Department for Transport

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UWE Bristol University of the West of England

Understanding the factors that influence people's use of rail infrastructure: A narrative literature review

Prepared by: The Behavioural Practice, Verian UK and the Centre for Transport and Society, University of the West of England

Authors: Natalie Gold, Sarah Bowen, James Gurd, Leah Panos, Caroline Bartle, Kiron Chatterjee

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Glossary

Key definitions

Term	Definition
COM-B	A framework used to understand an individual's behaviour as the product of their Capability, Opportunity and Motivation to perform that Behaviour
Difference-in-difference	A quasi-experimental method using time-series data to test for a causal change in the trend of outcomes following intervention between a treated group and a control group.
Narrative literature review	This approach provides a summary of current knowledge on a topic by drawing on previous research, typically without adhering to strict search and selection guidelines.
Randomised controlled trial (RCT)	A prospective method to compare the effect of an intervention to what would have happened without the intervention. Randomisation allocates participants to receive the intervention or not. The researcher delivers the intervention being tested, and this combined with randomisation allows RCTs to be used to draw causal claims about the effects of an intervention.
Statistical significance	A statistically significant effect is one that is unlikely to be due to random chance, as determined by a hypothesis test using a p-value (typically with a $p < .05$ threshold). However, statistical significance only indicates the likely presence of an effect, not whether its size has meaningful real-world implications.
Synthetic control methods	A method that uses historical data to construct a 'synthetic clone' of a group receiving a particular intervention. Differences between the performance of the actual group and its synthetic clone may be used as evidence that the intervention has had an effect. Most commonly applied to interventions applied at an area level.

Acronyms

Acronym	Definition
AUD	Australian dollars
BIT	Behavioural Insights Team
BCW	Behaviour Change Wheel
CCTV	Closed-Circuit Television
CTS	Centre for Transport and Society
DfT	Department for Transport
GBRTT	Great British Railways Transition Team
ITRD	International Transport Research Documentation
OECD	Organisation for Economic Co-operation and Development
RCT	Randomised Controlled Trial
RQ	Research Question
TOC	Train Operating Company
TRB	Transportation Research Board
TRID	Transport Research International Documentation
TRIS	Transportation Research Information Services

Executive summary

Introduction

The Department for Transport (DfT) commissioned Verian, in collaboration with the Centre for Transport and Society (CTS), to conduct a narrative literature review. The review aimed to understand the factors that shape current rail use behaviours in order to support development of interventions to increase ridership, addressing two research questions:

RQ1. What factors affect current, lapsed, and non-users' choices about whether, how, and when to use rail infrastructure?

RQ2. What types of interventions have been developed to overcome barriers and harness enablers, and which do the literature indicate have been most effective?

In collaboration with DfT and CTS, Verian collected evidence from online searches and stakeholders, and screened reports for relevance. The process identified 22 reports to address RQ1 and eight reports to address RQ2.

The review used the Behaviour Change Wheel (BCW) and COM-B as an approach to understand and target the factors that shape behaviour. The BCW is a framework for designing behaviour change interventions, linking an understanding of behaviour through the COM-B framework (Capability, Opportunity, Motivation – Behaviour) to evidence-based intervention functions (see **p21**). For RQ1, the researchers conducted a thematic analysis to identify barriers and enablers emerging from the reports and mapped these to the COM-B framework. The identified themes are reported by journey stage. For RQ2, Verian used the BCW to map interventions to the COM-B components affecting rail use identified in RQ1 (see **p34**).

Findings

This review was an exploratory research project, not intended to be a systematic review of all factors affecting rail travel. The findings should be considered as indicative evidence, that is, they provide an overview but are not exhaustive or definitive.

Factors that influence rail usage (RQ1): The review identified 24 thematic barriers and enablers to rail use. Themes were identified against each of the three COM-B components, but the majority related to opportunity (13) and motivation (9). This suggests

that improving external conditions (opportunity) and strengthening personal motivation may be key to increasing rail use.

Some key themes influenced decisions and experiences across **the whole journey**:

- passenger characteristics, information provision, confidence, emotions

While others were specific to a journey stage:

- **planning a journey:** accessibility of other forms of transport, availability of trains, disruption, door-to-door logistics and interchanges, information provision, train tickets, group identity, social influences, comfort, confidence, freedom (downtime/control), perceived quality, perceived value for money, habit/familiarity, individual and professional role identities
- **buying a ticket:** disruption, information provision, products/services, physical accessibility, station and onboard facilities/staff assistance, confidence
- **in the station/on the train:** passenger characteristics, awareness of information, physical accessibility, security, sensory, station and onboard facilities/staff assistance, other passengers, comfort, confidence, feeling safe, freedom (downtime/control), habit/familiarity
- **travelling to/from the station:** information provision, security, station and onboard facilities/staff assistance

Interventions to increase ridership (RQ2): The nine interventions reviewed used four of the nine intervention functions from the BCW: incentivisation, enablement, persuasion and environmental restructuring. None of the interventions identified in the review used the remaining five intervention functions: coercion, education, training, restriction or modelling. Although these types of intervention functions might be useful, for example to raise awareness, build confidence, or shift perceptions about rail travel. Due to the reliance on observational and qualitative methods rather than experimental designs, it was not possible to assess the effectiveness of many interventions.

Key insights

There were five key insights based on the findings of this review:

1. **Some barriers apply to all journey stages and all users, and especially affected lapsed/non-users**. These barriers would be key targets for interventions for increase ridership.
2. **Other barriers differ by journey stage**. Interventions that do not account for barriers at all journey stages may be ineffective.
3. **Many barriers occur at the journey planning stage**. If these are not overcome, the journey will not occur. These barriers are therefore targets for intervention.
4. **Barriers for lapsed and non-users differ**. Lapsed users stop using rail due to changes in physical health, complex journeys that require multiple modes and perceptions of rail as poor value for money. For non-users, barriers included fear, dislike of travelling with others, or overstimulation on rail journeys.

5. **Most interventions focused on incentivising rail use by reducing fares**. Evidence of their effectiveness was limited. Given the broad range of barriers, interventions should consider broader approaches beyond reducing cost.

Themes to consider when developing interventions to increase ridership

The themes identified in the review may systematically influence decisions to travel by rail. Considering these themes alongside predictions from demand models will produce a rich understanding of behaviour and guide interventions that encourage more people to choose rail. Themes include:

- accessibility of other forms of transport
- comfort preferences
- confidence
- control preferences
- costs
- disruption
- door-to-door journey time
- emotions
- existing and potential passenger characteristics
- feelings of safety
- habit/familiarity
- interchanges
- perceived quality
- perceived value for money
- personal identity
- products/services
- public transport integration
- social influences
- social preferences

There are also contextual themes that influence the mode chosen for travel. For instance, the degree to which rail is integrated with other forms of public transport and travel infrastructure is a barrier or an enabler to travelling by rail.

Introduction

Research background

Increasing demand for rail travel hinges not only on physical improvements to the network but also on a clear understanding of the behavioural and contextual factors that enable people to travel with confidence, ease, and dignity. Rail demand models provide a robust, quantitative baseline for estimating how new or upgraded infrastructure will affect passenger volumes. This review was designed to complement such models by adding insights into the factors that influence users, lapsed users and non-users of rail. Considering these factors alongside predictions from demand models will produce a rich understanding of behaviour and guide interventions that encourage more people to choose rail.

To inform the design of existing and future rail infrastructure schemes, the Department for Transport (DfT) needs better evidence on the range of factors that can influence decisions to use or not use rail infrastructure. In addition, DfT need to understand what these factors reveal about potential interventions to support the use of rail infrastructure.

Aims and objectives

DfT commissioned Verian, in collaboration with the Centre for Transport and Society (CTS), to conduct a narrative literature review.

First, the review aimed to understand what influences decisions to travel by train among current, lapsed, and non-users. It was designed to uncover the range of behavioural barriers and enablers to rail use so they can be used alongside existing demand modelling and address gaps in understanding.

RQ1. What factors affect current, lapsed, and non-users' choices about whether, how, and when to use rail infrastructure?

- 1.1 How do these factors map to the COM-B framework? See Methodology for more information about the COM-B framework.
- 1.2 How do these factors vary by age, gender, ethnicity, region, disability and income/deprivation?

Second, the review aimed to support increased ridership by understanding current interventions and informing the design of interventions - within existing or planned schemes - through a behavioural lens.

RQ2. What types of interventions have been developed to overcome barriers and harness enablers, and which do the literature indicate have been most effective?

2.1 How do these interventions map to the factors identified in RQ1?

2.2 How has effectiveness varied by age, gender, ethnicity, region, disability and income/deprivation?

Rail use context

Rail context across Great Britain

The **National Rail network in Great Britain** is managed by Network Rail and consists of 9,848 miles of standard-gauge lines [1]. There are 28 Train Operating Companies (TOCs) providing passenger services on the National Rail network with additional metro, light rail and tram systems in London, Glasgow and other conurbations. Surface rail (National Rail) accounted for 2 per cent of all trips made and 8 per cent of distance travelled for domestic travel in England in 2023 [2].

Rail service provision and passenger demand varies regionally [3]**.** Across England and Wales, London had the most passenger journeys (952m) to, from or within the region from April 2023 to March 2024, followed by the South East (255.2m) and the East of England (162.3m) [3]. Wales and the North East and had the lowest number of journeys (26.7m and 16.8m respectively) [3].

There was a **long-term trend of increasing rail use on the National Rail network up to the COVID-19 pandemic** with 589m passenger journeys in April 1995 to March 1996, rising to 1,520m passenger journeys in April 2018 to March 2019 [3]. There were only 344m passenger journeys reported during the height of the COVID-19 pandemic in April 2020 to March 2021, but by April 2022 to March 2023 this had risen to 1,228m journeys and it was 1,427m journeys in April 2023 to March 2024 [3].

What do we know about who uses rail?

Differences in propensity to use rail by different demographic groups are revealed by the National Travel Survey [4]. Data for 2023 shows:

- Males make 5 per cent more rail trips (19 per year) than females (18 per year).
- Young adults aged 17-29 make more rail trips (42 per year for 17–20 year olds, 37 per year for 21-29 year olds) than any other age group (18 per year for all ages).
- Adults aged 70 and over make one-third as many rail trips (6 per year) as all age groups (18 per year), whereas they make more bus trips and a similar number of car driver trips as all age groups.

- Those people in households without a car make nearly twice as many rail trips (30 per year) as those with a car (16 per year).
- Those people in households in the highest income quintile make 1.7 times more rail trips per year (31 per year) than the average for all people (18 per year).
- Those people with a mobility difficulty make one quarter of the rail trips (6 per year) as those with no mobility difficulties (22 per year) but nearly as many bus trips.
- Those people from non-white ethnic minorities make 1.6 times more rail trips (32 per year) than White people (20 per year).

Frequent train use (defined as using trains at least once a week) has been shown to be most influenced by not having access to a car (about three times more likely than average) and living in Greater London (about five times more likely than average) [5].

Rail attitudes and satisfaction

A one-off survey on **public attitudes towards train services,** conducted in February 2018 of a representative sample of residents of Great Britain, contrasted attitudes towards national rail services between users and non-users [6]. Both rail users (29%) and non-users (27%) thought that there were too many types of rail tickets available.

A survey for Transport Focus in 2023 on **motivations and barriers to train usage** (included in this review) found that around a quarter of lapsed train users are likely to consider using the train again, especially if encouraged by better value fares, reliability, and closer proximity to a station [7]. The majority of non-users do not use rail because they prefer to travel by car, although cost is also important. This Transport Focus report defines **'lapsed users'** as those who said: "I am not currently travelling by train, but used to" (10% of respondents), and **'non-users'** as those who said: "I don't use trains" (14%), with 'users' making up the remainder. However, definitions vary by report.

Satisfaction with the journey experience among those who use rail is high, according to the Rail User Survey run by Transport Focus [8]. Every week it asks a representative sample of people in Great Britain about their experience of travelling by rail in the last seven days. For those who have used rail it asks how satisfied they were with factors such as punctuality, cleanliness and value for money. In April 2025, satisfaction with the overall journey ranged between 82 and 87 per cent (across four survey waves). This is a slight drop from April 2022 when overall satisfaction ranged between 85 and 90 per cent (across five survey waves). However, overall satisfaction with the journey has generally been reasonably consistent since the start of this data series in 2021, and similar between men and women. Older age groups were more satisfied than younger age groups in both April 2025 and April 2022. Satisfaction with individual components of the rail journey shows greater variation however. In April 2025, 'value for money' was the factor attracting the lowest levels of satisfaction (between 50% and 57%). This has dropped since April 2022, when satisfaction with value for money ranged from 57 to 64 per cent.

Research for DfT on how passengers use the rail network across Great Britain, found the primary reason for travel was leisure (54% of respondents), followed by commuting for work or educational purposes (30%), and travelling for business (15%) [9]. Commuters

were the most frequent travellers. Among those whose primary reason for rail travel was commuting, 41 per cent travelled by rail at least once a week. In comparison, only 23 per cent of leisure travellers and 21 per cent of business travellers used rail weekly.

Methodology

Approach

The researchers conducted a narrative literature review, which provides a summary of current knowledge on a topic by drawing on previous research, typically without adhering to strict search and selection guidelines (in contrast to systematic reviews). However, the researchers did specify how they would conduct the searches and select reports in advance in a study protocol (see **Annex A**).

Identification of the literature

Verian followed a multi-step process to identify and screen relevant literature associated with each research question. In collaboration with CTS and DfT, Verian ran online searches, contacted key academics and rail industry stakeholders for recommendations and screened evidence for relevance to the research questions. See **Annex A** for a more detailed methodology and **Annex B** for the search strings used in the online searches.

The process was designed to identify 30 reports for inclusion in the review. The researchers selected 22 reports that explored barriers and enablers to rail use to address RQ1, and eight reports on interventions to overcome barriers and harness enablers to encourage rail use and address RQ2. We considered both academic and grey literature published from 2007 onwards for inclusion. The full inclusion and exclusion criteria are summarised in **Annex A**. The PRISMA flow diagrams in **Annex C** summarise the steps involved in this narrative literature review and the number of articles included or excluded at each stage.

Data extraction

Data from each report was extracted into a template developed in collaboration with CTS and agreed with DfT. One extraction template was designed for each research question (two in total) to systematically collect and organise relevant information from selected reports, ensuring consistency and accuracy in the review process. The extraction template captured information to streamline analysis such as research design, participants, and key findings. During data extraction, reviewers also assessed evidence quality. For RQ1, there were four dimensions: design, sample, analysis and reporting, findings. For RQ2, robustness of the methods was rated, and internal and external validity. The criteria for each dimension are in **Annex D**.

All researchers involved in data extraction first completed a calibration exercise to ensure consistency. This involved all researchers extracting data from the same two reports and coming together to discuss the results and any differences in data extracted or quality assessments.

Analysis

Factors that influence rail usage (RQ1): After data extraction, Verian conducted a thematic analysis to identify barriers and enablers emerging from the 22 reports and address RQ1, and classified these using the COM-B framework. The COM-B framework is used to understand an individual's behaviour as the product of three components: their Capability, Opportunity and Motivation to perform that behaviour [10]. The framework theorises that a behaviour will only occur when all three components are present and in sufficient quantity. These three components are further divided into six sub-components: Physical Capability, Psychological Capability, Physical Opportunity, Social Opportunity, Reflective Motivation, and Automatic Motivation. The analysis mapped the underlying reasons why people do or do not engage in rail travel to the six sub-components of the COM-B framework, in order to be able to identify effective strategies for promoting desired changes.

Interventions to increase ridership (RQ2): Verian used the Behaviour Change Wheel (BCW) to map interventions to the COM-B components affecting rail use identified in RQ1 (see Figure 1). The BCW contains the COM-B framework and can be used to understand how an intervention influences COM-B components to drive behaviour change [10]. The BCW was developed to help improve the design of evidence-based behaviour change interventions by underpinning them to a model of behaviour and the components that influence it. This allowed the researchers to determine which interventions addressed or harnessed which barriers and enablers, and therefore why they may or may not be effective at encouraging rail use.

