SUPPLEMENTARY WRITTEN SUBMISSION BY UK ULTRASPEED
INQUIRY INTO THE POTENTIAL BENEFITS OF HIGH-SPEED RAIL SERVICES

UK Ultraspeed welcomes this opportunity to submit supplementary evidence to the inquiry, primarily in clarification of issues pertaining to maglev, as distinct from conventional wheel-on-rail high speed rail. This document builds on evidence already posted here on the Committee's website.

Key differences between maglev and wheel on rail systems

Maglev	TGV-style rail
500 km/h [311 mph] cruising speed	300 km/h [186 mph] cruising speed
Acceleration to 300 km/h: 97 sec & 4.1 km	Acceleration to 300 km/h: ± 6 mins & ± 20 km
Guideway (track) integrates guidance, power supply, propulsion motor, signalling and operational control feedback into *one* system	Rail for guidance, overhead line for power supply, motor on board train, signalling via separate ERTMS systems, feedback via track circuits etc.
Elevated guideway by default. As little as 2.1 m^2 per linear metre land-take. Flexible routing able to follow existing corridors and brownfields by climbing 1-in-10 gradients and exploiting tight turn radius of 1,600m @ 300 km/h.	Ground-level track by default. 8 - 16 m^2 per linear metre land-take. Less flexible routing: only 1-in-25 maximum gradients and turn radius twice as inefficient, at 3,200m @ 300 km/h.
Flexible routing enables maglev to penetrate city cores without the need for expensive tunnelling, using DLR precedent for elevated, automated, mass transit guideway.	Typically requires expensive tunnelling into city cores. Example CTRL, required tunnel from outer fringes of London to St Pancras to enable TGVs to maintain speed into city.
2008 average infrastructure cost estimate including land per km in UK conditions ± £30m/km.	CTRL out-turn costs £56.42m/km. If adjusted to directly comparable 2008 values ± £60m/km.
Does not physically touch guideway when in motion, leading to major maintenance savings. Sheer speed enables more intensive operations of a smaller fleet. Again leads to lower O&M costs. O&M costs typically 50% – 65% of wheel-on rail systems. Whole-life costs typically ± 50% of rail.	Wheel-on-rail systems physically grind down their track with every run. Schedules calling for speeds greater than 300km/h have been abandonned (eg Madrid-Barcelona) due to excessive maintenance burden. Köln–Frankfurt rails are reported to require replacement twice as quickly as predicted.
Journey practically achievable in 2h 40m including stops:	
Glasgow – EDI Apt – SE Edinburgh – NCL Apt – Tyneside – Teesside – Leeds – Manchester – MAN Apt – West Midlands – BHX Apt – M25/M1 P&R – London or Heathrow	Edinburgh – London (+ max 1 intermediate stop?)
1h 45m non-stop Edinburgh – London	2h 40m non-stop Edinburgh – London
Energy consumption 5-car maglev (440 seats) 12.3 kwh/km @ 300 km/h 15.4 kwh/km @ 350 km/h 19.1 kwh/km @ 400 km/h 23.2 kwh/km @ 450 km/h	Energy consumption 8-car ICE3 (415 seats) 18.0 kwh/km @ 300 km/h 23.7 kwh/km @ 350 km/h *not achievable* *not achievable*
Noise: dB(A) measured @ 25m from pass-by	
TR08 series maglev 67 – 69 (less than urban background) @ 200 km/h 79 @ 300 km/h 86 @ 400 km/h 90 @ 500 km/h	TGV A series 86 @ 200 km/h (*also* classic rail diesel unit @ 100) 95 @ 300 km/h *not achievable* *not achievable*

Considerations re incremental build of maglev *vs* wheel-on-rail in UK conditions

Ultraspeed maglev has been developed with UK conditions in mind. Maglev technical advantages [see above] are coupled firstly with lower capital costs. Lower capex is mainly due to maglev's reduced land-take and to conversion of up-front capital land costs into rental payments for air-rights, right-of-way and right-of-access where land remains usable for its original purpose under the guideway. Maglev's much lower whole-life operating and maintenance costs then also come into play. Taking this all into account, maglev works both technically and economically *on a self-standing basis* over *shorter* initial routes. Such routes are, by definition (a) more affordable, (b) capable of delivering benefit rapidly and (c) lower in risk. Examples of potential Stage One routes would be Glasgow – Edinburgh or Liverpool – Manchester – Leeds.

