



BRIEFING PAPER

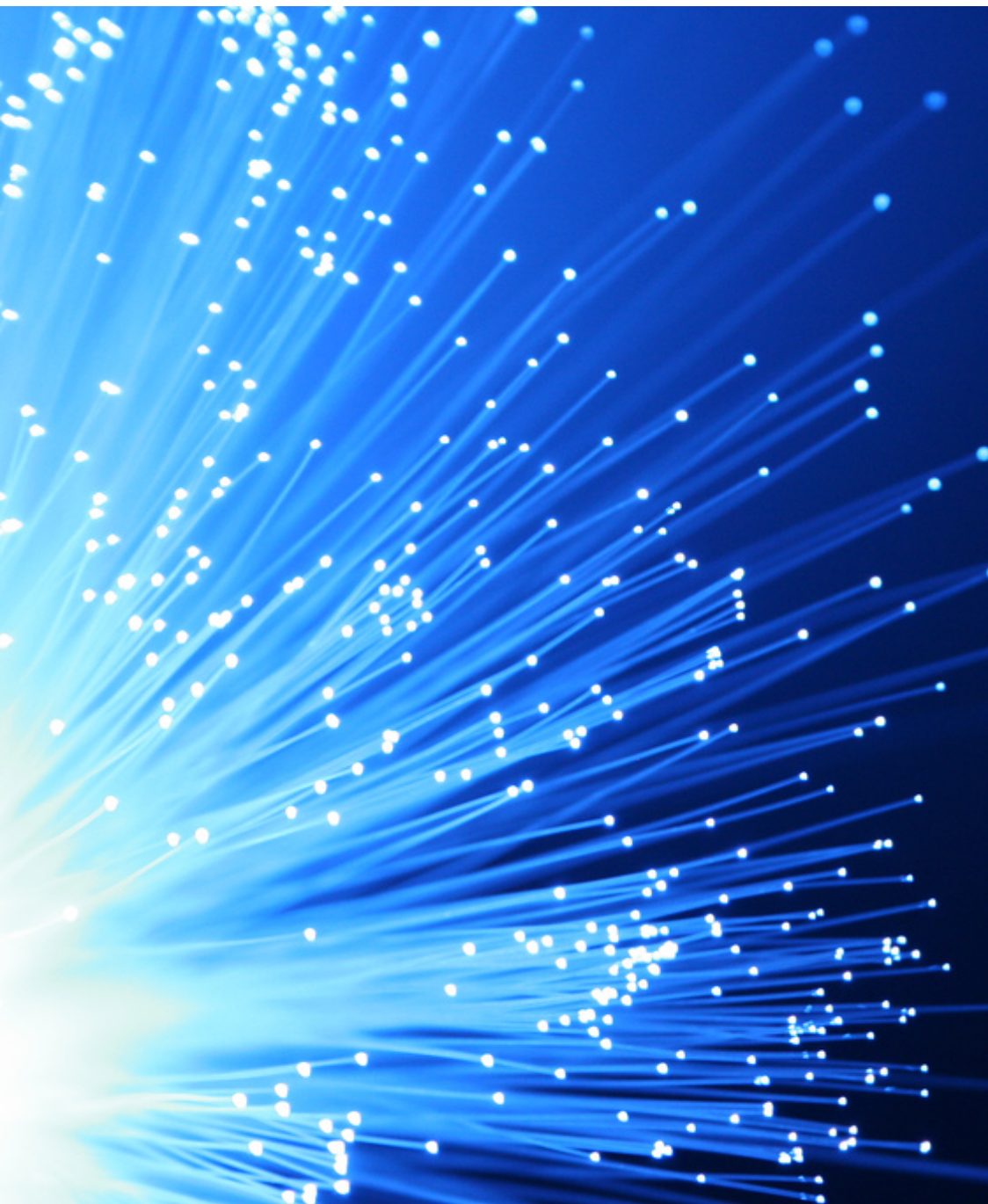
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Full-fibre networks in the UK

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Summary

What does broadband coverage look like today?

Since 2010, the Government has focused on the roll-out of superfast broadband, which it defines as download speeds of at least 24 megabits per second (Mbps). Superfast broadband has been mainly delivered using Fibre-to-the-Cabinet (FTTC) technology, which is a part-fibre, part-copper technology: fibre optic cables run from the exchange to a street cabinet, and existing copper telephone lines connect the cabinet to the premises. Superfast broadband availability reached 95% of UK premises as of February 2018 (according to Ofcom, based on 24 Mbps). The Library briefing paper on [Superfast broadband in the UK](#) provides more information.

Although the UK has high levels of superfast broadband coverage, access to full-fibre networks sits at 7% (as of January 2019). Constituency statistics for broadband coverage are available on the Library website: [Constituency data: broadband coverage and speeds](#).

What is full-fibre?

Full-fibre networks use fibre optic cables to connect the exchange directly to each premises. Full-fibre connections are capable of delivering speeds greater than 1 gigabit per second (Gbps; 1 Gbps is equal to 1000 Mbps). Full-fibre networks are more reliable than copper-based networks and cheaper to maintain and operate. Full-fibre networks are also important for supporting high capacity mobile broadband networks, particularly future [5G](#) networks.

Government's policy: Future Telecoms Infrastructure Review (FTIR)

The Government has set a target to build a UK-wide full-fibre network by 2033, with 15 million premises connected by 2025. The [Future Telecoms Infrastructure Review](#) (FTIR) published in July 2018, sets out the Government's strategy for delivering this target. The overarching approach is to promote commercial investment by encouraging a competitive market to build fibre infrastructure. The Government's assessment is that with policy reforms and targeted regulatory intervention in some areas, private investment should be able to deliver full-fibre to 90% of UK premises, with the remaining 10% requiring further public funding.

The FTIR is broadly in line with [recommendations made by the National Infrastructure Commission](#) in July 2018. Stakeholders have broadly welcomed the proposals as a clear statement of Government policy and direction. However, some [industry operators](#) have cautioned that the "devil is in the detail".

Building fibre infrastructure

Building a nationwide full-fibre network is a large infrastructure project and reforms to make building fibre networks easier form part of the Government's policy in the FTIR. The Government launched two consultations in October 2018 on proposals regarding [full-fibre connections to new build properties](#) and reform to procedures for obtaining wayleaves to build digital infrastructure to [tenanted properties](#). Other policy measures include Ofcom's work to facilitate access to Openreach's network of underground ducts and poles.

Government funding for full-fibre networks

There are currently three UK-wide Government funded programmes delivering full fibre networks, collectively now referred to as "The UK Fibre Programme"; the programmes are delivered by [Building Digital UK \(BDUK\)](#), part of DCMS:

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- 1 The Local Full Fibre Networks Programme (LFFN) supports a voucher scheme focused on small and medium sized businesses and provides grants to local public sector bodies on a competitive basis. The programme includes £287 million funding.
- 2 The [Rural Gigabit Connectivity Programme \(RGCP\)](#) includes a voucher scheme for rural premises and a trial scheme to connect public sector buildings such as schools and hospitals in rural areas. The programme is supported by £200 million funding.
- 3 The final stages of the [superfast broadband programme](#) will prioritise full-fibre connections. Delivery of the programme is led by local bodies in England and the devolved Administrations.

For information about the voucher schemes, see DCMS's [Gigabit Broadband Voucher Scheme website](#).

The Government [stated](#) in March 2019 that longer term funding options would be determined as part of the “forthcoming spending review”.

Is telecommunications a reserved power?

The UK Government has primary responsibility for broadband policy and coverage targets because telecommunications is a reserved power. However, the delivery of broadband infrastructure projects often involves local authorities or devolved responsibilities, for example, engagement with planning and highways authorities regarding street works.

1. Full-fibre networks: what and why?

1.1 Superfast broadband

Since 2010, the Government has focused on the roll-out of superfast broadband, which it defines as download speeds of at least 24 megabits per second (Mbps).¹ According to Ofcom, superfast broadband availability reached 95% of UK premises as of February 2018 based on this definition.²

The Government's superfast broadband programme supported the delivery of superfast broadband to areas not reached by the private sector. More information about the programme is provided in the Library briefing paper: [Superfast broadband in the UK](#).

Under the programme, superfast broadband was mainly delivered using Fibre-to-the-Cabinet (FTTC) technology. FTTC is a part-fibre technology: fibre optic cables run to a street cabinet, and then existing copper telephone wires are used to connect the cabinet to individual premises. The speed of connection decreases the further away from the cabinet the premises is based, because the signal loses strength as it travels along the copper wire.

FTTC relies on using the copper telephone network which (other than in Hull) is owned and operated by Openreach, the infrastructure division of the BT Group.³ Other technologies are also capable of supporting superfast broadband, including cable broadband (mainly delivered by Virgin Media) and fixed wireless connections (delivered by a number of smaller regional providers). See Section 5 (Glossary) for more information about broadband speeds and technologies.

The UK has high availability of superfast broadband (95%) provided mostly by part-fibre, part-copper networks.

1.2 Why full-fibre networks?

While superfast broadband is sufficient for current needs, the availability of and demand for data-intensive services such as online video streaming and video calls is increasing, and a growing number of "smart" devices are connected to the internet. To support this growing dependence on and demand for digital services, high capacity internet connections that can support fast download speeds and large amounts of data will be required.

The National Infrastructure Commission (see Box 1), in its July 2018 [National Infrastructure Assessment](#), highlighted that there is still some uncertainty about whether, and if so when, the growing demand for data will outstrip the capacity of the existing copper networks and the FTTC connections that use it. The Commission described that a decision

¹ There is no single definition of superfast broadband. Ofcom and the European Commission define superfast broadband as download speeds of 30 Mbps.

² Ofcom, [Connected Nations: Spring Update 2018](#), published 30 April 2018. Data was collected in January 2018.

³ See the Library briefing paper on [BT and Openreach](#) (CBP 7888, 11 January 2019) for more information.

to invest in full-fibre networks, compared to upgrading existing networks, was not “risk free” but was nevertheless a “risk worth taking” to avoid the potential consequences of not having digital infrastructure to support future needs.⁴ The Commission recommended that, given the time taken to build a nationwide full-fibre network – which the Commission estimated would take at least 10 years – investment should begin now.

Box 1: What is the National Infrastructure Commission?

The National Infrastructure Commission is an executive agency of HM Treasury that provides the Government with impartial, expert advice on major long-term infrastructure challenges. The Commission was established in 2015.⁵

The Commission produces a National Infrastructure Assessment (NIA) once every Parliament. The NIA analyses the UK’s long-term infrastructure needs up to 2050 and makes recommendations to the Government for meeting them.⁶ The first NIA was published on 10 July 2018. The Government is required to issue a formal response to each NIA stating clearly whether the Government accepts or rejects its recommendations.⁷

Alongside the 2018 Budget the Government issued an “[interim response](#)” to the National Infrastructure Assessment, and stated that it would respond formally to the NIA 2019.⁸

The Commission also produces other reports to Parliament, including interim reports, specific studies and an annual monitoring report that assesses the progress that Government has made taking forward the Commission’s recommendations.⁹

1.3 What is full-fibre?

Full-fibre connections can deliver download and upload speeds in excess of 1 gigabit per second (Gbps).¹⁰ 1 Gbps is equal to 1000 Mbps. The Government sometimes uses the term “gigabit-capable” connection – this refers to any technology that can deliver 1 Gbps connectivity. This includes full-fibre connections as well as other technology that can support gigabit speeds, for example, high speed cable broadband or potentially future 5G connections.

