HS2 Tunnels

This note gives a brief description of the HS2 tunnels and the expected levels of noise and vibration. The design of HS2 is still at an early stage, and we are continuing to work on it, so that during public consultation we will be able to demonstrate how the four main tunnels would be built and operated with minimal noise and vibration.

The tunnels would be built through a variety of soil conditions, including London clay and chalk. However the key determinant of any noise and vibration is the design of the track and associated components – known as the trackform.

So the first section of this note describes how we would design the trackform in the tunnels to avoid the transmission of noise and vibration from trains to properties. The following paragraphs describe how we would build the tunnels in each of the three tunnelling areas.

Trackform (rails, sleepers, supporting substructure and rail fastenings)

The track design for tunnels in the vicinity of properties and other sensitive locations, such as schools, hospitals and meeting halls, would use the latest modern trackforms. We would design all four tunnels to meet stringent engineering and environmental criteria in order to minimise track borne noise and vibration in all types of ground conditions.

We will examine systems recently used on other high speed systems, particularly HS1 whose systems were developed for similar ground and urban conditions. The systems adopted by HS1, Crossrail and other international rail projects including Cheonan Station (Korea), Germany, Japan and France have trackforms specified and designed to isolate the vibration from train wheels being transmitted to the tunnel structure and into the surrounding ground. Such designs are known as “floating track slabs.” The projects being designed now with these techniques, or that have been recently completed, include tunnels under locations such as the Barbican Concert Hall, high density urban and other sensitive properties.

London Tunnels – Euston to Old Oak Common

We have developed the proposed tunnels from Euston to just beyond Old Oak Common (8.2 km) in a very similar way to, and building on the experience of, the successful construction and operation of the HS1 tunnels from St Pancras.

The HS2 tunnels would be twin bores (two single track tunnels) of 7.25m internal diameter, with 4.0m internal diameter connecting cross passages every 250m to facilitate safe passenger evacuation from one tunnel to the other in the event of an emergency. These are the same sizes and arrangements as those used for HS1, as the maximum speed of the HS2 trains at this location would be similar to, or slightly lower than, those of HS1. The tunnels would run mainly through London clay, similar to the ground conditions HS1 faced under Islington and East London.

In developing the proposals for the HS2 tunnels, we have been helped by engineers and designers from the HS1 and Crossrail projects, who are considered experts of world standing in tunnelling under cities through similar ground. The HS1 tunnels were constructed safely and without structural impact to the housing and industrial properties above them, and have operated since without causing noise or vibration disturbance from trains.

The HS2 London tunnels design would use standard tunnel boring machines, the same method of construction used for the HS1 East London tunnels. Residents might become aware of some ground borne noise or vibration from the machines as they pass under a property, but this would only last a couple of days, as the typical rate of progress would be around 10m (30ft) a day.

Chiltern Tunnels – M25 to South Heath

In order to minimise noise and vibration during and after construction of the Chiltern tunnels, we would again build on HS1's experience, this time of tunnelling through similar ground in North Kent chalk.

The proposed twin single track tunnels running from the M25 Motorway to beyond Amersham Old Town (9.6km) would be bored through the chalk using tunnel boring machines. At 8.5m, their internal diameters would be slightly larger than those for the London tunnels to accommodate the aerodynamic effects from the higher line speeds (up to 320 kph) in this area. They would also have 4.0m internal diameter connecting cross passages every 250m for emergency evacuation.

The short tunnel from Little Missenden to South Heath (1.05km) would not need to be a twin bore as passenger evacuation from one tunnel to another would be unnecessary over such a short length. The single tunnel would have an internal diameter of 9.8m. Tunnels of this length are normally dug using a road header drill, with support provided by sprayed concrete linings. This construction is appropriate for the chalk ground and has been used, for example, by the current A3 road improvement works at Hindhead.

Long Itchington Wood Tunnel

This short tunnel (1.4km) would be a single bore with an internal diameter of 12.8m. The diameter would be necessary to alleviate the aerodynamic effects from the speed planned for this part of the route. Ground conditions and underlying rock strata in the vicinity of this tunnel are known to be mixed; so until a full geotechnical investigation has been carried out, we would not determine whether the tunnel would be constructed using a road header drill with spayed concrete lining, or a tunnel boring machine.