Glasgow City Council

City Development Plan 2

Background Report

Infrastructure Audit: Digital Communications

March 2024

Communications Infrastructure

Existing Communications Infrastructure

1. What is communications infrastructure and how is it used?

Communications infrastructure includes digital and telecommunication networks and connections. This paper will focus on digital connectivity which is an all-encompassing term used to describe mobile or fixed connections to the internet. Being connected in this way has become part of the fabric of everyday life – as important to communities and businesses as a water, gas or electricity connection.

The [Scottish Government Planning Guidance: Digital Communications](#) (December 2023) states:
"Modern telecommunications and digital connectivity has a central role in unlocking the potential of our places across all of Scotland. It is a fundamentally important utility which allows people to be connected for business and social purposes at work, home or remotely, with greater demands on fixed and wireless communications. It enables people to have immediate access to emergency services, healthcare, education, shopping, leisure etc. It supports living locally and helps to sustain and grow rural and island communities. Lack of coverage in some locations can disadvantage businesses, communities and individuals, both economically and socially, and can contribute to deprivation, social isolation and lack of wellbeing. Scotland competes within globally competitive markets, where productivity is vital, which has to be supported by a communications infrastructure that allow automation, innovation and efficiencies".

The land use planning system plays an important role in the delivery and enhancement of digital and telecommunications infrastructure. NPF4 requires local development plans to support the delivery of digital infrastructure, including fixed line and mobile connectivity, particularly in areas with gaps in connectivity and barriers to digital access.

Fixed line and mobile connections both use wireless transmission to connect devices (eg. computers, laptops, tablets, mobile phones etc.) to the internet. However, they rely on different technologies to provide a different kind of broadband service for connected devices. This is explained further below:
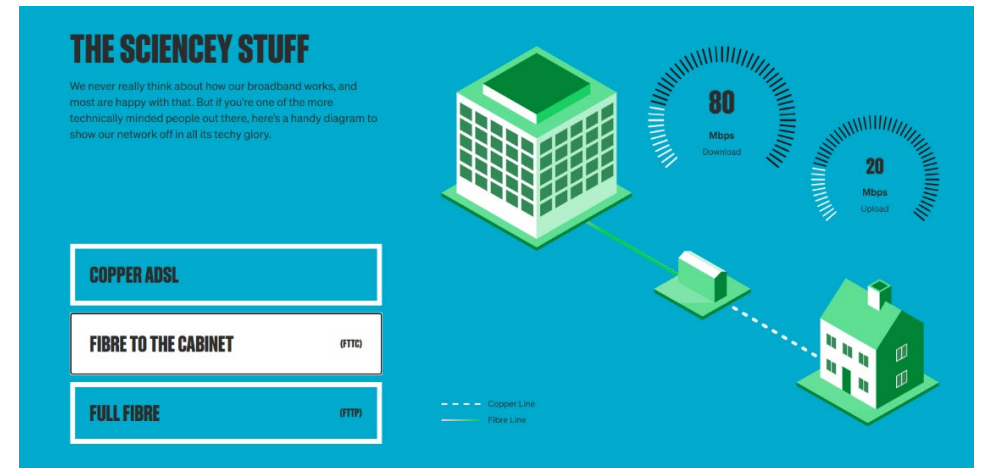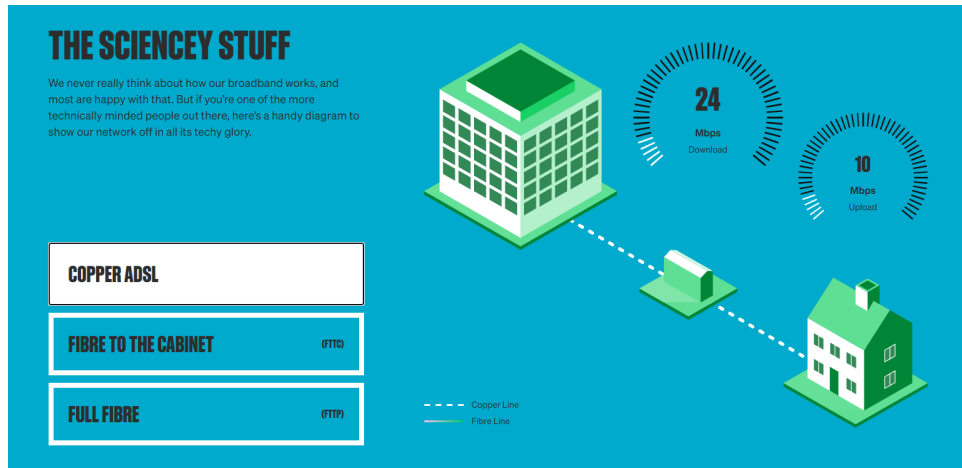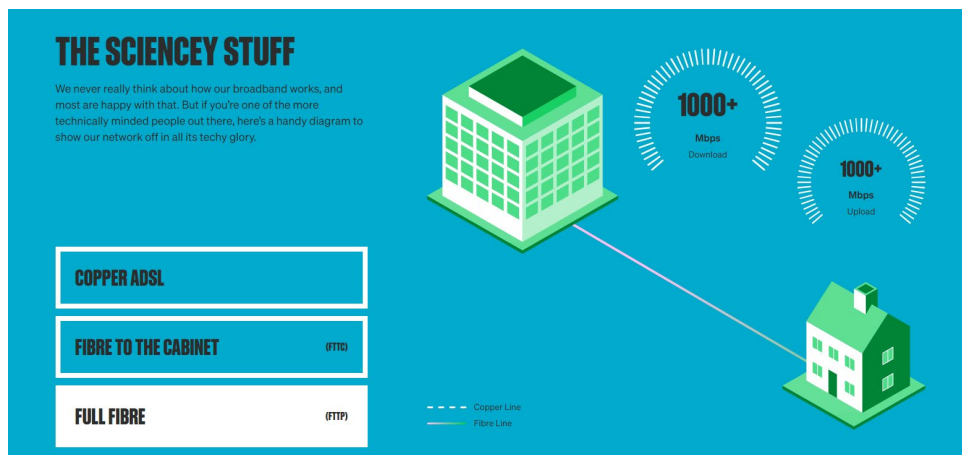
Fixed Line Connectivity

The term 'fixed line connectivity' covers all forms of internet connectivity that use a physical line, whether that's a fibre optic connection or a copper line, to a specific location. Fixed lines deliver data connectivity to premises across the UK, providing them with an internet connection. Fixed lines make up the UK's broadband network.
There are three main types of fixed line connections, as listed below and illustrated in Figure 1:

1. Full copper (ADSL) – uses a copper cable from the exchange to the cabinet and then from the cabinet to the premises. This is the slowest form of connectivity with download and upload speeds of 24 Mbps and 10Mbps respectively.
2. Fibre to the Cabinet (FTTC) – uses fibre optic cable from the telephone exchange to the green street cabinet; then a copper wire connects the cabinet to premises which reduces overall connections speeds to 80 Mbps for downloads and 20 Mbps for uploads.
3. Fibre to the Home/Premises (FTTH/FTTP) – uses a 100% fibre optic cable that runs from the telephone exchange directly to the property - offering one of the fastest form of internet connections with speeds exceeding 1000 Mbps for upload and download, near limitless bandwidth and reliable connectivity.