Full-fibre networks, also referred to as fibre-to-the-premises (FTTP) or fibre-to-the-home (FTTH), consist of fibre optic cables running from the local exchange directly to each premises. Fibre optic cables transmit data using light and can carry more data with faster speeds and significantly less signal loss with distance compared to copper cables.

In addition to high speeds, full-fibre is also the most reliable broadband technology currently available. Full-fibre connections experience fewer operating faults than copper-based networks and are cheaper to

Full-fibre networks can deliver download and upload speeds of over 1 Gbps.

Full-fibre networks are more reliable than copper-based networks and involve lower operating costs.

⁴ National Infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 21-22.

⁵ National Infrastructure Commission, [Date set for UK’s first-ever National Infrastructure Assessment](#), 2 July 2018.

⁶ National Infrastructure Commission, [Date set for UK’s first-ever National Infrastructure Assessment](#), 2 July 2018.

⁷ [PQ 135418, 18 April 2018 \[Infrastructure\]](#).

⁸ HM Treasury, [Government’s interim response to the National Infrastructure Assessment](#), 29 October 2018.

⁹ HM Treasury, [National Infrastructure Commission framework document](#), January 2017.

¹⁰ Ofcom, [Connected Nations update: October 2018](#), 2 October 2018.

maintain and operate.¹¹ Full-fibre connections are also less likely to slow down when many people use the network. However, full-fibre networks are usually expensive to deploy, because they require new infrastructure to be built.¹² Fibre infrastructure is also important for supporting high capacity mobile broadband networks, particularly for future 5G networks (see Box 2).

Box 2: 5G and full-fibre

5G is the next generation of wireless networks beyond 4G mobile networks. 5G is expected to support very fast download speeds and near instant response times, with the capacity to support many devices accessing large amounts of data at the same time. 5G technology is expected to deliver applications beyond mobile phone services; potential applications include health care services, automated manufacturing and traffic management services.

Fibre infrastructure is important for mobile broadband because the masts that transmit mobile broadband must be connected to a core internet network. The connection between a mobile mast and the core network is called backhaul. Backhaul is usually provided by fibre cables due to the need to support large volumes of data traffic. This is particularly the case for 5G due to the large volumes of data that 5G networks will support.

Future 5G applications may also see increasing numbers of base stations (cells and masts). This is because some future applications of 5G may use higher frequency spectrum which cannot travel long distances. This means that base stations must be placed closer together. Future 5G networks may see small base stations (called “small cells”) being deployed. These cells will require a dense fibre infrastructure to support them or new solutions to provide backhaul connections.¹³

More information is provided in the Library briefing paper on [5G](#).

1.4 Is telecommunications a reserved power?

The power to legislate with respect to telecommunications is reserved to the UK Parliament.^{14 15 16} The UK Government has primary responsibility for setting broadband policy and coverage targets. However, the delivery of broadband infrastructure projects often involves local authorities or devolved responsibilities – for example, engagement with planning and highways authorities regarding street works (see Section 3).

Under the superfast broadband programme, the UK Government has been providing funding to local authorities in England and the devolved Administrations to deliver infrastructure projects in their regions. More information is provided in the Library briefing paper: [Superfast broadband in the UK](#) (CBP06643). There is no equivalent project yet for full-fibre networks; see Section 4 for more information about funding for full-fibre networks.

¹¹ National infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018; Ofcom, [Building a full-fibre future](#), 26 April 2018, accessed 31 August 2018.

¹² National infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 21; Ofcom, [International Communications Market Report 2017](#), 18 December 2017, page 51

¹³ Ofcom, [Enabling 5G in the UK](#), 9 March 2018, para 1.24-1.48 and 4.48-4.58.

¹⁴ [Section C10 of Schedule 5 of the Scotland Act 1998](#).

¹⁵ [Section C9 of Schedule 7A of the Wales Act 2017](#).

¹⁶ Northern Ireland Department for the Economy, [Broadband policy context in Northern Ireland](#) and Cabinet Office, [Devolution settlement: Northern Ireland](#), 20 February 2013 [accessed 5 June 2018].

1.5 Current full-fibre availability

[Ofcom reported that 7.1% of UK premises](#) (2,092,302 million premises) had full-fibre connections available as of January 2019.¹⁷

For comparison, countries with the high levels full-fibre coverage (in 2017) include Spain (71%), Portugal (89%), Japan (97%) and South Korea (99%).¹⁸ For comparison to other European countries, France had 28% full-fibre coverage in June 2017 and is said to be increasing quickly.¹⁹ ²⁰ Germany's broadband coverage is more similar to the UK, with 7% full-fibre coverage and 84% superfast broadband coverage in 2017.²¹

Several factors can affect how easy or difficult it is to build full-fibre infrastructure, which should be kept in mind when comparing the UK with other countries. Such factors include: different geographies, population distributions, existing infrastructure and the history of telecoms regulation in that country or area. For example, South Korea and Japan have high population densities or large proportions of people living in urban areas, which reduces the cost-per-premises to deploy full-fibre connections.²² Germany and Spain, have larger populations living in apartments than in the UK, which also makes nationwide roll-out of full-fibre cheaper.²³

7% of UK premises had access to full-fibre networks as of January 2019.

1.6 How much will a nationwide full-fibre network cost to build?

The Government's [Future Telecoms Infrastructure Review](#) (FTIR), published on 23 July 2018, estimated that the national roll-out of full-fibre broadband would require a total investment "in the region of £30 billion".²⁴ The Government's approach is that most of this investment will come from the private sector.²⁵

The National Infrastructure Commission came to a similar figure, estimating that the cost of building and maintaining a nationwide full-fibre network would be £33.4 billion (over a 30 year period). This was estimated to be £11.5 billion more than the cost of incrementally upgrading existing copper infrastructure, but would save £5.1 billion in operating and running costs (between 2020 and 2050).²⁶ The

¹⁷ Ofcom, [Connected Nations: Spring 2019 Update](#), 8 May 2019.

¹⁸ National Infrastructure Commission, [Congestion, Capacity, Carbon: Priorities for National Infrastructure, October 2017](#).

¹⁹ European Commission, [Broadband Coverage in Europe 2017](#). Note that data for these figures was collected in June 2017 so coverage in these countries may now be higher. At that time, the UK had 2.3% full-fibre coverage.

²⁰ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018.

²¹ European Commission, [Broadband Coverage in Europe 2017](#).

²² Ofcom, [International Communications Market Report 2017](#), 18 December 2018, page 52.

²³ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018. See Section 2.3.2 of the FTIR for a discussion of international comparisons. A separate analysis of [international companions](#) produced by NERA Economic Consulting was also published alongside the FTIR.

²⁴ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018.

²⁵ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018.

²⁶ National infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 21-22.

Commission acknowledged that while the cost of a building a full-fibre network was higher, it was nonetheless worth doing to avoid the risk of not having the infrastructure to support future demands for data.

See Section 4 of this paper for information about Government funding programmes for full-fibre networks.

1.7 Government's approach: Future Telecoms Infrastructure Review (FTIR)

The Government has set a target to connect 15 million premises to full-fibre by 2025 and to deliver a nationwide fibre-to-the-premises network by 2033.²⁷ This target upgrades the Government's previous target in 2017 to connect 10 million premises to full-fibre "over the next decade".^{28 29}

The UK Government's strategy for meeting these commitments is set out in DCMS's [Future Telecoms Infrastructure Review](#) (FTIR), published on 23 July 2018.

The FTIR states that the Government's approach to full-fibre networks is to promote private investment by encouraging a competitive market to deploy fibre infrastructure. This means encouraging private sector infrastructure providers, such as Openreach, Virgin Media and others, to invest in building infrastructure (see Section 2 and Box 3). This is not a new statement of policy but the FTIR re-visited the Government's position and provided more information as to the direction of future policy measures to support it.

Both the National Infrastructure Commission and Ofcom – the communications regulator – also consider that market competition is the most appropriate way to encourage and deliver full-fibre deployment. The House of Commons Scottish Affairs Committee in its inquiry into Digital Connectivity in Scotland similarly concluded that "competition is fundamental to driving innovation, investment in infrastructure and customer choice".³⁰

This approach draws from international comparisons, such as with Spain, France and Portugal, where coverage of full-fibre networks has been shown to correlate with competitive market conditions. The Government published a report containing international comparisons alongside the Future Telecoms Infrastructure Review.³¹ More information about building a competitive market for fibre deployment is included in Section 2.

The Government has a target to connect 15 million premises to full-fibre networks by 2025 and deliver a nationwide full-fibre network by 2033.

²⁷ This target was first announced in a speech by the Chancellor in May 2018: HM Treasury, [Chancellor speech: CBI Annual Dinner 2018](#), 22 May 2018, accessed 31 August 2018.

²⁸ [Conservative and Unionist Party Manifesto](#), 2017.

²⁹ HM Government, [Industrial Strategy](#), November 2017, page 154.

³⁰ House of Commons Scottish Affairs Committee, Digital Connectivity in Scotland, 18 July 2018, [HC 654](#), para 75.

³¹ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018.

The Government says that it will monitor progress under the FTIR on an annual basis and undertake a “full review” of the strategy’s impact after three years.³²

1.8 Reactions to the Future Telecoms Infrastructure Review

The FTIR has been broadly welcomed as a statement of Government policy and direction.³³ The National Infrastructure Commission welcomed the review, saying it mirrored many of recommendations it made in its National Infrastructure Assessment.³⁴

Industry operators have particularly supported the measures to reduce barriers to deployment (see Section 3).³⁵ Trade group ISPA (representing internet service providers) described measures to reduce barriers to deployment as the “the single most important lever policymakers can use to accelerate the rollout of networks.”³⁶ Some operators, however, cautioned that “the devil is in the detail”.³⁷ Small rural infrastructure provider TrueSpeed urged the Government to consult more closely, and more quickly, with industry to ensure a “fair and equitable playing field for all infrastructure providers”.³⁸

Consumer group Which? welcomed the changes alongside a warning that the changes “must not result in significantly higher bills for customers”.³⁹ Operators City Fibre and TalkTalk also stressed the importance of consumer engagement to drive high demand for fibre services.⁴⁰ City Fibre’s Director of Strategy Mark Collins said:

...it is critical that the consumer is at the heart of this fantastic opportunity from the start, as this is the key to unlocking demand. That means avoiding price rises, ensuring switching between networks is simple and ending the years of misleading ‘fake fibre’

³² DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018.

