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HOW FAST AND HOW GOOD IS YOUR BROADBAND?

Better than Average- The Forest's Need for Effective Rural Broadband

DIGITAL CONNECTIVITY SUB-GROUP, FOREST ECONOMIC PARTNERSHIP

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How Fast How Good is Your Broadband Summary

Too often the debate about rural broadband is talked about in terms of catching up to an existing average, which is significantly behind what is attainable in the urban setting.

The How Fast How Good is Your Broadband (HFHGB) first survey measures responses in the Forest of Dean District against the current national average (urban and rural) provided by Ofcom and the current Fastershire programme of infrastructure upgrades.

But it also measures those responses against the rural opportunities, where better than average fits the emerging needs of industry 4.0 and the Smart economy; the desire for better work-life balance; the need to maintain landscapes and natural resources; and the opportunity to exploit rural's role in the City Region/powerhouse models.

The British Government has pledged to serve 97% of the UK population with superfast networks and through the Universal Service Obligation (USO) that 98% get a download speed of 10Mbps minimum.

Ofcom showed in its latest Home Broadband report that while the average UK download is 54.2Mbps and superfast take-up now at 66%; rural is lagging with downloads at 28Mbps average. But even that average overstates the case as it is drawn up by these using superfast. Slower ADSL lines, the majority in rural areas, have an average download of 7.2Mbps versus urban of 11.9Mbps.

HFHGB's 381 respondents had on average a download speed of 13.1Mbps and a median of 6.3. While non-ADSL averaged 31.1Mbps; ADSL lines averaged 5.6Mbps. These are both markedly worse than the national averages.

Some of that difference is explicable by the test method. Ofcom is done within the router; HFHGB used a speed checker typically accessed by a device through wifi. Will USO be seen to be met at the router or mastersocket where it enters the house? Or is it better measured on a wifi device within the same room as usable broadband?

The national average upload speed is shown at 7.2Mbps but ADSL2 only 0.8Mbps. Overall HFHGB achieves a mean of 3.5Mbps and a median of 0.9. ADSL is 0.7Mbps mean and median and non-ADSL average 10.1Mbps and 8.6Mbps median. The concern here is the broad range of whitespots across the district achieving only 1Mbps upload. The solution could be technological in a better network, but for some it may be improvements in practice and internal wiring. Either way with a world increasingly image-based a less than 1Mbps upload can seem to be painfully slow.

Latency in a data-centric world will become increasingly important to make secure decisions in real-time. Nationally ADSL delivers latencies in the 20-30ms range and other services 10-20ms. FTTP is the fastest with a stable latency of 5-10ms. HFHGB has a mean average 136ms and median of 51ms. The ADSL responses average 152ms (median 54ms) and Non-ADSL 84ms (median 40ms). Hopefully most of our young gamers have access to fibre to avoid repeated losses, which can occur beyond a 90ms latency! Latency impacts significantly on productivity. Voice-based search relies on low latency levels to operate effectively. Nationally and locally latency has large ranges and variations from the mean for ADSL lines, which is also shown on our data.

Nationally no data was collected on satisfaction by Ofcom. Overall HFHGB respondents are somewhat dissatisfied on a 5-point scale. Those on non-ADSL lines are overall neutral but those on ADSL are highly dissatisfied. 71% of all respondents are negative. The reasons for this will be explored in future surveys. Some of this level of negativity is due to social group-think (everyone

agrees broadband is bad isn't it) and some down to the perceived need for ever-faster speeds. Latency is more problematic as it is less noticeable, but there is some evidence to suggest a general need for less than 50ms. This is particularly true for a Smart world reliant on fast wifi powered through broadband. If broadband networks will provide the backbone to autonomous driving it would need real-time data transmission currently not possible through mobile networks

Analysis by brand shows that by mean averages virtually all the brands could argue for the district they already meet USO. A breakdown of BT however shows that is only valid if ADSL is combined with fibre, as where respondents have identified the brand, average downloads are 4.7Mbps.

If HFHGB reflects the general population in the District, then we are already in Industry 4.0 with excellent work-life balances minimising commutes to work. Half of respondents use broadband for business. This ranges from dedicated lines to shared use. For half of those estimating time, more than 50% of broadband time was used for business purposes. It is suggested that there is a false divide between home and business use of broadband. They are inextricably linked as a productivity and environmental drivers of the new economy.

FEP is focused on enabling practical improvements to broadband through 3 approaches:

1. **Continuing to work with partners to facilitate the technological fix**. While some are happy with ADSL performance; most are not. Across the district ADSL needs to be optimised to deliver its maximum performance where such performance meets the USO. For others fibre and wireless are the only option to achieve the speeds they want below ultrafast. This requires communities working together to understand real benefits which result from speed.
2. **Beginning to unpick issues of perception and knowledge**. Our focus is on practical useful broadband working at the current optimum performance for the technology used. As consumers we use available tools to measure for ourselves performance. Car manufacturers will tell us the miles per gallon or per litre; we devise some method to verify it. For broadband, speed checkers are that tool and typically use wifi from a device. Work needs to be down to reduce the internal problems that reduce performance.
3. **Leading on the reality of rural broadband through succeeding surveys**. 76% of respondents indicated a willingness to participate in further research. This will be more focused. Already envisioned are a HFHG Business Only survey to complement HFHGB; a fibre v ADSL reality time test; understanding broadband satisfaction; and what works internally: what are the issues survey.

1. The Relevant Contexts

The results of the How Fast How Good is your broadband (HFHGB) survey need to be considered first in context of national targets and reports, local technological upgrades and rurality.

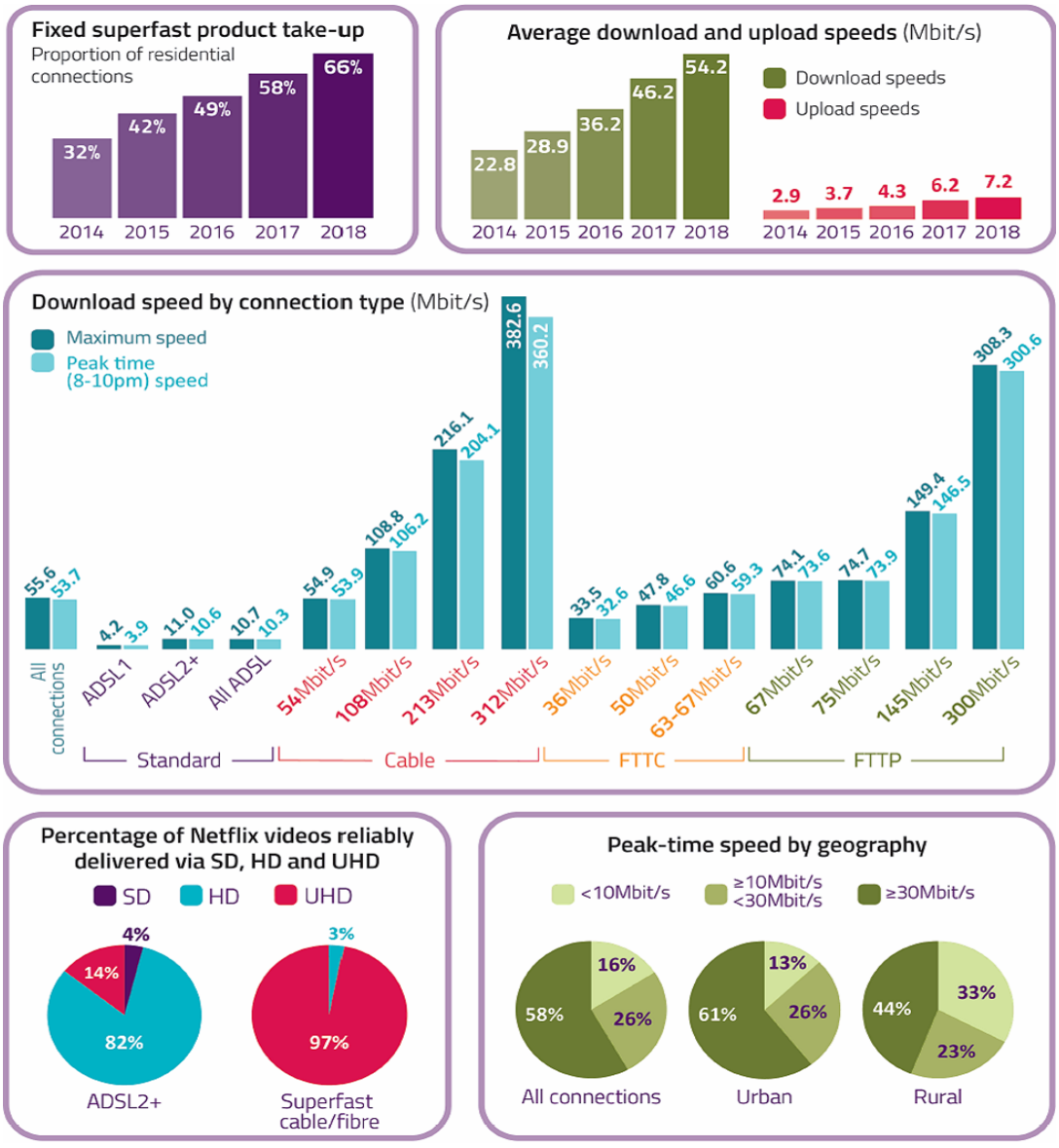
1.1 The National Context

The UK Government has pledged to:

- extend "superfast broadband" networks to cover at least 97% of the UK by March 2020; and
- meet a new Universal Service Obligation (USO), which sets a minimum download speed of at least 10Mbps for all from 2020

In addition, the Government wants Gigabit capable "full fibre" FTTP/H services to cover 10M premises by 2022, then 15M by 2025 and it has an aspiration for "nationwide" coverage by 2033.

In May 2019 Ofcom published its annual study of fixed line home broadband ISP speeds. This reported that the average download rate has risen to 54.2Mbps and uploads hit 7.2Mbps. But the gap between urban and rural areas has worsened. The Ofcom dashboard summarises the results.



Ofcom's data for the UK Home Broadband Performance Report was gathered during November 2018 via specially modified routers from SamKnows, which were installed in 4,918 volunteer homes across the UK. These routers monitor speeds throughout the day and week and is an accurate testing method. The sample size is however limited when compared to the 25M homes in the UK. It does provide useful data on overall speeds and performance of the largest Internet Service Providers (ISPs) such as BT, EE, Sky Broadband, Kcom, Plusnet, Talk Talk and Virgin Media but is weak on the other smaller providers. In the following overview of the national picture, the figure numbers are those of the Home Broadband Ofcom Report.

