Notes to the Reader

This report was developed prior to deposit of the Phase 2b Crewe to Manchester hybrid Bill. References to the environmental impact appraisal of the baseline scheme in this report may be superseded by those contained within the Environmental Statement supporting the hybrid Bill. Information contained within this report may also be superseded by the contents of the Integrated Rail Plan.

This report contains references to "CP3" (Control Point 3). This is an internal HS2 Ltd reference that generally corresponds to a level of design appropriate for hybrid Bill deposit. However, as above, the design and appraisal of the baseline option in this study (from Node MA (Manchester Airport) to Piccadilly) is now superseded by that contained within the deposited Phase 2b Crewe to Manchester hybrid Bill.

Partial alignments of a future NPR route described in this report were identified in this study solely for the purpose of enabling a like-for-like comparison (designs of equivalent level of maturity) of underground station options with the surface station provided in the Hybrid Bill. None of these partial NPR alignments constitute an initial preferred route at this stage nor do they prejudice further design and decision-making on a future Manchester-Leeds NPR route. There are many other possible alignments that could constitute an eventual preferred route. Whilst the overall scale of impacts assessed for each of the options for this study is representative, any specific impacts identified for the representative partial NPR route alignments may not be applicable to a future preferred NPR route.

In the baseline option, the route to the east of Manchester is referred to as NPR Remit 6 Option 0. This is taken from a separate study by HS2 Ltd, which reviewed the design for HS2 and NPR around Manchester to understand the capabilities of Manchester Piccadilly, and to understand the futureproofing requirements for NPR services towards Sheffield as well as Leeds.

Potential above-ground ventilation and/or intervention shaft locations have been identified as part of the study. For the level of design sufficient for the study, only the number of shafts and an indicative potential location for each site has been identified. If any of the options identified in this report were to be taken forward, further detailed study of specific locations would be required. Nevertheless, the environmental impact appraisal contained within this report is based on these indicative locations.

Certain elements of this report have been redacted due to their commercial sensitivity.

HS2

Manchester Piccadilly High Speed Station

Design of an Alternative Underground Station

Options Assessment - Sift Level 2 Appraisal

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1 Executive Summary

1.1.0 Manchester Piccadilly High Speed station will provide the Manchester terminus for High Speed 2 (HS2) services to the West Midlands and London and provide the Manchester city centre station for Northern Powerhouse Rail (NPR). The strategic objectives for the station are also to integrate with the existing transport network and to support growth and regeneration aspirations. It should also provide a high-quality passenger experience, both in terms of interchange and access to Manchester city centre, consistent with HS2 and NPR objectives.

1.1.1 HS2 Ltd has been working with stakeholders (TfN, TfGM, and MCC) to develop the design of a surface station, for inclusion within the Phase 2b Western Leg Hybrid Bill, catering for both HS2 and NPR. Following on from conversations with Manchester stakeholders and at their request, a letter issued by the Minister of State for Transport to the Mayor of Greater Manchester on 16 June 2020 referenced the alternative underground station proposals set out in the Manchester City Council - Bechtel report([1]) and the further recommendations that followed in the Richard George review. The Minister further requested HS2, in the interests of transparency and ensuring a fair and robust evidence base for decision making on integrating HS2 and NPR at Manchester, progress a design of an optimised alternative for a combined underground station.

1.1.2 This report sets out the findings of the study undertaken to consider the scope and requirements of a combined underground station for HS2 and NPR and a comparison with the HS2 Phase 2b Western Leg Hybrid Bill design for a surface station. An open and collaborative approach was taken throughout its development to assist stakeholders identify their preferred option for a combined underground station alternative to the surface station, as per the Minister's request.

1.1.3 A comparative assessment (sift) compared underground options against the surface station included in the hybrid Bill. Additional assessments and analysis, over and above what HS2 Ltd would normally consider at a similar stage of hybrid Bill development, were included to incorporate stakeholder requests for areas of scope development; construction methodology, economic benefits, utility impacts, Metrolink impact, railway systems handover, and relative operational resilience/capacity.

1.1.4 Three alignment options and construction methodologies were chosen following joint workshops between HS2 Ltd and the stakeholders on 29 October 2020 and 28 January 2021. These were alignment B (deep box) and alignment B1 (shallow box), which both run on a north-west to south-east alignment through the city centre, and alignment D (hybrid of deep box and mined construction) which runs on a broadly south-west to north-east alignment. The extents of each alignment were the south portal of the Manchester tunnel near Manchester Airport (Node MA) and a defined geographic point to the east of Manchester, just south of Oldham (Node 3). The three options give a broad range of understanding of the relative strengths and weaknesses of a range of potential underground options for Manchester when compared to the surface station.

1.1.5 HS2 Ltd and its consultants (MWJV) held a series of workshops with Stakeholders on 15 and 16 April 2021, to present the outcomes of the technical analysis, followed by a summary of the sift exercise and scoring on 22 April 2021.

1.1.6 To assist stakeholders in identifying their preferred alternative option, HS2 recommended alignment B1 as the better performing of the underground options. This was due to alignments B and D presenting far greater construction challenges, that would be unprecedented in scale and nature in the UK, posing significant risk to constructability, programme and cost.

1.1.7 All options would introduce significant construction complexity. However, for alignments B and D, the use of mined caverns of the proposed size, scale, and close spacing in a city centre introduces significant risk both in terms of safety and of damage to existing structures due to settlement risks. Alignment B1 ranks lowest on environmental impact but it ranks highest on strategic fit, urban design, construction, health and safety, commercial development and cost.

1.1.8 All of the underground options require significantly greater volumes of material to be imported and exported. This would require an increase in HGV journeys (two-way) in and out of Manchester city centre of between 13,500 HGV journeys (Option B1) and 43,500 HGV journeys (Option D) when compared to the surface station. The study uses an assumption that 90% of excavated material from the underground station sites (approximately 1.5-2.2million m^3) could be exported by rail. If this material instead needed to be removed by road it would generate 135,000 additional HGV journeys when compared to the surface station. The underground station options would also require significantly more material to be removed by road from the south portal of the Manchester Tunnel, which could lead to a doubling of HGVs movements in the area when compared to the baseline scheme.

1.1.9 The three underground station options have estimated delivery-into-service date ranges that are 7-13 years later than the delivery-into-service date of 2036 for the current hybrid Bill scheme.

1.1.10 The total cost of each of the three underground options (B, B1 and D) is estimated at £12.3Billion, £11.4Billion, and £12.1Billion respectively. These compare to a comparative cost of £7Billion for the baseline. This includes civils, railway systems and land and property costs between Node MA and Node 3 along with indirect costs and contingency.

1.1.11 The sift outcome showed that, when comparing underground station options against a surface station, the surface station would be the preferred option. The underground comparators all rated as 'moderate worsening' or 'major worsening' for the topics of construction feasibility, health and safety, cost, and schedule/delivery-into-service when compared to the baseline surface station scheme.

1.1.12 Stakeholders have suggested a number of areas for further work or development, particularly refinement of the station design and the assessment of wider economic benefits and commercial development opportunities. HS2 Ltd does not disagree that further design refinement is possible but maintains that a like-for-like comparison, commensurate with the level of design, has been carried out. HS2 Ltd does not believe it is best placed to carry out any further work on wider benefits or commercial development outside of the construction boundary.

1.1.13 It is HS2 Ltd's view that further detailed development of the options, based on the agreed scope and requirements of this study, is unlikely to significantly change the overall assessment and comparative difference between a surface and underground high-speed station at Manchester Piccadilly, particularly in respect to cost and programme.

1.1.14 It is therefore HS2 Ltd's recommendation that the Proposed Scheme for a Surface Station, to integrate HS2 and NPR at Manchester High Speed Station, is retained for the Phase 2b Western Leg hybrid Bill design, on grounds of cost, construction safety and programme implications to the Delivery-into-service date of HS2 to Manchester.

2 Introduction

2.1 Background to Study

2.1.0 The decision to locate the HS2 high speed station to serve Manchester city centre at Piccadilly was taken for the HS2 Phase 2b Preferred Route following a robust sifting process of alternatives, which demonstrated that the Piccadilly location was the best performing option. The hybrid Bill design for the 6-platform high speed surface station has been subject to public consultation and extensive engagement.

2.1.1 The decision by Transport for the North (TfN) to make Piccadilly their preferred location for the NPR Hub in Manchester, and to make use of the HS2 Manchester Spur as part of the Liverpool – Manchester solution, was made clear in the TfN NPR Preferred Network and Strategic Transport Plan of 2019. This study has therefore not re-opened consideration of alternative high-speed station locations in Manchester city centre.

2.1.2 In 2017 TfN were given the opportunity to make the case for the inclusion of passive provision for NPR in development of the HS2 P2b Hybrid Bill. DfT concluded in 2019 that a case had been made for inclusion of the two additional platforms in the Manchester Piccadilly High Speed surface station and instructed HS2 to include provision for this, and other junctions required for Liverpool to Manchester and Manchester to Leeds NPR services, in the HS2 P2b Hybrid Bill. The provision of NPR in the Phase 2b Western Leg Hybrid Bill has subsequently been consulted upon in the Design Refinement Consultations of 2019 and 2020.

2.1.3 However, a number of Greater Manchester stakeholders raised concerns that a comparative exercise had not been undertaken for a combined underground station for HS2 and NPR services, to establish a like for like comparison with the 6-platform Surface station included in the HS2 P2b Hybrid Bill design.

2.1.4 A concept for a combined HS2 and NPR underground station at Piccadilly was put forward by Greater Manchester in 2019. Whilst earlier concepts developed by HS2 on behalf of TfN for integrating NPR underground included a split-level station at Manchester, HS2 had no involvement in the split-level proposal developed by Bechtel for Manchester City Council.

2.1.5 Transport for the North (TfN) Board agreed at the 12 September 2019 meeting that an independent adviser, Richard George, should be appointed to review the work to date on integrating HS2 and NPR at Manchester Piccadilly High Speed station. The independent report completed by Richard George also took account of the Oakervee review and the proposed alternative concept of a combined underground station set out in the Manchester City Council commissioned Bechtel report.

2.1.6 The Richard George Report in March 2020 recommended that the only true 'like for like' comparison between concepts would be between a 6-platform HS2/NPR combined surface station and a 6-platform HS2/NPR combined underground station. The independent review recommended that a design and cost estimate should be developed for the combined underground station concept for HS2 and NPR.

2.1.7 Following further engagement between Government and Greater Manchester stakeholders, the HS2 Minister Andrew Stephenson issued a letter to Andy Burnham, Mayor of Greater Manchester in June 2020. The letter noted the Bechtel report and Richard George review and the forthcoming request to HS2, in the interests of transparency and ensuring a fair and robust evidence base for decision making on integrating HS2 and NPR at Manchester, to progress a design of an optimised alternative for a combined underground station.

2.2 Purpose of study

2.2.0 DfT requested that HS2 develop, and discuss with MCC, TfGM and TfN, the design of an optimised alternative 6-platform combined underground station for HS2 and NPR. The purpose of the study was to consider the scope and requirements of a combined underground station and compare the alternative with the hybrid Bill design for a surface station.

2.2.1 HS2 were requested to report the findings of the study to the Minister of State for Transport, with the final decision on the design to be made by the Secretary of State for Transport.

2.3 Original Scope of Study and Programme

2.3.0 The scope of the study was developed in a collaborative manner with input from HS2, DfT and the Manchester stakeholders during July and August 2020. The final scope was agreed and signed off by all parties on 1 September 2020. Refer to Appendix A for the signed-off scope.

2.3.1 The key aspects of the scope were:

- Three options named as A, B and C were agreed to be assessed.
- Design development to inform Decision Point 1 - Preliminary phase to assess what the best construction methodology (open cut vs. mined/tunnelled) was appropriate for each option.
- Decision Point 1 - Agree and select the preferred construction methodology for each option A, B and C. Those three options with the respective construction methodologies would be the ones to take forward to the sift level 2. In addition, the scope referred to a fourth option that would be taken to the sift level 2 based on an agreement to progress one of the options (A, B or C) with both a mined and open box construction methodology.
- Sift Level 2 to inform Decision Point 2 - Sift of alternative options following the HS2's Route Development Procedure (4) with the additional scope items as requested by the stakeholders and reflected on the scope (Appendix A).
- Decision Point 2 - agree with the stakeholders the preferred underground option amongst those sifted.
- Decision Point 3 - Ministerial review of study outcomes.

2.3.2 The agreed scope identified three opportunities for the stakeholders to review, discuss and input into the development of the study. However, shortly after commencing the study, stakeholders requested regular fortnightly technical workshops in order to input more into the detail of the study. These workshops commenced in mid-October 2020 and continued until the completion of the study (June 2021).

2.3.3 The programme for the study was circulated and agreed in advance with all parties. The first agreed programme, dated 19 October 2020, had the following key dates;

- Decision Point 1: 27 November 2020. Confirm options to take forward to the sift level 2
- Decision Point 2: 19 April 2021. Undertake SIFT of alternative underground options and seek to agree a preferred underground option
- Draft report: issued for stakeholder review: 31 May 2021
- Final report: submission to DfT for Ministerial review: 5 July 2021

2.4 Modified Scope of Study and Programme

2.4.0 In the technical workshop of 29 October 2020, prior to Decision Point 1, the stakeholders requested that two additional options, known as B1 and D be considered.

2.4.1 Following agreement with DfT, the two additional options were assessed and included in the design development stage to ascertain the best construction methodology for each.

2.4.2 In order to allow a proportionate amount of time to assess options without losing momentum, it was agreed with stakeholders that:

- Decision Point 1 would recommend three options to take forward to sift level 2 rather than four as originally agreed in the scope (refer to 1.4.1, third bullet)
- The review period of the three formal stakeholder feedback periods would be reduced from three weeks to two.

2.4.3 The programme was subsequently updated to reflect all the agreed changes. There were two iterations of the programme and the latest one agreed (dated 24 February 2021) had the key dates as follows:

- Decision Point 1: 28 January 2021 (2 months delay from the original programme). Selection of three options to take forward to the sift level 2
- Joint (HS2, DfT and stakeholders) Sift Workshops: 15 and 16 April 2021
- Decision Point 2: 22 April 2021. Undertake SIFT of alternative underground options and seek to agree a preferred underground option
- Draft report issued for stakeholder review: 28 May 2021
- Final report submission to DfT for Ministerial review: 29 June 2021

2.5 Decision Point 1 summary

2.5.0 The purpose of Decision point 1 was to determine the preferred construction methodology for each option, whilst undertaking a high-level analysis for each option of the station footprint, configuration and associated alignment.

2.5.1 The high-level analysis considered each option (A, B or C) as either a box or mined underground station and each were assessed against the criteria of; construction impact; indicative construction cost; risk and programme; passenger experience; commercial development and local environment.

2.5.2 Options A and B were deemed to be most suited to a deep box for the underground station (open cut). The location of the Underground station for option C was deemed to be less desirable due to the extent of the impact when considering local constraints, significant interface under the conventional railway and incompatibility with the Piccadilly Strategic Regeneration Framework.

2.5.3 The additional options requested by the stakeholders, B1 and D, were developed as option B1 in a shallow box and option D for a hybrid of both typical construction methodologies mined and open cut. Both additional options studied were analysed against the same set of criteria as options A, B and C.

2.5.4 All five options considered in the design development stage were assessed on a Red, Amber, Green (RAG) rating basis against the criteria for comparison purposes and ranked as 1 = best performing option and 4 = worst performing option. The high-level summary for the assessment of options considered in the design development stage is illustrated in *figure 1*.

Figure 1 - Option comparisons

2.5.5 The Decision Point 1 meeting was held on 28th January 2021. The aim of the meeting with DfT, TfN and Manchester stakeholders was to formalise Decision Point 1 and select three options to take forward to Sift Level 2.

2.5.6 Prior to the Decision Point 1 meeting in January 2021, stakeholders requested that four options instead of three options should be taken forward to the sift level 2 stage.

2.5.7 This request was not agreed by DfT and therefore the conclusion of Decision Point 1 was to take forward options B, B1 and D to the sift level 2 stage of the study. For reference, Option A was the fourth option that stakeholders wished to take forward along with Options B, B1 and D.

2.5.8 Supporting information for the design development stage of work up to Decision Point 1 is within Manchester Piccadilly high speed station an optimised alternative underground station stage 0: pre-sift Document no.: 2DE01-MWJ-EN-PRE-M003-000027

3 Scope of sift

3.1 Overview of the SIFT options

Baseline

3.1.0 The baseline option leaves the proposed HS2/NPR station at Piccadilly, heading eastward through the Pin Mill Brow area via a shared corridor supported on viaduct. As the corridor approaches the Ardwick area, the HS2 alignment commences its descent towards a tunnel portal in a south-easterly direction. At the same time, 1 NPR track (on the north side of the shared corridor) starts to pull away to the east, whilst 1 NPR track (on the south side of the shared corridor) starts to rise up such that it can soon pass over the HS2 alignment and join the other NPR track in a dedicated NPR corridor, immediately to the north of the existing Siemens rolling stock depot.

3.1.1 For the purposes of a like-for-like comparison with the alternative underground options the provision of stabling sidings for the hybrid Bill baseline plus Option 0 (see section 4) to Node 3 has been excluded from the assessment and costing of the baseline comparator option.

3.1.2 The NPR corridor then crosses over the NR Philips Park line, before passing immediately to the south of the NR Manchester Rail Operating Centre and parallel to the Manchester-Glossop NR line, to the south. The 2 tracks run parallel to the conventional rail corridor before descending into the tunnel portal in the Gorton area for the NPR route to Leeds.

3.1.3 The Leeds route then continues in tunnel in a north easterly direction all the way to the NPR node 3 to the south of Oldham. This section of the tunnel has 3 vent shafts, being located at Openshaw, Ashton Moss and Waterloo.

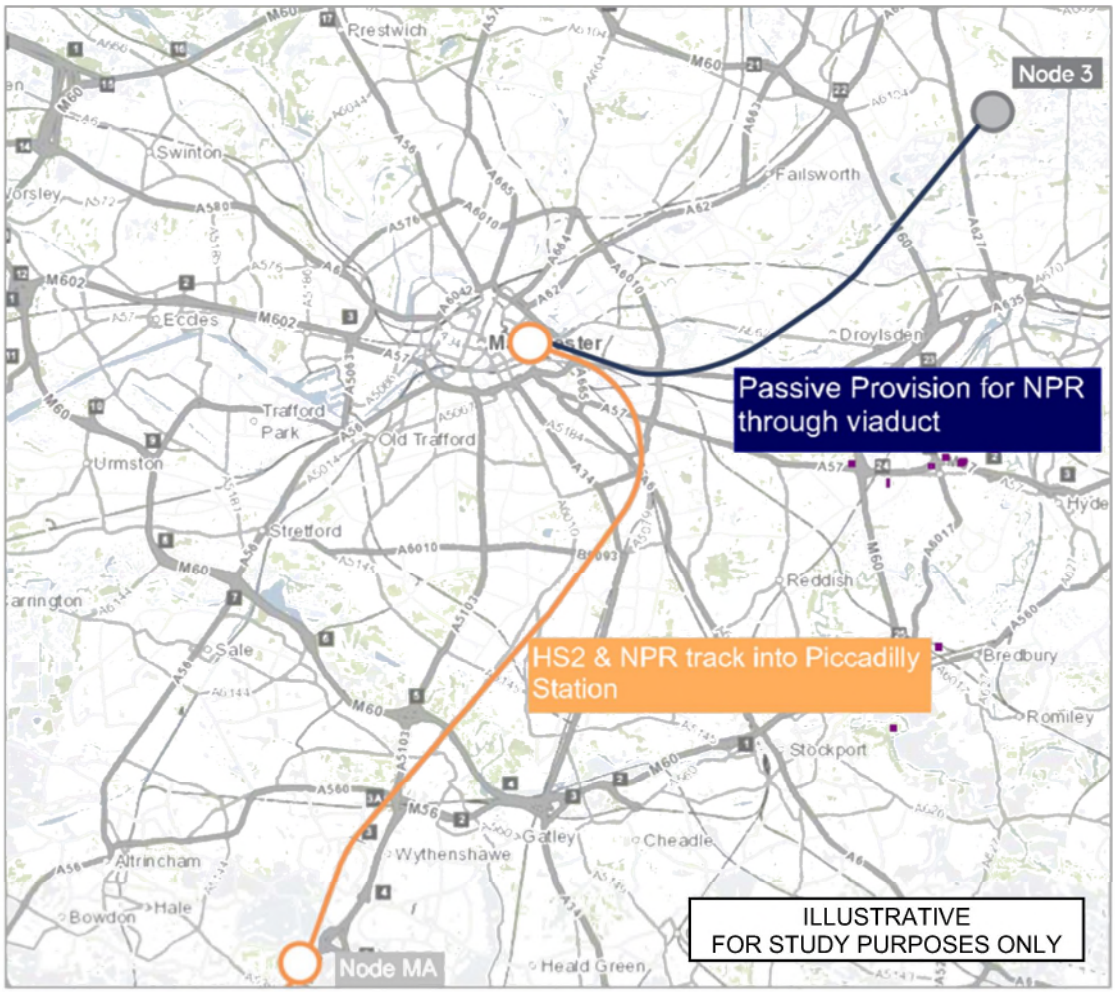

Figure 2 - Baseline overview

Options

3.1.4 All alignment option routes start at the proposed portal location at Manchester Airport High Speed Station (denoted Node MA) in Community Area MA07. Each travel underground towards one of three station locations in Manchester city centre within the vicinity of the existing Manchester Piccadilly Station (MA08)

3.1.5 The alignments then travel north east towards Leeds running in tunnels to Node 3, located southeast of Oldham.

3.1.6 Whilst Node MA is located on the hBD design alignment, the Node 3 location is a reasonable point of convergence of the different representative partial route alignments identified solely for the purposes of a like-for-like comparison of the station options.

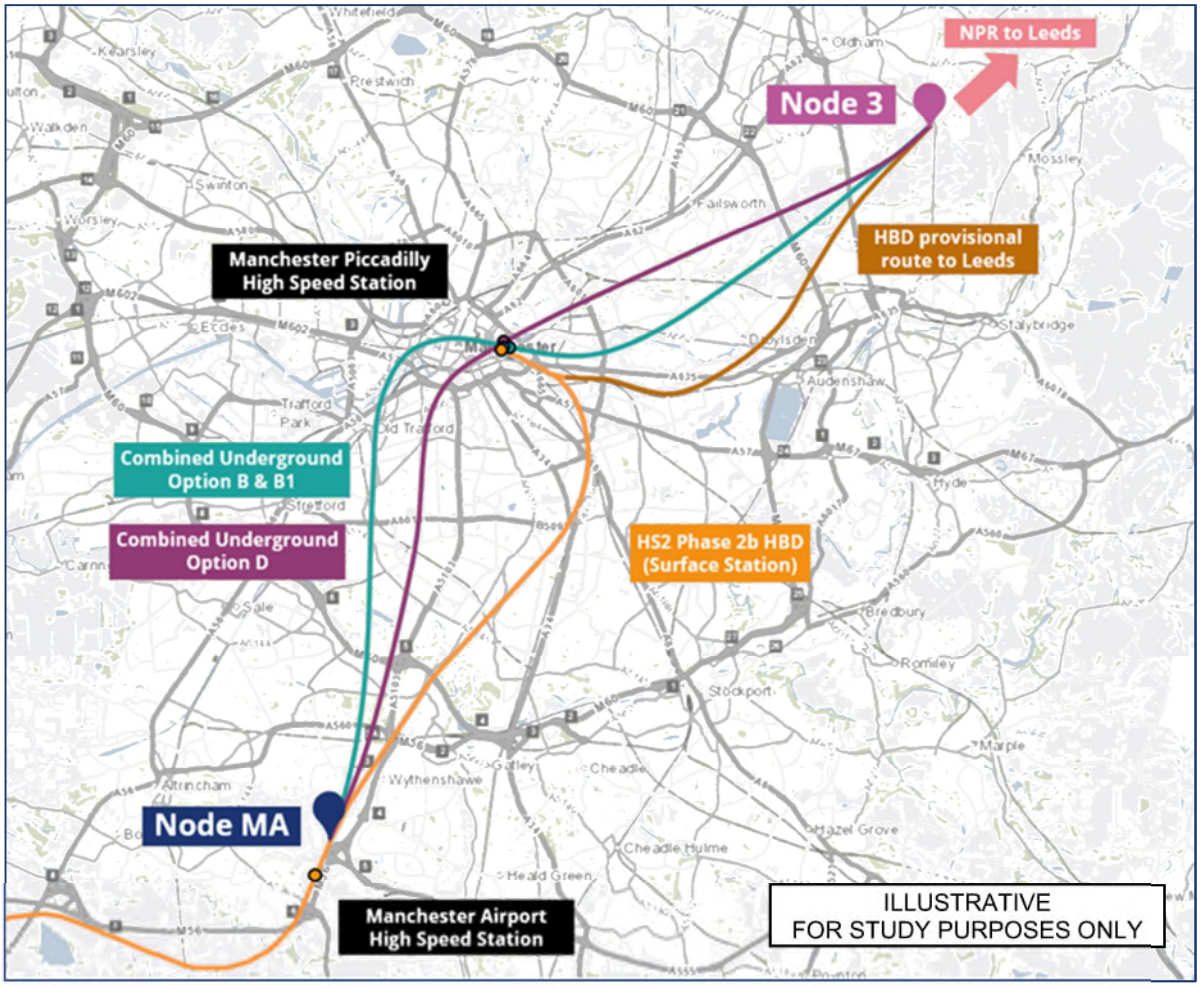

Figure 3 - Options overview

3.2 Summary of the SIFT process

3.2.0 The sift was undertaken in accordance with the HS2 Route Development Procedure (HS2-HS2-SA-PRO-000-000007 revision P08). This is the standard sift process used across the HS2 project to compare alternatives against a baseline.

3.2.1 The purpose of a level 2 sift is to give a structured and evidenced based approach to assess a design option or options against an existing design baseline. This provides the basis of an informed decision on whether to progress one of the options or to remain with the baseline.

3.2.2 Sifting uses standardised assessment criteria to measure the relative merits of an option against the baseline option.

3.2.3 For this sift HS2 Ltd used bespoke sift criteria, which were agreed in consultation with the stakeholders. These criteria are included with the agreed scope in Appendix A.

3.2.4 The option appraisal assessment criteria used is as follows:

Rating	Meaning
- - -	**Major worsening** on the Comparator / baseline option
- -	**Minor worsening** on Comparator / baseline option
o	**Neutral / no change** to Comparator / baseline option
+	**Minor improvement** on Comparator / baseline option
+ + +	**Major improvement** on Comparator / baseline option
N/A	**Not Applicable**

3.2.5 The appraisal of options against the sift criteria by HS2 was discussed with the stakeholders at a series of workshops on the 15/16 April; [redacted] MWJV presented the draft summary findings of the level 2 sift to DfT, HS2., MCC, TfGM and TfN on 22 April 2021. HS2 shared its presentation on 22 April including draft versions of the sift summary and the sift matrix with Manchester stakeholders on 4 May 2021.

3.3 Assumptions and exclusions for SIFT

Assumptions

3.3.0 The development of the designs for options B, B1 and D was made based on a number of assumptions, where information was not available. The assumptions were made following review of available information using professional judgement appropriate to the level of design appropriate for a level 2 sift.

3.3.1 Appendix B contains a full table developed during the design listing the assumptions made, rationale and potential impacts.

3.3.2 There are several key assumptions identified which may be summarised broadly as:

Title	Description	Rationale
Station and vicinity	Ground Conditions are only assumed from Desk Study sources.	No site or project specific intrusive ground investigation (GI) has been undertaken. Only anticipated geology and preliminary geotechnical parameters have been established.
Phasing	Airport Station will not be operational in advance of Manchester Piccadilly underground station i.e. no staged opening of the Western leg.	Current HS2 planning and business case does not allow for a phased opening.
Construction strategy	Ashley Railhead will be used to support the rail systems construction to the eastern extents of underground box/throat. E.g. the overall rail system and construction strategy is fundamentally similar to hBD	The existing strategy can be used to support the rail system construction without incurring a cost penalty of delivering additional works.
Approach Throat Layout	The track layout at the station approaches is identical at both ends.	Combined HS2 / NPR operational requirements have not been obtained at the time of the submission of this study.

Table 1 - Summary assumptions

Exclusions

3.3.3 The design has been undertaken to a high-level for each of the options at this stage, to sufficiently enable comparisons to be made. However, there are some exclusions from the scope of design.

- Vent shaft locations and head house designs: The preliminary design has established the numbers and potential locations only.
- Over site development (OSD): The station designs demonstrate how OSD might be incorporated into the structure of an underground station only.
- Potential connection to Sheffield: This is not considered in the alignment design.
- Stabling: Assumed to be outside of the scope area and not considered
- NPR continuity: The alignment design meets the node point given within the agreed brief provided by TfN but not considered any further.
- Design of Metrolink Track & Station: Metrolink requirement has been safeguarded through space proofing. Detail design of Metrolink track and station is not considered at this stage. Refer also 3.4.2
- Design of Car Park: Car Park requirement has been safeguarded through space proofing. Detail design of car park structure not considered at this stage and assumed to be outside of scope.

3.4 Basis of design for SIFT

3.4.0 The following design parameters have been adopted as part of the design briefing for the alternative options B, B1 and D in consultation with HS2. The items formed the starting point for design briefing.

Station design

Planning & Layout

- Use PRS as baseline for platform core and escalator layout (HS2)
- Use island platform width of 13m (Piccadilly CP3 design) as starting point. Referring to TS Station sizing HS2-HS2-AR-STD-000-000001 (7).
- Concourse unpaid: 3,245 sqm based upon Train Service Specification and capacity demand.
- 6 number of platforms, 415m long (each)

Forecourt (Based on Piccadilly CP3 Design, safeguarded through space proofing)

- Car 'kiss n ride' pick up: 121 bays
- Car 'kiss n ride' drop off: 18 bays
- Taxi pick up: 8 bays
- Taxi drop off: 14 bays
- Taxi rank: 84 bays
- Re-provision of Shuttle Bus: 5 bays
- Cycle spaces: 523

Car Park (Base on Piccadilly CP3 Design, safeguarded through space proofing)

- Number of bays: 1,998 bays

Metrolink (Based on Piccadilly CP3 Design)

- Platforms: 80m x 4m per platform face
- Assumed 4 platform faces required

3.4.1 Metrolink proposal for B1 and D were developed with TfGM designers over a series of workshops. Option B uses existing provision and does not include the new and additional underground Metrolink proposal shared with HS2 and MWJV in March 2021 due to programme constraint. Note; TfGM Metrolink preferred proposal for Option B requested an underground Metrolink arrangement located below the HS2 underground ticket hall. As noted, this was not incorporated due to programme constraint. In addition, the feasibility of underground Metrolink is untested and may impact station depth including adding complexity to vertical circulation as depth would add additional landings to escalators.

Urban Integration

3.4.2 Manchester Piccadilly Strategic Regeneration Framework March 2018 has been referenced as the basis of Urban Integration study (UIS) for all Alignment Options but extended beyond the Framework area to include land that is affected by the construction of HS2.

3.4.3 Where possible the proposed city grid structure has been adopted as defined in the MCC Manchester Piccadilly Strategic Regeneration Framework (March 2018).

Commercial Development

3.4.4 High level commercial development capacity testing has been conducted to estimate the indicative achievable floorspace for each of the alignment options. For assessment purposes the method of capacity testing has been aligned to Hybrid Bill Design Urban Integration Study (2DE01-MWJ-EN-REP-M005-000014 P02).

3.4.5 For SIFT purpose, only gross external area (GEA) quantum within consolidated construction boundary CCB has been assessed.

3.4.6 For the purpose of commercial development assessment, all development massing height tested to generate indicative achievable floorspace (GEA quantum) within CCB has been defined by MCC Manchester Piccadilly Strategic Regeneration Framework Height Plan. The building heights tested are compatible with current planning policy / consent schemes; this provides consistency across all alignment option. It should be noted that this is a theoretical urban planning model and no commercial or real estate assessment has been conducted to give real estate value to the assumed achievable floorspace generated.

Alignment Design

3.4.7 The design is in accordance with the HS2 design principles and standards. This means that aspects such asymmetrical station throats have been conservatively assumed at this stage.

3.4.8 Node 3 is approximately 30m underground at 124m AOD. This is a given link node point and gives rise to the conclusion that it is impractical to attempt to bring the alignment to the surface north of Piccadilly station. It is therefore assumed that any required train stabling requirement will be outside of the limit of the study and will be provided by others.

Rail Systems

3.4.9 The rail systems design was required to replicate the iTSS shown in *figure 4* as an underground through station layout in line with the agreed options from Decision Point 1.

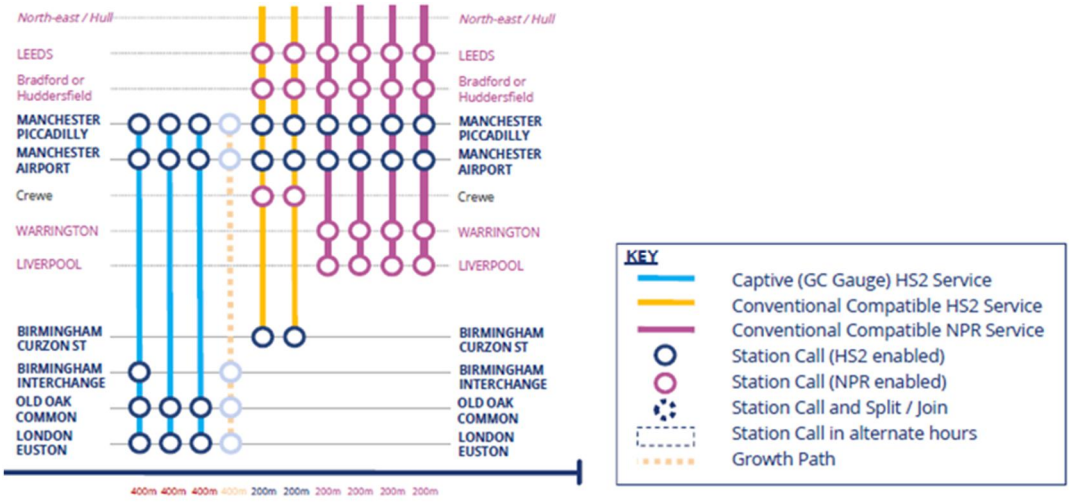

Figure 4 - Indicative Train Service Specification (iTSS)

3.4.10 The scope required the alternative designs to provide a like for like comparison to the baseline hybrid Bill design, the main criteria from the hybrid Bill design was adopted where possible in the underground options, namely;

- 6 platforms shall be provided at Manchester Piccadilly station
- All platforms shall be capable of accommodating 400 metre trains
- Trains from HS2 shall be able to arrive in all platforms, and trains shall be able to depart from all platforms to HS2
- Trains from NPR shall be able to arrive in all platforms, and trains shall be able to depart from all platforms to NPR
- All platforms and approach tracks/crossovers shall be bi-directional
- Splitting and joining of 400m trains shall be possible in all platforms
- Permissive working shall be possible in all platforms; that is a 200m train can arrive unimpeded into the ‘near’ end of any platform with a second 200m train already occupying the ‘far’ end
- Platform 2 arrivals parallel to Platform 3 departures (towards HS2)
- Platform 3 arrivals parallel to Platform 4 departures (towards HS2)
- Platform 4 arrivals parallel to Platform 5 departures (towards HS2)

- Assuming the station is configured as 3 island platforms, the 'NPR' end station throat shall be configured so that 'Eastbound' and 'Westbound' NPR services may remain in parallel irrespective of which platform islands are used, i.e.
- 'Eastbound' NPR services using Platform 1/2 must be fully parallel to 'Westbound' NPR services using Platform 5/6
- For movements in the same direction (in either direction), it shall be possible an arrival into any platform to be made simultaneously to a departure from another platform for any combination of points (i.e. Overlaps / End of Authorities to be clear of relevant point work).

Figure 5 - Layout and station approach

3.4.11 The layout of the throat design was set out in order to ensure the requirements could be satisfied. This led to the development of the throat layout to achieve the required movements into the station. This can be seen in *figure 5.*

3.4.12 It should be noted that in the interim stage between completion of HS2 and delivery of NPR, the underground station would need to operate as a terminus for HS2 services from London and Birmingham

Construction Programme

3.4.13 With the change in alignment as the HS2 tunnels approach the station there is no immediate site on the route to tunnel from both directions as in the baseline scheme and so the tunnels will be driven into the city centre from the Airport portal. Two HS2 TBMs are driven from the Manchester Airport portal all the way to Piccadilly, with a 2-month stagger. Activities prior to TBM launch are the same as for the Hybrid Bill design.

3.4.14 The TBM advance rate is 80 m/week after a 250m learning curve, which is limited by HGV movements allowed at the Airport Portal and is the same as for the hybrid Bill Design.

3.4.15 NPR approach civils construction occurs at the same time as the HS2 approach civils construction. This includes the portal shaft at Ardwick for B and B1 and at Barking Street for D, as well as intervention shafts. This will enable NPR TBMs to be driven into the portal shaft from outside the city and extracted and will minimise impacts on the station itself.

3.4.16 NPR construction and rail system integration are not on the critical path for HS2 delivery into service.

3.4.17 Metrolink construction (considered as a surface station) is assumed to be a minor non-critical element and not included in the construction programme for any of the underground options.

3.4.18 Enabling, advance and utilities works have the same duration as in the baseline for Piccadilly Station (the hybrid Bill Design) including demolitions.

3.4.19 Rock head levels taken as the 'average' level, i.e. at +30 mOD.

3.4.20 Depth of weathering and rock UCS (unconfined compression strength) taken as the 'average' values, i.e. 2 m of weathering and 20 MPa, respectively. (Note that in the programme the UCS affects the diaphragm wall excavation rate only and so a higher value is more conservative). Refer to geotechnical report for the basis of the values applied. (8).

3.4.21 Station box excavation is limited to 1800 m^3/day, which is the capacity of 3no. trains per day from Ardwick rail sidings based on 600m^3 per train. This is also estimated to be close to the upper limit for excavation plant operating in the box based on a number work fronts.

3.4.22 Civils and MEP fit-out of the station box finishes 2 years after internal concrete works (slabs, skin walls and RC columns). Where end sections of the box are used for mined approach construction and finish later than the main part of the station box, then civils and MEP fit-out can finish a minimum of 1 year after the internal civil concrete works have been finished in these areas.

3.4.23 Rail systems and MEP fit-out of HS2 approach structures starts after secondary lining of mined caverns has been completed for B and D. For B1 the rail systems and MEP fit-out of the approach tunnels, intervention shaft and portal shaft outside of the approach box can start after TBM extraction and secondary lining of the outer scissors cavern. Duration is 2 years.

3.4.24 Integrated testing and commissioning have a duration of 2 years, which may overlap with the latest civil and MEP fit-out activity by 1 year.

3.4.25 Trial operations follow after integrated testing and commissioning and have a duration of 1 year.

3.4.26 A high-level programme showing the construction durations can be found in Appendix F.

3.5 Applicable Safety Standards

National Standards

3.5.0 Operating a railway underground presents a higher risk for the safety of train passengers and on-board staff during operations. Fire, derailment, long stops and other accidents require preventive safety measures to minimise the risk and increase the comfort of passengers. In addition to the Railway Safety Directive (EU) 2016/798 applying to all infrastructures, specific requirements for tunnels are included in Regulation (EU) 1303/2014 on Technical Specification for Interoperability for Safety in Railway Tunnels (TSI SRT). The TSI SRT establishes safety specifications and recommendations for all tunnels and underground stations.

3.5.1 Following the UK's exit from the EU and the ending of the transition period on 31 December 2020, EU Technical Specifications for Interoperability (TSIs) have ceased to apply in the UK. The technical content of TSIs at the end of the transition period have been replicated as National Technical Specification Notices (NTSNs), which came into effect on 1 January 2021.

3.5.2 NTSNs define the technical and operational standards which must be met to satisfy the 'essential requirements', and to ensure the interoperability of the railway system. This allows all parts of our network to run as a whole system, providing benefits for our customers and our society.

3.5.3 The essential requirements are safety, reliability and availability, health, environmental protection, technical compatibility and accessibility. 'Interoperability' is defined in the Railways (Interoperability) Regulations 2011 (as amended) as 'the ability of the rail system to allow the safe and uninterrupted movement of trains which accomplish the required levels of performance for those lines'.

HS2 standards and Safety Approach

3.5.4 The design of the underground options has been undertaken against HS2 technical standards.

3.5.5 The Strategic goal for HS2 is "*to create a railway designed, built and operated to the highest health, safety and security standards." And sets the following objectives*

- To set a better standard for health and safety performance in the delivery of a major project.
- To prevent injury and proactively manage risk.
- To manage the health and wellbeing of all our workers to create a new, better standard in occupational health.
- To protect HS2 assets and those of its suppliers.

3.5.6 The following Principles of Practice, organised around seven focus areas, establish the baseline for a common, consistent approach to health and safety during construction and for our future operational workforce, passengers and public.

Table 2 - Extract from supply chain health and safety approach – HS2

4 Option Description

4.1 Baseline option + NPR Remit 6 Option 0

4.1.0 Option 0 comprises the NPR route from Manchester Piccadilly towards Leeds (node 3). The routes bifurcate from the HS2 alignment in the Ardwick area, continuing east to the Gorton area. Within the Remit 6 study a small quantity of rolling stock sidings is provided in the Gorton area, however, to ensure a like for like comparison in this study the provision of any stabling sidings in the baseline comparator are excluded. The Leeds route then runs in tunnel to node 3, located southeast of Oldham.

4.1.1 Option 0 leaves the proposed HS2/NPR station at Piccadilly, heading eastward through the Pin Mill Brow area via a shared corridor supported on viaduct. As the corridor approaches the Ardwick area, the HS2 alignment commences its descent towards a tunnel portal in a south-easterly direction. At the same time, 1 NPR track (on the north side of the shared corridor) starts to pull away to the east, whilst 1 NPR track (on the south side of the shared corridor) starts to rise up such that it can soon pass over the HS2 alignment and join the other NPR track in a dedicated NPR corridor, immediately to the north of the existing Siemens rolling stock depot.

4.1.2 This point (10m east of the Ardwick Box) has been identified as the design and construction touchpoint between HS2/NPR, i.e. the location beyond which NPR infrastructure can be built/commissioned without impeding the operation of the nearby HS2 route.

4.1.3 The NPR corridor then crosses over the NR Philips Park line, before passing immediately to the south of the NR Manchester Rail Operating Centre and parallel to the Manchester-Glossop NR line, to the south. Following this, the Manchester sidings for stabling rolling stock is in the Openshaw area to the north of the NPR corridor, comprising 4 sidings. (As stated in 3.4.8, stabling requirements are considered as being outside the remit of the study).

4.1.4 Beyond the end of the sidings, the 2 tracks on the NPR corridor descend into the tunnel portal for the NPR route to Leeds. The Leeds route then continues in tunnel in a north easterly direction all the way to the NPR node L to the southeast of Oldham.

4.1.5 This section of the tunnel has 3 vent shafts, being located at Openshaw, Ashton Moss and Waterloo.

Baseline Construction Methodology

4.1.6 The baseline option is a viaduct station with elevated platforms similar in typology to the Piccadilly NR Classic station. The HS2/NPR station has a western concourse at the same level as the existing NR concourse with end loading of the platforms. Below the platforms there is a lower concourse serving Metrolink (with platforms in a basement box below the station) and the HS2/NPR eastern concourse. The lower concourse connects at grade to proposed boulevard to the Piccadilly SRF and connects under the NR Classic station to the Mayfield development.

Baseline Above ground Station Site

4.1.7 The proposed Manchester Piccadilly High Speed station is located north of the existing Piccadilly station concourse and to the east of Gateway House. With the terminus ends of the HS2/NPR platforms broadly aligning with the ends of the NR station platforms.

4.1.8 The proposed station building itself is rectilinear, approximately 586m in length and 65m wide (excluding the width of the Boulevard and shared concourse) to accommodate the requirements for; HS2, Northern Powerhouse Rail (NPR) and the sunken Metrolink Piccadilly station.

4.1.9 Manchester Piccadilly High Speed station is a rail terminus station with a three-island platform configuration, located above street level and supported by a viaduct structure.

4.1.10 As the track heads east, it continues along a viaduct over the River Medlock and Mancunian Way (A635) where it descends towards a portal adjacent to the Ardwick Depot.

4.1.11 The current site is a mixture of light industry, offices, residential and car parking (both multi-story and ground level). The key landowner is Network Rail (NR).

4.1.12 It is not foreseen that any residential buildings will be demolished due to HS2 proposals in this study area.

4.1.13 The site is bisected by many roads which will be affected as part of this work, these include:

- Sheffield Street;
- Mancunian Way;
- Ashton Old Rd;
- Travis Street;
- St Andrews St;
- Helmet Street;
- Pin Mill Brow and
- Store Street

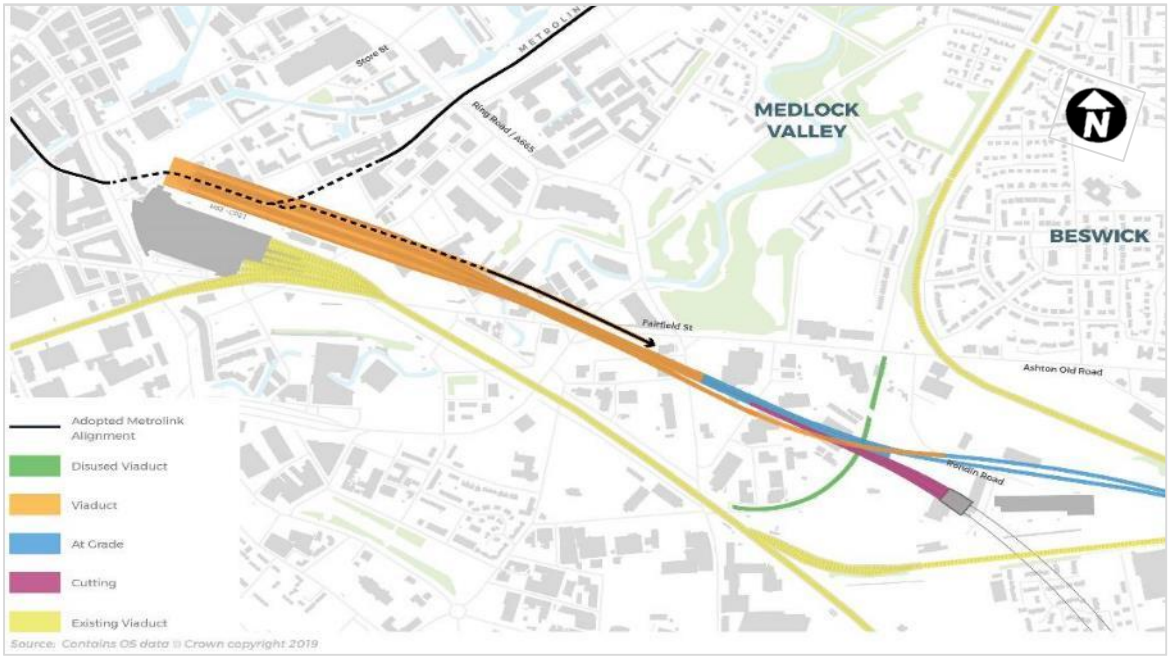

Figure 6 - High Speed Rail, NPR and Metrolink Alignment Baseline proposal

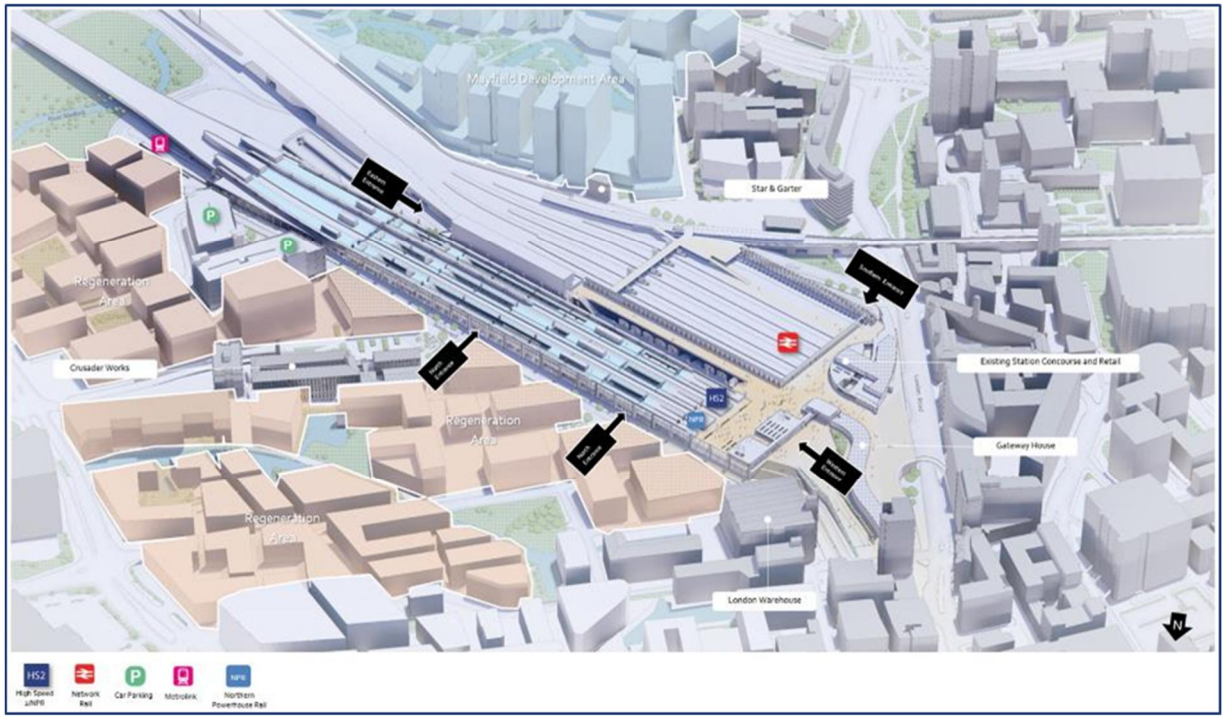

Figure 6 - Manchester Piccadilly High Speed Station Baseline proposal

Summary of General Arrangement

4.1.14 Manchester Piccadilly High Speed Station will be a new station on the HS2 route which will be located close to Manchester Piccadilly classic Network Rail station. The HS2 station is alongside the existing station so that it can operate and feel like a single station.

4.1.15 The six HS2 platforms in a 3-island configuration will be located on a viaduct. The platforms will be 415m in length with an additional 40 m buffer zone at the western end. The platforms are mostly under the station roof with full roof platform coverages. The remaining length of platforms will be provided with canopies. The tracks will run onto the approach viaduct to the east before connecting into the Manchester tunnel

4.1.16 The platforms and concourse sit below a single span vaulted roof volume spanning across the three island platforms providing weather protection, daylight and sense of arrival. The design provides view out though a glazed façade to the boulevard and views of the NR classic station listing façade through the shared concourse assisting wayfinding.

4.1.17 All internal occupied areas of the station need to be ventilated to control and dilute airborne contaminants (e.g. Carbon dioxide, etc), to exhaust unwanted heat and smoke (train heat emissions, and during or following a fire event), and to a lesser degree reduce internal moisture accumulation

4.1.18 The baseline proposal utilises the station roof volume as part of the ventilation strategy. The proposal includes areas that are naturally ventilated and areas requiring supply air only with space proof provision for mechanical and smoke extract on the roof subject to advance modelling during detailed design.

4.1.19 Under the platforms will sit the lower concourse with access to the HS2 eastern concourse and Metrolink platforms in the basement. The concourse will be accessible from the shared concourse providing a vertical link to the HS2/NPR western concourse and NR classic station concourse. It also provides north-south and east-west pedestrian connectivity and links to forecourt facilities.

4.1.20 The lower concourse and platform level concourse will include retail provision. The eastern and western loading bay links to the back of house with access between the two main levels.

4.1.21 In the basement box section will sit a new Metrolink stop with four platforms. These will be accessed from the lower concourse level.

