Phase 2b Western Leg Information Paper

D14: Tunnel shafts and portals

This paper 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.

It will be of particular interest to those potentially affected by the Government's proposals for high speed rail.

This paper was prepared in relation to the promotion of the High Speed Rail (Crewe - Manchester) Bill. Content will be maintained and updated as considered appropriate during the passage of the Bill.

If you have any queries about this paper or about how it might apply to you, please contact the HS2 Helpdesk in the first instance.

The Helpdesk can be contacted:

by email: HS2enquiries@hs2.org.uk

by phone (24hrs): 08081 434 434
08081 456 472 (minicom)

or by post: High Speed Two (HS2) Limited
2 Snowhill, Queensway
Birmingham
B4 6GA

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1 Introduction

1.1 High Speed Two (HS2) is the Government's scheme for a new, high speed north-south railway, which is being taken forward in a number of phases. Phase One will connect London with Birmingham and the West Midlands. Phase 2a will extend the route from the West Midlands to Crewe. The Phase 2b Western Leg will connect Crewe to Manchester. As set out in the Integrated Rail Plan, published in November 2021, HS2 East is proposed to deliver a new high speed line from the West Midlands to East Midlands Parkway.

1.2 HS2 Ltd is the non-departmental public body responsible for developing and promoting these proposals. The company works under the terms of a Development Agreement entered into with the Secretary of State for Transport.

1.3 The construction and operation of Phase One of HS2 is authorised by the High Speed Rail (London – West Midlands) Act 2017 and Phase 2a by the High Speed Rail (West Midlands – Crewe) Act 2021.

1.4 In January 2022, the Government introduced a hybrid Bill to Parliament (hereafter referred to as 'the Bill'), to seek powers for the construction and operation of the Phase 2b Western Leg (the Proposed Scheme), which is called the High Speed Rail (Crewe – Manchester) Bill. The Proposed Scheme comprises the Phase 2b Western Leg from Crewe to Manchester and several off-route works. It also facilitates the delivery of Northern Powerhouse Rail by providing the Crewe Northern Connection and junctions and other infrastructure to be used in future schemes.

1.5 The work to produce the Bill includes an Equalities Impact Assessment and an Environmental Impact Assessment (EIA), the results of which are reported in an Environmental Statement (ES) submitted alongside the Bill. The Secretary of State has also published draft Environmental Minimum Requirements (EMRs), which set out the environmental and sustainability commitments that will be observed in the construction of the Proposed

Scheme. For more information on the EMRs please see Information Paper E1: Control of environmental impacts.

1.6 The Secretary of State for Transport is the Promoter of the Bill through Parliament. The Promoter will also appoint a body responsible for delivering the Proposed Scheme under the powers granted by the Bill. This body is known as the 'nominated undertaker'. There may 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 EMRs and any commitments provided in the information papers.

1.7 These information papers have been produced to explain the commitments made in the Bill and the EMRs and how they will be applied to the design and construction of the Proposed Scheme. They also provide information about the Proposed Scheme itself, the powers contained in the Bill and how particular decisions about the Proposed Scheme have been reached.

2 Overview

2.1 This information paper sets out the purpose 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 Tunnel shafts are vertical openings connecting underground tunnels to the surface and open air. Figure 1 is a sketch of a typical tunnel shaft.

