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Further options for improving mobile coverage

Advice to Government

Summary of advice

Mobile coverage in the UK has improved over recent years through a combination of commercial investment, public policy and regulatory interventions. However, it is still not meeting people's expectations – currently 7% of the UK's landmass is not covered by any mobile operator and 30% does not receive voice and data services from all four operators. Given the importance consumers place on it, improving mobile coverage is one of our top priorities. We expect that competition will drive some further improvements in coverage. However, because the costs of providing coverage in outlying areas tend to be high, and the revenue generating opportunities low, we do not expect that market forces alone will deliver the levels of coverage consumers expect. Further intervention will therefore be required.

Ofcom's most established tool for improving coverage is imposing obligations in new spectrum licences. In 2019, we will auction spectrum in the 700 MHz band for mobile services. This spectrum is ideally suited for providing better mobile coverage. We recently consulted on proposals to include coverage obligations in this award. These would require two mobile operators to cover at least 92% of the UK's landmass and, separately, indoor coverage for 60% of those premises that are unserved by any mobile operator. The value of the spectrum constrains our ability to go further with these obligations, and we have set out in our consultation that we do not believe that these obligations can fix the coverage problem in its entirety. We are currently considering consultation responses and gathering further information from mobile operators on network rollout and costs. As a result of the evidence submitted, we may need to reconsider the number of obligations or their level.

There are four main levers for improving coverage beyond the levels in the proposed 700 MHz obligations. These would likely need to be used in combination to achieve near-universal mobile coverage:

1) Use public subsidy to pay for new coverage roll out: This is most likely to be an effective tool for covering total not spots (areas where no operators are currently present). The cost of covering total not spots will vary, depending on their location. While it is not possible to be certain of the costs, we estimate that addressing all total not spots would cost £3-6bn, once the 700MHz coverage obligations are factored in. Direct subsidy is less likely to be an appropriate means of tackling partial not spots as funding operators to overbuild their competitors' networks could create distortions to competition.

2) Rural wholesale access (otherwise known as roaming): This would involve operators allowing customers to roam onto one another's networks in rural areas. It could improve coverage by 2-3 percentage points for the holders of the 700 MHz coverage obligations and by 5-10 percentage for the other operators. Taken together with our proposed coverage obligations it could result in customers of all four operators getting coverage in around 90% of the UK. It introduces investment risks and consumer experience issues that could be mitigated to a degree. The surest way to introduce a rural wholesale access arrangement would be with the co-operation of operators. In the past, such arrangements have been strongly resisted by most mobile operators on the basis that the case to impose them is unsustainable, and we expect they will continue to take that position.

3) Infrastructure sharing. Mobile operators have extensive infrastructure sharing arrangements that allow them to share the costs of deploying coverage. Ofcom is considering ways in which we can facilitate further sharing.

4) Planning reform and other cost reduction measures: There are a range of measures the UK and devolved Governments could take to reduce the costs of building and operating mobile masts, and thereby facilitate coverage rollout. We believe the most useful potential measures include aligning the planning regime to give mobile operators the same compulsory purchase rights as other utilities, and extending the business rates relief recently granted for fibre deployment to mobile infrastructure.

Improving coverage is a longstanding priority for Ofcom

1.1 Consumers increasingly want to use their mobile devices wherever they are – at work, at home, or on the move. In order to enable them to do so, mobile networks need to offer widespread coverage and have sufficient capacity for growing consumer demand for data services. Improving mobile coverage and releasing new spectrum to cater for growing mobile data demand are therefore important strategic priorities for Ofcom.

1.2 Driven by competition, mobile operators have invested significant amounts in extending and enhancing their networks in recent years. However, mobile coverage remains incomplete. In particular, the commercial case for providing coverage in outlying areas is often weak as the costs of deploying in those areas tend to be high and the revenue-generating opportunities relatively low. Without policy intervention, therefore, commercially driven mobile coverage is not likely to reach a level that meets the expectations of all consumers.

