The Telegraph

High speed rail link 'at risk of derailment' because of 225mph trains

Secret research has been ordered into the safety of the Government's controversial HS2 rail scheme amid warnings that the high speeds proposed could cause catastrophic track failures and derailments.

HS2 claims it will be able to run up to 18 trains an hour – one every three minutes 20 seconds Photo: LNP

By Andrew Gilligan (http://www.telegraph.co.uk/journalists/andrew-gilligan/)

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Professor Peter Woodward, one of the world's leading experts on the geo-engineering of railways, said that high-speed running created "new problems" in track which "may threaten the stability and safety of the train".

In papers lodged with the Government's Engineering and Physical Sciences Research Council (EPSRC), Prof Woodward warned that speeds as high as those proposed by HS2 could trigger "significant amplification of train-track vibrations" causing "rapid deterioration of the track, ballast and sub-ballast, including possible derailment and ground failure".

High-speed rail in the West has a fairly good safety record, but experts are worried that HS2 plans to run trains faster than any other line in the world. Trains will travel at 225mph, rising to 250mph within a few years.

Most high-speed lines, including Britain's existing Eurostar, run no faster than 186mph and the world's current fastest rail-based trains, France's TGV Est, travel at 200mph.

Some trains on the new Chinese high-speed network used to run at 220mph, but were reduced to 186mph last year on safety grounds.

Boris Johnson: HS2 is 'not right' (http://www.telegraph.co.uk/news/uknews/road-and-rail-transport/9015127/High-speed-rail-Boris-Johnson-says-that-HS2-is-not-right-and-doesnt-work-properly.html)

High speed rail line given green light by Government (http://www.telegraph.co.uk/news/uknews/road-and-rail-transport/9004251/High-speed-rail-gets-green-light-with-tunnels-to-protect-countryside.html)

Prof Woodward declined to answer questions about his work.

However, he told *The Engineer* magazine that he was worried about "ground waves" of vibration, known as Rayleigh waves, developing in the rail at a certain speed.

"The analogy is that of an aircraft going through the sound barrier," he said.

As "critical track velocity" was approached, the track would "start to undergo strong ground vibrations," rippling visibly along the rails in front of the train.

"It is possible that if the train was allowed to run at this critical track velocity it would derail at high speed," he warned.

Professor Woodward, who is professor of railway geo-technical engineering at Heriot-Watt University in Edinburgh, and a colleague, Prof Mike Forde of Edinburgh University, have now been awarded almost £500,000 by the Government to investigate the issue.

Using a purpose-built test track bed, they are trying to find out what the danger speed is and whether HS2 will exceed it.

Emails released under the Freedom of Information Act show that Andy Went, HS2's head of track, now a senior engineer at Network Rail responsible for HS2, is closely involved in the research.

HS2, Professor Woodward and academics at Southampton University are also set to obtain Government funding for a further and larger but secret research project on the same subject.

The emails show that Hs2's chief engineer, Prof Andrew McNaughton, was closely involved in drawing up the new research proposal.

Heriot-Watt refused Freedom of Information Act requests about the new project, saying that releasing any information on it would cause "substantial prejudice to the effective conduct of public affairs".

HS2's involvement in the Edinburgh and Southampton projects calls into question Prof McNaughton's assurance to MPs on the Transport Select Committee that a 225mph service can run safely on current forms of track.

"We do not consider it requires technology development to achieve [the proposed service] at 225mph and we believe that only limited, foreseeable development would be necessary for [250mph]," he said.

Another expert in the field, Professor Victor Krylov of Loughborough University, who produced an influential early academic paper on the subject, said the danger was of a "ground vibration boom, similar to a sonic boom" which caused a sudden and "very large" increase in generated ground vibrations.

"What matters is when you cross the [speed] barrier," he said.

"If you do that, ground vibrations can increase twenty, thirty times."

Professor Krylov said the effect was greatest in soft ground and had been observed in trains travelling as slowly as 110mph in Sweden, across alluvial soil.

"The most straightforward way to improve the situation is just to make the ground stiffer – by injection of concrete, or by piling," he said. "But the best or cheapest measure you can do is just to reduce the speed."

However, HS2 needs to run at 225mph if it is to meet its ambitious business case and capacity claims.

Its planned two-track core route between London and the Midlands is supposed to be able to handle the traffic currently served by three separate main lines, to destinations including Birmingham, Manchester, the East Midlands, Sheffield, Leeds and Scotland.

HS2 claims it will be able to run up to 18 trains an hour – one every three minutes 20 seconds - along the core route, more than on any other such high-speed line in the world.

If the trains had to be slower, frequencies would have to be reduced, putting at risk the promised service to many destinations.

Running at the industry standard of 186mph would cut the £34 billion scheme's already shrinking benefit-cost ratio by 15 per cent.

A spokesman for HS2 said: "It is nonsense to suggest that we would design a railway that did not take into account the effects of Rayleigh waves.

"We are designing HS2 so that there is no possibility that Rayleigh waves would lead to any problems such as derailment.

"We will continue to work closely with and support leading researchers such as Prof Woodward to develop and design safe and efficient high speed train operations in the UK."