4.1.22 To the north of the station there will be car parking provision consisting of two car parks on the boulevard

4.1.23 Eastern Forecourt: Private car, ride hailing, taxi pick-up and drop-off facilities are located to the east of the station between the HS2 viaducts and the existing conventional rail viaducts.

4.1.24 Fairfield Street Forecourt: existing short-term pick-up and drop-off will be replaced with blue badge bays, whilst the taxi facility will remain

4.1.25 Piccadilly Boulevard: A linear intermodal forecourt will run parallel to the new station side of the road.

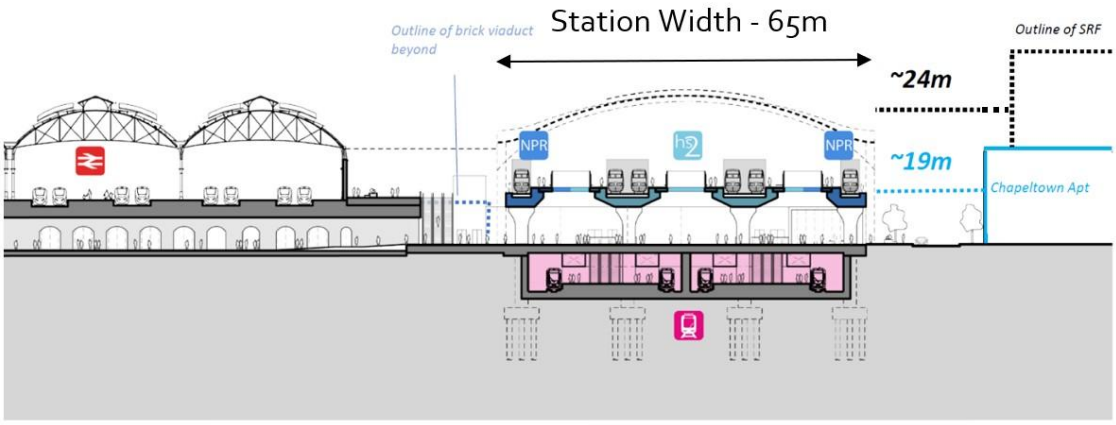

Figure 7 - Conceptual Section of Manchester Piccadilly Baseline Proposal

Platform Configuration

4.1.26 The Manchester Piccadilly High Speed station scheme selected has six platforms in a 3-island configuration. This configuration provides a more efficient overall station width than using separate side platforms. The current platform design has the following features:

4.1.27 Each platform is designed to accommodate the following vertical circulation for customers:

- 6 No: Escalators arranged as 2no: banks of 3 escalators leading to the lower concourse towards the eastern end of the platforms. The western end is end loaded.
- Four customer lifts, this is based on pairs of 2 with through Access from platform level to the lower eastern concourse;
- Three fire escape stairs with firefighting and evacuation lifts;
- Service lifts have been included at the eastern end of each platform, linked to the eastern loading bay

4.1.28 The following indicative facilities are also provided for on platforms

- Hydrants
- Communication & Electrical equipment rooms.
- Goods lift (catering and waste)
- Wheelchair storage
- Wheelchair accessible toilet
- Staff unisex toilet
- Seating

- Staff refuge point
- post mounted systems for lighting, PA/VA and CCTV

Concourse Configuration

4.1.29 The station has 2 main concourses, one at platform level and level with the NR concourse, and a second lower concourse at ground level. These two concourses are linked via the shared concourse providing vertical connection between the NR classic station and the HS2/NPR station and concourses

4.1.30 Provision has been made for the following facilities within the HS2/NPR Concourses:

- Retail
- Customer toilets and baby facilities
- Customer information points
- Waiting areas
- Lost luggage
- British Transport Police (front of house)
- Multi-faith room
- First Aid Room
- Customer experience hubs

Western Concourse

4.1.31 Providing a concourse at the ‘city end’ of the station enables a level connection from the end of the HS2 and NPR platforms and the existing station concourse for quick interchange times. Its configuration is designed to provide direct pedestrian access to and from the city centre via Station Approach or north of Gateway House. Provision for customer lounges and facilities are provided within two mezzanine areas. There is an opportunity for these to link to the existing station upper retail level

Eastern Concourse

4.1.32 The HS2/NPR eastern concourse sits below platforms as part of the lower concourse and provide access to the HS2 platforms via a total of 18 escalators and 8 lifts. Its location provides quick and direct interchange to the Metrolink platforms. Space provision has been made for customer waiting areas and retail facilities around the edges of the concourse.

Shared Concourse

4.1.33 The shared concourse connects the HS2 /NPR and NR classic station together in a double height atrium space for the full active length of the lower concourse Virtual transportation connects the lower concourse and the upper concourse with circulation space at both levels running along the listed façade and brick arches below.

Metrolink

4.1.34 HS2 have collaborated with TfGM to incorporate their concept for new Metrolink Stops at Piccadilly. It is intended that Metrolink relocation is done under the hybrid Bill powers and land requirements to enable a combined multi-modal hub. The scheme designed by TfGM consists of two stations. The stops are referred to as Piccadilly and Piccadilly Central.

Piccadilly

4.1.35 This will be the main Metrolink stop at Piccadilly. It is proposed that 4 underground platforms will act as interchange to the city network serving the existing and HS2/NPR station services as well as surrounding developments. The stops location provides direct connectivity to the lower concourse and onwards to the rest of the Piccadilly transport facilities.

Piccadilly Central

4.1.36 A secondary, two side platform Metrolink stop is proposed at grade to the east as passive provision. Level access from the Boulevard and the south is possible through excavation and levelling of the surrounding terrain. Further extension of this branch line as part of tram-train connection has been considered in conjunction with TfGM and is not precluded by the HS2 works

4.1.37 The platforms will be accessed with two set of vertical transportation at the west of the Metrolink platforms.

Ventilation and Smoke extract

4.1.38 The Metrolink Piccadilly stop requires a means to extract smoke in a fire scenario. As a result, an extract structure will be required adjacent to the station. An indicative location for this smoke extract point has been reserved to the west of the station. It is envisaged that a flue in the location could be successfully mitigated through a considered landscape, architectural or sculptural approach. Reference can be drawn from successful examples of high-quality responses such as Kings Cross Square, London.

Urban Integration

4.1.39 The Boulevard is located to the north of HS2 viaduct station.

4.1.40 The station ticket hall, concourse and back of house occupies the whole length of The Boulevard at ground floor level, fronting, animating and activating the Boulevard. The Boulevard acts as an armature for development, establishing a new commercial address for Manchester city centre.

4.1.41 Two ‘ gateways ’ has been envisioned by MCC Piccadilly SRF, one at Medlock Park with the highest visibility along the Ring Road and the second at HS2 and NR station entrance facing onto the city centre. Baseline option offers an HS2 Station that resembles the heroic arched station structure that pays homage to the listed Victorian NR Station. However, the baseline HS2 station is hidden behind the Gateway House with its ramp structure, providing a limited presence in the city centre. The location of baseline station forms a limited gateway experience into Manchester, with its presence bounded to The Boulevard only. Wayfinding into Manchester City centre has limited legibility if passenger exit onto The Boulevard.

4.1.42 With the relocation of Metrolink to below ground, baseline option allows pedestrian permeability under the NR station, linking the Piccadilly SRF area to Mayfield SRF development to the south.

4.1.43 Multi modal hub has been placed between the NR and HS2 approach viaduct.

4.1.44 HS2 alignment will be arriving from the east through the industrial dominated hinterland in a tunnel. The tracks will be exiting through the portal, the approach will raise onto an embankment and arriving on a viaduct into the city centre. Land where HS2 will be approaching from the east is currently sterilised by existing NR viaducts, railway sidings, depots and other infrastructure. Much of these NR infrastructures will remain in-situ with the addition of Metrolink tram-train infrastructure, HS2 embankment/portal and NPR embankment. Industrial dominated land to the east of Ring Road will be affected by the arrival of HS2 with its embankment/viaduct. It has been noted at hybrid bill design stage that these industrial dominated areas within the CCB can be redeveloped with the arrival of HS2.

4.1.45 Development opportunity within the CCB has been tested to the east of road ring at hybrid Bill Design stage, this has been documented in hybrid Bill Design Urban Integration Study (2DE01-MWJ-EN-REP-M005-000014 P02). Significant challenge remains with HS2 embankment and Metrolink tram train alignment which limits north-south connection between the two development parcels. Nonetheless, there is sufficient space in the north and south parcel to accommodate two blocks of development parcels each with adequate space to mitigate against the visual impact of the viaduct and embankment. It has been envisioned that retail and commercial opportunities can be

located under the HS2 viaduct connecting them back into the proposed urban structure. Existing disused NR Viaduct and historic building of interest can be retained and adaptively reused to develop the character of the new development area.

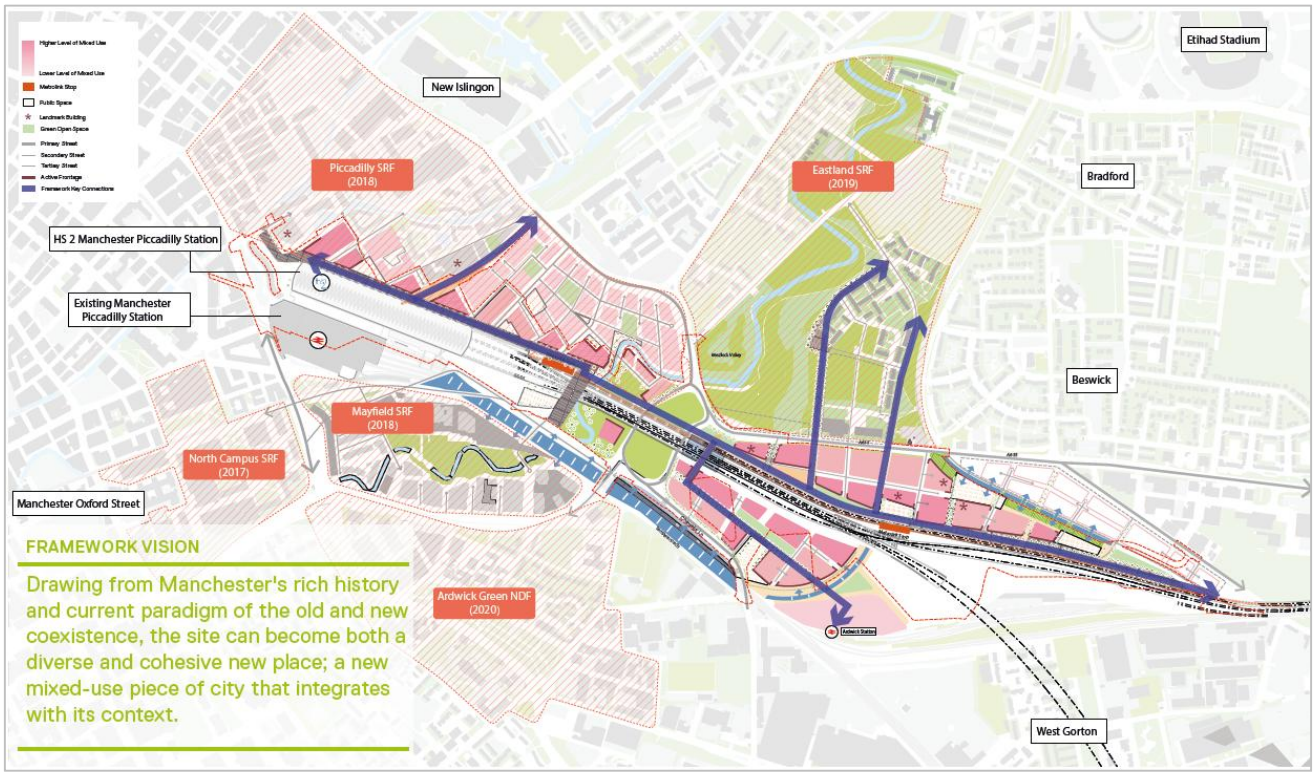

Figure 8 – Strategic Urban Framework developed for Hybrid Bill Design.

4.1.46 In order to provide adequate access to regenerate the development area to the east of Ring Road, it has been envisioned that the northern parcel will be served by the Metrolink Tram-Train Service (Hooper Street Station), The southern parcel will be served by Ardwick NR Station with increased frequency of service brought on by the new development.

4.2 Underground Option B

Underground Option B route alignment

4.2.0 Underground station Option B lies on alignment B. Alignment B is c.28km long between Node MA and Node 3 and is wholly underground. There is c.16km of route to the south of the station and c.12km to the north.

4.2.1 Alignment B initially proceeds north-east from Manchester Airport High Speed station, adopting the same horizontal and vertical alignment (including the tunnel portal) as the hybrid Bill alignment, before diverging to pass to the west of M60 junction 5 (with the A5103). The route then bears north-west passing under Longford park before reversing to pass approximately between Old Trafford Cricket Ground and Old Trafford Football Stadium. The route then continues as a long right-hand curve, passing beneath Salford Quays and the river Irwell, to tie in with the approximately north-west/south-east bearing of the proposed underground station adjacent to the existing Manchester Piccadilly conventional rail station, the rail level at the proposed station being 6m AOD.

4.2.2 Leaving the proposed underground station, and remaining underground, the route passes through the Ardwick area to the north of the shed at Ardwick depot. After passing under the railway at Ardwick depot the alignment bears north-east with a left-hand curve before reversing in Greenside. Following this the alignment bears east-north-east, following a right-hand curve which reverses under the M60 near Medlock hall.

Option B Selected Construction Methodology: Deep box

4.2.3 Option B is proposed as a deep box construction. A deep box is required to allow the tunnelled throat to connect to the station box and hence depth of station box is defined by construction requirements of the tunnel approach and interaction with geotechnics to provide enough cover to ground level to allow the approach structures to be constructed using mined excavation techniques. This had been identified as providing the potential advantage of minimising the surface disruption that open box excavation would otherwise mean. The deep box construction with tunnelled approach throat lessens surface impact as buildings above would not be required to be demolished in the case of the open cut, throat design of the shallow box construction. In both the shallow and deep box construction the station box is open and requires demolition of structures above.

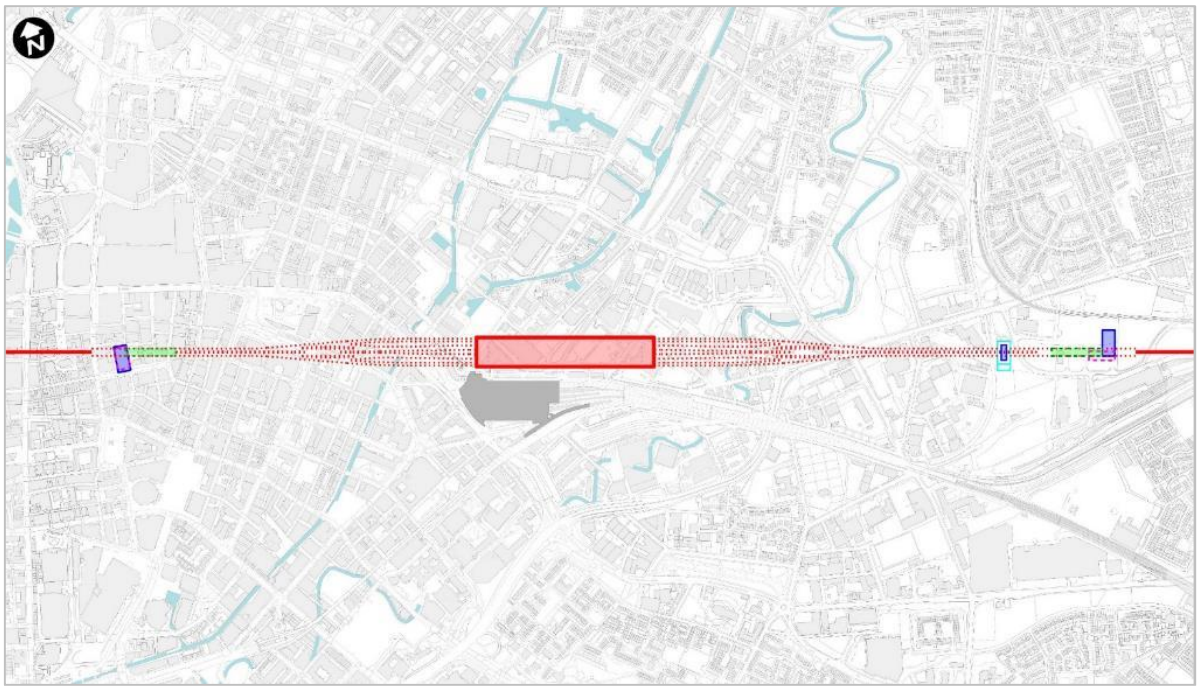

Figure 9 - Option B Alignment including station box, approach throats, inner and outer crossovers

Option B Site location

4.2.4 Alignment B site is located north of the existing station in a parallel configuration.

4.2.5 The proposed site is a mixture of light industry, offices, residential and car parking (both multi-story and ground level. The key landowner is Network Rail (NR)

4.2.6 The station box located below ground is 465m long 76.5m wide and Circa 38m deep noting that ground levels vary.

4.2.7 Track level is defined by the mined approach geotechnical requirements and established at +6AOD.

4.2.8 Above the station box is proposed Over Site Development (OSD) the OSD is provided access from ground level.

4.2.9 Station entrances providing access from ground level to the station platforms below ground are provided via ticket halls at the western and eastern end of the station box.

4.2.10 The station proposal is a through station. The station box is served by a mined cavern approach throat at each end. The inner scissors crossover is located within the throat. The station box is comprised of concrete retaining walls and internal column and beam arrangement supporting flows and integrating with Over Site Development (OSD)

4.2.11 Two outer scissors crossovers are required for normal operation and perturbed operation. The facility for trains to cross lines is an operational requirement. At the crossover ventilation and fire-fighting intervention access is provided.

4.2.12 Typically, a crossover includes provision for ventilation and pressure relief via an open cut (clear opening to atmosphere) in the region of 130m x 30m. This is inappropriate for a city centre location, particularly when it is a sensitive conservation area, therefore a mined cavern crossover with mechanically supported ventilation and pressure relief is proposed. The proposal includes a caverned mined crossover of similar size below ground providing the crossover requirement. The below ground box places the crossover below ground with connection above ground facility which includes mechanical ventilation and emergency intervention access.

4.2.13 The outer scissors crossovers are located to the West along King Street opposite Pall Mall Court requiring the replacement of an existing building with a vent shaft and headhouse. Similar structures are required to the East towards Ardwick.

4.2.14 As the shaft at the Ardwick crossover is further than 1000m from the nearest intervention core in the station an additional intervention core is required between Rondin Road and the disused railway viaduct.

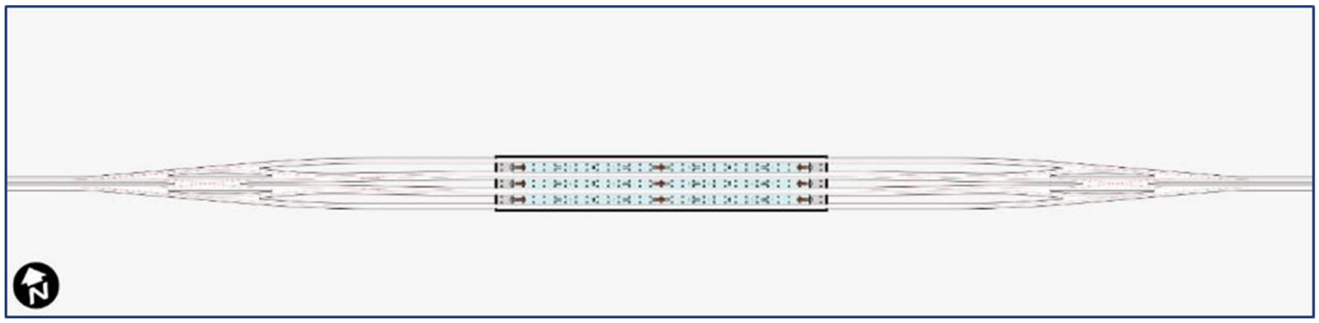

Figure 10 - Option B platform and throat arrangement

Summary of General Arrangement

4.2.15 The station box below ground is comprised of three horizontal levels including platform, ventilation service zone and concourse level.

4.2.16 Back of house service areas are provided at either end of the station where platform and passenger area ventilation systems connect to large fans and to air intake and extract at service mezzanine above ticket halls at either end of station box.

4.2.17 Ventilation service zone includes large smoke extract ducts with adjacent provision for ventilation of occupied spaces.

4.2.18 The concourse connects to the western and eastern ticket halls and internally connects via vertical circulation to the platforms below.

4.2.19 The station concourse and platforms are located below ground. The structural design includes retaining perimeter walls with column and beam supports for floor space and transfer of load from OSD above in an integrated proposal

4.2.20 The vertical circulation of the proposal includes escalators that connect the platform to the concourse level via opening on the concourse level. This assists wayfinding providing visual connection between levels.

4.2.21 Located above the opening in the concourse are lightwell openings in the ground floor slab level which provide a glimpse of daylight at platform or concourse level and assist wayfinding.

4.2.22 It should be noted the lightwells are not a part of the ventilation strategy.

4.2.23 All internal occupied areas of the station need to be ventilated to control and dilute airborne contaminants (e.g. Carbon dioxide, etc), to exhaust unwanted heat and smoke (train heat emissions, and during or following a fire event), and to a lesser degree reduce internal moisture accumulation

4.2.24 The station proposal makes provision for both ventilation and smoke exhaust within the ventilation service zone located in-between the platform and concourse spaces.

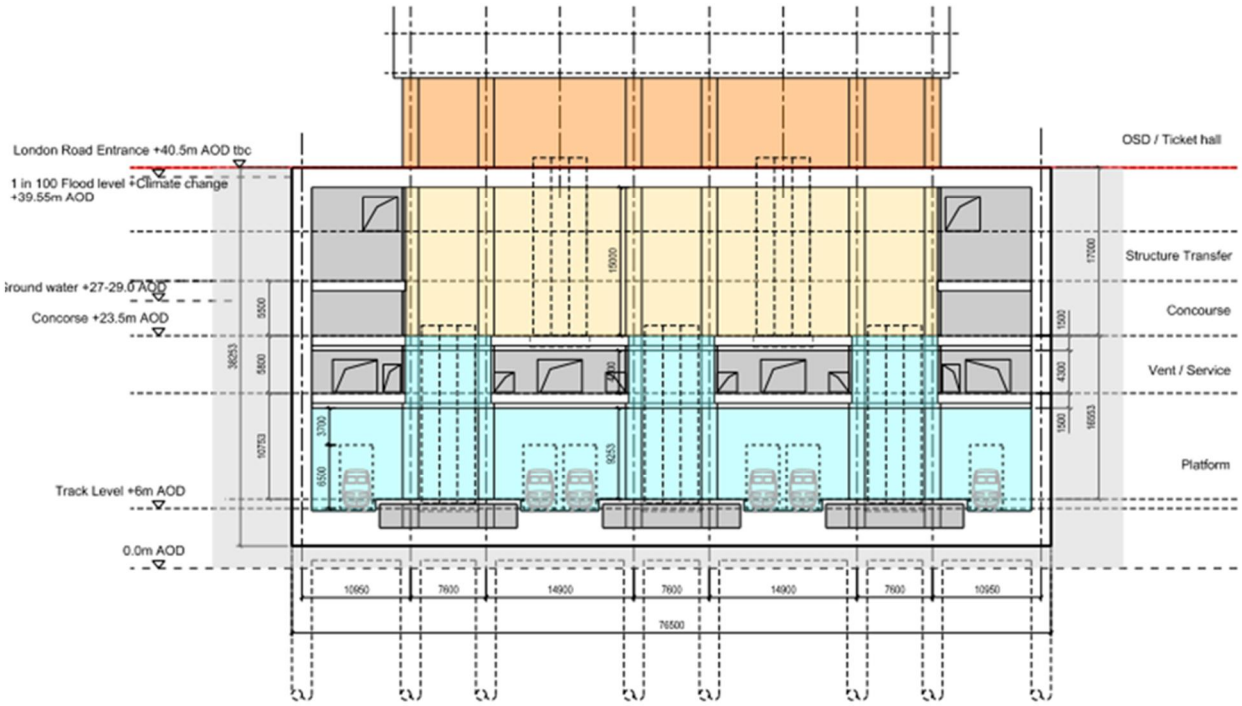

Figure 11 - Option B cross section

Platform Configuration

4.2.25 Platforms for alignment B are located below ground. The configuration includes three island platforms serving six through rail lines and include the following features:

4.2.26 The island platforms 415m long are 15.2m wide including a 6m zone for three escalators with space for 1.6m wide column either side of escalators and 3m clear zone from column to platform edge.

4.2.27 Structural columns are located either side of the escalators to reduce span length, and reduce beam depth. The structure integrates with the structure of the over site development (OSD) above, providing load path for OSD structure above. The design proposal looks to provide efficiency in structural design noting longer span beams can require deeper section and impact overall depth.

4.2.28 Alternative structure arrangements include single column on platform were examined however this is less preferred as span and depth of structural zone increases. A paired column arrangement is preferred to reduce span and enable coordination with structure of OSD.

4.2.29 Each platform is designed to accommodate the following vertical circulation:

- 12 no. escalators arranged as four banks of three escalators evenly distributed along the platform.
- Four customer lifts, this is based on pairs of two with through access.
- Three fire escape stairs with firefighting and evacuation lifts.
- Service lifts have been included at each platform end.

4.2.30 The following facilities shall be provided on the platform and would be described in more detail in subsequent design stages:

- Hydrants.
- Communication & Electrical equipment rooms.
- Goods lift (catering and waste).
- Wheelchair storage.
- Wheelchair accessible toilet.
- Staff unisex toilet.
- Seating.
- Staff refuge point.
- Post-mounted systems for lighting, PA/VA and CCTV.

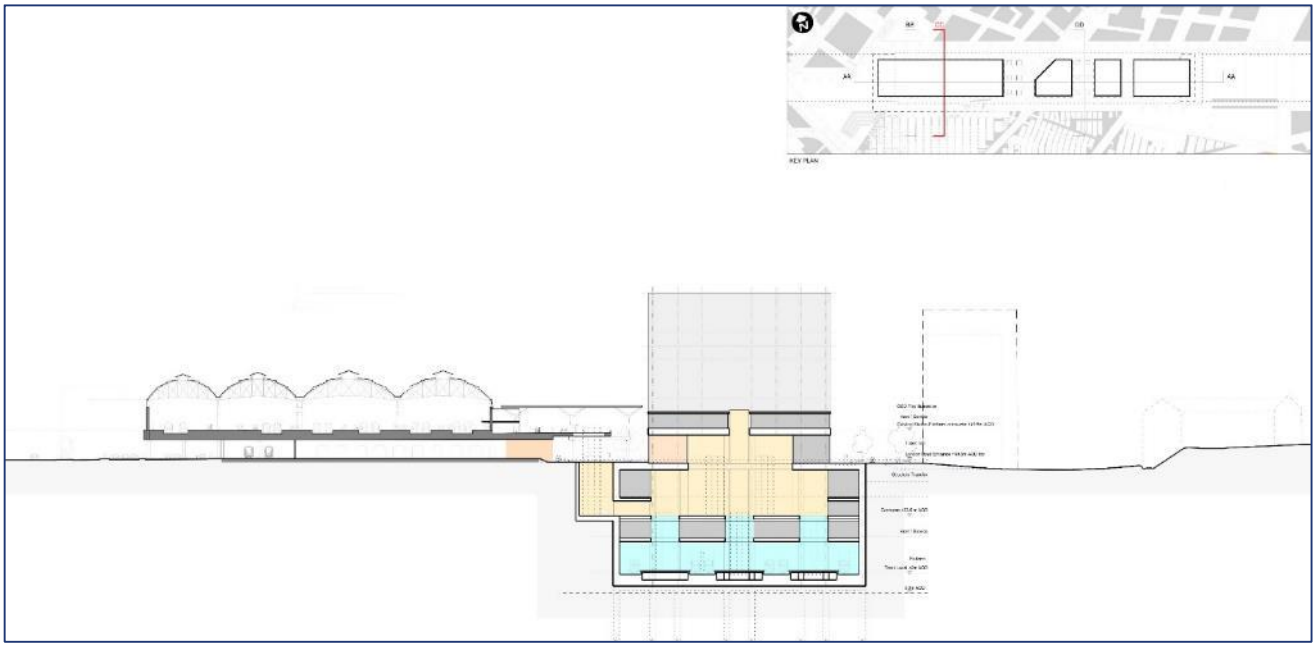

Figure 12 - Conceptual Section of Manchester Piccadilly Option B

Concourse configuration

4.2.31 The concourse level is located above the platform level and below ground and provides below ground horizontal weather protected connection to the western and eastern ticket halls.

4.2.32 The concourse includes a short tunnelled direct connection from HS2 underground concourse to the NR concourse with integrated vertical interchange.

4.2.33 From the western and eastern ticket halls passengers exit the station and connect externally to:

- The existing Piccadilly Station concourse
- Metrolink maintained in existing configuration (refer also 3.4.2)
- Station forecourt
- Boulevard

4.2.34 The following facilities shall be provided on the platform and would be described in more detail in subsequent design stages

- Retail
- Customer toilets and baby facilities
- Customer information points

- Waiting areas
- Lost luggage
- British Transport Police (front of house)
- Multi-faith room
- First aid room
- Customer experience hubs

Western Ticket Hall

4.2.35 Western Ticket hall is located at the city end and adjacent the existing station at ground level. Access to the NR concourse require vertical change in level via steps, lift or escalator.

4.2.36 The ticket hall for all options are sized using capacity-based demand with 75% of seated capacity boarding and alighting each train. The calculation defines waiting and circulation area which are combined to give the total unpaid concourse size distributed across the ticket halls.

4.2.37 Being located at the city end and near, the NR concourse the unpaid ticket hall is the larger including an unpaid ticket hall. The size is based on current train service specification and capacity-based demand. The unpaid concourse is required to be 2,768sqm.

4.2.38 The ground level ticket hall is connected to the below ground station concourse via lifts and escalators. Note: this is complimented by a direct access from below ground concourse to the NR concourse.

4.2.39 The ground level concourse provides level pedestrian access to forecourt and station approach. Including Boulevard to the north

4.2.40 A pedestrian space is located to the west and constrained by proximity of London warehouse grade II listed building, the existing station and London Road.

4.2.41 Note Gateway house is removed providing clear line of sight to city and London Road.

Eastern Ticket hall

4.2.42 The eastern ticket hall also at ground level is located to towards the east and faces proposed adjacent plaza. The plaza is overlooked by adjacent site development (ASD) and OSD between the entrance and the river Medlock.

4.2.43 The unpaid ticket hall responding to capacity-based demand is smaller than the western ticket hall. The unpaid concourse is required to provide 476sqm

4.2.44 The ground level ticket hall is connected to the below ground station concourse via lifts and escalators.

4.2.45 The ground level concourse provides level pedestrian access to forecourt and station approach. Including Boulevard to the north

Metrolink

4.2.46 Metrolink is maintained in its existing configuration within the existing station. Refer also to 3.4.1 regarding Metrolink options included.

4.2.47 The existing Metrolink infrastructure at Piccadilly Station includes 2 platforms located underneath the existing station, including lift and escalator access to/from the Network Rail concourse and level access from Fairfield St forecourt.

4.2.48 NPR uses access the Metrolink from the existing concourse via lifts and escalators described above. HS2 passengers require to travel up escalators to the ground level ticket hall and hence up to NPR existing concourse and from here down to Metrolink via lists and escalators previously mentioned.

4.2.49 The Metrolink provides

- North western connection towards Piccadilly Gardens and the city centre
- A north eastern connection towards New Islington

Urban Integration

4.2.50 Alignment option B replicates the urban structure of the baseline option and MCC Manchester Piccadilly SRF with the Boulevard located to the north of HS2 Station.

4.2.51 OSD has been allocated above the station box. This offers ground floor commercial / retail uses that activates the surrounding area, whilst improving upon the ground floor dynamics.

4.2.52 This configuration expands the Piccadilly SRF development to the south and incorporating the proposed HS2 station box into the urban realm.

4.2.53 Station plaza is shared between NR and HS2 Station in the west. With the demolition of Gateway House, the HS2 Station will have a clear line of sight onto London Road with improved wayfinding. Due to the closeness of the listed London Warehouse and NR Station, the size of public realm is limited outside the western ticket hall.

4.2.54 With Metrolink remaining in existing location (under NR station), Alignment option B limits NR Station ground floor permeability. Disconnecting Mayfield SRF development from Piccadilly SRF.

4.3 Underground Option B1

Underground Option B1 route alignment

4.3.0 Underground station option B1 lies on alignment B with the station south east of location of underground option B but still on the same straight. Alignment B is c.28km long between Node MA and Node 3 and is wholly underground. There is c.16km south of underground to the south of the station and c.12km to the north.

4.3.1 Alignment B initially proceeds north-east from Manchester Airport High Speed station, adopting the same horizontal and vertical alignment (including the tunnel portal) as the hybrid Bill alignment, before diverging to pass to the west of M60 junction 5 (with the A5103). The route then bears north-west passing under Longford park before reversing to pass approximately between Old Trafford Cricket Ground and Old Trafford Football Stadium. The route then continues as a long right-hand curve, passing beneath Salford Quays and the river Irwell, to tie in with the approximately north-west/south-east bearing of the proposed underground station adjacent to the existing Manchester Piccadilly conventional rail station, the rail level at the proposed station being 16.2m AOD. It should therefore be noted that the track levels for Station Option B1 are higher (to suit a shallower station box) than for Option B.

4.3.2 Leaving the proposed underground station, and remaining underground, the route passes through the Ardwick area to the north of the shed at Ardwick depot. After passing under the railway at Ardwick depot the alignment bears north-east with a left-hand curve before reversing in Greenside. Following this the alignment bears east-north-east, following a right-hand curve which reverses under the M60 near Medlock hall.

Option B1 Selected Construction Methodology: Shallow Box

4.3.3 Option B1 employs a shallow throat open cut approach for the train lines into the station box instead of the rail line being in individual caverns entering the station box as described in option B the approaching train lines are situated in a single shallow box created by slab and retaining walls constructed as an open cut requiring demolition of above ground buildings. The level of the track at +16.2 AOD is shallower in depth compared to option B where the track level is +6 AOD and which requires the station box of B to be deeper in comparison. While the depth of the deep box options with mined caverns are defined by constraint of construction and geotechnical requirements the depth of option B1 shallow box is constrained by the River Irwell and River Medlock which require approach tunnel and throat to provide adequate vertical separation from them. The shallow box comprises of base slab and retaining walls. Internally beams

provide bracing to the internal walls and connect to columns which support a re-provided ground plane above the throat. The columns are integrated with OSD structure providing structural load path.

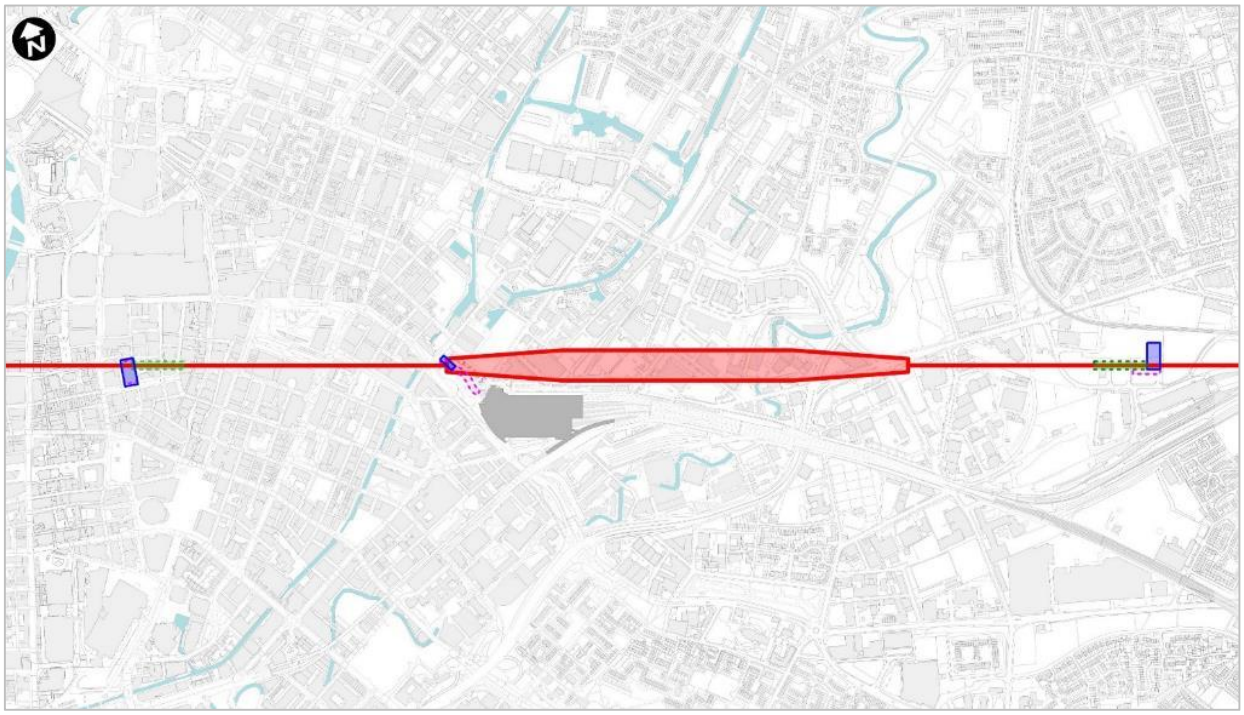

Figure 13 - Option B1 Alignment including station box, with approach throats and outer crossover Note inner crossover within station box

Option B1 Site location

4.3.4 Alignment B1 site is located north of the existing station in a parallel configuration. The alignment is similar to option B, but because the approaches are cut and cover the station is located further east to avoid London Road.

4.3.5 The proposed site is a mixture of light industry, offices, residential and car parking (both multi-story and ground level. The key landowner is Network Rail (NR). As the station is located further east than option B, the cut and cover box construction impact the existing River Medlock, part of which is concealed under a culvert, and the Pin Mill Brow ring road and its junctions.

4.3.6 Whereas the station box of options B & D can be described as two elements including the mined approach throats, and the station box. In option B1 the station box and throat are comprised as a single element as they are constructed from a single open cut. From beginning of throat to end of the other throat and including the station box component in-between the length is 1,166m long.

4.3.7 The station box component is 580m long where the geometry intersects with the approach throats each side and which are 293m each.

4.3.8 The depth of the station box is 28m, noting that ground levels vary across the site.

4.3.9 Track level is defined by the mined outer scissors crossover cavern geotechnical requirements and established at +16.2 AOD. The depth is constrained by the River Irwell and River Medlock. Note +16.2m AOD is shallower than +6.0m AOD which is deeper in respect of depth below ground level. (AOD = Above ordnance Datum) note also option B & D have track level at +6.0 AOD

4.3.10 From ground level to top of rail level the station is 24.3m deep (comparable to Bologna AV Central station which is circa 23m, refer also to 5.1.4).

4.3.11 Above the station box is proposed over site development (OSD). The OSD is provided access from ground level.

4.3.12 Station entrances providing access from ground level to the station platforms below ground are provided via ticket halls at the western and eastern end of the station box.

4.3.13 The station proposal is a through station. The station box and integrated throat as a shallow box construction incorporates the inner crossover scissor within the throat located east and west.

4.3.14 Two outer crossovers are required. The facility for trains to cross lines is an operational requirement. At the crossover ventilation and fire intervention access is provided

4.3.15 Typically, a crossover includes provision for ventilation and pressure relief via open cut (clear opening) in the region of 130m x 30m. This is inappropriate for a city centre location particularly when it is a sensitive conservation area therefore a mined cavern crossover with mechanically supported ventilation and pressure relief is proposed. This puts the bulk of the requirement below ground with a smaller footprint above ground. The proposal includes a caverned mined box below ground providing the crossover requirement. The below ground box is connected to the smaller above ground facility which includes mechanical ventilation and intervention access. Note; Option B and B1 utilising the same alignment employ the same crossover box design and location.

4.3.16 The outer crossovers are located to the west along King Street opposite Pall Mall Court, requiring the replacement of an existing building with a vent shaft and head house, and to the east towards Ardwick.

4.3.17 As the station site has been relocated towards the east the station is closer to the eastern outer crossover and further away from the western outer crossover, which is now greater

than 1000m from the nearest intervention core in the station. Hence an additional intervention core is required on the western side at the end of the cut and cover approach box, but not to the East.

4.3.18 The additional intervention core is located on the western side of the station throat within the western plaza.

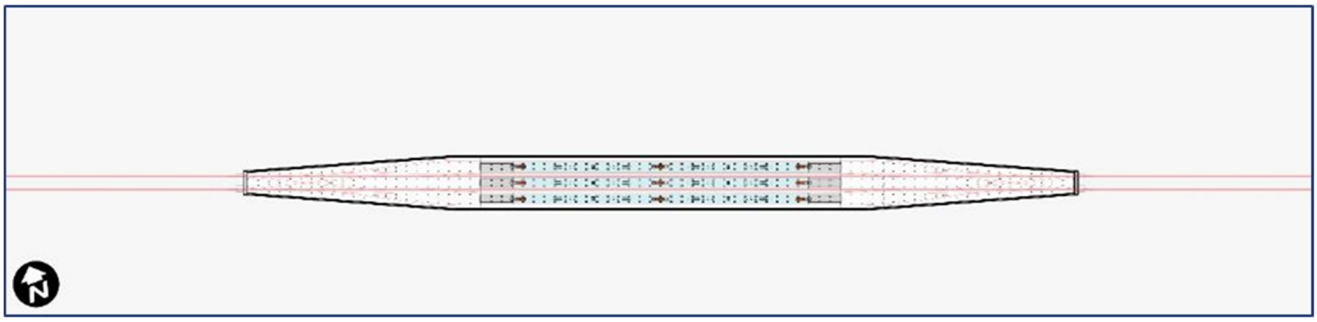

Figure 14 - Option B1 Platform and Throat Arrangement

Summary of General Arrangement

4.3.19 The station box below ground is comprised of three horizontal levels or components including platform, ventilation service zone and concourse level.

4.3.20 Back of house service areas are provided at either end of the station where platform and passenger area ventilation systems connect to large fans and to air intake and extract at service mezzanine above ticket halls at either end of station box.

4.3.21 Ventilation service zone includes large smoke extract ducts with adjacent provision for ventilation of occupied spaces.

4.3.22 The concourse connects to the western and eastern ticket halls and internally connects via vertical circulation to the platforms below.

4.3.23 The station concourse and platforms are located below ground. The structural design includes retaining perimeter walls with column and beam supports for floor space and transfer of load from OSD above in an integrated proposal

4.3.24 The vertical circulation of the proposal includes escalators that connect the platform to the concourse level via opening on the concourse level. This assists wayfinding providing visual connection between levels.

4.3.25 Located above the opening in the concourse are lightwell openings in the ground floor slab level which provide a glimpse of daylight at platform or concourse level and assist wayfinding.

4.3.26 It should be noted the lightwells are not a part of the ventilation strategy.

4.3.27 All internal occupied areas of the station need to be ventilated to control and dilute airborne contaminants (e.g. Carbon dioxide, etc), to exhaust unwanted heat and smoke (train heat emissions, and during or following a fire event), and to a lesser degree reduce internal moisture accumulation.

4.3.28 The station proposal makes provision for both ventilation and smoke exhaust within the ventilation service zone located in-between the platform and concourse spaces.

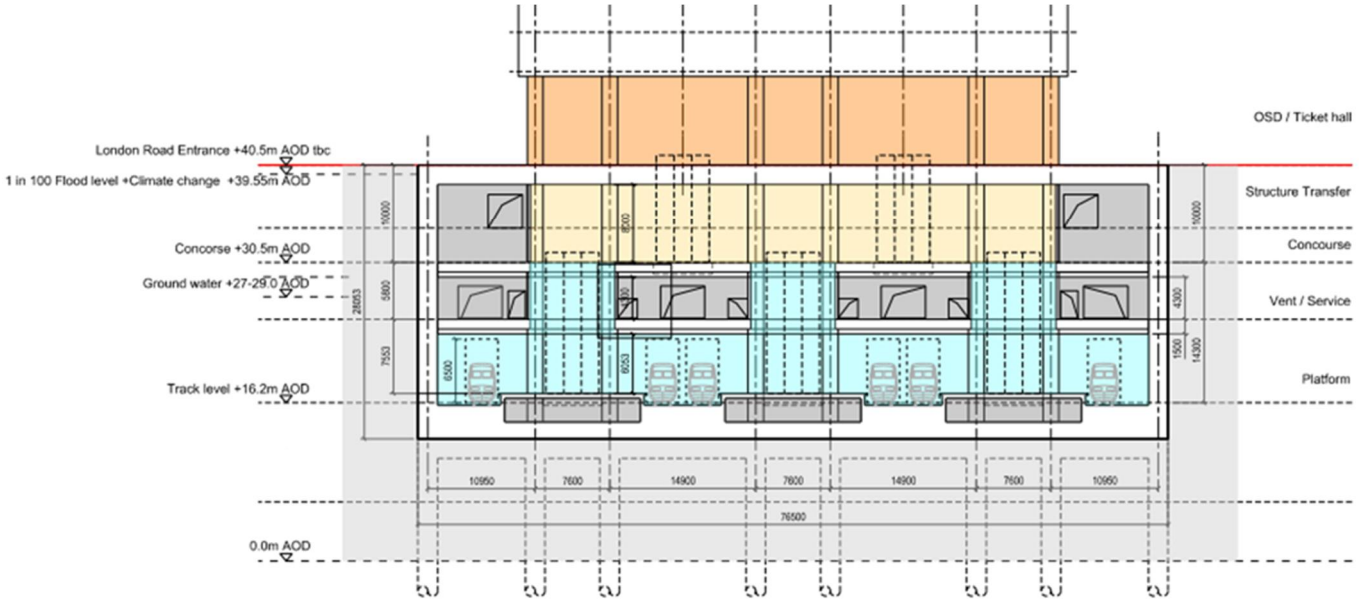

Figure 15 - Option B1 Cross Section

Platform Configuration

4.3.29 Platforms for alignment B1 are located below ground. The configuration includes three island platforms serving six through rail lines and include the following features:

4.3.30 The island platforms 415m long are 15.2m wide including a 6m zone for three escalators with space for 1.6m wide column either side of escalators and 3m clear zone from column to platform edge.

4.3.31 Structural columns are located either side of the escalators to reduce span length, and beam depth. The structure integrates with the structure of the over site development (OSD) above.

4.3.32 Alternative structure arrangements were considered e.g. single columns on the platforms, however the resulting increased structural zone was considered undesirable. A paired column arrangement is preferred to reduce span and enable coordination with structure of OSD.

4.3.33 Each platform is designed to accommodate the following vertical circulation:

- 12 No: escalators arranged as 4no: banks of 3 escalators arrangement evenly distributed along the platform 12.
- Four customer lifts, this is based on pairs of 2 with through access;
- Three fire escape stairs with firefighting and evacuation lifts;
- Service lifts have been included at each platform end

4.3.34 The Following facilities shall be provided on the platform and would be described in more detail in subsequent design stages

- Hydrants
- Communication & electrical equipment rooms.
- Goods lift (catering and waste)
- Wheelchair storage
- Wheelchair accessible toilet
- Staff unisex toilet
- Seating
- Staff refuge point
- post mounted systems for lighting, PA/VA and CCTV

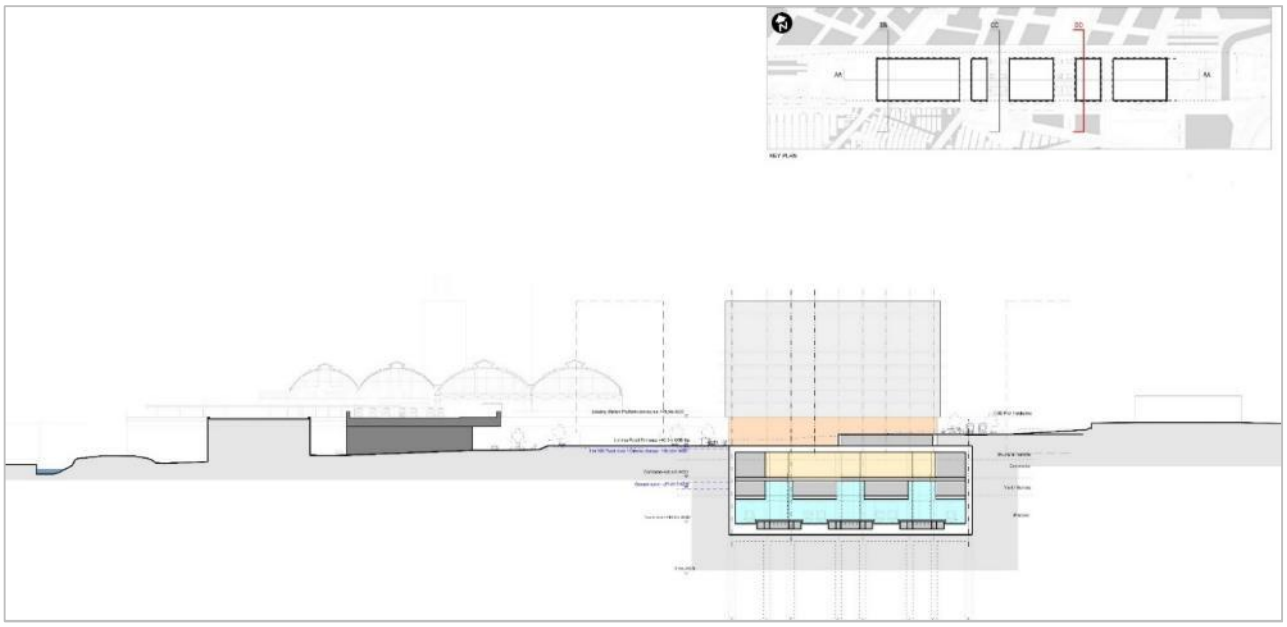

Figure 16 - Conceptual Section of Manchester Piccadilly Option B1

Concourse configuration

4.3.35 The concourse level is located above the platform level and below ground and provides below ground horizontal weather protected connection to the western and eastern ticket halls.

4.3.36 From the western and eastern ticket hall passengers exit the station and connect externally to:

- The existing Piccadilly Station concourse
- Metrolink located in Gateway plaza between HS2 western ticket Hall and existing station.
- Station forecourt
- Boulevard

4.3.37 The following facilities shall be provided on the platform and would be described in more detail in subsequent design stages

- Retail
- Customer toilets and baby facilities
- Customer information points
- Waiting areas

- Lost luggage
- British Transport Police (front of house)
- Multi-faith room
- First aid room
- Customer experience hubs

Western Ticket Hall

4.3.38 Western Ticket hall is located at the city end and further away from the existing station concourse due to requirements of construction methodology relocating the site as mentioned previously.

4.3.39 Access to the NR concourse require vertical change in level via steps, lift or escalator.

4.3.40 The site relocation offers the opportunity for provision of a gateway plaza that the western ticket hall and the existing NR concourse face towards. Within the plaza there is provision for forecourt and Metrolink proposal situated above ground with four platforms (Metrolink described in subsequent section)

4.3.41 Being located at the city end the unpaid ticket hall is the larger including an unpaid ticket hall. The size is based on current train service specification and capacity-based demand. The unpaid concourse is required to be 2,768sqm

4.3.42 The ground level ticket hall is connected to the below ground station concourse via lifts and escalators.

4.3.43 The ground level concourse provides level pedestrian access to forecourt and station approach. Including Boulevard to the south

4.3.44 The Gateway plaza is addressed (faced onto) by the western HS2 ticket hall and the existing station with entrances re-orientated towards the north. To the north, the plaza is defined by SRF ASD (Adjacent Site Development)

4.3.45 Note; Gateway house is removed providing clear line of sight to City and London Road and enhancing the civic presence of the space.

4.3.46 A pedestrian space is located to the west and defined by proximity of London warehouse grade ii listed building, the existing station and London Road.

Eastern Ticket hall

4.3.47 The eastern ticket hall is located towards the east addressing plaza overlooking the Medlock River park. Note; the River Medlock is taken out of an existing culvert and redirected allowing for the station eastern throat to pass under.