1.2 Technology's Impact Nationally

At present fixed line "*superfast broadband*" (24Mbps+) networks are available to around 96% of the United Kingdom, which is mostly via hybrid fibre such as the FTTC of Openreach or cable EuroDOCSIS technology. Cable covers over 50% of the UK. A very few are within reach of ultrafast over 100Mbps typically delivered by cable and by FTTP. The latter covers 7% of UK premises.

However, despite the wide coverage of superfast services, around 35% of the UK still takes slower and less reliable pure copper ADSL2+ (up to 20Mbps) lines. This drags the Ofcom overall results down. The take-up of faster connections should improve over time, but some people are also discouraged by issues of cost of faster connections, a lack of awareness or personal need and existing contract terms.

In Ofcom's Connected Nations report, Ofcom uses an alternative method of taking the technical data provided to ISPs as the speeds possible to that premise. This calculates higher performance speed as it does not allow for speed attenuation within the premises such as through internal wiring. However this adds confusion to the situation for the end-user as figures from speed checkers never tally with the 'possible' figure.

Any discussion of broadband can become quickly mired in technology discussions. These often focus on the performance of a technical solution rather than the experience of individuals, unaware of technical differences, who complain ardently of poor speed. For example, the Ofcom research shows that average download speeds in rural areas (28.0 Mbps) were less than half those in urban areas (62.9 Mbps). The Broadband Performance 2018 Report explains that some of this is due to technology:

"*A characteristic of the copper technologies used to deliver ADSL and FTTC broadband is that speeds slow down due to attenuation over the length of the copper over which data travels. With ADSL, data travels over copper all the way from the local exchange to the end user's premises, whereas with FTTC copper is only used from the street cabinet to the end-user. As ADSL copper lines tend to be shorter in urban areas than in rural ones (where population density is lower), urban lines tend to perform better than those in rural areas.*

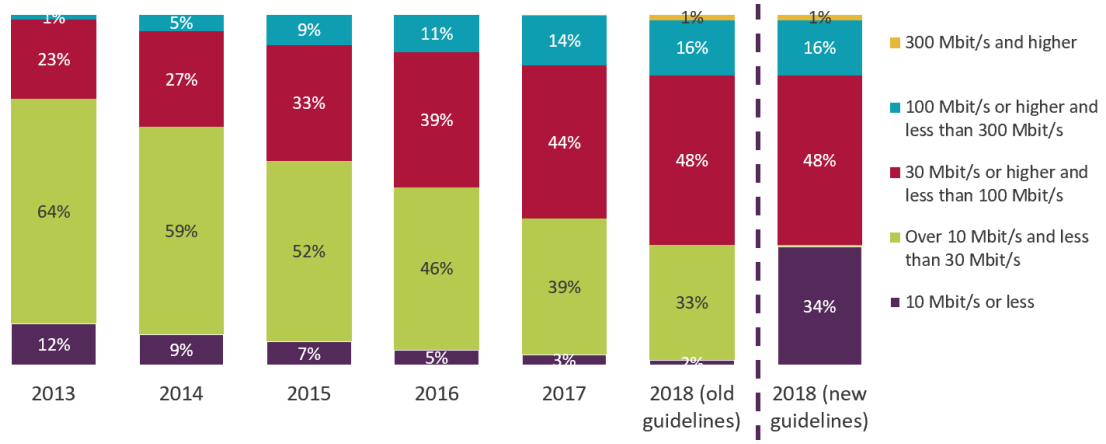
For ADSL connections, the average 24-hour download speed in urban areas (11.9 Mbps) was 65% higher than the 7.2 Mbps average in rural areas. There is less variation in the length of copper line from the street cabinet to the user's premises, and we found that average FTTC download speeds in rural areas (43.8Mbps) were in line with those in urban areas (47.8Mbps).

Most rural ADSL customers who upgrade to FTTC will experience a significant increase in performance, and average FTTC download speeds were around six times faster than ADSL average download speeds in rural areas in 2018."

So, the choice is therefore seen to be a purely technical-economic one. This assumes consumers understand the issues and choose logically.

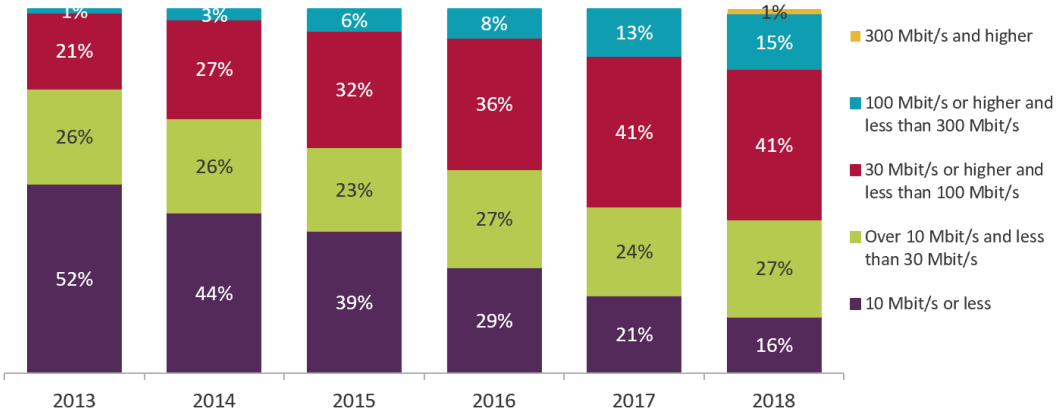
1.3 National Download Speeds

Figure 2: UK residential broadband lines, by advertised speed: 2013 to 2018



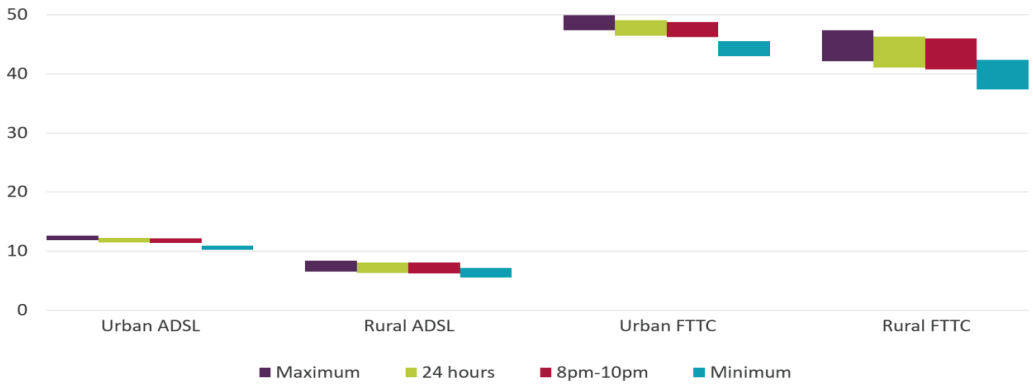
New guidelines were issued in 2018 on the download speeds that could be advertised for residential lines. This created a significant jump back to 34% of premises now being advertised at less than 10Mbps where under the old standard it was shown as 2%. This relates primarily to ADSL lines. While this is a change for the better to reduce confusion, it does little in the short term to promote trust in what is the real speed.

Figure 4: Distribution of average 24-hour download speeds: 2013 to 2018 (Mbit/s)



From Figure 4, 16% of the national population would in 2018 experience an average download speed of less than 10Mbps. 84% already achieve above the USO of 10Mbps.

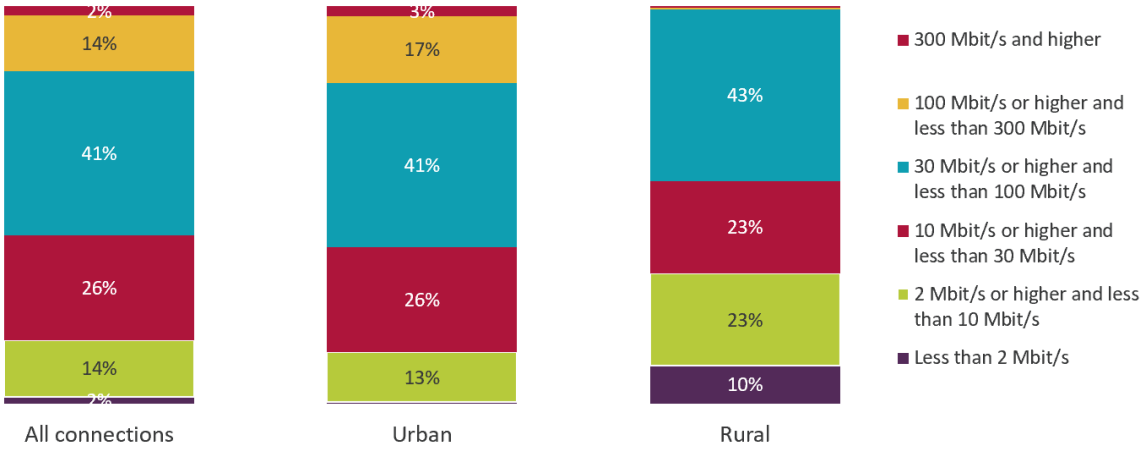
Figure 6: Average ADSL and FTTC download speeds, by rurality: 2018 (Mbit/s)



But the data shows a distinct rural:urban divide and compared to earlier reports that gap is widening. For example, Ofcom's figure 6 illustrates clearly the divide on ADSL. Urban domestic users achieve USO: rural falls below even on maximum speeds. There is less discrepancy between urban and rural areas on FTTC.

For domestic users 8-10pm is seen to be peak time when typically the whole family might be home with multiple devices in use for the range of social, leisure, work and study purposes.

Figure 7: Distribution of average peak-time, fixed broadband download speeds, by rurality: 2018 (proportion of lines)



Overall the proportion of lines receiving an average peak-time download speed greater than 30Mbps was lower in rural areas of the UK (44%) than in urban areas (61%), and while 13% of urban lines had a peak-time speed of under 10Mbps, the proportion was 33% in rural areas.

