

# Transrapid in Great Britain – Project UK Ultraspeed

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**ABSTRACT:** The Transrapid project in Great Britain is one of the younger international high speed maglev projects. The existing rail infrastructure in Great Britain is running at full capacity. The government has therefore committed itself to study the construction of a new north-south high speed link. There are substantial arguments that this link should be a maglev connection. The privately led ‘UK Ultraspeed’ project team is the driving force behind this maglev project, which has already gained major media attention.

UK Ultraspeed will be a Transrapid line ultimately connecting London and Glasgow. Intermediate stops will be in all major cities, like Edinburgh, Newcastle, Manchester and Birmingham. UK Ultraspeed will be integrated into existing infrastructure such as rail and airports.

## 1 PROJECT DATA

### 1.1 Proposed route

The route shown on the map (figure 1) illustrates the basic alignment of the proposed British Transrapid project, called ‘UK Ultraspeed’.



Figure 1: UK Ultraspeed potential route

This approx. 800 km route runs from north to south. It connects Scotland with England’s Northeast, with England’s Northwest, with the Midlands, and with Greater London. It includes both stations within city centres and at airports. All stations are well connected to other modes of transport, be it road,

railways, light rail, air or at the London end the high speed train to the Channel Tunnel.

### 1.2 Estimated trip times

Table 1 shows the trip times travelling from London Heathrow to Glasgow. The indicated times include a 2 minute stop at each station. The maximum speed on the longer sections is 500 km/h.

Table 1: Trip time estimates

min	station
0	London Heathrow
9	London St Albans (M25)
31	Birmingham
41	Wolverhampton (West Midlands)
59	Manchester Airport
72	West Yorkshire
80	Leeds (West Yorkshire)
106	Gateshead (Teesside)
114	Newcastle Airport
142	SE Edinburgh
151	Edinburgh Airport
164	Glasgow

The trip from Manchester Airport to Liverpool will take 10 minutes.

### 1.3 Passenger forecast

The first passenger forecasts by ‘The Railway Consultancy’ are very promising. Taking all the factors

influencing passenger behaviour into account, the 'base case' demand for UK Ultraspeed is forecast to be at least 40 million passengers per year. It is expected that this baseline figure will be exceeded, especially as UK Ultraspeed will itself create new travel demand. For the sake of prudent forecasting, however, this suppressed demand was not factored in to the baseline case.

#### 1.4 Key features

A number of key features of the UK Ultraspeed service proposition are already clear at this stage:

- 10 minute frequency on the core route section south of Manchester.
- regular 'clock face' service pattern - every ten minutes at the same minutes past the hour at Birmingham, with the pattern carried back northwards up the route as far as possible.
- Manchester Airport as UK Ultraspeed's key hub, through which UK Ultraspeed's North-South and trans-North services pass.

## 2 ADVANTAGES OF TRANSRAPID IN UK

At the very fundamental level of basic geography, the distribution of Britain's cities is ideal for very high speed intercity ground transport. Britain has a significant number of very large conurbations which are separated by distances from around 50 to around 200 kilometres of relatively sparse population.

In Britain this basic geography ideally hits the 'sweet spot' for very high speed ground transport. Firstly, most journeys are long enough to exploit the maglev speed advantage over all other ground transport. Yet secondly, they are also mostly short enough for the inherent speed of air travel to be undermined by the time wasted by airport formalities, crowded taxiways and air traffic control delays which effectively triple the actual airborne time of short haul flying in the UK.

Furthermore, it is not just the distribution of Britain's cities that is relevant - it is also their size. Not only do they lie an ideal distance apart to benefit from very fast connections between the conurbations, there are also large enough markets within the conurbations to support the intensive, rapid service the Transrapid will provide.

The speed of the Transrapid maglev technology - as opposed to 300 km/h traditional wheel-on-rail high-speed trains, let alone conventional rail or motorways - has another major advantage in UK geography. UK Ultraspeed can offer journey times that are faster than air travel between most of the major

centres of population along Britain's North-South spine, with a single main route.

This means that UK Ultraspeed is significantly more efficient and cost-effective than any other North-South strategic transport solution on the basic measure of the quantum of infrastructure required.

- The existing North-South motorway network is split into Eastern and Western corridors.
- The existing North-South rail network is split into East Coast and West Coast main lines.
- Both the rail and motorway routes are linked by East-West routes across the Pennines - the motorway M62 and various rail options between the Northwest and Yorkshire.

So where rail and road each require three routes to serve the major centres of population, UK Ultraspeed will serve most of these centres with one mainline system.

## 3 BENEFITS OF UK ULTRASPEED TO UK

Transrapid can deliver both North-South and East-West strategic transport with less infrastructure and faster journey times than a hypothetical 'best case' high speed rail solution. This reflects the minimum objective of the project - to provide Britain with an advanced ground transport network. But strong improvement in transport is only one of the principles on which the project is founded. UK Ultraspeed is designed not only to deliver a step-change in Britain's transport, but also to empower Britain's economy and enhance Britain's environment.