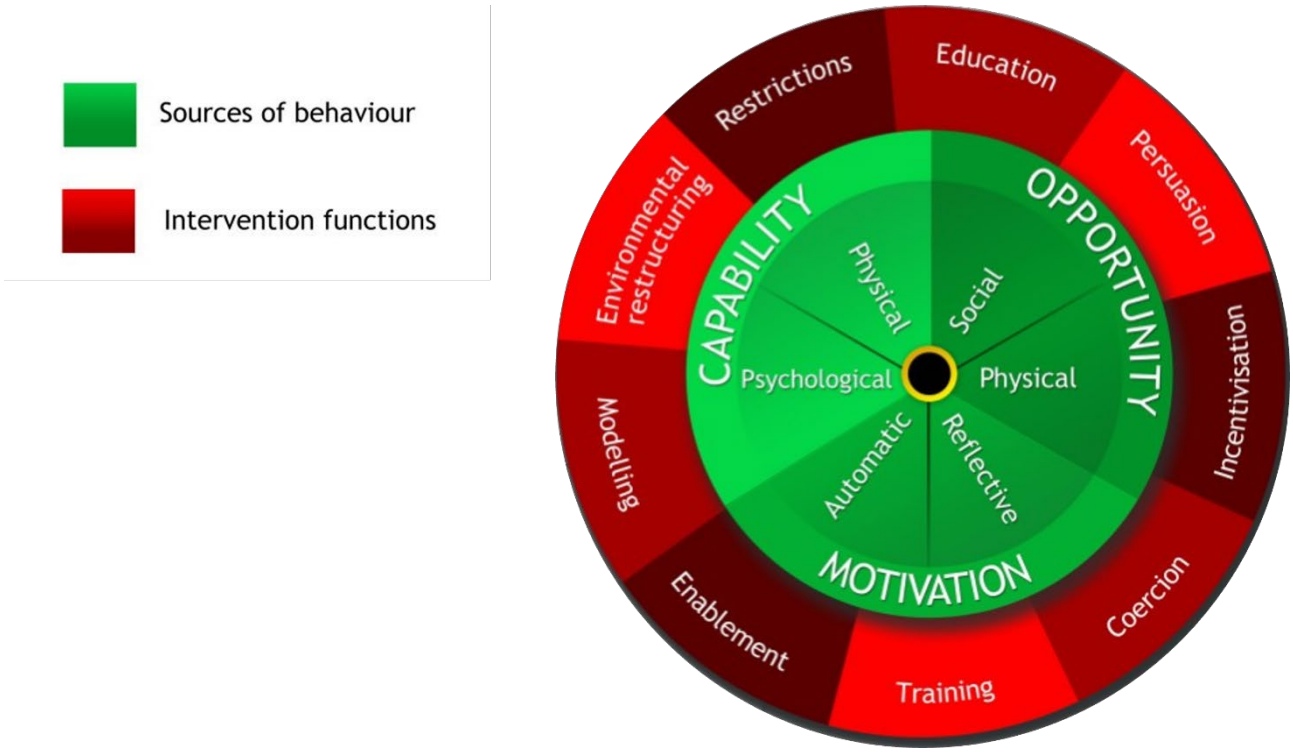

Figure 1. The Behaviour Change Wheel (BCW) mapped onto the COM-B components and sub-components [10]

Findings

Evidence overview

Review scope

This was an exploratory research project using 30 sources of evidence to identify the range of psychological and behavioural barriers and enablers to using rail infrastructure, and initiatives to address and harness them. It is not a systematic review of all factors impacting all groups of interest. Therefore, the findings should be considered as indicative evidence, that is, they provide an overview, but are not exhaustive or definitive.

Evidence approach, scope, and type

The 22 reports included in RQ1 explored the factors influencing decisions to use rail, using qualitative research, survey research, literature reviews, or a combination of these approaches. Most reports that focused on a particular type of rail examined heavy rail (services on the mainline national rail network) [11], [12], [13], [14], [15] rather than light rail (services that operate on tramways, metro systems, or underground) [16]. See Table 1 for more information about the authors, year, methods, analysed sample sizes, and key findings of reports included in the RQ1 narrative literature review.

For RQ2, two reports used experimental or quasi-experimental methods to evaluate the impact of interventions [17], [18]. The other six reports used observational, case study or qualitative methods [19], [20], [21], [22], [23], [24]. Three of the reports described small-scale pilots that provided indicative evidence about interventions as proof-of-concept [20], [22], [23]. One report focused on the role of community rail, which is not an intervention in itself, but a network through which initiatives have been designed and implemented to encourage rail use [24]. Therefore, we have limited evidence to determine which interventions have been effective, and how effectiveness varies between demographic groups. See Table 2 for more information about the authors, year, methods, analysed sample sizes, and key findings of reports included in the RQ2 narrative literature review.

Quality of the evidence

Researchers assessed the quality of qualitative and survey RQ1 research using criteria for a low-quality report (Red) and a high-quality report (Green) (see Appendix Table 3). The quality of evidence varied. For RQ1 reports, limitations included lack of transparency about research design and sample recruitment methods. Only one report was flagged as Red due to a lack of transparency in the analysis [25]. However, the exclusion of this report would not change the results. For the reports relevant to RQ2, limitations included a lack of robust methods to evaluate the effectiveness of the initiatives on behaviour use, small sample sizes, and sampling approaches that restrict generalisability of findings to the wider population. See **Annex D** for a more information about the evidence quality of included reports.

Author and source	Publisher	Year	Design	Transport mode	Geographic scope	Research population	Sample size	Key findings
BIT [11]	Transport for Wales	2024	Mixed methods	Passenger heavy rail	South Wales	General population (Survey) Regular and less regular users, non-users (focus groups, interviews)	800 respondents (survey) 41 participants (6 focus groups and 6 interviews)	Barriers to train use stem from real issues and misperceptions. Less frequent users perceived obstacles more strongly. Combining tangible improvements with strategies to reshape user attitudes and to close the gap between perception and reality can help address both service quality and public perception.
Blainey et al. [12]	Transport Reviews	2012	Literature review	Passenger heavy rail	UK and international	Non-users	86 studies	Identified 37 barriers to rail use, grouped into hard (infrastructure/cost/time), soft (personal/trip-specific), and complementary (lifestyle/cultural) factors.
Brons et al. [26]	Transportation Research Part A: Policy and Practice	2009	Survey	No specific type of rail	Netherlands	Users and general population	17,033 respondents	Satisfaction and the level and quality of access to the station influences the overall journey satisfaction. The quality and level of accessibility is an important element in explaining rail use.
Brons & Rietveld [25]	Built Environment	2009	Survey	No specific type of rail	Netherlands	Users	17,986 respondents	Travel comfort and time reliability were the two most important determinants of rail use. Infrequent users were more satisfied and attached more importance to accessibility and travel time reliability, and less importance to travel comfort. Users with car availability were slightly more satisfied than captive users.
Chatterjee et al. [5]	Department for Transport	2019	Survey	No specific type of rail	England	General population	Respondents in 40,000 households	While most had access to and frequently used cars, a third did not and rely on public and other transport modes to support their lives. Limited car access was more common among young adults, mobility impairments, unemployed people and those with low incomes.
Deakin & Orsolic [27]	Transport for the North	2025	Survey	No specific type of rail	North of England	Users and non-users	2,012 respondents	Respondents with substantial health conditions/illnesses experienced more difficulties and found rail station experience less accessible than those without such conditions. This was evident across journey planning, getting to the station, navigating the station, obtaining information, and using station facilities.
Givoni & Rietveld [28]	Transport Policy	2007	Survey	No specific type of rail	Netherlands	Users	2,542 respondents	Most passengers chose walking, cycling or public transport to get to or from the railway station. Car availability did not strongly impact access mode to the station. Station quality and the access/egress facilities strongly impacted the perception of traveling by rail.

Author and source	Publisher	Year	Design	Transport mode	Geographic scope	Research population	Sample size	Key findings
Kurup et al. [13]	Rail Human Factors Conference	2017	Qualitative	Passenger heavy rail	UK	Users	16 participants (8 commuter interviews and 8 leisure interviews)	Commuters prioritise efficiency and practical improvements over the overall travel experience, unlike leisure travellers who value the journey itself. There is a need for tailored information catering to diverse groups of travellers, and a refined model of passenger priorities based on journey type, personal context and knowledge of the rail traveller.
Lowson & Townsend [29]	Community Rail Network	2021	Literature review	No specific type of rail	UK	No data	No data	'Place-based' approaches and community-led activity, engaging and empowering local people, are key for modal shift. A range of work is taking place in community rail to bring partners together, engage local people, create modal alignment, and promote active travel.
Lowson & Townsend [30]	Community Rail Network	2023	Literature review	No specific type of rail	UK	Non-users. People with dementia, autism or mental health conditions, marginalised groups	No data	Community rail improved accessibility when grounded in local knowledge, involving those with lived experience, and using creative, holistic approaches that bring people together and provide a voice to marginalised people. These initiatives should maximise access and inclusion for a diverse audience.
Midlands Connect [31]	Midlands Connect	2022	Qualitative	No specific type of rail	The Midlands, England	Infrequent users, non-rail users, and users	26 focus groups of max. 5 participants per group	The common barriers to rail travel were high cost, unreliable service, lack of staff at stations/on trains, ticket complexity, early departure of last trains, and seat reservation issues. Recommendations included specific interventions for each attitudinal group (who differ on their train travel perceptions), simplifying fares, improving reliability, improving leisure travel, extending service hours, increasing staff presence, enhancing safety, tackling anti-social behaviour.
Musselwhite & Roberts [32]	Quality in Ageing and Older Adults	2021	Qualitative	No specific type of rail	South West of England	Infrequent users Older people	8 participants (in station audits and rolling stock accompanied by a researcher)	Two main themes were found across both rolling stock and station audits: accessibility and information provision.
Quadrangle [14]	Transport Focus and GBRTT	2022	Survey	Passenger heavy rail	England	Users	3,979 respondents	Accurate, timely, and consistent travel information was the top driver of passenger satisfaction, particularly for commuters. Business and leisure travellers valued a broader mix of priorities: simplified ticketing, wi-fi, safety, and accessibility. Reliable, on-time service remained the fundamental need across all groups.

Author and source	Publisher	Year	Design	Transport mode	Geographic scope	Research population	Sample size	Key findings
Rigby & Wheeler [16]	Transport for Greater Manchester	2019	Qualitative	Public transport and active travel	UK	Users and non-users	4,500 participants (interviews)	Frequent users valued speed, comfort, and savings, while infrequent users cited high fares, overcrowding, cleanliness and customer service issues. Challenges like unclear information, inconsistent service between operators, and personal preference for cars further impacted rail use.
Savanta [33]	Department for Transport	2024	Survey	No specific type of rail	England	Users	8,132 respondents	While digital ticket purchasing methods are widely used and preferred, ticket office use extends beyond ticket purchasing. Staff presence at the station was considered important for personal safety and customer support. Age and region influenced purchasing behaviour and preferences, with bank account access lowest among those aged under 26.
Sherwin & Parkhurst [15]	Cycling and Society Symposium	2008	Mixed methods	Passenger heavy rail	Bristol, England	Users	135 respondents	The majority were substituting a walking journey to the station with cycling with main motivations being saving time and getting exercise. The journeys included a mixture of journeys to work/education, socialising, shopping and leisure.
Sundling & Ceccato [34]	Transportation Research Part F: Psychology and Behaviour	2022	Literature review	No specific type of rail	International	Users and potential users	52 studies	Lighting, surveillance, other people's behaviour, time of day, and one's own gender affected passengers' safety. The review supported a link between certain physical environment characteristics and perceived safety.
Transport Focus [35]	Transport Focus	2019	Literature review	No specific type of rail	UK	Non-users	5 studies	While a small proportion of people were unlikely to ever consider rail, most people remained open to switching if key barriers—cost and convenience—are addressed. Both real and perceived issues, like service frequency, reliability, and pricing influence rail use attitudes.
Transport Focus [36]	Transport Focus	2022	Survey	No specific type of rail	UK	Users and lapsed users	12,565 users 2,661 lapsed	Top priorities for passengers were value for money, reliability, frequency of service, accurate and timely information, and getting a seat on the train.
Transport Focus [7]	Transport Focus	2024	Survey	No specific type of rail	UK	Users and non-users	2,006 respondents	While the impact of COVID-19 on public transport use continues to affect some people, nearly a fifth of current users increased their train usage in the last year. Key enablers that could encourage greater rail use included better value fares, improved reliability, and fewer disruptions.

Author and source	Publisher	Year	Design	Transport mode	Geographic scope	Research population	Sample size	Key findings
Verian [37]	Department for Transport	2025	Mixed methods	No specific type of rail	UK	Users, lapsed, and non-users People with disabilities	30 users 30 non-users including lapsed	Confirmed known physical and social barriers to travel and identified new ones: lack of knowledge, confidence and certainty; declining health and increased physical inaccessibility; perceptions of rail travel. Enablers included: real time information on facilities at stations/on trains for advanced planning, multi-modal provision of live travel information, accessible infrastructure, and integrated services.
Whittle et al. [38]	Travel Behaviour and Society	2022	Survey	No specific type of rail	UK	Car drivers	8,132 respondents	Residential relocation and parenthood were associated with changes in travel mode use frequency. Transport specific event (e.g. acquiring a driving licence) often accounted for greater likelihood of travel mode use change, though this varied by mode.

Table 1: RQ1 evidence exploring barriers and enablers to rail use included in the narrative literature review

Author and source	Publisher	Year	Design	Transport mode	Geographic scope	Research population	Sample size	Key findings
Golightly et al. [23]	European Transport Research Review	2024	Demonstration sites and survey	No specific type of rail	Athens, Greece; Brno, Czech Republic; Helsinki, Finland	No data	93 participants (16 in Athens, 17 in Helsinki, and 60 in Brno)	The research demonstrated the technical feasibility of Ride2Rail, a ridesharing app for making the first and last mile to and from the rail station.
Gravert & Collentine [18]	Journal of Economic Behavior & Organization	2021	Randomised controlled field trial with three-groups	Public transport	Skåne, Sweden	People who just moved to or within the region - some probably non-users of the regional transport but may be previous users of mode	14,282 cards (Participants per group: Control N = 4,764, Social norm group N = 4,758, 4-week travel card group N = 4,760)	There was no statistically significant effect of the social norm message on travel behaviour. However, participants in the 4-week travel card group were more likely to activate the card and use the travel card six months after the free trial ended, compared to the control group.
Ho & Mulley [21]	Australasian Transport Research Forum	2013	Cross-sectional household survey data	Public transport	Sydney, Australia	Families (households with children)	2,532 trips (number of households not specified)	The research identified no statistically significant effect of the group travel discount on travel behaviour in households with children. The authors suggest this may have been a result of scheme restrictions, such as only being valid on Sundays when people are less likely to travel and only being available for a small target population.
Ricci [19]	Centre for Transport & Society	2017	Qualitative	Passenger heavy rail	West of England	Infrequent and first-time rail users (non-users). Low income/ deprived communities	134 bookings (2,063 participants) 60 passenger feedback forms	The scheme was perceived as effective and reached groups of refugees, asylum seekers, people with mental and physical disabilities and families on low incomes. Non-users made up 28% of participants, and lapsed users 59%.
Ryan et al. [20]	Lighting Research & Technology	2022	Qualitative	Passenger heavy rail	Southwest of England	Users	24 survey participants 6 staff interviewed	Observations of passenger movements showed that some passengers interacted with the lights as expected. Survey responses suggest that the lights' meanings were not always understood. The results have implications for further product development and highlighted practical difficulties of trialling interventions in operational railway stations.

Author and source	Publisher	Year	Design	Transport mode	Geographic scope	Research population	Sample size	Key findings
Townsend [24]	Sustainable Railway Engineering and Operations	2022	Case studies	No specific type of rail	Britain	No data	Not relevant	The report examined the role of the community rail across Britain, drawing on qualitative and quantitative evidence collected by the Community Rail Network.
Tsirimpa et al. [22]	Transportation Research Part F: Traffic Psychology and Behaviour	2019	Demonstration sites and survey	Public transport	Birmingham, England and Vienna, Austria	Users Young, educated individuals who are tech avid	64 participants (35 in Birmingham, 29 in Vienna)	During the intervention period participants spent more time travelling by public transport and active travel (particularly walking) after points could be earned, compared to the baseline period.
Wallimann [17]	Transport policy	2024	Difference-in-difference with a synthetic control	Passenger heavy rail	Austria	No data	Panel dataset of 6 companies	The results indicate that the KlimaTicket had no statistically significant impact on short-run passenger growth compared to a data-driven counterfactual (constructed using other European railway companies to mimic the number of passengers of the Austrian Federal Railways without the KlimaTicket).

Table 2: RQ2 evidence about interventions to increase rail demand or improve passenger experiences included in the narrative literature review

RQ1: Factors that influence rail usage

The narrative literature review identified 111 factors, grouped into 24 thematic barriers and enablers to rail use. These were categorised using the COM-B framework, which has six sub-components:

- psychological capability – mental skills, such as attention, memory, and decision-making skills, and knowledge needed to perform a behaviour
- physical capability – physical strength, stamina, and dexterity needed to perform a behaviour
- physical opportunity – environmental factors, such as time, location and resource
- social opportunity – environmental factors as the result of social factors, such as cultural norms and social cues
- reflective motivation – deliberative mental processes, such as making plans and weighing up costs and benefits
- automatic motivation – automatic mental processes such as desires, impulses, and inhibitions

Capability and motivation are internal to an individual, whereas opportunity refers to factors external to the individual.

The review identified themes in all six COM-B sub-components: ten under physical opportunity, six under reflective motivation, three under social opportunity, three under automatic motivation, one physical capability, and one psychological capability (see Figure 2). For more information about each factor within each theme see **Annex E**, Appendix Table 6.

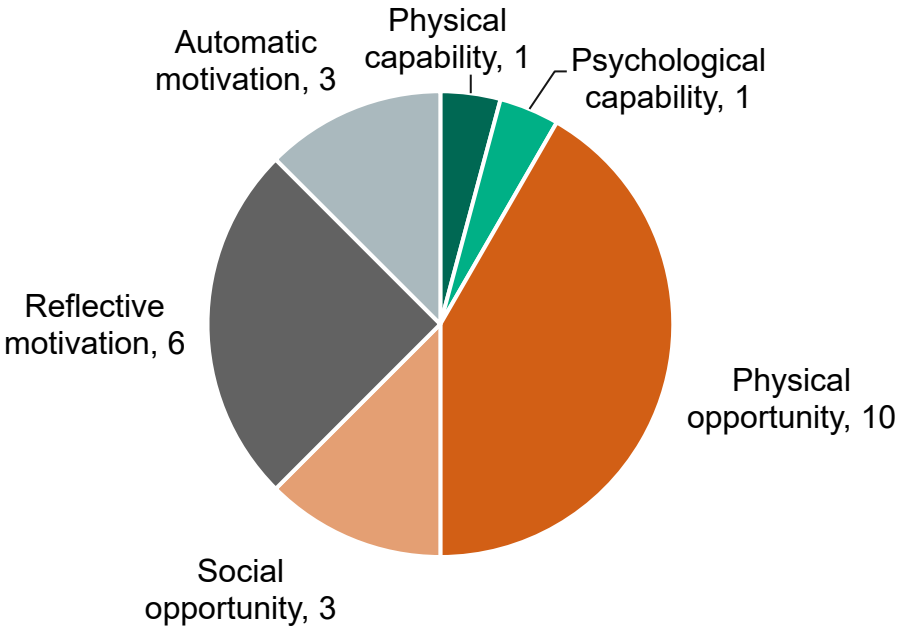

Figure 2. The number of themes identified against each of the COM-B sub-components

The findings are organised in four rail journey stages:

- planning a journey
- buying a ticket
- in the station/on the train
- travelling to/from the station

Table 3 shows the themes that were identified and the journey stage(s) they apply to. Most themes were relevant to more than one journey stage. Themes that are relevant to all journey stages are reported once under 'whole journey' but may have some stage-specific themes that are also reported separately under another stage. For example, passenger characteristics can impact travel behaviour and rail experiences at all stages of the journey, but there are particular passenger characteristic factors, like travelling with cumbersome baggage, that impact behaviour and experiences in the station/on the train.