1.3 Ofcom, the UK Government and the devolved administrations have undertaken several previous interventions to encourage and facilitate further rollout of coverage:

a) **Including coverage obligations in spectrum licences**. We included a coverage obligation in one of the licences in the 800 MHz band auctioned in 2013 (the '2013 coverage obligation'), and in all mobile operators' licences following an agreement

between the UK Government and the operators on extending geographic coverage in 2014.

b) **Improving consumer information**. Ofcom provides accurate accessible coverage information through a mobile coverage app and a mobile coverage checker on our website.

c) **Changing planning rules**. The UK and Scottish Governments have introduced significant changes to the planning regimes in England and Scotland in the last two years. These make it easier for mobile operators to expand their networks, including through the use of 'permitted development rights' to enable the deployment of taller masts without planning permission.

d) **Facilitating railway coverage**. The UK Government is examining options for improving coverage on railways. Ofcom is supporting this by considering suitable spectrum bands that could support better passenger connectivity.

e) **Public procurement**. The UK Government has implemented a Mobile Infrastructure Programme (MIP) to provide mobile coverage to some of the premises that previously lacked it. More recently the Scottish Government has launched a procurement programme to deliver improved 4G coverage in Scotland.

Current coverage levels are not good enough

1.4 However, coverage is still not good enough. We publish data on current levels of mobile coverage in our Connected Nations reports.[1] Following an extensive programme of consumer testing, and a recommendation from the National Infrastructure Commission (NIC), we have recently updated the way in which we measure coverage to more accurately reflect consumer experience and the performance of modern smartphones.[2] The figures shown in Table 1 using this revised measure shows that 7% of the UK's landmass does not receive a voice and data service from any mobile operator. In addition, only 70% of the UK's landmass receives data services from all four operators. Coverage tends to be markedly worse in rural areas than urban areas and, as a result, coverage levels are particularly poor in Scotland and Wales.

[1] https://www.ofcom.org.uk/research-and-data/multi-sector-research/infrastructure-research

[2] We define mobile coverage in a way that is likely to deliver a decent experience to smartphone users: nearly all 90-second telephone calls should be completed without interruption; and, nearly all connections should deliver a speed of at least 2Mbit/s. This is fast enough to allow users to browse the internet and watch glitch-free mobile video.

Table 1: UK Geographic coverage

	Voice from at least one operator	Voice from all operators	Data services (3G or 4G) from at least one operator	Data services (3G or 4G) from all operators
UK	93%	76%	93%	70%
England	99%	91%	99%	86%
NI	99%	87%	99%	80%
Scotland	83%	50%	82%	42%
Wales	95%	73%	95%	70%

Source: Ofcom, Connected Nations update Spring 2018

1.5 Mobile operators have not yet completed their 4G deployment programmes so we can expect coverage to grow further over the next few years. Moreover, technological innovations could help to improve coverage in future. For instance, improvements in smartphones' ability to make voice calls over WiFi could improve consumers experience of indoor coverage, although consumers need a good quality fixed broadband connection in order to benefit from this technology.

1.6 However, these developments will not be sufficient to improve coverage to a level that meets all consumers' expectations. In order to solve the coverage challenges the UK faces, therefore, further action from Ofcom, UK and national Governments, and the mobile industry will be needed.

Our proposed 700 MHz coverage obligations are a key lever for improving coverage, but are not sufficient on their own

1.7 The primary lever Ofcom has for improving coverage is imposing coverage obligations in new spectrum licences. In 2019 we will auction 80 MHz of spectrum in the 700 MHz band for mobile use. This spectrum is ideally suited for providing wide-area coverage. In our 2015 Strategic Review of Digital Communications we stated that we would include coverage obligations in some of the licences we award as part of the 700 MHz auction.

1.8 We recently consulted on proposals to include three obligations in this award. These would require two mobile operators to cover at least 92% of the UK's landmass and one operator to cover 60% of those premises which are unserved at the time of the auction.

1.9 Our consultation closed on 4 May. In their responses, the mobile operators generally argue that we have gone too far, with Vodafone in particular suggesting that we have significantly underestimated the number of new masts required. Rural and business groups argue we need to go further. We are currently considering consultation responses and

gathering further information from mobile operators on network rollout and costs. As a result of the evidence submitted, we may need to reconsider the number of obligations or their level. We will consult again in the autumn.

1.10 Whilst these proposed obligations would be an important step forward, we believe further action will be needed in order to give consumers the level of coverage they expect. The UK Government has requested advice on the key options policy makers have for facilitating improvements in coverage.