Figure 1: Fixed line connection types

THE SCIENCEY STUFF

We never really think about how our broadband works, and most are happy with that. But if you're one of the more technically minded people out there, here's a handy diagram to show our network off in all its techy glory.

1000+ Mbps Download

1000+ Mbps Upload

COPPER ADSL

FIBRE TO THE CABINET (FTTC)

FULL FIBRE (FTTP)

- - - - Copper Line
———— Fibre Line

Source: https://cityfibre.com/homes

Fixed line connectivity across Glasgow City is provided and maintained by the following Wireless Infrastructure Providers (WIPs):

- City Fibre;
- Openreach; and
- Virgin Media O2 (VMO2).

Mobile Connectivity

Mobile connectivity allows transportable devices to be connected to the web as the user moves from location to location through a service provided by a mobile phone provider. Mobile phone networks allow devices containing a SIM card (phones, tablets, modems/dongles etc.) to make calls, send and receive messages, browse the internet, stream audio and video and use apps on the move.

Mobile phone networks are made up of cells. Each cell has one or more base stations that transmit the data to and from mobile devices. In densely populated urban areas, a cell will often cover a few hundred metres; in a suburban area a cell will cover a couple of miles; in a sparsely populated rural area it may be much larger.

Mobile networks are made up of a mix of different types of infrastructure – ground-based masts, rooftop equipment and small antenna – and most of this infrastructure is unnoticed by passers-by. Base stations are sited to maximise coverage in a local area and there are many factors affecting where they can be sited. Also, as cells only cover a limited area and can only handle a finite amount of traffic, their layout is primarily driven by consumer demand, provided they meet with Ofcom requirements and Government direction.

Mobile phone networks use several types of technology. They are grouped into families and named after the 'generation' in which they were introduced, with each generation being introduced roughly a decade after the previous one – see Figure 2 below. Each network is faster, more secure and more reliable than the one that preceded it. All modern smartphones support 2G, 3G, 4G and more are now supporting 5G.

Figure 2: Mobile Phone Network Technologies

1G: Voice Only – 1G supports voice only calls. 1G is analogue technology, and the phones using it had poor battery life and voice quality, little security, and were prone to dropped calls. The maximum speed of 1G technology was 2.4 Kbps.

2G: SMS and MMS – The launch of 2G in 1991 effectively took mobile phones from analogue to digital communications. The 2G telephone technology introduced call and text encryption, along with data services such as SMS, picture messages, and MMS. Speed was limited to 50 Kbps.

3G: Data, Video Calling and Mobile Internet – The introduction of 3G networks in 1998 ushered in faster data-transmission speeds. The term "mobile broadband" was first applied to 3G cellular technology. The maximum speed of 3G was around 2 Mbps for non-moving devices and 384 Kbps in moving vehicles.

4G: Faster Speeds and More Data – 4G was released in 2008. Like 3G, it supports mobile web access and also gaming services, HD mobile TV, video conferencing, 3D TV, and other features that demand high speeds. The max speed of a 4G network when the device is moving is 100 Mbps. The speed is 1 Gbps for low-mobility communication such as when the user is stationary or walking.

5G: Ultrafast Speeds – 5G is a wireless technology that was launched in 2019. It promises significantly faster data rates, higher connection density, much lower latency, and energy savings, among other improvements. The anticipated theoretical speed of 5G connections is up to 20 Gbps per second.

Source: https://www.lifewire.com/1g-vs-2g-vs-2-5g-vs-3g-vs-4g-578681

The mobile phone networks are provided and operated in the UK by four main commercial providers, known as Mobile Network Operators (MNOs). They include the following:
- EE;
- O2;
- Three; and
- Vodafone.

In addition, there are more than 60 Mobile Virtual Network Operators (MVNOs) which use the networks owned by the MNOs.

The UK Government's UK Wireless Infrastructure Strategy (April 2023) sets an ambitious target "*to deliver nationwide coverage of standalone 5G to all populated areas by 2030*". In addition, there is a commitment to the Government, from the MNOs, to phase out the older 2G and 3G technologies by 2033. It is against this backdrop that MNOs deploy and manage their networks in the Glasgow City Council area.

2. Capacity and Condition

Mobile Network Operators (MNOs) and Wireless Infrastructure Providers (WIPs) hold information for their own networks (e.g. hot spots, coverage, customer base). Information is commercially sensitive and MNOs/WIPs don't tend to share the information on where the infrastructure is deployed. The Council do not have access to this information and cannot influence where the operators deploy infrastructure.

Building Digital UK (BDUK) is a UK Government Executive Agency that was set up to help bring fast and reliable fixed broadband and mobile coverage to hard-to-reach places across the UK. The Council has been advised that BDUK holds data on all existing networks and roll out programmes for all operators across the UK and this is updated on a quarterly basis. However, a licence agreement is required to access this data. Glasgow City Council doesn't have such an agreement in place.

The recently published Scottish Government Planning Guidance: Digital Telecommunications (December 2023) includes a section to encourage 'working together for the delivery of highly effective communication infrastructure through the planning system' (Section 3, page 11). We hope that MNOs and WIPs will consider this guidance and engage with the Council to help inform the City Development Plan 2 Evidence Report, which includes this Infrastructure Audit.
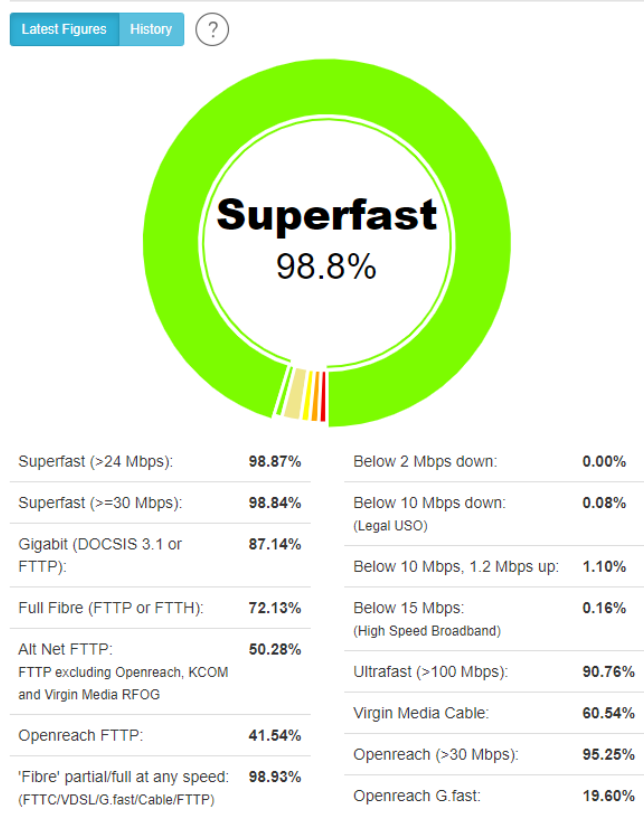
Fixed Line Connectivity

Glasgow City Council requested existing and proposed network information from WIPs including City Fibre, Openreach and Virgin Media O2 but, to date, have not received any responses.

