

The Innovate UK response to the National Infrastructure Committee's call for evidence on Connecting Northern Cities.

1. Innovate UK is the UK's innovation agency, a non-departmental public body sponsored by BIS. It is the prime channel through which the Government incentivises innovation in business. Innovate UK is business-led. Our governing board and executive team is comprised of experienced business innovators and experts. We work with people, companies and partner organisations to find and drive the science and technology innovations that will increase productivity and exports and grow the UK economy.
2. We are working to:
 - Accelerate UK economic growth by nurturing small high-growth potential firms in key market sectors, helping them to become high-growth mid-sized companies with strong productivity and export success;
 - Build on innovation excellence throughout the UK, investing locally in areas of strength;
 - Developing Catapults within the national innovation system, to provide access to cutting edge technologies, encourage inward investment and enable technical advances in existing businesses.

Working with the research community and across government to turn scientific excellence into economic impact, and deliver results through innovation.

 - Evolve our funding models to explore ways to help public funding go further and work harder, while continuing to deliver impact from innovation.
3. In line with our strategy¹ we operate across Government and advise on policies which relate to technology, innovation and knowledge transfer. We also support Government departments to become more efficient by supporting them in developing innovative solutions through harnessing the creativity that businesses can offer.
4. Innovate UK was established in July 2007 (as the Technology Strategy Board). We have committed more than £1.5 billion to date and independent evaluations have established that overall Innovate UK has created over £6 of GVA for every £1 it has invested and 7 jobs for every business it has invested in. Over the last 8 years this has added up to delivering a total of £7.5Bn and 35,000 jobs. The private sector more than matches that investment, doubling the power of public sector money, and we have directly supported over 6,500 companies. We work with nearly every University in the UK to stimulate the commercialisation of leading-edge academic research and innovation.
5. Transport Systems as well as vehicle technology across Automotive, Aerospace, Marine and Rail have had a major focus within Innovate UK over the last eight years. We have placed significant investment in collaborative R&D partnerships, driving growth within businesses and supply chains, both nationally and for exports. These areas continue to be prime focal points as we build on success in these sectors of national importance by delivering the Advanced Propulsion

¹ 'Concept to Commercialisation: A strategy for business innovation, 2011-2015'.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/360620/Concept_to_Commercialisation_-_A_Strategy_for_Business_Innovation_2011-2015.pdf

Centre and Aerospace Technology Institute programmes on behalf of the Department of Business, Innovation and Skills.

6. The Transport sector has grown into one of Innovate UK's key priorities. Our aim is to help innovative UK businesses to take advantage of the opportunities that a rapidly changing transport system will present, both in the UK and in overseas markets. Over the last parliament we have invested up to £70m per year of our core budget in support of hundreds of innovative businesses developing new products across the transport sector, from new powertrain technologies, through to new unmanned aerial systems and intelligent mobility services. Our focus from 2007-2015 grew from the Low Carbon Vehicle Innovation Platform to cover Aerospace, Rail, Marine and Transport Systems.
7. Innovate UK supports businesses in two main ways. Firstly, we provide funding to allow development of high potential, ground-breaking new technologies and products that are too early and too risky for the private sector to fund alone. Secondly, we help businesses connect to the right partners, expertise, test facilities, financiers and influencers that can accelerate their route to market. Examples of this support are the Catapult centres, launched by Innovate UK to provide critical expertise and test facilities to businesses in developing new products. With the core capability context of transport we have High Value Manufacturing and Transport Systems as well as Future Cities Catapults. Additionally, to meet the challenging convergence of other enablers such as the Digital and Satellite Applications Catapults are extremely important.
7. Specifically within the Northern Powerhouse the High Value Manufacturing Catapult has three centres to enhance manufacturing capability that are strategically placed to provide significant opportunities for local economic and business growth. These are:
 - **The Advanced Manufacturing Research Centre² (AMRC)** is located at Sheffield focuses on advanced machining and materials research for aerospace and other high-value manufacturing sectors. It identifies, researches and resolves advanced manufacturing problems on behalf of its industrial partners. Around 70 companies have joined as members, from global aerospace giants such as Boeing, Rolls-Royce, BAE Systems and Messier-Bugatti-Dowty, to local small businesses. The centre also works with hundreds of other manufacturers on specific research projects.
 - **The Nuclear Advanced Manufacturing Research Centre³ (Nuclear AMRC)**, also located in Rotherham, aims to enhance the capabilities and competitiveness of the UK civil nuclear manufacturing industry, and help British manufacturing companies compete for nuclear contracts worldwide.
 - **The Centre for Process Innovation⁴ is located in Redcar** and uses applied knowledge in science and engineering combined with state of the art development facilities to enable our clients to develop, prove, prototype and scale up the next generation of products and processes.

