Foundation for Integrated Transport

The environmental and socioeconomic benefits of rail travel:

Should these carry a stronger weight in rail investment decisions?

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FIT fellowship report

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Acronyms and abbreviations

AIReF	Independent Authority for Fiscal Responsibility (Spain)
AST	Appraisal Summary Table
BCR	Benefit-cost ratio
CBA	Cost-benefit analysis
CEF	Connecting Europe Facility
DEFRA	Department for Environment, Food & Rural Affairs
DfT	Department for Transport
ECMT	European Conference of Ministers of Transport
EIA	Equality Impact Assessment
FBC	Final business case
GVA	Gross value added
IEA	International Energy Agency
IEMA	Institute of Environmental Management and Assessment
OEP	Office for Environmental Protection
RSSB	Rail Safety and Standards Board
RSVT	Rail Social Value Tool
SEA	Strategic Environmental Assessment
SROI	Social return on investment
STAG	Scotland's Transport Appraisal Guidance
TAG	Transport Analysis Guidance
WelTAG	Welsh Transport Appraisal Guidance
WLC	Whole-Life Carbon

Executive Summary

This paper explores the evolving role of environmental and social value in the appraisal of transport projects in England, with a particular focus on the railway sector. It argues that while rail offers significant economic, environmental, and social benefits, current appraisal frameworks, particularly those used in England, continue to prioritise short-term economic returns and monetised impacts, often at the expense of broader, long-term sustainability and social equity goals.

The Value of Rail

Rail is a uniquely efficient and sustainable mode of transport, offering substantial benefits to passengers, non-passengers, and the environment. It enables faster, more cost-effective journeys, reduces congestion, and contributes to improved air quality and lower carbon emissions. In 2019, the UK rail sector contributed £43 billion in gross value added to the UK economy and supported 710,000 jobs. For every £1 spent on rail, £2.50 is returned to the wider economy.

Environmentally, rail is the cleanest mode of transport, accounting for only 1.4% of UK transport CO_2 emissions while delivering 9.5% of all passenger kilometres. Electrification and renewable energy adoption are expected to further reduce emissions, with electric trains projected to produce 85% fewer emissions by 2050 compared to 2020 levels. Modal shift from road to rail also supports public health, social inclusion, and urban regeneration.

Challenges in Transport Appraisal

Despite these benefits, England's transport appraisal framework, anchored in HM Treasury's Green Book and the Department for Transport's Transport Analysis Guidance (TAG), remains heavily reliant on cost-benefit analysis (CBA) and benefit-cost ratios (BCR). These tools, while useful for comparing projects, often fail to capture long-term, non-monetised benefits such as biodiversity, social cohesion, and climate resilience.

TAG includes mechanisms for assessing environmental and social impacts, but these are often treated as secondary to economic efficiency. Environmental impacts are monetised using carbon pricing and other valuation tools, while social impacts are frequently assessed qualitatively. This creates a bias toward projects with easily quantifiable benefits, often favouring road schemes over rail, and underrepresenting the value of projects that promote social inclusion or environmental sustainability.

Strategic Case and the Need for Reform

The strategic case within the Five Case Model, which is the approach for developing business cases recommended by HM Treasury, is intended to align transport investments with broader policy goals, such as net zero, levelling up, and public health. However, in practice, it is often overshadowed by the economic case. The 2020 Green Book Review highlighted a

widespread failure to engage with strategic objectives, leading to decisions driven by BCRs rather than long-term societal goals.

To address this imbalance, this paper recommends strengthening the strategic case by mandating alignment with key government policies and expanding its scope to include long-term environmental and social outcomes. It also advocates for improved methods to monetise or qualitatively assess these outcomes, and for the consistent use of tools such as the Rail Social Value Tool (RSVT), which enables the rail industry to measure and report social value across 12 impact areas.

Proposal for a Dedicated Environmental (and Social Value) Case

One of the paper's central recommendations is the introduction of a dedicated "environmental case" within the business case appraisal framework. This would elevate environmental considerations to equal status with economic and strategic factors, ensuring that impacts such as carbon reduction, biodiversity and climate resilience are systematically assessed and reported.

While critics argue that a separate environmental case could lead to duplication or siloed thinking, the paper outlines several mitigating actions. These include cross-referencing between cases, interdisciplinary appraisal teams, proportional requirements for smaller projects, and outcome-focussed reporting. A dedicated environmental case would also enhance transparency, accountability and innovation in sustainable transport design. Furthermore, a stronger environmental case would subsequently support wider societal benefits by reducing health inequalities, enhance public well-being and enhanced social mobility through environmentally conscious transport planning, hence the link to a "Social Value" Case.

International and Domestic Comparisons

The paper examines how other countries have addressed similar challenges. Germany, for example, uses a "red flag" system that can halt projects with unacceptable environmental impacts, regardless of their economic merits. In France and Spain, major rail investments have been made based on national integration and social equity goals, even when economic cases were weak.

Closer to home, Scotland and Wales offer compelling examples of more balanced, policy-driven appraisal frameworks. Scotland's Transport Appraisal Guidance (STAG) gives equal weight to economic, environmental, safety, integration and social inclusion criteria. It emphasises qualitative integration of environmental and social benefits early in the appraisal process and aligns closely with national climate and equity goals. The Borders Railway project exemplifies this approach, having delivered significant social and environmental benefits despite a low BCR.

Wales' Transport Appraisal Guidance (WelTAG) framework is even more progressive, embedding the Well-being of Future Generations Act into transport planning. It prioritises walking, cycling, and public transport, and requires all projects to demonstrate their impact on health, equality, community and the environment. Wales has paused most new road building to focus on sustainable transport, setting ambitious modal shift and emissions targets.

Lessons and Recommendations

The paper concludes that England's current transport appraisal framework, while methodologically rigorous, is overly focussed on short-term economic returns. To better reflect the full value of rail and other sustainable transport modes, the UK government should:

1. **Expand the strategic case** to include long-term environmental and societal goals.
2. **Mandate alignment** with key policies such as net zero and the Environment Act.
3. **Integrate tools such as the RSVT** into official guidance to consistently measure social value.
4. **Introduce a dedicated environmental case** to elevate sustainability in decision making and subsequently enhance the wider social value of projects.
5. **Learn from international and devolved administrations**, particularly Scotland and Wales, alongside France and Spain, which have successfully embedded broader policy goals into transport appraisal.

The paper also highlights the systemic issue of short-termism in UK infrastructure planning, driven by political cycles and rigid budgetary processes. Projects such as HS2 and Restoring Your Railway have suffered from inconsistent funding and shifting priorities, undermining long-term benefits. Breaking this cycle requires bipartisan commitment to long-term investment and reform of budgetary processes.

Conclusion

Rail offers a powerful means to achieve economic growth, environmental sustainability and social equity. However, to unlock its full potential, England's transport appraisal framework must evolve. By adopting a more balanced, policy-aligned approach, drawing on best practices from Scotland, Wales and international peers, the UK can ensure that future transport investments deliver lasting value for people, communities and the environment.

Background Context

It is commonly accepted knowledge that the huge benefits generated by rail in relation to the subsidy that flows into it constitute what researchers define "the value of rail". This can be thought of as the benefits rail provides to passengers, non-passengers and the environment. Previous approaches to describing the value of rail have focussed on the employment it generates, and the gross value added (GVA) associated with the rail industry (Ernst & Young, 2025). However, these have been recently reviewed to foreground the most critical reason to have a railway – being a mass shifter of people and goods across different places. A recent study (Oxford Economics, 2025) has highlighted how these passenger and freight journeys create benefits for:

- **Passengers**: by enabling them to make faster and/or more cost-effective journeys than the second-best transport alternative, creating access to employment and other services which are not as easily accessible by other modes of transport, particularly for households who do not have access to a car.
- **Non-passengers**: by reducing congestion on other transportation networks and stimulating productivity in urban areas through agglomeration.
- **The environment**: by reducing carbon emissions and noise pollution and improving air quality, which are especially significant in urban centres.

The economic analysis conducted by Ernst & Young on a number of case studies unequivocally suggests that rail generates greatest value in high-volume, intercity routes, such as London and Birmingham or Manchester, by providing mass transportation to and from major urban centres where congestion is most material, and faster travel over long distances (Oxford Economics, 2025). Conversely, rail delivers lower value in rural areas that are not congested and where usage of the rail network is low. In these areas it therefore achieves lower overall benefits, and the net subsidy that flows into it is higher (Ernst & Young, 2025).

It is within this broader concept of "value" that the substantial economic, social and environmental contribution of rail to the fabric of the UK, and by extension of other developed countries, should be examined.

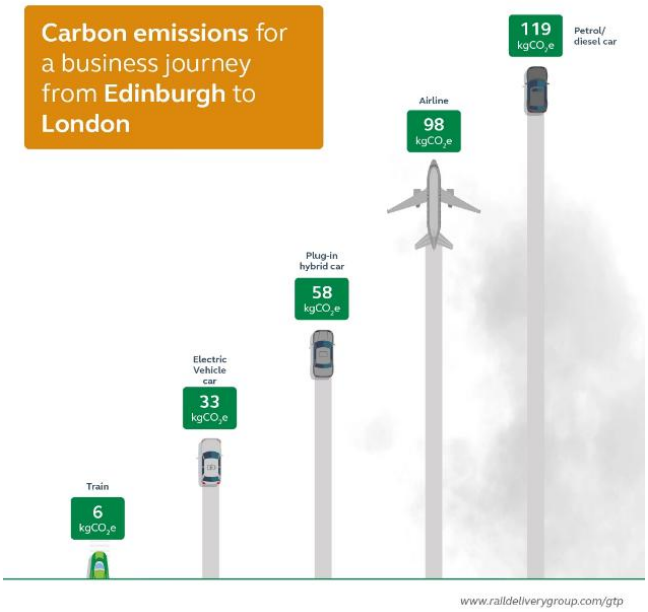
According to Oxford Economics (2021), in 2019, the railway sector contributed £43 billion to the UK economy in terms of GVA and supported 710,000 jobs. It is estimated that for every £1 spent on rail, a return of £2.50 is generated in the wider economy. It is to be noted that whereas the total "economic footprint" is the sum of direct, indirect and induced impacts such as the economic production stimulated along the UK supply chain and the payment of wages by the businesses involved, it does not account for other dimensions of wider socioeconomic benefits, such as net user benefits, environmental gains and contribution to the economy's long-term growth prospects. When these areas are also considered, a more comprehensive and compelling picture can be drawn of the role played by the UK's rail network in supporting

its socioeconomic fabric by bolstering social mobility, improving public health and reducing carbon emissions.

If we look exclusively at pure environmental benefits, rail provides by far the cleanest mode of transport, with significantly lower production of greenhouse gas emissions and other pollutants. It is estimated that the UK rail sector's share of UK transport CO_2 emissions is 1.4%, while it accounts for 9.5% of all passenger kilometres. This difference is expected to rise in the future, with electric trains anticipated to produce 14 times fewer emissions than conventionally fuelled trains in 2050, as technology advances (Oxford Economics, 2022). If all rail services were provided by electric trains, emissions would be expected to decrease by 85% by 2050, with each train producing an estimated 11 tonnes of CO_2 emissions per annum, down from 72 tonnes of CO_2 in 2020.

Figure 1 shows carbon emissions for a business journey from Edinburgh to London using different modes of transport.

Figure 1. Carbon emissions for a business journey from Edinburgh to London



Source: RDG (2024).

In addition to being intrinsically less polluting, rail systems are also more energy efficient and can be powered by renewable energy, further reducing emissions compared to fossil-fuel dependent cars (Department for Transport, 2021). It is estimated that switching one 30-mile car journey per month to rail could save 4.4 Mt CO_2 annually, reducing total car emissions by 6.5% (Sustrans, 2023). A single long-distance train can replace over 400 cars, alleviating congestion and reducing urban space usage by vehicles. Modal shift is also connected to public health benefits by its contribution to reduced congestion costs and improved air quality. It also promotes equitable access to transportation for low-income and marginalised groups, thus supporting further societal benefits and economic growth (Sustainable Transport Alliance, 2023).