We have therefore sourced information online. The UK Parliament's House of Commons Library broadband data dashboard includes statistics on broadband coverage by constituency. The dashboard uses data supplied by telecoms regulator Ofcom for its annual Connected Nations reports. The House of Commons Library also refers to unofficial data providing monthly coverage updates from ThinkBroadband. It should be noted that coverage is not the same as take-up. Customers need to purchase a broadband package to benefit from the rollout.

The most up-to-date (unofficial) statistics for Glasgow City from ThinkBroadband are provided in Figures 3 and 4 below.

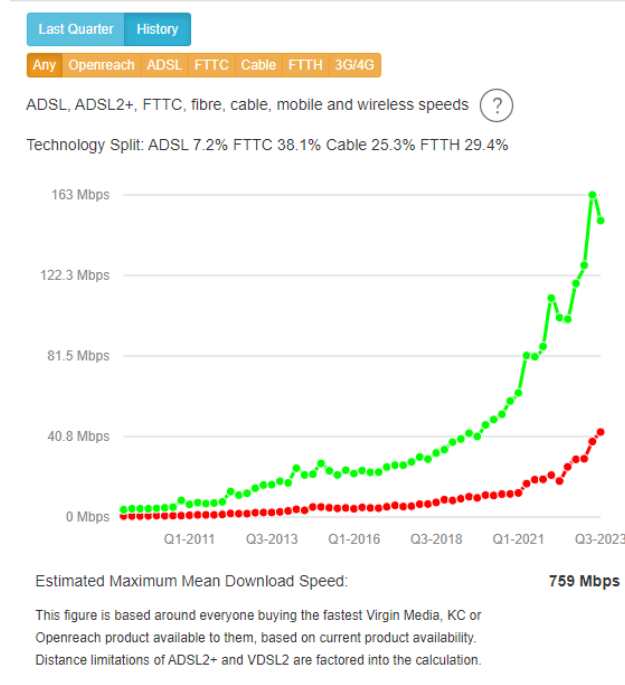**Figure 3: Broadband Coverage and Speeds – Glasgow City (Q3 2023)**

Glasgow City Superfast and Fibre Coverage

Superfast (>24 Mbps):	**98.87%**
Superfast (>=30 Mbps):	**98.84%**
Gigabit (DOCSIS 3.1 or FTTP):	**87.14%**
Full Fibre (FTTP or FTTH):	**72.13%**
Alt Net FTTP: FTTP excluding Openreach, KCOM and Virgin Media RFOG	**50.28%**
Openreach FTTP:	**41.54%**
'Fibre' partial/full at any speed: (FTTC/VDSL/G.fast/Cable/FTTP)	**98.93%**
Below 2 Mbps down:	**0.00%**
Below 10 Mbps down: (Legal USO)	**0.08%**
Below 10 Mbps, 1.2 Mbps up:	**1.10%**
Below 15 Mbps: (High Speed Broadband)	**0.16%**
Ultrafast (>100 Mbps):	**90.76%**
Virgin Media Cable:	**60.54%**
Openreach (>30 Mbps):	**95.25%**
Openreach G.fast:	**19.60%**

Coverage percentages include both residential and business premises and is based around postcode level data. The speed available are determined by a model that reconstructs the Openreach exchange/cabinet based network, and takes into account the distance limitations of ADSL2+ and VDSL2/G.fast (FTTC) services.

The use of an independant model constructed and continually updated as the network roll-outs continue is different to the methodology used by Ofcom which is reliant on data provided by broadband providers. By running our model we are able to provide a verification for the Ofcom data and are not reliant on quarterly data releases but can update data on a daily or weekly basis as needed. The largest factor for any differences with the Ofcom analysis is down to the timing of publication.

Glasgow City Speed Test Results (Mbps)

Technology Split: ADSL 7.2% FTTC 38.1% Cable 25.3% FTTH 29.4%

Estimated Maximum Mean Download Speed: **759 Mbps**

This figure is based around everyone buying the fastest Virgin Media, KC or Openreach product available to them, based on current product availability. Distance limitations of ADSL2+ and VDSL2 are factored into the calculation.

Speed test results are based on the analysis of results from our speed test or partners who use our speed test service. We believe this is the largest analysis of crowd sourced speed test data for the UK and the technology splits by area help to show what the public is experiencing for the different types of services across the UK.

