



# Standalone 5G and the UK's Road and Rail Network

A WPI Strategy report for Vodafone UK

September 2024

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## What is 5G Standalone?

Until now, 5G has sat on existing networks and therefore relied on 4G technology. Whereas 5G Standalone (SA) is an end-to-end 5G solution, delivering more reliable connectivity, enhanced security, improved battery life and low latency (bufferless) experiences.

## Methodology

WPI Strategy modelled for the benefits to the UK's road and rail networks if their systems had access to a standalone 5G network. It used a range of studies and pilot scheme results to determine how 5G can reduce traffic congestion and pre-empt faults on the rail network, alongside Department for Transport data and Teneo survey results on road users and train journeys to model for the various outputs.

## About Vodafone UK

Vodafone UK is a technology communications company that connects people, businesses and devices to help our customers benefit from digital innovation. Our services span mobile, fixed-line connections, home and office broadband, and the Internet of Things (IoT).

We have a strong track record as a tech pioneer, making the UK's first mobile phone call, sending the first text message, and making the UK's first live holographic call using 5G in 2018. We were the first to start carrying live 5G traffic from a site in Salford, Greater Manchester and now have 5G in locations across Germany, Ireland, Italy, Spain as well as the UK. Meanwhile, our 4G network coverage currently reaches over 99% of the UK population.

Today, Vodafone serves more than 18 million mobile and fixed-line customers in the UK. Vodafone is the largest provider of full fibre in the UK – our superfast broadband services are now available to nearly 12 million homes across the UK.

Sustainability is also at the heart of what we do: as of 1 July 2021, 100% of the grid electricity we use in the UK is certified to be from renewable sources.

For more information about Vodafone UK, please visit: [www.vodafone.co.uk](http://www.vodafone.co.uk)



# Executive Summary

The Government has made clear its five national missions, with kickstarting economic growth the central goal. Productivity is fundamental to this with the UK at risk of failing to unlock its full potential without improvements and modernisation of the UK's railways and roads.

The opportunity is significant. Investment in the rollout of 5G Standalone (5GSA) coverage would improve connectivity for rail passengers, enabling them to work productively, and add potentially £1 billion per year to the UK economy, whilst the new, connected technology could also result in up to £2 billion being saved on fuel spending for drivers.

Rail and road networks serve a critical function in the UK, facilitating the movement of people, goods and services across all regions. These connections are vital across the entirety of the country, both urban and rural areas.

For many people in the UK, railways and roads facilitate access to critical services, like schools and hospitals. They also provide freedom and independence, enhancing quality of life. These are essential networks for millions of people travelling for work and leisure.

The challenge for government is ensuring that the nation's transport infrastructure can meet constant demands, improve in order to achieve these opportunities and provide true value for money. With a recent poll finding 63% of respondents think the UK is 'going nowhere fast', it is important the Government takes meaningful steps to improve this experience.<sup>1</sup>

In order to make these improvements and support the UK's national growth mission, investment and development of existing and new technologies is key. The UK needs investment in nationwide 5G in every part of the country – a manifesto promise of the new Government.



# 1. Policy context

The Government has committed to transforming transport infrastructure throughout the country. These commitments include improved performance on road and rail, greener transport, and enhanced passenger productivity.<sup>2</sup> Investment in delivering standalone 5G directly supports the objectives of the Government across both the rail and road networks. On railways, 5G technology can reduce delays and increase customer satisfaction. On roadways, it can boost productivity by cutting travel times, reduce the cost of living by limiting fuel consumption, and reduce vehicle emissions with minimised traffic congestion.

## **Increasing productivity**

The Government's goal of achieving the highest economic growth in the G7 requires significant boosts in productivity. However, recent figures show stagnating productivity rates across the UK and growing regional disparities.<sup>3</sup> To tackle the productivity crisis, the Government's manifesto set intentions to remove barriers to productive growth, including the slow rollout of new technology.<sup>4</sup>

The increase in connectivity from the rollout of standalone 5G throughout the UK will boost productivity across the board, reducing time workers spend delayed in traffic and allowing passengers to work productively on train journeys. Alongside knowledge workers, standalone 5G would boost the everyday productivity of logistics drivers, who rely upon navigational technology to provide time-effective routes for deliveries.

## **Aiding the cost of living**

5G on roadways can play an important role in offsetting the cost of living, saving consumers money through decreased fuel costs. With 5G's potential to reduce traffic congestion and improve route optimisation, motorists will spend less time sitting in traffic and, in turn, use less fuel. Potential cost saving on fuel will additionally serve as a positive step in improving the Government's difficult relationship with motorists, in part as a result of proposed bans on new petrol vehicles.