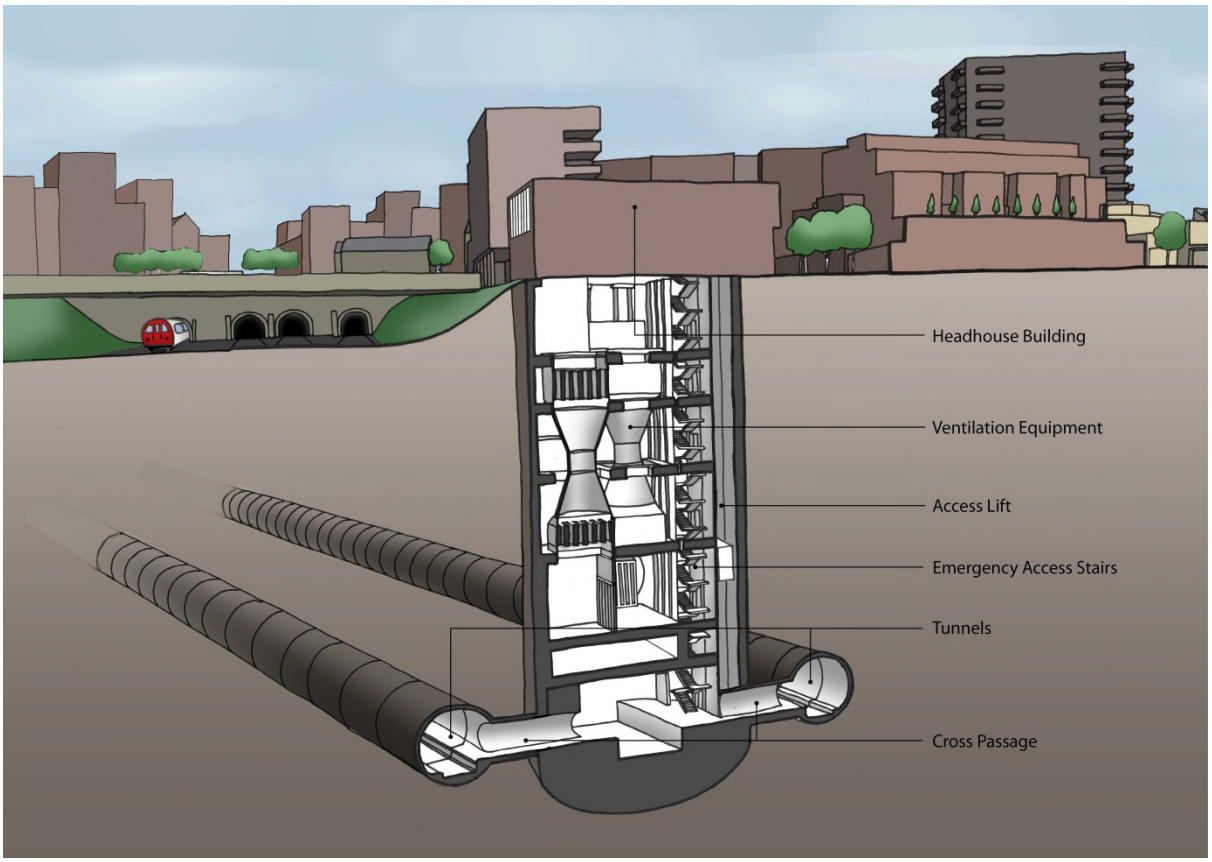
3.2 The purpose of tunnel shafts are to:

- in the event of a fire, to enable the smoke produced 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.

3.3 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.

Figure 1: A typical tunnel shaft



4 Tunnel shaft locations

Spacing requirements

4.1 Tunnel shafts are only required in tunnels more than 3 km long.

4.2 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.

4.3 The requirements for evacuation facilities and emergency access are set out in section 4.2.1.5 in the National Technical Specification Notice: Safety in Railway Tunnels. A link to this document can be found in the reference section at the end of this paper.

4.4 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. However, on the Proposed Scheme cross-passages will be spaced at 350m near to shafts and throughout green cut and cover tunnels and every 500m elsewhere.

Locations

4.5 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 The shafts will be designed to be:

- safe, secure, efficient, and consistent with the requirements of whole-life operation and maintenance alongside initial buildability;
- 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 Information paper E11: Control of noise from the operation of stationary systems.

5.2 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.

5.3 The final architectural designs of the tunnel headhouse buildings will be approved by local authorities in accordance with the planning regime set out in the Bill.

