Network Rail Submission to the National Infrastructure Commission

Call for Evidence on the Second National Infrastructure Assessment Report February 2022

Introduction

Network Rail owns, operates and develops Britain's railway infrastructure including 20,000 miles of track, 30,000 bridges, tunnels and viaducts and the thousands of signals and level crossings. We manage 20 of the UK's largest stations and over 2,500 more are managed by the train operating companies.

More than 4.8 million journeys are made in the UK with people depending on Britain's railway for their daily commute, to visit friends and loved ones and to get them home safe every day. Our role is to deliver a safe and reliable railway. We manage and deliver thousands of projects every year to grow, expand and improve the resilience of the railway network to meet the needs of our passengers and freight users.

Weather and climate change impacts are some of our most serious risks and to the people and businesses who rely on us. Their impacts on us and our other infrastructure that we depend on can materially influence our ability to; safely and efficiently operate our services, buildings and infrastructure. With this in mind please see our responses below to the questions posed in the Baseline Report.

Questions

1. **Do the nine challenges identified by the Commission cover the most pressing issues that economic infrastructure will face over the next 30 years? If not, what other challenges should the Commission consider?**

Whilst the majority of the challenges do cover most of the most pressing issues, we have the following thoughts:

Biodiversity and Natural Capital - Although these are discussed throughout Chapter 3 of the report and specifically in 3.2, both in terms of risks and opportunities, there is no reference to them within the challenges. Given the scale of the infrastructure spend in the UK and the potential future spend to address climate change, growth and levelling up this seems like a missed opportunity to enhance their role in asset management and planning and hence their impact.

Interdependencies – Whilst it can be argued that appropriate asset management and planning should incorporate consideration of external impacts from changes in the performance of assets/services from other sectors of the economy it is generally accepted that this area of resilience is not sufficiently mature. Chapter 3 should therefore include a consideration the role of interdependencies in challenging resilience and the how asset management could be used to improve the situation. This should take multimodal/cross sector approach.

Challenge 5 – Although Chapter 3 clearly recognises the current and increasing impacts of climate change on assets and the role that asset management can play in mitigating these the wording of the challenge does not communicate this. It could also be misread to mean that the commission will consider how asset management can support barriers to investment. Alternative wording could be:

'the Commission will consider; how asset management can support current and future resilience, barriers to investment, and the use of data and technology to improve the way assets are maintained.'

Challenge 6 - It is encouraging to see the significant issue of surface water flooding being addressed, and we acknowledge that the commission has taken improvements in planning and response to river and coastal flooding into account when deciding not to undertake new work. However we would hope that:

1. Appropriate consideration would be given to surface water flooding from non-sewered catchments/areas, and
2. That the consideration of natural flood management solutions for surface water flooding should not be carried out in isolation from the wider considerations of catchment management.

2. What changes to funding policy help address the Commission's nine challenges and what evidence is there to support this? Your response can cover any number of the Commission's challenges

Key decisions on funding availability and the required outputs for rail infrastructure are made by the UK government (for England & Wales) and by the Scottish Government (for Scotland) as the principle funders of rail infrastructure, through the periodic review process. The 2023 Periodic Review (PR23) will determine Network Rail's funding (operations, maintenance and renewals expenditure) and outputs for the next Control Period (CP7) which runs from 1 April 2024 to 31 March 2029, and will reflect funders' objectives for the railway, within the funds available.

A major challenge in delivering sustainable resilience solutions is in the area of funding and investment planning timescales. Government, regulators and infrastructure operators need to strike a balance between short-term cost saving measures which could reduce resilience, actions that deliver short-term resilience, appropriate medium to long-term resilience measures and providing excessive resilience at high cost. This necessitates a longer-term approach that needs to recognise that:

- Significant proportions of the UK infrastructure is a legacy of the 19th century, that there are concerns that maintenance and replacement is not keeping pace with the rate of asset deterioration and that climate change could accelerate the costs and challenges of asset management,
- Long term challenges such as climate change adaptation and strategic network wide activities such as the low carbon transition and freight planning require multi-investment period planning and delivery,
- Many sustainable solutions may require longer lead in times for multiple stakeholder inclusion and potentially have higher initial costs and longer benefits realisation periods with costs and benefits shared across the stakeholders, and
- The prioritisation/rationale for such actions as opposed to quick win short term benefit actions will require incentives, for example policies that;
  o Support funding allocation where life cycle carbon reduction is proven rather than just in the initial project impact,

- o Enable aligned supply chain capability – e.g. incentivising cross sector / shared solutions, standardised components with proven low carbon , resilience and low waste credentials, and
- o Avoid undue efficiency challenge in the short-term that may compromise making the right long-term decision.

