



Department for
Digital, Culture,
Media & Sport

Trans Pennine Initiative Trial: Call for Information

August 2018

Department for Digital, Culture, Media & Sport

1. Introduction

This Call for Information (Cfi) seeks written responses from parties with an interest in the Trans Pennine Initiative (TPI), which was announced at the Autumn Budget 2017.

2. Trans Pennine Initiative Wireless Summary

The Department for Digital, Culture, Media and Sport (DCMS) intends to use part of the £35m funding announced for rail passenger connectivity improvements at Autumn Budget 2017 to conduct the Trans Pennine Initiative, which is a joint effort between the Local Full Fibre Networks (LFFN) and 5G Testbeds and Trials (5GTT) Programmes, with Network Rail (NR) as our delivery partner.

Key objectives of TPI are:

- To trial delivering high capacity fibre to premises using Network Rail's assets between Manchester and York;
- To provide high speed connectivity to the train utilising the rail corridor between Manchester Piccadilly and Leeds along with infrastructure currently being deployed along the route; and
- To create a 5G test bed at Network Rail's 'Rail Innovation Development Centre' (RIDC) at Melton Mowbray.

The Trans Pennine Cfi will support the Government's ambitions to improve passenger connectivity along mainline routes. It will be a testbed for the UK to be amongst the world leaders in 5G.

With regards to track to train connectivity, we anticipate that through TPI, we will:

a. Fund construction of TPI pilot facility on the Trans Pennine route:

- Finance the deployment of new and separate fibre and power cables along the Trans Pennine route between Manchester Piccadilly and York, including Points of Presence (PoPs) which will be placed at strategic locations on the rail boundary so that non-rail related operators can easily interconnect.
- Finance the deployment of telecoms masts along the route between Manchester and Leeds, at approximately 500m intervals and of alternating 8m and 20m heights (above track level). This infrastructure will be available to all selected trialists (reference bullet 'c' below) to facilitate the deployment, operation, and trial of potential trackside technologies.
- Provide financial support for installation activities

b. Fund a 5G Testbed in Melton Mowbray:

Upgrade NR's Melton Mowbray RIDC test track facility to deploy:

- new alternating 8m and 15m masts at approximately 500m intervals;
- a new high fibre count telecoms cable and power cables; and
- a central equipment building where the radio distribution points between each new mast will interconnect via the fibre infrastructure

This will allow trialists an alternative, non-operational location where technologies can be tested.

c. **Carry out a selection process for part-funded trials on the TPI Pilot facility:**

- Fund an output focused competition to select several different technologies capable of solving the problem of delivering enhanced track-to-train wireless network services up to 1Gbps.
- Trialists will be given the opportunity to deploy their trial radio equipment on the TPI pilot route (Manchester to Leeds), along all of the trackside infrastructure as well as in trains, without the need to invest in trackside infrastructure. This pilot will provide the following key benefits:
 - a. It will allow trialists the opportunity to demonstrate their solutions viability in a live environment with a wide demographic of passengers (business commuters, day trippers, long distance travellers etc.) allowing for testing of capacity, availability, coverage, security etc.
 - b. It will provide trialists with testing scenarios using actual passengers through different communities along the TPI route such as cities, suburbs, towns, rural villages etc. This information will allow solutions to be optimised to passenger needs along the route as well as providing valuable research and development opportunities to trialists.
- Trialists will be evaluated on their ability to deploy track-to-train and on-train radio solutions to deliver optimised bandwidth services up to 1Gbps and demonstrate how they will achieve this using the provided passive infrastructure. The TPI Pilot trial is anticipated to start in March 2019 and is anticipated to run for up to 12 months.

d. **Support trials at RIDC**

- Facilitate technology trials of radio equipment at the RIDC Testbed to enable trialists to demonstrate different technologies capable of delivering enhanced track-to-train wireless network services up to and beyond 1Gbps.
- Trialists will be able to install radio equipment along all or part of the trackside infrastructure as well as in trains, without the need to invest in trackside infrastructure.
- The RIDC Testbed technology trials are anticipated to start in January 2019.

Appendix 1 provides more background to TPI and the wider associated rail policy

Appendix 2 provides further information on the TPI pilot facility

Appendix 3 provides further information on RIDC

3. Wireless Trial Options, Infrastructure, and Assumptions

A series of questions are outlined in Section 5 and in Appendix 4. These are intended to provide DCMS with information to assist in trial deployment and to identify any constraints and concerns that potential trialists envisage.