Transrapid has been envisioned on a comprehensive, inter-city scale, but is designed to deliver economic benefits at many levels. Clearly 500 km/h maximum speed has a dramatic effect on journey times between regions, but equally the acceleration and braking also reduces trip times between cities in the same region. The common factor is speed, transforming access to and between key centres of the UK economy. UK Ultraspeed will deliver economic benefits on the following levels:

### 3.1 Regions and metropolitan areas

Regional: effectively transforming neighbouring cities into single economic entities, thus enabling them to compete as 'more than the sum of the parts' in the global economy.

Metropolitan: significantly accelerating some journeys across or around major metropolitan areas.

In regions with two or more distinct economic poles, UK Ultraspeed connections will create cohesion on a regional scale. It is this performance over

relatively short distances that enables UK Ultraspeed to bind city-pairs such as Liverpool and Manchester, Teesside and Tyneside, or Glasgow and Edinburgh into single super-cities, effectively combining the strengths of both halves to compete more powerfully in the global economy. A compelling precedent exists from Scandinavia, where an infrastructure intervention - the bridge between Copenhagen and Malmo - has combined major cities in two countries into a new European metropolis of 3.6 million population. Independent studies have identified a very significant increase in inward investment into the area. Similar or greater benefits would be expected by linking any two major UK economic centres, ideally with an internationally-served airport also connected directly to the route.

### 3.2 Super-regions

Overcoming the historic divisions between regions caused by distance.

The main focus with regards to super-regional benefits lies on England's so-called 'Greater North' (the North West, Yorkshire and Humberside and the North East). For this super-region the UK Government has launched 'the Northern Way' programme with the aim 'to establish the North of England as an area of exceptional opportunity combining a world class economy with a superb quality of life'. With the East-West route section offering a 60 minute link across the whole North (Merseyside - Manchester - Yorkshire - Teesside - Tyneside) UK Ultraspeed will deliver most powerfully on the 'Northern Way' agenda. The Northern Way Business Plan identifies: 'International evidence demonstrates that regions prosper when they are well connected internationally and internally, and that world-class transport links are essential elements of competitive advantage.' UK Ultraspeed can deliver both, very fast direct connections between the Greater North's centres and international connections via the airports in Manchester and Newcastle.

Expanding the Northern Way to include the Scottish Central Belt further reinforces the super-regional economics. Adding the metropolitan centres of Edinburgh and Glasgow (and one or both of their major airports) creates a very strong globally competitive economy.

Preliminary independent macro-economic study by the 'Centre for Urban and Regional Development Studies' (CURDS) at the University of Newcastle, analysed the potential impact of UK Ultraspeed over a Glasgow - Edinburgh - Tyneside - Teesside - West Yorkshire - Manchester - Merseyside route. They measured the effect of an ultra-high-speed connection between these centres, by comparing the overall economic power of these city-regions to that of to-

day's Greater London, both before and after the construction of such a link. Part of the results of this study are presented in table 2.

Table 2: CURDS' macroeconomic comparison

City regions (examples)	macro-economic power expressed as a percentage of the Greater London region's current status	
	current position	with UK Ultraspeed
Greater Manchester	32.1%	78.5%
West Yorkshire	17.0%	33.9%
Tyneside	15.3%	33.6%
Glasgow	18.1%	47.1%

As the CURDS team themselves conclude, the positive effect of UK Ultraspeed in currently peripheral economies is to 'reduce the friction of distance to around one third of its current levels [...and...] for the first time in over a century, [...to] create the very real possibility of a major realignment in the UK's economic geography'.

### 3.3 National benefits

#### Rebalancing Britain

UK Ultraspeed will create a more sustainable balance between London and regional economies of the Midlands, the English North and Scotland, by transforming these areas as business locations, by making them as accessible as London itself.

In short, UK Ultraspeed has the potential to rebalance Britain, to engender a more sustainable relationship between Britain's world city - London - and the regional economies of Scotland and the English north, by helping create world-class locations, with rapid access, outside the capital. Nationally, UK Ultraspeed is thus designed to act as an anchor and a catalyst for the broader economic development thrust to 're-profile' peripheral economies, to make them more accessible to the global economy and, thereby empower them to attract and retain investment in the face of global competition.

### 3.4 International benefits

Ultraspeed will make the international connections of Britain's airports - including Heathrow - more easily accessible to and from the North than many locations within the M25 motorway surrounding London, are today. It is not proposed to construct a Transrapid route into the traditional centre of London. Rather, in the East, UK Ultraspeed supports the

major regenerative push eastwards into the Thames Gateway, serving London via seven rail, underground and light rail connections from a terminal at London's best connected transport hub at Stratford. To the West, Ultraspeed serves both London and enhances national access to Heathrow Airport. Thus, even at the essentially local level of terminal location the international dimension is firmly in mind. Taking Stratford as an example, in addition to its local feeder/distributor links by underground, light rail, and national rail, it also allows Ultraspeed to offer direct connections between the North and the European Continent, via the Channel Tunnel Rail Link.