³³ See, for example, techUK, [initial response to Future Telecoms Infrastructure Review](#), 23 July 2018; Independent Networks Cooperative Association (INCA), [INCA welcomes Government’s Future Telecoms Infrastructure Review](#), [accessed 17 August 2018]; Broadband Stakeholder Group, [A long read – Forging our Full-Fibre and 5G Future](#), 23 July 2018, accessed 24 July 2018.

³⁴ National Infrastructure Commission, Chairman Sir John Armit, [New Telecoms Review will help deliver full fibre to all communities](#), 23 July 2018, accessed 17 August 2018.

³⁵ Gigaclear and Hyperoptic and TrueSpeed comments quoted in *ISP Review*, [Gov Detail BIG Changes to Boost UK Full Fibre Broadband and 5G UPDATES](#), Mark Jackson, 23 July 2018, accessed 24 July 2018.

³⁶ Internet Services Providers’ Association (ISPA), [ISPA supports government ambition for world class connectivity – addressing barriers to rollout should be the no 1 priority](#), 23 July 2018, accessed 24 July 2018.

³⁷ Gigaclear and Hyperoptic and TrueSpeed comments quoted in *ISP Review*, [Gov Detail BIG Changes to Boost UK Full Fibre Broadband and 5G UPDATES](#), Mark Jackson, 23 July 2018, accessed 17 August 2018.

³⁸ Gigaclear and Hyperoptic and TrueSpeed comments quoted in *ISP Review*, [Gov Detail BIG Changes to Boost UK Full Fibre Broadband and 5G UPDATES](#), Mark Jackson, 23 July 2018, accessed 17 August 2018.

³⁹ Which?, [Which? response to the DCMS Future Telecoms Infrastructure Review](#), 23 July 2018, accessed 14 July 2018.

⁴⁰ CityFibre, [Government’s bold full fibre ambition is welcome, but consumers must be at its heart](#), 23 July 2018. For TalkTalk, see: <https://twitter.com/talktalkgroup/status/1021319311053533184?s=11> [23 July 2018].

advertising. Getting both sides of the equation right is key to ensuring millions of homes and businesses will benefit – we now need to see the Government and Ofcom push these plans through.⁴¹

The Country Land and Business Association and consumer group USwitch expressed concern about the length of time the Government says will be necessary to deliver nationwide full-fibre.⁴² The Institute of Directors also argued that the FTIR does not go far enough to ensure fast change:

At the projected rate of fibre optic rollout, we will take until 2025 to get where many of our competitors were a few years ago. Until there is a commitment to a nationwide copper switch-off date and much lower physical infrastructure charges paving the way for shared rather than duplicated telecom infrastructure, the UK will fall further behind in world rankings for both broadband and mobile upload and download speeds.⁴³

Mobile UK, a trade body for mobile operators, argued that the FTIR lacked urgency and clear deadlines for action:

The problem is the language here. Ensure, consider, explore, encourage – these are all words with no definite timeline. [...] The report talks of using the full range of available levers yet deadlines do not appear to be one of those levers. Urgency is the watchword here, as if the aim is to the lead the world we need to be ahead of our nearest competitors. Without clear actions and deadlines, we will simply be watching as others surge ahead...⁴⁴

⁴¹ CityFibre, [Government's bold full fibre ambition is welcome, but consumers must be at its heart](#), 23 July 2018, accessed 24 July 2018.

⁴² *ISP Review*, [Gov Detail BIG Changes to Boost UK Full Fibre Broadband and 5G UPDATE5](#), Mark Jackson, 23 July 2018, accessed 17 August 2018; *The Times*, [Every home to get fast broadband \(but it will take 15 years\)](#), 24 July 2018.

⁴³ Institute of Directors, [Government's telecoms review 'doesn't go far enough'](#), Dan Lewis, Senior Advisor on Infrastructure, 23 July 2018, accessed 17 August 2018.

⁴⁴ Mobile UK, [Future Telecoms Infrastructure Review is a positive step but it is deadlines that will achieve its goals](#), Gareth Elliot, Head of Policy and Communications, July 2018, accessed 31 August 2018.

2. Promoting a competitive market

2.1 Defining the market

There are two main types of broadband providers, representing two different competitive markets; companies may operate in either or both markets:

- Wholesale communications providers, or infrastructure providers, which build, own and operate physical network infrastructure. Wholesale providers may sell access to their network to retail service providers, or, they may use the network to sell their own retail services.
- Retail communications providers (also called ISP providers or service providers) sell broadband packages to customers. Retail providers will either purchase wholesale access to another providers' network, or deliver services using their own network.

Companies that offer both wholesale and retail services (for example, Virgin Media) are called vertically integrated providers.

The Government's approach in the FTIR is to promote competition in the wholesale market. This is quite different from the superfast broadband roll-out where Openreach had dominance due to its ownership of the copper network, which was used to deliver FTTC connections (outside the Hull area). Virgin Media is the only major infrastructure competitor to Openreach in terms of superfast broadband; its cable network covered 45% of the UK in 2017.⁴⁵

There is a growing competitive market for the delivery of full-fibre infrastructure, with several smaller providers in addition to Openreach and Virgin Media investing. Ofcom estimated in August 2018 that investments already announced by industry could bring full-fibre coverage to 20% of the UK by 2020.^{46 47}

Box 3 provides a summary of some industry investments in full-fibre networks.

Ofcom estimated in 2018 that investments already announced by industry could bring full fibre coverage to 20% of the UK by 2020.

⁴⁵ Ofcom, Connected Nations 2017: [Data Analysis, Fixed broadband networks and services](#), 15 December 2017.

⁴⁶ Ofcom, [New Ofcom rules to boost full-fibre broadband](#), 23 February 2018, accessed 17 August 2018.

⁴⁷ Ofcom, [Wholesale Local Access Market Review Statement – Volume 1](#), 28 March 2018, paragraph 5.31.

Box 3: Industry investments in full-fibre networks

The following provides some examples of investments in full-fibre networks announced by industry (as summarised by Ofcom in December 2018):⁴⁸

- **Openreach's** Fibre First program aims to roll-out full-fibre broadband to 3 million UK homes and small businesses by the end of 2020, with a target of covering 10 million homes by 2025.
- **Virgin Media** plans to reach 4 million premises by the end of 2019/20, as part of its Project Lightning network expansion (includes a mix of full-fibre and cable broadband).
- **CityFibre**, in partnership with **Vodafone** as a retail provider have announced plans to roll out full-fibre to 5 million homes and businesses by 2025.
- **TalkTalk** has launched a new company (FibreNation) to roll out full-fibre to 3 million homes and businesses in medium sized towns across the UK.
- **Hyperoptic** plans to reach 500,000 premises by the end of 2019, 2 million by 2022 and 5 million by 2025 and to extend its full-fibre network to 50 towns and cities.
- **KCOM** (in the Hull area) plans to have 100% full-fibre availability across its network by March 2019.

2.2 What can the market deliver?

Despite a growing competitive wholesale market, the Government concluded in the FTIR that, without further Government policy intervention, commercial markets would at best reach only 75% of the UK and take more than 20 years to do so.

To reach 100% coverage, the Government, in the FTIR, define three "zones" for fibre deployment, in which different levels of policy intervention will be required in each:

- 1 Areas that can support commercial roll out of two or more gigabit capable networks (which could be delivered by full-fibre networks or another technology capable of gigabit speeds). The Government expects that about 80% of premises fall into this category, although policy reform is required to reach this (see Section 3: building fibre infrastructure).
- 2 Areas that can support the commercial roll-out of a single fibre network – a further 10% of premises. The Government anticipates that these areas require additional regulatory intervention by Government. The Government has said it will review and consider these options during the 3-year review of the FTIR.
- 3 Areas that are unable to support commercial roll-out, which the Government considers will be approximately 10% of premises. Additional public funding will be required for these areas. See Section 4.

2.3 How will the Government promote a competitive market?

In the FTIR the Government commits to delivering a regulatory and policy framework that promotes infrastructure competition and gives providers confidence to invest. The Government identifies five factors that it says are necessary for this model to work:

⁴⁸ Ofcom, [Connected Nations 2018](#) (full report, page 12), 18 December 2019.

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1. Making the cost per premises as low as possible by addressing barriers to deployment, which are delaying and increasing the cost of deployment [section 2.4 of the FTIR];
2. Supporting market entry and expansion by alternative network operators, by reducing demand risk and through easy access to Openreach's ducts and poles, complemented by access to other utilities' infrastructure (for example, sewers) [section 2.5 of the FTIR];
3. Stable and long-term regulation that incentivises network investment [section 2.6 of the FTIR];
4. An 'outside in' approach to deployment that means fibre build across the country is achieved in parallel, and no areas are systematically left behind [section 2.7 of the FTIR]; and
5. A switchover process that stimulates demand for full fibre networks [section 2.8 of the FTIR].

Most of these topics align with the National Infrastructure Commission's recommendations to the Government regarding what a strategy for delivering a national full-fibre network should contain.⁴⁹ More information about facilitating fibre infrastructure build is covered in Section 3 of this paper; Section 4 covers public funding for full-fibre networks.

2.4 Ofcom's work in promoting full-fibre

Ofcom has an ongoing programme of work directed towards promoting fibre infrastructure competition. In its [Strategic Review of Digital Communications](#) in 2016 Ofcom stated that it would make a "strategic shift" towards encouraging deployment of new ultrafast networks, including full-fibre.⁵⁰

Ofcom published a series of new measures to promote full-fibre investment in February 2018.⁵¹ The measures include two main strands:⁵²

- 1 Duct and pole access (DPA): new measures to further open access to Openreach's network of poles and underground tunnels (called ducts) to allow competitors to install fibre optic cables to homes and businesses at a lower up-front cost – see Section 3.5 of this paper for more information.
- 2 Regulating the cost of some, but not all, of BT/Openreach's wholesale services. Ofcom's approach aims to promote investment in building full-fibre networks by encouraging providers to build their own networks (rather than relying on wholesale access from BT), while also protecting consumers that rely on BT's copper network.

⁴⁹ National Infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018.

⁵⁰ Ofcom's [Strategic Review of Digital Communications](#), 23 February 2016.

⁵¹ Ofcom, [New Ofcom rules to boost full-fibre broadband](#), 23 February 2018; For full details see Ofcom's webpage [Wholesale local access market review](#) which collates all consultation documents. Full statements on the new measures are contained in the Statements (Volume 1 and 2) published on 28 March 2018.

⁵² Ofcom, [New Ofcom rules to boost full-fibre broadband](#), 23 February 2018, accessed 17 July 2018.

Following the publication of the Government's FTIR, Ofcom [published](#) a document setting out its vision and proposals for future regulatory reform. Many of Ofcom's proposals reflect the Government's conclusions from the FTIR and priorities in the Government's draft Statement of Strategic Priorities to Ofcom (see Box 4), including:⁵³

- Regulating residential and business markets together;
- Further reform to duct and pole access (see Section 3.5 of this paper);
- Taking different regulatory approaches in different parts of the country depending on levels of competition for full-fibre build;
- Moving to longer market review cycles (from 3 to at least 5 years) to provide longer periods of regulatory stability for investors.