There are four main options for improving coverage further

1.11 Broadly speaking we believe there are four main options:

- Public subsidy to fund further rollout of coverage.
- Rural wholesale access: allowing consumers to use one another's networks in rural areas where their own network lacks coverage.
- Infrastructure sharing between operators.
- Further easing of planning barriers or other cost reduction measures.

1.12 We discuss these levers for improving coverage in more detail below. Some of the levers in question sit with Ofcom and some with the UK and devolved Governments. In order to make sustained progress on coverage, we therefore believe Ofcom and Government will need to collaborate closely. We will also continue dialogue with the mobile operators and other relevant stakeholders about what more they can do to improve coverage and how Ofcom, the UK Government, the devolved administrations and local authorities can facilitate their efforts.

1.13 As we explain below, there are challenges associated with all of the options we have considered. We have a longstanding public commitment to include coverage obligations in the 700MHz award. We therefore view the measures discussed in this document (if taken forward) as potential complements to the 700 MHz coverage obligations rather than substitutes for them.

Subsidy would be needed to materially improve coverage in total not spots

Section summary

- Any public subsidy is a matter for government, but subsidy is likely to be required to address total not spots that continue to exist after the 700MHz coverage obligations are delivered.
- Achieving near universal coverage would cost around £3-6bn.
- Direct subsidy is unlikely to be an effective means of addressing partial not spots.

1.14 Areas of poor coverage fall into two broad categories: 'total not spots', where no operators are present; and 'partial not spots', where at least one, but not all, operators are present. While this distinction is meaningless to a consumer experiencing poor coverage, it is

important for determining the most appropriate route to fixing the problem. As set out in Table 1, total not spots currently make up around 7% of the UK's landmass and partial not spots make up around 23%. We believe that once the 700 MHz coverage obligations have been delivered around 4-5% of the UK's landmass will be in a total not spot.

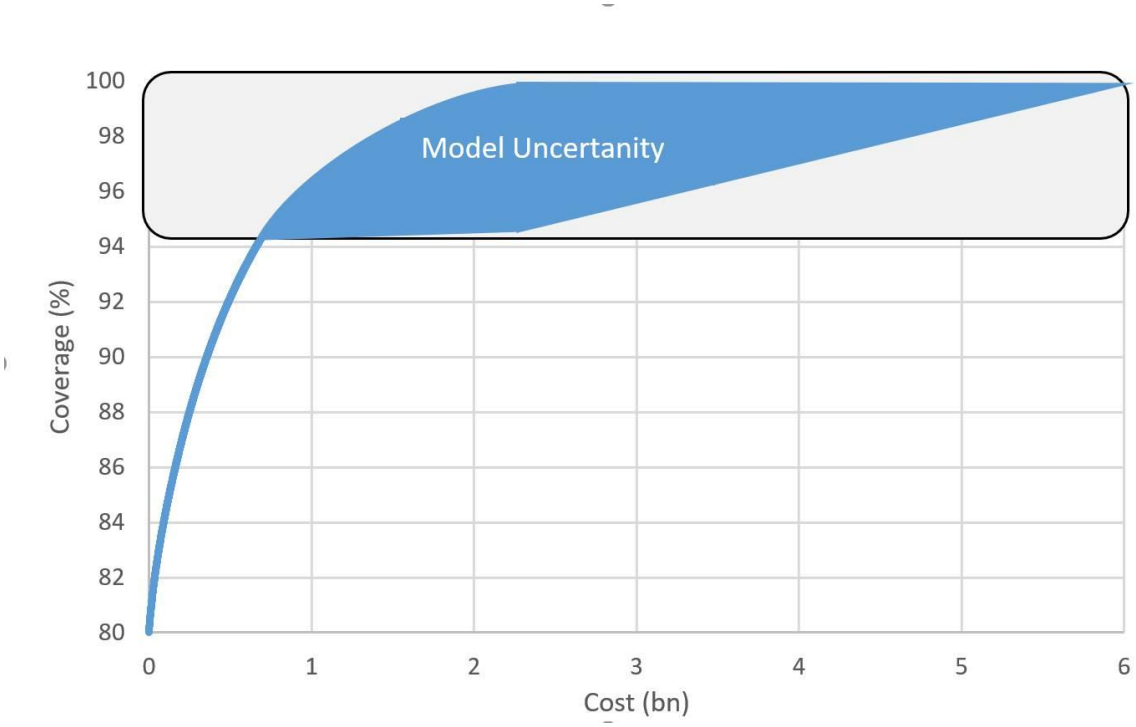
1.15 Once the 700 MHz obligations have been delivered, some form of public subsidy would likely be needed in order to bring about any further material reductions in total not spots. Any decisions on subsidy would be a matter for Government. Consumer benefits would be greatest if new coverage was available to customers of all operators. However, it would not be efficient to roll out four sets of infrastructure in total not spots. Therefore if the UK Government or devolved administration chose to subsidise new coverage there would be a strong argument for contracting one operator to build and operate masts in total not spots and allow customers of all networks to access the coverage provided by those masts. There is an argument that contracting a mobile operator to build sites in outlying areas would be more effective than contracting a third party. This is because mobile operators would have the incentives and expertise to locate sites in areas which provide useful coverage. Whereas a third party may be incentivised to locate sites where it was easiest to build them even if this did not optimise coverage.