Source: https://labs.thinkbroadband.com/local/S12000049

Figure 4: Broadband coverage and speed details in each of the constituency areas across Glasgow (Q3 2023)
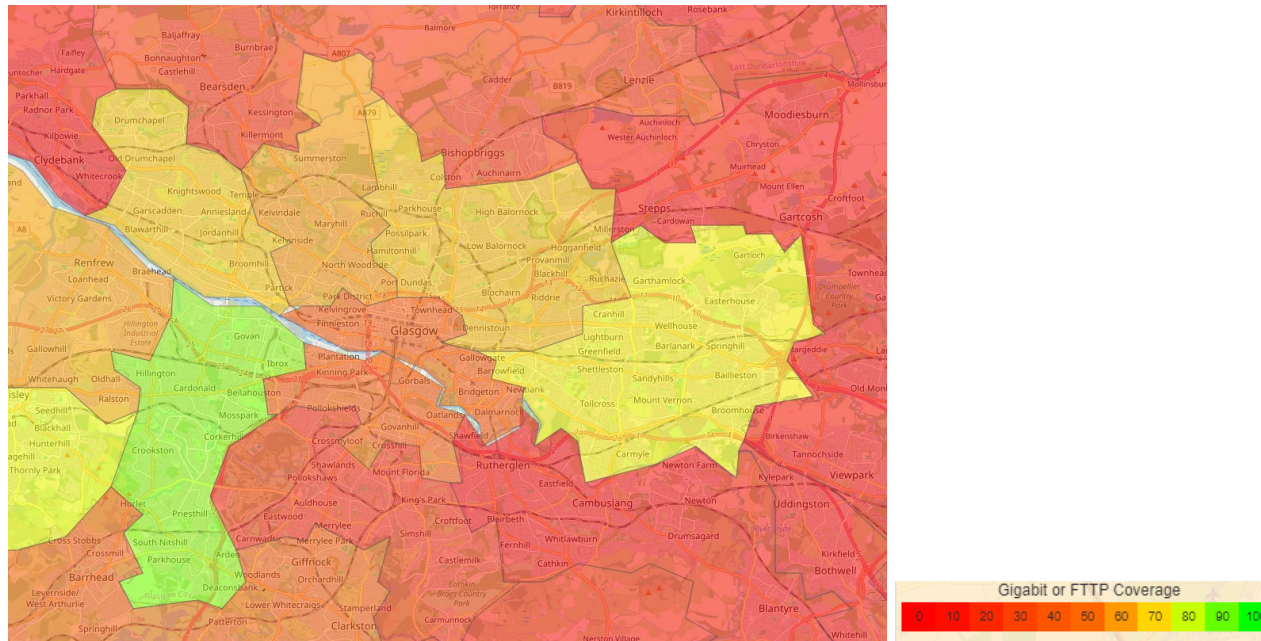
Glasgow Constituency	Superfast (>30Mbps)	Gigabit (>1000Mbps)	Full Fibre (FTTP)	Average Download Speed (Mbps)*	Average Upload Speed (Mbps)*
Glasgow Central	94.7%	78.7%	59.6%	147.9	67.5
Glasgow North West	99.8%	91.1%	73.2%	120.9	24.4
Glasgow North	99.8%	95.3%	67.1%	167.0	60.1
Glasgow North East	99.8%	89.8%	71.8%	177.6	36.9
Glasgow East	99.7%	87.9%	78.6%	155.3	27.5
Glasgow South West	99.7%	93.6%	93.0%	182.1	52.9
Glasgow South	99.8%	73.0%	53.2%	98.2	20.4

* Speed test results Q3/2023

Source: https://labs.thinkbroadband.com/local/broadband-map#12/55.8516/-4.2018/fttp/

The above data shows that 98.8% of Glasgow City has access to Superfast broadband with speeds of at least 30Mbps. Almost all constituency areas have more than 99% coverage and the only area with less is Glasgow Central with 94.7% coverage.

The City-wide coverage of Gigabit-capable broadband is 87.1%. This reaches over 90% in Glasgow North West, Glasgow North and Glasgow South West constituencies but is less than 80% in Glasgow Central and Glasgow South.

The roll out of Full Fibre is underway across the City with an overall coverage of just over 72% City-wide. The most progress has been made in the Glasgow South West constituency with 93% coverage; and the slowest progress is in Glasgow South constituency with only 53.2% coverage.

Mobile Connectivity

We contacted the four MNOs (EE, O2, Three and Vodafone) to request information for the Evidence Report and, to date, have received two responses from EE and Three. Their responses will be included in the relevant sections of this Infrastructure Audit.

None of the MNOs have provided existing or programmed network information to the Council. In the absence of this information from MNOs or access to BDUK data, mobile network coverage maps have been sourced online at https://www.nperf.com/en/. We are aware that there is disagreement on the accuracy of online mobile coverage maps as much of the coverage data is generated by computer modelling rather than real life testing. The maps should, nevertheless, provide a reasonable indication of the level of mobile coverage across the Glasgow City Council area.

Figure 5: 5G coverage across Glasgow

Source: https://www.nperf.com/en/map/5g
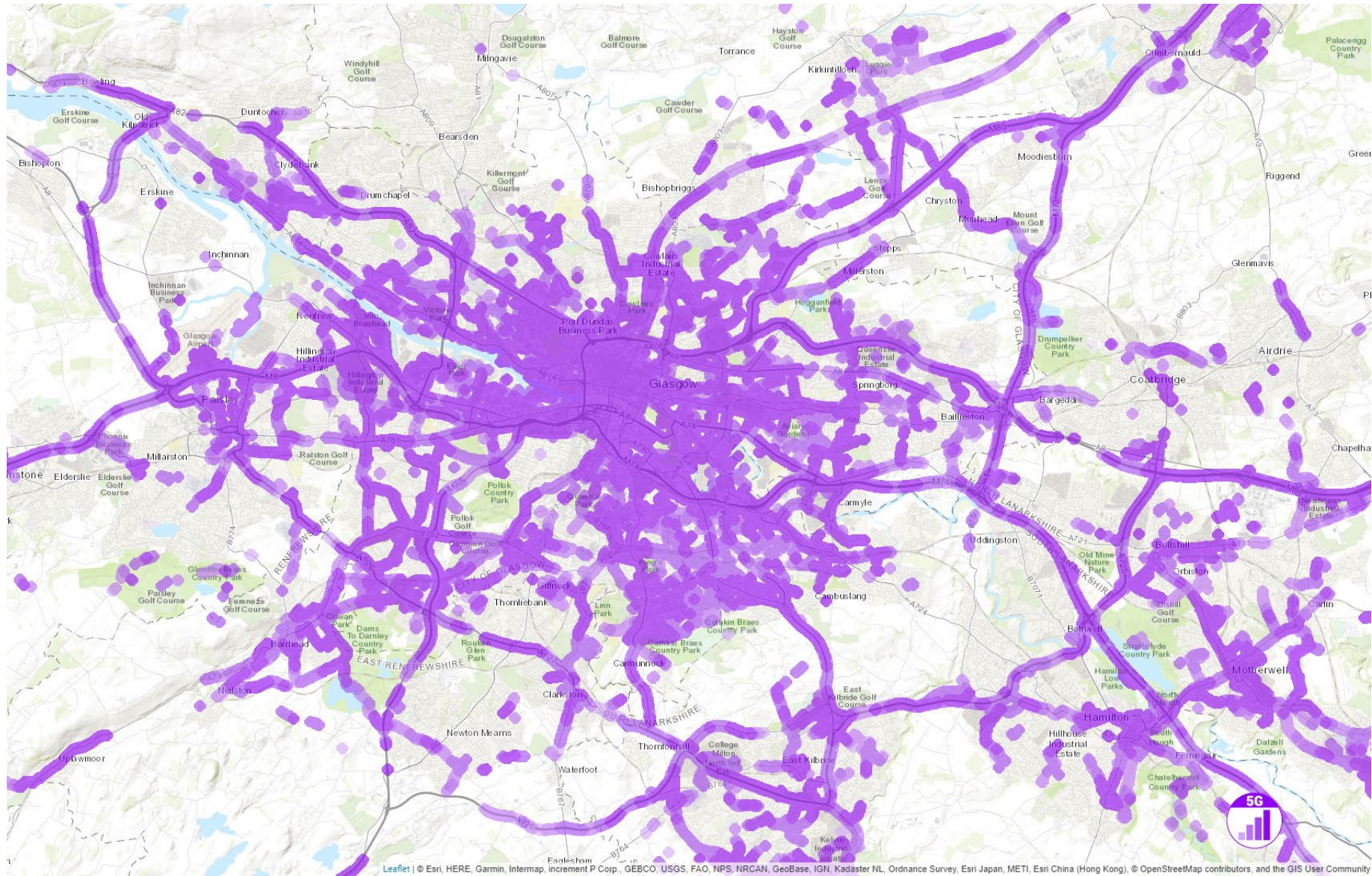
Figure 5 shows good 5G coverage across large parts of the city. However, this data does not show the user experience of that coverage. For example, although there is 5G coverage in the City Centre, the network is often congested due to high usage. The signal can be intermittent or not at all in some areas of the City Centre.