4.3.48 Option B1 provides what can become two distinct identities to the ticket halls. A city side to the west and a Park side to the east. Giving identity assists with wayfinding.

4.3.49 The unpaid ticket hall responding to capacity-based demand is smaller than the western ticket hall. The unpaid concourse is required to provide 476sqm

4.3.50 The ground level ticket hall is connected to the below ground station concourse via lifts and escalators.

4.3.51 The ground level concourse provides level pedestrian access to forecourt and station approach. Including Boulevard to the north

Metrolink

4.3.52 Metrolink provision includes four platforms arranged in parallel above ground served by tracks, also above ground.

4.3.53 Metrolink is accessed from NPR Concourse by traveling down escalators to ground level and hence towards the plaza where Metrolink is situated at ground level. For HS2 passengers they would traverse up escalators to the HS2 Ticket hall and then travel at ground level towards the Metrolink platforms.

4.3.54 The Metrolink provides

- North western connection towards Piccadilly Gardens and the city centre
- A North eastern connection towards New Islington

4.3.55 The Metrolink acts as an integrator of urban connectivity and interchange and is ideally located along the pedestrian route between the HS2 concourse and existing station concourse.

Urban Integration

4.3.56 Alignment option B1 replicates the urban structure of the baseline option and MCC Manchester Piccadilly SRF apart from the Boulevard being located to the south of HS2 Station.

4.3.57 OSD has been allocated above the HS2 station box. This offers ground floor commercial / retail uses that activates the surrounding area, whilst improving upon the ground floor dynamics.

4.3.58 The proposed station box is parallel to existing NR station but shifted eastwards. The shifting of station box opens a bigger public realm to house the interchange function between HS2, NR and Metrolink. This creates a 'gateway' plaza for Piccadilly SRF and forms part of the HS2 arrival experience. The inclusion of interchange function within the 'gateway' plaza animates the space, adding drama to the public realm. The new 'gateway' plaza has the potential to deliver a long-lasting legacy, adding new civic space to the wider Manchester city centre experience.

4.3.59 By locating the Boulevard to the south of HS2 station, it signals the inclusion of OSD as part of Piccadilly SRF urban structure. This will blur the line between HS2 station and the urban realm, offering a much better integration to the surrounding context.

4.3.60 The new Boulevard will be fronted by the adaptive reuse of NR viaduct listed structures with retail/commercial uses, adding character to the area whilst celebrating the historical heritage. With Metrolink located in the gateway plaza, alignment option B1 enables permeability beneath the NR Station. This will allow pedestrian connection through the NR station to Mayfield SRF development. With the new Boulevard configuration, it can be fully pedestrianised, improving the urban experience around the station.

4.3.61 HS2 Eastern ticket hall has been located further to the east along the Boulevard, creating a ticket hall within a waterfront plaza setting, serving communities to the east of ring road.

4.3.62 The construction of Alignment B1 will affect existing Pin Mill Brow junction. A redesign of the junction as envisioned in alignment B1 would allow a safer NMU connection from the city centre beyond the Ring Road to the east. This allows the Boulevard to extend to the east instigating a regeneration to the existing industrial hinterland. With HS2 alignment being placed below ground the regeneration to the east will be unhindered, extending towards Ardwick NR Station. Furthermore, the shift of HS2 Eastern Ticket to the east will enable part of the development to fall within the catchment area of HS2 Station, giving alignment B1 a real opportunity to expand Manchester city centre beyond the ring road.

4.4 Underground Option D

Underground Option D route alignment

4.4.0 Underground station option D lies on alignment D. Alignment D is c.25km long between Node MA and Node 3 and is wholly underground. There is c.14km of the route to the south of the station and c.12km to the north.

4.4.1 Alignment D initially proceeds north-east from Manchester Airport High Speed station, adopting the same horizontal and vertical alignment (including the tunnel portal) as the hybrid Bill alignment, before diverging and bearing north-east to pass to the west of M60 junction 5 (with the A5103). The route then continues north, taking a right-hand curve before reversing under Chorlton park. A left-hand curve then bears the route north, passing under the field adjacent to Maine Road football club. The route enters a long right-hand curve near the junction of the A5076 and B5218 to tie in with the approximately south-west / north-east bearing of proposed underground station option D, the rail level at the proposed station being 6m AOD

4.4.2 Leaving the proposed underground station, and remaining underground, the route approximately follows the route of Old Mill Street before bearing east, adjacent to Philips Park Cemetery. This right-hand curve continues before reversing under Clayton Vale to follow a long left-hand curve, under Lumb Clough and Littlemoss.

Option D Selected Construction Methodology Deep Box Hybrid

4.4.3 Alignment D is a hybrid approach integrating mined outer platforms and a slimmer deep box to accommodate integration with the station constraints including London Warehouse and Store Street Aqueduct. A central box for four platforms is proposed with the two additional platforms provided by mining tunnels on either side of the central box.

Figure 17 - Option D Alignment including station box, approach throats with inner crossover. (Outer crossover at extremity of image)

Option D Site location

4.4.4 Alignment D site is located north of the existing station and rotated to almost align with Store Street.

4.4.5 The proposed site is a mixture of light industrial and car parking with element of residential.

4.4.6 The site contains numerous listed assets including London Warehouse grade II, Stable building grade II and Store Street Viaduct grade II star.

4.4.7 The site is bisected by the Ashton canal. The Canal would require stopping up during construction and re-connected as part of station design proposal.

4.4.8 The station box is a hybrid design including a narrow deep box located below ground and is 465m long, 49.6m wide and approximately 38m deep, noting that ground levels vary. The station box structure includes perimeter retaining walls with internal beam and column arrangement providing restraint to perimeter walls and support to internal floors. The structure is designed to accommodate the load of Oversite Development above as with the other options.

4.4.9 Four platforms are arranged as a central island and two side platforms within the central narrow deep box which is flanked by a mined cavern platform on each site. Option D has 6 platforms in total serving 6 through rail lines.

4.4.10 The mined platforms enable the proposal to integrate and retain London Warehouse grade II and Store Street Viaduct grade II star. Note the Stable building grade II is demolished. Demolition and relocation may be a possible consideration however it should be noted context is an important factor.

4.4.11 The proposal requires the Ashton canal to be temporarily diverted during construction and is re-provided above the station box.

4.4.12 Track level is defined by the mined approach geotechnical requirements and established at +6AOD

4.4.13 Above the station box is proposed over site development (OSD) the OSD is provided access from ground level.

4.4.14 Station entrances providing access from ground level to the station platforms below ground are provided via ticket halls at the south west and north eastern end of the station box

4.4.15 The station proposal is a through station. The station box is served by mined cavern approach throat on east and west. The inner scissor crossover is located within the throat

4.4.16 Two outer crossovers are required. The facility for trains to cross lines is an operational requirement. At the crossover ventilation and fire intervention access is provided

4.4.17 Typically, a crossover includes provision for ventilation and pressure relief via an open cut (clear opening) in the region of 130m x 30m. This is inappropriate for a city centre location particularly when it is a sensitive conservation area therefore a mined cavern crossover with mechanically supported ventilation and pressure relief is proposed. This puts the bulk of the requirement below ground with a smaller footprint above ground. The proposal includes a caverned mined box below ground providing the crossover requirement. The below ground box is connected to the smaller above ground facility which includes mechanical ventilation and intervention access.

4.4.18 Alignment D is on a different bearing from B or B1 hence the locations of the outer crossover caverns are in different locations and further out from the city centre compared to B or B1. As both outer crossovers are greater than 1000m from the nearest intervention core in the station, additional intervention cores are required on both approaches.

4.4.19 The southern outer crossover is located within the Premier Inn site on Medlock street. A southern intervention shaft is required and located on Whitworth Street where an existing building would be required to be demolished. This is regarded as the least-worst location as the site is surrounded by listed buildings.

4.4.20 The northern outer crossover is located on Bradford Road near the existing gasworks. The northern intervention core is also located on Bradford Road and avoids the listed Cotton Mill Building

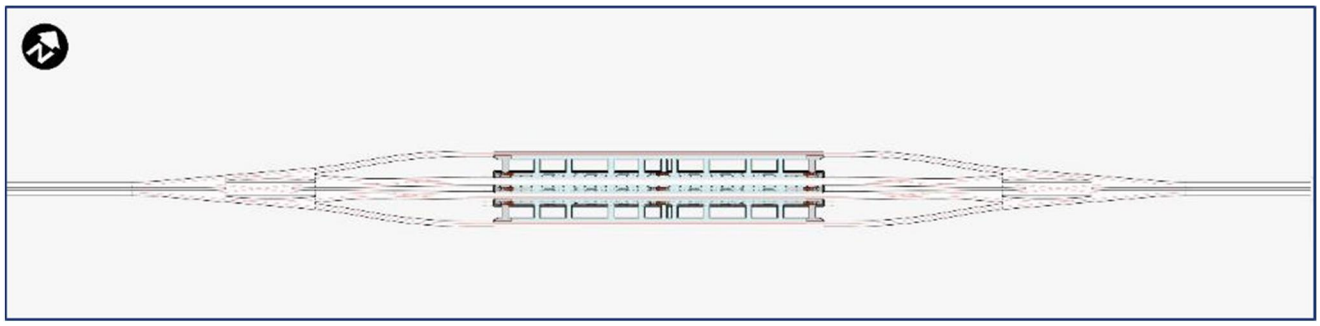

Figure 18 - Option D Platform and throat arrangement

Summary of General Arrangement

4.4.21 The station box below ground is comprised of three horizontal levels including platform, ventilation service zone and concourse level.

4.4.22 Back of house service areas are provided at either end of the station where platform and passenger area ventilation systems connect to large fans and to air intake and extract at service mezzanine above ticket halls at either end of station box.

4.4.23 Ventilation service zone includes large smoke extract ducts with adjacent provision for ventilation of occupied spaces.

4.4.24 The concourse connects to the south western and north eastern ticket halls and internally connects via vertical circulation to the platforms below.

4.4.25 The station concourse and platforms are located below ground. The structural design includes retaining perimeter walls with column and beam supports for floor space and transfer of load from OSD above in an integrated proposal

4.4.26 The two outer platforms are constructed as mined caverns with each serving a single line. The outer platforms connect to the inner box via cross passages.

4.4.27 The vertical circulation of the proposal includes escalators that connect the platform to the concourse level via openings in the concourse slab. This assists wayfinding providing visual connection between levels.

4.4.28 Located above the opening in the concourse are lightwell openings in the ground floor slab level which provide a glimpse of daylight at platform or concourse level and assist wayfinding.

4.4.29 It should be noted the lightwells are not a part of the ventilation strategy.

4.4.30 All internal occupied areas of the station need to be ventilated to control and dilute airborne contaminants (e.g. Carbon dioxide, etc), to exhaust unwanted heat and smoke (train heat emissions, and during or following a fire event), and to a lesser degree reduce internal moisture accumulation

4.4.31 The station proposal makes provision for both ventilation and smoke exhaust within the ventilation service zone located in-between the platform and concourse spaces.

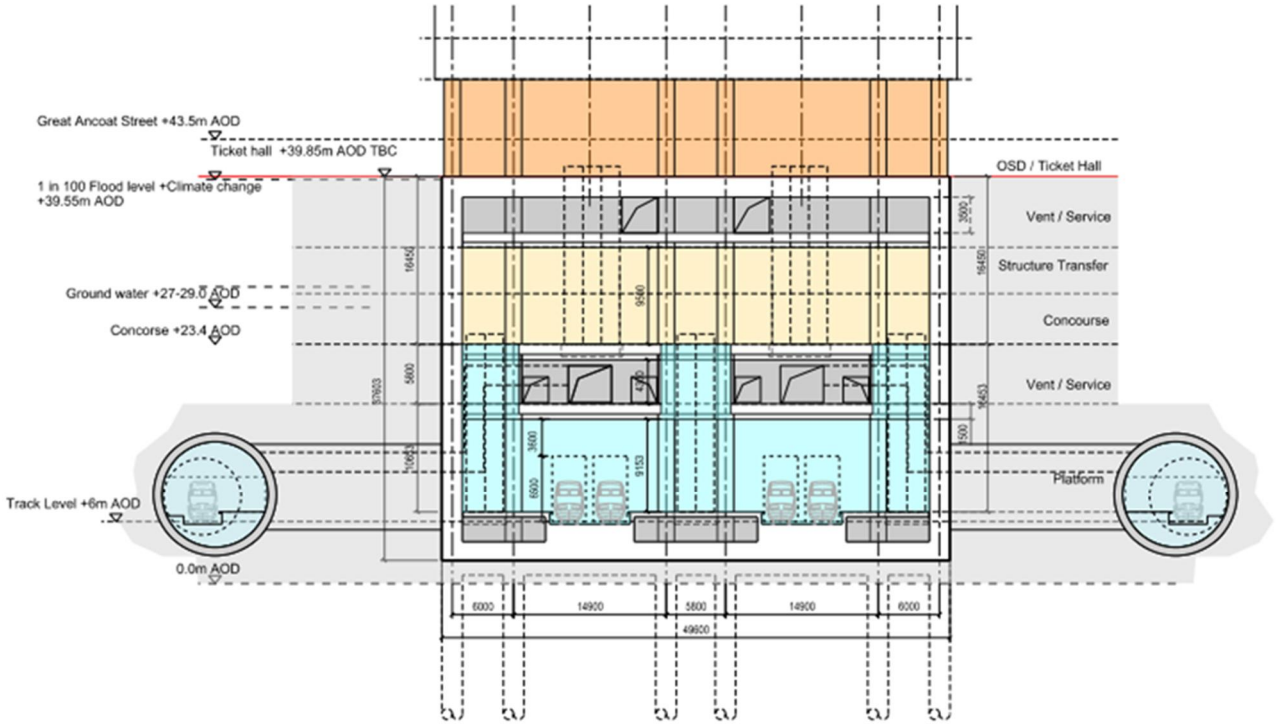

Figure 19 - Option D cross Section

Platform Configuration

4.4.32 Platforms for alignment D are located below ground. The configuration includes the inner deep and narrow box containing a single island and two side platforms. On either side of the station box there are two outer platforms constructed as caverns each serving a single line. This hybrid configuration of deep box and cavern platforms serve six through rail lines.

4.4.33 The inner station box 465m long 49.6m wide and 38m deep provides a central island platform 13.4m wide with two side platforms 8.7m wide. The outer cavern and the station box are spaced approximately 16m apart.

4.4.34 The island platform includes space provision for 2 escalators side by side with 1.6m structure zone for columns either side along with 3m clear zone from platform edge to structural zone. The side platforms also include 2 escalator arrangement with structural and clear zone 1.6m and 3m respectively. Two further side platforms are provided in the mined outer cavern platforms. Vertical circulation is accessed in the deep box.

4.4.35 Structural columns are located either side of the escalators to reduce span length and beam depth. The structure integrates with the structure of the over site development (OSD) above providing load path for OSD structure above

4.4.36 Alternative structure arrangements include single column on island platform were examined however this is less preferred as span and depth of structural zone increases. A paired column arrangement is preferred to reduce span and enable coordination with structure of OSD.

4.4.37 Each platform is designed to accommodate the following vertical circulation:

- 12 No: escalators arranged as 6no: banks of 2 escalators arrangement evenly distributed along the platform.
- Four customer lifts are provided.
- Three fire escape stairs with firefighting and evacuation lifts;
- Service lifts have been included at each platform end

4.4.38 The passenger and lift arrangement is different in alignment D compared to B or B1. The station box is constrained by London warehouse grade II and Store Street Viaduct grade II * to provide clearance from the listed assets the station box is slimmer hence the configuration of escalators and lifts is rearranged.

4.4.39 The escalator arrangement differs from B and B1. Providing 6 pairs of 2 escalators compared to 4 banks of 3 escalators however passenger clearance of platforms has been

maintained to HS2 standard. Note the overall quantum of 12 escalators is the same across B, B1 & D.

4.4.40 The lifts are not provided in pairs as with option B or B1, but as single lifts evenly distributed across the platform. A paired lift configuration provides operational resilience if one lift breaks down the other may still function. In option D as there is insufficient space to provide lifts in pairs, operational resilience may be affected. The lack of paired lifts reduces operational resilience.

4.4.41 The following facilities shall be provided on the platform and would be described in more detail in subsequent design stages:

- Hydrants
- Communication & electrical equipment rooms.
- Goods lift (catering and waste)
- Wheelchair storage
- Wheelchair accessible toilet
- Staff unisex toilet
- Seating
- Staff refuge point
- post mounted systems for lighting, PA/VA and CCTV

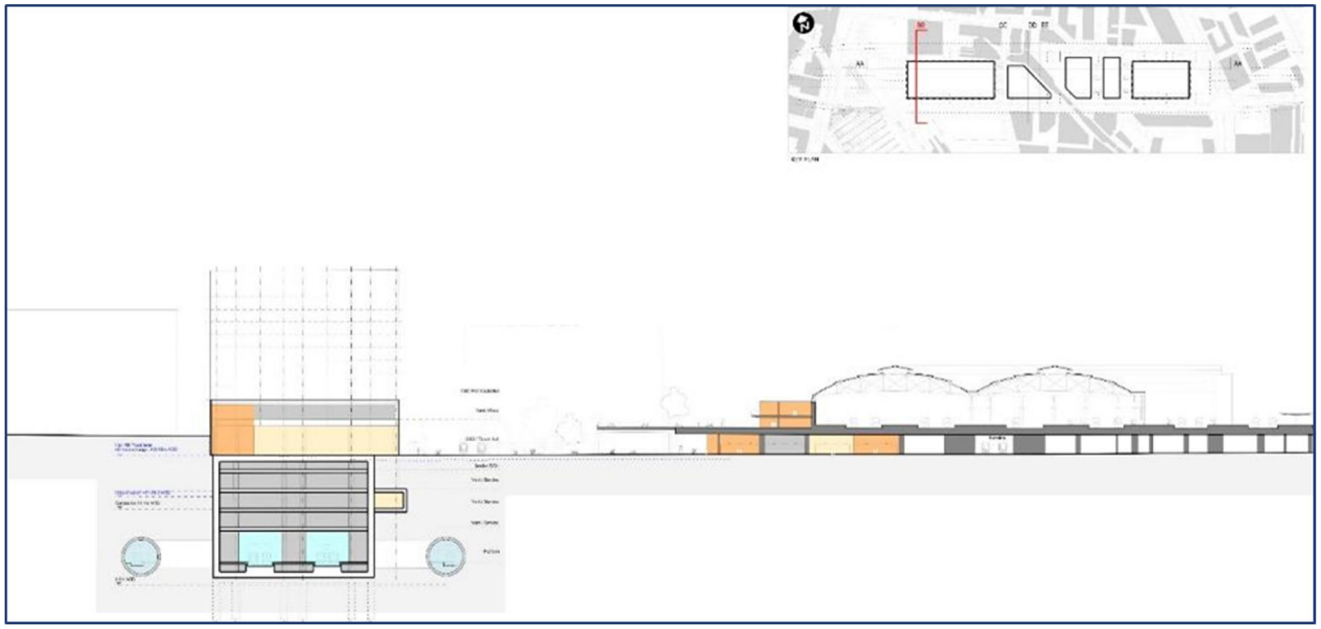

Figure 20 - Conceptual Section of Manchester Piccadilly Option D

Concourse configuration

4.4.42 The concourse level is located above the platform level and below ground and provides below ground horizontal weather protected connection to the south western and north eastern ticket halls.

4.4.43 The concourse configuration includes a tunnelled direct connection from the HS2 underground concourse to the NR concourse.

4.4.44 From the south western and north eastern ticket halls passengers exit the station and connect externally to:

- The existing Piccadilly Station concourse
- Metrolink located in plaza to east of south western ticket hall entrance.
- Station forecourt
- Arrival plaza between HS2 entrance and existing station

4.4.45 The following facilities shall be provided on the platform and would be described in more detail in subsequent design stages

- Retail
- Customer toilets and baby facilities
- Customer information points
- Waiting areas
- Lost luggage
- British Transport Police (front of house)
- Multi-faith room
- First aid room
- Customer experience hubs

South Western Ticket Hall

4.4.46 The south western Ticket hall is located at the city end and adjacent London Warehouse and addresses the existing station to south. The ticket hall is located at ground level.

4.4.47 Access to the NR concourse require vertical change in level via steps, lift or escalator.

4.4.48 Being located at the city end and near, the NR concourse the unpaid ticket hall is the larger including an unpaid ticket hall. The size is based on current train service

specification and capacity-based demand. The unpaid concourse is required to be 2,542sqm

4.4.49 The ground level ticket hall is connected to the below ground station concourse via lifts and escalators. Note: this is complimented by a direct access from below ground concourse to the NR concourse. (longer travel distance than option B)

4.4.50 The ground level concourse provides level pedestrian access to forecourt and station approach. Including arrival plaza.

4.4.51 The arrival plaza is bounded by London Warehouse, hs2 ticket hall, London road, existing station and adjacent development. The plaza benefits from removal of Gateway House providing clear sight to city centre.

4.4.52 The plaza provides above ground location for Metrolink provision.

North Eastern Ticket hall

4.4.53 The eastern ticket hall is located to towards the north east addressing Great Ancoats Street.

4.4.54 The unpaid ticket hall responding to capacity-based demand is smaller than the western ticket hall. The unpaid concourse is required to provide 703sqm. Note the overall are requirement 3,245sqm is the same for all the options but distributed in the ticket halls differently depending on location.

4.4.55 The ground level ticket hall is connected to the below ground station concourse via lifts and escalators.

4.4.56 The ground level concourse provides level pedestrian access to forecourt and station approach. Including Boulevard to the north

Metrolink

4.4.57 Metrolink provision include four platforms arranged in parallel above ground served by tracks also above ground.

4.4.58 Metrolink is accessed from NPR Concourse by traveling down escalators to ground level and hence towards the plaza where Metrolink is situated at ground level. For HS2 passengers they would traverse up escalators to the HS2 Ticket hall and then travel at ground level towards the Metrolink platforms.

4.4.59 The Metrolink provides

- North western connection towards Piccadilly Gardens and the city centre
- A North eastern connection towards New Islington

4.4.60 The Metrolink acts as an integrator of urban connectivity and interchange and is ideally located along the pedestrian route between the HS2 Concourse and existing station concourse.

Urban Integration

4.4.61 Alignment option D orientates the station in a north-east to south-west orientation, departing dramatically from the Baseline Option. A different urban grain direction structure based on Piccadilly SRF 2018 has been tested as a result of the new orientation.

4.4.62 The overall regeneration area will be similar to the baseline option, although the redevelopment area to the east near Medlock Park will be catalysed through the arrival of the Metrolink Tram-Train service.

4.4.63 The southern ticket hall of alignment D fronts onto a public realm that houses the interchange function between HS2, NR and Metrolink. Both NR and HS2 station entrance are facing each other enclosing the public realm. This creates a ‘ gateway ’ plaza for Piccadilly SRF with high visibility from London Road. This 'gateway' plaza forms part of the HS2 arrival experience. The inclusion of interchange function within the 'gateway' plaza animates the space, adding drama to the public realm. The new 'gateway' plaza has the potential to deliver a long-lasting legacy, adding new civic space to the wider Manchester city centre experience.

4.4.64 Alignment option D lends itself to regenerate and activate the historic Rochdale and Ashton Canal due to its closeness. This allows the OSD to resolve the level difference between the surrounding context and the historic canals (up to ~7.5m difference). As the result, alignment option D has the potential to open the leisure non-motorised user (NMU) route along historical canals in Manchester.

4.4.65 The main pedestrian connection for Alignment D still offers a similar east-west connection to the proposed Piccadilly SRF Boulevard albeit with the lack of HS2 station presence along the south side. The new east-west pedestrian corridor will be fronted by the activated NR viaduct listed structures, adding character to the area through the inclusion of historical heritage. With Metrolink relocated, Alignment option D allow the NR Station ground floor to be permeable. Connecting Mayfield SRF development from Piccadilly SRF.

4.5 Rail Systems

4.5.0 A core requirement of the study was to follow the iTSS of the surface station baseline in order to establish a like for like comparison of the alternative options to the baseline. This led to a consistent approach to how the route and approach was configured between the options.

4.5.1 One of the early considerations of the scope was to examine whether there would be any opportunity to operate the iTSS as a four-platform configuration for the alternative underground stations. The outcome of this examination concluded that this was not possible because for the iTSS to offer the same choice of timetable flexibility and capacity as the surface station by combining the turnback nature of the HS2 services with the through nature of the NPR services in this underground through layout, then it must provide two through platforms per direction for NPR services, segregated from two platforms to turnback HS2 Euston services whose turnaround times at Piccadilly are fixed by constraints at Euston.

4.5.2 A point to note in developing the underground stations as a through station layout to satisfy the iTSS of trying to achieve the combined operation of one turnback service (HS2) and one through service (NPR) is that the full potential capability of the through layout is not realised.

4.5.3 The final configuration was set out in a schematic for the purposes of coordinating between all disciplines and for quantifying the infrastructure required for the alternative options. These are shown in figure 21 below.

4.5.4 The general principle of the design replicates the baseline design in that the route from Manchester Airport station enters into tunnel at the same location as the baseline for all options and continues underground all the way to Manchester Piccadilly station. It then carries on eastward towards Node 3 underground.

4.5.5 The design speeds of the tunnels are the same as that of the baseline which is 230km/h on the route and 60km/h in the turnouts at the throat.

4.5.6 The technical headway of 150 seconds or less was replicated from the baseline. Explorative modelling exercise was carried out that confirmed the maximum spacing between the vent shafts of 3.3km except for the final vent shaft approaching the station which was a maximum of 3km from the platforms.

4.5.7 Each vent shaft is expected to provide rooms for the necessary rail systems infrastructure such as ventilation fans, signalling equipment rooms, autotransformer stations (ATS),

non-traction power, etc. The specific components required at each are identified within the route schematic diagram.

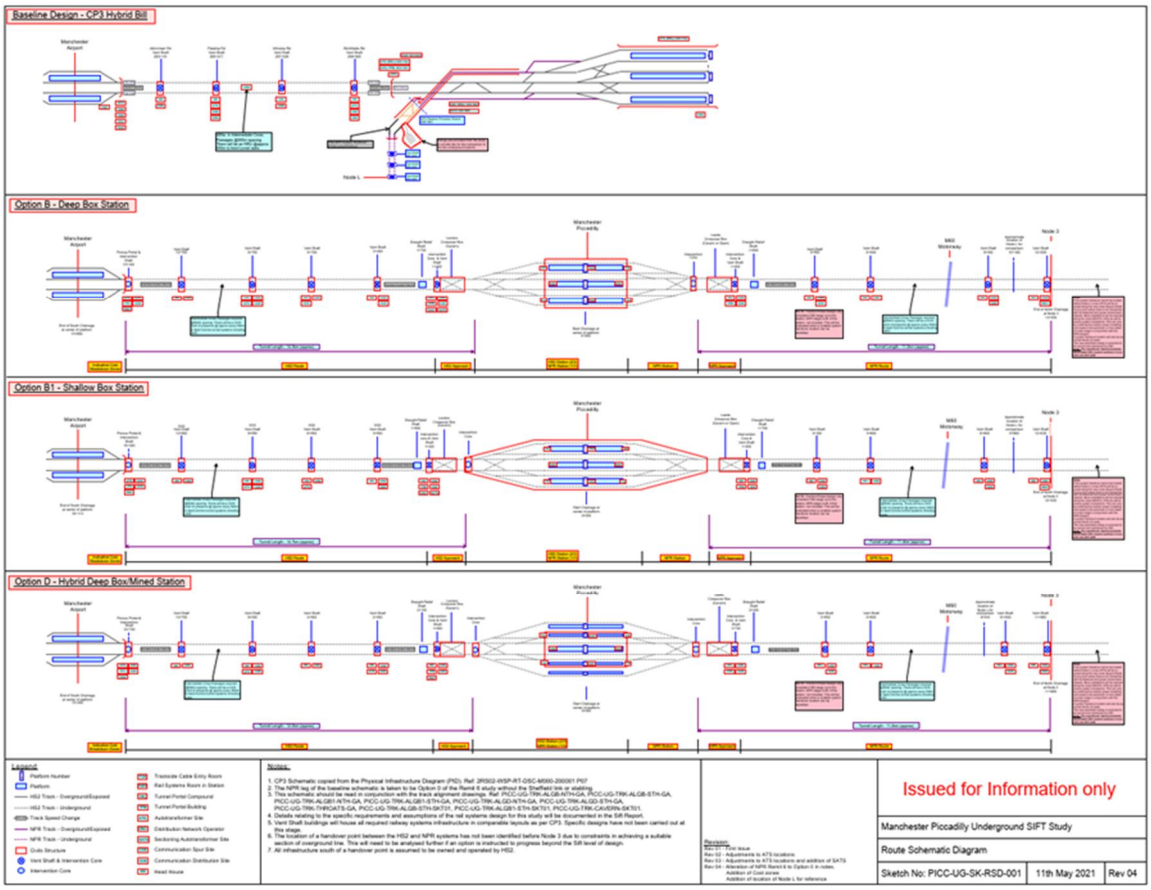

Figure 21 - Route Schematic Layout of Baseline and Options

4.5.8 Note *figure 21* is replicated to full size in Appendix J.

5 Case studies of underground high speed rail stations

5.1 Large box construction precedents

5.1.0 The underground options station box dimensions are:

Option	Length	Width	Average depth
B	465 m	76.5 m	39.8 m
B1	1,166 m	76.5 m	29.1 m
D	465 m	49.6 m	40.8 m

Table 3 - Station box dimensions for the three underground station options.

5.1.1 For B and D, the depth is driven by the need for good rock cover over the mined caverns needed for the approach track junctions. For B1, the depth is driven by the space proofing of the station but is close to the minimum needed to ensure sufficient good rock cover over the outer scissors caverns.

Stratford International HS1 station

5.1.2 This is a high speed rail station of similar length to B1 at 1,070 m long. It contains four platforms, two through tracks, and a central inclined viaduct. It is 50 m wide (approximately the same as option D), but only 16-22 m deep. A photograph is shown in Figure 22 (credit: Bayley, 2007: The building of the Channel Tunnel Rail Link. London: Merrell).

5.1.3 Groundwater was a particular challenge and was dealt with using deep well dewatering. In the permanent situation, 22 deep wells continue to be used to lower the groundwater to prevent flotation of the box.

5.1.4

Figure 22 - Stratford International HS1 station

5.1.5 The main differences are:

- Stratford box is open air and there is only one ticket hall and concourse at ground level approximately mid-platform. This would not be acceptable in Manchester city centre, where the concourse needs to be below ground level and forced ventilation is needed because the box cannot be open to the atmosphere.
- It was built on derelict railway lands, i.e. not in or near a dense urban centre. The area has since been developed.
- The volume of excavation was only 0.75 Mm^3, compared to 2.25 Mm^3 for B1.
- Excavated material was not transported off-site, but was used to raise the ground level over the whole area by 6-7 m. This included the 0.75 Mm^3 from the station box and 1.5 Mm^3 from the TBM drives.

Bologna AV central station, Italy

Figure 23 - Bologna AV central station, Italy

5.1.6 Bologna AV central station is a high speed rail station with four platforms, in a dense city centre adjacent to the existing railway station. It is 642 m long, 56 m wide and 23 m deep. A photograph during construction is shown in (from Balestrieri, Lunardi & Antonelli, 2017). The station was later covered over with a roof, but with no over-site development.

5.1.7 The main differences are:

- With only four platforms, the junctions at each end of the station are much simpler than for the six platforms needed at Manchester Piccadilly.
- The ground in Bologna is very soft, and extensive jet grouting was needed outside the diaphragm walls and below the base slab to allow safe construction.

Stuttgart high speed rail station

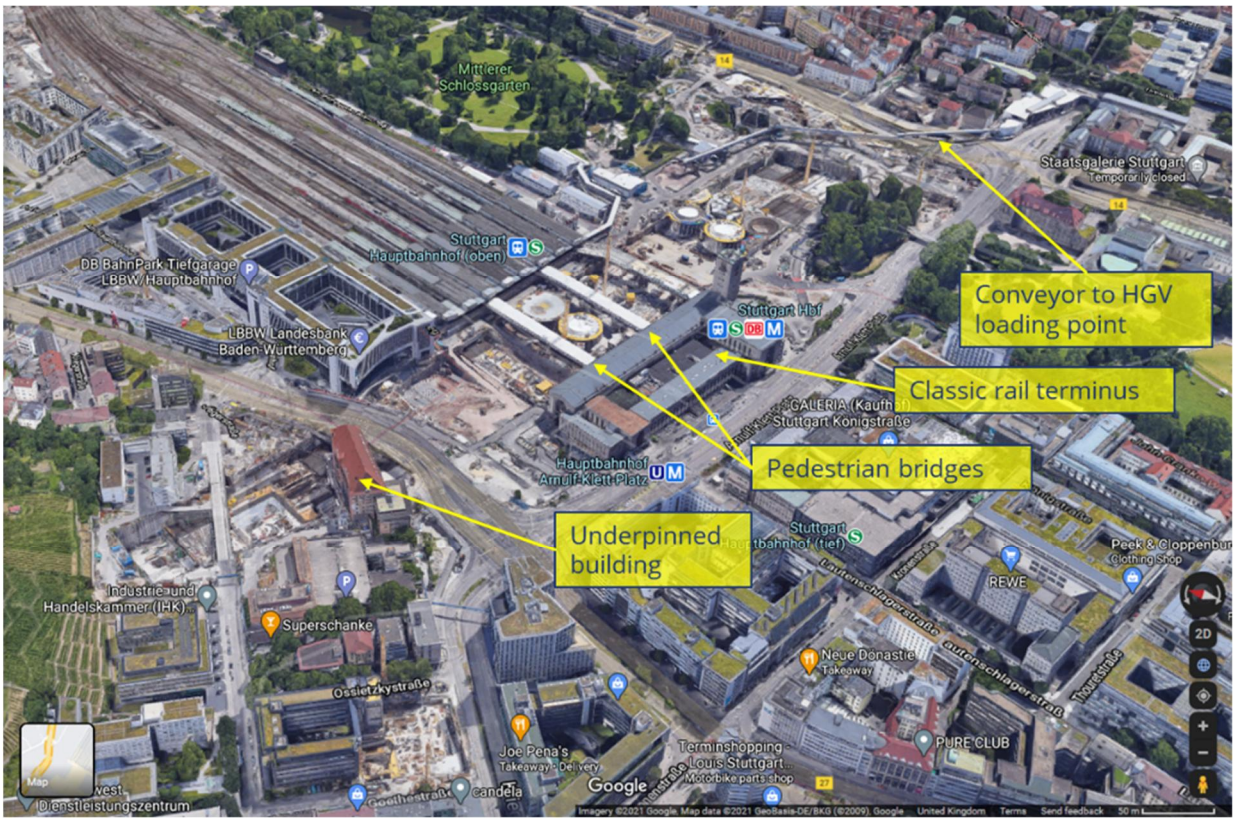

Figure 24 - Stuttgart high speed rail station (image from Google Maps).

5.1.8 Stuttgart high speed rail station is being built perpendicular to the existing rail terminus, between the station building and the platforms (which were moved up the tracks). Access is via two pedestrian bridges over the construction site from the station concourse to the platforms. The box structure contains eight platforms and is 80 m wide and 830 m long. It is relatively shallow because the tunnel portals at each end of the box go into the sides of hills.

5.1.9 The main differences are:

- The station box does not need to be deep to provide cover for the tunnels.
- Above much of the station box a park will be reinstated, allowing structures to be built which allow natural light into the station, and also structures for ventilation. There is no over-site development.

Old Oak Common HS2 high speed station

5.1.10 Old Oak Common high speed station is approximately 17 m deep, 75 m wide and 910 m long.

5.1.11 The main differences are:

- The concourse is at the surface.
- There is no depth requirement to enable construction of mined caverns, only TBM-bored tunnels, which are smaller and can be shallower.
- The functional equivalent of the Manchester Piccadilly underground station options' outer scissors crossover cavern is the Victoria Road crossover, which is in an open box.

Badaling Great Wall high speed rail station, China

5.1.12 This station opened in December 2020. It is an entirely mined station, with six platforms in three caverns separated only by pillars, at a maximum depth of 102 m. At the end of the platforms, after a transition length, the lines go into a single cavern 32.7 m wide. The total plan area of the caverns is 40,000 m^2, which is more than the plan area of the station box for option B, at 34,000 m^2. The escalators are over 120 m long. There are four vertical ventilation shafts.

5.1.13 The rock was hard enough to require drilling and blasting, but the type of rock is unknown.

5.1.14 There is very little information available about this station. A 3D model is shown in *figure 27*. (credit: TunnelTalk Extra video: https://youtu.be/ybx0w6CnK1o).

5.1.15

Figure 25 - Badaling Great Wall high speed rail station, China

Summary

5.1.16 There are no exact precedents for the station box at Manchester Piccadilly, but it is clear that the technology exists, and it is feasible.

5.1.17 There are very few international precedents for underground high speed rail stations. The few there are do not have over-site development, and only Bologna has an underground concourse level.

5.2 Large cavern construction precedents

5.2.0 The scissors crossover caverns required for all three underground stations are approximately 21 m wide. There are several other turnouts and twin tunnel caverns in the approach, but 21 m is the maximum width required.

Channel Tunnel UK undersea crossover

5.2.1 The crossover cavern on the UK side of the Channel Tunnel was 21.2 m wide and 164 m long. It was excavated sequentially using a twin sidewall drift method, in chalk. An illustration is shown in *figure 28* (from Fugeman, Hawley & Myers, 1993).

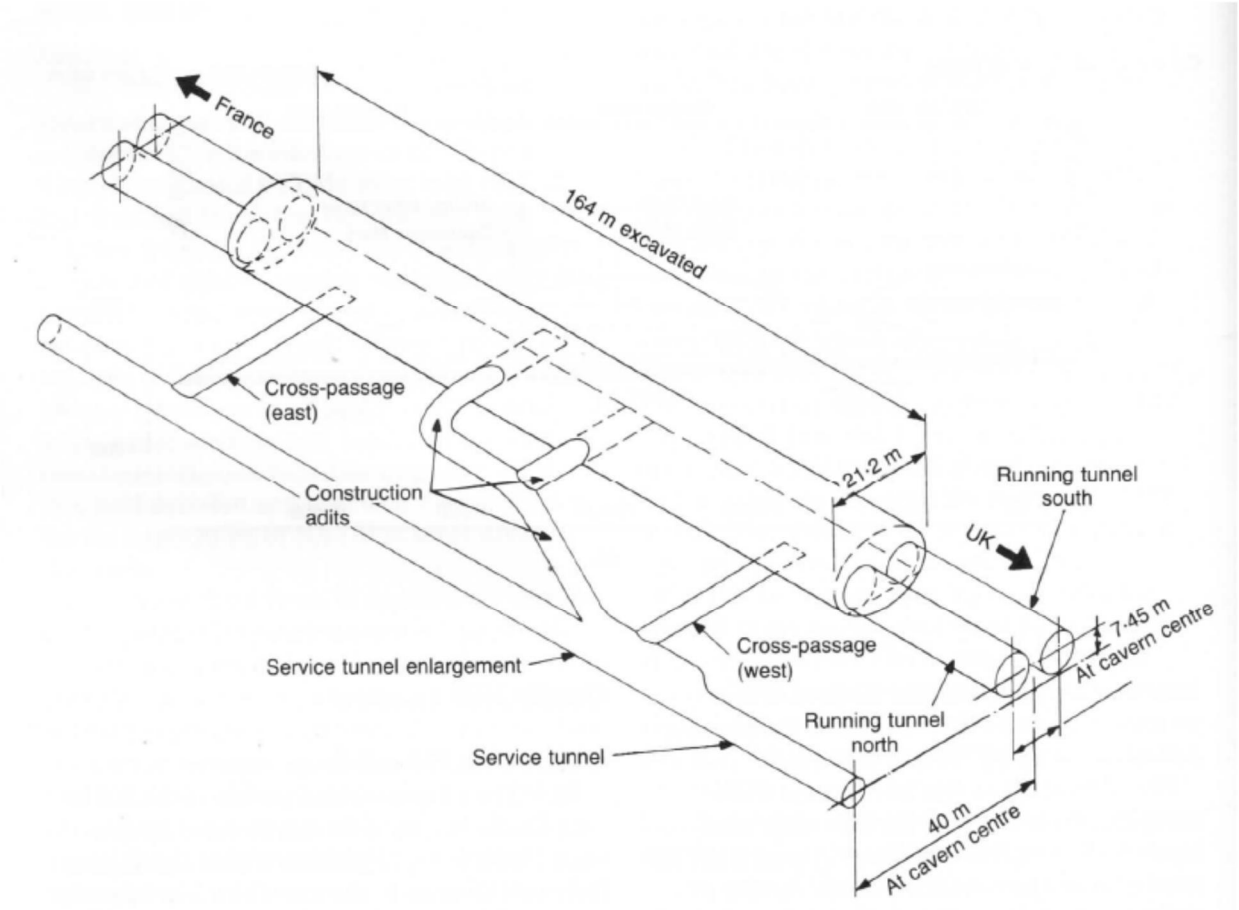

Figure 26 - Channel Tunnel UK undersea crossover cavern.

Figure 27 - Channel Tunnel UK undersea crossover cavern.

5.2.2 The main difference is that the mined caverns in Manchester are excavated in Sherwood Sandstone. There is a major risk that the Sherwood Sandstone may not be strong enough, and it is impossible to know this until a detailed site investigation has been done.

5.2.3 For option B and D, the inner scissors crossover caverns have turnout caverns very close on either side. There is no precedent for this in these ground conditions. If detailed design determines that these caverns cannot be so closely spaced, they will need to be staggered longitudinally, increasing the overall length of the approaches.

5.2.4 It is notable that extensive site investigation including boreholes and geophysics were done to assess the feasibility of the Channel Tunnel many years before parliament gave the project the go-ahead.

Crossrail Stepney Green cavern

5.2.5 The crossover cavern at Stepney Green was 18 m wide and was excavated in London Clay and the Lambeth Group. Deep wells were used to lower the groundwater in Lambeth Group.

5.2.6 Although Stepney Green is not as wide as the crossover caverns in Manchester, the ground was probably much softer and hence design and construction more challenging. However, Stepney Green crossover does not have caverns adjacent to it.

Summary

5.2.7 If the Sherwood Sandstone in Manchester is encountered at the depth assumed and is of sufficient strength, then caverns up to 21 m wide may be feasible.

5.2.8 There are no precedents for such large caverns in such close proximity in these ground conditions, and so feasibility cannot be assured until detailed site investigation and design analyses have been undertaken.

5.2.9 Even if the design analyses show the caverns can be built safely, a major residual risk will be the ground settlements induced by such large caverns, which may cause damage to overlying buildings and utilities in central Manchester. The magnitude of ground movements induced by tunnelling is related to the strength and stiffness of the ground.

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6 Environment Appraisal

6.1 Baseline option: Hybrid Bill Design and NPR Remit 6 Option 0

6.1.0 An appraisal of the baseline (hybrid Bill design as assessed in the Stage 3 Formal Environmental Statement and NPR Remit 6 Option 0 - reference: P2B-HS2-PM-NOT-600-000) identified a number of environmental impacts including those of the route at surface, the tunnel portal and proposed vent shafts locations.

6.1.1 The main environmental constraints associated with the tunnel baseline relates to the Palatine Road vent shaft which is located in the Didsbury Flood Storage Basin and results in the loss of the Withington Golf Club due to the demolition of its club house; and the Birchfields Road vent shaft which results in 50% loss of the Fallowfield Retail Park and its associated car park.

6.1.2 There are also potential impacts in Ardwick and at the site of the Piccadilly Station High Speed station associated with site clearance during construction and the new station and viaducts and other structures in Ardwick Waste material impacts have been identified, as construction will generate a significant quantity of material, as well as air quality due to the construction within the Greater Manchester Air Quality Management Area. Sound, Noise and Vibration are also potentially impacted during construction due to the proximity of construction compounds and tunnel portals to both residential and commercial areas, as well as additional traffic during the construction phase on the local road network. There is a risk that the operational railway could lead to ground-borne noise or vibration effects to areas above the tunnel, as well as noise from the tunnel vent shafts. Finally, the potential for major accidents and disasters was flagged as a risk. This is in addition to heritage, ground conditions, and water resource impacts around individual structures on the route.

NPR Remit 6 Option 0

6.1.3 Environmental impacts for the major infrastructure interventions, such as the route at surface, the tunnel portal and proposed vent shafts locations, required for Option 0 are described in the following section.

6.1.4 The immediate section of surface route that interfaces with the HS2 scheme up to West Gorton Underbridge (Option 0 route crossing over the Phillips Park conventional railway line) is assumed to fall within the HS2 construction boundary for the Phase 2b Western

Leg hybrid Bill scheme. As a consequence, no new demolitions, environmental constraints or impacts have been identified for this section of route at surface.

6.1.5 For the surface route beyond the West Gorton Underbridge and up to the tunnel portal, a few existing buildings and retaining walls will require demolition in the for Option 0 and it is possible that elements of the retaining wall structures would be considered non-designated heritage assets, where they are contemporaneous with the original viaduct construction or its historic alterations.

6.1.6 The Manchester and Bridge Colleges are located close to the indicative construction compounds in the Ashburys area. Construction activities may, therefore, impact the learning environment for students at the college. There is potential for amenity impacts (air quality, noise, sound and vibration and dust) on the businesses of the local areas in addition to potential traffic and transport impacts as a result of this underbridge.

6.1.7 Local residents along Ambrose and Textile Street are both sensitive receptors which could be temporarily impacted by amenity impacts including air quality, noise, sound and vibration and dust. The surface route section for Option 0 otherwise passes through what is mainly an industrial area and follows adjacent to the existing conventional railway corridor.

6.1.8 Demolitions and land acquisitions are required within the aggregates yard / asphalt plant at Ashbury, the Openshaw Police Complex and the industrial unit off Lawton Street for the Option 0 route at surface from Ashburys to the tunnel portal in the Gorton area.

6.1.9 The tunnel portal in the Gorton area and associated construction compound will likely require seven industrial buildings to be demolished. In addition, the construction compound to the west of Gorton is close to residential properties along Cherry Avenue and to the south along Thorpeness Square so there is a risk of noise and air quality impacts on these receptors during construction.

6.1.10 The proposed Ashton Moss vent shaft location and associated construction compound sits immediately south and east of sensitive residential receptors. Hawthorns Community School and its playing fields are located in close proximity and there is the potential to impact these sensitive receptors through amenity impacts primarily during construction including air quality, noise, sound and vibration and dust effects.

6.1.11 The proposed Ashton Moss vent shaft is located within an area of semi- natural habitat and is within 500m of water bodies. This proposed vent shaft, therefore, has the potential to impact protected and notable species including roosting and foraging bats, great crested newt (GCN), other native amphibians, and breeding birds.

6.1.12 The Moorside Street historic landfill site is located immediately to the north of the proposed Ashton Moss vent shaft location and there is also potential for archaeological remains to be present in the peat deposits at Ashton Moss.

6.1.13 The proposed Oldham Road vent shaft is likely to result in the demolition of up to two residential buildings and two tank storage units. The River Medlock and its valley to the north, Daisy Nook Country Park to the north-west and associated woodland, including Holden Clough Ancient Woodland, provide a strong corridor of high-quality landscape.

6.1.14 Indirect impacts for the proposed Oldham Road vent shaft relate to a nearby ancient woodland and a pond which has the potential to result in the loss of suitable GCN terrestrial habitat.

6.1.15 The proposed Lees New Road vent shaft and associated construction compound are situated close to the River Medlock and the north eastern corner of the construction compound is likely to fall within flood zone 3. Water quality within the Pennine Lower Coal Measures may be poor, in this location, therefore, treatment of the dewatering water may be needed before it is discharged.

6.1.16 Cockfields Farm, a children's visitor attraction, and residential receptors are located in close proximity to the proposed Lees New Road vent shaft. There is therefore potential for amenity impact upon Cockfields Farm a sensitive receptor during construction.

6.2 Underground Option B

6.2.0 An environmental appraisal of option B has identified the following environmental issues:

Construction

6.2.1 During construction of alignment B several buildings are to be demolished within the city centre, including an office block at 55 King Street (and the closure of the adjacent public plaza during the construction period) at the site of the southern ventilation headhouse, and a 4-storey residential building at 31-35 Sparkle Street. Whilst other community demolitions remain the same as the baseline, potentially resulting in changes to access to surrounding buildings and the amenity of local residents/occupants/users, it should be noted that as the construction period is significantly greater than the Baseline these impacts will be felt for a longer period of time.

6.2.2 Overall, the disruption of a number of public parks and green spaces, alongside the proximity of residential properties and community resources mean that the alignment B route is considered to be a major worsening for community and health compared to the baseline, in particular during construction.

6.2.3 Both the alignment and station underground construction means that there is significantly more material to be excavated than the baseline. However, the plan is to remove 90% of this material by rail which will mitigate the impact of construction traffic and the associated air quality and traffic impacts. Nevertheless, due to the significant air quality impacts identified for the design of the alignment B station and presence of the Air Quality Management Area (AQMA) this is considered to be a minor worsening compared to the baseline.

6.2.4 The consolidated construction boundary of the combined underground station site has similar impacts to the baseline in terms of the removal of non-designated buried assets. Despite the station being underground, there will still be direct physical impacts to the Grade II listed train shed, required to enable connectivity between the two stations. The Western Kings Street Crossover box and Ventilation Headhouse construction boundary is adjacent to the Grade II listed Pall Mall Court (NHLE 1246934), including raised Piazza and Podium to the west side, and may result in both direct physical impacts and impacts through changes in setting to the asset. Additionally, the location is within the Upper King Street Conservation Area and surrounded by a number of other Grade I, II* and II listed buildings, all of which could experience adverse impacts due to changes in their setting. The additional impact of the headhouse location represents a minor worsening of impacts for the historic environment in comparison to the baseline.

6.2.5 In terms of water resources, as alignment B proposes a station box similar in size to the baseline, but transposed to the east, and there are two additional areas of deep

excavation at King Street and at Ardwick Depot. Overall, this is likely to be a minor worsening due to an increased footprint of excavation in potentially contaminated soils and the risk of encountering groundwater and dewatering in excavation more likely to be required. However, the vent shafts and underground route are considered to be a minor improvement over the baseline scheme route due to better interactions with various groundwater tables and flood zones.

6.2.6 With regard to landscape and visual impacts, the removal of Gateway House will have a large impact upon the character of the station approach area causing disturbance during construction, and visual impacts for people accessing the station. Ardwick Ventilation Headhouse: Given the low-quality existing landscape character and lack of visual receptors in the area, impacts are expected to be similar to the baseline option. Given the increase in impacts as a result of additional areas of construction within the city centre, in particular around King Street, it is considered that this option would result in a minor worsening compared to the baseline option during construction. Furthermore, the vent shafts associated with this route potentially increases impacts to features that contribute to landscape character and the increase in impacts to recreational receptors, it is considered that this route would result in a worsening compared to the baseline option during operation.

6.2.7 In total, 94 business resources are likely to be impacted resulting in approximately 3,600 job losses. Given the increase of ~900 job losses, it is considered this option would result in a major worsening for socioeconomics compared to the baseline option during construction.

6.2.8 With regard to waste and minerals, the deep box excavation is likely to result in increased waste when compared to the baseline, and it is of concern that the Barlow Tip tunnel vent shaft site includes a methane extraction plant to the west of the landfill, which indicates that the site contains significant organic waste. This material would require suitable disposal when excavated and could pose a major adverse impact. In addition, the vent shaft of Somerset Road, is in a mineral safeguarding area. In terms of materials proposed, this option will require a similar quantity of material to construct the various vent shafts, head houses and escape cores as well as the underground track as the baseline, given they are of similar length.

6.2.9 In terms of sound, noise and vibration, the number of vent shafts and the proximity of residential properties and sensitive non-residential receptors means that the route of alignment B is considered to be a minor worsening compared to the baseline. The change in the station CCB could lead to a minor worsening of construction phase impacts on the surrounding communities and sensitive non-residential receptors surrounding the station, headhouses and the intervention shafts.