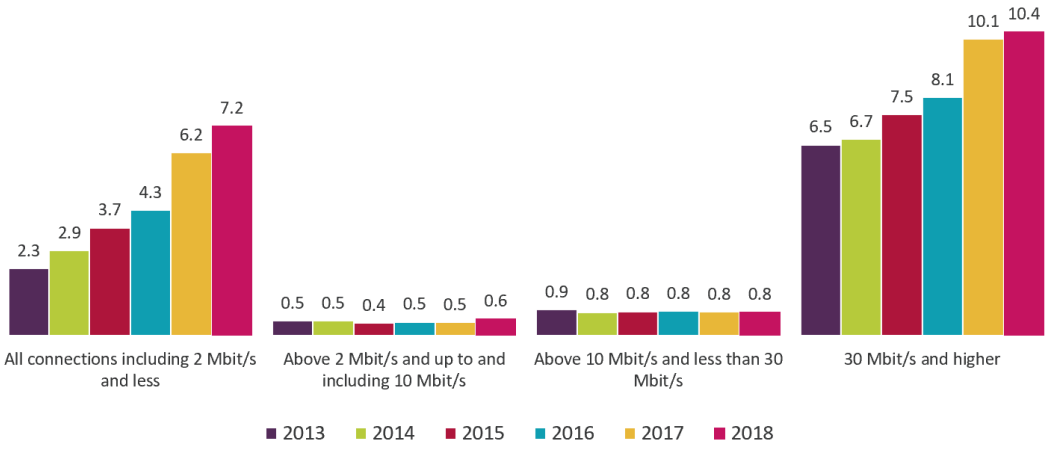
Technologies that use copper wire (ie FTTC and ADSL) are often negatively impacted by signal attenuation over distance and are prevalent in rural areas. Likewise, ISP network congestion, traffic management and service faults (branches on the line) also have an impact. These results are measured to the router; no allowance is therefore made for the impact of wifi, which often slows performance much further.

There are still some parts of the UK where "*superfast*" connections have yet to reach. At the same time commercial deployments of "*ultrafast*" networks in urban areas are naturally growing at a

faster pace than in rural locations. Both highlight a growing and worrying split. Ofcom's data only really considers the two most common rural broadband technologies, hybrid fibre FTTC and pure copper ADSL lines.

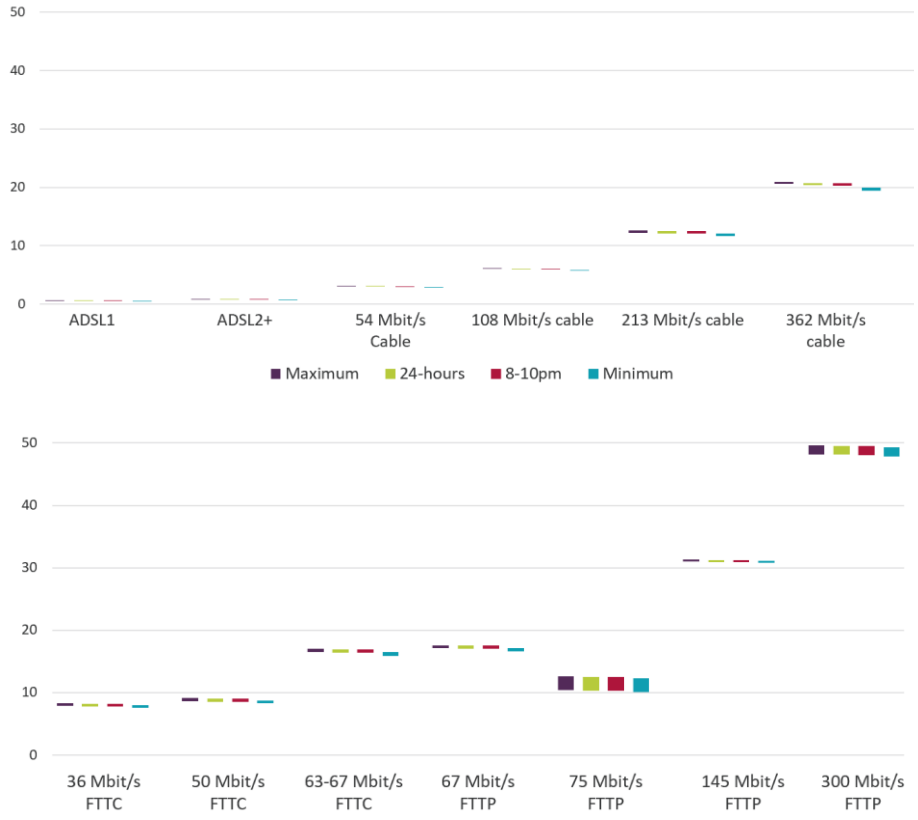
1.4 National Upload Speeds

Figure 27: Average UK fixed broadband upload speeds (Mbit/s): 2013 to 2018



In 2018 the average national upload speed was 7.2Mbps. But there is a significant skew with technology. ADSL2 achieves an average of 0.8Mbps but FTTC 10.4Mbps. This is seen in figure 28 where upload is shown by technology type. ADSL is barely off the baseline.

Figure 28: Maximum, average, peak-time and minimum upload speeds, by technology & service tier:



1.5 National Latency Levels

The third factor of interest is latency. This is a useful measure of the time (delay in milliseconds) that it takes for a packet of data to travel from your router to a remote server and then back again (ping). A lower number (shortest time = faster) here is better. This is particularly important for fans of online multiplayer games, where a low ping can result in smoother gameplay. Most modern connections should deliver good latency performance, unless there's a problem within the providers own network, local network setup or a remote internet server.

Overall ADSL2+ typically deliver latencies of 20-30ms and other services typically 10-20ms at the national level. FTTP is the fastest with a stable latency of around 5-10ms.

All broadband services suffer from contention (when networks become congested in busy periods). This can impact on latency at peak time but such network congestion can be localised. The Ofcom data shows that those likely to suffer most with the largest coefficient in variation (the biggest range around the mean average) are ADSL1 (56%) and ADSL2 (44%) compared to 20% FTTC or 5% FTTP.

1.6 The Local Technology Context

Fastershire is a partnership between Herefordshire Council and Gloucestershire County Council to bring faster broadband to the two counties, with funding from central government's Broadband Delivery UK matched by the local authorities. The ultimate aim is that by the end of 2019/20 there will be access to fast broadband for all who need it.

Phase 2 of the project's strategy will increase total superfast coverage to around 98%, as phase 2 seeks to provide faster broadband to premises that were not covered by Phase 1 or commercial rollout.

However, Fastershire is not only about technology, the project also includes social and digital inclusion activities, and an extensive business support programme, FasterBusiness. The programme is designed to help small and medium size businesses get the most from fibre broadband and be more competitive. In fact, it is expected that Fastershire will help to boost the local economy by £420m over the next ten years.

The Strategy falls in the following phases to provide a technological fix:

Phase 1 of the Fastershire strategy has provided approximately 90% of the homes and businesses across Herefordshire and Gloucestershire with access to superfast broadband and speeds of 30Mbps or above. Note this percentage is across the whole of both counties and includes urban centres.

Phase 2, Stage 3 - Rural Herefordshire and Gloucestershire. Gigaclear has been awarded the Fastershire delivery contract for rural areas of the county. Gigaclear is a wholesale network provider and internet service provider (ISP) who specialise in connecting rural communities by installing its pure fibre network straight into the property. Pure fibre, also known as Fibre to the Premise (FTTP) offers a more future-proof solution and broadband speeds of up to 1000Mbps. This technology is not affected by how far your home is from the network cabinet and the connection is symmetric so you get the same upload and download speeds.

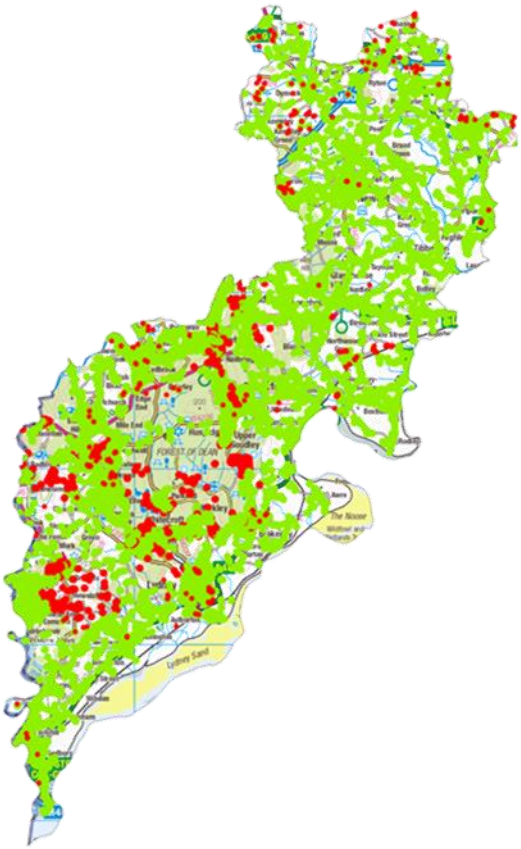
Phase 2, Stage 4 For the remaining, hardest to reach properties, Fastershire is using a mix of solutions, including a bespoke grants and contract extensions.

- *Business Grant*. Fastershire, in partnership with Connecting Shropshire and Superfast Telford and part funded by the European Regional Development Fund, have designed the Marches

and Gloucestershire Broadband Grant. The grant provides up to 100% of the capital installation cost for an eligible SME that not be included in Fastershire's main rollout and that can demonstrate the economic return.

- *Viable Clusters*. Fastershire has been awarded funding from the European Agricultural Fund for Rural Development (EAFRD) and has identified a number of significant property clusters that could benefit from this funding.
- *Contract Extensions*. For the remaining properties, Fastershire will be exploring possible contract extensions with BT and Gigaclear to provide access to faster broadband.

The images below highlight achievements to date and work still to be done within the Forest of Dean District area. The green dots reflect completed work; the red work in progress or planned. 2,249 district premises are currently included directly in Fastershire work.



Stage 3 2018

Stage 4 2019-

1.7 The Current Rural Context of the District

The Forest of Dean District is officially classified by DEFRA as being 95% rural. Forestry and agriculture have been traditional mainstays of the economy and still employ 6.9% of the workforce. It is one of 2 rural, 2 semi-rural and 2 urban districts in the county of Gloucestershire.

The District borders the counties of Herefordshire and Monmouthshire (and a bit of Worcestershire). Each of these are still predominantly rural and together are the lower half of the historic Marcher counties which formed the protective defensive forgotten buffer between Wales and England. For the District relative isolation was made easier by the rivers Severn and Wye providing natural

boundaries and geology creating issues for road-building. Its early use as a Royal Hunting Forest for Anglo Saxon Kings established the beginnings of its tourist trade, now employing 7% of its workforce.

Yet if a visitor looks at the district as a rural place built on agriculture/tourism and solely reliant upon it economically, they would be mistaken as 86% of the workforce are not employed in those sectors.