1.16 We estimate that the costs of one operator providing outdoor coverage across the final 5% of the country, and opening this up to customers of all networks, would be between £3bn and £6bn. Around half of the total cost is likely to be associated with capex required for mast build and the remaining half is the 20 year NPV of ongoing operating costs (power, site rental, backhaul etc). We estimate that costs would be roughly double if all four operators extended coverage to the final 5% of the country using their existing infrastructure sharing joint ventures.

1.17 In our consultation on the proposed 700 MHz coverage obligations we estimated that it would cost around £300m for an individual operator to increase its geographic coverage from c. 80% to 92%. As this comparison demonstrates the costs of providing coverage increase exponentially in the final few per cent of the country. This part of the country consists mostly of remote areas where the terrain makes it especially difficult and costly to find sites for and construct mobile masts. Not only is each individual mast likely to be more costly in the final 5% of the country, but the number of masts needed to provide coverage will be especially high. This is because the challenging terrain in these areas will mean that on average each individual mast provides less coverage than normal.

1.18 There is a large degree of uncertainty around our cost estimates for covering the final 5% of the country. The costs will vary significantly from site to site and will depend in large measure on the specific design challenges encountered at the sites in question. Without doing a detailed network planning exercise, it is not possible to be certain of the costs. The mobile operators are likely to have their own views on the costs and challenges associated with achieving near-universal coverage. We have factored this uncertainty into the cost range we show in Figure 1.

Figure 1: Costs of increasing an operator's coverage from 80% to 99-100%



Source: Ofcom estimates

1.19 Consistent with our definition of coverage, these cost estimates are for a service which delivers a high certainty of 2Mbits/s data download speeds. Costs would be significantly higher if the UK Government or devolved administrations wanted to deliver a high certainty of higher speeds.

1.20 The value for money case for covering 100% of the country may not be clear cut. In the final few per cent of the country there is likely to be a case for identifying which areas are local priorities for coverage deployments and focussing any subsidy on those areas in the first instance. This prioritisation exercise would need to be undertaken or facilitated by a central procuring body. However, Ofcom could support any such exercise for instance through provision of information on existing coverage. This would allow devolved administrations or local authorities to push forward their own national, regional or local initiatives.

1.21 Public subsidy could be direct (e.g. public procurement); or indirect (e.g. coverage obligations in new spectrum licences). There is an argument that direct subsidies are generally likely to be more efficient than indirect subsidies as they are less likely to distort operators' behaviour and incentives.

Rural wholesale access is challenging but has the potential to be a credible solution for partial not spots

Section summary

- Rural wholesale access arrangements could result in a coverage uplift of 5-10 percentage points for the lagging operator. Taken together with our proposed coverage obligations, this could mean that customers of all four operators could get coverage in around 90% of the UK.
- We estimate introducing rural wholesale access would cost £5-15m per operator and annual opex of £2-3m per operator.
- There is a risk rural wholesale access could undermine investment incentives, but prima facie we think wholesale pricing could mitigate this risk to some extent.
- Operators have raised questions about our legal powers to mandate wholesale access in the mobile market. The surest way to introduce rural wholesale access arrangements would be in collaboration with the operators. Reaching such an agreement would be challenging.