	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation
Planning a journey	**Passenger characteristics**	No themes identified	**Information provision**	Group identity	**Confidence**	**Emotions**
			Accessibility of other forms of transport	Social influences	Comfort	Habit/familiarity
			Availability of trains		Perceived value for money	Individual and professional role identities
			Disruption		Freedom (downtime/control)	
			Door-to-door logistics & interchanges		Perceived quality	
Buying a ticket	**Passenger characteristics**	No themes identified	**Information provision**	No themes identified	**Confidence**	**Emotions**
			Disruption			
			Physical accessibility			
			Station and onboard facilities			
			Train tickets			
In the station/ On the train	**Passenger characteristics**	Awareness of information	**Information provision**	Other passengers	**Confidence**	**Emotions**
			Physical accessibility		Comfort	Habit/familiarity
			Security		Feeling safe	
			Sensory		Freedom (downtime/control)	
			Station and onboard facilities			
Travelling to/ from the station	**Passenger characteristics**	No themes identified	**Information provision**	No themes identified	**Confidence**	**Emotions**
			Physical accessibility			
			Security			
			Station and onboard facilities			

Table 3. Themes identified in RQ1 organised by journey stage (rows) and COM-B sub-component (columns). Bold is used to highlight themes relevant for the whole journey

Whole journey

Some themes affect the journey as a whole: from the point of deciding whether to make a journey by rail, through purchasing a ticket, travelling to and from stations, and the passenger experience in stations and onboard. The themes identified across whole journey covered all three components of behaviour - capability, opportunity and motivation.

Passenger characteristics impact individual capability and can create barriers to using public transport in general and rail specifically. Examples in the literature included physical impairments and health conditions, neurodiversity or being digitally excluded. Information provision is an opportunity factor; different users have different information needs at each stage of the journey that, when met, can enable decisions to travel by train.

Motivation themes relevant to the whole journey include confidence and emotions. Being confident in one's own abilities to make journeys by rail generally – and at particular journey stages – can enable rail travel. However, a lack of confidence is a barrier for some groups (e.g. younger travellers and non-users). Positive emotional associations with rail travel can be an enabler to choosing rail, for example taking enjoyment from the scenery or being also to socialise with friends and family can be a reason to choose rail over other modes. However, negative emotional associations can be a barrier, particularly where individuals associate train travel with feelings of fear or anxiety.

Physical capability themes

Passenger characteristics. Individual characteristics that affect physical capability include mobility impairments [5], [11], [13], [30], [37], neurodiversity [30] and poor physical health [7], [27], [35]. These are barriers to planning and making a rail journey. Those travelling with dependents such as young children [5], [35] are also more prone to find public transport – including trains – unattractive due to challenges travelling in a family group or boarding/alighting with a pram, small children or luggage. A model based on data from the UK Household Longitudinal Study found that people who become parents, whether for the first time or not, are less likely to increase their use of train use compared to people who have not become parents [38]. Digitally excluded groups also face further barriers to using rail where systems are mostly or wholly online [33].

Physical opportunity themes

Information provision. Rail journeys are facilitated by information: knowing the station layout and the location of ticket machines, when your train will arrive, and whether and when to make interchanges allows people to plan their journey and respond to changes and challenges as they arise. This information is especially enabling when it is relevant, accurate, and personalised [11], [14], [27], [36]. The absence of such information can be a barrier, especially for commuters [14], neurodivergent users and those with a mental health or neurological condition [36]. Accurate and timely information about train times is one of the most important features for rail travellers, ranked next after value for money, the reliability and punctuality of trains, and the actual frequency of services [36]. Real time updates are valued by users across the journey span [14], [16], [26], [37], especially by younger users [26]. This information helps travellers to plan their journeys and make any necessary changes in good time – for example, to leave earlier or to book a taxi for their

onward journey. Consistent information provided across multiple sources before and during a journey – for example, online, on apps, and on station boards – is also an enabler of rail travel [13], [27]. Inconsistent information across sources, or a lack of information from particular sources, can lead to confusion and uncertainty. For groups with physical disabilities, impairments and health conditions, appropriate accessible information enables both planning and making journeys [13], [26], [27], [30], [32], [35], [37]. Examples of accessible information can include adapted signage and timetables for easier use by people with dementia [32] or autism [30] and hearing loops/Bluetooth support via hearing aids for those with hearing impairments [27], [35].

Reflective motivation themes

Confidence. Low confidence can lead to uncertainty around how to purchase tickets, and navigate stations and trains [31]. Lack of confidence in one's ability to plan and make a rail journey can invoke feelings of anxiety, or anticipated anxiety, that could be avoided by choosing a more familiar form of transport over train travel [30], [31], [35], [37]. This is a theme that especially affects younger travellers and non-users [37]. Initiatives have been piloted to improve confidence in train travel among marginalised groups. For example, virtual reality technology has been used to develop an immersive station walkthroughs for people with conditions such as autism; these virtual environments allow people to build confidence before attempting real journeys [30]. Educational group trips and guided 'wellbeing walks' for people less aware of how to travel by train have also been used to increase confidence [30].

Automatic motivation themes

Emotions. Fear, stress and anxiety are recurring barriers arising both generally across all journey stages and specifically from being in crowded public spaces [37]. These include purchasing the correct ticket [31], boarding and alighting trains (especially if the platform is crowded) [31], [32], finding one's seat reservation and having to confront other passengers if they are sitting there [31]. Some non-users would not consider travelling alone due to these fears [31]. Heightened feelings of stress and anxiety were particularly relevant to individuals with mental health issues, neurodivergent people, and wheelchair and mobility scooter users [37]. By contrast, personal resilience (for example patience and pragmatism in the face of challenges) and willingness to ask for help can enable rail travel [37]. Fear is also related to safety and security concerns, with the perceived risk of accidents or emergencies while using trains being a barrier to use [11].

Conversely, positive emotions can be an enabler of rail use. For example, enjoyment can enable rail travel for those who find it more relaxing and less stressful than driving [11], [16]. These individuals enjoy the opportunity to socialise with friends and family in a group and to have an alcoholic drink [11]. Others find cycling to and from the station a source of pleasure [15]. Enjoyable journeys by rail in groups could increase the likelihood of returning to train travel for some lapsed users. For example, some community rail groups have run projects giving people with dementia who have not travelled by train in many years the chance to go on a trip that will encourage happiness and evoke memories [30].

Planning the journey

Planning a journey involves working out how to get from A to B, including by considering which mode of transport is most convenient, comfortable, or provides sufficient control; whether interchanges between and across modes of transport are needed; and the cost of making the journey. Planning a journey can also take into consideration the expected barriers and enablers at other stages. Decisions to travel by rail at this stage are impacted by many of the opportunity and motivation themes. Barriers at this stage may be felt more strongly by infrequent users, neurodiverse users and those with a mental health condition.

In terms of opportunity to travel by rail at the journey planning stage, choosing rail is less likely when levels of disruption are high and when it is difficult to access stations or to make interchanges. However, providing clear information about station and rail services, and offering frequent rail services can enable planning journeys by rail. Cultural identity and social influences also emerged as opportunity barriers to choosing to travel by rail. For example, social norms and values (such as wanting to be seen as environmentally friendly) can increase the attractiveness of public transport over private vehicles. However, for some people owning and driving a car brings with it social status that is not afforded by travelling by train.

In terms of motivation themes, enablers included perceiving the quality of rail services as high, in terms of their running on time and being clean among other factors, and that the cost provides value for money. On the other hand, making journeys habitually using other modes of transport or feeling less familiar with railway stations and rail travel were barriers to choosing rail. Some individual and professional role identities make rail travel more or less likely; for example, having a job linked to car or van travel.

Physical opportunity themes

Accessibility of other forms of transport. A lack of access to alternative transport (e.g. a car) can encourage rail use [5], [15], [38]. By contrast, people who have access to a car (or other mode of transport) may find that more convenient than rail for their journey and be less likely to use the train [7], [12]. Having access to a car could make it easier for people to get to the train station. However, having access to a car is not a strong determinant of how people choose travel to stations when other options are available (e.g. walking, cycling or taking a bus) [28].

Disruption. The reliability and punctuality of rail services, including delays and cancellations, can be a barrier to travel by rail [7], [11], [12], [13], [14], [16], [25], [31], [35], [36], [37]. A reliable and punctual train service was ranked the second most important feature by rail users (out of 25) [36]. This is true for all of users, lapsed users and non-users, but may be especially relevant to infrequent travellers, who attach more value to travel time reliability [25], and to commuters and those in rural settings [36]. Some reports specifically highlighted the impacts of rail strikes [7] and engineering works, which can be planned to minimise disruption [14].

Information provision. Rail travel is enabled by the provision of information about station facilities and rail services – for example, whether lifts are available, or the busyness of services [11], [26], [27], [32], [37]. This is especially helpful for disabled users [37]. In relation to disruption, passengers value having information about delays and their

alternative travel options, and being kept informed about ongoing disruption [14], [16], [36]. This is particularly valued by women, younger travellers, and those with a mental health condition [36]. Information about multi-modal travel, including the journey to the station, is also valuable for those with multi-stage journeys [14], [29].

Door-to-door logistics and interchanges. The duration of a journey from starting point to final destination can be an enabler or barrier to rail travel. Journeys by rail can take longer than alternatives (e.g. by car or air [12]), so rail may be impracticable or less preferable [7], [11], [12], [14], [31], [35], [36]. The absolute distance of a journey may change whether an individual prefers to travel by car or public transport [38]. Infrequent train users tend to overestimate train journey and wait times, or overestimate how quick car travel is [11]. Infrequent train users may also allow more time for accessing the station than they need, increasing journey times [12]. There is evidence that men value shorter journey times more than women [36].

When planning a trip by rail, users must consider the convenience of getting to and from the station at either end of their journey, including the distance and duration of that stage of the journey, the accessibility and comfort of the journey, and the travel modes available [5], [7], [11], [12], [15], [25], [26], [27], [29], [30], [35], [38]. Convenience may be weighed directly against the convenience of completing the whole journey by car. The (in)convenience of the journey as a whole is a theme among both users and non-users, and can be more of a barrier for those with a health condition [27].

Effective integration of rail with wider public transport networks – including road infrastructure, bus, tram or metro infrastructure, and coordinated timetabling – is also an enabler of rail travel [11], [14], [28], [29], [35], [36], [37]. Likewise, the requirement to make connections between rail services can be a barrier [7], [11], [14], [16], [35], [36], [37]. This is a barrier among users, lapsed users and non-users (e.g. [36], [37]). Good connectivity between services can enable travel for commuters [36]. Rail travel may be less convenient for trips with luggage or 'linked trips': chains of short, connected trips, for example travelling home via school and the supermarket. Women are more likely to make these trips [31] and they are more complicated for those travelling with children [12].

Availability of trains. The frequency of rail services, and the times at which they run, enable rail travel if they can they help meet an individual's journey needs [14], [16], [35], [36]. Infrequent or inconveniently timed services are a barrier, which is more likely to be an issue during off-peak hours [11], in less-populated areas [11], or for the last train of the day [31]. Sufficiently frequent trains is ranked as one of the most important features for rail travellers, after value for money and reliability [36]. Similarly, the destinations served by rail can be an enabler (e.g. locations harder to access by car) or a barrier (e.g. locations easier to access by car) [7], [35].

Social opportunity themes

Group identity. Some individuals may have a cultural group identity that influences how they travel, for example, those who belong to faiths where women cannot travel alone [12].

Social influences. For some, owning a private vehicle is a status symbol, while public transport can be seen as lacking status [11], [31]. Other social norms and values may affect rail use. For example, wanting to be environmentally friendly may increase use [14],

[29], [36]), whereas perceiving public transport as (un)desirable may reduce use [11], [29]. Community engagement or social recruitment, where individuals are invited by others from their social context, can enable rail uptake [11], [15], [29] because it capitalised on existing relationships and creates social norms of rail use.

Reflective motivation themes

Comfort. How comfortable a journey is to make can depend on contextual factors such as whether it is expected to rain on the day. Adverse weather can discourage people from using public transport [12].

Perceived quality. Perceptions that the quality of rail services is low – for example, that trains don't run on time, stations and trains are not clean, and there is no support available during the journey – is a barrier to travel [11], [12], [13], [14], [25], [31], [35], [37], especially for non-users [12]. This may or may not be a fair assessment of the actual service quality, but perceptions affect behaviour nonetheless.

Confidence. Some users may not be confident in making interchanges, either between rail services or between transport modes [14], [35], which is a barrier for some journeys. For example, users may be concerned about whether they are able to alight, navigate the station and board in time.

Perceived value for money. The perception of poor value for money can be a barrier for many people [7], [11], [16], [25], [26], [28], [29], [36], with cost comparisons are often made between rail travel and other modes (predominantly by car) [5], [12], [13], [31], [35], [37]. Increases in car travel cost, such as fuel costs, can be an enabler to travelling by train [7]. However, car-associated costs are treated differently – they may be underestimated or considered as necessary [11]. Some reports describe the perceived actual cost of rail travel as a barrier [7], [11], [13], [14], [27], [31]. Perceived cost or value for money is ranked as the most important feature of the rail service for rail users [36]. Perceived value for money is an especially important factor for leisure travellers [13], [36]; commuters are more likely to be influenced by season ticket prices [13].

Freedom (Downtime/control). Using rail means that travellers have less control over how they make their journey, which can be a barrier for some users [11], [13], [16], [35]. Aspects of control include choosing the time that one leaves home to start a journey and being able to make changes to travel plans in the event of disruption [13]. By contrast, rail travel means that travellers have more freedom to integrate active travel into their journey, for example by walking or cycling to the station [15], [29].

Automatic motivation themes

Habit/familiarity. Some individuals have default modes of travel: those whose default is car or van are unlikely even to consider rail travel [12], [29], [35], while those whose default is active travel may be more disposed to multi-modal travel including rail [15]. These modes may be specific to a particular kind of journey, for example, travel to work or for leisure [29]. More frequent journeys can reinforce the habit of using a particular mode [7], [15], [30], [31]. Those who have recently moved house have the opportunity to adopt new habits for their commute [38]. Familiarity with rail products and services leads to minimal effort

using them, which can increase perceived convenience and reinforce habit loops [29], [30], [35], [37].

Individual and professional role identities. Particular individual and professional role identities may make someone more likely to travel by rail; for example, identifying as environmentally conscious or active [29]. Some people identify with a particular form of transport, for example seeing themselves as a 'cyclist' [15], 'van driver', 'car driver' or a 'rail user' [16]]. This sense of identity can influence behaviour, making individuals more likely to choose that mode over others, even when alternative modes are available.

Buying a ticket

Buying a ticket involves two main steps: choosing the right ticket for your journey and purchasing that ticket, either online or at the station. This stage is predominantly affected by opportunity themes, but also motivation.

Opportunity themes include the complexity of fares or services, and the quality of information provided about products; these themes interact to determine how easy it is to make the right choice. Having the opportunity to buy tickets online and in person, from station offices or ticket machines, enables rail travel for people who have strong preferences for how they like to buy tickets. For example, older travellers may prefer to buy tickets at the station, and younger travellers online or through a ticketing app.

In terms of motivation, a lack of confidence in choosing the right ticket (e.g. knowing the difference between an advance single, off-peak, and super-off-peak ticket; or confidence in using digital tickets) can be a barrier, especially among those with lower confidence using rail generally and those from digitally excluded groups.

Physical opportunity themes

Physical accessibility. Inaccessible ticket offices and machines are a barrier to buying tickets [27]. This happens when offices and machines are the wrong height or hard to reach and can particularly affect those with physical impairments or health conditions.

Disruption. Train use can be enabled if tickets remain valid for other services in the event of disruption [14]. The impact of disruption as a barrier is also reduced when rail operators make it easy to claim compensation following delays [14]. However, the ease of claiming compensation is not a priority for most users when they are considering purchasing a ticket [36].

Information provision. Clear explanations of ticket and fare options, and how to choose the right ticket for your journey(s) – as distinct from the actual complexity of tickets or fares – enable rail travel [11], [14], [30], [31], [37]. This was identified in a general population sample [11], as well as samples of people with dementia, autistic people, people with mental health conditions, marginalised groups [30], and people with disabilities [37]. In the absence of clear information, providing education about ticket types [30] or support from staff can overcome this barrier [31].

Train tickets. Aspects of tickets/fares that are complex include: peak hours, single/return types, zones, different operators [2], and split tickets [12]. Some groups prefer manual/cardboard tickets (e.g. disabled users), while others prefer online tickets (e.g. younger users) [33]. Lack of access to a bank account, which is especially an issue among younger people, can be a barrier to purchasing rail tickets online [33]. Having diverse payment options available (e.g. cash and online) enables different groups (e.g. disabled or older people versus younger users) to pay the way they prefer [33]. Several reports highlighted that (simple) multi-mode tickets (e.g. across rail, bus, ferry or tram services) enable rail use among users and non-users, by reducing the need to understand and purchase different tickets for each mode [7], [14], [29], [37].