## **Decreasing vehicle emissions**

With its stated commitment to achieving net zero by 2050, tackling the Government's goals on climate change requires a sustained reduction of emissions. 5G technology can play an important role in reducing emissions on UK roadways. By decreasing delays and congestion, vehicles will spend less time idling in traffic, releasing fumes and contributing to emissions.

## **Improving UK railways**

As outlined in the King's Speech, the Government aims to significantly improve the UK's rail system. The Government's goals focus on addressing persistent delays, increasing passenger experience, and enhancing connectivity, particularly in the North of England.

Standalone 5G coverage can play a crucial role in reducing delays and wait times by improving data flow and communication between trains, operators, and stations. Standalone 5G connectivity on railways could save an estimated 26 million hours annually in avoidable delays, while also reducing the financial burden on rail networks, which paid over £101 million in compensation between April 2023-2024.

With passenger experience at the heart of the new Government's goals, 5G connectivity across UK rail networks is also a strong step towards increasing passenger satisfaction in the immediate future. Better connectivity provides passengers with greater ability to use devices for both work and entertainment.

## Research

This new research reveals impressive results when quantifying the benefits of standalone 5G. It can be a truly transformative technology for transport.

We find that:

- Standalone 5G can support technologies to reduce traffic by 25%.
  - This would save regular drivers in the UK a total of 216 million hours per year.
  - Less traffic would save regular road users £2 billion annually in fuel costs, or as much as £140 per driver, at a time where the cost of living remains a challenge for millions of Brits.
  - As an example of how less traffic can boost productivity for freight drivers, the logistics sector alone could make productivity savings of £140 million each year by making deliveries of goods more time efficient.
- If standalone 5G can reduce train delay times by 10%, then this could:
  - Add £1 billion per year to the UK economy through people who would like to work on the train but do not do so currently due to poor connectivity.
  - Save rail users 26 million hours per year
  - Make up to 660 million rail journeys per year more enjoyable for rail users
  - Save over £10 million across the rail industry per year in compensation claims alone, where this money could be reinvested back into improving train services and networks

To deliver these rewards, the UK needs nationwide 5G in every part of the country – a manifesto promise of the Government – which as part of the proposed merger, Vodafone UK and Three UK promise to deliver through a self-funded £11 billion investment to roll out 5G SA to 95% of the population by 2030 and 99% by 2034.





## 2. Technology

The improved connectivity that comes with investment in standalone 5G coverage can significantly enhance the functioning of road and rail transport technologies, including sensors, vehicle-to-everything communication, and communications on rail networks.

### How 5G improves sensors

Sensors are frequently used in road and rail infrastructure to measure data on numerous factors, including vehicle speed, track conditions, and traffic flow. Sensors can create predictive maintenance systems to detect faults before they cause delays or safety hazards. 5G technology can significantly improve the efficiency and accuracy of sensors relied upon for traffic management, road safety, and track monitoring.

- **Standalone 5G improves the accuracy of sensors.** Transmission of high resolution data at faster speeds allows sensors to provide more accurate and timely readings. Highly accurate readings allow for route and track optimisation, improving the flow of transport.
- **Standalone 5G increases network capacity,** enabling a greater number of devices to utilise the same network without causing congestion and slow-downs. This allows a large number of sensors to be utilised across transport networks, transmitting data on track position and traffic flow in real-time.
- **5G increases the power efficiency of sensors,** decreasing the frequency with which batteries need to be replaced. High power efficiency has time and cost-saving benefits, particularly on large infrastructure projects where frequent maintenance of sensors is unfeasible.

### 5G and Vehicle-to-Everything communication

Vehicle-to-Everything communication (V2X) is the wireless exchange of data and information between vehicles (V2V) and between vehicles and infrastructure (V2I). Data shared in real-time from V2X is used to improve road safety, reduce collisions, and alleviate traffic congestion. 5G technology can improve V2X through high reliability, and low latency.

- **Improved network reliability** with 5G ensures data transmission and flow between vehicles is consistent. This is of particular importance for V2X-reliant safety technology, such as automatic emergency braking systems.
- **5G provides low latency,** or the time it takes for data to travel from sender to receiver, speeding up data transmission. This ensures traffic data, including road closures and accidents, are reported quickly, allowing navigational systems to reroute drivers and reduce congestion.

### 5G and rail communication

Rails networks rely on accurate and timely communication between operators and platforms to reduce delays and prevent accidents. Standalone 5G can make rail networks smarter, through enhanced communication between trains, signals and stations, optimising track selection and reducing wait times.