The Forest has always been a working forest where timber production and silviculture is important. However, 15.9% of its employees are in manufacturing with sites spread across the District in large and local business parks and small individual premises. This is twice the urban national average and 4% higher than the rural national average. And more than those employed in tourism and agriculture combined. 4%, the highest proportion in Gloucestershire, work in transport and storage aka logistics. While education and health & social care make up almost a quarter of the workforce from the Gloucestershire Agrifood and Rural Economy report for Gfirst.

The District's 4,300 companies are by ONS categories typically small and medium sized enterprises. But within those companies are niche world-beaters with significant export markets inside and outside the EU. The whole workforce in the District is not just those employed in District-based businesses. With greater work-life flexibility and the opportunities offered by the digital world; it is apparent that a number of managers and specialist staff may work from home for a number of days per week. This opportunity requires effective broadband for a seamless service.

Industry 4.0 is reliant on effective broadband to deliver its benefits. The District already has a very mixed economy which can integrate effectively with others either as the producer of goods or the designers producing elsewhere. A business only survey is planned for 2020 to complement HFHGB.

From discussions within the sub-group and approved by the stakeholder group of 160+ organisations, FEP sees specific opportunities for the district related to digital connectivity which go beyond mean averages:

- **Smart Rural Leadership**. Much is made of Smart Urban. Often the commentary is about smart cities where the economies of scale and population density enable the deployment of technology that underpins the apps and expected functions. This exactly matches broadband deployment. FEP has previously highlighted the growing gap between urban and rural and creation of diverging twin track economies and technology. Development of smart vehicles for example is currently predicated on urban where sufficient sensors can be deployed outside of the vehicle to keep its weight low enough to be environmentally friendly. What happens when there are no broadband or 5G powered sensors in the rural environment? FEP seeks to fill this leadership void through collaborating to develop practical solutions that balance needs with cost. For example, we have debated the need for deliberate whitespots to respond to quality of life issues and build costs to ensure that widely understood pragmatism is used.
- **Tech Nation Aspiration**. With a district history of innovation, FEP will be assessing the potential for a Tech Nation cluster with others in the relevant travel to work area. This also relates to the potential for cyber-security at all levels with the developments at Cheltenham and Newent. This aspiration balances natural capital with the ability to work remotely already evidenced by some ICT companies in the district.
- **The national Industrial Strategy promotes 4 Grand Challenges**. Three apply directly to broadband in the District:
    1. AI and a Data driven economy demands effective broadband operating reliably at set standards. It also requires that the rural economy accepts that unless the price premium for highest speeds are met, they are not attainable for all. Conversely a lower constant

speed and latency can be depended upon that meets and exceeds actual needs for most people. Given the issues of the ADSL fixed line networks, this might only be attainable through fibre or 5G. But some are happy with the current capabilities. HFHGB looks to establish some baselines.

2. Mobility is crucial to rural areas with a rebalancing of the use of public and private vehicles. Here app-based technology has a role to play which integrates mobile with broadband to create real time flexibility. This is a project currently proposed as a discussion in UK 5G Connected Rural Communities projects.
3. The District population is an ageing population where the creation of a new hospital requires integration with other health and non-health provider to create efficient services. It is inconceivable that effective broadband does not have a role to play.

2. HFHGB Methodology and Sample

The aim of this survey was to understand more fully the actual speeds experienced by users in the District and their level of satisfaction with those speeds.

This survey was not an attempt to repeat the SamKnows/Ofcom approach at a local level nor to use the technical tools to say what speeds a property might receive at the router level. Rather it asked respondents to report their tested speeds from an individual speed checker as this reflects more closely the speeds they might actually experience from their devices. Complaints arise from the actual speeds experienced not from a speed that is said to be technically possible from a router plugged into a master socket and then linked by a short cable to a device. When a domestic property checks its speed it will do so through a speed checker, not through asking what the provider says is possible. The latter is a purchase option decision; the former purchase remorse from poor or less than expected experience.

Respondents to this survey self-selected to answer. They became aware of the survey url by the following means:

- Emails to the FEP stakeholder group
- Social media posts on Facebook and Twitter and some social media advertising on Facebook
- Publication of some interim results in the local free Review newspaper which appeared online and in hard copy.
- Referrals by others such as neighbours and local activists
- Business networking group presentations such as CAP.

The survey remained open from 6th June to 6th August. The Review article appeared at the end of July. Over half of the responses were completed in the last 2 weeks.

On getting to the url, respondents were requested to follow the link to the Which Broadband checker and to run the checker. They were to note down the three figures on response time (latency), download and upload speeds. The remaining seven questions covered:

- Level of satisfaction with broadband speed from highly satisfied, somewhat satisfied, neutral, somewhat dissatisfied and highly dissatisfied.
- Whether the broadband was used solely for domestic or business purposes or both. If both could they estimate the domestic percentage.
- Who was their broadband provider from a list with prefer not to answer and other with a request for the provider name.
- Address details.

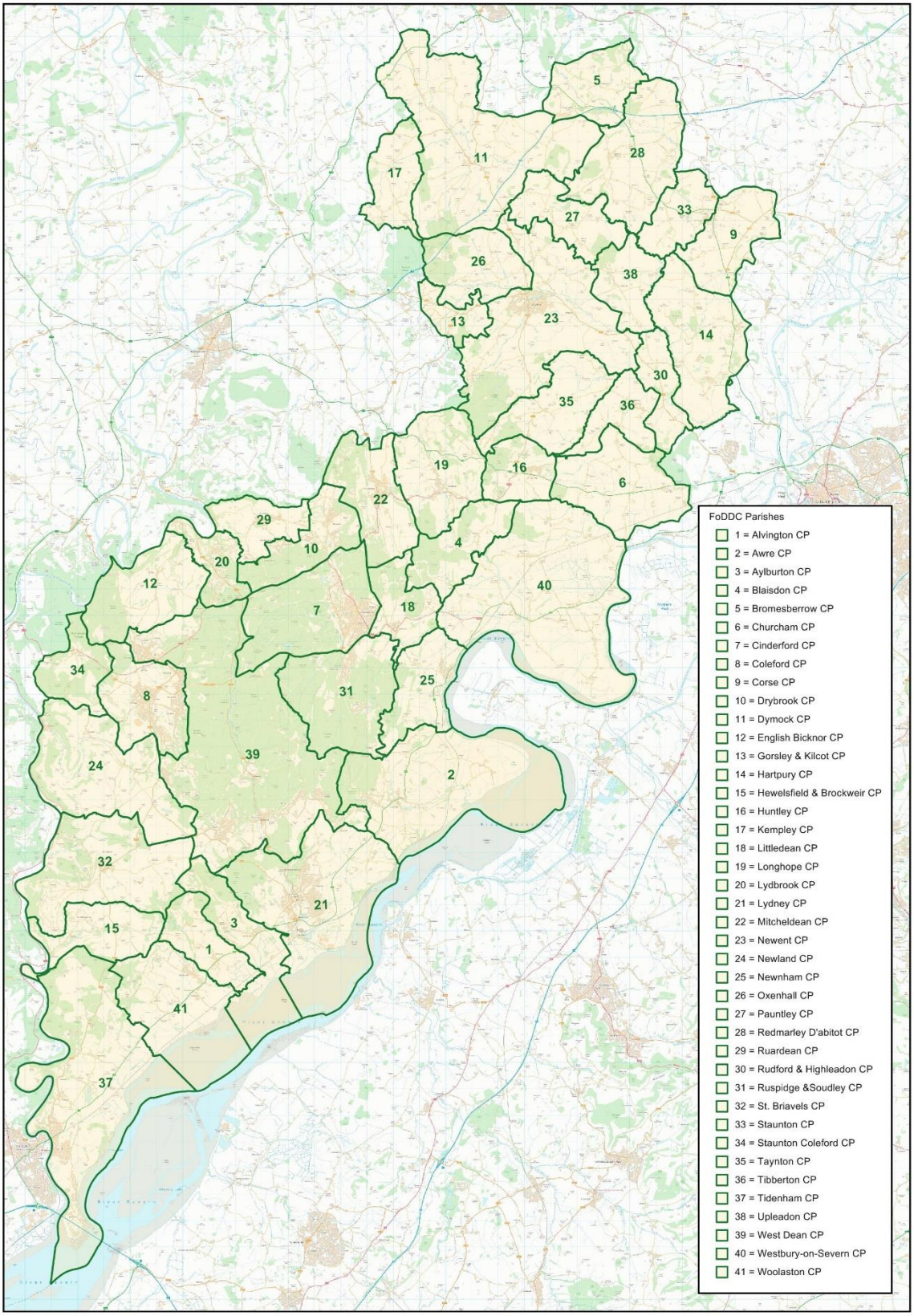
- Age group of respondent.
- Current employment status.
- Whether they wish to be involved in future research stages.

The survey software automatically logged the date and time of the response. It was assumed that this would be roughly the same time as the checker had been used. As each had to provide their address, we were able to exclude those who did not live in the District such as Cheltenham and central Chepstow.

Appendix A discusses the recognised limitations of this survey approach. There were over 407 on-line responses to the survey. These were reduced to 381 complete questionnaires when those out of District, duplicate answers for the same property, offensive/nonsensical responses and those not providing an address were removed.

The responses were drawn from across the District. Response levels were higher in the South and Western parts of the area. 6 parishes had no responses typically in the North of the district. The data is shown at parish level to avoid the identification of particular areas and the opportunity for mis-use of the data. It was clear from the responses that for some villages there were particular active people who rallied their neighbours to respond such as in Clifford's Mesne part of Newent, Kempley or Hewelsfield. We thank those activists who prove that community driven solutions are heard.