Figures 6 - 7 below represent the coverage of 2G, 3G, 4G and 5G mobile networks across Glasgow for each of the following Mobile Network Operators: EE, O2, Three and Vodafone.

Source: https://www.nperf.com/en/map/GB/-/-/signal/?ll=55.751357157443756&lg=-3.4249999999999963&zoom=5

Figure 6: EE Network Coverage

EE currently has a developed 2G – 5G network across the Glasgow City Council area. 5G coverage is not yet established across the whole City area and EE are still working on 5G roll-out.
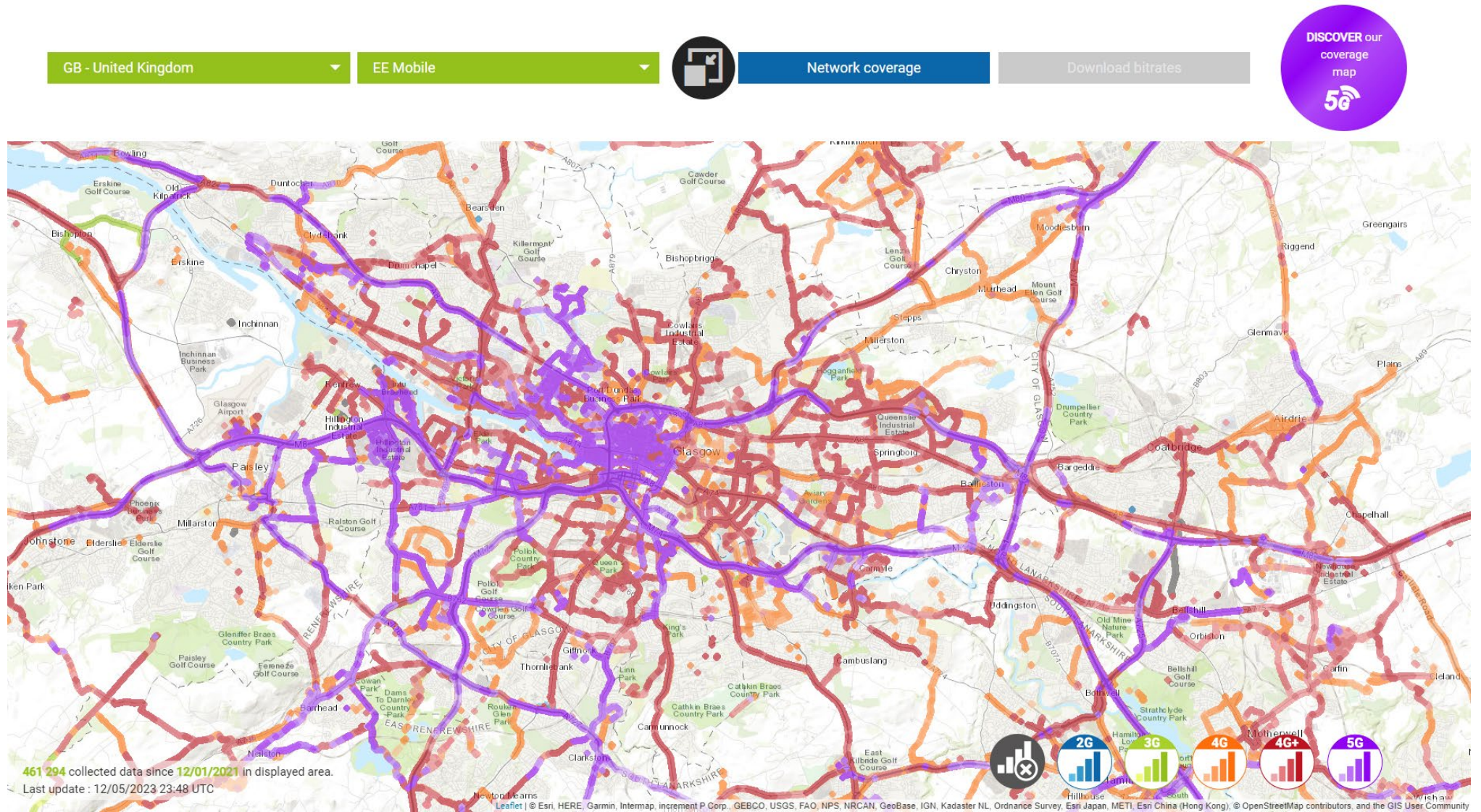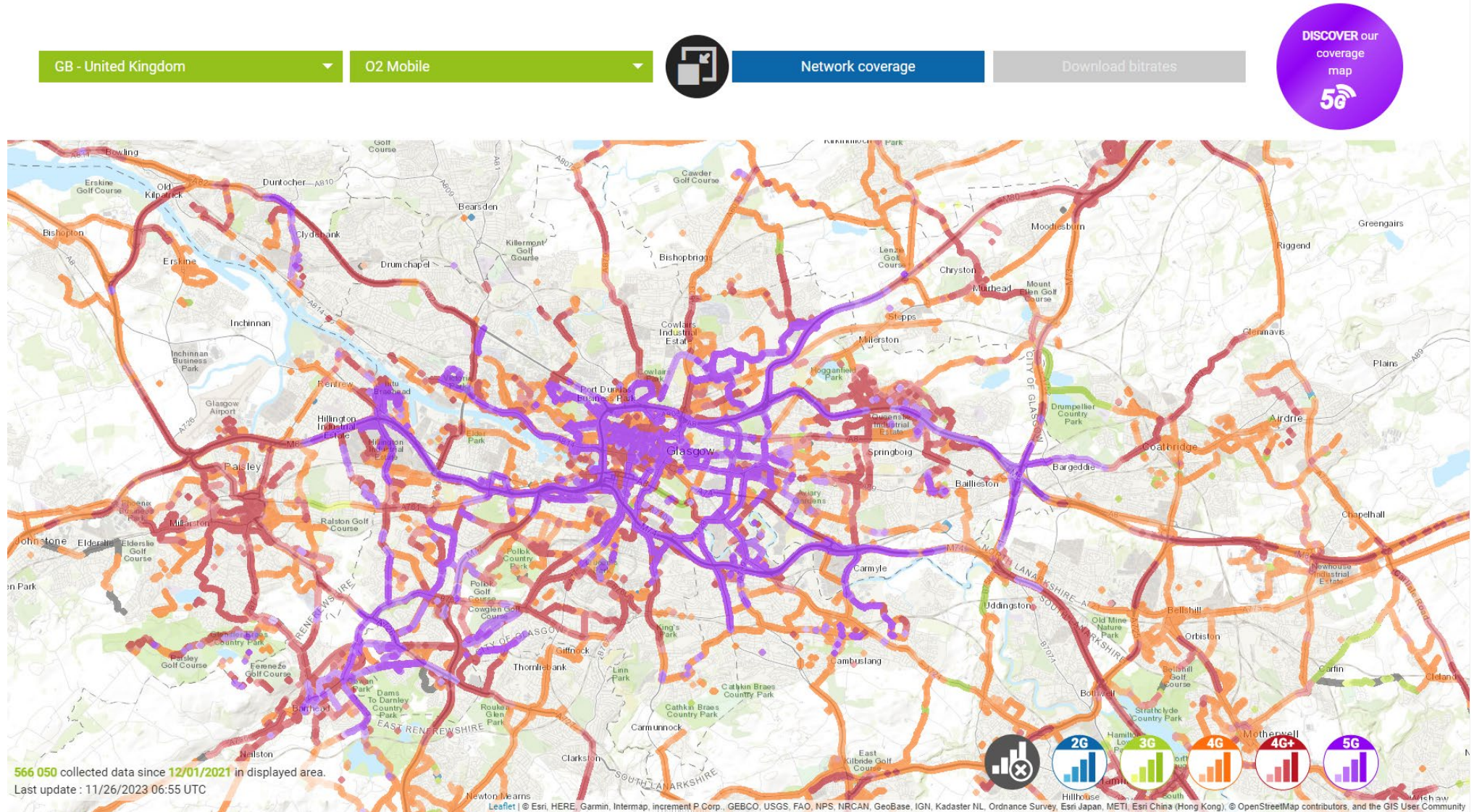
Figure 7: O2 Network Coverage