Ofcom is consulting on regulatory measures to apply from 2021; [initial proposals](#) reflecting the above points were published in March 2019.⁵⁴

Box 4: Statement of Strategic Priorities to Ofcom

The *Digital Economy Act 2017* introduced powers for the Government to make a "statement of strategic priorities" relating to telecommunications, spectrum management and postal services to which Ofcom (the communications regulator in the UK) must have regard when carrying out its functions.⁵⁵

The Government published a [draft Statement of Strategic Priorities](#) to Ofcom in February 2019.⁵⁶ The Statement broadly follows the priorities the Government set out in the FTIR, such as promoting competition and investment in full-fibre networks as well as protections for consumers, focusing on parts that are particularly relevant to Ofcom's work, such as market regulation, duct and pole access, and overseeing the switchover from copper to fibre networks. The consultation on the draft Statement closed on 27 March 2019.

⁵³ Ofcom, [Regulatory certainty to support investment in full-fibre broadband](#): Ofcom's approach to future regulation, 24 July 2018.

⁵⁴ Ofcom, [Consultation: Promoting competition and investment in fibre networks – Initial proposals – Approach to remedies](#), 26 March 2019.

⁵⁵ Section 2A of the *Communications Act 2003* (as amended). This provision was introduced by the *Digital Economy Act 2017* (section 98).

⁵⁶ DCMS, [Public consultation on the Statement of Strategic Priorities](#), 15 February 2019.

3. Building fibre infrastructure

Building a nationwide full-fibre network is a major national infrastructure project. It requires new fibre optic cables to be built to every premises.

Industry operators argue that the willingness to invest in fibre networks exists but that there are barriers to infrastructure deployment which are holding the market back. Commonly cited barriers include:

- negotiating wayleaves for access to land (particularly in the situation of absentee landlords);
- negotiating with local authorities regarding street works; and
- accessing existing infrastructure to reduce building costs.⁵⁷

In 2018 DCMS established a “Barrier Busting Task Force”, which is a cross-Government group working to address barriers to digital infrastructure deployment.⁵⁸ Task Force has developed a [Digital Connectivity Portal](#) that provides resources and advice for local authorities and commercial providers that is intended to facilitate deployment of digital infrastructure (full-fibre and mobile networks). The following sections provide some information about building infrastructure and proposals for reform, and the Portal is a helpful resource for practical guidance.

DCMS’s [Digital Connectivity Portal](#) provides practical guidance and resources about building digital infrastructure.

3.1 Installing infrastructure on land

This section outlines how telecoms companies can obtain rights to install infrastructure on public and private land. A separate framework exists for installing infrastructure on public roads (commonly referred to as street works) which is set out in section 3.2 below.

Wayleaves

A wayleave is a form of access agreement whereby a landowner grants a communications provider a licence to install, access and maintain equipment on their land. This is generally in return for a rental payment which is agreed by negotiation between the parties. Wayleaves are private legal agreements and the specific terms may differ in each case. A wayleave may also bind any subsequent owners or occupiers.⁵⁹

These agreements are usually entered into consensually between the parties. If such an agreement cannot be reached however, the telecoms company may apply to the courts to impose a wayleave agreement through powers contained in the Electronic Communications Code (see below).

Further information is provided on the Government’s Digital Connectivity Portal page: [guidance on access agreements](#). Several

⁵⁷ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, page 5-6.

⁵⁸ There is no webpage dedicated to the Barrier Busting Task Force. The [FTIR](#) (July 2018) provided a summary of the work of the Task Force at pages 5-6.

⁵⁹ [Electronic Communications Code](#), Part 2, paragraphs 10.

broadband providers also provide information about wayleaves on their website, for example, [Openreach](#) and [Virgin Media](#).⁶⁰

The Electronic Communications Code

The [Electronic Communications Code](#) (ECC) provides telecoms companies (called network operators) with rights, called “code rights”, to install, operate, maintain and upgrade electronic communications infrastructure (such fibre broadband cables) on private and public land. It is contained in Schedule 3A to the [Communications Act 2003](#) (as amended). For information about reforms to the ECC in 2017, see the Library briefing paper on: [Mobile Coverage in the UK](#).

Code rights in respect of land may only be conferred on an operator by a written agreement between the occupier of the land and the operator⁶¹ – e.g. a wayleave, as described above. If such an agreement cannot be agreed consensually, the operator can apply to the Court to impose an agreement to confer the code rights. The powers of the Court to impose an agreement are set out in Part 4 of the ECC. Part 4 also includes provisions for calculating the rent to be paid to landowners for hosting equipment under an imposed agreement.⁶² Following reforms in 2017, rent is now calculated based on the value of the land to the landowner rather than the value to the telecoms company.

The Code only applies to operators that have been granted Code Powers by Ofcom, following a public consultation.⁶³ Ofcom publishes a [Register of operators with powers under the ECC](#) which can be consulted for specific companies.

Ofcom has published a [Code of Practice](#) to accompany the ECC that provides a framework for what landowners and network operators should expect from each other when negotiating wayleave agreements.⁶⁴ This Code of Practice suggests best practice to facilitate positive and productive engagement between all parties, including some practical examples.

Further reform

Even with ECC rights, operators argue that there are still administrative barriers that delay getting access to land. Operators argue this is particularly the case in relation to unknown, absent, or disengaged landlords, for example, in multi-dwelling units, office blocks and business parks, which can result in delays for tenants getting services.⁶⁵

The National Infrastructure Commission recommended that the Government should simplify and standardise the processes for obtaining wayleaves by implementing a notification scheme similar to those used

⁶⁰ Openreach, [Obtaining Wayleaves](#), accessed 3 September 2018; Virgin Media, [What's an access agreement?](#) accessed 3 September 2018.

⁶¹ [Electronic Communications Code](#), Part 2, paragraphs 9 and 11.

⁶² [Electronic Communications Code](#), Part 4, paragraph 24.

⁶³ Ofcom, [Register of persons with powers under the Electronic Communications Code](#), 11 May 2018, accessed 31 August 2018.

⁶⁴ Ofcom, [Electronic Communications Code: Code of Practice](#), 15 December 2017.

⁶⁵ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 52. Some industry responses to the FTIR consultation specifically raise this, such as [Virgin Media](#), [TalkTalk](#), and [BT](#).

by other utilities by 2019.⁶⁶ The FTIR includes a commitment to bring forward primary legislation in the next Parliamentary session to “address issues” with wayleaves. The FTIR states the Government’s intention is to bring telecoms companies in line with other utilities by creating a “right to entry”:

54. We do not think it is acceptable for landlords to be able to deny their tenants a service if an operator is prepared to provide it. We want to bring telecoms operators in line with the gas, energy and water sectors by providing a ‘right to entry’, where a landlord is given notification of an operator’s intention to access a property, with a magistrate providing the warrant to entry.⁶⁷

The Government [launched a consultation](#) on 29 October 2018 on the following proposals:

- Amending the Electronic Communications Code to place an obligation on landlords to facilitate the deployment of digital infrastructure when they receive a request from their tenants.
- Enabling communications providers to use magistrates courts to gain entry to properties where a landlord fails to respond to requests for improved or new digital infrastructure.⁶⁸

The consultation stated that amendments to the Electronic Communications Code would be via primary legislation, subject to Parliamentary time.⁶⁹ The consultation closed on 21 December 2018.

Industry operators and the National Infrastructure Commission have welcomed the Government’s general commitment in the FTIR to reform wayleave approvals.⁷⁰ Telecommunications news website, ISP Review quoted Tana Tobak, CEO of Hyperoptic, who said that reforms to the wayleaves process is welcome, but noted the importance of maintaining safety and quality for residents:

However, the devil will be in the detail and delivery. For example, we welcome the review of the wayleave process to expedite full fibre rollout, but industry must not forget that wayleaves underpin the relationship between network builders and landowners to ensure safety and quality for residents, so we shouldn’t be too quick to undermine this.⁷¹

3.2 Street works: installing infrastructure on public roads

Part 8 of Electronic Communications Code (ECC) provides designated telecoms companies with rights to install telecommunications infrastructure on or under public roads and to carry out the necessary

⁶⁶ National infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 21-22.

⁶⁷ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 54.

⁶⁸ DCMS, [Ensuring tenants’ access to gigabit-capable connections](#), 29 October 2018

⁶⁹ DCMS, [Ensuring tenants’ access to gigabit-capable connections](#), 29 October 2018

⁷⁰ *ISP Review*, [Gov Detail BIG Changes to Boost UK Full Fibre Broadband and 5G UPDATE5](#), 23 July 2018, accessed 17 August 2018.

⁷¹ *ISP Review*, [Gov Detail BIG Changes to Boost UK Full Fibre Broadband and 5G UPDATE5](#), 23 July 2018, accessed 17 August 2018.

associated street works to do so. This provides the legal basis for those telecoms companies to be considered statutory undertakers (along with other utilities companies) under Parts III and IV of the [New Roads and Street Works Act 1991](#) in England, Wales and Scotland (the 1991 Act), and under the *Street Works (Northern Ireland) Order 1995* ([SI 1995/3210](#)) in Northern Ireland.^{72 73} The 1991 Act and associated regulations allows statutory undertakers to carry out street works on public roads without the prior consent of the local highway authority. This means that telecoms companies do not need to agree a wayleave to install infrastructure on/under a public road; a wayleave would however be required for a private road (see section 3.1 above).

The 1991 Act provides some powers to local highway authorities to manage *how* companies conduct works and requires utility companies to provide advance notice of the works to the authority. Some areas have introduced permit or lane rental schemes, which give the highway authority more control over works. More information on street works generally is provided in the Library briefing paper: [Street works in England](#) (CBP 8500).

In addition, telecoms companies must comply with the [Electronic Communications Code \(Conditions and Restrictions\) Regulations 2003](#) (SI 2003/2553, as amended),⁷⁴ which apply UK-wide. These regulations require operators to consult with or give notice to local highways and planning authorities in certain circumstances. For example, operators are required to give notice to planning authorities in areas where they have not previously installed infrastructure (with some exceptions), and planning authorities can set reasonable requirements that it wishes the operator to comply with. The Regulations also include specific conditions relating to the installation of infrastructure in proximity to listed buildings and in relation to conservation and protected areas.⁷⁵

Calls for reform

Telecoms companies have raised concerns about inconsistent approaches between local authorities to the management of street works and interpretation of street works legislation, arguing that this inconsistency has created uncertainties and inefficiencies when seeking

⁷² In England and Wales the 1991 Act was heavily amended by Parts 3 and 4 of the [Traffic Management Act 2004](#); in Scotland by Part 2 of the [Transport \(Scotland\) Act 2005](#).

⁷³ A comparison of street works and planning legislation relevant to building telecoms infrastructure in each nation is provided in a report by Analyst Masons, commissioned by the Broadband Infrastructure Group, [Lowering barriers to telecoms infrastructure deployment](#), Dr Matt Yardley, Ian Adkins, Dr Robert Woolfson, May 2017.