Station & onboard facilities. The provision of staffed ticket offices is important for some users (e.g. cash users [33] and older people [14], [27]) and those with a health condition [27]), while some are more likely to use ticket vending machines (e.g. men [33]). However, ticket machines that are difficult to use or navigate can be a barrier to buying a ticket [14], [27], [37]. Some rail users prefer stations where they can tap in and out with contactless payment, bypassing the need to buy a ticket [14].

Reflective motivation themes

Confidence. High or low confidence in choosing the right ticket for the journey can be an enabler or barrier for rail use [30], [37]. This emerged in communities with lower confidence in rail travel more generally: those with a disability [37], mental health condition, dementia, autism and members of marginalised communities [30]. A lack of digital confidence may also be a barrier to buying a ticket for some people [33].

In the station/on the train

This stage of the journey covers moving through the railway station, boarding the train, and on the train itself. By this stage, travellers have already decided to travel by rail, but experiences at this stage may influence whether and how people travel by rail again. This research identified themes at this stage from all three COM-B components that may influence future rail use.

Capability themes include passenger characteristics: for some passengers, travelling with luggage is a barrier to using rail, particularly to moving freely around stations, boarding trains, and finding luggage space. Awareness of information and of where to get information and assistance also influences the experience of getting in and around the railway station.

Opportunity themes at this stage include the availability and accessibility of station facilities (such as waiting rooms or toilets); this was particularly important for disabled or older people. The physical security of stations and the presence of staff (e.g. on platforms providing help and information) are also enablers for some travellers including female and older users. However, the presence of other passengers can be an enabler (e.g. providing reassurance or a sense of safety) or a barrier (e.g. overcrowding, unpleasant smells and noise from other passengers).

In terms of motivation, familiarity with train station layouts, confidence using rail, feeling comfortable (e.g. getting a seat, carriages being a comfortable temperature) and safe can all contribute to a positive experience. When people expect rail travel to be easy, comfortable, and safe, this increases the attractiveness of rail over other modes of transport.

Physical capability themes

Passenger characteristics. Cumbersome baggage (e.g. suitcases or work tools) may be a barrier to using rail depending on passenger capability to carry heavy loads; this was a reason to travel in a car or van instead [12].

Psychological capability themes

Awareness of information. Not knowing where to find information or assistance can be barrier [14], [30], [37], both for non-users [30], [37] and users [14], [37]. There may be specific services, for disabled people for example, that would enable their rail travel if they were aware of them [37].

Physical opportunity themes

Physical accessibility. The physical accessibility of stations and their facilities can enable rail travel [13], [14], [16], [27], [30], [32], [36], [37], including features such as toilets [13] [37], hearing loops [32], and the physical terrain [32] [37]. The physical accessibility of trains, including gaps when boarding/alighting [32], space to manoeuvre, [32] [37] and toilets [32] [37], can also be an enabler or barrier [7], [14], [16], [32], [36], [37]. Interchanges may impose additional physical demands, for example the need to rush [30], so can exacerbate existing accessibility barriers, such as the need for assistance or working lifts [14], [16], [27], [32]. An accessible railway system has been found to be more of a priority for travellers who are younger [36], disabled [14], [33], [36] [36] [33], have a health condition [30], [33] or are neurodivergent [30]. For those who are travelling with a bicycle, the ease or difficulty of taking their bike on the train can be an enabler or a barrier [15].

Security. Physical security at stations and onboard trains is influenced by lighting [32], [34], surveillance via CCTV or security guards [11], [14], [34], and whether the station is empty or has staffed activity nearby, for example, a food counter [11], [34]. The security of the environment is a more important theme for women than for men [34]. Personal security in stations and on trains is ranked 6th in importance out of 25 features of the rail service [36].

Sensory. There are sensory barriers to travelling by train, including lighting (which may be too bright or too dark), noise (e.g. from trains, freight, or other passengers) and smells (e.g. from train fumes or unclean facilities) [32], [37]. These were noted as barriers for disabled and older users [32], [37]. Sensory factors may lead to overstimulation, which is a barrier for non-users including those with autism or a mental health condition [30].

Station and onboard facilities. The availability of facilities – including waiting areas, seating, toilets and shelters – enables rail travel [11], [25], [26], [28], [32], especially for older users [32]. A lack of space for bags/luggage on trains and in stations is also a barrier

[14], [16], [32], although this is of low importance for most passengers, ranked lowest of 25 features of the rail service [36]. Passengers value a reliable Wi-Fi/internet connection or mobile signal, for work, leisure and so they can access information during the journey [11], [13], [14], [36]. However, reliable Wi-Fi or mobile reception is not a high priority for users compared to other features of the rail service [36].

The presence of visible, approachable, informed and helpful staff – in the station, on the concourse and onboard – benefits all types of travellers [14], [15], [16], [30], [31], [32], [33], [34], [37]. Travellers want staff to be available to provide general support and reassurance [30] [32] [33] [34], support their access to trains and facilities [15], [31], [37], and ensure the consistency of services [32]. The presence of staff is more important to older and disabled travellers [33]. For passengers with particular accessibility needs, staff awareness of their needs [16], [30], [37] and an effective Passenger Assistance service [32] are also enablers.

Social opportunity themes

Other passengers. Some individuals dislike being around other people or in crowds; the risk of overcrowding on a train may lead them to prefer to travel alone or by car [7], [11], [13], [32], [34], [35]. Overcrowding is a barrier for all user types [7], [34]. Unwanted social interactions on trains, for example around seat reservations or being hurried to disembark, can also be a barrier – identified by disabled and neurodivergent individuals [30], [37] as well as more generally [31]. However, travellers with particular access needs may benefit more from the support of other passengers [13], [30].

Other passengers can sometimes exhibit antisocial behaviour, including loudness and drunkenness, which may threaten users or otherwise worsen their experience [7], [13], [32], [34].

Reflective motivation themes

Comfort. A comfortable journey is an enabler of rail travel [16], [30]. This includes the cleanliness of stations, trains and their facilities, such as waiting rooms and toilets [7], [11], [13], [32], [34], and the temperature of train carriages [13], [16]. For some users, the journey is more comfortable when they can get a seat or table, which they cannot always know in advance [11], [13], [14], [36]. Getting a seat on the train is one of the most important features for passengers, ranked 5th out of 25 features, and is more important for leisure travellers [36].

Confidence. Confidence in using routes and stations, for example, how to navigate a station, where to find information and how to interpret it, is an enabler for rail travel. Among disabled people, who may have more particular needs, confidence to ask for help can mitigate this barrier [37].

Feeling safe. Users' sense of personal security, that is, their feeling of safety and perception of the security of their belongings, can be a barrier to rail travel [11], [12], [16], [26], [34], especially at particular times (e.g. at night) [34]. Feeling safe while travelling is especially important to women and those with a mental health condition [36]. A sense of insecurity can be worsened by platforms that make travellers feel exposed [34], not

knowing when the train will arrive [34], and the absence of visible staff or passengers who might provide reassurance [32], [34].

Freedom (Downtime/control). While on the train, passengers are able to travel and socialise in groups [11], and are able to work or relax on the way [13], [15], [16], [35], including by having an alcoholic drink [11], [16]. These freedoms are not afforded in the same way by car travel.

Automatic motivation themes

Habit/familiarity. Familiarity with station layouts mean that users can automatically move through, without the need to navigate station signage [30], [37]. This is especially beneficial for non-users with a disability [30], [37], mental health condition or autism [30].

Travelling to/from the station

Travelling by rail involves getting to and from the station. Depending on access, preference and convenience, this stage of the journey can be made on foot, by bicycle, by public transport, or by car or taxi. The themes at this stage of the journey are especially relevant for users with a disability or mobility impairment, and travellers making multi-stage or multi-modal journeys.

Travel to/from the station is influenced by opportunity themes, including physically accessible routes to the station (e.g. cycle paths); safe routes (e.g. paths with good visibility); and station facilities that enable onward travel, such as drop-off points, parking and cycle storage. Stations without these features could expect lower uptake of their services.

Physical opportunity themes

Physical accessibility. The availability of routes to and from the station – for example, safe roads, pavements, and cycle paths – enable travel by rail, especially for multi-modal journeys [15], [29].

Security. Rail travel is enabled by safety in the areas around stations, including visibility in on paths, alleys and underpasses leading to or away from the station [34], the security of car and bike parking [11], [15], and the local crime rate [34].

Station and onboard facilities. Stations that have sufficient drop-off points [27] or sufficient parking or bicycle storage [14], [15], [16], [27] enable travel to the stations by taxi, car, motorbike or bicycle. This is especially relevant for disabled travellers who may not be able to access the station on foot or by bus [27].

RQ2: Interventions to improve ridership

The research team identified eight reports focused on interventions to encourage rail use or improve rail passenger experiences [17], [18], [19], [20], [21], [22], [23], [24]. One of these reports focused on community rail, rather than a specific intervention, so was not included in the BCW analysis [24].

The interventions identified in the narrative literature review were coded into the nine BCW intervention functions. These intervention functions are broad categories of ways to change behaviour:

- enablement – increasing means/reducing barriers to increase capability or opportunity
- environmental restructuring – changing the physical or social context
- restriction – using rules to reduce the opportunity to engage in the target behaviour (or to increase the target behaviour by reducing the opportunity to engage in competing behaviours)
- persuasion – using communication to induce positive or negative feelings or stimulate action
- incentivisation – creating expectation of reward
- coercion – creating expectation of punishment or cost
- modelling – providing an example for people to aspire to or imitate
- education – increasing knowledge or understanding
- training – imparting skills

Most intervention functions address multiple COM-B components to enable behaviour; and the same intervention may serve multiple intervention functions. For example, a marketing campaign might include education, persuasion and modelling. Table 4 shows which COM-B sub-components are addressed by each intervention function.

	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation
Enablement	✓	✓	✓	✓		✓
Environmental restructuring			✓	✓		✓
Restriction			✓	✓		
Persuasion					✓	✓
Incentivisation					✓	✓
Coercion					✓	✓
Modelling						✓
Education		✓			✓	
Training	✓	✓				

Table 4: Mapping of the BCW intervention functions to the COM-B components they most effectively address

In this section, we map the interventions identified in the review to the BCW intervention functions to identify whether they target the barriers and enablers identified in RQ1. The interventions used four of the BCW intervention functions: incentivisation [17], [18], [19], [21], [22], enablement [17], [19], [21], [23], persuasion [18], and environmental

restructuring [20]. Table 5 shows how the interventions map onto the BCW intervention functions. Three of the interventions that reduced cost of travel combined this with enablement functions, such as making ticketing simpler and more flexible [17], [21] or removing the need to buy a ticket altogether and allowing existing community groups to travel together [19]. One intervention used incentivisation in the form of a points scheme [22] and one used a 4-week free travel card scheme [18]. One intervention used environmental restructuring [20] and one used social norms [18] to encourage rail or public transport use. None of the interventions identified in the review used coercion, education, training, restriction or modelling as intervention functions. For more information about the intervention design, context, evaluation and findings in each report, see **Annex E,** Appendix Table 7.

The interventions in the review addressed 36 out of the 111 factors identified in the RQ1 narrative literature review. The number of factors addressed by each intervention varied from two [18] to 19 [19]. The themes most commonly addressed by the interventions were cost [17], [19], [21], physical accessibility [19], [20], [23], confidence [17], [19], [21], products and services [17], [19], [21], and social influences [18], [19], [22].

Research that explored enablers to encouraging Bike-to-Rail travel, included in RQ1 [15], led to the piloting of an intervention to encourage rail use [39]. The result of this pilot is discussed below as one of the nine interventions, but the results are not included in Table 5 or Appendix Table 7

Many of the most frequently cited barriers and enablers in the previous section (identified in four or more texts) were not targeted by any of the nine interventions. These unmet barriers represent areas for potential future interventions and include:

- **information provision:** interventions could focus on making information more accessible, consistent, relevant, accurate and personalised. In particular, focusing on providing information about facilities and services, delays and travel options in the event of disruption, journeys that require multiple modes of transport and clear explanations of tickets and fare options help to overcome barriers to travelling by train. Information is a stronger enabler when it is delivered consistently through multiple communication channels, and when it is relevant, accurate, personalised, accessible and delivered in real-time.
- **downtime benefits of rail over car travel:** interventions could focus on improving passenger experiences and communicating these benefits. For example, being able to work and relax during the journey (compared to driving).
- **perceived and actual safety:** interventions could focus on reducing antisocial behaviour from other travellers.
- **comfort of rail travel:** interventions could focus on increasing the provision of visible staff available to help, improving seat reservation systems and the cleanliness of stations/trains.
- **cars versus rail (cars perceived as less expensive, more convenient, providing more control over the journey):** interventions could focus on improving trains as a viable and attractive alternative to cars. This could be done by making rail travel more accessible, affordable (in terms of actual and perceived costs) and convenient.
- **rail service coverage, frequency and connections:** interventions could focus reducing the need to make multiple train connections or to switch between multiple

modes to make an end-to-end journey, reducing the door-to-door journey duration when travelling by rail, and improving the reliability of services.

- **physical accessibility:** enabling access to stations and to facilities inside stations (such as waiting rooms, ticket offices/machines and toilets), and enabling access to trains (including for those with bicycles or during interchanges) will help to overcome barriers. This is especially the case for those who have additional accessibility needs, such as disabled users.
- **tickets:** rail services and products that are structured simply and available through different means (e.g. digital or manual tickets, and diverse payment options) enable travel. Multi-modal tickets (such as across bus and rail services) and tickets that remain valuable in the event of disruption also help to mitigate barriers and leverage enablers.
- **station and onboard facilities:** the available station facilities can enable rail travel and help to overcome barriers; the absence of facilities may be a barrier for some users. Facilities that should be considered include parking/drop-off points, staffed ticket offices, ticket machines, waiting areas/seating, Wi-Fi and Passenger Assistance. The presence and visibility of helpful, informed staff is also an important factor for travellers and contributes to the security of stations.

	Enablement	Environmental restructuring	Restriction	Persuasion	Incentivisation	Coercion	Modelling	Education	Training
Ride2Rail [23]	✓								
Skånetrafiken (Social norms) [18]				✓					
Skånetrafiken (Extra 2-week free travel) [18]					✓				
Family Funday Sunday ticket scheme [21]	✓				✓				
Days out scheme [19]	✓				✓				
Lighting [20]		✓							
OptimumPoints programme [22]					✓				
KlimaTicket [17]	✓				✓				

Table 5: Interventions identified in the RQ2 narrative literature review and their primary associated BCW intervention functions

The findings of the RQ2 studies are presented by intervention function, in order of prevalence. Starting with incentivisation, and followed by enablement, environmental restructuring, and persuasion.

Incentivisation

Incentivisation interventions address motivation by creating an expectation of reward or by reducing or removing the costs associated with a behaviour. Five interventions directly incentivised rail use: two by offering a discounted rail ticket [17], [21], one with reward points [22], one by making a day trip free [19] and one by increasing the duration of a free trial travel pass [18].

The Family Funday Sunday scheme and KlimaTicket both reduced the cost of travelling by rail [17], [21]. The Family Funday Sunday ticket cost $2.50 AUD per person, which was the same as a single trip ticket at the time. The KlimaTicket offered unlimited travel for a year at a fixed price of 1,095 Euros (and 821 Euros for youths, seniors, and individuals with disabilities). Compared to its predecessor, the Österreichcard, the KlimaTicket was a price reduction of 44 per cent. Both schemes addressed reflective motivation enablers such as wanting to take advantage of ticket deals that provide greater perceived value for money compared to a single-trip ticket (if used for multiple journeys). Interventions that reduce the actual cost of train tickets also address financial opportunity barriers that occur when trains are relatively more expensive than other modes of transport, or too expensive for people to use at all.

However, there was no evidence to indicate that the Family Funday Sunday Scheme increased rail use for families with children [21]. The research evaluating the scheme was based on cross-sectional household survey data, so could not have established a causal link between the introduction of the scheme and a change a travel behaviour. Regardless, the authors found that the proportion of group trips taken by eligible households using public transport was 5.7% before the scheme was introduced and 4.9% afterwards. However, this difference was not statistically significant. Almost all group trips on Sundays by the target population were made by car, both before and after the scheme was introduced.

There was also no evidence that the KlimaTicket increased the number of rail passengers in the first two years it was launched [17]. The research evaluating the impact of the KlimaTicket used a quasi-experimental design to identify a causal relationship between the introduction of the scheme and the number of rail passengers. On average passenger growth in the first two years of the scheme on the Austrian national railway was positive. However, there was no statistically significant relationship between the KlimaTicket and rail travel demand growth. The authors conclude that their research supports a wider finding in the literature that attractive pricing alone does not incentivise shifts to rail transport from private cars.

The Days Out Scheme went one step further and offered a free day return trip for community groups of up to 20 people [19]. In doing so, the Days Out Scheme reduced reflective motivation and opportunity barriers to train use associated with the perceived and actual cost of rail travel compared to other modes. A follow-up survey was conducted with participants to explore perceptions around barriers to rail travel. The results showed

that affordability was by far the biggest perceived barrier to rail travel; 58 per cent said cost of train fares was a barrier.

The Skånetrafiken 4-week free travel card also incentivised the use of public transport by removing reflective motivation barriers about the cost of using public transport [35]. The intervention sat within an existing flyer campaign that was sent to people who had recently moved to or within Skåne, Sweden. The timing was deliberately chosen to optimise the interventions' chances of success, as people were likely in the process of establishing new travel habits. The flyer included the resident's name, their closest public transport stop, information about Skånetrafiken, and the offer of a travel card free trial. The researchers ran a randomised controlled trial (RCT) to test the impact of offering a 4-week free trial, compared to a 2-week free trial. Participants in the 4-week free trial group were statistically more likely to activate the travel card (44.12%, n = 2,100) compared to the 2-week free trial group (34.45%, n = 1,614). After six months, the proportion of travel cards still in use fell in both groups, although there were more active cards in the 4-week free trial group (5.63%, n = 268) than the 2-week free trial group (3.76%, n = 79). Therefore, the evidence suggests that increasing the free-trial period from 2-weeks to 4-weeks did increase the number of people who activated a travel card and the number whose travel card was still active after six months. However, most participants who activated the card stopped using it once the free trial had ended.

