such cases, either rail fare and/or journey time reductions or punitive measures to reduce the attractiveness of other modes would be required. Because such measures tend to be highly unpopular, and because it is simply not possible to provide an adequate rail service for all potential users (Bonsall, 2005), this review concentrates on the first issue. Furthermore, as the potential for mode shift from bus or coach to rail appears relatively small and relevant literature is limited, this study concentrates on barriers to mode shift from car and air, rail’s main UK competitors. A number of the barriers to rail use are not unique to rail, but may also act as barriers to public transport use in general. However, rail has clear distinguishing features as a transport mode, particularly as far as public perceptions are concerned (Passenger Focus, 2011), which mean that it is both valid and useful to consider it in isolation.

There are three types of barrier to mode shift, although these are not entirely discrete. Hard barriers comprise factors which are included in conventional transport demand models and are relatively straightforward to measure or estimate (DHC, 2003). They affect all travellers in a particular flow, although they may be of varying importance to different individuals, and their impact may be measured by quantitative measures such as elasticities (ATOC, 2009; Balcombe et al., 2004). In contrast, soft barriers are specific and/or of varying importance to particular travellers, trips and places. Complementary (or lifestyle) barriers do not relate directly to mode quality, but instead to the impact on travel choices of people’s activity and lifestyle choices, and of wider cultural and economic factors. The impacts of softer and complementary barriers are harder to quantify, but can be measured by the resultant demand uplifts and changes in mode share (Moser & Bamberg, 2008).

Within these categories, 37 distinct barriers to mode shift were identified, and the following section of this paper considers each of these barriers individually. It concentrates on first-order barriers which directly influence mode choice, although some second-order barriers (those which influence first-order barriers, for example, contractual incentives which encourage train operators to cut costs and therefore reduce service quality) are also considered. Wherever possible,

the paper focuses on evidence relating to non-rail users, but in some cases no such evidence exists.

2. Hard Barriers

2.1 *Travel Time*

Relative travel times play a major role in mode choice decisions, and the existence of stable “travel time budgets” (Metz, 2008) can emphasize the importance of journey times, with travellers aiming to maximize the utility gained from a set amount of travel time. Numerous studies have shown that average door-to-door journey times by public transport are longer than those by car (Accent, 2009b; Eriksson, Friman, & Gärling, 2008; Hine & Scott, 2000), and this can form a significant barrier to mode shift. Journey time is also the most significant determinant of choice between air and rail on intercity journeys (Gonzalez-Savignat, 2004; Roman, Espino, & Martin, 2007). Reducing journey times, for example, by constructing new high-speed rail lines, can therefore increase rail’s relative attractiveness. This increase may, though, not be as great as is sometimes suggested (Preston, 2009), as the importance of the station access/egress component of rail journey times may be understated. This issue is considered further in Section 2.7.

2.2 *Reliability*

In this context, reliability describes how closely actual journey times relate to expected journey times. A distinction is sometimes made between punctuality (whether or not a service arrives on time) and reliability (whether or not a service runs at all), but the two terms are not mutually exclusive (Bates, Polak, Jones, & Cook, 2001), as if a train is delayed so that it runs later than a following service then as far as passengers are concerned it has effectively been cancelled. Journey time unreliability primarily impacts on people’s use of time, as a result of actual and potential late arrival, rescheduling costs and spending longer in certain activities than is desired or anticipated (Bates, 2001). Car travel tends to be associated with “control” over arrival times (Bates et al., 2001), whereas rail is often viewed as being unpredictable or unreliable, although such perceptions are not universal (Accent, 2009b).

Improving rail journey time reliability can be difficult, and there can be a conflict between reliability and journey time as the incorporation of increased recovery time in schedules to improve reliability will inevitably lengthen advertised journey times. It also takes time for travellers to become aware of improved reliability and alter their travel behaviour, with non-rail users least likely to notice the change. The likelihood of diminishing returns with successive increases in reliability means that tackling the perception gap associated with reliability may give greater rewards (see Section 3.1).

2.3 *Service Frequency and Timetabling*

If train frequencies are low (Eriksson et al., 2008) or if timetabled departure and arrival times do not correspond with the needs of travellers, then this can discourage rail use. Poor service frequencies increase wait times, which are a major disadvantage of using public transport, and incur a much greater disbenefit per

minute than travel time, particularly for shorter trips where wait time forms a greater proportion of total travel time (Nijkamp & Rienstra, 1996). The importance of frequency and reliability are linked, as with high train frequencies the average inconvenience due to scheduling is low, but only while the service remains reliable, whereas lower frequencies create an unavoidable base level of inconvenience, making the impact of the same level of unreliability less significant (Bates, 2001). Limits to the operating hours of rail services can also form a barrier to rail use, as, for example, respondents to UK studies in Glasgow (DHC, 2003), the West Midlands (Passenger Focus, 2006a) and South London (Passenger Focus, 2008) reported that rail services stopped operating too early in the evenings. Increasing train frequencies is expensive and would have to attract a significant amount of additional patronage to be cost-effective. An alternative might be to carry out market research to establish the times when users (and just as importantly non-users) wanted trains to be provided, and adjust timetabling accordingly without altering total frequencies.