6.2.10 All other environment impacts during construction are expected to the similar to the Baseline.

Operation

6.2.11 As alignment B proposes a station open deep cut station box with mined approaches there is less site clearance as a result of reduced CCB in comparison to the baseline, and therefore less opportunity for continuous development and links with wider area including Medlock Valley, whereas other options may allow for a more holistic regeneration of the surrounding station area. However, coupled with the fact that the route approach to the station will be underground rather than on viaduct compared with the baseline option, the landscape effects of the alignment B station is neutral in comparison to the baseline option.

6.2.12 Wider traffic and transport traffic demand associated with the proposed HS2 station, will be similar to that of the baseline, however the higher levels of highway capacity that are retained to the east of the station in this option will result in lower congestion. This would result in a minor improvement in air quality (assuming that lower congestion doesn't result in an increase in traffic growth).

6.2.13 Within the CCB, there is 513,683 sqm of Gross External Area for commercial development opportunities, less than that of baseline. Coupled with a predicted increase of 900 job losses in comparison to that of the baseline due to the increased station CCB, it is considered this option would result in a major socio-economic worsening compared to the baseline option during construction.

6.2.14 In terms of carbon emissions, alignment B will result in in 323,000m3 of concrete required for the station and approaches as well as 56,500 tonnes of steel resulting in additional materials and emissions when compared against the baseline, which is a major worsening. Furthermore, this option will also require the demolition of 28,400m2 of commercial and residential properties, increasing the emissions to undertake the activity and transport to dispose of the construction demolition waste. Although the alignment B has a smaller CCB than the baseline, the mining element still creates a minor worsening in terms of carbon emissions, in comparison to the baseline.

6.2.15 Overall, option B is considered to be a major worsening over the baseline.

6.2.16 All other environmental impacts during operation are expected to be similar to the baseline.

Summary

6.2.17 In summary, option B is considered a minor worsening compared to the baseline. Potential major worsening have been identified for Community and Human Health, Minor

worsening have been identified for ecology, historic environment, landscape and Visual, socio-economic during construction. Between the three options, alignment B represents the best choice as it would result in less worsening of impacts in comparison to the others, and in the instance that alignment B be taken forward, a detailed review of the current indicative vent shaft location for Barlow Tip is recommended to try and remove or reduce the environmental impacts identified in this sift.

6.3 Underground Option B1

6.3.0 An environmental appraisal of the option B1 has identified the following environmental issues:

Construction

6.3.1 Alignment B1's station proposes a shallow box excavation, which is likely to result in increased waste when compared to the baseline. The increased size of the station box will result in significantly more material being excavated when compared to the baseline - estimated to be approximately 1.5Mm^3 of excavated material more than the Baseline.

6.3.2 In terms of carbon considerations, this option will result in in 245,000m^3 of concrete required for the station and approaches, as well as 24,800 tonnes of steel resulting in additional materials and emissions. This represents a minor worsening when compared against the baseline. Furthermore, this option will also require the demolition of 53,610m^2 of commercial and residential properties further increasing plant emissions to undertake the activity and transport to dispose of the construction demolition waste. Overall, this option is considered to be a major worsening for carbon over the existing baseline.

6.3.3 With regard to water resources, the station and Metrolink are to be constructed in a shallow box with a similar location and orientation to the baseline station option, however the box will be significantly longer than the baseline option and will be below groundwater level in the Chester Formation Principal aquifer. The shallow box would therefore create a local barrier to groundwater flow in the area, and additional mitigation (such as behind wall drainage) may be needed to ensure no adverse increase in groundwater levels. Risk of groundwater flooding from the barrier to groundwater flow in the glacial till would be the same as baseline. This is considered a slight worsening on groundwater over baseline due to the impacts on the Principal aquifer.

6.3.4 In addition, a temporary diversion of the River Medlock would be required during construction of the Box structure in this area and the creation of the new river channel. This will have a temporary adverse impact on the River Medlock. Consideration in management of the flood risk both temporarily during construction and permanently is required to ensure no increase in flood risk to local receptors (likely to include requirement for replacement floodplain storage).

6.3.5 The Ardwick Headhouse and Intervention/Escape Core, will extend through the superficial glacial till (Secondary (Undifferentiated) aquifer) and into the underlying Halsowen Formation (Secondary A aquifer) but only to a small extent. This is considered a minor improvement over the baseline option as it removes the need for extensive retaining walls and reduces risk of groundwater flooding. Overall for water resources, due to the impacts on groundwater flows in the Principal aquifer and the impacts on WFD on the River Medlock this is considered a major worsening compared to baseline. However, the vent shafts and underground route are considered to be a minor improvement over the baseline route due to better interactions with various groundwater tables and flood zones.

6.3.6 In terms of traffic and transport, there is significantly more material to be excavated than the baseline. However, the plan is to remove 90% of this material by rail which will mitigate the impact of construction traffic. There will be significant temporary disruption to the local road network to the north and east of the station with long term diversions that will be longer than those in the baseline, including disruption to Pin Mill Brow which will necessitate the construction of a new junction. Overall the construction impact is minor worsening when compared to the baseline.

6.3.7 The increased CCB proposed at Manchester Piccadilly could lead to a minor worsening of construction phase sound, noise, and vibration impacts on the surrounding communities, and sensitive non-residential receptors surrounding the station, headhouses, the intervention shafts, and vent shafts. It is noted that this option is likely to generate additional spoil/HGV movements when compared to option B.

6.3.8 The socio-economic impacts of alignment B1 includes approximately 4,300 job losses, an increase of ~1,600 job losses from the baseline, and therefore a major worsening compared to the baseline option during construction.

6.3.9 With regard to human health, the construction of the 55 King Street headhouse will result in the loss of access to the adjacent public plaza, and construction may result in changes to access to surrounding buildings and the amenity of the outside environment. The Piccadilly Station CCB will result in the demolition of Mr Fit personal training centre, and a 4 storey residential building at 31-35 Sparkle Street, additional demolitions to the baseline. Other community demolitions remain the same as the baseline. As detailed in the baseline, construction work may result in noise, visual, transport and air quality impacts on residents in the area. Overall, this alignment is considered to result in a minor worsening compared to the baseline due to the significantly longer duration of construction work.

6.3.10 The disruption of a number of public parks and green space, alongside the proximity of residential properties and community resources mean that the B1 route is considered to be a major worsening compared to the baseline, in particular during construction.

6.3.11 In terms of landscape and visual impacts, the removal of Gateway House will have a large impact upon the character of the station approach area causing disturbance during construction, and visual impacts for people accessing the station. However, the Ardwick Ventilation Headhouse is in the surrounding of a low-quality existing landscape character and lack of visual receptors in the area, impacts are expected to be similar to the baseline option. Given the increase in impacts as a result of additional areas of construction within the city centre, in particular around King Street, it is considered that this option would result in a minor worsening compared to the baseline option during construction. Furthermore, the vent shafts associated with this route potentially increases impacts to features that contribute to landscape character and the increase in impacts to recreational receptors, it is considered that this route would result in a minor worsening compared to the baseline option during operation.

6.3.12 With respect to the historic environment, the construction boundary of the combined underground station site has similar impacts to the baseline in terms of the removal of non-designated buried assets. Despite the station being underground, there will still be direct physical impacts to the Grade II listed train shed, required to enable connectivity between the two stations. The Western Kings Street Crossover box and Ventilation Headhouse construction boundary is adjacent to the Grade II listed Pall Mall Court (NHLE 1246934), including raised Piazza and Podium to the west side, and may result in both direct physical impacts and impacts through changes in setting to the asset. Additionally, the location is within the Upper King Street Conservation Area and surrounded by a number of other Grade I, II* and II listed buildings. All of which could experience adverse impacts due to changes in their setting. Given the tunnelled nature of the scheme across the city, it is likely that considerably more listed buildings will require monitoring due to the potential impacts caused by settlement than the current baseline. The additional impact of the cross over box and headhouse location represents a minor worsening of impacts in comparison to the baseline.

6.3.13 With regard to waste and minerals, it is of concern that the Barlow Tip vent shaft site includes a methane extraction plant to the west of the landfill, which indicates that the site contains significant organic waste. This material would require suitable disposal when excavated and could pose a major adverse impact. In addition, the vent shaft of Somerset Road, is in a mineral safeguarding area. In terms of materials proposed, this option will require a similar quantity of material to construct the various vent shafts, head houses and escape cores as well as the underground track as the baseline, given they are of similar length.

6.3.14 All other environmental construction impacts are expected to be similar to the baseline.

Operation

6.3.15 With regard to traffic and transport, the station area highway disruption for alignment B1 is similar to baseline, although there is a potential to provide greater permeability across

the station footprint on completion for pedestrians, cyclists and surface public transport which is an improvement on the baseline. The space available will allow a similar sized junction or equivalent to that which is there at present with links to Mancunian Way, Great Ancoats Street, Ashton Old Road and Chancellor Lane all retained. Wider traffic and transport traffic demand for access to the proposed HS2 Station will be similar to that for baseline, however the higher levels of capacity that are retained to the east of the station in this option will result in lower congestion generally in the area and therefore it is considered that this option will be a major improvement in traffic and transport terms when compared to the baseline.

6.3.16 However, the higher levels of capacity that are retained to the east of the station in this option will result in lower congestion. This would result in a minor improvement in air quality (assuming that lower congestion doesn't result in an increase in traffic growth).

6.3.17 Under alignment B1, Manchester Piccadilly Station will have a potential significant adverse airborne noise impact due to the new highway layout has been identified for the community of Chapeltown Street, together with a beneficial airborne noise impact due to reduced traffic flows at residential properties on Store Street (including committed developments).

6.3.18 Alignment B1 would create an opportunity for the commercial development 821,302sqm of Gross External Area, an increase compared to 614,134sqm under the baseline.

6.3.19 The proposals at Piccadilly Station within alignment B1 would create more site clearance as a result of the increased CCB will create more opportunity for continuous development and links with wider area including SRFs and Medlock Valley. Although the approaches will be underground rather than on viaduct compared with the baseline option the Ventilation Headhouse in King Street is likely to have townscape character impacts from the change to the street high quality street scene and King Street Conservation Area, potentially causing visual impacts to recreational users of the busy thoroughfare, residents and workers in surrounding multi-storey buildings that overlook the Site. It is therefore considered that alignment B1 would result in a minor worsening compared to the baseline option during operation.

6.3.20 All other environmental operational impacts are the same as the baseline.

Summary

6.3.21 Overall Alignment B1 is considered a minor worsening compared to the baseline. However, it is worse performing than option B as it generates worse impacts in terms of Traffic & Transport, and Water Environment during construction of the station elements. As with alignment B, there are negative impacts with regard land quality and waste/minerals along the route due to the Barlow Tip vent shaft. In the instance that either alignment B or B1 be taken forward, a detailed review of the current indicative vent

shaft location is recommended to try and remove or reduce the environmental impacts identified in this sift.

6.4 Underground Option D

6.4.0 An appraisal of option D has identified the following environmental issues:

Construction

6.4.1 In terms of waste and minerals, the station box excavation of the alignment D station is also likely to result in increased waste than the baseline. However, it is projected that as the tunnel track length is approximately 3km shorter than the baseline this will result in significantly less material being excavated when compared to the Baseline. However, as the alignment is indicative at this stage it is assumed that following design refinement alignment D will require a similar quantity of material to construct the various vent shafts, head houses and escape cores as the baseline, and there will be a number of new areas considered for demolition generating waste that require managing.

6.4.2 The quantity of build materials also affects the potential carbon impacts, as alignment D will result in in 366,000m³ of concrete required for the station and approaches as well as 64,050 tonnes of steel resulting in additional materials and emissions when compared against the baseline. The demolition of 34,210m2 of commercial and residential properties further increases plant emissions to undertake the activity, and transport to dispose of the construction demolition waste.

6.4.3 As the vent shaft locations are out of flood zone areas, despite Carriage Street being located over the existing Cornbrook culvert, in terms of watercourses the route of alignment D is overall likely to be slight improvement over the baseline scheme route. However, the depth of the station is considered to cause a slight worsening on groundwater over the baseline due to the impacts on the Principal aquifer.

6.4.4 In terms of noise, sound, and vibration, it is noted that the number of vent shafts and the proximity of residential properties and sensitive non-residential receptors means that alignment D is considered to be a minor worsening compared to the baseline.

6.4.5 In terms of socio-economic impacts, it is estimated that alignment D would result in approximately 2,050 job losses. As this is a decrease of ~1,300 job losses compared to the baseline, it is considered this option would result in a major improvement compared to the baseline option during construction. However, there is 140,000 sqm of Gross External Area for commercial development opportunities, a decrease from the baseline.

6.4.6 With regard to the historic environment, the number of listed buildings potentially affected by the route of the tunnel, coupled with the additional impacts from the vent shaft locations, results in a slight worsening in comparison to the baseline. This is due to the tunnelled nature of the scheme across the city and it is likely that considerably more listed buildings will require monitoring due to the potential impacts caused by settlement

than the baseline, and also due to the vent shafts at Clayton Vale and Lumb Lane. However, of more significant impact is that of the alignment D city centre works - the requirement for the demolition of the Grade II listed building stable block and the impacts to the Ashton Canal and Grade II* listed Store Street Aqueduct (albeit temporary) along with the additional impacts through changes to the setting of listed buildings created by the escape core and headhouses (including the Whitworth Street Conservation Area and its associated Grade II and Grade II* listed buildings, and the Grade II listed Brunswick Mill), as well as the setting of listed buildings including the Grade II listed London Warehouse and Crusader Works. The cumulative impact of all of these results in a major worsening of impacts in comparison to the baseline.

6.4.7 The Clayton Vale vent shaft is also located within a Local Nature Reserve, which means that Alignment D would result in a minor worsening with regard to ecology compared to the baseline.

6.4.8 Dust emissions are assumed to be controlled through Code of Construction Practice (CoCP) measures to avoid significant air quality impacts, however due to alignment D construction occurring in close proximity to a number of receptors, this represents a minor worsening in comparison to the baseline due to the disruption to the highway network and additional material to be transported from the tunnel portals. Furthermore, construction within the city centre proposes significantly more material to be excavated than the baseline due to the amount of excavated material. Although the plan is to remove 90% of this material by rail, which will mitigate the impact of construction traffic, due to the significant impacts identified for the baseline station and the presence of the AQMA this is still considered to be a minor worsening during construction compared to the baseline.

6.4.9 Alignment D demolishes a number of community receptors in the city centre during construction that differ from the baseline, including:

- the River Street Tower Student accommodation,
- approximately 200 residential apartments within the Manchester New Square apartment block;
- the Wharf Close Apartments;
- residences at 2-6 Laystall Street;
- residences at Whittles Croft; and
- the Eternal Life Sanctuary Church.

6.4.10 Differing from the baseline, and the vent shafts will require the permanent loss of:

- part of Baguley Park;

- the potential loss of the adjacent Early Inspirations Pre-School;
- three grass sports pitches at University of Manchester Wythenshawe Sports Ground;
- the informal public open space adjacent to Maine Road Football Club;
- potentially the play area on Carriage Street;
- the loss of a church (AD MSBN church) on the Globe Trading Estate;
- one fifth of Clayton Vale;
- on the car park, playground and playing field of Laurus Ryecroft High School; and
- a public open space with a number of footpaths running across it, including the Oldham Way.

6.4.11 Overall, the loss of a number of public parks and green space, alongside the impacts on a number of educational facilities, proximity of residential properties and community resources mean that this route is considered to be a major worsening compared to the baseline.

6.4.12 With respect to Land Quality, the location of structures in Bradford and the realigned station box intercepts a number of historical potentially contaminating sites, which is considered to be a minor worsening given the additional shaft sites in areas of former industrial usage (incl. gas works).

6.4.13 All other environmental construction impacts are expected to be similar to the baseline.

Operation

6.4.14 Due to the number of vent shafts that are placed within rural and recreational areas within the alignment D proposals, this increases the impacts to features that contribute to landscape character and the increase in impacts to recreational receptors, in addition to the increase in impacts as a result of additional features within the city centre (in particular around Whitworth Street and on PRoW along Ashton Canal) it is considered that this route would result in a worsening compared to the baseline option during operation with regards to landscape and visual impacts.

6.4.15 Furthermore, the amount of parks and public spaces that are to be impacted by the vent shafts, both in construction and during operation, is also seen as a minor worsening in terms of community, and coupled with the large CCB at Piccadilly, this could lead to a change and potential minor worsening of the significant adverse impacts on the surrounding communities and sensitive non-residential receptors surrounding the station and intervention shafts.

6.4.16 The overall traffic and transport impact is likely to be a major improvement when compared to the baseline due to the reduction in impact on Pin Mill Brow and the Ring Road. Despite the impacts of air quality representing a minor worsening for alignment D, this option represents a minor improvement to the baseline due to the reduction in air quality impact on Pin Mill Brow and the Ring Road (assuming that lower congestion doesn't result in an increase in traffic growth).

6.4.17 All other environmental construction impacts are expected to be similar to the baseline.

Summary

6.4.18 Not only does alignment D represent a worsening in comparison to the baseline, the impacts are the most worsening across the three alternatives due to the potential of the carbon impacts. D has considerable detrimental effects on the historic environment and surrounding businesses of the proposed station due to the required demolitions, and the negative impact on community and health impacts, particularly with regard to Laurus Ryecroft High School. In the instance that alignment D is taken forward, a detailed review of the current indicative vent shaft location is recommended to try and remove or reduce the environmental impacts identified in this sift.

7 Stakeholders input to SIFT

7.1 Decision Point 1

Introduction

7.1.0 There has been a substantial amount of stakeholder collaboration with MCC, TfGM and TfN throughout the duration of the study. This commitment from DfT and HS2. has included the co-writing of the project scope, design development workshops and a bespoke, collaborative Level 2 Sift.

7.1.1 MCC, TfGM and TfN have been part of the decision making for the initial selection of a shortlist of three options (A, B and C). Following the Stage 0 (construction methodology) work on options A, B and C in October and November 2020, stakeholders requested two additional alignment studies (B1 and D). These were commissioned by DfT in December 2020.

7.1.2 Following the completion of the additional studies in January 2021, the stakeholders selected four options to take forward to Stage 1: Sift Level 2 (A, B, B1 and D). Following consultation with DfT, three options B, B1 and D were progressed to Sift Level 2 in April 2021.

7.1.3 MCC, TfGM and TfN were given the opportunity to select a preferred alignment option at Decision Point 2 in April 2021.

7.1.4 Stakeholder Engagement Regular Technical Engagement Workshops have been held throughout the study with additional meetings arranged in May 2021. Key stakeholder inputs are summarised in *Figure 30* below.

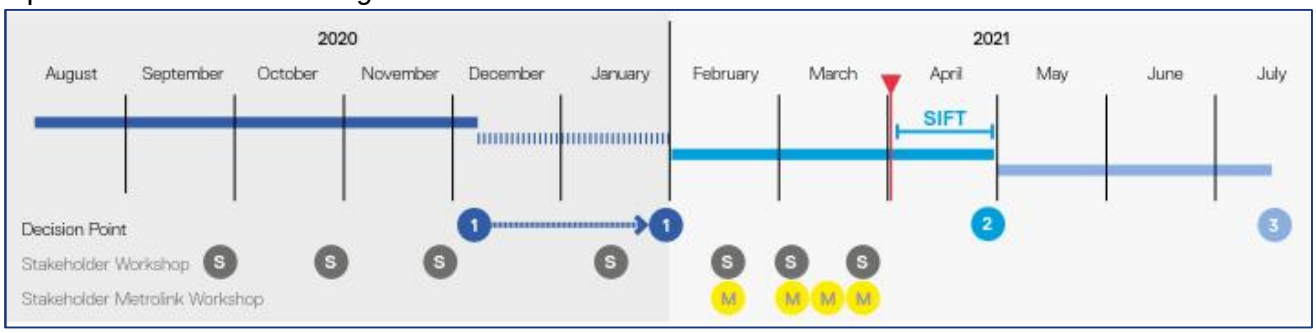

Figure 28 - Key stakeholder inputs to decision point 2

7.1.5 HS2 and its consultant MWJV has shared emerging design information with MCC, TfGM and TfN's technical specialists for feedback and input throughout the study. Various disciplines have presented including track and alignment, tunnel and ventilation, construction and logistics, stations architecture and urban design and integration.

Date	Details
15/10/20	Stakeholder Meeting: Presentation of work in progress by MWJV on the three options: Stakeholder requested a track meeting to understand alignment features.
29/10/20	Stakeholder Meeting: Stage 0 - Pre-sift presentation for Decision Point 1: Stakeholder proposed: An alternative for Alignment C (further towards the city) Moving option B further away from the city. A workshop on ventilation was requested.
02/11/20	Stakeholder Meeting: Review of Pre - sift: Current actions Alignment A to proceed with a deep box construction methodology Alignment B to proceed with a box construction methodology. Further work is to determine deep or shallow box. Alignment C discussion revolved around moving the alignment to the north
12/11/20	Stakeholder Meeting: Presentation and discussion of tunnel and station ventilation design issues.
26/11/20	Stakeholder Meeting: Presentation and discussion of track alignment design issues. TfN concerns for the inclusion of NPR standards for a more efficient design.
07/12/20	Instruction to proceed with studies on the additional options raised by the stakeholders.
14/01/21	Stakeholder Meeting: Presentation by MWJV to provide the stakeholders with a working update on progress on the additional study work.
28/01/21	Stakeholder Meeting: Presentation and workshop by MWJV on the conclusions of the additional studies for B1 and D, incorporating stakeholder comments received prior to and following the meeting on the 14/01/21. Provided information to confirm Decision Point 1. Discuss and agree the construction methodology for options B1 and D. Decision Point 1
29/01/21	HS2 instruction (email) to take forward the options B, B1 and D into Level 2 sift.
25/02/21	Stakeholder Meeting: Urban Integration and Station Depth
02/03/21	Stakeholder Meeting: Metrolink -to discuss integration and impact on the Metrolink
03/03/21	New Metrolink Station integration slides issued by HS2 to MWJV. Initial meeting.
04/03/21	Stakeholder Meeting: Presentation of update and working discussion focused on Alignment, Station depth and Ventilation
09/03/21	Stakeholder Meeting: Metrolink
11/03/21	Stakeholder technical meeting
16/03/21	Stakeholder Meeting: Metrolink -to discuss integration and impact on the Metrolink. TfGM presented an additional and new Metrolink option for alignment B
18/03/21	HS2 Meeting: Programme delivery. HS2 Instructed that Integration of the Metrolink station not be considered as will impact the programme.
18/03/21	Construction and Logistics stakeholder workshop
01/04/21	Stakeholder meeting: Drawing review and presentation Alignment B, B1& D
08/04/21	Stakeholder drop in meeting. MWJV Team provides clarifications on drawings.
15/04/21	Joint sift workshop 01 and 02
16/04/21	Joint sift workshop 03
22/04/21	Decision Point 2 Stakeholder workshop
06/05/21 20/05/21	Stakeholder additional technical workshop Stakeholder additional technical workshop

Figure 29 - Stakeholder meetings

7.1.6 In addition to the above meetings, HS2 has held regular Senior Project Meetings with DfT, MCC, TfGM and TfN since Summer 2020. These have been on Mondays and are generally every two weeks.

7.1.7 The study has also been presented to, and discussed at, the Piccadilly Joint Board (see 7.4 below).

Decision Point 1

7.1.8 As described earlier in this report, the first stage of the study (Stage 0) was a footprint comparison of the two construction methodologies of open box vs mined with construction and logistics input for a six platform, 400m long station. Three shortlisted alignments called options A, B and C were agreed by partners from a long list.

7.1.9 Stage 0 culminated in 'Decision Point 1' where MCC, TfGM and TfN agreed and selected a preferred construction methodology (open box vs mined) for each of the three options. Stakeholders also were given the opportunity to agree which of the options (A, B or C) would be progressed (as both an open box and mined methodology) to allow direct comparison of the two construction methodologies during Stage 1, Sift Level 2.

7.1.10 A stakeholder Meeting was held on 15 October 2020 with MCC, TfGM and TfN. MWJV provided a presentation of work in progress on the options A, B and C.

7.1.11 Stakeholders requested a track meeting to understand alignment features.

7.1.12 A stakeholder Meeting was held on 29 October 2020 to present the Stage 0 - Pre-sift presentation for Decision Point 1. The preferred construction methodology for each alignment was agreed as follows:

- Option A Deep Box;
- Option B Deep Box; and
- Option C Mined.

7.1.13 Manchester Stakeholders also proposed alternative alignments for option C (further towards the city) and option B (moving further away from the city centre). A workshop on ventilation was requested. Stakeholders recommended that HS2 carry out additional work to look at these two alternative options. It was recommended that this was done before Decision Point 1/prior to undertaking Stage 1: Sift Level 2.

7.1.14 HS2 produced the document *Manchester Piccadilly High Speed Station: an Optimised Alternative Underground Station Stage 0: Pre-sift* (Ref: 2DE01-MWJ-EN-PRE-M003-000027). HS2 shared this with Manchester Stakeholders for comment.

7.1.15 A further stakeholder meeting was held on 2 November 2020 to review the pre – sift presentation.

7.1.16 Two other technical stakeholder meetings were held on 12 and 26 November 2020. The first covered a presentation and discussion of tunnel and station ventilation design issues. The second covered a presentation and discussion of track alignment design issues

7.1.17 In November 2020, MCC, TfGM and TfN provided written comments on the Stage 0 Pre-Sift Work. [redacted] HS2 and its consultants provided a written response to each comment on 25 November 2020 (See Appendix E).

7.1.18 Following the meetings on 29 October and 2 November 2020, MCC, TfGM and TfN provided two new alignments for additional study. Option B1 was provided as a potential alternative to option B and option D as a potential alternative to option C

7.1.19 HS2 formally instructed MWJV to proceed with the alternative studies on 7 December 2020 and develop options B1 and D were to be developed to the same level of detail as the Stage 0: Pre-Sift study for options A, B and C.

7.1.20 MCC, TfGM and TfN requested that the additional study for option B1 was to be for a shallow box investigating opportunities to reduce city centre impacts.

7.1.21 The additional study for option D was to investigate alternative alignment similar to a previous HS2 Long List option (called option F). The additional study would review shallow box, deep box & mined station options.

7.1.22 An Interim Draft of Options B1 and D was prepared on 16 December 2020, which HS2 shared with MCC, TfGM and TfN for feedback. [redacted]

7.1.23 HS2 and its consultant prepared a technical response on 29 December 2020 (circulated on 12 January 2021). This is included in Appendix E.

7.1.24 A follow up stakeholder meeting with MCC, TfGM and TfN was held on 14 January 2021. At this meeting, HS2 and its consultant provided a working update on progress on the additional study work. The presentation *Manchester Piccadilly High Speed Station Alternative Alignment Studies* (*Document no.: 2DE01-MWJ-EN-PRE-M003-00003*) was produced on 21 January 2021 and shared with MCC, TfGM and TfN on 22 January 2021.

7.1.25 A stakeholder meeting with MCC, TfGM and TfN was held on 28 January 2021 (Decision Point 1). HS2 and its consultant presented its conclusions to the additional studies for options B1 and D (following the Initial Draft of 16 December 2020). Also, on 28 January

2021, TfGM on behalf of MCC, TfGM and TfN emailed HS2 to advise that four of the underground station options provided should be considered at the next sift. These options were alignment A (Deep Box), alignment B (Deep Box), alignment B1 – shallow box and alignment D – Hybrid (deep box/mined).

7.1.26 The stakeholders also said that "*The subjective nature of the RAG status makes it difficult to discount alignment options at this early stage of development. Similarly, we do not think it is appropriate for all options to employ the same construction methodology at this stage as a comparison of 'deep', 'shallow' and 'hybrid' options is an essential consideration for the sift*".

7.1.27 The request to proceed with four options was not agreed by DfT and the conclusion of Decision Point 1 was to take forward Options B, B1 and D to the Sift Level 2 stage of the study. Following Decision Point 1 on 28 January 2021, HS2 instructed MWJV on 29 January 2021 to take forward the options B, B1 and D into Stage 1: Sift Level 2.

7.2 Engagement up to sift workshops

7.2.0 For Stage 1, Sift Level 2, MWJV was scoped with developing and sifting the preferred options in accordance with the Route Development Procedure ref HS2-HS2-SA-PRO-000-000007 P08 and using a bespoke sift matrix created by HS2 to reflect the requirements of the stakeholders.

7.2.1 Stage 1 has two Decision Points:

- Decision Point 2 – Agree preferred underground station (22 April 2021); and
- Decision Point 3 – Ministerial Review (July 2021 TBC)

7.2.2 On 25 February 2021, a stakeholder meeting was held with MCC, TfGM and TFN. MWJV gave presentations on emerging work on urban integration and station depth.

7.2.3 On 4 March 2021, a stakeholder meeting was held with MCC, TfGM and TFN. MWJV gave a design update presentation and there was a working discussion focused on alignment, station depth and ventilation. Comments were captured by HS2 and its consultant in an Excel spreadsheet and the technical response is enclosed in the comments sheet (see Appendix E)

7.2.4 A series of workshops were held on 2, 9 and 16 March 2021 with TfGM on the Metrolink interface with the three options. New proposals for Metrolink underground and over ground stations were shared with HS2 and its consultant for the first time. On 16 March 2021, TfGM presented an additional and new Metrolink concept for option B (underground Metrolink station below as per hybrid Bill Design).

7.2.5 HS2. and its consultants incorporated the design proposal from TfGM for options B1 and D. HS2 did not receive a design proposal from TfGM for option B other than a statement in a Workshop that it preferred B to be integrated as an underground proposal. HS2 advised TfGM that an underground option could not be integrated in the agreed programme. It should be noted that the feasibility of TfGM's Option B concept is untested including the potential impact on the depth of a high-speed rail station.

7.2.6 A construction and logistics stakeholder workshop was held on 18 March 2021 with MCC, TfGM and TfN. Comments were captured by HS2 and its consultant in an Excel spreadsheet and the technical response is enclosed in the comments sheet (see Appendix E)

7.2.7 Following the design freeze on 31 March 2021, MWJV presented design drawings of the alignments B, B1 and D to MCC, TfGM and TfN on 1 April 2021. The drawings were included in the technical note document 2DE01-MWJ-EN-NOT-M003-000006 and were submitted by HS2 to MCC, TfGM and TfN on 1 April 2021 for formal feedback in advance of the Joint Sift.

7.2.8 A follow up workshop was held on 8 April 2021 with MCC, TfGM and TfN . This gave stakeholders the opportunity to raise any issues /ask questions etc on the information provided on 1 April.

7.3 Input at Sift Workshops

7.3.0 On 15 and 16 April 2021, the joint sift workshop was held. This took place on Microsoft Teams over three, 2.5-hour sessions and was attended by DfT, HS2, MCC, MWJV, RSADS, TfGM and TfN.

7.3.1 The purpose of the collaborative workshop was:

- to share information that will form the basis of the sifting exercise being done in accordance with the HS2 Route Development Procedure; and
- to record comments and feedback that may inform the final sift scoring.

7.3.2 The objective, where possible, was to record stakeholder views on a preferred alignment and station option or topic areas where they may be a clear preference for one option over the other two.

7.3.3 The agenda for Session 1 was as follows:

- Presentation of design options [redacted]
- Rail systems, [redacted]
- Alignment, [redacted]
- *Comfort break*
- Stations, [redacted]
- Urban integration, [redacted]

7.3.4 The agenda for Session 2 was as follows:

- Environment, [redacted]
- Strategic Interfaces, [redacted]

- *Comfort Break*
- Construction and Logistics, [redacted]
- Order of magnitude cost update, [redacted]
- Strategic programme, [redacted]
- *Comfort Break*
- Summary sift table run through, [redacted]

7.3.5 In the final session, HS2 and its consultant attempted to capture stakeholder feedback on the three options using a Sift summary template. The following 'Big Ticket Items' were discussed and evaluated using the Sift Matrix Summary:

- Commercial Development;
- Construction and Logistics – Station;
- Construction Risks;
- Environment; and
- Sift Summary.

7.3.6 This session was also an opportunity for stakeholders to share their feedback on options presented on 1 and 15 April 2021.

7.3.7 [redacted]

7.3.8 On 22 April 2021 (Decision Point 2), the sift summary was presented again, this time with HS2 and its consultants' assessment and rankings. MCC, TfGM and TfN were due to agree a preferred underground option on that day as part of Decision Point 2.

7.3.9 Following discussion with HS2, Decision Point 2 was deferred to allow MCC, TfGM and TfN more time to consider and advise HS2. which option they preferred.

7.3.10 'Drop in sessions' were held on 6 and 20 May 2021 to invite stakeholder feedback on the technical work shared on 1 April, the sift presentations shared on 15 and 16 April and the draft sift summary and matrix.

7.4 Piccadilly Joint Board Workshop

7.4.0 A request was made at the Manchester Piccadilly Joint Board on 21 April 2021 that HS2 brief the emerging findings of the study to board members.

7.4.1 A workshop for the Board members was arranged and held on the 19 May 2021. A summary presentation, which reflected content from the previous Sift Workshop sessions, was provided to the Board in advance of the meeting on the 14 May 2021, the document reference number was P2B-HS2-DS-PRE-M005-000005 and was titled '*Piccadilly Underground – Piccadilly Board Workshop Slide Pack '*

7.4.2 A number of comments and observations from Board members were noted by HS2 as follows:

a) Request for comparison to Stuttgart 21 project in Germany;
b) Request for an understanding of the scale of costs that have gone into other worldwide High Speed Railway Underground stations;
c) Request for a comparison of platform transit times for the alternative Underground options compared to current 'Pendolino' services;
d) Request to explain differentiation between mid and end of platform transit times;
e) Request to explain how period of blighting with larger station footprints has been taken into account;
f) Request for examples of Headhouse Size/Aesthetics;
g) Noted that the study has not considered fully the wider development opportunities, particularly outside CCB and beyond the potential returns to SoS;
h) Request for the baseline HS2 hybrid Bill comparator scheme costs to be presented alongside the costs of the alternative Underground options;
i) Request for a methodology notes and assumptions to be articulated for cost summaries and the wider benefits analysis; and
j) Noted the conflicting assumptions of car parking requirements with city plans

7.4.3 The requests of a), d), e), f), h) and i) are evidenced in the assessment of the alternative underground options within this report, such as the appendix and in the supporting documentation provided at the Sift Workshops ([2]). Information in response to (b) can be sourced in the public domain, but can be difficult to interpret due to inconsistencies in how numbers are reported, and was therefore not included in this report. Commentary on pedestrian transit times (c) is presented in Chapters 8 and 9. Responses to (g) have been provided as part of this report. Comments relating to (j) have also been made in relation to the hybrid Bill design – a like-for-like assessment has been presented in this report.

7.5 Stakeholder comments and opportunities

7.5.0 As noted above, stakeholders' comments have been received at various stages of the study. These have been received as a formal set of comments for response or captured by HS2 during a meeting (e.g. Joint Sift Workshop).

Stage 0 Pre-Sift Work (Construction Methodologies)

7.5.1 In November 2020, Manchester stakeholders provided written comments on the Stage 0 Pre-Sift Work. [redacted]

7.5.2 HS2 and its consultant provided a written response to each comment on 25 November 2020 (see Appendix E).

Stage 0 Pre-Sift Work (Additional Studies Interim Draft)

7.5.3 An Interim Draft of options B1 and D was prepared by HS2 and its consultant on 16 December 2020. HS2 shared this with MCC, TfGM and TfN for feedback. [redacted]

7.5.4 HS2 and its consultant prepared a technical response on 29 December 2020 (circulated on 12 January 2021). This is included in Appendix E.

Stage 1 Sift Level 2: Track Alignments / Station Box Depth / Station Ventilation (4 March 2021)

7.5.5 On 4 March 2021, a stakeholder meeting was held with MCC, TfGM and TFN. HS2 and its consultant gave a design update presentation. There was a working discussion focused on alignment, station depth and ventilation. Comments were captured by HS2 in an Excel Spreadsheet and the response is enclosed in the comments sheet (see Appendix E).

Stage 1 Sift Level 2: Construction and Logistics Stakeholder Workshop (18 March 2021)

7.5.6 A Construction and Logistics stakeholder workshop was held on 18 March 2021 with MCC, TfGM and TfN. Comments were captured by HS2 and its consultant in an Excel spreadsheet and the technical response is enclosed in the comments sheet (see Appendix E).

Stage 1 Sift Level 2: Key Opportunities and Queries Note from TfN (30 March 2021)

7.5.7 A list of 'key opportunities and queries' was sent by [redacted] to HS2 on 30 March 2021. The document, sent on behalf of MCC, TfGM and TfN, raised a number of issues which are summarised as follows:

- The length and layout of the station throat/approaches;
- Opportunities to create further hybrids of shallow/deep/mined station layouts;
- The perturbation crossovers in the city centre;
- Refinement of platform requirements (length/width/curvature);
- Integration of Metrolink into the options being considered;
- Integration with the conventional rail station at Manchester Piccadilly;
- The depth of the 'shallow box' Option B1;
- Relaxation of HS2 standards and requirements;

Quantifying the potential benefits of a 'through' layout in terms of rail capacity/performance (i.e.; potential additional paths, flexibility, resilience); and

- Alternative ways to accommodate the train service specification with a through station.

7.5.8 A multi-disciplinary response to the [redacted] note of 30 March 2021 was prepared by HS2. and its consultant. This is included in Appendix E.

7.5.9 It should be noted that the response advises that "further design development has not been instructed and any additional design development would be pending Decision Point 3 (Ministerial Decision)".

Stage 1 Sift Level 2: Design Presentation (1 April 2021)

7.5.10 Following the design freeze on 31 March 2020, MWJV presented design drawings to MCC, TfGM and TfN on 1 April 2021. HS2 circulated the full set of drawings to the Stakeholders on 1 April 2021. No feedback was received from MCC or TfGM on the design drawings.

Stage 1 Sift Level 2: Joint Sift Workshop (15 and 16 April 2021)

7.5.11 [redacted]. Copies of the presentation were circulated to MCC, TfGM and TfN for feedback. Comments on the Design Presentation and some of the Sift presentations have been received from [redacted] These are included in Appendix E along with a technical response.

Stage1 Sift Level 2: Comments on the draft Report

7.5.12 On 28 May 2021, HS2 sued the draft final report '*Manchester Piccadilly High Speed Station - Design of an Alternative Underground Station - Options Assessment - Sift Level 2 Appraisal* ' (Ref: 2DE01-MWJ-EN-REP-M003-000032 P02) to MCC, TfGM and TfN for review, as per the agreed programme. On 14 June 2021, HS2 received consultation responses from MCC, TfGM and TfN in line with the agreed programme.

7.5.13 [redacted] In total, 442 comments and two reports totalling 27 pages.

7.5.14 HS2 and its consultant has reviewed the consultation responses and the covering reports as part of finalising this Report

8 Summary for comparison of underground options against one another

8.1 Comparison of Underground options against each other –

Railway Systems

8.1.0 While there are subtle variations in each of the options, there are no significant technical differences in the rail systems design between the options that feature as key differentiators in this study, particularly when compared to the civils and environmental considerations of these options.

8.1.1 The one exception to this is for journey times where Option D scores better because of the shorter tunnel length. The outputs of this exercise are shown in figure 30 below. These values show the variance in the timetabled train journey times compared to the baseline.

	Airport <> Piccadilly	Assumed Piccadilly Dwell Time	Piccadilly <> Leeds	Airport <> Leeds
CP3 Baseline	+/0 minutes	5 minutes	+/0 minutes	+/0 minutes
Option B	+¼ minute	3* minutes	- ¼ minute	-2 minutes
Option B1				
Option D	-½ minute		-½ minute	-3 minutes

Figure 30 - journey time assessment

Station

8.1.2 The underground options are not differentiated from each other or the base line from an operational feasibility Station design point of view and this is reflected in the sift matrix scoring.

8.1.3 The proposals diverge when operation feasibility- station for passenger & place is considered.

8.1.4 Assessing passenger flow in emergency and normal operation, the underground options are comparable with each other. It is note-able that option D employs a different arrangement of escalators that B or B1 the quantum 12 no. is the same and has been tested to meet passenger clearance standards. Due to the narrow width of option D there are less passenger lifts 3 no. are provided instead of 4 on B or B1 typical platform, while there are no lifts on the mined platforms the reduction in provision may reduce operational resilience.

8.1.5 Assessing the wayfinding of the underground station layouts the flow is intuitive from platform to vertical interchange and to ticket hall via underground concourse. The spaces are clearly laid out and don't obstruct general flow. Numerous requirements of vertical interchange can hinder wayfinding and impact passenger experience. This is similar for all the underground options. As a sequence of spaces and journeys connected by vertical interchange the options are not significantly differentiated from each other.

8.1.6 Assessing the relative security or perception of security the options are not differentiated.

8.1.7 Assessing passenger connectivity between HS2 underground with existing station and onward modes of travel the proposals diverge as outlined in the sift matrix which the following points examine Option B1 and D with equal scoring are ranked better than option B

8.1.8 Travel time to forecourt and carparking is comparable across all the options.

8.1.9 Travel time to NR concourse is comparable between option B and D. Option B1 is a longer horizontal journey above ground due to the site location which is further east than the other two options. Note travel time to B1 may be improved with reorientation of existing NR concourse to address the southern side of the existing station.

8.1.10 While the travel time to Metrolink from underground platform is comparable across the options the provision and passenger experience is different. Option B Metrolink provision is as existing which includes two platforms below the existing station. The journey includes vertical interchanges in each station with horizontal and vertical interchange externally in between. Compounded with travel through the NR concourse affecting capacity the experience is poor. Option B1 & D are similar to each other where the journey to the Metrolink is completed by short horizontal journey to four platform provided in urban plaza that each option addresses. Omitting the additional onward horizontal and vertical interchanges the experience is improved along with the provision of Metrolink which, is more Civic in its location as part of an urban plaza. (noting Metrolink provision is not TfGM preference refer also 3.4.1)

8.1.11 In summary: Option B1 and D with equal scoring are ranked better than option B.

8.1.12 It is notable that option B1 includes a larger plaza which serves as a gateway plaza and is of greater civic presence than the smaller plaza provided in option D.

8.1.13 The options can be further differentiated by constraints.

8.1.14 Option D is constrained on one end by Great Ancoat street and Metrolink track line and London Warehouse on the other. This limits the flexibility of future extension of the ticket halls. Option B western ticket hall which is located in close proximity to existing station and nearby listed buildings including London warehouse may be limited in future expansion due to the proximity. In comparison option B1 is less constrained in respect of future expansion, in particular the western ticket hall.

8.1.15 Option B which is in close proximity to the existing station with smaller plaza between the city end ticket hall and London Road. The ticket hall can align to the north of the existing station utilising the space between the two stations however this leaves less space for provision of Metrolink as an above ground proposal between the station or to the north of the HS2 underground proposal and consequently the utilisation of the existing provision which is not preferred.

8.1.16 Notably; a below ground Metrolink provision has been proposed by stakeholders. While the feasibility is untested the constraints mentioned for option B including preference not to make the station deeper) will limit potential of underground Metrolink option for option B. Option D or B1 may be more feasible candidates for a below ground Metrolink option instead with B1 being the better of the two if space in the cut and cover throat construction can be utilised. Note; this is also untested.

Urban Integration

8.1.17 All underground options provide ground floor retail / commercial activation along the length of the station box, animating the public realm. With the station box being located below ground, the overall station integrates well within its context allowing pedestrians to flow between the proposed OSD above the station box. Alignment option B and B1 fronts onto The Boulevard as proposed by MCC Piccadilly SRF (2018), framing The Boulevard as an armature for development, catalysing the regeneration of East Manchester.

8.1.18 Alignment option D is located along Store Street in a north-east to south-west orientation, limiting station exposure to the Boulevard. Both stations entrance NR and HS2 front onto the main public realm, creating a ‘gateway’ plaza for Piccadilly SRF. It should be noted, the lack of exposure to MCC Piccadilly SRF Boulevard does not necessarily mean the station will not integrate with the surrounding city context, rather it implies that a different city regeneration strategy and urban grain structure may be formed as a result of the new orientation of alignment option D station.

8.1.19 Alignment option B has limited space to form a ‘gateway’ plaza with the closeness of listed London Warehouse and NR Station has the limiting factor. Limiting option B's placemaking opportunity in comparison to alignment option B1 and D.

8.1.20 Overall, alignment option B1 offers a much-improved public realm and more immersive integration between Piccadilly SRF and HS2 station in comparison to alignment option B and D. This can be summarised by two differentiating factors;

8.1.21 Station box positioned further to the east

8.1.22 HS2 western ticket hall has been located further to the east along the Boulevard, opening a bigger public realm to house the interchange function between HS2, NR and Metrolink. This creates a 'gateway' plaza for Piccadilly SRF and forms part of the HS2 arrival experience. The inclusion of interchange function within the 'gateway' plaza animates the space, adding drama to the public realm. The new 'gateway' plaza has the potential to deliver a long-lasting legacy, adding new civic space to the wider Manchester city centre experience.

8.1.23 HS2 eastern ticket hall has been located further to the east along the Boulevard, creating a ticket hall within a waterfront plaza setting, serving communities to the east of ring road.

8.1.24 Boulevard located to the south of HS2 Station, by locating the Boulevard to the south of HS2 station, it signals the inclusion of OSD as part of Piccadilly SRF urban grain. This will blur the line between HS2 station and the urban realm, offering a much better integration to the surrounding context.

8.1.25 The new Boulevard will be fronted by the listed NR viaduct, adapted to house commercial / retail use, adding character to the area through the inclusion of historical heritage. This will open up NR Station to the north allowing a direct pedestrian connection to Mayfield development through the undercroft of NR station. With the new Boulevard configuration, the area can be fully pedestrianised, improving the urban experience around the station.

8.1.26 All underground alignment options will support OSD and ASD, with OSD being built over the station box. The OSD is less flexible in comparison to ASD (which is built on clean plots), OSD supporting structure must be built into the original design of the station box. For example, demolishing an OSD and re-building above the station box will be restricted to areas designated to support the OSD structure. The inclusion of OSD as part of the city grid structure will limit the city’s ability to adapt to future city dynamics such as changing demographic, environmental or economical requirements.

Environmental Impacts

8.1.27 Whilst all three options in this sift (B, B1 and D) are considered a major worsening compared to the baseline. This section briefly compares the options against each other. Option B is the preferred option because it generates the least environmental impacts of the three underground options considered in this sift. Option B1 that generates more significant construction impacts on the River Medlock; and option D demolishes a Grade II listed former stable block.

8.1.28 Options B and B1 have the same tunnel alignment, so have scored the same in the sift. Although the option B/B1 tunnel alignment is likely to have significant environmental impacts such as the Barlow Tip vent shaft, option D generates more community impacts such as the vent shaft on the school site loss of active sports pitches.

Construction programme

8.1.29 Major programme assumptions were listed in Section 3.4.

8.1.30 The overall construction programme durations from Royal Assent to handover to the Client (i.e. not including Trial Operations) are shown in *Table 4.*

Option	Duration
Option B	14.5 years
Option B1	15.5 years
Option D	15.5 years

Table 4 - Overall programme durations from Royal Assent to Handover

8.1.32 Table 4 shows that there is only 7% difference between the construction programme durations of the three underground options. This is insignificant given the assumptions made and the level of detail.

8.1.33 Due to the increased geotechnical risk of options B and D relative to B1, they have a higher risk of programme extension if ground conditions are worse than expected.

Construction feasibility – TBM drives

8.1.34 The TBM strategy for all the underground options is to drive two TBMs from Manchester Airport Portal all the way to Manchester Piccadilly. This is because the HS2 end of the underground stations does not have a suitable drive site for launching and driving TBMs to the south.

8.1.35 The long drive length for the underground options is not critical to the programme and gives time for the station boxes to be ready for reception of the TBMs. Although option

D has a shorter alignment from the Manchester Airport Portal to Manchester Piccadilly High Speed Station, it is planned to drive the TBMs along the outer platform alignments and then on to the Barking Street portal shaft. Therefore, in terms of drive lengths, all three options are similar.

8.1.36 The TBM drive alignments of all three options pass under Manchester city centre, with a similar risk of settlement damage to utilities and buildings, including many listed buildings and conservation areas, as well as the Guardian Underground Telephone Exchange.

Construction feasibility – station

8.1.37 'Station' here means the portal shafts, outer scissors crossover caverns, approaches and station. For Options B and D, the approach track junctions are in mined caverns, whereas for B1 these are in a cut and cover box. For this reason, option B1 carries significantly less geotechnical risk than B or D.

8.1.38 The mined approaches have no precedent for such large caverns in close proximity to each other in these ground conditions. Their feasibility will depend on detailed site investigation, design analyses and possibly full-scale trials demonstrating the rock has sufficient strength and that groundwater ingress can be controlled by grouting or other measures. It is likely that extensive ground treatment and partial dewatering will be required. Ground between adjacent caverns may need to be replaced by reinforced concrete pillars.

8.1.39 The mined approaches and outer scissors crossover caverns have a major risk of causing settlement damage to overlying buildings and utilities. This includes large areas of the historic city centre and includes many listed buildings, as well as other assets such as the Guardian Underground Telephone Exchange, canals, sewers and culverted rivers. This risk is significantly higher for option B and D.

8.1.40 Options B and B1 require closure of the Metrolink Ashton line for approximately 7 years or 9 years, respectively. Option D only requires closure for short periods when it is relocated.

8.1.41 Option D requires closure of the Ashton Canal for approximately 10 years. This is a significant impact.

8.1.42 Option B1 has significant impacts on the ring road Pin Mill Brow and its junctions, which will need diverting. It also requires a realignment of the River Medlock.

8.1.43 Option D requires a temporary diversion of Great Ancoats Street for the duration of construction. This may also require a short diversion of the Travis Street sewer, which runs along Great Ancoats Street.

8.1.44 Options B and B1 require a significant diversion of the Travis Street sewer, which will be redirected via Ducie Street and London Road as per the hBD.

Construction and logistics summary of three underground options comparison

8.1.45 Geotechnical risk is by far the most important factor, and for this reason option B1 is preferred, even though some of the construction impacts of B1, such as the realignment of the River Medlock and diversions of Pin Mill Brow do not feature in the other two options.

Health and Safety

8.1.46 Construction, operation and maintenance underground are always inherently more risky than a surface option and require measures to mitigate risks to acceptable levels. To compare the underground options against each other the focus becomes that of the construction method. Option D requires more construction by mining and would be regarded as riskier than the other options from the perspective of health and safety to those carrying out the construction.

Commercial Development

8.1.47 Commercial Development has been assessed based on potential development opportunities within the defined CCB for each alignment options in the form of indicative achievable floorspace (GEA). With the arrival of HS2 and NPR in Manchester City centre, it is anticipated that there will be a wider economic benefit to the city as a whole. Given the high-level nature of the study and the given programme, a detailed economic assessment has not been conducted at this stage.

8.1.48 In comparison to the underground alignment options, option B1 provides a major improvement in achievable floorspace at 821,302 sqm (GEA) with option B and D assessment quantum achieving 513,683 sqm (GEA) and 419,980 sqm (GEA) respectively.

8.1.49 It should be noted that the indicative achievable floorspace for alignment option D is higher (575,328 sqm, GEA) in comparison to the assessment quantum (419,980 sqm GEA). Through the assessment process, we have noted that Central Retail Park is currently being regenerated and promoted by MCC under the current Baseline option scheme. For assessment purposes, the quantum attributed to Central Retail Park in alignment option D has been deducted.

8.1.50 Based on the achievable floorspace set out above, HS2 has provided high-level estimates for residual land values. These were derived from standard property industry software development appraisals of land that would be permanently acquired by the Secretary of State for Transport and anticipated to not be required for future operational railway purposes.

[redacted]

[redacted]

8.1.53 As a general observation, it should be noted that only alignment option B1 have the potential to offer a continuous development from Piccadilly SRF expanding to the east beyond the Ring Road

Benefits analysis

8.1.54 Taking journey time outputs and indicative construction boundaries provided by HS2's consultants, the Department for Transport (DfT) together with Transport for the North (TfN) worked to provide an indication of the productivity and journey time benefits and the jobs impacts that the underground stations could have.