The OptimumPoints programme took a different approach to incentivisation, allowing users to earn reward points for time spent using public transport, cycling and walking [22]. The number of points users could earn per minute varied by city, but active transport (cycling and walking) was always worth more points per minute than public transport. This was by design, to encourage people to use the most sustainable transport modes. Car usage was not rewarded. Points could be traded for money, or for public transport tickets and shopping vouchers, depending on where the programme was piloted. The programme created monetary and non-monetary rewards via:

- reflective motivation – because the scheme created additional perceived value for money for travelling by train.
- automatic motivation – because the scheme created an enjoyable experience (earning rewards every time participants used public transport), facilitated 'reinforcement learning' and reinforced the connection between public transport use and identifying as an environmentally friendly conscious and active person.

The report piloted the OptimumPoints programme with 64 users (35 in Birmingham and 29 in Vienna) and observed their travel behaviour using a mobile application. During the pilot the mean time spent on public transport increased from 54 minutes per week (in the 2-week baseline period with no rewards) to 201 minutes per week (in the 4-week intervention period). The average time spent walking and cycling also increased between the baseline and intervention period. The research was based on observations of 64 participants who selected into the trial and there was no control group, so robust conclusions about the effectiveness of the programme cannot be drawn.

Enablement

Enablement interventions address a combination of capability, opportunity, and motivation components through the provision of something tangible such as a rail ticket scheme and

support at a free or subsidised rate. Four interventions used enablement functions, increasing the means or reducing barriers to rail use [17], [19], [21], [23].

The KlimaTicket and Family Funday Sunday scheme both addressed physical opportunity barriers to using public transport by being valid for multiple journeys across the public transport network [17], [21]. The barriers addressed include reducing fare complexity, making tickets and fare options simpler, and mitigating concerns about ticket validity during disruption. The Family Funday Sunday scheme was an all-day ticket, valid on Sundays on the train, ferry, and bus in Sydney, Australia for family groups (of at least one related adult and child) travelling together. At the time it was introduced in December 2008, it was the only multi-modal ticket across the whole network that was as inexpensive as a single trip ticket. The KlimaTicket offered more flexibility in use, as an annual season ticket valid across the whole of Austria's national and regional public transportation network. However, as mentioned above, there was no evidence that these schemes were effective at increasing public transport or rail demand.

The Days Out Scheme offered free group rail tickets to people from disadvantaged socio-economic backgrounds for day trips in the West of England [19]. The scheme had two enablement components: partner organisations applied for the scheme on behalf of the groups they worked with, and existing community groups travelled together. Therefore, as well as addressing reflective motivation through the increased affordability of travel, the scheme also targeted:

- physical capability – because passengers travelled in groups, they could support each other during travel. For instance, helping each other with luggage, navigating the station and the train, making interchanges, and reducing barriers from travelling with children and travelling with mobility impairments.
- physical opportunity – because the partner organisations booked the tickets, the scheme addressed barriers around fare complexity, and lack of information about ticket options, how to travel by train, and availability of train services.
- social opportunity – because the scheme targeted community groups, the scheme addressed enablers such as community engagement and social assimilation.
- reflective motivation – because passengers travelled in groups, the scheme addressed barriers such as a lack of confidence, and built on enablers such as feeling reassured by having other passengers present and being able to socialise with group members; a few scheme participants mentioned that they did not usually travel "far from home", and normally have "nowhere to go, no one to visit, no one to support, to accompany" them.

The report qualitatively evaluated the perceived effectiveness of the scheme. The scheme delivered 134 days out by train (trips) for 2,063 people, many of whom had never travelled by train before. One participant from each group was invited to complete a monitoring form on the return leg of their journey to capture basic information about the number and demographics of participants and questions about travel behaviour. In total, 60 monitoring forms were completed and returned to the researchers (the response rate was 45%) with information about 773 participants, equivalent to 37% of the sample population. Data from the monitoring forms found that the average group size comprised 13 people and only a small minority of participants (13%) had travelled by train in the previous month or week before participating in the scheme. This means that the scheme was used by people who were either first-time train users (28%) or occasional/infrequent users (59%). However, because the research uses qualitative methods to explore who used the scheme and their

experiences, we cannot make causal inferences about whether the scheme was effective or not.

The Ride2Rail scheme was designed to enable train use by making it easier for people to travel to and from rail stations [23]. Ride2Rail is a ride sharing app designed to help passengers make the first and last mile of a door-to-door journey. The intervention was specifically designed to support passengers living in rural or suburban areas, where options to get to and from rail stations are limited. The scheme therefore targets physical opportunity barriers to using rail, by providing a more convenient way to get to and from the station and overcoming a lack of public transport integration with the rail network. The report included results from three demonstration locations, the biggest of which was a two-week trial in Brno, Czech Republic which trialled the use of the Ride2Rail app with 60 testers. The results found that average user experience, measured using the System Usability Scale, was 59 (where a score of 0 is the lowest usability score and 100 is the highest). The report did not evaluate the impact of the app on travel behaviour, so it is unclear whether Ride2Rail impacted rail passenger demand, or which user groups it was effective for.

Environmental restructuring

Environmental restructuring interventions address opportunity by changing the physical environment to make rail travel more accessible and convenient, or by providing cues, such as visual prompts, to encourage the desired behaviour. These types of interventions include building new infrastructure or improving existing infrastructure.

One report focused on lighting interventions, designed to influence passenger waiting behaviours on platforms and movements on stairways in train stations [20]. The interventions were designed to address problems faced by passengers navigating train stations, identified in a previous research project [40]. There were two interventions: The first was a projected lighting product that produced light zones indicating the optimal waiting positions for boarding. This was created to address the problem of passengers not knowing where to wait and not dispersing along the length of the platform, which led to overcrowded areas, passenger uncertainty, and longer dwell times for trains at stations. The second intervention was a handrail lighting product using coloured and chasing lights to indicate which side passengers should walk on. This aimed to address the problems of blockages, passenger frustration and safety incidents, created where passengers needed to use tight spaces (such as bridges and stairways) to navigate between platforms.

These interventions addressed:

- physical opportunity – because they improved the accessibility and navigability of stations, especially when making interchanges or travelling at busy times; this also addressed sensory factors. Additional lighting in stations could also improve physical security at stations.
- social opportunity – because the environmental restructuring reduced barriers such as overcrowding and dealing with other passengers in the station.
- reflective motivation – because the lighting addresses sense of security.

A station located in the Southwest of England was used to pilot the two lighting interventions. The researchers used a combination of measures to explore how

passengers responded to the initiatives in an operational railway station. This included observations (direct observations by researchers and indirect observations using footage from a fixed video camera), a passenger survey, and interviews with station staff. A theory-based approach was taken to analyse whether passengers interacted with and were influenced by the lighting interventions in anticipated ways (e.g. passengers move and respond to the lighting to stand for their carriage door). Observations in the railway stations suggest that the lighting interventions may have influenced passenger movements; however, a lack of understanding of the intended meaning conveyed by the lights may have limited behaviour change. As there was no data from stations without the lighting intervention, we cannot compare the behaviour in the presence of the lighting interventions to its absence, and we cannot determine the extent to which the lighting interventions changed passenger behaviour or improved passenger experiences in stations.

Research included in the RQ1 review explored enablers to using bikes to travel to and from rail stations (Bike-to-Rail travel), [15]. This led to the piloting of an intervention to make it easier for people to travel to and from the rail station [39]. The intervention was designed to encourage people to use a combination of rail to travel to Bristol Parkway railway station, and bicycle to travel onwards to the University of West England campus (a 20-25 minute walk or 5-15 minute cycle). The intervention involved changing the physical environment by providing bike hire hubs on the university campus and at the railway station [39]. Researchers collected data on participants who had registered an interest in the scheme or joined the scheme (n = 345), 7 per cent categorised themselves as never having cycled before; 61 per cent as occasional cyclists. The results suggest that Bike-to-Rail integration interventions may be more attractive to people who already cycle. However, as the research was exploratory and based on a survey with a small sample size, the effectiveness of this intervention on travel behaviour is not known.

Persuasion

Persuasion interventions target motivation by using communication to challenge or reinforce people's beliefs, encourage behaviour, and support the achievement of intentions or goals.

Social norms can be used as a persuasion intervention that encourage behaviour change by challenging or reinforcing people's beliefs about what other people do. In theory, a social norms message could harness reflective motivation enablers (choosing to follow the social norm) and automatic motivation (habits and familiarity because of default modes) to encourage rail travel. An example of a social norm intervention designed to encourage public transport use comes from the Skånetrafiken campaign RCT [18] (see the **Incentivisation** subsection above for a summary of the trial design). In the social norms intervention group participants received the business-as-usual Skånetrafiken flyer (sent to control group participants, addressed to the resident, with information about their closest public transport stop, Skånetrafiken, and a free two-week trial offer) but with a printed social norms message. The message read: "Did you know that most people in Skåne travel with us? 72 per cent of us living in Skåne travel by public transport occasionally. So join your neighbours and try it out". The researchers collected data on the number of travel cards activated, and use of the card on public transport during the trial period. There was no statistically significant effect of the social norms message on travel card activation rate and use, compared to the control group.

Conclusion

What did we learn?

This review examined the barriers and enablers to choosing to travel by rail, and the design and effectiveness of interventions to increase ridership. The key learnings are summarised below.

What factors affect current, lapsed, and non-users' choices about whether, how, and when to use rail infrastructure?

The review identified 24 thematic barriers and enablers to rail use (RQ1),classified under the three COM-B components. Most themes related to opportunity (13 themes) and motivation (9 themes) suggesting that improving external conditions (opportunity) and strengthening personal motivation may be key to increasing rail use.

Four barriers apply to all journey stages and all users, and especially affected lapsed/non-users: individual characteristics (e.g. neurodiversity), information provision, emotions such as stress, and confidence. These barriers would be key targets for interventions to increase ridership. Other barriers differ by journey stage, meaning that interventions that do not account for barriers at all journey stages may be ineffective. Many barriers occur at the journey planning stage. If these are not overcome the journey will not occur. These planning-stage barriers are therefore targets for intervention.

How do these factors vary by age, gender, ethnicity, region, disability and income/deprivation?

Most themes identified in the review were relevant to all passengers, though the evidence mainly focused on current rail users. There was evidence that lapsed and non-users experience barriers to rail travel more strongly than users, and the barriers for these groups differ: Lapsed users stop using rail due to changes in physical health, complex journeys that require multiple modes, and perceptions of rail as poor value for money. For non-users, barriers included fear, dislike of travelling with others, or overstimulation on rail journeys.

The review found some evidence that different demographic groups face distinct but overlapping barriers and enablers to rail travel. Neurodivergent individuals and those with

mobility impairments both experienced barriers such as poor accessibility, low confidence, and complex journeys. Low confidence, familiarity and social interactions were additional challenges for neurodivergent individuals, and complex journeys provided an additional barrier to those with mobility impairments. Evidence specific to older travellers included smells and social pressure in feeling hurried along. No evidence explored differences by gender or region.

What types of interventions have been developed to overcome barriers and harness enablers, and which do the literature indicate have been most effective?

Although the review targeted interventions beyond those centred on cost, nonetheless, most of the nine interventions prioritised incentivising rail use by reducing fares. Beyond cost, interventions focused on physical accessibility, confidence, products of services and social influences. Evidence of their effectiveness was limited.

Given the broad range of barriers to rail use, interventions should consider broader approaches beyond reducing cost. Many of the most frequently cited barriers (identified in four or more texts) were not targeted by any of the nine interventions. These unmet barriers represent opportunities for interventions, including: improving the provision, accessibility and personalisation of information about rail services; improving the attractiveness of trains compared to cars by improving comfort, cost, and convenience; and improving train ticketing.

More generally, few interventions appeared to be based on evidence or theory explaining why they were expected to work. Few reports applied a behavioural lens to understand the underlying mechanisms of behaviour change and therefore the most effective intervention strategies.

Limitations

This research was not a systematic literature review, and was limited to 30 sources. Therefore, some relevant research was not included. The research team ensured that the most relevant evidence was included, by working closely with DfT and CTS experts and contacting rail stakeholders for evidence recommendations. However, we cannot be certain that the evidence gaps we discovered truly reflect an absence of evidence.

Evidence on interventions to increase rail demand or improve passenger experience was limited, with few using robust methods to evaluate effectiveness, possibly due to the difficulty and cost of conducting a field experiment or quasi-experimental evaluation. Most focused on proof of concept, observational data, or qualitative assessments, limiting our ability to answer RQ2 on the effectiveness of interventions.

Additionally, most interventions targeted the general population rather than particular user groups. Little research targeted lapsed and infrequent users, or specifically addressed particular types of journeys (such as commuting or leisure), and the barriers and enablers to those journeys.

Themes to consider when developing interventions to increase ridership

The themes identified in the review may systematically influence decisions to travel by rail. Considering these themes alongside predictions from demand models will produce a rich understanding of behaviour and guide interventions that encourage more people to choose rail.

Capability themes

- **existing and potential passenger characteristics:** whether travellers have health conditions, mobility impairments, are neurodiverse, or are travelling with children or heavy baggage will impact their preferences to travel by rail or other modes, and the way they prioritise other factors.

Opportunity themes

- **accessibility of other forms of transport:** which modes of transport are available to travellers for the journey instead of taking the train.
- **costs:** the actual cost of travelling by train, including any discounts or ticket deals. The relative cost of rail travel compared to other modes could also be considered a quantitative factor (including car fuel costs and cost per person for group travel).
- **disruption:** the extent of delays and cancellations on services, including planned engineering works and the effects of rail strikes.
- **door-to-door journey time:** the time taken to complete a journey from leaving the starting point until arriving at the destination. For rail journeys, this includes travel to and from the station and waiting times.
- **interchanges:** whether it is necessary to change between modes to complete the journey, including making train connections.
- **products/services:** the frequency of trains and the times at which they run, as well as the destinations of services.
- **public transport integration:** the quality of the public transport infrastructure around stations, and the extent to which services are coordinated (e.g. between bus and rail services).

Motivation themes

- **comfort preferences:** travellers consider how comfortable they will be travelling by rail, including, for example, the weather, whether they will get a seat or table and the cleanliness of stations and trains. For some individuals, comfort is closely related to sensory barriers to travel.
- **confidence:** whether or not travellers are confident in how to use rail in general, the quality and reliability of rail services, making interchanges (within modes and between modes), using digital technology, selecting tickets and services, navigating stations/routes, and asking for assistance if needed.
- **control preferences:** whether travellers prefer to be able to relax or work during their journey, or to have more control over it (such as deciding when to leave or to stop on the way).
- **emotions:** negative emotions, including stress, anxiety and fear, induced by travelling by train, as well as positive emotions, such as enjoyment and nostalgia, that can be evoked by rail travel.
- **feelings of safety:** whether travellers feel that they, and their belongings, are safe and secure while travelling. This is related to station facilities and the availability of staff.
- **habit/familiarity:** where travellers have habits about modes of transport, especially for journeys taken frequently or specific journey types, they are likely to default to continue using that mode. Habits may be disrupted at moments of change, so such as moving home or the provision of new rail infrastructure.

- **perceived quality:** whether travellers feel that they can rely on trains to get them to their destination on time and without delay, that stations and carriages will be clean and safe places, and the journey will be enjoyable.
- **perceived value for money:** the perceived value of rail travel, including in comparison to other transport modes.
- **personal identity:** identities can shape travel choices by influencing how individuals see themselves and what behaviours align with their values, roles, or social norms. For example, identifying as a car driver or belonging to a faith where women cannot travel alone may reduce someone's likelihood to travel by whereas identifying as active or environmentally conscious may increase preference for rail.
- **social influences:** social norms and values, such as cars as status symbols, being seen by others as environmentally friendly, or considering public transport as undesirable.
- **social preferences:** travellers have concerns about antisocial behaviour, unwanted social interactions, crowds, and whether they prefer to travel alone or with the support of others.

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Annex A: Methodology

Identification of the literature

Verian and CTS followed a five-step process to identify 30 evidence sources for the narrative evidence review. First, this process was followed to identify 18 to 22 evidence sources on the factors affecting current, lapsed, and non-users' choices about whether, how, and when to use rail infrastructure (RQ1). Then, the process was repeated to identify 8 to 12 evidence sources on interventions to overcome barriers and harness enablers to travelling by rail (RQ2).

The five-step process is outlined below.

Step 1: Compile a list of evidence from a range of sources (removing duplicates)

Verian ran searches using Google scholar, Scopus, and Google and CTS conducted searches using the TRID database. See **Annex B** for the search stings used in the online searches. Verian, CTS, and DfT also contacted rail stakeholders for recommendations of evidence to include in the review.

The results from each search and recommendations from stakeholders were compiled into a longlist in an Excel document. After all the searches had been run, Verian identified and removed duplicate results using a range of Excel functions including conditional formatting to highlight duplicate titles, sort functions to order results by title, year, author, and filters functions to investigate potential duplicates and remove them. By the end of Step 1, the longlist included all evidence identified by the online searches and stakeholder recommendations with duplicates removed.

Google Scholar

Verian ran a Google scholar search in Publish or Perish (Version 8). This was a keywords search using the search string in **Annex B** with a date filter, to return evidence published from 2007 onwards. The results list included evidence that matched the search terms anywhere in the searched documents (author, title, source, abstract, references). TO expand on this, for RQ1, the same search was run again with an additional filter for review articles only.