2.4 *Interchange*

The need to, and facilities for, interchange between rail services for some trips can be a barrier to rail use. Interchange incurs a variable disbenefit related to the amount of wait and transfer time required and a fixed disbenefit related to the inconvenience and risks involved (Wardman & Hine, 2000). The fixed disbenefit is made up of several components, including the (lack of) information provision during interchange (Hine & Scott, 2000), the (poor) quality of the interchange environment and waiting facilities (Wardman & Hine, 2000), the amount of walking required (particularly for mobility-impaired passengers) (Hine & Scott, 2000) and worries about personal safety (Wardman, Hine, & Stradling, 2001). Some travellers may start their journeys early to reduce the risk of missing a connection (Accent, 2009a), thereby incurring an increased journey time penalty. Interchange penalties vary by traveller type, with car users tending to have higher values than non-car users (Wardman & Hine, 2000), and some car users may also view the need to change from the access/egress mode to the train at the railway station as an interchange (Wardman et al., 2001). Improving the interchange environment might help matters, although there is no evidence to show whether this would have a significant effect on mode shift.

2.5 *Network Limitations*

Network limitations may pose a major barrier to mode shift where there is no railway at all or where railways do not connect the right origin – destination pairs. However, while the physical distance to the station can only be changed by opening new stations or routes, there are ways in which the psychological distance to and from stations can be reduced (Accent, 2009a), and this is discussed in Section 3.1.

2.6 *Cost*

While the cost of rail travel is often cited as one of the largest barriers to mode shift (for example Accent, 2009a), recent work indicates that in the UK it is frequently cheaper than car travel (Blainey & Preston, 2010). This barrier may therefore partly result from misperceptions (see Section 3.1), perhaps related to the fact that the

current fare structure is viewed as being complex and confusing (Passenger Focus, 2006a). Unlike for car travel where any expenditure tends to be viewed as a necessity (UOTSU, 1995), expenditure on rail travel for many trips is seen as a luxury. Cost can also be an important determinant of mode choice between air and rail (Starkie, 2002), with low-cost airlines having a particular impact, as described by Antes, Friebel, Niffka, and Rompf (2004) in Germany.

Rye and McGuigan (2001) found that the provision of discounted season tickets to commuters as part of a workplace travel plan encouraged mode shift from car to rail. However, a Belgian study found that only 9% of surveyed car drivers would definitely switch to rail if services were entirely free (De Witte, Macharis, & Mairesse, 2008), illustrating the limitations of fare reductions in achieving modal shift (see also Thøgersen, 2009). Cost's future importance is linked to the general economic situation, as if economic growth stagnates then travel cost will become relatively more important in mode choice decisions, whereas if individual wealth increases then quality is likely to become relatively more important.

2.7 Station Access and Egress

Rail transport's attractiveness is highly dependent on the level of connectivity with access and egress modes (Nijkamp & Rienstra, 1996), with almost half of UK rail passengers using a mechanized mode for station access (Figure 1). While rail is often faster than the car for centre-to-centre journeys, this advantage is lost when travellers' origins and destinations are some distance from stations (Passenger Focus, 2008; Van Wee, 2002), particularly for infrequent rail users who tend to allow too much time for station access (Accent, 2009b). Station egress can be even more problematic, because travellers tend to be less familiar with their destinations than their origin and because private egress modes (e.g. car and bicycle) are not usually available (Givoni & Rietveld, 2007). Interchange between the access/egress mode and rail can also pose a barrier, and for both private and public access modes a lack of intermodal integration may exacerbate the barrier posed by station access and egress.

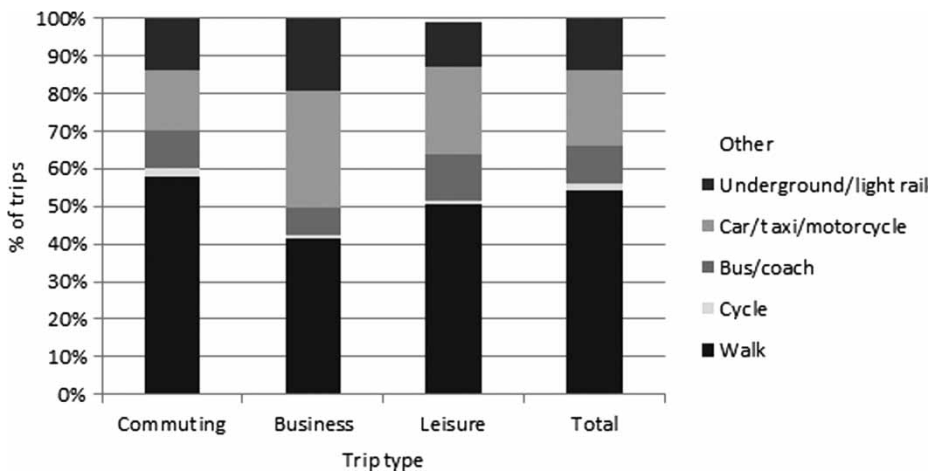


Figure 1. Main station access modes for UK rail passengers (from National Rail Travel Survey, DfT, 2010).

The main barrier for those accessing stations by car is a lack of safe, well-lit parking spaces at stations. Many UK station car parks operate close to capacity, and this overcrowding may worsen in the future, leading to an increase in “kiss and ride” access, people driving to more distant stations with larger car parks and people driving for complete journeys (Steer Davies Gleave, 2007). If a station car park becomes full during the morning peak, this then forms a barrier to off-peak travel, and may lead people to travel earlier to be sure of getting a parking space, worsening on-train peak overcrowding (Steer Davies Gleave, 2007). Poor security at station car parks may also deter rail use (Cozens, Neale, Whitaker, & Hillier, 2003), as may parking costs, particularly for off-peak travellers. More flexibility in charging could be an easy way to increase rail use (Accent, 2009b), as, for example, free weekend parking might generate more revenue in ticket sales than is currently raised in parking charges (Steer Davies Gleave, 2007).