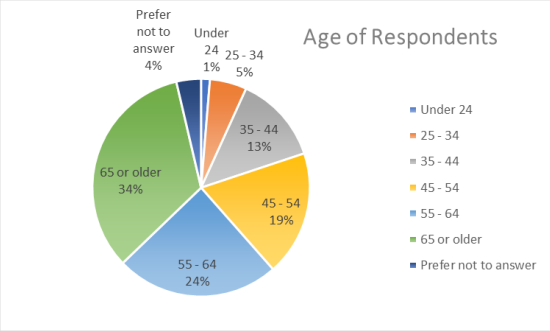
Map Key	Parish Name	Sample Size
1	Alvington CP	8
2	Awre CP	6
3	Aylburton CP	6
4	Blaisdon CP	-
5	Bromesberrow CP	-
6	Churcham CP	3
7	Cinderford CP	19
8	Coleford CP	31
9	Corse CP	-
10	Drybrook CP	8
11	Dymock CP	2
12	English Bicknor CP	1
13	Gorsley and Kilcot CP	5
14	Hartpury CP	-
15	Hewelsfield and Brockweir CP	25
16	Huntley CP	4
17	Kempley CP	17
18	Littledean CP	7
19	Longhope CP	11
20	Lydbrook CP	11
21	Lydney CP	19
22	Mitcheldean CP	6
23	Newent CP	38
24	Newland CP	12
25	Newnham CP	8
26	Oxenhall CP	6
27	Pauntley CP	1
28	Redmarley D'abitot CP	1
29	Ruardean CP	5
30	Rudford and Highleadon CP	-
31	Ruspidge and Soudley CP	13
32	St. Briavels CP	11
33	Staunton Coleford CP	9
34	Staunton CP	1
35	Taynton CP	4
36	Tibberton CP	1
37	Tidenham CP	20
38	Upleadon CP	-
39	West Dean CP	49
40	Westbury-on-Severn CP	5
41	Woolaston CP	8

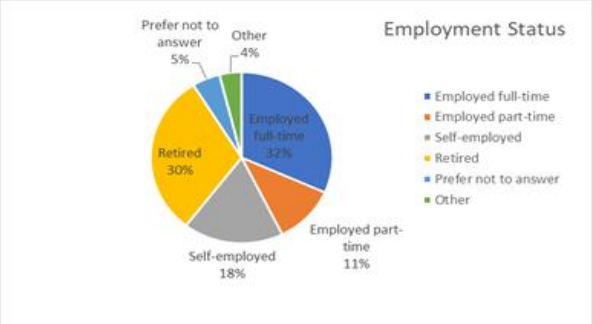


Parish Boundaries in the Forest of Dean District

A third of the respondents were over 65 (34%) while the proportion in the population is higher at just over 40%. The almost quarter of 55-64 year olds may be an over-representation, but does reflect that the District does have an ageing population in common with much of Gloucestershire and rural districts generally. Lower proportions at younger age groups may also reflect fewer homes currently owned by the younger groups.

61% of respondents were in some form of work and only 30% stated they were retired.

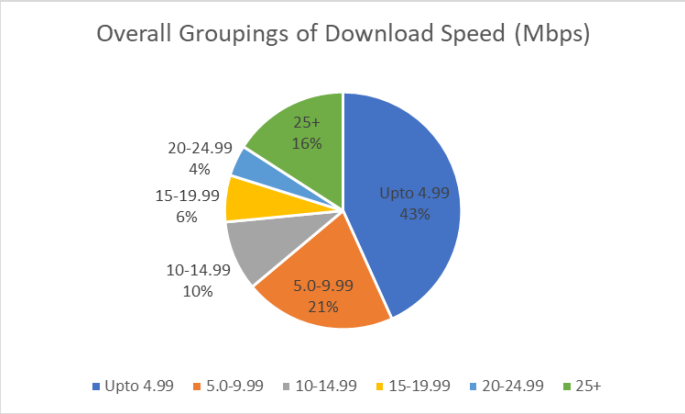




3. How Fast How Good is Your Broadband Results

3.1 HFHGB Download Results

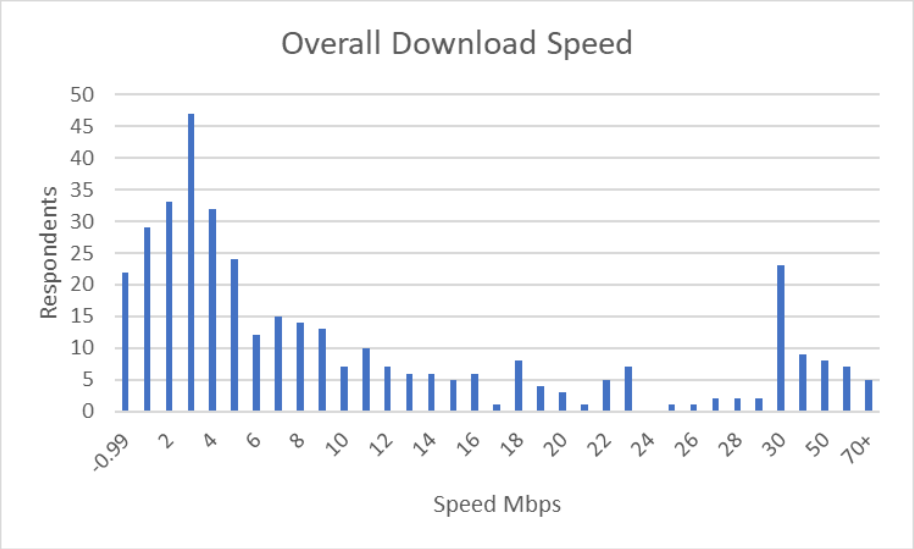
While at a national level 33% of rural homes are deemed to receive up to 10Mbps download speeds, the results of the HFHG survey show that 64% of the Forest of Dean are in the bottom category. At over 30Mbps the national rural average is 44%; the survey has only 13%. Based on this data, the District will miss the USO by some margin for most of its inhabitants.



Some of the discrepancy between the national and survey averages is explicable by methodology. The disgruntled are more likely to report as an opportunity to vent their frustration. Those with higher speeds might have been less likely to take part. However, the satisfaction data does not bear this out with satisfaction shown at all speeds.

Another reason for the discrepancy is in the take up of non-ADSL options across the District as a whole. Ofcom shows 66% of the whole country use fibre or non-ADSL; in the survey it is 30% assumed to use non-ADSL technology based on speeds. If more non-ADSL users are factored in then the discrepancy decreases, assuming that the number of fibre users was as high as the national average. With the continued rollout of Fastershire in the District, this is unlikely. Unfortunately, in the Report there is no breakdown of the percentage of rural users with non-ADSL for a direct

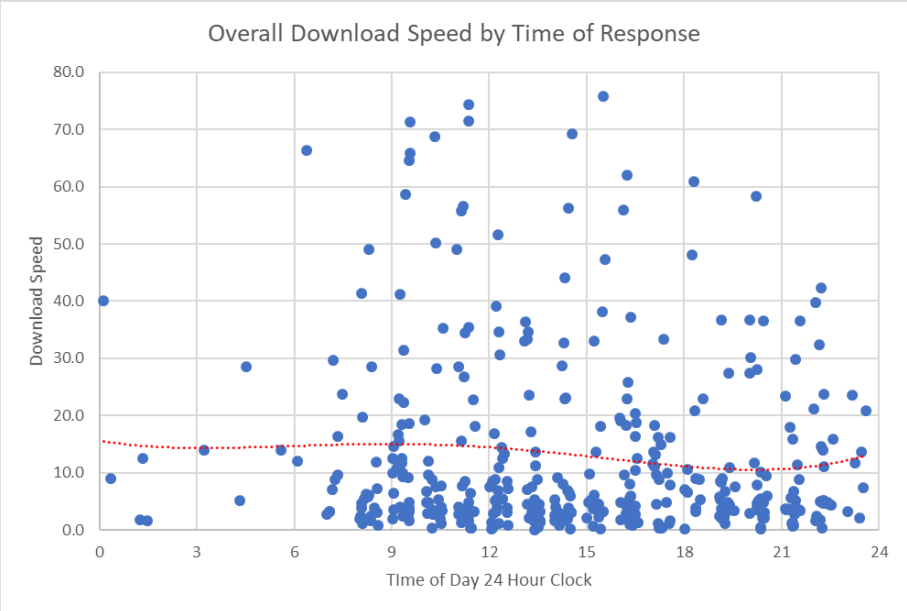
comparison. We assume that the rural take-up is lower and that therefore a rural district in a county seen to be prosperous is some way behind the national average for non-ADSL.



The Overall Download Speed chart shows clearly that there are two peaks. Given the range it is difficult to show them sensibly using a regular scale.

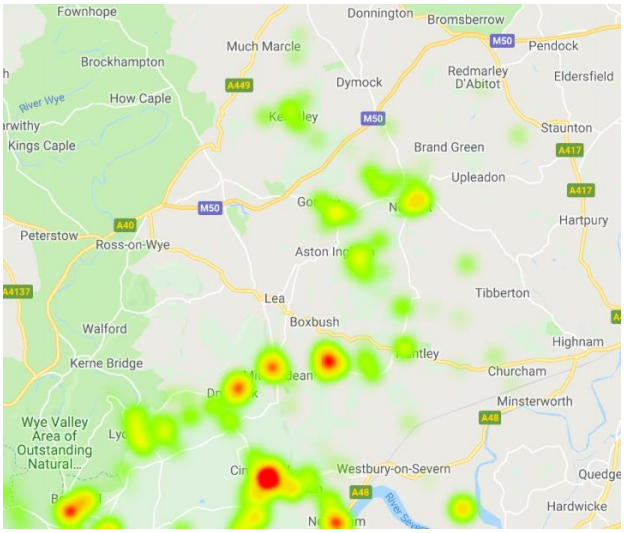
There is a significant tail below 4.99Mbps which accounts for 43% of respondents. More than 5% of those responding indicated a download speed of less than 1Mbps. 13% had lower than 2Mbps. On the positive side this has enabled FEP to identify some areas where speeds warrant further research to enable a technical fix and others where the solution might be one of awareness of options and best practice. On the negative side is the evident need for a range of actions to enable the district to be part of the increasingly digital world and how they might be effectively resourced given FEP is a voluntary organisation.

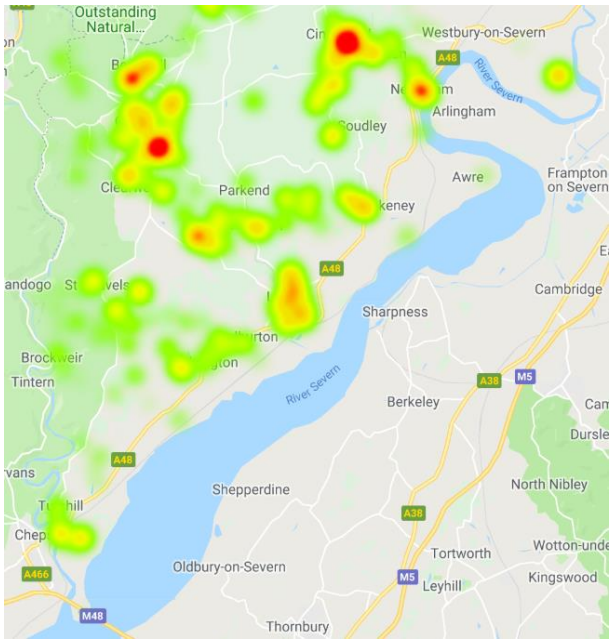
If the USO is for a potential technical speed of 10Mbps, this may mean that the practical speed tested by users might be 7-8Mbps (based on known losses over internal wiring/ distance from router). The survey again shows the district to be distant from this aspiration.