For the RQ1 search, Verian exported the top 100 search results (and the top 20 from the review article only search) into the longlist. For the RQ2 search, Verian exported the top 50 results into the longlist.

Other search engines (TRID, Scopus, Google)

CTS ran the Transport Research International Documentation (TRID) searches using the search strings in **Annex B**. TRID is an integrated database that combines the records from the Transportation Research Board's (TRB) Transportation Research Information Services database (TRIS), and the Organisation for Economic Co-operation and Development (OECD) and Joint Transport Research Centre's International Transport Research Documentation database (ITRD). CTS screened the search results using titles and abstracts until either two consecutive results pages had been scanned without any potentially relevant results or a total of 12 pages had been scanned, whichever occurred first. All articles screened as clearly or potentially relevant by CTS were added to the longlist.

Verian used Publish or Perish to search the Scopus database using the search strings in **Annex B**. A filter was applied to the date, to return evidence published from 2007 onwards. Verian exported the top 50 results for the RQ1 search, and the top 20 results for the RQ2 search into the respective longlists.

For RQ2, Verian also ran a Google search to identify grey literature using the same search string in **Annex B**. Verian opened and scanned the top 40 search results and added any clearly or potentially relevant reports to the RQ2 longlist.

Stakeholder recommendations

In collaboration with DfT and CTS, Verian compiled a list of relevant stakeholders including UK based academics and research groups with a focus on rail transport and travel behaviour, policy makers, transport bodies, and charities (see Appendix Table 1). Verian, CTS, and DfT sent out requests for evidence recommendations relevant for both research questions via email. CTS and DfT contacted stakeholders they had relationships with to increase the chances of engagement with the evidence request. Verian contacted the remaining stakeholders.

CTS screened the titles and abstracts for all stakeholder recommendations and added clearly or possibly relevant titles for RQ1 and RQ2 searches to the respective longlists.

CTS and DfT also provided a list of potentially relevant evidence sources (evidence recommended by CTS and DfT for inclusion is labelled "Known evidence" in the PRISMA flow diagrams, see **Annex C**).

Stakeholder	Contacted by
Academics at the University of Leeds	CTS
Academics at the University of Southampton	CTS
The International Association for Travel Behaviour Research (IATBR) membership list (a list of international travel behaviour researchers)	CTS
The Universities' Transport Study Group (UTSG) mailing list (a UK-based list for transport academics but is enrolled on by many academics from outside UK and transport practitioners)	CTS
Department for Transport policy team	DfT
England's Economic Heartland	DfT
Midlands Connect	DfT
Transport for London	DfT
Transport for the North	DfT
WCPD (HS2)	DfT
Campaign for Better Transport and Community Rail Network	Verian
Centre of Excellence in Infrastructure	Verian
Confederation of Passenger Transport UK (CPT)	Verian
Global Centre of Rail Excellence	Verian
Great British Railways	Verian
Network Rail	Verian
Office for Rail and Road	Verian
Peninsula Transport	Verian
Transport East	Verian
Transport Focus	Verian
Transport for the South East	Verian
Transport Scotland	Verian
Western Gateway	Verian
Rail Safety and Standards Board (SPARK rail knowledge hub)	Verian

Appendix Table 1. Stakeholders contacted for evidence recommendations

Step 2: Verian and CTS screened titles and abstracts in the longlist for relevance to the research questions

Two Verian researchers independently screened the publication titles and abstracts (or if there was no abstract, the executive summary or introduction) in the longlists for relevance. Each report was rated clearly relevant, potentially relevant, or clearly not relevant to the research question. A third researcher was consulted when the researchers disagreed on relevance ratings.

Following this, Verian and CTS met to discuss the relevance ratings and identified any potential gaps in the evidence at this stage. For RQ1, Verian and CTS considered coverage of different journey types, passenger types, and demographic groups. For RQ2, Verian and CTS considered coverage of different intervention types and functions. Verian communicated the results of these discussions with DfT to consider for Step 3.

Step 3: Verian opened a select number of articles to hand search and added additional results to the longlist

Verian planned to run hand searches to identify additional evidence if the number of clearly or potentially relevant reports was low (less than 40 for RQ1 searches, or less than

20 for RQ2 searches), or if there were any potential gaps in the evidence. As a high number of clearly or potentially relevant reports had been identified for RQ1 at this stage, Verian did not run a hand search. This was not the case for RQ2, so a hand search was conducted to try and find more evidence for consideration in the review.

Hand searching is relatively more resource intensive than the other evidence search methods, and so Verian worked with CTS and DfT to decide which of the reports that were identified as clearly relevant in Step 2 to hand search. Hand searching involved:

- screening the reference list inside the report to find older research
- using Google scholar or the journal website to find newer research citing the report
- looking at the top three similar reports recommended by the journal publisher

Verian ran the hand searches and added any new clearly or potentially relevant evidence to the longlist.

Step 4: Verian and CTS applied the inclusion criteria and prioritisation criteria to recommend a short list of evidence

At this stage, Verian and CTS applied the inclusion and exclusion criteria to the clearly and potentially relevant reports (see Appendix Table 2). Verian and CTS discussed the remaining reports to decide which to recommend for inclusion. The researchers used the following prioritisation criteria to help make recommendations:

- year of publication: prioritising newer evidence over older evidence
- relevance to the UK: prioritising evidence from the UK over evidence from abroad
- relevance to heavy rail: prioritising evidence specific to rail use servicing trips between towns and cities over evidence for light rail or intra-city public transport
- coverage of demographic groups/user types: prioritising a set of evidence that covers as many key demographic groups and user types as possible
- coverage of barriers and enablers (for RQ1): prioritising research that investigates psychological factors
- coverage of different types of intervention functions (for RQ2): prioritising innovative intervention functions

Step 5. DfT agreed evidence to be opened for the narrative evidence review

Verian shared the list of Verian and CTS recommended reports and a reserve list with DfT, who decided which reports would be opened for data extraction.

Type	Inclusion criteria	Exclusion criteria
Relevance	RQ1: Reports examining factors influencing rail use (barriers and enablers), especially behavioural and attitudinal factors. RQ2: Reports examining interventions to increase rail use or improve perceptions of/attitudes towards rail travel among population in general and particular sub-groups. Interventions should analyse behavioural mechanisms or outcomes.	
Methods	RQ1: Qualitative research and quantitative research, systematic reviews, meta-analyses. RQ2: Quantitative and qualitative tests of effectiveness and evaluations.	
Report type	Academic and grey literature.	News articles, opinion pieces, guidance, theoretical models.
Journal type		Internationally non-recognised transport journals (assessed by CTS), journals or publishers that appear on publicly available predatory journal lists.
Year published	Published in 2007 onwards.	
Language	Written in English.	
Countries	UK, Germany, France, Spain, Italy, Netherlands, Ireland, Switzerland, Austria, Sweden, Norway, Finland, Denmark, Portugal, Belgium, Hong Kong and Japan (USA and Canada only included if needed).	China.
Rail users	Current, lapsed, and/or non-users of rail travel.	
Passenger demographics	All demographic groups. With interest in age, gender, ethnicity, region, disability and income/deprivation.	
Rail trip types	All trip types.	
Rail context	Focus on passenger heavy rail (e.g. high-speed rail, commuter, intercity, regional) that services trips between towns and cities. Also include research focusing on light rail (trams), subway systems and other rail systems that serve urban areas (within towns and cities) if they have broader relevance to national rail.	Freight rail.

Appendix Table 2. Inclusion and exclusion criteria

Data extraction

A data extraction template was created for each research question. Each report was only extracted into one data extraction template. The templates included columns to capture information about the research sample (passenger type, sample size, demographics, country), context (trip type, mode of transport), and methodology.

For evidence about the barriers and enablers to travelling by train (RQ1), data was extracted into six COM-B sub-component columns. The extraction template for evidence about interventions to increase rail use (RQ2) instead captured information about the intervention, evaluation design (including sample population, the control group, and outcome measures) and findings about the effects and effectiveness of the intervention.

Verian assessed the quality of the research during data extraction. For RQ1, Verian based the quality indicators and criteria for design, sample, analysis and reporting, and findings on an existing qualitative evaluation framework [41]. For RQ2, researchers critically

assessed the internal and external validity of research in the data extraction template. For more detail about the quality assessment, see **Annex D**.

Verian and CTS researchers completed a calibration exercise to ensure consistency in data extraction across researchers. In the exercise all researchers read the same reports and extracted data into the template. Then the researchers met to discuss the process and compare results. This exercise was completed twice, once for each data extraction template. Each exercise involved extracting data from two reports from the bibliography.

In total, Verian extracted data from 22 reports into the RQ1 extraction template, and 8 reports into the RQ2 extraction template.

Analysis

Verian conducted a thematic analysis of the barriers and enablers to rail travel. First, the researchers inductively generated theme labels for the barriers and enablers and coded each factor into a theme. Then, the researchers coded the themes into one of the six COM-B subheadings. The thematic and COM-B coding was then shared with CTS, who helped refine the analysis further.

Following this, Verian conducted a strategic behavioural analysis to map intervention functions used by the interventions (identified in RQ2 sources) to the factors identified by the RQ1 review.

Annex B: Search strings

Verian, CTS and DfT developed two search strings to identify evidence relevant for Research Questions 1 and 2. Verian tested different combinations of search terms and Boolean logic in Google Scholar and made changes to the string when searches did not generate relevant publications in the top 20 hits. All search strings needed to be less than the 256-character limit in Google Scholar.

Research Question 1 search string:

("rail journey" OR "rail travel" OR "train journey" OR "train travel") AND ("public transport") AND (user OR passenger OR traveller OR rider* OR usage) AND (choice OR decision OR behavi* OR barrier OR motivat* OR influence OR attitude* OR perception* OR facilitat* OR enabl* OR determinant OR habit* OR prefer* OR driver* OR experience)

Research Question 2 search string:

("rail journey" OR "rail travel" OR "train journey" OR "train travel") AND ("public transport") AND ("behaviour change" OR "behavior change" OR "mode shift") AND (intervention OR scheme OR program* OR evaluat* OR initiative OR improvement OR policy)

Annex C: PRISMA flow diagram

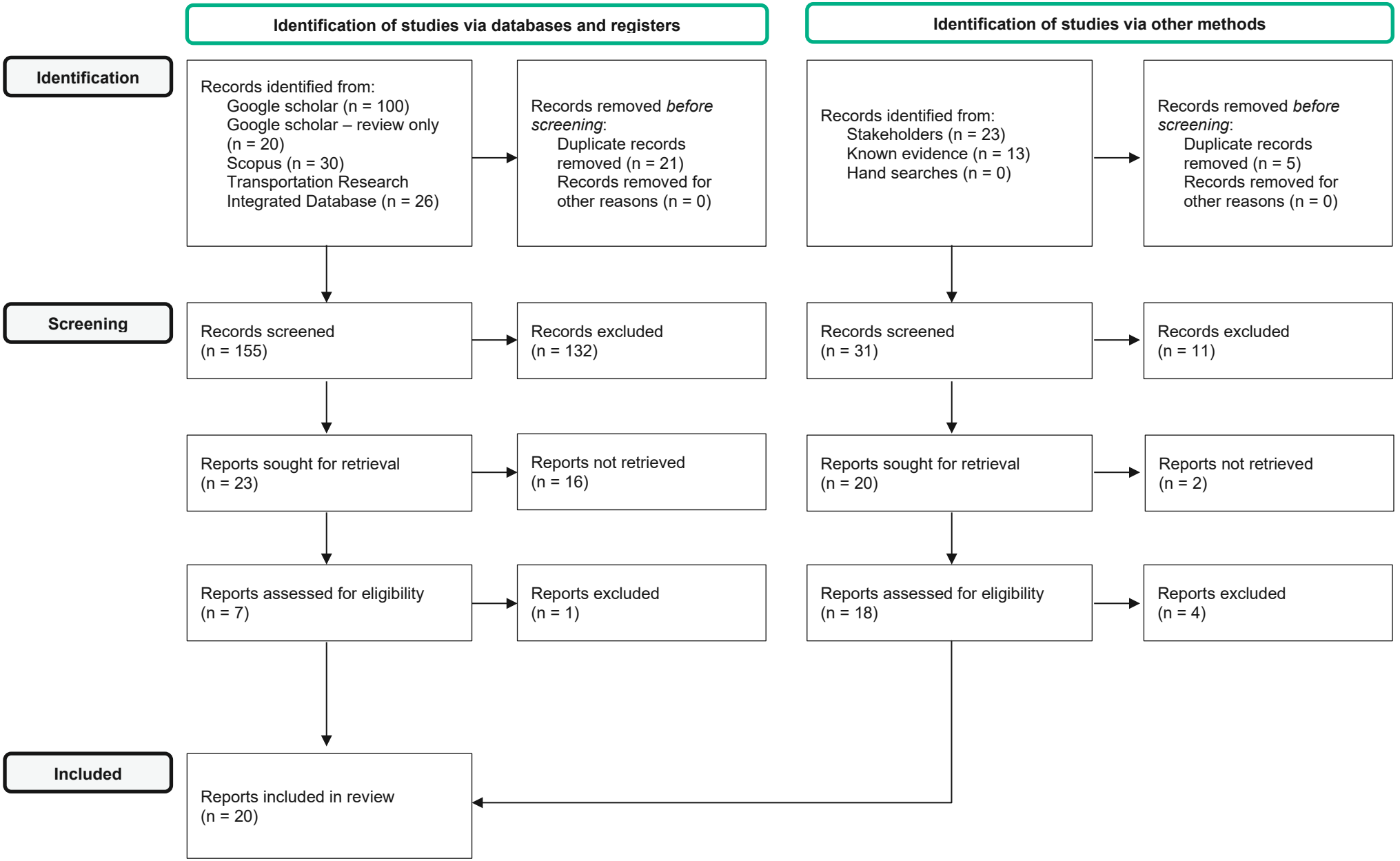
The PRISMA flow diagrams show the number of records identified, included and excluded for the narrative evidence review. Appendix Figure 1 shows the process to identify evidence for RQ1, and Appendix Figure 2 shows the process for RQ2.

Verian, DfT, and CTS emailed stakeholders for evidence recommendations relevant to both research questions between the 30th January 2025 and the 14th February 2025.

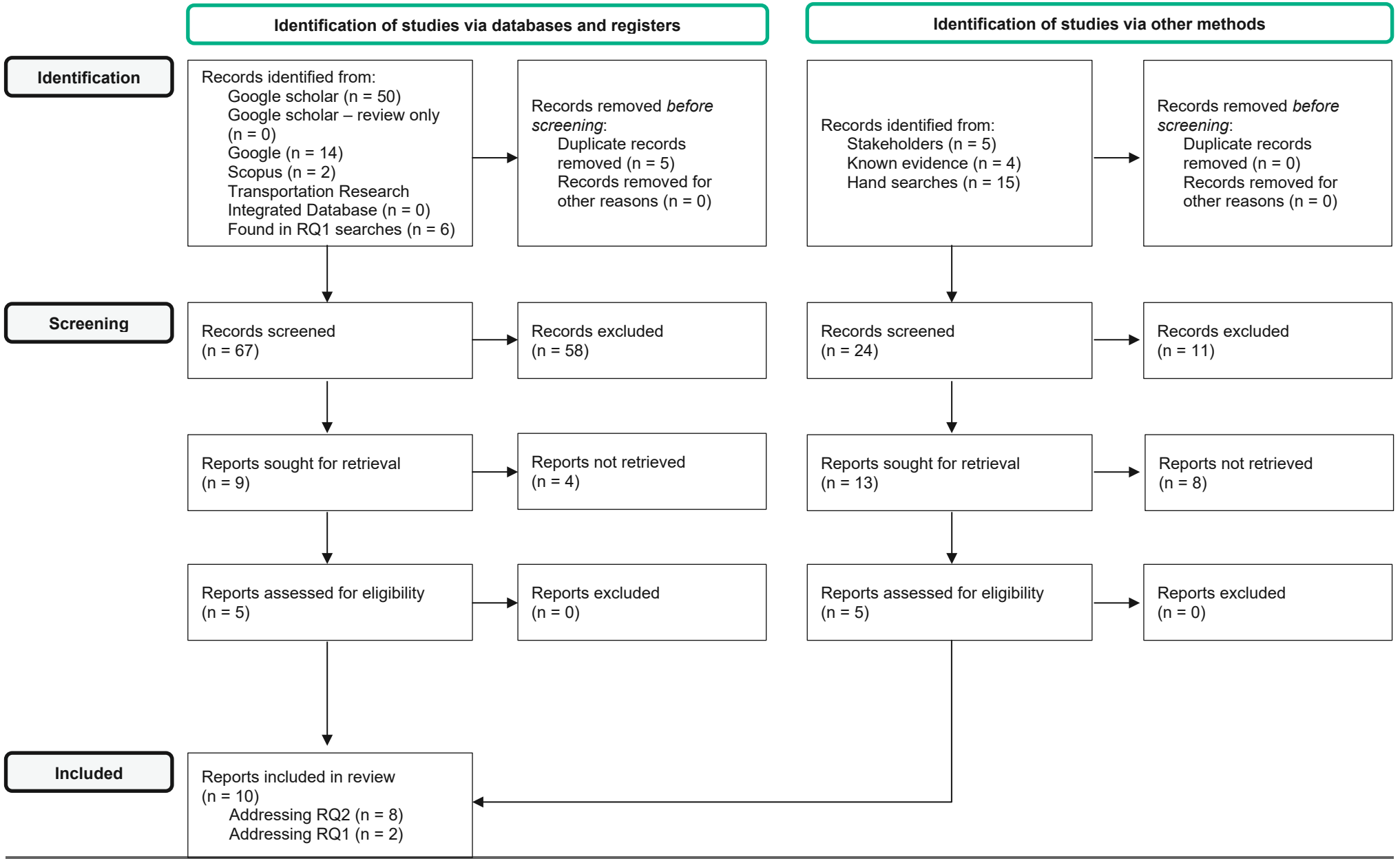
Verian and CTS ran the RQ1 online searches between the 11th and 12th February 2025 and screened the results between the 17th and 24th February 2025. The searches identified 186 sources of evidence, 155 from online searches, and 31 from stakeholder suggestions and evidence known to CTS and DfT. After screening titles and abstracts for relevance, 43 sources were coded as clearly or potentially relevant. On applying exclusion and prioritisation criteria agreed with DfT, 20 sources were selected for data extraction.