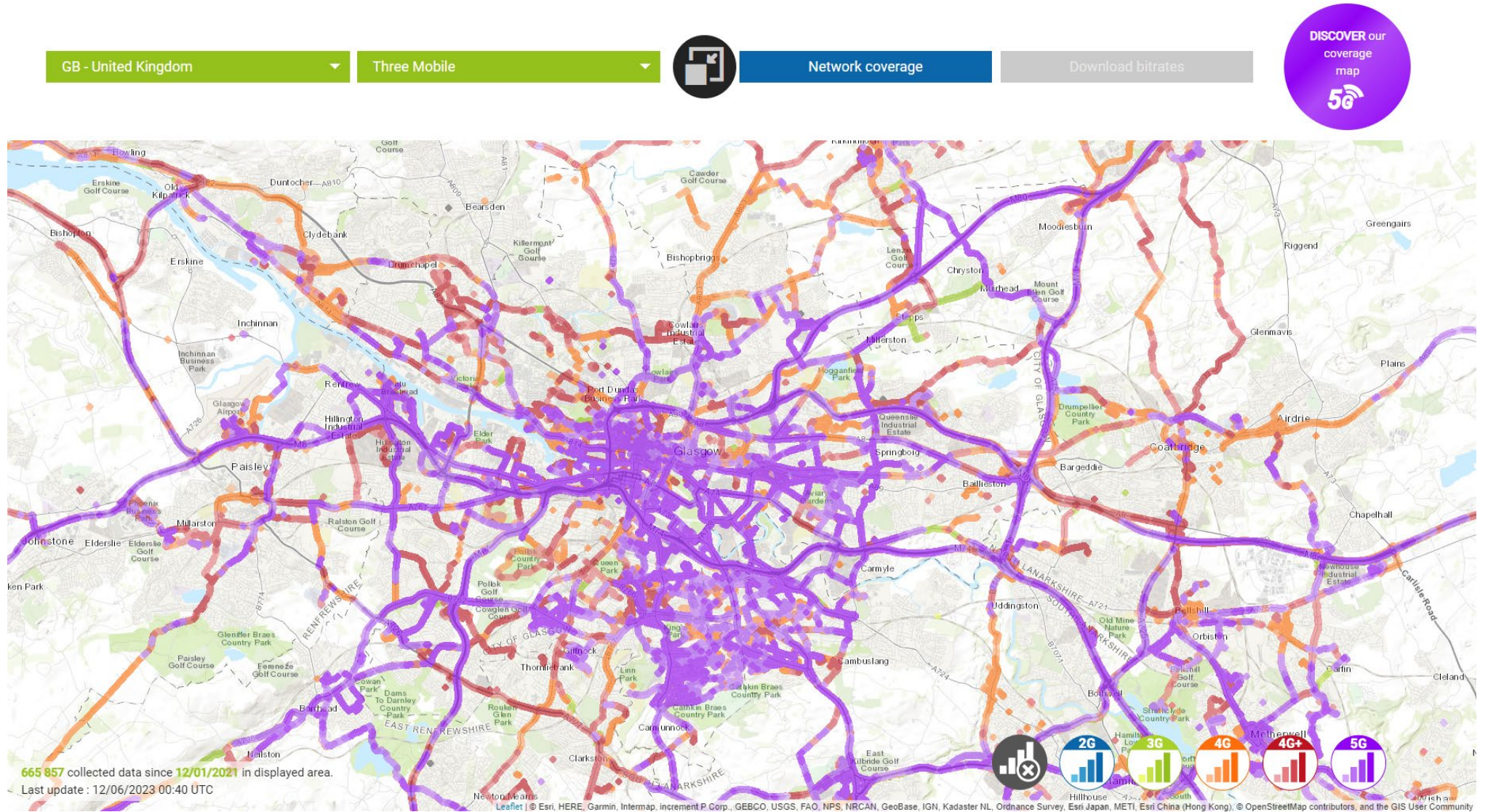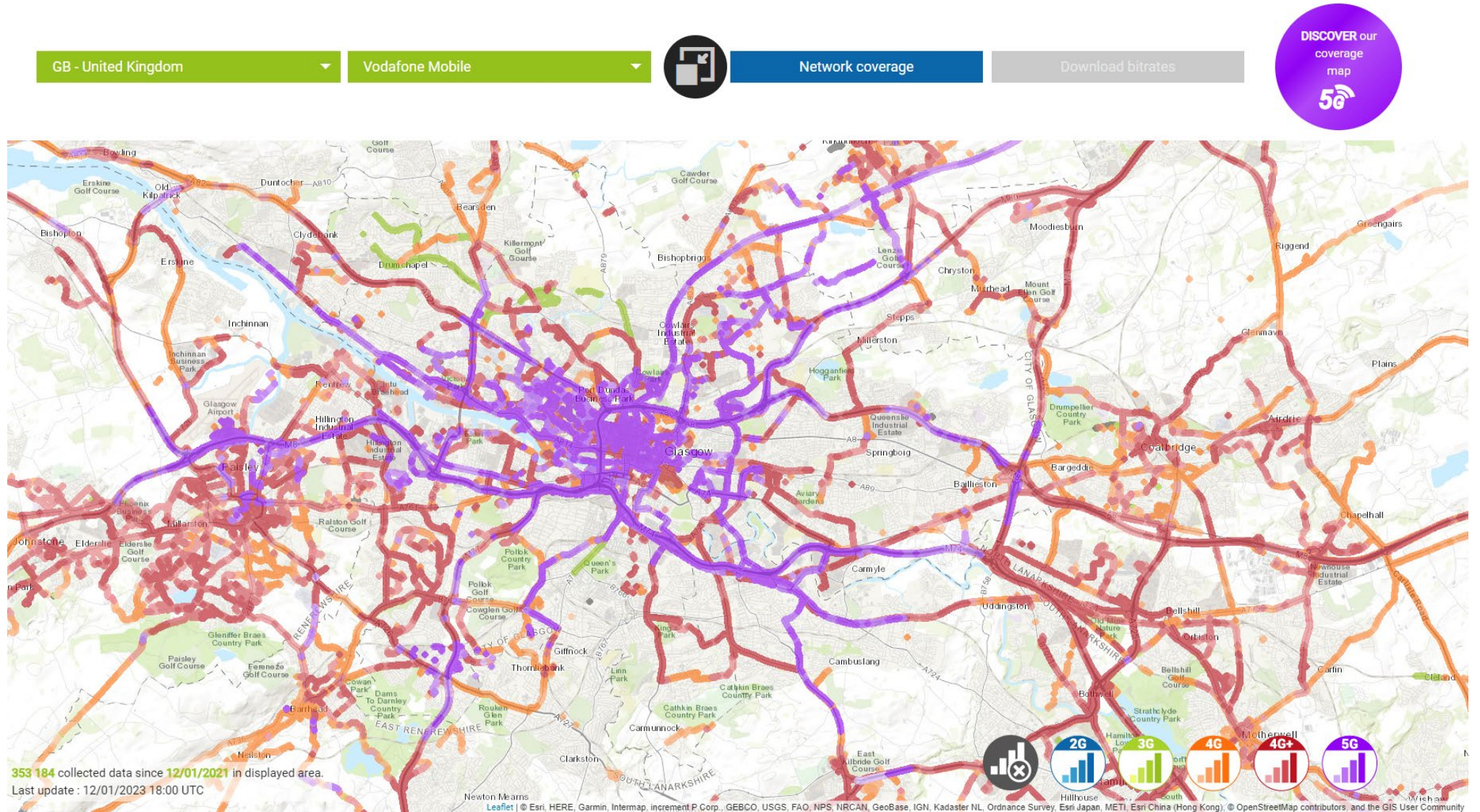**Figure 8: Three Network Coverage**

