The Future is Slow

How Low Speed Rail could revolutionise UK rail capacity. | Joe Inniss, Luke Smith and team

Introduction

Construction is underway on Phase 1 of HS2, Britain's high-speed rail network. This phase runs from London to Birmingham, adding to (but not connecting with) the current stretch of high-speed rail connecting London to the Channel Tunnel. Linking the UK's two largest cities will be a massive step forward. Subsequent steps, however, may well benefit from a different approach. A network of new low-speed lines dedicated to freight transit would greatly increase the UK rail system's overall capacity at a much lesser initial and ongoing cost to both taxpayers and the environment.

To be clear, we must increase rail capacity. Passenger and freight rail networks may seem to exist independently of one another, but their current layouts are deeply intertwined and prone to interfering with each other, as regular rail travellers know all too well. Add to this dynamic a growing population and an increased need for energy-efficient transit, and the benefits of significantly expanding the UK's passenger-rail system are clear.

For all its prestige, high-speed rail may not be the best way forward. Not only is it less efficient than low-speed rail, it also presents engineering challenges that require a host of fiscally and environmentally undesirable accommodations that low-speed rail does not.

To address our rail system's problems as fully and efficiently as possible, it is time to consider a new, low-speed freight rail network.

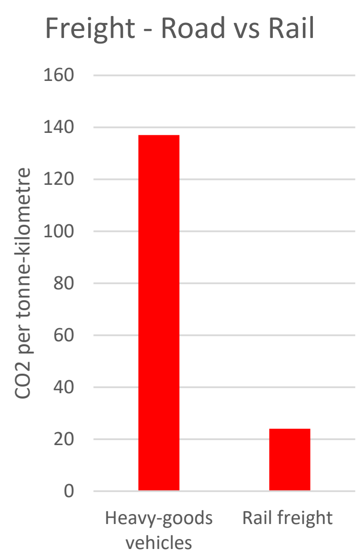
Before we describe in detail the benefits of such a network, let's step back to consider why projects like HS2 and our proposed alternative—call it LS1—are so important.

More Rail is Good

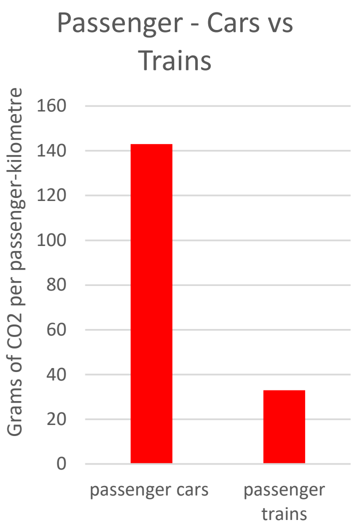
Simply put, rail is the most efficient way to move large quantities of goods and large numbers of passengers over long distances. The sheer capacity of freight and passenger trains allows them to operate on economies of scale far beyond what aircraft and heavy-goods vehicles can deliver, and the energy required to keep rubber tyres rolling on pavement or to get an aeroplane aloft greatly exceeds that needed to turn steel wheels on rails.

The mechanical advantages of rail travel contribute greatly to this discrepancy, but the electrification of rail lines throughout the UK and the world has also played a large part. Diesel trains are already far more energy-efficient than similarly-powered lorries—by a factor of 11, according to one US study[i]. Electric trains operate even more efficiently, delivering roughly 95% of the power[ii] they consume directly to their wheels, while diesel trains manage roughly 33%. Electric lorries may never achieve anything close to the efficiency of electric trains, both because they are mechanically less efficient and because they must carry their power sources with them.

Since different modes of transport are powered differently, another way to measure the relative efficiency of rail is to consider a common factor: the GHG emissions generated by rail and its competitors. The European Environment Agency finds that passenger cars generate an average of 143 grams of CO_2 per passenger-kilometre[iii] (the amount of energy needed to transport one passenger over one kilometre), while passenger trains produce less than a quarter of that amount, just 33 grams.



Freight transport benefits even more significantly. Heavy-goods vehicles produce an average of 137 grams of CO_2 per tonne-kilometre, while rail freight uses just 24 grams, less than 18% of what the average lorry contributes.



Rail holds great advantages for our energy infrastructure, our economy, and our environment. But how exactly should we expand our rail network? High-speed rail may be a convincing answer in some parts of the world – where urban centres a separated by open countryside. But given the relatively dense land use in the UK a more nuanced approach is required.

The Drawbacks of High-Speed Rail

In Europe, North America, and other parts of the world in which people routinely travel thousands of kilometres, high-speed rail is a compelling alternative to air travel. Not only does it use a vanishingly small fraction of the energy consumed by passenger aircraft, but high-speed rail is also more reliable and convenient.