The impacts of modal shift on local communities can be even more pronounced in agglomerations compared to average in the UK and elsewhere. For example, in the European Union, the transport sector is responsible for 40% of CO_2 emissions in urban areas as opposed to 30% on average (Pietrzak and Pietrzak, 2018). Due to the higher traffic density and congestion experienced in cities where short car trips are dominant, the socioeconomic benefits of investment in public transport are amplified through increased productivity (Sustainable Transport Alliance, 2023), offering greater opportunities for inclusive social mobility with access to jobs and healthcare (Climate Change Committee, 2023), and freeing up urban space previously occupied by cars for other uses such as green spaces or pedestrian zones (Dickinson, 2021). These are often the reason why rail is widely positioned as the backbone of sustainable transport in national decarbonisation strategies, with modal shift from road transport identified as a critical means of realising rail's full benefits potential.

Early research indicates that rail is likely to maintain an environmental sustainability advantage over road transport in the long term, even with full electrification and automation of road transport. This is mainly due to inherent features of rail such as lower energy intensity, higher capacity and centralised decarbonisation efforts. For example, current electric rail emits as little as 6g CO_2e per passenger kilometre vs. 13–53g CO_2e/km for electric cars, depending on occupancy (Greenly, 2022). Future automated electric trucks could reduce road emissions via platooning and eco-driving, but studies suggest circa 9% energy savings from automation, which are offset by added power demands from sensors and computing (Nikitas et al., 2021). Rail also presents systemic advantages such as scalability, while roads will face congestion limits even with automation. There are also a number of uncertainties around the progress of road's renewable technologies and transition. Boston Consulting Group estimates that rail could achieve net zero by 2050 via renewables and hydrogen, while road freight relies on unproven large-scale battery recycling (Nikitas et al., 2021; Greenly, 2023). DHL (2023) notes that rail's sustainability hinges on full electrification and green energy adoption, both progressing faster than road's renewable transition. However, rail's sustainability advantage is going to narrow with road's transition to renewable and automation – understanding the extent of which will require further research and analysis in the coming years.

Crucially, there are also broader, less immediate socioeconomic benefits associated with rail's positive impact on the environment, typically visible over a longer period of time, and therefore less readily calculable at project inception stage. However, barriers to public transport range from the so-called hard factors, like cost, time efficiency or limited geographical cover that restricts accessibility, to social and complementary factors, such as cultural preference for car ownership, and perceptions of greater comfort and privacy provided by car journeys compared to rail travel. Addressing these barriers requires targeted interventions such as improving rail affordability and accessibility for all, expanding network coverage and promoting integrated transport solutions – which can be extremely costly and require complex integrated strategies and partnerships between governments and local communities. However, according to a study published by the University of Cambridge (Thomas and Serrenho, 2024), reducing the barriers to public transport, with particular

emphasis on rail, could support a 30% reduction in domestic transport emissions through both direct impact and indirect return via broader positive ramifications on local communities. The European Union's Agency for Railways (2024) goes as far as describing modal shift from road and air transport to rail as potentially the greatest contribution of rail to the environment, if it can meet its aspiration to become carbon neutral by 2050.

The data clearly suggests that an extensive decarbonisation programme in Britain and elsewhere is critical to achieving net zero targets, creating more sustainable and efficient transport systems in both urban and rural areas, and unlocking complementary socioeconomic benefits such as improved social mobility, access to jobs and public healthcare. This paper supports the case for significant further investment in sustainable railway projects in the decades ahead and argues that a review into the treatment of environmental benefits and social value in rail projects business case appraisal in England is required to reflect the modern-day needs of an increasingly sustainable, socially mobile society.

In the first section, it discusses the state of play as to the role of environmental benefits, natural capital and social impacts in the Treasury's transport business case appraisal guidance. It argues that, despite some attempts to address calls for sustainability and wider socioeconomic outcomes to be granted adequate weight in transport appraisal decision making, England's approach remains over-reliant on monetisation of benefits and centred around cost-benefit analyses and short-term economic returns. Some recommendations are set out as to how these shortcomings could be addressed, such as through the introduction of a dedicated environmental case. The second section discusses how similar trade-offs dilemmas have been addressed internationally and encourages England to learn lessons from countries such as France or Spain, which have historically taken a wider societal view of the benefits of rail and made decision to invest in significant transport infrastructure despite weak or negative economic cases. Further crucial lessons could be learned from two of the UK's devolved administrations – Scotland and Wales – where progressive transport appraisal frameworks prioritise policy alignment, treatment of non-quantifiable benefits and integration of qualitative analysis over financial returns. The success of this type of business case appraisal architecture is exemplified through Scotland's Borders Railway project case study.

Since undertaking the ground research that has informed this paper, the government has published a Green Book Review (HM Treasury, 2025) that touches on the key themes hereby presented, such as the over-reliance on benefit-cost ratio (BCR), poor strategic cases underpinning projects and ineffectiveness at assessing transformational change. The review suggests some concrete actions to be taken that are in line with the recommendations made in this paper, including giving proper consideration to unmonetisable benefits, wider socioeconomic benefits and appraising projects over appropriate time horizons. Whereas there has been insufficient time between the publication of the Green Book Review and that of this research to fully assess and incorporate the outcomes of the review, it is acknowledged

here that action seems now likely to be taken in the near future to address some of the shortcomings in transport projects appraisal presented in this report.

Section One: The State of Play in Transport Appraisal Decision Making and its Shortcomings

The Overwhelming Role of the Economic Statement in Transport Appraisal Decision Making in England

Transport projects aim to reduce costs, improve connectivity and enhance productivity. England's transport business case guidance uses a Five Case Model to promote robust, evidence-based decision making. The framework outlined in the Treasury's Green Book for investment decision appraisal encompasses the strategic, economic, financial, commercial and management dimensions, and is applied progressively through three appraisal stages: Strategic Outline Business Case, Outline Business Case and Full Business Case. While the Five Case Model is intended to create a holistic picture of the project spectrum to support optimal decision making, as shown further in this section, there is a breadth of evidence to suggest that economic efficiency is often the dominant objective when transport project performance is being assessed in England, therefore leading to the economic case bearing disproportionate influence.

The Department for Transport's (DfT) Transport Analysis Guidance (TAG),[1] a vital instrument for the economic appraisal of transport projects in England, aims to provide a detailed and standardised framework to appraise projects. The key roles of TAG in the appraisal of transport projects can be summarised as follows (Transport Analysis Guidance, DfT, 2023):

- **Standardised methodology**: TAG outlines comprehensive guidance for transport studies, including setting objectives, identifying problems, developing solutions and conducting appraisals. The aim of this function is to ensure consistency across projects and compliance with the Treasury's Green Book principles.
- **Cost-benefit analysis (CBA)**: Central to TAG is the preparation of the CBA to calculate the benefit-cost ratio (BCR), assessing the net economic value of projects. Key features of the CBA are the monetisation of all measurable impacts, both costs and benefits, an incremental approach that compares a "project scenario" vs. a "non-project scenario" to calculate net benefits, and the time value of money, through which future costs and benefits are discounted to present value to ensure comparability over time.
- **Support for business cases**: TAG also facilitates the development of robust business cases by linking economic, strategic, financial, commercial and management considerations (the Five Case Model) into a unified evidence base.

[1] The UK's Transport Analysis Guidance (TAG), developed by the Department for Transport, serves as the central framework for appraising transport projects in England. However, consistently with transport being a devolved matter, Scotland and Wales have developed their own appraisal frameworks, STAG and WelTAG respectively, which are tailored to their devolved policy contexts and priorities. All frameworks share a foundation in the UK Treasury's Green Book principles but diverge in application to reflect local governance and policy contexts.

With a view to align projects with sustainability goals and address equity concerns, environmental and social considerations are integrated into TAG's structured appraisal framework through various mechanisms. The guidance uses largely fixed methodologies to quantify impacts such as air quality, carbon emissions, journey quality and accessibility, embedding them in the analytically rigid CBA for larger projects and programmes. This report shows that the emphasis of TAG on monetised impacts supports the claim that the CBA and BCR are often the predominant factor to determining whether a project is worth public investment.

Indeed, it is not trivial to observe that building new transport infrastructure is vastly expensive and has a major impact on the financial trade-offs that any government needs to make while managing the public purse. This is even more true in densely populated countries like the UK compared to areas where population density is much lower, as construction needs more complex engineering solutions (like tunnelling and elevated tracks) and faces the challenge of minimising disruption to existing communities and significant infrastructure, such as water mains and sewage (Thadani, 2022; Cambridge Centre for Smart Infrastructure and Construction, 2024). This partly explains the cost-centred approach of investment appraisal guidance in the UK and other densely populated western countries.

The following mechanisms are used to account for most environmental and some socioeconomic impacts in England's Transport Analysis Guidance:

- **Environmental Impact Appraisal (TAG Unit A3)**: TAG Unit A3 provides detailed guidance on assessing environmental impacts, including effects on air quality, noise, greenhouse gas emissions, biodiversity and the built environment. These impacts are quantified systematically through tools like noise and air quality worksheets. A key methodology used in this unit is the so-called "value of carbon", whereby carbon emissions and savings are monetised using the UK government's carbon pricing framework, which assigns a financial value to emissions – either increased or reduced. The value of carbon affects the BCR of projects, making them more or less attractive in financial terms. Moreover, through the "environmental capital approach", the importance of natural assets like biodiversity, landscapes and heritage features is evaluated by using a set of standardised indicators to assess their significance and interrelationships. This approach then describes how transport project proposals impact on those features and produces an overall assessment score on a seven-point scale (large adverse to large beneficial) across all impacted areas.
- **Strategic Environmental Assessments (SEA)**: TAG incorporates the requirements of the SEA Directive (2001), which mandates evaluating the environmental impacts of transport plans and programmes. The SEA process includes stages such as setting objectives, assessing alternatives, predicting impacts and proposing mitigation measures.

  Whereas TAG Unit A3 and Strategic Environmental Assessments have evolved to increasingly incorporate total environmental costs, rather than just operational ones,

the extent and treatment of different cost types depends on the guidance version, project type and stage of appraisal. TAG does consider a range of environmental impacts, namely greenhouse gas emissions (from both construction and operation), air quality, noise and vibration, biodiversity, landscape and townscape, water environment, and heritage. In most recent updates of the guidance, construction-related environmental impacts, such as embodied carbon in materials and fuel used in machinery, are increasingly being included, especially for major schemes such as High Speed 2 (HS2). Supply chain emissions can be considered if a lifecycle assessment (LCA) or whole-life carbon (WLC) analysis is undertaken, which TAG encourages for the most significant infrastructure. However, routine or smaller projects still mostly focus on operational phase impacts (e.g. emissions from vehicles over time once the scheme is complete and in operation) and monetised environmental costs related to air quality or greenhouse gases in use. Furthermore, TAG does not always fully monetise or include indirect or embedded emissions across the supply chain (unless explicitly assessed), end-of-life impacts such as decommissioning infrastructure, and non-monetised environmental externalities, which are typically described qualitatively. This approach does not necessarily ensure that the total environmental costs of transport projects, from construction supply chain to end-of-life dismantling, are consistently assessed in business case appraisal.

- **Social Impacts Appraisal (TAG Unit A4.1)**: Similarly to the Environmental Impact Appraisal discussed above, TAG Unit A4.1 focuses on assessing the social impact of transport interventions, including categories such as accidents, security, journey quality, accessibility and personal affordability. Differently from TAG Unit A3, however, social impacts are assessed either quantitatively or qualitatively, depending on the scale and severity of the intervention. This reflects the complexities involved in monetising social impacts and the significant uncertainties associated with this methodology, which some commentators have argued can undermine confidence in the results of the analysis (Department for Transport, 2022). Furthermore, whereas the guidance also includes distributional analysis to evaluate how impacts vary across different social groups, arguably such impacts are not sufficiently considered or robustly integrated into appraisals. Commentators have pointed out that vulnerable groups, such as low-income individuals or those reliant on public transport, may not receive adequate attention (Shortall and Mouter, 2021).
- **Appraisal Summary Table (AST)**: The AST consolidates environmental, social and economic impacts into a single framework. It offers a qualitative approach of appraisal on a seven-point scale (i.e. large averse to large beneficial, as seen for the Environmental Capital Approach in TAG Unit A3), where individual impacts are considered to be of lesser importance or where sufficient data or valuations are unavailable to undertake a quantitative approach. This is more frequent where appraisal of social impacts is concerned. The treatment in TAG of a qualitative approach to describe environmental and socioeconomic impacts as an intrinsically less desirable methodology as opposed to monetisation supports the argument that,

where social value is difficult to calculate in monetary terms, there is a risk that this is overlooked in transport project decision making.

