

Tunnel shafts and portals

This factsheet sets out the need for shafts along tunnels and porous portals on the Proposed Scheme. It also describes design principles that are expected to be used to minimise the effects of the visible headhouses at the top of shafts on the local area.

1 Introduction

- 1.1.1 High Speed Two (HS2) is the Government's proposal for a new, high speed north-south railway. The proposal is being taken forward in phases: Phase One will connect London with Birmingham and the West Midlands. Phase 2a will extend the route to Crewe. Phase 2b will extend the route to Manchester, Leeds and beyond (the 'Proposed Scheme').
- 1.1.2 The construction and operation of Phase One of HS2 is authorised by the High Speed Rail (London – West Midlands) Act (2017). In July 2017, the Government introduced a hybrid Bill to Parliament to seek powers for the construction and operation of Phase 2a. A hybrid Bill to seek powers for the construction and operation of Phase 2b is expected to be introduced to Parliament in 2020.
- 1.1.3 HS2 Ltd is the non-departmental public body responsible for developing and promoting these proposals. The company works to a Development Agreement made with the Secretary of State for Transport.
- 1.1.4 The work to produce the Phase 2b Bill will include an Environmental Impact Assessment (EIA), the results of which will then be reported in an Environmental Statement (ES). The ES would be submitted alongside the Phase 2b Bill when it is introduced to Parliament. The emerging findings of the EIA were reported in a working draft Environmental Statement (WDES) that was consulted on in late 2018.
- 1.1.5 As was the case with Phase One and Phase 2a, when the Phase 2b Bill is introduced to Parliament, the Secretary of State will also publish draft Environmental Minimum Requirements (EMRs). The EMRs will set out the environmental and sustainability commitments that will be observed in the construction and operation of Phase 2b.
- 1.1.6 A series of information papers were produced for the Phase One and Phase 2a hybrid Bills, explaining the commitments made in those Bills and EMRs. It is the Secretary of State's intention to follow a similar process for the Phase 2b Bill. These information papers for Phase 2b will be used to provide information about Phase 2b itself, the powers contained in the Phase 2b Bill when it is introduced to Parliament and how decisions on Phase 2b have been reached. It is currently proposed that these information papers for Phase 2b will be published at the time the Phase 2b Bill is introduced in Parliament.
- 1.1.7 The Secretary of State for Transport will be 'the Promoter' of the Phase 2b Bill. The Promoter will also eventually appoint a body responsible for delivering the Proposed Scheme under the powers to be granted by the Phase 2b Bill. This body will be known as the 'nominated undertaker'. There may well be more than

one nominated undertaker. However, any and all nominated undertakers will be bound by the obligations contained in the Phase 2b Bill, the policies established in the Phase 2b EMRs and any commitments provided in the Phase 2b information papers.

- 1.1.8 These Phase 2b Factsheets have been produced to provide information on the emerging proposals for measures to manage the design process for Phase 2b and to control impacts which may arise from the construction and operation of the Proposed Scheme. These measures may then be applied to Phase 2b as commitments made through the eventual Phase 2b Bill, EMRs or information papers.

2 Overview

- 2.1.1 This factsheet sets out the need for shafts along tunnels and porous portals on the Proposed Scheme. It also describes design principles that are expected to be used to minimise the effects of the visible headhouses at the top of shafts on the local area.
- 2.1.2 It should be noted that the information below applies to new tunnels constructed for HS2. This does not apply to tunnels and vent shafts on the existing railway network, for instance along the Midland Main Line between Clay Cross and Sheffield Midland, which now forms part of the Proposed Scheme.

3 Tunnel shafts

- 3.1.1 Tunnel shafts are vertical openings connecting underground tunnels to the surface and open air.
- 3.1.2 The purpose of tunnel shafts are to:
- enable the smoke produced in the event of a fire to be extracted in a controlled manner, and to provide fresh air in order to create smoke-free evacuation routes;
 - provide access for the emergency services; and
 - meet the comfort requirements of passengers and staff in tunnels by keeping the air quality and temperature within prescribed limits.
- 3.1.3 The figure below is a sketch of a typical tunnel shaft.

