

Civil engineering insights into Northern Powerhouse Rail

May 2022

Overview

The North of England is home to around 1.1 million businesses,¹ 7.1 million jobs² and has a population of 15.5 million people – 23% of the UK total.³ Its economy generated £423.8 billion GDP in 2019 – almost a fifth of the total for the UK.⁴ However, over the next decade the North is forecast to experience slower population growth⁵ and lower levels of economic growth compared to the rest of England.⁶

The Northern Powerhouse concept first emerged under the 2010–2015 Coalition Government and formed part of the 2017 Industrial Strategy of Theresa May’s Government.⁷ It envisioned a super-connected, globally competitive Northern economy with a flourishing private sector, a highly skilled population and world-renowned civic and business leadership.⁸

More recently, the Johnson Government has replaced the May-era Industrial Strategy with a ‘Build Back Better’ plan for growth.⁹ The Northern Powerhouse vision has effectively been merged with the Levelling Up agenda, which aims to raise productivity and quality of life across the UK to reduce regional imbalances.¹⁰

Underlying these shifting strategic visions is the notion that more action is needed to unlock the economic potential of the North, which would deliver benefits for the region and the wider country. Investment in transportation has been seen as necessary to support this. The National Infrastructure Commission (NIC), while noting transport is not the whole solution, has called it ‘the sector with the most opportunity for helping to reduce disparities between places’.¹¹

However, underinvestment in transport in the North is a long-standing problem. Analysis by IPPR North of transport spending between 2009/10 and 2019/20 found that the North received £349 per person, below the UK average of £430 per person.¹² In London, the figure was £864 per person. Today, the rail network across the North is struggling, with poor connectivity and limited capacity impacting on performance.

Northern Powerhouse Rail (NPR) was the centrepiece of Transport for the North’s (TfN) 2019 Strategic Transport Plan, designed to address these issues.¹³ A final NPR strategy was agreed by all stakeholders in 2021 which set out a vision of new and upgraded north–south and east–west rail connections across the North.¹⁴ It built on analysis from the NIC’s High Speed North study¹⁵ and the Northern Powerhouse Independent Economic Review.¹⁶

¹ House of Commons Library (2022) [Regional and National Economic Indicators](#)

² Office for National Statistics (2021) [Annual Population Survey](#)

³ Office for National Statistics (2021) [Regional Economic Activity by Gross Domestic Product, UK: 1998 to 2019](#)

⁴ Ibid

⁵ Office for National Statistics (2020) [Subnational Population Projections for England: 2018-based](#)

⁶ House of Commons Library (2022) [Regional and National Economic Indicators](#)

⁷ HM Treasury (2016) [Northern Powerhouse Strategy](#)

⁸ SQW (2016) [The Northern Powerhouse Independent Economic Review](#)

⁹ HM Treasury (2021) [Build Back Better: Our Plan for Growth](#)

¹⁰ Department for Levelling Up, Housing and Communities (2022) [Levelling Up the United Kingdom](#)

¹¹ National Infrastructure Commission (2021) [The Second National Infrastructure Assessment: Baseline Report](#)

¹² IPPR North (2021) [Broken Transport Promises Come as New Evidence Shows Widening Transport Spending Gap](#)

¹³ Transport for the North (2019) [Strategic Transport Plan](#)

¹⁴ Transport for the North (2021) [Northern Powerhouse Rail](#)

¹⁵ National Infrastructure Commission (2016) [High Speed North](#)

¹⁶ SQW (2016) [The Northern Powerhouse Independent Economic Review](#)

To achieve the Northern Powerhouse vision, TfN has argued that the full NPR network, the Transpennine Route Upgrade and High Speed 2 (HS2) are integral to the North's future network.¹⁷ However, in 2021 the government set out its own vision for the future of rail in the North in its Integrated Rail Plan for the North and Midlands (IRP).¹⁸ This plan scales back much of TfN's preferred option to prioritise a 'core' NPR network focused on connecting Liverpool, West Yorkshire and Greater Manchester.

Purpose of this paper

This insights paper reviews the current status of NPR and examines its proposed benefits and possible alternatives. The paper aims to inform the broader policy debate on NPR by providing analysis and insight from published evidence, ICE Fellows and industry experts from the North of England.

