Crossrail
Technical Report
Assessment of Noise and Vibration Impacts
Volume 4 of 8
Central Section

Report No. 1E315-C1E00-00001
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<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>2. ENVIRONMENTAL BASELINE AND ASSESSMENT OF IMPACTS – ROYAL OAK PORTAL TO PUDDING MILL LANE PORTAL AND THE ISLE OF DOGS</td>
<td>6</td>
</tr>
</tbody>
</table>

Appendix A - Construction Impact Summary Tables, Route Windows C1 to C13
1. INTRODUCTION

1.1 This report presents the specialist noise and vibration assessment for route windows C1 to C13 and auxiliary route windows C8a and C13a of the Crossrail scheme.

OVERVIEW OF CROSSRAIL WORKS IN CENTRAL ROUTE SECTION

1.2 The central route section represents the largest scale engineering component of the project. The route will comprise 6 m diameter twin-bore tunnels running under central London that will connect existing railways to the east and west. The tunnels will generally be at a depth of between 20 metres and 40 metres. At a point beneath Stepney Green, the route will fork: one route will continue north-eastwards towards Stratford, the other will head south-eastwards towards the Isle of Dogs.

1.3 New Crossrail stations will be provided at intervals along the new tunnel alignment at Paddington, Bond Street, Tottenham Court Road, Farringdon, Liverpool Street, Whitechapel and the Isle of Dogs. Each of these stations (except the Isle of Dogs) will have two entrances and ticket halls to provide access to the east and west ends of the below-ground platforms. At Whitechapel, the option of providing the second ticket hall as a separate works is considered. At the Isle of Dogs station, there will be passive provision for a second ticket hall.

1.4 New portal structures will be provided in the west at Royal Oak (Paddington) and in the east at Pudding Mill Lane (Stratford). For the southeast route to Docklands, the tunnel will be continued east of the Isle of Dogs – this is addressed in the southeast route section. At particular locations along the new railway, shafts connecting the tunnels with the surface will be provided for access and/or ventilation. Some of these shaft structures will be incorporated into the new station buildings; others will be located independently of the stations in accordance with safety requirements.
1.5 The twin-bore tunnels will be excavated using tunnel-boring machines. Up to nine of these will be working in the central section at any one time. Excavated material will be removed at the west and east portals and via a temporary tunnel linking Hanbury Street shaft to a temporary shaft on Pedley Street, from where it will be taken by a conveyor to a holding site in Mile End Park, prior to removal by rail. Excavated material from station construction will generally be removed by road, except for the Isle of Dogs station, where transportation by barge is planned.

1.6 Provision of new station entrance buildings and ticket halls will require that existing buildings be demolished. The Bill does not provide powers for development to replace these, however, it is extremely unlikely that such developments will not be constructed.

1.7 Enabling works will be required prior to the main construction works. These may take up to two years at each site, although at locations where only minor enabling works are required, the durations of these works could be much shorter.
### Main Construction Works in the Central Section

<table>
<thead>
<tr>
<th>Route Window</th>
<th>Route Window Name</th>
<th>Main Works</th>
<th>Description of the Works</th>
<th>Local Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Royal Oak portal reversal</td>
<td>Westbourne Park reversing facility</td>
<td>Provision of a reversing facility consisting of two island platforms and four tracks to enable some or all of the westbound Crossrail service to terminate at Paddington.</td>
<td>Royal Borough of Kensington and Chelsea and City of Westminster</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Royal Oak portal</td>
<td>Construction of the western portal of the central area tunnels, located west of Lord Hill’s Bridge, consisting of an approach ramp and cut and cover tunnel between the portal and the tunnel eye located between Ranelagh Bridge and Westbourne Bridge.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Westbourne Bridge shaft</td>
<td>Provision of a shaft for the construction of twin-bore tunnels. The shaft will be used to house ventilation equipment and provide access as an emergency intervention point (EIP).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tunnel eye</td>
<td>Works at the point where bored tunnelling begins, located between Ranelagh Bridge and Westbourne Bridge.</td>
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<tr>
<td></td>
<td></td>
<td>Twin-bore tunnels</td>
<td>Construction of the twin tunnels with the rails at a depth of between 15 and 20 m below street level.</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>Paddington station</td>
<td>Paddington station</td>
<td>Works to the station consisting of a new 340 m length box with a 210 m island platform and new ticket halls at the eastern and western ends. The station will be located underneath Eastbourne Terrace. The station will include a narrow glazed structure above-ground called the ‘light spine’.</td>
<td>City of Westminster</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paddington station shafts</td>
<td>Provision of ventilation and EIP facilities, to be located at the eastern and western ends of the station box.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Twin-bore tunnels</td>
<td>Construction of the twin tunnels with the rails at a depth of approximately 20 to 30 m below street level.</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>Hyde Park shaft and Park Lane Shafts</td>
<td>Hyde Park shaft</td>
<td>Construction of a shaft to house ventilation equipment and provide access as an EIP. The shaft will be located at the northern boundary of Hyde Park, close to Victoria and Clarendon Gates. The shaft surface building will be up to 2 m high and located to the west of Victoria Gate Lodge.</td>
<td>City of Westminster</td>
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<tr>
<td></td>
<td></td>
<td>Park Lane shaft</td>
<td>Construction of a shaft to house ventilation equipment and provide access as an EIP. The shaft will be located in the central reservation of Park Lane immediately south of Marble Arch and opposite Green Street. The surface building will be approximately 2 m high.</td>
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<tr>
<td></td>
<td></td>
<td>Twin-bore tunnels</td>
<td>Construction of the twin tunnels with the rails at a depth of between 27 m and 30 m below street level.</td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>Bond Street station</td>
<td>Bond Street station</td>
<td>Works at the station to provide new 245 m length platform tunnels fitted out to 210 m between Davies Street and Hanover Square. Ventilation and access as an EIP will be provided at each end of the station.</td>
<td>City of Westminster</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Western and Eastern ticket halls</td>
<td>Construction of a new one storey western facility at 65 Davies Street, to include a ventilation stack approximately 30 m high. Construction of a new 7 m high eastern ticket hall to include a ventilation stack approximately 35 m high at 18/19 Hanover Square.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Twin-bore tunnels</td>
<td>Twin tunnels will be constructed with the rails at a depth of approximately 26 to 32 m below street level.</td>
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</tr>
<tr>
<td>C5</td>
<td>Tottenham Court Road station</td>
<td>Tottenham Court Road station</td>
<td>Works at the station to provide new 245 m length platform tunnels fitted out to 210 m between Great Chapel Street and Charing Cross Road.</td>
<td>City of Westminster and LB Camden</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Western and Eastern ticket halls</td>
<td>Construction of a new ticket hall beneath the Plaza at the front of Centre Point. The deep station box at Goslett Yard will include a shaft that will house ventilation equipment and provide access as an EIP. This ticket hall is an extension of the existing London Underground ticket hall.</td>
<td></td>
</tr>
<tr>
<td>Route Window Name</td>
<td>Route Window Name</td>
<td>Main Works</td>
<td>Description of the Works</td>
<td>Local Authority</td>
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<tr>
<td></td>
<td></td>
<td>Construction of a new western ticket hall at Dean Street. Ventilation equipment and EIP access will be constructed at Fareham Street.</td>
<td>LB Camden, LB Islington and City of London</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fisher Street shaft</td>
<td>Construction of a shaft that will house ventilation equipment and provide access as an EIP at Fisher Street on the site of 8–10 Southampton Row. The original building façade to 8–10 Southampton Row will be retained.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Twin-bore tunnels</td>
<td>Construction of the twin tunnels with the rails at a depth of between 20 and 30 m below street level.</td>
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</tr>
<tr>
<td>C6 Farringdon station</td>
<td>Farringdon station</td>
<td>Works at the station to provide new 245 m length platform tunnels fitted out to 210 m between Farringdon Road and Lindsey Street.</td>
<td>City of London and LB Tower Hamlets</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Construction of a new 8 m high western ticket hall at Farringdon Road (to include EIP access and ventilation equipment within its footprint).</td>
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<td></td>
<td></td>
<td>Construction of a new 8 m high eastern ticket hall at Lindsey Street at the west end of Barbican station, to include EIP and ventilation equipment. Emergency escape will be via a new separate shaft in 38–42 Charterhouse Street.</td>
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</tr>
<tr>
<td></td>
<td>Twin-bore tunnels</td>
<td>Construction of the twin tunnels with the rails at a depth of approximately 12 to 36 m below street level. A crossover will be constructed to the east of the station.</td>
<td></td>
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</tr>
<tr>
<td>C7 Liverpool Street station</td>
<td>Liverpool Street station</td>
<td>Works at the station to provide new 245 m length platform tunnels fitted out to 210 m between Moorfields and Blomfield Street.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Moorgate ticket hall</td>
<td>Construction of a new 8 m deep western ticket hall at Moorgate station, to include EIP access and ventilation equipment within its footprint (shaft is approximately 20 m high).</td>
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<tr>
<td></td>
<td>Finsbury Circus</td>
<td>Replacement of the pavilion and bowling green and re-establishment of the gardens that are lost to the construction site at this location.</td>
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</tr>
<tr>
<td></td>
<td>Blomfield Street shaft</td>
<td>Construction of a shaft approximately 28 m high at 11–12 Blomfield Street to contain ventilation equipment and provide EIP access.</td>
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<tr>
<td></td>
<td>Twin-bore tunnels</td>
<td>Construction of the twin tunnels with the rails at a depth of approximately 36 to 42 m below street level.</td>
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<tr>
<td>C8 Whitechapel station</td>
<td>Hanbury Street shaft</td>
<td>Construction of a shaft to contain ventilation equipment and provide EIP access; the surface structure will be approximately 12 m high.</td>
<td>LB Tower Hamlets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hanbury Street to Pedley Street temporary tunnel and shaft.</td>
<td>Construction of a single-bore temporary tunnel from the Hanbury Street shaft to a temporary shaft at Pedley Street. This tunnel and shaft will be used to transfer excavated materials from the central section tunnelling works by conveyor and then onto the stockpile at Mile End (Devonshire Street) sidings for onward transport by rail together with the supply of construction material such as tunnel segments.</td>
<td></td>
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<tr>
<td></td>
<td>Whitechapel station</td>
<td>Works at the station to provide new 245 m length platform tunnels fitted out to 210 m between Court Street and Cambridge Heath Road.</td>
<td></td>
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<tr>
<td></td>
<td>Ticket halls</td>
<td>Construction of a new western ticket hall above the LUL District line tracks at Court Street and of an eastern ticket hall at the junction of Cambridge Heath Road and Whitechapel Road, including ventilation and EIP.</td>
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<tr>
<td></td>
<td>New ticket hall over the London Underground District Line platforms including a new concourse at Essex Wharf to allow access to the western end of the Crossrail platforms.</td>
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<tr>
<td></td>
<td>Durward Street shaft</td>
<td>Construction of a ventilation and EIP access shaft as part of the Whitechapel Station Essex Wharf concourse structure.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Twin-bore tunnels</td>
<td>Construction of twin-bore tunnels with the rails at a depth of between 25 m and 38 m below street level.</td>
<td></td>
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</tr>
<tr>
<td>Route Window</td>
<td>Route Window Name</td>
<td>Main Works</td>
<td>Description of the Works</td>
<td>Local Authority</td>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>C8A</td>
<td>Mile End corridor</td>
<td>Temporary</td>
<td>Temporary works will take place within this route window to construct a conveyor belt to take excavated material from Pedley Street to temporary excavated material handling facilities, to be constructed at Mile End (Devonshire Street) sidings and Mile End Park.</td>
<td>LB Tower Hamlets</td>
</tr>
<tr>
<td>C9</td>
<td>Stepney Green</td>
<td>Stepney</td>
<td>Provision of a ventilation, escape and EIP access shafts on Stepney Green between an all weather sports ground and Garden Street, which will include two 7.5 m high structures at ground level.</td>
<td>LB Tower Hamlets</td>
</tr>
<tr>
<td></td>
<td>shafts</td>
<td>Twin-bore</td>
<td>Construction of twin tunnels with the rails at a depth of between 22 m and 37 m below street level. Two turn out caverns beneath Stepney Green will be constructed to allow for the junction between the Shenfield and the Abbey Wood branches.</td>
<td></td>
</tr>
<tr>
<td>C10</td>
<td>Lowell Street</td>
<td>Lowell</td>
<td>Construction of a ventilation, escape and EIP access shaft of approximately 15 m in height at the comer of Commercial Road and Basin Approach (610 Commercial Road).</td>
<td>LB Tower Hamlets</td>
</tr>
<tr>
<td></td>
<td>shaft</td>
<td>Twin-bore</td>
<td>Construction of the twin tunnels with the rails at a depth of between 32 m and 40 m below street level.</td>
<td></td>
</tr>
<tr>
<td>C11</td>
<td>Isle of Dogs</td>
<td>Hertsmere</td>
<td>Construction of an EIP access shaft on Hertsmere Road, which will include an 8 m high structure at the surface.</td>
<td>LB Tower Hamlets</td>
</tr>
<tr>
<td></td>
<td>station</td>
<td></td>
<td>Isle of Dogs station Construction of a station and crossover within a 475 m long box located below West India North Dock. The crossover will be constructed within the western part of the box and the station, with a 210 m long island platform which will be constructed in the eastern part of the box. The crossover will enable trains to terminate at the station and return to central London or Abbey Wood. Construction of a screen entry/exit point to the west of Great Wharf Bridge, which will be rebuilt. Construction of escape and ventilation shafts within the station box, one at the eastern end and one at the western end of the station platform.</td>
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<tr>
<td></td>
<td></td>
<td>Twin-bore</td>
<td>Construction of the twin tunnels with the rails at a depth of approximately 30 m to 50 m below street level.</td>
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<tr>
<td>C12</td>
<td>Mile End Park</td>
<td>Mile End</td>
<td>Construction of a ventilation, escape and EIP access shaft in the southeast comer of Mile End Park next to Burdett Road, which will include a 7 m high surface structure.</td>
<td>LB Tower Hamlets</td>
</tr>
<tr>
<td></td>
<td>and Eleanor Street</td>
<td>Park</td>
<td>Construction of an EIP access and ventilation shaft in the eastern end of the current caravan park site, which will include an 11 m high surface structure.</td>
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</tr>
<tr>
<td></td>
<td>shafts</td>
<td>Twin-bore</td>
<td>Construction of twin tunnels with the rails at a depth of between 23 m and 28 m below street level.</td>
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</tr>
<tr>
<td>C13</td>
<td>Pudding Mill Lane</td>
<td>Twin-bore</td>
<td>Construction of twin tunnels with the rails at a depth of up to 38 m below street level rising to emerge through the tunnel eye at Pudding Mill Lane.</td>
<td>LB Tower Hamlets and LB Newham</td>
</tr>
<tr>
<td></td>
<td>portal</td>
<td>Twin-bore</td>
<td>Construction of the eastern portal of the central area tunnels along with EIP and escape facilities.</td>
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<tr>
<td></td>
<td></td>
<td>Pudding Mill</td>
<td>The line will emerge through a tunnel eye and rise up a ramp, partly within a cut and cover tunnel.</td>
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<td></td>
<td></td>
<td>Lane portal</td>
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<tr>
<td></td>
<td></td>
<td>Changes to</td>
<td>Re-alignment of the DLR to the south and provision of a replacement DLR Pudding Mill Lane station.</td>
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<td></td>
<td></td>
<td>Docklands</td>
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<td></td>
<td>Light Railway</td>
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<td></td>
<td></td>
<td>Changes to</td>
<td>Re-alignment of the westbound (up line) electric track of the Great Eastern Mainline (GEML) to accommodate Crossrail.</td>
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<td></td>
<td></td>
<td>Great</td>
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<td></td>
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<td>Eastern</td>
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<td></td>
<td></td>
<td>Main Line</td>
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</tbody>
</table>
2. ENVIRONMENTAL BASELINE AND ASSESSMENT OF IMPACTS – ROYAL OAK PORTAL TO PUDDING MILL LANE PORTAL AND THE ISLE OF DOGS

ROUTE WINDOW C1 – ROYAL OAK PORTAL

Overview of Route Window C1

2.1 The Crossrail route runs along surface railway within the existing rail corridor through the western part of this route window. The route then passes into a tunnel at Royal Oak. The permanent works will consist of:

- a train reversing facility at Westbourne Park and track alterations to the Great Western Main Line;
- an approach ramp, a portal at Royal Oak, a cut and cover tunnel, and twin-bore tunnel commencing at Westbourne Park; and
- Westbourne Bridge shaft, containing intervention and ventilation facilities.

2.2 This route window lies partly within the Royal Borough of Kensington and Chelsea and partly within the City of Westminster. Land uses within this part of London are predominantly residential or associated with transport, the elevated A40 Westway and the Great Western Main Line (GWML) and the London Underground rail corridor to Paddington station being predominant features. There are a number of commercial land uses to the north of the railway, including a concrete batching plant, transport-related uses (including a taxi servicing facility and Westbourne Park bus garage) and workshops, including Great Western Studios. There are residential areas further to the north containing high-rise and medium-rise blocks. Residential areas also lie to the south of the railway corridor and to the east of Bishops Bridge Road.

2.3 The permanent infrastructure will be located in the busy transport corridor. The main roads, including the A40 Westway and Great Western Road, are heavily trafficked, resulting in high noise levels.
Baseline

2.4 The baseline noise survey locations and durations applicable to this route window are listed in the following table and identified on Drawing No: E0415-C1E00-E01-F-00001:

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium term (24-hours)</th>
<th>Short-Term (3-hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WE01</td>
<td>93 Westbourne Park Villas</td>
<td>x</td>
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<td></td>
</tr>
<tr>
<td>WE02</td>
<td>15 Torquay Street</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>WE03</td>
<td>Clifford Court, Westbourne Park Villas</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>WE04</td>
<td>17 Bourne Terrace</td>
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<td>x</td>
<td></td>
</tr>
<tr>
<td>WE05</td>
<td>Orsett Terrace (rear façade)</td>
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<td>x</td>
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</tr>
<tr>
<td>WE31</td>
<td>Orsett Terrace (front façade)</td>
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</tbody>
</table>

2.5 The weekday daytime $L_{Aeq,12hr}$ baseline level measured at Westbourne Park Villas (WE01) was 75 dB with a night-time $L_{Aeq,8hr}$ level of 69 dB. These levels are relatively high as would be expected for a location overlooking a busy railway in an urban location. The corresponding period noise levels recorded at the weekend were 2 dB and 3 dB lower both for the daytime and night-time periods. For WE01 the measured noise levels reflect the high night-time levels from the railway. The receptor at the rear façade of Orsett Terrace is subject to a daytime $L_{Aeq,12hr}$ baseline level of 68 dB and a night-time $L_{Aeq,8hr}$ level of 63 dB. The noise environments at locations WE02, WE03 and WE04 are dominated by varying combinations of railway noise and road traffic noise, the latter from the elevated A40 Westway. The position at the rear façade of Orsett Terrace (WE05) was also influenced by cars using the Paddington Station car park. The $L_{A90}(21:00-01:30$ and $05:30-07:00)$ background level at this position was found to be 55 dB.

2.6 The front façade of Orsett Terrace (WE31), which was outside the north-west façade of 140 Westbourne Terrace, a corner property, was dominated by noise from the traffic on Westbourne Terrace. The daytime $L_{Aeq,3hr}$ level at this location was 70 dB, falling to 66 dB in the evening (19:00 to 23:00 hours).

Impact Assessment - Temporary Impacts

Impacts during Construction

2.7 Temporary impacts from construction activities are illustrated on Drawing No. E0315-C1E00-E01-F-00001.
Noise from Surface Activity

2.8 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

Construction Sites and Works including Onsite Traffic and Grout Shafts

Royal Oak Worksite East (Royal Oak Portal)

2.9 For work that may take place in the day period (07:00 to 19:00 hours), only Gloucester Terrace near Ranelagh Bridge is predicted to experience significant noise impacts.

2.10 No significant noise impacts are predicted from construction works taking place during the evening period (19:00 to 23:00 hours).

2.11 Construction activity during the night-time (23:00 to 07:00 hours) may result in noise levels in excess of the threshold of significance, again for residential properties along Gloucester Terrace near Ranelagh Bridge and Westbourne Park Villas. Night-time working would be required for the tunnelling works, however it is the diaphragm walling near the operational railway which would lead to the greater noise levels. The installation of diaphragm walls at night will be kept to a minimum and be limited to those where the proximity of the construction to the existing railway requires that it is undertaken in possession periods for reasons of safety. Only essential plant would operate at night, including use of cranes to move material into and out of the tunnel, a conveyor removing excavated material, an excavator levelling the excavated material heap, the grout plant and tunnel ventilation fans. The diaphragm walling is programmed to occur for approximately 2 months.

Royal Oak Worksite West (Westbourne Park Reversing Facility)

2.12 No residential or otherwise noise-sensitive properties would be impacted by construction activities undertaken as part of the Westbourne Park Reversing Facility programme. As part of this works, however, permanent-way track-works into Route Window West 1 will be undertaken. These are assessed in the section for that area.

2.13 No evening or night-time noise impacts are predicted. In addition, no non-residential noise-sensitive properties are expected to receive significant noise impacts as a result of these works.
Off Site Road Traffic

2.14 The peak period for construction traffic on the public highway occurs over a three month period. Construction vehicles will only use the highway during the daytime (0700 – 1900). At façades overlooking roads used by construction traffic, the existing hourly $L_{A10}$ during the daytime is predicted to increase by less than 1 dB, except for façades along the Brunel Estate Service Road and Alfred Road. At façades overlooking the Brunel Estate Service Road between the Great Western Road (A4207) and Westbourne Park (B412), and in Alfred Road (off Harrow Road – A404) increases of around 1 dB are predicted. There are therefore no significant impacts arising from construction traffic.

Vibration from Surface Activity

2.15 The plant likely to be required to demolish the existing buildings or structures and construct the Crossrail elements in this route window and the plant associated with the tunnelling in the area has been reviewed to identify sources that may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings or damage to buildings.

Royal Oak Worksite East

2.16 The construction information provided by Crossrail for the Royal Oak Worksite East indicates that an oscillatory bored piling rig, a vibratory piling rig, and hydraulic breakers will be required for the demolition and construction activities at this worksite. Excavated material will be removed from the site by train. Vibration levels from oscillatory bored piling are predicted not to be significant at the nearest potentially sensitive receptors. However, it is recommended that the tracks used by the trains removing excavated material should be CWR, wherever possible.

2.17 Vibration levels in the region of 1.5 to 7 mm/s are predicted at the foundations of the Westbourne Green Sports Complex, during vibratory piling of the closest section of the retaining wall to the concrete batcher sidings. Vibration levels may exceed the threshold of significance for building damage during piling adjacent to the Westbourne Green Sports Complex.

2.18 Vibration levels due to the demolition of industrial units on site during site clearance are predicted not to be significant outside the boundary of the site.

2.19 All demolition and construction activities are expected to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’.

2.20 It is noted from the listed buildings information that Westbourne Bridge is a Grade II listed building. Based upon the detailed method statements, construction activities in this area (excluding any settlement effects) should not compromise the structure. No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.
Royal Oak Worksite West

2.21 The construction information provided by Crossrail indicates that a vibrating roller is required for the construction of new tracks. Vibration levels during these works are predicted to be less than 1 mm/s at the foundations of the Derrycombe House, which is the closest building to the proposed works. Vibration levels are predicted not to exceed the threshold of significance for building damage at all receptors during all proposed works at this site.

2.22 The construction activities at Royal Oak Worksite West are predicted to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’.

2.23 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.24 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds will be exceeded while the temporary railway is running.

Tunnel Boring Machines

2.25 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.

2.26 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories "low probability of adverse comment" and "adverse comment possible"; i.e. there is not likely to be a total absence of adverse comment.
Noise and Vibration Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.27 Hoardings 3.6 m high would be provided along the southern boundary, from near the Westbourne Park Villas footbridge east to tie into existing walls running to Paddington Station. It has also been assumed that the Westway and Harrow Road will provide significant screening along the northern site boundary east of Westbourne Terrace. The grouting plant would be mitigated by an enclosure providing 15 dB of attenuation. A mitigated, enclosed conveyor system will be used to transport the excavated material from the main tunnelling site to the excavated material heap. This corresponds to Tier 2 mitigation.

2.28 As a result of the Royal Oak Portal construction works, a total of 40 properties are expected to be eligible for noise insulation, no properties would be eligible for temporary re-housing. Four residential properties would be subject to a significant residual daytime impact.

2.29 As a result of the Westbourne Park Reversing Facility, no properties are expected to be eligible for noise insulation and no properties would be eligible for temporary re-housing. No properties would be subject to a significant residual construction noise impact.

2.30 In summary, within this route window, approximately 40 properties are expected to be eligible for noise insulation due to construction noise, of which no properties would be eligible for temporary re-housing, in accordance with the assumed scheme for the provision of NI and TRH during construction; presented in Chapter 5, Volume 1 of this technical report. This number arises from the close proximity of a large number of residential properties to the Royal Oak Worksites, which combined, are over a kilometre in length, but is limited due to the relatively high baseline levels arising from the existing railway services. It can be seen from Appendix A that 4 residential properties, located on Gloucester Terrace, would be subject to significant residual impacts from construction noise with noise insulation in place.

Offsite Road Traffic

2.31 There are no significant residual impacts.

Vibration from Surface Activity

2.32 Vibration mitigation will be required during vibratory piling adjacent to the Westbourne Green Sports Complex. An appropriate continuous vibration-monitoring regime should be adopted during works to allow monitoring of levels and cessation of activity should levels exceed relevant limits.
Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.33 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machines

2.34 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

Impact Assessment - Permanent Impacts

Impacts during Operation

2.35 Permanent impacts from operation of Crossrail are illustrated on Drawing No. E0315-C1E00-E02-F-00001.

Noise from the Surface Railway

2.36 This Route Window includes Westbourne Park Station, the Westbourne Reversing facility, the Royal Oak Portal and a number of bridges. Crossrail tracks will run parallel to Great Western Main Line corridor and the Hammersmith and City line. Sensitive receptors are mostly located to the south of the railway, with some to the north, but these areas are subject to high ambient noise levels day and night-time due to the presence of the railway corridor. In addition to this, the new lines will not in general be significantly closer to sensitive receptors. On this basis, a Level 2 (assessment based upon changes in railway traffic on existing lines and on other infrastructure alterations) assessment has been carried out.

2.37 The intensification of train flows along the line will result in a maximum noise change of less than 3 dB during both the day and at night. This is below the significance criterion, hence no significant impacts are predicted in this Route Window, based on the assumptions made.

2.38 A detailed study of the potential maximum noise levels arising from the operation of trains has not been undertaken, as it is considered unlikely that the $L_{max,F}$ levels associated with the proposed infrastructure and traffic pattern changes will be any higher than those already experienced at nearby receptors.

Vibration from the Surface Railway

2.39 Changes in vibration levels affecting sensitive receptors will be below levels at which impact is deemed to arise.

Noise from Road Traffic

2.40 There is no change predicted in baseline traffic flows in the route window as a result of Crossrail, therefore not applicable in this route window.
Noise from Ventilation Shafts

2.41 No residential properties close to the proposed ventilation shaft at Westbourne Bridge Station are predicted to be subject to significant noise impacts when the ventilation fan is in operation. At the nearest residential building, the Rating Level of the plant in normal operation is predicted to be 11 dB less than the existing $L_{A90}$ (21:00-01:30 and 05:30-07:00) background noise level (this represents a level 16 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

2.42 It is estimated that the noise levels emitted by a ventilation shaft during maintenance operations would be approximately 20 dB lower than during full flow rate operation. The above operational assessment is based on full flow rate operation. Therefore, no residential properties close to the proposed ventilation shaft are predicted to be subject to significant noise impacts during maintenance operations. On the above basis, significant residual impact is not deemed to occur and no further mitigation measures are required.

Vibration and Groundborne Noise from the Underground Railway

2.43 There are no residential properties affected by groundborne noise and vibration. There is one commercial building, the Lynx building, Bishops Bridge Road which has piled foundations. The maximum level of groundborne noise is predicted as 42 $dB_{L_{Amax},S}$ and vibration 0.045$mms^{-1.75}$ VDV. If, following detailed numerical modelling of the building, the prediction is confirmed, special trackform will be required to meet the design target of 40 $dB_{L_{Amax},S}$. Groundborne noise levels are shown on Drawing No: 1E315-C1E00-E03-F-00001.

Mitigation and Residual Impacts During Operation

Noise from the Surface Railway

2.44 It can be seen from the assessment that no significant noise impacts have been identified and, as such, no mitigation is considered necessary.

2.45 A preliminary assessment has been undertaken to identify the number of residential properties which may be eligible for noise insulation under the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996, as a result of operational railway noise from modified or altered works in the vicinity.

2.46 The results of this preliminary eligibility assessment indicate that no properties are expected to be eligible for noise insulation under the Regulations.

Vibration from the Surface Railway

2.47 There are no significant residual impacts in this route window.

Noise from Road Traffic

2.48 Not applicable in this route window.
Noise from Ventilation Shafts

2.49 There are no significant residual impacts in this route window.

Vibration and Groundborne Noise from the Underground Railway

2.50 There are no significant residual impacts in this route window.

Impacts on Sites Granted Planning Permission

2.51 Westminster City Council has received outline planning permission for the redevelopment of Stowe Boys Youth Club and adjacent land, at 258 Harrow Road. The outline application consists of the demolition of the club and erection of a 3-storey building. The development will provide new youth club and health centre facilities. Due to the location of the proposed site, distant from any worksites or operational facilities, it is unlikely that either the construction or operation of Crossrail will result in a noise or vibration impact at this location.

NOISE ASSESSMENT OF NEW TARMAC CONCRETE BATCHING PLANT AT PADDINGTON NEW YARD SIDINGS

Introduction

2.52 Due to the requirement for Paddington New Yard to be used as a worksite for railhead and tunnel operations, the existing concrete batching plant will be removed until Crossrail works are complete and the Yard can be returned to other uses. By this time, a Permanent Turnback Facility would have been constructed on the southern side of the Yard adjacent to the Mainline tracks.

2.53 Once Crossrail works are complete, Tarmac Southern Limited intends to develop a new concrete batching plant on the site of the old facility. The main difference between the old and the new facility is that aggregate will be held in silos rather than in open stockpiles, which is the current arrangement. Delivery of aggregate will still be by rail. The plant will be new and hence of modern design which will feature noise control measures.

2.54 The operation of the plant will also be subject to the Pollution Prevention and Control Regulations as a Part B (LAPPC) process and consent to carry out bulk cement storage and handling will be required from the applicable London Borough, the City of Westminster.

Baseline Environment

2.55 Paddington New Yard lies to the west of Paddington Station and just to the north and east of Westbourne Park Station. The Great Western Mainlines lies directly to the south of the site with sidings that will feed into the site. The elevated A40 Westway lies to the north and crosses over the Yard and the A420T lies to the west. The environment is hence subject to transportation noise from multiple sources.