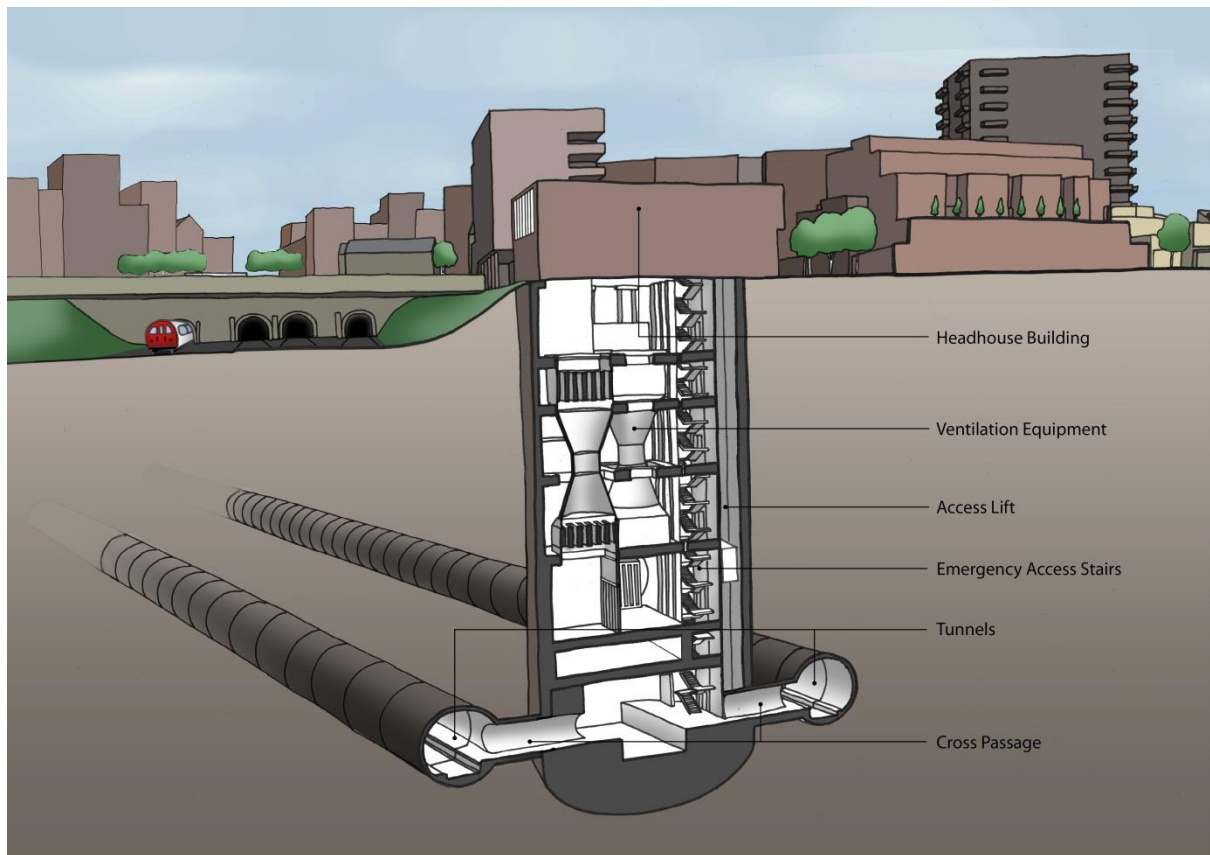


Figure 1. A typical tunnel shaft

- 3.1.4 Tunnels are ventilated with the aid of the 'piston effect' (the forced airflow as a vehicle moves through a tunnel). As the train moves through the tunnel, the air is pushed out of the tunnel shaft ahead of the train, and air from the surface is drawn in through the tunnel shaft behind the train.

4 Tunnel shaft locations

Spacing requirements

- 4.1.1 Tunnel shafts are only required in tunnels more than 3 km long.
- 4.1.2 The distance between shafts is determined by operational considerations. Only one train can be in a section between shafts at any one time. This ensures that in the event of a fire, smoke can be drawn away from the direction of escape. Therefore, the spacing between the shafts needs to support the proposed frequency of service. Closer shafts also reduce the time needed by the emergency services to reach an incident on foot, carrying breathing apparatus and other equipment.
- 4.1.3 The requirement for access for emergency services is set out in the Technical Standards for Interoperability (TSI):

4.1.4 "The design of a tunnel shall take into account the need for provision of facilities to allow the self-rescue and evacuation of train passengers and staff and allow the rescue services to rescue people in the event of an incident in a tunnel."¹

- A number of technical solutions fulfil this requirement. These include:
- emergency exits to the surface every kilometre;
- cross-passages to the other bore of a twin-bored tunnel or box of a cut-and-cover tunnel; and
- alternative technical solutions that provide an equivalent safety level, agreed with the relevant national authority².

4.1.5 In relation to the HS1 scheme, an alternative technical solution was adopted. This solution required shafts approximately every 3km, with cross-passages between the tunnel bores every 380m along the tunnel. It is a proven and technically compliant arrangement. Following discussions with the Department for Transport and the Fire and Rescue Services, the alternative technical solution adopted for HS1 will be the scheme adopted for HS2.

Locations

4.1.6 Two of the tunnels on the Proposed Scheme are currently identified as requiring shafts. These are the Crewe tunnel and Manchester tunnel on the western leg. The proposed shaft locations have been based on the above spacing requirements, access to the road network and an assessment of their potential environmental impacts. The proposed locations are:

- On the Crewe tunnel (6.1km / 3.8 miles long) two shafts, one at Cowley Way and the other at Middlewich Street;
- On the Manchester tunnel (12.8km / 8 miles long) four shafts. The first at Altrincham Road, the second at Palatine Road, the third at Wilmslow Road, and the fourth at Birchfields Road (the Secretary of State is currently consulting on the proposed locations of the Palatine and Birchfields Road vent shafts).