While accessing the station by public transport (usually bus in the UK, but frequently tram and trolleybus elsewhere) removes the need to find parking, this brings its own problems. Intermodal integration may be undermined by disintegrated implementation, insufficient funds (Hull, 2008), irregular service frequencies (Brons, Givoni, & Rietveld, 2009), inadequate or inaccurate timetables and poorly planned connections (Campaign For Better Transport, 2007), problems which are often exaggerated by negative perceptions of integration (Accent, 2009b). Improved intermodal connections and the production of integrated publicity material and timetables (Lyons & Harman, 2002) may help, but the poor performance of some dedicated connecting bus services (for example between Llanhilleth and Abertillery in South Wales) indicates that other factors are involved in determining whether or not people will access stations by bus.

Many passengers walk to railway stations, but while the greatest barrier to such access is usually distance (Hine & Scott, 2000), its attractiveness is also dependent on soft and complementary factors such as the weather, the need to carry goods (DHC, 2003), poor signage and safety concerns (Campaign For Better Transport, 2007). Similar factors can deter cycle access, along with the perceived insecurity of cycle storage facilities and inconsistent cycle carriage policies. However, while many people aspire to walk or cycle to the station (Accent, 2009b) such aspirations are far from universal, as many people have a serious antipathy to walking and particularly cycling on their journey to work (Joshi & Senior, 1998).

2.8 *Ticketing Complexity and Inter-Availability*

Despite recent attempts to simplify the UK ticketing structure, confusion over differences in ticket validity and peak-hour restrictions can still render ticket machines effectively unusable for occasional travellers, and in such cases a more widespread provision of ticket offices might encourage rail use (Passenger Focus, 2006b). Several studies have indicated that greater provision of intermodal zonal ticketing and of carnets for frequent but irregular travellers would generate modal shift to public transport (DHC, 2003; Halcrow, 2002; Shannon et al., 2006).

2.9 *Structural Car Dependence*

The term “car dependence” is for many people a misnomer, as they perceive cars as providing independence along with other advantages including minimal

journey planning requirements, financial savings, privacy from “unpleasant” public transport users, an enjoyable feeling of control and pleasure taken from driving (Anable, 2005). Car dependence has two forms: structural dependence and conscious dependence (Gray, Farrington, Shaw, Martin, & Robert, 2001), with the latter forming a soft barrier (see Section 3.2). In contrast, structural dependence describes situations where people have no viable alternative to car use because the alternatives are very inferior or pressures of time and opportunity are large (UOTSU, 1995). Structural car dependence is particularly prevalent in rural areas, where car ownership can be an essential pre-requisite of an acceptable standard of living (Gray et al., 2001), and where public transport seldom offers a viable alternative. However, UOTSU (1995) suggested that only 15% of UK car trips have no realistic alternative mode, indicating that there is significant latent potential for mode shift (albeit not necessarily to rail).

2.10 *Land-Use patterns*

For several decades, planners in many countries have tended to favour dispersed land-use patterns which emphasize the advantages of car use over rail use. Dispersed development almost inevitably includes abundant car parking, which increases the convenience of car use (Knoflacher, 2003) while forming a significant barrier to rail use (Hull, 2008; Rienstra, Vlieghe, & Nijkamp, 1996). A change in planning policy to more centralized or clustered residential and commercial could encourage rail use by, for example, focusing new construction on transit-oriented developments (Curtis, Renne, & Bertolini, 2009), perhaps coupled with extensions to rail networks. However, finding a strong relationship between urban forms and travel patterns is not the same as showing that a change in urban design will lead to a change in travel behaviour (Handy, 1996), as the impact of personal characteristics on location choice may also play a role (Naess, 2005) (see Section 4.8).

2.11 *Government Policy*

While government policy may seem to have little direct impact on individual travellers’ mode choice, to obtain large-scale mode shift government backing is probably essential. It is therefore unfortunate that many public administrations are to some extent locked into catering for public expectations of car penetration and speed of access (Hull, 2008). For example, in the UK the Transport Act 2000 included explicit backing for mode shift, and Bonsall (2000) identified four themes that were fundamental to this policy: a consensus that modal shift is necessary; a clear commitment to the principle of integration; cooperation between public and private sectors; and a strategy of persuasion through consciousness-raising, public transport enhancement and increased penalties for car use. However, some measures which might have increased rail patronage, such as early investment in capacity enhancements or fare reductions, remained absent (Shaw, Walton, & Farrington, 2003). While the UK government and major opposition parties are in theory still committed to mode shift to rail, this rhetoric does not always translate into action, particularly where fiscal measures to limit car use are concerned. This may partly result from aggressive lobbying by the automotive and airline industries, and also from inherent “short-termism” in the political system due to the need to fight elections (Currie & Rose, 2008). There

can also be direct or indirect government subsidy of road and air transport (such as the Welsh Assembly-supported air service from Cardiff to Anglesey) which artificially reduce rail's competitiveness. In general, attempts by government to influence mode choice in the UK have focused on measures involving a high degree of intervention (the higher rungs on the "ladder of intervention" (DfT, 2011c)) such as regulation to restrict choice and the use of financial disincentives, although the balance has now begun to change towards less interventionist approaches which aim to enable choice and provide information and education (Preston, 2012).

A closely related issue is the choice of governance method for managing and regulating transport. It has been suggested that, in many European countries, governance systems have incentivized public transport operators to focus more on cost control than on growing patronage (Van de Velde, 1999), as seen in practice in the British rail market where often the initial response to demand growth is to use pricing measures to restrict patronage, rather than providing additional capacity to accommodate increasing passenger numbers.