2.56 Residential property lies to the north and south of the site, with the Paddington Community Hospital also lying to the north. However, these sensitive receptors are mostly distant and separated from the site by either the main rail lines or the A40 Westway; hence these transportation links will be the dominant sources of noise in the area.
2.57 The nearest baseline monitoring location is WE01, 93 Westbourne Park Villas, which lies to the east of the site on the southern side of the main rail lines. Daytime, weekday $L_{Aeq, 12hr}$ and night-time $L_{Aeq, 8hr}$ ambient levels were high at 75 and 69 dB, respectively, due to these transportation sources. Background noise levels were also high at 63 dB $L_{A90, 16hr}$ during the day and 56 dB $L_{A90, 8hr}$ during the night. Levels over the weekend were slightly lower during the day but the same at night.

2.58 Baseline data (predicted) available from an assessment undertaken for the effects associated with the relocation of the Westbourne Park Bus Garage indicate ambient $L_{Aeq}$ daytime levels ranging from circa 68 to 79 dB for the ground to the fourth floor of the nurses accommodation at the Community Hospital. Night-time levels range from circa 64 dB for the ground floor to 75 dB for the fourth floor. Levels are also provided for Riverford House, which lies to the south of the railway where daytime levels range from 71 dB for the ground floor with no increase to the fourth floor. Night-time levels range from circa 63 dB for the ground floor with no increase to the fourth floor.

2.59 Background levels are not provided for these locations but are also likely to be high.

2.60 The distances from the nearest part of the proposed facility to the nearest noise sensitive receptor range from 75 m to Radway House, 90 m to the Community Hospital and 110 m to Riverford House.

**Noise Assessment**

**Construction**

2.61 Construction requirements will include a new aggregate wagon unloading hopper and conveyor, the four new aggregate silos and the three cement silos plus the batching plant. No activity should be required outside normal daytime weekday and Saturday morning working hours. The current assessment for Crossrail construction activities in this area does not indicate that any impacts will occur except at some flats to the northeast off Alfred Road (Radway House). These are distant from the proposed facility and with the high ambient levels in the area and the more limited activities, no significant impacts from the construction of this facility are considered likely.

**Operation**

2.62 The operation of the facility will require delivery of aggregates by rail, cement by road, the mixing of cement and aggregate, and the subsequent despatch of concrete, which is assumed to also be by road. The introduction of silos, relative to the current situation of open stockpiles, should reduce noise emissions from the site, as mobile plant (front shovels) should not be required to feed the batching plant. The more modern facility and conveyor systems should also be quieter than the current plant. The preferred operating hours are not stated but it is assumed that they will be at least early morning to late afternoon with deliveries at other times as well.

2.63 A facility of this type would normally be assessed using BS 4142, which requires the Rating Level from the plant to be compared with the “typical” background noise level during the periods when the plant would operate. A difference of +5 dB is described to be of “marginal significance” and at +10 dB, complaints are considered to be likely.
2.64 Given the high likely background noise levels in the area of 63 dB $L_{A90,16hr}$ during the day and 56 dB $L_{A90,8hr}$ during the night at Westbourne Park Villas, the distance to the nearest noise sensitive property and the other dominant sources between the facility and the noise sensitive property, it is considered most unlikely that the operation of the facility would result in significant noise impact at the nearest noise sensitive properties. In addition to this, given that the new plant will be in a similar situation to the existing plant, and it should also be quieter, noise impacts should be no worse than, and will probably be better than, the existing situation.

Conclusions

2.65 Due to the high ambient and background noise levels in the area, the distance to the nearest noise sensitive properties and the other dominant noise sources in the area, it is considered that neither the construction nor the subsequent operation of the Tarmac Concrete Batching Plant will result in a significant noise impact.
## Route window C1: Royal Oak Portal, Westbourne Bridge Shaft (and Westbourne Park Reversing Facility) – Temporary Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction of Westbourne Bridge Shaft, Royal Oak Portal and tunnel construction works</td>
<td>Daytime noise impacts at 10 residential properties. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts at 40 residential properties. (Note: a total number of 44 properties are impacted cumulatively.) Religious facilities: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts</td>
<td>Significant</td>
<td>BPM to reduce noise, 3.6 m high hoarding to screen noise, enclosure of static plant associated with 24-hour working. Mitigation = Tier 2</td>
<td>An estimated 40 properties would be eligible for noise insulation. No properties are expected to be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 4 residential properties. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Religious facilities: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
</tr>
<tr>
<td>Construction of Westbourne Park Reversing Facility</td>
<td>Daytime noise impacts at 0 residential property. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Religious facilities: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts</td>
<td>Not significant</td>
<td>BPM to reduce noise, 3.6 m high hoarding to screen noise, enclosure of static plant associated with 24-hour working. Mitigation = Tier 2</td>
<td>It is estimated that no residential properties would be eligible for noise insulation. It is estimated that no properties would be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 0 residential property. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Religious facilities: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
</tr>
<tr>
<td>Works and potential impact</td>
<td>Potential Impact</td>
<td>Significance</td>
<td>Assumed Mitigation</td>
<td>Residual Impact</td>
</tr>
<tr>
<td>----------------------------</td>
<td>------------------</td>
<td>--------------</td>
<td>--------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Operation of Railway</td>
<td>No noise impacts</td>
<td>Not significant</td>
<td>Not required</td>
<td>No impacts</td>
</tr>
<tr>
<td>Ventilation Shaft at Westbourne Bridge Station – operational noise impacts during operation of tunnel ventilation fans</td>
<td>No noise impacts</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
<tr>
<td>Groundborne noise and vibration from the underground railway</td>
<td>Significant</td>
<td>Floating slab track beneath certain buildings</td>
<td>None</td>
<td>Not significant</td>
</tr>
</tbody>
</table>
ROUTE WINDOW C2 – PADDINGTON STATION

Overview of Route Window C2

2.66 Crossrail's twin-bore tunnels will pass beneath the surface railway lines that run into Paddington station. The route will then follow the alignment of Eastbourne Terrace before continuing under Spring Street and Sussex Square in twin-bore tunnels, with rails at a depth of between approximately 20 and 30 metres below street level. At Paddington station, the permanent works will consist of:

- a new Crossrail station with two new ticket halls under Eastbourne Terrace;
- two new ventilation and emergency intervention structures, one at each of the ticket halls; and
- works at the Red Star deck

2.67 The route window lies within the City of Westminster. Land uses in the area are dominated by Paddington station and associated rail land. The main road access to the area from the south and east is Sussex Gardens, with smaller streets running off it. The area is typically residential in character, with small retail uses lining Praed Street. Multi-storey offices front Eastbourne Terrace opposite the station. Surrounding streets consist mainly of residential and hotel accommodation, with St Mary’s Hospital and its associated medical school to the east of Paddington station. A spur of the Paddington branch of the Grand Union Canal passes immediately north of the station.

2.68 The area surrounding Paddington station is undergoing a regeneration programme and several major developments are under construction or have been recently completed. The area, which is referred to in the Westminster Unitary Development Plan (UDP) as the Paddington Special Policy Area (PSPA), is the largest development area in Westminster and a site of strategic importance in London. The PSPA includes major redevelopments at Paddington Basin, Paddington Goods Yard (Paddington Central) and St Mary’s Hospital.
2.69 The existing station and surrounding land uses give rise to high pedestrian flows and the main thoroughfares, including Sussex Gardens and Eastbourne Terrace, are heavily trafficked resulting in generally high noise. The townscape to the south and east of Paddington station and around Harrow Road to the north includes numerous listed buildings, protected squares and the Bayswater and Maida Vale conservation areas. Paddington station itself is a Grade I listed building.

Baseline

2.70 The baseline noise survey locations and durations are listed in the following table and identified on Drawing No. 1E0415-C1E00-E01-F-00002:

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium-term (24-hours)</th>
<th>Short-term (3 hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WE06</td>
<td>Telstar House, Eastbourne Terrace</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WE07</td>
<td>16 Chilworth Street</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WE08</td>
<td>Great Western Hotel</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.71 The measured weekday daytime $L_{Aeq,12hr}$ baseline levels at Eastbourne Terrace (WE06) and the Great Western Hotel (WE08) were 73 dB and 71 dB respectively, with night-time $L_{Aeq,8hr}$ levels of 68 dB and 65 dB. Such levels would be expected from city centre locations affected by main roads. In this case, noise levels are dominated by traffic on Eastbourne Terrace, which runs alongside Paddington Station. Weekend daytime levels were found to reduce by 1 to 2 dB, with lesser decreases for the night periods. The $L_{A90(21:00-01:30 and 05:30-07:00)}$ background level at WE06 was found to be 68 dB. Noise levels at Chilworth Street (WE07), which fronts on to a less busy street, were up to 4 dB lower than at WE08.

Impact Assessment – Temporary Impacts

Impacts during Construction

2.72 Temporary impacts from construction activity are illustrated on Drawing No. 1E0315-C1E00-E01-F-00002.

Noise from Surface Activity

2.73 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.
Construction Sites and Works including Onsite Traffic and Grout Shafts

2.74 The construction programme is scheduled to run for approximately four years and includes both works to the new station areas and the Lynx (formerly Red Star Depot) building. During the daytime period a number of properties are predicted to experience noise levels above the threshold at which impact is considered to occur. These include; 16 Chilworth Street and 21 Spring Street, for a total of 6 months; 1 and 3 Craven Road would be partly affected for a total duration of 11 months; 7 Craven Street would only be affected over one month; Sussex Court Public House, which has been assessed as a residential property due to the potential ‘live in’ accommodation, would experience high noise levels for three separate months; The Great Western Hotel would also be affected for a 14 month non-continuous period and 13 and 18 Spring Street, for total periods of 5 and 11 months respectively. To the northeast of Paddington Station, some parts of St Mary’s Hospital would also be impacted by noise.

2.75 Few properties would be impacted during the evening, weekend or night-time period as none of the main construction works are programmed for these periods. Night works on the Red Star Depot would, however, result in an impact at parts of St Mary’s Hospital during these periods.

Offsite Road Traffic

2.76 The peak period for construction traffic on the public highway is for up to 18 months. Construction vehicles will only use the highway during the daytime (0700 – 1900). At façades overlooking roads used by construction traffic, the existing hourly LA10 during the daytime is predicted to increase by less than 1 dB. There are therefore no significant impacts arising from construction traffic.

Vibration from Surface Activity

Paddington Central Worksite

2.77 There is no surface activity at this worksite.

Platform 1a Worksite

2.78 Activities at this site are limited to offices, storage, and lorries unloading. Site clearance includes demolition of 4-18 Bishops Bridge Road, which are minor one-storey buildings that will be demolished using hand-held tools. On this basis, significant vibration impacts will not occur.

Red Star Deck Worksite

2.79 The construction information provided by Crossrail for works at this worksite will require use of pneumatic breakers, vibrating roller, and a CFA piling rig. Vibration levels from CFA piling are predicted not to be significant at the nearest potentially sensitive receptors. Use of breakers includes constructing openings in the end walls of the depot, site clearance, and demolition of the remaining existing sections of ramp. Due to the separation distance between the sections of existing ramp and potentially sensitive buildings and, assuming that good site practice is adopted, no significant vibration impacts are considered likely to occur from the demolition of the remaining existing sections of ramp.
2.80 Vibration levels are predicted to be in the region of 2 to 5 mm/s at the foundations of the nearest sensitive receptor, the northeast façade of Paddington Station, when the vibratory roller operates at the southwestern edge of the Red Star Depot area.

2.81 The threshold of significance for screening purposes for building damage may be exceeded at Paddington Station, which is a listed building.

_Eastbourne Terrace Worksite_

2.82 The construction information provided by Crossrail indicates that demolition of the retaining wall between Eastbourne Terrace and Departures Road with a hydraulic breaker, vibratory sheet piling in Eastbourne Terrace/Departures Road, and use of a vibratory roller during the reinstatement of the roads is required. Vibration levels during demolition works are predicted to be in the region of 0.5 to 2 mm/s at the foundations of the buildings on the south side of Eastbourne Terrace; and 1 to 4 mm/s at the foundations of the south side of Paddington Station. Vibration levels during diaphragm walling and vibratory piling are predicted to be in the region of 1 to 4 mm/s at the foundations of the buildings on the south side of Eastbourne Terrace; and at least 4 mm/s at the foundations of the south side of Paddington Station. Vibration levels during use of a vibrating roller are predicted to be at least 3 mm/s at the foundations of the south side of Paddington Station when the roller operates on Departures Road.

2.83 The construction information provided by Crossrail indicates that demolition of 191-195 Praed Street with a hydraulic breaker is required. Vibration levels during demolition works are predicted to be in the region of 0.5 to 2 mm/s at the foundations of the Great Western Hotel.

2.84 It is noted that buildings at 189 and 197 Praed Street are attached or contiguous to buildings proposed for demolition. Vibration levels in these buildings, and Paddington Underground Station, are likely to be a cause for concern due to the structural continuity between buildings or proximity to works. The threshold of significance for screening purposes may be exceeded at Paddington Underground Station during demolition at Praed Street. Therefore, mitigation will be required to ensure that damage does not occur to these structures.

2.85 Vibratory sheet piling and demolition with a hydraulic breaker in Eastbourne Terrace may result in vibration levels that exceed the threshold of significance for screening purposes for building damage for Paddington Station, which is a listed building. Demolition activities and use of a vibrating roller in Eastbourne Terrace are expected to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Vibratory piling activities may give rise to vibration levels that correspond to a semantic rating of ‘a low probability of adverse comment’ at the south side of Eastbourne Terrace, and ‘adverse comment probable’ in buildings on Departures Road.

2.86 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.
2.87 There is no surface activity likely to cause significant levels of vibration at this worksite.

Vibration and Groundborne Noise from Underground Construction Activity

Construction Trains

2.88 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds may also be exceeded while the temporary railway is running.

Tunnel Boring Machines

2.89 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.

2.90 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.91 Hoardings 3.6 m high would be provided around the worksites. It has been assumed that mitigation of noise from concrete deliveries and the operation of the concrete pump would be provided by the use of a temporary building, which would house the concrete lorries during unloading during later phases of work for both worksites. The compressors would also be located in noise reducing enclosures during these construction phases. This corresponds to Tier 2 mitigation.

2.92 In this route window, an estimated 8 properties are expected to be eligible for noise insulation due to construction noise. It can be seen from Appendix A that an estimated 20 residential properties would be subject to significant residual impacts from construction noise with the implementation of these mitigation measures. Some properties at Craven Road, and Spring Street are predicted to be eligible for noise insulation, with no properties eligible for re-housing.
**Offsite Road Traffic**

2.93 There are no significant residual impacts.

**Vibration from Surface Activity**

Paddington Central Worksite

2.94 None required.

Platform 1a Worksite

2.95 None required.

Red Star Deck Worksite

2.96 Vibration mitigation will be required during use of a vibrating roller in the Red Star Deck Worksite. An appropriate continuous vibration-monitoring regime should be adopted during works to allow monitoring of levels and cessation of activity should levels exceed relevant limits. For the listed buildings, condition surveys should be undertaken to define appropriate vibration limits.

Eastbourne Terrace Worksite

2.97 Vibration mitigation will be required during demolition and vibratory piling activities at this worksite. Where there are listed and non-listed buildings that are attached or contiguous to buildings that are proposed for demolition, the attached buildings should be unattached, as far as possible using non-vibratory techniques, such as diamond sawing, before demolition commences, and should continue as it progresses. Detailed assessment should be undertaken prior to commencement of works to inform selection of specific items of plant and working methods. An appropriate continuous vibration-monitoring regime should be adopted during demolition works allow monitoring of levels and cessation of activity should levels exceed relevant limits. For the listed buildings, condition surveys should be undertaken to define appropriate vibration limits.

2.98 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential of building damage at their location.

Circle Line Link Worksite

2.99 None Required.

2.100 With appropriate mitigation, which will take a number of forms as identified above, no significant residual impacts are predicted to arise from works within this Route Window.
Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.101 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machines

2.102 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

Impact Assessment – Permanent Impacts

Impacts during Operation

2.103 Permanent impacts from operation of Crossrail are illustrated on Drawing No. E0315-C1E00-E02-F-00002.

Noise from the Surface Railway

2.104 A level 2 (assessment based upon changes in railway traffic on existing lines and on other infrastructure alterations) assessment has been carried out.

2.105 This has indicated that a reduction in total train movements into/out of Paddington station with Crossrail may give a noise decrease of less than 1 dB. However, there is displacement of diesel trains with electric, which would further decrease the noise, but is predicted not to result in a noise decrease of 3 dB or more. Hence no significant impacts are predicted in this Route Window, based on the assumptions made.

2.106 A detailed study of the potential maximum noise levels arising from the operation of trains has not been undertaken, as it is considered unlikely that the $L_{A_{max,F}}$ levels associated with the proposed infrastructure and traffic pattern changes will be any higher than those already experienced at nearby receptors.

Vibration from the Surface Railway

2.107 Changes in vibration levels affecting sensitive receptors will be below levels at which impact is deemed to arise.

Noise from Road Traffic

2.108 When the Crossrail scheme is operational, it will cause only small increases in the 18-hour traffic flow on roads in this route window. The change in $L_{A_{10,18hr}}$ corresponding to this increase in traffic is predicted to be less than 1 dB. There are therefore no significant impacts arising from increases in operational traffic as a result of the scheme.
Noise from Ventilation Shafts

2.109 No residential properties close to the proposed ventilation shafts above the Paddington Western and Eastern Ticket Halls are predicted to be subject to significant noise impacts when the ventilation fan is in operation. At the nearest buildings to the western vent shaft, which are not residential, the Rating Level of the plant in normal operation is predicted to be at least 18 dB below the existing $L_{A90} (21:00\text{-}01:30 \text{ and } 05:30\text{-}07:00)$ background noise level (this represents a level 23 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997. At the nearest residential buildings to the eastern vent shaft, the Rating Level of the plant in normal operation is predicted to be at least 3 dB below the existing $L_{A90} (21:00\text{-}01:30 \text{ and } 05:30\text{-}07:00)$ background noise level (this represents a level 7 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

2.110 It is estimated that the noise levels emitted by a ventilation shaft during maintenance operations would be approximately 20 dB lower than during full flow rate operation. The above operational assessment is based on full flow rate operation. Therefore, no residential properties close to the proposed ventilation shafts are predicted to be subject to significant noise impacts during maintenance operations.

2.111 On the above basis, significant residual impact is not deemed to occur and no further mitigation measures are required.

Vibration and Groundborne Noise from the Underground Railway

2.112 There are office buildings along the southwest side of Eastbourne terrace, and some commercial uses in Paddington Station. Telstar House has piled foundations, as do 10, 20 and 30 Eastbourne Terrace. The highest predicted groundborne noise levels is 40 dB $L_{A_{max},S}$ and vibration 0.041mms$^{-1.75}$ VDV. There are mixed uses including residential property in Praed Street, Spring Street, Sussex Gardens and Sussex Square. The highest level of groundborne noise is predicted as 29 dB $L_{A_{max},S}$ and vibration 0.026mms$^{-1.75}$ VDV. Groundborne noise levels are shown on Drawing No: 1E315-C1E00-E03-F-00002.

Mitigation and Residual Impacts During Operation

Noise from the Surface Railway

2.113 There are no significant residual impacts in this route window.

Vibration from the Surface Railway

2.114 There are no significant residual impacts in this route window.

Noise from Road Traffic

2.115 There are no significant residual impacts in this route.

Noise from Ventilation Shafts

2.116 There are no significant residual impacts in this route window.
There are no significant residual impacts in this route window.

**Impacts on Sites Granted Planning Permission**

There are planning permissions for proposed changes to two residential buildings in Phase 1 gaining one additional residential unit. This is for a development at Paddington Central, Bishops Bridge Road. Due to the location of the proposed development, distant from any worksites or operational facilities, and in a high ambient area, it is unlikely that either the construction or operation of Crossrail will result in a noise or vibration impact at this location.
### Route window C2: Paddington Station – Temporary Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction of Paddington Station west, central and east station boxes and associated ventilation shafts. Red Star deck</td>
<td>Daytime noise impacts at 28 residential properties and 1 hotel (Great Western Hotel). Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Place of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: Day and night-time noise impacts at St Mary’s Hospital. Public open spaces: No noise impacts.</td>
<td>Significant</td>
<td>BPM to reduce noise, 3.6 m high hoarding to screen noise, enclosure of static plant associated with 24-hour working. Mitigation = Tier 2</td>
<td>An estimated 8 residential properties would be eligible for noise insulation. No properties are expected to be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 20 residential properties and 1 hotel (Great Western Hotel). Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Place of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: Day and night-time noise impacts at St Mary’s Hospital. Public open spaces: No noise impacts.</td>
</tr>
</tbody>
</table>
### Route window C2: Paddington Station – Permanent Impacts

<table>
<thead>
<tr>
<th>Works &amp; potential impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Description</td>
<td>Significance</td>
<td></td>
</tr>
<tr>
<td>Noise from operational (surface) railway</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
<tr>
<td>Ventilation Shafts above Paddington Western and Eastern Ticket Halls – operational noise impacts during operation of tunnel ventilation fans</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
<tr>
<td>Groundborne noise and vibration from the underground railway</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
</tbody>
</table>
ROUTE WINDOW C3 – HYDE PARK & PARK LANE SHAFTS

Overview of Route Window C3

2.119 Crossrail’s twin-bore tunnels will pass between Lancaster Gate in the west and Park Street in the east with the rails at an approximate depth of between 27 metres and 34 metres below street level. East of Lancaster Gate the alignment runs under Hyde Park roughly parallel with Bayswater Road and then parallel to Oxford Street. Other permanent works will consist of provision of a shaft in Hyde Park and another shaft in Park Lane.

2.120 Hyde Park and residential and commercial properties along its edge dominate land uses within this part of London. There are various commercial land uses, including hotels, on the north side of Oxford Street and residential areas to the north of Bayswater Road and the east of Park Lane.

2.121 The permanent infrastructure will be located in a busy transport corridor. The main roads, including Bayswater Road and Park Lane, are heavily trafficked, resulting in high noise levels. The heritage of the area is evident in the Royal Parks and Mayfair conservation areas, the Grade I registered park and the listed buildings on Bayswater Road and Park Lane.

Baseline

2.122 The baseline noise survey locations and durations are listed in the following table and identified on 1E0415-C1E00-E01-F-00003:
### Impact Assessment – Temporary Impacts

**Impact during Construction**

2.125 Temporary impacts from construction activities are illustrated on Drawing No. 1E0315-C1E00-E01-F-00003.

**Noise from Surface Construction Activity**

*Construction Sites and Works including Onsite Traffic and Grout Shafts*

2.126 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

2.127 The significant daytime noise impacts from construction works in this route window include several properties situated on Hyde Park Gardens, Park Lane and Avenfield House also located on Park Lane. Predictions highlight that some areas of Hyde Park Gardens will be affected by daytime construction noise for 2 months. Residential properties at 128 Park Lane and Avenfield House may later be subject to noise levels in excess of the threshold of significance for daytime construction activity for one month; these properties may be eligible for noise insulation.

2.128 No other non-residential noise-sensitive properties would be impacted during the construction programme.
Offsite Road Traffic

2.129 The peak periods for construction traffic on the public highway are for two separate periods of five months and two months. Construction vehicles will only use the highway during the daytime (0700 – 1900). At façades overlooking roads used by construction traffic, the existing hourly L_{A10} during the daytime is predicted to increase by less than 1 dB. There are therefore no significant impacts arising from construction traffic.

Vibration from Surface Construction Activity

2.130 The plant likely to be required for the works at the vent shaft sites and the plant associated with the tunnelling in the area, has been reviewed to identify sources which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings or damage to buildings.

Hyde Park Worksite

2.131 For the Hyde Park Worksite, the construction information provided by Crossrail indicates that vibratory sheet piling is required at ground level for the Fireman’s Passage and that there is occasional use of a vibratory roller. Use of a hydraulic breaker is required for connection of the Fireman’s Passage to the access shaft, but this is predicted not be significant as the nearest receptors, on Hyde Park Gardens, are some 110 metres away.

2.132 Vibration levels in the region of 0.5 to 2 mm/s, 0.5 mm/s, and less than 0.5 mm/s are predicted at the foundations of Victoria Lodge, Hyde Park Gardens, and the Royal Lancaster Hotel, respectively, during vibratory piling at the western end of the Fireman’s Passage. Vibration levels in the region of 0.5 to 1.5 mm/s, 0.5 mm/s, and less than 0.5 mm/s, are predicted at the foundations of Victoria Lodge and Hyde Park Gardens and the Royal Lancaster Hotel, respectively, during use of the vibratory roller at the western end of the Fireman’s Passage.

2.133 Victoria Lodge, 25 - 28 Hyde Park Gardens, and 18 - 24 Hyde Park Gardens are Grade II listed buildings. Vibration levels are not expected to exceed the threshold of significance for screening purposes for building damage during piling or use of the roller at any receptor during either works.

Park Lane Worksite

2.134 For the Park Lane Worksite, the construction information provided by Crossrail indicates that some oscillatory bored piling and use of a hydraulic breaker is required at ground level for the Plantroom Structure and that there is occasional use of a vibratory roller. Vibration levels in the region of 1 to 2 mm/s are predicted during all works, at the foundations of the nearest buildings, 129 to 131 Park Lane, which are Grade II listed buildings. Vibration levels are predicted not to exceed the threshold of significance for screening purposes for building damage at all receptors during all proposed works at this site.
2.135 Vibratory piling activities at the west end of Fireman’s Passage may give rise to vibration levels that correspond to a semantic rating of ‘a low probability of adverse comment’ in Victoria Lodge. The remainder of construction activities at the Park Lane Shaft worksite are predicted to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.136 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

Vibration and Groundborne Noise from Underground Construction Activity

Construction Trains

2.137 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds may also be exceeded while the temporary railway is running.

Tunnel Boring Machines

2.138 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.

2.139 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

Noise and Vibration Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.140 Hoardings 3.6 m high would be provided around the worksites. It has been assumed that mitigation of noise from concrete deliveries and the operation of the concrete pump would be provided by the use of a temporary building, which would house the concrete lorries during unloading during later phases of works at both worksites. The compressors would also be located in noise reducing enclosures during these construction phases. No evening or night-time construction work has been programmed except that essential for any tunnelling operations. This corresponds to Tier 2 mitigation.
2.141 In this route window, an estimated 7 properties are expected to be eligible for noise insulation due to construction noise. It can be seen from Appendix A that an estimated 14 residential properties would be subject to significant residual impacts from construction noise with the implementation of these mitigation measures. Some areas of Hyde Park, including the paddock area adjacent to the Hyde Park worksite, would also be subject to significant residual impact.

2.142 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the noise or vibration impact, and how it relates to the potential of disturbance or building damage at their location.

Offsite Road Traffic

2.143 There are no significant residual impacts.

Vibration from Surface Activity

2.144 No vibration mitigation measures are required on account of building damage during construction of the Hyde Park Shaft and the Park Lane Shaft. There are no significant residual impacts.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.145 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machines

2.146 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

Impact Assessment – Permanent Impacts

Impacts during Operation

2.147 Permanent impacts from operation of Crossrail are illustrated on Drawing No. E0315-C1E00-E02-F-00003.

Noise from the Surface Railway

2.148 Not applicable to this route window.

Vibration from the Surface Railway

2.149 Not applicable to this route window.
Noise from Road Traffic

2.150 There is no change predicted in baseline traffic flows in the route window as a result of Crossrail, therefore not applicable in this route window.

Noise from Ventilation Shafts

2.151 No residential properties close to the proposed ventilation shafts at Hyde Park and Park Lane are predicted to be subject to significant noise impacts when the ventilation fans are in operation. At the nearest residential building to the Hyde Park Shaft, the Rating Level of the plant in normal operation is predicted to be at least 12 dB below the existing $L_{A90}(21:00-01:30 \text{ and } 05:30-07:00)$ background noise level (this represents a level 8 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997. At the nearest residential buildings to the Park Lane Shaft, the Rating Level of the plant in normal operation is predicted to be at least 23 dB below the existing $L_{A90}(21:00-01:30 \text{ and } 05:30-07:00)$ background noise level (this represents a level 28 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

2.152 It is estimated that the noise levels emitted by a ventilation shaft during maintenance operations would be approximately 20 dB lower than during full flow rate operation. The above operational assessment is based on full flow rate operation. Therefore, no residential properties close to the proposed ventilation shafts are predicted to be subject to significant noise impacts during maintenance operations.

2.153 On the above basis, significant residual impact is not deemed to occur and no further mitigation measures are required.

Vibration and Groundborne Noise from the Underground Railway

2.154 There are residential properties in Stanhope Terrace, Brook Street and Hyde Park Gardens, and to the east of Park Lane. The highest level of groundborne noise is predicted as 29 dB $L_{A_{max},S}$ and vibration $0.026 \text{mms}^{-1.75} \text{VDV}$. Groundborne noise levels are shown on Drawing No: 1E315-C1E00-E03-F-00003.

Mitigation and Residual Impacts during Operation

Noise from the Surface Railway

2.155 Not applicable to this route window.

Vibration from Surface Activity

2.156 Not applicable to this route window.

Noise from Road Traffic

2.157 There are no significant residual impacts in this route window.

Noise from Ventilation Shafts

2.158 There are no significant residual impacts in this route window.
Vibration and Groundborne Noise from the Underground Railway

2.159 There are no significant residual impacts in this route window.

Impacts on Sites Granted Planning Permission

2.160 No extant planning permissions that might be affected by the scheme have been identified in this route window.
### Route window C3: Hyde Park & Park Lane Shafts – Temporary Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
</table>
### Route window C3: Hyde Park & Park Lane Shafts – Permanent Impacts

<table>
<thead>
<tr>
<th>Works &amp; potential impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilation Shafts at Hyde Park and Park Lane – operational noise impacts during operation of tunnel ventilation fans</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
<tr>
<td>Groundborne noise and vibration from the underground railway</td>
<td>Not significant</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>
ROUTE WINDOW C4 – BOND STREET STATION

Overview of Route Window C4

2.161 The permanent works will consist of new twin-bore tunnels and a new station at Bond Street featuring two ticket halls. The route window is located within the City of Westminster. The route runs beneath Mayfair, Regent Street and the western edge of Soho. Retail uses dominate along Oxford Street; offices are the main land use in surrounding streets. There are also a number of residential properties around Davies Street and Hanover Square. Other land uses include the open spaces of Grosvenor Square and Hanover Square gardens. Bond Street and Oxford Circus Underground stations are to the north of the alignment, on Oxford Street.

2.162 This is the busiest retail area in London: the existing stations and numerous shops and offices give rise to high pedestrian flows and the main streets, including Oxford Street, are heavily trafficked, especially by buses and taxis, giving rise to generally high levels of noise.