- **Mitigation and monitoring**: TAG emphasises identifying mitigation measures for adverse environmental effects and monitoring significant impacts during project implementation. However, this approach focusses on remediation and reduction of the negative impacts associated with a project as an unwanted effect, with lesser prominence being given to achieving desired environmental outcomes as a fundamental factor behind the attractiveness of a business case.

The appraisal mechanisms presented above show that England's business case guidance tends to prioritise quantifiable outcomes like BCRs, which may distort decision making by focussing too heavily on the economic case. It can be argued that, when environmental and socioeconomic impacts are concerned, TAG tends to over-quantify effects and outcomes, which can sometimes result in overlooking strategic objectives, such as addressing regional inequality or sustainability goals, if they cannot be translated into a positive financial outturn (Urban Transport Group, 2018). As correctly emphasised by supporters of the superiority of the economic case compared to other dimensions, desired environmental outcomes and the social value of transport projects are typically the most difficult to quantify (HM Treasury, 2022). There are, however, evolving methodologies and techniques, such as the social return on investment (SROI) and well-being evaluation, which are increasingly robust and accepted (Arvidson et al., 2010; Nicholls et al., 2012). Furthermore, the UK's Green Book and TAG already encourage inclusion of these impacts in the assessment, therefore better capacity building, data collection and guidance enforcement could improve implementation.

The wider economic impacts of transport projects, such as increased productivity, employment effects and induced investments, are appraised using TAG Unit A2-1. Such impacts are relevant when transport schemes improve accessibility, support dependent development or address imperfect competition in markets. The guidance emphasises using welfare and non-welfare measures to consistently communicate economic impacts across the transport business case. However, even where wider economic impacts appraisal is concerned, welfare analysis captures economic impacts primarily by estimating user benefits as a result of journey time savings, which are most easily quantifiable.

Supporters of the dominance of CBA and BCR in transport projects appraisal have emphasised that these tools provide a standardised, quantifiable method to compare diverse projects, ensuring public funds are allocated efficiently (Boardman et al., 2018). In theory, BCRs can be used to rank projects based on their BCR, where a BCR > 1 indicates that benefits outweigh costs. This would mean that at early stages, CBA can act as a "sifting test", narrowing down a wide range of proposals to a manageable set of options for detailed evaluation (Atkins et al., 2017). Thus projects with "high" or "very high" BCR (i.e. above 2:1) are more likely to receive funding, as they demonstrate strong value for money. However, in practice, CBA is often conducted only after a project has gained significant political momentum, and it is rarely used to rank and select projects purely based on their BCRs. The Institute for Government highlights that CBA is frequently used to justify decisions that

have already been made, rather than to inform them. This means that once a project has political backing, often due to lobbying, regional pressure or strategic priorities, CBA is conducted to support the case, rather than to objectively assess alternatives (Atkins et al., 2017).

Furthermore, CBA often gives a misleading sense of precision, especially when monetising non-market impacts like biodiversity or social cohesion. It also aggregates benefits and costs, masking where the trade-offs of gains and losses are, to the detriment of social equity. The use of complementary tools such as multi-criteria analysis or distributional impact assessments allows to capture broader impacts while retaining consistency and comparability.

Despite its limitations, BCR remains a central metric in public discourse and official documentation. For example, the HS2 project's BCR was repeatedly revised downward as costs rose, which significantly influenced public and political debates about its value (Tetlow and Pattison, 2023). Even when decisions are politically driven, BCRs are used to justify or challenge those decisions, making them influential in shaping narratives and accountability. Furthermore, because the BCR offers a standardised way to compare diverse projects across sectors and regions, this makes it especially important in a context where public funds are limited. BCRs do help civil servants and analysts assess relative efficiency and potential returns, which can inform prioritisation and budget allocation (Atkins et al., 2017). The Green Book Review by HM Treasury (2025) acknowledges that BCRs often fail to capture long-term, transformational benefits such as social cohesion, resilience or biodiversity, and can disadvantage projects in lower-income areas. This is why the review recommends moving away from rigid BCR thresholds and incorporating broader strategic and place-based considerations. However, until these reforms are fully implemented, BCRs still dominate many decision-making processes.

How Strategic is the Use of the Strategic Case?

As seen in the previous section, traditional CBA often undervalues environmental and social impacts of transport proposals, largely as a result of business case guidance emphasis on the monetary value of projects, and the fact that environmental and social value is difficult to quantify. In fact, transport appraisal methods in England have historically prioritised economic metrics since their inception in the 1960s. Over recent years, however, there has been a recognition amongst funders and decision makers that although the BCR should still be a key consideration in the allocation of public funding, it should not carry a disproportionate weight (Charlesworth, 2023).

To some extent, the strategic case does influence the prioritisation of transport projects in England by acting as a framework for assessing how investment proposals contribute to long-term policy objectives through their impact on the areas above. However, the 2020 Green Book Review found a "common failure of those writing appraisals to engage properly with the strategic context in which their proposal sits" (p.3), resulting in business cases that do not "thoroughly understand and address the contribution of a proposal to strategic policy

goals" (p.4). The review goes on to state that "with a lack of strategic direction now baked into the appraisal process, the selection of the option to be presented as the best becomes heavily reliant on a BCR that is not aligned to the decision makers' objectives" (p.4).

Updated versions of the Green Book have sought to address these failings. Guidance around the use of the strategic case in the Treasury's Five Case Model has been recently updated to address this gap by broadening appraisal criteria to include wider benefits like health, equity and sustainability, thus aligning infrastructure investment with broader policy objectives and long-term strategic goals (International Transport Forum, 2021; Keep at al., 2022).

Key contributions of the strategic case to transport investment decision making include:

- **Environmental benefits**: the strategic case can emphasise decarbonising transport systems to meet climate commitments as a primary objective of projects, promoting modal shift to public transport and active travel while reducing reliance on private vehicles. It also incorporates resilience planning to address the impacts of extreme weather events, supporting infrastructure durability.
- **Socioeconomic benefits**: investments guided by the strategic case often improve access to jobs, education and services, particularly benefiting deprived areas and low-income groups. Social inclusion is also promoted by enhancing mobility options and reducing barriers to employment, which supports regeneration and reduces inequalities.
- **Quality of life improvements**: public and active transport investment enhance health outcomes by reducing air pollution and increasing physical activity. They also improve urban aesthetics and foster community connectivity, contributing to overall well-being.
- **Economic growth**: the strategic case links transport projects with productivity gains through better urban agglomeration, reduced congestion and improved labour market access. It supports local economies by boosting footfall in high streets through sustainable travel interventions.

Nonetheless, there is evidence to suggest that the economic case, and in particular the CBA and BCR, continue to play a dominant role in transport project appraisals in England, primarily due to their structured approach and alignment with government guidelines, as discussed above. More specifically, the Department for Transport mandates that a CBA is undertaken for transport projects seeking government approval, and the BCR represents a key determinant of value for money. High Speed 2 (HS2) is a major example: despite being an eye-catching illustration of the influence of the strategic case on investment decisions, having been largely justified on strategic goals such as adding capacity to the rail network, improving connectivity between major cities, and boosting economic growth across the UK (Department for Transport, 2013), it is notable how the programme would originally achieve a BCR of 2.3, indicating substantial economic benefits relative to costs (House of Lords Economic Affairs Committee, 2015). The subsequent decision to axe HS2's "Phase 2" stages years later, which saw the curtailment of the new line to Birmingham, made largely on cost-cutting grounds, meant that the project's originally intended benefits – increased rail capacity

and improved economic growth – will not be delivered to the scale expected, while costs will significantly exceed the approved budget.

Because the CBA emphasises quantifiable benefits such as time savings, productivity gains and reduced costs, which are central to economic performance, road improvements have historically been favoured over rail schemes due to the significant user benefits identified under Road Investment Strategy 1 (RIS1), accruing to business and freight, and directly enhancing economic output (Frontier Economics, 2017). This approach is deficient in the tackling of social inclusion inequalities, as highway improvements are almost unavoidably restricted to the proportion of the community with access to a vehicle. In fact, highway schemes are rarely packaged with a guaranteed bus service. Conversely, rail is in principle available to all members of the community, making the network one step closer to being fully accessible (Steer Davies Gleave, 2002). It must be noted that, as seen in this section of the paper, with more emphasis placed on social inclusion, the government has moved to include considerations of distribution and equity in scheme appraisal. However, limitations remain in the ability of government guidance to capture broader socioeconomic benefits and strategic impacts in transport investment decision making.

Expanding and emphasising the use of the strategic case in transport project appraisal in England can help ensure that environmental and social outcomes are prioritised alongside or over economic considerations. For example, stronger policy alignment could be achieved by ensuring that the strategic case explicitly aligns with key government policies, such as the UK's Net Zero by 2050 target, the Levelling Up Agenda and the Environment Act 2021. This would make it mandatory for transport projects to demonstrate contribution to environmental sustainability and social equity. A more holistic approach could be adopted by expanding the scope of the strategic case to include long-term societal goals, such as improving public health, reducing inequality and enhancing urban liveability. Actionable strategies to further embed social equity considerations in the strategic case include increasing focus on accessibility by emphasising projects that improve access to jobs, education, healthcare and services for disadvantaged communities. A detailed distribution analysis to assess how transport projects impact different socioeconomic groups and regions, either in a positive or negative fashion, could be mandated to ensure a more equitable distribution of benefits.

As far as environmental metrics are concerned, more robust methods could be developed to monetise or qualitatively assess environmental outcomes, such as reduction in carbon emissions, improvements in air quality and biodiversity protection. This would give environmental factors greater weight in decision making. Additionally, carbon impact assessments could be made mandatory so that carbon accounting becomes a core element of the strategic case for all transport projects, ensuring alignment with decarbonisation goals.

Appraisal methodologies could also be looked into to move away from a decision-making approach that heavily prioritises economic metrics. Appraisal criteria could be broadened to move beyond traditional CBA by incorporating wider benefits into appraisal frameworks, including but not limited to the use of multi-criteria analysis to balance economic,

environmental and social factors. There is also an opportunity to develop tools to better integrate non-monetised benefits into the decision-making process, such as improved health outcomes from active travel.

The Rail Social Value Tool

Attaching a monetary figure to strategic environmental outcomes and the social value of transport projects through an analytical approach remains challenging. It is relatively easy to measure inputs, like connecting communities, providing employment, taking carbon off the roads, but it can be difficult to put a monetary value on the outputs. With this assumption in mind, the Rail Safety and Standards Board (RSSB) has developed the Rail Social Value Tool (RSVT). The necessity for the RSVT rests on the premise that a business' social licence to operate depends greatly on its social sustainability, and therefore we need to consider not only our current social value, but the social value rail could offer. RSSB suggests that economic arguments for new projects or activities are no longer enough, and good social ones are needed too. The RSVT aims to help the rail industry measure the social value of its activities, infrastructure projects and daily operations. It evaluates the impact on welfare, well-being and broader societal benefits using 500 indicators across 12 social impact areas, such as safety improvements, biodiversity enhancement, air quality changes, job creation, inclusivity and community engagement. The RSVT enables users to forecast, monitor and report social value through monetised metrics aligned with the Treasury's Green Book principles. It incorporates qualitative evidence and case studies to showcase benefits and supports resource allocation and decision making. Reporting dashboards allow tracking performance over time. The tool's approach to integrate social value metrics into decision-making frameworks can be included in the strategic case of transport projects to strengthen the weight of broader societal impacts in appraisals.

Since its launch in late 2021, the RSVT has seen some adoption across the UK rail industry, but its usage has varied. Early adopters include Network Rail and its supply chain, which used the tool across projects such as station redevelopments and infrastructure enhancements to incorporate inclusivity, accessibility and environmental improvements. For example, the Blackheath Station Biodiversity Project saw native planting and the creation of a hibernaculum undertaken following signalling works to enhance biodiversity and improve the local environment (Network Rail, 2021). By 2023, organisations such as South Western Railway had integrated the RSVT into their operations, reporting significant social value contributions using the tool (South Western Railway, 2023). In the same year, Northern Railway used the RSVT to launch the Woodworking Warriors Initiative, a project that supported veterans and community members in County Durham through woodworking workshops, reducing loneliness and improving mental health (Northern Trains Limited, 2023).

However, adoption across the entire rail industry remains inconsistent and unclear. While some organisations actively use the tool for forecasting and reporting, broader uptake may depend on training, integration with other systems and alignment with stakeholder priorities.