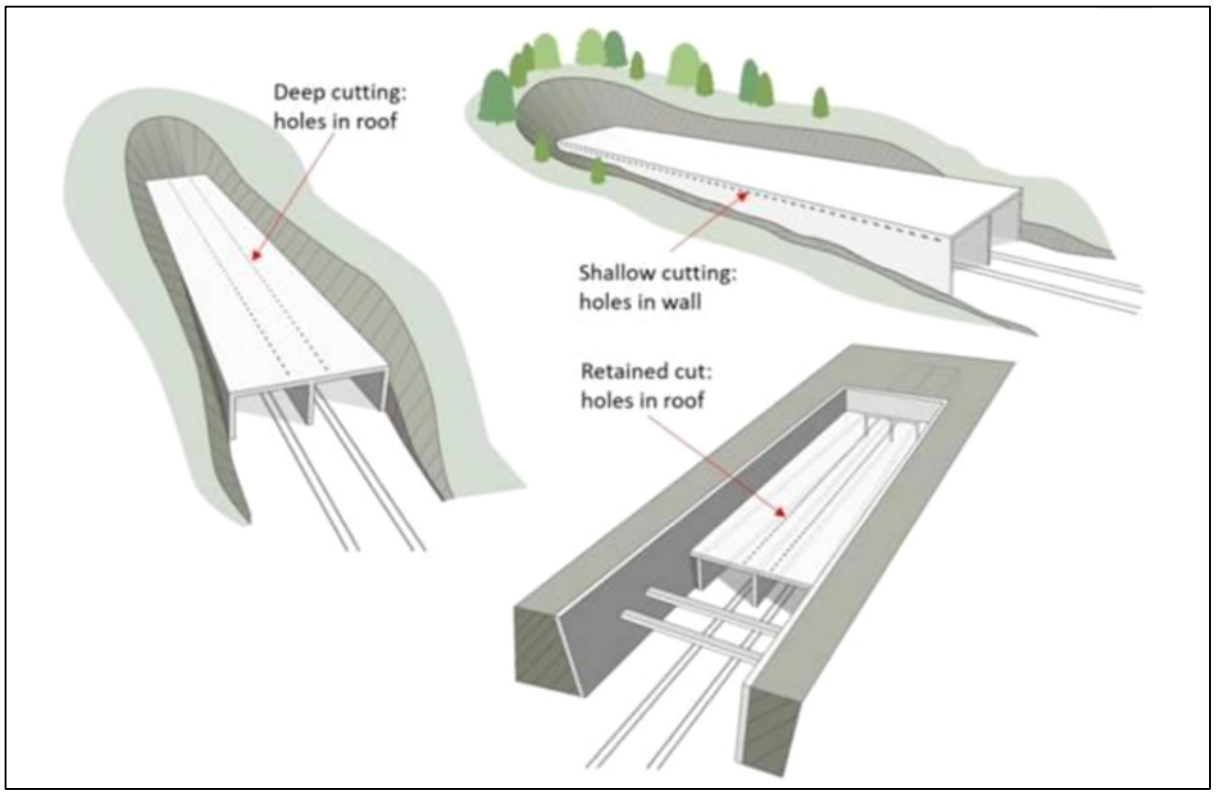
6 Porous Portals

6.1 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.

6.2 On high speed railways, the purpose of a porous portal at the entry of a tunnel is to ensure that the micro pressure waves produced by the 'piston effect' of the train moving through the tunnel, which can otherwise result in noise as the train exits the tunnel, are controlled and kept at a level which does not adversely affect the surrounding area.

6.3 Figure 2 below illustrates how porous portals on the Proposed Scheme could look:

Figure 2: Examples of porous portal



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

7 More information

7.1 More detail on the Bill and related documents can be found at www.gov.uk/hs2-phase2b-crewe-manchester.

References

National Technical Specification Notices – Safety in Railway Tunnels

https://www.rssb.co.uk/en/standards/understanding-and-applying-standards/national-technical-specification-notices