2.12 *Safety*

While safety (in terms of the risk of accidents) is an important issue for passengers, it is usually taken for granted that rail travel is safe (Outlook Research, 2007), and therefore is unlikely to form a barrier to mode shift, particularly given the relatively poor safety record of car travel. However, there can still be misperceptions of the relative safety of car and rail travel, because rail fatalities tend to be more concentrated in space and time and more prominently reported than fatalities in road traffic accidents, and because of the perceived lack of individual control in rail travel. Safety's relative unimportance as a barrier in the UK may therefore partly result from the welcome absence of recent fatal rail accidents in the UK at the time of writing (Evans, 2012).

2.13 *Inherent Unsuitability of Trips for Rail*

A final (insurmountable) hard barrier to mode shift is the fact that some trips simply are not suitable for rail. A significant proportion of car trips are over distances so short that rail would only prove a viable alternative if both the origin and destination were immediately adjacent to railway stations, and therefore efforts should be concentrated on capturing trips which are long enough for rail to be competitive. While rail tends to be more competitive with car over longer trips, for the longest trips (longer than 3–4 hours) air may become a significant competitor, as illustrated in Figure 2 by data from the UK National Travel Survey (DfT, 2011b).

3. **Soft Barriers**

3.1 *Inaccurate Perceptions*

People often avoid using rail when it offers a superior travel option to other modes because their perceptions of the rail service on offer differ significantly from reality. Such perceptions are particularly important for those who rarely use rail services, because they are unlikely to have any personal experience of the

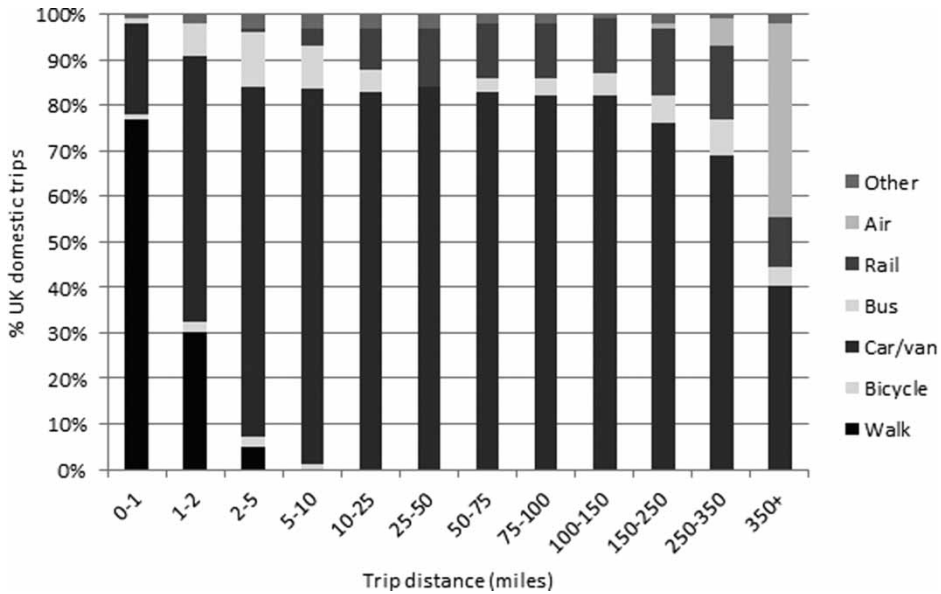


Figure 2. UK mode choice by trip distance.

reality. Perceptions vary widely between individuals with some groups much more resistant to rail use than others (Anable, 2005), seeing it as being unreliable, inconvenient, uncertain, risky, time-consuming, costly and incompatible with modern lifestyles (Kenyon & Lyons, 2003). In particular, people tend to overestimate the cost of rail travel and underestimate the cost of car travel (Gardner & Abraham, 2007). Inaccurate perceptions may be compounded by “cognitive dissonance”, where people adjust their perceptions and attitudes to suit their current behaviour (DHC, 2003), meaning that negative perceptions of rail amongst non-users will be exaggerated. Extreme events may also skew perceptions, with travellers remembering the one time their train was seriously delayed rather than the 19 times it arrived on time. The generally negative attitude of the British media to the rail industry can reinforce misperceptions (Gardner and Abraham, 2007; Prynne, 2009), particularly as transport providers are sometimes perceived as being out of touch and unconcerned with the views of the travelling public (DHC, 2003).

While changing perceptions and attitudes can be a time-consuming and difficult task (Currie & Rose, 2008), seemingly minor experiences or improvements sometimes have a major effect on perceptions of rail travel, for example, the provision of power points on trains (Outlook Research, 2007). Direct contact may be necessary to address misperceptions by non-rail users (Sustrans, 2002), by using “immersion” techniques where people are encouraged to use rail for a trial journey or period (Thøgersen, 2006) or conducting individual travel-marketing programmes (Brog, Erl, Ker, Ryle, & Wall, 2009; Shannon et al., 2006). However, such methods can be very resource-intensive and depend on individuals being receptive to the information provided, as suspicion of the programme’s motives may reinforce pre-existing preferences (Kenyon & Lyons, 2003). It should also be noted that “perceptual gaps” may not exist for all “hard” barriers to mode shift, and the provision of reliable information on the comparative merits of different modes for a particular journey may therefore sometimes reinforce car dependence (Bonsall, 2005).