It is worth noting that although the RSVT is explicitly designed to align with the Green Book's principles for appraising and evaluating social value, the Green Book fails to reference the tool in its guidance, or to provide any guidelines as to how to use it and integrate it into the decision-making process. To date, this lack of reciprocity is a missed opportunity to further address the widely accepted over-reliance of business case guidance on CBA and modelling. The government could consider the benefits of taking advantage of a relatively mature social value calculator that offers a more in-depth approach to integrating sustainability in its broader meaning into the decision-making process, thus making appraisal of transport projects more balanced by providing much needed emphasis on strategic, environmental and social outcomes. By proactively including the RSVT in its Transport Appraisal Guidance, the government has an opportunity to promote social value at a higher level. It would also encourage more organisations to adopt the tool in a more systematic and consistent way, thus creating a wider and more reliable data base to evaluate its effectiveness and impacts, and further perfect the decision-making process.

Making the Case for an Environmental (and Social Value) Case

As discussed so far in this chapter, there are strong arguments that support the necessity to address the gap between the prominence of the economic statement and that of the wider environmental and social considerations in transport projects appraisal in England. Whereas more recent versions of the Green Book have sought to address these shortcomings by broadening appraisal criteria to include wider benefits like health, equity and sustainability, the evidence suggests that CBA and BCR still carry a disproportionate weight in decision making for environmental and socioeconomic priorities to be fully integrated within transport investment decisions.

There is growing public and stakeholder demand for transport investment decisions to prioritise environmental sustainability alongside economic growth. The acceleration of climate change related issues and subsequent policy commitments provide strong grounds to argue for environmental sustainability to be given equal status to economic and other strategic considerations in transport projects appraisal. A clear-cut way in which this could be achieved would be introducing a dedicated "environmental case" in business case guidance for transport projects. A number of key arguments support this approach.

Firstly, a dedicated environmental case would elevate environmental and sustainability considerations to equal standing when compared to monetised benefits in the economic case or high-level policy alignment in the strategic case. Environmental factors such as carbon reduction, air quality, resilience and biodiversity would be granted their own dedicated space for evaluation, rather than being subsumed under the economic or strategic cases – thus providing direct focus and reducing marginalisation (Molthan-Hill et al., 2015).

Secondly, as briefly seen at the beginning of this section, a dedicated environmental case would ensure stronger alignment with some ambitious government commitments related to climate change, such as net zero by 2050. A distinct environmental case would require all transport projects to demonstrate robust contributions to climate targets (or justify the lack

of the same). It would also support other legal and policy obligations, such as compliance with the Environment Act 2021, air quality standards and other statutory requirements (National Infrastructure Commission, 2023).

Furthermore, by making environmental impacts a standalone, standardised part of the appraisal, assessment methods and trade-offs would be made clearer to decision makers, stakeholders and the public, thus improving transparency and accountability. It would also allow for more rigorous monitoring and reporting of environmental outcomes post-implementation. A dedicated environmental case can systematically assess cumulative impacts of multiple projects (e.g. on greenhouse emissions, water, habitats) that are often missed when projects are appraised in isolation. In the longer term, with specific environmental targets and indicators, project promoters would be incentivised to innovate – for example by adopting low-carbon materials, nature-based solutions or climate-resilient designs.

As clearly stated in a paper from the Department for Environment, Food & Rural Affairs (DEFRA) that recommended the establishment of the Office for Environmental Protection (OEP) in 2020, well-enforced environmental regulations, supported by robust business case processes, would provide stability for those same businesses and can enhance trade opportunities by showcasing the UK's commitment to environmental standards. Since its establishment, the OEP has sought to influence business-case decisions primarily by holding public authorities accountable for compliance with environmental law and by clarifying legal expectations, which can shape how environmental factors are considered in business cases. This paper argues that the time is now ripe to consider whether such strategic influence and oversight could be taken a step further and promote the introduction of a dedicated environmental case in the Treasury's business case guidance.

Opponents of the recommendation to introduce a dedicated environmental case have typically framed their criticism around the risks of duplication, bureaucracy and potential unintended consequences for the appraisal process. A key concern is the risk that separating out the environmental case could lead to siloed thinking, where environmental considerations are isolated rather than integrated across all aspects of project appraisal (Mackie and Worsley, 2015). Furthermore, adding another case may lengthen business case development, increasing costs and administrative burdens for public authorities and project sponsors, and smaller authorities may even lack the capacity or expertise to prepare a detailed standalone environmental case. Other downsides identified, albeit minor, include the risk that a dedicated environmental case could become a formality or tick-box exercise, meeting minimum targets without driving genuine environmental ambition, and that the diverse scale and nature of transport projects means a prescriptive environmental case might not be proportionate for smaller or routine schemes. On this basis, critics of the environmental case have argued that environmental concerns should be more deeply and effectively integrated into all aspects of project appraisal, rather than isolated in a new silo. Instead of introducing a new case, they advocate for strengthening existing guidance, sharpening requirements and improving integration with land use, social and economic

assessments (AECOM, 2023; Institute of Environmental Management and Assessment (IEMA), 2023; Digital Manual for Roads and Bridges, 2020).

Whereas such concerns are broadly justified, there are a number of mitigating actions that can be put in place to ensure that environmental priorities are robustly addressed without causing undue duplication, complexity or siloed thinking. The key risks to the introduction of a dedicated environmental case in business case guidance and possible mitigating actions that could be put in place are summarised in Table 1 below.

Table 1. Risks of environmental case and mitigating actions

Argument	Key Concern	Mitigating Action
Risk of duplication	Overlaps with existing cases; inefficiency	Cross-referencing, shared data, integrated teams
Risk of siloed thinking	Environmental considerations isolated, not integrated or holistic	Interdisciplinary teams, co-development workshops to integrate findings
Increased complexity and bureaucracy	Slower, costlier, harder for smaller projects	Proportional requirements, streamlined digital tools
Decision-maker overload	Too much information, harder to make decisions	Unified presentation, clear summaries, training
Risk of tick-box compliance	Superficial and not transformative	Outcome focus, independent reviews, stakeholder input
Flexibility/proportionality	May not suit all project types	Screening, tiered analysis, scalable templates

In terms of the mitigating actions, firstly, integration could be achieved by requiring clear references between the environmental case and other cases to avoid duplication. For example, carbon and air-quality analyses in the environmental case should directly inform and be reflected in the strategic and economic case. Shared environmental datasets and analysis tools could be made accessible to all parts of the business case, promoting consistency and reducing workload duplication. To avoid siloed thinking, the formation of appraisal teams that include both environmental specialists and experts in strategic, economic and social appraisal should be encouraged; such teams should hold co-development workshops at key stages of the business case production where all cases are reviewed together, ensuring findings are integrated and mutually reinforcing. Furthermore, to reduce complexity and bureaucracy, the process could be streamlined by synchronising the preparation of the environmental case with other business case elements to reduce delays, and employing digital platforms for data collection, impact modelling and reporting to simplify and speed up assessment. The risk of information overload for decision makers could be mitigated by publishing clear, detailed, practical guidance and case studies for preparing environmental cases, ensuring clarity on what is required and best practice approaches. Training and support could also be provided to local authorities, especially those with limited resources or experience. Focussing the environmental case on achieving clear, measurable outcomes (e.g. net zero alignment, biodiversity net gain, etc.), rather than just

compliance with process requirements, could prevent the development of "tick-box" approaches. Instituting independent peer reviews or environmental scrutiny panels for major projects could ensure genuine environmental ambition.

Some of the actions hereby presented would require more in-depth examination to establish feasibility and proportionality of costs to benefits. However, it is the view being expressed in this paper that they should be given further consideration to show willingness to address the increasingly widespread demands to enhance the status of environmental sustainability in transport project appraisal in England.

A stronger environmental case in transport appraisal not only supports ecological sustainability but also fosters social cohesion and wider societal benefits. Cleaner air, reduced noise pollution and greener public spaces contribute to healthier, more liveable communities, particularly in underserved areas. These improvements can reduce health inequalities, enhance public well-being and create shared spaces that encourage social interaction and inclusion. Moreover, environmentally conscious transport planning can promote equitable access to mobility, connecting people to jobs, education and services, thereby reinforcing social equity and resilience. By embedding these broader social outcomes into the environmental case, transport projects can deliver more holistic and lasting value to society.

Summary and Recommendations

This chapter has described key aspects of the role of the economic case, CBA and BCR in transport projects appraisal in England, compared to non-monetised or partially monetised aspects such as environmental sustainability and wider social value. It has argued that appraisal mechanisms tend to prioritise quantifiable outcomes like cost-benefit ratios, which may distort decision making by focussing too heavily on the economic case – even when CBA is conducted to support projects that already have significant political momentum, rather than in a pure prioritisation exercise. Even when environmental and socioeconomic impacts are considered, TAG tends to over-quantify effects and outcomes, which can sometimes result in overlooking strategic objectives, such as addressing regional inequality or sustainability goals, if they cannot be translated into a positive, and often relatively short-term, financial outturn. The strategic case influences the prioritisation of transport projects in England to some extent, by acting as a framework for assessing how investment proposals contribute to long-term policy objectives such as environmental sustainability and wider socioeconomic benefits. However, despite attempts to address the over-reliance on economic metrics, the evidence suggests that the financial statement, and in particular the CBA and BCR continue to play a dominant role in transport project appraisals in England.

To address these shortcomings, several different approaches could be adopted.

- The role of the strategic case could be enhanced and its scope expanded to include long-term societal goals. Stronger policy alignment could be achieved by ensuring that the strategic case explicitly aligns with key government policies, such as the UK's Net Zero by 2050 target. This would make it mandatory for transport projects to

demonstrate contribution to environmental sustainability and social equity alongside their contribution to economic growth.

- As far as environmental metrics are concerned, more robust methods could be developed to monetise or qualitatively assess environmental outcomes, such as reduction in carbon emissions, improvements in air quality and biodiversity protection.
- Clear government guidelines should be developed for existing, relatively mature sustainability calculators, such as RSSB's Rail Social Value Tool, to be adopted consistently across industry and be fully integrated in the decision-making process.
- The introduction of a dedicated environmental case in Treasury's business case guidance should also be considered. Whereas some risks are associated with this practice, such as potential duplication of work and siloed thinking, these could be addressed by effective risk management and mitigating actions. The introduction of a dedicated environmental case could provide environmental sustainability with nearly equal status as economic growth in transport projects appraisal in England. A stronger environmental case would subsequently support wider societal benefits by reducing health inequalities, enhancing public well-being and improving social mobility through environmentally conscious transport planning.

Section Two: International Examples and Lessons of Transport Appraisal Frameworks

Balancing the complex trade-offs between the multiple dimensions of large transport projects for the purpose of investment decision appraisal is an extremely complicated process that requires skilful consideration and clear guidance at the same time. So far, this paper has argued that, despite the increasing demand for environmental and social outcomes to carry more weight in decision making, and some attempts to address this, the economic case and CBA continue to play a largely dominant role in transport project appraisal in England. Other countries have started to tackle a similar problem through appraisal frameworks that have explicitly integrated sustainability or environmental cases into their project appraisal decision-making processes. These frameworks go beyond traditional economic CBA to ensure infrastructure projects, especially in transport, support green growth, climate resilience, biodiversity conservation and social equity. In this section, we take a look at some of these international examples, including the different treatment of environmental and wider socioeconomic benefits in business-case guidance in Scotland and Wales, and suggest what lessons England could learn from the frameworks used in other countries. It also illustrates Scotland's successful Borders Railway project as a case study.

International Approaches

Similarly to England, most developed countries use a combination of CBA and non-monetised assessment to appraise transport projects, embedding environmental and societal considerations in their frameworks. While the broad structure is not dramatically different from England's, in some cases there are notable dissimilarities in aspects such as emphasis, methods, transparency and usage of the guidance. It is worth noting that England tends to be seen as a leader in transparency and open documentation such as TAG (Gühnemann at al., 2013); however, some other countries and international development banks are moving towards more explicit sustainability ratings, which go further than traditional CBA in highlighting non-monetised impacts, with a particular focus on environmental performance (Popescu et al., 2023).

Germany provides an example of how non-quantifiable environmental impacts play a major role in transport projects appraisal. Mackie and Worsley (2013) have identified that, whereas there are some federal differences between the methods used across different tiers of government, the German approach follows a BCR ranking scheme only after non-quantifiable impacts on habitats and the environment are taken into full account. The appraisal of these impacts is used to establish what mitigation measures or alternatives will be implemented to protect natural resources, and their feasibility and affordability. This approach utilises a "red flag" type of procedure, which allows for a transport project to be halted if it violates environmental constraints or presents a significant negative impact on non-monetised strategic goals, regardless of its economic merits.