⁷⁴ Amending legislation includes: [SI 2013/1403](#), [SI 2016/1049](#) and [SI 2017/753](#).

⁷⁵ Regulations 6-8, *Electronic Communications Code (Conditions and Restrictions) Regulations 2003* (as amended); see amending legislation: [SI 2016/1049](#), [SI 2013/1403](#) and [SI 2009/584](#).

to build infrastructure.^{76 77} The Government has stated that road and street works account for 70% of the cost of fibre deployment.⁷⁸

The National Infrastructure Commission recommended that local authorities appoint a ‘digital champion’ with responsibility for engaging with telecoms providers. It recommended:

The digital champion in each local planning authority should be responsible for coordinating and facilitating digital infrastructure deployment in their area, acting as the single point of contact for all telecoms providers, and assisting them in delivering better connectivity for the local area. Digital champions should prioritise:

- reforming and streamlining the process around permissions for street works, reducing the variability across the country and removing inefficient delays
- improving the accessibility of their publicly owned assets, making it easier and cheaper for operators to deploy digital infrastructure in the local area.⁷⁹

Similar calls have been made by the Broadband Stakeholder Group and the thinktank Centre for Cities.^{80 81}

On the other hand, local highway authorities have argued that telecoms companies take an inconsistent approach to sharing information about their deployment plans, which makes it difficult for them to coordinate works (across multiple utilities – not just telecoms companies) effectively.⁸² Local authorities also complain about poor quality work carried out by undertakers. While local authorities currently have powers to demand reinstatement of the road to an acceptable standard, this takes extra time if the work is not completed properly in the first place, with the additional consequences of traffic disruption and, depending on the location, loss of local business and trade.

In the FTIR, the Government noted that there was a “culture of mistrust” between local authorities and operators.⁸³ The FTIR stated that the Government’s aim is to “ensure a uniform approach” to street works across the country with both local authorities and undertakers “promoting a collaborative and flexible approach”.

The Government has published a [Street Works Toolkit](#) (for England and Wales) that provides practical guidance for managing street and road works for the deployment of broadband infrastructure. The Toolkit was agreed between the Government and Street Works UK (on behalf of

⁷⁶ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 60.

⁷⁷ See also for example, a report by Analyst Masons, commissioned by the Broadband Infrastructure Group, [Lowering barriers to telecoms infrastructure deployment](#), Dr Matt Yardley, Ian Adkins, Dr Robert Woolfson, May 2017.

⁷⁸ DCMS, DfT, [Street Works Toolkit](#), 23 May 2019.

⁷⁹ National Infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 30.

⁸⁰ [Delivering change: How cities can make the most of digital connections](#), Simon Jeffrey and Lahari Ramuni, Centre for Cities, July 2018.

⁸¹ Analyst Masons, commissioned by the Broadband Infrastructure Group, [Lowering barriers to 5G deployment](#), Dr Matt Yardley, Janette Stewart, Ian Adkins, Dr Robert Woolfson, July 2018.

⁸² DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 61.

⁸³ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 61.

operators), the Joint Authorities Group (on behalf of local authorities) and the Highway Authorities and Utilities Committee. In the FTIR the Government also refers to wider work undertaken by the Department for Transport regarding street works.⁸⁴

3.3 New builds

There is currently no obligation on developers to connect new build properties with broadband infrastructure, and historically, most new build properties have been connected to either only copper-based connections, or more recently, part-fibre, part-copper connections.⁸⁵

There have been two reforms since 2016 that aimed to improve digital connectivity in new builds:

- 1 [A voluntary agreement between BT Openreach and the Home Builders Federation \(HBF\)](#) was brokered by the Government in February 2016.⁸⁶ It does not place any legal requirement on developers but the aim of the agreement is that “fibre-based” broadband is installed in new housing developments either at no cost to the developer or co-funded by the developer and Openreach. Virgin Media and GTC (another infrastructure provider) have since signed similar agreements with the HBF.⁸⁷ According to the HBF, its members deliver about 80% of the new homes built in England and Wales each year.⁸⁸
- 2 Amendments were made in 2016 to building regulations in each UK nation to implement the EU *Broadband Cost Reduction Directive* 2014/61/EU.⁸⁹ The amended regulations require that all new buildings have the infrastructure required to support a superfast broadband connection (such as cable ducts) but do not go as far as to require provision of the connection itself. The amended regulations apply to any new building applications submitted after 31 December 2016. Local authorities have a duty to ensure that building regulations are complied with in their area.

Further reform

In the FTIR the Government accepted that connectivity in new build developments is “not as good as it should be” and that new builds “must be connected to fibre networks”.⁹⁰

In October 2018 the Government [launched a consultation](#) on the following main proposals to “ensure delivery of gigabit-capable connections to all new build homes”:

- Developers and network operators share the cost of connecting new build sites to gigabit-capable networks.

⁸⁴ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 64.

⁸⁵ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 56.

⁸⁶ DCMS, [Superfast connectivity in new homes](#), 5 February 2016.

⁸⁷ [PQ HL6920, 30 April 2018 \[Housing: Broadband\]](#).

⁸⁸ Home Builders Federation, [About the HBF](#), accessed 23 August 2018.

⁸⁹ For England, see: [Approved Document R \(England\)](#); for Wales, see: [Approved Document R \(Wales\)](#); for Scotland, see: [Building Standards Technical Handbook \(Domestic\)](#), part 4.14; for Northern Ireland, see: [Technical Booklet M](#).

⁹⁰ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 56-58.

- Introducing a 'duty to connect' provision upon network operators.
- Amending Building Regulations Approved Document Part R: (Physical infrastructure for high-speed electronic communications networks). This will mean all new build sites will be built with the necessary infrastructure in place to support gigabit-capable networks.⁹¹

The consultation closed on 21 December 2018.

3.4 Access to existing infrastructure: ducts and poles

The biggest cost for fibre deployment is the civil engineering works required – physically digging trenches and laying cables. Accessing existing infrastructure to host telecoms cables can help reduce this cost. The main policy measure in place to facilitate access to existing infrastructure is to open access to Openreach's network of ducts (underground tunnels) and poles for use by competitors.

The Government and the National Infrastructure Commission have both strongly supported opening access to Openreach's ducts and poles, framing it as one of the most important reforms that could quickly enhance infrastructure build. Both stressed the importance of monitoring the success of this approach, and to consider further intervention if take up is low.^{92 93}

Background information is provided in the POST briefing paper: [Telecommunications Infrastructure: Cables, Ducts and Poles](#) (March 2017).

Duct and pole access: reforms

Openreach has been required to allow competitors (e.g. telecoms companies other than BT) to rent access to its ducts and poles since 2010 for the purpose of laying fibre cables for high-speed broadband services (but not, for example, fibre for the purposes of supporting mobile networks, see Box 2 on 5G).

In 2016, the *Communications (Access to Infrastructure) Regulations 2016* (ATI regulations) were introduced, which included the requirement for operators of utilities to share physical infrastructure with competing network operators (including other utilities such as gas, electricity and water). In the FTIR the Government noted that the ATI regulations have had limited success and stated it would carry out a review in 2019.⁹⁴

Ofcom introduced reforms to duct and pole access in March 2018, following its 2017, having found the above two measures had not had high take up by operators.^{95 96} The reforms included introducing a non-

⁹¹ DCMS, [New Build Developments: Delivering gigabit-capable connections](#), 29 October 2018.

⁹² DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 68.

⁹³ National Infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 28.

⁹⁴ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 69.

⁹⁵ Ofcom, [Wholesale Local Access Review, Volume 3](#), 28 March 2018, para 2.11-2.19.

⁹⁶ Ofcom, [Wholesale Local Access Review, Volume 3](#), 28 March 2018.

discrimination requirement, meaning that Openreach must provide access nationally to other providers as easily as to BT, including the same service levels and digital data maps. Ofcom stated that the reforms could cut the cost of laying fibre cables by 50% and reduce the time taken from days to hours.⁹⁷ The primary purpose of the network deployment must be for a retail (consumer and small business) broadband network.⁹⁸

In May 2019 Ofcom announced further reforms to allow Openreach's ducts and poles to be used for all telecoms services, by extending duct and pole access to lines serving large businesses and high-speed lines used to support mobile broadband networks.⁹⁹

3.5 Copper switch-over

What does this mean?

Copper "switch-off" refers to retiring Openreach's copper network. Openreach's copper network supports the analogue telephone network, copper-based broadband connections (including FTTC) and other devices such as house alarms. Switching off the copper network would require all premises and devices to have a non-copper based telephone and broadband connection. For example, this could include a full-fibre connection or, a cable connection (such as provided by Virgin Media) or a wireless connection.

What are the advantages and disadvantages?

The FTIR sets out the benefits of switching to a full-fibre network, including:

- benefits to network providers such as greater certainty on their investment case by providing certainty as to future customers;
- benefits to consumers through the improved connectivity and reliability that comes with fibre networks;
- benefits to retail service providers through lower operating costs and improved customer satisfaction (because fibre provides a higher quality service); and
- running a fibre network and copper network in parallel has high costs (this is an incentive for Openreach to retire the copper network).¹⁰⁰

Concerns have been raised however about the impact that switching to full-fibre services would have on consumers, particularly vulnerable consumers.¹⁰¹ Clive Selley, CEO of Openreach, estimated that copper switch off could result in broadband wholesale charges increasing by £5

⁹⁷ Ofcom, [Opening up BT's infrastructure for new fibre broadband](#), 20 April 2017, accessed 17 August 2018.

⁹⁸ Ofcom, [Wholesale Local Access Review, Volume 1](#), 28 March 2018, para 1.2.6.

⁹⁹ Ofcom, [Further Ofcom rules to support fibre investment](#), 24 May 2019.

¹⁰⁰ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 140-142.

¹⁰¹ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 142; National Infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 27-28.

per month more (which would likely result in retail price increases for consumers).¹⁰²

The National Infrastructure Commission recommended that any switch off plan should contain protection for vulnerable consumers:

The transition plan will need to include protection for potentially vulnerable consumers. Some consumers will not want fibre but will receive it anyway. Openreach should not be able to charge customers extra that had no need for the upgrade.¹⁰³

Concerns have also been raised about consumers who do not have a broadband connection and rely on the copper network for telephone calls. A switch to fibre would require a phone adapter to transmit phone calls via the internet (called "Voice over Internet Protocol" or VoIP). Openreach is already working on plans to move towards VoIP services (which also includes VoIP calls using the copper broadband network), stating an intention to withdraw the Public Switched Telephone Network (PSTN) by 2025.¹⁰⁴

There are other devices, too, such as security alarms that use the copper network that will need to be considered in any switch-off plan.^{105 106}

"Switch-off" or "switchover"?