HFHGB did not set a time to log the download speed unlike SamKnows where the readings are taken over the day and data revealed over the peak 8-10 usage. That peak is shown above with a decline in reported speeds at this time in the night. The trend line suggests that this starts earlier from 15.00 as the schools begin to come home. While we are concerned that some respondents were only able to undertake the survey between 11pm and 6 am, over the day the data appears to reflect patterns found elsewhere on broadband use.

Reported Download Broadband Speeds for FoDDC as Hotspots



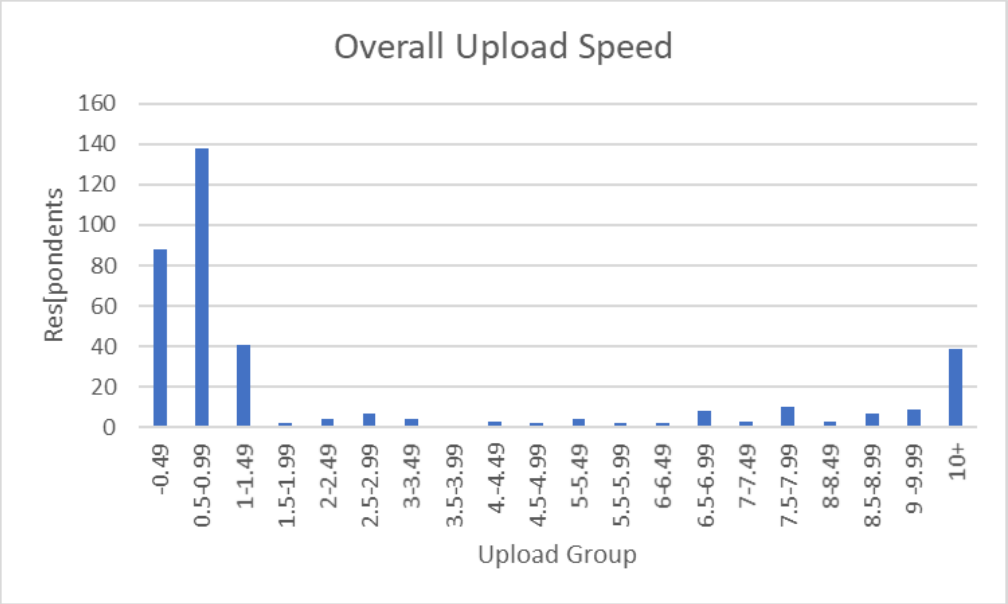


Care should be taken with the above as some sample sizes are small for particular areas. Mapping this way typically reflects where people have upgraded to fibre and can therefore report significantly higher speeds. This is the same issue that gives the UK an average speed of 54.2Mbps with those getting the fastest speeds dominating the many with very slow speeds. Given USO, of more interest are the smudges of green where respondents are struggling to achieve usable download speeds.

3.2 HFHGB Upload Results

The average upload speed was 3.5Mbps and the median 0.9Mbps. This is well short of the Ofcom national average of 7.2Mbps. 39 of those on non-ADSL achieve an upload speed in excess of 10Mbps

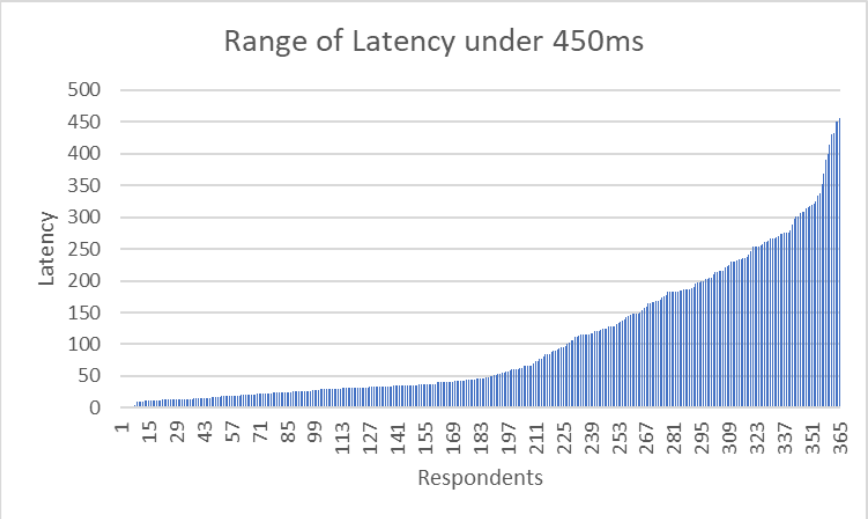
with one exceeding 75Mbps. Conversely 226 (59%) struggle to achieve 1Mbps upload from their device. This further emphasises that setting and measuring the standard to the router might mean that USO is achieved, but that achievement is not practically usable in the way that a 1Mbps upload speed is intended.



If 23% of HFHGB are unable to achieve an upload speed of 0.5Mbps, it is likely that this is a common problem and the 59% not substantially overstated. The geographical analysis shows the issue to be still prevalent across the District. While there are known pockets where a technological fix is required, this is a general problem for the network based on ADSL where the most advanced version could only deliver 2Mbps.

Given that upload speeds are set by technology in narrow bands, improvements here might be achieved through greater understanding of wifi needs and router positioning for those on ADSL rather than a simple assumption of go to fibre for an immediate improvement at increased cost.

3.3 HFHGB Latency Results



The reported latency ranges from too slow to register to an almost unbelievable 0.9ms. The usable range for 365 respondents was 0.9 to 450ms when the outliers where excluded. Half of the

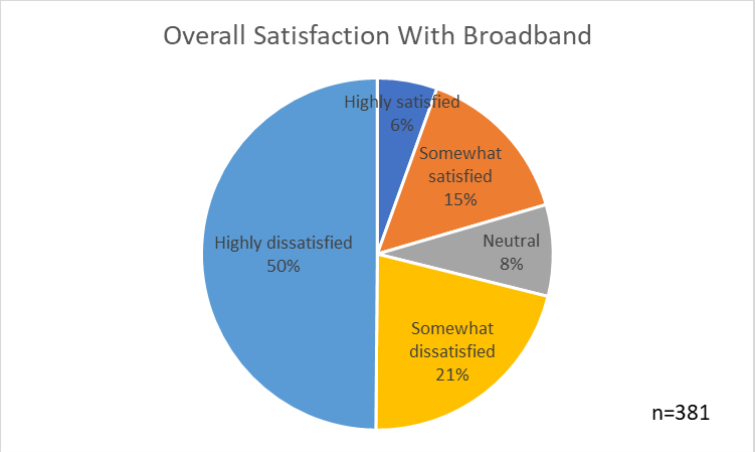
respondents achieved latency of less than 50ms. But the national levels are 20-30ms for ADSL and 10-20ms for non-ADSL. Only 112 HFHGB respondents achieve those levels. But Ofcom itself flags up high variation levels in that data to set the national level. The mean average for those assumed to be ADSL lines was 152.5ms with a median of 54ms. For non-ADSL mean was 84.3ms and median 40ms. Both ADSL and fibre are some way from the national average.

Perhaps the better question is what is the necessary latency requirement to futureproof rural homes as they are increasingly used to enable them to play a full role in the digital economy and life. For example, young people in a dispersed rural area typically play on-line with their school/college friends. High latency levels are key in increasingly complex games to respond effectively and win. Those with higher latency therefore have a marginal advantage and probably better experiences. An example where unintentionally faster urban beats slower rural.

Given the Ofcom variation should 50ms or even 100ms be set as a target rural level which allows for increased distances from exchanges and cabinets? With those where latency is a pressing need then they have to take fibre. In either case, rural latency will be an increasing issue for things such as voice-based search. This typically does not commence until the last word is uttered in order to capture all nuances and sounds.

3.4 HFHGB Broadband Satisfaction

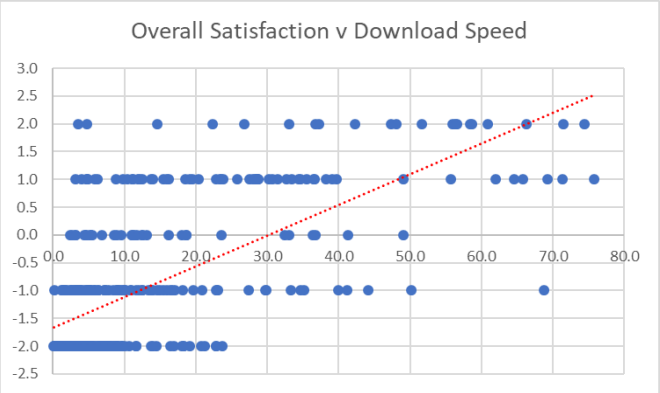
The responses to a simple 5-point satisfaction level identifies some interesting and perhaps unexpected variations.

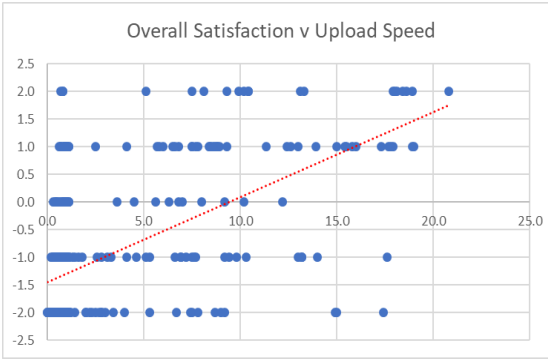


Overall half of respondents are highly dissatisfied with the performance of their broadband and over two thirds dissatisfied to some degree. Less than a quarter are satisfied. Whichever way these are looked at, clearly the District is unhappy with the current situation as represented by the respondents to HFHGB

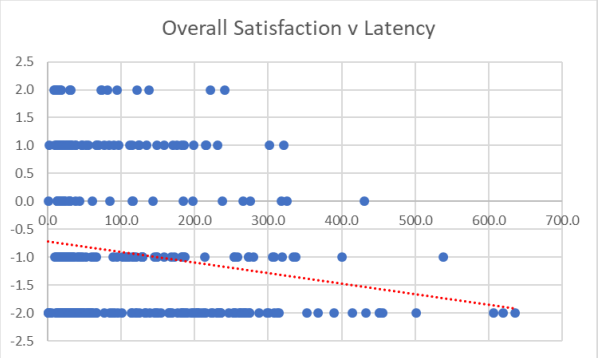
Are the overall levels of dissatisfaction, this stark for all 38,000 homes in the district? Probably not. The common norm is that broadband is terrible and indeed it is the brave who say it is good or they are happy. Providers sell based on a faster, superfast or ultrafast service which has to be better than what we currently have. The government confirms this is a reasonable expectation “We all want to be able to download things much more quickly so we have to have the infrastructure there” Nicky Morgan 27th August 2019. This expectation will never be met as there will always be a need to go faster like the development of cars until speed became less important and economy of use more so. But we don’t currently choose domestic broadband like the cars of the 40’s to 70’s