3.2 *Conscious Car Dependence*

Conscious car dependence is a mental condition linked to inaccurate perceptions, and because there are many segments of car users with varying degrees of conscious car dependence (Hensher & Reyes, 2000) the misperceptions causing this dependence will vary (Anable, 2005). People who report a strong reliance on the car tend to perceive locally available bus and rail services as being intrinsically inferior options, but also tend to be unfamiliar with such services (UOTSU, 1995). Conscious car dependence is a distinct barrier in its own right, with some aspects of car use increasing the likelihood of further car use. For example, people may see little point in owning a car and then not using it (DHC, 2003). Many travellers have a “modal identity” fixed in their mind (Kenyon & Lyons, 2003), and psychological attitudes characteristic of car dependency include independence, variety-seeking, a desire for privacy, a need for control and a desire for convenience. Such people are likely to derive significant psychological benefits from car use (Anable, 2005). “Negative” psychological characteristics such as laziness may encourage car use if travel by other modes involves greater physical or mental effort. Kenyon and Lyons (2003) found attitudinal evidence to suggest that those with less-favourable attitudes to rail are naturally less predisposed to use it.

However, there are also aspects of car travel which many people find inherently unattractive, including isolation, lack of exercise, the anti-social nature of car travel, discomfort and the stress of driving (DHC, 2003). If rail operators were able to contrast rail’s positive performance in these areas this might help overcome conscious car dependence (Stradling, 2002), although this would need to be backed up by reality to avoid immediate disillusionment.

3.3 *Convenience and Freedom*

A major advantage of car use is the ability to make uninterrupted door-to-door journeys at any time of day or night. 60% of infrequent and non-rail users surveyed in the UK by Accent (2009b) said that the main reason for their current mode choice was convenience, including factors such as access/egress distance, familiarity and service frequency/availability. Many studies have emphasized the convenience and flexibility of the car as a significant barrier to mode shift (Currie & Rose, 2008; Davison & Knowles, 2006; Wardman et al., 2001), and by implication this means that rail is seen as being a relatively inconvenient and inflexible mode. While better integration of the rail journey with station access and egress could improve rail’s convenience, rail travel is still very unlikely to match the private car in this respect.

3.4 *Lack of Control*

The control over journey characteristics exercised by car travellers (as described by Van Hagen, Apeldoorn, Eijssink, & Verhoeven, 2012) contrasts with the feelings of powerlessness and loss of control experienced by some people when using public transport (Ellaway, Macintyre, Hiscock, & Kearns, 2003; Gardner & Abraham, 2007; Kenyon & Lyons, 2003), which can cause distress and may therefore inhibit rail use. The most effective way to increase feelings of control for rail users is to simplify journey planning requirements and improve information provision (see Sections 3.5 and 3.6).

3.5 *Journey Planning Requirements*

Irregular travellers often find it much more complex to plan a trip by public transport than by car (Hine & Scott, 2000), which can make car travel seem more convenient even if rail is faster and cheaper. Problems relating to rail journey planning are often based on poor past experiences and inaccurate perceptions, and immersion techniques may therefore prove productive (Accent, 2009b). Personalized journey planning can also help (Halcrow, 2002), but is equally resource-intensive and tends to be most useful where improvements to public transport have been or are being made, as it will only work in isolation where there is a large gap between perceptions of public transport and the reality (DfT, 2002).

3.6 *Information Provision*

Inadequate information on public transport and inadequate knowledge of how to use it may “lock” people into car dependence, and the provision of good quality, reliable, up to date information may therefore be a straightforward way to achieve mode shift (Sustrans, 2002). “In-journey” information provision on punctuality, connections and platform allocation can be just as important as pre-trip information (Passenger Focus, 2006b). However, the type and targeting of publicity and information needs to be considered carefully, as in practice public transport marketing may be more successful in encouraging existing customers to make more journeys than in attracting new customers out of their cars (Bonsall, 2005; Halcrow, 2002). Ideally it should be targeted at groups who yield a higher utility from rail use (Hensher & Reyes, 2000) and emphasize areas in which rail has a competitive advantage (Harrington & Parolin, 1991). It is also crucial that information is accurate, as otherwise it may reduce trust and increase negative perceptions of rail travel (Currie & Rose, 2008).

An immersion experiment by Accent (2009b) found that for non-rail users the information barriers in reality were less significant than had been anticipated, and the largely habitual nature of mode choice (see Section 4.2) may mean that information provision currently plays a minor role in such decisions. Integrated multimodal traveller information sources may help overcome preconceptions (Kenyon & Lyons, 2003), and while the increasing ubiquity of satellite navigation systems for car journeys may raise expectations of the information systems provided for and during rail journeys (Bonsall, 2005), this challenge is increasingly being met by the increased penetration of smartphone applications which make such information personally accessible during journeys.

3.7 *Station Facilities*

While most passengers have very basic needs at stations, centred on shelter, warmth and cleanliness (as predicted by Maslow’s hierarchy of needs), these can be hard to deliver effectively (Outlook Research, 2007). The provision of an acceptable level of facilities and information is particularly important at interchange stations (Wardman et al., 2001). The importance of (a lack of) station facilities as a barrier to rail use will vary from station to station, but the improvement of facilities at stations where they are currently substandard could encourage mode shift to rail, and equally if facilities at particular stations decay then there is a risk

of mode shift away from rail (University of Southampton, Accent & University of Leeds, 2008).

3.8 *Cleanliness and Maintenance*

While the provision of hygienic conditions will never excite passengers, without them perceptions of rail will be much more negative (Outlook Research, 2007). Passenger Focus (2006b) found that passengers consistently rank the cleanliness, upkeep and repair of stations as amongst the most important aspects of the total journey experience. While a lack of cleanliness is unlikely to be a primary reason for people not using rail, for some individuals it may contribute to a wider perception of rail as a relatively undesirable means of travel when compared to the car.