Baseline

2.163 The baseline noise survey locations and durations are listed in the following table and identified on Drawing No 1E0415-C1E00-E01-F-00004:
<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium-term (24-hours)</th>
<th>Short-term (3 hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WE13</td>
<td>48 Gilbert Street</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WE14</td>
<td>25 St Anselm's Place</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>WE15</td>
<td>18 South Molton Street</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>WE16</td>
<td>68 New Bond Street</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>WE17</td>
<td>13 Hanover Square</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>WE18</td>
<td>Hanover Square Garden</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WE19</td>
<td>10 Hanover Square</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.164 Around Davies Street, noise levels are typical of central London back streets, with traffic being the dominant noise source. The weekday daytime $L_{Aeq,12hr}$ baseline level measured at 48 Gilbert Street (WE13) was 63 dB with a night-time $L_{Aeq,8hr}$ level of 56 dB; the corresponding weekend daytime level was 61 dB, with a night-time level of 58 dB. The $L_{A90(21:00-01:30 and 05:30-07:00)}$ background level at this receptor was found to be 48 dB. Noise levels in South Molton Street were dominated by the numerous air conditioning units in the locality.

2.165 Near to the eastern part of the proposed works, at 60 New Bond Street (WE16) and 13 Hanover Square (WE17), weekday daytime $L_{Aeq,12hr}$ baseline levels were 67 dB and 66 dB respectively, with night-time $L_{Aeq,8hr}$ levels of 62 dB and 60 dB at both properties. The positions around Hanover Square generally have a similar noise climate to those in the vicinity of Davies Street. The $L_{A90(21:00-01:30 and 05:30-07:00)}$ background level at 60 New Bond Street (WE16) was measured as 53 dB.

Impact Assessment – Temporary Impacts

Impacts during Construction

2.166 Temporary impacts from construction activities are illustrated on Drawing No. 1E0315-C1E00-E01-F-00004.

Noise from Surface Activity

2.167 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.
Construction Sites and Works including Onsite Traffic and Grout Shafts

Davies Street Worksite

2.168 The residential properties in Weighhouse Street, St Anselm’s Place and Gilbert Street, directly overlooking the proposed Bond Street Western Ticket Hall site at 65 Davies Street, may all be subject to noise levels in excess of the threshold of significance for daytime construction activity throughout the main construction period. The noisiest phases of work would be during the demolition of the existing building, which would last for approximately 5 months, although high levels would occur throughout phases 1 and 2 and the main works for phase 3, which encompasses piling and construction of the station box and vent shafts. The and use of a temporary construction shaft in part of Hanover Square Garden would result in a noise impact in the remaining part of the garden.

2.169 This group of properties would also potentially be subject to noise levels exceeding the threshold of significance for work during the evening (19:00 to 23:00 hours) and night-time period (23:00 to 07:00 hours), specifically during ten months of the construction work. Significant night-time construction noise impacts for residential properties are predicted to be limited to Weighhouse Street, Gilbert Street and St Anselm’s Place, as indicated on Plan 1E0415-C1E00-E01-F-00004.

2.170 Commercial premises in Davies Street and Gilbert Street, near to the proposed worksite, are also predicted to be exposed to high levels of construction noise, with levels in excess of 80 dB L_{Aeq,12hour} occurring for significant periods in the early phases of the construction programme. The King’s Weigh House Church (The Ukrainian Cathedral) would also be impacted.

Hanover Square Worksite

2.171 The Bond Street Eastern Ticket Hall and associated over site development would be constructed at 18-19 Hanover Square and would be built in a similar way to the Western Ticket Hall. There are no noise-sensitive receptors in Hanover Square, apart from the Hanover Square Garden. Daytime construction noise levels are predicted to exceed the significance criterion in Hanover Square Garden for a three-year period, which is approximately 75% of the construction period. Hanover Square is flanked by commercial buildings, as is New Bond Street, where the backs of some buildings would be adjacent to the proposed Bond Street Station building.

2.172 Commercial properties in Tenterden Street, and on the northern side of Hanover Square, situated only a few metres from the proposed worksite, would experience construction noise levels in the range 53 dB to 84 dB L_{Aeq,12hour}, depending upon the exact location and construction phase being undertaken. The rear façade of 68 New Bond Street would experience levels in the range of 69 dB to 81 dB over the construction period, but again depending upon the construction phase being undertaken.

2.173 The nearest residential property at number 10 Princes Street is predicted to experience significant daytime construction noise for a total of 30 months. There are no predicted impacts during the evening or weekend periods at this receptor location. There is, however, a predicted impact during the night-time period for up to four months. Regent Hall Church, a religious building at 7 Princes Street, would experience similar significant impacts to those at 10 Princes Street during the same periods and construction phases.
Offsite Road Traffic

2.174 The peak periods for construction traffic on the public highway are predicted to occur for a period of up to eleven months. Construction vehicles will only use the highway during the daytime (0700 – 1900). At façades overlooking roads used by construction traffic, the existing hourly $L_{A10}$ during the daytime is predicted to increase by less than 1 dB. There are therefore no significant impacts arising from construction traffic.

Vibration from Surface Activity

2.175 The plant likely to be required to demolish the existing buildings and structures and construct the Bond Street Station and associated with any tunnelling in the area, has been reviewed to identify sources which may produce levels of vibration sufficient to cause adverse comment from the occupants of building or damage to buildings.

Davies Street Worksite

2.176 For the Davies Street Worksite, the construction information provided by Crossrail indicates that oscillatory bored piling, demolition using hydraulic breakers, and use of a gantry crane is required. Vibration levels due to oscillatory bored piling and from the gantry crane are not expected to be significant. However, vibration from the gantry crane can be minimised by ensuring that there are no joints in the track. Vibration levels due to use of the hydraulic breaker are predicted to be in the region of 0.5 to 3 mm/s at the foundations of the closest building when operating at ground level at the site boundary.

2.177 The threshold of significance for building damage may be exceeded at 27 Gilbert Street, which is a Grade II listed building, during demolition using the hydraulic breaker, although this threshold is predicted not to be exceeded at any other of the surrounding buildings.

2.178 Demolition activities are expected to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’ in the surrounding buildings. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.

2.179 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

Hanover Square Worksite

2.180 For the Hanover Square worksite, a gantry crane is required but levels from this source can be minimised by ensuring that there are no joints in the track. However, in addition to this, buildings are required to be demolished which are attached to two listed buildings (see below) and oscillatory bored piling is proposed for the construction of the new ticket hall. Demolition is likely to be by excavator with hydraulic breaker and hence, due to the structural continuity between buildings, vibration levels of concern could occur.
2.181 20 Hanover Square, a Grade II* listed building, is among the buildings that are attached to those which require demolition. Vibration levels at the foundations of surrounding buildings not attached to buildings requiring demolition, including 21 Hanover Square, a Grade II listed building, are predicted to be in the region of 0.5 to 3 mm/s when works are at ground level, and closest to the receptor.

2.182 The threshold of significance for building damage may be exceeded at 21 Hanover Square during demolition, although the threshold of significance is predicted not to be exceeded at any other of the surrounding buildings.

2.183 Demolition activities are expected to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’ in the surrounding buildings. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.

2.184 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.185 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds may also be exceeded while the temporary railway is running.

Tunnel Boring Machines

2.186 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.

2.187 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

Mitigation and Residual Impacts during Construction

Noise from Surface Activity
Construction Sites and Works including Onsite Traffic and Grout Shafts

2.188 Hoardings 3.6 m high would be provided around both the Davies Street and Hanover Square worksites. It has been assumed that mitigation of noise from concrete deliveries and the operation of the concrete pump would be provided by the use of a temporary building, which would house the concrete lorries during unloading during later phases of the works for both worksites. The compressors would also be located in noise reducing enclosures during these construction phases. Evening and night construction work has been programmed for some phases of works associated with tunnelling operations and other below ground works. The level of mitigation corresponds to Tier 2 mitigation at both worksites.

2.189 For the Davies Street Worksite, an estimated 41 dwellings may be eligible for noise insulation due to construction noise, with 31 dwellings eligible for temporary re-housing. With this mitigation, no residential properties would be subject to significant residual impacts from construction noise with the implementation of these mitigation measures. For the Hanover Square Worksite it is estimated that one dwelling may be eligible for noise insulation due to construction noise. With this mitigation, one residential property would be subject to significant residual impacts from construction noise with the implementation of these mitigation measures.

2.190 Therefore, in total for this route window, an estimated 42 dwellings may be eligible for noise insulation due to construction noise. The King’s Weigh House Church (The Ukrainian Cathedral) and Regent Hall Church would be subject to significant residual noise impact.

Offsite Road Traffic

2.191 There are no significant residual impacts.

Vibration from Surface Activity

Davies Street Worksite

2.192 Vibration mitigation will be required during demolition at this worksite to mitigate potential impacts on structures. Detailed assessment should be undertaken prior to commencement of works to inform the selection of specific items of plant and working methods. An appropriate continuous vibration-monitoring regime should be adopted during demolition works allow monitoring of levels and cessation of activity should levels exceed relevant limits. For the listed buildings, condition surveys should be undertaken to define appropriate vibration limits.

2.193 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential of building damage at their location.
Hanover Square Worksite

2.194 Vibration mitigation will be required during demolition at this worksite to mitigate potential impacts on structures. Where there are listed and non-listed buildings that are attached or contiguous to buildings that are proposed for demolition, the attached buildings should be unattached, as far as possible using non-vibratory techniques, such as diamond sawing, before demolition commences, and should continue as it progresses. Additionally, detailed assessment should be undertaken prior to commencement of works to inform the selection of specific items of plant and working methods. An appropriate continuous vibration-monitoring regime should be adopted during demolition works allow monitoring of levels and cessation of activity should levels exceed relevant limits. For the listed buildings, condition surveys should be undertaken to define appropriate vibration limits.

2.195 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential of building

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.196 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machines

2.197 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

Impact Assessment – Permanent Impacts

Impacts during Operation

2.198 Permanent impacts from operation of Crossrail are illustrated on Drawing No. E0315-C1E00-E02-F-00004.

Noise from the Surface Railway

2.199 Not applicable to this route window.

Vibration from the Surface Railway

2.200 Not applicable to this route window.
Noise from Road Traffic

2.201 When the Crossrail scheme is operational, it will cause only small increases in the 18-hour traffic flow on roads in this route window. The change in $L_{A10,18hr}$ corresponding to this increase in traffic is predicted to be less than 1 dB. There are therefore no significant impacts arising from increases in operational traffic as a result of the scheme.

Noise from Ventilation Shafts

2.202 No residential properties close to the proposed ventilation shafts at Bond Street Western Ticket Hall are predicted to be subject to significant noise impacts when the ventilation fans are in operation. At the nearest buildings the Rating Level of the plant in normal operation is predicted to be at least 12 dB below the existing $L_{A90}$ (21:00-01:30 and 05:30-07:00) background noise level (this represents a level 17 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997. This assessment is based on Mott MacDonald’s initial design, with no additional mitigation, but with the vent outlet facing east rather than west.

2.203 No residential properties close to the proposed ventilation shafts above the Bond Street Eastern Ticket Hall are predicted to be subject to significant noise impacts when the ventilation fans are in operation. At these receptors, the Rating Level of the plant in normal operation is predicted to be at least 3 dB below the existing $L_{A90}$ (21:00-01:30 and 05:30-07:00) background noise level (this represents a level 8 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

2.204 It is estimated that the noise levels emitted by a ventilation shaft during maintenance operations would be approximately 20 dB lower than during full flow rate operation. The above operational assessment is based on full flow rate operation. Therefore, no residential properties close to the proposed ventilation shafts are predicted to be subject to significant noise impacts during maintenance operations.

2.205 On the above basis, a significant impact is not deemed to occur for properties close to the proposed ventilation shaft above either the Bond Street Western Ticket Hall or the proposed ventilation shaft above the Bond Street Eastern Ticket Hall and no further mitigation measures are required for these sites.

Vibration and Groundborne Noise from the Underground Railway

2.206 There is mixed residential and commercial property along the alignment in this route window. There are two churches, St Marks (29 dB $L_{Amax,S}$ 0.026 mms$^{-1.75}$ VDV) and King’s Weigh House Church (30 dB $L_{Amax,S}$ 0.023 mms$^{-1.75}$ VDV), a Court at Gt Marlborough St (20 dB $L_{Amax,S}$ 0.02 mms$^{-1.75}$ VDV) and four studios including the London College of Music (27 dB $L_{Amax,S}$ 0.021 mms$^{-1.75}$ VDV). Several buildings have piled foundations (worst case 31 dB $L_{Amax,S}$ 0.029 mms$^{-1.75}$ VDV).
2.207 There are studios in Balderton St (30 dB $L_{A_{max,S}}$ 0.027 mms$^{1.75}$ VDV), Foubert’s Place (27 dB $L_{A_{max,S}}$ 0.21 mms$^{1.75}$ VDV) and Gt Marlborough St (27 dB $L_{A_{max,S}}$ mms$^{1.75}$ 0.02 VDV) and the London College of Music (27 dB $L_{A_{max,S}}$ 0.021 mms$^{1.75}$ VDV). London Palladium is predicted as (29 dB $L_{A_{max,S}}$ 0.024 mms$^{1.75}$ VDV). If, following detailed numerical modelling of the building, the prediction is confirmed, it will be protected by the use of special trackform so as to ensure achievement of the target for large theatres of 25 dB $L_{A_{max,S}}$. Groundborne noise levels are shown on Drawing No: 1E315-C1E00-E03-F-00004.

Mitigation and Residual Impacts During Operation

Noise from the Surface Railway

2.208 Not applicable to this route window.

Vibration from the Surface Railway

2.209 Not applicable to this route window.

Noise from Road Traffic

2.210 There are no significant residual impacts in this route window.

Noise from Ventilation Shafts

2.211 There are no significant residual impacts in this route window.

Vibration and Groundborne Noise from the Underground Railway

2.212 There are no significant residual impacts in this route window.

Impacts on Sites Granted Planning Permission

2.213 Two planning permissions potentially susceptible to impact by the scheme have been identified. The first refers to the demolition and redevelopment of 20-21 and 24 - 29 Princess Street. The development, albeit almost complete, will provide four retail units, restaurant/bar, office and residential, whilst incorporating the retained façade. The second planning permission relates to an existing application at 354-358 Oxford Street. The application requests an amendment to take into account alterations to the construction programme, for a previous application granted in 1998. The alteration refers to a proposed 6th floor extension. Due to the location of the proposed sites, distant from any worksites or operational facilities, it is not predicted that either the construction or operation of Crossrail would result in a significant noise or vibration impact at these locations.
## Route window C4: Bond Street Station Construction – Temporary Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daytime noise impacts at 33 residential properties.</td>
<td>Significant</td>
<td>BPM to reduce noise, 3.6 m high hoarding to screen noise, concrete deliveries and</td>
<td>An estimated 41 properties would be eligible for noise insulation, of these 31 properties are expected to</td>
</tr>
<tr>
<td></td>
<td>Evening/weekend noise impacts at 37 residential properties.</td>
<td></td>
<td>concrete pump would be housed in a temporary building, following the diaphragm</td>
<td>be eligible for temporary re-housing. With this mitigation:</td>
</tr>
<tr>
<td></td>
<td>Night-time noise impacts at 41 residential properties.</td>
<td></td>
<td>walling/piling work phase. Mitigation = Tier 2</td>
<td>Daytime noise impacts at 0 residential properties.</td>
</tr>
<tr>
<td></td>
<td>Evening/night/weekend noise impacts at 1 place of worship; King’s Weigh House</td>
<td></td>
<td></td>
<td>Evening/weekend noise impacts for 0 residential properties.</td>
</tr>
<tr>
<td></td>
<td>Church (The Ukrainian Cathedral) Educational facilities: No noise impacts.</td>
<td></td>
<td></td>
<td>Night-time noise impacts for 0 residential properties.</td>
</tr>
<tr>
<td></td>
<td>Medical facilities: No noise impacts.</td>
<td></td>
<td></td>
<td>Evening/night/weekend noise impacts at 1 place of worship;</td>
</tr>
<tr>
<td></td>
<td>Public open spaces: No noise impacts.</td>
<td></td>
<td></td>
<td>King’s Weigh House Church (The Ukrainian Cathedral)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Educational facilities: No noise impacts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Medical facilities: No noise impacts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Public open spaces: No noise impacts.</td>
</tr>
</tbody>
</table>
Eastern Ticket Hall - Demolition of 18/19 Hanover Square, construction of Bond Street station east, construction support for tunnelling from Hanover Square worksite - Construction noise

<table>
<thead>
<tr>
<th>Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daytime noise impacts at 2 residential properties. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts at 1 residential property, which would be eligible for noise insulation.</td>
<td>Significant</td>
<td>BPM to reduce noise, 3.6 m high hoarding to screen noise, concrete deliveries and concrete pump would be housed in a temporary building, following the diaphragm walling/piling work phase. Mitigation = Tier 2</td>
<td>An estimated 1 property would be eligible for noise insulation. No properties are expected to be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 1 residential property. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts for 0 residential properties. Daytime noise impacts at 1 place of worship; Regent Hall Church Educational facilities: No noise impacts. Medical facilities: No noise impacts. Daytime noise impacts at 1 public open space (Hanover Square Gardens).</td>
</tr>
</tbody>
</table>

Route window C4: Bond Street – Permanent Impacts

<table>
<thead>
<tr>
<th>Works &amp; potential impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ventilation Shaft above Bond Street Station Western Ticket Hall – operational noise impacts during operation of tunnel ventilation fans</strong></td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
<tr>
<td><strong>Ventilation Shaft above Bond Street Station Eastern Ticket Hall – operational noise impacts during operation of tunnel ventilation fans</strong></td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
<tr>
<td><strong>Groundborne noise and vibration from the underground railway</strong></td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
</tbody>
</table>
2.214 Crossrail’s twin-bore tunnels will pass between Poland Street in the west and Jockey’s Fields in the east with rails at a depth of approximately 24 metres below street level. East of Poland Street the alignment runs under Soho, approximately parallel with Oxford Street, towards Charing Cross Road. The alignment then turns northeast and passes under New Oxford Street into Holborn. As well as the twin-bore tunnels, the permanent works will consist of a new station at Tottenham Court Road with two ticket halls, each with a street entrance, and a new shaft at Fisher Street.

2.215 This route window lies within the City of Westminster and LB Camden. The existing land use is predominantly commercial with several office blocks, most notably Centre Point, and retail uses. Oxford Street is an internationally renowned shopping area and Charing Cross Road is a specialist retail street noted for its large number of bookshops. The largest concentration of residential units is located on the upper floors of Centre Point House, with a smaller amount of residential accommodation at Shaldon Mansions in Denmark Place. Other residential blocks are located on Charing Cross Road opposite the plaza site and above the Tottenham pub.

2.216 This is a busy commercial area, and the existing stations and the numerous offices and retail outlets give rise to high pedestrian flows. The main streets, including Oxford Street, New Oxford Street, Charing Cross Road, Kingsway and High Holborn are heavily trafficked, resulting in high noise levels.

Baseline

2.217 The baseline noise survey locations and durations are listed in the following table and identified on Drawing No 1E0415-C1E00-E01-F-00001:
<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium-term (24-hours)</th>
<th>Short-term (3 hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WE20</td>
<td>23 Great Chapel Street</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>WE21</td>
<td>1 Dean Street</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>WE22</td>
<td>18 Great Chapel Street</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>WE23</td>
<td>Godem Court (West End Hostel)</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WE24</td>
<td>16 Soho Square</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>WE25</td>
<td>Falconberg Mews</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>WE26</td>
<td>St Patrick’s RC Church</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>WE27</td>
<td>Goslet Yard</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WE29</td>
<td>Newman Street</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>CA01</td>
<td>138 Charing Cross Road</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA02</td>
<td>8 Southampton Row (North Facade)</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA03</td>
<td>Catton Street</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

2.218 The long term, 7 day sites were located at Godem Court (WE23), Goslet Yard (WE27) and Charing Cross Road (CA01). The daytime L_{Aeq,12hr} baseline level measured at Godem Court (WE23) was 63 dB, falling to a night-time L_{Aeq,8hr} level of 59 dB, indicating this is a quiet location for a Central London back street. Locations WE20, WE21, WE29, WE24 and WE26 are all near to Oxford Street or Charing Cross, where noise levels are dominated by road traffic. The L_{A90(21:00-01:30 and 05:30-07:00)} background level at Goslet Yard (WE27) was measured as 59 dB.

2.219 In the vicinity of the proposed Fisher Street vent shaft, the daytime L_{Aeq,12hr} baseline level was 72 dB at 8 Southampton Row (CA02), the L_{A90(21:00-01:30 and 05:30-07:00)} background level was 61 dB and the night-time L_{Aeq,8hr} level was 67 dB. A short term daytime measurement result of 70 dB L_{Aeq,3hr} was obtained at Catton Street (CA03). This indicates baseline noise levels at night remain fairly high in this vicinity, with the dominant sources of traffic noise on Southampton Row and Procter Street affecting the two measurement locations respectively.

Impact Assessment – Temporary Impacts

Impacts during Construction

2.220 Temporary impacts from construction activities are illustrated on Drawing No. 1E0315-C1E00-E01-F-00005.

Noise from Surface Activity
2.221 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

**Construction Sites and Works including Onsite Traffic and Grout Shafts**

**Tottenham Court Road Station**

2.222 In the vicinity of the Dean Street worksite, the main noise sensitive property that would be significantly affected is the West End Hostel. This building has a facade in Diadem Court directly overlooking the Western Ticket Hall site. This property is predicted to be subject to noise levels in excess of the threshold of significance for daytime construction activity through most of the construction works. During the evening and night-time period, the Hostel is expected to experience significant noise levels over a 33 month period.

2.223 The Medical Centre in the same building would also be subject to significant noise impacts over the same periods as the Hostel, although night-time impacts would not be relevant as the property would not be expected to be in use at night.

2.224 Near to the Astoria Worksite, the residential part of the Tottenham Public House on Oxford Street would be subject to significant construction noise activity during day and night-time periods. 52 Andrew Borde Street would also be subject to significant construction noise activity during the daytime period only.

2.225 St Patrick’s Church may also experience significant noise impacts throughout the majority of the construction period, for a total of 49 non-consecutive months, running over the total construction period.

**Grout Shafts Associated with Tunnelling in the Area of Tottenham Court Road Station**

2.226 Assessment of the impact of grout shafts is based on their predicted locations and operation. There is a potential requirement for a grout shaft to be located adjacent to 16 Soho Square, which is a 4 – 5 storey residential property. Shaft construction is estimated to take 2 months and will be carried out during the daytime. Compensation grouting could occur for 12 months and will be a 24-hour activity, by necessity. This property is predicted to experience significant noise impacts during the day, during shaft construction activities, and at night, during compensation grouting. In the surrounding area of the work site, no other sensitive sites experience a significant noise level due to the works.
2.227 There is a potential requirement for a grout shaft to be located adjacent to 13 Great Chapel Street, which is a 4 storey property currently occupied by Great Chapel Street Medical Centre and West End Hostel. Shaft construction is estimated to take 2 months and will be carried out during the daytime. Compensation grouting could occur for 12 months and will be a 24-hour activity, by necessity. This property is predicted to experience significant noise impacts during the day, during shaft construction activities, and at night, during compensation grouting. In the surrounding area of the work site, no other sensitive sites experience a significant noise level due to the works.

_Fisher Street Vent Shaft_

2.228 St Martins College of Art and Design and the University of Westminster are both situated immediately adjacent to the Fisher Street worksite, to the north. These are the only noise sensitive properties that would be significantly affected by construction noise from the vent shaft works. Due to their close proximity to the worksite, the Fisher Street façades of these buildings would be seriously affected throughout the construction period.

_Offsite Road Traffic_

2.229 The peak periods for construction traffic on the public highway are for three distinct periods; of five, four and four months respectively. Construction vehicles will only use the highway during the daytime (0700 – 1900). At façades overlooking roads used by construction traffic, the existing hourly $L_{An}$ during the daytime is predicted to increase by less than 1 dB. There are therefore no significant impacts arising from construction traffic.

_Vibration from Surface Activity_

2.230 The plant likely to be required to demolish the existing buildings and structures and construct the Crossrail elements at the Fareham Street Worksite, Newham Street Worksite, Astoria Worksite, Goslett Yard Worksite, Charing Cross Road Worksite, Fisher Street Worksite, and associated with any tunnelling in the area, has been reviewed to identify sources which may produce levels of vibration sufficient to cause adverse comment from the occupants of building or damage to buildings.

_Fareham Street Worksite_

2.231 For the Fareham Street Worksite worksites, the construction information provided by Crossrail indicates that demolition will include use of a tracked excavator with breaker will be required at the Fareham Street Worksite Street.

2.232 Vibration levels due to use of the hydraulic breaker have been predicted at the foundations of buildings for the worst-case situation where the breaker operates at ground level at the boundary of the site closest to each receptor. For this situation, vibration levels at the foundations of buildings closest to the site are predicted to be in the region of 0.5 to 1.5 mm/s at Oxford Street, and Grade II listed buildings at 105 - 109 Oxford Street (16 - 18 Hollen Street), 152 - 160 Wardour Street, and 17 Carlisle Street. Values are predicted to be in the region of 0.5 to 3 mm/s at Dean Street, including 6 - 8 Dean Street, which are Grade II listed buildings, and at Great Chapel Street; and in the region of 1.5 - 7 mm/s at Diadem Court, which is a hostel. 94 Dean Street is within the Fareham Street worksite and is proposed for demolition.
2.233 The threshold of significance for screening for building damage may be exceeded at 6 to 8 Dean Street, and Diadem Court when demolition works are undertaken near to the boundary of the site that is closest to the receptors.

2.234 Demolition activities are predicted to give rise to vibration levels that are below those that correspond to a semantic rating of 'a low probability of adverse comment' in the majority of buildings around the site. However, construction activity may give rise to vibration levels that correspond to a semantic rating of 'a low probability of adverse comment' in Diadem Court, and in two nearby studios, which are TVI Studio 142 Wardour Street, and the British Board of Film Classification 3 Soho Square. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.

2.235 Other than the two studios listed above, no receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

**Goslett Yard and Astoria Worksite**

2.236 For the purpose of this assessment the works at Goslett Yard Worksite, the LUL works at Astoria Worksite and the Crossrail works at the Astoria Worksite have been combined and assessed cumulatively.

2.237 For the Goslett Yard and Astoria Worksite, the construction information provided by Crossrail indicates that demolition will include use of a tracked excavator with hydraulic breaker, and additionally, oscillatory bored piling and a gantry crane will be required for the Goslett Yard site. Vibration levels due to oscillatory bored piling are not expected to be significant. Vibration levels from the gantry crane are not expected to be significant, but can be minimised by ensuring that there are no joints in the track.

2.238 It is noted that buildings on the south side of Oxford Street are attached or contiguous to buildings proposed for demolition at Goslett Yard worksite, and that St Patrick's RC Church, Soho Square, which is a Grade II listed building, is attached or contiguous to buildings proposed for demolition at the Goslett Yard worksite.

2.239 Vibration levels due to use of the hydraulic breaker have been predicted at the foundations of unattached buildings for the worst-case situation, which is where the breaker operates at ground level at the boundary of the site closest to each receptor. For this situation, vibration levels at the foundations of buildings closest to the site at the rear of Falconberg Mews are predicted to be in the region of 1.5 to 7 mm/s at the rear of buildings on Falconberg Mews, and less than 1 mm/s at Centrepoint, which is a Grade II* listed building, during demolition at the north of the Astoria Worksite; 1 to 4 mm/s at St Patrick's RC Church, Soho Square, during demolition works at the south of the Goslett Yard Worksite, which is a Grade II listed building, and at buildings in Goslett Yard; 0.5 to 1.5 mm/s at the closest buildings on the north side of Oxford Street; and 0.5 to 1 mm/s at 21 Soho Square, 14 Manette Street and 16-17 Manette Street, which are all Grade II listed buildings.
2.240 Vibration levels in buildings that are attached to or contiguous with buildings proposed for demolition are likely to be a cause for concern due to the structural continuity between buildings. The threshold of significance for screening purposes for building damage may be exceeded at Falconberg Mews, and St Patrick’s RC Church.

2.241 Vibration levels that correspond to a semantic rating of ‘a low probability of adverse comment’ are expected at Falconberg Mews, Centrepoint, and St Patrick’s RC Church, when works are undertaken at the closest area of the site to the receptor. Vibration levels below those that correspond to a semantic rating of ‘a low probability of adverse comment’ are expected in a studio at 8 Denmark Street, when works are undertaken at the closest area of the site to this receptor. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.

2.242 Other than the studio at 8 Denmark Street, no receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and recording studios, have been identified that are significantly close to this worksite.

Newham Street Worksite

2.243 Activities at this site are limited to offices, storage and a lorry holding area. On this basis it is concluded that significant vibration impacts will not occur.

Charing Cross Road Worksite

2.244 For the Charing Cross Road Worksite, the construction information provided by Crossrail indicates that demolition of the Centrepoint pool/plaza structure and 148 Charing Cross Road will include use of a tracked excavator with hydraulic breaker. It is noted that 144 and 146 Charing Cross Road are attached or contiguous to 148 Charing Cross Road, which is proposed for demolition.

2.245 Vibration levels are predicted to be in the region of 1.5 to 7 mm/s at Centrepoint, which is a Grade II* listed building, during demolition of the pool/plaza structure. Vibration levels in buildings that are attached to or contiguous with buildings proposed for demolition are likely to be a cause for concern due to the structural continuity between buildings. The threshold of significance for screening purposes for building damage may be exceeded at Centrepoint and 144 and 146 Charing Cross Road.

2.246 Vibration levels that correspond to a semantic rating of ‘a low probability of adverse comment’ are expected at Centrepoint and 144 and 146 Charing Cross Road, when works are undertaken at the closest area of the site to the receptor.

2.247 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and recording studios, have been identified that are significantly close to this worksite.
Fisher Street Worksite

2.248 For the Fisher Street worksite, the construction information provided by Crossrail indicates that demolition will include use of a tracked excavator with breaker. Works include demolition of Carlisle House, 8 and 10 Southampton Row, 1-2 Fisher Street, 2-6 Catton Street, with retention of the Grade II* listed façade. It is also noted that an electricity substation building is attached to, or contiguous with buildings proposed for demolition. Vibration mitigation will be required to ensure that damage does not occur to these two structures.

2.249 Vibration levels due to use of the hydraulic breaker have been predicted at the foundations of unattached buildings for the worst-case situation where the breaker operates at ground level at the boundary of the site closest to each receptor. For this situation, vibration levels at the foundations of buildings closest to the site may be in the region of 1.5 to 7 mm/s at Central St Martins College of Art and Design, which is a Grade II* listed building, Baptist Church House, 2 - 6 (even) Southampton Row, which is a Grade II* listed building and also on the Buildings at Risk Register, and Kingsway Tram Subway, which is Grade II listed building and on the Buildings at Risk Register; and in the region of 0.5 to 3 mm/s at the southern end of 15 - 17 Southampton Row - Sicilian Avenue, which is a Grade II listed building.