But across shorter distances, like those travelled within the UK, air travel gives way to passenger vehicles, and high-speed rail loses some of its advantages. After all, it only achieves high speeds once passengers are already aboard, and time spent getting to and negotiating the train station is, from the traveller's perspective, part of the trip itself. High-speed rail, in other words, may continue to appeal to travellers with an inherent interest in rail travel, without significantly affecting the broader population's choice of transport.

Note that currently available technologies limit high-speed rail to passenger duties. The lightweight materials necessary to sustain high train speeds, along with the increased dangers of derailment, and high-power requirements to accelerate heavy goods, mean that high-speed rail is not suitable for freight carriage.

The logistical and engineering requirements of high-speed rail also merit consideration. Trains travelling at higher speeds on curves create centrifugal forces impacting passenger comfort to an unacceptable degree. This means that high-speed rails must be laid out in the straightest lines possible. Lower speed rail lines can curve to accommodate private property, public lands, and delicate ecosystems. Without passengers, freight only lines can be more aggressive in turns. They can also accommodate hills and mountains, finding the best way through with minimal need for tunnels and bridges. High-speed rail offers next much less of this flexibility, and the farther north our high-speed network extends, the more trouble it is likely to cause.

Low-Speed Rail to the rescue

We propose a new network of low-speed rail devoted to freight duties as an alternative to extending HS2. While this approach may lack the cutting-edge allure of high-speed rail, it has several distinct advantages including, of all things, improved passenger timetable reliability.

As we mentioned earlier, today's passenger- and freight-rail networks must coordinate their schedules. When delays affect one train, be it a passenger conveyance or a 500-metre freight train, the knock-on effect can be felt for hours, along dozens of other routes.

Much of our rail network was planned—and a significant amount of it built—in Victorian times. A new freight-only rail network would incorporate modern switching and traffic-management technologies that adjust for unforeseen delays and re-route freight traffic to allow passenger trains to adhere to their timetables. This would support much more reliable passenger service with negligible impact on freight. After all, a ninety-minute delay in delivering a parcel to a warehouse may go unnoticed; that kind of delay can be catastrophic to an individual passenger's day.

Optimising timetables and increasing reliability would allow our existing passenger rail system to close an already small gap between its speed and that of HS2. Current projections suggest that the high-speed connection between London and Birmingham would reduce travel time by roughly half an hour. If the benefits of LS1 shave just a few minutes off realised journey times (taking account of current delays), the marginal benefits of high-speed rail become all the more meagre, especially when weighed against the economic and environmental consequences of extending HS2. Most passengers can afford to lose 20 minutes or so in their schedules. They may not be as sanguine over poor reliability, higher taxes, the destruction of ancient woods, or the incursion of rail lines on private land.

Investing in a new system of freight rail lines would also allow integration of those lines more fruitfully with existing freight infrastructure. Further automation of passenger travel is extremely challenging, but a new freight rail infrastructure could introduce cost- and time-saving technologies to ports and unloading facilities. The Port of Rotterdam already supports automated barges and blockchain-based freight tracking; a new freight-rail network would allow the UK to keep pace with these advancements. Lower speed freight trains on a dedicated network themselves can also be automated, allowing for much longer signalling block sections without the need for stations.

Slow and Steady Wins the Race

No one denies the appeal of high-speed transit, and the prospect of cutting just a few minutes off a lengthy journey will always have its supporters. But further extension of HS2 would be short-sighted. The project's financial cost, both to build new lines and purchase new trains, is enough to make anyone consider what the UK's public stands to gain from it, and the dire consequences to our environment and in some cases to our property should give us further pause.

The real problem, as we see it, is that passenger rail in the UK is overly subject to delays and interruptions. Simply speeding up the trains would only slightly improve this outlook, and at a massive cost to our taxpayers and our conservation efforts.

A more flexible system of new low-speed freight lines would make better use of existing infrastructure while conveying the full benefits of automated technology, delivering increased, capacity, reliability, and overall speed for all rail traffic.

TL;DR

1. Rail is environmentally friendly and efficient, which is good.
2. UK passenger rail faces capacity constraints, which is bad.
3. Investment in new low speed freight routes would be better than investment in new high speed passenger routes.

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[i] https://tedb.ornl.gov/
[ii] https://www.eesi.org/articles/view/electrification-of-u.s.-railways-pie-in-the-sky-or-realistic-goal
[iii] https://www.eea.europa.eu/publications/rail-and-waterborne-transport