3.9 *Personal Security*

Concerns over personal security may deter some people from using rail (Mackett & Babalik Sutcliffe, 2003), particularly during the hours of darkness and at smaller stations. Many people have fears about accessing stations, waiting in stations and travelling on trains at night (Cozens et al., 2003), and while improved lighting and the provision of help points and CCTV can help, at smaller stations feelings of isolation may persist, making security concerns particularly noticeable (Outlook Research, 2007). Staff provision tends to be the most effective way to make stations feel safer, but this does not address concerns over station access, where rail travel compares unfavourably to the door-to-door security offered by car travel. Interestingly, UOTSU (1995) found no evidence to support the suggestion that the particular nature of travel during the hours of darkness is a significant force in driving car dependence. However, security can also be an issue during daylight hours with the potential hazards of traffic and undesirable elements of society posing a particular barrier to rail use for journeys involving children (Jones & Bradshaw, 2000) and the elderly.

3.10 *Staff Presence*

In addition to personal security issues, some passengers find the presence of staff to provide information very important, particularly during interchange (Hine & Scott, 2000). Accent (2009b) found that where staff are present feelings towards them were somewhat mixed, with some passengers suggesting that staff are not always visible or immediately available when required. While additional staff provision may increase rail's attractiveness, the cost of this provision is substantial, and a reduction in the proportion of tickets purchased at booking offices may further reduce its viability.

3.11 *Comfort*

Variations in values of time for travel by different modes tend to be strongly correlated with income, but within income groups in the UK rail travel tends to attract lower values than car (DHC, 2003), which suggests that the comfort of rail travel should not form a major barrier to modal shift, a conclusion backed up by Paulley et al. (2006) and Outlook Research Ltd (2007). There is, though,

likely to be a relationship between comfort and crowding levels, and while trains may be viewed as being comfortable when sufficient seats are available, this will change when they are operating at crush capacity (Accent, 2009b) (see Section 3.12). There has also been a continuing tendency for the comfort and facilities offered by private cars to improve at a faster rate than those offered by trains, which may increase the importance of comfort as a barrier to mode shift.

3.12 *Crowding*

Because different people have different perceptions of what constitutes a “crowded” train, crowding is classified here as a soft barrier. In a survey of existing passengers carried out in 2007, capacity-related improvements were found to have a higher priority than had been the case in 2005 (MVA Consultancy, 2007), indicating that overcrowding is becoming an increasingly significant cause of passenger dissatisfaction. There appears to have been very little research undertaken into the extent to which actual or perceived overcrowding deters non-rail users, but if it did prove to be significant then only an increase in capacity (or possibly a redistribution of travel demand to quieter periods) would generate significant mode shift.

3.13 *Other Passengers*

The privacy offered by the private car is for some a major advantage over rail, because it allows users to avoid any direct interaction with strangers (Currie & Rose, 2008). In addition to concerns over personal security, other passengers may reduce individuals’ utility by excessive use of their mobile phones, using personal music players at a high volume, attempting to make unwelcome conversation, taking up multiple seats, consuming alcohol or strong-smelling food, engaging in unpleasant personal habits, blocking aisles with luggage, using bad language and partaking in a range of other activities (Walmsley, 2009). Annoyance caused by other passengers may have increased in importance as a barrier in recent years as lifestyles have become progressively more individualistic (Putnam, 2000), although more research would be needed quantify the extent to which this deters rail use.

3.14 *Image of Public Transport*

Travel by bus is sometimes seen as lacking status (Ellaway et al., 2003), and this may form an indirect barrier to rail use where bus services form the most feasible access/egress mode (Accent, 2009b). However, image problems associated with rail in the UK tend to be linked with value for money and crowding (Passenger Focus, 2011) rather than status, and this barrier is therefore best tackled by dealing with these underlying problems.

4. **Complementary Barriers**

4.1 *Trip Chaining*

“Trip chains” are trips which visit multiple destinations before returning to the origin, and as such trips increase in complexity, the physical, cognitive and

affective costs of using public transport will increase relative to car use, because of people's higher valuation of walking and waiting time and negative perceptions of interchange (Vande Walle & Steenberghen, 2006). The inflexibility of the rail ticketing system in areas where travelcard-type tickets are not available means that the relative financial costs of rail use will also increase with trip complexity.

Trip chaining is a growing phenomenon (Hensher & Reyes, 2000), and there may be feedback between car availability and the propensity to trip chain, with, for example, employees using their car to travel from the office to obtain lunch, and this habit of going out for lunch then becoming a barrier to mode shift to public transport (Bhat & Sardesai, 2006). The presence of children in households also reduces the relative utility of public transport use by making household travel patterns more complex (Jones & Bradshaw, 2000), and as trip making becomes more complex, finding generic ways of getting car users to switch to public transport becomes increasingly difficult (Hensher, 2001). Rail's attractiveness for complex trip chains could however be increased through wider implementation of zonal and intermodal ticketing, by simplifying station access through better intermodal integration or by filling in obvious "missing" public transport links (Vande Walle & Steenberghen, 2006).

4.2 *Habit*

While related to conscious car dependence (see Section 3.2), habit can form a significant barrier to mode shift in its own right, as past mode choices are a strong predictor of current mode choice (Thøgersen, 2006). The term "habit" can describe various sources of resistance to changes in behaviour that would be made on purely "rational" grounds, including a reluctance to upset an ordered and well-understood routine, perception thresholds below which changes in the relative attractiveness of different modes are not noticed and barriers to the relevant information on different modes reaching travellers (Goodwin, 1977). While the factors discouraging car travel are often at best latent (Accent, 2009b), if habits can be broken there may be potential for significant mode shift. This is most achievable when habits are disrupted as a result of major life events such as changes in residential or employment location or as a result of transport disruptions such as major infrastructure repairs (Friedrichsmeier, Matthies, & Kloeckner, 2013), and there is therefore potential for targeting publicity and information at people in such circumstances.