Countries such as the Netherlands, Sweden, Australia, New Zealand and the United States all use manuals similar to England's TAG, combining monetised and non-monetised impacts. However, features such as discount rates, project lifespans and, importantly, the weight given to environmental factors vary. For example, Sweden applies a 30% uplift to public expenditure to account for positive border impacts (Mackie and Worsley, 2013), and the United States includes metrics like jobs per dollar and Gross Domestic Product (GDP) per dollar in addition to environmental factors. In some specific jurisdictions, such as New South Wales, Australia, non-monetised impacts can be explicitly weighed against monetised impacts, potentially bearing a greater influence on project approval (Mackie and Worsley, 2013). Conversely, in certain specific instances, the Netherlands applies a standard percentage mark-up to account for indirect or non-monetised impacts, blending qualitative reasoning with a quantitative adjustment. However, neither of these two approaches are applied consistently internationally.

The key features of international approaches to the treatment of environmental considerations in transport projects appraisal are summarised in Table 2. The UK government should consider how some of these approaches could be integrated into domestic guidance to help create a more balanced approach to the recommended inclusion of environmental and social considerations in transport investment decisions.

Table 2. Key international differences in the treatment of environmental considerations

Aspect	**England (TAG/NATA)**	**Germany**	**Netherlands/Sweden/ Other EU**	**US/Australia/ New Zealand**
Core method	CBA + non-monetised impacts	CBA + "red flag" for environment	CBA + non-monetised impacts	CBA + additional metrics
Environmental assessment	Embedded in appraisal and SEA	Red flag can stop projects	Embedded, often non-monetised	Embedded, sometimes monetised
Monetisation of environment	Increasingly common (noise, CO_2)	Less emphasis	Varies, often less monetised	Varies, sometimes monetised
Transparency	High, open documentation	Framework table	Varies, generally high	Varies, sometimes less transparent
Discount rates/ project life	Low rates, long project life	Low rates, long project life	Low rates, long project life	Higher rates, shorter life

Taking a closer look at how the European Union treats non-quantifiable benefits in transport investment appraisal, the most noticeable feature is probably the introduction in 2001 of a legal requirement for public bodies to undertake a Strategic Environmental Assessment (SEA) of certain statutory plans and programmes. SEA is a process to appraise the environmental impact of projects, as well as their contribution (or lack of) to a number of stated strategic objectives (European Conference of Ministers for Transport, 2000). Whereas the UK has not formally scrapped this regulatory requirement after exiting the European

Union, its application is not always consistent across the board, and TAG lacks a distinct SEA tier.

As far as the decision-making weight of non-monetised impacts is concerned, there is not a diametrical difference between the European Union and United Kingdom approaches, as non-quantified impacts rarely override cost-benefit ratio and economic analysis in transport projects appraisal. However, guidance in England tries to actively expand monetisation of impacts such as carbon emissions, air pollution and biodiversity using TAG dataset, whereas the European Union uses a more mixed approach where the same are only partially monetised but mostly addressed qualitatively (European Commission, 2020). In England, projects are required to justify excluding monetisation of impacts, whereas in the European Union some environmental impacts such as carbon emissions are usually monetised only in projects funded through specific mechanisms. Non-monetisation reflects the challenges of quantifying some environmental and social impacts, and indirectly acknowledges the importance of integrating qualitative analysis in appraisal frameworks to fully encompass all critical aspects of a project in decision making.

Lastly, it is to be noted how the appraisal of wider socioeconomic impacts and social equity is less developed in the European Union than it is in England. The Connecting Europe Facility (CEF) guidelines in fact exclude indirect socioeconomic effects such as agglomeration benefits and industrial spillover. These are treated separately outside of the individual transport project business cases, which focus narrowly on transport-specific outcomes (European Commission, 2024). Conversely, as we have seen in previous sections, England's Transport Appraisal Guidance permits limited inclusion of wider economic impacts in TAG, albeit maintaining strict rules to prevent overstatement. Equally, social impacts such as accessibility and affordability remain secondary to economic and environmental criteria in funding decisions in the European Union (European Commission, 2021). Table 3 compares the treatment of non-quantifiable impacts in the European Union and England.

Table 3. EU–England comparison of non-quantifiable impacts treatment

Aspect	**EU Approach**	**England's Approach**
Environmental	SEA-driven, transboundary focus, carbon incentives	Project-level monetisation, climate valuation
Socioeconomic	Narrowly defined, avoids indirect effects	Broader inclusion with safeguards
Non-quantifiable	Framework tables, limited veto power	Structured ASTs, explicit trade-off guidance

Critical lessons could be learned by the UK government by looking at how some European countries still often take a wider societal view of the benefits of rail and make decisions to invest in significant transport infrastructure despite weak or negative economic cases, driven by broader national priorities. It is the case, for example, of France and Spain, where decisions to build new railways have often reflected a willingness to prioritise national integration, environmental sustainability and societal equity over strict economic returns. In 2023, the

French government announced a €100 billion investment plan to expand and upgrade the rail network – primarily to promote regional development, reduce carbon emissions and address inequalities in transport access, even when financial constraints or weak economic cases exist (Rail Target, 2024). Spain has built the world's second largest, and Europe's most extensive, high-speed rail network, often without strong economic or mobility criteria backing each project (Global Railway Review, 2023). The Spanish Independent Authority for Fiscal Responsibility (AIReF) notes that while high-speed rail operations can be profitable, the construction costs are rarely recovered. Nevertheless, projects have proceeded due to strong political and social consensus, regional equity goals, and the desire to enhance national cohesion and connectivity (AIReF, 2020). Whereas England has occasionally pursued major rail projects based on broader national priorities, even when the economic case was marginal or contested (such as HS2, where the BCR was, at various stages, close to or below the Treasury's usual value for money threshold), this does not happen as routinely or explicitly as in France or Spain. It is the view expressed in this paper that the United Kingdom's, and particularly England's, social tissue could benefit from embedding a wider societal view of the benefits of rail that countries such as France and Spain take with respect to transport projects investment decisions.

To conclude, while international frameworks are broadly similar, England's approach is notable for its transparency and breadth, but some countries such as Germany give environmental constraints more direct power to halt project or are piloting sustainability ratings that could influence future practice. Non-monetised impacts play a significant but varied role in transport project appraisal worldwide. They are universally presented to decision makers, but their influence on final decisions ranges from supplementary context to decisive veto power, depending on the country and its appraisal decisional flow. England can be positioned somewhere halfway through this scale, with non-quantifiable impacts consistently structured and explicit trade-off guidance available in TAG, however there would be an opportunity to improve this position by considering how approaches like vetoes could be integrated in domestic guidance. On its part, the European Union prioritises systemic, cross-border environmental governance, while England seems to excel in methodological rigour and transparency for project-specific appraisals. However, both systems struggle with fully capturing non-quantifiable benefits, with England's framework offering slightly clearer pathways for integrating qualitative judgements. Crucially, however, other European countries such as France and Spain have historically been significantly more prepared than England to invest in new transport infrastructure on the basis that "it is the right thing to do", often despite a weak or negative economic case. This paper considers such approach best practice and recommends that the UK government considers how this example can be followed.

Scotland

Scotland offers an interesting, and close-to-home, example of how environmental benefits, wider socioeconomic and other non-quantifiable impacts should be more closely aligned with sustainability goals in England's Transport Analysis Guidance. A separate transport

appraisal guidance, the Scottish Transport Appraisal Guidance (STAG) was published in September 2003, and is designed to reflect Scotland's distinct policy priorities, institutional design and strategic objectives that stem from the devolution arrangements. STAG is broader and more policy-driven than TAG, giving equal weight to economic, environmental, safety, integration and social inclusion criteria, and explicitly aligning with the Scottish Government priorities (Transport Scotland, 2015).

Table 4 summarises the key differences between STAG and TAG.

Table 4. Key differences between STAG and TAG

Aspect	STAG (Scotland)	TAG (England)
Objectives	Focuses on five main criteria: Economy, Environment, Safety, Integration and Accessibility & Social Inclusion.	Emphasises value for money, with a strong focus on the BCR and alignment with DfT objectives.
Criteria	Mix of quantitative and qualitative appraisal across all five criteria, with explicit attention to distributional impacts and integration with Scottish policy.	Heavily quantitative, with BCR as central metric; includes social and distributional impacts but often as supplementary to economic analysis.
Approach	Broader, policy-driven and designed to fit Scotland's devolved priorities; places equal weight on all five criteria.	More standardised and economics-focussed, with a tendency to prioritise schemes with strong BCRs.
Reporting	Requires detailed reporting on each criterion, including economic welfare and distributional effects, not just aggregate economic value.	Uses Appraisal Summary Tables (AST) with a strong emphasis on monetised impacts and BCR for decision making.

STAG's approach to the treatment of environmental benefits is one of the most distinct elements when compared to England's business case guidance.

- **Integrated policy context**: STAG is closely aligned with Scotland's national climate targets, such as achieving net zero emissions by 2045 and reducing car kilometres by 20% by 2030. Environmental benefits are embedded within broader policy priorities such as the Sustainable Travel Hierarchy and the National Transport Strategy, ensuring that environmental considerations shape all stages of transport planning and appraisal (Southeast Scotland Transport Strategy, 2022). England's approach is more focussed on compliance with specific environmental impact criteria and monetised valuation of impacts such as noise and air quality.
- **Strategic assessments (environment and equality impacts)**: Scottish transport strategies are routinely accompanied by Strategic Environmental Assessment (SEA) and Equality Impact Assessment (EIA) reports. These assessments ensure that

environmental and socioeconomic issues are considered from the outset and throughout the appraisal process, not just as a separate or later stage analysis.

- **Qualitative and quantitative balance**: while both STAG and England's TAG consider environmental impacts, STAG places greater emphasis on qualitative integration of environmental and social benefits early in the appraisal process, with quantitative analysis supporting decision making as projects develop. This allows for broader consideration of local context, biodiversity and climate resilience. England's approach is more prescriptive, requiring detailed quantitative impact assessments when thresholds are met, with less emphasis on qualitative integration.
- **Whole-systems and lifecycle approach**: Scottish guidance encourages a whole-life cycle approach, considering future maintenance of assets, adaptability and opportunities for environmental improvements over time, rather than focussing solely on immediate monetised impacts, which often means that whole-life carbon impacts are underestimated and there is an overemphasis on travel-time savings.

It is particularly interesting to note how Scottish policy explicitly connects biodiversity protection to climate adaptation, specifically addressing risks like coastal erosion and habitat fragmentation. Its Climate Change Adaptation Programme integrates transport infrastructure resilience with ecosystem health. Projects prioritise habitat creation and wildlife protection. For example, Transport Scotland mandates that schemes minimise ecological disruption and actively enhance biodiversity through measures like green corridors (Transport Scotland, Biodiversity Reporting Duty 2021-2023). Again, England's approach to biodiversity emphasises compliance with legal thresholds, such as biodiversity net gain targets, and quantifies impacts through monetised CBA. Biodiversity Reporting Duty compliance involves mitigating impacts through measures like green bridges and habitat connectivity, often tied to specific funding (gov.uk, 2023).

As seen in previous sections, England's approach to environmental effects (as outlined in TAG Unit A3) is more prescriptive and focussed on developing detailed, often monetised, environmental impact appraisals to inform value for money decisions, with statutory thresholds guiding when full assessments are required. Conversely, Scotland's STAG offers a more holistic, policy-driven integration of environmental benefits, more closely aligned with long-term strategic goals and offering greater balance between qualitative and quantitative assessments.

It is worth mentioning that there are similar differences in how Scotland and England treat wider socioeconomic benefits in transport projects appraisal; however, these are less pronounced than for environmental impacts. Similarly to environmental ones, socioeconomic outcomes in STAG are assessed through a holistic, policy-driven lens, integrating economic, social, health, equality and accessibility impacts at all stages of the appraisal process. There is a strong emphasis on rights-based access, social inclusion and reducing inequalities, with appraisals considering how transport interventions support broader policy goals like health, well-being and equal access to jobs and services (Transport Scotland, 2015). Furthermore, qualitative and distributional impacts, such as on low-income or rural populations, are

considered alongside quantitative analysis, again offering greater balance between qualitative and quantitative assessments. In England, socioeconomic benefits are also assessed in detail, as discussed in previous sections of this paper; however, the methodology prioritises monetised appraisals of health, safety and accessibility impacts. The approach is more standardised and quantitative, focussing on CBA and specific metrics such as value of a quality-adjusted life for health benefits (TAG Unit A4.1). Social impacts are indeed appraised; however, the process is typically less integrated in England, which has broader rights-based or social inclusion frameworks, than it is in Scotland. These differences mirror, albeit being somewhat less stark than, those seen in environmental impact assessments.