Flexible funding and asset management approaches will be increasingly important for maintaining and improving resilience to low probability, high impact incidents such as flooding, while also responding to the risk of accelerated deterioration from more gradual changes in weather conditions.

3. How can better design, in line with the design principles for national infrastructure, help solve any of the Commission's nine challenges for the next Assessment and what evidence is there to support this? Your response can cover any number of the Commission's challenges

At this time design thinking includes some considerations of resilience and has increasingly addressed carbon reduction. However for much design work these are not the prime drivers or outcomes, so solutions have not yet been optimised around lifecycle cost, longer term resilience, or carbon and waste reduction.

A targeted programme to improve capture and calculation of carbon costs/benefits, define numerate targets for resilience and develop standard designs based on full lifecycle analysis would make inroads into these objectives. The development of best practice recommendations from this and their incorporation into the design principles would aid the dissemination and uptake.

4. What interactions exist between addressing the Commission's nine challenges for the next Assessment and the government's target to halt biodiversity loss by 2030 and implement biodiversity net gain? Your response can cover any number of the Commission's challenges.

The creation, operation and management of infrastructure assets across the board has the capability to either damage or enhance the natural environment depending on the manner in which it is carried out. There is therefore a very strong interaction with Challenges 5 and 6 with both of these providing large opportunities for infrastructure to assist in delivering the government's target. While there are less obvious links to the other seven challenges any strategy or action that that interacts physically with that natural environment has the capacity to enhance it or at least reduce its impact, for example solar farms can have biodiverse habitat around them or building can have green roofs or be bat friendly.

It is however notable that whilst Chapter 3 clearly notes the links between infrastructure and the natural environment none of the challenges explicitly mention it.

5. What are the main opportunities in terms of governance, policy, regulation and market mechanisms that may help solve any of the Commission's nine challenges for the Next Assessment? What are the main barriers? Your response can cover any number of the Commission's challenges.

In the majority of cases relevant policy and legislation already exist and improvements to the delivery incentives and the communication of expectations, targets and best practice are what

would be necessary. Much of this will be achieved through the delivery of the Great British Railways: Williams-Shapps Plan for Rail.

Within this and the current model funding for renewals, maintenance and operations activity on our network is likely to be and is currently determined through a periodic review process. Any changes to funding policy should be addressed through the PR23 process (this also true with regards to governance, regulation and market mechanisms).

Traditionally interventions to assets and operations have been made to achieve a fixed service expectation set irrespective of changes that may occur in the 'environment' in which we and our passengers and stakeholders operate. The speed of transformation in the natural environment, the economy and our user's travel needs is increasing, this coupled with higher expectations of reliability and on demand availability means that we need to think more flexibly about what resilience means, what the service expectation should be and how to deliver it.

Work is already under way, for example the target to agree different service expectations under extreme weather conditions included in our [Environmental Sustainability Strategy](#) climate change adaptation roadmap (p27).

6. **In which of the Commission's sectors (outside of digital) can digital services and technologies enabled by fixed and wireless communications networks deliver the biggest benefits and how much would this cost?**

<u>Resilience</u>

Data and digitisation and smart assets are directly related to resilience but other technology development areas such as transforming command, control and signalling are too as they drive affordability which underpins our ability to have reliable assets in service.

Very substantial progress has already been made in the area of intelligent infrastructure. We are developing remote monitoring mechanisms for most assets and R&D is increasingly focused on improving this technology-enabled capability. The remote monitoring of assets to provide data combined with artificial intelligence to offer insights and map-based visualisation is supporting decision-making to extend asset lives and pre-empt failure.

Using even the best current systems there can still be asset resilience and performance issues due to inaccuracies in the models used and the measurements behind the assumptions used in them. Digital services could provide a rail network model to enable us, and our stakeholders and partners to test changes for their impacts on services and the environment and to understand and optimise them. This would drive a more evidence-based approach speeding up and simplifying investment decision-making and prioritisation and delivering efficiencies by:

- Avoiding the need to routinely build 'disposable' models,
- Increasing the value of outputs from development work by providing a repository and exploitation mechanism for outputs,
- Enabling suppliers to build and test business cases without substantial client involvement, unlocking productivity improvements across 'white collar' client roles that support investment decision-making, procurement and supplier management and product development, and
- Reducing or even replacing physical enhancements with digital optimisation

Examples of current technology transitions are:

The increasing use of AI to triage the data from the lidar cameras used on measurement trains in our Plain Line Pattern recognition system, dramatically reducing the workload on inspectors, and

The first steps in the rollout of the European Train Control System replacing traditional ground based systems with the business case for wider rollout being based on long-term financial savings and increased resilience, performance, network capacity and safety.