About Northern Powerhouse Rail

Transport for the North's preferred strategy

Rather than a single project, NPR sets out a major rail programme to support the long-term transformation of the North's economy. The strategy developed by TfN proposes an expanded rail network combining a mix of new and significantly upgraded and electrified lines.

TfN argues its proposal would increase the capacity, speed and resilience of the rail network, radically improving connectivity between major economic centres and transport hubs throughout the North East, North West and Yorkshire and the Humber.¹⁹

TfN published its final proposals for NPR in June 2021.²⁰ Its preferred network would deliver:

- a new line between Liverpool and Manchester via central Warrington
- upgrades and journey-time improvements between Manchester and Sheffield
- a new line between Manchester and Leeds via a new station in central Bradford
- upgrades to the East Coast Mainline between Leeds and Newcastle
- upgrades and electrification between Leeds and Hull and Leeds and Sheffield
- connecting Sheffield to the HS2 Eastern Leg and Leeds.

What does the Integrated Rail Plan say?

TfN has argued that both NPR and HS2 are integral to the North's future rail network and should be planned as part of the wider network, not in isolation.²¹ Its strategic plan envisions further investment in road, rail, bus, aviation and freight routes.²²

This approach was also recommended by the Oakervee Review of HS2, which concluded that, while the government should proceed with HS2, a further rail plan for the North and Midlands should also be developed to ensure HS2 is properly integrated with other transport strategies, including NPR.²³

¹⁷ Transport for the North (2019) [Strategic Transport Plan](#)

¹⁸ Department for Transport (2021) [Integrated Rail Plan for the North and Midlands](#)

¹⁹ Transport for the North (2019) [Northern Powerhouse Rail](#)

²⁰ Transport for the North (2021) [Northern Powerhouse Rail](#)

²¹ Transport for the North (2019) [Northern Powerhouse Rail: At a Glance](#)

²² Transport for the North (2019) [Strategic Transport Plan](#)

²³ Department for Transport (2020) [Oakervee Review of HS2](#)

In November 2021, the government published the IRP, informed by the work carried out by TfN, the Oakervee Review and the NIC's Rail Needs Assessment for the Midlands and the North.²⁴

However, the IRP sets out significantly scaled-back plans for NPR compared to TfN's preferred vision, including rejecting the proposed new high-speed line between Manchester and Leeds via a new station in central Bradford. It also scraps much of the planned Eastern Leg of HS2 between Birmingham and Leeds.

Instead, the IRP identifies a 'core NPR network' connecting Liverpool, West Yorkshire and Greater Manchester. The plan reasons these are 'the three largest economic areas in the North, where unifying labour markets will create the most new job and business opportunities'.²⁵

This core package includes:

- 40 miles of new high-speed line on the Liverpool–York route between Warrington, Manchester and as far as Standedge in Yorkshire, with upgraded and electrified lines along the rest of the route
- upgrades and electrification of the Leeds–Bradford section of the Calder Valley Line
- electrification of the Leeds–York route, with some sections of four-tracking
- improvements to the previous Transpennine Route Upgrade plans between Manchester and Leeds, including electrification of the whole route, digital signalling and significantly longer sections of three- and four-tracking. This will now form the first phase of NPR.

In the IRP, the government argues that the core NPR network will deliver similar outputs in the Manchester–Liverpool and Manchester–Leeds corridors to TfN's preferred option but at lower cost, while accelerating some of the improvements. This would see some NPR services starting to run this decade. However, the timeframe means most improvements are still scheduled for delivery in the 2030s and 2040s, with the 'transformational benefits' to be realised by 2050.

The core NPR network is now part of the £96.4-billion IRP pipeline, which includes £17.2 billion for the NPR core Liverpool–York route and £5.4 billion for the Transpennine Route Upgrade base scope, including full electrification.

Responses to the Integrated Rail Plan

TfN has stated that the IRP proposals 'fail to achieve the long-term step change for the rail network across the North'.²⁶ There are also concerns that the IRP falls short of providing the detail and supporting evidence required of a deliverable infrastructure plan.²⁷

On the other hand, while the IRP scales back significant parts of the NPR and HS2 proposals, it does set out significant investment in rail schemes in the North. It is uncertain how set in stone the plan is and what will be the scope for future adjustments or further investment beyond the core projects outlined.