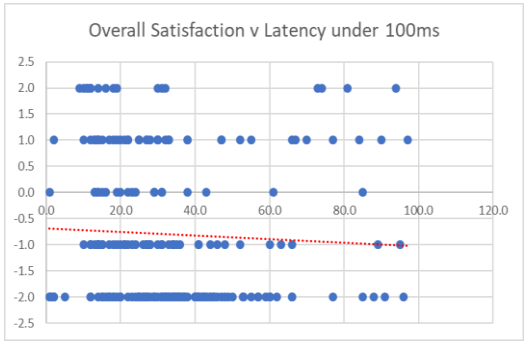
If satisfaction is based only on speed then there would be a strong correlation between download and upload speeds experienced and stated levels of satisfaction in HFHGB. As the trend lines on charts overleaf show this is the case. On the charts a score of plus 2 is highly satisfied and minus 2 highly dissatisfied. Those ratings are plotted against the speeds registered. But what is surprising are the numbers who are neutral, somewhat or highly satisfied at the lower download and upload speeds. For some getting a download speed of 5Mbps and an upload of 1Mbps is satisfactory.





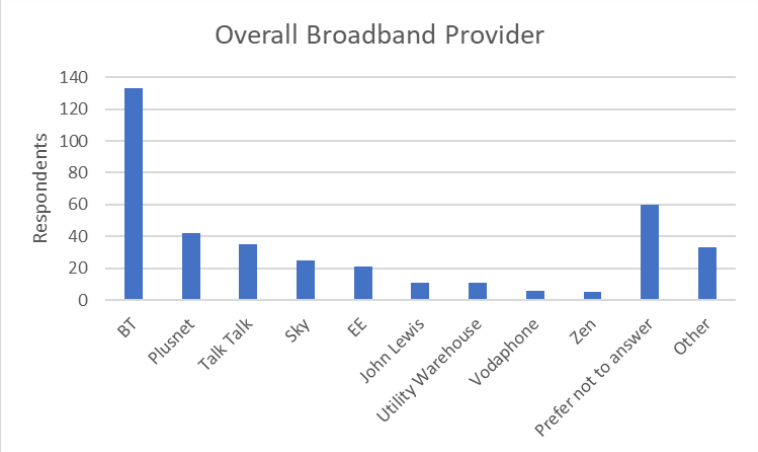
Satisfaction versus latency is more problematic from the data. The lower the actual recorded latency the better the performance. It is important to note that individuals were not asked to score their satisfaction against latency or up/download rather whether there is an imputed correlation.





Broadly those with low latency typically have low satisfaction. There is some evidence that a latency below 50ms makes latency less likely to affect the satisfaction rating with the numbers reporting highly and somewhat satisfied above this point. This requires further work

3.5 HFHGB Broadband Providers



60 (15.7%) of the 381 respondents preferred not to answer this question. Brands with more than 5 respondents have been shown on the graph. Zen is a local supplier of BT wholesale services. The chart shows that BT is still the dominant supplier of named brands. This particularly so when Plusnet another BT company is added to those who identified BT.

The table overleaf shows the variations by brand for those with more than 10 users. Statistically it is more reliable for the top three named brands. For each factor the mean average is shown.

At no stage was HFHGB intending to assess the effectiveness of each brand or in using this data to level criticism. What the table does show is that with the exception of one brand, all could justify by mean average that they already meet USO. However this might involve the combination of all types of line which is why BT's, where there are sufficient respondents, is broken into the 2 types.

A consistent thread through HFHGB is that a focus on mean averages distorts the understanding of the reality of broadband particularly in the rural context. For many individuals the desire is for fast broadband service that is reliable and where fast means today 10Mbps download, 1Mbps upload and latency of 50-100ms.

Brand	Sample	Latency	Download	Upload	Satisfaction
BT	132	184	10.3	2.4	-1.4
Plusnet	42	107.8	16.6	4.5	-0.6
Talk Talk	35	115.4	10.6	2.6	-0.9
Sky Broadband	25	117.3	16.3	4.2	-0.6
EE	21	147.0	17.6	4.2	-0.8
John Lewis	11	303.9	3.9	0.6	-1.5
Utility Warehouse	11	103.5	10.6	2.1	-0.6

BT's performance shows that those on fibre are somewhat satisfied with an average download speed of 36.1Mbps and upload of 11.1. The latency is perhaps lower than expected for fibre as an average and median over 60ms. On ADSL there are many dis-satisfied clients despite an average download of 4.7Mbps and median 3.6. This may relate to some paying for 10Mbps service which is technologically possible to their router or wall but cannot actually be delivered to their device. Some BT clients might of course be legacy clients where the householder has limited knowledge to go elsewhere or limited options due to the physical network.

BT's performance on HFHGB split by technology type

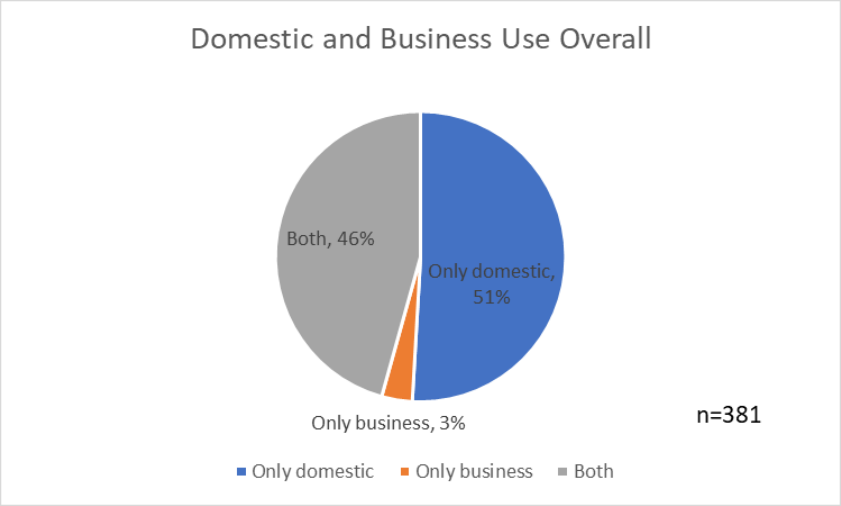
Non-ADSL n= 35	Latency ms	Download Mbps	Upload Mbps	Satisfaction -2 to +2
Average	91.9	36.1	11.1	0.3
Median	73.5	32.9	9.4	Somewhat satisfied
ADSL n=97				
Average	204.1	4.7	0.6	-1.6
Median	159.0	3.6	0.5	Highly dissatisfied

3.6 HFHGB Broadband Business Use

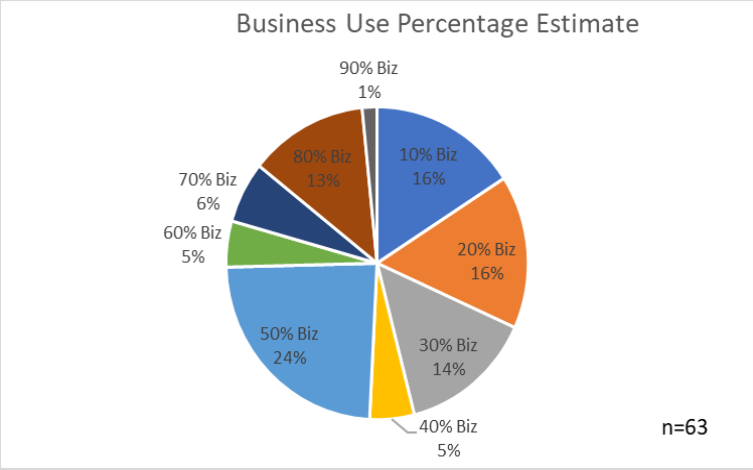
In the context of Industry 4.0, increased work-life balance and understanding of the types of workers in the District, a simple question was asked about usage of broadband split between domestic and work. This built upon earlier work by FEP which was included in The Scale and Impact of Farming,

Food, Drink and Rural Economy in Gloucestershire. County-wide this challenged some of the presumptions about the types of businesses in rural areas.

Where respondents opted for both domestic and work, they were asked to estimate the percentage of time used for domestic in an open text box. Some opted to put in additional comments such as "*I work mostly from home for a overseas based technology company and I'm stuck on a BT "Exchange Only" line that delivers ADSL+ The worst part is what happens in a fault - as I'm designated a Residential customer, fix time is 3 days*." This demonstrates a breakdown of a continuing presumption that of work in designated factories, workshops and offices and the reality of more home-working either as an independent business or through flexible working.



Of the 381 respondents, half only used broadband for domestic purposes but 46% used for both. 3% of respondents reported using it for business only. Analysis of the majority of the business only showed that it was use of a dedicated line for business at home or use in a shared office facility as a small or in one case medium-sized business. Typically these businesses were on non-ADSL lines.



63 respondents estimated the split between domestic and business and the numbers reporting in each estimation are shown above. Half of those responding used their broadband for more than 50% of the time for business from a domestic address.

Of the 194 using only for domestic purposes, 50 had upgraded from ADSL. Of the 187 using for business at least part of the time, 65 or just over a third had upgraded. The reasons for this lack of

uptake is worthy of further investigation not least because there is no correlation between the percentage of time spent using broadband for business and satisfaction levels.

4. HFHGB Geographical Split Tables

4.1 Overall District

	All Types n=381			ADSL n=266			Non-ADSL n=115		
	Mean Average	Median	Range	Mean Average	Median	Range	Mean Average	Median	Range
Latency (ms)	136.5	51	0.9-2116	152.5	54	0.9-2116	84.3	40	2-607
Download (Mbps)	13.1	6.3	0.1-75.8	5.6	4.5	0.1-19.7	31.1	28.6	2.8-75.8
Upload (Mbps)	3.5	0.9	0.1-48.8	0.7	0.7	0.1-1.4	10.1	8.6	1.8-48.8
Satisfaction	-1	-1	-2 to +2	-1.4	-2	-2 to +2	0.1	0.1	-2 to +2

This and the following tables display the mean average for each factor, the median or middle value and the range. While for the 381 respondents the mean average latency is 136.5ms, this is distorted upwards by some very high values. The median here is 51ms and is a more useful gauge. This also clearly shows the dangers of taking an average to understand whether an area meets the Universal Service Obligation. On overall mean average the district achieves USO with a 13.1Mbps download and 3.5Mbps upload but the median is 6.3 and 0.9 respectively. This is a fail on both counts.