The global manufacturing market is worth £6.7tn and the UK currently performs strongly as the 11th largest manufacturing nation worldwide. Although there has been a decline since the 1970s, recent figures show that manufacturing makes up 11% of the UK GVA and 54% of UK exports, directly employing 2.6 million people and accounting for over 70% of investment in R&D.

² <http://www.amrc.co.uk/>

³ <http://namrc.co.uk/>

⁴ <http://www.uk-cpi.com/>

8. Since 2010 the Innovate UK Transport team has specifically generated **£47m** of investment in the North (North East, North West and Yorkshire & Humber regions) and has provided grants worth **£29.3m**. This has supported:
 - **35 projects**, involving **168 organisations** from the North of England covering industries in the automotive, rail, marine, intelligent mobility and aerospace sectors;
 - Supported include major OEM's such as Nissan, Caterpillar and Leyland DAF;
 - **87 SMEs** via **£13.6m** of grant funding; and,
 - **15 different universities** in the North.
9. Highlights include Hyperdrive Innovation in the North East who developed lithium-ion battery systems for automotive, off highway, industrial, marine and standby power applications, and Datasys Limited in Manchester, who provide complex Rail Management Systems which facilitate the integration and capture of data, analysis and distribution of management information to support the UK's Train Operating Companies to improve their performance and service.
10. Within Innovate UK's wider Transport Team the Low Carbon Vehicle Innovation Platform (LCV IP) focuses on supporting the development of low carbon technologies for the automotive sector. A range of projects in the North of England have been funded including Nissan and Caterpillar and their supply chains. In 2015, a review commissioned by Innovate UK concluded that for every £1 invested by Government there is a forecast return of £8 in the medium term (10 years) and £20 in the long term (15 years). When the supply chain effects multiplier is used, these figures rise to £14 and £34.
11. Innovate UK has a longstanding relationship with Nissan to develop its UK supply chain and undertake greater levels of research, development and innovation in the UK, forging new partnerships with SMEs. Project examples include developing new flywheel energy storage technologies, light weight commercial vehicles and an integrated propulsion and charging system.
12. The demand for transport and its infrastructure is proving to be a critical challenge for the UK in enabling businesses to function and to support economic growth through the movement of people and goods. Notwithstanding social development, wellbeing and environmental impacts, we see great potential in balancing demand and optimising connectivity through evaluation of new innovations and technologies and how these trends can offer greater utilisation of the National Transport infrastructure. Equally advancements in new innovation for asset management and connectivity can provide cost savings in operational maintenance for local authorities.
13. We have shown how major demonstrations of new innovations and technologies, such as electric vehicles, can attract international investment into the UK and accelerate market adoption of low emission technologies and reduced risk for industry to bring new products to market. New business models provide value across the range of transport issues and we have also seen valuable insights into the complexities of the network users and how disruptive and innovative thinking can drive a change in behaviour towards transport.
14. Expertise and sector knowledge at Innovate UK can bring significant change in the transport market. Through working closely with industry and evaluating past projects Innovate UK provide timely and value added interventions to drive supply chain growth and productivity. We

demonstrate how the collaboration across industries can open new value to capture and meet the future challenges of transport.