2.250 Vibration levels in buildings that are attached to, or contiguous with, buildings proposed for demolition are likely to be a cause for concern due to the structural continuity between buildings. The threshold of significance for building damage may be exceeded at all buildings surrounding the site, which are attached to or contiguous with, buildings proposed for demolition.

2.251 Demolition activities may give rise to vibration levels that correspond to a semantic rating of 'a low probability of adverse comment' at buildings on Fisher Street and Catton Street. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.

2.252 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.253 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds may also be exceeded while the temporary railway is running.
Tunnel Boring Machines

2.254 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.

2.255 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.256 Raised 3.6 m high hoardings would be provided around the worksites. It has been assumed that mitigation of noise from concrete deliveries and the operation of the concrete pump would be provided by the use of a temporary building, which would house the concrete lorries during unloading during later phases of the works for both worksites. The compressors would also be located in noise reducing enclosures during these construction phases. This corresponds to Tier 2 mitigation.

2.257 In total for this route window, 2 properties may be eligible for noise insulation and may also qualify for temporary re-housing, in accordance with the assumed scheme for the provision of NI and TRH during construction; presented in Chapter 5, Volume 1 of this technical report. With the implementation of these mitigation measures, 2 properties would be subject to significant residual noise impacts, within the Tottenham Court Road site. With Tier 2 mitigation, there would be no significant residual noise impacts on residential property associated with the construction of the Fisher Street vent shaft. In summary, 4 non-residential sensitive properties are expected to be impacted, these include a Medical Centre, St Patrick’s Church, parts of the University of Westminster and parts of St Martins College of Art and Design.

Grout Shafts Associated with Tunnelling in the Area of Tottenham Court Road Station

2.258 Assessment of the impact of grout shafts is based on their predicted locations and operation. Assuming the construction site at Soho Square is surrounded by 2.4 metre hoardings at a distance of 10 metres from the noise source, and that other Tier 1 mitigation measures are applied, the adjacent property is predicted to be eligible for noise insulation during shaft construction. During compensation grouting, assuming near full enclosure of the worksite is possible, no further impacts will arise. On the basis of the proposed mitigation, works associated with the grout shaft in this location are not deemed significant.
2.259 Assuming the Great Chapel Street construction site is surrounded by 2.4 metre hoardings at a distance of 10 metres from the noise source, and that other Tier 1 mitigation measures are applied, there are no residential properties eligible for noise insulation but one sensitive non-residential property will be impacted. During compensation grouting, assuming near full enclosure of the worksite is possible, no further impacts on sensitive non-residential property will arise. On the basis of the proposed mitigation, works associated with the grout shaft in this location are not deemed significant.

Offsite Road Traffic

2.260 There are no significant residual impacts.

Vibration from Surface Activity

Fareham Street Worksite

2.261 Vibration mitigation will be required during demolition at this worksite to mitigate potential impacts on structures. Detailed assessment should be undertaken prior to commencement of works to inform selection of specific items of plant and working methods. An appropriate continuous vibration-monitoring regime should be adopted during demolition works to allow monitoring of levels and cessation of activity should levels exceed relevant limits. For the listed buildings, condition surveys should be undertaken to define appropriate vibration limits.

2.262 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential of building damage at their location.

Goslett Yard and Astoria Worksite

2.263 Vibration mitigation will be required during demolition at this site to mitigate potential impacts on structures. Where there are listed and non-listed buildings that are attached or contiguous to buildings that are proposed for demolition, the attached buildings should be unattached, as far as possible using non-vibratory techniques, such as diamond sawing, before demolition commences, and should continue as it progresses. Additionally, detailed assessment should be undertaken prior to commencement of works to inform selection of specific items of plant and working methods. An appropriate continuous vibration-monitoring regime should be adopted during demolition works to allow monitoring of levels and cessation of activity should levels exceed relevant limits. For the listed buildings, condition surveys should be undertaken to define appropriate vibration limits.

2.264 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential of building damage at their location.

2.265 With appropriate mitigation, which will take a number of forms as identified above, no significant residual impacts are predicted to arise from works at this worksite.
Newham Street Worksite

2.266 No vibration mitigation measures are required.

Charing Cross Road Worksite

2.267 Vibration mitigation will be required during demolition at this worksite to mitigate potential impacts on structures. Where there are listed and non-listed buildings that are attached or contiguous to buildings that are proposed for demolition, the attached buildings should be unattached, as far as possible using non-vibratory techniques, such as diamond sawing, before demolition commences, and should continue as it progresses. Additionally, detailed assessment should be undertaken prior to commencement of works to inform selection of specific items of plant and working methods. An appropriate continuous vibration-monitoring regime should be adopted during demolition works allow monitoring of levels and cessation of activity should levels exceed relevant limits. For the listed buildings, condition surveys should be undertaken to define appropriate vibration limits.

2.268 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential of building damage at their location.

2.269 With appropriate mitigation, which will take a number of forms as identified above, no significant residual impacts are predicted to arise from works at this worksite.

Fisher Street Worksite

2.270 Vibration mitigation will be required during demolition at this site to mitigate potential impacts on structures. Where there are listed and non-listed buildings that are attached or contiguous to buildings that are proposed for demolition, the attached buildings should be unattached, as far as possible using non-vibratory techniques, such as diamond sawing, before demolition commences, and should continue as it progresses. Additionally, detailed assessment should be undertaken prior to commencement of works to inform selection of specific items of plant and working methods. An appropriate continuous vibration-monitoring regime should be adopted during demolition works allow monitoring of levels and cessation of activity should levels exceed relevant limits. For the listed buildings, condition surveys should be undertaken to define appropriate vibration limits.

2.271 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential of building damage at their location.

2.272 With appropriate mitigation, which will take a number of forms as identified above, no significant residual impacts are predicted to arise from works at this worksite.
Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.273 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machines

2.274 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

Impact Assessment – Permanent Impacts

Impacts during Operation

2.275 Permanent impacts from operation of Crossrail are illustrated on Drawing No. E0315-C1E00-E02-F-00005.

Noise from the Surface Railway

2.276 Not applicable to this route window.

Vibration from the Surface Railway

2.277 Not applicable to this route window.

Noise from Road Traffic

2.278 When the Crossrail scheme is operational, it will cause only small increases in the 18 hour traffic flow on roads in this route window. The change in $L_{A_{10,18hr}}$ corresponding to this increase in traffic is predicted to be less than 1 dB. There are therefore no significant impacts arising from increases in operational traffic as a result of the scheme.

Noise from Ventilation Shafts

2.279 No residential properties close to the proposed ventilation shafts above the Tottenham Court Road Western and Eastern Ticket Halls, or at Fisher Street are predicted to be subject to significant noise impacts when the ventilation fans are in operation. At the nearest buildings to the western vent shaft, although these are not noise-sensitive, the Rating Level of the plant in normal operation is predicted to be not more than 3 dB above the existing $L_{A_{090(21:00-01:30 and 05:30-07:00)}}$ background noise level (this represents a level 2 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997. At the nearest buildings to the eastern vent shaft, although these are not noise-sensitive, the Rating Level of the plant in normal operation is predicted to be at least 5 dB below the existing $L_{A_{090(21:00-01:30 and 05:30-07:00)}}$ background noise level (this represents a level 10 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.
2.280 At two properties used for education on Fisher Street, the nearest sensitive receptors, the Rating Level of the plant in normal operation is predicted to be not more than 1 dB above the existing $L_{A90(21:00-01:30 \ and \ 05:30-07:00)}$ background noise level (this represents a level 4 dB below the criteria at which impact is deemed to occur).

2.281 It is estimated that the noise levels emitted by a ventilation shaft during maintenance operations would be approximately 20 dB lower than during full flow rate operation. The above operational assessment is based on full flow rate operation. Therefore, no residential properties close to the proposed ventilation shafts are predicted to be subject to significant noise impacts during maintenance operations. On the above basis, a significant impact is not deemed to occur and no further mitigation measures are required.

Vibration and Groundborne Noise from the Underground Railway

2.282 There is wide range of noise/vibration sensitive properties including studios, churches and theatres, and many piled buildings.

2.283 There are studios in the Wardour St and Denmark St area with predicted figures of 30 dB $L_{Amax,S}$ 0.022 mms$^{-1.75}$, the MGM theatre in Shaftesbury Avenue (22 dB $L_{Amax,S}$ 0.015 mms$^{-1.75}$ VDV), a Studio in Neal Street (24 dB $L_{Amax,S}$ 0.018 mms$^{-1.75}$ VDV), and a studio in Drury Lane (26 dB $L_{Amax,S}$ 0.021 mms$^{-1.75}$ VDV) together with studios at and Bedford Row (29 dB $L_{Amax,S}$ 0.024 mms$^{-1.75}$ VDV) and the Holborn Centre for the Performing Arts (27 dB $L_{Amax,S}$ 0.022 mms$^{-1.75}$ VDV)

2.284 If, following detailed numerical modelling of the buildings, the predictions are confirmed, there will be protection by the use of special trackform so as to ensure achievement of the target for large theatres of 25 dB $L_{Amax,S}$ at the Phoenix Theatre (26 dB $L_{Amax,S}$ 0.018 mms$^{-1.75}$ VDV), Shaftesbury Theatre (28 dB $L_{Amax,S}$ 0.022 mms$^{-1.75}$ VDV), and the New London Theatre (37 dB $L_{Amax,S}$ 0.037 mms$^{-1.75}$ VDV) and the target of 30 dB $L_{Amax,S}$ for studios at Neal's Yard (32 dB $L_{Amax,S}$ 0.024 mms$^{-1.75}$ VDV), 182-184 High Holborn (32 dB $L_{Amax,S}$ 0.025 mms$^{-1.75}$ VDV), and Macklin Place (35 dB $L_{Amax,S}$ 0.03 mms$^{-1.75}$ VDV)

2.285 Elsewhere the worst case with standard trackform and piled buildings will be 40 dB $L_{Amax,S}$ 0.2 mms$^{-1.75}$ VDV. Groundborne noise levels are shown on Drawing No: 1E315-C1E00-E03-F-00005.

Mitigation and Residual Impacts during Operation

Noise from the Surface Railway

2.286 Not applicable to this route window.

Vibration from the Surface Railway

2.287 Not applicable to this route window.

Noise from Road Traffic

2.288 There are no significant residual impacts in this route.
Noise from Ventilation Shafts

2.289 There are no significant residual impacts in this route window.

Vibration and Groundborne Noise from the Underground Railway

2.290 There are no significant residual impacts in this route window.

Impacts on Sites Granted Planning Permission

2.291 No extant planning permissions that might be affected by the scheme have been identified in this route window.
<table>
<thead>
<tr>
<th><strong>Works</strong></th>
<th><strong>Potential Impact</strong></th>
<th><strong>Significance</strong></th>
<th><strong>Assumed Mitigation</strong></th>
<th><strong>Residual Impact</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tottenham Court Road Station: Demolition of existing buildings and construction of Western (Dean Street) ticket hall. Demolition of existing buildings and construction of Eastern (Plaza) ticket hall.</td>
<td>Daytime noise impacts at 4 residential properties. Evening/weekend noise impacts at 1 residential property. Night-time noise impacts at 1 residential properties. Noise impacts at 1 place of worship (St Patrick’s RC Church) during daytime and night-time periods. Educational facilities: No noise impacts. Medical facilities: 1 noise impact (Medical Centre in Diadem Court) Public open spaces: No noise impacts. Other community facility: West End Hostel</td>
<td>Significant</td>
<td>BPM to reduce noise, 3.6 m high hoarding to screen noise, enclosure of static plant associated with 24-hour working. Mitigation = Tier 2</td>
<td>It is estimated that 2 residential properties would be eligible for noise insulation and may also be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 2 residential properties. Evening/weekend noise impacts for 0 residential properties. Night-time noise impacts for 0 residential properties. Noise impacts at 1 place of worship (St Patrick’s RC Church) during daytime and night-time periods. Educational facilities: No noise impacts. Medical facilities: 1 noise impact (Medical Centre in Diadem Court) Public open spaces: No noise impacts. Other community facility: West End Hostel</td>
</tr>
<tr>
<td>Construction of Fisher Street Vent Shaft</td>
<td>Daytime noise impacts at 0 residential properties. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Noise impacts at 2 educational facilities (St Martins College of Art and Design and the University of Westminster) during daytime, evening/weekend and night-time periods. Places of Worship: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
<td>Significant</td>
<td>BPM to reduce noise, 3.6 m high hoarding to screen noise. Mitigation = Tier 2</td>
<td>It is estimated that 0 residential properties would be eligible for noise insulation. It is estimated that 0 properties would be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 0 residential properties. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts for 0 residential properties. Noise impacts at 2 educational facilities (St Martins College of Art and Design and the University of Westminster) during daytime, evening/weekend and night-time periods. Places of worship: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
</tr>
</tbody>
</table>
### Route window C5: Tottenham Court Road Station & Fisher Street Vent Shaft – Permanent Impacts

<table>
<thead>
<tr>
<th>Works &amp; potential impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilation Shafts at Tottenham Court Road and Fisher Street – operational noise impacts during operation of tunnel ventilation fans</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
<tr>
<td>Groundborne noise and vibration from the underground railway</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Not significant</td>
</tr>
<tr>
<td>None</td>
<td>Not significant</td>
</tr>
</tbody>
</table>
ROUTE WINDOW C6 – FARRINGDON STATION

Overview of Route Window C6

2.292 The Crossrail tunnels pass from Holborn, beneath the Fleet Valley and Smithfield, and then to Aldersgate and the Barbican, with the rails at a depth of about 31 metres. The permanent works will consist of a twin-bore tunnel, and a new station at Farringdon, with western and eastern ticket halls and integrated ventilation and emergency access. A new rail crossover will also be constructed between Farringdon and Liverpool Street stations, beneath the Barbican.

2.293 The route window is located within the City of London, the LB Camden and LB Islington. Land uses within this part of London are mixed and include residential, commercial and retail uses. Smithfield Market is adjacent to the site of the eastern ticket hall. It is one of London’s oldest markets, where meat has been bought and sold for over 800 years. The Medical College of St Bartholomew’s Hospital, and the hospital itself, are located to the north and south of the Smithfield Market, respectively. The Barbican, a major residential and cultural development, is further to the east. The Crossrail station design at Farringdon does not depend on Thameslink 2000 works. It can be constructed independently and is also compatible with current Thameslink 2000 project proposals although both works could be ongoing at the same time.

2.294 This is a busy commercial area: the existing stations and numerous offices give rise to high pedestrian flows, and the main streets, including Holborn and Clerkenwell Road, are heavily trafficked, resulting in generally high noise levels.

Baseline

2.295 The baseline noise survey locations and durations are listed in the following table and identified on Drawing No. 1E0415-C1E00-E01-F-00006:
<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium-term (24-hours)</th>
<th>Short-term (3 hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA04</td>
<td>4 Raymond Buildings</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>IS01</td>
<td>4 Farringdon Road (Rear Façade)</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>IS02</td>
<td>64-65 Cowcross Street</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>IS03</td>
<td>79 Charterhouse Street</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS04</td>
<td>99 Charterhouse Square</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS05</td>
<td>33 Charterhouse Square</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>CL01</td>
<td>Hayne Street</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>CL02</td>
<td>Lindsey Street</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.296 For the Jockey’s Fields site, a short term daytime measurement result of 55 dB $L_{Aeq,3hr}$ was obtained at Raymond Buildings (CA04).

2.297 Major construction works would be carried out for the proposed Farringdon Station, where a vent shaft is to be located, and in the Barbican area. The daytime $L_{Aeq,12hr}$ baseline level measured at 4 Farringdon Street (IS01) was 68 dB, falling only marginally to a night-time $L_{Aeq,8hr}$ level of 67 dB. This location was dominated by noise from mechanical services plant surrounding the car park, which it overlooked. At 64-65 Cowcross Street (IS02) the night-time $L_{Aeq,8hr}$ level of 67 dB is similar due to the night-time working at the nearby Smithfield Market and noise from its power station. Night-time noise levels at 99 Charterhouse Square (IS04) exceed daytime levels by a smaller margin. The power station is believed to have dominated night-time noise levels at this location, with road traffic noise being the dominant source during the day. Works will also take place on a strip of land along Aldersgate Street.

**Impact Assessment – Temporary Impacts**

**Impacts during Construction**

2.298 Temporary impacts from construction activities are illustrated on Drawing No. 1E0315-C1E00-E01-F-00006.

**Noise from Surface Activity**

2.299 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.
Construction Sites and Works including Onsite Traffic and Grout Shafts

2.300 Construction works may affect a small number of residential properties in the Farringdon area. The assessment indicates that daytime impacts are expected in Long Lane, Cowcross Street, Charterhouse Street and Florin Court. However, evening and night-time impacts are only expected to occur in Charterhouse Street, in the area to the north of the Lindsey Street Ticket Hall site. Impacted properties included two public houses, which, for assessment purposes have been classified as residential, due to the potential 'live-in' accommodation. Public houses are located at 34 to 35 Cowcross Street and 105 Charterhouse Street.

2.301 Non-residential receptors predicted to be subject to a significant impact include Howard House and Chapel Court, both to the north of the worksite, off Charterhouse Square. The buildings form part of Charterhouse School. A daytime noise impact is also expected at 62 to 66 Long Lane, the location of a surgery.

Offsite Road Traffic

2.302 The peak periods for construction traffic on the public highway occur for a duration of approximately ten months. Construction vehicles will only use the highway during the daytime (0700 – 1900). At façades overlooking roads used by construction traffic, the existing hourly $L_{A10}$ during the daytime is predicted to increase by less than 1 dB. There are therefore no significant impacts arising from construction traffic.

Vibration from Surface Construction Activity

2.303 The plant likely to be required to demolish the existing buildings and structures and construct the Crossrail elements of Farringdon Station and crossover, and associated with any tunnelling in the area, has been reviewed to identify sources which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings or damage to buildings.

Cardinal House Worksite

2.304 For the Cardinal House worksite, the plant schedule indicates that demolition will include use of a tracked excavator with hydraulic breaker, and that a gantry crane will be required during construction. Vibration levels from the gantry crane are not expected to be significant and can be minimised by ensuring that there are no joints in the track. For works in the basement, the plant schedule indicates that breaking-out works will include use of handheld air tools. Vibration levels due to the use of such tools is not significant in terms of building structural response or building occupant response.

2.305 Vibration levels due to use of the hydraulic breaker have been predicted at the foundations of buildings for the worst-case situation where the breaker operates at ground level at the boundary of the site closest to each receptor. For the northern section of the Cardinal House worksite, vibration levels at the foundations of buildings closest to the site are predicted to be in the region of 0.5 to 2 mm/s at Farringdon Station, which is a Grade II listed building; and 0.5 to 3 mm/s at Smith New Court House. For the eastern section of the Cardinal House worksite, vibration levels at the foundations of buildings closest to the site are predicted to be in the region of 0.5 to 3 mm/s at 25-27 Farringdon Road.
2.306 The threshold of significance for screening purposes for building damage is predicted not to be exceeded at any of the buildings closest to the site.

2.307 Demolition activities are predicted to give rise to vibration levels that are below those that correspond to a semantic rating of 'a low probability of adverse comment' in any of the buildings closest to the site. Hence the impact to occupants of the buildings is not predicted to be significant.

2.308 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

Lindsey Street Worksit

2.309 For the Lindsey Street Worksit, the plant schedule indicates that demolition will include use of a tracked excavator with hydraulic breaker, and that oscillatory bored piling and a gantry crane will be required during construction. Vibration levels due to oscillatory bored piling are not expected to be significant. Vibration levels from the gantry crane are not expected to be significant and can be minimised by ensuring that there are no joints in the track.

2.310 It is noted that buildings at 2 Hayne Street, and at 38 Charterhouse Square are attached or contiguous to buildings proposed for demolition. Vibration mitigation will be required to ensure that damage does not occur to these structures.

2.311 Vibration levels due to use of the hydraulic breaker have been predicted at the foundations of unattached buildings for the worst-case situation where the breaker operates at ground level at the boundary of the site closest to each receptor. Vibration levels at the foundations of buildings closest to the site are predicted to be in the region of 1.5 to 7 mm/s at buildings on Hayne Street opposite the site; in the region of 0.5 to 3 mm/s at the East building of Smithfield Market, which is a Grade II* listed building; 1 to 4 mm/s at buildings on Long Lane opposite the site, which includes 74 Long Lane, a Grade II listed building; and 1 to 4 mm/s at buildings on Charterhouse Square to the north of the site.

2.312 Vibration levels in buildings that are attached to, or contiguous with, buildings proposed for demolition are predicted to be a cause for concern due to the structural continuity between buildings. The threshold of significance for screening purposes may be exceeded at buildings on Hayne Street opposite the site, at the East building of Smithfield Market and at 74 Long Lane.

2.313 Demolition activities are predicted to give rise to vibration levels that correspond to a semantic rating of 'a low probability of adverse comment' in office buildings on Hayne Street opposite the site. Hence the impact to occupants of the buildings is not predicted to be significant.

2.314 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.
Fox and Knot Street Worksite

2.315 For the Fox and Knot Street Worksite, the plant schedule indicates that demolition will include use of a tracked excavator with hydraulic breaker.

2.316 Vibration levels due to use of the hydraulic breaker have been predicted at the foundations of unattached buildings for the worst-case situation where the breaker operates at ground level at the boundary of the site closest to each receptor. Vibration levels at the foundations of buildings closest to the site are predicted to be in the region of 1.5 to 7 mm/s at buildings on Charterhouse Square opposite the site.

2.317 The threshold of significance for screening purposes for building damage may be exceeded at buildings on Charterhouse Square opposite the site.

2.318 Demolition activities are predicted to give rise to vibration levels that correspond to a semantic rating of ‘a low probability of adverse comment’ in buildings on Charterhouse Square opposite the site. Hence the impact to occupants of the buildings is not predicted to be significant.

2.319 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

Smithfield Market Basement Worksite

2.320 For the Smithfield Market Basement Worksite, the plant schedule indicates that breaking-out works will include use of handheld air tools. Vibration levels due to the use of such tools would not be significant in terms of building structural response or building occupant response.

Farringdon Crossover Worksite

2.321 For the Farringdon Crossover Worksite, the plant schedule indicates that a gantry crane will be required during construction. Vibration levels from the gantry crane are not expected to be significant, and can be minimised by ensuring that there are no joints in the track.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.322 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds may also be exceeded while the temporary railway is running.
Tunnel Boring Machines

2.323 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.

2.324 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not predicted to be a total absence of adverse comment.

Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.325 Hoardings, 3.6 m high, would be provided around the worksites. It has been assumed that mitigation of noise from concrete deliveries and the operation of the concrete pump would be provided by the use of a temporary building, which would house the concrete lorries during unloading during later phases of works at both worksites. The compressors would also be located in noise reducing enclosures during these construction phases. No evening construction work has been programmed except that essential for any tunnelling operations. This corresponds to Tier 2 mitigation.

2.326 In this route window, an estimated 1 property is expected to be eligible for noise insulation due to construction noise. No dwellings will be eligible for temporary re-housing, in accordance with the assumed scheme for the provision of NI and TRH during construction; presented in Chapter 5, Volume 1 of this technical report. With the implementation of these mitigation measures, 19 dwellings are expected be subject to significant residual impacts from construction noise.

Offsite Road Traffic

2.327 There are no significant residual impacts.

Vibration from Surface Activity

2.328 Vibration mitigation will be required during demolition at all sites in this route window. Detailed assessment should be undertaken prior to commencement of works to inform selection of specific items of plant and working methods. An appropriate continuous vibration-monitoring regime should be adopted during demolition works allowing monitoring of levels and cessation of activity should levels exceed relevant limits. For the listed buildings, condition surveys should be undertaken to define appropriate vibration limits.
2.329 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential of building damage at their location.

2.330 Additionally, at the Lindsey Street worksite, where there are listed and non-listed buildings that are attached or contiguous to buildings that are proposed for demolition, the attached buildings should be unattached, as far as possible using non-vibratory techniques, such as diamond sawing, before demolition commences, and should continue as it progresses.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.331 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machines

2.332 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

Impact Assessment – Permanent Impacts

Impacts during Operation

2.333 Permanent impacts from operation of Crossrail are illustrated on Drawing No. E0315-C1E00-E02-F-00006.

Noise from the Surface Railway

2.334 Not applicable to this route window.

Vibration from the Surface Railway

2.335 Not applicable to this route window.

Noise from Road Traffic

2.336 When the Crossrail scheme is operational, it will cause only small changes in the 18-hour traffic flow on most roads in this route window. The change in $L_{A10,18hr}$ corresponding to these changes in traffic is predicted to be less than 1 dB. Most of these changes in $L_{A10}$ are increases, but in St John Street between Cowcross Street and Charterhouse Street it is a decrease of less than 1 dB. Decreases of less than 1 dB in the $L_{A10,18hr}$ are predicted to occur in Cowcross Street itself; in the section between Farringdon Road and Turnmill Street, a decrease of 2 to 3 dB is predicted. None of the above changes constitutes a significant impact.
2.337 In the section of Cowcross Street between Farringdon Road and St John Street, decreases of around 5 dB in the $L_{A10,18hr}$ are predicted. This is a significant positive impact.

Noise from Ventilation Shafts

2.338 No residential properties close to the proposed ventilation shafts above the Farringdon Western Ticket Hall are predicted to be subject to significant noise impacts when the ventilation fans are in operation. At the nearest buildings, although these are not noise-sensitive, the Rating Level of the plant in normal operation is predicted to be not more than 2 dB above the existing $L_{A90}(21:00-01:30 \text{ and } 05:30-07:00)$ background noise level (this represents a level 3 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

2.339 No residential properties close to the proposed ventilation shafts above the Farringdon Eastern Ticket Hall are predicted to be subject to significant noise impacts when the ventilation fans are in operation. At the nearest residential buildings, the Rating Level of the plant in normal operation is predicted to be not more than 3 dB above the existing $L_{A90}(21:00-01:30 \text{ and } 05:30-07:00)$ background noise level (this represents a level 2 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

2.340 It is estimated that the noise levels emitted by a ventilation shaft during maintenance operations would be approximately 20 dB lower than during full flow rate operation. The above operational assessment is based on full flow rate operation. Therefore, no residential properties close to the proposed ventilation shafts are predicted to be subject to significant noise impacts during maintenance operations. On the above basis, a significant impact is not deemed to occur and no further mitigation measures are required.

Vibration and Groundborne Noise from the Underground Railway

2.341 There is a wide range of noise/vibration sensitive properties including studios, churches and auditoria, and many piled buildings.

2.342 St Alban's Church is predicted at $27.0 \text{ L}_{A\text{max},S} 0.022s^{-1.75} \text{ VDV}$, studios at Pilot House, 3-5 Bleeding Heart Yard, are predicted at $29.0 \text{ L}_{A\text{max},S} 0.024s^{-1.75} \text{ VDV}$. If, following detailed numerical modelling of the buildings, the predictions are confirmed, there will be protection by the use of special trackform so as to ensure achievement of the target for large theatres of $25 \text{ dB L}_{A\text{max},S}$ at the Barbican Arts Centre (31.0 $\text{ L}_{A\text{max},S} 0.029s^{-1.75} \text{ VDV}$), and the target of $30 \text{ dB L}_{A\text{max},S}$ for the Guildhall School of Music and Drama (32.0 $\text{ L}_{A\text{max},S} 0.03s^{-1.75} \text{ VDV}$) and of $40 \text{ dB}$ for offices in Farringdon Road, Bedford Row, Leather Lane and Kirby Street that are predicted at $43.0 \text{ L}_{A\text{max},S} 0.048s^{-1.75} \text{ VDV}$. Groundborne noise levels are shown on Drawing No: 1E315-C1E00-E03-F-00006.

Mitigation and Residual Impacts during Operation

Noise from the Surface Railway

2.343 Not applicable to this route window.
Vibration from the Surface Railway

2.344 Not applicable to this route window.

Noise from Road Traffic

2.345 There are no significant road traffic noise increases but there is one section of Cowcross Street where a significant noise decrease occurs.

Noise from Ventilation Shafts

2.346 There are no significant residual impacts in this route window.

Vibration and Groundborne Noise from the Underground Railway

2.347 There are no significant residual impacts in this route window.

Impacts on Sites Granted Planning Permission

2.348 Planning permission for a 13 unit residential development on Turnmill Street, is set back a considerable distance from the worksite, thus indicating that the development is predicted not to be affected by noise or vibration from the construction or operation of Crossrail.

2.349 Also included in this Route Window is a planning permission located at 17 to 23 Farringdon Road, which consists of the development of an eight storey building to provide retail, office and residential floorspace. Crossrail construction works associated with the Farringdon Station, Cardinal House Worksite have the potential to significantly impact the residential aspects of the proposed development.
<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demolition of 54-63 Cowcross Street and construction of Cowcross Street Ticket Hall. Demolition of properties in Charterhouse Square, Hayne Street and Lindsey Street for Lindsey Street Ticket Hall and construction of the Farringdon Crossover - Construction Noise</td>
<td>Daytime noise impacts at 20 residential properties. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: 1 noise impact (Parts of Charterhouse School) Medical Facilities: 1 noise impact (62 to 66 Long Lane). Open Spaces: No noise impacts.</td>
<td>Significant</td>
<td>BPM to reduce noise, 3.6 m high hoarding to screen noise, enclosure of static plant associated with 24-hour working. Mitigation = Tier 2</td>
<td>It is estimated that 1 residential property would be eligible for noise insulation. It is estimated that 0 residential properties would be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 19 residential properties. Evening/weekend noise impacts for 0 residential properties. Night-time noise impacts for 0 residential properties. Places of worship: No noise impacts. Educational facilities: 1 noise impact (Parts of Charterhouse School) Medical Facilities: 1 noise impact (62 to 66 Long Lane). Open Spaces: No noise impacts.</td>
</tr>
<tr>
<td>Route window C6: Farringdon Station &amp; Vent Shaft – Permanent Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>---------------------------------------------------------------</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Works &amp; potential impact</strong></td>
<td><strong>Assumed Mitigation</strong></td>
<td><strong>Significance</strong></td>
<td><strong>Description</strong></td>
<td><strong>Significance</strong></td>
</tr>
<tr>
<td>--------------------------------</td>
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</tr>
<tr>
<td>Ventilation Shaft above Farringdon Station Western Ticket Hall – operational noise impacts during operation of tunnel ventilation fans</td>
<td>Not required</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Ventilation Shaft above Farringdon Station Eastern Ticket Hall – operational noise impacts during operation of tunnel ventilation fans</td>
<td>Not required</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Reduction in road traffic flow on Cowcross Street between Turnmill Street and St John Street. This results in a 5 dB L_{A10,18hr} reduction in road traffic noise for an estimated 27 residential properties.</td>
<td>Not required</td>
<td>Significant positive impact</td>
<td>Significant positive impact</td>
<td>Significant positive impact</td>
</tr>
<tr>
<td>Groundborne noise and vibration from the underground railway</td>
<td>Not required</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
</tbody>
</table>
ROUTE WINDOW C7 – LIVERPOOL STREET STATION

Overview of Route Window C7

2.350 Crossrail’s twin-bore tunnels will pass between Moorgate in the west and Commercial Street in the east. East of the Barbican the alignment runs approximately parallel with and north of London Wall, before swinging northwards beyond Liverpool Street station. The permanent works will consist of twin-bore tunnels, a new station at Liverpool Street with a new ticket hall at Moorgate, and a separate shaft structure on Blomfield Street.