4.2 Sub-District Analysis

While only fools would try to create new geographical areas in the Forest of Dean District; nonetheless the best way to show the geographic variations is by creating 5 sub-districts. We apologise to anyone we offend. Our reasons are the needs:

- to show geographic variations between areas
- to aggregate data in the public domain rather than showing individual postcodes which could be misused
- to reflect that much of the first fibre was been laid down the main roads which connect the bigger centres of population. Our areas use local knowledge to assume where the natural pull *may* be towards a town to create a grouping of parishes and postcodes.

We are aware from this data that particular parishes have issues or have been particularly active in this survey. This will inform FEP's Bridging the Gap Project working on technology solutions.

Coleford/West Dean (Parishes of Coleford, Newland, StauntonColeford, English Bicknor & West Dean)

	All Types n=101			ADSL n=70			Non-ADSL n=31		
	Mean Average	Median	Range	Mean Average	Median	Range	Mean Average	Median	Range
Latency (ms)	112.4	45	2-1681	121.9	47	2-1681	91.1	29	9-607
Download (Mbps)	14.7	6.9	0.2-74.4	5.7	4.6	0.2-19.1	34.9	31.4	3.1-74.4

Upload (Mbps)	3.9	0.8	0.2-48.8	0.7	0.6	0.2-2.0	11.2	9.2	2.5-48.8
Satisfaction	-0.8	-1	-2 to +2	-1.2	-2	-2 to +2	0.2	1	-2 to +2

Cinderford & Middle Forest (Cinderford, Newnham, Awre, Ruspidge & Soudley, Lydbrook, Ruardean, Drybrook, Mitcheldean, Longhope, Huntley, Churcham, Westbury, Littledean)

	All Types n=100			ADSL n=54			Non-ADSL n=46		
	Mean Average	Median	Range	Mean Average	Median	Range	Mean Average	Median	Range
Latency (ms)	136.4	66	0.9-1602	167.2	33.5	0.9-1602	87.8	66.5	5-431
Download (Mbps)	18.7	11.8	0.2-75.8	8.6	7.8	0.2-19.7	32.7	30.1	3.3-75.8
Upload (Mbps)	5.3	1.1	0.3-48.6	1	0.9	0.3-1.6	10.7	9.1	1.8-48.6
Satisfaction	-0.6	-1.0	-2 to +2	-0.9	-1	-2 to +1	0.1	0.5	-2 to +2

Newent & North District (Newent, Gorsley, Oxenhall,Dymock, Kempley, Redmarley, Staunton Corse, Pauntley, Taynton, Tibberton)

	All Types n=76			ADSL n=65			Non-ADSL n=11*		
	Mean Average	Median	Range	Mean Average	Median	Range	Mean Average	Median	Range
Latency (ms)	194.2	91	2-2116	207.5	108.5	2-2116	-	-	-
Download (Mbps)	6.2	3.3	0.2-15.5	3.7	3.0	0.2-12.5	-	-	-
Upload (Mbps)	2.0	0.6	0.1-9.8	0.6	0.5	0.1-1.3	-	-	-
Satisfaction	-1.5	-2	-2 to +2	-1.6	-2	-2 to +1	-	-	-

*Sample too small to be statistically relevant.

Lydney & Severnside (Lydney, Aylburton, Alvington, Woolaston)

	All Types n=48			ADSL n=26			Non-ADSL n=22		
	Mean Average	Median	Range	Mean Average	Median	Range	Mean Average	Median	Range
Latency (ms)	84.9	35.0	1-400	96.3	35.5	1-400	71.4	26.5	2-319
Download (Mbps)	15.4	11.2	0.8-65.8	7.6	7.2	0.8-16.2	24.7	23.4	3.1-65.8
Upload (Mbps)	4.5	1.1	0.2-17.4	0.7	0.7	0.2-1.2	9	7.9	2.6-17.4
Satisfaction	-0.6	-1	-2 to +2	-1	-1	-2 to +1	-0.1	0	-2 to +2

Wyeside & South (Tidenham, Hewelsfield & Brockweir, St Briavels)

	All Types n56			ADSL n=51			Non-ADSL n=5*		
	Mean Average	Median	Range	Mean Average	Median	Range	Mean Average	Median	Range
Latency (ms)	146.6	58.5	1-688	149	57	1-688	-	-	-
Download (Mbps)	7.2	4.7	0.1-49.1	4.9	4.5	0.1-18.2	-	-	-
Upload (Mbps)	1.1	0.8	0.2-8.8	0.7	0.7	0.2-1.1	-	-	-
Satisfaction	-1.5	-2	-2 to +1	-1.6	-2	-2 to +1	-	-	-

*Sample too small to be statistically relevant.

Appendix A Limitations of Survey

We recognised the following potential limitations of the survey. Some of these arise from the desire to keep this survey short to enable as many as possible to answer:

- Extended open time. The elapse time is long at 2 months during which changes could occur with the network and/or with the onset of school holidays performance could slow. Over half the responses were in the last two weeks. This overcomes some of the problems caused by elapse. The performance data was slower, but this could result from a lower number of non-ADSL users.
- Choice of tester. All results were deemed to have come from the same tester and therefore suffer from the same defects and provide results that are consistent between respondents. Where other testers were used or the data was incomplete, the responses were excluded from the survey. Pre-survey trials demonstrated that different testers provide markedly different results for the same premises tested in the same place with the same machine. The Which tool was selected because it provided all three tests and was an independent test of performance. Other 'independent' tools may suggest alternative suppliers and may not then be unbiased.
- No knowledge of how test was taken. The Which test suggests connecting the device directly to the router to get the best results without wifi degradation. Some respondents may have taken this option. Others may have tested at the furthest distance from their router. We assume most have taken the easiest option of wifi and being in the same room.
- No question on whether fibre or copper was being used. This question would undoubtedly have made the analysis easier. The split between ADSL and non-ADSL was made with the operating assumptions that a download speed of higher than 24Mbps or an upload of greater than 2Mbps was non-ADSL as these are beyond the standards of ADSLs. A third corroborator was the choice of supplier as some are only fibre based or use an alternative technology such as the 3 respondents using satellite or mobile technology. One respondent was excluded as a BT wholesaler of broadband with significantly higher speeds.
- Responses accepted as genuine and transcribed accurately. The results are shown with a mean average, a median value and a range to enable wider understanding and to overcome sample errors. If there were any doubts over the responses they were excluded from the survey.
- Self-presenting so a likely bias to the negative and poor performance. The Review article was negative and those who responded in the last two weeks reported lower performance and higher dis-satisfaction. However, there were a number of instances during the survey time where individuals moaned loudly about how shocking their broadband was but then didn't answer the survey! It is also clear that in some areas there was a degree of activism which contrasts with the 6 parishes where there was no response. Was the latter because they were on fibre and happy or could see a solution coming? Perhaps but equally some of those parishes might not see themselves as being part of the District. The sample equates to over 1% of the homes in the District and expresses a full range of views with clear trends.
- Incomplete data to inform the full picture. This survey sought performance data, satisfaction levels and whether a domestic or work use. Other studies are planned that will use specified timeslot testing and deeper questions; address issues of internal optimisation; support the need for external technical solutions. Given the contexts described above there is sufficient data to create an informative picture.

Appendix B A Bit About FEP

The Forest Economic Partnership (FEP) was launched in 2018 by the FoDDC. Its mission is to deliver a thriving economy in the Forest of Dean District by connecting business, councils, people, ideas and resources. Already over 160 organisations/individuals voluntarily participate in its quarterly steering group or four sub-group meetings. The four voluntary sub-groups focus on areas of particular challenge to the District and are shown with their individual missions below:

- **Education & Skills.** Within a lifelong learning context, how do we get the workforce we need for the District now and in the future to power and sustain economic growth by removing barriers and raising aspirations.
- **Transport & Infrastructure.** The District Plan guides future development that gives us the space to work, live and play. Once those uses are known we can consider the transport routes in the District to enable them become fit for purpose. What is the practical new vision that defines the Forest we want to be and the balance between the use of space?
- **Digital Connectivity.** We are told we live in a digital world. What practical steps can we take to get the speed, reliability and connectivity to support the ways we increasingly work, live, study and play now and in the future.
- **Bridges & Borders**. The Severn and Wye have preserved the Forest. The best future protection is connection with all those around us to ensure a mutual understanding of economic needs. Looking outwards, what do we need and want to trade for bridges; participation in the South Wales-West of England economic powerhouse; and neighbours' plans.

Work is ongoing to shape a new economic plan so that in 2050 the District is an attractive, vibrant and dynamic destination to live, work and do business. It has actively contributed to a number of consultations such as the House of Lords investigation of the Rural Economy where FEP's submission was cited.

Authors

HFHGB was undertaken by the Digital Connectivity Sub-Group of FEP following approval at the last quarterly stakeholder meeting.

The main analyst and author was Andrew Callard who runs a management and marketing consultancy Aimed Business. Following his MBA at Warwick in 1985 he joined a Japanese market research consultancy using quantitative and qualitative methods to analyse the telecoms, office automation and consumer electronics markets in the main European countries. While there he undertook significant projects in fax machines and mobile telephony networks. Subsequently he spent a decade working in Higher and Further Education increasing the volume and quality of applied and blue-sky research and vocational training through business engagement. He has been a board member of the Institute for Research in Applicable Computing at the University of Bedfordshire. His first involvement with the web was in 1996 through running a EU Leonardo project Since 2007 he has worked extensively in the rural economy and assisting the businesses based there.

David Trevelyan is the Sub-Group Leader for Digital Connectivity and runs a technology and sustainability consultancy. 20 years ago, starting out in an international food business as a commercial analyst, very early on there was recognition of the importance of data drive decision, implementing analytical tools that improved operational performance. Mid 2000's saw a switch to a the construction sector and implementation of leading edge analytical and IT tools. The 2000's saw increasing demand for business sustainability and a switch into delivering Environmental and Sustainability programmes for prestige UK Infrastructure projects including Heathrow Terminal 5, 2012 Olympics, and Crossrail. A final 5 year stint in a FTSE35 implementing IT, Energy, Sustainability and Supply Chain systems he has an extensive knowledge of agricultural, construction, utilities and rail industries alongside global supply chain and international business.