4.3 *Individuality*

A person's choice of car and the way in which they drive it form conduits through which they can express their personality, because owning a car offers identifiable values such as independence, freedom and affluence (Gray et al., 2001), and cars can therefore be very psychologically important. Those with access to a car appear to gain more psychosocial benefits (mastery, self-esteem and feelings of autonomy, protection and prestige) from their habitual mode of transport than public transport users (Ellaway et al., 2003), but it seems unlikely that this on its own forms a barrier to rail use for many individuals.

4.4 *Age, Health and Disability*

There will always be some people for whom, due to infirmity, public transport is unattractive or impractical (Bonsall, 2005), and in the UK (along with many developed economies) the size of this group is expected to increase. Age-related barriers are not confined to the elderly, as travelling by rail can be expensive and difficult for families too, particularly when interchanges are involved (Outlook Research, 2007). While major improvements have been made in recent years, accessing some trains and stations may still pose problems for the mobility-impaired (Hine & Mitchell, 2001). While few of the barriers relating to mobility problems seem insurmountable, major investment may be required to overcome them, and research is needed to establish whether such investment is cost-effective or would generate significant mode shift.

4.5 *Ethnicity, Faith and Culture*

Cultural barriers to rail use may exist amongst particular ethnic and faith groups, with, for example, restrictions on women travelling alone on communal modes of transport (DHC, 2003) and the social effects of the 2005 London terrorist bombings making rail a non-viable travel option. However, this is only likely to be a barrier to rail use for a relatively small segment of the population in most Western countries, albeit a segment that might be expected to increase in size.

4.6 *Goods and Baggage*

The need to transport large quantities of luggage, for example, from bulk shopping trips (UOTSU, 1995), to school (Jones & Bradshaw, 2000) or on holiday may deter people from using the train (Passenger Focus, 2006b), both because of the difficulty of moving this luggage and because of inadequate luggage space provision on board trains. Changing land-use patterns can exacerbate this problem if facilities are located to optimize road rather than rail journeys.

4.7 *Locational Preferences*

While the effects of urban structure on modal shift are normally considered as a “hard” barrier, in some cases they are “complementary” barriers, as some people may find residential locations near to railway stations unattractive because of the non-transport-related characteristics of the neighbourhood (DHC, 2003). There is also evidence of feedback between land use and mode choice, with people choosing a residential environment that suits their travel preferences, so that, for example, those people who like to travel by car will tend to choose to live in places where car parking is easy and the urban structure favours car use (Cao, Mokhtarian, & Handy, 2009).

4.8 *Influence of Employers*

Employers and employment conditions can have a major impact on employee mode choice, for reasons such as work-related car requirements, working hours not corresponding to public transport availability, a need for flexibility to allow for late working or emergencies (DHC, 2003) and the choice of office locations

which maximize ease of access by car rather than by public transport. While the introduction of workplace parking levies could address the latter problem (Halcrow, 2002) their effects might be diluted by employer relocation. Some employers take active measures which effectively subsidize car use, such as free parking provision, over-generous mileage allowances, “essential car user” designations and company cars, and these inevitably discourage public transport use (Davison & Knowles, 2006; Hine & Scott, 2000). The fact that even some major public transport providers offer such “perks” (Finch & Bowers, 2009) indicates the scale of this barrier.

There are some positive examples of actions by UK employers achieving modal shift from car to rail through the provision of public transport passes as part of employee benefit packages or the implementation of workplace travel plans (Rye & McGuigan, 2001). When train-operating companies work in partnership with employers and local authorities in the production of such plans (Halcrow, 2002), they can be extremely effective in promoting public transport use (Van Exel & Rietveld, 2009), but they are still uncommon in the UK, perhaps because there are not sufficiently consistent, targeted regulatory and fiscal measures to stimulate their widespread adoption (Enoch & Potter, 2003).

4.9 *Sub-optimal Market Prices*

In addition to the barrier posed by fare levels, the market prices of other goods and services may form a barrier to mode shift. For various reasons, consumers may not always bear the full costs of their choices, for example, because car-dependent land is underpriced or because the cost of using the car does not cover the full environmental costs of this travel choice (Litman, 2002).

4.10 *Weather*

The idiosyncrasies of the British weather may form a barrier to rail use and also reinforce other barriers by making station access and the waiting experience more unpleasant than would otherwise be the case, particularly if access is by bike or on foot or if no sheltered waiting areas are available. Kalkstein, Kuby, Gerrity, and Clancy (2009) investigated the effect of daily weather conditions on transit ridership in three US cities, and found that usage tended to increase on dry and mild days but decrease on wet and cold days, and that this pattern was particularly strong for leisure travel. However, this study was looking at total rail usage rather than rail’s mode share, and the weather might therefore have a similar impact on the volume of travel by other modes. The UK’s notoriously unpredictable rainfall may be less of an issue elsewhere, but weather and climate can still play a role in discouraging travel where, for example, extremes of heat and cold make waiting for (and in some cases travelling on) trains unpleasant.

5. **Packages of Barriers**

Rather than considering barriers on an individual basis, travellers will assess them simultaneously when making mode choice decisions, and therefore sufficient barriers will need to be addressed to overcome a particular traveller’s threshold level of resistance to rail travel before mode shift can be achieved (DHC, 2003). Second-

any barriers may therefore need to be dealt with to generate significant mode shift even though they do not pose major barriers in themselves. The consensus seems to be that even initiatives exhibiting significant potential for achieving mode shift will have most impact if they are implemented as part of a package, and some measures which have no discernible effect on their own may contribute materially to the effects of a package (Halcrow, 2001). It also seems to be more effective to do a lot for small target groups than a little for all target groups (European Union, 1999). This suggests that efforts to achieve mode shift to rail should initially be targeted at routes where rail's current share of traffic is less than might be expected given the relative quality of the services provided by the different modes available.