Scotland's more balanced approach to the treatment of environmental and social impacts in transport investment decisions offers an immediate, close-to-home opportunity for the Department for Transport to learn lessons on how to counterweight the prevalence of CBA and BCR in England's business-case appraisal. For example, greater emphasis on the qualitative integration of environmental and social benefits early in the appraisal process, with quantitative analysis supporting decision making as projects develop, would allow for broader consideration of impacts such as biodiversity and climate resilience. Furthermore, an approach that privileges whole-systems and lifecycle assessment of a project, rather than focussing on short-term financial returns to establish value for money, would also provide a more holistic and comprehensive view of the impact of transport proposals, particularly for those designed to bring about transformational change.

The pinnacle of demonstrable success of the Scottish holistic and more balanced approach to environmental and other non-quantifiable benefits in transport project appraisal is probably the Borders Railway, explored below.

Case Study: Scotland's Borders Railway

The Borders Railway is a 30-mile rail line connecting Edinburgh to Galashiels and Tweedbank in the Scottish Borders, largely following the route of the historic Waverley line that was closed in 1969 during the Beeching cuts. After decades of campaigning by local communities, the Scottish Government approved the project in 2006, with construction starting in 2013 and the line officially opening in September 2015. The project restored direct rail connectivity to the Borders region for the first time in nearly 50 years, linking communities in Midlothian and the Scottish Borders to Edinburgh and the wider UK network. Other key achievements include the construction of 7 new stations and 42 bridges along the single-track route, making it the longest new domestic railway built in the UK for over a century. The project cost £294 million in 2012 prices and was notably delivered on time and within budget (Transport Scotland, 2015). It is a transformative infrastructure project that has revitalised the Scottish Borders, driving economic development, improving transport links and laying the groundwork for future expansion.

The investment case for the Border's Railway was built around four key strategic objectives (Ernst & Young, 2012):

1. To promote accessibility to and from the Scottish Borders and Midlothian to Edinburgh (including the airport) and the central belt.
2. To foster social inclusion by improving access to key serviced for those without access to a car.
3. To prevent decline in the Borders population by securing ready access to Edinburgh's labour market.
4. To create a modal shift from the car to public transport.

It is remarkable that none of the investment objectives for the project were improved value for money or economic return. Notably, the Final Business Case (FBC) produced by Ernst & Young displays a substantive worsening of the economic appraisal of the project compared to the Outline Business Case, with the already less than high BCR of 1.2 plummeting to 0.5. The FBC goes on to state that, if accessibility and social inclusion benefits were included in the economic appraisal, the BCR would raise back to 1.3 (Ernst & Young, 2012).

Evidence from evaluation indicates that, in less than 10 years of operations, the Borders Railway has made strong progress toward achieving all four investment objectives (Transport Scotland, 2017). The railway has reintroduced rail service to nearly 200,000 residents of the Scottish Borders and Midlothian, regions that previously had no direct access to the national rail network. This has greatly expanded public transport options, especially compared to the limited and less reliable bus services, creating connections to key services and markets and therefore supporting regional integration.

Around 21% of households in the Borders do not have access to a car (Johnston and Causley, 2012). The railway, along with its public transport interchanges, such as at Galashiels, have enabled these residents to access jobs, services and leisure opportunities that were previously difficult to access. This has contributed positively to social inclusion in the region, and is particularly significant for the elderly, young people and those on low incomes who are less likely to own a car and more prone to social exclusion.

By offering a direct, fast rail link to Edinburgh (two trains per hour in each direction on weekdays and Saturdays), the line provides frequent and dependable access to Edinburgh city centre and the wider Central Belt, making it easier for people to commute, study or access healthcare and other services. This has made the Borders more attractive for residents and commuters, supporting population stability and growth in the region.

Lastly, but just as importantly, the opening of the railway has led to a significant shift from car to train travel, with the number of annual car trips along the route forecast to reduce by approximately 530,000 (or 60,000 peak trips per year), supporting environmental and congestion reduction goals (Transport Scotland, 2017).

There is further evidence that the railway has generated wider, indirect economic benefits by spurring significant business growth, tourism and housing development along its route. For example, new housing developments like Shawfair have emerged, and local attractions have seen increased visitor numbers (Transport Scotland, 2017).

Scotland's Borders Railway evaluations from Transport Scotland have also demonstrated strong performance in delivering measurable environmental benefits:

- **Reduced carbon emissions**: the significant shift from car to rail travel generated by the Borders Railway resulted in a net saving of 33,865 tonnes of carbon dioxide emissions over a 60-year lifespan (2015–2070). This modal shift is a direct contributor to Scotland's decarbonisation goals and is a major example of how environmental benefits are effectively integrated in the nation's transport appraisal practices.
- **Improved air quality and congestion**: fewer car journeys have tangibly reduced congestion and improved air quality along the corridor between Edinburgh and the Borders, as estimated in the FBC.
- **Lower accident rates**: the reduction in car travel is expected to prevent around 360 road accidents over the same 60-year appraisal period, further supporting indirect environmental and public health outcomes.
- **Sustainable development**: the project is seen as a model for sustainable railway development, supporting broader goals of energy efficiency and reduced pollution, which are at the core of the benefits a sustainable railway has to offer (Walton, 2020).

In 2016, Transport Scotland published a report outlining the findings of a process evaluation of the Borders Railway. The evaluation found the project to have been exceptionally well run, and an example of best practice in programme management, governance and stakeholder engagement (Transport Scotland, 2016). According to interviewees, most of the significant challenges encountered as part of the delivery of the project, such as unexpected sale of land or last-minute changes to the scope of the project, were overcome through the existing strong inter-organisational relationships between partners. The noteworthy result was that every single milestone of the project was met, and the project was delivered under budget. In 2016, the Borders Railway was named Scottish Infrastructure Project of the Year by the Royal Institution of Chartered Surveyors.

Reference should also be made to the fact that the Borders Railway offers significant opportunities for future developments. In 2025, both the Scottish and the UK government approved funding for a feasibility study to extend the line from Tweedbank to Carlisle. If built, this extension would enhance connectivity, support further economic growth and provide environmentally friendly transport options for more local and sometimes disadvantaged communities in southern Scotland and the north of England. Proposals have also been advanced for extensions to the line that would allow the transfer of some freight flows, such as timber, from road to rail. Again, such propositions are rooted in the environmental benefits they would generate – such as cutting emissions, road damage and pollution in the future (Campaign for Borders Rail, 2017).

In summary, Scotland's Borders Railway is a pivotal example of how transport investment decisions supported by strategic objectives related to accessibility, social inclusion and sustainability, as opposed to strict value for money or economic return, can be transformational to local communities, particularly the most prone to social exclusion;

support population stability and economic growth; and deliver tangible environmental benefits such as reduced carbon emissions and improved air quality. Indirect benefits also include improved transport safety and public health, housing development and increased tourism in the region.

The Borders Railway is a transformational transport infrastructure project that has largely exceeded expectations. Passenger numbers are almost three times higher than originally forecast, with over 1.7 million journeys recorded by 2018/19 (East West Rail Company, 2024). It has revitalised local economies, boosted business investment, improved accessibility and social inclusion, and reduced congestion and carbon emissions by generating modal shift from road to rail travel. The Borders Railway is widely regarded as a model for how rail investment can rejuvenate regions, promote economic growth and enhance quality of life.

Wales

Similar lessons can be learned from how wider socioeconomic benefits, not limited to environmental impacts, are addressed in transport investment appraisal in Wales. Wales, like Scotland, takes a more holistic, well-being-centred and policy-driven approach to socioeconomic benefits.

The Welsh Transport Appraisal Guidance (WelTAG) puts well-being and climate change at the centre of transport planning, to the point that appraisal is structured around the Well-being of Future Generations (Wales) Act 2015, requiring all projects to demonstrate their impact on aspects such as health, equality, community, the environment and the Welsh language (WelTAG). Notably, England does not have an equivalent statutory framework guiding all transport policy. In the Welsh guidance, qualitative and quantitative measures are used in a more balanced, equitable fashion, and the process emphasises stakeholder engagement, social inclusion and the delivery of benefits, as opposed to purely their calculation. What is more, funding is exclusively made available for schemes that align with Wales's long-term ambitions for a transport system that is good for people, communities, the environment, the economy and culture. Priority is granted to walking and cycling schemes in the first instance, followed by ultra-low emission vehicles, with private cars being the lowest priority for transport planning and investment (Welsh Government, 2021). This hierarchy is central to all Welsh transport strategies and funding decisions, whereas England's is far less prescriptive in this sense, and often continues to prioritise road building and car-based solutions as the ones typically offering the greatest return on investment.

Wales has set explicit modal shift and emissions targets (Welsh Government, 2021):

- Reduce car miles per person by 10% by 2030.
- Increase the share of trips made by public transport and active travel to 45% by 2040.
- Achieve a 98% reduction in passenger transport emissions by 2050.

England's targets are less stringent and less directly tied to modal shift or car use reduction.

Significantly, to meet its goals, Wales has paused nearly all new road building, shifting investment toward sustainable modes of transport and infrastructure that supports the hierarchy discussed above. As seen, England continues to invest heavily in the construction of new roads.

Wales's community and well-being focus is achieved through its emphasis on transport's role in supporting equal access, healthy communities and regional fairness, with strong stakeholder engagement and outcome-focussed appraisals. England's appraisal remains centred around value for money and economic efficiency.

Summary

In this chapter, we have looked at international approaches to the treatment of environmental, socioeconomic and other non-quantifiable impacts in transport investment appraisal processes, and discussed some key differences with the UK, and particularly England's, guidance. Whereas most developed countries use broadly similar appraisal frameworks, they have occasionally developed different solutions for the complex trade-offs between BCRs, non-monetised impacts and long-term sustainability goals, that England could consider applying to its own guidance to demonstrate serious commitment to policy ambitions such as decarbonisation, social inclusion and public health. For example, Germany utilises a "red flag" type of procedure, which allows to halt a transport project if it violates environmental constraints or presents a significant negative impact on non-monetised strategic goals, regardless of its economic merits. In some specific jurisdictions, such as New South Wales, Australia, non-monetised impacts can be explicitly weighed against monetised impacts, potentially bearing a greater influence on project approval, and the Netherlands applies a standard percentage mark-up to account for indirect or non-monetised impacts, blending qualitative reasoning with a quantitative adjustment. On the other hand, by remaining centred on CBA and financial return, England's approach seems to excel in methodological rigour and transparency; however, this is somewhat to the detriment of some socioeconomic benefits and broader strategic goals. Importantly, some European countries like France and Spain have often demonstrated a willingness to move beyond their own economic appraisal guidance and invest in significant transport infrastructure on the basis that is it "the right thing to do" to promote regional development, reduce carbon emissions and address inequalities in transport access, even when financial constraints or weak economic cases exist. This chapter has argued that the UK, and England in particular, could benefit from embedding a wider societal view of the benefits of rail that countries such as France and Spain take with respect to transport projects investment decisions.

Interestingly, the most progressive frameworks that have emerged in this research in terms of policy alignment, treatment of non-quantifiable benefits and integration of qualitative analysis, are two of the UK's devolved administrations – Scotland and Wales. Research has shown that STAG, the Scottish Transport Appraisal Guidance, is broader and more policy-driven than TAG, giving equal weight to economic, environmental, safety, integration and social inclusion criteria, and explicitly aligning with the Scottish Government priorities.

Qualitative integration of environmental and social benefits happens early in the appraisal process, with quantitative analysis supporting decision making as projects develop, ensuring that environmental and socioeconomic considerations shape all stages of transport planning and appraisal. The pinnacle of demonstrable success of the Scottish approach to appraisal is probably the Borders Railway, a transformative project that has revitalised local economies, boosted business investment, improved accessibility and social inclusion, and reduced congestion and carbon emissions by generating modal shift from road to rail travel. Wales takes possibly an even more progressive approach to transport planning and investment decisions, requiring all projects to demonstrate their impact on aspects such as health, equality, community, the environment and the Welsh language, and making funding available exclusively for projects that align with these long-term goals. The Scottish and Welsh transport appraisal frameworks and their success offer a breadth of opportunity for the UK government to learn lessons and integrate similar treatment of environmental impacts, socioeconomic benefits and long-term policy ambitions into England's Transport Appraisal Guidance and therefore achieve improved outcomes that move beyond pure financial return on investment.