2.351 This route window lies within LB Tower Hamlets and the City of London. Land uses within this part of London are dominated by the financial and business services of the City, which extend about 1 kilometre southwards to the River Thames. Grand office buildings of Portland stone surround the formal gardens at Finsbury Circus, while small retail uses line the streets on Moorgate, Moorfields, Liverpool Street and Bishopsgate, with offices above. Moorgate Underground station is located in the west and Liverpool Street station and the vast commercial buildings of Broadgate predominate in the central part of the area. Residential uses as well as Spitalfields determine the character east of Bishopsgate.

2.352 This is a busy commercial area and the existing stations and numerous offices give rise to large numbers of pedestrians. The main streets, including London Wall and Bishopsgate, are heavily trafficked giving rise to generally high noise levels.

Baseline

2.353 The baseline noise survey locations and durations are listed in the following table and identified on Drawing No. 1E0415-C1E00-E01-F-00007:
<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium-term (24-hours)</th>
<th>Short-term (3 hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL03</td>
<td>Moorfields Highwalk</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>CL04</td>
<td>London Metropolitan University</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CL05</td>
<td>Garden House, 18 Finsbury Circus</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CL06</td>
<td>Broad Street Avenue</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>CL07</td>
<td>100 Liverpool Street</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>CL08</td>
<td>Great Eastern Hotel</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.354 At London Metropolitan University (CL04), the daytime $L_{Aeq,12hr}$ baseline level was 75 dB, with a night-time $L_{Aeq,8hr}$ level of 70 dB. A short term daytime measurement result of 71 dB $L_{Aeq,3hr}$ was obtained at Moorfields Highwalk (CL03). Such noise levels are as expected for locations close to the heavily trafficked Moorgate and Liverpool Street areas. Finsbury Circus (CL05) gave a lower daytime $L_{Aeq,12hr}$ baseline level of 66 dB. This location and the position on the roof of the Great Eastern Hotel (CL08) have lower exposures to traffic noise. CL08 was also influenced by noise from ventilation plant on the roof of the hotel.

**Impact Assessment – Temporary Impacts**

**Impacts during Construction**

2.355 Temporary impacts from construction activities are illustrated on Drawing No. 1E0315-C1E00-E01-F-00007.

**Noise from Surface Activity**

2.356 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

**Construction Sites and Works including Onsite Traffic and Grout Shafts**

2.357 In the vicinity of the Moorgate Worksite, the only noise sensitive property that would be significantly affected is London Metropolitan University (formerly the London Guildhall University). This building is predicted to be subject to noise levels in excess of the threshold of significance for daytime construction activity for three distinct periods. No significant impacts are predicted from evening construction.
2.358 Directly overlooking the Liverpool Street Worksite, the residential part of the Railway Tavern Public House would be subject to significant construction noise effects during day, evening and night-time working. The residential part of this property may also be eligible for noise insulation due to the secant piling work.

2.359 The rear of 15 Liverpool Street would be subject to significant residual effects associated with noise from the Blomfield Street construction site, with secant piling also causing the greatest impacts. Flats at this property are expected to be eligible for noise insulation based on the current construction programme.

2.360 Within the vicinity of the Liverpool Street Worksite, a Dental Practice and Medical Direct Clinic, both located at Bell Court House, 11 Blomfield Street, have been identified as being subject to a significant residual effect.

Utilities Worksites - Temporary and Permanent London Bridge Sewer Diversion at Moorgate

2.361 The works will be carried out within the main worksite and at the same time as the main works. There will only be daytime working apart from possible short-term 24-hr working during connections to existing sewers. Each of these works should take about 3 months.

2.362 Two manholes are to be formed, which would require sheet piles to form the boxes/shafts. Bearing piles might also be required since the manholes have to carry the temporary road deck.

2.363 Noise from these utilities works are not expected to cause significant noise impacts at the nearest noise-sensitive buildings.

Offsite Road Traffic

2.364 The peak periods in construction traffic on the public highway will last for approximately 15 months. Construction vehicles will only use the highway during the daytime (0700 – 1900). At façades overlooking roads used by construction traffic, the existing hourly $L_{A10}$ during the daytime is predicted to increase by less than 1 dB. There are therefore no significant impacts arising from construction traffic.

Vibration from Surface Activity

2.365 The plant likely to be required to demolish the existing buildings and structures and construct the Crossrail elements of Liverpool Street Station, and associated with any tunnelling in the area, has been reviewed to identify sources which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings or damage to buildings.

Moorgate Worksite

2.366 The construction information provided by Crossrail for the Moorgate Worksite indicates that demolition will include use of a tracked excavator with breaker and that oscillatory bored piling will also be required. Vibration levels due to oscillatory bored piling are not expected to be significant.
2.367 Vibration levels due to use of the hydraulic breaker have been predicted at the foundations of unattached buildings for the worst-case situation where the breaker operates at ground level at the boundary of the site closest to each receptor. Vibration levels at the foundations of buildings closest to the site are predicted to be in the region of 1 to 4 mm/s at 137-141 Moorgate, which is a Grade II listed building, and at Moorgate Station; and in the region of 0.5 to 2 mm/s at the London Metropolitan University, which is a Grade II listed building, and at Britannic House, 1-6 Finsbury Circus, which is a Grade II* listed building.

2.368 It is noted that 87 Moorgate is attached or contiguous to buildings proposed for demolition at the Moorgate Worksite, and that 87 Moorgate is a Grade II listed building. Vibration mitigation will be required to ensure that damage does not occur to this structure. Vibration levels in buildings that are attached to or contiguous with buildings proposed for demolition are predicted to be a cause for concern due to the structural continuity between buildings. The threshold of significance for building damage may be exceeded at 137-141 Moorgate.

2.369 Demolition activities may give rise to vibration levels that correspond to a semantic rating of ‘a low probability of adverse comment’ in 1-14 Liverpool Street, and ‘adverse comment possible’ in the Railway Tavern, if it is assessed as residential use. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.

2.370 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

**Finsbury Circus Worksite**

2.371 The construction information provided by Crossrail for the Finsbury Circus Worksite indicates that a gantry crane or cranes will be required. Levels at adjacent buildings or structures are predicted not to be significant and levels can be reduced at source by either having no joints in the rails or by minimising joint separation. The former option is preferred.

2.372 The threshold of significance for building damage or human response is predicted not to be exceeded at any receptor during any works at this site.

**Liverpool Street Worksite**

2.373 The construction information provided by Crossrail for the Liverpool Street Worksite indicates that oscillatory piling and use of a tracked excavator with breaker is necessary. Vibration levels due to oscillatory bored piling are not expected to be significant.

2.374 Vibration levels due to use of the hydraulic breaker have been predicted at the foundations of buildings for the worst-case situation where the breaker operates at ground level at the boundary of the site closest to each receptor. Vibration levels at the foundations of buildings closest to the site are predicted to be in the region of 1.5 to 7 mm/s at 1-14 Liverpool Street and Railway Tavern; in the region of 1 to 4 mm/s at 76-80 Old Broad Street, which is a Grade II listed building; and in the region of 0.5 to 3 mm/s at 100 Liverpool Street.
2.375 The threshold of significance for building damage may be exceeded at buildings at 1-14 Liverpool Street and Railway Tavern and at 76-80 Old Broad Street during demolition using the hydraulic breaker.

2.376 Demolition activities are predicted to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’ in 1-14 Liverpool Street and Railway Tavern. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.

2.377 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

**Blomfield Street Worksite**

2.378 The construction information provided by Crossrail for the Blomfield Street Worksite indicates that use of a tracked excavator with breaker, a vibratory piling rig and an oscillatory bored piling rig will be necessary. Vibration levels due to oscillatory bored piling are not expected to be significant.

2.379 Vibration levels due to use of the hydraulic breaker have been predicted at the foundations of unattached buildings for the worst-case situation where the breaker operates at ground level at the boundary of the site closest to each receptor. Vibration levels at the foundations of buildings closest to the site are predicted to be in the region of 0.5 to 3 mm/s at 22 and 23 Blomfield Street and 25 London Wall Buildings, which are a Grade II listed buildings, and at 1-14 Liverpool Street and New Broad Street House; in the region of 2.5 mm/s at 56-60 and 62 New Broad Street and 76-80 Old Broad Street, which are Grade II listed buildings, and at Railway Tavern; and in the region of 1.5 mm/s at Church of All Hallows on the Wall, which is a Grade I listed building.

2.380 It is noted that 10 Blomfield Street and 42-47 New Broad Street are attached or contiguous to buildings proposed for demolition at the Blomfield Street Worksite. Vibration mitigation will be required to ensure that damage does not occur to these two structures. Vibration levels in buildings that are attached to or contiguous with buildings proposed for demolition are predicted to be a cause for concern due to the structural continuity between buildings. The threshold of significance for building damage may be exceeded at buildings at 22 and 23 Blomfield Street, 25 London Wall Buildings.

2.381 Demolition activities are predicted to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.

2.382 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.
Utilities Worksites - Temporary and Permanent London Bridge Sewer Diversion at Moorgate

2.383 The construction information provided by Crossrail indicates that sheet piling is listed for the construction of manholes to provide access to the sewer diversion.

2.384 If vibratory piling is used to install the sheet piles for the manhole ‘boxes’, vibration levels, are predicted to be in the region of 2.5 to 10 mm/s at the foundations of the closest building on the east side of Moorgate, which is the London Metropolitan University. These levels exceed the threshold of significance based on the potential for cosmetic potential building damage.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.385 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds may also be exceeded while the temporary railway is running.

Tunnel Boring Machines

2.386 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.

2.387 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.
Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.388 Hoardings 3.6m high would be provided around the worksites. It has been assumed that mitigation of noise from concrete deliveries and the operation of the concrete pump would be provided by the use of a temporary building, which would house the concrete lorries during unloading during later phases of the works each worksite. The compressors would also be located in noise reducing enclosures during these construction phases. This corresponds to Tier 2 mitigation. Further on-site mitigation measures may be considered, with the intention of reducing the impact and numbers of eligible properties. No evening construction work has been programmed except that essential for any tunnelling operations. This corresponds to Tier 2 level mitigation.

2.389 In this route window, an estimated 3 properties are expected to be eligible for noise insulation due to construction noise. With this mitigation, 1 residential property and three community facilities (a Dental Practice, the Medical Direct Clinic and London Metropolitan University), would be subject to significant residual impacts from construction noise with the implementation of these mitigation measures.

Offsite Road Traffic

2.390 There are no significant residual impacts.

Vibration from Surface Activity

2.391 Vibration mitigation measures will be required for the Moorgate, Liverpool Street, and Blomfield Street Worksites to mitigate potential impacts on structures. Where there are listed and non-listed buildings that are attached or contiguous to buildings that are proposed for demolition, the attached buildings should be unattached, as far as possible using non-vibratory techniques, such as diamond sawing, before demolition commences, and should continue as it progresses. Additionally, detailed assessment should be undertaken prior to commencement of works to inform selection of specific items of plant and working methods. An appropriate continuous vibration-monitoring regime should be adopted during demolition works allow monitoring of levels and cessation of activity should levels exceed relevant limits. For the listed buildings, condition surveys should be undertaken to define appropriate vibration limits.

2.392 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential of building damage at their location.
Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.393 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machine

2.394 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

Impact Assessment – Permanent Impacts

Impacts during Operation

2.395 Permanent impacts from operation of Crossrail are illustrated on Drawing No. E0315-C1E00-E02-F-00007.

Noise from the Surface Railway

2.396 Not applicable to this route window.

Vibration from the Surface Railway

2.397 Not applicable to this route window.

Noise from Road Traffic

2.398 When the Crossrail scheme is operational, it will cause only a small change in the 18-hour traffic flow on roads in this route window. The change in L_{A10,18hr} corresponding to this change in traffic is predicted to be less than 1 dB. There are therefore no significant impacts arising from increases in operational traffic as a result of the scheme.

Noise from Ventilation Shafts

2.399 No residential properties close to the proposed ventilation shaft above the Moorgate Ticket Hall are predicted to be subject to significant noise impacts when the ventilation fans are in operation. At the nearest buildings, although these are not noise-sensitive, the Rating Level of the plant in normal operation is predicted to be at least 1 dB below the existing L_{A90(21:00-01:30 and 05:30-07:00)} background noise level (this represents a level 6 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.
2.400 No residential properties close to the proposed Blomfield Street ventilation shaft are predicted to be subject to significant noise impacts when the ventilation fans are in operation. At the nearest residential buildings, the Rating Level of the plant in normal operation is predicted to be at least 3 dB below the existing $L_{A90}(21:00-01:30 \text{ and } 05:30-07:00)$ background noise level (this represents a level 8 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

2.401 It is estimated that the noise levels emitted by a ventilation shaft during maintenance operations would be approximately 20 dB lower than during full flow rate operation. The above operational assessment is based on full flow rate operation. Therefore, no residential properties close to the proposed ventilation shafts are predicted to be subject to significant noise impacts during maintenance operations.

2.402 On the above basis, significant residual impact is not deemed to occur for properties close to either the proposed Moorgate or Blomfield Street ventilation shafts, and no further mitigation measures are required at these sites.

Groundborne Noise and Vibration from the Underground Railway.

2.403 Receptors in route window C7 are mainly commercial buildings, although there is a hotel, several colleges and churches.

2.404 Standard trackform achieves the noise design aims in all cases with only a small exceedence for blocks in Moorfields ($43 \text{ } L_{Amax,5} 0.053s^{-1.75} \text{ VDV}$), where, following detailed numerical modelling of the buildings, if the predictions are confirmed, there will be protection by the use of special trackform. Groundborne noise levels are shown on Drawing No: 1E315-C1E00-E03-F-00007.

Mitigation and Residual Impacts during Operation

Noise from the Surface Railway

2.405 Not applicable to this route window.

Vibration from the Surface Railway

2.406 Not applicable to this route window.

Noise from Road Traffic

2.407 There are no significant residual impacts in this route.

Noise from Ventilation Shafts

2.408 There are no significant residual impacts in this route window.

Vibration and Groundborne Noise from the Underground Railway

2.409 There are no significant residual impacts in this route window.
Impacts on Sites Granted Planning Permission

2.410 No extant planning permissions that might be affected by the scheme have been identified in this route window.
# Route window C7: Liverpool Street Station – Temporary Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential Vibration Impacts</td>
<td>Vibration levels: Above that for building damage at 1-14 Liverpool Street and Railway Tavern and at 76-80 Old Broad Street.</td>
<td>Significant</td>
<td>BPM and mitigation as described in text above</td>
<td>No residual vibration impacts</td>
</tr>
</tbody>
</table>
## Route window C7: Liverpool Street Station – Moorgate and Blomfield Street Ventilation Shafts – Permanent Impacts

<table>
<thead>
<tr>
<th>Works &amp; potential impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilation Shafts at Moorgate and Blomfield Street Street – operational noise impacts during operation of tunnel ventilation fans</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
<tr>
<td>Groundborne noise and vibration from the underground railway</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
</tbody>
</table>


ROUTE WINDOW C8 – WHITECHAPEL STATION

Overview of Route Window C8

2.411 Crossrail’s twin-bore tunnels will pass between Commercial Street in the west and Stepney Green in the east with the rails at an approximate depth of between 26 metres and 31 metres from street level. East of Commercial Street the alignment runs approximately parallel with and south of the Great Eastern Main line (GEML), before swinging southeastwards beyond Whitechapel station. Other permanent elements of the scheme will consist of:

- a shaft at Hanbury Street;
- a new station at Whitechapel with an interchange concourse beneath Durward Street and, shaft structures, all integrated with the station.

2.412 The Hanbury Street shaft will be connected via a temporary tunnel under Spital Street to a temporary construction shaft at Pedley Street. This will be used for the delivery and removal of materials during the tunnelling phase. The temporary shaft at Pedley Street will be backfilled and the site reinstated towards the end of the construction phase of the running tunnels.

2.413 This route window lies within LB Tower Hamlets. Land uses within this part of London are predominantly residential and commercial properties. The Hanbury Street shaft site is adjoined by residential and retail property.

2.414 The Pedley Street worksite and temporary shaft site lie in an area comprising mainly warehousing, storage and retail buildings, a large number of which are vacant, particularly to the south, along with some residential properties.
2.415 The areas around the Whitechapel Crossrail station and the Durward Street shaft site are characterised mostly by retail and educational uses. The Royal London Hospital is located on the south side of the A11 Whitechapel Road across from Whitechapel station.

2.416 Whitechapel station lies in a busy commercial area and serves the District line and East London line and in the 2016 baseline the Metropolitan line replacing the current Hammersmith and City services. The station and numerous retail facilities give rise to high numbers of pedestrians. The principal thoroughfares in the locality, A11 Mile End Road/Whitechapel Road and A107 Cambridge Heath Road, are heavily trafficked, and generally high noise levels.

Baseline

2.417 The baseline noise survey locations and durations are listed in the following table and identified on Drawing No. 1E0415-C1E00-E01-F-00008:

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium-term (24-hours)</th>
<th>Short-term (3 hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH01</td>
<td>51 Princelet Street</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TH02</td>
<td>65 Hanbury Street</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>TH03</td>
<td>58 Princelet Street</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>TH04</td>
<td>Vallance Road Gardens</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TH05</td>
<td>1 Granary Road</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>TH06</td>
<td>Swanlea School – Durward Street</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>TH07</td>
<td>10 Brady Street</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>TH08</td>
<td>Grindall House – Darling Row</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>TH09</td>
<td>335 Mile End Road</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TH10</td>
<td>1 Cambridge Heath Road</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>TH11</td>
<td>Weaver House</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>TH12</td>
<td>10 Bartholomew Square</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.418 The daytime $L_{Aeq,12hr}$ baseline level measured at 51 Princelet Street (TH01) was 57 dB, falling to a night-time $L_{Aeq,8hr}$ level of 49 dB, indicating that this is a quiet location affected by various distant ambient noise sources. Additional short term measurements were also undertaken at 58 Princelet Street (TH03), where the measured $L_{Aeq,3hr}$ level was 64 dB and 65 Hanbury Street (TH02), where the measured $L_{Aeq,3hr}$ level was 60 dB.
2.419 The $L_{A90,6hr}$ background level for the vent shaft assessment was 48 dB at 51 Princelet Street (TH01). At Vallance Road Gardens (TH04), the $L_{A90(21:00-01:30 and 05:30-07:00)}$ background level for the vent shaft assessment was 51 dB. Road traffic noise was the dominant noise source at positions TH02 to TH04.

2.420 The daytime $L_{Aeq,12hr}$ baseline level measured at 335 Mile End Road (TH09), overlooking the Sainsbury’s car park, was 66 dB, falling to a night-time $L_{Aeq,8hr}$ level of 61 dB. The noise environment was dominated by road traffic.

Impact Assessment – Temporary Impacts

Impacts during Construction

2.421 Temporary impacts from construction activities are illustrated on Drawing No. 1E0315-C1E00-E01-F-00008.

Noise from Surface Activity

2.422 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

Construction Sites and Works including Onsite Traffic and Grout Shafts

Hanbury Street Vent Shaft

2.423 Residential properties predicted to be subject to significant construction noise impacts lie along Hanbury Street to the north, Princelet Street to the south, through to Daplyn Street to the east. It has been assumed that only essential activity associated with tunnelling would take place during the evenings due to the large concentration of housing close to the worksite. The noisiest phases of work would be during the demolition of the existing buildings, which would last for approximately 5 months, although high levels would occur through the diaphragm walling for the shaft and excavation for the main box and base slab.

2.424 The rear façades of 61 to 67 Princelet Street would be the worst affected properties as they directly adjoin the construction site. Similarly, properties on Hanbury Street and Princelet Street nearest the site will also be significantly affected. Highest predicted levels are 87 dB $L_{Aeq,12hour}$ during the daytime from demolition and 80 dB $L_{Aeq,8hour}$ at night during the tunnel construction. The residential aspects of 57 to 67 Princelet Street and 105 to 111 Hanbury Street may also be subject to significant impact. The residential blocks of Vollasky House and Boden House may also have some areas affected.

Whitechapel Station

2.425 Noise-sensitive properties subject to significant construction noise impacts are concentrated around Mile End Road, Durward Street, Winthrop Street and Kempton Court.
2.426 At Mile End Road, close to the main Whitechapel Station worksite, the construction noise impacts at the worst affected property would occur throughout most of the construction programme. Other properties in this area are also likely to be subject to extended periods of noise impact.

2.427 Significant daytime impacts will be expected at the following non-residential sensitive receptors: Swanlea School, the Young Peoples Centre on Cambridge Heath Road, and the Albion Health Centre at 333 Whitechapel Road. Although night-time impacts are predicted at Swanlea School and the Health Centre, due to the nature of the buildings, it is unlikely that they will be in use during these periods and will therefore only constitute a significant impact during the daytime period. Swanlea School and the Health Centre are not predicted to be impacted during the evening period.

2.428 From works on the District Line Link, significant day and evening construction noise impacts are concentrated within the vicinity of Durwood Street and Wodeham Gardens. In addition, night-time impacts are also expected to occur in the Whitechapel Road and Winthrop Street areas.

2.429 A dual impact may occur at 6 Winthrop Street, due to construction noise from both the Durward and District Line Link sites. Activities at the Whitechapel site may cause a significant daytime noise impact to the eastern façade over a 2 month period. Activities at the District Line Link site may cause a significant night-time noise impact to the southern façade also over 2 month period. As the predicted impacts are expected to occur on different façades and during different periods, the impacts have therefore have been reported separately.

Pedley Street

2.430 The Pedley Street site is split into two Route Windows, 8 and 8a due to the nature of the construction activities taking place. The main worksite is at Pedley Street; however a conveyor system will be constructed alongside the existing railway tracks. This will carry excavated material from Pedley Street to be loaded onto trains at the sidings. At night it will be stockpiled in Mile End Park before being carried to the sidings on conveyor in the morning.

2.431 In this Route Window, approximately 52 residential properties would be affected by the construction activities undertaken at Pedley Street. The construction programme is expected to run for approximately three years, with day, evening and night-time works taking place. Key sensitive receptors include several blocks of properties overlooking and close to the existing railway.

2.432 Mainly due to the night-time construction of the conveyor, a significant number of properties would experience noise levels exceeding the noise threshold, and would therefore be expected to be eligible for noise insulation, with approximately all 52 properties eligible for noise insulation and 17 also qualifying for temporary re-housing.

2.433 No day, evening or night-time impacts are predicted to occur at any non-residential properties.
Utilities Worksite - Diversion of NE Storm Relief Sewer at Swanlea School, Whitechapel (Site 1/26C)

2.434 The work consists of the construction of a new sewer via a 3.6 metres shaft sunk using the caisson method. This access shaft will be located in the forecourt of Swanlea Secondary School. This area will be used as a worksite for the main works (Durward Street Worksite).

2.435 The tunnel for the new sewer will be excavated using hand tools and a mini-excavator, not a tunnel boring machine. Excavated material will be transported along the tunnel to the vertical shaft using the mini-excavator and/or small trucks, there will be no construction railway.

2.436 After breaking open the ground surface (a few day’s work), the main part of the operation consists of excavating and removing excavated material during the sinking of the shaft, and from the tunnel.

2.437 Works here will take about 7 months. There will be 24-hour working during the excavation of the tunnel (about 7 weeks work), but excavated material will only be removed from site during normal working hours. Most of the working would be daytime only apart from pumps, which would be operated continuously to dewater the excavations.

2.438 The table below presents the construction noise assessment. The distances from the sites within which significant impacts could occur are shown in Table 1/26C-1. These distances are on the basis of no on-site mitigation, since it is assumed that standard hoardings at 2.4 m high do not cut the line of sight for 4 m high receptors. Baseline noise levels obtained from monitoring and the distances to the nearest dwellings are also shown.

<table>
<thead>
<tr>
<th>Site</th>
<th>Use</th>
<th>Baseline Location</th>
<th>Day</th>
<th>Eve</th>
<th>Night</th>
<th>Nearest houses (m)</th>
<th>Potential Impact Zone (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/26C</td>
<td>Access shaft</td>
<td></td>
<td>Period</td>
<td>L_{Aeq} dB</td>
<td>façade</td>
<td>Approx</td>
<td>Day</td>
</tr>
<tr>
<td>A</td>
<td>Access shaft</td>
<td>TH04</td>
<td>64.5</td>
<td>62.5</td>
<td>59.8</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Criteria</td>
<td>TH04</td>
<td>69</td>
<td>67</td>
<td>65</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Criteria</td>
<td>TH06</td>
<td>~</td>
<td>~</td>
<td>~</td>
<td>114</td>
<td>113</td>
</tr>
<tr>
<td></td>
<td>Criteria</td>
<td>TH09</td>
<td>65.5</td>
<td>63.5</td>
<td>60.5</td>
<td>68 2</td>
<td>68 1</td>
</tr>
</tbody>
</table>

Notes:
1) Façade level above criterion for duration of 1 week or more assuming mitigation of 0 dB on-site and unobstructed view of site
2) Assuming Day-Night difference of approx 5 dB as at 24-hour sites (TH04, TH09)

Offsite Road Traffic

2.439 The peak periods for construction traffic on the public highway will last for slightly less than two years. Construction vehicles will only use the highway during the daytime (0700 – 1900). At façades overlooking roads used by construction traffic, the existing hourly $L_{A10}$ during the daytime is predicted to increase by less than 1 dB, except for facades along Durward Street (between Brady Street and Vallance Road) and along Brady Street (between Durward Street and Merceron Street). At façades overlooking those sections of road, increases of around 1.5 dB are predicted. However, there are no significant impacts arising from construction traffic.
Vibration from Surface Construction Activity

2.440 The plant likely to be required to demolish the existing buildings or structures and construct the Hanbury Street Shaft, the Pedley Street Temporary Shaft, the Pedley Street to Mile End Park Conveyor and Whitechapel Station, and associated with any tunnelling in the area, has been reviewed to identify sources which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings or damage to buildings.

Hanbury Street Worksite

2.441 The construction information provided by Crossrail for the Hanbury Street Worksite indicates that demolition of structures and the construction of adits and tunnels will involve use of a tracked excavator with breaker.

2.442 Vibration levels due to use of the hydraulic breaker have been predicted at the foundations of unattached buildings for the worst-case situation where the breaker operates at ground level at the boundary of the site closest to each receptor. Vibration levels at the foundations of buildings closest to the site are predicted to be in the region of 1 to 4 mm/s at buildings in Hanbury Street and Princelet Street that are directly opposite to the site; 0.5 to 1.5 mm/s at Boden House; and less than 1 mm/s at 114-116 Brick Lane, which is a Grade I listed building.

2.443 It is noted that 66 Hanbury Street and 51 Princelet Street are attached or contiguous to buildings proposed for demolition and construction at this worksite. Vibration mitigation will be required to ensure that damage does not occur to these structures. Vibration levels in buildings that are attached to or contiguous with buildings proposed for demolition are likely to be a cause for concern due to the structural continuity between buildings. The threshold of significance for building damage is predicted not to be exceeded at any unattached building around this worksite during any activity.

2.444 Demolition activities may give rise to vibration levels that correspond to a semantic rating of ‘a low probability of adverse comment’ in buildings on Hanbury Street and Princelet Street adjacent and opposite to the site. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.445 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

Pedley Street Worksite

2.446 The construction information provided by Crossrail for the Pedley Street worksite, including tunnelling and disposal of excavated material, indicates that an excavator with hydraulic breaker will be required for demolition of parts of a disused viaduct between Pedley Street and GEML lines and site clearance at the Pedley Street worksite, and that a gantry crane will be required during shaft construction at Pedley Street.
2.447 Vibration levels from the gantry crane are not expected to be significant and can be minimised by ensuring that all trackwork will be joint minimal. Where joints are necessary, the vertical and horizontal separation will be minimised and subject to regular inspection and maintenance. The only significant structures to be demolished on the Pedley Street Worksite are the parts of a disused viaduct. This activity is predicted to be the only significant source of vibration due to site clearance at Pedley Street Worksite.

2.448 Vibration levels due to use of the hydraulic breaker at the Pedley Street site have been predicted at the foundations of buildings for the worst-case situation where the breaker operates at ground level at the section of disused viaduct of the site closest to each receptor. Vibration levels at the foundations of buildings closest to each part of the viaduct are predicted to be in the region of 1 to 4 mm/s at 12-17 Surma Close; and 0.5 to 3 mm/s at 21 Fakruddin Street and 1-16 Weaver House.

2.449 The threshold of significance for building damage is predicted not to be exceeded at any building around this worksite during any activity.

2.450 Demolition activities may give rise to vibration levels that correspond to a semantic rating of ‘a low probability of adverse comment’ at 12-17 Surma Close. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.

2.451 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

*Pedley Street to Mile End Park Conveyor Worksite*

2.452 The construction information provided by Crossrail for the Pedley Street to Mile End Park Conveyor Worksite indicates that there are no significant sources of vibration associated with demolition or construction in this route window.

*Durward Street Worksite*

2.453 For this worksite, the construction information provided by Crossrail indicates that works will include use of a tracked excavator with hydraulic breaker, and that oscillatory bored piling will be required during box construction. Vibration levels due to oscillatory bored piling are not expected to be significant.

2.454 There is no piling at any of the utilities worksites. The nearest noise-sensitive buildings (dwellings) are 25 metres away. Consequently, it is considered that there will be no significant vibration impacts from above ground sources for these works.

2.455 Vibration levels due to use of the hydraulic breaker have been predicted at the foundations of buildings for the worst-case situation where the breaker operates at the boundary of the box closest to each receptor. Vibration levels at the foundations of buildings closest to the site, during use of a hydraulic breaker, are predicted to be in the region of 1.5 to 7 mm/s at the Durward Street Sports Hall, and at 1-4 Durward Street; and 0.5 to 3 mm/s at Swanlea School.
2.456 The threshold of significance for building damage may be exceeded at Durward Street Sports Hall and at 1 - 4 Durward Street.

2.457 Demolition activities may give rise to vibration levels that correspond to a semantic rating of ‘a low probability of adverse comment’ at Durward Street Sports Hall, and ‘adverse comment possible’ at 1 - 4 Durward Street. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.

2.458 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

District Line Link Worksite

2.459 The construction information provided by Crossrail for the District Line Link Worksite indicates that oscillatory bored piling will be required during box construction. Vibration levels due to bored piling are not expected to be significant.