In developing the trial, several key assumptions around trialist participation have also been made:

For the TPI Pilot:

- a. Each trialist will free-issue their own trackside equipment, e.g antennas, active equipment, brackets and cables, and on train equipment.
- b. Each trialist will be expected to install and optimise their own equipment for the trial using Network Rail Telecom (NRT), the Train Operating Companies (TOCs) or trialists third party sub-contractors. Some funding may be available to support trialists installation costs.

For RIDC Testbed:

- c. Each trialist will be expected to free-issue, install and optimise their own on-train equipment for the test trains allocated at the RIDC Testbed using Network Rail Telecom (NRT) or their third party sub-contractor.

General assumptions

- d. Trialists will commit to providing trial support services, such as a dedicated staff to support during the period of the trial, to address operations and maintenance, issue resolution and performance reporting.
- e. Trialists will need to confirm that their solution will either be compatible with any on-train Wi-Fi gateways and Wi-Fi access points or provide an alternative solution.

Note that the above assumptions have been made specifically for this Cfl and will not necessarily be used on wider mainline routes.

4. Local Full Fibre Network

As part of TPI, Network Rail are deploying a high capacity (433 fibre) spine along the route between Manchester and York as part of the Government's Local Full Fibre Network (LFFN) programme. This is being built as a new overlay to any existing fibre that may exist alongside this rail route, and therefore is isolated from any mission critical systems operated by Network Rail. It is also intended to provide connectivity from this spine into both the Manchester and Leeds Internet Exchanges.

This fibre will be used to provide back-haul connectivity from the mast locations and support the trial. However, there will be unused fibres which can be used to provide fixed network connectivity between locations along this rail corridor.

It is envisaged that there will be jointing points at 500m-1km intervals along the fibre, corresponding to mast locations, to facilitate back-haul connectivity. In addition to this Network Rail intend to deploy a number of Points of Presence (PoPs) along the route. These PoPs will provide secure co-location space for trialists equipment, as well as pre-configured and pre-terminated network, power, and cable options. It is intended that PoPs will be located in positions such that access to them is possible without requiring track-side working.

5. Call for Information Questions

In order to inform decision making around the trial, this Cfl is seeking responses to the following essential questions from potential trialists and other interested parties:

- i. Would you be interested in taking part in the TPI trial?

- ii. If so, would you be interested in the TPI Pilot, or the RIDC Testbed? Please provide any reasoning that you can to support your choice including highlighting the benefits and risks.
- iii. What specific information would you require when we issue further details on the trial?
- iv. Do you have any comments on the key assumptions made above, including funding and timescales?
- v. In addition, please provide any responses that you can to the additional questions raised in Appendix 4.
- vi. We invite comments on how this fibre infrastructure might be used to provide connectivity solutions over and above track to train connectivity.

6. Next Steps

The next steps in the process are:

- i. Review of Cfl responses from industry
- ii. The reviewed responses will determine the next steps
- iii. Updated objectives and next steps will be announced in the autumn

7. General Instructions for Submission Cfl Responses

DCMS welcomes your views in response to the six questions contained within Section 5 as well as the questions outlined in Appendix 4. DCMS are keen to hear your views regarding the design, deployment, and operation of your solutions along the Trans Pennine route and at the RIDC Testbed facility including how best to deal with the issues around funding, and timescales as highlighted within this document. Any answers provided will assist DCMS in finalising the passive infrastructure design and deployment, as well as ensuring industry evidence-based views are considered in any subsequent competition planning, evaluation, and contract terms.

Electronic responses are preferred and should be sent to: 5genquiries@culture.gov.uk. Please use 'TPI CFI Response' as the subject line of your email response and follow the instructions for the format of the responses as outlined in Section 9.

Questions or enquiries specifically relating to this Cfl should also be sent to the above email address. Please use 'TPI CFI Question' as the subject line for your email. Any questions regarding this Cfl should be raised to DCMS by no later than **24th August 2018**.

8. Response Deadline

The closing date for comments to be submitted is noon **14th September 2018**.

Any response received after the response deadline will not be considered or opened. However, DCMS, at its own discretion may extend the deadline and in such circumstances, will notify all participants of any change.