- **Improved network reliability can enhance the functioning of rail networks.** Consistent flow of data provides more accurate tracking of wait times and progress of trains along tracks. High-speed, continuous monitoring of tracks can additionally aid predictive maintenance of rail systems, which detect faults before they cause delays.
- **Low latency has additional implications for rail networks.** Quick data transmission speeds ensure track data, including any delays or changes in train speed are reported quickly, enabling optimal track selection and signalling.

## Smart Transport: 5G-powered road and rail

There could be up to **28.2 million train journeys per year** where people can't work due to poor connectivity. 5G Standalone could help remote workers keep connected while commuting – which could translate into **£1 billion** for the UK economy per year.

Better connectivity could also make up to **660 million train journeys** more enjoyable and productive for those who wish to work, catch up with friends or watch a film. Commuters could also save **26 million hours per year** due to reduced delays – saving rail companies **£10 million per year** in delay compensation fees.

5G Standalone could help reduce traffic congestion by **25%**, saving UK drivers collectively up to **£2 billion per year**. That's as much as **£139.50 per driver**.

Less time spent in traffic could save **1.82 million tonnes of CO2 per year**. That's the same as taking **1.5 million cars** off the road every year.

5G allows cars and road infrastructure devices to share data on issues like road hazards and traffic conditions, which helps reduce accidents and address the number one concern for UK drivers: potholes and uneven roads causing damage to their cars.

5G technology could help goods move around the country more easily, saving delivery drivers **4 million hours per year** – translating into productivity savings of **£140 million per year** for the sector.



## Conclusion

The Government's focus on kickstarting economic growth is closely tied to improving productivity, particularly through the modernisation of its transport infrastructure. Our research shows that enhancing connectivity on railways and roads is essential to unlock the country's full potential. Improved rail passenger productivity alone offers a potential £1 billion annual boost to the economy, while fuel savings for drivers could reach £2 billion.

Investment in Standalone 5G is vital to supporting these improvements. The self-funded £11 billion investment, part of the proposed merger, Vodafone UK and Three UK, would see SA5G rolled out to 95% of the population by 2030 and 99% by 2034.

That increase in connectivity will enable a more efficient, data-driven transport system that meet the needs of passengers and the demands of a modern economy.

## Methodology - Road

- **Assumptions on how 5G technologies reduce traffic, fuel use and CO2 emissions:** We created a systematic review of academic studies and smart city pilot schemes to determine the plausible output ranges for how much technologies using either 5G networks or real-time data networks can reduce avoidable traffic, waiting times and fuel use.
- **Determining the number of regular road users and road freight workers:** We categorise 'regular' road users as those that stated in the 2021 Census that they primarily travel to work via a car or van (including where they are passengers), or take a bus, coach or taxi. We use Department for Transport data on road freight drivers.
- **Determining hours spent in traffic and fuel savings:** We create an average estimate based on external analysis (such as the Inrix Global Traffic Scorecard) and recent polling from Teneo.
- **Assumptions on road freight productivity:** We use the latest ONS figures on GVA per hour for warehousing and support activities for transportation, and logistics.





## Methodology - Rail

- **Determining the number of passenger journeys and hours saved, and total delays:** We use data from the Office of Road and Rail and the Department for Transport on journey volumes and delays across 2023-24. We then use a 10% time saving as an indicative assumption on how 5G technologies can reduce delay times, in line with our previous analysis (A Digital Society).
- **Determining productivity and satisfaction benefits for passengers that work on the train:** We use recent polling from Teneo on delay experiences and those that are likely to work on the train or access media but currently do not do so due to poor connectivity. We then assume that each person in scope would work one hour per journey. GVA figures are calculated using the latest ONS data on labour productivity per worker per hour in the UK and is weighted towards occupations that typically allow for remote working.
- **Determining rail industry savings:** Train companies paid out £101.3 million for service delays or cancellations across 2022/23 and are on track to pay even more this year. A 10% delay reduction could therefore result in a £10 million cost saving.





## Endnotes

- 1 One Poll for Vodafone, September 2024
- 2 <https://www.gov.uk/government/news/transport-secretary-sets-out-5-key-priorities-to-deliver-the-biggest-overhaul-to-transport-in-a-generation>
- 3 <https://www.niesr.ac.uk/publications/economic-priorities-2024-general-election?type=general-election-briefing>
- 4 <https://labour.org.uk/wp-content/uploads/2024/06/Change-Labour-Party-Manifesto-2024-large-print.pdf>



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**September 2024**

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