Rural wholesale access would help address partial not spots, the costs do not appear disproportionate

1.22 Mobile operators have chosen to focus to different degrees on achieving wide coverage – some view coverage as a competitive differentiator while others focus instead, for example, on low prices. This gives rise to partial not-spots where one or more operators are present but others are not. One way of addressing partial not-spots would be for the mobile operators to put in place rural wholesale access agreements, whereby they allowed one another's customers to roam onto each other's networks in rural areas. This would mean that where operator A was present and operator B was not, operator A would carry traffic from operator B's customers, and vice versa. Whilst it would help address rural partial not-spots, it would not improve coverage in total not spots.

1.23 If implemented, it would make sense to constrain these arrangements to rural areas. This is because:

a) it would allow some mitigation of the resulting investment risks;

b) coverage problems are primarily concentrated in rural areas;

c) technically we do not think it would be possible to implement wholesale access in densely populated localities in a way which gave an acceptable consumer experience.

1.24 When assessing the impact rural wholesale access agreements would have, we have used the levels of coverage we anticipate after delivery of our proposed 700 MHz coverage

obligations as a baseline. We believe that if we implement the coverage obligations we have proposed:

a) Around 95% of the UK's landmass will end up with coverage from at least one operator;

b) Two operators will provide 92% geographic coverage; and

c) The operators that do not hold obligations are likely to deploy coverage to 80-85% of the UK's landmass.

1.25 The improvement in coverage rural wholesale access would deliver would depend on a wide range of factors including: who acquires the obligations and where they roll-out new coverage; the extent to which operators collaborate to optimize the process of handing traffic over from customer's home network to the host network (the network carrying the consumer's call when their home network is not present); and the specific technical details of how handover between networks is managed. At this stage there is some uncertainty about these factors. By implication, it is not possible to be certain about the precise impact. However, indicatively we believe that, if coupled with our proposed coverage obligations, wholesale access could result in customers of all networks getting coverage in around 90% of the UK. In the most optimistic scenario, it might possibly result in customers of all networks getting coverage in up to 95% of the country.

1.26 The quality of consumer experience when on a host network would not be as good as when covered by their home network. When phones switched from the home network to another network, calls would likely drop and data sessions would stall. There would be a time lag between disconnecting from the home network and reconnecting to the host network. We estimate this could last in the order of up to a minute (although this would depend on the precise technical solution used). In order to ensure rural wholesale access delivered a decent quality of consumer experience, it would be important for the operators to work together to optimise the way the service worked.

1.27 The impact of rural wholesale access on good quality data coverage would be markedly less pronounced if it were implemented without the 700 MHz coverage obligations. This is because the coverage obligations will expand the amount of 4G coverage there is for people to roam on to.

1.28 Our provisional estimate, based on a report from consultants Real Wireless, is that wholesale access agreements in rural areas might cost each operator in the region of £5-15m in capex and £2-3m per year in opex to implement. Real Wireless has also estimated that implementing such agreements would take between 9 and 18 months from the point of a decision to implement (although this implementation period would be preceded by a significant period of discussion between operators, Ofcom and the UK Government around the specification of the service).

There is a risk that rural wholesale access arrangements could undermine investment incentives

1.29 Rural wholesale access would reduce the extent to which operators could differentiate themselves on the basis of coverage or network quality. There is therefore a potential risk that it could have a chilling effect on investment in networks. This could manifest itself in three ways:

a) Operators might decommission existing masts in some rural areas if offering coverage in these areas ceased to be a source of competitive differentiation. If left unmitigated this could result in a reduction in coverage in some areas;

b) Operators might stop building new masts to expand coverage in rural areas if doing so no longer gave them a competitive advantage; and

c) Operators might be deterred from upgrading masts to new technologies in existing partial not spots in rural areas if other operators could piggy-back off their networks. For example, there is a risk rural wholesale access could have an adverse effect on incentives to invest in 5G.

We believe risks can be mitigated to a degree

1.30 Creating a climate which is conducive to investment is at the core of our strategy. Greater investment can benefit consumers by increasing the availability of high quality services. Any material worsening of the investment climate therefore has the potential to harm consumers. Consequently, if rural wholesale access were introduced it would be important to find a way of mitigating the investment risks we have highlighted.