Conclusions and Recommendations

Rail is a mass shifter of people and goods across different places, delivering benefits for passengers, non-passengers and the environment. It provides greatest value in high-volume, intercity routes, and lower value in rural areas where usage of the rail network is low. Rail allows faster and/or more cost-effective journeys across locations, creating access to employment and other services, reduces congestion on other transportation networks, decreases carbon emissions and noise pollution, and improves air quality. The analysis presented in this paper has been framed within this wider understanding of the "value of rail".

Rail is one of the most significant contributors to the UK's economy. In 2019, the railway sector contributed £43 billion to the UK economy in terms of GVA and supported 710,000 jobs across the country. It is estimated that for every £1 spent on rail, a return of £2.50 is generated in the wider economy. Rail is also by far the cleanest mode of transport. It is estimated that the UK rail sector's share of UK transport CO_2 emissions is 1.4%, while it accounts for 9.5% of all passenger kilometres. This difference is expected to rise sharply in the future as technology develops and is rolled out across the network.

There are also broader, less immediate socioeconomic benefits associated with rail's positive impact on the environment, typically visible over a longer period. There are in fact close links between environmental and social factors. Reduced air pollution and greenhouse gas emissions directly benefits public health and quality of life in surrounding communities (Rail Industry Association, 2022). Sustainable rail strategies aim to support local economies, create jobs and foster social inclusion by making rail accessible and affordable to all (RSSB, 2021). Therefore, rail's environmental and social benefits should be addressed together in industry and government strategies, recognising that a sustainable rail system is one that delivers on both fronts.

Despite increasingly widespread calls for a more balanced approach to transport appraisal decision making, integrating economic analysis and monetised impacts with broader, less easily quantifiable long-term sustainability goals, and recent attempts to address these shortfalls in updated versions of the DfT's Transport Analysis Guidance, the economic case, and in particular cost-benefit analyses and BCRs, continue to play a dominant role in transport project appraisals in England. This paper has recommended that the UK government explores possible approaches to give environmental sustainability and social value outcomes equal status to economic growth in transport projects decision-making guidance in England.

- The role of the strategic case could be expanded to include long-term environmental and societal goals, and/or ensure it explicitly aligns with key government policies such as net zero.

- Clear government guidelines should be developed so that existing, relatively mature sustainability calculators, such as RSSB's Rail Social Value Tool, can be adopted consistently across industry and be fully integrated in the decision-making process.
- The introduction of a dedicated environmental case in Treasury's business case guidance should also be considered, to elevate environmental and sustainability considerations to equal standing when compared to monetised benefits in the economic case. A stronger environmental case would subsequently support wider societal benefits by reducing health inequalities, enhance public well-being, and enhance social mobility through environmentally conscious transport planning.

Important lessons can be learned from the solutions adopted by other Western countries to address the complex trade-offs between BCRs, non-monetised impacts and long-term sustainability goals. Some of them have been directly incorporated into transport business case guidance, such as Germany's "red flag" procedure, which allows a transport project to be halted if it violates environmental constraints or presents a significant negative impact on non-monetised strategic goals, regardless of its economic merits. Other European countries such as France and Spain may have not introduced dramatically novel procedures in their transport appraisal guidance; however, they have historically taken a wider societal view of the benefits of rail and made decisions to invest in significant transport infrastructure despite weak or negative economic cases, prioritising national integration, environmental sustainability and social equity over strict economic returns. The UK government could examine more closely how such investment decisions have generated major socioeconomic and secondary benefits in the countries involved and consider taking a similar approach more consistently.

Importantly, the most progressive appraisal frameworks that have emerged in this research in terms of policy alignment, treatment of non-quantifiable benefits and integration of qualitative analysis are two of the UK's devolved administrations – Scotland and Wales. For example, the Scottish Transport Appraisal Guidance is broader and more policy-driven than TAG, giving equal weight to economic, environmental, safety, integration and social inclusion criteria, and explicitly aligning with the Scottish Government priorities. Qualitative integration of environmental and social benefits happens early in the appraisal process, with quantitative analysis supporting decision making as projects develop, ensuring that environmental and socioeconomic considerations shape all stages of transport planning and appraisal. The success of Scotland's approach is solidly exemplified by the delivery of the Borders Railway, a transformational transport infrastructure project that has revitalised local economies in southern Scotland, boosted business investment, improved accessibility and social inclusion, and reduced congestion and carbon emissions by generating modal shift from road to rail travel. Crucially, none of the strategic objectives that drove the investment decision were improved value for money or economic return. It is noteworthy how such an example of best practice is found domestically within the UK. This certainly provides significant opportunities for similar approaches to be adopted more broadly in the country, including in England.

Separate consideration should be given to the challenges the UK faces due to short-termism in investment policy and affordability constraints tied to parliamentary cycles, which create systemic issues across public services, infrastructure and economic growth. These problems stem from political, financial and structural factors that prioritise immediate outcomes and economic returns over long-term benefits, growth and resilience. Short-term spending reviews and rigid annual budgets set by governments often prevent investment in long-term projects whose benefits are not felt until several years, sometimes decades, later, and make existing multi-year projects difficult to manage due to insufficient long-term funding commitments. Projects like HS2 highlight how inconsistent, politically driven funding leads to delays, cost overruns and cancellations. The partial cancellation of HS2, followed by a government-ordered sale of land to prevent future reversal, is just one example of a lack of commitment to long-term solutions for national connectivity and capacity (Institution of Civil Engineers, 2023). The recent closure of the Restoring Your Railway project is an additional example of the stop-start approach driven by short-term budget balancing within a parliamentary cycle. Whereas the cancellation of the programme was aimed to drive a saving of £85m, it undermined its intended long-term positive impacts, such as reconnecting communities and boosting local economies, on which £43m for early-stage development had already been spent. Short-term cost cutting often leads to false economies – such as building rail lines with too few stations or neglecting future demand – ultimately resulting in higher overall costs, missed opportunities for growth and reduced long-term public benefit (Institution of Civil Engineers, 2023). Breaking this loop requires bipartisan commitment to long-term capital investment, stable policy environments and reform to budgetary processes that transcend electoral cycles.

Early research indicates that rail is likely to maintain a sustainability advantage over road transport in the long term, even with full electrification of vehicles, including freight lorries, and automation of road transport. This is due to inherent features of rail such as lower energy intensity, higher capacity and centralised decarbonisation efforts, and uncertainties around the progress of road's renewable technologies and transition. This creates a double mandate for the UK government and the rail industry. First, they should take more decisive steps to move beyond a transport appraisal framework heavily biased towards CBA and short-term economic returns, to give equal, if not greater, weight to sustainability and social value considerations in the decision-making process. Second, they must not give in to the temptation to become complacent with being by nature most sustainable and socially valuable transport option and instead continue to make and strengthen the case for a sustainable, socially equitable and financially viable railway in the UK and beyond.

Bibliography

AECOM. *2023 Annual Report: Extending Our Advantage*. AECOM, Dallas, TX, 2023. https://aecom.com/wp-content/uploads/documents/reports/2023/AECOM_2023_annual-report_10k.pdf

AIReF (Independent Authority for Fiscal Responsibility). *Transport Infrastructures: Spending Review Phase II*. Madrid, Spain, 2020. https://www.airef.es/en/news/airef-reports-strong-investment-in-high-speed-rail-over-insufficient-investment-in-suburban-rail-and-proposes-shifting-focus-to-mobility-criteria

Arvidson, M., Lyon, F., McKay, S., & Moro, D. (2010). The Ambitions and Challenges of SROI. TSRC Working Paper 49. University of Birmingham. Retrieved from https://www.birmingham.ac.uk/Documents/college-social-sciences/social-policy/tsrc/working-papers/working-paper-49.pdf

Atkins, G., Davies, N., & Kidney Bishop, T. (2017). How to Value Infrastructure: Improving Cost Benefit Analysis. Institute for Government. Retrieved from https://www.instituteforgovernment.org.uk/publication/report/how-value-infrastructure

Atkins, G., Davies, N., & Kidney Bishop, T. (2017). Improving Cost Benefit Analysis for Infrastructure. Institute for Government. Retrieved from https://www.instituteforgovernment.org.uk/sites/default/files/publications/IfG%20Report%20CBA%20infrastructure%20%5Bweb%20final%5D.pdf

Boardman, A. E., Greenberg, D. H., Vining, A. R., & Weimer, D. L. *Cost–Benefit Analysis: Concepts and Practice*, 5th ed. Cambridge University Press, Cambridge, UK, 2018. https://students.aiu.edu/submissions/profiles/resources/onlineBook/E5V5H3_Cost-benefit%20analysis%20_%202018.pdf

Cambridge Centre for Smart Infrastructure and Construction. (2024). *Case studies and research on tunnelling and infrastructure resilience*. University of Cambridge. Retrieved from https://www-smartinfrastructure.eng.cam.ac.uk/

Campaign for Borders Rail. *Campaign Report Calls for a New Cross-Border Rail Link*. Campaign for Borders Rail, Edinburgh, 2017. [Online]. Available: https://campaignforbordersrail.org/2017/05/30/campaign-report-calls-for-a-new-cross-border-rail-link-campaign-for-borders-rail-press-release-30-may-2017/

Charlesworth, J. *Transport Business Cases: Beyond the BCR*. Sweco UK, Leeds, UK, 2023. https://www.sweco.co.uk/blog/transport-business-cases-beyond-the-bcr/

Climate Change Committee. (2023). *Progress in reducing UK emissions: 2023 Report to Parliament*. Climate Change Committee. Retrieved from https://www.theccc.org.uk/wp-

content/uploads/2023/06/Progress-in-reducing-UK-emissions-2023-Report-to-Parliament-1.pdf

Department for Environment, Food & Rural Affairs. *Annual Report and Accounts 2019–2020*. HM Government, London, UK, December 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945689/defra-annual-report-and-accounts.pdf

Department for Environment, Food & Rural Affairs. *Complying with the Biodiversity Duty*. GOV.UK, London, 2023. [Online]. Available: https://www.gov.uk/guidance/complying-with-the-biodiversity-duty

Department for Transport. *The Strategic Case for HS2*. HM Government, London, UK, October 2013. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/260525/strategic-case.pdf

Department for Transport. (2022). *TAG Unit A4.1: Social Impact Appraisal*. UK Government. Retrieved from https://www.gov.uk/government/publications/tag-unit-a4-1-social-impact-appraisal

Department for Transport. (2023). *Transport Analysis Guidance (TAG): Data book and appraisal guidance*. UK Government. Retrieved from https://www.gov.uk/guidance/transport-analysis-guidance-tag

DHL Freight. (2023). *The DHL Freight Green Technology Roadmap*. DHL Group. Retrieved from https://dhl-freight-connections.com/wp-content/uploads/2025/05/DHL_Freight_Technology_Roadmap_Whitepaper_EN.pdf

Dickinson, K. (2021). Better neighbourhoods: The benefits of walkable cities. *CityChangers.org*. Retrieved from https://citychangers.org/case-for-walkable-cities/

East West Railway Company. *Economic and Technical Report*. East West Rail, London, 2024. [Online]. Available: http://eastwestrail.co.uk/routeupdate/economic-and-technical-report

Ernst & Young LLP. *Borders Railway Full Business Case*. Prepared for Transport Scotland, Edinburgh, 2012.