8.1.55 Further information on the methodology and outputs of that work is provided in Appendix I.

OOM costs

8.1.56 The total cost for each of the underground options is as follows;

- Option B = £12.3Billion
- Option B1 = £11.4Billion
- Option D = £12.1Billion

8.1.57 For further details, including supporting assumptions and caveats, please refer to Appendix G

Indicative Programme to Delivery-into-Service

8.1.58 The Delivery-into-Service date ranges for each of the three options are estimated to be 2044-2048 for Alignment B, 2043-2047 for Alignment B1, and 2045-2049 for Alignment D.

8.1.59 TfN have advised that their anticipated NPR delivery date is nominally in 2040, but this has not been subject to detailed planning.

8.2 Explanation of why the 1,2,3 relative rankings were provided

8.2.0 The ranking system (shown in the table section 11 figure 37) was produced to help illustrate a relative level of hierarchy of sift elements that would otherwise score the same under the route development procedure. The was presented to the stakeholders on the 22 April 2021 to assist them to reach a choice on their preferred option.

9 Comparison of options to the baseline

Route Sections Summaries

	Hybrid Bill/NPR Remit 6	Alignment B	Alignment D
Alignment length (approx..)	28km	28km	25km
N/S split (approx..)	15km/13km	16km/12km	14km/12km
Above vs below ground	underground between Node MA and the Ardwick area before coming above ground for station, route then enters another tunnel near Ardwick after reversing to continue underground to Node 3.	Wholly underground	
Station approaches	All station approaches (from London and Leeds) converge via a single throat to a terminating station	"Through " station comprising symmetrical approach throat layouts at each end, with approaches from London (south) and Leeds (north) from opposing ends.	

Railway Systems

9.1.0 When compared to the baseline option, there are a number of differences in the underground alternative to note as set out below.

9.1.1 The railway operations of the underground stations were designed to work in a similar manner to the baseline surface station where the aim was to achieve a neutral outcome in the alternative designs in order to maintain the ambition of a like for like sift comparison.

9.1.2 One exception to this is with the station approach. In the baseline it is open to atmosphere which lends itself to some operational advantages. The nature of the underground approach is governed by only allowing one train per vent section at any one time. This is comparable along the line of route but when the tunnel is extended to the station throat this means that the transit time of the final ventilation section becomes limiting as trains decelerate towards the station throat which becomes the binding constraint on technical headway. This is a restriction on the throughput of the station throat. In the surface station baseline, the trains exit the portal approximately 2km away from the station into open atmosphere meaning that there is greater flexibility in the number of trains at the throat at one time.

9.1.3 Journey times for the NPR services are shown to be improved in the underground alternatives when compared to the baseline. The key feature that enables this is attributed to the assumed dwell time of a train that is proceeding through the station of 3 minutes whereas a train that is moving in turnback is assumed to be 5 minutes thereby

saving 2 minutes for the NPR services. This is enhanced a further minute for option D due to the shorter route length.

9.1.4 Journey times for the HS2 services are less affected because they terminate at Manchester Piccadilly and so the dwell time is the same as the baseline surface station. Options B and B1 are ¼ minute slower due to a slight increase in the route length whereas option D is ½ minute quicker due to a decrease route length.

	Airport <> Piccadilly	Assumed Piccadilly Dwell Time	Piccadilly <> Leeds	Airport <> Leeds
CP3 Baseline	+/0 minutes	5 minutes	+/0 minutes	+/0 minutes
Option B	+¼ minute	3* minutes	- ¼ minute	-2 minutes
Option B1				
Option D	-½ minute		-½ minute	-3 minutes

Figure 31 – Journey time assessment

9.1.5 A query was raised by the stakeholders to assess the potential capacity of the NPR leg of the alternative underground designs to determine if there were any improvements resulting from the alternatives compared to the baseline.

9.1.6 The team explored a scenario where 2tph or 4tph NPR leg shuttle services terminating at Manchester Piccadilly Station were overlaid onto the iTSS on top of the 6tph NPR through services. The indicative findings were that this would be worse than the baseline option for two reasons;

- The surface station is advantageous for this because it is a turn back layout. This means that “top train working” can be employed for terminating shuttle services; one can arrive at the buffer stop end of the platform, and then through NPR services can arrive and depart at the “country” end. After this the shuttle departs after its turnaround time. This is clearly not possible on a through station as the trains would block each other.
- The baseline surface station option adopted the two-track “chords” to aid the turnback operation so that departures/arrivals on the same side of the station to/from NPR could operate in parallel with NPR through services.

9.1.7 The tunnel ventilation design of the alternative underground options is considered to be more difficult compared to the baseline surface station. In the baseline, the tunnel sections are distinctly separated from the station because the throat is open to atmosphere which results in a more straight forward solution. In the alternative underground options, this delineation does not exist and therefore the tunnel ventilation system and the station ventilation system need to integrate which requires a more technically complex solution.

9.1.8 The crossover section in the baseline was open to atmosphere in the Ardwick area. However, due to the reorientation of the approach coming from the west, this crossover is situated in the historic city centre underground. This required a dedicated crossover box ventilation system including intervention core that could not be open to atmosphere. A mechanically ventilated cavern solution introduces further complexity when compared to the baseline.

9.1.9 A further complication for the alternative options may exist where a mandatory requirement of the NTSN/TSI to provide a firefighting point in tunnels longer than 20km could add further complexity. In the alternative underground options, Manchester Airport portal to Node 3 is considered as a continuous tunnel and is greater than 20km which means an underground rescue facility option may need to be developed where Manchester Piccadilly station acts as the firefighting point to comply with this requirement. Similar facilities have been incorporated for HS2 and also in certain long rail tunnels in Europe but with different site-specific risks and constraints to those that apply to HS2.

9.1.10 Maintenance activities of the alternative underground station options are considered to be marginally worse than the baseline because there is an increase in the restricted space along the route for maintenance activities, most notably where the station approach in the baseline is above ground, it is either in caverns or open box in the alternatives. This presents added complexity in the renewal of switches and crossings and associated infrastructure. Generally, along the route the activities are considered to be comparable.

9.1.11 The final point to highlight is the location of a neutral handover section. Due to the rising topography from Manchester Piccadilly towards the Pennines, the track alignment could not achieve the requirements of a 2km surface section before Node 3 and so, a neutral handover location was not identified.

9.1.12 Notwithstanding, the exercise did identify that a likely location will be at a point where the capacity of the traction power of the current infrastructure will be exceeded because the capacity in the baseline is nearing the limits and the need to introduce an autotransformer feeder station (ATFS) is likely to be required to boost this capacity.

9.1.13 The eventual siting of this neutral handover section is expected to be somewhere around Node 3 or beyond. This means that HS2 will need to own and operate a greater length of the route when compared to the baseline. It is assumed that this will require a reallocation of DfT funding between NPR and HS2 where the funding previously allocated to NPR for this section will be transferred to HS2 and therefore the only additional expenditure will be in the additional traction power ATFS required to strengthen the HS2 traction power system for this additional length of route .

Station

9.1.14 The baseline site is located to north of the existing NR station and aligned parallel in an east-west alignment. Option B is in a similar east-west alignment. With city end parallel to existing. Option B1 is similar in alignment, however the station box is relocated further east. Option D is rotated in a southwest-northeast alignment and with city end near with the existing station.

9.1.15 The baseline location is mostly light industrial with less impact noting there are less sensitive environmental, or heritage receptors compared to D which required demolition of some listed assets and is constrained by numerous sensitive receptors including listed building and the Ashton Canal. Option B & B1 alignments are similar in bearing to the Baseline however, the mined deep box and shallow box construction of B & B1 respectively have a larger environmental impact compared to the Baseline. Noting that B1 has less impact that B of the underground options.

9.1.16 Baseline design incorporates elevated rail lines arriving via viaduct to the east terminating as three elevated platforms serving six terminating lines parallel to the existing NR station with integrated concourse configuration connecting to the NR concourse at grade on western city end and to ground level below platform level via lower concourse which also serves Metrolink. Station proposal is for above ground construction of viaduct -station including single span vaulted spanning across three island platforms serving six terminating rail lines.

9.1.17 Options B, B1 & D incorporate underground rail lines serving 6 platforms in a through station configuration. Option B & D employ deep box mined cavern construction methodologies while B1 employs a shallow box cut and cover methodology for the station box and throat. All underground options include inner crossover in the station throat and outer crossover proposed as underground mined cavern construction. As a below ground proposal the station includes commercial oversite development.

9.1.18 Baseline proposal incorporates two concourses. The HS2/NPR station has a western concourse at same level as existing NR concourse. The west concourse connects legibly to the NR concourse with spaces and onward travel connections visible in intuitive manner. The lower concourse sits below the elevated platforms and connects to boulevard at grade.

9.1.19 Baseline Interchange between the NR and HS2 concourse is predominantly horizontal from platform to concourse providing a cohesive single station experience. Interchange between the NR and HS2 underground proposals requires vertical changes in level from platform to concourse and Hs2concourse to NR concourse. The interchange is a sequence of vertical changes and horizontal journeys including below ground and external. Alignment B is parallel with the existing station with western ticket hall at grade requiring vertical interchange with NR concourse. It is augmented by a direct tunnelled

and vertical interchange with platforms 1&2 of the existing station. Option B1 is located further east requiring longer horizontal journey externally. Option D with rotated alignment addresses the existing station from across an arrival plaza the below ground concourse of D connects to the NR Concourse via tunnel link like that described with option B. Further development of vertical circulation location will improve horizontal journeys.

9.1.20 Experience of the baseline as a single station experience is complimented by the large span roof volumes with uninterrupted line of site which benefit from the horizontal arrangement of the elevated HS2 platforms located in parallel arrangement alongside NR platforms. The roof spans and design provide daylight with elevations allowing visibility of the City providing sense of arrival and contributes to wayfinding of onward journey through multiple access points on the station elevation.

9.1.21 The underground options requiring combination of vertical and horizontal journeys is less intuitive and will require wayfinding to assist flow of passengers to desired ticket hall and hence to onward journeys. Whilst the underground station itself is coherent and legible as a volume it is disconnected physically and visually from the NR station and onward journeys. The rooflights above the vertical interchange from platform to underground concourse provides a moment of daylight with a glimpse of the outside and assist wayfinding. The OSD has not been the primary focus of the study, further OSD design coordination with rooflights would include development of scale of OSD and rooflight.

9.1.22 The baseline above ground proposal includes single span vaulted roof volume over the three island platforms. The underground options B, B1&D include below ground platforms connected to ticket halls at each end of the station box by below ground concourse. Being below ground the proposal provides over site development (OSD) above the station box. The OSD provides commercial and retail activation of the surrounding area.

9.1.23 The baseline proposal relocates Metrolink to and underground proposal below the HS2 platforms. This releases space to allow growth of the retail experience of the station. The retail serves mainly rail passengers rather than being a retail destination of the city. The underground proposals which include OSD above the station box provides commercial growth and potential for retail activation at ground level addressing the city at street level enhancing urban experience.

9.1.24 The baseline relocates the Metrolink from below the NR station where it is constrained and locates it Below ground and below the HS2 Eastern concourse providing clear connection to 4 platforms. The location of option B constrains capacity to integrate Metrolink as an above ground option providing 4 platforms (above ground options were examined including elevated on NR ramp, in between HS2 and existing station and towards east of HS2 western ticket hall). Option B maintains the existing Metrolink

provision below the NR station which includes 2 platforms. (Note also TfGM preferred option which is an underground Metrolink station below HS2 ticket hall which was not incorporated due to time constraint refer also 3.4.2) The interchange from HS2 underground platform to Metrolink requires numerous vertical interchanges both up and down combined with horizontal journey through NR concourse affecting NR capacity. Wayfinding and passenger experience in this arrangement is a worsening compared to the Baseline. The Metrolink in option B1 is located within a gateway plaza that addresses (faces) both the western HS2 ticket hall and the northern elevation of NR station which can be activated with retail experience located facing the plaza. Option B1 provides 4 platforms in an above ground arrangement within a shared plaza. Option D provides 4 Metrolink platforms in a similar external shared plaza configuration as B1. Note the option D plaza is smaller with the Metrolink further east compared to B1.

9.1.25 The baseline proposal maintains Gateway House which is a visual and physical barrier that separates the existing NR and Baseline HS2 Proposal from the City. In comparison all the underground options remove Gateway house providing better urban connectivity with the City, in-particular B1, which provides a gateway plaza with the City addressing it on two sides and The NR and HS2 stations addressing the plaza from the other two sides with Metrolink further activating the space. The plaza of B1 Can be a destination in-itself activated by retail and commercial development surrounding the perimeter and within the plaza.

Urban Integration

9.1.26 Manchester Piccadilly Station and its surrounding area are characterised by predominate light industrial uses, with surface / multi-storey car parks. Limited residential development can be found near Ashton and Rochdale Canal with two office building scattered within the area. It is anticipated by Manchester City Council that the surrounding area limited within the Ring Road will be regenerated through the arrival of HS2 and NPR. Acting as a catalyst for a ‘ one-in-a-century ’ opportunity to transform the east side of the city centre. This is envisioned within the published MCC Manchester Piccadilly SRF (2018). The study assesses how well the underground station will integrate within a regenerated urban context with Manchester Piccadilly SRF as the base.

9.1.27 The baseline option HS2 station arrives elevated and parallel to the existing NR station, offering a viaduct station with permeability on the ground floor. The station ticket hall, concourse and back of house occupies the whole length of The Boulevard at ground floor level fronting, animating and activating the key public realm. The Boulevard acts as an armature for development, establishing a new commercial address for Manchester city centre. Alignment option B and B1 offers similar orientation of station alignment parallel to the NR station. With the station box being placed below ground, it offers ground floor commercial / retail uses and activating the surrounding area. Improving ground floor dynamics whilst maintaining its permeability. Ticket hall for alignment option B and B1 are housed in separated buildings, eastern and western ticket hall with over site

developments (OSD) placed above the station box between the two ticket halls. This configuration expands the Piccadilly SRF development to the south and engulfing the proposed station box for alignment option B and B1. As the result Alignment option B and B1 improves upon the baseline option in regard to station integration within the urban context as set out by MCC Piccadilly SRF.

9.1.28 In alignment option B1, the Boulevard has been relocated to the south of HS2 Station between the NR Station with a more vehicularly orientated east-west connection along the north side of HS2 station. This option provides a more immersive integration of Piccadilly SRF with HS2 and NR station in comparison to baseline and alignment option B. This option creates a Boulevard that is fronted by proposed OSD and the adaptive reuse of listed NR viaduct structure that houses commercial/retail uses.

9.1.29 Alignment option D orientate the station in a north-east to south-west orientation, departing dramatically from baseline option east-west orientation. Therefore, it has minimal interaction with the proposed Boulevard. It should be noted, the departure from the baseline and Piccadilly SRF does not necessarily mean the station will not integrate with the surrounding city context, rather it implies that a different city regeneration strategy and urban grain structure may be formed as a result of the new orientation. The overall Piccadilly SRF regeneration area will be similar to baseline option, although the eastern side of Piccadilly SRF will be regenerated through the arrival of Metrolink Tram-Train service. Alignment option D lend itself to regenerate and activate the historic Rochdale and Ashton Canal due to its proximity but also station location. This allows the OSD to resolve the level difference between surrounding context and the historic canals. Main pedestrian connection still offers a similar east-west connection to Piccadilly SRF Boulevard and in Baseline Option. In Alignment option D, no HS2 station will be positioned parallel to the NR Station, freeing up additional land for redevelopment.

9.1.30 Although Alignment option D will provide ground floor activation with OSD above the below ground station box. The area is constraint with the historic canal and listed buildings to the west and limited flexibility to the east with Store Street and its listed aqueduct structure. Much of the eastern side is well established residential area with Oxygen Store Street development nearing completion, limiting strategic options to integrate the station into the Piccadilly SRF area without major social disruption. With the Baseline option HS2 Station offering good ground floor activation that front onto The Boulevard. In general Alignment option D offer minor urban integration improvements in comparison to baseline option.

9.1.31 In terms of civic benefits, the baseline option offers a HS2 Station that resemble the heroic arched station structure that pays homage to the listed Victorian NR station. The baseline HS2 station is hidden behind the Gateway House with its ramp structure, providing limited presence in the city centre. The location of baseline station struggles to form a gateway experience into Manchester, with its presence limited to The Boulevard

only. Wayfinding into Manchester city centre has limited legibility if HS2 passenger exiting onto the Boulevard.

9.1.32 All underground options, including alignment option B, B1 and D offers civic benefit improvements for the city centre with much improved wayfinding into Manchester city centre in comparison to baseline option. Alignment option B1 offer major improvements with civic plaza fronted by HS2, NR proposed northern entrance with Metrolink animating the square in the middle. Forming a 'Gateway' experience for HS2 arrival into Manchester city centre.

9.1.33 In addition to placemaking qualities, alignment option B1 provides a major improvement in comparison to Baseline option. Alignment option B1 creates an eastern Ticket hall that is further to the east in comparison to other options, bringing the building in close proximity to River Medlock. This creates a strong riverfront public realm for the Ticket hall, leading users into proposed Medlock Park and across the Ring Road. This provides wider connectivity into communities to the east of Ring Road. Likewise, Alignment Option D offers a ticket hall fronting onto Great Ancoats street, providing greater presence in the city in comparison to Baseline Option. Alignment Option D have the potential to act as a catalyst for the regeneration to the north of Great Ancoats Street. However, it should be noted that Alignment Option D north-west Ticket hall has limited public realm and plaza, furthermore MCC have already started the process of regeneration to the north of Great Ancoats Street with Baseline option. Therefore, it would be difficult to score Alignment option D as an improvement in comparison to Baseline option.

9.1.34 Below are general urban integration observations where it has been difficult to determine whether underground alignments offer improvement in comparison to baseline options.

9.1.35 It should be noted that baseline option provides adjacent site development (ASD) which are clean plot developments, providing greater flexibility to adapt to changing city dynamics. The baseline option does not include OSD above the station box. The below ground options include ASD and OSD, with OSD being built over the underground station box in alignment option B, B1 and D. The OSD is less flexible in comparison to ASD, it is limited in flexibly that must be built into the original design of the station box structure. For example, demolishing an OSD and re-building above the station box in area designated to support the OSD structure.

9.1.36 The presence of viaduct and embankment along the approach of Baseline option HS2 track alignment hinders pedestrian permeability and future flexibility to the surrounding development, particularly in development area to the east of ring road within the CCB. As noted in Section 4.1, development opportunity to the east of ring road has been tested for hybrid bill design (i.e. baseline option) and it is possible but with challenge. All underground options will have a smaller permanent at-grade footprint in comparison to Baseline option. With less above ground HS2 permanent infrastructure to the east of Ring

Road in all underground options in comparison to Baseline option, it will be possible to redevelop the industrial/railway hinterland to the east of Ring Road as the market demands. Some of the industrial/railway hinterland to the east of Ring Road is not required for the construction of HS2 and therefore falls outside the CCB for Alignment Option B and D. The industrial / railway hinterland to the east of Ring Road will be affected on a temporary basis in Alignment B1, displacing the industrial uses similar to Baseline option with permanent at-grade structures. Therefore, Alignment option B1 and Baseline option offers opportunity to regenerate the area as the HS2 arrives, brought on by the side effect of displacing existing industrial uses during construction period. The arrival of HS2 in Alignment option B1 and Baseline option will by default consolidate land ownership that will support a coherent regeneration process, potentially accelerating the regeneration process. It should be noted that only Alignment option B1 support unhindered redevelopment of the industrial hinterland to the east of Ring Road and Baseline option will introduce HS2 embankment limiting north south connectivity, introducing challenges to regenerate the area.

9.1.37 Nonetheless, it can also be interpreted that HS2 arrival may hinder the pace of regeneration if the market demand redevelopment before the arrival of HS2. It would be difficult to assess whether HS2 will hinder or accelerate regeneration to the east of Ring Road as this will depend on future market demand and this can only be done purely on speculative forecasting.

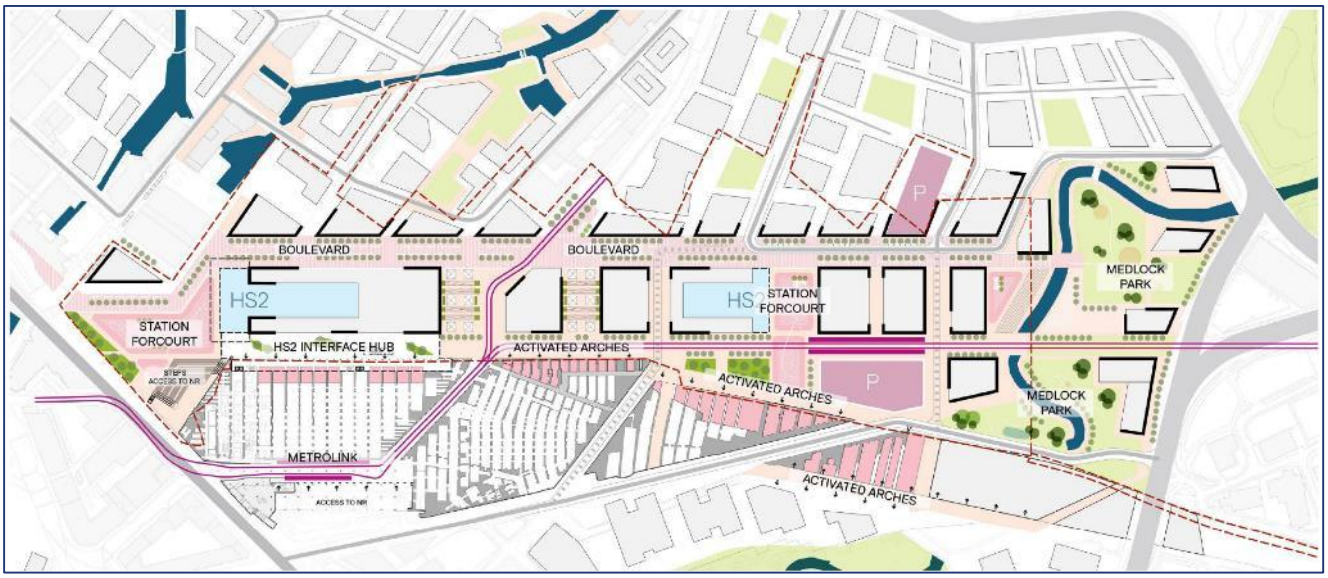

Figure 32 – Alignment B Illustrative Urban Framework

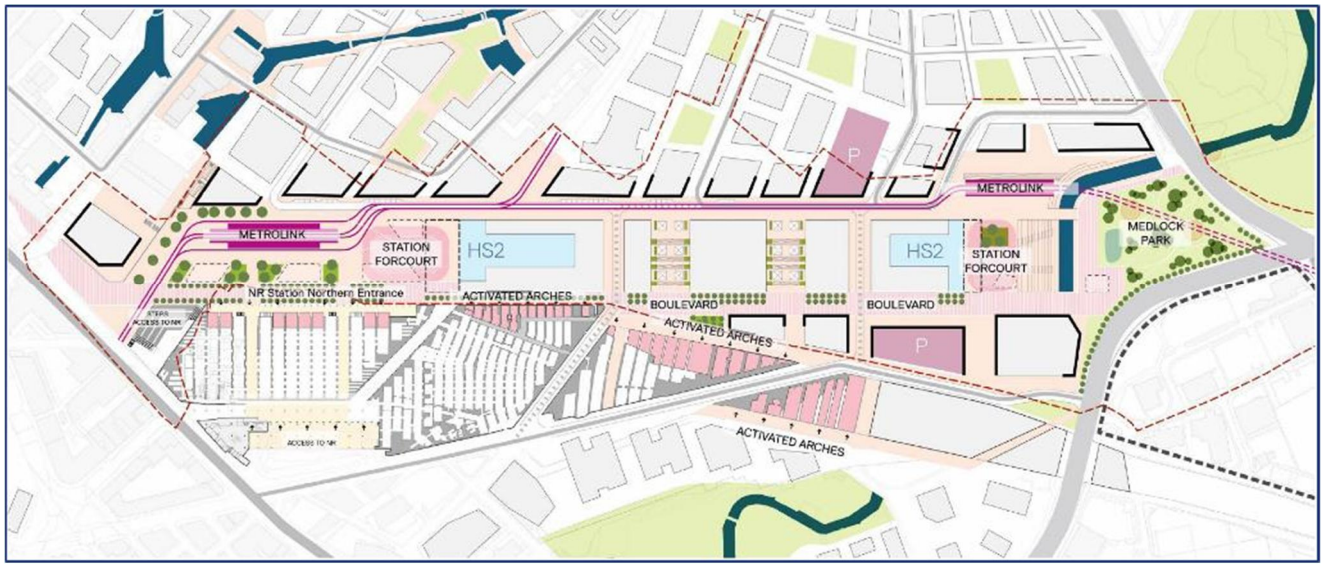

Figure 33 – Alignment B1 Illustrative Urban Framework

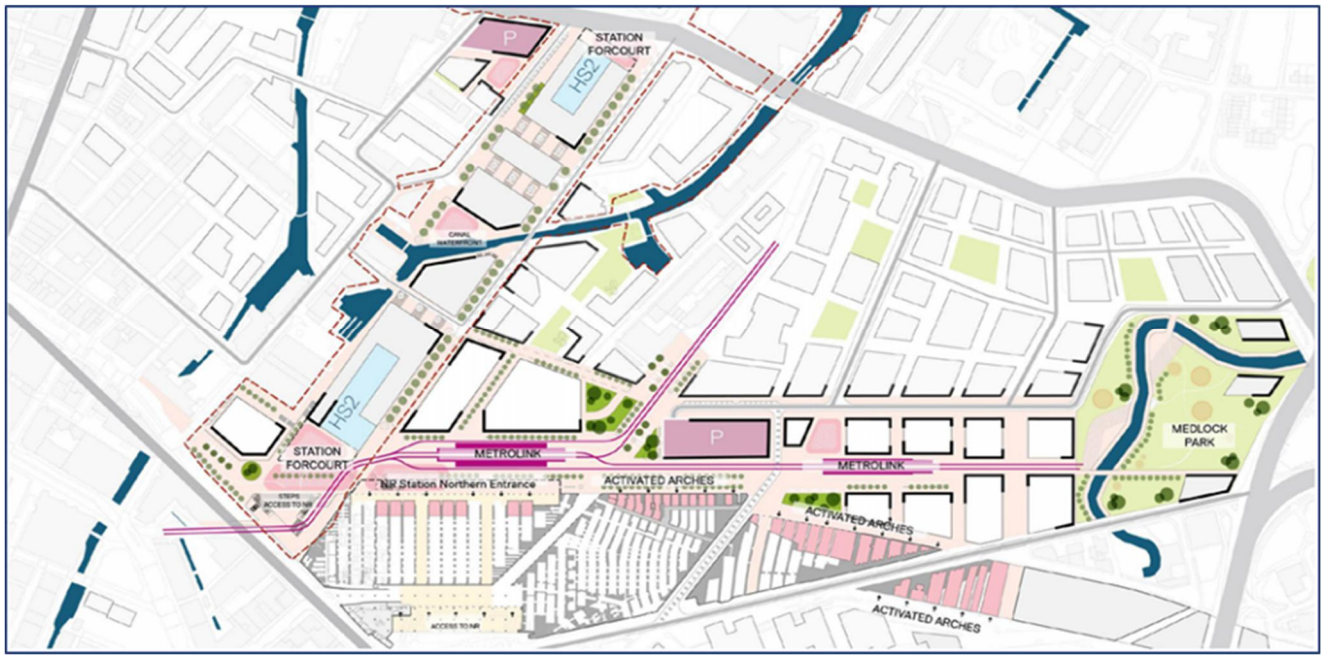

Figure 34 – Alignment D Illustrative Urban Framework

Environmental Impacts

9.1.38 Option B is considered a minor worsening compared to the baseline. Potential major worsening has been identified for Community and Human Health, Minor worsening have been identified for ecology, historic environment, landscape and Visual, socio-economic during construction. Between the three options, Alignment B represents the best choice

as it would result in less worsening of impacts in comparison to the others, and in the instance that alignment B be taken forward, a detailed review of the current indicative vent shaft location for Barlow Tip is recommended to try and remove or reduce the environmental impacts identified in this sift.

9.1.39 Overall Alignment B1 is considered a minor worsening compared to the Baseline. However, it is worse performing than Option B as it generates worse impacts in terms of Traffic & Transport, and Water Environment during construction of the station elements. As with Alignment B, there are negative impacts with regard land quality and waste/minerals along the route due to the Barlow Tip vent shaft. In the instance that either alignment B or B1 be taken forward, a detailed review of the current indicative vent shaft location is recommended to try and remove or reduce the environmental impacts identified in this sift.

9.1.40 Not only does Alignment D represent a worsening in comparison to the baseline, the impacts are the most worsening across the three alternatives due to the potential of the carbon impacts. D has considerable detrimental effects on the historic environment and surrounding businesses of the proposed station due to the required demolitions, and the negative impact on community and health impacts, particularly with regard to Laurus Ryecroft High School. In the instance that Alignment D is taken forward, a detailed review of the current indicative vent shaft location is recommended to try and remove or reduce the environmental impacts identified in this sift.

Construction and Logistics

9.1.41 Major programme assumptions were listed in Section 3.4.

9.1.42 The overall construction programme durations from Royal Assent to Handover to Client are shown in *table 5*.

Hybrid Bill Design	10.5 years
Option B	14.5 years
Option B1	15.5 years
Option D	15.5 years

Table 5 – Overall programme durations from Royal Assent to Handover

9.1.43 Table 5 shows that changing to an underground station will add 4-5 years to the construction programme.

9.1.44 After ‘Handover to Client’ there will be a period of ‘Trial Operations’ by the Client, currently estimated to be 1 year, before ‘Delivery into Service’. This applies to all options and the baseline.

9.1.45 All underground options are currently concept design only. To develop an underground station scheme to hybrid Bill design level of detail will take 2-3 years followed by updated Parliamentary Plans and Environmental Assessment. This will be a 3-4 year period before hybrid Bill deposit. For the hBD, hybrid Bill deposit is expected to be in late 2021. Therefore, selection of an underground option will add a minimum of 3-4 years to the front end of the programme.

9.1.46 Therefore, as shown in the indicative programme in Appendix F, the underground station options will delay 'Delivery into Service' of the Western Leg of Phase 2b by 8-12 years for Alignment B, 7-11 years for Alignment B1, and 9-13 years for Alignment D.

9.1.47 The hybrid Bill design has the Manchester South tunnels as the critical path to opening of the Phase 2b Western Leg. The underground options all have the Manchester Piccadilly High Speed station as the critical path, even though the Manchester tunnels have a longer duration than in the hBD. This is because the underground stations take much longer to build than the surface station in the hBD.

Construction feasibility – route

9.1.48 'Route' here means the bored tunnels and shafts outside the portal shafts. The portal shafts, outer scissors crossover caverns, connecting tunnels, approaches and station are 'station'.

9.1.49 The tunnel boring machine (TBM) strategy for the hBD involves driving two TBMs from Manchester Airport Portal and two TBMs from Ardwick, extracting them from Palatine Road shaft. The TBM strategy for the underground options is to drive two TBMs from Manchester Airport portal all the way to Manchester Piccadilly. This is because the HS2 end of the underground stations does not have a suitable drive site for launching and driving TBMs to the south.

9.1.50 The longer drive length for the underground options is not critical to the programme and gives time for the station boxes to be ready for reception of the TBMs. However, the increased drive length does increase the risk of major mechanical failure of the TBMs. In addition, excavated material can only be removed from Manchester Airport portal by road, increasing the environmental impact. In the hBD, excavated material from the Manchester North tunnels can be taken away by rail from Ardwick.

9.1.51 The alignments of the underground options, particularly options B and B1, pass under more of Manchester city centre, increasing risk of settlement damage to buildings, including many listed buildings and conservation areas.

Construction feasibility – station

9.1.52 'Station' here means the portal shafts, outer scissors crossover caverns, connecting tunnels, approaches and station box. For options B and D, the approach track junctions

are in mined caverns, whereas for B1 these are in a cut and cover box. For the baseline, the approach includes a cut and cover portal and ramp, embankments and viaducts into an elevated station.

9.1.53 For the underground options, geotechnical risk is high because we do not have much information about the ground and the construction methods are very sensitive to changes in ground conditions. For the baseline, geotechnical risk is relatively low as there is just the Metrolink box below ground in a relatively shallow cut and cover box.

9.1.54 The mined approaches and outer scissors crossover caverns have no precedent for such large caverns in close proximity to each other in these ground conditions. Their feasibility will depend on detailed site investigation, design analyses and possibly full-scale trials demonstrating the rock has sufficient strength and that groundwater ingress can be controlled by grouting or other measures. It is likely that extensive ground treatment and partial dewatering will be required. Ground between adjacent caverns may need to be replaced by reinforced concrete pillars.

9.1.55 The mined approaches and outer scissors crossover caverns have a major risk of causing settlement damage to overlying buildings and utilities. This includes large areas of the historic city centre and includes many listed buildings, as well as other assets such as the Guardian Underground Telephone Exchange, canals, sewers and culverted rivers.

9.1.56 The scale of construction of the underground options is much larger than the baseline, in terms of volume of excavation, consumption of materials and construction duration. The volume of excavated materials is shown in *figure 35*. For comparison, excavation volumes at London Euston are estimated to be 672,000m^3.

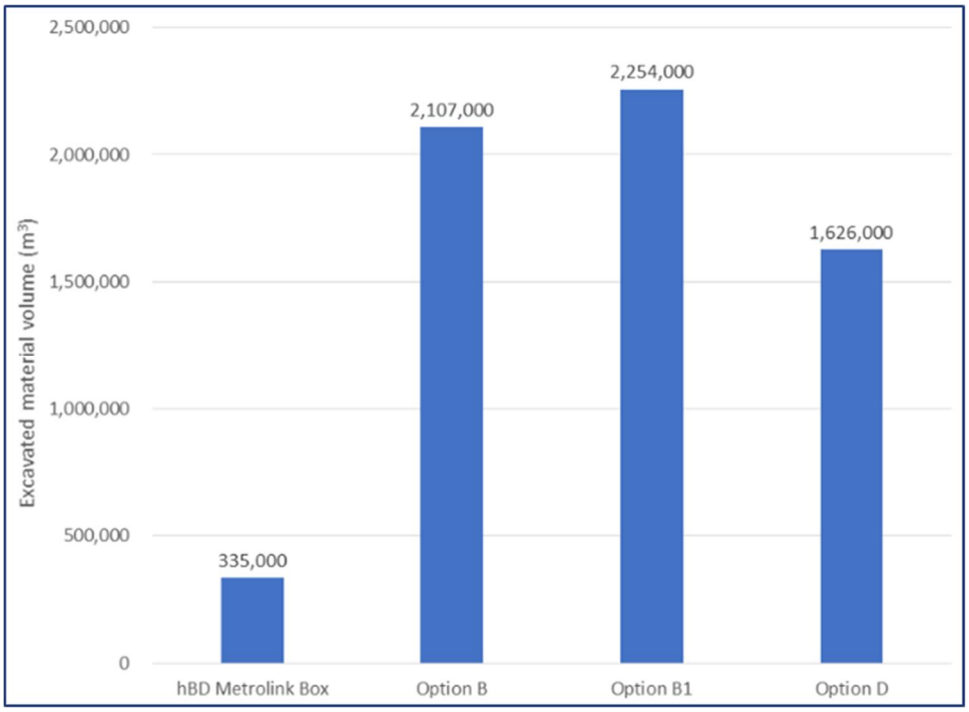

Figure 35 – Volume of excavated material comparison.

9.1.57 Options B and B1 require closure of the Metrolink Ashton line for approximately 7 years or 9 years, respectively. Option D only requires closure for short periods to allow relocation of the tram stop to a new location. The hybrid Bill Design requires 8 months of single line running and 23 months of full closure.

9.1.58 Where the underground station options have similar impacts on the city compared to the baseline, such as highways, utilities and Network Rail, the underground options are often scored worse in the sift matrix because of the longer duration of impacts.

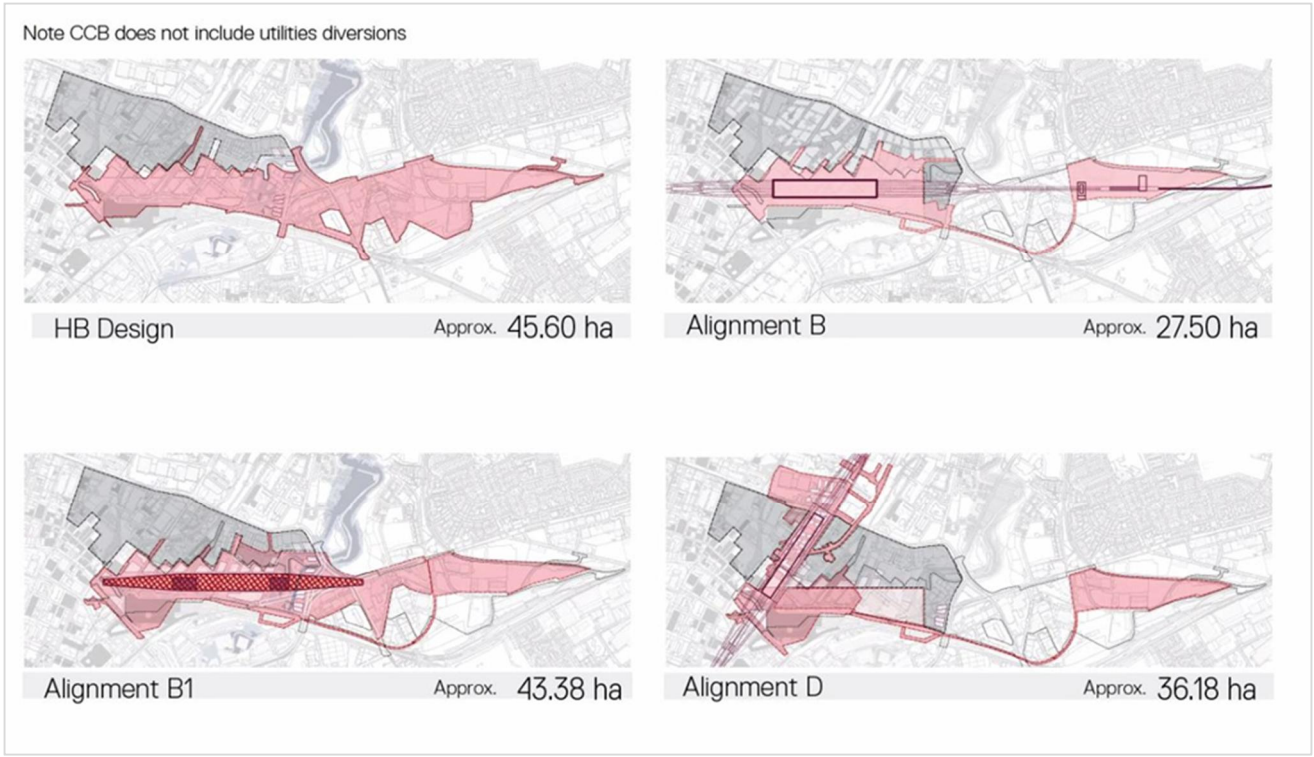

Figure 36 – Comparison of indicative CCB area

Health and Safety

9.1.59 Construction, operation and maintenance underground are always inherently more risky than a surface option and require measures to mitigate risks to acceptable levels. To compare the underground options against each other the focus becomes that of the construction method. Option D requires more construction by mining and would be regarded as riskier than the other options from the perspective of health and safety to those carrying out the construction.

Commercial Development

9.1.60 HS2 has provided high-level estimates for residual land values. These were derived from standard property industry software development appraisals of land that would be permanently acquired by the Secretary of State for Transport and anticipated to not be required for future operational railway purposes.

[redacted]

[redacted]

9.1.63 Further information supporting this assessment can be found in Appendix H

Benefits analysis

9.1.64 Taking journey time outputs and indicative construction boundaries provided by HS2's consultants, the Department for Transport (DfT) together with Transport for the North (TfN) worked to provide an indication of the productivity and journey time benefits and the jobs impacts that the underground stations could have.

9.1.65 Further information on the methodology and outputs of that work is provided in Appendix I.

OOM costs -HS2

9.1.66 The total cost for each of the underground options is as follows;

- Option B = £12.3Billion
- Option B1 = £11.4Billion
- Option D = £12.1Billion

9.1.67 These compare to a cost for the baseline comparator of £7Billion.

9.1.68 For further details, including supporting assumptions and caveats, please refer to Appendix G

Indicative Programme to Delivery-into-Service

9.1.69 The Delivery-into-Service date ranges for each of the three options are estimated to be 2044-2048 for Alignment B, 2043-2047 for Alignment B1, and 2045-2049 for Alignment D. This compares to a 2036 Delivery-into-Service for the hybrid Bill scheme.

9.1.70 As outlined in 8.1.59, TfN have advised that their anticipated NPR delivery date is nominally in 2040, but this has not been subject to detailed planning.

9.1.71 Further information on the programme, and supporting assumptions, are provided in Appendix F.

Passenger Experience

9.1.72 Interchange times from the HS2/NPR platforms to Metrolink, station forecourt, and car parks all increase for the underground station options in comparison with the surface station. This can be seen in the sift matrix in Appendix C under "Operational Feasibility - Station for passenger and place' and is reproduced in the table below.

(units = minutes)	Surface Station		Option B		Option B1		Option D	
From HS2/NPR Platform	From Mid Platform	From End Platform	From Mid Platform	From End Platform	From Mid Platform	From End Platform	From Mid Platform	From End Platform
To NR Concourse	3	5	6	9	9	11	6	9
To Metrolink	4	6	7	10	7	10	6	9
To Forecourt	4	6	5	8	6	9	5	8
To Car Parks	5	7	6	9	6	9	5	8

10 Stakeholder comment and further work

10.1.0 MCC, TfGM, and TfN provided comments on a draft version of this report prior to its finalisation. Written responses to each of those comments are provided within Appendix E with the final version of this report having been revised accordingly, where possible, to address these comments.

10.1.1 Throughout the comments, a number of areas for further work or development have been suggested by stakeholders, particularly around optimisation of the station design itself and the assessment of wider economic benefits and commercial development opportunities outside of the proposed construction boundary.

10.1.2 One of the key themes of the feedback is a desire to reduce the size of the underground station as far as possible, potentially by reducing the number of platforms from six to four, and shortening the station approaches by reducing the number of switches and crossings. As outlined in Appendix E in response to a previous query, six platforms are required to operate the iTSS. However, HS2 Ltd does not dispute that further optimisation of the station designs is possible but this may deviate from producing a like-for-like comparison with the surface station, unless the surface station itself was also optimised in a similar way. This level of further optimisation would typically be carried out following Royal Assent when the detailed design of the station is carried out. HS2 Ltd maintains that a like-for-like comparison, commensurate with the level of design for Sift Level 2, as per the HS2 Route Development Procedure has been carried out and described in this report.

10.1.3 Should further optimisation of an option (or options) be desired, a revised Train Service Specification and a clear set of operational assumptions (e.g. use of platforms (NPR or HS2), timetable intervals, stabling, etc.) would need to be agreed between all parties (including DfT) prior to any development. If an optimised underground station was progressed and this led to a functionally different station arrangement, an alternative assessment approach to the HS2 Route Development Procedure may also need to be agreed. The procedure is intended for comparing like-for- like options and may not accurately capture differences between further refined options.

10.1.4 Another key theme has been about the level of benefits analysis and commercial development opportunities, particularly wider opportunities away from the station itself. As per the agreed scope, benefits analysis is outside the remit of HS2 Ltd and its consultants, although noting that inputs provided, such as journey time savings, have been used by others.

10.1.5 Analysis of commercial development opportunities (see Appendix H) has been limited to being within the proposed construction boundary. Stakeholder comments have suggested that this analysis should be extended to consider a much wider area. HS2 Ltd cannot provide a robust view on development opportunities outside the proposed construction boundary. Land within the construction boundary and not subsequently required for the operational railway, would be subject to acquisition by the Secretary of State and would potentially be available to be returned to its original owner for development after construction assuming the land has not materially changed. This has been quantified as part of the study. However, no view can be provided on development opportunities beyond the construction boundary, as these would be subject to wider market forces. If further work on wider benefits and commercial development opportunities is to be carried out, this should be done by an organisation other than HS2 Ltd.

11 Conclusions and recommendations

11.1.0 A comparative assessment (sift) compared underground options against the surface station included in the hybrid Bill. Additional assessments and analysis, over and above what HS2 would normally consider at a similar stage of development, were included in line with stakeholder wishes during the scope development.

11.1.1 Options B, B1 and D were assessed in a like-for-like comparison with the hybrid Bill design comparator scheme between the HS2 node at Manchester Airport tunnel portal and Node 3, south of Oldham for the NPR route to Leeds.

11.1.2 HS2 and its consultants (MWJV and WSP) held a series of workshops with stakeholders on 15 and 16 April 2021, to present the outcomes of the technical analysis, followed by a summary of the sift exercise and scoring on 22nd April 2021.

Sift Appraisal - Summary of node to node ratings

Location	Manchester Piccadilly Station for HS2 and NPR
Purpose of Sift	to assess alternative Underground options for integrating HS2 and NPR at Manchester Piccadilly
Sift Level	2

Options Considered	**BASELINE** hBD Surface Station for Phase 2b + NPR route to Node 3	**Option B** Combined Underground - deep box station		**Option B1** Combined Underground - 'shallow' box station		**Option D** Combined Underground - hybrid box/mined station	
Description	*A terminus station with on viaduct at surface level. Approach to the station is on viaduct and includes for grade seperated junction for route to Manchester Airport High Speed Station and route towards Leeds (Node 3) for NPR.*	*A through underground station, the main station box is constructed top down with diaphragm wall and the approaches are mined construction. The Metro station remains unaltered under the classic station, car parking numbers as per the Baseline.*		*A through underground station, the main station box and approaches are constructed top down with diaphragm walls . The Metro station has been relocated and enlarged, car parking numbers as per the Baseline.*		*A through underground station. The reduced station box is constructed top down with diaphragm walls . The approaches and additional outside platforms will be constructed using a mining technique. The Metro station has been relocated and enlarged, car parking numbers as per the Baseline.*	
Headings	**ROUTE DEVELOPMENT PROCEDURE RATING**	**ROUTE DEVELOPMENT PROCEDURE RATING**	**RELATIVE RANKING FOR COMPARISON OF UNDERGROUND OPTIONS**	**ROUTE DEVELOPMENT PROCEDURE RATING**	**RELATIVE RANKING FOR COMPARISON OF UNDERGROUND OPTIONS**	**ROUTE DEVELOPMENT PROCEDURE RATING**	**RELATIVE RANKING FOR COMPARISON OF UNDERGROUND OPTIONS**
Strategic Fit - HS2 Strategic Goals	0	0	3	0	1	0	3
Strategic Fit - Urban Design	0	+	2	+ + +	1	0	3
Construction Feasibility - route	0	- - -	3	- - -	3	- -	1
Construction Feasibility - station	0	- - -	2	- - -	1	- - -	3
Operation Feasibility - railway operations	0	+	0	+	0	+	0
Operation Feasibility - station design	0	0	0	0	0	0	0
Operational Feasibility - passenger & place	0	- - -	3	- -	2	- -	2
Maintenance	0	- -	0	- -	0	- -	0
Environment	0	- - -	1	- - -	3	- - -	2
Stakeholders	0	+	0	+	0	+	0
Commercial Development	0	- -	2	+	1	- -	3
Commitments	N/A	N/A	0	N/A	0	N/A	0
Health and/or Safety	0	- - -	2	- - -	1	- - -	3
Demand - Journey Times	0	0	2	0	2	+	1
Cost - station	0	- - -	2	- - -	1	- - -	2
Cost - route	0	- - -	3	- - -	2	- - -	1
Cost - total for node to node	0	- - -	2	- - -	1	- - -	3
Phasing Opportunities	0	0	0	0	0	0	0
Schedule and Delivery into Service	0	- - -	3	- - -	2	- - -	3
HS2 Ltd Preferred Option:	Preferred Option						
Reason:	All combined Underground options are compartively worse performing in the majority of categories - notably for construction feasibility, environment and health and safety.	Whilst alignments B, B1, and D all represent a worsening compared to the baseline option, on balance the Option B/B1 alignment is considered marginally better due to less community and health impacts, particularly on the Lumb Lane vent shaft site. However, Option B/B1 generates worse impacts on land quality and waste/minerals due to the Barlow Tip vent shaft so in the instance that either alignment be taken forward, a detailed review of the current indicative vent shaft location is recommended to try and remove or reduce the environmental impacts identified in this sift.					
Stakeholder Preferred Option:							
Reason:							

Figure 37 - Sift summary table

11.1.3 For information supporting the summary table above the reader is directed towards Appendix C for the full sift matrix and Manchester Piccadilly High Speed Combined Underground Station – Technical Note Document no: 2DE01-MWJ-EN-NOT-M003-000006

11.1.4 Within the context of the study, and to help stakeholders identify their preferred optimised alternative for an underground station, HS2 Ltd recommended alignment B1 as the better performing underground option. Alignments B and D present greater construction challenges, that would be unprecedented in scale and nature in the UK, posing significant risk to constructability, programme and cost.

11.1.5 All options would introduce significant construction complexity. However, for alignments B and D, the use of mined caverns of the proposed size, scale, and close spacing in a city centre introduces significant risk both in terms of safety and of damage to existing structures due to settlement risks. Alignment B1 ranks lowest on environmental impact but it ranks highest on strategic fit, urban design, construction, health and safety, commercial development and cost.

11.1.6 All of the underground options require significantly greater volumes of material to be imported and exported. This would require an increase in HGV journeys (two-way) in and out of Manchester city centre of between 13,500 HGV journeys (Option B1) and 43,500 HGV journeys (Option D) when compared to the surface station. The study uses an assumption that 90% of excavated material from the underground station sites (approximately 1.5-2.2million m^3) could be exported by rail. If this material instead needed to be removed by road it would generate 135,000 additional HGV journeys when compared to the surface station. The underground station options would also require significantly more material to be removed by road from the south portal of the Manchester Tunnel, which could lead to a doubling of HGVs movements in the area when compared to the baseline scheme.

11.1.7 The sift outcome showed that, when comparing underground station options against a surface station, the surface station would be the preferred option. The underground comparators all rated as 'moderate worsening' or 'major worsening' for the topics of construction feasibility, health and safety, cost, and schedule/delivery-into-service when compared to the baseline surface station scheme.

11.1.8 It is HS2 Ltd's view that further detailed development of the options, based on the agreed scope and requirements of this study, is unlikely to significantly change the overall assessment and comparative difference between a surface and an underground High Speed station at Manchester Piccadilly, particularly in respect to cost and programme.

11.1.9 It is therefore HS2 Ltd's recommendation that the proposed scheme for a surface station, to integrate HS2 and NPR at Manchester High Speed Station, is retained for the Phase 2b Western Leg hybrid Bill design, on grounds of cost, construction safety and programme implications to the delivery-into-service date of HS2 to Manchester.