9. Format of Responses

Each Cfl response submitted must conform to the following submission instructions:

- Participants are asked to provide details for two points of contact in their organisation in their Cfl response. DCMS will not be responsible for contacting (if required) any participants through any route other than the nominated contacts
- All information text should be generated in Arial font size 12 and formatted in A4 page layout. The font size may be smaller in diagrams and tables if required. All submission documentation as a minimum must have the document identifier (example: title block, document label).
- Cfl responses should not exceed 20 pages in total (and should be no more than 20MB in size)
- For ease of recognition, Cfl responses submitted shall contain footers sequentially numbered, titled and cross-referenced whenever necessary
- Unsolicited materials such as sales brochures, or supplementary information that has not been requested, must NOT be attached to any completed Cfl responses
- Although most file types can be used to support the Cfl response, it is recommended that participants upload documents using MS Office Word, ME Office Excel, or PDF
- All responses should be in English
- All Cfl responses must be in a single zipped file with the following naming convention
"TPI_CFI_[name of Participant]"

10. Confidentiality & Freedom of Information

Information provided in response to this Call for Information, might be published or disclosed in accordance with the access to information regimes. These are primarily the Freedom of Information Act 2000 (FOIA), the Data Protection Act 2018 (DPA) and the General Data Protection Regulation (GDPR). If you want the information that you provide to be treated as confidential, please be aware that, under the FOIA, there is a statutory Code of Practice with which public authorities must comply with and which deals, amongst other things, with obligations of confidence.

In view of this it would be helpful if you could explain to DCMS why you regard the information you have provided as confidential. If government receives a request for disclosure of the information, DCMS will take full account of your explanation, but it cannot give an assurance that confidentiality will be maintained in all circumstances.

An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded as binding on the Department for Digital, Culture, Media and Sport.

More information about the Freedom of Information Act can be found on the website of the Ministry of Justice, Freedom of Information pages.

Appendix 1: Background to rail connectivity policy and relationship to Trans Pennine Initiative

Mobile voice and data service coverage on rail services across Great Britain is typically poor due to reasons including radio signal attenuation getting into train carriages (particularly

those with metalised windows), a large number of cuttings and tunnels on the GB network that block line-of-sight to existing mobile phone masts, and the tendency of mobile network operators' (MNO) coverage to focus on high population densities.

The Department for Transport's (DfT) has recognised the importance of mobile connectivity to rail passengers and has encouraged train operating companies to offer better connectivity to their passengers. This builds on a previous DfT policy to ensure trains have WiFi capability, with over 70% of trains now fitted with WiFi equipment and this will continue to be rolled out over the next couple of years.

The majority of solutions to provide this connectivity at present rely on existing MNO networks. Set against these coverage/ capacity issues is the anticipation that passenger demand for data services will increase over time, with likely future requirements being potentially as high as gigabit per second connectivity to the train. The National Infrastructure Commission has therefore identified a likely need for trackside infrastructure to meet future demand for connectivity.

The Government is considering the option of using trackside infrastructure to deliver connectivity on mainline rail routes. This is enabled through three basic elements:

1. Dedicated trackside infrastructure (radio transceivers, network equipment, fibre, and power)
2. A radio network linking the train's exterior to the trackside backhaul infrastructure
3. In-carriage networks that provide Wi-Fi and/or mobile coverage on the train itself

The Trans Pennine Initiative (TPI) aims to test the deployment and operation of solutions to provide high quality passenger connectivity to trains using trackside infrastructure, including addressing issues related to access, processes, and costs. In doing so, it will assist in developing the Government's policy aim of main line rail routes having uninterrupted mobile coverage and guaranteed Wi-Fi.

Appendix 2: The Trans Pennine Express (TPE) route and the Passive Infrastructure planned to be built for the TPI Trial

The Trans Pennine Express (TPE) route from Manchester to York via Huddersfield and Leeds is 117km in length. The trial of track-to-train connectivity will take place on the 77km section of track between Manchester to Leeds. There are 23 stations and nearly 10km of tunnels on this section (as per the table below), and the route's geography presents significant challenges to the provision of high-speed track-to-train wireless connectivity.

Tunnel		Length (m)
Manchester – Huddersfield	Stalybridge	557m
	Scout	183m
	Standedge	4,883m
	Gledholt (2 tunnels)	220m
Huddersfield – Leeds	Morley	3,080m
	Katherine Street	81m
	Huddersfield (2 tunnels)	660m

First Group is the main TOC running across the Trans Pennine route and will provide up to twelve trains consisting of five carriages to make up a train set. These trains will have been refurbished to include a new Gigabit LAN switch fabric, the Wi-Fi services and media gateways by August 2018.