Figure 9: Vodafone Network Coverage

3. Compatibility with Investment Hierarchies

The rollout of high speed fixed and mobile digital infrastructure is compatible with the following Investment Hierarchies:

- Determine future need by increasing availability of digital platforms and technological innovation.

By increasing the availability of digital platforms and technological innovation, there is greater potential to also meet the following Investment Hierarchies:

- Maximise the useful life of existing assets – due to digital monitoring.
- Reduce the need to travel unsustainably – due to improved availability and capabilities of services online.

Proposed Communications Infrastructure

4. Future Needs

Fixed Line Connectivity

As technology evolves, faster broadband speeds will be required to accommodate a greater demand for more services. There will therefore be a need to support and facilitate the continued rollout of Gigabit and Full Fibre broadband infrastructure across Glasgow City.

Mobile Connectivity

The rollout of 5G mobile connectivity is enabling new services and applications including:
- Faster mobile broadband and a more consistent experience in congested areas with a very high number of devices.
- Industrial applications, enabling businesses to improve their productivity, for example through predictive maintenance and real-time analytics.
- Internet of Things (IoT) services, many of which will help councils and businesses deliver services more efficiently including:
    - transport and logistics: connected parcels and fleet tracking;
    - health and social care;
    - environmental monitoring: sensors monitoring air quality and water pollution in real-time;
    - smart agriculture and smart animal farming, smart retailing; and
    - connected and autonomous cars: allowing cars to communicate with each other, other road users and even the road infrastructure.

The 5G roll out will see MNOs re-use existing 4G sites to install new infrastructure and also propose new sites to install new base stations to widen coverage further.

In December 2022, Ofcom produced a conclusions paper on Ofcom's Future Approach to Mobile Markets and Spectrum which encourages longer-term thinking about how mobile networks in the UK may need to evolve to meet future demand, in light of expected growth and demand for spectrum from other users. In summary, it states the following:

- Mobile data traffic has grown by an average of 40% year on year in recent years and we expect it to continue to grow. However, there is a high degree of uncertainty about the rate of future growth, particularly beyond 2030.
- Mobile networks will need to evolve to meet future demand and deliver the quality of experience needed by consumers and businesses. There are a number of ways in which they might do this, including:

- More extensive deployment of existing spectrum holdings and planned future spectrum for mobile e.g. in the millimetre wave (mmWave) bands;
- Using technology upgrades to increase the efficiency of the spectrum they use; and
- Network densification – deploying more cell sites – in particular using small cells to leverage the capacity offered by the large bandwidths available from mmWave spectrum.

The above document provides an indication of the future direction of infrastructure deployment in the city.

To meet this likely future demand, **EE** has advised that it will require the following infrastructure to be rolled out:
- Upgrading existing apparatus;
- Deployment of new base stations (especially for 5G); and
- Deployment of more street-based solutions, be they street poles or small cells.

This apparatus will need to be deployed on a city-wide basis and in all land use types.