The NIC noted that there was insufficient money available for all the proposed major rail schemes across the Midlands and the North.²⁸ It therefore recommended that the government commit to a 'core set of programmes' and add additional schemes subject to the availability of further funding and the core pipeline being delivered on time and to budget.

The government has argued that it is taking this adaptive approach and that further development work on other NPR corridors could happen, depending on the affordability and deliverability of the core portfolio. The NIC has since said that the IRP provides clarity and a long-term plan for rail in the North and Midlands and the adaptive approach is 'sensible' in the face of public spending constraints.²⁹

²⁴ National Infrastructure Commission (2020) [Rail Needs Assessment for the Midlands and the North – Final Report](#)

²⁵ Department for Transport (2021) [Integrated Rail Plan for the North and Midlands](#)

²⁶ Transport for the North (2022) [Written Evidence to the Transport Select Committee Inquiry on the Integrated Rail Plan](#)

²⁷ Institution of Civil Engineers (2022) [ICE Submission to the Transport Committee's Inquiry on the Integrated Rail Plan](#)

²⁸ National Infrastructure Commission (2020) [Rail Needs Assessment for the Midlands and the North – Final Report](#)

²⁹ National Infrastructure Commission (2022) [Infrastructure Progress Review 2022](#)

The future of Transport for the North

Following publication of the IRP, the government announced that the Department for Transport would take over as sole client for the NPR programme in early 2022.³⁰ TfN would continue to play an active role as a co-sponsor, offering strategic direction, analysis and advice. However, the move will see TfN's role and funding cut significantly.

Proposed benefits of Northern Powerhouse Rail

Greater connectivity for the North

Both the NPR strategy and the IRP rest on the idea that investing in the rail network to deliver better, faster and more reliable transport connections is essential for economic growth and closing the opportunity gap across the country.³¹

Analysis by Network Rail of intercity commuting patterns prior to the Covid-19 pandemic found that commuting between Northern cities was lower than in other parts of the UK. The analysis also highlighted the disparity between access to jobs in London compared with other cities. For example, the average number of jobs accessible within 60 minutes by rail available to someone living in the North West was 187,000, compared to 1.7 million for someone living in London.³²

According to a recent study by Be the Best Communications, the six worst-connected major cities in the UK are in the North and Midlands, with Bradford performing worst due to a lack of direct routes and slow connections.³³ Liverpool and Hull are also in the top five worst-performing cities, underlining the poor state of east–west regional connectivity.

In general, intercity train journey times and frequencies in the North compare poorly against similar journeys in South East England and comparative international journeys.³⁴ NPR has the potential to significantly improve journey times, although the core network set out in the IRP would deliver slightly slower improvements along fewer routes.

Corridor	Typical performance (2019) ³⁵		Potential performance – NPR preferred option ³⁶		Potential performance – IRP ³⁷	
	Mins	Trains/hr	Mins	Trains/hr	Mins	Trains/hr
Liverpool–Manchester	37–57	4	29.5	6	35	6
Manchester–Sheffield	49–57	2	34.5	4	50	2–3
Manchester–Leeds	46–58	4	30	6	33	8
Leeds–Newcastle	88–95	3	72.5	4	76	3
Leeds–Hull	57	1	46	2	57	2
Sheffield–Hull	80–86	1	67	2	77	1

Table 1: Proposed journey time and capacity improvements according to NPR and the IRP

By increasing the size of the network and the speed and frequency of trains, TfN argues that the full NPR network, combined with HS2 and the Transpennine Route Upgrade, would bring an additional 3.8 million people within 90 minutes of at least four Northern cities.³⁸ The government argues the IRP will still deliver 'similar outputs at lower cost and with earlier benefits than alternative options', including the full NPR.³⁹

³⁰ Transport for the North (2022) [Integrated Rail Plan Update](#)

³¹ HM Government (2020) [PM Confirms HS2 Will Go Ahead Alongside Revolution in Local Transport](#)

³² Transport for the North (2019) [Northern Powerhouse Rail: At a Glance](#)

³³ Be the Best Communications (2021) [Integrated Rail Plan: Study of Thousands of Train Journeys Shows Six Worst Connected Cities are in the North and Midlands](#)

³⁴ National Infrastructure Commission (2016) [High Speed North](#)