12 Abbreviations

12.1.0 The abbreviations, descriptions and project terminology used within this document are listed below:

AOD – Above Ordnance Datum
BOH – Back of house
CCB - Consolidated Construction Boundary
CoCP - Code of Construction Practice
CP2 - Control Point 2 (Design Milestone for hybrid Bill work)
CP3 - Control Point 3 (Design Milestone for hybrid Bill work)
DfT - Department for Transport
DP1 – Decision Point 1
DP2 – Decision Point 2
GEA – Gross External Area
GMCA - Greater Manchester Combined Authority
GMSF - Greater Manchester Strategic Framework
hBD - hybrid Bill Design
HGV - Heavy Goods Vehicle
HLCA - Historic Landscape Character Assessment
HS2 - High Speed 2 Limited
LCA - Landscape Character Area
MAG - Manchester Airport Group
MCC - Manchester City Council
MWJV - Mott Macdonald WSP Joint Venture
NPR - Northern Powerhouse Rail
OSD – Over site development
RSADS – Rail Systems Application Design Services
SRF – Strategic Regeneration Framework
TBM – Tunnel Boring Machine
TfGM - Transport for Greater Manchester
TfN - Transport for the North

13 References

References to other documents not included in sift report:

1. Manchester City Council, Development of Piccadilly station, Technical report, 12 December 2019
2. Manchester Piccadilly High Speed Combined Underground Station – Technical Note Document no: 2DE01-MWJ-EN-NOT-M003-000006
3. Manchester Piccadilly high speed station an optimised alternative underground station stage 0: pre-sift Document no.: 2DE01-MWJ-EN-PRE-M003-000027
4. HS2 Route Development Procedure HS2-HS2-SA-PRO-000-000007 revision P08
5. Hybrid Bill Design Urban Integration Study (2DE01-MWJ-EN-REP-M005-000014 P02
6. Stage 3 Formal Environmental Statement and NPR Remit 6 Option 0 - reference: P2B-HS2-PM-NOT-600-000)
7. HS2 standard for Station sizing HS2-HS2-AR-STD-000-000001
8. Geotechnical Desk Study for the Piccadilly Station Undergrounding 2PT24-MWJ-GT-REP-M005-000001

14 Appendix A – Scope document

HS2

HS2 – Manchester Piccadilly High Speed Combined Underground Station - Sift Level 2 Criteria Note

Document no: P2B-HS2-EN-NOT-M005-000001

Revision	Author	Date	Reason for revision
P01	[redacted]	05/10/2020	First revision

Security classification: OFFICIAL

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1 Context

1.1.1 HS2 Ltd have been commissioned by the Department for Transport the design of an optimised alternative Manchester Piccadilly High Speed Station. The hybrid bill design is a 6-platform surface station and the work commissioned by DfT is to design a combined HS2 and Northern Powerhouse Rail (NPR) station underground.

1.1.2 One of the key aims of the study is to be able to undertake a like for like comparison ("apples with apples) between the surface hybrid Bill station and the underground alternative.

1.1.3 The scope of the alternative design was agreed in collaboration with the Manchester stakeholders: Transport for the North, Manchester City Council and Transport for Greater Manchester on 1 September 2020.

1.1.4 As requested by the Manchester stakeholders in a meeting on 28 September 2020 this document outlines the sift criteria to be used to compare the underground station with the surface station. To that end, all the different design alternatives considered across the HS2 route in Phase 1, Phase 2a and Phase 2b used the HS2 Route Development Procedure which establishes the criteria to be considered.

2 Sift 2 scope set out in the HS2 Route Development Procedure.

2.1 Sift 2 introduction

2.1.1 Sift level 2 is described in the Route Development stage and is meant to outline routes for development.

2.1.2 The normal sift scope for sift level 2 has an objective to outline options for development, before going into more detail at either Sift level 2.5 or Sift level 3.

2.1.3 For this assessment Revision P08 was used despite there being a revision P09. Revision P09 is not currently instructed to Phase 2b and does not change the sift criteria or appraisals.

2.2 Sift 2 headers

2.2.1 Below features the standard HS2 Ltd assessment criteria with the designated level of analysis for sift level 2.

Strategic fit

2.2.2 The scheme will be assessed against the HS2 Ltd strategic goals and programme benefits (included in appendix A) and ensure that they are being met.

2.2.3 It will also be assessed against the HS2 Ltd Phase 2b Project Requirements Specification to ensure compliance is met.

2.2.4 This makes sure that overall, the options considered meet the overall expectation of the DfT, our Client.

Construction feasibility

2.2.5 Construction feasibility would assess the complexity of construction of the build, as well as how long it might take to build the proposal.

2.2.6 This will also require assessment of impacts on existing infrastructure such as existing Highways, Railways, and in certain circumstances utilities, and other means of public transport.

Operation feasibility – Trains (HS2, NR & NPR)

2.2.7 Operational feasibility for the trains will be assessed under this header, looking at both HS2, Network Rail, and Northern Powerhouse Rail.

2.2.8 An assessment into the reliability and capacity of the track layout and interaction with the train service specification will provide the scoring.

Operation feasibility – Operations for Stations

2.2.9 This part of operational feasibility looks at how the station will operate; this is a broad ranging topic covering many areas.

2.2.10 The station control and effectiveness of the 'back of house functions. back of house functions in this regard includes such areas as catering, staff and equipment provision, and accommodation for transport police.

2.2.11 The header will also require assessment on passenger facilities such as ease of access, ticket office, travel information, toilets, retail provision, and left luggage services.

2.2.12 The assessment of multi-modal interchange will also be assessed here.

Operation feasibility – Operations for Passengers

2.2.13 Operational feasibility – operation for passengers looks at how the station fits into the bigger multi-modal passenger dispersal.

2.2.14 This will include assessing connectivity between different modes of transport, such as high speed rail, classic rail, bus, coach, car, taxi, bicycle, pedestrian, and tram.

2.2.15 The passenger flow is also calculated here for normal and perturbed scenarios of operation.

2.2.16 The ease of navigation around the station and other modes will be assessed,

2.2.17 Assessing the relative security or perception of security of station layouts.

Maintenance

2.2.18 Assessment of the ease to maintain the railway and station will be assessed under this section.

Demand

2.2.19 Likely journey times will be covered under demand.

Costs

2.2.20 Estimations for the capital cost of both building the scheme from an engineering, and environmental side will be considered here, as well as land and property costs.

Stakeholders

2.2.21 Assessments will be undertaken as to the impacts on stakeholders, and if stakeholder requirements have been met.

Health and Safety

2.2.22 The health and safety implications of each proposal will be assessed for both the construction, operational, maintenance, and decommissioning phases.

Commitments

2.2.23 Previous explicit or implicit public assurances or commitments to third parties will be checked to make sure HS2 Ltd is not in breach of the undertaking and Assurances. This is mainly applicable to the phases that have passed through Hybrid Bill.

Commercial development

2.2.24 Assessment into the options if they provide opportunities for development in particular for over station development.

Environment

2.2.25 A broad range of environmental topics will be assessed to assist in informing the Environmental Statement.

2.2.26 These include:

1. Agriculture, forestry, and soils
2. Air Quality
3. Climate change
4. Community
5. Cultural heritage
6. Ecology
7. Land Quality
8. Landscape, visual assessment, and townscape
9. Socio-economics
10. Sound Noise, and vibration
11. Traffic and Transport
12. Water resources and flood risk assessment
13. Waste and material resources
14. Equalities impact
15. Health impact
16. BREEAM
17. Electromagnetic interference.

2.2.27 These will be assessed in with the construction and operational phase.

2.3 Scorings

2.3.1 Scorings are dictated by the Route Development Procedure, and fall into 6 ratings, which can be seen below:

Rating	Meaning
- - -	**Major Worsening** on the comparator / baseline option
- -	**Minor Worsening** on the comparator / baseline option
O	**Neutral / no change** on the comparator / baseline option
+	**Minor Improvement** on the comparator / baseline option
+ + +	**Major Improvement** on the comparator / baseline option
N/A	**Not Applicable**

3 Additional sift 2 scope (areas requested by stakeholders)

3.1.1 As requested by the Manchester stakeholders during the scope development process, a series of additional areas were agreed to be assessed which are over and above what a "normal" (e.g. where stakeholders have not been involved in preparing the scope) sift 2 would have considered.

3.1.2 The specific additional items are highlighted in blue.

3.1.3 Reference to "scope items" refer to the scope for the combined alternative underground station agreed with the Manchester stakeholders and appended in Appendix B for reference.

3.2 Scope item 3

3.2.1 "Sift level 2 on the agreed 4 options and construction methodology: Option A, Option B, Option C and an additional option (A, B or C) with the mined or open box method to progress on the options to the same detail with both construction methodologies. Understand implication of the alignment but starting point and driver is the most optimal station with SRF and what impact this has on the alignment. "

3.2.2 HS2 Ltd.'s normal sift procedure does not dictate construction methodology at sift level 2.

3.2.3 HS2 Ltd.'s construction methodologies are usually determined by the professional services consultant to determine the most efficient way to build structures, and assets at this design stage.

3.2.4 The sift level 2 process is historically aimed at informing the proposed scheme limits, and if the site itself is suitable.

3.2.5 As a result, we believe that separate construction methodologies are above an over what HS2 Ltd would consider at this stage.

3.2.6 This would be best suited to a sift level 2.5 or sift level 3 level of detail.

3.3 Scope item 5

3.3.1 Deliverable: Initial costs versus benefits assessment, including consideration of impact on land, comparative journey times and economic benefits such as jobs created, increased business space etc. It is agreed that it is not the HS2 Ltd.'s Consultants scope to undertake the economic benefits analysis. DfT will take the outcomes of the deliverables from HS2 Ltd.'s consultants and will discuss with their Analysts to see what can be done with the information available regarding the assessment of the economic benefits. This assessment is to be aligned with TfN's business case development.

3.3.2 HS2 Ltd.'s normal sift procedure does not require a section on economic benefits at sift level 2.

3.3.3 HS2 Ltd is cognisant that this is not within scope but notes that for this stage of design HS2 Ltd would make a high-level statement on the Over Station Development.

3.4 Scope item 8d

3.4.1 "Order of magnitude costs and high-level benchmarking, where possible, with similar structures in UK (Old Oak Common and Crossrail etc). Costs to include the station and the alignment and approach to allow a direct comparison, including savings from potential reductions in tunnel length. "

3.4.2 HS2 Ltd is only required to deliver "Broad costs to show significant relative differences". Broad costs in this case are assumed to be order of magnitude costs.

3.4.3 High level benchmarking whilst a useful exercise would normally be undertaken at later sift stages.

3.5 Scope item 8k

3.5.1 "Impact on utility works including diversions "

3.5.2 Historically Sift level 2 was undertaken at a stage that utilities were not known. This was due to the high-level stage of route development undertaken, and HS2 Ltd not having engaged with the utility companies.

3.5.3 HS2 Ltd would normally look at available utility records where available, and we propose this approach as well.

3.6 Scope item 8m

3.6.1 "Metrolink impact"

3.6.2 Metrolink impact would be considered as existing infrastructure and would be assessed at a very high level.

3.7 Scope item 8o

3.7.1 Identification of a suitable handover point between HS2 systems/design and NPR for each alignment option. This handover point will be located at the closest practicable point to Manchester Piccadilly, likely to be a tunnel portal east of the station on the route towards Leeds.

3.7.2 HS2 Ltd would usually consider that a system handover can be provided, not necessarily located at sift level 2.

3.7.3 HS2 Ltd usually identifies this during the sift level 2.5 or sift level 3 stage.

3.8 Scope item 8q

3.8.1 Consideration of relative operational resilience/capacity of each option and opportunities for additional services (if any functional differences between options) using methodology appropriate for sift level 2.

3.8.2 HS2 Ltd only develops and delivers a design that caters to the Train Service Specification (TSS).

3.8.3 As part of the design HS2 Ltd would consider resilience and capability of the railway, the requirements for additional services is above an over what is normally considered.

4 Appendices

4.1 Appendix A: HS2 Ltd programme strategic goals and Objectives

HS2 Strategic Goals

Catalyst for growth

Be a catalyst for sustained and balanced economic growth across the UK.

Capacity & connectivity

Add capacity and connectivity as part of a 21st century integrated transport system.

Value for money

Deliver value to the UK taxpayer and passenger.

Customer experience

Set new standards in customer experience.

Skills & employment

Create opportunities for skills and employment.

Health, safety & security standards

Set new standards in health, safety and security in the construction and operation of the railway.

Sustainable & a good neighbour

Create an environmentally sustainable solution and be a good neighbour to local communities.

The HS2 Programme strategic goals and objectives

HS2 will be a catalyst for sustained and balanced economic growth across the UK	HS2 will add capacity and connectivity as part of a 21st century integrated transport system	HS2 will deliver value to the UK tax payer and passenger	HS2 will set new standards in customer experience	HS2 will create opportunities for skills and employment	HS2 will set new standards for health, safety, and security in the construction and operation of the railway	HS2 will create an environmentally sustainable solution and be a good neighbour to local communities
1.1 To enhance the productivity of the UK by connecting cities and supporting local, regional and rural growth strategies	2.1 To deliver the required capacity, journey time, reliability and availability	3.1 To deliver the programme on time and on cost while achieving the expected benefits	4.1 To be the mode of first choice and to deliver passenger experience and customer service that is recognised worldwide as leading the way in high speed travel	5.1 To create sustainable job opportunities for young people, local people and those from diverse groups	6.1 To prevent injury and proactively manage risk	7.1 To design every part of HS2 and its service to be sympathetic to the people and places we affect and to stand the test of time
1.2 To maximise the business growth opportunities in the UK for our suppliers, including in the sharing of international best practice, and make bidding for appropriate contracts as accessible as possible for local businesses and SMEs	2.2 To integrate seamlessly with complementary transport modes	3.2 To deliver and operate a quality railway efficiently and to ensure commercial viability	4.2 To place people at the heart of our design, setting new standards for travel and ensuring HS2 is accessible to all passengers	5.2 To foster and develop talent and to create an engaged and highly skilled workforce for the delivery of HS2	6.2 To manage the health and wellbeing of all our workers to create a new better standard in occupational health	7.2 To actively communicate with neighbours and interest groups to minimise the impact of HS2 construction and operation on people and the environment.
1.3 To develop all stations and depots in ways that facilitate regional and local regeneration and development	2.3 To maximise benefits for the whole UK transport network	3.3 To actively seek innovative opportunities to achieve new standards and practices in order to increase whole life value		5.3 To be an exemplar of EDI practice	6.3 To protect HS2 assets and those of its suppliers	7.3 To design, construct and operate HS2 to reduce carbon and promote sustainably sourced resources

HS2's Strategic Goals and Objectives are shared by all of the organisations contributing to the HS2 Programme, specifically HS2 Limited, High Speed and Major Rail Projects Group and Rail Group at the Department for Transport (DfT – sponsoring department for the programme), the Ministry for Housing, Communities and Local Government (MHCLG – sponsoring department for HS2 local growth strategies), and the Department for Education (DfE – sponsoring department for National College for High Speed Rail)

4.2 Appendix B: Manchester Piccadilly high Speed Station – Final scope for the sift 2 of an optimised alternative underground station

01/09/2020

MANCHESTER PICCADILLY HIGH SPEED STATION

FINAL SCOPE FOR THE SIFT 2 OF AN OPTIMISED ALTERNATIVE UNDERGROUND STATION

This document sets-out the proposed scope for a fully underground station at Manchester Piccadilly High Speed Station, following the letter from the HS2 Minister Andrew Stephenson to the Mayor of Greater Manchester, Andy Burnham on 16/6/2020. The work aims to inform a more detailed costing and benefit analysis of the option jointly selected with TfGM, MCC and TfN as part of the review process below. The overall aim of the work is to select and develop a wholly underground station concept to the point where it can be fully and fairly compared with the CP3 hybrid Bill wholly surface option.

DEFINITIONS & REFERENCES

- Alignment refers to the track entering the Piccadilly underground station coming from Manchester Airport High Speed Station and towards Leeds and Sheffield.
- Orientation refers to the direction the station faces.
- Options A, B and C, and the associated nodes, are as per Annex A.
- The starting point for the design is the indicative Train Service Specification (iTSS) in Annex B, which is the same as that used for the CP3 hybrid Bill design (with HS2 services operating first and then NPR ones). This will allow a consistent comparison between underground and surface station options. The TSS will determine the number and length of platforms required. The Consultant is to confirm the right number of platforms and length at the earliest opportunity in order to inform the sift.
- For Option A, the alignment towards Leeds is to aim towards Node 1 (Rochdale).
- For Option B and C, the alignment towards Leeds is to aim towards Node 3 (Marsden).

STAGE 0: Pre-Sift

1. Footprint comparison of the two construction methodologies of open box vs mined with construction and logistics input for a 6 platform, 400m long station. Compare mined and open box construction on both orientations: orientation 1 as per Option A and B and orientation 2 as per Option C. The comparison is to include:
    a. "Plain language" pros and cons.
    b. Impact on Manchester city during and after construction, including constraints on future development of the city, the building environment of the city centre, and impact on the Manchester Piccadilly Strategic regeneration Framework (SRF).
    c. Passenger experience during operation - difference between temporary scenario and permanent station layout.
    d. Construction timescale and length of blight.

e. Live examples in UK and Europe, as discussed between partners.

It is likely that stakeholders will seek technical advice themselves to allow for an independent review of the information provided by HS2 Ltd and their consultants. It is expected that stakeholders and their advisors will be involved in regular meetings with HS2 Ltd, supported by DfT, to understand and discuss the technical aspects as the work is progressed by HS2 Ltd and their consultants. Stakeholders may also need to liaise directly with DfT from time to time.

2. **Decision point 1:** Agree and select the preferred construction methodology (open box vs mined) for each of the Options A to C. Agree which of the options (A, B or C) will be progressed as both an open box and mined methodology to allow direct comparison of the two construction methodologies during Sift Level 2. This will be subject to the outcomes in terms of technical viability of the mined methodology.

STAGE 1: SIFT LEVEL 2

Note: By Decision Point 3 at the end of sift level 2 we will have;
outline underground station designs and requirements that include cross sections and general arrangements high level assessments of modal interchanges, order of magnitude costs and high level benchmarking, approximate sizing of underground structure including excavated volumes, land take, construction and logistics information including buildability assessments, high level rail systems assessments, sizing and location of above ground structures, TBM strategies, alignment information, journey time implications, utilities impacts, high level construction programmes with staging, impacts to Metrolink, system handover points, ground conditions assessments and consideration of relative operational resilience / capacity of each option including opportunities for additional services. The detailed stages to achieve this are described below.

3. Sift level 2 on the agreed 4 options and construction methodology: Option A, Option B, Option C and an additional option (A, B or C) with the mined or open box method to progress on the options to the same detail with both construction methodologies. Understand implication of the alignment but starting point and driver is the most optimal station with SRF and what impact this has on the alignment.

4. Deliverable: sift technical note (TN) focused on the station element and SRF integration, comparing the 4 options with consideration of the associated optimal route alignments. The opportunities to reduce costs (e.g. due to reduced tunnelling) should be considered here.

5. Deliverable: Initial costs versus benefits assessment, including consideration of impact on land, comparative journey times and economic benefits such as jobs created, increased business space etc. It is agreed that it is not the HS2 Ltd's Consultants scope to undertake the economic benefits analysis. DfT will take the outcomes of the deliverables from HS2 Ltd's consultants and will discuss with their Analysts to see what can be done with the information available regarding the assessment of the economic benefits. This assessment is to be aligned with TfN's business case development.

6. Deliverable: Assessment of train movement margins and timetable development flexibility.

7. Stakeholders will be informed throughout the development process and given a minimum of three opportunities to review/discuss/input into the emerging work. To ensure reasonable project time frames and that project deadlines are maintained stakeholders will provide

input within 21 days of receipt. We note that, given this will require advance planning to resource, this is dependent on the agreed programme milestones being achieved. The timings of meetings will be agreed based on the agreed programme. As a minimum these meetings are suggested to occur:

a. During option development once initial options have been produced
b. Near completion of option development but prior to sifting to allow any final stakeholder comments to be addressed
c. During sifting to review interim findings prior to finalising

8. The TN will sift up to four options using the HS2 Route Development Procedure, taking into consideration the following aspects for each of the four options:
    a) Requirements and outline design for combined underground station (site and orientation)
    b) High level assessment of modal interchanges for each Underground station site
    c) High level GAs and cross sections. The focus will be on the stations aspects. However, the alignment is to be developed at high level to appreciate likely difference in length between the different options. – station and throat only; no need to prepare for the alignment
    d) Order of magnitude costs and high level benchmarking, where possible, with similar structures in UK (Old Oak Common and Crossrail etc). Costs to include the station and the alignment and approach to allow a direct comparison, including savings from potential reductions in tunnel length.
    e) Approximate size of the underground structure, excavated volumes, land take, C&L including buildability
    f) High level railway systems assessment against a generic station option: all switches and crossings, ventilation and fire strategy (including number of vent shafts) for the station
    g) Size and location of the above ground infrastructure. The focus of the work will be on the station but a high level appreciation of the potential location of cross-over boxes and headhouses will be required to ensure there are no 'showstoppers'.
    h) TBM strategy for Manchester Tunnel.
    i) Alignments from Manchester Airport and towards Leeds/Sheffield (either Node 1 or 3). This will consider, in high level terms, the potential length of tunnels, and number of vent shafts, from Manchester Airport to Piccadilly and Piccadilly towards Leeds for each option.
    j) Journey Time implications (Manchester Airport to Piccadilly and Manchester Airport towards Leeds), relative comparison between options only to an agreed common point.
    k) Impact on utility works including diversions
    l) Construction programme and staging (high level)
    m) Metrolink impact
    n) Consider underground obstructions such as existing tunnels, building foundations etc and confirm no stoppers
    o) Identification of a suitable handover point between HS2 systems/design and NPR for each alignment option. This handover point will be located at the closest practicable point to Manchester Piccadilly, likely to be a tunnel portal east of the station on the route towards Leeds.
    p) High level review of ground conditions and potential risks/challenges for each option (if any differentiators)

q) Consideration of relative operational resilience/capacity of each option and opportunities for additional services (if any functional differences between options) using methodology appropriate for sift level 2.

9. Compare options against CP3 surface station, using a set of criteria agreed between partners. As noted above, this analysis will include consideration of futureproofing against future operational concepts (point q), journey times (point j) and above ground infrastructure (point g), which will allow for consideration of benefits and opportunities.

10. **Decision point 2:** Agree with stakeholders which is their preferred underground station option.

11. Stakeholders provide recommendations for Ministers, via DfT, for consideration ahead of Decision Point 3, seeking to reach consensus where possible. We note that, at this stage, further work will not have been undertaken to optimise the design of any recommended solution.

12. Interim updates and feedback to be provided as dictated by the updated programme of work, in line with the principles set out in paragraph 7

13. **DECISION POINT 3** – Ministerial review of study outcomes. Ministerial consideration as to whether to change approach to station site choice and configuration in central Manchester as part of Western Leg hybrid Bill, and any related implications to line of route. Assessment of implications of any change of approach on preparation and schedule for development of Bill.

STAGE 2: FURTHER DESIGN DEVELOPMENT AND COSTING

14. Develop the selected scheme option if appropriate following DECISION POINT 3.

15. HS2 would need to seek further governance to carry on the work (eg. agree a quotation and programme for the following stage). This is done following contractual process with HS2 consultants.

Note: while it is not part of this scope, it is noted that Manchester Stakeholders still have concerns about the performance of the hybrid Bill surface station. There is ongoing work to review these concerns and an action to coordinate with Manchester stakeholders to ensure they have sight of it.

ANNEX A: OPTIONS

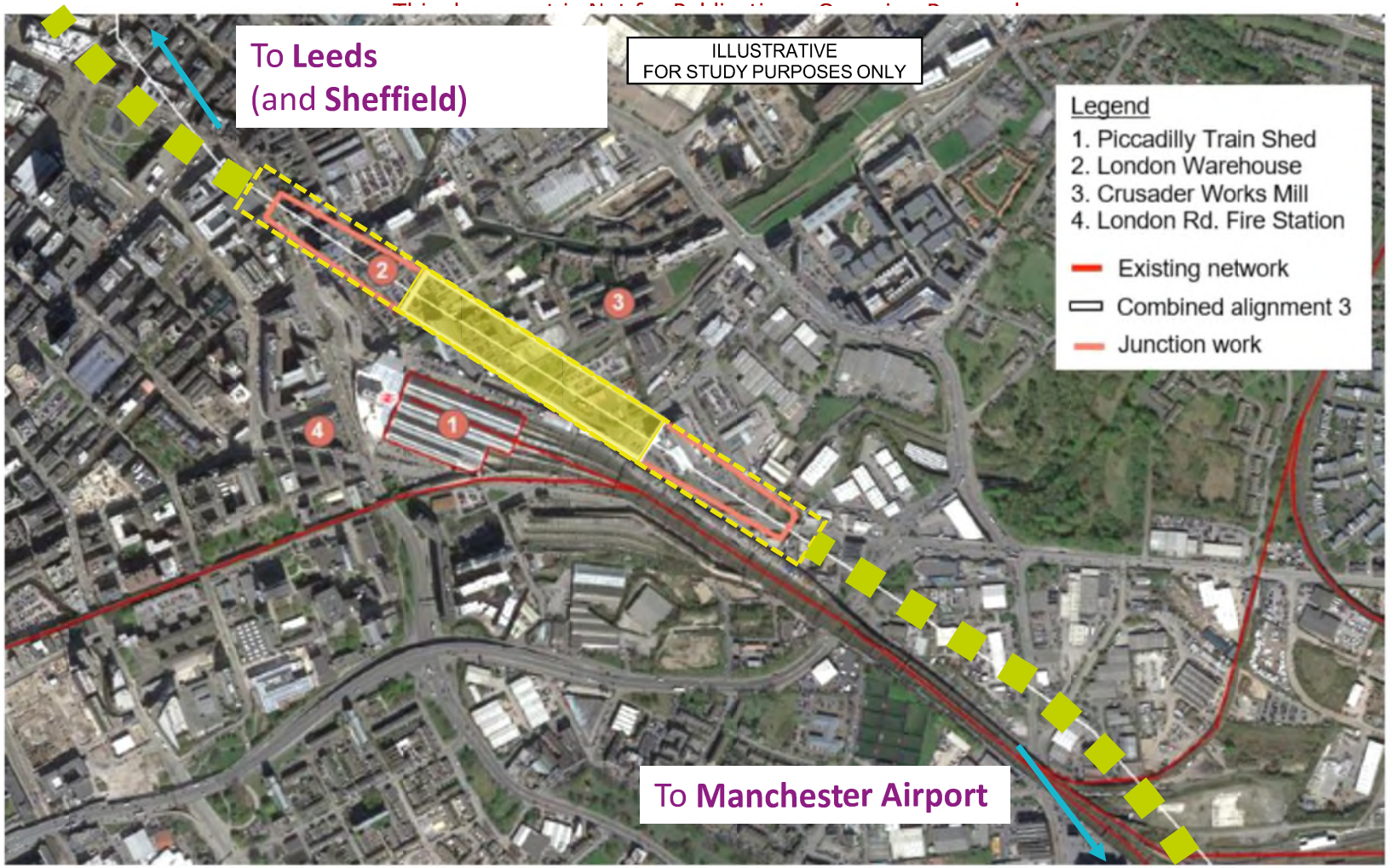
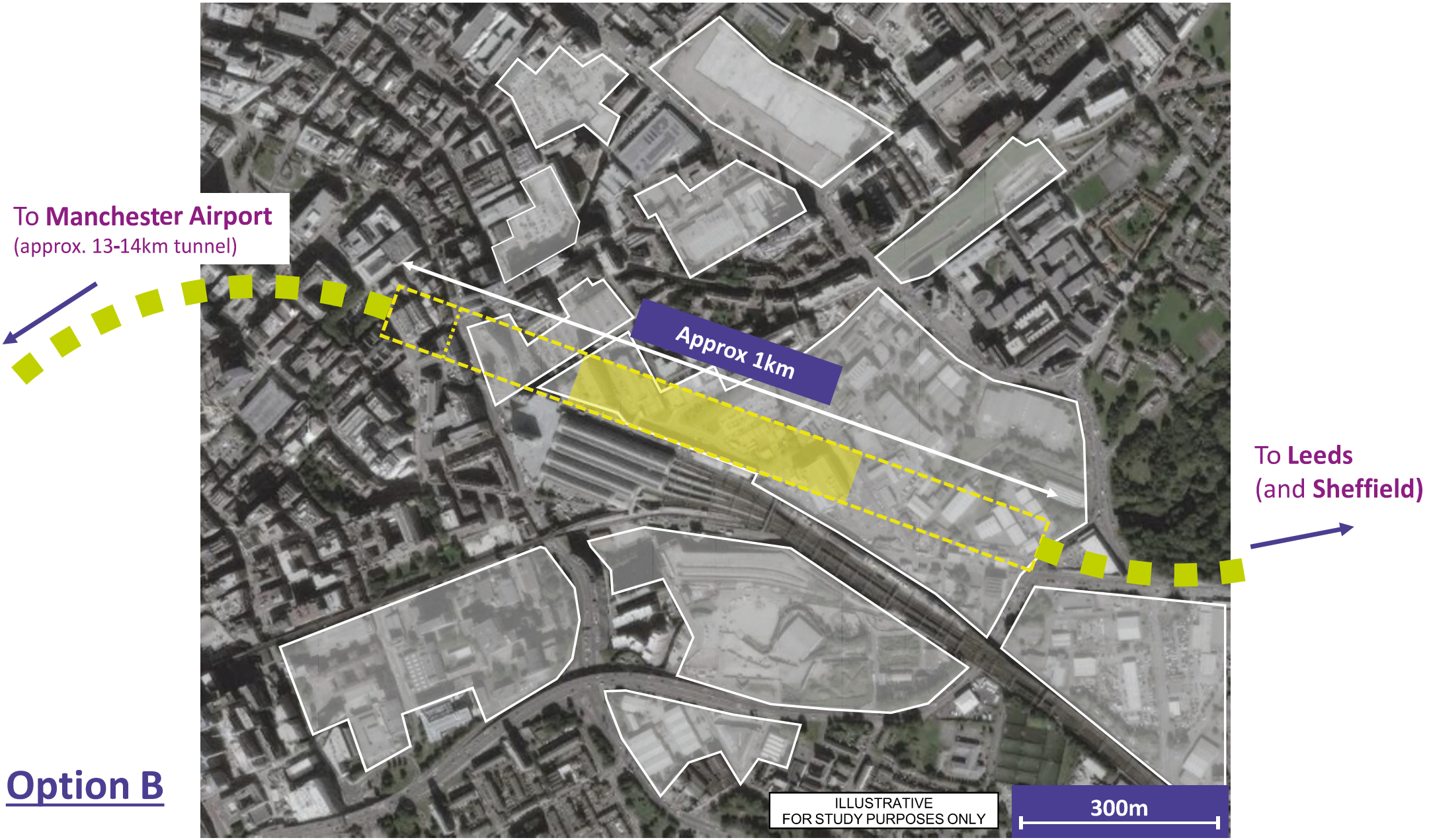


Figure 27 - Aerial view of alternative concept along combined alignment 3

Option A


To **Manchester Airport**
(approx. 13-14km tunnel)
Approx 1km
To **Leeds**
(and **Sheffield)**
ILLUSTRATIVE
FOR STUDY PURPOSES ONLY
300m

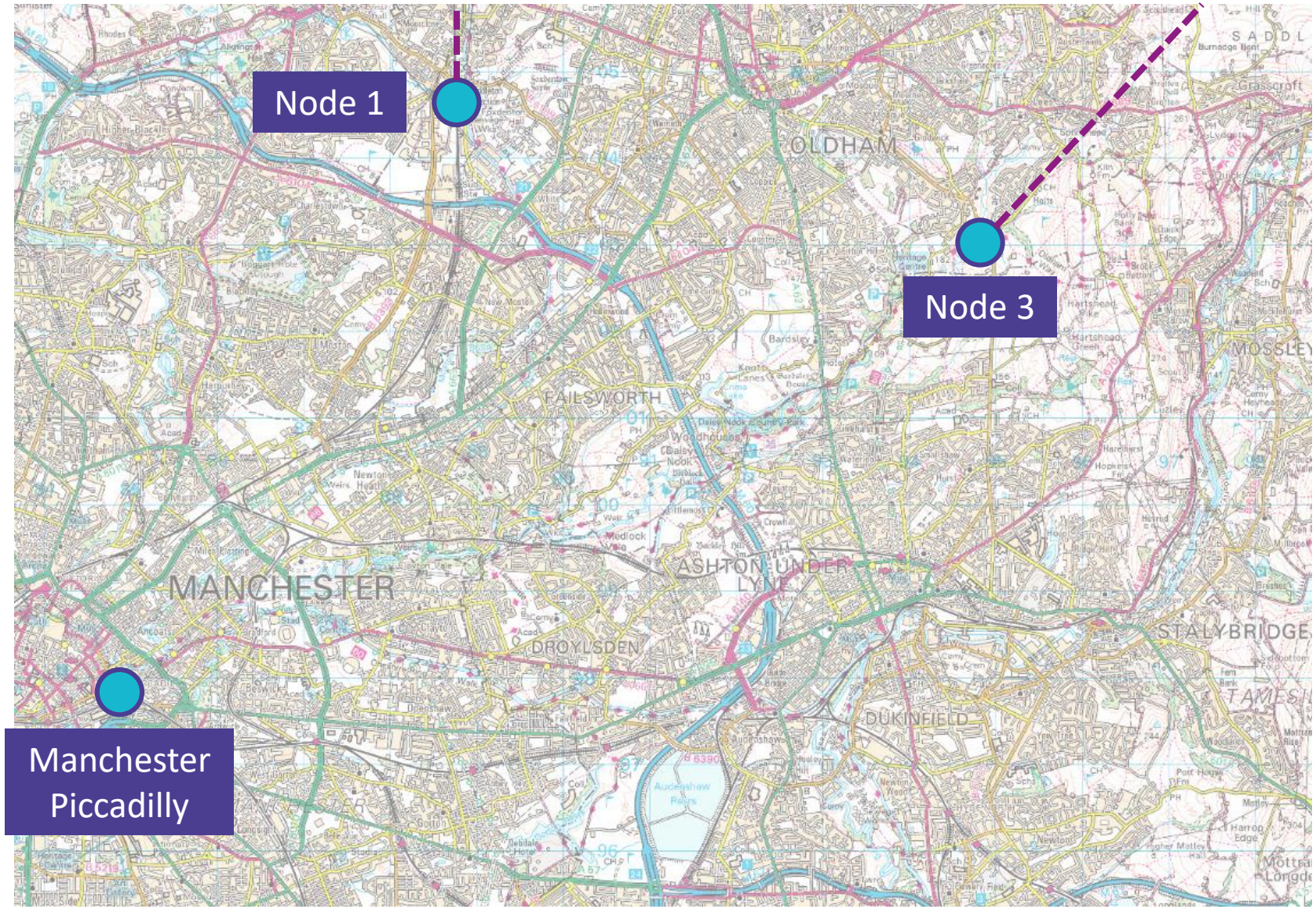
Option B

Option C


To **Leeds**
(and **Sheffield**)
Underpinning of NR Viaducts would be required.
Prefer to avoid train shed roof structure foundations
To **Manchester Airport**
(approx. 12-13km tunnel)
ILLUSTRATIVE
FOR STUDY PURPOSES ONLY
300m

Node 1 is on a north-south alignment parallel to the existing railway.

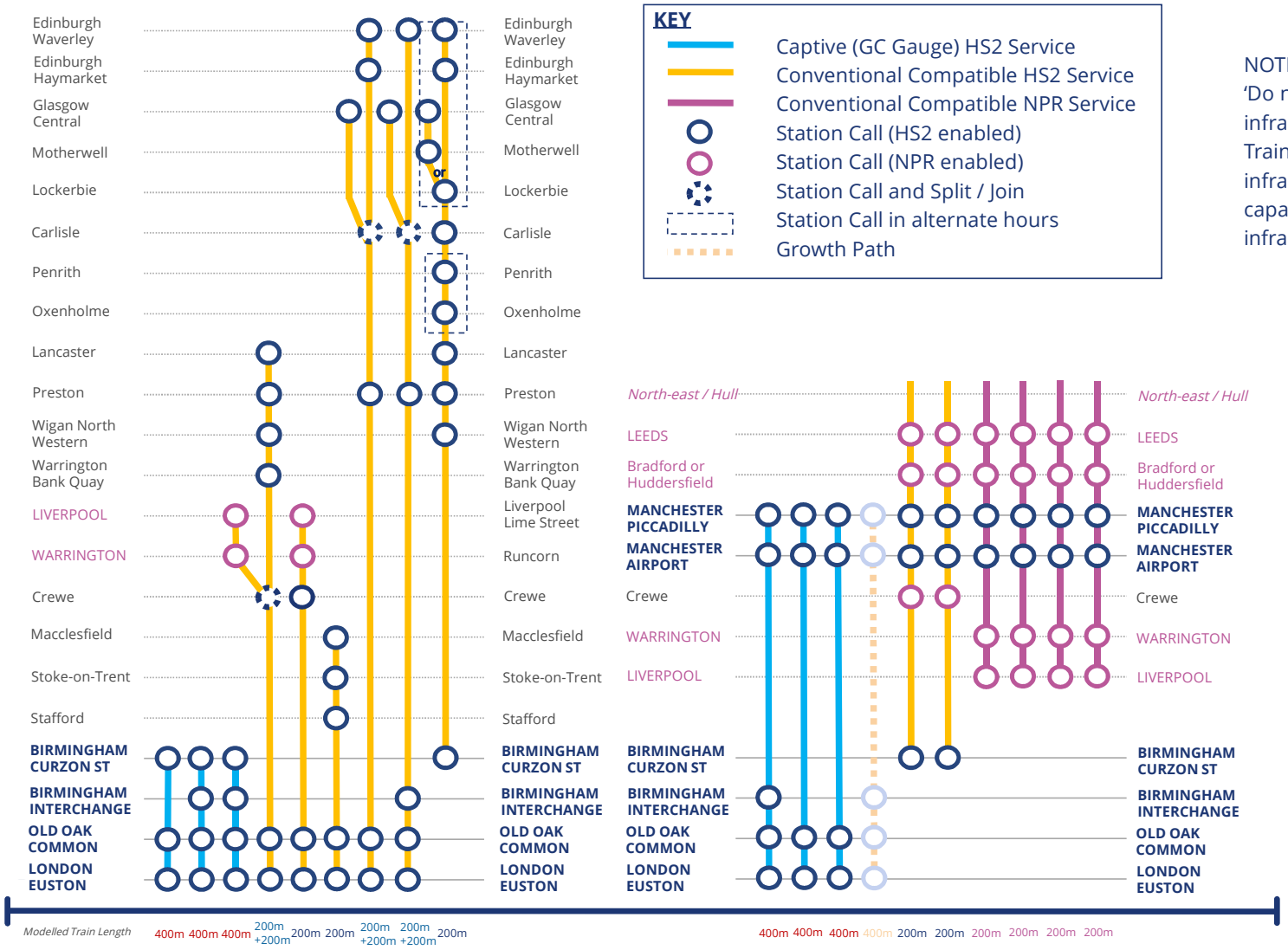
Node 3 is on a south-west/north-east alignment towards Marsden



This document is Not for Publication - On-going Research

ANNEX B: INDICATIVE TRAIN SERVICE SPECIFICATION

Indicative Train Service Specification (ITSS) for HS2 Phase 2b hB to not preclude for Northern Powerhouse Rail



KEY

- Captive (GC Gauge) HS2 Service
- Conventional Compatible HS2 Service
- Conventional Compatible NPR Service
- Station Call (HS2 enabled)
- Station Call (NPR enabled)
- Station Call and Split / Join
- Station Call in alternate hours
- Growth Path

NOTES:
'Do not preclude for NPR' has been instructed to HS2 as infrastructure provision rather than a TSS to achieve. The Train Service Pattern illustrated should be tested on HS2 infrastructure to test that the infrastructure has the capability to support this, on the assumption all other infrastructure/trains etc. (purple) is provided by others.

15 Appendix B – Assumptions

Piccadilly Underground station

Design assumptions against their risks and opportunities

Rev 2

Design Assumptions, Exclusions and Opportunities						Potential consequential risk/opportunity		Key Assumption
Ref	Discipline	Title	Assumption Description	Basis for Assumption	Assumption / Exclusion / Opportunity	Description of Potential Impacts if the assumption is invalid	Risk Category	
1	Geotech	Station and vicinity	Ground Conditions are only assumed from Desk Study sources.	No site or project specific intrusive ground investigation (GI) has been undertaken as yet. Only anticipated geology and preliminary geotechnical parameters have been established.	Risk	Underground design and construction of open excavation boxes and mined caverns may be affected by adverse or difficult ground necessitating complex solutions.	Increase in cost	
2	Construction	Phasing	Airport Station will NOT be operational in advance of Man Picc under ground station e.g. no staged opening of the Western leg.	Current HS2 planning and business case does not allow for a phased opening.	Risk	To operate the Airport Station in advance would require a redesign of the station as a terminus and may impact the flow of construction materials to the tunnel.	Increase in cost	
3	Construction	Construction strategy	Ashley Railhead will be used to support the rail systems construction to the eastern extents of underground box/throat. E.g. the overall rail system and C&L strategy is fundamentally the similar to CP3.	The existing strategy can be used to support the rail system construction without incurring a cost penalty of delivering additional works.	Risk	If an extension of addition to the current railhead was required there would be additional costs and perhaps programme implications.	Increase in time	
4	Construction	Phasing	The western leg has 1 Entry Into Service (EIS) date	Current HS2 planning and business case does not allow for a phased opening.	Risk	A change in phasing will affect programme and cost.	Increase in cost	
5	Construction	TBM drives	2no. HS2 TBMs are driven from the Manchester Airport Portal all the way to Piccadilly, with a 2 month stagger. Activities prior to TBM launch are the same as for the Hybrid Bill Design.	With the change in position to how the HS2 tunnels approach the station there is no immediate site on the route to tunnel from both directions as in the baseline scheme and so the tunnels will be driven into the city centre from the Airport Portal.	Opportunity	An intermediate shaft for launching and receiving TBMs could be identified for each underground option, and this would reduce the TBM drives duration, but since this activity is not on the critical path, this has not been investigated.		
6	Construction	Approaches	NPR approach civils construction occurs at the same time as the HS2 approach civils construction. This includes the portal shaft at Ardwick for B and B1 and at Barking Street for D, as well as intervention shafts.	This will enable NPR TBMs to be driven into the portal shaft from outside the city and extracted, and will minimise impacts on the station itself.		This increases the up-front cost of HS2 construction. If NPR scheduled to be constructed later, up-front cost could be reduced by deferring some of these works.		
7	Construction	Station and approaches	Enabling, advance and utilities works have the same duration as in the baseline for Piccadilly Station (the Hybrid Bill Design) including demolitions.	These works are similar in extent for B and B1, and likely also for D, compared to the HBD. Insufficient information to programme these works in detail at this stage.	Risk	Particularly challenging demolitions or utilities works may be identified during design development, which may increase the duration.	Increase in time	
8	Construction	Station and approaches	Depth of weathering and rock UCS taken as the 'average' values, i.e. 2 m of weathering and 20 MPa, respectively.	In the programme, the UCS affects only the rate of diaphragm wall excavation. Stronger rock may increase the duration.	Risk	Programme would increase. On the other hand, very strong rock could present an opportunity to change the design, potentially replacing the lower part of the diaphragm walls with shotcrete and rock bolts. This would require pre-excavation grouting of the rock fissures to reduce groundwater inflows.		
9	Construction	Station and approaches	Rock head levels taken as the 'average' level, i.e. at +30mOD. Depth of weathering taken as 'average' value of 2m.	If the rock cover over the caverns is found during site investigation to be less than assumed, the caverns and the station may need to be moved lower, or significant design changes may be needed, e.g. extensive jet grouting, permeation grouting, canopy tubes.	Risk	Station depth. Cavern design.		
10	Construction	Station and approaches	Station box excavation is limited to 1800 m^3/day,	This is the capacity of 3no. trains per day from Ardwick rail sidings based on 600m^3 per train. This is also estimated to be close to the upper limit for excavation plant operating in the box based on a number work fronts.	Risk	If train paths unavailable, programme duration could increase and/or use of HGVs could increase. Station box and approaches excavation are on the critical path.		
11	Construction	Approaches	Construction of mined caverns can be achieved without damage to overlying buildings and utilities.	If the rock cover and rock mass properties are sufficient and the construction sequence is carefully designed, then ground movements should be small. However, without detailed site investigation and design calculations, it is not possible to be certain that the caverns are feasible at this stage. There are no precedents.	Risk	Mined caverns for approaches in B and D. Only the outer scissors caverns for B1.		
12	Construction	Station, approaches and route	There are no artificial hard obstructions (e.g. piles, basements, tunnels etc) that clash with planned shafts, tunnels, caverns or station box.	It is understood that most buildings in Manchester do not have piles. Refer to desk study 2PT24-MWJ-GT-REP-M005-000001.	Risk	Station, approaches, TBM drives and vent shafts		
13	Construction	Station, approaches and route	Contaminated ground and groundwater is not present.	No information currently available. Site investigation required.	Risk	If the ground is contaminated, this may require treatment of excavated material before disposal, which may increase cost and programme. If the groundwater is contaminated, the use of dewatering may be limited because it will not be possible to discharge directly into sewers. This will increase the need for other methods of ground improvement, such as grouting, increasing cost and programme.		
14	Ventilation	Platform smoke control ventilation	Exhaust capacity of 120m3/s per 220m of the station	Based on Old Oak Common West portal smoke control	Risk	Increase in exhaust capacity	Increase in cost	
15	Ventilation	Concourse smoke control ventilation	Exhaust capacity of 200m3/s per 220m of the station	Based on previous Old Oak Common experience	Risk	Increase in exhaust capacity	Increase in cost	
16	Ventilation	Replacement air	Supply capacity of 200m3/s per 220m of the station	Based on concourse smoke control ventilation.	Opportunity	May be omitted or use as platform cooling plant	Decrease in cost	
17	Ventilation	Acoustic - Smoke control fans	Noise impact on surrounding receptors	one 3m long atmosphere side sound attenuator was considered.	Risk	Additional sound attenuation may be required either in the form of diffuser type or splitter type. The latter meant that the room rise might increase by 4m to accommodate additional sound attenuator.	Increase in cost	
18	Ventilation	Smoke control - downstands	depth of downstand	Based on previous Old Oak Common experience	Risk	The depth required may change	Increase in cost	
19	Alignment	General	The proposed route alignments and station approach layouts are of an appropriate level of maturity for Sift Level 2	The proposed alignments and approach layouts have undergone an iterative design process with multi discipline consultation, including HS2 and stakeholders.		There remains opportunity within the current route alignment and station approach layouts design for further development which could realise improvements in quality, cost and constructability. Development of these potential improvements has necessarily been curtailed by the timescale afforded to this study. Conversely, there are inherent risks associated with the imposition of truncated timescales on the development of the track design.		Key Assumption

Design Assumptions, Exclusions and Opportunities						Potential consequential risk/opportunity		Key Assumption
Ref	Discipline	Title	Assumption Description	Basis for Assumption	Assumption / Exclusion / Opportunity	Description of Potential Impacts if the assumption is invalid	Risk Category	
20	Alignment	Standards	HS2 design principles and standards shall be adhered to.	The work has been instructed under the contract for Hybrid Bill which mandates HS2 standards.	Opportunity	Relaxation of horizontal and vertical geometry constraints, under HS2 HoTE approval, could lead to construction cost/duration decreases and potential environmental benefit, noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	
21	Alignment	Standards	HS2 design principles and standards shall be adhered to.	The work has been instructed under the contract for Hybrid Bill which mandates HS2 standards.	Risk	Relaxation of horizontal and vertical geometry constraints could lead to increased maintenance requirements with associated H&S ramifications, noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in quality	Key Assumption
22	Alignment	Route Alignments (General)	The proposed route alignments are indicative only.	The proposed routes have undergone an iterative design process with only a single route option being chosen for each platform footprint option.	Opportunity	A number of alternative route options between nodes were considered during the early phases of this study. For expediency and to ensure project timescales were met, only a single route for each station footprint option was progressed to the level of detail shown on the Track General Arrangements. Further design development (which exceeds the remit of this study), subject to one of the options being progressed, should be cognisant of the potential for realignment of the routes, based on operational, environmental and constructability assessments.		Key Assumption
23	Alignment	Route Alignments (General)	The development of the indicative route alignments is considered to be of a suitable maturity for Level 2 Sift.	The Route Alignments are indicative single (centreline) alignments which broadly represent the proposed development corridor. Their purpose is to provide an equitable comparison between the combined HS2 hybrid Bill / NPR remit 6 studies, and each other. Design is in accordance with HS2 document no.: HS2-HS2-RT-STD-000-000001 (P04) - Technical Standard - Track Alignment Design.	Risk	Further development of both Up & Down lines, with more detailed assessment of speed profiles at station approaches, is likely to alter the indicative routes which could affect the following: vent shaft locations, vent shaft quantities, tunnel depths, outer scissors locations, station approach layouts. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in cost	
24	Alignment	Route Alignments (General)	The bearing and locations of the Station Footprints (B, B1 & D) is fixed	Numerous multi-disciplinary workshops have been undertaken to determine the optimum locations for station footprints.	Opportunity	Adjustments to the station footprint locations or their bearings could improve the mainline approaches and result in less circuitous routes. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	
25	Alignment	Route Alignments (General)	The alignments between Airport station and Piccadilly and between Piccadilly and Node 3 will be in individual (twin-bore) tunnels.	Practice adopted by hybrid Bill design and NPR Remit 6 designs.	Opportunity	Adopting a single bore tunnel to house both Up and Down lines (node to node) may realise cost and time benefits, particularly with the outer scissors being housed within bored tunnel rather than mined caverns. However it should be noted that there would be significant impact upon ventilation, maintenance and operations which would need to be addressed. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	
26	Alignment	Route Alignments (Horizontal)	Multi-disciplinary considerations undertaken during development of the route alignments are considered to be of a suitable maturity for Level 2 Sift.	The development of the route alignments has taken high level consideration of constraints and limitations imposed by, but not limited to, operational, safety, environmental and construction issues.	Opportunity	Further development, with more detailed assessment of multi-disciplinary considerations, in particular the location and spacing of ventilation/intervention shafts, may result in less circuitous route alignments. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in time	
27	Alignment	Route Alignments (Horizontal)	Multi-disciplinary considerations undertaken during development of the route alignments are considered to be of a suitable maturity for Level 2 Sift.	The development of the route alignments has taken high level consideration of constraints and limitations imposed by, but not limited to, operational, safety, environmental and construction issues.	Risk	Further development, with more detailed assessment of multi-disciplinary considerations, in particular the location and spacing of ventilation/intervention shafts, may result in more circuitous / longer route alignments. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in cost	Key Assumption
28	Alignment	Route Alignments (Horizontal)	Maximum achievable speed (node to node) is 230kph	This is comparable with the hybrid Bill design speed between Airport and Piccadilly. Limiting the design speed for the purposes of this Level 2 Sift serves to provide an equitable comparison between the combined HS2 hybrid Bill / NPR remit 6 studies, and each of the route alignment and station footprint options.	Risk	Higher speed requirements could affect the following: route alignments, vent shaft locations, tunnel diameters, tunnel depths, outer scissors locations, station approach layouts.	Increase in cost	Key Assumption
29	Alignment	Route Alignments (Horizontal)	Track geometry for the indicative single (centreline) alignments on approach to the underground station is a series of compound curves with consistent cant which provide approximately equal deficiency values during train deceleration.	This is the same philosophy as adopted by the CP3 design, and as prescribed in Item 03.05 of HS2-HS2-RT-STD-000-000001 (P04) - Technical Standard - Track Alignment Design, and is assumed to be appropriate for this level of design.	Opportunity	Item 03.05 of HS2-HS2-RT-STD-000-000001 (P04) also allows for cant transitions along a single horizontal curve, or a long transition with constant cant subject to HS2 HoTE approval. Implementation of these variations could offer greater flexibility in the Node to Node alignment geometry, with associated benefits to ventilation shafts' placement. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	
30	Alignment	Route Alignments (Vertical)	The depth below surface to the twin-bore tunnels' crowns is required to be >18m	It is understood that any sub-surface disruption which is <18m will require HS2 Ltd to purchase the land above.	Opportunity	The Alignments' vertical profiles take account of this requirement which dictates the depth of ventilation/intervention shafts (in their indicative locations). Relaxation of this requirement could lead to shallower tunnels and shorter intervention shafts. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	
31	Alignment	Scissors Crossovers (General)	The outer scissors are required during normal operation for access to the opposite outermost platforms	HS2 Operational requirements provided by RSADS and based on HS2 Project Requirements Specification PRS704	Opportunity	Should the outer scissors not be required at the Airport end of the station (for normal operation or under perturbation) the construction impact on the city centre would be significantly improved for all options. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	
32	Alignment	Scissors Crossovers (General)	The outer scissors are required during normal operation for access to the opposite outermost platforms	HS2 Operational requirements provided by RSADS and based on HS2 Project Requirements Specification PRS704	Opportunity	Should the outer scissors not be required at the Leeds end of the station (for normal operation or under perturbation) the construction impact would be significantly improved for all options. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	
33	Alignment	Scissors Crossovers (General)	HS2 Head of Track Engineering approval, as required by Item 8.3.4 of HS2-HS2-RT-STD-000-0002 (Draft Rev P03) Technical Standard – Track: Switches & Crossing Geometric Design, will be obtained for the use of scissors crossovers.	The spatial constraints imposed on the station throats within a city centre location.	Risk	Should the use of scissors be deemed unacceptable, there will be a significant increase in throat length. There will be double the number of outer crossover caverns with a possible adverse affect on headway and operational feasibility. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in cost	Key Assumption