5. Programmed Improvements

Fixed Line Connectivity

All fibre providers are continuing to deploy Full Fibre across Glasgow City. It is anticipated that Full Fibre will be rolled out across the City Centre by the beginning of 2025 which will provide a much-needed improvement to broadband speeds in the Glasgow Central area where currently only 59.6% of properties have access to Full Fibre broadband (see Figure 4).

Virgin Media O2 are deploying 2-Gigabit broadband to residential properties in Glasgow. This will provide broadband speeds more than 28 times faster than the UK average.

Mobile Connectivity

Glasgow City Region has secured £3.2 million UK Government funding from the 5G Innovation Regions programme to establish itself as 'The Glasgow 5G Innovation Region'. GCR will utilise existing Internet of Things (IoT) deployments and smart city applications to identify, deliver and propagate use cases for utilising advanced wireless technologies and driving improvements in public and private sector service delivery. It will focus on 4 projects initially:
- Asset Monitoring and Maintenance;

- Net Zero Social Housing;
- Data Aggregation; and
- Health and Social Care Monitoring.

These projects will build upon a strong existing base to prove business models and scalability that will drive more efficient and effective services whilst also helping further grow regional economic specialisms.

Three UK are upgrading the Glasgow City Centre network with 53 Small 5G Cells as part of the UK Government funded [SCONDA project](). SCONDA creates a small cell densification layer in high demand urban hotspots to provide a better customer experience in terms of both coverage and capacity. The works are due to start in March 2024 and should be completed by the end of summer 2024.

6. Further improvements required?

Fixed Line Connectivity

The following government funding is available to eligible residential and business properties to improve broadband speeds:
- Project Gigabit is the UK Government's flagship £5 billion programme to enable hard-to-reach communities to access lightning-fast gigabit-capable broadband. The fast, reliable connections delivered by Project Gigabit will level-up mostly rural and remote communities across the UK, as well as tackling pockets of poor connectivity in urban areas, including Glasgow City. To complement this work and to support pace of delivery, there is up to £210 million to give people in eligible areas immediate financial help to get gigabit-capable speeds. The scheme is accessible through broadband service providers that have registered to provide connections through the scheme. Vouchers worth up to £4,500 for homes and businesses help to cover the costs of installing Gigabit broadband to people's doorsteps.
- Reaching 100% (R100) programme is a Scottish Government funded commitment to provide access to superfast broadband of 30 Megabits per second (Mbps) to those homes that have slower broadband speeds and aren't yet able to receive Gigabit broadband. The Scottish Broadband Voucher Scheme (SBVS) provides funding of up to £5,000 to help homes and businesses not in scope of either Reaching 100% (R100) contracts or planned commercial investment to obtain superfast broadband where providers may not ordinarily go.

There are currently approximately 1000-1200 homes and business properties in Glasgow City that are eligible for funding to obtain Gigabit-capable and superfast (>30 Mbps) broadband. The Council's Telecoms Unit will be encouraging eligible residents and businesses to apply for these vouchers to fund the suppliers' costs of broadband installation.

Consideration needs to be given to other barriers to accessing broadband, particularly for residents in Glasgow, including limited digital skills, financial constraints or lack of personal digital equipment. These issues will be considered separately in the Community Facilities Infrastructure Audit.

Mobile Connectivity

Mobile Network Operators (MNOs) EE and Three have submitted information to Glasgow City Council on how to improve digital infrastructure rollout. Their submissions are summarised below:

EE states that MNOs will need supportive policies which allow fast and consistent decision making across all land uses and areas within the City Region. NPF4 demonstrates the links between communication and other development. People access devices in all areas and in all land uses and increasingly machine-to-machine connectivity (Internet-of-Things or IoT) will emphasise this ubiquity even more.

EE requires that decision-makers and those drafting and approving planning policy and strategy understand the level of demand and that it is accelerating as devices become more sophisticated and more uses for data come onstream. Previous supporting documents with planning applications such as radio coverage plots, which were and are useful pictorial guides where new coverage is being proposed, don't give any indication of the underlying demand for data in that area or the capacity of the networks in that area.

Below are two specific examples of where EE has challenges getting applications for 5G infrastructure through the planning process:

- Mast heights - communications masts only exist to support antennas. Antennas propagate the radio signal. Depending on wavelength and frequency that radio signals travel a certain distance and penetrate buildings materials. Masts are often compared to their environment and other vertical features such as streetlights. This is not helpful as they perform very different functions. Under Part 67 of the GPDO, permitted development rights existing for new ground-based masts subject to the prior approval of the planning authority for their siting and appearance. Under this regime any comparisons are therefore not relevant to any assessment of the siting and appearance of a new ground mased mast, the rights and the height limitations for ground-based masts, if comparisons are to be made they should be against other ground-based masts.

- ICNIRP restrictions – tying in with the above is the different characteristics of 5G technology with regard to the ICNIRP guidelines. In effect, the power output profile is different which in practice means taller masts and, if building-based, greater separation of antennas on the host roof. This brings with it greater visual impacts. It also limits the ability to face mount antennas on building.

EE advocates closer working between stakeholders to facilitate the deployment of new infrastructure and cites the current stakeholder engagement that exists with Glasgow City Council (Telecoms Unit) and the Scottish Government (Scotland 5G Centre) as an exemplar. EE would welcome further engagement through the evolution of new planning policy for Glasgow City Council.

Three requests that policy supports and encourages the deployment of telecoms equipment and references as such when new developments are considered. It also recommends that PAN62* is referred to and the overall intention to encourage the deployment of the latest technology. It recommends that policy recognises the importance of telecoms.

* Superseded by 'Scottish Government Planning Guidance: Digital Communications' in December 2023

7. Deliverability

Both the UK and Scottish Governments have supportive policies and selective financial assistance in place to promote the roll out of digital infrastructure across the country.

Glasgow City Council Planning Authority works closely with colleagues in the Council's Telecoms Unit who liaise directly with WIPs and MNOs to understand their requirements and provide the necessary support to facilitate the smooth rollout of their investment programmes. This is the only such unit in Scotland and operators have confirmed that this is a progressive model that should be rolled out to other Councils to support the ongoing development of digital infrastructure across Scotland.

To improve planning and delivery of digital infrastructure across Glasgow, it would be helpful if all WIP and MNO operators would fully engage with Glasgow City Council to advise on their individual requirements and how City Development Plan 2 can support and facilitate infrastructure delivery most efficiently.

It would also be helpful if Councils could secure access to Building Digital UK (or similar spatial database) to view relevant data on existing networks and roll out programmes for all operators across their Council area.

In producing CDP2 consideration will be required of appropriate planning policies that support the ongoing rollout of digital infrastructure whilst also protecting visual amenity - including the requirement to remove redundant infrastructure and consideration of siting and design of equipment.