

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. The Western Leg of Phase 2b comprises an extension of the network to Manchester and a connection to the West Coast Main Line at Golborne, and is referred to as the Western Leg hybrid Bill. The Eastern Leg of Phase 2b currently comprises an extension of the network from the West Midlands through the East Midlands to Leeds.
- 1.1.2 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.
- 1.1.3 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.
- 1.1.4 In February 2020, the Government announced its intention to draw up an Integrated Rail Plan. This will recommend a way forward on scoping, phasing and sequencing the delivery of HS2 Phase 2b, Northern Powerhouse Rail, Midlands Rail Hub and other proposed rail investments across the north. At the same time, the Government asked HS2 Ltd to prepare the Western Leg hybrid Bill, provided it does not prejudge any recommendations or decisions that will be taken in this plan, which will be published by the end of the year.
- 1.1.5 It is intended to deposit a Western Leg hybrid Bill seeking powers to construct and operate this phase in Parliament in early 2022 or sooner if possible (the Proposed Scheme). The work to produce the 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 Bill when it is introduced to Parliament. As was the case with Phase One and Phase 2a, when the 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 of the Proposed Scheme.
- 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 Western Leg Bill. These information papers will be used to provide information about the Proposed Scheme itself, the powers contained in the Bill and how decisions on

the Proposed Scheme have been reached. It is currently proposed that these information papers for the Western Leg of Phase 2b will be published at the time the Bill is introduced in Parliament.

1.1.7 The Secretary of State for Transport will be ‘the Promoter’ of the Western Leg Bill. The Promoter will also eventually appoint a body responsible for delivering the Proposed Scheme under the powers to be granted by the 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 Bill, the policies established in the Western Leg EMRs and any commitments provided in the Western Leg information papers.

1.1.8 These Western Leg factsheets have been produced to provide information on the emerging proposals for measures to manage the design process for the Proposed Scheme and to control impacts which may arise from the construction and operation of the Proposed Scheme. These measures may then be applied to the Western Leg as commitments made through the eventual 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.

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:

- house vent fans and other mechanical equipment 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 maintenance workers; and
- meet the comfort requirements of passengers and maintenance 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.

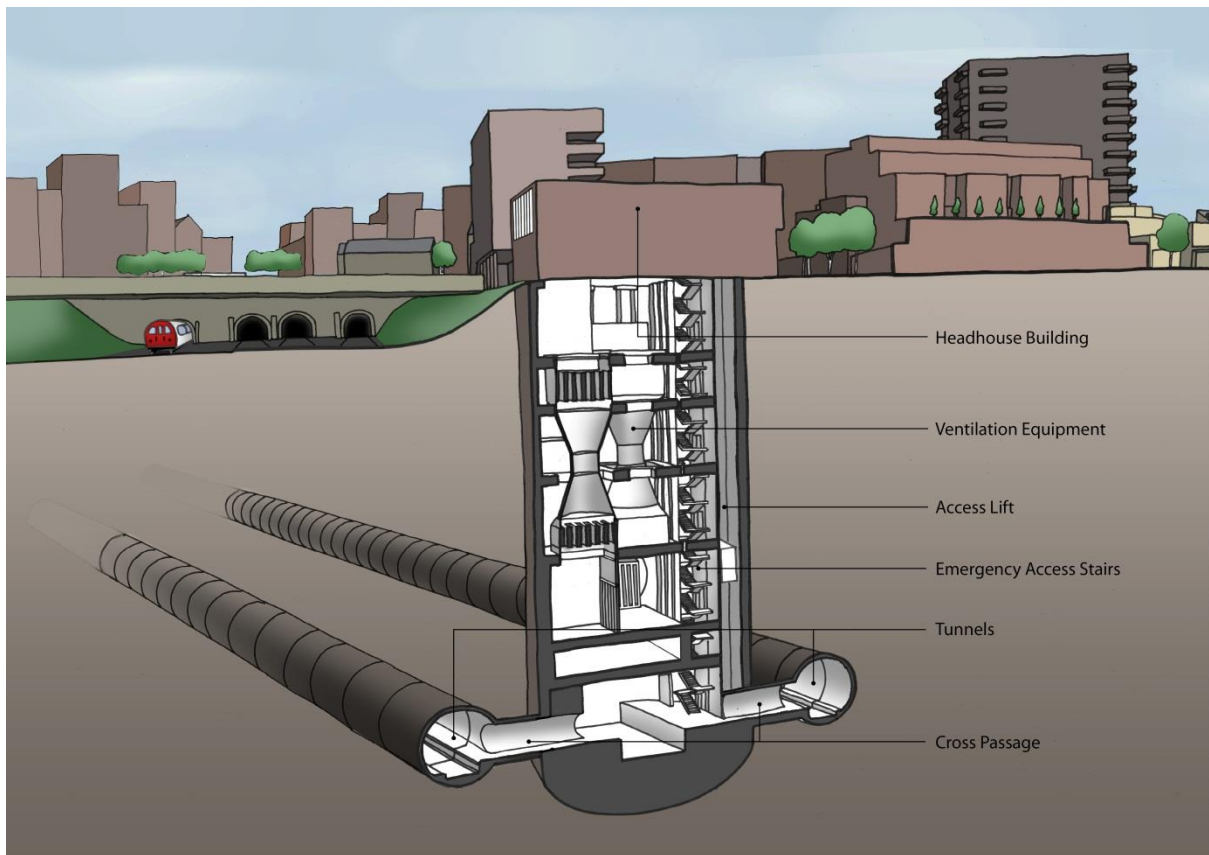


Figure 1. A typical tunnel shaft

- 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

4.1.5 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.