Ernst & Young LLP. *UK Regional Economic Forecast 2025*. London: EY, 2025. Available at: https://www.ey.com/content/dam/ey-unified-site/ey-com/en-uk/newsroom/2025/03/ey-uk-regional-economic-forecast-03-2025.pdf

European Commission. *Handbook on the External Costs of Transport*. Directorate-General for Mobility and Transport, Brussels, Belgium, 2020. https://op.europa.eu/en/publication-detail/-/publication/9781f65f-8448-11ea-bf12-01aa75ed71a1

European Commission. *Regulation (EU) 2021/1153 Establishing the Connecting Europe Facility (CEF) 2021–2027*. Official Journal of the European Union, Brussels, Belgium,

2024. https://transport.ec.europa.eu/transport-themes/infrastructure-and-investment/connecting-europe-facility_en

European Conference of Ministers of Transport (ECMT). *Strategic Environmental Assessment for Transport*. OECD Publishing, Paris, 2000. https://www.itf-oecd.org/sites/default/files/docs/00sea.pdf

European Parliament & Council. (2001). *Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment*. Official Journal of the European Communities, L197, 30–37. Retrieved from https://eur-lex.europa.eu/eli/dir/2001/42/oj/eng

European Union Agency for Railways. (2024). *Rail Environmental Report*. Luxembourg: Publications Office of the European Union. https://doi.org/10.2821/243881

Frontier Economics. *Exploring the Economic Benefits of Strategic Roads*. Report for the Department for Transport, London, UK, July 2017. https://assets.publishing.service.gov.uk/media/5fd0fffcd3bf7f305cb6034a/Exploring_the_economic_benefits_of_strategic_roads-document.pdf

Global Railway Review. *Spanish High-Speed Rail: The Most Extensive in Europe*. Global Railway Review, 8 November 2023. https://www.globalrailwayreview.com/news/147158/spanish-high-speed-rail/

Greenly. (2022). *Train vs Car: What are their carbon footprints?* Retrieved from https://greenly.earth/en-gb/blog/company-guide/train-vs-car-what-are-their-carbon-footprints

Gschösser, F., Cordes, T., Lumetzberger, D., Tautschnig, A., & Bergmeister, K. (2020). Railway transport systems' contribution to sustainable development. *IOP Conference Series: Earth and Environmental Science, 588*(5), 052024. https://doi.org/10.1088/1755-1315/588/5/052024

Gühnemann, A., Laird, J., & Pearman, A. (2013). *Combining Cost–Benefit and Multi-Criteria Analysis to Prioritise a National Road Infrastructure Programme*. Journal of Transport Economics and Policy, 47(2), 245–261.

HM Treasury. (2024). *The Green Book: Appraisal and evaluation in central government*. UK Government. Retrieved from https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government

HM Treasury. (2025). Green Book Review 2025: Findings and Actions. Retrieved from https://assets.publishing.service.gov.uk/media/687129f52557debd867cc06f/Green_Book_Review_2025.pdf

House of Lords Economic Affairs Committee. *The Economics of High Speed 2*. HL Paper 134, UK Parliament, London, UK, 2015. https://publications.parliament.uk/pa/ld201415/ldselect/ldeconaf/134/13412.htm

Institute for Government. (2023). HS2: Costs and Controversies. Retrieved from https://www.instituteforgovernment.org.uk/explainer/hs2-costs

Institute of Environmental Management and Assessment. *A New Perspective on Land and Soil in Environmental Impact Assessment*. IEMA, Lincoln, UK, 2023. https://www.iema.net/articles/iema-publishes-new-land-and-soils-guidance

Institution of Civil Engineers. *ICE Briefing Paper: The Cancellation of HS2's Northern Leg – Learning Lessons*. ICE, London, 2023. [Online]. Available: https://www.ice.org.uk/news-views-insights/policy-and-advocacy/policy-insights/ice-briefing-lessons-hs2-northern-leg-cancellation

International Energy Agency (IEA). (2019). *The Future of Rail: Opportunities for Energy and the Environment*. IEA Publications. Retrieved from https://www.iea.org/reports/the-future-of-rail

International Transport Forum. *Broadening Transport Appraisal: Summary and Conclusions*. ITF Roundtable Reports, No. 188, OECD Publishing, Paris, 2022. https://www.itf-oecd.org/sites/default/files/docs/broadening-transport-appraisal.pdf

Keep, M., Hutton, G., & Lewis, S. *Infrastructure in the UK*. House of Commons Library Research Briefing, UK Parliament, London, 2025. https://commonslibrary.parliament.uk/research-briefings/sn06594/

Logan, K.G., Nelson, J.D., McLellan, B.C., & Hastings, A. (2021). *Japan and the UK: Emission predictions of electric and hydrogen trains to 2050*. Transportation Research Interdisciplinary Perspectives, 10, 100344. https://doi.org/10.1016/j.trip.2021.100344

Mackie, P., & Worsley, T. (2013). *International Comparisons of Transport Appraisal Practice*. Institute for Transport Studies, University of Leeds. Prepared for the UK Department for Transport. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/209530/final-overview-report.pdf

Mackie, P., & Worsley, T. *Transport Policy, Appraisal and Decision-Making*. RAC Foundation, London, UK, May 2015. https://www.racfoundation.org/wp-content/uploads/2017/11/Transport_policy_appraisal_decision_making_worsley_mackie_May_2015_final_report.pdf

Molthan-Hill, P., Worsfold, N., Nagy, G. J., Leal Filho, W., & Mifsud, M. (2019). *Climate Change Education for Universities: A Conceptual Framework from an International Study*. Journal of Cleaner Production, 226, 1092–1101. Nottingham Trent University. https://irep.ntu.ac.uk/id/eprint/36695/1/14009_a1547_Molthan-Hill.pdf

National Highways. *GG 101: Introduction to the Design Manual for Roads and Bridges*. Design Manual for Roads and Bridges, UK, 2020. https://www.standardsforhighways.co.uk/tses/attachments/25cefcd4-3464-4e41-8e4f-fffc155723ea

National Infrastructure Commission. *Delivering Net Zero, Climate Resilience and Growth: Improving Nationally Significant Infrastructure Planning*. National Infrastructure Commission, London, UK, April 2023. https://www.gov.uk/government/publications/government-response-to-the-national-infrastructure-commission-report-on-improving-nationally-significant-infrastructure-planning

Network Rail. *Social Value Framework*. Network Rail, London, UK, August 2021. https://www.networkrail.co.uk/wp-content/uploads/2021/09/Network-Rail-Social-Value-Framework-August-2021.pdf

Nicholls, J., Lawlor, E., Neitzert, E., & Goodspeed, T. *A Guide to Social Return on Investment*. The SROI Network, London, UK, 2012. https://socialvalueuk.org/resources/a-guide-to-social-return-on-investment-2012

Nikitas, A., Michalakopoulou, K., Njoya, E. T., & Karampatzakis, D. (2021). Platooning of connected automated electric trucks: A review of benefits and challenges. *Transportation Research Interdisciplinary Perspectives, 10*, 100403. https://doi.org/10.1016/j.trip.2021.100403

Northern Trains Limited. *Social Value Report 2023–2024*. Northern Trains Ltd, Manchester, UK, 2024. https://www.northernrailway.co.uk/sites/default/files/2024-07/Social%20value%20report%202024.pdf

Oxford Economics. *Planning Resilient Trade Infrastructure for a Changing Global Economy*. Oxford: Oxford Economics, 2025. Available at: https://www.oxfordeconomics.com/case-study/planning-resilient-trade-infrastructure-for-a-changing-global-economy/

Oxford Economics & Railway Industry Association. (2022). *The economic, environmental, and social opportunities that rail brings to the UK*. Oxford Economics. Retrieved from https://www.oxfordeconomics.com/resource/the-economic-environmental-and-social-opportunities-that-rail-brings-to-the-uk/

Pietrzak, O., & Pietrzak, K. (2019). The role of railway in handling transport services of cities and agglomerations. *Transportation Research Procedia, 39*, 405–416. https://doi.org/10.1016/j.trpro.2019.06.043

Popescu, C.-E., Pentescu, A., & Shivarov, A. *Sustainability, ESG Ratings and Corporate Performance in the Manufacturing Sector: A Research Review*. European Journal of Interdisciplinary Studies, 2023. https://www.ejist.ro/files/pdf/533.pdf

Rail Industry Association. *High Speed Rail: Net Zero Voices*. Rail Industry Association, London, 2022. [Online]. Available: https://www.rail-leaders.com/publications/high-speed-rail-net-zero-voices/

Rail Safety and Standards Board. *Sustainability and Social Value in Rail*. RSSB, London, 2021. [Online]. Available: https://www.rssb.co.uk/about-rssb/insights-and-news/blogs/sustainability-and-social-value-in-rail

Rail Safety and Standards Board (RSSB). (2023). *The Sustainable Rail Blueprint*. Rail Safety and Standards Board. Retrieved from https://www.rssb.co.uk/sustainability

Rail Target. *France Announces €100 Billion Rail Investment Plan for Greener Transport*. RailTarget.cz, 2024. https://www.railtarget.cz/business/france-announces-100-billion-rail-investment-plan-for-greener-transport-4739.html

SEStran. *SEStran Regional Transport Strategy 2035*. South East of Scotland Transport Partnership, Edinburgh, 2022. [Online]. Available: https://sestran.gov.uk/wp-content/uploads/2021/11/SEStran_RTS_accessible.pdf

Shortall, R., & Mouter, N. (2021). *Assessing social impacts in transport appraisal: Addressing the needs of vulnerable groups*. [Unpublished manuscript or working paper]

South Western Railway. *Social Value Report 2023–2024*. South Western Railway, London, UK, 2023. https://www.southwesternrailway.com/-/media/files/other/about-us/social-value-report/social-value-report-2023-2024.pdf

Steer Davies Gleave. (2002). *The Case for Rail: Final Report*. Prepared for Transport 2000, Association of Train Operating Companies, English, Welsh & Scottish Railways, Railway Industry Association, The Railway Forum, Rail Passengers' Council, and Passenger Transport Executive Group.

Sustainable Transport Alliance. (2023). *Accelerating modal shift: Evidence on carbon savings and co-benefits*. Sustainable Transport Alliance. Retrieved from https://communityrail.org.uk/wp-content/uploads/2023/09/Accelerating-modal-shift-STA-Aug-23.pdf

Sustrans. (2023). *Reducing carbon emissions through active travel*. Sustrans. Retrieved from https://www.sustrans.org.uk/media/12853/reducing-carbon-emissions-through-active-travel-blog-copy-1.pdf

Tetlow, G., & Pattison, J. *HS2: Costs and Controversies*. Institute for Government, London, UK, 2023. https://www.instituteforgovernment.org.uk/explainer/hs2-costs

Thadani, A. (2022). Tunneling under operating highways and railways: Part 1. *Tunnels & Tunnelling International*. Retrieved from https://www.tunnelsandtunnelling.com/analysis/tunneling-under-operating-highways-and-railways-part-1-10378534/

Thomas, H., & Serrenho, A. C. (2024). Using different transport modes: An opportunity to reduce UK passenger transport emissions? *Transportation Research Part D: Transport and Environment*. https://doi.org/10.17863/CAM.104214

Transport Scotland. *Guidance for the Evaluation of Rail Projects*. Transport Scotland, Edinburgh, 2015. [Online]. Available: https://www.transport.gov.scot/media/11093/transport-research-rail-evaluation-rail-evaluation-guidance-2015-version-final-pdf-may-2015.pdf

Transport Scotland. *Process Evaluation of the Borders Railway*. Transport Scotland, Edinburgh, 2015. [Online].
Available: https://www.transport.gov.scot/media/5363/648816_v8_20160301.pdf

Transport Scotland. *Process Evaluation of the Borders Railway*. Transport Scotland, Edinburgh, 2016. [Online].
Available: https://www.transport.gov.scot/media/5363/648816_v8_20160301.pdf

Transport Scotland. *Borders Railway Year 1 Evaluation*. Transport Scotland, Edinburgh, 2017. [Online]. Available: https://www.transport.gov.scot/media/39388/borders-railway-1-year-evaluation.pdf

Transport Scotland. (2022). Scottish Transport Appraisal Guidance: Managers Guide. Retrieved from https://www.transport.gov.scot/publication/scottish-transport-appraisal-guidance-managers-guide/

Transport Scotland. *Biodiversity Reporting Duty 2021–2023*. Transport Scotland, Edinburgh, 2023. [Online].
Available: https://www.transport.gov.scot/publication/biodiversity-reporting-duty-2021-2023/

Urban Transport Group. *Number Crunch: Transport Trends in the City Regions*. Urban Transport Group, Leeds, UK, 2018. https://www.urbantransportgroup.org/number-crunch-reports

Walton, S. *Sustainable Campaigning in the Borders*. Rail Professional, July 2020. [Online]. Available: https://www.railpro.co.uk/railpro-magazine/july-2020/sustainable-campaigning-in-the-borders

Welsh Government. *Llwybr Newydd: The Wales Transport Strategy 2021*. GOV.WALES, Cardiff, 2021. [Online]. Available: https://www.gov.wales/llwybr-newydd-wales-transport-strategy-2021-html

Welsh Government. *Welsh Transport Appraisal Guidance (WelTAG)*. GOV.WALES, Cardiff, 2024. [Online]. Available: https://www.gov.wales/welsh-transport-appraisal-guidance-weltag