However there is still an opportunity gap. To meet the expectations placed upon our complex network with its increasing interconnectedness and dependency on and with other interconnected systems we will need to be able to respond in near real time to events and from the perspective of individual users (some of whom will be highly flexible ranging to others that are highly constrained). Technology provides options to close this opportunity gap, for example 'digital twins' that are potentially openly accessible to underpin exploitation by tech companies, or through a relationship with a data marketplace.

<u>Decarbonisation</u>

As the current most practical energy source for decarbonising the railway is electricity there will need to be improvements in value managing and value engineering the electrification system, particularly the cost-effectively retro-fitting of systems to existing rail routes. This will require innovations in modelling, system redesign, automation and the area of energy generation and storage.

7. **What barriers exist that are preventing the widescale adoption and application of these new digital services and technologies to deliver better infrastructure services? And how might they be addressed? Your response can cover any number of the Commission's sectors outside digital (energy, water, flood resilience, waste, transport).**

There is a complex mix of factors blocking digital services and technology including: a risk/change averse culture, commercial arrangements and proprietary products, fragmentation of the industry which disrupts the value chain, pre-existing standards and processes, a lack of or mis-aligned incentives (sometimes the costs and benefits of innovation sit within different organisations), uncertainty in the long-term direction and expectations for the industry and training and competency. The [Rail in the future transport system](#) paper (May 2019) from the Williams Rail Review provides a recent summary of these barriers.

Organisations should be encouraged and incentivised to challenge current ways of working, to identify smarter, safer and more efficient, environmentally friendly and resilient products and operating methods. Regulators, funders and delivery organisations should work together to develop an environment which fosters a partnership approach involving academic and supply chain partners. This requires:

- The definition of an approach to innovation that defines expected outcomes and clearly articulates a culture of 'fair failure' i.e. reasonable experimentation that does not penalise occasional failure and tolerates and acceptable levels of risk,
- Stable and sustainable levels of Research, Development and Innovation (R, D&I) funding. Without this it is hard for organisations to commit to R, D&I programmes and build long-term

relationships with suppliers and academia. The recent doubling of funding for R&D and Innovation in our current investment period (CP6) coupled with the creation of an aggregated R, D&I portfolio has led to The Railway industry Association 2021 survey on perceptions of innovation showing a 21% increase in positive perceptions of innovation from 2019,

- Better understanding of cost and benefit distribution and mechanisms to make this more equitable – The current structure of the industry can place the cost of innovation on one organisation with the benefits falling in another acting as a disincentive, and
- Improved communication and guidance - This had two angles 1) stakeholder communication to improve the perception of innovation as beneficial rather than negative e.g. improving job quality rather than challenging job security, and 2) better guidance for navigating funding streams and building Rail, academic and supplier partnerships.

The delivery of the Great British Railways: Williams-Shapps Plan for Rail will address many of these barriers, particularly around the issues related to industry fragmentation. This will provide a long-term industry strategy and improve the adoption of innovation in the industry.

Other activities already underway in this space within Network Rail, across the rail sector and within the research community include:

- The creation of our R, D&I portfolio, developing new routes to market, becoming more engaged with supplier-led innovation (eg Innovate UK competitions) partnering with Research and Technology Organisations including Innovate UK, Catapults and universities. This includes a major focus on marketing and communications that is multi-channel, multi-organisation (cross-sector) and addresses all stages of supplier/innovator involvement from understanding the challenges requiring solutions to success stories,
- We have developed and published and 'innovation journey' available on the Rail Industry Association (RIA) website [here](#),
- Our 'open for business' programme which has initiated changes to processes including a route to challenge standards,
- We have established a 'digital factory', partnering with a developer to rapidly build digital modular solutions in IT to automate processes across NR using 'low-code' technology,
- The Rail Sector Deal and industry participation,
- The Shift2Rail programme within Horizon 2020,
- The UK Rail Research and Innovation Network,
- The RIA is developing an innovation navigator, and
- UKRI is seeking to bring together funding opportunities helping to rationalise and simplify the landscape for innovators.