³⁵ Transport for the North (2019) [The Potential of Northern Powerhouse Rail: Improve Connectivity, Unlock Opportunity](#)

³⁶ Transport for the North (2021) [Northern Powerhouse Rail](#)

³⁷ Department for Transport (2022) [Integrated Rail Plan for the North and Midlands – Technical Annex](#)

³⁸ Transport for the North (2021) [Northern Powerhouse Rail](#)

³⁹ Department for Transport (2021) [Integrated Rail Plan for the North and Midlands](#)

NPR would also boost international connectivity and access to the global economy. TfN argues the full network would more than double the number of people able to access Manchester Airport within 90 minutes from 2 million to 4.3 million.⁴⁰ According to the government, the core IRP will still significantly ‘enhance’ access to the airport.⁴¹ This could reduce the pressure on London’s busy transport networks by enabling more Northern air passengers to use Northern airports.

Expanded rail capacity in the North

Prior to the Covid-19 pandemic, there were high volumes of rail journeys to and from many large city centres in the North and demand was growing. From 2010 to 2019, passenger arrivals by rail during the morning peak increased by 36% in Manchester and 19% in Leeds.⁴² During the same period, passenger journeys between Liverpool and Manchester grew at an average annual rate of 8% and between Manchester and Leeds at a rate of 5%.⁴³

Capacity was struggling to keep up with the growth in demand and crowding was common. In 2019, peak morning trains were operating excess capacity in standard class of 1.8% in Manchester and 2.3% in Leeds.⁴⁴ Poor punctuality and reliability is also common across the North, with many operators performing below the national average.⁴⁵ High levels of crowding combined with unreliable services makes rail travel unattractive and suppresses demand.⁴⁶

While the impact of the Covid-19 pandemic makes predicting future travel demand uncertain, there is evidence that passenger and freight usage was recovering in the North prior to the onset of the Omicron variant in late 2021. According to TfN, demand for some periods was 85% of pre-Covid levels and leisure travel reached 89% on the TransPennine Express.⁴⁷

The NIC has cautioned that it is too early to assume that recent behavioural change will lead to completely different patterns of infrastructure use long term.⁴⁸ ICE’s analysis argued that long-term demand drivers, including population growth and the need for modal shift from private cars to public transport to help deliver net zero, will mean more people will need to complete more journeys by rail in the future.⁴⁹

In this uncertain context, operators will need to be flexible and able to respond to demand shifts. However, the rail service in parts of England, including the North, is currently not agile enough to make the necessary adjustments.⁵⁰ The current rail network is constrained by its largely twin-track infrastructure and struggles to balance the competing demands of long-distance, regional, local and freight services.⁵¹

Both the government and TfN have emphasised the capacity benefits of NPR. TfN has suggested the full NPR network could increase the number of seats between key Northern cities by up to 35,000 per hour.⁵² According to the government, the NPR core network set out in the IRP would increase seat capacity between Manchester and Liverpool by 268% and Manchester and Leeds by 299%.⁵³

A more sustainable transport network

In the UK, surface transport is the largest source of CO₂ emissions, contributing 23% of UK territorial emissions in 2019.⁵⁴ However, these emissions derive primarily from the use of petrol and diesel in road transport. Rail is a relatively low-carbon transport mode, meaning increasing modal shift from private vehicles and air travel to rail will be key to meeting the government’s 2050 net-zero greenhouse emissions target.⁵⁵

⁴⁰ Transport for the North (2021) [Northern Powerhouse Rail](#)

⁴¹ Department for Transport (2021) [Integrated Rail Plan for the North and Midlands](#)

⁴² National Infrastructure Commission (2020) [Rail Needs Assessment for the Midlands and the North – Final Report](#)

⁴³ Department for Transport (2021) [Integrated Rail Plan for the North and Midlands](#)

⁴⁴ Department for Transport [Passengers in Excess of Capacity \(PiXC\) on a Typical Autumn Weekday by City: Annual from 2011](#)

⁴⁵ Office of Rail and Road (2020) [Passenger Rail Performance 2019–20 Q4](#)

⁴⁶ National Infrastructure Commission (2016) [High Speed North](#)

⁴⁷ Transport for the North (2022) [Written Evidence to the Transport Select Committee Inquiry on the Integrated Rail Plan](#)