1.31 In principle, we believe that wholesale pricing has the potential to alleviate our concerns about investment incentives to a degree. If the wholesale price on which operators offered to their competitors were set at the right level then we would expect investment incentives to be largely preserved. Conceptually, we believe that to mitigate the investment risks the price of rural wholesale access agreements would need to be sufficient to offset:

a) the marginal cost of carrying additional wholesale traffic; plus

b) loss of the benefit the host operator derived from offering superior coverage in a given area.

1.32 If a price achieved this, it would in effect compensate operators for any loss of commercial advantage and ensure they retained incentives to invest. Ensuring that the price was at broadly the right level would therefore be critical to the success of the regime.

1.33 If rural wholesale access were introduced, we believe that at a high level there are two potential approaches to pricing:

a) **Commercial negotiation with arbitration as a backstop**: Under this approach, operators would be required to offer wholesale access to each other's networks on

commercially reasonable terms. If they could not reach an agreement they could refer a dispute to Ofcom. Such disputes could be challenging to resolve.

b) **Ofcom sets the wholesale price upfront:** Setting a price would be complex. Information asymmetries between us and the operators mean that it would be difficult to quantify the impact of any loss of competitive advantage an operator incurred as a result of allowing its rivals access to its network. If we set the price too low there is a risk that investment incentives would be harmed. If we set the price too high there is a risk that no operators would take the service up. Our initial view is that, if in future we had to set a wholesale price, the balance of risks would be better managed by erring on the side of setting a high price and running the risk of reduced uptake of the service.

1.34 Whatever approach we took, establishing a price would be difficult. However, prima facie we consider that it is credible to think that we could design a pricing mechanism which mitigated, to an extent, the investment risks associated with rural wholesale access.

The best way to introduce rural wholesale access would be with the co-operation of operators

1.35 In the past, most mobile operators have been strongly opposed to the idea of Ofcom or Government mandating wholesale access arrangements in the mobile market. They have argued that Ofcom's powers and case to mandate such arrangements are unsustainable and we expect they will continue to take that position. As we have set out above, rural wholesale access would be more likely to deliver a good quality of consumer experience if operators willingly collaborated to optimise the service. If Government wished to implement wholesale access the surest way of doing so would be to introduce it in co-operation with operators. However, given their historic opposition, getting this sort of co-operation from operators would likely be very challenging.

Infrastructure sharing may have a role to play in improving coverage

1.36 Infrastructure sharing can improve the business case for rolling out new sites by allowing operators to share costs. It may also have a role to play in closing partial not spots as it grants operators access to existing sites in areas not covered by their own network. However, its use in partial not spots will be constrained by the fact that some existing masts may not be suitable for sharing.

1.37 A significant amount of infrastructure sharing already occurs in the UK, particularly within the following two joint ventures :

a) Cornerstone: O2 and Vodafone have developed a joint network, dividing the UK into two geographic zones outside London (east and west). London is treated differently and is divided north to south for 4G technology. Within each territory, one operator is the 'host', owning and operating the sites used by both companies. The arrangements involve both passive sharing (within London) and active sharing (in the rest of the UK).

The resulting shared network has consolidated traffic over a reduced number of sites. Both operators maintain their own core networks.

b) MBNL: Three and EE share nationally passive infrastructure for most of their network technology and have shared active elements of their 3G network. The two operators maintain their separate core networks.

1.38 These are commercially led agreements and we estimate that within each joint venture most sites sites are shared. However, there is only a limited amount of site sharing between the joint ventures. Together with the UK Government and devolved administrations we have supported the use of sharing where it is practicable. To this end there are measures currently in place to facilitate, and even mandate, sharing. These include:

a) The Electronic Communications Code (Conditions and Restrictions) Regulations:[3] Regulation 3(4) of the Code Regulations states: "A code operator, where practicable, shall share the use of the electronic communications apparatus." The Electronic Communications Code was also recently updated to make the process of sharing sites easier for MNOs.

b) The Communications (Access to Infrastructure) Regulations:[4] The ATI Regulations grant MNOs the right to request information, a survey and access to competitors' sites for the purposes of installing high speed network equipment. Operators may refuse a request where it is unreasonable, based on objective, transparent and proportionate grounds.

1.39 Newer forms of sharing may become increasingly prevalent in future. For example, the advent of 5G, will enable 'network slicing' - dedicated virtual networks that are tailored to different services or customers using a common network infrastructure.