15. The value of working closely with UK Governments on specific societal challenges can bring about timely change in regulation and standards to match the pace of technology and innovation and how these drive new customer demands. Projects funded through Innovate UK show how risk reduction through targeted innovation investment can overcome perceived challenges and drive collaboration across industries on a common challenge. Innovate UK welcomes the National Infrastructure Committee's inquiry into Connecting Northern Cities. Set out below is our response to the questions raised by the Committee.

1. To what extent are weaknesses in transport connectivity holding back northern city regions (specifically in terms of jobs, enterprise creation and growth, and housing)?

16. The low level of UK Government investment in transport infrastructure is evident in Northern cities, especially in comparison with London and the South-East. Transport infrastructure is vital as it facilitates the movement of people and goods, providing services, enhancing social well-being, driving businesses, enhancing knowledge and skills, and helping to build economic clusters around areas of commercial specialism. The lack of government investment in infrastructure in the North of England has directly contributed to holding back economic growth within and between northern cities, and has contributed to the sense of a 'divided England' evidenced through inflated house prices and higher average wages in the South compared to the North.
17. Transport services to the North are hindered through the Midlands, in the North East and North West, with the Pennines presenting a natural geographical obstacle between these regions. Transport is predominantly by road and over-ground rail. Light rail and underground rail feature in major urban areas, but coastal shipping to encourage an intermodal, integrated transport system for both people and goods should be encouraged with funding from programmes such as motorways of the sea⁵.
18. Higher levels of infrastructure investment should focus on rebalancing the transport system and creating greater city-to-city access, interconnecting with rural and local transport. This will help to strengthen connectivity, to enhance commercial competitiveness and drive innovation.
19. In the main, excluding waterborne freight, many of these issues are captured by the UK Government's National Infrastructure programme which sets out plans to connect the North through its Northern Powerhouse programme – an extract from the National infrastructure plan is as follows:

The government has been clear on the need to rebalance the economy in order to restore economic growth in this country. An important aspect of such rebalancing is to ensure that all areas of the country are able to realise their full economic potential and prosperous cities in the North can complement prosperous cities in the South. The Chancellor has set out plans to create a Northern Powerhouse, through provision of modern transport connections, support for science and universities and more power and control to civic government to maximise the potential of the North of England and reduce the decades-old gap between London and other cities.

⁵ http://ec.europa.eu/transport/modes/maritime/motorways_sea/index_en.htm

20. The plans for High Speed 2 (HS2) are already forming part of the Northern Powerhouse connectivity through its second phase which connects faster routes between London and Birmingham, onwards to Liverpool, Manchester, Sheffield and Leeds.
 21. The major motorways and 'A' roads in and around the Midlands and North are highly congested. These include the M42, M6, M5, M56 and M1, and further north the A1 and M67 around Sheffield. The M6 toll road has not resolved the challenges of congestion in the Birmingham area, and many road-users opt for the non-tolled route.
 22. In Northern cities the rail capacity during the morning and evening peaks has now been exceeded by demand (Manchester passenger numbers are 103.3% of capacity, Leeds 101.6%, Birmingham 101.2%⁶). Standing passengers struggle to make productive use of their time and passenger journeys are showing a trend towards doubling every 10 years, presenting a significant obstacle to growth.
 23. The natural obstacle of the Pennines presents a challenge for both road and rail transport and sees the M62 climbing to nearly 400 metres, and a relatively small number of east-west trunk routes. Similar challenges are seen for rail connectivity. With combined pressures to reduce CO2 emissions and to minimise the disruption caused by inclement weather, the recent trans-Pennine road tunnel concept⁷ merits consideration. Similar initiatives to re-open trans-Pennine rail tunnels have also been proposed.
 24. The case for investment in new infrastructure should highlight businesses likely to prosper in the northern cities by virtue of their location, and links into London may be considered as a secondary priority. For example, better rail and road links across the Pennines have clear potential to remove the need for goods to be transported south to the Ports of Tilbury, Folkestone, and Southampton for onward shipping. For example, Caterpillar Articulated Trucks are currently moved by road transporter, from Peterlee in County Durham to Southampton for global distribution, a journey of some 300 miles.
 25. Road, rail and aviation infrastructure is often built near to existing transport pinch-points. This may inhibit the free flow of business traffic, but business will also follow where transport infrastructure leads. Witness the historical examples of the M25, A43, and A14 where businesses (for example logistics parks) and workers found new opportunities to travel further more quickly and relocated their businesses and activities accordingly.
- 2. What cost-effective infrastructure investments in city-to-city connectivity could address these weaknesses? We are interested in all modes of transport.**
26. With 15 population centres to be connected Innovate UK would suggest a thorough study of the transport effectiveness between cities for people and freight transport and consideration to the time taken in relation to speed for each of the journeys. For commuters below are high-level estimate views of average speeds (km/h) between cities in the UK. Deeper analysis of this nature can evidence efficient investment in the pinch points.