⁴⁸ National Infrastructure Commission (2021) [Behaviour Change and Infrastructure Beyond Covid-19](#)

⁴⁹ ICE (2020) [Covid-19 and the New Normal for Infrastructure Systems](#)

⁵⁰ Public Policy Projects (2022) [The Future of GB Rail](#)

⁵¹ Transport for the North (2022) [Written Evidence to the Transport Select Committee Inquiry on the Integrated Rail Plan](#)

⁵² Transport for the North (2019) [The Potential of Northern Powerhouse Rail: Improve Connectivity, Unlock Opportunity](#)

⁵³ Department for Transport (2022) [Integrated Rail Plan for the North and Midlands – Technical Annex](#)

⁵⁴ Climate Change Committee (2020) [Sixth Carbon Budget](#)

⁵⁵ Committee on Climate Change (2019) [Net Zero: The UK’s Contribution to Stopping Global Warming](#)

TfN says the full NPR network could reduce road usage by 58,000 car trips per day. It would also release rail capacity to shift additional freight transport from road to rail. Taking modal shift and electrification together, TfN argues the full NPR programme could reduce the North's car and rail emissions by 1–2% in 2040.⁵⁶

Addressing the North's productivity challenge

Overall productivity in the North trails behind the UK average.⁵⁷ For the last 30 years, the North's economic value per person (measured as Gross Value Added (GVA)) has been consistently around 10–15% below the average of the rest of England (excluding London).⁵⁸ While there are many factors behind this productivity gap, including skills, technology and investment, poor transport connectivity is a key issue.⁵⁹

In its Rail Needs Assessment, the NIC did not assess the impact of NPR alone but looked at the potential impact of a range of investment levels and rail packages on the North and Midlands. It suggested that prioritising investment in regional rail, largely east–west links, could boost productivity in city centres by £30–71 billion, depending on the specific measures and level of investment.⁶⁰ This was likely to be more beneficial than prioritising long-distance links.

TfN's own analysis suggests the full NPR package could support an uplift in GVA of £3.4 billion in 2040 and £14.4 billion by 2060. It argues NPR would help create a net gain of 74,000 new jobs and up to 20,000 additional businesses in the North by 2060.⁶¹

The government has acknowledged that a full analysis of the wider economic impacts of the different options for investment in rail in the North has not been completed at this time.⁶² Further independent analysis is needed to properly understand the likely impact of NPR on productivity and economic development.

International comparators

The Northern Powerhouse vision sought to better connect the region's key economic centres so they could function as a single economy.⁶³ This was inspired by the Randstad in the Netherlands and Rhine-Ruhr in Germany⁶⁴ – two other polycentric urban regions that, like the North of England, have a number of cities located close together.⁶⁵

Both the Randstad and Rhine-Ruhr have productivity (measured using GVA per worker) above their national averages and are more productive than the North of England. However, analysis by Centre for Cities shows commuting between city regions in the Randstad and Rhine-Ruhr is not significantly greater than across city regions in the North, nor are train links much quicker.⁶⁶

Instead, the analysis shows strong regional economies require strongly performing cities because the benefits of a large economy are only achieved when combined with the concentration of economic activity in specific places.⁶⁷ The NIC has noted that good rail connections both into and between cities tend to be present in comparable groups of cities in other countries but what distinguishes them is the frequency, rather than speed, of services.⁶⁸

Centre for Cities concludes that while there is a case for improving intercity transport in the North, it should not divert attention from improving the cities themselves. Indeed, both the NIC and Centre for Cities caution that the lesson from

⁵⁶ Transport for the North (2021) [Transport Decarbonisation Strategy](#)

⁵⁷ Office for National Statistics (2021) [Annual Regional Labour Productivity](#); Office for National Statistics (2018) [Regional Economic Activity by Gross Value Added: 1998 to 2017](#)

⁵⁸ SQW (2016) [The Northern Powerhouse Independent Economic Review](#)

⁵⁹ Ibid; PwC (2019) [UK Economic Outlook: What Drives Regional Productivity Gaps across the UK and How Can these be Closed?](#)

⁶⁰ National Infrastructure Commission (2020) [Rail Needs Assessment for the Midlands and the North – Final Report](#)

⁶¹ Transport for the North (2021) [Northern Powerhouse Rail](#)

⁶² Department for Transport (2022) [Integrated Rail Plan for the North and Midlands – Technical Annex](#)