Research suggests, unsurprisingly, that travellers are more likely to consider a modal change if they are experiencing problems with car use as a result of congestion or a lack of parking (Rye & McGuigan, 2001). If this is not the case, but mode shift to rail is still required, then local authorities may need to impose restrictions on car travel. However, if public support is required for public transport improvements then people will need to see personal benefits from their implementation (Bonsall, 2000). It is also important that efforts are targeted at the groups where they are likely to have most impact, particularly when they are intended to tackle soft barriers to mode shift (Anable, 2005), as strategies which are effective at encouraging some people to use the train instead of their cars may reinforce the car use of other people. Before any measures aimed at stimulating mode shift are implemented, their likely impacts need to be evaluated with care, as they may also influence trip timing and destinations and route choice (Hensher, 2001), leading to unintended and potentially undesirable consequences. Even if trips do transfer from car to rail, this will not necessarily reduce road traffic, as they may simply be replaced from latent demand previously suppressed by traffic congestion (Rye, 2002).

6. Conclusions

The barriers faced by travellers considering a shift of mode to rail are many and varied. Hard factors undoubtedly prevent significant numbers of people from considering rail as a serious travel option, and the policy focus to date has centred on tackling such factors, with some success. However, research suggests that there are also a significant number of people who are deterred from using rail by less-tangible factors, and there may therefore be a great deal of potential to improve rail's modal share without the need for expensive infrastructure enhancements. It is likely that the mode shift impacts of addressing a barrier will be largest in situations where the factor in question has been particularly neglected, so, for example, cleaning a station which has not been cleaned for 6 months will have a greater impact than cleaning a station which has not been cleaned for 24 hours. Equally, though, there may be circumstances where only a very small improvement is necessary to change a factor from an "unacceptable" level (and therefore acting as a barrier) to an "acceptable" level where passengers' threshold level of resistance to rail travel will be overcome. It is therefore important when selecting interventions to attempt to identify the "marginal" impact on passenger perceptions of a particular improvement, as "quick wins" are most likely to be achieved where a marginal change in a factor will lead to this threshold being crossed.

Figure 3 provides a qualitative assessment (based on the evidence reviewed for this paper) of the likely importance of particular barriers and the feasibility and cost-effectiveness of addressing them in the UK context, although it should be noted that in reality (for the reasons discussed above) this classification will vary significantly in different situations and locations. This shows that, somewhat unfortunately, those barriers which are of high importance and which would in theory be highly cost-effective to address are likely to prove difficult to tackle in practice. Conversely, while addressing some other barriers appears to pose few technical challenges, these barriers are either relatively unimportant or unlikely to generate sufficient additional revenue to justify their removal. In practice, current funding constraints mean that absolute cost may be more important than cost-effectiveness, and therefore the policy focus in future may well shift to tackling soft barriers, with the aim of “nudging” people towards rail use. It appears that resources will be best used by targeting packages of improvements at small groups with particular potential for mode shift, for example, staff at workplaces and patrons of shopping and

Importance			
Cost-effectiveness	High	Medium	Low
High	• Conscious car dependence (P) • Station access (P) • Habit (D) • Land use patterns (D)	• Government policy (P) • Employers' influence (P) • Cost (D) • Inaccurate perceptions (D) • Sub-optimal market prices (D)	• Ticketing complexity (S) • Image (P)
Medium	• Interchange (P) • Service frequencies (P) • Travel time (P) • Trip chaining (D)	• Crowding (P) • Network limitations (D)	• Cleanliness and maintenance (S) • Comfort (S) • Information provision (S) • Station facilities (S) • Lack of control (P) • Goods and baggage (D) • Individuality (D)
Low	• Convenience and freedom (D)	• Journey planning requirements (S) • Age, health and disability (P) • Other passengers (P) • Personal security (P) • Reliability (D) • Structural car dependence (D)	• Staff provision (S) • Safety (P) • Ethnicity, faith and culture (D) • Locational preferences (D) • Unsuitability of trips for rail (D) • Weather (D)

Figure 3. Estimated importance, cost-effectiveness and feasibility of addressing barriers to mode shift.

Notes: Suffix letter indicates feasibility, with S, straightforward; P, possible; D, difficult.

entertainment facilities which are located close to railway stations (as with Station Travel Plans). Travellers place a high priority on seamless journeys, and therefore initiatives to better integrate station access and egress with the rail journey and reduce the uncertainty of interchange could pay dividends. There is also potential for mode shift to be stimulated through targeted publicity and effective public relations by the rail industry to close the “perceptual gap” of non-users. While this review has focused particularly (but not entirely) on the UK, most of the barriers identified (and the potential solutions) also apply in other countries, although as in the UK their relative importance will inevitably be affected by local conditions.

Identification of barriers does not necessarily mean that their removal will lead to travel behaviour change, and this review should therefore inform further work to explore strategies for and the effects of barrier removal. For example, Stanton et al. (2012) used Cognitive Work Analysis to highlight the interrelationships and interdependencies between different barriers and to identify context-related strategies to encourage mode shift. Investigation of case studies where rail patronage has increased significantly to identify the barriers which had been overcome to achieve this growth might also provide useful insights. Further research is similarly needed to establish the relative cost-effectiveness of interventions aimed at encouraging mode shift and to explore how barriers to rail use are likely to change in importance in the future, when climate change, peak oil and technological development may stimulate increased public transport use (Currie & Rose, 2008).

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