For RQ2, Verian and CTS conducted the online searches on the 5th of March 2025, and Verian ran the hand searches on the 11th March 2025. Screening was completed between the 6th and the 17th March 2025. The searches identified 91 sources of evidence, 67 from online searches (including 6 reports identified in RQ1 searches) and 24 from stakeholder suggestions, known evidence, and hand searches. After screening titles and abstracts for relevance to RQ2, 22 sources were coded as clearly or potentially relevant. On applying exclusion and prioritisation criteria, 10 sources were selected for data extraction. Of these, seven described interventions to encourage rail travel (not all of these reports tested effectiveness on behaviour). Two sources did not focus on specific interventions but provided additional insight into potential gaps and opportunities for future research. These focused on:

- community rail, a membership body for over 75 community rail partnerships and 1,300 station adoption groups where interventions and improvements have been designed and implemented across the UK) [24]
- barriers and enablers to using Bike-to-Rail provisions, included in the RQ1 narrative evidence review [15]
- potential rail industry initiatives to improve passenger satisfaction, included in the RQ1 narrative evidence review [14].



Appendix Figure 1. PRISMA flow diagram for Research Question 1



Appendix Figure 2: PRISMA flow diagram for RQ2

Annex D: Evidence quality assessments

Researchers assessed the quality of qualitative and survey RQ1 research using the criteria for a low-quality report (Red) and a high-quality report (Green) in Appendix Table 3. An Amber rating was given to studies that fell between the criteria for a low- and high-quality report. A Red rating suggests that the evidence may be of low quality, and that less weight should be given to its findings. The researchers did not assess the quality of literature reviews.

Only one report in RQ1 was flagged with a Red quality rating, this was due to a lack of transparency in the analysis about how rankings of importance were assigned to factors for comparison [25]. The quality assessments for RQ1 are summarised in Appendix Table 4.

The quality assessment for RQ2 highlighted limitations including a lack of robust methods to evaluate the effectiveness of the initiatives on behaviour use, small sample sizes, and sampling approaches that restrict generalisability of findings to the wider population. Six reports used observational, case study, or qualitative methods so do not provide evidence of intervention effectiveness [19], [20], [21], [22], [23], [24]. Appendix Table 5 summarises researcher assessments of the internal and external validity of the RQ2 studies using experimental or quasi-experimental research designs.

Aspect	Red Criteria	Green Criteria
Design	Study design is inappropriate for the research aims, the study is not clear in what it seeks to do, no rationale is given for the study design, no underpinning values/assumptions/theories are discussed, the design introduces bias that is not addressed or accounted for in the results	Research is designed to address the study aims, clear and sensible rationale is given for the research design, the research is designed to mitigate bias, qualitative research is an appropriate method (e.g. study aims to explore range of responses, meanings, experiences, etc.)
Sample	No discussion of sampling strategy, no description of population of interest or achieved sample, no rationale for the basis of selection of target sample	Description of population of interest and how sample selection relates to it, provides rationale for basis of selection of target sample (e.g. typical, extreme case, diverse constituencies etc.), detailed profile of achieved sample, maximised inclusion (e.g. language matching or translation, specialised recruitment, etc.)
Analysis and reporting	Makes unsubstantiated claims and broad/sweeping statements, does not report the findings in detail or place them within personal contexts	Report reaches factually sound conclusions supported by the data/study evidence discussed, unpacks nuance within the data, identification of patterns and exceptions, participant perspectives are placed in personal contexts (e.g. use of case studies, vignettes, quotations, etc.)
Findings	Findings not supported by study/data, no discussion of relationship with other research	Findings supported by study/data, discussion of relationship with other research

Appendix Table 3. Criteria against which RQ1 reports were RAG rated

Author and source	Publisher	Year	Design	Research population	Sample size	Design	Sample	Analysis and reporting	Findings
BIT [11]	Transport for Wales	2024	Mixed methods	General population (Survey) Regular and less regular users, non-users (focus groups, interviews)	800 respondents (survey) 41 participants (6 focus groups and 6 interviews)	Green	Green	Green	Amber
Blainey et al. [12]	Transport Reviews	2012	Literature review	Non-users	Over 100 studies				
Brons et al. [26]	Transportation Research Part A: Policy and Practice	2009	Survey	Users and general population	17,033 respondents	Green	Amber	Amber	Green
Brons & Rietveld [25]	Built Environment	2009	Survey	Users	17,986 respondents	Amber	Green	**Red**	Amber
Chatterjee et al. [5]	Department for Transport	2019	Survey	General population	Respondents in 40,000 households	Green	Green	Green	Green
Deakin & Orsolic [27]	Transport for the North	2025	Survey	Users and non-users	2,012 respondents	Green	Green	Amber	Amber
Givoni & Rietveld [28]	Transport Policy	2007	Survey	Users	2,542 respondents	Amber	Green	Amber	Green
Kurup et al. [13]	Rail Human Factors Conference	2017	Qualitative	Users	16 participants (8 commuter interviews and 8 leisure interviews)	Amber	Amber	Amber	Amber
Lowson & Townsend [29]	Community Rail Network	2021	Literature review	No data	No data				
Lowson & Townsend [30]	Community Rail Network	2023	Literature review	Non-users. People with dementia, autistic people, people with mental health conditions, marginalised groups	No data				
Midlands Connect [31]	Midlands Connect	2022	Qualitative	Infrequent users, non-rail users, and users.	26 focus groups of max. 5 participants per group	Green	Green	Green	Amber
Musselwhite & Roberts [32]	Quality in Ageing and Older Adults	2021	Qualitative	Infrequent users Older people	8 participants	Green	Green	Green	Green
Quadrangle [14]	Transport Focus and GBRTT	2022	Survey	Users	3,979 respondents	Amber	Amber	Amber	Amber
Rigby & Wheeler [16]	Transport for Greater Manchester	2019	Qualitative	Users and non-users	4,500 participants (interviews)	Amber	Amber	Amber	Amber
Savanta [33]	Department for Transport	2024	Survey	Users	8,132 respondents	Green	Green	Green	Amber

Author and source	Publisher	Year	Design	Research population	Sample size	Design	Sample	Analysis and reporting	Findings
Sherwin & Parkhurst [15]	Cycling and Society Symposium	2008	Mixed methods	Users	135 respondents	Amber	Amber	Green	Amber
Sundling & Ceccato [34]	Transportation Research Part F: Psychology and Behaviour	2022	Literature review	Users and potential users	52 studies				
Transport Focus [35]	Transport Focus	2019	Literature review	Non-users	5 studies				
Transport Focus [36]	Transport Focus	2022	Survey	Users and lapsed users	12,565 users 2,661 lapsed	Amber	Green	Green	Amber
Transport Focus [7]	Transport Focus	2024	Survey	Users and non-users	2,006 respondents	Green	Amber	Green	Amber
Verian [37]	Department for Transport	2025	Mixed methods	Users, lapsed, and non-users People with disabilities	30 users 30 non-users including lapsed	Green	Green	Green	Green
Whittle et al. [38]	Travel Behaviour and Society	2022	Survey	Car drivers	8,132 respondents	Green	Green	Green	Green

Appendix Table 4. Quality appraisals for the 22 reports included in RQ1

Author and source	Publisher	Year	Design	Research population	Sample size	Research design allows for causal evidence about intervention effectiveness	Internal validity concerns	External validity concerns
Golightly et al. [23]	European Transport Research Review	2024	Demonstration sites and survey	No data	93 participants (16 in Athens, 17 in Helsinki, and 60 in Brno)	No		
Gravert & Collentine [18]	Journal of Economic Behavior & Organization	2021	Randomised controlled field trial with three-groups	People who just moved to or within the region - some probably non-users of the regional transport but may be previous users of mode	14,282 cards	Yes	None identified.	Findings are specific to the Swedish rail context, and may not generalise outside the context of recently moving home.
Ho & Mulley [21]	Australasian Transport Research Forum	2013	Cross-sectional household survey data	Families (households with children)	2,532 trips	No		
Ricci [19]	Centre for Transport & Society	2017	Qualitative	Infrequent and first-time rail users (non-users). Low income/deprived communities	134 bookings (2,063 participants) 60 passenger feedback forms	No		
Ryan et al. [20]	Lighting Research & Technology	2022	Qualitative	Users	24 survey participants 6 staff interviewed	No		
Townsend [24]	Sustainable Railway Engineering and Operations	2022	Case studies	No data	No data	No		
Tsirimpa et al. [22]	Transportation Research Part F: Traffic Psychology and Behaviour	2019	Demonstration sites and survey	Users Young, educated individuals who are tech avid	64 participants	No		
Wallimann [17]	Transport policy	2024	Difference-in-difference with a synthetic control	No data	Panel dataset of 6 companies	Yes	None identified.	Findings are specific to the Austrian rail context.

Appendix Table 5. Internal and external validity appraisals of RQ2 studies using experimental or quasi-experimental research designs

Annex E: Supplementary results tables

Appendix Table 6 provides an overview of all the identified factors influencing rail use grouped by theme, COM-B sub-component and relevant journey stage. This table also shows which user types and demographic groups the factors were identified for and in which reports. The table could be used, for example, to identify which factors particularly affect non-users, or which affect people at a particular journey stage.

The last column of the table summarises which interventions (discussed in the RQ2 findings) addressed each factor. If the last column is blank, it means that none of the included interventions addressed that specific factor.

Appendix Table 7 provides more information about the RQ2 reports, including their primary intervention function, the description and context of the intervention, research design, outcome measure, and evaluation start and end date.

Journey stage	COM-B sub-component	Themes	Factors	User groups sampled	Demographic groups sampled	RQ2 intervention (BCW intervention function)
Planning a journey	Physical opportunity	Accessibility of other forms of transport	Access to alternative transport (e.g. car) [5], [7], [12], [15], [28], [38]	Users [7], [15], [28] Non-users [7], [12] Not specified [5], [38]	Car drivers [38]	
Planning a journey	Physical opportunity	Disruption	Reliability – delays & cancellation of services [7], [11], [12], [13], [14], [16], [25], [31], [35], [36], [37]	Users [7], [11], [13], [14], [16], [25], [31], [36], [37] Lapsed users [36], [37] Non-users [7], [11], [12], [16], [31], [35], [37]	People with disabilities [37]	
			Planned engineering works [14]	Users [14]		
			Rail strikes [7]	Users, Non-users [7]		
Planning a journey	Physical opportunity	Door-to-door logistics and interchanges	Journey duration [7], [11], [12], [14], [31], [35], [36], [38]	Users [7], [11], [14], [31], [36] Lapsed users [36] Non-users [7], [11], [12], [31], [35] Not specified [38]	Car drivers [38]	
			Convenience getting to and from station (e.g. long distance, poor transport options) [5], [7], [11], [12], [15], [25], [26], [27], [29], [30], [35], [38]	Users [7], [11], [15], [25], [26], [27] Non-users [7], [11], [12], [27], [35] Not specified [5], [29], [38]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30], Car drivers [38]	Ride2Rail (enablement) [23]
			Public transport integration [11], [14], [28], [29], [35], [36], [37]	Users [11], [14], [28], [36], [37] Lapsed users [36], [37] Non-users [11], [35], [36], [37] Not specified [29]	People with disabilities [37]	Ride2Rail (enablement) [23]

Journey stage	COM-B sub-component	Themes	Factors	User groups sampled	Demographic groups sampled	RQ2 intervention (BCW intervention function)
			Making linked trips (e.g. work, school, supermarket) [12], [31]	Users [31] Non-users [12], [31]		
			Train connections [7], [11], [14], [16], [35], [36], [37]	Users [7], [11], [14], [16], [36], [37] Lapsed users [36], [37] Non-users [7], [11], [16], [35], [36], [37]	People with disabilities [37]	
Planning a journey	Physical opportunity	Information provision	Information about facilities and services [11], [26], [27], [32], [37]	Users [11], [26], [27], [32], [37] Lapsed users [37] Non-users [11], [27], [37]	Older people [32], People with disabilities [37]	Days Out Scheme (enablement) [19]
			Information about delays and travel options [14], [16], [36]	Users [14], [16], [36] Lapsed users [36] Non-users [16]		
			Information about multi-modal travel [14], [29]	Users [14] Not specified [29]		
Planning a journey	Physical opportunity	Availability of trains	Frequency/timings of trains [11], [14], [16], [31], [35], [36]	Users [11], [14], [16], [31], [36] Lapsed users [36] Non-users [11], [16], [31], [35]		
			Destination availability [7], [35]	Users [7] Non-users [7], [35]		
Planning a journey	Social opportunity	Group identity	Cultural factors (e.g. faiths where women can't travel alone) [12]	Non-users [12]		
Planning a journey	Social opportunity	Social influences	Car as status symbol [11], [31]	Users, Non-users [11], [31]		

Journey stage	COM-B sub-component	Themes	Factors	User groups sampled	Demographic groups sampled	RQ2 intervention (BCW intervention function)
			Social norms and values (e.g. being environmentally friendly, public transport as undesirable) [11], [14], [29], [36]	Users [11], [14], [36] Lapsed users [36] Non-users [11] Not specified [29]		Skånetrafiken (Social norms) (persuasion), [18] OptimumPoints programme (incentivisation) [22]
			Community engagement [29]	Not specified [29]		Days Out Scheme (enablement) [19]
			Social assimilation/recruitment [15], [29]	Users [15] Not specified [29]		Days Out Scheme (enablement) [19]
Planning a journey	Reflective motivation	Comfort	Weather (e.g. rain discourages public transport use) [12]	Non-users [12]		
Planning a journey	Reflective motivation	Perceived quality	Perceptions of service quality [11], [12], [13], [14], [25], [31], [35], [37]	Users [11], [13], [14], [25], [31], [37] Lapsed users [37] Non-users [11], [12], [31], [35], [37]	People with disabilities [37]	
Planning a journey	Reflective motivation	Confidence	Confident in making interchanges [14], [35]	Users [14] Non-users [35]	People with disabilities [37]	Days Out Scheme (enablement) [19]
Planning a journey	Reflective motivation	Perceived value for money	Car perceived as less expensive/trains as more expensive [5], [7], [11], [12], [13], [16], [31], [35], [37]	Users [7], [11], [13], [16], [31], [37] Lapsed users [37] Non-users [7], [11], [12], [16], [31], [35], [37] Not specified [5]		
			Perceived cost [7], [11], [13], [14], [27], [31]	Users [7], [11], [13], [14], [27], [31] Non-users [7], [11], [27], [31]		Family Funday Sunday ticket, Days Out Scheme, KlimaTicket, Skånetrafiken (Extra 2-week free travel) (incentivisation) [17], [18], [19], [21]
			Ticket deals & discounts/subsidies [13], [15], [31], [37]	Users [13], [15], [31], [37] Lapsed users [37] Non-users [31], [37]	People with disabilities [37]	Family Funday Sunday ticket, Days Out Scheme, KlimaTicket Skånetrafiken (Extra 2-week free travel) (incentivisation) [17], [18], [19], [21]

Journey stage	COM-B sub-component	Themes	Factors	User groups sampled	Demographic groups sampled	RQ2 intervention (BCW intervention function)
			Perceived value for money [7], [11], [16], [25], [26], [28], [29], [36]	Users [11], [13], [16], [25], [26], [28], [36] Lapsed users [36] Non-users [7], [11], [16] Not specified [29]		Family Funday Sunday ticket, KlimaTicket, OptimumPoints programme, Skånetrafiken (Extra 2-week free travel) (incentivisation) [17], [18], [21], [22]
Planning a journey	Reflective motivation	Freedom (Downtime/control)	Prioritising more active travel [15], [29]	Users [15] Not specified [29]		
			Control over your journey (in a car) [11], [13], [16], [35]	Users [11], [13], [16] Non-users [16], [35]		
Planning a journey	Automatic motivation	Habit/familiarity	Journey frequency reinforcing habit of mode [7], [15], [30], [31]	Users [7], [15], [31] Non-users [7], [30], [31]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30]	
			Familiarity with services – minimal effort reinforces habit loop [29], [30], [35], [37]	Users [37] Lapsed users [37] Non-users [30], [35], [37] Not specified [29]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30], People with disabilities [37]	
			Siloed thinking about specific journeys [29]	Not specified [29]		
			Default modes [12], [15], [29], [35]	Users [15] Non-users [12], [35] Not specified [29]		Skånetrafiken (persuasion and incentivisation) [18]
		Individual and professional role identities	Identifying with a particular form of transport [15], [16], [29]	Users [15], [16] Non-users [16] Not specified [29]		