### 3.5 Environmental benefits

Empowering economic growth and thus engendering a more sustainable balance between Britain's North and South is, in itself, a major environmental gain at a strategic level. A connected, competitive North takes pressure off the stretched housing, land and water resources of the South, whilst bringing Northern surpluses of these national strategic assets into long term play. But UK Ultraspeed also performs at an immediate, short term, level - the fundamentals of the Transrapid technology make significant contributions to reducing the environmental costs of transport whilst simultaneously delivering increased economic benefits of speed, connectivity and capacity.

Transrapid systems reduce the environmental burden of travel through efficient design and operation. To cite a few key examples:

- contactless vehicle movement reduces noise emissions to a minimum
- low energy consumption due to contactless vehicle movement
- regenerative braking returns power to the grid when vehicles decelerate
- no local exhausts
- less land required than for a motorway or high speed train corridor
- electromagnetic fields five times lower than that of a TV

By connecting more places, with fewer and faster vehicles, with more seats per vehicle, operating along a single route, the overall power requirement to provide a given number of Available Seat Kilometres in a given period of time is exceptional. Preliminary results show that UK Ultraspeed consumes less energy than a typical high speed rail service from London to Northern destinations. Road or short haul air with a similar capacity would use a multiple of the energy used by the Transrapid, with the car being much slower and the plane not offering all stops along the route.

Finally, UK Ultraspeed delivers economic advantage at the international level whilst simultaneously reducing a pressing environmental burden of national importance. By offering journeys that are quicker, more frequent and more comfortable than domestic air travel, UK Ultraspeed has the potential to replace a high proportion of short haul air travel in the UK. Firstly this reduces atmospheric pollution, with as little as 20% of the emissions being achievable, depending on aircraft type, route length and electricity generation mix. Secondly, this also frees up thousands of runway slot pairs each week, most notably at the very congested Heathrow airport in London. This leads to yet a third tier of benefit resulting from the airport capacity becoming available for use by medium and long haul traffic, which is both environmentally more efficient and economically more beneficial, as it enhances Britain's international connections.

## 4 COMPARISON WITH HIGH SPEED RAIL IN UK CONTEXT

The fundamental aspects of the UK Ultraspeed case are also strong when compared with potential High Speed Rail solutions. Recent work by WS Atkins indicates that, three typical high-speed train alignments would be required to deliver attractive journey times to the North West, Yorkshire and the North East. This is simply a factor of the slower speed (300 km/h) and the less favourable alignment criteria of wheel-on-rail technology.

The WS Atkins best-case 'Option 8' scenario (the only scenario offering a national set of journey times that is comparable with UK Ultraspeed) illustrates the point. The high-speed wheel on rail train WS Atkins envisages, running in 85 minutes on a new direct high-speed track from London to Leeds, splits into separate branches. That is why several UK Ultraspeed journeys are simply not possible on even the 'best case' high-speed wheel on rail network. These include the important 'Northern Way' backbone needed to create a globally competitive super-region from the three regions of the English North (North West England, Yorkshire, North East England), as well as several rapid East-West connections between key city-regions within that area.

In short, wheel-on-rail as currently proposed only answers a North- South brief. UK Ultraspeed can deliver a better and faster North-South solution whilst providing a strategic East-West link across the North of England. Yet the 800km UK Ultraspeed network would be up to 200km shorter overall than the 'Option 8' high speed rail proposals.

## Operational efficiency

With no major moving parts, and no friction between vehicles and guideway, Transrapid has very low maintenance costs. Overall lifecycle costs are also considerably lower than for high speed rail. Highly automated failsafe operation also makes for very low staffing costs. The viability of UK Ultraspeed is thus underpinned by the fundamental efficiency of the maglev technology itself.

## 5 DEVELOPMENT / NEXT MOVES

To date the UK Ultraspeed project has been presented to several audiences all over Britain, such as the national Government, the Department for Transport, the Northern Way project, the Association of North Eastern Councils, the northern Regional Development Agencies. The feedback has been consistently positive. The project has generated a lot of media attention and its convincing arguments are setting the agenda in the debate on the future of British transportation infrastructure.

Discussion with relevant groups is ongoing and further studies will be undertaken, to harmonise the balance between overall speed and the number and location of terminals, allowing UK Ultraspeed to strike the balance between optimum speed and optimum accessibility for the greatest possible number of passengers in the widest possible catchment areas. A key issue over the next months will also be the identification of the first segment of the UKU network.

## 6 REFERENCES

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