8. **What are the greatest risks to security of supply in a decarbonised power system that meets government ambition for 2035 and what solutions exist to mitigate these risks?**

The greatest risks are intermittent generation not being able to meet demand and grid instability due to diminishing spinning reserve. Storage could potentially mitigate both of these, but the technology currently isn't proven at scale and could be expensive. Smart devices may also help.

9. **What evidence do you have on the barriers to converting the existing gas grid to hydrogen, installing heat pumps in different types of properties, or rolling out low carbon heat networks? What are the potential solutions to these barriers?**

NR does not have any direct experience of these technologies yet. Hydrogen production and heat pumps are much more expensive than gas-based technologies at present so that is the most significant barrier. Better building insulation is also a potential solution for heating and cooling. More widespread use of heat pumps may bring prices down.

10. **What evidence do you have of the barriers and potential solutions to deploying energy efficiency in the English building stock**

No specific evidence to offer on individual solutions, but the cost of retro-fitting solutions to existing stock can be prohibitive.

11. **What barriers exist to the long term growth of the hydrogen sector beyond 2030 and how can they be overcome? Are any parts of the value chain (production, storage, transportation) more challenging than others and if so why?**

We have no response to give with respect to the growth of the hydrogen sector, but do note that the practicality of developing and using hydrogen trains will depend significantly on the maturity of the UK hydrogen network and the costs associated with hydrogen as a fuel.

12. **What are the main barriers to delivering the carbon capture and storage networks required to support the transition to a net zero economy? What are the solutions to overcoming these barriers?**

No response

13. **In what ways will current asset management practice need to improve to support better infrastructure resilience? Your response can cover any number of the Commission's sectors.**

Asset management requires a complete understanding of the assets we have and how these perform, what assets we need, and the level of service expected from them and knowledge of/application of lifecycle efficient ways to adapt the infrastructure to meet these needs. The changes necessary to support better infrastructure resilience are:

An improved understanding of asset carbon, waste and resilience performance (knowing more about what we've already got),

Better modelling of future climate and through life carbon impacts (understanding how what we have will respond and knowing more about what we will need),

The development of future proof standards and improved standard design solutions that make current and future resilience planning the default rather than an add on (the means by which we will adapt to the coming changes and improve the resilience of the infrastructure),

A more cross sector approach including strengthened supply chain engagement/development – to identify and access solution efficiency and reach from multi stakeholder approaches, and

Appropriate regulatory requirements/financial incentives that promote a multimodal transport approach and stimulates a whole infrastructure system approach to resilience.

14. What are the barriers to and solutions for expanding recycling capacity, both now and in the future to deliver environmental and net zero targets?

While we do not have a detailed response to this specific question, we do note that there is limited reference to a circular economy in the report as a whole and then only in the context of waste. This is a very small element within a truly circular economy and if done well it should be designed out as much as possible. Ideally there should be a wider consideration of the full remit of circularity in the development, operation and end of life of new infrastructure. Focus should be given to reuse and repurposing existing assets and maximising the lifespan of assets during first use, and any subsequent uses rather than purely the recycling of waste. End of life options should be identified from the outset and only with all other options exhausted, should the material become waste. This would support many other elements of the assessment, e.g. net zero, asset management, financial sustainability.

15. What is the likely environmental impact of waste streams from construction across economic infrastructure sectors, over the next 30 years, and what are the appropriate measures for addressing it?

Waste in any economic activity has the capacity to have significant environmental impacts from the production of the raw materials at the start of its life through to the activities involved in its disposal. The focus should be on avoiding waste with infrastructure designed to maximise reuse and repurpose existing materials aiming for zero waste. When infrastructure reaches the end of its life repurposing should always be the preferred option before building new. Any waste that does arise should be recycled, retaining the highest possible value. This will require a whole lifecycle approach and needs consideration of the appropriate structural changes to the sector and for recycling and replacement research and innovation for materials and products that are currently difficult to reuse or recycled.

16. What evidence is there of the effectiveness in reducing congestion of different approaches to demand management used in cities around the world, including, but not limited to, congestion charging, and what are the different approaches used to build public consensus for such measures?

No response

17. What are the barriers to a decision-making framework on interurban transport that reflects a balanced approach across different transport modes?

No response