By road:

⁶ <https://www.gov.uk/government/statistics/rail-passenger-numbers-and-crowding-on-weekdays-in-major-cities-in-england-and-wales-2014>

⁷ <http://www.bbc.co.uk/news/uk-england-34964253>

	Population (1,000 s)	Bradford	Carlisle	Chester	Hull	Lancaster	Leeds	Liverpool	Manchester	Newcastle upon Tyne	Preston	Salford	Sheffield	Sunderland	Wakefield	York
Bradford	467															
Carlisle	101	73.4														
Chester	118	66.0	79.4													
Hull	240	73.4	70.3	75.0												
Lancaster	135	47.1	77.9	67.9	66.8											
Leeds	720	31.1	62.1	72.3	70.8	52.8										
Liverpool	440	61.3	74.0	39.7	75.2	54.5	67.7									
Manchester	420	43.9	77.6	56.8	66.2	61.9	51.8	55.6								
Newcastle upon Tyne	259	80.0	66.4	66.2	64.0	57.3	68.9	61.6	63.0							
Preston	130	48.8	83.0	60.2	71.9	51.6	57.1	47.8	51.8	59.6						
Salford	215	51.6	83.9	62.7	71.4	67.6	58.8	61.0	12.0	63.7	56.2					
Sheffield	512	45.5	65.0	51.6	66.9	52.3	49.5	50.5	37.1	72.1	48.9	39.4				
Sunderland	280	65.3	59.3	70.5	62.9	60.5	72.9	66.1	66.4	32.7	60.5	66.8	73.9			
Wakefield	316	38.2	66.5	64.1	70.0	53.7	34.2	78.1	47.0	73.8	55.2	51.9	45.3	78.6		
York	182	51.6	69.3	71.7	47.0	53.1	40.0	70.7	60.8	68.2	59.3	63.3	54.3	69.9	54.7	

By rail:

	Population (1,000 s)	Bradford	Carlisle	Chester	Hull	Lancaster	Leeds	Liverpool	Manchester	Newcastle upon Tyne	Preston	Salford	Sheffield	Sunderland	Wakefield	York
Bradford	467															
Carlisle	101	67.9														
Chester	118	35.8	91.3													
Hull	240	61.8	52.4	50.0												
Lancaster	135	41.1	123.4	76.0	48.8											
Leeds	720	46.7	55.5	49.3	86.0	40.0										
Liverpool	440	48.4	70.8	34.2	71.6	50.3	75.0									
Manchester	420	48.5	85.8	50.5	67.9	73.0	70.7	79.4								
Newcastle upon Tyne	259	68.8	61.6	55.6	70.2	46.9	87.3	64.3	74.1							
Preston	130	46.6	113.4	66.3	53.4	106.7	44.7	45.4	60.3	45.6						
Salford	215	42.6	82.2	39.1	57.4	53.4	53.1	50.5	30.0	63.7	71.9					
Sheffield	512	39.1	63.9	49.0	62.0	54.2	69.1	59.4	65.0	101.7	51.7	49.6				
Sunderland	280	45.8	48.8	47.0	46.8	40.9	59.0	54.4	52.5	53.1	36.6	50.9	61.4			
Wakefield	316	26.3	52.1	39.6	58.3	36.9	72.2	64.1	45.0	87.3	34.3	31.5	85.0	57.1		
York	182	51.6	57.5	53.8	48.7	41.1	73.7	73.7	75.6	124.2	44.6	54.3	78.4	66.9	56.2	