Network Rail will deploy trackside infrastructure consisting of 'tall' masts (20m above track level) together with 'short' masts (8m above track level) placed at an intermediate point between each tall mast pair, to maximise line-of-sight along the track.

Trialists will have the option of either:

- a) a location towards the top of the short masts and an equivalent height on the tall masts, or
- b) an antenna location towards the top of the tall masts only

The typical spacing between tall masts will be around 1km, though this will vary significantly along the length of the track depending on topography, with the aim of meeting consistent cell planning criteria. The mast heights and spacings are not optimised for any particular technology, and they have been chosen as a generic base on which different technologies operating over a wide range of frequency bands can be deployed.

Tunnel solutions are currently being investigated and DCMS are interested in further solutions from the market. For the initial stage of the trial masts will be located as close as possible to tunnel entrances and exits in order to provide coverage within tunnel locations.

From the above, there will be various aspects of the trial that may not be the optimum for any trialist's particular solution. However, part of the anticipated output of the trial will be to understand and forecast how each solution would perform in a dedicated deployment and across differing route geographies.

It is currently assumed that a small number of train sets will be equipped with each trialist's on-train wireless equipment – with one trialist solution per train set. This equipment will interface with the existing gateway, LAN and Wi-Fi infrastructure on the train set.

Trialists will therefore need to supply, at no cost to the Government, NRT or the TOC, the on-train terminal equipment and any associated antenna(s). Trialists will also need to supply, on the same basis (i.e. at no cost to the Government, NRT or the TOC), mast site antennas, feeder cables and base station equipment, together with any core network equipment required for their solution to be operational in a live rail environment. Some funding may be available to support trialists installation and optimisation costs.

Appendix 3: RIDC and the Passive Infrastructure to be built for the Testbed

The Rail Innovation & Development Centre (RIDC) at Melton Mowbray provides a safe environment where new and modified rolling stock, plant, on-track machines, infrastructure, equipment, and technology can be tested. It closely represents the operational railway and includes many characteristics found across the national rail network.

It currently has two separate test tracks: a high-speed facility between Melton Junction and Edwalton, incorporating 13 miles of track up to 125mph (11 miles of this with overhead line equipment) – and a slow-speed test track from Old Dalby to Stanton Tunnel, with four miles of track up to 60mph.

Government will fund the build of new alternating 8m and 15m masts every 500m along the RIDC route as well as a high fibre count network and a new power network. It is anticipated that test trains will also be available at RIDC for use by trialists.

Trialists will therefore need to supply, install, and commission at no cost to the Government or NR, any on-train equipment. Trialists will also need to supply, on the same basis (i.e. at no cost to the Government or NR), mast site antennas, feeder cables and base station equipment, together with any core network equipment required for their solution to be operational. Some funding may be available to support trialists installation and optimisation costs. Some funding may be available to support trialists installation and optimisation costs.

Appendix 4: Additional Trial Questions

If you are interested in participating in the trial (either the TPI Pilot, the RIDC Testbed or both), please answer the questions below as fully as possible. Any answers provided will assist DCMS in finalising the passive infrastructure design and deployment, and trial competition.

A.5.1 Questions: Technical deployment; Architecture

1. Please describe the logical architecture you propose to use for the trial?
2. How will your equipment be placed on the infrastructure deployed such as trackside, remotely located (PoPs/ datacentre) and on-train? In your response, please comment specifically on how you would expect to address tunnel coverage given the constraints highlighted in the Cfl?
3. What radio system that you would plan to trial?
4. What bit rate would you expect this radio system to deliver, both under 'good' radio conditions and at boundaries between 'cells'?
5. How would you recommend that this should be evaluated, to reflect user experience for the likely applications (including a mix of internet browsing, video streaming and voice and video calls)?
6. What other parameters do you believe to be important in characterising the performance of a track-to-train wireless system?
7. Whilst preference will be given to solutions that address the full track length, consideration will be given to solutions that address on part of the track length. Would you intend to provide a full or partial solution, in this sense?