After successful Stage One implementation, maglev then *also* offers unbeatable speed, *with the same vehicles and operational control systems* over the longer inter-city sectors which come into play as a strategic system extends incrementally over time.

By contrast, TGV-style systems would *not* be viable over, say, the Glasgow – Edinburgh Airport – Edinburgh route, where maglev delivers a 17.5 minute city-to-city journey time *including* the intermediate stop. Rail's inferior performance would only produce journey times in the order of 30 minutes. Furthermore, rail's less flexible routing parameters would either require tunnelling to access the city cores or extensive capital works to quadruple, re-gauge and resignal existing railway approaches. Core estimate for Glasgow – EDI – Edinburgh maglev is £1.9 bn; capex estimates for a hypothetical TGV-style link range from £4 bn to £7 bn.

Generically, flexibility routing enables maglev to serve the hearts of cities, in addition to edge-of-town P&Rs, airports etc, with lower costs and far shorter end-to-end trip times than TGV-style rail. For the avoidance of doubt, UK maglev has been explicitly designed to serve city-centre transport hubs *and* out-of-town terminals. The objective is to maximise the attractiveness of maglev as the fastest possible, low-carbon, alternative to *both* the car and short-haul aviation by enabling the maximum number of passengers to link the maximum number of origin:destination pairs with the minimum number of mode changes.

On a whole-UK scale, the fundamental flexibility of sinuous maglev routing versus TGV-style requirement for tunnels, viaducts and other large-scale civils works also comes to the fore on the traverse of the Pennines. Here, maglev can closely follow the existing M62 corridor. The both minimises new environmental intrusion and enables a *single* maglev main line to serve all the major catchments on *both* the 'East Coast' and 'West Coast' corridors. TGV-style rail, by contrast, would either requires *two* lines splitting into 'east and 'west' to the south of the Pennine chain, or would need an unfeasibly expensive 'base tunnel' under the mountains.

With all the above in mind, maglev in Britain is explicitly designed to work initially on city-to-city routes, then to be expanded on a super-regional scale, with the phased roll out of a full-scale national network ultimately in mind.

By contrast, French-style incremental development of TGV-type *rail* would not work in the UK. Under the French model, high speed trains run off partially-built dedicated high speed lines and use the classic network for (a) long-term city centre access and (b) interim journey continuation to regions not yet directly served by a high speed route.

Whilst this is indeed the policy in France and elsewhere, UK loading gauge restrictions, the capacity constraints of an already-overloaded classic network, plus Britain's notorious signalling incompatibilities, mean that this approach will not work physically and financially in the UK. As others have put it, the 'incremental build' TGV rationale just does not work here: "in the case of the UK many of the railway networks around our major conurbations are so congested already that they would not be able to handle the significant extra traffic that a high speed service would generate anyway". [Prof R Smith et al for DfT, 2006]

The Channel Tunnel Rail Link proves the point. If ever there was a case for running TGV-style trains over cheaply upgraded classic infrastructure from the edge of a city to a terminus it is CTRL. Such a French-style approach would have avoided many of the costs of working a new alignment into Central London. In the event, there simply was not the capacity to operate at anything like TGV speeds on the classic network into London. So an expensive tunnel had to be built from the edge of East London to the platforms at St Pancras. TGV to the edge of town plus classic rail into the centre was a strictly temporary measure.

It is this *impossibility* of fitting 'anything-like-high-speed rail' onto UK classic infrastructure and the necessity of constructing expensive tunnelled access to a city centre which resulted in CTRL's out-turn cost of £56.42m per km (or ± £60m per km in 2008 terms). This capital cost is substantially higher than typical average maglev capex of around £30m per km.