4.1.6 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

4.1.7 Two of the tunnels on the Proposed Scheme are currently identified as requiring shafts. These are the Crewe tunnel and Manchester tunnel. The proposed shaft locations have been based on the above spacing requirements, access to the road network, sufficient space for a temporary construction compound and the permanent structures, 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.

5 Tunnel shaft and headhouse design

5.1.1 The shafts will be designed to be:

- safe, secure, 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)

- architecturally 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. The headhouse provides the entrance from the surface into the shaft.

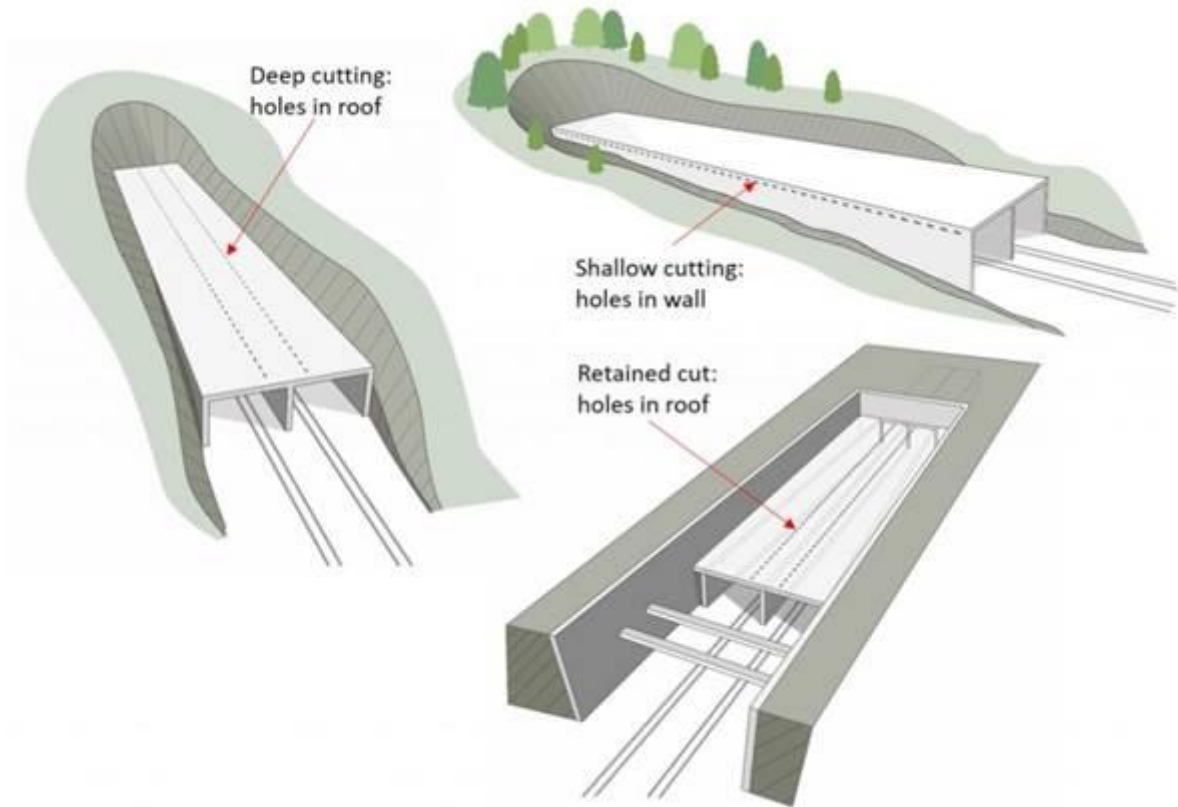
5.1.3 It is expected that the final architectural designs of the tunnel headhouse buildings would be approved by local authorities in accordance with the planning regime established in a future Phase 2b Western Leg hybrid Bill.

6 Porous portals

6.1.1 A portal is the entry or exit section of a tunnel. 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.

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'. The porous portal slows the build-up of the pressure wave in the tunnel, reducing the resulting effect, and also prevents excessive pressure which can lead to passenger discomfort.

Figure 2. Illustrations of porous portals



6.1.3 All bored tunnels built for the Proposed Scheme are expected to have porous portals.

7 More information

7.1.1 Further factsheets and details on the Proposed Scheme can be found at:
www.hs2.org.uk/phase2b