The BBC Radio 4 Today programme reported on 17 July 2018 that during a meeting in Parliament, the Chancellor said that the Government would announce a date for copper "switch-off", describing this as "*probably the single biggest stimulus we can give to investment in fibre*".¹⁰⁷ The Telegraph and telecommunications news site *ISP Review* quoted a Treasury spokesperson to say that while "*the Chancellor has been clear that we must start thinking now about the switchover from copper to fibre*", no "*final decisions*" had been taken.¹⁰⁸

In the FTIR the Government carefully distinguishes between copper "switch-off" (retiring the copper network) and "switchover" (moving customers over to new non-copper based networks). The Government only expressed clear support for an industry-led copper "switch over".¹⁰⁹

The Government commits to setting up a mechanism with Ofcom and industry to plan for a switchover, and identifies the following policy conditions that such a switchover should meet:

¹⁰² [BBC Radio 4 Today Programme, 17 July 2018](#), at 1:16:55.

¹⁰³ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, page 28.

¹⁰⁴ [Openreach Consult UK ISPs on WLR Telephone Network Closure](#), *ISP Review*, Mark Jackson, 19 April 2018; Openreach, [Openreach to consult Communication Provider customers on switch to digital phone services by 2025](#), 15 May 2018, accessed 17 August 2018.

¹⁰⁵ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 148

¹⁰⁶ Internet Telephony Services Providers' Association (ITSPA), [ITSPA welcomes Government drive for full fibre rollout but adds caution to current plans for PSTN switch off](#), 23 July 2018, accessed 24 July 2018.

¹⁰⁷ [BBC Radio 4 Today Programme, 17 July 2018](#), at 1:16:55.

¹⁰⁸ [Copper internet cables will be 'switched off' to improve broadband](#), Katie Morley, *The Telegraph*, 17 July 2018; [Cityfibre Respond as Chancellor Preps Date for Copper Switch Off](#), *ISP Review*, Mark Jackson, 17 July 2018, accessed 18 July 2018.

¹⁰⁹ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 138.

- Plans support a timely switchover;
- Efficient, so that switchover is smooth with minimal consumer disruption;
- Transparent, so that customers have the information they need to make informed choices and clearly signalled via notice periods so operators have certainty;
- Consistent, with existing regulatory and consumer obligations;
- Pro-competitive, so processes are in place to support easy switching between networks; and
- A fair deal for consumers, including adequate safeguards for vulnerable customers.¹¹⁰

How and when will it happen?

In its National Infrastructure Assessment, the National Infrastructure Commission recommended that the Government develop a plan to allow for copper "switch-off" by 2025. The NIC noted however that the decision to "switch off" the copper network is ultimately a commercial decision for Openreach.¹¹¹

While not specifying a firm date, the Government expects that "switchover" will be underway in a "majority of the country by 2030" but that timing depends on the pace of the full-fibre roll-out. The Government expects switchover to start when a significant proportion of the population has taken-up new fibre services.¹¹²

Trade body ITSPA (which represents VoIP providers) said that a switch from copper is welcome but stressed that the process could endanger competition and harm smaller providers and certain groups of consumers if not undertaken correctly.¹¹³ City Fibre's Director of Strategy, Mark Collins, said that any switchover strategy must ensure a competitive market, so that not only Openreach benefits.¹¹⁴ The Institute of Directors on the other hand called for a clearer commitment for a "switch-off" date, arguing that without it, fibre roll-out would be too slow.¹¹⁵

The Government's draft Statement of Strategic Priorities to Ofcom (see Box 4) states that Ofcom will have an "important oversight role" in ensuring industry readiness for switchover, including protecting the interests of consumers, promoting competition between networks and ensuring switching processes are efficient and transparent.¹¹⁶ [Ofcom set out expectations](#) for industry regarding protections for consumers

¹¹⁰ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 143

¹¹¹ National Infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 27.

¹¹² DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 144.

¹¹³ Internet Telephony Services Providers' Association (ITSPA), [ITSPA welcomes Government drive for full fibre rollout but adds caution to current plans for PSTN switch off](#), 23 July 2018, accessed 24 July 2018.

¹¹⁴ [BBC Radio 4 Today programme](#), 23 July 2018, at approx. 2:40:00.

¹¹⁵ Institute of Directors, [Government's telecoms review 'doesn't go far enough'](#), Dan Lewis, Senior Advisor on Infrastructure, 23 July 2018, accessed 17 August 2018.

¹¹⁶ DCMS, [Public consultation on the Statement of Strategic Priorities](#), 15 February 2019.

during the transition to VoIP services in February 2019.¹¹⁷ Ofcom's expectations for industry include having strategies in place to identify and support migrating customers and engaging with relevant service providers.

¹¹⁷ Ofcom, [The future of fixed telephone services](#), 22 February 2019 [accessed 15 March 2019].

4. Government funding for full-fibre networks

Summary: Government funding for full fibre networks

Additional public funding will be required to deliver full-fibre networks to areas not reached by commercial investment. In the FTIR the Government estimated that this would be approximately 10% of UK premises (3 million premises), mostly in rural areas, and could require between £3-5 billion public funding. The Government has said it will pursue an “outside in” approach to full fibre deployment, which means targeting hardest to reach premises first.

There are currently three UK-wide Government funded programmes delivering full-fibre networks. The programmes are delivered by [Building Digital UK \(BDUK\)](#), part of DCMS, and are now grouped under an overarching banner called “the UK Fibre Programme”.¹¹⁸

- 1 The [Local Full Fibre Networks Programme \(LFFN\)](#) aims to stimulate demand for full-fibre networks across the UK. It supports a voucher scheme focused on small and medium sized businesses (see Box 5) and provides grants to local public sector bodies on a competitive basis. The programme includes £287 million investment.
- 2 The [Rural Gigabit Connectivity Programme \(RGCP\)](#) is the first programme providing funding specific to rural areas by the “outside-in” approach. It includes a voucher scheme for rural premises (see Box 5) as well as a trial scheme to connect public sector buildings such as schools and hospitals in rural areas. £200 million funding has been allocated to the programme, drawn from the National Productivity Investment Fund (see Box 6).
- 3 The final stages of the superfast broadband programme will prioritise full-fibre connections. Delivery of the programme is led by local bodies in England and the devolved Administrations. The Library briefing paper on [Superfast broadband in the UK](#) provides more information about this programme.

Other funding initiatives to support investment in full-fibre include tax breaks for building full-fibre infrastructure (Section 4.5) and the Digital Infrastructure Investment Fund (Section 4.6).

4.1 More public funding will be required for some rural areas

The National Infrastructure Commission highlighted in July 2018 that more public funding will be required to deliver a nationwide full-fibre network.¹¹⁹ The Commission recommended that a taxpayer-subsidised infrastructure programme to deliver full-fibre connections to areas that cannot support commercial investment, largely rural areas, should start by 2020. It said that such a programme should be along the lines of the Government’s “successful” superfast broadband programme, but should focus on delivering the hardest to reach premises first.¹²⁰ More

¹¹⁸ DCMS, [£200 million rollout of full fibre broadband begins](#), 19 May 2019 [accessed 30 May 2019].

¹¹⁹ National infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018.

¹²⁰ National infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 25-26.

information about the superfast broadband programme is available in the Library briefing paper: [Superfast broadband in the UK](#).

In the FTIR, the Government acknowledged that more funding will be necessary for full-fibre networks to reach areas that are not viable for commercial investment. The Government estimates that this will be approximately 10% of premises, largely in remote rural areas with low population density and challenging geographies.¹²¹ Challenging geographies increase the cost of deployment, and low population densities reduce the returns that operators receive from customers taking up services. As such, commercial operators are unlikely to service these areas without public funding support. Some full-fibre providers, however, do target rural areas, for example [Gigaclear](#), [TrueSpeed](#) and [B4RN](#).

The FTIR indicated that other technologies that can deliver "gigabit capable connectivity" (such as hybrid fibre-wireless solutions) may be necessary for some of the hardest to reach premises.¹²²

Outside-in approach

The Government stated that it would pursue an "outside-in" strategy to supporting full-fibre deployment. This means starting with the commercially most difficult to reach premises and to enable these premises to receive gigabit-capable connectivity within the same timeframe as commercial areas.¹²³ The FTIR described a staged programme of investment, starting with areas that do not currently have superfast broadband:

Investment in these areas will be phased, starting with areas that currently do not have superfast (and for which the productivity gains would be maximised given the low baseline of existing connectivity). A staged programme of investment would allow for testing and developing different technologies and implementation approaches before deploying them more widely. The Government sees advantages in a reverse auction-style model, in which operators would competitively bid for funds to roll out to the maximum number of premises in an area by a certain date.¹²⁴

The "outside in" approach is a policy shift compared to how the previous superfast broadband strategy was delivered and has been [largely welcomed by rural stakeholders](#).¹²⁵ The House of Lords Committee on the Rural Economy, in their [April 2019 report](#), expressed optimism about the approach to rural areas in the FTIR but stressed the need for effective implementation:

The Government appears to have identified the challenges and we are optimistic about the overall direction of travel outlined in the FTIR which is giving greater focus to rural areas. [...]

The Government estimates that 10% of premises will require additional public investment to deliver full-fibre networks.

The FTIR commits to an "outside in" approach to delivering full-fibre to rural areas. This means tackling hardest to reach premises first.

¹²¹ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 135.

¹²² DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 137, page 45-46.

¹²³ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 129-130.

¹²⁴ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 130.

¹²⁵ For example: Rural Services Network, [Rural welcome for Government's digital connectivity plan](#), 25 July 2018; Country Land and Business Association, [CLA responds to DCMS announcement of £200 million for rural broadband](#), 21 May 2019; INCA, [INCA welcomes Government's Future Telecoms Infrastructure Review](#), 23 July 2018.

We welcome the Government's ambition to achieve nationwide full fibre connectivity by 2033 as set out in the Future Telecoms Infrastructure Review (FTIR) but stress the need for effective coordination, monitoring and accountability in its implementation.¹²⁶

No new Government funding was announced with the FTIR in July 2018. The Government estimated that the additional funding required to deliver full-fibre to the 10% of premises not likely to attract commercial investment, could be between £3-5 billion.¹²⁷ The following sections outline funding programmes that have been announced to date. In response to a PQ in March 2019 the Government stated that longer term funding options would be determined as part of the "forthcoming spending review".¹²⁸

The Government estimates that between £3-5 billion public funding could be required to deliver full-fibre to non-commercially viable areas.

4.2 Local Full Fibre Networks (LFFN) Programme

The Local Full Fibre Networks (LFFN) programme is directed towards stimulating demand for full-fibre networks and is set to run until 2021.