27. For freight and by sea transport this is more difficult to assess. There are circa 120 commercial ports in the United Kingdom, ranging from the major all-purpose ports, such as London and Liverpool, to the smaller ports catering for local traffic. The majority of freight movements are concentrated among a comparatively small percentage of ports, with the top 20 ports accounting for over 80% of the total number of freight movements. There exists a clear opportunity to increase utilisation of the port network by expanding short-sea shipping. We would recommend an analysis of the case for investment.

28. For maritime freight traffic, there is a need for improved market use of tools to provide more accurate predictions of end-to-end journey times, to minimise early arrivals and waiting time, and to help optimise the use of tidal windows. This will enable ports to operate improved scheduling systems for berthing and 'just-in-time' logistics to increase throughput and maximise revenue.

29. Highways England are undertaking a significant programme of improvements for inter-city connectivity throughout the North through road enhancements including:

- A smart motorway spine linking London, Birmingham, Manchester and Leeds;
- Increasing capacity on the M1 by delivering a four lane Smart motorway which will improve connection from Rotherham to Sheffield and Wakefield to Leeds;
- Adding capacity on the M60 and M62 motorways around Manchester through the delivery of a further 9 lane miles using Smart motorways;
- improving the A556 between Knutsford to Bowdon, which will make journeys more reliable along this key transport corridor linking Birmingham and the South of England with Manchester, Manchester Airport and the North of England;
- Enhancing capacity on the M1 between Derby and Nottingham, reducing congestion and aiding economic growth in the region and improving the interchange of the M1 with the

M6 and A14 near Rugby. This will remove a key bottleneck and reduce significantly the number of accidents and incidents.

- Improving capacity on the M6 by providing an additional 19 lane miles to relieve congestion in Staffordshire.
30. While road capacity can be increased through innovations such as managed motorways, similar initiatives are in place to increase rail capacity. For example, where rail capacity is not limited by the capacity of the network, but by the available rolling stock, smart rolling stock procurement is providing innovations for high-capacity vehicle designs, reduced manufacturing costs and lightweight engineering design (as promoted by the Warwick Manufacturing Group part of the High Value Manufacturing Catapult). Similar initiatives are in place to provide informed travel for rail passengers, e.g. to support passengers in electing to travel on services with available capacity.
31. The concept of true intermodal public transport increasingly offers an attractive alternative, particularly to the use of a private car. With advancements in open-data platforms and a greater openness of data, informed travel choices are more readily available. Intermodal transport and its supporting services can now provide a greater choice in how people travel, how public transport is provided, and how freight is moved. Strategically connecting the UK ports with rail hubs, air-freight terminals and land based distribution centres could offer greater efficiency in how goods and people are moved, thus reducing operational costs, energy consumption, the cost of new infrastructure, reducing vehicle ownership, as well as delivering greater reliability and predictability.
32. Intermodal freight transport involves the transportation of freight in an intermodal container or vehicle, using multiple modes of transportation (rail, maritime, and road), without any handling of the freight itself when changing between modes. Through this, a clear benefit is provided to industry through reducing the requirement for goods handling, improving security, reducing damage and loss, and allowing freight to be transported faster and more efficiently.
33. Intercity connectivity is probably best covered by a combination of road and rail, with consideration for short distances and safer routes for cyclists – motor cycles and pedal cycles, and equally the use of canals for non-critical freight whilst opening regional rivers to carry freight.
- 3. Which city-to-city corridor(s) should be the priority for early phases of investment?**
34. To provide greater clarity into this complex question, a comprehensive study is recommended to address a number of factors, to determine which cities should be the priority, and to define which may benefit in the short, medium and long term.
35. The study should consider how transport and its infrastructure efficiency may be optimised through:
- reviewing the current connectivity of the Northern Cities, the journey times using different modes of transport, and the overall performance of the distributed transport network, one that is inherently more complex than the Southern transport network, typically centred on London in a radial manner;
 - improving the customer experience for public transport through multi-modal journeys and reviewing how this can be enhanced through the convergence of emerging technologies and innovations;