Design Assumptions, Exclusions and Opportunities						Potential consequential risk/opportunity		Key Assumption
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34	Alignment	Scissors Crossovers (General)	Maximum gradient for Scissors crossovers, which are considered "complex" S&C, is 0.5%	Ref: Item 26 of HS2-HS2-RT-STD-000-000001 (P04) - Technical Standard - Track Alignment Design	Opportunity	In exceptional circumstances, when using slab track, complex S&C may be sited on gradients ≤1.0% subject to vehicle dynamics modelling and HS2 HoTE approval. Applying this exceptional limit could provide some or all of the following benefits: Greater flexibility for the location of the outer scissors. Increased cover for caverns at station throats and outer scissors. Less onerous vertical profile between river Irwell and Station throat B1. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	Key Assumption
35	Alignment	Scissors Crossovers (Outer)	The bearing and locations of the outer scissors for each station footprint (B, B1 & D) is fixed.	Numerous multi-disciplinary workshops have been undertaken to determine the optimum locations for the outer scissors crossovers.	Opportunity	Adjustments to the outer scissors locations, which have been based on environmental and constructability criteria in conjunction with their related station footprint orientation, could present the opportunity for less surface disruption and/or alternative construction methods. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	
36	Alignment	Scissors Crossovers (Outer)	The outer scissors employ preferred components: R760 turnouts and 1:6.964 diamond, which achieve 80kph through the scissors.	Standard combination of turnout and diamond as defined in HS2-HS2-RT-STD-000-0002 (Draft Rev P03) Technical Standard – Track: Switches & Crossing Geometric Design.	Opportunity	Reducing the outers scissors speed requirement to 60kph or 50kph would decrease the size of the mined cavern. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	
37	Alignment	Scissors Crossovers (Inner)	Within the station throats the inner scissors crossovers are comprised of R500-1:12 turnouts connecting to 1:4.444 diamonds. It is assumed that continuing the turnout radius through the turnout heel, resulting in the virtual transition being located outside the turnout heel is acceptable.	This combination of turnout and diamond provides the shortest possible scissors unit for the track interval utilising S&C components specified in HS2-HS2-RT-STD-000-0002 (Draft Rev P03) Technical Standard – Track: Switches & Crossing Geometric Design. The turnout crossing casting remains standard; only the heel geometry alters. The slab track construction will provide additional lateral support at the virtual transition.	Risk	Given that R300 turnouts, which naturally tie into the 1:444 diamond geometry, cannot be used in passenger carrying lines - in accordance with 7.3.13 of HS2-HS2-RT-STD-000-0002 (Draft Rev P03) - and a fully preferred scissors arrangement would be as per the outer scissors - i.e. R760 turnouts and 1:6.964 diamond, this would lead to an increase in the length of the inners scissors of up to 90m in footprint B1 and up to 20m in footprints D & B. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in cost	
38	Alignment	Scissors Crossovers (Inner)	Within the station throats the inner scissors crossovers are comprised of R500-1:12 turnouts connecting to 1:4.444 diamonds. It is assumed that continuing the turnout radius through the turnout heel, resulting in the virtual transition being located outside the turnout heel is acceptable.	This combination of turnout and diamond provides the shortest possible scissors unit for the track interval utilising S&C components specified in HS2-HS2-RT-STD-000-0002 (Draft Rev P03) Technical Standard – Track: Switches & Crossing Geometric Design. The turnout crossing casting remains standard; only the heel geometry alters. The slab track construction will provide additional lateral support at the virtual transition.	Opportunity	R300 turnouts, which naturally tie into the 1:444 diamond geometry, should not be used on main running lines. However the CP3 layout for Old Oak Common has used these in the station approaches. The turnout speed is 50kph. Should this be deemed acceptable at Piccadilly, from an OPS perspective, there may be scope to reduce the length of the inner scissors. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	
39	Alignment	Approach Throat Layout	The complexity of the track layout at the station approaches is defined by the operational requirements.	HS2 Project Requirements specifications PRS704 & PRS779.	Opportunity	Whilst PRS704 requires parallel trains moves into / out of all platforms, PRS779 states that Manchester Piccadilly shall include 4 dedicated HS2 platforms. The current throat layout enable parallel moves across 6 platforms. Clarity on this requirement may enable a shorter track layout to be developed. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	Key Assumption
40	Alignment	Approach Throat Layout	The track layout at the station approaches is identical at both ends.	Combined HS2 / NPR operational requirements have not been obtained at the time of the submission of this study.	Opportunity	Less onerous operational requirements at the Leeds end of the station, with fewer parallel moves required, would result in a shorter throat length. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	Key Assumption
41	Alignment	Approach Throat Layout	It is assumed that the limiting distance between switch toes and vertical changes in geometry (20m as defined in Item 25.02 of HS2-HS2-RT-STD-000-000001 (P04) - Technical Standard - Track Alignment Design) is acceptable.	Achieving desirable separation would increase the throats' length.	Risk	Increased throat length will lead to greater extent of excavation and possibly reduced flexibility in the location of the outer scissors. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in cost	
42	Alignment	Approach Throat Layout	The limiting distance between switch toes and vertical changes in geometry (20m as defined in Item 25.02 of HS2-HS2-RT-STD-000-000001 (P04) - Technical Standard - Track Alignment Design) can be reduced.	Item 25.02 of HS2-HS2-RT-STD-000-000001 (P04) - Technical Standard - Track Alignment Design states - "In station throat areas on slab track the limiting distance may be reduced subject to HS2 HoTE approval."	Opportunity	Reduced distances between S&C and changes in vertical geometry will present the opportunity to reduce the length of station approach throats, leading to reduced excavation and greater flexibility in the location of the outer scissors with the consequential benefits to surface disruption. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	
43	Alignment	Approach Throat Layout	All platforms are straight and parallel. Track horizontal and vertical geometry cannot encroach within the platforms.	All platforms are required to accommodate 400m trains (or 2 x 200m trains arriving from opposite ends). Their widths are defined by the safe movements of passengers and to accommodate structural supports.	Opportunity	Curving of platforms (min 1000m radius for operational lengths) may lead to a reduction in the length of the approach throats. However this would require a greater understanding of combined operational requirements than is currently available, and also further development of the station box's structural and operational design. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	
44	Alignment	Approach Throat Layout	Construction method for the throats (mined vs open cut) is identical at both ends for all options considered under this study.	Time and cost restrictions imposed on this study did not allow for myriad composite construction options to be considered.	Opportunity	For all footprint / alignment options (B, B1, D), combining alternate construction methods (mined versus open cut) at each throat may realise overall project benefits. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	
45	Alignment	Approach Throat Layout	It is assumed that the current approach throat track layout provides adequate space for maintenance access and track side infrastructure.	Offsets to internal cavern walls replicate those within bored tunnels.	Risk	Larger caverns or increase in separation of S&C will lead to longer throat layouts which, in turn, could impact upon construction and operability. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in cost	
46	Alignment	Approach Throat Layout	It is assumed that the current approach throat track layout provides adequate space for signalling requirements.	Detailed signalling design has not been undertaken at this stage of design.	Risk	Increased separation between S&C, or signal sighting issues within the caverns may lead to longer throat layouts which, in turn, could impact upon construction and operability. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in cost	

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Ref	Discipline	Title	Assumption Description	Basis for Assumption	Assumption / Exclusion / Opportunity	Description of Potential Impacts if the assumption is invalid	Risk Category	
47	Alignment	Approach Throat Layout	Piccadilly Underground Station requires 6 platforms.	Based on current understanding and interpretation of ITSS	Opportunity	Reducing the number of platforms to 4 would be entirely dependent upon an operational assessment and possible change to ITSS. However, its implementation would realise significant reductions in overall footprint sizes for all options. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	
48	Alignment	Approach Throat Layout	Piccadilly Underground Station requires 6 platforms.	Based on current understanding and interpretation of ITSS	Opportunity	Increasing the number of platforms to 8 would provide future proofing benefits with comparatively small increases in the overall construction area. This would be particularly relevant to Option B1; less so with Option B; whilst for Option D it would be more likely to prove prohibitively costly. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in quality	
49	Alignment	Approach Throat Layout	The track layout for the approach throats is largely defined by the arrangement of platforms which are proposed under this study for Options B, B1 & D.	Options B & B1 consist of 3 island platforms of equal width within an open cut box, whereas Option D is a hybrid with a combination of open cut and mined platforms.	Opportunity	There are possible alternative arrangements for platforms within the underground station, some of which may realise benefits from a purely track alignment perspective. However each possible alternative would need to be considered on its overall project impact. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in quality	
50	Alignment	Node 3	Node 3 is approximately 30m underground at 124m AOD.	The level (Above Ordnance Datum) of the termination is provided in the document P2B-HS2-EN-NOT-M005-000001 forming the scope of the sift	Risk	Bringing the alignment to the surface between Manchester and Node 3 would then need to account for civils works to provide a tunnel portal. Noting that investigation of this was excluded from the remit following discussion with HS2, and any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in cost	Key Assumption
51	Alignment	Node 3	The location and bearing of Node 3, provided in document P2B-HS2-EN-NOT-M005-000001, is not at the optimum location relative to the station footprints.	The alignments, (alignment D in particular), have to adopt reverse curves in order to approach Node 3 at the specified bearing.	Opportunity	Relocation of Node 3 and/or its approach bearing would shorten the northern sections of the route, in particular Alignment D. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Decrease in cost	Key Assumption
52	Alignment	Manchester north tunnel	The route alignment between Manchester Piccadilly and Node 3 will be wholly underground.	The level of the track at the proposed underground station (shallow option) together with the rising landscape towards node 3 and limitations of track gradient render the potential to emerge from the ground before node 3 impractical. This has been excluded from the design remit following instruction with HS2.	Risk	The design would then need to account for civil works to provide a tunnel portal and consider the land impacts on the high density housing. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in cost	
53	Alignment	North portal	The location of any portal north of Node 3 is outside the remit of this study.	Limits of the work are established in the scope in document P2B-HS2-EN-NOT-M005-000001	Risk	The design would then need to account for civil works to provide a tunnel portal. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in cost	
54	Alignment	Train stabling facility	Any requirement for a dedicated stabling facility shall be accommodated north of Node 3, and is outside the remit of this study.	The options for train stabling (if required) are to either provide an surface site or an underground facility. The limitations on track design together with the dense building occupation of the area make the former impractical whilst the latter would add disproportionate costs to the scheme. This has been excluded from the design remit following instruction with HS2.	Risk	A track spur together with tunnels and potentiality in the case of an under ground structure almost a separate 'underground station' would be needed (without the need to accommodate passengers. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in cost	
55	Alignment	Sheffield Connectivity	A connection to Sheffield from the Leeds bound (northern) section of the route has been excluded from this study	Excluded from the design remit following instruction from HS2 on the premise that that alignments are wholly underground between Piccadilly and Node 3.	Risk	The track layout would need to account for a double junction to provide a connection to Sheffield which would need to be located underground, or alternatively the alignment would need to be brought to the surface south of Node 3. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in cost	Key Assumption
56	Alignment	Sheffield Connectivity	A connection to Sheffield from the Leeds bound (northern) section of the route has been excluded from this study	Excluded from the design remit following instruction from HS2 on the premise that that alignments are wholly underground between Piccadilly and Node 3.	Opportunity	The current complexity of the Leeds end throat may allow for Sheffield connectivity within the proposed Station approach. Whilst it would involve more complex civils work at the Leeds end of the station to create an underground double-junction, the combined Leeds/Sheffield access may then be accommodated within, or in close proximity to, the current proposed throat layout. This would be subject to further information relating to NPR's operational requirements becoming available at a later date, with the later design development exceeding the remit of this study and being subject to one of the options being progressed.		
57	Alignment	Platforms (Lengths)	Platform lengths (currently proposed as 415m) are sufficient for splitting and joining of trains.	As defined in HS2-HS2-DS-REP-600-000010 P01 - (HS2 NPR Manchester Pic Combined Underground Long List)	Risk	Platform lengths may be required to increase by up to 50m to accommodate splitting and joining of trains.	Increase in cost	Key Assumption
58	Alignment	Platforms (Stabling)	It is assumed that implementation of protection points for the stabling of trains in stations platform are not required.	Although HS2 will be using the outer platforms for stabling of trains it is still part of the station infrastructure.	Risk	The throat box/cavern may need to increase in size to incorporate protection points. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in cost	
59	Alignment	System Handover	HS2 / NPR System Handover requirements shall be developed at later design stages.	With the northern section of the route being wholly underground, consideration of a suitable system handover has been excluded from this study.	Risk	It is acknowledged that a system handover, if required to be located between Piccadilly and Node 3, will be above surface. This will require significant further development of vertical and horizontal alignments for both routes, with cognisance of the rising topography (circa 1% gradient) to the north of Piccadilly. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in cost	Key Assumption
60	Alignment	Transition from Terminal to Through station	It is assumed that the current alignment design (based on final state operations) can be adapted to incorporate buffer stops and stress transitions to function as a terminal station.		Risk	The length of station box may increase. Noting that any further design development exceeds the remit of this study and would be subject to one of the options being progressed.	Increase in cost	
61	Rail Systems	Traction Power	The HS2 / NPR system handover location has not been identified due to track alignment and topography constraints and thus has been excluded from the study.	Handover locations are required to be on an open relatively straight and level length of track.	Exclusion	Determination of location of the handover could result in an increase in HS2 traction power infrastructure and the addition of a new ATS Feeder Station at significant cost.	Increase in cost	Key Assumption
62	Rail Systems	Rail Operations	Dwell time of a turnback station is assumed to be 5 minutes whereas dwell time of a through station is assumed to be 3 minutes.	Agreed assumption across the HS2 works and allows the rail operations to determine the journey times and capacity.	Assumption	Suitable timetabling and consequently appropriate sizing of the station could be affected.	Increase in cost	

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63	Rail Systems	Rail Operations	Train Stabling when NPR services are running is assumed to be required in order to efficiently manage train movements but has been excluded from the baseline and option designs.	Identification of a suitable train stabling location and design is not possible at this level of design and can be assumed to be reasonably consistent between the baseline and options thus cancelling out as a differentiator.	Exclusion	Element of capital costs not captured in the design. Further work required to define stabling requirements and then propose a suitable design in a suitable location.	Increase in cost	Key Assumption
64	Rail Systems	Tunnel Ventilation	Vent Shafts along the route are assumed to be similar in layout and configuration to those in the baseline design	Vent Shaft locations require a specific layout suitable for the location in order to fit into the surrounding environment with minimal interference to that environment. Each requires a Sift itself.	Assumption	Significant change in location or layout could affect the headway.	Increase in time	
65	Rail Systems	Tunnel Ventilation	Fan orientation is assumed to be horizontal.	The CP3 design has vertical fans but is going to change through the AP stage to horizontal fans. In order to ensure there are no 'showstoppers' in line with the scope, the horizontal fans were adopted in this study in order to assess the worst case ground footprint.	Assumption	Location of the vent shafts, most particularly those at the crossover boxes may need to be relocated to alternative locations, affecting track layout and operational headway parameters.	Increase in time	
66	Rail Systems	Tunnel Ventilation	It is assumed that NPR rolling stock are electric powered and the design fire is not greater than the HS2 design fire load.	In order to apply a like for like design to the baseline.	Assumption	Tunnels and shafts could require increased design interventions to mitigate any increased fire loading.	Increase in cost	
67	Rail Systems	Tunnel Ventilation	Assume NPR rolling stock heat release rejection and design fire load is no different to HS2 rolling stock specification.	The ventilation system design is based on an agreed design fire load.	Risk	This impacts the ventilation capacity in the tunnel and in the station.	Increase in cost	
68	Rail Systems	Tunnel Ventilation	Assume south porous portal length remains unchanged.	HS2 aerodynamicist has not been engaged to produce aerodynamic modelling for this tunnel configuration. As a consequence project has retained existing length of porous portal	Risk	This impacts the length of porous portal.	Increase in cost	
69	Rail Systems	General	All infrastructure up to the identified handover location will be owned and operated by HS2 Ltd.	Standard practice to delineate two different rail systems at a point where the power and signalling systems are independent of each other.	Assumption	An alternative approach would lead to a more complicated ownership and control mechanism that would need further design analysis to prove.	Increase in time	Key Assumption
70	Rail Systems	Construction & Logistics	It is assumed that there will not be any phased opening of the Manchester spur i.e. an early phasing of entry into service for Manchester Airport is not considered.	Changing this entry into service strategy would alter the baseline strategy and add further complexity to the construction of the scheme with little added benefit compared to the disruption caused.	Assumption	Added complexity of breaking the opening sequence of Manchester Airport ahead of Manchester Piccadilly would ultimately delay the entry into service of the HS2 trains and add complexity to how to deliver this partial phase.	Increase in cost	Key Assumption
71	Rail Systems	Construction & Logistics	NPR is assumed to be completed at a point in time after the entry into service of the HS2 trains.	Strategic programme of the NPR construction is unknown and so assumed to follow the completion of the HS2 construction in line with the strategy of the NPR Remit 6 works.	Assumption	Greater interface and possible supply chain shortfalls to initiate two major programmes of works in parallel	Increase in time	
72	Rail Systems	Construction & Logistics	The NPR construction would require a railhead somewhere east of Manchester Piccadilly	The railhead at Ashlet depot will be decommissioned on completion of the HS2 works.	Assumption	Consequences of trying to maintain the Ashley railhead would require line sharing of the live HS2 lines with NPR construction traffic which would significantly affect progress of constructing the NPR line.	Increase in time	
73	Rail Systems	Construction & Logistics	The eastern throat is assumed to be built in the initial phase to allow for installation of the sequential phase of NPR rail systems infrastructure in a manner that does not significantly impact the operation of the HS2 trains.	Reasonable space needs to be provided to allow for construction of the NPR infrastructure without affecting a live railway adjacent.	Assumption	Increase in service disruption to the HS2 network would affect the realised benefits and be a significant reputational issue to close a new railway for long periods if it has only just opened.	Increase in time	Key Assumption
74	Traffic and trans	Transport impact	Detailed transport modelling has not been undertaken.	Not included in the instruction.	Exclusion	Traffic and transport impact on the highway network for both operations and construction have been assessed qualitatively.	Increase in cost	Key Assumption
75	Station Design	Services	Indicative Back of House and Plant requirement has been taken into account as space proofing. Detailed design not developed at this stage.	Back of House areas have been developed with input form Tunnel ventilation engineers including space provisions. While station operations are informed by understanding of baseline design they have not been laid out to the same level of detail given the programme. Railway operations within the building have not been defined and would require detailed brief in subsequent design stages.	Assumption	Sizing of station may need to increase if additional space is required.	increase in cost	
76	Traffic and trans	Transport Impact	Metrolink requirement has been safeguarded through space proofing at this stage of design. Detail design not developed at this stage. Space proofing assumptions has been based upon Baseline Option	Metrolink requirement has been developed using Baseline Option design with input from TfGM through design workshops. Whilst track and station are informed by understanding of baseline design they have not been laid out to the same level of detail given the programme.	Assumption	Sizing of station and track may need to increase if additional space is required	Increase in cost	
77	Traffic and trans	Transport Impact	Forecourt requirement has been safeguarded through space proofing at this stage of design. Detail design not developed at this stage. Space proofing assumptions has been based upon Baseline Option	Forecourt facility allocation has been developed with input from traffic and transport engineers. Space provision in baseline design has been developed up building layout detail.	Assumption	Sizing of forecourt facility may increase if additional space is required	Increase in cost	

16 Appendix C – Sift matrix

HS2

hybrid Bill design alternatives for HS2 and NPR Underground Options at Manchester Picccadilly

Sift Appraisal - Summary of node to node ratings

Location	Manchester Piccadilly Station for HS2 and NPR
Purpose of Sift	to assess alternative Underground options for integrating HS2 and NPR at Manchester Piccadilly
Sift Level	2

Options Considered	**BASELINE** hBD Surface Station for Phase 2b + NPR route to Node 3	**Option B** Combined Underground - deep box station		**Option B1** Combined Underground - 'shallow' box station		**Option D** Combined Underground - hybrid box/mined station	
Description	*A terminus station with on viaduct at surface level. Approach to the station is on viaduct and includes for grade seperated junction for route to Manchester Airport High Speed Station and route towards Leeds (Node 3) for NPR*	*A through underground station, the main station box is constructed top down with diaphragm wall and the approaches are mined construction. The Metro station remains unaltered under the classic station, car parking numbers as per the Baseline.*		*A through underground station, the main station box and approaches are constructed top down with diaphragm walls . The Metro station has been relocated and enlarged, car parking numbers as per the Baseline.*		*A through underground station. The reduced station box is constructed top down with diaphragm walls . The approaches and additional outside platforms will be constructed using a mining technique. The Metro station has been relocated and enlarged, car parking numbers as per the Baseline.*	
Headings	**ROUTE DEVELOPMENT PROCEDURE RATING**	**ROUTE DEVELOPMENT PROCEDURE RATING**	**RELATIVE RANKING FOR COMPARISON OF UNDERGROUND OPTIONS**	**ROUTE DEVELOPMENT PROCEDURE RATING**	**RELATIVE RANKING FOR COMPARISON OF UNDERGROUND OPTIONS**	**ROUTE DEVELOPMENT PROCEDURE RATING**	**RELATIVE RANKING FOR COMPARISON OF UNDERGROUND OPTIONS**
Strategic Fit - HS2 Strategic Goals	O	O	3	O	1	O	3
Strategic Fit - Urban Design	O	+	2	+ + +	1	O	3
Construction Feasibility - route	O	- - -	3	- - -	3	- -	1
Construction Feasibility - station	O	- - -	2	- - -	1	- - -	3
Operation Feasibility - railway operations	O	+	0	+	0	+	0
Operation Feasibility - station design	O	O	0	O	0	O	0
Operational Feasibility - passenger & place	O	- - -	3	- -	2	- -	2
Maintenance	O	- -	0	- -	0	- -	0
Environment	O	- - -	1	- - -	3	- - -	2
Stakeholders	O	+	0	+	0	+	0
Commercial Development	O	- -	2	+	1	- -	3
Commitments	N/A	N/A	0	N/A	0	N/A	0
Health and/or Safety	O	- - -	2	- - -	1	- - -	3
Demand - Journey Times	O	O	2	O	2	+	1
Cost - station	O	- - -	2	- - -	1	- - -	2
Cost - route	O	- - -	3	- - -	2	- - -	1
Cost - total for node to node	O	- - -	2	- - -	1	- - -	3
Phasing Opportunities	O	O	0	O	0	O	0
Schedule and Delivery into Service	O	- - -	3	- - -	2	- - -	3
HS2 Ltd Preferred Option:	Preferred Option						
Reason:	All combined Underground options are comparitively worse performing in the majority of categories - notably for construction feasibility, environment and health and safety.	Whilst alignments B, B1, and D all represent a worsening compared to the baseline option, on balance the Option B/B1 alignment is considered marginally better due to less community and health impacts, particularly on the Lumb Lane vent shaft site. However, Option B/B1 generates worse impacts on land quality and waste/minerals due to the Barlow Tip vent shaft so in the instance that either alignment be taken forward, a detailed review of the current indicative vent shaft location is recommended to try and remove or reduce the environmental impacts identified in this sift.					
Stakeholder Preferred Option:							
Reason:							

Notes

1. Guidance for rating

- - -	Major worsening on the Comparator Scheme
- -	Minor worsening on Comparator Scheme
O	Neutral / no change to Comparator Scheme
+	Minor improvement on Comparator Scheme
+ + +	Major improvement on Comparator Scheme
N/A	Not applicable

2. Guidance for Strategic Fit – Urban Design SIFT Appraisal Criteria

People
i. Design for the needs of our diverse audience (inclusive design)
ii. Engage with communities over the life of the project
iii. Inspire excellence through creative talent (multi-
dis. teamwork)

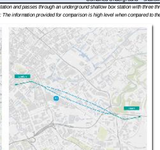
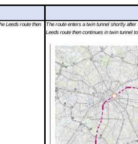
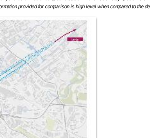
Agglomeration: does the design facilitate the social and economic dynamic of the city for its community (at the city scale)?
Place
iv. Design places and spaces that support quality of life (regeneration)
v. Celebrate the local within a coherent national narrative (identity)
vi. Demonstrate commitment to the natural world

Placemaking: does the design enhance/ distract the existing city fabric/ network?
Time
vii. Design to adapt for future generations (future-proofing/ whole-life costs)
viii. Place a premium on the personal time of customers (interchange)
ix. Make the most of the time to design (creative culture)

Design sustainability: is the design flexible to adapt to changing city (economic and environmental) dynamic?
Legacy
What design success looks like:
i. National pride in the system is matched by a sense of local ownership.
ii. Adds to our (HS2 route/ national/ local) cultural and natural heritage

Does the design create a new civic building/ space that is reflective of Manchester city/ does the city proud?

Location	Manchester Piccadilly , MAxx - Node MA (Manchester Airport tunnel portal) to Node 3 (NPR route towards Leeds)
Purpose of Sift	to assess alternative Underground options for integrating HS2 and NPR at Manchester Piccadilly
Sift Level	2

Options Considered		BASELINE HbD Surface Station for Phase 2b + NPR route to Node 3		Option B Combined Underground - deep box station		Option B1 Combined Underground - 'shallow' box station		Option D Combined Underground - hybrid box/mined station	
Description: All routes start at Node MA, the propsed portal location at Manchester Airport and terminate at node 3.		*The route enters a twin tunnel shortly after Manchester Airport station and emerges to the west of Ardwick depot and enters a four platform terminating surface station adjacent to the classic rail station. The onward passage of NPR trains would then be facilitated by returning to Ardwick and crossing over the HS2 line, eastward towards the Gorton area. At Gorton rolling stock sidings are provided. The route then continues towards Leeds running in tunnels to Node 3, located southeast of Oldham. The Baseline information is taken from the more IPD design for HS2 and the Remit 6 design study for the provision of NPR.*  Baseline Track & Route  Baseline Surface Station		*The route enters a twin tunnel shortly after Manchester Airport station and passes through a deep box underground station with three through platforms orientated approximately east-west and adjacent to the existing classic rail station . The Leeds route then continues in twin tunnel to Node 3, located southeast of Oldham. Note: The information provided for comparison is high level when compared to the detail of the Baseline design.*  Alignment B Track & Route  Alignment B Deep Box		*The route enters a twin tunnel shortly after the Manchester Airport station and passes through an underground shallow box station with three through platforms orientated approximately east-west and adjacent to the existing classic rail station . The Leeds route then continues in twin tunnel to node 3, located southeast of Oldham. Note: The information provided for comparison is high level when compared to the detail of the Baseline design.*  Alignment B1 Track & Route  Alignment B1 Shallow Box		*The route enters a twin tunnel shortly after the Manchester Airport station and passes through a hybrid box/mined underground station with three through platforms orientated approximately northeast-southwest and adjacent to the existing classic rail station . The Leeds route then continues in twin tunnel to Node 3, located southeast of Oldham. Note: The information provided for comparison is high level when compared to the detail of the Baseline design.*  Alignment D Track & Route  Alignment D Hybrid	
Headings	**Appraisal Criteria**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**
Strategic Fit - HS2 Strategic Goals	The scheme will be assessed against the HS2 Ltd strategic goals and programme benefits and ensure that they are being met.	**1. Catalyst for growth** The design aim to integrates with Manchester City Council (MCC) Manchester Piccadilly Strategic Regeneration Framework (SRF) and support the MCC Manchester Core Strategy (MCS) 2012 – 2027 Policy CC1 to expand beyond the Ring Road to the East as part of Chancellor Place City Fringe Growth Area. All Alignment Options supports and integrate with Manchester Piccadilly SRF with additional development opportunities provided as Over Site Development that is unique to Underground Options. All Alignment Options will support MCS Policy CC1 allowing redevelopment opportunity to the east of Ring Road (Chancellor Place City Fringe Growth Area) albeit with varying degrees of challenges for each alignment options. With HS2 Alignment Option B, B1 and D being located below ground, these alignment options will have limited HS2 surface facilities, allowing the land to be redeveloped according to the market. Redevelopment to the east of Ring Road will be challenging in Baseline Option due to the nature of elevated HS2 alignment, limiting north-south connectivity and reducing the amount of land available for redevelopment. Although it is challenging to redevelopment the industrial hinterland to the east of Ring Road in Baseline Option, it is still possible as tested in HS2 Manchester Piccadilly Station Hybrid Bill Urban Integration Study (2DE01-MWJ-EN-REP-M005-000014 P02). In Baseline option, the redevelopment area to the east of Ring Road will be dependent on the arrival of TfGM proposed Hooper Street Tram Train Station to service the land to the north of proposed HS2 embankment and the increase service frequency of Ardwick Network Rail Station to service the land to the south of proposed HS2 embankment. **2. Capacity and connectivity** The design delivers city centre connectivity i.e. Manchester to Birmingham and London. The ITSS in the agreed scope also facilitates NPR services to/from Liverpool, Leeds, and other locations across the north of England. Connectivity is provided with the existing National Rail station. Integration with complementary transport modes, such as Metrolink, is enabled. This is reflected in the scoring of Operational Feasibility - Station for Passenger and Place. Improvements to journey times for HS2 and NPR provide benefits across the whole rail network. **3. Value for money** The underground options are more expensive and have a later delivery-into-service date than the baseline option. Commercial viability remains as per baseline - same services in the ITSS are used for both baseline and comparator options. Regarding whole life value, the underground options provide commercial development opportunity to recoup value. **4. Passenger Experience** The design provides an underground station with ease of modal interchange e.g. it has been shown that passengers can walk to a classic train service within the NR accepted ten minute interchange threshold for Manchester Piccadilly Station. Increased vertical circulation for the underground options, compared to broadly horizontal circulation for the surface station, will provide a different passenger experience. This is reflected in the scoring of Operational Feasibility - Station for Passenger and Place. **5. Skills and employment** The design will provide employment opportunities for the construction and operation of the station. No differentiator between the surface and underground options is anticipated within this strategic goal at this design stage. **6. Achieving new standards** Designs have been delivered in accordance with HS2 standards. The construction and operation of an underground station introduces additional health and safety risks over and above that present for the surface station. This is reflected in the scoring of Health and/or Safety.	o	**1. Catalyst for growth** The design aim to integrates with Manchester City Council (MCC) Manchester Piccadilly Strategic Regeneration Framework (SRF) and support the MCC Manchester Core Strategy (MCS) 2012 – 2027 Policy CC1 to expand beyond the Ring Road to the East as part of Chancellor Place City Fringe Growth Area. 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	Does the option meet the strategic needs of the HS2 and NPR ITSS?	The Indicative Train Service Specification (ITSS) for HS2 Phase 2b hB can be achieved with the design and does not not preclude Northern Powerhouse Rail Maintenance of the trackworks in this combined NPR/HS2 approach throat could result in disruption to services both south and north of Piccadilly.	o	The Indicative Train Service Specification (ITSS) for HS2 Phase 2b hB can be achieved with the design and does not not preclude Northern Powerhouse Rail Maintenance of the trackworks at one end of the station would not necessarily impact on operations at the other end..	o	The Indicative Train Service Specification (ITSS) for HS2 Phase 2b hB can be achieved with the design and does not not preclude Northern Powerhouse Rail Maintenance of the trackworks at one end of the station would not necessarily impact on operations at the other end..	o	The Indicative Train Service Specification (ITSS) for HS2 Phase 2b hB can be achieved with the design and does not not preclude for Northern Powerhouse Rail Maintenance of the trackworks at one end of the station would not necessarily impact on operations at the other end..	o
Strategic Fit - Urban Design	Assess how the design of the HS2 asset addresses its context and delivers good Urban design, integration and legacy in line with HS2 guidance	An urban integration design was developed as part of a separate detailed study undertaken with the consultation Stakeholders under the guidance of HS2.	o	Urban integration has been developed against this option through the consultation with Stakeholders.	o	Urban integration has been developed against this option through the consultation with Stakeholders.	o	Urban integration has been developed against this option through the consultation with Stakeholders.	o
	Assess the option with respect to three core HS2 Design vision principles of people, place and time.	**Reviewing against the three core principles & legacy:** People Rail infrastructure elevated on a viaduct allowing for groundfloor flow within an elongated station body. Elongated station activates Piccadilly SRF Boulevard, agglomeration opportunity. Place Strong civic / public realm in the form of The Boulevard as proposed by Piccadilly SRF. Station forecourt sits behind Gateway house connected to existing NR elevated forecourt. Time Efficient interchange between NR, Metrolink uses. Elevated station has inherent flexibility to adapt possible future change to station operation. ASD have greater flexibility commercial and physically in comparison to OSD. Legacy As elevated station, it delivers a strong 'gateway station' building that complements existing NR station with prominence along the main future development thoroughfare (Piccadilly SRF proposed Boulevard). Adding value to Piccadilly SRF. Nonetheless, the strong 'gateway station' image is located behind Gateway House offering limited city-wide presence.	o	**Reviewing against the three core principles & legacy:** People: Rail infrastructure underground enhances city groundfloor (flow) dynamic and agglomeration opportunity; enhanced. Place: Strong civic/ public realm surrounding and integrated across station box; enhanced placemaking. Spatial relation potentially limited and constraint by close proximity of NR Station and listed London Warehouse Time: Station and OSD limited construction and commercial flexibility; but OSD building change-of-use possible Station Ticketthall future flexibility also limited by proximity to NR Station and listed London Warehouse Legacy: With Gateway House demolished in Alignment B, the HS2 Station will be located in an area with clear sight of view. With strong public presence in comparison to a hidden station in Hybrid Bill Design. Offers an opportunity to create a improved 'gateway' station building with civic benefit. [Relative ranking for underground options: = 2]	+	**Reviewing against the three core principles & legacy.** People: Rail infrastructure underground enhances city groundfloor (flow) dynamic and agglomeration opportunity, enhanced. Place: Strong civic/ public realm surrounding and integrated across station box; enhanced placemaking; Gateway plaza becomes one of the key destinations of the city, providing city-wider opportunity; Pedestrian boulevard placed between NR and OSD (HS2) development. Time: Station and OSD limited construction and commercial flexibility; but OSD building change-of-use possible. Alignment B1 location offers future flexibility for development of the urban realm around the Gateway Plaza, including the expansion of HS2 tickethall and connection of gateway plaza to the new NR northern entrance. Legacy: With Gateway House demolished in Alignment B1, the HS2 Station will be located in an area with clear sight of view. With strong public presence in comparison to a hidden station in Hybrid Bill Design. Offers an opportunity to create a improved 'gateway' station building with civic benefits. Design delivers a strong 'gateway' station city quarter and civic plaza; enhanced [Relative ranking for underground options: = 1]	+++	**Reviewing against the three core principles & legacy:** People: Rail infrastructure underground city groundfloor dynamic and agglomeration opportunity limited in comparison to other alignments Although station will encourage regeneration of Piccadilly SRF area, however the structure of the urban framework will be different from the envisioned scheme by MCC. Place: Station Insertion into city fabric – limited city-wide placemaking (i.e. The Boulevard) but encouraging local placemaking opportunity (i.e. additional opportunity, such as a series of connected pocket park); Suggest a limited city expansion opportunity that is in direct adajcency to HS2 Station. Hybrid Bill Design Station area would be available for regeneration albeit not part of ASD development area and outside of CCB. Potentially limited and constraint by close proximity of NR Station, listed buildings and sensitive receptors. Time: Station and OSD limited construction and commercial flexibility; but OSD building change-of-use possible. Alignment does offer significant new development area outsie of CCB which is not above station site. Station ticketthall future flexibility also limited by proximity to NR Station, listed buildings and sensitive receptors. Legacy: With Gateway House demolished in Alignment D, the HS2 Station will be located in an area with clear sight of view. With strong public presence in comparison to a hidden station in Hybrid Bill Design. Offers an opportunity to create a improved 'gateway' station building. City facing 'Gateway' entrance to the south with a synegtic connection between HS2 Ticket Hall and NR Station as a fulcrum connecting the city and Metrolink plaza. Creating a new major civic square for Manchester. Northern and Southern HS2 Tickethall are constraint with limit future flexibility for growth in comparison to Alignment B and B1. [Relative ranking for underground options: = 3]	+
Construction Feasibility - Route	Assess the route alignment changes, i.e formation of route and length of route	A total route length from node to node of approximately 25km comprising 20km of tunnel.	o	Route length Airport Station (mid-platform) to Node 3 = 28.14km Airport Station Portal is 750m north of mid-platform Total route approximately 25.5km in twin bore tunnel, plus 590m long mined throats and 130m long outer scissors caverns at either end of a 465m long x 77m wide x 38m deep station box.		Route length Airport Station (mid-platform) to Node 3 = 28.14km Airport Station Portal is 750m north of mid-platform Total route approximately 25.9km in twin bore tunnel, plus 376m long open cut throats and 130m long outer scissors caverns at either end of a 465m long x 77m wide x 28m deep station box.		Route length Airport Station (mid-platform) to Node 3 = 25.33km Airport Station Portal is 750m north of mid-platform Total route approximately 23.9km in twin bore tunnel, plus 509m long mined throats and 130m long outer scissors caverns at either end of a 465m long x 50m wide x 38m deep station box with 2 x 465m outer platform tunnels.	
	Assess the relative complexity of construction	Section of route from Manchester Tunnel North Portal is in retained structure, short section of embankment and then Station Approach Viaduct. These are standard construction techniques with low risk. Slight complexity with need to amend the existing highways but Options B1 and D also have impacts on highways including A635 Mancunian Way. HS2 Manchester Tunnel is driven from both directions. North drives start from Ardwick with excavated material removed by rail. South drives start from Airport Station with excavated material removed by road. Reduced tunnelling rate at Airport due to practical limit of vehicles. TBMs recovered from Palatine Road Shaft. 4 Ventilation Intervention Shafts on route.	o	HS2 Running Tunnels and Intervention Shafts. Similar to baseline in complexity. Longer tunnel drives increase risk of TBM mechanical breakdowns. Drive rate from south is reduced. Palatine Road Shaft size can be reduced. Settlement damage to utilities and buildings is a risk. This may require utility protection, utility diversion, building protection and support. Compared to HBD, the HS2 bored tunnels alignment for B passes under much more of the city centre and several listed buildings. Overall more risk and complexity than the existing Hybrid Bill Scheme. NPR Running Tunnels and Intervention Shafts. Not in baseline but considered similar in complexity. **[Relative ranking for underground options: =3]**	---	HS2 Running Tunnels and Intervention Shafts. Similar to baseline in complexity. Longer tunnel drives increase risk of TBM mechanical breakdowns. Drive rate from south is reduced. Palatine Road Shaft size can be reduced. Settlement damage to utilities and buildings is a risk. This may require utility protection, utility diversion, building protection and support. Compared to HBD, the HS2 bored tunnels alignment for B1 passes under much more of the city centre and several listed buildings. Overall more risk and complexity than the existing Hybrid Bill Scheme. NPR Running Tunnels and Intervention Shafts. Not in baseline but considered similar in complexity. **[Relative ranking for underground options: =3]**	---	HS2 Running Tunnels and Intervention Shafts. Similar to baseline in complexity. Longer tunnel drives increase risk of TBM mechanical breakdowns. Drive rate from south is reduced. Palatine Road Shaft size can be reduced. Settlement damage to utilities and buildings is a risk. This may require utility protection, utility diversion, building protection and support. Compared to HBD, the HS2 bored tunnels alignment for D ends a similar distance from the city centre and does not impact listed buildings. Overall more risk and complexity than the existing Hybrid Bill Scheme. NPR Running Tunnels and Intervention Shafts. Not in baseline but considered similar in complexity. **[Relative ranking for underground options: =1]**	--
	Assess the relative construction programme	Overall programme has Manchester Tunnel as the critical path to the overall Delivery into Service date of HS2 Phase 2b Western Leg. The Piccadilly Station works are close to the critical path. 2no. TBMs driven from Airport to Palatine Road vent shaft, 2no. TBMs driven from Ardwick to Palatine Road vent shaft. Station and bored tunnels close to critical path for Phase 2b western leg. From hybrid Bill Royal Assent to Handover to Client is approx. 10.5 years.	o	Due to inability to drive TBMs from Manchester Piccadilly to the South, bored tunnels driven only from Airport. This increases the bored tunnels construction programme. However, the station programme will be significantly longer than baseline and will be the critical path for Phase 2b western leg. Construction duration from hybrid bill Royal Assent to Handover to Client is approx. 14.5 years.	---	Due to inability to drive TBMs from Manchester Piccadilly to the South, bored tunnels driven only from Airport. This increases the bored tunnels construction programme. However, the station programme will be significantly longer than baseline and will be the critical path for Phase 2b western leg. Construction duration from hybrid bill Royal Assent to Handover to Client is approx. 15.5 years.	---	Due to inability to drive TBMs from Manchester Piccadilly to the South, bored tunnels driven only from Airport. This increases the bored tunnels construction programme. However, the station programme will be significantly longer than baseline and will be the critical path for Phase 2b western leg. Construction duration from hybrid bill Royal Assent to Handover to Client is approx. 15.5 years.	---
	Assess the relative disruption to existing infrastructure, e.g. rail, highways, etc.	All route in tunnel except for short section up to station from the North portal. Approach Viaduct interfaces with Mancunian Way, Fairfield Street and Chancellors Lane with a few other minor roads this overlaps with the Station Considerations. .	o	Similar to HBD.	o	Similar to HBD.	o	Similar to HBD.	o
Construction Feasibility - Station	Assess the relative complexity of construction, this includes an assessment of the volume and removal of excavated material and the extent of the construction footprint.	Station structure consists of shallow below ground Metrolink Box for 4 platform tram stop, Station track viaduct and platforms and Station Shed structure. All works in are in open area following demolitions and geotechnical risk is low. Possible to maintain Metrolink Ashton Line through large period of works and this is included in the sequence. The works use proven construction methodologies and is similar to other major station works previously carried out in UK. It is considered less complex than HS1 St Pancras Station and NR London Bridge Station. There are a few sub elements with a degree of complexity including coordination of Metrolink works and underpinning of Gateway Hose for the Metrolink Western Entrance. Approx. 335,000m³ excavated material from Metrolink box removed by road. CCB areas = 45.6 ha Includes Manchester tunnel Drive site	o	Deep box station: Involves more geotechnical risk and is more complex than baseline. Scale of construction is much larger in terms of volumes of excavation, consumption of materials (e.g. concrete), and time. Station Box is deep and partially in rock. Diaphragm Wall/Piled retaining walls installation and overall excavation rates will be reduced in rock. Mined throat and outer scissors caverns: No precedent in the scale and the construction in ground conditions for such large caverns in close proximity to each other, and in an urban setting. Mined Approach structures have increased complexity related to ground and groundwater conditions. Likely that extensive ground treatment and partial dewatering required. Ground between structures may need to be replaced by pillars. Involves significantly more geotechnical risk than the baseline. Approx. 2,107,000m³ excavated material from station box and mined approaches >90% removed by rail. CCB areas = 27.5 ha Overall significantly more scale and complexity compared to baseline. **[Relative ranking for underground options: =3]**	---	Shallow box station: Involves more geotechnical risk and is more complex than baseline. Scale of construction is much larger in terms of volumes of excavation, consumption of materials (e.g. concrete), and time. Station Box is not as deep at Option B but still requires construction in rock. Diaphragm Wall/Piled Retaining Walls installation and overall excavation rate will be reduced in rock. Approach throat structures are in retained cut and cover boxes. The section towards Ardwick crosses the River Medlock, Fairfield Street, Mancunian Way and Ashton Old Road. These will need temporary realignments and reinstated back on top of the cut and cover box. Approx. 2,254,000m³ excavated material from station box and mined approaches >90% removed by rail. CCB areas = 43.4 ha Overall significantly more scale and complexity compared to the baseline. Extent of mined structures less than options B1 and D and so the geotechnical risk is reduced in area of impacts. **[Relative ranking for underground options: 1]**	---	Deep box station: Involves more geotechnical risk and is more complex than baseline. Scale of construction is much larger in terms of volumes of excavation, consumption of materials (e.g. concrete), and time. Station Box is deep and similar to Option B in being partially in rock. Diaphragm Wall/Piled Retaining walls and excavation rates will be reduced in rock. Station Box extends into Gt Ancoats Street requiring temporary diversion and instatement including utilities. Station Box crosses Ashton Canal. This needs to be closed during construction and reinstated onto of the structure Mined throat and outer scissors caverns: No precedent in the scale and the construction in ground conditions for such large caverns in close proximity to each other, and in an urban setting. Mined Approach structures has increased complexity related to ground and groundwater conditions. Likely that extensive ground treatment and partial dewatering required. Ground between structures may need to be replaced in pillars. Involves significantly more geotechnical risk than the baseline. Approx. 1,626,000m³ excavated material from station box, outer platforms and mined approaches >90% removed by rail. CCB areas = 36.2 ha Overall significantly more scale and complexity compared to the baseline. **[Relative ranking for underground options: =3]**	---
	Assess the relative construction programme	From hybrid bill Royal Assent to Handover to Client approx. 10.5 years.	o	Construction duration from hybrid bill Royal Assent to Handover to Client is approx. 14.5 years. **[Relative ranking for underground options: =3]**	---	Construction duration from hybrid bill Royal Assent to Handover to Client is approx. 15.5 years. This underground option has less programme risk than B and D, because it doesn't have the mined approaches. **[Relative ranking for underground options: 1]**	---	Construction duration from hybrid bill Royal Assent to Handover to Client is approx. 15.5 years. **[Relative ranking for underground options: =3]**	---
	Assess the relative disruption to existing conventional rail infrastructure	Disruption to NR facilities, car parks, Loading Bay and offices. New facilities re provided.	o	Disruption to NR facilities, car parks , loading bay and offices similar to HbD. New facilities re provided. Demolition of Gateway House and Station Approach Ramps additional to baseline. Will need to be managed during construction.	o	Disruption to NR facilities, car parks, loading bay and offices similar to hBD. Demolition of Gateway House and Station Approach Ramps additional to baseline. Will need to be managed during construction.	o	Disruption to NR facilities, car parks and loading bay similar to hBD for Metrolink Facilities. No demolition of Network Rail Square One building. The Metrolink Tram surface works and new entrance location has similar impacts on NR station to hBD. Demolition of Gateway House and Station Approach Ramps additional to baseline. Will need to be managed during construction.	o
	Assess the relative disruption to existing Metrolink infrastructure	Closure of Ashton branch during construction. Shallow box enables period of closure to be reduced (8 months single line working, 23 months full closure). Existing Piccadilly Tram Stop is removed.	o		---	Closure of Ashton line during construction for approx. 9 years. It is not possible to maintain operation over the deep box construction. Closure duration is longer than baseline. Existing Piccadilly Tram Stop is removed and replaced in a new location with 4 longer platforms as per baseline.	---	Able to maintain existing line for majority of period of construction. Will be realigned for a new 4 platform surface tram stop. Period of closure will be less than hBD but still disruption. Existing Piccadilly Tram Stop is removed and replaced in a new location with 4 longer platforms as per hBD.	+
	Assess the relative disruption to existing highways infrastructure	Station Area. Approach Viaduct interfaces with Mancunian Way, Fairfield Street and Chancellors Lane with a few other minor roads. Impacts to minor highways around station including Travis Street and Sheffield Street.	o	Station Area highway disruption similar to baseline. Improvement on baseline by reduced impact from Approach Viaduct impacts on Mancunian Way.	+	Similar disruption to hBD but for longer duration. Mancunian Way area significantly impacted	--	No changes to Mancunian Way junctions needed, but diversion of Great Ancoats Street required at East end of station box including utilities.	o
	Assess the relative disruption to existing utilities infrastructure	Major sewer along Travis Street impacted requiring diversion. Multiple major utilities in the vicinity of Piccadilly requiring diversion.	o	Travis Street sewer diversion still required. Limited scope for localised diversion/ integration into station design. Diversion of other major utilities broadly comparable to baseline design. King Street portal shaft may clash with or cause settlement damage to GUTE tunnel - TBC. Settlement above mined caverns may require protection and/or diversions of utilities.	--	Travis Street sewer diversion still required. Limited scope for localised diversion/ integration into station design. Diversion of other major utilities broadly comparable to baseline design. King Street portal shaft may clash with or cause settlement damage to GUTE tunnel - TBC. River Medlock requires diversion.	--	Impact on major Travis Street sewer diversion reduced. This sewer is in Gt Ancoats Street and will need diversion with the highway diversion. Alignment of Option D is pedominantly outside of utilities search area. Impact on major utilities in Gt Ancoats Street and London Road largely unknown. Ashton Canal closure for approx. 10 years. Mined approaches on West side may clash with or cause settlement damage to GUTE tunnel - TBC. (risk with potential significant impact) Settlement above mined caverns may require protection and/or diversions of utilities.	--
Operation Feasibility - railway operations	Assess the relative flexibility and reliability of the track layout	Meets the HS2 Phase 2b iTSS enables HS2 to be timetables around the Euston constraints by providing flexibility and capability at Manchester Piccadilly.	o	Likely minor incrrease in technical headways approaching the station due to fully tunnelled approach Track layout funcitonality otherwise comparable with CP3	--	Likely minor incrrease in technical headways approaching the station due to fully tunnelled approach Track layout funcitonality otherwise comparable with CP3	--	Likely minor incrrease in technical headways approaching the station due to fully tunnelled approach Track layout funcitonality otherwise comparable with CP3	--
	Assess the relative futureproofing capability of the track layout	Supports addition of NPR services on top of HS2 services without affecting the ability to timetable HS2 services around Euston.	o	Provides similar future proofing capability to Baseline	o	Provides similar future proofing capability to Baseline	o	Provides similar future proofing capability to Baseline	o
	Assess the station dwell requirements for HS2 and NPR services	HS2 will be 20 minutes for trains from Euston and 15 minutes for trains from Curzon St. NPR services require 5 minute reversal times for through services.	o	The dwell requirements of the underground option are assumed to be 3 minutes whereas the baseline is assumed to be 5 minutes. This provides a benefit to the journey time.	+	The dwell requirements of the underground option are assumed to be 3 minutes whereas the baseline is assumed to be 5 minutes. This provides a benefit to the journey time.	+	The dwell requirements of the underground option are assumed to be 3 minutes whereas the baseline is assumed to be 5 minutes. This provides a benefit to the journey time.	+
	Assess the relative train maintenance and servicing arrangements, e.g. Empty Coaching Stock moves	During HS2 only services, the expectation is to utilise the additional 2 platforms for stabling of peak strengthening train sets during off peak periods. Once NPR services come online then a stabling facility is identified in the NPR Remit 6 work but for comparison purposes, a similar stabling solution was not derived for the underground options and therefore is also excluded in the baseline for cost comparison purposes.	o	It is assumed that in the operation of the HS2 service in advance of the entry into service of the NPR insfrastructure that the arrangements are considered to be comparible to the baseline at this level of design. More design needs to be carried out to determine the effects of the NPR leg once details such as where a handover section can be achieved and therefore possible stabling locations identified to determine whether there is a benefit or loss experienced at this stage of operations.	o	It is assumed that in the operation of the HS2 service in advance of the entry into service of the NPR insfrastructure that the arrangements are considered to be comparible to the baseline at this level of design. More design needs to be carried out to determine the effects of the NPR leg once details such as where a handover section can be achieved and therefore possible stabling locations identified to determine whether there is a benefit or loss experienced at this stage of operations.	o	It is assumed that in the operation of the HS2 service in advance of the entry into service of the NPR insfrastructure that the arrangements are considered to be comparible to the baseline at this level of design. More design needs to be carried out to determine the effects of the NPR leg once details such as where a handover section can be achieved and therefore possible stabling locations identified to determine whether there is a benefit or loss experienced at this stage of operations.	o
Operation Feasibility - Station Design	Assess the effectiveness of location and space for station control	Overall space has been allocated for station operation however, operational requirements have not been identified or located at this level of detail.	o	Overall space has been allocated for station operation however, operational requirements have not been identified or located at this level of detail.	o	Overall space has been allocated for station operation however, operational requirements have not been identified or located at this level of detail.	o	Overall space has been allocated for station operation however, operational requirements have not been identified or located at this level of detail.	o
	Assess the effectiveness of location and space for accommodating staff, catering, transport police and other "back of house" activities	Overall space has been allocated for back of house facilities however, specific requirements have not been identified or located at this level of detail.	o	Overall space has been allocated for back of house facilities however, specific requirements have not been identified or located at this level of detail.	o	Overall space has been allocated for back of house facilities however, specific requirements have not been identified or located at this level of detail.	o	Overall space has been allocated for back of house facilities however, specific requirements have not been identified or located at this level of detail.	o
	Assess the effectiveness of location and space for passenger facilities such as ticket office, travel information, toilets, left luggage etc	Overall space has been allocated for passenger facilities however, specific requirements have not been identified or located at this level of detail.	o	Overall space has been allocated for passenger facilities however, specific requirements have not been identified or located at this level of detail.	o	Overall space has been allocated for passenger facilities however, specific requirements have not been identified or located at this level of detail.	o	Overall space has been allocated for passenger facilities however, specific requirements have not been identified or located at this level of detail.	o
	Assess the effectiveness of location and provision for ticket barriers	Not applicable	N/A	Not applicable	N/A	Not applicable	N/A	Not applicable	N/A
Operational Feasibility - Station for passenger & place	Assess Passenger Dispersal covering road (right of way), rail and public transport	Passengers leave at points along the platforms down to the street level concourse, 10m below, or if at the terminus end will continue along to the gateline gaining pedestrian access to the city or to the classic station. Below the street level concourse is the relocated Metro station and along the boulevard immediately outside access to taxi and car parking.	o	Passengers must travel approximately 37m vertically to reach street level from which a further ascent to the classic rail concourse and platforms. Note that there is a tunneled connection between the classic station and the underground station. The Metro station under this proposal remains in position and passengers could continue to the use the current access arrangement from the classic rail concourse or a more direct route provided through the arches. Street level would still provide access to taxis and cars. This represent a minor worsening in comparison to baseline option.	---	Passengers must travel approximately 23m vertically to reach street level from which a further ascent to the classic rail concourse and platforms. The Metro station under this proposal is relocated above station box providing a more direct route of dispersal. Street level would still provide access to taxis and cars. This represent a minor worsening in comparison to baseline option.	---	Passengers must travel approximately 37m vertically to reach street level from which a further ascent to the classic rail concourse and platforms. Note that there is a tunneled connection between the classic station and the underground station. The Metro station under this proposal is relocated adjacent to the station box providing a more direct route of dispersal compared to Option B. Street level would still provide access to taxis and cars. This represent a minor worsening in comparison to baseline option.	---
	Assess the relative Passenger Connectivity at stations between high speed rail, classic rail, bus, coach, car, taxi, bicycle and pedestrians	Interchange times shown below CP3 Design — From HS2/NPR Platforms / From Mid Platform / From End Platform: to NR Concourse: 3 / 5 to Metrolink: 4 / 6 to Forecourt: 4 / 6 to Car Parks: 5 / 7	o	Interchange times shown below: Alignment B (in minutes) — From HS2/NPR Platforms / From Mid Platform / From End Platform: to NR Concourse: 6 / 9 to Metrolink: 7 / 10 to Forecourt: 5 / 8 to Car Parks: 6 / 9 Whilst, the interchange time between underground alignment for Metrolink is comparable across the station options. However Aligment B has a poor passenger experience compared to Alignment B1 and D due to changes in level and direction compromising wayfinding experience.	---	Interchange times shown below: Alignment B1 (in minutes) — From HS2/NPR Platforms / From Mid Platform / From End Platform: to NR Concourse: 9 / 11 to Metrolink: 7 / 10 to Forecourt: 6 / 9 to Car Parks: 6 / 9 As underground alignment option, vertical changes and distances would be greater than baseline option. Complicating interchange between different modes of transport, namely metrolink and network rail. In general underground alignment option offers a poorer passenger experience in comparison to baseline option.	---	Interchange times shown below: Alignment D (in minutes) — From HS2/NPR Platforms / From Mid Platform / From End Platform: to NR Concourse: 6 / 9 to Metrolink: 6 / 9 to Forecourt: 5 / 8 to Car Parks: 5 / 8 As underground alignment option, vertical changes and distances would be greater than baseline option. Complicating interchange between different modes of transport, namely metrolink and network rail. In general underground alignment option offers a poorer passenger experience in comparison to baseline option.	---
	Assess the relative passenger flow characteristics during emergency evacuation and normal operation at stations	In the event of an emergency e.g. fire, passengers would need to descend 10m to the street level concourse then exit.	o	In the event of an emergency e.g. fire, passengers would need to ascend approx. 34m via escape cores to the street level concourse then exit. The design is compliant with safety standards.	---	In the event of an emergency e.g. fire, passengers would need to ascend approx. 23m via escape cores to the street level concourse then exit. The design is compliant with safety standards.	---	In the event of an emergency e.g. fire, passengers would need to ascend approx. 33m via escape cores to the street level concourse then exit. The design is compliant with safety standards. In normal operation option D has 1 less passemger lifts which may reduces operational resiliance.	---
	Assess the relative 'Way Finding' of station layouts i.e. logical flow	The design has two entrances; the main off the Boulevard at street level visually indicated with the architecture and the other making use of the existing classic station approach. The street entrance flows towards the escalators the station approach entrance deviates to the left to arrive at the HS2/NPR concourse. There are a number of entrances and exit points to the station Although there are mulitple exit and entrance point, horizontally it is legible as passenger have a clearer line of sight with elements within station and outside station. Providing good wayfinding.	o	Two isolated street level concourses which lead down via an intermediate level to the platforms. The direction of passenger flow has no options and therefore provides a better way finding solution for passeger disperal from platform level onto tickethall. Although wayfinding for passenger disperal from platform level to tickethall is better in the underground option. However with limited line of sight with elements within station and outside station, it doesn't offer passenger clear legible wayfinding for on-ward travel, including to and from NR concourse.	---	Two isolated street level concourses which lead down via an intermediate level to the platforms. The direction of passenger flow has no options and therefore provides a better way finding solution. Although wayfinding for passenger disperal from platform level to tickethall is better in the underground option. However with limited line of sight with elements within station and outside station, it doesn't offer passenger clear legible wayfinding for on-ward travel, including to and from NR concourse.	---	Two isolated street level concourses which lead down via an intermediate level to the platforms. The direction of passenger flow has no options and therefore provides a better way finding solution. Although wayfinding for passenger disperal from platform level to tickethall is better in the underground option. However with limited line of sight with elements within station and outside station, it doesn't offer passenger clear legible wayfinding for on-ward travel, including to and from NR concourse.	---
	Assess the relative security or perception of security of station layouts	Highly permeable design which can be operated to an acceptable level of security from CCTV, access control etc, however it could be perceived by the travelling public that the directions of travel present opportunities for crime .	o	Access and egress to the underground station very much limited and controlled by the street concourse entrances/exits. It is inherently more controllable and probably perceived as such although not considred a differentiator	---	Access and egress to the underground station very much limited and controlled by the street concourse entrances/exits. It is inherently more controllable and probably perceived as such although not considred a differentiator	---	Access and egress to the underground station very much limited and controlled by the street concourse entrances/exits. It is inherently more controllable and probably perceived as such although not considred a differentiator	---
Maintenance	Assess the relative route infrastructure maintenance and servicing arrangements	Access arrangements for maintenance via access routes along the surface tracks.	o	Access for maintenance - worse than baseline, Deep Box Option B is worse than B1 with respect to access / space around P&C located at each end of the station. OPEX (Maintenance Costs) - worse than baseline - Asset Count (i.e. no of P&C, no of Vent Shafts, track length) - 10 fan & vent shafts compared to 7 in baseline between Airport and Node 3, 4 crossovers compared to 2 in baseline.	--	Access for maintenance - worse than baseline, Shallow Box Option B1 appears to provide better access / space around the P&C located on either side of the station which would be preferrable for maintenance and renewals than Options B and D, OPEX (Maintenance Costs) - worse than baseline - Asset Count (i.e. no of P&C, no of Vent Shafts, track length) - 10 fan & vent shafts compared to 7 in baseline, 4 crossovers compared to 2 in baseline. Note that the design proposal has "both vertical and horizontal curvature" between the two crossovers at the River Irwell end of the station which could potentially result in a slight increase in maintenance cost compared to options B and D.	--	Access for maintenance - worse than baseline, Hybrid Box Option D is worse than option B1 with respect to access / space around P&C located on either side of the station. OPEX (Maintenance Costs) - worse than baseline - Asset Count (i.e. no of P&C, no of Vent Shafts, track length) - 10 vent shafts compared to 7 in baseline, 4 crossovers compared to 2 in baseline. In terms of route km and asset count, Option D is approximately 3 track-km shorter that option B/B1 (measuring Airport to Node 3) but similar to baseline.	--
Environment	overall summary / rating from ENVIRONMENTAL APPRAISAL for ROUTE	See separate assessment	o	See separate assessment	---	See separate assessment	---	See separate assessment	---
	Overall summary / rating from ENVIRONMENTAL APPRAISAL for STATION	See separate assessment	o	See separate assessment	---	See separate assessment	---	See separate assessment	
Stakeholders	Assess the impacts on stakeholders - Impact for Station on Greater Manchester during construction and in operation, including constraints on future development of the city, the building environment of the city centre, and impact on the Manchester Piccadilly strategic regeneration Framework (SRF).	A significant area of the city centre will be affected by the works through noise, dust and the vehicle movements to bring in materials and plant. The station design delivers the principles of the MCC SRF along side the existing station with a relocated Metrolink station beneath.	o	The affected area will be comparible to that of the Baseline and require the same demolitions albeit there will be significantly more lorry movements over a greater timescale to remove the excavated spoil. A sub surface station is the preference from the Stakeholders to provide greater opportunities and improved integration. Minimal impact to Manchester Piccadilly Strategic Regeneration Framework (SRF) with limited north-south connectivity.	+	The affected area will be comparible to that of the Baseline and require the same demolitions albeit there will be significantly more lorry movements over a greater timescale to remove the excavated spoil. A sub surface station is the preference from the Stakeholders to provide greater opportunities and improved integration. Minimal impact to Manchester Piccadilly Strategic Regeneration Framework (SRF) with enhance north-south connectivity and the opportunity to enhance pedestrian connection across Manchester Ring Road. Supporting city expansion to the east of Manchester Ring Road.	+	The affected area will be comparible to that of the Baseline and require the same demolitions albeit there will be significantly more lorry movements over a greater timescale to remove the excavated spoil. A sub surface station is the preference from the Stakeholders to provide greater opportunities and improved integration. Location of HS2 Station will fundamentially change Manchester Piccadilly SRF, however Strategic Principles are still present in the amended framework. Opportunity to regenerate development land to the north of NR Station viaduct, bringing Manchester Piccadilly SRF closer to Mayfield Development.	+
	Does the option support a wider development opportunity including and beyond Piccadilly SRF? Note: A high-level Wider Development Opportunity Area assessment has been conducted in agreement with stakeholders. Wider Development Opportunity Area includes GEA within CCB, remaining GEA within Piccadilly SRF (as defined by MCC) and the remaining development area as tested in HS2 Manchester Piccadilly Urban Integration Study for Hybrid Bill Design.	The design aligns well with the MCC Strategic Regeneration Framework. Hybrid Bill Design - Wider Development Opportunity = 1,201,188 sqm (GEA) Hybrid Bill Design accommodate additional wider development opportunity beyond the Piccadilly SRF development area to the east of Manchester Ring Road (Mancunian Way). This is due to the arrival of HS2 via viaduct, requiring additional land during construction and operation phase of the station. Noting that some of these land will be permanently required for the operation of HS2, such as viaduct, portal and embankment. Therefore reducing the overall land avaiable for future development. The HS2 infrastructure to the east of Ring Road would also limit north-south permeability and would rely on Ardwick NR Station and the proposed Hoop Street Metrolink Tram-Train service to serve the area.	o	The design aligns with the MCC Strategic Regeneration Framework - Strategic Principles. Alignment B Wider Development Opportunity = 1,525,351 sqm (GEA) A high-level Wider Development Opportunity Area assessment has been conducted in agreement with stakeholders. Wider Development Opportunity Area includes GEA within CCB, remaining GEA within Piccadilly SRF (as defined by MCC) and the remaining development area as tested in HS2 Manchester Piccadilly Urban Integration Study for Hybrid Bill Design. The achievable GEA in Alignment B (circa 1.5 million sqm) is comparable to Alignment B1 (1.4 million) and the re-interpreted Alignment D (1.6million sqm). Given the scale of development and the high-level assessment nature of Piccadilly Underground Study, it is difficult to give a preference from one Alignment over another. Currently, assessed differences can be easily overcome by minor adjustment to the assumed achievable height tested. Therefore, it is difficult to draw conclusions from the Wider Development Opportunity Exercise. Nonetheless, the overall quantum is higher than Hybrid Bill Design, resulting in a minor improvement. Assumptions: •Development height tested derived from MCC Piccadilly SRF Height Plan where possible. •GEA quantum for development to the east of Pin Mill Brow Road adopted density as tested in HS2 Manchester Piccadilly Urban Integration Study for Hybrid Bill Design (i.e. FSI 3.4).	+	The design aligns with the MCC Strategic Regeneration Framework - Strategic Principles. Alignment B1 Wider Development Opportunity = 1,429,769 sqm (GEA) A high-level Wider Development Opportunity Area assessment has been conducted in agreement with stakeholders. Wider Development Opportunity Area includes GEA within CCB, remaining GEA within Piccadilly SRF (as defined by MCC) and the remaining development area as tested in HS2 Manchester Piccadilly Urban Integration Study for Hybrid Bill Design. The achievable GEA in Alignment B1 (circa 1.4 million sqm) is comparable to Alignment B (1.5 million) and the re-interpreted Alignment D (1.6 million sqm). Given the scale of development and the high-level assessment nature of Piccadilly Underground Study, it is difficult to give a preference from one Alignment over another. Currently, assessed differences can be easily overcome by minor adjustment to the assumed achievable height tested. Therefore, it is difficult to draw conclusions from the Wider Development Opportunity Exercise. Nonetheless, the overall quantum is higher than Hybrid Bill Design, resulting in a minor improvement. Assumptions: •Development height tested derived from MCC Piccadilly SRF Height Plan where possible. •GEA quantum for development to the east of Pin Mill Brow Road adopted density as tested in HS2 Manchester Piccadilly Urban Integration Study for Hybrid Bill Design (i.e. FSI 3.4).	+	The design aligns with the MCC Strategic Regeneration Framework - Strategic Principles with an alternative to The Boulevard providing east-west connection. Alignment D Wider Development Opportunity = 1,914,102 sqm (GEA) / 1,627,086 sqm (GEA) discounting Central Retail Park & OSD Development outside of SRF Boundary A high-level Wider Development Opportunity Area assessment has been conducted in agreement with stakeholders. Wider Development Opportunity Area includes GEA within CCB, remaining GEA within Piccadilly SRF (as defined by MCC) and the remaining development area as tested in HS2 Manchester Piccadilly Urban Integration Study for Hybrid Bill Design. The achievable GEA in Alignment D (circa 1.9 million sqm) is by far the greatest in comparison to other alignments. As noted above, for a more comparative quantum Alignment D should discount quantum generated from Central Retail Park. Additionally, the station box occupies sites that are outside Piccadilly SRF as defined in March 2018 revision. These sites are predominately occupied by light industrial uses and surface car park. Given the adjacency of these sites to HS2 Station, the sites will likely be redeveloped in all Alignment Options and not a specific Alignment D advantage. As a more comparative quantum, Alignment D GEA should be re-interpreted by discounting both OSD outside SRF and Central Retail Park, resulting in circa 1.6 million sqm (GEA). For assessment purposes, the re-interpreted Alignment D GEA (circa 1.6 million sqm) is comparable to Alignment B (1.5 million sqm) and Alignment B1 (1.4 million sqm). Given the scale of development and the high-level assessment nature of Piccadilly Underground Study, it is difficult to give a preference from one Alignment over another. Currently, assessed differences can be easily overcome by minor adjustment to the assumed achievable height tested. Therefore, it is difficult to draw conclusions from the Wider Development Opportunity Exercise. Nonetheless, the overall quantum is higher than Hybrid Bill Design, resulting in a minor improvement. Assumptions: •Development within CCB height tested derived from MCC Piccadilly SRF Height Plan where possible. •GEA quantum for development to the east of Pin Mill Brow Road adopted density as tested in HS2 Manchester Piccadilly Urban Integration Study for Hybrid Bill Design (i.e. FSI 3.4). •GEA quantum for development to the north of Great Ancoats Street adopted density as tested in Draft of the Former Central Retail Park Development Framework by MCC (i.e. FSI 4.0). •GEA quantum for development within MCC Piccadilly SRF but outside CCB adopted density as tested in Piccadilly SRF by MCC (i.e. FSI 4.0).	+