⁶³ SQW (2016) [The Northern Powerhouse Independent Economic Review](#)

⁶⁴ ICE (2016) [State of the Nation 2016: Devolution](#)

⁶⁵ House of Commons Library (2016) [Research Briefing: The Northern Powerhouse](#)

⁶⁶ Centre for Cities (2016) [Building the Northern Powerhouse: Lessons from the Rhine-Ruhr and Randstad](#)

⁶⁷ Ibid

⁶⁸ National Infrastructure Commission (2020) [Rail Needs Assessment for the Midlands and the North – Final Report](#)

international comparisons is that rail investment has the best chance to succeed if it is integrated with a broader package to strengthen cities that includes skills, land-use planning and urban transport.⁶⁹

The public's expectations on transport provision in the North

According to a 2019 YouGov poll, one in five small and medium-sized businesses in the North said public transport was poor.⁷⁰ In a more recent survey, Northern areas made up five of the top ten counties where people felt they have actively bad train services. Just 49% of respondents in the North West and 42% in the North East rated their rail services as very good or fairly good, compared to 72% in London.⁷¹

The NIC commissioned social research which, while it covers views from the Midlands as well as the North, provides useful insights into the public's expectations for rail provision. The public saw scope for improvement but were sceptical that it would be delivered. Thus, they favoured tangible service improvements, including increased capacity and reliability, over new lines. Indeed, capacity and reliability were a greater priority than other outcomes, such as increases in train speed.⁷²

Alternatives to Northern Powerhouse Rail

Business-as-usual rail upgrades

One alternative would be simply to continue the current programme of investments in rail upgrades. Network Rail conducts a detailed long-term planning process (LTPP) to understand the capability of the network up to 30 years into the future so that it can promote efficient use of network capability and capacity. The most recent LTPP informs planning for Control Period 6 (2019–2024).⁷³

But TfN has argued that there are challenges to merely adding extra or more frequent services to the constrained, largely two-track rail infrastructure in the North. Even with planned improvements to rail capacity, TfN has said that pre-Covid-19 forecast growth would lead to significant crowding by 2033 on some parts of the network, followed by unsustainable levels of crowding and congestion without further investment.⁷⁴

The ongoing capacity and reliability issues along the Castlefield rail corridor in Manchester are well established and provide an illustrative example of the limitations of an ad hoc approach to rail upgrades.⁷⁵

Investment in the road network

The North's road network already has considerable capacity issues. Prior to the Covid-19 pandemic, over 80% of commuting trips and 87% of freight movements used the road network in the North. Journey times can be relatively slow, particularly centre-to-centre trips. The journey time between Liverpool and Manchester, for example, is around 51 minutes to cover the 34 miles, with an average speed of only around 40 mph.⁷⁶

TfN's Major Roads Report identifies future network requirements and provides a case for investment in Northern roads.⁷⁷ For example, the M62 is the only continuous east–west dual carriageway road across the North and carries half of all trans-Pennine traffic. It is both congested and unreliable and there are significant risks associated with the North being so heavily dependent on the successful operation of just one road.⁷⁸

⁶⁹ Ibid and Centre for Cities (2016) [Building the Northern Powerhouse: Lessons from the Rhine-Ruhr and Randstad](#)

⁷⁰ YouGov (2019) [The 2019 SME Agenda](#)

⁷¹ YouGov (2021) [How Do Britons Rate their Local Train Services?](#)

⁷² National Infrastructure Commission (2020) [Rail Needs Assessment for the Midlands and the North – Final Report](#)

⁷³ Network Rail (2020) [Long-Term Planning](#)

⁷⁴ Transport for the North (2019) [Strategic Transport Plan](#)

⁷⁵ Network Rail (2019) [Castlefield Corridor Congested Infrastructure Report](#)

⁷⁶ Transport for the North (2019) [Strategic Transport Plan](#)

⁷⁷ Transport for the North (2021) [Major Roads Report](#)

⁷⁸ Transport for the North (2019) [Strategic Transport Plan](#)

However, investment in road networks at the expense of rail is unlikely to realise the same level of productivity improvements nor agglomeration benefits. Enabling the shift of people and freight from road to rail will be necessary for decarbonising transport as well as easing congestion on the roads.

About ICE

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