The programme includes:

- 4 The [LFFN Challenge Fund](#) (£190 million), which awards grants to local public sector bodies on a competitive basis. It aims to support full-fibre infrastructure projects that have the potential to leverage further commercial investment in the area.¹²⁹
- 5 The [Gigabit Broadband Voucher Scheme](#) (see Box 5), provides vouchers to small and medium sized businesses (SMEs) to support the cost of installing a gigabit capable connection. Residents can also apply as part of a group project that includes businesses. The scheme is run centrally by DCMS and is supported by £67 million funding.¹³⁰
- 6 The programme also includes the [Trans-Pennine Initiative](#), which is a joint project between the LFFN and 5G Testbeds and Trials Programme "to investigate the potential of using the rail network to enhance connectivity for rail passengers and the population more generally".¹³¹

The Government stated in response to a [PQ March 2019](#) that it will have invested "almost £300 million" by the end of the LFFN programme.¹³² This includes £287 million investment.¹³³

- £200 million, drawn from the National Productivity Investment Fund (see Box 6) and first announced in the [Spring Budget 2017](#).

¹²⁶ House of Lords Committee on the Rural Economy, [Time for a strategy for the rural economy](#), Report of Session 2017–19, HL 330, 27 April 2019, para 252-254.

¹²⁷ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 135.

¹²⁸ [PQ 226650, 7 March 2019](#) [Broadband: rural areas]

¹²⁹ DCMS, [Revised Guidance for the Local Full Fibre Networks Challenge Fund](#), August 2018.

¹³⁰ DCMS, [£67 million boost for a Full Fibre future](#), 15 March 2018, [accessed 31 May 2019].

¹³¹ DCMS, [Trans Pennine Initiative Trial: Call for Information](#), updated 30 January 2019 [accessed 3 June 2019].

¹³² [PQ 226650, 7 March 2019](#) [Broadband: rural areas]

¹³³ House of Commons Library correspondence with DCMS, 3 June 2019.

This £200 million includes the initial £10 million LFFN [trial projects](#) and the £190 million Challenge Fund (announced in the [Autumn Budget 2017](#)).

- £67 million for the Gigabit Broadband Voucher Scheme; and
- £11.1 million for the fibre deployment along the Trans-Pennine rail link.¹³⁴

Box 5: Gigabit broadband voucher schemes

There are [three voucher schemes](#) that support the cost of installing a gigabit capable connection:

1. **Gigabit voucher scheme (UK wide):** eligible small and medium sized businesses (SMEs) can claim up to £2500 against the cost of installing a gigabit capable connection, either individually or as a group. Residents can claim up to £500 as part of a group project that includes businesses. This scheme is part of the Local Full Fibre Networks programme.
2. **Welsh top-up voucher:** the [Welsh Government has provided funding](#) to top-up vouchers issued through the above gigabit voucher scheme in Wales, providing an additional £3000 per business and up to £300 per residential premises.¹³⁵ This means that as of March 2019 in Wales, eligible SMEs can claim up to a total of £5500 per businesses and £800 per residential premises (as part of a group project).
3. **Rural gigabit voucher scheme (UK-wide):** residents and SMEs in rural areas that cannot access superfast broadband speeds (30 Mbps) can claim vouchers towards the cost of a gigabit capable connection. SME's can claim up to £3,500 and residents up to £1,500 (per premises). This is part of the Rural Gigabit Connectivity Programme. The vouchers can only be used to support group schemes (where two or more SMEs and/or residents combine their vouchers). Rural areas are defined based on standard classifications used in each nation – see the [rural voucher scheme webpage](#) for more information.

The vouchers support the cost of a gigabit capable connections – this means a full-fibre connection or any other technology capable of supporting 1 Gbps upload or download speeds.

The schemes are supplier-led which means suppliers request the vouchers on behalf of their customers. To access funding, customers should contact a [registered supplier](#) operating in their area.

More information about all three voucher schemes, including eligibility requirements, is available on the [Gigabit Broadband Voucher Scheme website](#).

Funding under the LFFN Challenge Fund has been awarded in 3 Waves:

- 1 Wave 1 funded trial projects, including [six projects](#) in different areas announced in September 2017.¹³⁶ In February 2019 DCMS [published a list of rural schools](#) to be connected under a pilot project that aimed to inform the development of the Rural Gigabit Connectivity Programme.¹³⁷
- 2 Wave 2 was the first round of local projects to be funded by the LFFN Challenge Fund; 13 projects were announced in the [2018](#)

¹³⁴ House of Commons Library correspondence with DCMS, 3 June 2019: originally the Trans-Pennine project included the construction of physical masts to support 5G and was funded by approximately £22 million, which brought the overall figure to £294 million. For information about changes to the TPI project, see DCMS, [Trans Pennine Initiative Trial: Call for Information](#), updated 30 January 2019 [accessed 3 June 2019]

¹³⁵ DCMS, Welsh Government, [Gigabit broadband voucher scheme boost for Wales](#), 22 March 2019.

¹³⁶ DCMS, [Local Full Fibre Networks Challenge Fund Guidance](#), 22 November 2017 [accessed 1 June 2019]; DCMS and HM Treasury, [Six areas to pilot UK's fastest broadband as part of £200 million project](#), 3 September 2017.

¹³⁷ DCMS, [More than 100 rural schools to get gigabit speed broadband](#), 26 February 2019 [accessed 15 March 2019]. House of Commons Library correspondence with DCMS (3 June 2019) confirmed this was part of Wave 1 of the LFFN programme.

[Spring Statement](#) in the following areas, with a total of £95 million funding:

Armagh City, Banbridge & Craigavon; Highlands; Cardiff; Manchester; North Yorkshire (Nynet); Coventry, Solihull & Warwickshire (CSW); Wolverhampton; London; Mid Sussex; Portsmouth; Cambridgeshire; Belfast and Blackpool.¹³⁸

- 3 Wave 3 projects, funded by the remaining £95 million in the Challenge Fund, are being announced individually and include projects in the following areas:¹³⁹

Suffolk Council (£5.9m);¹⁴⁰ Plymouth (£3.0m);¹⁴¹ Herts and Essex (£2.1m); Colchester (£3.5m); Rutland (£2.0m); Isle of Wight (£0.8m); Shetland Islands (£2.0m); Norfolk (£8.0m); South Essex (£4.5m); North Wales (£8.0m); Stoke-on-Trent (£9.2m); Northern Ireland (£15.0m).¹⁴²

4.3 Rural Gigabit Connectivity (RGC) Programme

The Government describes the Rural Gigabit Connectivity (RGC) Programme as the “first step” in the process of providing funding for full-fibre for rural areas via the outside-in approach described in the FTIR.

The two-year programme [commenced in May 2019](#) and will run until the end of March 2021.¹⁴³ The Government has committed £200 million to the programme, first announced in the 2018 Autumn Budget and drawn from the National Productivity Investment Fund (Box 6).¹⁴⁴

The RGC Programme has two parts:

- 4 A [voucher scheme](#) for rural residents and small and medium sized businesses to help support the cost of installing a gigabit capable connection (see Box 5); and
- 5 A trial programme to connect rural public sector buildings such as schools and hospitals (‘Hubs’) to a gigabit capable connection.

The Hub approach is a trial that the Government states has been designed to “validate a potential approach and forecast costs”. The Government described the benefits of the “Hub” approach as being two-fold: first to provide an improved public service and secondly, the surrounding area may then become increasingly viable for commercial investment.¹⁴⁵ The voucher scheme is also intended to help stimulate commercial investment.

¹³⁸ DCMS, Guidance: [Local Full Fibre Networks Programme](#), 13 March 2018.

¹³⁹ House of Commons Library Correspondence with DCMS, 3 June 2019.

¹⁴⁰ HM Treasury, [Autumn Budget 2018](#), 29 October 2018, para 4.13.

¹⁴¹ Plymouth County Council Newsroom, [Ultra-fast broadband coming to Plymouth](#), 26 March 2019 [accessed 3 June 2019].

¹⁴² HM Treasury, [Spring Statement 2019: Written Ministerial Statement](#), 13 March 2019, page 2 includes a list of 9 projects funded under Wave 3 of the LFFN.

¹⁴³ DCMS, [£200 million rollout of full fibre broadband begins](#), 19 May 2019 [accessed 30 May 2019].

¹⁴⁴ HM Treasury, [Budget 2018](#), 29 October 2018, para 4.13.

¹⁴⁵ DCMS, [RGC Programme Key Information](#), 29 May 2019, [accessed 30 May 2019].

The Programme team are currently working with the Department for Education and the Department of Health and Social Care as strategic partner organisations.¹⁴⁶ The Government [announced the first 31 primary schools](#) to be connected under the programme in May 2019, and provided details about which areas had been first prioritised:

RGCP is a two year, £200 million UK-wide programme focused on rural areas. Government has initially prioritised sites in Cornwall, Cumbria, Northumberland and Pembrokeshire. Additional sites in Scotland, Northern Ireland, Wales and the rest of England will be announced in the coming months.

The RGCP Programme will trial a model connecting local hubs* in rural areas, starting with primary schools. Working with the Department for Education, DCMS has identified the first 31 schools eligible for a connection under the scheme. These new speeds will enable whole classes to simultaneously surf the internet on tablets as part of structured lessons, and gives schools easier access to online training and educational learning.

Further information is provided in the [RCG Programme guide](#) including how local authorities can express an interest in becoming a strategic partner under the programme.

Box 6: National Productivity Investment Fund

The Government has allocated £740 million to telecoms investment up to 2023 through the [National Productivity Investment Fund](#) (NPIF), in particular to support the roll out of full fibre networks and future 5G communications.¹⁴⁷

The National Productivity Investment Fund also covers other areas, including transport, housing, and research and development. It was first announced in the [Autumn Budget 2016](#) as a £23 million fund to 2020-2021. The [Autumn Budget 2017](#) extended the overall NPIF to £31 billion, which corresponds to an extra £7 billion for 2022-2023. The [Autumn Budget 2018](#) extended the NPIF to 2023-24, and expanded it to £37 billion overall.

Telecoms programmes supported by NPIF funding have included:

- £200 million for the Local Full Fibre Networks Programme (LFFN);
- £200 million for the Rural Gigabit Connectivity Programme (RGCP);
- £160 million to support for 5G development;
- £35 million to improve connectivity on trains (combination of mobile and fibre broadband).¹⁴⁸

4.4 Superfast broadband programme

The superfast broadband programme has been providing funding to local bodies in England and the devolved Administrations to fund superfast broadband infrastructure build in regions not reached by commercial networks. The programme has largely funded Fibre-to-the-Cabinet connections. More information about the programme is available in the Library briefing paper: [Superfast broadband in the UK](#).

In the FTIR the Government stated that the final stages of superfast programme (Phase 3) would prioritise delivery of full-fibre networks and that £200 million existing funding in that programme had been

¹⁴⁶ DCMS, [RGCP Programme Key Information](#), 29 May 2019, [accessed 30 May 2019].

¹⁴⁷ HM Treasury, [Autumn Budget 2016](#), 23 November 2017.

¹⁴⁸ HM Treasury, [Autumn Budget 2017](#), 22 November 2017.

identified for this purpose.¹⁴⁹ Regarding full-fibre delivery under the superfast broadband programme, the Broadband Stakeholder Group commented that “in practice this is accelerating what is already underway”.¹⁵⁰

Delivery of superfast broadband under the programme is led by local bodies in England and the devolved Administrations. See Box 1 of the Library paper on [superfast broadband](#) for how to find information about local projects.