Whitechapel Station – Sainsbury’s Car Park Worksite

2.460 The construction information provided by Crossrail for Sainsbury’s Car Park Worksite indicates that an oscillatory bored piling rig is required for the box construction at this site. Vibration levels due to oscillatory bored piling are not expected to be significant.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.461 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds may also be exceeded while the temporary railway is running.

Tunnel Boring Machines

2.462 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.
Utilities Worksite - Diversion of NE Storm Relief Sewer at Swanlea School, Whitechapel (Site 1/26C)

2.463 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

2.464 The new tunnel passes under a building on the south side of Durward Street. However, the tunnel will not use either a TBM or a construction railway; it will be excavated using a mini-excavator plus hand tools. Consequently, there will be no significant vibration impacts from below ground sources.

Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.465 Hoardings 5.0 m high would be provided around the Hanbury Street worksite, and also around each of the Whitechapel worksites. It has been assumed that no demolition work would take place outside normal daytime working hours given the close proximity of large numbers of residential properties to this worksite. It has also been assumed that mitigation of noise from concrete deliveries and the operation of the concrete pump would be provided by the use of temporary buildings, which would house the concrete lorries unloading from the main box excavation phases onwards. The compressors would also be located in noise reducing enclosures during these construction phases.

2.466 For piling works at the Sainsbury’s Car Park worksite, Cambridge Heath Road, it has been assumed that the concrete pour has been mitigated by partial enclosure of this activity and the 30T 360° excavator has been replaced with a 20T excavator.

2.467 No evening construction work has been programmed except that essential for any tunnelling operations. This corresponds to Tier 2 mitigation. However, it should be noted that some continuous 24hr works would likely be necessary (and as such, is programmed) for each of the worksites within this route window.

2.468 At the Pedley Street, 3.6m hoardings would be used to control noise from the principle work areas. With this, mainly due lorry movements accessing the site, a significant number of properties would experience noise levels exceeding the noise threshold, and would therefore be expected to be eligible for noise insulation.
2.469 In total for this route window, approximately 150 properties may be eligible for noise insulation due to construction noise. Included within this number are the residents of approximately 48 properties who may be eligible for temporary re-housing for a period, in accordance with the assumed scheme for the provision of NI and TRH during construction; presented in Chapter 5, Volume 1 of this technical report. With this mitigation, 30 properties would be subject to significant residual noise impacts, around the Hanbury Street work site area, as demonstrated in Appendix A and mapping. Within this route window, daytime impacts at non-residential properties include Swanlea School, the Young Peoples Centre on Cambridge Heath Road, and the Albion Health Centre at 333 Whitechapel Road. A summary of the mitigation and residual effects for each site is given below.

<table>
<thead>
<tr>
<th>Site</th>
<th>Impact</th>
<th>Noise Insulation</th>
<th>Temporary Housing</th>
<th>Residual Noise Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hanbury Street</td>
<td>62</td>
<td>32</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Whitechapel</td>
<td>66</td>
<td>66</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Pedley Street</td>
<td>52</td>
<td>52</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>180</strong></td>
<td><strong>150</strong></td>
<td><strong>48</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

**Utilities Worksite - Diversion of NE Storm Relief Sewer at Swanlea School, Whitechapel (Site 1/26C)**

2.470 Construction activity at the site with 10 dB of on-site mitigation applied would cause significant impacts at unobstructed buildings within 22 metres during the daytime and 36 metres during night-time working. With this level of mitigation, there would be no significant daytime noise impacts.

2.471 Increasing the on-site mitigation to 14 dB at night would reduce the range at which buildings having a clear view of the site would experience significant impacts from the works to 23 metres. There would then be no significant night-time noise impacts.

2.472 This level of on-site mitigation should be achievable with Tier 2 mitigation (including 5 m site hoardings) for first floor receivers. The buildings to the south of the worksite (in Durward Street) appear to be flats, which might be multi-storey. If that is the case, then to achieve 14 dB of on-site mitigation for the upper storeys might require further measures than Tier 2 provides. However, the main works at this location already give rise to significant impacts at this building, which might be eligible for TRH. Consequently, these utilities works might not cause any significant change in the effects on it.

**Offsite Road Traffic**

2.473 There are no significant residual impacts.
Vibration from Surface Activity

2.474 Vibration mitigation will be required at the Hanbury Street Worksite during demolition works and at the Durward Street Worksite during use of the hydraulic breaker. Where there are buildings that are attached or contiguous to buildings that are proposed for demolition at these two Worksites, the attached buildings should be unattached, as far as possible, using non-vibratory techniques, such as diamond sawing, before demolition commences, and should continue as it progresses. Detailed assessment should be undertaken prior to commencement of works to inform selection of specific items of plant and working methods. An appropriate continuous, real-time vibration-monitoring regime should be adopted during demolition works to allow monitoring of levels and cessation of activity should the levels exceed relevant limits.

2.475 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential of building damage at their location.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.476 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machines

2.477 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

Impact Assessment – Permanent Impacts

Impacts during Operation

2.478 Permanent impacts from operation of Crossrail are illustrated on Drawing No. E0315-C1E00-E02-F-00008.

Noise from the Surface Railway

2.479 Not applicable to this route window.

Vibration from the Surface Railway

2.480 Not applicable to this route window.
Noise from Road Traffic

2.481 When the Crossrail scheme is operational, it will cause only small increases in the 18 hour traffic flow on roads in this route window. The change in $L_{A10,18hr}$ corresponding to this increase in traffic is predicted to be less than 1 dB. There are therefore no significant impacts arising from increases in operational traffic as a result of the scheme.

Noise from Ventilation Shafts

2.482 No residential properties close to the proposed ventilation shaft at Hanbury Street are predicted to be subject to significant noise impacts when the ventilation fans are in operation. At the nearest residential buildings, the Rating Level of the plant in normal operation is predicted to be at least 4 dB below the existing $L_{A90(21:00-01:30 \text{ and } 05:30-07:00)}$ background noise level (this represents a level 1 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

2.483 No residential properties close to the proposed ventilation shaft at Essex Wharf are predicted to be subject to significant noise impacts when the ventilation fans are in operation. At the nearest residential buildings, the Rating Level of the plant in normal operation is predicted to be not more than 3 dB above the existing $L_{A90(21:00-01:30 \text{ and } 05:30-07:00)}$ background noise level (this represents a level 2 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

2.484 No residential properties close to the proposed ventilation shaft above the Cambridge Heath Road Ticket Hall are predicted to be subject to significant noise impacts when the ventilation fan is in operation. At the nearest residential buildings, the Rating Level of the plant in normal operation is predicted to be at least 8 dB below the existing $L_{A90(21:00-01:30 \text{ and } 05:30-07:00)}$ background noise level (this represents a level 13 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

2.485 It is estimated that the noise levels emitted by a ventilation shaft during maintenance operations would be approximately 20 dB lower than during full flow rate operation. The above operational assessment is based on full flow rate operation. Therefore, no residential properties close to the proposed ventilation shafts are predicted to be subject to significant noise impacts during maintenance operations.

2.486 On the above basis, significant impacts are not deemed to occur for properties close to the proposed ventilation shafts at Hanbury Street, Essex Wharf, and Cambridge Heath Road, and no further mitigation measures are required at those sites.

Vibration and Groundborne Noise from the Underground Railway

2.487 Piled buildings at Hobsons Place, Tannery House, Chicksand Estate, Vallance Garden and Kempton Court are predicted to receive groundborne noise levels below 40 dB $L_{A_{max,s}}$ with standard trackform.

2.488 Piled buildings at O'Leary Square and Dundry Place are predicted to receive noise levels below 40 dB $L_{A_{max,s}}$ with standard trackform. Groundborne noise levels are shown on Drawing No: 1E315-C1E00-E03-F-00008.
Mitigation and Residual Impacts during Operation

Noise from the Surface Railway
2.489 Not applicable to this route window.

Vibration from the Surface Railway
2.490 Not applicable to this route window.

Noise from Road Traffic
2.491 There are no significant residual impacts in this route window.

Noise from Ventilation Shafts
2.492 There are no significant residual impacts in this route window.

Vibration and Groundborne Noise from the Underground Railway
2.493 There are no significant residual impacts in this route window.

Impacts on Sites Granted Planning Permission
2.494 No extant planning permissions that might be affected by the scheme have been identified in this route window.

WHITECHAPEL STATION SCENARIOS

Impacts during Construction

Construction Sites and Works including Onsite Traffic and Grout Shafts
2.495 Within the Whitechapel scheme, a number of alternate scenarios are being considered to the preferred base-case; Scenario 1. For Scenario 2; a new eastern ticket hall would be provided, including the same ventilation, escape and EIP infrastructure, to the west of Cambridge Heath Road at the junction with Whitechapel Road. The eastern end of the Crossrail platforms would be accessed from this street level ticket hall via a single flight of escalators (Scenario 2a). Subsequently, a new western ticket hall would be constructed over the District line east of Court Street (Scenario 2b). The scope of works overall is not made significantly greater by the splitting into two halves, and so no new impacts or increased mitigation would arise. There is the possibility of increased duration of impact, however this is thought to be unlikely to occur in actuality.

2.496 Scenario 3 comprises a new eastern ticket hall, including ventilation, escape and EIP infrastructure, to the west of Cambridge Heath Road at the junction with Whitechapel Road as in scenario 2a. The eastern end of the Crossrail platforms would be accessed from this street level ticket hall via a single flight of escalators. This scenario, therefore, has no material difference in noise terms from the base case assessed above. Appendix A includes tables of noise for all three scenarios. In summary, other scenarios will involve less building, and will therefore result in a lower impact.
Offsite Road Traffic

2.497 The alternative scenarios considered here would not materially change the number of vehicle movements, offsite. Therefore, there would be no change from the assessment above.

Vibration from Surface Activity

2.498 The potential impacts would be the same or lesser than those for the Crossrail base case.

Noise and Vibration Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.499 Hoardings of height of 5.0 m would be provided around the active sites. This corresponds to Tier 2 mitigation. Appendix A includes tables of noise impacts and mitigation for all three scenarios. A summary of impacts and mitigation is provided in the table below.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Impact</th>
<th>Noise Insulation</th>
<th>Temporary Housing</th>
<th>Residual Noise Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1 (Preferred option)</td>
<td>66</td>
<td>66</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Scenario 2 (a)</td>
<td>31</td>
<td>31</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Scenario 2 (b)</td>
<td>35</td>
<td>35</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>66</td>
<td>66</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Works</td>
<td>Potential Impact</td>
<td>Significance</td>
<td>Assumed Mitigation</td>
<td>Residual Impact</td>
</tr>
<tr>
<td>-------</td>
<td>------------------</td>
<td>--------------</td>
<td>-------------------</td>
<td>-----------------</td>
</tr>
</tbody>
</table>
### Demolition of existing buildings and construction of Whitechapel Station

- **Daytime noise impacts at 47 residential properties.**
- **Evening/weekend noise impacts at 32 residential properties.**
- **Night-time noise impacts at 58 residential properties.**
- Places of worship: No noise impacts.
- Noise impacts at 1 educational facility (Swanlea School) during the daytime period and 1 Young Peoples Centre.
- Medical facilities: Albion Health Centre at 333 Whitechapel Road.
- Public open spaces: No noise impacts.

**Significant**

BPM to reduce noise, 5.0 m high hoarding to screen noise, concrete deliveries and concrete pump would be housed in a temporary building, following the piling work phase.

Mitigation = Tier 2 plus.

An estimated 66 properties would be eligible for noise insulation. Approximately 11 dwellings may be eligible for temporary re-housing. With this mitigation:
- **Daytime noise impacts at 0 residential properties.**
- **Evening/weekend noise impacts at 0 residential properties.**
- **Night-time noise impacts at 0 residential properties.**
- Places of worship: No noise impacts.
- Noise impacts at 1 educational facility (School) during the daytime period and 1 Young Peoples Centre.
- Medical facilities: Albion Health Centre at 333 Whitechapel Road.
- Public open spaces: No noise impacts.

### Pedley Street – construction of tunnel access shaft, excavated material stockpile, segment storage and conveyor

- **Daytime noise impacts at 17 residential properties.**
- **Evening/weekend noise impacts at 31 residential properties.**
- **Night-time noise impacts at 52 residential properties.**
- Places of worship: No noise impacts.
- Educational Facilities: No noise impacts.
- Public open spaces: No noise impacts.

**Significant**

BPM to reduce noise, 3.6 m high hoarding to screen noise, enclosure of static plant associated with 24-hour working

Mitigation = Tier 2

An estimated 52 properties would be eligible for noise insulation. Approximately 17 dwellings may be eligible for temporary re-housing. With this mitigation:
- **Daytime noise impacts at 0 residential properties.**
- **Evening/weekend noise impacts at 0 residential properties.**
- **Night-time noise impacts at 0 residential properties.**
- Places of worship: No noise impacts.
- Educational Facilities: No noise impacts.
- Public open spaces: No noise impacts.

**Not significant**
<table>
<thead>
<tr>
<th>Route window C8: Hanbury Street Vent Shaft &amp; Whitechapel Station – Permanent Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Works &amp; potential impact</strong></td>
</tr>
<tr>
<td><strong>Residual Impact</strong></td>
</tr>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td><strong>Significance</strong></td>
</tr>
<tr>
<td><strong>Assumed Mitigation</strong></td>
</tr>
<tr>
<td><strong>Significance</strong></td>
</tr>
<tr>
<td>Ventilation Shafts at Hanbury Street and Whitechapel Station East and West ventilation shafts – operational noise impacts during operation of tunnel ventilation fans</td>
</tr>
<tr>
<td>None</td>
</tr>
<tr>
<td>Not significant</td>
</tr>
<tr>
<td>Not required</td>
</tr>
<tr>
<td>Not required</td>
</tr>
<tr>
<td>Groundborne noise and vibration from the underground railway</td>
</tr>
<tr>
<td>None</td>
</tr>
<tr>
<td>Not significant</td>
</tr>
<tr>
<td>Not required</td>
</tr>
<tr>
<td>Not required</td>
</tr>
</tbody>
</table>
ROUTE WINDOW C8A MILE END CONVEYOR CORRIDOR

Overview Route Window C8A

2.500 This route window contains the eastern part of the conveyor from Pedley Street, Mile End (Devonshire Street) sidings at which excavated material will be loaded onto trains, and the northern part of Mile End Park, which will form a stockpiling area for excavated material.

Baseline

2.502 The route window includes no baseline noise survey locations. Baseline noise levels at affected receptors have been estimated based on the locations in Route Window C8. The properties affected by the Pedley Street worksite are split across Route Windows 8 and 8A.

Impact Assessment – Temporary Impacts

Impacts during Construction

2.503 Temporary impacts from construction activities are illustrated on Drawing No. E0315-C1E00-E01-F-00014.
Noise from Surface Activity

2.504 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.505 The Pedley Street site is split across two Route Windows, 8 and 8a due to the nature of the construction activities taking place. The main worksite is at Pedley Street; however a conveyor system will be constructed alongside the existing railway tracks. This will carry excavated material from Pedley Street to be loaded onto trains at the sidings. At night it will be stockpiled in Mile End Park before being carried to the sidings on conveyors in the morning.

2.506 In this Route Window, several sensitive non-residential properties will be affected by the construction activities undertaken at Mile End. The construction programme is expected to run for approximately three years, with day, evening and night-time works taking place. Key sensitive receptors include The London Hospital at Mile End and the University Accommodation, both situated to the south of the site. A number of residential units in Brancaster House will also experience daytime noise impacts due to site works.

2.507 Night-time construction impacts are also predicted to occur at several noise sensitive residential properties situated in Haverfield Road and Grove Road; both located on the northern side of the existing tracks. In total, approximately 60 residential properties would be affected by the construction activities.

Offsite Road Traffic

2.508 Construction vehicles will only use the highway during the daytime (0700 – 1900). At façades overlooking roads used by construction traffic, the existing hourly LA10 during the daytime is predicted to increase by less than 1 dB. There are therefore no significant impacts arising from construction traffic.

Vibration from Surface Activity

Pedley Street to Mile End Park Conveyor Worksite

2.509 The construction information provided by Crossrail for the Pedley Street to Mile End Park Conveyor Worksite indicates that Globe New Furniture will be demolished. It has been assumed that excavators with hydraulic breakers will not be required to demolition Globe New Furniture, as it is a minor structure (corrugated steel construction) and vibration levels are predicted not to be significant.

2.510 The threshold of significance for building damage is predicted not to be exceeded at any building around the worksite, during any activity.
2.511 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

*Mile End Park Excavated Material Handling Site*

2.512 The construction information provided by Crossrail for the Mile End Park Excavated Material Handling Site indicates that vibrating rollers will be required for the preparation of the site.

2.513 Vibration levels at the foundations of the Climbing Wall Centre, the closest building to the site, are predicted to be in the region of 1.5 to 3.5 mm/s when the vibrating roller operates at the closest site boundary.

2.514 The threshold of significance for building damage is predicted not to be exceeded at any building around this worksite. Activities are predicted to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’ in any of the buildings closest to the site, therefore, the impact to occupants of the buildings is not predicted to be significant.

2.515 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

**Vibration and Groundborne Noise from Underground Activity**

*Construction Trains*

2.516 Not applicable to this route window.

*Tunnel Boring Machines*

2.517 Not applicable to this route window.

**Mitigation and Residual Impacts during Construction**

Noise from Surface Activity subject to revision

*Construction Sites and Works including Onsite Traffic and Grout Shafts*

2.518 The discrete worksites in this route window will be enclosed by 3.6m hoardings, in accordance with Tier 2 mitigation. It has also been assumed that mitigation of noise from concrete deliveries and the operation of the concrete pump would be provided by the use of temporary buildings, which would house the concrete lorries unloading after the initial phases on site. The compressors would also be located in noise reducing enclosures during these construction phases. It will not be possible to screen the conveyor mechanism for its whole length, however, and so good design and internal mitigation and regular maintenance will be relied upon to ensure the conveyor operates without undue noise, given the conveyor’s operation on a 24-hour basis.
2.519 Due to the night-time construction of the conveyor system, an estimated 7 dwellings may be eligible for noise insulation; however no properties would be eligible for temporary re-housing. The daytime excavated material-handling activities do not trigger the noise insulation criteria at any location, however a number of properties are impacted. With the implementation of these mitigation measures, it is estimated that 45 residential properties would be subject to significant residual impacts due to construction noise. Residual impacts will also occur at The London Hospital at Mile End and the proposed University Accommodation.

*Offsite Road Traffic*

2.520 There are no significant residual impacts.

Vibration from Surface Activity

2.521 Vibration mitigation will not be required during construction activities at this worksite.

Vibration and Groundborne Noise from Underground Activity

2.522 No underground activity will take place within the bounds of this route window.

**Impact Assessment – Permanent Impacts**

**Impacts during Operation**

2.523 Permanent impacts from operation of Crossrail are illustrated on Drawing No. E0315-C1E00-E02-F-00014.

Noise from the Surface Railway

2.524 Not applicable to this route window.

Vibration from the Surface Railway

2.525 Not applicable to this route window.

*Offsite Road Traffic*

2.526 Not applicable to this route window

Noise from Ventilation Shafts

2.527 Not applicable to this route window.

Vibration and Groundborne Noise from the Underground Railway

2.528 Not applicable to this route window.

**Mitigation and Residual Impacts during Operation**

2.529 Not applicable to this route window.
Impacts on Sites Granted Planning Permission

2.530 Planning permission for the former goods yard on Warley Street will involve the construction of an up to 11-storey, 316 residential unit development. This site lies just to the north of the Pedley Street to Mile End Conveyor Worksite. Crossrail construction works associated with this worksite have the potential to significantly impact the residential aspects of the proposed development.

2.531 Tower Hamlets has also granted planning permission for a multi-use development at Victoria Wharf, off Palmers Road. The 12-storey building will be divided between commercial, B1 work units and residential. TH21 is located away from the worksite, indicating that no significant noise impacts are expected to occur due to Crossrail construction works.
## Route window C8a: Mile End Conveyor Corridor– Temporary Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mile End Conveyor and Mile End sidings excavated material transfer operation</td>
<td>Daytime noise impacts at 45 residential properties. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts at 7 residential properties. Places of worship: No noise impacts. Educational Facilities: Day and night-time noise impact at the University Accommodation. Daytime and night-time noise impact at 1 medical facility (The London Hospital, Mile End). Public open spaces: No noise impacts.</td>
<td>Significant</td>
<td>BPM to reduce noise, 3.6m high hoarding around worksites (but not the length of conveyor) to screen noise, enclosure of static plant associated with 24-hour working</td>
<td>An estimated 7 residential properties would be eligible for noise insulation, with 0 properties eligible for temporary re-housing. Daytime noise impacts at 45 residential properties. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: Day and night-time noise impact at the proposed University Accommodation. Daytime and night-time noise impact at 1 medical facility (The London Hospital, Mile End). Public open spaces: No noise impacts.</td>
</tr>
</tbody>
</table>
## Route window C8A: Mile End Conveyor Corridor – Permanent Impacts

<table>
<thead>
<tr>
<th>Works &amp; potential impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Description</td>
</tr>
<tr>
<td>No permanent works</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
</tbody>
</table>

Significance: Not significant

Assumed Mitigation: None
ROUTE WINDOW C9 – STEPNEY GREEN SHAFTS

Overview of Route Window C9

2.532 Crossrail's twin-bore tunnels will pass between Stepney Green in the west and the Regent’s Canal in the east. East of Stepney Green the alignment divides into two, the northern tunnel continuing eastwards towards the southern end of Mile End Park and the southern tunnel running southeast towards Limehouse and the A13, Commercial Road. The new Stepney Green shaft structures are the only above-ground Crossrail features within this route window.

2.533 This route window lies within LB Tower Hamlets. Land uses within this part of London are dominated by residential properties and recreational areas. The Stepney Green shaft site is located in Stepney Green park, an area of outdoor recreation that includes an all-weather sports pitch, an urban farm and a number of archaeological ruins. St Dunstan's Church lies at its eastern edge.

2.534 The shaft site lies in a busy residential area and the main streets, including Mile End Road, Stepney Green and Commercial Road, are heavily trafficked, resulting in high noise levels.

Baseline

2.535 The baseline noise survey locations and durations are listed in the following table and identified on Drawing No. 1E0415-C1E00-E01-F-00009:

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium-term (24-hours)</th>
<th>Short-term (3 hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH13</td>
<td>120 Stepney Green</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>TH14</td>
<td>58 Stepney Green</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TH15</td>
<td>Sir John’s Cass’s Secondary School</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>
2.536 At 58 Stepney Green (TH14), the daytime $L_{Aeq,12hr}$ baseline level was 69 dB, with a night-time $L_{Aeq,8hr}$ level of 60 dB; short-term daytime measurement results of 69 dB and 73 dB $L_{Aeq,3hr}$ were obtained at 120 Stepney Green (TH13) and Sir John's Cass's Secondary School (TH15). At 58 Stepney Green, the $L_{A90(21:00-01:30 and 05:30-07:00)}$ background level for the vent shaft assessment was 52 dB. Road traffic noise was the dominant noise source at all the locations.

Impact Assessment – Temporary Impacts

Impacts during Construction

2.537 Temporary impacts from construction activities are illustrated on Drawing No. 1E0315-C1E00-E01-F-00009.

Noise from Surface Activity

2.538 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.539 In the vicinity of the Stepney Green Vent Shaft, Community Housing to the north of the site would be significantly affected by construction noise during the daytime period. This impact is primarily caused by the diaphragm walling and excavation, and by the use of hand tools in the reinforced cage fixing area. The bungalow to the south of the site would also be affected.

2.540 During the evening and night periods, works on the excavation of the turnouts would continue, however no properties are predicted to be affected by this aspect of the work.

Offsite Road Traffic

2.541 The peak periods for construction traffic on the public highway are for two periods, of five and four months respectively. Construction vehicles will only use the highway during the daytime (0700 – 1900). At façades overlooking roads used by construction traffic, the existing hourly $L_{A10}$ during the daytime is predicted to increase by less than 1 dB. There are therefore no significant impacts arising from construction traffic.
Vibration from Surface Construction Activity

2.542 The plant likely to be required at the Stepney Green Worksite has been reviewed to identify sources that may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings, or cause damage to buildings. The construction information provided by Crossrail indicates that a gantry crane will be required. Vibration levels from the gantry crane are not expected to be significant and can be minimised by ensuring that there are no joints in the track.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.543 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds may also be exceeded while the temporary railway is running.

Tunnel Boring Machines

2.544 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.

2.545 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.546 Hoardings 3.6 m high would be provided around the worksites. The principle of best practicable means would be followed in the operation of works on site, including use of silenced compressors and mains electricity where possible. No evening construction work has been proposed for the purposes of assessment, except that essential for any tunnelling or pilling operations. This corresponds to Tier 2 mitigation.
2.547 In this route window, no properties are expected to be eligible for noise insulation due to construction noise. Neither are any properties predicted to be eligible for temporary re-housing, in accordance with the assumed scheme for the provision of NI and TRH during construction; presented in Chapter 5, Volume 1 of this technical report. However, 13 residential properties would be subject to significant residual impacts from construction noise, as identified in Appendix A.

Offsite Road Traffic
2.548 There are no significant residual impacts.

Vibration from Surface Activity
2.549 There are no significant residual impacts.

Vibration and Groundborne Noise from Underground Activity

Construction Trains
2.550 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machines
2.551 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

Impact Assessment – Permanent Impacts

Impacts during Operation
2.552 Permanent impacts from operation of Crossrail are illustrated on Drawing No. E0315-C1E00-E02-F-00009.

Noise from the Surface Railway
2.553 Not applicable to this route window.

Vibration from the Surface Railway
2.554 Not applicable to this route window.

Noise from Road Traffic
2.555 When the Crossrail scheme is operational, it will cause only a small change in the 18-hour traffic flow on roads in this route window. The change in $L_{A10,18hr}$ corresponding to this change in traffic is predicted to be less than 1 dB. There are therefore no significant impacts arising from increases in operational traffic as a result of the scheme.
Noise from Ventilation Shafts

2.556 No residential properties close to the proposed ventilation shaft at Stepney Green are predicted to be subject to significant noise impacts when the ventilation fan is in operation. At the nearest buildings, the Rating Level of the plant in normal operation is predicted to be at least 9 dB below the existing $L_{A90(21:00-01:30 and 05:30-07:00)}$ background noise level (this represents a level 14 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

2.557 It is estimated that the noise levels emitted by a ventilation shaft during maintenance operations would be approximately 20 dB lower than during full flow rate operation. The above operational assessment is based on full flow rate operation. Therefore, no residential properties close to the proposed ventilation shaft are predicted to be subject to significant noise impacts during maintenance operations.

2.558 On the above basis, significant impacts are not deemed to occur for properties close to the proposed ventilation shaft at Stepney Green, and no further mitigation measures are required at that site.

Vibration and Groundborne Noise from the Underground Railway

2.559 If, following detailed numerical modelling of the buildings, 40 dB $L_{A_{max,s}}$ is predicted to be exceeded, there will be protection by the use of special trackform for the piled buildings of the Stepney Green Nursing Home.

2.560 With standard trackform the design aim for groundborne noise is achieved for buildings of standard noise-sensitivity (40 dB $L_{A_{max,s}}$) without deep or piled foundations in all locations, and groundborne noise at the church of St Dunstan and All Saints is not predicted to exceed the target for churches of 35 dB $L_{A_{max,s}}$.

2.561 Piled buildings in the developments in Aston Street and Maroon Street are predicted to receive noise levels below 40 dB $L_{A_{max,s}}$ with standard trackform. Groundborne noise levels are shown on Drawing No: 1E315-C1E00-E03-F-00009.

Mitigation and Residual Impacts during Operation

Noise from the Surface Railway

2.562 Not applicable to this route window.

Vibration from the Surface Railway

2.563 Not applicable to this route window.

Noise from Road Traffic

2.564 There are no significant residual impacts in this route window.

Noise from Ventilation Shafts

2.565 There are no significant residual impacts in this route window.
Vibration and Groundborne Noise from the Underground Railway

2.566 There are no significant residual impacts in this route window.

**Impacts on Sites Granted Planning Permission**

2.567 No extant planning permissions that might be affected by the scheme have been identified in this route window.
## Route window C9: Stepney Green Shafts – Temporary Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
</table>
### Route window C9: Stepney Green Vent Shafts – Permanent Impacts

<table>
<thead>
<tr>
<th>Works &amp; potential impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilation Shafts at Stepney Green – operational noise impacts during operation of tunnel ventilation fans</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
<tr>
<td>Groundborne noise and vibration from the underground railway</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
</tbody>
</table>
Overview of Route Window C10

2.568 The Docklands Light Railway (DLR) runs east-west on a Victorian viaduct through this route window, which lies within LB Tower Hamlets. Crossrail’s twin-bore tunnels will pass beneath Commercial Road before swinging southwards to pass beneath the DLR between Limehouse and Westferry stations. The Lowell Street shaft and surface building are the only permanent works within this route window.

2.569 The area is mainly residential, but with some offices, storage/warehousing, retail and educational buildings. High value residential development at the waterside of Limehouse Basin, which is to the south of the site, contrasts with the run-down, bustling east London character of Commercial Road. Regent’s Canal and Limehouse Cut run north-south from Limehouse Basin. The River Thames is located further to the south.

2.570 Properties close to the busy Commercial Road and the DLR experience relatively high noise levels.

Baseline

2.571 The baseline noise survey locations and durations are listed in the following table and identified on Drawing No. 1E0315-C1E00-E01-F-00010:

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium-term (24-hours)</th>
<th>Short-term (3 hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH24</td>
<td>697 Commercial Road</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>TH25</td>
<td>96 Basin Approach</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TH26</td>
<td>Hertsmere House</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.572 The daytime L_{Aeq,12hr} baseline level measured at 93 Basin Approach (TH25) was 66 dB, falling to a night-time L_{Aeq,8hr} level of 61 dB. The short term L_{Aeq,3hr} level at 697 Commercial Road (TH24) was 80 dB as the location was close to this heavily trafficked road. The noise climate at TH25 was also dominated by road traffic noise although it was affected by noise from the DLR. The L_{A90}(21:00-01:30 and 05:30-07:00) background level for the vent shaft assessment was 53 dB at 93 Basin Approach.

Impact Assessment – Temporary Impacts

Impacts during Construction

2.573 Temporary impacts from construction activities are illustrated on Drawing No. 1E0315-C1E00-E01-F-00010.

Noise from Surface Activity

2.574 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

Construction Sites and Works including Onsite Traffic and Grout Shafts

Lowell Street Vent Shaft

2.575 Significant noise impacts from daytime construction works would affect the flats at Basin Approach and Regents Canal House. It is estimated that approximately 35 properties would experience a significant impact exceeding the daytime construction noise threshold.