- addressing the social issues around fragmentation in relation to rural and local transport and traffic management;
- examining the costs of travel and the business models that support public transport such as rail franchising;
- defining how a greater emphasis on regional interoperability could unlock congestion bottle-necks, coupled with a rigorous analysis of inter-city journey times to assess how the transport networks could be balanced more efficiently through greater understanding of peak and off-peak congestion;
- addressing how regulatory and policy reforms can unlock seamless travel through the use of such innovations as smart-ticketing and inter-region connectivity;
- reviewing the commercial opportunities for private and public data integration;
- drafting a national strategy for multi modal integration of transport systems;
- considering the tangible regional benefits that may be more broadly derived from national initiatives such as HS2 and the investment into such programmes;
- looking at the existing and emerging industries across the North, where there are located and obtaining a greater understanding of how they can gain a stronger critical mass by being better connected; and,
- completing an analysis of how the use of new innovation and technology can directly enhance overall network capacity.

Innovate UK is well placed to identify emerging industries (using Innovation mapping) and to participate in all aspects of the proposed review.

4. What are the key international connectivity needs likely to be in the next 20-30 years in the north of England (with a focus on ports and airports)? What is the most effective way to meet these needs, and what constraints on delivery are anticipated?

36. Efficient access to ports and airports for freight, either by road or rail may present a number of challenges, particularly as this access is generally through the environments of towns or cities. Infrastructure connectivity systems over the next 20-30 years need to provide innovative prioritising solutions for freight, to and from ports and airports. Additionally, asset tracking systems, ship location technologies, and port logistics connectivity tools can provide greater integration of pathways for the goods being imported and exported, reducing emissions with improved scheduling of embarkation of shipping providing overall efficiency for the movement of goods across the network.
37. Major industry in the North of the UK cites connectivity for freight with the European market as a critical requirement. In addition, current reliance on the Channel Tunnel has proved problematic during recent years and there is a desire to seek other transport options to provide alternatives and to increase the robustness of the system. The European Trade route E20 connecting Ireland, through North Wales, past Liverpool, Manchester, and Leeds to the Humber ports is cited as being a critical trade route, with companies looking at options to locate themselves along its length.
38. Rail freight is considered an attractive option for present and future needs, offering a cost-effective and low carbon solution. In past times, industry was well connected to the rail network, with freight sidings at many industrial sites. In many cases these sidings still exist, but are no longer connected to the national network. Reconnecting these factory sidings is not proving a simple exercise, and coupled with challenges in establishing paths for rail freight movement between the East and West coasts, this is presenting an obstacle. Innovation is required to streamline the reconnection of dormant freight facilities to the network, and to create new ones. In addition constraints imposed by the capacity of the current network need to be

overcome, especially in relation to running freight and passenger services in parallel, and to better understand the challenges imposed by the capacity of the trans-Pennine routes.


39. To help resolve the issues, a number of options are available, including initiatives to re-open railway lines closed in the later decades of the 20th century (e.g. the Woodhead trans-Pennine route) and planning tools to help identify circuitous routes, avoiding congested areas of the rail network. HS2 (planned to open in phases between 2026 and 2033) may also contribute through diverting existing passenger traffic from the West Coast Main Line and freeing capacity for freight.

Evidence submitted on behalf of the Innovate UK by:

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Signed:

A handwritten signature in black ink, appearing to read 'Ruth', with a long horizontal stroke extending to the left.

Date: 12.01.16

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