4.5 Business rates relief

The [Telecommunications Infrastructure \(Relief from Non-Domestic Rates\) Act 2018](#) was granted Royal Assent on 8 February 2018 and applies to England and Wales. The Act provides the powers necessary to implement the Government's commitment to 100% business rates relief for full, new fibre infrastructure for 5 years, retrospectively from 1 April 2017. This is to support and incentivise the roll-out of broadband and 5G services. Relief is only granted in respect of 'new fibre' that has not yet been laid. Secondary legislation implementing the relief is now in force in England: [The Non-Domestic Rating \(Telecommunications Infrastructure Relief\) \(England\) Regulations 2018](#).

For more background information, see the [Library briefing paper on the Telecommunications Infrastructure \(Relief from Non-Domestic Rates\) Bill](#) (17 January 2018).

4.6 Digital Infrastructure Investment Fund

The Government announced the Digital Infrastructure Investment Fund (the DIIF)¹⁵¹ in the [March 2016 Budget](#) to support the roll out of ultrafast broadband by increasing the amount of capital available for investment:

Supporting the market to deliver ultrafast broadband (roughly defined as providing speeds greater than 100 mbps) to as many premises as possible is a government manifesto commitment and the Fund is a key element in delivering this. The main policy objective, therefore, is to increase the amount of capital invested in the sector, particularly (but not exclusively) more “debt-like” capital that would enable faster expansion of ultrafast broadband networks.¹⁵²

The [Autumn Statement 2016](#) confirmed £400 million of Government investment in the Fund to invest in new fibre networks over the next four years, which the Government expects to be matched by private finance.¹⁵³

¹⁴⁹ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 135.

¹⁵⁰ Broadband Stakeholder Group, [A long read – Forging our Full-Fibre and 5G Future](#), 23 July 2019.

¹⁵¹ Referred to in the Budget as a Broadband Investment Fund but has since been renamed as the Digital Infrastructure Investment Fund – this has been confirmed in House of Commons Library correspondence with DCMS as the same fund.

¹⁵² HM Treasury, [Broadband Investment Fund: request for proposals](#), 16 June 2016 [accessed on 17 June 2016].

¹⁵³ HM Treasury, [Autumn Statement 2016](#), 23 November 2017, paragraph 4.7 *Digital communications*. The £400 million is not listed as a new policy cost in the HM

The Government announced the [launch of the fund in July 2017](#). The fund is expected to release over £1 billion funding available for industry:

The fund, which is expected to more than double the government's £400 million investment, and unlock over £1 billion of capital in the sector, will be managed and invested on a commercial basis by private sector partners, generating a commercial return for the government. It will ignite interest from private finance to invest in the sector, resulting in more alternative providers entering and expanding in the market.¹⁵⁴

Investments from the fund have included a £35 million [investment in Wightfibre](#) (towards building a full-fibre broadband network across the Isle of Wight)¹⁵⁵ and an £18 million [investment in Community Fibre](#) (a business aiming to provide full-fibre broadband to social and private housing estates in London).¹⁵⁶

Government, [Autumn Statement 2016 policy decisions](#), Table B.2 (Treasury scorecard of policy decisions). The press release launching the fund in July 2017, stated that the £400 million investment was "in addition to" the National Productivity Investment Fund (HM Treasury, [Billion pound connectivity boost to make buffering a thing of the past](#), 3 July 2017).

¹⁵⁴ HM Treasury, [Billion pound connectivity boost to make buffering a thing of the past](#), 3 July 2017, accessed 31 August 2018.

¹⁵⁵ Wightfibre, [Major Investment And New Jobs As Wightfibre Announces "Gigabit Island"](#), Zoe Heyett, 8 November 2019.

¹⁵⁶ Amber Infrastructure Group, [Community Fibre receives backing from NDIE](#), 23 April 2018, accessed 31 August 2018; [London FTTH Broadband ISP Community Fibre Raises Extra £25m](#), Mark Jackson, *ISP Review*, 23 April 2018; [Community Fibre raises cash to connect social housing](#), Nic Fildes, *Financial Times*, 23 April 2018 (subscription only).

5. Glossary

Broadband speeds

Megabits and megabytes

Megabits (Mb) and megabytes (MB) are units for expressing a quantity or amount of data. 8 megabits (Mb) is equal to 1 megabyte (MB); 8 gigabits is equal to 1 gigabyte (GB).

Upload and download speeds

Broadband speeds are expressed as the amount of data downloaded or uploaded per second, usually in megabits per second (Mbps). Upload and download speeds are also called the bandwidth.

Download speeds refer to how long it takes to download data to your computer or device. Upload speeds refer to how long it takes for a file to transfer from your device to the internet.

Most typical internet activities, such as browsing websites and checking emails require higher download speeds than upload speeds. Therefore, most internet connections have higher download speeds than upload speeds. Reasonable upload speeds are necessary for applications such as video calling and uploading large files to social media. A “symmetric” connection is one that delivers the same upload and download speed.

More information about typical broadband speeds and what you can do with them is provided in the Library briefing paper: [Superfast broadband coverage in the UK](#) (SN06643).

Decent broadband

Ofcom and the UK Government define a “decent” broadband as a connection capable of delivering a download speed of at least 10 Mbps and an upload speed of at least 1 Mbps.¹⁵⁷ This is the specification for the Governments Universal Service Obligation (USO). For more information, see the Library briefing paper on the [Universal Service Obligation \(USO\) for Broadband](#) (CBP8146, 8 June 2018).

Superfast broadband

Superfast broadband does not have a single definition. The UK Government defines it as download speeds greater than 24Mbps, whereas Ofcom and the European Commission define it as download speeds greater than 30Mbps.

For more information about superfast broadband in the UK, see the Library briefing paper: [Superfast broadband coverage in the UK](#) (SN06643).

Ultrafast broadband

Ultrafast broadband does not have a single definition. The UK Government defines it as download speeds of 100 Mbps and higher, whereas Ofcom defines it as download speeds greater than 300 Mbps. It can be delivered by technologies such as cable broadband, G-fast and

The Government’s [Future Telecoms Infrastructure Review](#) also contains a useful Glossary of key terms used in the FTIR.

¹⁵⁷ Ofcom, [Connected Nations 2017](#), December 2017.

full-fibre. Ofcom reported that ultrafast broadband (300 Mbps) was available to 53% of UK premises as of January 2019.¹⁵⁸

Gigabit-capable connection

The UK Government defines a gigabit capable connection as one that can support 1 gigabit per second (Gbps) download or upload speeds. 1 Gbps is equal to 1000 Mbps.

Broadband technologies

ADSL

ADSL (asymmetric digital subscriber line) technology delivers broadband using copper telephone lines—the connection speed will depend on which type of ADSL is being used; and the quality and length of the line from the telephone exchange to the premises. The further away from the telephone exchange, the slower the connection.

Fibre optic cable

Fibre optic cables are made of glass or plastic. They transmit data using light. Fibre optic cables can transmit more data with faster speeds and significantly less signal loss with distance compared to copper wires.

Fibre to the Cabinet (FTTC)

Fibre to the Cabinet (FTTC) is the main technology used for superfast broadband roll-out in the UK. FTTC connections use fibre optic cables to carry the signal from the exchange to street cabinets and then existing copper telephone lines are used from the cabinet to premises.

FTTC technology can provide download speeds of up to around 80 Mbps. However, the maximum speed that a premises can receive reduces the further away it is from a cabinet, with superfast speeds (above 24 Mbps) available up to approximately 1000 m from the cabinet.

For more information, see the POST briefing on [Telecommunications Infrastructure](#) (24 March 2017).

G-fast

[G-fast](#) is a broadband technology being deployed in a pilot commercial trial by Openreach.¹⁵⁹ G-fast is a variant of FTTC technology that allows ultrafast download speeds (up to 300 Mbps) to be delivered using the same copper telephone lines that are used in FTTC technology.¹⁶⁰ It works by expanding the frequency range over which signals are transmitted, allowing for higher speeds.¹⁶¹ Higher frequencies slow sharply with distance however so only premises within 350 meters of the cabinet are expected to benefit. G-fast is installed by fitting an 'extension pod' onto existing cabinets, and therefore can be installed quickly at low cost.

¹⁵⁸ Ofcom, [Connected Nations: Spring 2019 Update](#), 8 May 2019.

¹⁵⁹ Openreach, [Ultrafast fibre – G-fast](#), accessed 7 September 2017.

¹⁶⁰ Openreach, [Ultrafast fibre – G-fast](#), accessed 7 September 2017.

¹⁶¹ [Is G.fast the answer to the UK's fibre vs copper debate?](#), *Computer Weekly*, 22 October 2015; [Openreach Extend 330Mbps G.fast Broadband Pilot to 1 Million UK Premises](#), *ISP Review*, 17 August 2017.

Cable Broadband [or Hybrid Fibre Coaxial (HFC)]

Most cable broadband in the UK is provided by Virgin Media. Cable networks use a combination of fibre optic cables to street cabinets and high-grade co-axial cables (which are also used for cable TV) from the cabinets to premises. Co-axial cables experience less signal loss over distance compared to copper wires. The latest standard DOCSIS3.1 allows for speeds of around 1 Gbps (1000 Mbps) by cable.

Full-fibre [Fibre to the Premises or Home (FTTP/FTTH)]

Full-fibre is a technology where the fibre optic cable runs from the exchange directly to the premises or home. Full-fibre connections can provide download and upload speeds in excess of 1 Gbps (1000 Mbps). Full-fibre is also called Fibre-to-the-Premises (FTTP) or Fibre-to-the-Home (FTTH).

5G

5G is the next generation of wireless networks. 5G is expected to support fast download speeds and near instant response times, with the capacity to support many devices operating at the same time. 5G is expected to offer advantages beyond mobile broadband, supporting a wide array of internet connected devices and services, for example, from healthcare to manufacturing.

For more information, see the Library briefing paper on [5G](#) (CBP7883) which also includes a Glossary.

Fixed Wireless

Fixed Wireless uses specific frequencies of the radio spectrum to transmit signals through the air in a similar way to mobile phone networks, doing away with wires. Depending on the number of users served by the wireless connection, wireless networks may be capable of delivering superfast speeds. Most wireless ISPs only offer limited coverage in specific areas, for example rural villages.

Satellite broadband

Satellite broadband is an option for those who live in rural areas where traditional fixed-line based broadband services aren't available. It uses a satellite dish to provide access to broadband services. The main advantage of satellite broadband is that it can be provided virtually anywhere in the world, as long as there is a clear line of sight to the satellite (south for the UK). Limitations of satellites include lower latency and lower bandwidth (data capacity), although technologies are improving.

Next-Generation Access (NGA) Broadband

The EU uses the terminology "next-generation access" (NGA) broadband. The EU defines NGA broadband to be networks that consist wholly or in part of optical fibre cables that are capable of delivering broadband with enhanced characteristics compared to already existing copper networks.

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