2.576 Significant evening/weekend impacts may be experienced at two dwellings at Regents Canal House, for a period of about one year. One of these properties would be eligible for noise insulation.

2.577 Significant night-time impacts would occur throughout this same year period at 5 properties in Commercial Road and 3 in Regents Canal House. The properties at Regents Canal House would be eligible for noise insulation.

Offsite Road Traffic

2.578 Construction vehicles will only use the highway during the daytime (0700 – 1900). At façades overlooking roads used by construction traffic, the existing hourly L_{A10} during the daytime is predicted to increase by less than 1 dB.

Vibration from Surface Construction Activity

2.579 The plant likely to be required to construct the Lowell Street Ventilation Shaft and associated with any tunnelling in the area, has been reviewed to identify sources which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings or damage to buildings.
**Lowell Street Worksite**

2.580 The construction information provided by Crossrail indicates that a vibratory piling rig is required to prepare the caisson for this site and that an excavator with hydraulic breaker is required below ground to assist with works associated with forming openings for the running tunnels in the shaft.

2.581 Vibration levels due to use of the vibratory piling rig and hydraulic breaker have been predicted at the foundations of buildings and listed structures for the worst-case situation where the rig or breaker operates at its closest location to each receptor. Vibration levels at the foundations of buildings and structures closest to the site are predicted to be in the region of 1.5 to 7 mm/s at the Commercial Road Bridge and Commercial Road Viaduct, which are a Grade II listed structures; 0.5 to 2 mm/s at the Mill Place Accumulator Tower and 608 Commercial Road, which are Grade II listed structures; and 0.5 to 1 mm/s at 683-691 Commercial Road, which are Grade II listed buildings.

2.582 The threshold of significance for screening purposes for building damage may be exceeded at the Commercial Road Bridge and Commercial Road Viaduct although, the threshold of significance for damage to listed buildings is likely to be over-conservative when applied to a bridge structure that is statically safe, and, in the case of Commercial Road Viaduct, currently carrying DLR trains.

2.583 Vibratory piling activities may give rise to vibration levels that correspond to a semantic rating of ‘a low probability of adverse comment’ at 608 Commercial Road. Vibration levels are predicted to be below those that correspond to a semantic rating of ‘a low probability of adverse comment’ during the remainder of the works at all receptors. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.

No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

**Vibration and Groundborne Noise from Underground Activity**

*Construction Trains*

2.584 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds may also be exceeded while the temporary railway is running.

*Tunnel Boring Machines*

2.585 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.
2.586 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.587 Hoardings 3.6 m high would be provided around the worksites. It has been assumed that mitigation of noise from concrete deliveries and the operation of the concrete pump would be provided by the use of a temporary building, which would house the concrete lorries during unloading during later phases of the works for both worksites. The compressors would also be located in noise reducing enclosures during these construction phases. No evening construction work has been programmed except that essential for any tunnelling operations. This corresponds to Tier 2 mitigation.

2.588 In this route window, an estimated 12 properties are expected to be eligible for noise insulation due to construction noise, with one of those properties eligible for temporary re-housing. With this mitigation, an estimated 23 residential properties would be subject to significant residual impacts from construction noise with the implementation of these mitigation measures.

Offsite Road Traffic

2.589 There are no significant residual impacts.
Vibration from Surface Activity

2.590 Vibration mitigation will be required during construction works at the Lowell Street site. Detailed assessment should be undertaken prior to commencement of works to inform selection of specific items of plant and working methods. An appropriate continuous, real-time vibration-monitoring regime should be adopted during construction works to allow monitoring of levels and cessation of activity should the levels exceed relevant limits. For the listed buildings or structures, condition surveys should be undertaken to define appropriate vibration limits.

2.591 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential of building damage at their location.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.592 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machines

2.593 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

Impact Assessment – Permanent Impacts

Impacts during Operation

2.594 Permanent impacts from operation of Crossrail are illustrated on Drawing No. E0315-C1E00-E01-F-10010.

Noise from the Surface Railway

2.595 Not applicable to this route window.

Vibration from the Surface Railway

2.596 Not applicable to this route window.

Noise from Road Traffic

2.597 There is no change predicted in baseline traffic flows in the route window as a result of Crossrail, therefore not applicable in this route window.
Noise from Vent Shafts

Lowell Street Vent Shaft

2.598 No residential properties close to the proposed Lowell Street ventilation shaft are predicted to be subject to significant noise impacts when the ventilation fan is in operation. At the nearest buildings, the Rating Level of the plant in normal operation is predicted to be at least 11 dB below the existing $L_{A90}$ (21:00-01:30 and 05:30-07:00) background noise level (this represents a level 16 dB below that set within the adopted criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

2.599 It is estimated that the noise levels emitted by a ventilation shaft during maintenance operations would be approximately 20 dB lower than during full flow rate operation. The above operational assessment is based on full flow rate operation. Therefore, no residential properties close to the proposed ventilation shaft are predicted to be subject to significant noise impacts during maintenance operations.

2.600 On the above basis, significant impacts are not deemed to occur for properties close to the proposed ventilation shafts at Lowell Street, and no further mitigation measures are required at those sites.

Vibration and Groundborne Noise from the Underground Railway

2.601 With standard trackform the design aim for groundborne noise is achieved for buildings of standard noise-sensitivity (40 dB $L_{Amax,s}$) without deep or piled foundations in all locations.

2.602 There are several piled buildings with residential use, the Stephen Hawking and Cyril Jackson Schools and a church. In all cases the relevant noise targets are predicted to be achieved with standard trackform. Groundborne noise levels are shown on Drawing No: 1E315-C1E00-E03-F-00010.

Mitigation and Residual Impacts During Operation

Noise from the Surface Railway

2.603 Not applicable to this route window.

Vibration from the Surface Railway

2.604 Not applicable to this route window.

Noise from Road Traffic

2.605 Not applicable to this route window

Noise from Ventilation Shafts

2.606 There are no significant residual impacts in this route window.
Vibration and Groundborne Noise from the Underground Railway

2.607 There are no significant residual impacts in this route window.

**Impacts on Sites Granted Planning Permission**

2.608 No extant planning permissions that might be affected by the scheme have been identified in this route window.
## Route window C10: Lowell Street Shaft – Temporary Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Significance</th>
<th>Assumed Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant</td>
<td>BPM to reduce noise, 3.6 m high hoarding to screen noise, enclosure of static plant associated with 24-hour working. Mitigation = Tier 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
</tr>
<tr>
<td>Significant An estimated 12 properties would be eligible for noise insulation, of these, 1 dwelling may be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 23 residential properties. Evening/weekend noise impacts at 0 residential property. Night-time noise impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts</td>
</tr>
</tbody>
</table>

| Significance |
|--------------|-------------|
| Significant  |             |
## Route window C10: Lowell Street Vent Shaft – Permanent Impacts

<table>
<thead>
<tr>
<th>Works &amp; potential impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilation Shaft at Lowell Street – operational noise impacts during operation of tunnel ventilation fans</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
<tr>
<td>Groundborne noise and vibration from the underground railway</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
</tbody>
</table>
ROUTE WINDOW C11 – ISLE OF DOGS STATION

Overview of Route Window C11

2.609 Crossrail’s twin-bore tunnels will pass under the northern part of the Isle of Dogs between Westferry Road in the west and the Blackwall Tunnel in the east with the rails at a depth of about 30 metres below street level. East of Westferry Road, the alignment runs under West India Docks, North Dock (roughly parallel with the Docklands Light Railway (DLR)) and Aspen Way. The main permanent features within this route window comprise the Hertsmere Road emergency intervention shaft and the Isle of Dogs station. The main temporary features will be the North Quay and Billingsgate worksites, with the Isle of Dogs station acting as tunnel worksite to for the drive to Stepney Green and the receipt of the TBMs from Limmo.

2.610 This route window lies within LB Tower Hamlets and is centred on Canary Wharf, a major commercial and retail development area and part of the Docklands. The predominant land uses are offices and retail, with some outdoor recreation and storage/warehousing, surrounded by, or adjacent to, West India Dock. The River Thames lies to the south of the alignment beyond the docks, with Billingsgate Market being located towards the east end of the North Dock.

2.611 The permanent infrastructure will lie in a busy transport corridor comprising the DLR and Aspen Way, which is heavily trafficked. This results in high levels of railway and road traffic noise.

Baseline

2.612 The baseline noise survey locations and durations are listed in the following table and identified on Drawing No. 1E0315-C1E00-E01-F-00011:
2.613 It has not been possible to carry out the survey at West India Quay (TH27) due to continuing construction work at the new apartments at No.1 West India Quay. Baseline levels in this area have been estimated based on measurements at other locations.

2.614 The daytime $L_{\text{Aeq,12hr}}$ baseline level measured at Boardwalk Place (TH28) was 72 dB, falling to a night-time $L_{\text{Aeq,8hr}}$ level of 70 dB. The ‘shoulder position’ $L_{\text{Aeq,6hr}}$ background level for the vent shaft assessment was 68 dB.

2.615 Road traffic noise was the dominant noise source at location TH28.

### Impact Assessment – Temporary Impacts

#### Impacts during Construction

2.616 Temporary impacts from construction activities are illustrated on Drawing No. 1E0315-C1E00-E01-F-00011.

#### Noise from Surface Activity

2.617 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

#### Construction Sites and Works including Onsite Traffic and Grout Shafts

2.618 Without additional mitigation, works associated with the Hertsmere Road EIP Shaft are predicted to result in noise impact at the West façade of Port East Apartments and the “Museum in Docklands”. Elevated noise levels are also predicted to impact upon Riverside House; a Salvation Army hostel.

2.619 No noise-sensitive properties are predicted to be significantly affected during day, evening, weekend or night-time periods during works associated with the Isle of Dogs Station.
Offsite Road Traffic

2.620 The peak periods for construction traffic on the public highway occur over two periods of five and six months respectively. Construction vehicles will only use the highway during the daytime (0700 – 1900). At façades overlooking roads used by construction traffic, the existing hourly $L_{A10}$ during the daytime is predicted to increase by less than 1 dB. There are therefore no significant impacts arising from construction traffic.

Vibration from Surface Activity

Hertsmere Road Worksite

2.621 For this worksite, the construction information provided by Crossrail indicates that CFA, and oscillatory bored, piling rigs are required to construct the basement. Vibration levels from CFA and oscillatory bored piling are predicted not to be significant at the nearest potentially sensitive receptors. The threshold of significance for building damage is predicted not to be exceeded at the nearest sensitive receptors and activities are predicted to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’.

2.622 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

North Quay Worksite

2.623 The plant likely to be required at this worksite has been reviewed and has not identified any sources that may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings or damage to buildings. No vibration impacts from surface activity at this worksite are predicted.

Billingsgate Worksite

2.624 The plant likely to be required at this worksite has been reviewed and has not identified any sources that may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings or damage to buildings. No vibration impacts from surface activity at this worksite are predicted.

Isle of Dogs Box Worksite

2.625 The Isle of Dogs Box Worksite is located within the dock area to the south of North Quay Worksite and to the west of Billingsgate Worksite, it is almost entirely constrained to the area of the North Dock east of the Docklands Light Railway bridge. The Box is 38m wide and overall length is 475m. The cofferdam enclosing this site extends 13m beyond the perimeter of the box and will be used as a haul road as well as siting plant. Although the construction activity here is to be served by North Quay and Billingsgate Worksites, the works within the Box Worksite is distinct and forms the main site for construction and plant activity in this route window.

2.626 The plant likely to be required at this worksite has been reviewed to identify sources that may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings or damage to buildings.
2.627 The construction information provided by Crossrail indicates that construction involves one or more vibratory piling rigs, a vibratory roller and oscillatory bored piling. Vibration levels due to use of the vibratory roller have been predicted at the foundations of buildings for the worst-case situation where the plant operates at its closest potential location to each receptor. Vibration levels at the foundations of buildings and structures closest to the site are predicted to be in the region of 0.5 to 1.5 mm/s at the Canary Wharf office buildings and at Billingsgate Market; and less than 0.5 mm/s at Warehouses Nos. 1 and 2, which are Grade I listed buildings, and Preston's Road Hydraulic Accumulator, which is a Grade II listed structure. Vibration levels from oscillatory bored piling are predicted not to be significant at the nearest potentially sensitive receptors.

2.628 Vibration levels due to use of the vibratory piling rig have been predicted at the foundations of buildings for the worst-case situation where the plant operates at its closest potential location to each receptor. Vibration levels at the foundations of buildings and structures closest to the site are predicted to be in the region of 0.5 to 3 mm/s at the Canary Wharf office buildings and at Billingsgate Market; and less than 0.5 mm/s at Warehouses Nos. 1 and 2, which are Grade I listed buildings, and Preston's Road Hydraulic Accumulator, which is a Grade II listed structure.

2.629 The threshold of significance for building damage is predicted not to be exceeded at any receptor during all works at this site.

2.630 Construction activities may give rise to vibration levels that correspond to a semantic rating of ‘a low probability of adverse comment’ in the Canary Wharf office buildings. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.

2.631 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

Bellmouth Passage Conveyor Worksite

2.632 The plant likely to be required at this worksite has been reviewed and has not identified any sources that may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings or damage to buildings. No vibration impacts from surface activity at this worksite are predicted.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.633 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds may also be exceeded while the temporary railway is running.
Tunnel Boring Machines

2.634 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.

2.635 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic and Grout Shafts

Hertsmere Road Shaft

2.636 For works at the Hertsmere Road site, standard 2.4 m high hoardings would be provided around the worksites. This corresponds to Tier 1 mitigation.

2.637 With this mitigation, no dwellings are expected to be eligible for noise insulation or temporary re-housing. Significant residual impacts from construction noise in this area are predicted to occur at the west façade of the Port East Apartments. Two non-residential sensitive properties are also predicted to receive a significant residual impacted by noise; these are the Museum in Docklands and Riverside House, a Salvation Army hostel.

Isle of Dogs Station

2.638 For works at the Isle of Dogs Station, standard 2.4 m high hoardings would be provided around the worksites as appropriate. This corresponds to Tier 1 mitigation.

2.639 No properties are expected to be eligible for noise insulation, temporary re-housing or subject to significant residual impacts from construction noise in this Route Window.

Offsite Road Traffic

2.640 There are no significant residual impacts.

Vibration from Surface Activity

2.641 No vibration mitigation is required at the worksites in this route window to mitigate potential impacts on structures.
2.642 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential of building damage at their location.

Vibration and Groundborne Noise from Underground Activity

Construction Trains
2.643 Mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machines
2.644 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

Impact Assessment – Permanent Impacts
2.645 Permanent impacts from operation of Crossrail are illustrated on Drawing No. E0315-C1E00-E01-F-10011.

Noise from the Surface Railway
2.646 Not applicable to this route window.

Vibration from the Surface Railway
2.647 Not applicable to this route window.

Noise from Road Traffic
2.648 There is no change predicted in baseline traffic flows in the route window as a result of Crossrail, therefore not applicable in this route window.

Noise from Ventilation Shafts

Hertsmere Road Shaft
2.649 The primary function of the Hertsmere Road shaft is intervention for emergency services and maintenance personnel to gain access to the running tunnels. There will be no tunnel ventilation from this shaft, hence, no ventilation fans and, therefore, no potential noise impact.
Isle of Dogs ventilation shafts

2.650 No residential properties close to the proposed ventilation shaft above the western Isle of Dogs ventilation shaft are predicted to be subject to significant noise impacts when the ventilation fan is in operation. At the nearest buildings, although not a residential property, the Rating Level of the plant in normal operation is predicted to be at least 17 dB below the existing L_{A90(21:00-01:30 and 05:30-07:00)} background noise level (this represents a level 22 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

2.651 No residential properties close to the proposed ventilation shaft above the eastern Isle of Dogs ventilation shaft are predicted to be subject to significant noise impacts when the ventilation fan is in operation. At the nearest buildings, although not residential property, the Rating Level of the plant in normal operation is predicted to be at least 23 dB below the existing L_{A90(21:00-01:30 and 05:30-07:00)} background noise level (this represents a level 28 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

2.652 It is estimated that the noise levels emitted by a ventilation shaft during maintenance operations would be approximately 20 dB lower than during full flow rate operation. The above operational assessment is based on full flow rate operation. Therefore, no residential properties close to the proposed ventilation shafts are predicted to be subject to significant noise impacts during maintenance operations.

2.653 On the above basis, significant impacts are not deemed to occur, and no further mitigation measures are required.

Vibration and Groundborne Noise from the Underground Railway

2.654 With standard trackform the design aim for groundborne noise is achieved for buildings of standard noise-sensitivity (40 dB L_{Amax,s}) without deep or piled foundations in all locations.

2.655 The buildings are mainly commercial, with residential development in Gaselee Street. In all cases the relevant noise targets are predicted to be achieved with standard trackform.

Mitigation and Residual Impacts during Operation

Noise from the Surface Railway

2.656 Not applicable to this route window.

Vibration from the Surface Railway

2.657 Not applicable to this route window.
Noise from Road Traffic

2.658 Not applicable to this route window.

Noise from Ventilation Shafts

2.659 There are no significant residual impacts in this route window.

Vibration and Groundborne Noise from the Underground Railway

2.660 There are no significant residual impacts in this route window.

Impacts on Sites Granted Planning Permission

2.661 A number of planning applications have been identified within route window they include, a change of use from Council offices to educational use at 117 Poplar High Street; construction of a 5/6 storey extension teaching accommodation block at 112 Poplar High Street; construction of a 2-storey building for A1, possible partial D1 use in Churchill Place; an amendment for outline redevelopment of buildings comprising up to 122,000 m2 commercial development, 600 dwellings and 78,000 m2 at Canary Riverside, Westferry Road; amendments to a previous application relating to outline redevelopment plans consisting of commercial and residential use in Canary Riverside, Westferry Road; the permanent mooring of a cruise liner at Marsh Wall, at the South Quay on West India Dock. The liner will incorporate a hotel, cinema, business centre, restaurant, health club and retail units. Developers have also submitted planning permission for a time extension amendment on a previous planning application relating to a 592-bedroom hotel with conference facilities, to include office and retail units. It is predicted that the residential or sensitive aspects of these developments would not be subject to significant noise or vibration impacts, as a result of the construction or operation of Crossrail, due to the distance between the locations and the worksites.

2.662 Planning permission for the demolition of an existing hostel and construction of two blocks, which will provide 40 'direct access' bedroom units and 20 one bedroom 'resettlement' hostel flats, has been submitted for Riverside House, off Garford Street. Due to the close proximity of the Hertsmere Road Worksite, it is predicted that significant construction noise impacts will be experienced at the Hostel.
<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daytime noise impacts at 2 residential properties.</td>
<td>Significant</td>
<td>Standard Mitigation = Tier 1</td>
<td>An estimated 0 properties would be eligible for noise insulation. 0 dwelling would be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 2 residential properties. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: Museum of Docklands Medical facilities: No noise impacts Community facilities: Riverside House</td>
</tr>
<tr>
<td>Construction of Hertsmere Road shaft</td>
<td>Evening/weekend noise impacts for 0 residential properties. Night-time noise impacts for 0 residential properties. Places of worship: No noise impacts. Educational facilities: Museum of Docklands Medical facilities: No noise impacts Community facilities: Riverside House</td>
<td>None</td>
<td>Standard Mitigation = Tier 1</td>
<td>None</td>
</tr>
<tr>
<td>Construction of Isle of Dogs station and vent shaft</td>
<td>None</td>
<td>Not significant</td>
<td>Standard Mitigation = Tier 1</td>
<td>None</td>
</tr>
<tr>
<td>Works &amp; potential impact</td>
<td>Significance</td>
<td>Assumed Mitigation</td>
<td>Residual Impact</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------------</td>
<td>--------------------</td>
<td>--------------------</td>
<td>-----------------------</td>
<td></td>
</tr>
<tr>
<td>Ventilation Shaft at Isle of Dogs Western ticket hall – operational noise impacts during operation of tunnel ventilation fans</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Groundborne noise and vibration from the underground railway</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>
ROUTE WINDOW C12 – MILE END PARK & ELEANOR STREET SHAFTS

Overview of Route Window C12

2.663 Crossrail's twin-bore tunnels will broadly follow beneath the alignment of the London, Tilbury and Southend (LT&S) Line in this route window, with the rails at an approximate depth of between 23 metres and 28 metres from street level. Other permanent works within this route window will be the Mile End Park shaft and Eleanor Street shaft.

2.664 This route window lies within LB Tower Hamlets. The main land uses are residential, with many residential Victorian terraces. However, there are significant areas of open green space, including Mile End Park and Tower Hamlets Cemetery Park. Bow Road Underground station and Bow Church DLR station are to the north, with the Royal London Hospital further to the west, all on the A11 Bow Road. There are also a number of schools in the area.

2.665 Properties close to the busy Bow Road experience relatively high noise levels.

Baseline

2.666 The baseline noise survey locations and durations are listed in the following table and identified on Drawing No. 1E0315-C1E00-E01-F-00012:

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1-week)</th>
<th>Medium term (24-hours)</th>
<th>Short-Term (3-hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH16</td>
<td>3 Jamuna Close</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TH17</td>
<td>Elmslie Point</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>TH18</td>
<td>Wilcox House</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TH19</td>
<td>118 Belton Way</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>TH20</td>
<td>13 Fairfoot Road</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>TH21</td>
<td>38 Arnold Road</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.667 At Jamuna Close (TH16), opposite the proposed vent shaft location at Mile End Park, the $L_{A90(21:00-01:30 \text{ and } 05:30-07:00)}$ background level for the vent shaft assessment was 51 dB. The noise climate at this location was dominated by railway noise, although the background level is likely to be controlled by more distant sources, principally road traffic noise.

2.668 Noise levels at Wilcox House (TH18) are dominated by the existing railway line. The daytime $L_{Aeq,12hr}$ baseline level was 66 dB, with a night-time $L_{Aeq,8hr}$ level of 56 dB and night-time $L_{Amax,F}$ level of up to 87 dB. A short term daytime measurement result of 63 dB $L_{Aeq,3hr}$ was obtained at Elmslie Point (TH17).

2.669 Close to the proposed Eleanor Street vent shaft site, 13 Fairfoot Road (TH20) had a measured daytime $L_{Aeq,12hr}$ baseline level of 63 dB, with a night-time $L_{Aeq,8hr}$ level of 55 dB. Noise levels from the railway to the rear of 38 Arnold Road (TH21) were $L_{Aeq,12hr}$ 71 dB, with a night-time $L_{Aeq,8hr}$ level of 58 dB. The $L_{A90(21:00-01:30 \text{ and } 05:30-07:00)}$ background level for the vent shaft assessment was 48 dB at 13 Fairfoot Road.

Impact Assessment – Temporary Impacts

Impacts during Construction

2.670 Temporary impacts from construction activities are illustrated on Drawing No. 1E0315-C1E00-E01-F-00012.

Noise from Surface Activity

2.671 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

Construction Sites and Works including Onsite Traffic and Grout Shafts

Eleanor Street Vent Shaft

2.672 In the vicinity of the Eleanor Street Shaft, one area of existing housing and three areas proposed or currently under development for housing would be significantly affected by construction noise.

2.673 The end of the terrace 46/47 Navenby Walk, off Rounton Road, would be significantly affected by day and night-time construction activities during a three month period. Three residential blocks proposed or currently under development would also receive significant impacts during the day.

2.674 No impacts are predicted at any receptors during the evening or weekend periods.
**Mile End Park Vent Shaft**

2.675 Close to Mile End construction site, a number of properties are predicted to receive a significant noise impact from construction activities. Residential properties which may experience significant noise levels during the daytime period include, Wager Street (156-182 and 141-187), Elmslie Point, and properties on Timothy Road. The duration of the impact will vary depending upon the exact location of the property.

2.676 Several properties on Wager Street may also experience significant evening noise disturbance from the construction site over a period of approximately five months, and one of these properties might be eligible for noise insulation.

2.677 In addition, properties on Wager Street, Elmslie Point and Timothy Road will also experience night-time noise levels in excess of the threshold. Some of these properties would be affected for a period of 10 months, with some affected for a further five months later in the works. All the properties that are predicted to experience significant impacts would also be expected to be eligible for noise insulation, and one of them might also be eligible for temporary re-housing. These properties are primarily affected by the 24-hour above-ground works associated with the construction of the vent shafts and the construction intervention. However, other day-time works are also predicted to cause significant noise impacts.

**Offsite Road Traffic**

2.678 The peak period for construction traffic on the public highway is for two months. Construction vehicles will only use the highway during the daytime (0700 – 1900). At façades overlooking roads used by construction traffic, the existing hourly LA10 during the daytime is predicted to increase by less than 1 dB. There are therefore no significant impacts arising from construction traffic.

**Vibration from Surface Activity**

2.679 The plant likely to be required to demolish the existing buildings and structures and construct the Mile End Park and Eleanor Street Shafts, and associated with any tunnelling in the area, has been reviewed to identify sources which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings or damage to buildings.

**Mile End Park Worksite**

2.680 The construction information provided by Crossrail indicates that a tracked excavator with a hydraulic breaker is required for demolition and site clearance at ground level, and to construct openings in the tunnels and chambers below ground level. It is likely that vibration levels will be higher from use of the breaker at ground level than at below ground level, due to the increased mass of soil around below ground activities. In addition, a vibratory roller and oscillatory bored piling rig are required. Vibration levels from oscillatory bored piling are predicted not be significant at the nearest potentially sensitive receptors.
2.681 Vibration levels due to use of the hydraulic breaker have been predicted at the foundations of buildings for the worst-case situation where the breaker operates at ground level at the boundary of the site closest to each receptor. Vibration levels at the foundations of buildings closest to the site are predicted to be in the region of 0.5 to 2.5 mm/s at the south end of 155 to 182 Wager Street; 0.5 to 1 mm/s at 1 to 10 Timothy Road; and less than 1 mm/s at King Georges Field, the East London Stadium, and at Elmslie Point, which is a Grade II* listed building.

2.682 Vibration levels due to use of the vibratory roller have been predicted at the foundations of buildings for the worst-case situation where the roller operates at ground level at the boundary of the site closest to each receptor. Vibration levels at the foundations of buildings closest to the site are predicted to be in the region of 0.5 to 1.5 mm/s at the south end of 155 to 182 Wager Street; and less than 1 mm/s at 1 to 10 Timothy Road, at King Georges Field, the East London Stadium, and at Elmslie Point, which is a Grade II* listed building.

2.683 The threshold of significance for building damage is predicted not to be exceeded at any receptor during any works at this site.

2.684 Demolition and construction activities are predicted to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’ at receptors during all works. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.

2.685 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

Eleanor Street Worksite

2.686 The construction information provided by Crossrail indicates that a tracked excavator with a hydraulic breaker is required for demolition and site clearance, and that a CFA piling rig will also be required. Vibration levels from CFA piling are predicted not to be significant at the nearest potentially sensitive receptors.

2.687 Vibration levels due to use of the hydraulic breaker have been predicted at the foundations of buildings for the worst-case situation where the breaker operates at ground level at the boundary of the site closest to each receptor. Vibration levels at the foundations of buildings closest to the site are predicted to be in the region of 0.5 to 3 mm/s at the works building at the north of Bow Triangle; 0.5 to 1.5 mm/s at the works building at the east of Bow Triangle and at the southeast building of the new residential development at Rounton Road; and less than 1 mm/s at the eastern end of Arnold Road, which are Grade II listed buildings.

2.688 The threshold of significance for building damage is predicted not to be exceeded at any receptor during any works at this site.

2.689 Demolition activities are predicted to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’ at receptors during all works. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.
2.690 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.691 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds may also be exceeded while the temporary railway is running.

Tunnel Boring Machines

2.692 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.

2.693 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

Noise and Vibration Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.694 Hoardings 3.6 m high would be provided around the worksites, apart for locations where the surrounding railway embankments already provide comparable screening. It has been assumed that mitigation of noise from concrete deliveries and the operation of the concrete pump would be provided by the use of a temporary building, which would house the concrete lorries during unloading during later phases of works. The compressors would also be located in noise reducing enclosures during these construction phases. No evening construction work has been programmed except that essential for any tunnelling operations. This corresponds to Tier 2 mitigation.

Eleanor Street Vent Shaft

2.695 In this route window, an estimated 3 properties are expected to be eligible for noise insulation due to construction noise. With the implementation of these mitigation measures no properties would be subject to a significant residual construction noise impact.
**Mile End Vent Shaft**

2.696 In this route window, an estimated 34 properties are expected to be eligible for noise insulation against construction noise of which one is expected to be eligible for temporary rehousing. With the implementation of these mitigation measures, there would be no significant impacts.

**Offsite Road Traffic**

2.697 There are no significant residual impacts.

Vibration from Surface Activity

2.698 No vibration mitigation measures are required at worksites in this route.

Vibration and Underground Noise from Underground Activity

**Construction Trains**

2.699 Mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

**Tunnel Boring Machines**

2.700 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

**Impact Assessment – Permanent Impacts**

**Impacts during Operation**

2.701 Permanent impacts from operation of Crossrail are illustrated on Drawing No. E0315-C1E00-E02-F-00012.

Noise from the Surface Railway

2.702 Not applicable to this route window.

Vibration from the Surface Railway

2.703 Not applicable to this route window.

Noise from Road Traffic

2.704 There is no change predicted in baseline traffic flows in the route window as a result of Crossrail, therefore not applicable in this route window.
Noise from Ventilation Shafts

**Eleanor Street Vent Shaft**

2.705 No residential properties close to the proposed Eleanor Street ventilation shaft are predicted to be subject to significant noise impacts when the ventilation fan is in operation. At the nearest buildings, the Rating Level of the plant in normal operation is predicted to be no greater than the existing $L_{A90}(21:00-01:30 \text{ and } 05:30-07:00)$ background noise level (this represents a level 5 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

**Mile End Park Vent Shaft**

2.706 No residential properties close to the proposed Mile End Park ventilation shaft are predicted to be subject to significant noise impacts when the ventilation fan is in operation. At the nearest buildings, the Rating Level of the plant in normal operation is predicted to be at least 16 dB below the existing $L_{A90}(21:00-01:30 \text{ and } 05:30-07:00)$ background noise level (this represents a level 21 dB below the criteria at which impact is deemed to occur), assessed in accordance with BS 4142:1997.

2.707 It is estimated that the noise levels emitted by a ventilation shaft during maintenance operations would be approximately 20 dB lower than during full flow rate operation. The above operational assessment is based on full flow rate operation. Therefore, no residential properties close to the proposed ventilation shafts are predicted to be subject to significant noise impacts during maintenance operations.

2.708 On the above basis, significant impacts are not deemed to occur, and no further mitigation measures are required.

Vibration and Groundborne Noise from the Underground Railway

2.709 With standard trackform the design aim for groundborne noise is achieved for buildings of standard noise-sensitivity (40 dB $L_{A_{max.s}}$) without deep or piled foundations in all locations.