1.40 We are considering ways in which Ofcom can facilitate further sharing, particularly for new sites (since some existing masts are unsuitable for sharing). This includes a proposal within the 700 MHz consultation to require operators to share information on new sites in rural areas earlier in the planning process. In addition, we are investigating whether more could be done to encourage passive sharing, for example via further reform of planning frameworks or by adjusting the spectrum licensing framework to facilitate the emergence of neutral hosts.

[3] SI 2003/2553.
[4] SI 2016/700

Further planning reform would facilitate coverage rollout, but is unlikely to bring about a step-change on its own

Section summary

- Further liberalisation of planning rules would help improve mobile coverage.
- Closer alignment between the planning rules applying to mobile operators and those for water and energy operators would make it easier and cheaper to expand coverage.
- Business rates make up a significant proportion of opex at rural sites. Business rates relief could therefore play a meaningful role in facilitating new coverage roll out.

1.41 The UK Government has reformed regulations to reduce barriers to deploying mobile infrastructure and we have supported this effort. As well as updating the Electronic Communications Code to make it easier for operators to deploy and maintain mobile sites, planning reforms were introduced in England in 2016 to allow higher mobile masts under 'permitted development rights' to support rural coverage. Scotland introduced its own reforms in 2017. While these reforms will have a beneficial impact for coverage, particularly in rural areas, their effect will take some time to feed through.

1.42 We support the UK Government's creation of a cross-government barrier busting taskforce that is considering how to overcome the specific challenges in the deployment of telecoms infrastructure. The taskforce is looking at issues such as the costs of street-works, further planning liberalisation, simplification of wayleave agreements, as well as tackling any other barriers to rollout. We believe this is an important initiative and we are keen to support it where possible. The barrier busting task force has identified a range of measures that could reduce the costs of building and operating new masts, thereby facilitating coverage roll out both in total and partial not spots. Three salient examples of steps that could help are:

a) **Aligning mobile operators' rights with those of other utilities -** Agreements between operators and landlords are voluntarily negotiated, and may require agreement from multiple parties. This can take time and result in higher fees being paid for access. This process could be aligned with those available to utility companies, in which prices can be capped and operators have rights of access (i.e. a form of compulsory purchase). This will lower costs, reduce delays and prevent landlords from denying access under the new regime. The rights of the landlords will however need to be taken into consideration in developing this process. We estimate that site access agreements typically cost operators in the region of £4-8k p.a. This is a significant proportion of opex per site, which we estimate is £20-40k p.a. on average in rural areas. Taking steps to reduce site access costs in this way could therefore play a meaningful role in facilitating coverage roll out. It could also significantly reduce operators' cost base across their existing network and make network densification in urban areas with high levels of data traffic cheaper.

b) **Aligning rules on mast heights in Wales and Northern Ireland with those in the rest of the UK –** Wales and Northern Ireland place tighter restrictions on mast heights than England and Scotland. This makes it harder to expand coverage. The Welsh Government is considering amending its planning regime to align provisions on mast heights with England and Scotland. Our analysis suggests that this could make it significantly easier to deploy new coverage in Wales. For example, increasing a mast's height from 15m to 20m can boost the coverage it provides by 10%. Increasing its height from 20m to 25m can increase its coverage by a further 19%.

c) **Business rates relief –** The UK Government recently enabled 100% business rates relief for fixed operators that install new fibre broadband. Providing similar business rates relief for mobile mast deployments could have a significant impact by making the commercial case for network expansion easier. We estimate that on average business rates account for around 15-20% of annual opex for mobile masts.

Next steps

1.43 This autumn we will publish a consultation on the 700 MHz auction. We will use this to provide more detail on our proposed coverage obligations and to set out proposals on auction design.

1.44 In parallel to developing our thinking on the 700 MHz coverage obligations, we wish to continue our dialogue with the UK Government and the devolved administrations, the operators and other stakeholders on the analysis set out in this document. This will include further dialogue with the operators on further measures they could take to improve coverage and on steps Ofcom and UK and national Governments could take to facilitate coverage roll out.

1.45 As set out above, we will also progress our thinking on potential mitigations to the investment and consumer experience risks associated with reciprocal wholesale access. This includes further work on the role of wholesale pricing.