A.5.2 Questions: Technical deployment; Mast sites

1. Please confirm the number of antennas that you currently envisage deploying at mast sites, together with indicative individual dimensions (HxWxD), weight and (optimal/ideal) height (or height range) – as well as the number expected to be deployed
2. Please indicate whether you foresee deployment of any other mast-mounted equipment, such as amplifiers, access points, remote radio units/ heads or

transmission related equipment (such as CWDM multiplexers). If so, please detail indicative individual dimensions (HxWxD), weight and (optimal/ideal) height (or height range) – as well as the number expected to be deployed

3. How would you expect any mast-mounted equipment (including antennas) to be installed, given expected limitations around cherry-picker use at the mast sites (ie. it may not be possible to use cherry-pickers at all mast locations)
4. Please indicate whether the solution that you are envisaging requires any ground-based equipment at mast sites. If so, please indicate what your preferred containment solution (such as a separate cabinet or space within an existing cabinet) might be, as well as indicative dimensions (HxWxD / rack size/ number of U) and weight. Please confirm cooling requirements, if any
5. Please indicate your preferred power presentation (AC/DC, together with Supply Voltage), or the range of options that could be used/ accommodated
6. Please provide indicative aggregate power consumption figure (average and peak) for the on-site equipment that you are envisaging
7. Please indicate what your preferred backhaul connectivity option might be and its presentation (managed or wires-only Ethernet/IP or dark fibre pair, with examples of interface type), or the range of options that could be used/ accommodated. Please also provide indicative backhaul dimensioning/ bandwidth per mast site, if relevant.
8. Please confirm your expectations around where this backhaul connectivity will terminate (such as at a PoP or datacentre) and any known distance limitations for that connectivity.
9. We would welcome any additional information or recommendations that you can provide on the location or number of masts (note that we may not be able to fulfil these, due to differing recommendations or external constraints).
10. What would be the lead time for availability of trackside radio transmitting equipment?

A.5.3 Questions: Technical deployment; Network equipment

1. Please indicate your expectations around PoP/ datacentre equipment locations (i.e. number required, preferred physical proximity to radio antennas, and distribution along the trial route, if needed)
2. Please indicated the space and power requirements you currently envisage needing at each PoP/ datacentre equipment location
3. Please confirm your expectations around how upstream Internet access might be delivered
4. Please confirm whether you envisage needing connectivity to the Internet at any PoP/ datacentre equipment location, together with the dimensioning for any relevant equipment
5. What would be the lead time for availability of network equipment?

A.5.4 Questions: Technical deployment; On-train

1. Please indicate any expectations or specific requirements around any 'active' physical infrastructure that you anticipate will be provided/ available (such as inter-carriage LAN, cooling/venting, POE IEEE 802.3af, etc)
2. Please indicate the number, preferred locations, and indicative dimensions (HxWxD / number of U) and weight of the on-train terminal equipment that you envisage deploying

3. Please confirm the number of antennas that you might expect to deploy on-train, together with preferred locations, indicative dimensions (HxWxD), weight and (ideal) height (or height range) – recognising that there will be existing installations and the need for appropriate separation distances
4. Please indicate your preferred power presentation (AC/ DC, together with Supply Voltage), or the range of options that can be used/ accommodated
5. Please provide indicative an aggregate power consumption figure (average and peak) for the on-train equipment that you envisage deploying
6. Please indicate your on-train terminal equipment's connectivity presentation or the range of options that could be used/ accommodated, for interconnection with any required on-train network. Please also provide indicative dimensioning/ bandwidth, if relevant
7. What would be the lead-time for availability of on-board radio equipment?

A.5.5 Questions: Other (Regulatory/ Spectrum/ Commercial/ Financial/ Legal)

1. Please confirm, if you are able to, whether you expect to be bidding/participating/working as part of a consortium – and, if so, who else might make up that consortium
2. Please indicate the magnitude of costs that you expect to bear for participation in the trial with a high-level breakdown of those costs (including as between you and any other consortium members).
3. What frequency band and bandwidth would you intend to use for the trial? Do you currently have a licence from Ofcom for this spectrum? If not, what method would you intend to use to obtain authorisation (Ofcom non-operational licence, working in partnership with licensee, licence-exempt spectrum etc)? Would you seek any changes from Ofcom to current licensing conditions for the trial?
4. What cyber security defence and compliance standards are included within your equipment and what would you include in the design of your solution architecture for the trial (either TPI or RIDC) to reduce cyber threats and vulnerabilities?
5. What, if any, specific constraints would you seek to place on sharing trial data, results and know-how with DCMS and Government to contribute towards the stated purpose of the trials?
6. Please list any other constraints (technical, as well as regulatory, commercial, financial and/ or legal) that you foresee for your participation

A.6.6 Performance evaluation

1. What other parameters do you believe to be important in characterising the performance of a track-to-train wireless system?
2. What internal system performance monitoring data would you be able to share with DCMS and Government, to contribute towards the objectives of the trial?