2.710 There is residential development in the Ackroyd Drive area, foundation details of which are unknown.

2.711 If, following detailed study of the building foundations, 40 dB $L_{A_{max.s}}$ is predicted to be exceeded, there will be protection by the use of special trackform. Groundborne noise levels are shown on Drawing No: 1E315-C1E00-E03-F-00012.

Mitigation and Residual Impacts during Operation

Noise from the Surface Railway

2.712 Not applicable to this route window.

Vibration from the Surface Railway

2.713 Not applicable to this route window.
Noise from Road Traffic

2.714 Not applicable to this route window

Noise from Ventilation Shafts

2.715 There are no significant residual impacts in this route window.

Vibration and Groundborne Noise from the Underground Railway

2.716 There are no significant residual impacts in this route window.

Impacts on Sites Granted Planning Permission

2.717 At Burdett Road, at the southern end of Mile End, a development to provide new sports facilities, including a leisure centre is planned. This is close to the Mile End Park Shaft Worksite. Significant construction noise impacts may be experienced at the new sports facilities during the construction phase of this ventilation and intervention shaft.

2.718 A large multi-use development has been proposed at a site, on the southwest junction of Arnold Road. The planning application will involve the demolition of light industrial structures and redevelopment of the site to create a bungalow, 18 houses, 34 flats and a residential home with 20 bed-sit units for vulnerable youths. The development lies in the area of the Eleanor Street Worksite but would appear to be sufficiently distant for any impacts to arise during construction.
## Route window C12: Eleanor Street Vent Shaft & Mile End Park Vent Shaft Construction – Temporary Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
</table>
### Mile End Park: Construction of basement structure, shaft and tunnels

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Level</th>
<th>Mitigation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daytime noise impacts at 34 residential properties.</td>
<td>Significant</td>
<td>BPM to reduce noise, 3.6 m high hoarding to screen noise, enclosure of static plant associated with 24-hour working. Mitigation = Tier 2</td>
<td>An estimated 34 properties would be eligible for noise insulation of which 1 property is expected to be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 0 residential properties. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts for 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts Public open spaces: No noise impacts</td>
</tr>
<tr>
<td>Evening/weekend noise impacts at 4 residential properties.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Night-time noise impacts for 34 residential properties.</td>
<td></td>
<td></td>
<td>Not significant</td>
</tr>
<tr>
<td>Places of worship: No noise impacts.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational facilities: No noise impacts.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical facilities: No noise impacts.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public open spaces: No noise impacts</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Not significant
### Route window C12: Eleanor Street Vent Shaft & Mile End Park Vent Shaft – Permanent Impacts

<table>
<thead>
<tr>
<th>Works &amp; potential impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilation Shafts at Eleanor Street – operational noise impacts during operation of tunnel ventilation fans</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventilation Shafts at Mile End Park – operational noise impacts during operation of tunnel ventilation fans</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groundborne noise and vibration from the underground railway</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Overview of Route Window C13

2.719 Crossrail's twin-bore tunnels will pass between the A11, Bow Road and under the River Lea at a depth of about 17 metres from street level, before emerging from the ground near Pudding Mill Lane. Other elements of the scheme in this route window include a replacement Docklands Light Railway (DLR) station and some realignment of existing railway. North of Bow Road, the alignment runs roughly parallel with the DLR corridor towards Pudding Mill Lane station. From Pudding Mill Lane station the alignment shares the existing surface railway corridor to the east. There are substantial enabling works including sewer diversions.

2.720 The main temporary features will be the Bow Midland Yard worksite to the north of the alignment and the Pudding Mill Lane worksite to the south.

2.721 Between Bow Road and the River Lea, Crossrail lies within LB Tower Hamlets. To the east of the River Lea, Crossrail lies within LB Newham. This route window covers a highly built-up residential area in its western part, while the remainder consists of industrial areas, extensive railway lands and the north-south corridors of a number of rivers including the River Lea, the City Mill River, the Waterworks River and the Bow Back River. The DLR and Great Eastern Main Line (GEML) run east-west through the route window. The A12 Blackwall Tunnel Approach Road is to the west with the A11 Bow Road and A118 High Street to the south.

2.722 The permanent infrastructure lies in a busy transport corridor. This results in high levels of railway and road traffic noise.

Baseline

2.723 The baseline noise survey location and duration is listed in the following table and identified on Drawing No. 1E0315-C1E00-E01-F-00013:
2.724 A short-term daytime measurement result of 77 dB $L_{Aeq,3hr}$ was obtained at 3 Baldock Street (TH30). The noise climate at this location was dominated by traffic on the Blackwall Tunnel Approach Road.

**Impact Assessment – Temporary Impacts**

**Impacts during Construction**

2.725 Temporary impacts from construction activities are illustrated on Drawing No. E0315-C1E00-E01-F-00013.

**Noise from Surface Activity**

2.726 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

**Construction Sites and Works including Onsite Traffic and Grout Shafts**

2.727 The Pudding Mill Lane area is predominantly industrial/commercial. The nearest noise-sensitive receptors are in Baldock Street, although these are to the west of, and overlooking, the very heavily trafficked Blackwall Tunnel Approach road. As a result no significant noise impacts are predicted from construction activity in this area.

**Utilities Worksites - Diversion of Hackney to Abbey Mills and Wick Lane Sewers at Pudding Mill Lane**

2.728 These works will occupy seven locations: five in this route window and two in route window C13a, described subsequently.

2.729 In this route window, the works involve three shafts, of which two are required for the insertion or recovery of a TBM; the other shaft is for access during and after the works. The fourth location is to provide access to the fifth working location where a Head Manhole will be provided.

2.730 Site A is located between Wrexham Road and the Blackwall tunnel. A reception shaft for the TBM and access to connect to the existing sewers will be constructed over a period of 16 months. Most of the working will be during normal daytime hours, although pumps for dewatering will operate continuously. However, three short periods of night time working will occur; at least two of these will be for periods of not more than a week at a time.
2.731 Site B is located in the Heron Industrial Estate. A shaft will be constructed from which the TBM will drive two tunnels: one short section south-west to Site A, the other approximately west toward Site C. The work will take 8 months and will require 24-hour working during the driving of the tunnel but excavated material will only be removed from site during normal working hours.

2.732 Site C is located at Pudding Mill Lane in an industrial/commercial area. A shaft will be constructed here from which the TBM would be recovered after driving the tunnels from Site B (see below). Works at this site would last 5 months. Construction work is confined to normal hours but pumps will run continuously to dewater the excavation.

2.733 Site F is off the Blackwall Tunnel Northern Approach, where access will be created for the Head Manhole at Site G. Works at this site would occur for 6 months. Construction work is confined to normal hours but pumps will run continuously to dewater the excavation.

2.734 Site G is on the Blackwall Tunnel Northern Approach, where a Head Manhole will be constructed. Works at this site would last for 1 month. Continuous working will be required but all the works are below ground.

2.735 The distances from the sites within which significant impacts could occur are shown in the table below. These distances are on the basis of no on-site mitigation, since it is assumed that standard hoardings at 2.4 m high do not cut the line of sight for 4 m high receptors. Baseline noise levels obtained from monitoring and the distances to the nearest dwellings are also shown.

<table>
<thead>
<tr>
<th>Site Use</th>
<th>Baseline Location</th>
<th>Day</th>
<th>Eve</th>
<th>Night</th>
<th>Nearest houses (m)</th>
<th>Potential Impact Zone</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>AW/00 200-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A TBM receptor shaft</td>
<td>TH30 Criteria</td>
<td>77.3</td>
<td>3</td>
<td>60</td>
<td>13</td>
<td>36</td>
<td>60</td>
</tr>
<tr>
<td>B TBM Drive shaft</td>
<td>TH30 Criteria</td>
<td>77.3</td>
<td>3</td>
<td>73</td>
<td>148</td>
<td>36</td>
<td>44</td>
</tr>
<tr>
<td>C TBM receptor shaft</td>
<td>Precautionary – likely to be higher Criteria</td>
<td>65</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F Access for Head Manhole</td>
<td>TH30 Criteria</td>
<td>77.3</td>
<td>3</td>
<td>73</td>
<td>11</td>
<td>36</td>
<td>22</td>
</tr>
<tr>
<td>G Head manhole TBM receptor shaft</td>
<td>TH30 Criteria</td>
<td>77.3</td>
<td>3</td>
<td>73</td>
<td>47</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

Notes:
1. Façade level above criterion for any duration assuming mitigation of 0 dB on-site and unobstructed view of site.
2. Assumed to be approx 10 dB below daytime value since main source is road traffic.
Offsite Road Traffic

2.736 The peak period for construction traffic on the public highway is for a period of eight months. Construction vehicles will only use the highway during the daytime (0700 – 1900). At façades overlooking roads used by construction traffic, the existing hourly $L_{A10}$ during the daytime is predicted to increase by less than 1 dB. There are therefore no significant impacts arising from construction traffic.

Vibration from Surface Activity

Pudding Mill Lane Worksite

2.737 The plant likely to be required at the Pudding Mill Lane Worksite and associated with the construction of the main running tunnels to Whitechapel has been reviewed to identify sources that may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings or damage to buildings.

2.738 For this worksite, the construction information provided by Crossrail indicates that demolition of existing industrial buildings and DLR structures will include use of a tracked excavator with hydraulic breaker, that vibratory piling is required for the construction of the west side cofferdam, and a vibratory roller will be used on the site. Oscillatory bored piling will be required during construction. Vibration levels due to oscillatory bored piling are not expected to be significant.

2.739 Demolition of the existing DLR deck and abutments will require vibration mitigation to ensure that damage does not occur to the railway structures that are not intended for demolition, which may be adjacent, attached, or contiguous.

2.740 Vibration levels due to use of the hydraulic breaker have been predicted at the foundations of nearby industrial buildings for the worst-case situation where the breaker operates at ground level at the closest potential location to each receptor. Vibration levels at the foundations of industrial buildings that are immediately to the south of the demolition site are predicted to be in the region of 0.5 to 2 mm/s during demolition of industrial buildings; and less than 1 mm/s during demolition of the DLR deck and abutments.

2.741 Vibration levels due to use of the vibratory roller have been predicted at the foundations of nearby industrial buildings for the worst-case situation where the roller operates at ground level at the closest potential location to each receptor. Vibration levels at the foundations of industrial buildings that are immediately to the south of the worksite are predicted to be in the region of 0.5 to 1.5 mm/s.

2.742 Vibration levels due to use of the vibratory piling rig have been predicted at the foundations of nearby industrial buildings for the worst-case situation where the rig operates at ground level at the closest potential location to each receptor. Vibration levels at the foundations of industrial buildings that are immediately to the south of the west side cofferdam site are predicted to be in the region of 0.5 to 3 mm/s.

2.743 The threshold of significance for building damage is predicted not to be exceeded at any receptor during any works at this site.
2.744 Demolition and construction activities are predicted to give rise to vibration levels that are less than those that correspond to a semantic rating of ‘a low probability of adverse comment’. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.

2.745 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

Bow Midland Yard Worksite

2.746 The plant likely to be required at the Bow Midland Yard Worksite and associated with support to the main tunnelling operations at the Pudding Mill Lane worksite has been reviewed to identify sources which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings or damage to buildings.

2.747 For this worksite, the construction information provided by Crossrail indicates that vibratory rollers are required during soil preparation.

2.748 Vibration levels due to use of the vibratory roller have been predicted at the foundations of nearby industrial buildings for the worst-case situation where the roller operates at ground level at the closest potential location to each receptor. Vibration levels due to ground preparation are predicted to be less than 0.5 mm/s at the depot building to the east of the site.

2.749 The threshold of significance for building damage is predicted not to be exceeded at any receptor during any works at this site.

2.750 Demolition and construction activities are predicted to give rise to vibration levels that are less than those that correspond to a semantic rating of ‘a low probability of adverse comment’. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not predicted to be significant.

2.751 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

Vibration and Groundborne Noise from Underground Construction Activity

Construction Trains

2.752 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds may also be exceeded while the temporary railway is running.
Tunnel Boring Machines

2.753 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.

2.754 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

Noise and Vibration Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.755 Standard 2.4 m high hoardings would be provided around the worksites. The compressors would also be located in noise reducing enclosures during these construction phases. No evening construction work has been programmed except that essential for any tunnelling operations. This corresponds to Tier 1 mitigation.

2.756 In this route window, no properties are expected to be eligible for noise insulation, temporary re-housing or be subject to a significant impact due to construction noise.

Utilities Worksites - Diversion of Hackney to Abbey Mills and Wick Lane Sewers at Pudding Mill Lane

2.757 At Sites at Sites B, C, and G, the Table AW/0020-1 shows that no significant impacts will occur from daytime or night-time working.

2.758 Works at site A would give rise to significant daytime impacts at noise-sensitive buildings having a clear view of the site and lying within 22 metres and 60 metres for the night-time period. The provision of Tier 2 mitigation, including the erection of hoarding up to 5 m height round the site as appropriate, would prevent the daytime impacts. In order to avoid night-time impacts, a total reduction of 15 dB is required and this could be achieved by a full 5 m hoarding in conjunction with selection of quiet plant. However, if only 10 dB of attenuation is achieved by the on-site mitigation, then dwellings within 19 metres of the site will be eligible for noise insulation in respect of significant impacts at night. Fewer than 5 properties would be eligible for this treatment.

2.759 At Site F, significant impacts would occur at properties within 20 metres during the day, and 22 metres at night, assuming no on-site mitigation or intervening buildings. The provision of Tier 2 mitigation including a 5 m site hoarding will reduce the impact zones to 6 metres and 7 metres for daytime and night-time working respectively. This will avoid significant impacts occurring around this worksite.
2.760 A summary of the mitigation provision required for each worksite is set out in the following table. With the provision of these mitigation measures, there would be no significant residual impacts.

<table>
<thead>
<tr>
<th>Site</th>
<th>Daytime</th>
<th>Night-time (additional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5m hoarding</td>
<td>Select quiet plant or NI for 5 properties</td>
</tr>
<tr>
<td>B</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>C</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>F</td>
<td>5m hoarding</td>
<td>No additional mitigation beyond daytime</td>
</tr>
<tr>
<td>G</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Offsite Road Traffic

2.761 There are no residual noise impacts.

Vibration from Surface Activity

*Pudding Mill Lane Worksite*

2.762 Demolition of the existing DLR deck and abutments will require vibration mitigation to ensure that damage does not occur to the railway structures that are not intended for demolition, which may be adjacent, attached or contiguous. This should be an appropriate continuous real-time vibration-monitoring regime during demolition works to allow monitoring of levels and cessation of activity should levels exceed relevant limits.

*Bow Midland Yard Worksite*

2.763 None required. No significant residual impacts.

Vibration and Groundborne Noise from Underground Activity

*Construction Trains*

2.764 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

*Tunnel Boring Machines*

2.765 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.
Impact Assessment – Permanent Impacts

Impacts during Operation

2.766 Permanent impacts from operation of Crossrail are illustrated on Drawing No. E0315-C1E00-E02-F-00013.

Noise from the Surface Railway

2.767 There is a short section of surface railway running from the Pudding Mill Lane Portal to the route window boundary with NE1. No sensitive properties lie close to this section, and so no noise impacts are predicted to occur.

Vibration from the Surface Railway

2.768 There are no significant residual impacts in this route window.

Noise from Road Traffic

2.769 There is no change predicted in baseline traffic flows in the route window as a result of Crossrail, therefore not applicable in this route window.

Noise from Ventilation Shafts

2.770 Not applicable to this route window.

Vibration and Groundborne Noise from the Underground Railway

2.771 With standard trackform the design aim for groundborne noise is achieved for buildings of standard noise-sensitivity (40 dB $L_{A_{max,s}}$) without deep or piled foundations in all locations.

2.772 There is residential development in Ridgdale Street foundation details of which are unknown.

2.773 If, following detailed study of the building foundations, 40 dB $L_{A_{max,s}}$ is predicted to be exceeded, there will be protection by the use of special trackform. Groundborne noise levels are shown on Drawing No: 1E315-C1E00-E03-F-00013.

Mitigation and Residual Impacts during Operation

Noise from the Surface Railway

2.774 The effect of intensification of rail services in this route window (not taking account of any infrastructure changes) would be to increase the daytime $L_{A_{eq,16hr}}$ by 0.8 dB and the night-time $L_{A_{eq,8hr}}$ by 1.1 dB. These changes are not significant.

Vibration from the Surface Railway

2.775 There are no significant residual impacts in this route window.
Noise from Road Traffic
2.776 Not applicable to this route window.

Noise from Ventilation Shafts
2.777 Not applicable to this route window.

Vibration and Groundborne Noise from the Underground Railway
2.778 There are no significant residual impacts in this route window.

Impacts on Sites Granted Planning Permission
2.779 No extant planning permissions that might be affected by the scheme have been identified in this route window.

PUDDING MILL LANE PORTAL - OLYMPICS SCENARIO

Impact Assessment – Temporary Impacts

Impacts during Construction

Construction Sites and Works including Onsite Traffic and Grout Shafts
2.780 With London’s Olympics proposal, segment storage and excavated material loading would be located on land between the River Lea and the Blackwall Tunnel Northern Approach Road. This would put the worksite closer to the nearest noise-sensitive receptors of Baldock Street Park East and Manhattan Buildings. However, even with the reduced distance between the worksite and these residential receptors, no significant noise impacts are predicted from construction activity in this area.

Offsite Road Traffic
2.781 Considering this Olympic scenario, it is estimated that there would be approximately 260 movements of lorries transporting excavated material per day during tunnelling with this scenario. This is because all excavated material from the tunnel portal would be exported by lorry rather than by rail as in the Crossrail base case. However, the vehicles would use the A12 East Cross Route/Blackwall Tunnel Approach as the lorry route, with only slip roads and short lengths of Wick Lane to be traversed to access and leave the site. Therefore, considering this and the high baseline noise levels in the vicinity from traffic using the A12, no significant noise impacts from offsite road traffic would be expected.

Vibration from Surface Activity
2.782 The potential impacts would be the same or lesser than those for the Crossrail base case.
Noise and Vibration Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.783 Standard 2.4 m high hoardings would be provided around the worksites. No evening or night construction work has been programmed except that essential for any tunnelling operations. This corresponds to Tier 1 mitigation.

2.784 In this route window, no properties are expected to be eligible for noise insulation, temporary re-housing or be subject to a significant impact due to construction noise.

Offsite Road Traffic

2.785 No significant residual impacts are predicted.

Vibration from Surface Activity

2.786 Same comments apply as for Crossrail base case.

Impact Assessment – Permanent Impacts

2.787 The permanent effects would be no different from the Crossrail base case.
<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Residual Impact</th>
<th>Description</th>
<th>Assumed Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pudding Mill Lane Construction Site</td>
<td>Daytime noise impacts at 0 residential properties.</td>
<td>No properties are expected to be eligible for noise insulation. No properties are expected to be eligible for temporary re-housing. With this mitigation:</td>
<td>Standard Mitigation = Tier 1</td>
</tr>
<tr>
<td></td>
<td>Evening/weekend noise impacts at 0 residential properties.</td>
<td>Even evening/weekend noise impacts at 0 residential properties.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Night-time noise impacts at 0 residential properties.</td>
<td>No noise impacts at 0 residential properties.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Places of worship: No noise impacts.</td>
<td>No noise impacts at 0 residential properties.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Educational facilities: No noise impacts.</td>
<td>No noise impacts at 0 residential properties.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical facilities: No noise impacts.</td>
<td>No noise impacts at 0 residential properties.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public open spaces: No noise impacts.</td>
<td>No noise impacts at 0 residential properties.</td>
<td></td>
</tr>
</tbody>
</table>

Significance: Not significant
## Route window C13 Pudding Mill Lane Portal – Permanent Impacts

<table>
<thead>
<tr>
<th>Works &amp; potential impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundborne noise and vibration from the underground railway</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Not significant</td>
</tr>
</tbody>
</table>
ROUTE WINDOW C13A – ABBEY MILLS

2.788 The works in this route window, which is located in LB Newham, comprise the diversion of the Hackney to Abbey Mills and Wick Lane sewers, as a result of alignment of the Crossrail running tunnels at Pudding Mill Lane (Route Window C13). The works will take approximately fifteen months to complete.

2.789 The works will involve two shafts, one of which is required for the insertion or recovery of a TBM; the other shaft is for access during and after the works. A new pumping station will be constructed at the Abbey Mills site. Material, including excavated material, will be transported by road.

2.790 The main construction plant to be used at the worksite will include cranes, excavators and mechanical breakers.

2.791 Construction of the intermediate access shaft will take approximately five months. Construction work is confined to normal hours but pumps will run continuously during construction of the shaft.

2.792 Construction of the shaft for the TBM access will take 13 months and 24-hour working will be required during the driving of the tunnel but excavated material will only be removed from site during normal working hours. During the last six-months of this work, a new pumping station will also be constructed at the site. At the end of the 13-month construction phase, there will be a two-month commissioning period before the pumping station is fully operational.

2.793 During the peak period of construction, the number of lorries accessing the worksites will be about 10 per day.
2.794 The worksite for the intermediate access shaft is located in a residential area on an open space lying between Claypole Road and Leggatt Road. The worksite for the launch of the TBM is located within the site occupied by Thames Water Utilities Limited existing Abbey Mill Pumping Station.

Baseline

2.795 The baseline noise survey location and duration is listed in the following table and identified on Drawing No. 1E0315-C1E00-E01-F-00015:

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1-week)</th>
<th>Medium term (24-hours)</th>
<th>Short-Term (3-hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE09</td>
<td>Leggatt Road / Claypole Road</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>NE10</td>
<td>Riverside Road / Bay Road</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>NE11</td>
<td>Riverside Road / Mill Meads</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

2.796 Additional baseline noise monitoring was undertaken in this route window as part of the utilities assessment. A number of short-term measurements were undertaken at the three sites in an area to the south of Pudding Mill Lane. Monitoring was located in a predominately residential area, with an industrial unit located close by. Attended daytime measurements consisted of three 15-minute measurement periods, carried out for three consecutive hours, undertaken at (NE09, NE10 and NE11). Attended night-time measurements were also undertaken at the same locations. In this instance, two 15-minute measurement periods were carried out at NE10 and NE11, with one 15-minute measurement undertaken at NE09. The measurement procedure is representative of the 3-hour measurement period.

2.797 The daytime $L_{Aeq,3hr}$ ranged between 55 and 62 dB, with the highest levels recorded at NE09. The $L_{Amax}$ measured at each site respectively, were 87 dB, 71 dB and 77 dB. The local noise environment was dominated by aircraft passing overhead, road traffic, a crane located within the vicinity of the monitoring location and industrial plant, which was audible throughout the duration of the survey period.

2.798 The night-time $L_{Aeq,3hr}$ ranged between 44 and 50 dB, with the highest level recorded at NE09. The $L_{Amax}$ measured at each site respectively, were 72 dB, 68 dB and 54 dB. The local noise environment was dominated by a combination of distant road traffic noise, distant rail noise and aircraft passing overhead.

2.799 Although the night-time $L_{Aeq}$ recorded at survey position NE09 was 50 dB, this was before midnight and for only one period during which there was some local activity. Consequently, the default lower limit for night-time impacts of 45 dB has been used.

Impact Assessment – Temporary Impacts

Impacts during Construction

Noise from Surface Activity
**Construction Sites and Works including Onsite Traffic and Grout Shafts**

2.800 The distances from the sites within which significant impacts could occur are shown in the following table. These distances are on the basis of no on-site mitigation, since it is assumed that standard hoardings at 2.4 m high do not cut the line of sight for 4 m high receptors. Baseline noise levels obtained from monitoring and the distances to the nearest dwellings are also shown.

<table>
<thead>
<tr>
<th>Site</th>
<th>Use</th>
<th>Baseline Location</th>
<th>Day</th>
<th>Eve</th>
<th>Night</th>
<th>Nearest houses (m)</th>
<th>Potential Impact Zone (^1) (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AW/0020</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>TBM receptor shaft</td>
<td>TH30 (67(^2))</td>
<td>77.3</td>
<td>(67(^2))</td>
<td>13</td>
<td>36</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Criteria</td>
<td></td>
<td>81</td>
<td></td>
<td>71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>TBM Drive shaft</td>
<td>TH30 (67(^2))</td>
<td>77.3</td>
<td>(67(^2))</td>
<td>148</td>
<td>36</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Criteria</td>
<td></td>
<td>81</td>
<td></td>
<td>71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>TBM receptor shaft</td>
<td>Precautionary – likely to be higher</td>
<td>148</td>
<td>75</td>
<td>141</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Nearest houses are screened by buildings, zone assumes 10 dB for this.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Criteria</td>
<td></td>
<td>65</td>
<td></td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Access for Head Manhole</td>
<td>TH30 (67(^2))</td>
<td>77.3</td>
<td>(67(^2))</td>
<td>11</td>
<td>36</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Criteria</td>
<td></td>
<td>81</td>
<td></td>
<td>71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Head manhole TBM receptor shaft</td>
<td>TH30 (67(^2))</td>
<td>77.3</td>
<td>(67(^2))</td>
<td>47</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Criteria</td>
<td></td>
<td>81</td>
<td></td>
<td>71</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes**

1. Façade level above criterion for any duration assuming mitigation of 0 dB on-site and unobstructed view of site except where stated

2. Assumed to be approx 10 dB below daytime value since main source is road traffic

**Offsite Road Traffic**

2.801 Assessment of off-site construction traffic in this route window, within which no main works are being undertaken, indicates that changes in roadside noise levels resulting from Crossrail construction traffic for the utilities works in this route window will be less than 1 dB (A). This will not be sufficient to give rise to a significant impact.
Vibration from Surface Activity

2.802 No piling is involved at any of the worksites. Consequently, it is considered that there will be no significant vibration impacts from above ground sources for these works.

Vibration and Groundborne Noise from Underground Construction Activity

2.803 The tunnel passes under residential properties in the following roads:

- Between shafts C and D - Bisson Road
- At Shaft C - Claypole Road, Leggatt Road
- Between shafts D and E - Riverside Road, Streimer Road

Tunnel Boring Machines

2.804 Groundborne noise and vibration from the passage of the tunnel boring machines may be perceptible. However, this will be a transient effect lasting only a few days and will not be significant.

Noise and Vibration Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic and Grout Shafts

2.805 At site D, unscreened buildings within about 130 metres would experience significant impacts from daytime working, as would properties within about 450 metres at night. Although the night-time $L_{Aeq}$ recorded at survey position NE09 was 50 dB, this was before midnight and for only one period during which there was some local activity. Consequently, the default lower limit for night-time impacts of 45 dB has been used. Note that at the nearby survey positions NE10 and NE11, (for site E), the night-time $L_{Aeq}$ was 40 dB and so the default value of 45 is used there. The night-time $L_{A90}$ values for all these positions was similar (about 38 dB).

2.806 The provision of Tier 2 mitigation including the erection of hoarding of up to 5 m height round the site as appropriate (assumed equivalent to a 10 dB reduction) would reduce the zone within which buildings would experience significant impact to 42 metres during the day and about 140 metres at night. The foregoing distances assume a clear view of the site; properties screened by intervening buildings would only experience significant impacts if they were within 13 metres during the daytime, or 45 metres at night.

2.807 The night-time impacts arise from the operation of an on-site generator and enclosure to provide a further reduction of 20 dB would avoid night-time impacts.

2.808 Dwellings within 42 metres of the site, and having an unobstructed view of it, may be eligible for noise insulation in respect of daytime impacts. This would encompass approximately 52 houses in the Claypole Road/Leggatt Road area overlooking the green. Provision of this treatment would result in no significant residual impacts for this site.
2.809 At Site E, buildings within about 67 metres (daytime) or about 300 metres (night-time) would experience significant impacts with no on-site mitigation. The erection of 5 m hoarding would reduce the impact zones to about 20 metres (daytime) and 90 metres (night-time). To further reduce the range at which impacts would be experienced, additional screening/ enclosure will be required (e.g. round the shaft) such that the total on-site mitigation is 20 dB. This would limit the properties at which significant impacts occurred to those within about 30 metres. This would include approximately 32 properties in Riverside Road having a clear view of the site; these dwellings may be eligible for NI.

2.810 Provided night-time activity does not encroach within 20 metres of the site boundary, no eligibility for TRH will arise. However, if night-time activity extends into this part of the site some or all of the 32 properties that may qualify for NI may also be eligible for TRH.

2.811 The provision of NI to the above–mentioned dwellings would permit daytime works up to the site boundary without giving rise to significant impacts or triggering TRH.

2.812 A summary of the mitigation provision required for each worksite is set out in the following table. With the provision of these mitigation measures, there would be no significant residual impacts.

| Summary of mitigation required to avoid residual impacts – Site AW0020 |
|-----------------|-----------------|------------------|
| Site | Daytime | Night-time (additional) |
| D | 5m hoarding | 20 dB enclosure for generators |
| | NI of approx 52 houses | |
| E | 5m hoarding, enclosure/screening of shaft | No working within 20 m of site boundary or potential TRH for up to 32 households |
| | NI of approx 32 houses | |

**Offsite Road Traffic**

2.813 No significant residual impacts expected.

**Vibration from Surface Activity**

2.814 No significant residual impacts expected.

**Vibration and Groundborne Noise from Underground Construction Activity**

**Construction trains**

2.815 No significant residual impacts expected.

**Tunnel Boring Machines**

2.816 No significant residual impacts expected.
Impact Assessment – Permanent Impacts

2.817 A new pumping station (PS) will be operated at site E. This PS will be designed to avoid significant noise impacts to nearby noise sensitive properties.

Impacts on Sites Granted Planning Permission

2.818 No extant planning permissions that might be affected by the scheme have been identified in this route window.
<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft D</td>
<td>Daytime noise impacts at 52 residential properties.</td>
<td>Residual Impact</td>
<td>Significant Standard Mitigation = Tier 2 5m hoardings around worksite Generators to be enclosed</td>
</tr>
<tr>
<td></td>
<td>Evening/weekend noise impacts at 0 residential properties.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Night-time noise impacts for 52 residential properties.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Places of worship: No noise impacts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Educational facilities: No noise impacts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical facilities: No noise impacts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public open spaces: No noise impacts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>An estimated 52 properties would be eligible for noise insulation. No properties are expected to be eligible for temporary re-housing. With this mitigation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Daytime noise impacts at 0 residential properties.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evening/weekend noise impacts for 0 residential properties.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Night-time noise impacts for 0 residential properties.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Places of worship: No noise impacts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Educational facilities: No noise impacts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical facilities: No noise impacts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public open spaces: No noise impacts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not significant</td>
<td></td>
<td></td>
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</table>

**Route window C13a Abbey Mills – Permanent Impacts**

<table>
<thead>
<tr>
<th>Works &amp; potential impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
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</thead>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Description</td>
</tr>
<tr>
<td>Pumping Station</td>
<td>Significant</td>
<td>Appropriate design</td>
<td>None</td>
</tr>
</tbody>
</table>
APPENDIX A

Construction Impact Summary Tables, Route Windows C1 to C13