Journey stage	COM-B sub-component	Themes	Factors	User groups sampled	Demographic groups sampled	RQ2 intervention (BCW intervention function)
			Identifying as environmentally conscious [29]	Not specified [29]		OptimumPoints programme (incentivisation) [22]
			Identifying as an active person [29]	Not specified [29]		OptimumPoints programme (incentivisation) [22]
Buying a ticket	Physical opportunity	Disruption	Ease of claiming compensation [14]	Users [14]		
			Ticket validity when disrupted [14]	Users [14]		Family Funday Sunday ticket, KlimaTicket (enablement) [17], [21]
Buying a ticket	Physical opportunity	Information provision	Explanation of tickets/fare options [11], [14], [30], [31], [37]	Users [11], [31], [37] Lapsed users [37], Non-users [11], [30], [31], [37]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30], People with disabilities [37]	Family Funday Sunday ticket, Days Out Scheme, KlimaTIcket (enablement) [17], [19], [21]
Buying a ticket	Physical opportunity	Physical accessibility	Accessible ticket offices [27]	Users, Non-users [27]		
			Accessible ticket machines (e.g. wrong height/ hard to reach) [27]	Users, Non-users [27]		
Buying a ticket	Physical opportunity	Train tickets	Manual ticket availability [33]	Users [33]		
			Online ticket availability [33]	Users [33]		
			Multi-mode tickets [7], [14], [29], [37]	Users [7], [14], [37] Lapsed users [37] Non-users [7], [37] Not specified [29]	People with disabilities [37]	Family Funday Sunday ticket, KlimaTicket (enablement) [17], [21]
			Availability of diverse payment options (cash/online) [33]	Users [33]		
			Fare complexity [11], [31]	Users [11], [31] Non-users [11], [31]		Family Funday Sunday ticket, Days Out Scheme, KlimaTIcket (enablement) [17], [19], [21]
Buying a ticket	Physical opportunity	Station and onboard facilities	Able to tap in/out with contactless [14]	Users [14]		

Journey stage	COM-B sub-component	Themes	Factors	User groups sampled	Demographic groups sampled	RQ2 intervention (BCW intervention function)
			Staffed ticket offices [27], [33]	Users [27], [33] Non-users [33]		
			Complex ticket machines [14], [27], [37]	Users [14], [27], [37] Lapsed users [37] Non-users [37]	People with disabilities [37]	
			Ticket machine availability [33]	Users [33]		
Buying a ticket	Reflective motivation	Confidence	Confidence with tickets/services [30], [37]	Users [37] Lapsed users [37] Non-users [30], [37]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30], People with disabilities [37]	Family Funday Sunday ticket, KlimaTIcket (incentivisation) [17], [21]
			Digital confidence [33]	Users [33]		
In the station / On the train	Physical capability	Passenger characteristics	Cumbersome baggage [12]	Non-users [12]		Days Out Scheme (enablement) [19]
In the station / On the train	Psychological capability	Awareness of information	Knowing where to find information and assistance [14], [30], [37]	Users [14], [37] Lapsed users [37] Non-users [30], [37]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30], People with disabilities [37]	
In the station / On the train	Physical opportunity	Physical accessibility	Ease/difficulty of taking a bike on the train [15]	Users [15]		
			Physical accessibility of interchanges [14], [16], [27], [32]	Users [14], [16], [27], [32] Non-users [16], [27]	Older people [32]	Days Out Scheme, In-station lighting (enablement) [19], [20]

Journey stage	COM-B sub-component	Themes	Factors	User groups sampled	Demographic groups sampled	RQ2 intervention (BCW intervention function)
			Physical accessibility of stations/facilities [13], [14], [16], [30], [32], [36], [37]	Users [13], [14], [16], [32], [36], [37] Lapsed users [36], [37] Non-users [16], [30], [37]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30], Older people [32], People with disabilities [37]	Days Out Scheme, In-station lighting (enablement) [19], [20]
			Physical accessibility of trains [7], [14], [16], [30], [32], [36], [37]	Users [7], [14], [16], [32], [36], [37] Lapsed users [36], [37] Non-users [16], [30], [36], [37]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30], Older people [32], People with disabilities [37]	Days Out Scheme (enablement) [19]
In the station / On the train	Physical opportunity	Security	Lighting in stations and car parks [32], [34]	Users [32], [34] Non-users [34]	Older people [32]	In-station lighting (environmental restructuring) [20]
			Isolated stations vs. staffed/busy activity nearby [11], [34]	Users, Non-users [11], [34]		
			CCTV or security guards [11], [14], [34]	Users [11], [14], [34] Non-users [11], [34]		
In the station / On the train	Physical opportunity	Sensory	Lighting [32], [37]	Users [32], [37] Lapsed users [37] Non-users [37]	Older people [32], People with disabilities [37]	In-station lighting (environmental restructuring) [20]
			Noise [32], [37]	Users [32], [37] Lapsed users [37] Non-users [37]	Older people [32], People with disabilities [37]	

Journey stage	COM-B sub-component	Themes	Factors	User groups sampled	Demographic groups sampled	RQ2 intervention (BCW intervention function)
			Overstimulation [30]	Non-users [30]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30]	
			Smells [32]	Users [32]	Older people [32]	
In the station / On the train	Physical opportunity	Station and onboard facilities	Visible and helpful staff on trains and in stations [14], [15], [16], [30], [31], [32], [33], [34], [37]	Users [14], [15], [16], [31], [32], [33], [34], [37] Lapsed users [37] Non-users [16], [30], [31], [34], [37]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30], Older people [32], People with disabilities [37]	
			Passenger Assistance service [32] [37]	Users [32], [37] Lapsed users [37] Non-users [37]	Older people [32], People with disabilities [37]	
			Awareness of accessibility issues from staff [16], [30], [37]	Users [16], [37] Lapsed users [37] Non-users [16], [30], [37]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30], People with disabilities [37]	
			Availability of facilities (e.g. waiting areas/seating, toilets) [11], [25], [26], [28], [32]	Users [11], [25], [26], [28], [32] Non-users [11]	Older people [32]	
			Wi-Fi/internet or phone connection [11], [13], [14], [36]	Users [11], [13], [14], [36] Lapsed users [36] Non-users [11]		

Journey stage	COM-B sub-component	Themes	Factors	User groups sampled	Demographic groups sampled	RQ2 intervention (BCW intervention function)
			Space for luggage on trains and in stations [14], [16], [32]	Users [14], [16], [32] Non-users [16]	Older people [32]	
In the station / On the train	Social opportunity	Other passengers	Antisocial people/behaviour (e.g. drunk, loud) [7], [13], [32], [34]	Users [7], [13], [32], [34] Non-users [7], [34]	Older people [32]	
			Passenger awareness of support needs [13], [30]	Users [13] Non-users [30]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30]	
			Social pressure - feeling hurried along [32]	Users [32]	Older people [32]	
			Social interactions on trains (e.g. someone in your seat) [30], [31], [37]	Users [31], [37] Lapsed users [37] Non-users [30], [31], [37]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30], People with disabilities [37]	
			Dislike of being in crowds or around other people [7], [11], [13], [32], [34], [35]	Users [7], [11], [13], [32], [34] Non-users [7], [11], [34], [35]	Older people [32]	In-station lighting (environmental restructuring) [20]
In the station / On the train	Reflective motivation	Comfort	Cleanliness of stations/trains (incl. seating, toilets) [11], [14], [16], [32], [36]	Users [11], [14], [16], [32], [36] Lapsed users [36] Non-users [11], [16]	Older people [32]	
			General comfort [16], [30]	Users [16] Non-users [16], [30]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30]	

Journey stage	COM-B sub-component	Themes	Factors	User groups sampled	Demographic groups sampled	RQ2 intervention (BCW intervention function)
			Train temperature [13], [16]	Users [13], [16] Non-users [16]		
			Getting a seat/table on the train [11], [13], [14], [36]	Users [11], [13], [14], [36] Lapsed users [36] Non-users [11]		
In the station / On the train	Reflective motivation	Confidence	Willingness to ask for help [37]	Users, Lapsed users, Non-users [37]	People with disabilities [37]	
			Confidence with stations/routes [37]	Users, Lapsed users, Non-users [37]	People with disabilities [37]	
In the station / On the train	Reflective motivation	Feeling safe	High visibility on platform can make you feel exposed [34]	Users, Non-users [34]		
			Sense of personal security [11], [12], [16], [26], [34]	Users [11], [16], [26], [34] Non-users [11], [12], [16], [34]		
			Reassurance of having other passengers present [32], [34]	Users [32], [34] Non-users [34]	Older people [32]	Days Out Scheme (incentivisation) [19]
			Not knowing when the train will arrive [34]	Users, Non-users [34]		
			Staff visibility [32], [34]	Users [32], [34] Non-users [34]	Older people [32]	
In the station / On the train	Reflective motivation	Freedom (Downtime/control)	Able to travel/socialise with family/friends/in a group [11]	Users, Non-users [11]		Days Out Scheme (incentivisation) [19]
			Can have a drink while out [11], [16]	Users, Non-users [11], [16]		
			Able to work/relax on the way [13], [15], [16], [35]	Users [13], [15], [16] Non-users [27], [35]		

Journey stage	COM-B sub-component	Themes	Factors	User groups sampled	Demographic groups sampled	RQ2 intervention (BCW intervention function)
In the station / On the train	Automatic motivation	Habit/familiarity	Familiarity with station layout - automatically moving through [30], [37]	Users [37] Lapsed users [37] Non-users [30], [37]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30], People with disabilities [37]	
Travelling to/from the station	Physical opportunity	Physical accessibility	Route to and from station (e.g. roads, pavements, cycle paths) [15], [29]	Users [15] Not specified [29]		Ride2Rail (enablement) [23]
Travelling to/from the station	Physical opportunity	Security	Pathways to stations - alleys/ low visibility is a barrier [34]	Users, Non-users [34]		
			Security of car/bike parking [11], [15]	Users [11], [15] Non-users [11]		
			Areas with higher crime rates [34]	Users, Non-users [34]		
Travelling to/from the station	Physical opportunity	Station and onboard facilities	Drop-off points [27]	Users, Non-users [34]		
			Car parking/bike storage [14], [15], [16], [27]	Users [14], [15], [16], [27] Non-users [16], [27]		
Whole journey	Physical capability	Passenger characteristics	Mobility impairments [5], [11], [13], [30], [37]	Users [11], [13], [37] Lapsed [37] Non-users [11], [30], [37] Not specified [5]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30], People with disabilities [37]	Days Out Scheme (enablement) [19]
			Physical health [7], [27], [35]	Users [7], [27] Non-users [7], [27], [35]		Days Out Scheme (enablement) [19]

Journey stage	COM-B sub-component	Themes	Factors	User groups sampled	Demographic groups sampled	RQ2 intervention (BCW intervention function)
			Neurodiversity [30]	Non-users [30]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30]	Days Out Scheme (enablement) [19]
			Digital exclusion [33]	Users [33]		
			Having a child/travelling with multiple children [5], [35], [38]	Non-users [35] Not specified [5], [38]	Car drivers [38]	Days Out Scheme (enablement) [19]
Whole journey	Physical opportunity	Information Provision	Relevant, accurate, personalised information [11], [14], [27], [36]	Users [11], [14], [27], [36] Lapsed users [36] Non-users [11], [27]		
			Consistent information provided in stations/on trains/online (e.g. station boards, apps) [13], [16], [27]	Users [13], [16], [27] Non-users [16], [27]		
			Real-time updates [14], [16], [26], [37]	Users [14], [16], [26], [37] Lapsed users [37] Non-users [16], [37]	People with disabilities [37]	
			Accessibility of information (all modes or channels of providing information) [13], [26], [27], [30], [32], [35], [37]	Users [13], [26], [27], [32], [37] Lapsed users [37] Non-users [27], [30], [35], [37]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30], People with disabilities [37]	

Journey stage	COM-B sub-component	Themes	Factors	User groups sampled	Demographic groups sampled	RQ2 intervention (BCW intervention function)
Whole journey	Reflective motivation	Confidence	Confidence in travelling by rail [30], [31], [35], [37]	Users [31] Lapsed users [37] Non-users [30], [31], [35], [37]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30], People with disabilities [37]	Days Out Scheme (incentivisation) [19]
Whole journey	Automatic motivation	Emotions	Stress & anxiety [31], [32]	Users [31], [32] Non-users [31]	Older people [32]	
			Resilience/openness (e.g. to trial-and-error) [15], [37]	Users [15], [37] Lapsed users [37] Non-users [37]	People with disabilities [37]	
			Fear [11], [31], [34]	Users, Non-users [11], [31], [34]		
			Enjoyment [7], [11], [15], [16]	Users [7], [11], [15], [16] Non-users [7], [11], [16]		OptimumPoints programme (incentivisation) [22]
			Nostalgia [30]	Non-users [30]	People with dementia, autistic people, people with mental health conditions, marginalised groups [30]	

Appendix Table 6: Summary of themes and factors identified in RQ1, organised by journey stage and COM-B sub-component

Intervention functions	Intervention and source	Description	Context	Design	Outcome measure	Evaluation start and end	Sample size	Key findings
Enablement	Ride2Rail [23]	A ridesharing app for making the first and last mile to and from the rail station.	The ridesharing function was piloted in Athens, Helsinki, and Brno. Each pilot had a different objective and duration from one week up to two months. Early pilots took place in Helsinki and Athens, focussed more on the usability assessment.	Living labs in four European cities, with an online survey.	System usability scale	2022 to 2023	93 participants (16 in Athens, 17 in Helsinki, and 60 in Brno)	The research demonstrated the technical feasibility of Ride2Rail for supporting the first and last mile to and from the rail station.
Persuasion and Incentivisation	Skånetrafiken (Social norms) [18] Skånetrafiken (Extra 2-week free travel) [18]	Treatment 1: A social norms message: "Did you know that most people in Skåne travel with us? 72 per cent of us living in Skåne travel by public transport occasionally. So join your neighbours and try it out". Treatment 2: A 4-week free trial travel card offer Control: A 2-week free travel card	Flyers with a message and a 2-week free travel card offer were sent to working aged adults who had recently moved to or within Skåne. The experiment tested the impact of providing a social norms message and providing a 4-week travel card.	Randomised controlled field trial with three-groups:	Use of free travel card (held against the bus, tram, or tarin card reader at least once)	February 2018 to March 2018 (following up period six months later in August 2018.	14,282 travel cards (participants per group: Control N = 4,764, Social norm group N = 4,758, 4-week travel card group N = 4,760)	There was no statistically significant effect of the social norm message on travel behaviour. However, participants in the 4-week travel card group were more likely to activate the card and use the travel card six months after the free trial ended, compared to the control group.
Incentivisation and enablement	Family Funday Sunday ticket scheme [21]	Ticket that allows family groups of at least one child and one adult unlimited travel on trains, buses, ferries on Sundays with a flat fare of $2.50 per person.	Launched in Sydney, Australia on Sunday 21 December 2008. At the time, it was the only concessionary multi-model ticket available until April 2010.	Cross-sectional household survey data	Share of travel starting and ending at home using public transport travel, on Sundays	2007 to 2010	2,532 trips (number of households not specified)	The research identified no statistically significant effect of the group travel discount on travel behaviour in households with children. The authors suggest this may have been a result of scheme restrictions, such as only being valid on Sundays when people are less likely to travel and only being available for a small target population.

Intervention functions	Intervention and source	Description	Context	Design	Outcome measure	Evaluation start and end	Sample size	Key findings
Incentivisation and enablement	Days out scheme [19]	Offered free group tickets to people in socio-economic disadvantage for day trips.	Covering rail lines between Cardiff, Bristol, Swindon, Westbury, Bath Spa, Severn beach line, Weston-super-Mare, Taunton. Implemented in collaboration with the Severnside Community Rail Partnership and over 120 partner organisations. Partner organisations applied for free day trip travel cards on behalf of groups of disadvantaged people they worked with and helped.	Qualitative	Not applicable	July 2016 to February 2017	134 bookings (2,063 participants) 60 passenger feedback forms	The scheme was perceived as effective by participants, and reached groups of refugees, asylum seekers, people with mental and physical disabilities and families on low incomes. Non-users made up 28% of participants lapsed users, 59%.
Environmental restructuring	Lighting [20]	Two lighting interventions in stations to guide passengers' movements and waiting behaviours	Pilots ran in one station in the Southwest of England	Qualitative evaluation	Not applicable	October 2019 to January 2020	24 survey participants 6 staff interviewed	Observations of passenger movements showed that some, but not all passengers interacted with the lights as expected. Survey responses suggest that the lights' meanings were not always understood. The results have implications for further product development and highlighted practical difficulties of trialling interventions in operational railway stations.
Incentivisation	OptimumPoints programme [22]	An app that awards points for using active and environmentally friendly modes of travel	Demonstrations ran in Birmingham (England) and Vienna (Austria). Active transport was worth twice as many points as public transport. Car usage was not rewarded. Points could be traded for money in Vienna, and public transport tickets and shopping vouchers in Birmingham.	Observational before-after evaluation	Average travel time by mode	2018 (2 weeks unrewarded period, 4 weeks reward period)	64 participants (35 in Birmingham, 29 in Vienna)	During the intervention period participants spent more time travelling by public transport and active travel (particularly walking) after the introduction of points, compared to the baseline period.

Intervention functions	Intervention and source	Description	Context	Design	Outcome measure	Evaluation start and end	Sample size	Key findings
Incentivisation and enablement	KlimaTicket [17]	A cheap annual season ticket allowing unlimited access to Austria's public transport network at a fixed price of 1095 Euros (and 821 Euros for youths, seniors, and individuals with disabilities)	Introduced in October 2021. At the time, a season ticket for the rail network was 1964 Euros. The concept of a season ticket valid for Austria's whole public transportation network has been part of various government programmes since 2006.	Difference-in-difference with a synthetic control	Rail passenger demand	Pre-treatment period from 2015 to 2020, post-treatment period 2021 to 2023	Panel dataset of 6 companies	The results indicate that the KlimaTicket had no statistically significant impact on short-run passenger growth compared to a data-driven counterfactual (constructed using other European railway companies to mimic the number of passengers of the Austrian Federal Railways without the KlimaTicket).

Appendix Table 7**. Summary of interventions identified in RQ2, to encourage rail use and improve passenger experience**