

## **The Foundation for Science and Technology**

**25<sup>th</sup> June, 2008**

### **Transport – High Speed Rail as a 21<sup>st</sup> Century Option**

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We are asked to address the question: Is it possible to have a sustainable transport system? The answer of course is yes. For by sustainable we mean one which allows us to live within environmental limits, promotes a strong, healthy and just society, ensures a strong economy, is decided upon using principles and practices of good governance, and uses sound science responsibly to get there.

#### **1. Systems Thinking is Crucial to Transport Decisions**

Government likes to do things, preferably things that get the attention of the public. And in some ways that is not bad thing. But when it comes to transport, we have to engage in systems thinking. There is a great deal of interconnection, it is inherent in the nature of transport that it is tightly interlocked in systems, within and between modes, and whatever we do has consequences. If we don't understand the system archetypes in which we are operating, then we will get consequences which are at best unforeseen, and more likely are the opposite of what we want. If we have a system that is in an undesirable state (for example traffic congestion) and we simply take some measure to relieve it (like park and ride) the system will likely relax to some other undesirable state (like congestion in a different place). A good example of this was the proposed, now aborted, road charging scheme, which probably would have had the effect of increasing emissions in the overall system.

#### **2. Time for a New Rail Network?**

So let's think about the rail system in this way. It is timely, and coincidentally (because I planned to speak about this anyway) there has been a recent announcement from Network Rail about the need to take a hard look at a major high speed rail network for Britain. This is to be welcomed, as the Eddington report pushed aside high speed rail on both priority and economic grounds, and the Rail white paper of 2007 shelved it on environmental grounds. It is possible that none of these arguments holds up.

The Channel Tunnel rail link is the only main line railway to have been built in Britain in more than 100 years! Today, on our rail lines with the exception of the CTRL, we are at a speed that we achieved about 30 years ago. We now need to think about the rail infrastructure for the 21<sup>st</sup> century. Some time ago, say 20 years ago, there may have been the view that rail was 'so 20<sup>th</sup> century' and that the future was all about air transport for distance, personal transport by car, and freight by air or large lorry. And yet, despite huge increases in rail fares for commuters, and for many long distance travelers, rail passenger traffic is the highest it has ever been. And this at not very high speed.

### 3. What is it?

First, what do we mean by high speed. Today, it means about 350 km/hr, about 210 mph in old money. And getting faster. This means, if we did it non stop, that a trip from Aberdeen to London could be done in probably 2 1/2 hours. Studies in Spain showed that if you can get people from city centre to city centre in 2 ½ hours or less they would switch from plane to train. That is possible throughout Great Britain.

I am not here talking about the Maglev train. As a scientist and engineer, I love Maglev, and the idea of a rail system going at 600 km/hr and even faster. But the build costs are very high, the energy costs are high, and the operation still difficult to achieve safely. So let's set Maglev on one side, because I think it is more suitable to the US than to the UK.

In Spain, they are building 10,000 km of new high speed rail. This is well advanced with several key lines now open, including the recent link between Barcelona and Madrid taking 2 ½ hours. Incidentally, on the more established high speed links in Spain the promise to the passenger is arrival within 5 minutes of scheduled time or full refund. So far they are achieving this for 99.84% of the service! Spain is much more difficult in terms of construction because of the large amount of tunneling required compared to GB. However, it has to be said that more land is available. Of course this not just about Spain. It is about Japan, France, Taiwan, and Germany, all of which have shown that high speed rail can reduce air travel, and facilitate business and leisure travel.

### 4. Consequences of HSR

The goal in Spain is elimination of all internal flights. We could achieve this much more easily, and it is a worthwhile goal

From an economic development point of view, there are several key points. HSR must not just be hub and spoke with London at the centre. There must be better connection between other cities as part of it.

HSR offloads key long distance intercity trains from the existing railway, and should be used to improve service between cities and towns that are closer together. It also should allow us the opportunity to move more freight off the roads and onto the existing rail lines. Both of these system changes have positive economic development consequences.

We need to think, longer term, about there being a few airports that are used for long haul flights. Connection to these will be by high speed rail links rather than by flights from regional airports. This is also important for economic development. The open skies agreement is already putting flights from regional airports to hubs at risk, because they are not able to make a profit on the high slot fees being charged. We can start to plan for this now as an integral part of the system.

Two points about the environment. First, it is often said that high speed trains are much less environmentally friendly than today's trains, emitting much more CO<sub>2</sub> per passenger kilometer. These data come from the TGV trains the French use, and the situation for the Japanese trains is very different. The French have made their trains very heavy as they have increased speed, leading to much higher energy consumption. The Japanese have always tried to get weight reduction to go with every increase in speed, and have managed to get the speed up from 200 to 350 km/hr with no increase in emissions. Today the Shinkansen in Japan achieves power consumption 1/6<sup>th</sup> that of air travel (and 1/3 that of Maglev). So we need to be careful about the data we cite, a point that was not taken in the Rail White Paper.

Second, this is just one more example of why we need to move, in parallel, with decarbonising our electricity system completely. We must completely electrify the railways, and we must have generation which is low carbon or carbon free for the railway to operate on. Incidentally, trains can be hybrids too, and already use (or are equipped with) regenerative braking. It is also possible to build a lot of intelligence into the train, to achieve the maximum speed over diverse terrain, and to sense what conditions are ahead adjusting speed accordingly. The trains must be as efficient as possible, and the emissions from them as low as possible. But this is consistent with what we know we need to do anyway.

HSR offers us a great opportunity to create a 21<sup>st</sup> century transport infrastructure for Britain, one that uses each mode, road, rail, and air, walking and cycling, for that which it is best suited, and makes the most of the system interconnections between these modes.