4.1.7 The final locations of vent shafts will be reported in the Phase 2b formal Environmental Statement.

5 Tunnel shaft design

5.1.1 The shafts will be designed to be:

- safe, efficient, and consistent with the requirements of whole-life operation and maintenance alongside initial buildability;

¹ 'Safety in railway tunnels' TSI, Section 4.2.2.6.2.

² The national authority in the UK is The Office of Rail Regulation (ORR)

- sympathetic to their context, environment and social setting; and
- consistent with the requirements for the control of noise from stationary systems, the Proposed Scheme's intended approach to this is set out in the Factsheet "Control of noise from the operation of stationary systems".

5.1.2 The tunnel shafts have buildings on the surface, called headhouses, which will be openly visible and will be designed in accordance with the above principles.

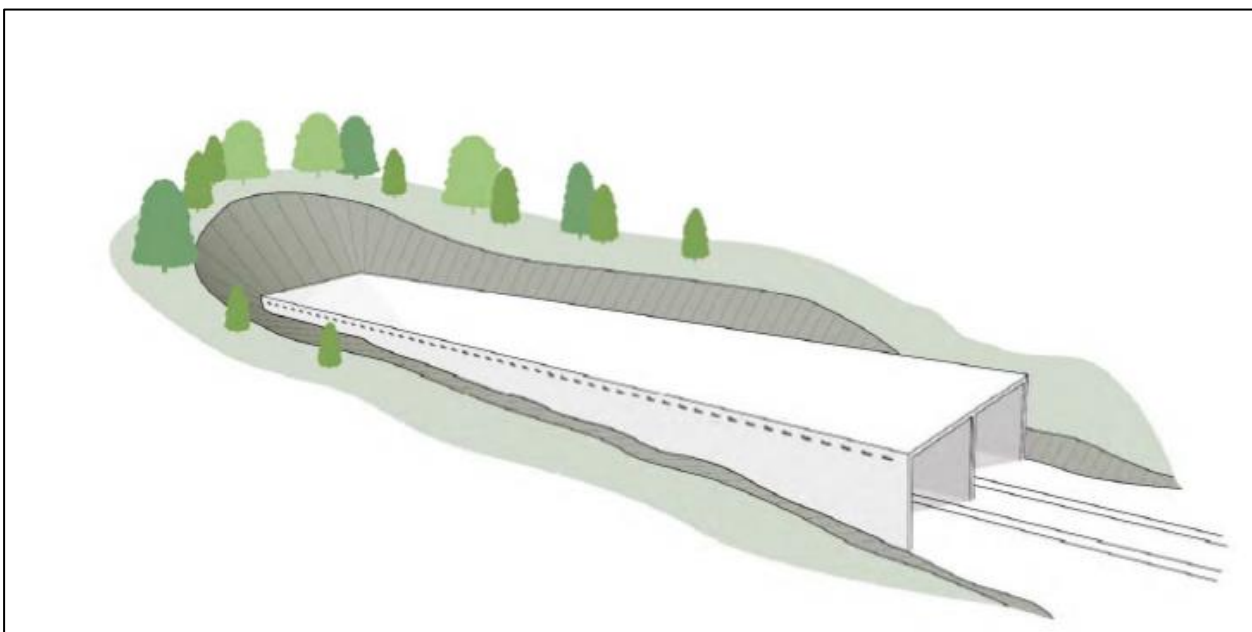
5.1.3 It is expected that the final designs of the tunnel headhouse buildings would be approved by local authorities in accordance with the planning regime established in a future Phase 2b hybrid Bill.

6 Porous portals

6.1.1 A portal is the entry or exit section of a tunnel. A 'porous portal' is a section at either end of a tunnel which has openings to the outside air along its length.

6.1.2 The purpose of a porous portal is to ensure that the micro pressure waves produced by the 'piston effect' of the train moving through the tunnel, which can result in noise as the train exits the tunnel, are controlled and kept at a level which does not affect the surrounding area. This effect is mitigated by adding a 'porous portal'. A 'porous portal' is generally achieved by providing perforated structures, usually of concrete, at the tunnel portal. These structures have openings of increasing diameter, open to the outside air, running along their length. The porous portal slows the build-up of the pressure wave in the tunnel, reducing the resulting effect.

Figure 2. Illustration of a porous portal



- 6.1.3 The Red Hill tunnel, to the north west of Radcliffe-on-Soar power station, is not currently proposed to have porous portals due its comparatively short length and the size of its cross-sectional area. All other bored and mined tunnels built for the Proposed Scheme are expected to have porous portals.

7 More information

- 7.1.1 More detail on the Bill and related documents can be found at: www.gov.uk/HS2