Topic	Criterion	Baseline (HbD)	Rating	Option B	Rating	Option B1	Rating	Option D	Rating
Commercial Development	Does the option support the active use of land above or adjacent to Station assets and infrastructure for development - including homes, business space, retail and other mixed use. Note: Commercial Development will only assess potential development opportunities within the defined CCB. For 'Wider Development Opportunity' please refer to the 'Stakeholders' assessment criteria.	Considering the development opportunities within the CCB for the HbB design Hybrid Bill Design accommodate additional wider development opportunity beyond the Piccadilly SRF development area to the east of Manchester Ring Road (Mancunian Way). This is due to the arrival of HS2 via viaduct, requiring additional land during construction and operation phase of the station. Noting that some of these land will be permanently required for the operation of HS2, such as viaduct, portal and embankment. Therefore reducing the overall land avaiable for future development. The HS2 infrastructure to the east of Ring Road would also limit north-south permeability and would rely on Ardwick NR Station and the proposed Hoop Street Metrolink Tram-Train service to serve the area. **GEA within SRF 250,224 sqm** **GEA outside SRF 353,910 sqm** **Total GEA 614,134 sqm** **Total area within the CCB 45.6 ha**	O	Considering the development opportunities within the CCB only Alignment B Preliminary CCB = 27.50 hectares Alignment B Indicative achievable GEA within CCB = 513,683 sqm (GEA) Alignment B CCB has the smallest footprint, this is due to the nature of the deep-box construction method adopted. This has resulted in a lower achievable floorspace when compared to Hybrid Bill Design. The developable area within CCB is separated into two distinctive parcels; 1.Within Piccadilly SRF 2.Outside Piccadilly SRF near West Ashbury Due to the separated nature of the two parcels, it would be difficult to assume the arrival of HS2 would drive further expansion of Manchester City Centre to the east beyond the Ring Road. Development outside Piccadilly SRF near West Ashbury is more likely to be a separated local centre serving West Ashbury, catalysed by the arrival of Metrolink Tram-Train service.	--	Considering the development opportunities within the CCB within CCB only Alignment B Preliminary CCB = 43.38 hectares Alignment B Indicative achievable GEA within CCB = 821,302 sqm (GEA) Alignment B1 CCB has the largest footprint, this is due to the nature of the shallow-box construction method adopted. This has resulted in the highest achievable floorspace when compared to Hybrid Bill Design, Alignment B1 and D. The developable area within CCB is almost continuous from Piccadilly SRF, expanding to the east towards West Ashbury. Due to the nature of HS2 Ticket-hall being position further to the east in comparison to Hybrid Bill Design, Alignment B and D, HS2 Eastern Ticket-hall can serve development to the east of Pin Mill Brow. This will catalyse the expansion of Manchester City centre to the east, beyond the Ring Road. With the temporary disruption to Pin Mill Brow junction, pedestrian crossing can be improved for Alignment B1. This further suggests Alignment B1 can unlock regeneration potential to the east of Pin Mill Brow junction.	+	Considering the development opportunities within the CCB only Alignment D Preliminary CCB = 36.18 hectares Alignment D Indicative achievable GEA within CCB = 575,328 sqm (GEA) / 419,980 sqm (GEA) discounting Central Retail Park for assessment purpose Alignment D CCB footprint is greater than Alignment B but smaller than Alignment B1. Although the Hybrid construction method adopted in Alignment D should yield a smaller CCB footprint. Due to the nature of the north-south orientation of the station box, the Alignment will require additional land to accommodate parking, Metrolink, temporary infrastructure works (including Ashton Canal and the diversion of Great Ancoats Street) and construction & logistics requirements. Nonetheless, Alignment D will likely deliver a lower achievable floorspace when compared to Hybrid Bill Design. A further assessment would suggest the achievable GEA within CCB should be adjusted to discount quantum generated from Central Retail Park. Currently, MCC has promoted the re-development of Central Retail Park based on HS2 arrival into Manchester via a viaduct. A re-interpreted achievable GEA for Alignment D should discount Central Retail Park, reducing the quantum to 419,980 sqm. The developable area within CCB is separated into two distinctive parcels;	--
Commitments	Previous explicit or implicit public assurances or commitments to third parties	Not applicable	N/A	Not applicable	N/A	Not applicable	N/A	Not applicable	N/A
Health and/or Safety	Assess the relative risks to health and safety during construction of the route	The Baseline route is in large part in tunnel with the exception of the Ardwick to Piccadilly section which requires the construction of a viaduct into and out of the station.	O	Similar to HbD Except for mined approach	O	Similar to HbD with exception of mined crossovers.	O	Slighter shorter route length to HbD except for mine approach.	O
	Assess the relative risks to health and safety during construction of the station	The Baseline station comprises the construction of a sub surface Metro station, a viaduct above and a large roof construction. The key risks relate to working deep excavations, working at height and adjacent to a working railway.	O	Extensive underground works in mined caverns. Large station box excavation. Greater volume and duration of work relative to HbD. [Relative ranking for underground options: =3]	- - -	Underground works in mined caverns for outer scissors crossovers. Large station box excavation. Greater volume and duration of work relative to HbD. [Relative ranking for underground options: 1]	- - -	Extensive underground works in mined caverns. Large station box excavation. Greater volume and duration of work relative to HbD. [Relative ranking for underground options: =3]	- - -
	Assess the relative risks to health and safety during Operations	There are no exceptional risks to health and safety in operation identifiable at this level of design detail.	O	Underground station inherently less safe in the event of a fire or terrorist action.	--	Underground station inherently less safe in the event of a fire or terrorist action.	--	Underground station inherently less safe in the event of a fire or terrorist action.	--
	Assess if capable to be accepted through the CSM-RA, in accordance with HS2 System Safety processes - CSM Risk Evaluation and Assessment, recorded and justified	The design is complient with HS2 safety processes for the HbD level of design.	O	Nothing know to preclude this process.	O	Nothing know to preclude this process.	O	Nothing know to preclude this process.	O
Demand	Likely Journey Times to London for HS2	For the purposes of comparison against baseline, the journey times outside Manchester Airport (Node MA) to Node 3 are considered to be unchanged and the Sift examines the relative difference of the journey times between Node MA to Node 3.	O	Journey times between Manchester Piccadilly and Manchester airport are estimated to be 15 seconds slower than the baseline based on a high level desktop study.	--	Journey times between Manchester Piccadilly and Manchester airport are estimated to be 15 seconds slower than the baseline based on a high level desktop study.	--	Journey times between Manchester Piccadilly and Manchester airport are estimated to be 30 seconds quicker than the baseline based on a high level desktop study.	+
	Likely Journey Times to Birmingham for HS2	For the purposes of comparison against baseline, the journey times outside Manchester Airport (Node MA) to Node 3 are considered to be unchanged and the Sift examines the relative difference of the journey times between Node MA to Node 3.	O	Journey times between Manchester Piccadilly and Manchester airport are estimated to be 15 seconds slower than the baseline based on a high level desktop study.	--	Journey times between Manchester Piccadilly and Manchester airport are estimated to be 15 seconds slower than the baseline based on a high level desktop study.	--	Journey times between Manchester Piccadilly and Manchester airport are are estimated to be 30 seconds quicker than the baseline based on a high level desktop study.	+
	Likely Journey Times to Manchester Airport for HS2 and NPR	For the purposes of comparison against baseline, the journey times outside Manchester Airport (Node MA) to Node 3 are considered to be unchanged and the Sift examines the relative difference of the journey times between Node MA to Node 3.	O	Journey times between Manchester Piccadilly and Manchester airport are estimated to be 15 seconds slower than the baseline based on a high level desktop study.	--	Journey times between Manchester Piccadilly and Manchester airport are estimated to be 15 seconds slower than the baseline based on a high level desktop study.	--	Journey times between Manchester Piccadilly and Manchester airport are are estimated to be 30 seconds quicker than the baseline based on a high level desktop study.	+
	Likely Journey Times to Liverpool for NPR	For the purposes of comparison against baseline, the journey times outside Manchester Airport (Node MA) to Node 3 are considered to be unchanged and the Sift examines the relative difference of the journey times between Node MA to Node 3.	O	Journey times between Manchester Piccadilly and Manchester airport are estimated to be 15 seconds slower than the baseline based on a high level desktop study.	--	Journey times between Manchester Piccadilly and Manchester airport are estimated to be 15 seconds slower than the baseline based on a high level desktop study.	--	Journey times between Manchester Piccadilly and Manchester airport are are estimated to be 30 seconds quicker than the baseline based on a high level desktop study.	+
	Likely Journey Times to Leeds for NPR	For the purposes of comparison against baseline, the journey times outside Manchester Airport (Node MA) to Node 3 are considered to be unchanged and the Sift examines the relative difference of the journey times between Node MA to Node 3.	O	Journey times between Manchester Piccadilly and Manchester airport are estimated to be 15 seconds slower than the baseline based on a high level desktop study.	+	Journey times between Manchester Piccadilly and Manchester airport are estimated to be 15 seconds slower than the baseline based on a high level desktop study.	+	Journey times between Manchester Piccadilly and Manchester airport are are estimated to be 30 seconds quicker than the baseline based on a high level desktop study.	+
	Likely Journey Times Liverpool to Leeds via Manchester for NPR	For the purposes of comparison against baseline, the journey times outside Manchester Airport (Node MA) to Node 3 are considered to be unchanged and the Sift examines the relative difference of the journey times between Node MA to Node 3.	O	2 minute reduction in journey time estimated, primarily due to reduction of dwell time at Manchester Piccadilly from 5 minutes (assumed value) to 3 minutes (Assumed value based on pedestrian flow modelling)	+++	2 minute reduction in journey time estimated, primarily due to reduction of dwell time at Manchester Piccadilly from 5 minutes (assumed value) to 3 minutes (Assumed value based on pedestrian flow modelling)	+++	3 minute reduction in journey time estimated, primarily due to reduction of dwell time at Manchester Piccadilly from 5 minutes (assumed value) to 3 minutes (Assumed value based on pedestrian flow modelling)	+++
	Likely Relative passenger numbers	N/A	N/A	Not applicable	N/A	Not applicable	N/A	Not applicable	N/A
	Likely Demand	N/A	N/A	Not applicable	N/A	Not applicable	N/A	Not applicable	N/A
Cost (excluding HS2 indirect costs and contingency)	Estimated whole life cycle costs to give relative assessment	Not applicable	N/A	Not applicable	N/A	Not applicable	N/A	Not applicable	N/A
	Estimated initial capital costs for route and approaches	Civil engineering scope of work - £2,190m Railway systems - £318m Total - £2,508m	O	Civil engineering scope of work - £2,227m Railway systems - £334m Total - £2,561m	- - -	Civil engineering scope of work - £2,198m Railway systems - £337m Total - £2,535m	- - -	Civil engineering scope of work - £2,122m Railway systems - £308m Total - £2,430m	- - -
	Estimated initial capital costs for station	Civil engineering scope of work - £870m Railway systems - £58m Total - £928m	O	Civil engineering scope of work - £3,243m Railway systems - £78m Total - £3,321m	- - -	Civil engineering scope of work - £2,774m Railway systems - £71m Total - £2,845m	- - -	Civil engineering scope of work - £3,164m Railway systems - £75m Total - £3,239m	- - -
	Estimated total initial capital costs to give relative assessment (The capital costs include construction, land and compensation costs)	Civil engineering scope of work - £3,060m Railway systems - £376m Land, property and compensation - £453m Total - £3,889m	O	Civil engineering scope of work - £5,470m Railway systems - £412m Land, property and compensation - £326m Total - £6,208m	- - -	Civil engineering scope of work - £4,972m Railway systems - £408m Land, property and compensation - £396m Total - £5,776m	- - -	Civil engineering scope of work - £5,286m Railway systems - £383m Land, property and compensation - £500m Total - £6,169m	- - -
Phasing opportunities	Assess the opportunities for phasing elements of NPR scope in the Phase 2b hybrid Bill (as active or passive provision)	To allow for future delivery of NPR the station would operate in the interim as a terminus. The construction of NPR has been been allowed for by planning for the construction of all the platforms at Manchester Piccadilly station together with the Ardwick box structure sufficient to allow construction of the track and handover point without impacting the operation of HS2.	O	Phasing of the future NPR connection is possible with the correct provisions designed into the scheme early enough with the knowledge of the future phases. This needs to be as active provision. There is more technical challenge to this with it being in tunnels compared to the Hybrid Bill+NPR surface scheme - as underground construction is logisitcally more challenging	-	Phasing of the future NPR connection is possible with the correct provisions designed into the scheme early enough with the knowledge of the future phases. This needs to be as active provision. There is more technical challenge to this with it being in tunnels compared to the Hybrid Bill+NPR surface scheme - as underground construction is logisitcally more challenging	-	Phasing of the future NPR connection is possible with the correct provisions designed into the scheme early enough with the knowledge of the future phases. This needs to be as active provision. There is more technical challenge to this with it being in tunnels compared to the Hybrid Bill+NPR surface scheme - as underground construction is logisitcally more challenging	-
Schedule & Delivery into Service	Assess the relative programme impacts to the hybrid Bill deposit	The existing scheme design and development is mature and planned for hybrid Bill deposit in late 2021.	O	All options are currently concept design only. To develop scheme to hybrid Bill design level of detail will take 2-3 years followed by updated Parliamentary Plans and environmental Assessment. This will be a 3-4 year period before hybrid bill deposit.	- - -	All options are currently concept design only. To develop scheme to hybrid Bill design level of detail will take 2-3 years followed by updated Parliamentary Plans and environmental Assessment. This will be a 3-4 year period before hybrid bill deposit.	- - -	All options are currently concept design only. To develop scheme to hybrid Bill design level of detail will take 2-3 years followed by updated Parliamentary Plans and environmental Assessment. This will be a 3-4 year period before hybrid bill deposit.	- - -
	Assess the schedule impacts to the delivery into service date for HS2 Phase 2b Crewe to Manchester	The current forecast Delivery into Service date is 2036 to 2040.	O	With the increased design and development for the hybrid Bill and increased construction programme the Delivery into service date for HS2 Phase 2b Crewe to Manchester would be 8-12 years later than hBD	- - -	With the increased design and development for the hybrid Bill and increased construction programme the Delivery into service date for HS2 Phase 2b Crewe to Manchester would be 7-11 years later than hBD	- - -	With the increased design and development for the hybrid Bill and increased construction programme the Delivery into service date for HS2 Phase 2b Crewe to Manchester would be 9-13 years later than hBD	- - -
		Overall Rating	O	Overall Rating		Overall Rating		Overall Rating	
	Preferred Option:								
	Reason:								

Environmental Appraisal for Route

Location	Manchester Piccadilly , MAxx - Node MA (Manchester Airport tunnel portal) to Node 3 (NPR route towards Leeds)
Purpose of Sift	to assess alternative Underground options for integrating HS2 and NPR at Manchester Piccadilly
Sift Level	2

Options Considered			BASELINE HbD Surface Station for Phase 2b + NPR route to Node 3		Option B Alignment (same as Option B1 Aligment)		Option B1 Alignment (same as Option B1 Aligment)		Option D Combined Underground - hybrid box/mined station	
Description			*12.8km Manchester Tunnel* *Altrincham Road vent shaft* *Palatine Road vent shaft* *Wilmslow Road vent shaft* *Birchfields Road Vent shaft Manchester tunnel north portal* *NPR Oldham Road vent shaft* *NPR Ashton Road vent shaft* *NPR Node L vent shaft*		*Vent Shaft B S1 Princes Spiny* *Vent Shaft B S2 Barlow Tiip* *Vent Shaft B S3 Longford Park* *Vent Shaft B S4 North Phoebe Street* *Vent Shaft B N1 Elusian Street* *Vent Shaft B N2 Somerset Road* *Vent Shaft B N3 Knott Lane* *Vent ShaftB N4 Lees New Road*		*Vent Shaft B 1 Princes Spiny* *Vent Shaft B1 S2 Barlow Tiip* *Vent Shaft B S3 Longford Park* *Vent Shaft B S4 North Phoebe Street* *Vent Shaft B N1 Elusian Street* *Vent Shaft B N2 Somerset Road* *Vent Shaft B N3 Knott Lane* *Vent ShaftB N4 Lees New Road*		*Vent Shaft D S1* *Vent Shaft D S2* *Vent Shaft D S3* *Vent Shaft D S4* *Vent Shaft D N1* *Vent Shaft D N2* *Vent Shaft D N3* *Vent Shaft D N4*	
Topic	**Stage : Construction or Operation**	**Environmental Design Aim considered (inc. Topic and Ref No)**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**
Agriculture, Forestry and Soils	Construction	6, 13	There are no impacts on agricultural land and limited impacts on soils except .	O	Impacts are expected to be similar to the Baseline.	O	Impacts are expected to be similar to the Baseline.	o	Impacts are expected to be similar to the Baseline.	o
	Operation	6	There would be no permanent loss of any agricultural land and would have limited impacts on soil.	O	Impacts are expected to be similar to the Baseline.	O	Impacts are expected to be similar to the Baseline.	o	Impacts are expected to be similar to the Baseline.	o
Air Quality	Construction	4, 10	Air quality impacts during construction are not considered significant.	O	Construction dust (all elements): Construction would be in close proximity to a number of receptors. Dust emissions are assumed to be controlled through CoCP measures to avoid significant air quality impacts. Construction traffic (vent shafts): Similar to baseline Construction traffic (tunnel route): Minor worsening expected due to the disruption to the highway network and additional material to be transported from the tunnel portals	- -	Construction dust (all elements): Construction would be in close proximity to a number of receptors. Dust emissions are assumed to be controlled through CoCP measures to avoid significant air quality impacts. Construction traffic (vent shafts): Similar to baseline Construction traffic (tunnel route): Minor worsening expected due to the disruption to the highway network and additional material to be transported from the tunnel portals	- -	Construction dust (all elements): Construction would be in close proximity to a number of receptors. Dust emissions are assumed to be controlled through CoCP measures to avoid significant air quality impacts. Construction traffic (vent shafts): Similar to baseline Construction traffic (tunnel route): Minor worsening expected due to the disruption to the highway network and additional material to be transported from the tunnel portals	- -
	Operation	4, 10	Air quality impacts during operation are not considered significant.	O	Impacts are expected to be similar to the Baseline.	O	Impacts are expected to be similar to the Baseline.	o	Impacts are expected to be similar to the Baseline.	o
Community	Construction	1, 2, 3, 4, 6	Altrincham Road vent shaft: No impacts. Palatine Road vent shaft: The loss of one residential property, Withington Golf Club's club house, car park and four holes of the course. The loss of land at the gold course will affect its ability to operate. Wilmslow Road vent shaft: Approximately 150 residential properties on Wilmslow Road will experience significant noise and visual impacts. Demolition of three residential properties and The Christie Hospital Car Park D. Birchfield Road vent shaft: Approximately 20 residential properties on Birchfields Road will experience significant noise and visual impacts. Birchfields Primary school (60m north of vent shaft site) will experience significant noise and visual impacts. Construction of the vent shaft will require land from the car park at Fallowfields Retail Park. 123 out of 196 spaces lost. As well as parking for the retail park, the car park is used as part of a 'park and stride' scheme for parents to drop-off and pick-up pupils at Birchfields Primary School and MEA Academy. Loss of car park is significant. Manchester Tunnel north portal: No impacts. NPR Oldham Road vent shaft: Demolition of one (possibly 2) residential properties. Visual impacts for local residents. One PRoW will be affected. NPR Ashton Moss vent shaft: A PRoW crosses the construction compound and a network of PRoWs are situated to the east. Views for footpath users would likely be adversely impacted. The Ashton Moss vent shaft is immediately south of residents along Warne Avenue and east of residents along Wren Close. Hawthorns Community School and its playing fields, and Aldwyn Primary School are located approximately 150m to the south. NPR Node L vent shaft: Cockfields Farm, a children's visitor attraction, is located to the south of the vent shaft and residential receptors are also located approx. 200m north-west of the Node L vent shaft location.	O	Vent Shaft B S1 Princes Spinney: Princes Spinney is not publicly accessible so no loss to open space. Residential properties are located immediately west of the site on Baxter Gardens, and on the opposite side of Royal Oak Road (Maldon Grove and Pentwyn Grove). These properties may experience noise and visual impacts during construction. Vent Shaft B S2 Barlow Tip: Barlow Tip is publicly accessible open space, with maintained footpaths throughout. The temporary and permanent loss of this space may result in a significant community impact given the urban location. A footpath along the River Mersey runs along the southern edge (National Cycle Route 62 follows the same route), Chorlton Water Park is located immediately east of the site, and Chorlton-cum-Hardy Golf Club is immediately north and west of the site,. The amenity of these sites during construction may be affected. The loss of this open space may affect users of the local footpath network along the river and through the water park due to loss, or changes to, access. Chorlton Water Park Sure Start Children's Centre and Barlow Hall Primary School are located approximately 300m north-east of the site, there may be adverse noise and visual impacts on these resources, as well as for the residential receptors along Redwing Avenue and Woodpecker Road. Vent Shaft B S3 Longford Park: Land will be required both temporarily and permanently from open space and parkland within a residential area. Loss of approx 1/3 of area used for disc golf - the loss of the open space and recreational facility will be significant. Firswood Community centre is located immediately to the north of the site, construction may have noise and visual impacts on users of the centre. Land required for the vent shaft will cover parts of the footpaths within Longford Park, which may affect access to all parts of the park for local residents. Longford Park School and St Teresa's Primary School are approximately 350m to the west and east (respectively) of the proposed site. Residential properties are located immediately north, south and east of the site. These receptors may experience impacts during construction. Vent Shaft B S4 North Phoebe Street: Construction will result in the demolition of Jump Ninja Trampoline Park, there are no alternatives in the local area. Manchester Private Hospital is approximately 200m to the west of the site and may be impacted by construction noise and traffic. Vent Shaft B N1 Elysian Street: The site covers the south-eastern corner of Openshaw Park. Construction will result in the permanent loss of two children's play areas, a tennis court and a Mixed Use Games Area (MUGA). Access to the park may be affected, particularly from the southern and eastern sides. There are limited alternatives in the local area which is a mixture of residential and industrial. Residential properties are located immediately east and approximately 50m to the north. These properties may experience noise, visual and construction traffic impacts. Vent Shaft B N2 Somerset Road: Construction will result in the loss of publicly accessible green space between houses on Gloucester Road and the railway line. There are a number of alternative spaces in the area. Residential properties along Gloucester Road will be immediately south of the site and may experience noise and visual impacts during construction. Vent Shaft B N3 Knott Lane: Located on the southern edge of Daisy Nook Country Park. Footpaths leading into and out of the country park may be impacted by land requirements for construction of the vent shaft. Vent Shaft B N4 Lees New Road: The proposed site is public open space with a number of footpaths running across it, including the Oldham Way. A number of footpaths, including the Oldham Way, may be affected by construction of the vent shaft, and may need to be permanently diverted depending on the exact location of the vent shaft once construction is complete. Cockfields Farm, a children's visitor attraction is located approximately 350m to the south of the site. Alt Academy (primary school) is located 340m uphill from the site. There are residential properties approximately 100m to the north-east of the site. Alt Academy and the residential properties may experience noise and visual impacts during construction. Overall, the requirement for a number of public parks and green space, alongside the proximity of residential properties and community resources mean that this route is considered to be a major worsening compared to the baseline.	- - -	Vent Shaft B S1 Princes Spinney: Princes Spinney is not publicly accessible so no loss to open space. Residential properties are located immediately west of the site on Baxter Gardens, and on the opposite side of Royal Oak Road (Maldon Grove and Pentwyn Grove). These properties may experience noise and visual impacts during construction. Vent Shaft B S2 Barlow Tip: Barlow Tip is publicly accessible open space, with maintained footpaths throughout. The temporary and permanent loss of this space may result in a significant community impact given the urban location. A footpath along the River Mersey runs along the southern edge (National Cycle Route 62 follows the same route), Chorlton Water Park is located immediately east of the site, and Chorlton-cum-Hardy Golf Club is immediately north and west of the site,. The amenity of these sites during construction may be affected. The loss of this open space may affect users of the local footpath network along the river and through the water park due to loss, or changes to, access. Chorlton Water Park Sure Start Children's Centre and Barlow Hall Primary School are located approximately 300m north-east of the site, there may be adverse noise and visual impacts on these resources, as well as for the residential receptors along Redwing Avenue and Woodpecker Road. Vent Shaft B S3 Longford Park: Land will be required both temporarily and permanently from open space and parkland within a residential area. Loss of approx 1/3 of area used for disc golf - the loss of the open space and recreational facility will be significant. Firswood Community centre is located immediately to the north of the site, construction may have noise and visual impacts on users of the centre. Land required for the vent shaft will cover parts of the footpaths within Longford Park, which may affect access to all parts of the park for local residents. Longford Park School and St Teresa's Primary School are approximately 350m to the west and east (respectively) of the proposed site. Residential properties are located immediately north, south and east of the site. These receptors may experience impacts during construction. Vent Shaft B S4 North Phoebe Street: Construction will result in the demolition of Jump Ninja Trampoline Park, there are no alternatives in the local area. Manchester Private Hospital is approximately 200m to the west of the site and may be impacted by construction noise and traffic. Vent Shaft B N1 Elysian Street: The site covers the south-eastern corner of Openshaw Park. Construction will result in the permanent loss of two children's play areas, a tennis court and a Mixed Use Games Area (MUGA). Access to the park may be affected, particularly from the southern and eastern sides. There are limited alternatives in the local area which is a mixture of residential and industrial. Residential properties are located immediately east and approximately 50m to the north. These properties may experience noise, visual and construction traffic impacts. Vent Shaft B N2 Somerset Road: Construction will result in the loss of publicly accessible green space between houses on Gloucester Road and the railway line. There are a number of alternative spaces in the area. Residential properties along Gloucester Road will be immediately south of the site and may experience noise and visual impacts during construction. Vent Shaft B N3 Knott Lane: Located on the southern edge of Daisy Nook Country Park. Footpaths leading into and out of the country park may be impacted by land requirements for construction of the vent shaft. Vent Shaft B N4 Lees New Road: The proposed site is public open space with a number of footpaths running across it, including the Oldham Way. A number of footpaths, including the Oldham Way, may be affected by construction of the vent shaft, and may need to be permanently diverted depending on the exact location of the vent shaft once construction is complete. Cockfields Farm, a children's visitor attraction is located approximately 350m to the south of the site. Alt Academy (primary school) is located 340m uphill from the site. There are residential properties approximately 100m to the north-east of the site. Alt Academy and the residential properties may experience noise and visual impacts during construction. Overall, the requirement for a number of public parks and green space, alongside the proximity of residential properties and community resources mean that this route is considered to be a major worsening compared to the baseline.	- - -	Vent Shaft D S1: Bowland Road - Approximately one half Baguley Park will be required temporarily during construction, with a smaller area required permanently. The loss of the recreational space, as well as the potential loss of Early Inspirations Pre-School will result in a significant community impact, although there are a number of alternative nurseries nearby. Residential properties are located on all sides of the site, and there is a residential retirement complex to the east. Baguley Methodist Church is located immediately to the west, and Baguley Hall Primary School, Kids Start Nursery and Holyrood Nursery are located approximately 150m to the west. These residential properties and community resources may experience noise and visual impacts during construction. Vent Shaft D S2: Fairy Lane - Construction will result in the temporary loss of approximately three of 28 grass sports pitches at University of Manchester Wythenshawe Sports Ground. The permanent land required for the vent shaft will also affect these sports pitches. Vent Shaft D S3: Wilbraham Road - The temporary and permanent land required for construction of the vent shaft will result in the loss of informal public open space adjacent to Maine Road Football Club (the land may also be used informally by the football club). The land is accessed by the public from Wilbraham Road, to the south. Construction may result in noise and visual impacts on residential properties immediately adjacent to the site to the north, south and east. Vent Shaft D S4: Carriage Street: Land required for the construction of the vent shaft may result in the loss of a play area on Carriage Street and the loss of a church (AD MSBN church) operating out of the industrial estate that is being demolished. Residential properties are located immediately adjacent to the site. There are a number of community facilities within a 250m radius of the site including: St Alphonsus Primary School, Afifah School, Old Trafford Children's Centre, Lowry Lodge Sheltered Housing, Brooks Bar Medical Centre, Arabic Church Manchester, Jame'ah Majid E Noor Mosque, Igreja Evangelica Brasileira and Kingdom Hall. These community facilities may experience adverse impacts as a result of construction noise and views of the site. Vent Shaft D N1: Clayton Vale: Approximately one fifth of Clayton Vale is required for the construction of the vent shaft. It is a recreational area used for activities including picnics, biking and walking. Noise and visual impacts may impact residential receptors approximately 100m to the south, and St. Willibrods Catholic Primary School, approximately 200m to the east. Vent Shaft D N2: Lumb Lane The vent shaft will be located on the car park, playground and playing field of Laurus Ryecroft High School. The permanent loss of these school facilities may affect the schools ability to function. If not, there will be noise and visual impacts on the school, and residential properties to the east and south. Vent Shaft D N3: Alt Hill Lane: Residential properties adjacent to the site may experience noise and visual impacts during construction. Vent Shaft D N4: Lees New Road: The proposed site is public open space with a number of footpaths running across it, including the Oldham Way. A number of footpaths, including the Oldham Way, may be affected by construction of the vent shaft, and may need to be permanently diverted depending on the exact location of the vent shaft once construction is complete. Cockfields Farm, a children's visitor attraction is located approximately 350m to the south of the site. Alt Academy (primary school) is located 340m uphill from the site. There are residential properties approximately 100m to the north-east of the site. Alt Academy and the residential properties may experience noise and visual impacts during construction. Overall, the requirement for a number of public parks and green space, alongside the impacts on a number of educational facilities, proximity of residential properties and community resources mean that this route is considered to be a major worsening compared to the baseline.	- - -
	Operation	2, 3, 4, 6	No operational community impacts.	O	For the purpose of this assessment is it assumed that there will be a permanent requirement for land for the vent shafts but that the rest of the land required during construction can be returned to its original use. Taking into account the loss of community resources detailed above and the assumption, there are not expected to be any further community impacts during operation. However, given the land required from public parks and green spaces, this route is considered to be a minor worsening compared to the baseline.	- -	For the purpose of this assessment is it assumed that there will be a permanent requirement for land for the vent shafts but that the rest of the land required during construction can be returned to its original use. Taking into account the loss of community resources detailed above and the assumption, there are not expected to be any further community impacts during operation. However, given the land required from public parks and green spaces, this route is considered to be a minor worsening compared to the baseline.	- -	For the purpose of this assessment is it assumed that there will be a permanent requirement for land for the vent shafts but that the rest of the land required during construction can be returned to its original use. Taking into account the loss of community resources (and potential residential properties) detailed above and the assumption, there are not expected to be any further community impacts during operation. However, given the land required from public parks and green spaces, this route is considered to be a minor worsening compared to the baseline.	- -
Ecology	Construction	5	Overall , loss of habitats mainly at Palatine Road vent shaft and Manchester Tunnel north portal. This includes the loss of woodland and open mosaic habitat on previously developed land. Air quality assessments to be updated, which may result in an impact on designated sites. No other impacts on designated sites or ancient woodland, including Sites of Biological Interest (SBIs). impacts on protected and notable species includes loss of bat roosts and temporary disturbance and/or loss of foraging and commuting habitats, temporary impacts to terrestrial great crested newt habitats, and loss of black red start and peregrine falcon nesting habitats.	O	Construction would result in the loss of the woodland at **Princess Spinney vent shaft**. This area is a Site of Biological Interest and woodland habitat, therefore woodland compensation would be required and would need to be considered in terms of CCB location and size. The vent shaft has the potential to support other notable and protected species such as roosting and foraging bats and breeding birds. **Barlow Pit vent shaft,** depending on CCB exact location, is located within 100m of Chorlton Water Park Local Nature Reserve (LNR) comprising a lake surrounded by grasslands and woodlands and supports a winter wildfowl population. The vent shaft is located within Barlow Eye Tip SBI comprising grassland, scrub and woodland, resulting in a direct impact to the SBI and its supporting habitats. The SBI supports a number of protected and notable species including a number of bat and bird species. A number of water bodies are located within 500m of the vent shaft site, which may have the potential to support breeding great crested newt (GCN). Therefore, the site could be supporting terrestrial habitat for GCN. **Longford Park vent shaft** is located within 1.5km of Chorlton Ees and Ivy Green SBI. Habitats within the areas appear to be of local ecological value. The vent shaft location may support some common protected and notable species. **Phoebe Street vent shaft** is a highly urbanised site, which consists of hardstanding and buildings only. The buildings may be suitable to support roosting bats **Northern Elysian Street vent shaft** is located in a highly urbanised environment of habitats of low ecological value. **Northern Somerset Road vent shaft** located within 50m of Medlock Vale & Lumb Clough (South) SBI consisting of woodland and water bodies and 700m of Clayton Vale LNR consisting of unimproved grassland, woodland, water bodies and the River Medlock. The habitats at the vent shaft consist of woodland . The vent shaft site consists of woodland habitat. No records of protected and notable species on the site, however, it has the potential to support a number of species including bat, badger, breeding birds. **Northern Knott Lane vent shaft** is located within approximately 1km of Hollinwood Branch Canal Site of Special Scientific Interest (SSSI) and two areas of ancient and semi-natural woodland (Daisy Nook Wood and Holden Clough) are located immediately north of the vent shaft site. A number of water bodies are located within 500m of the vent shaft site, which could have the potential to support breeding GCN. Therefore, the site could be supporting terrestrial habitat for GCN. No records of protected and notable species on the site, however, it has the potential to support a number of species including bat, badger, breeding birds, birds listed under Schedule I of The Wildlife and Countryside Act 1981, (as amended). **Northern Lees New Road vent shaft** is not located within the vicinity of any statutory or non-statutory designated sites. The habitats within the vent shaft site consist of grassland and scrub, immediately adjacent to the River Medlock. No records of protected and notable species on the site, however, it has the potential to support a number of species including bat, badger, breeding birds, and GCN. **Given the impacts at Princess Spinney and Barlow Pit vent shafts, including direct impact to SBIs, it is considered that this route would result in a worsening compared to the baseline.**	- -	Construction would result in the loss of the woodland at Princess Spinney vent shaft. This area is a Site of Biological Interest and woodland habitat, therefore woodland compensation would be required and would need to be considered in terms of CCB location and size. The vent shaft has the potential to support other notable and protected species such as roosting and foraging bats and breeding birds. **Barlow Pit vent shaft,** depending on CCB exact location, is located within 100m of Chorlton Water Park Local Nature Reserve (LNR) comprising a lake surrounded by grasslands and woodlands and supports a winter wildfowl population. The vent shaft is located within Barlow Eye Tip SBI comprising grassland, scrub and woodland, resulting in a direct impact to the SBI and its supporting habitats. The SBI supports a number of protected and notable species including a number of bat and bird species. A number of water bodies are located within 500m of the vent shaft site, which may have the potential to support breeding great crested newt (GCN). Therefore, the site could be supporting terrestrial habitat for GCN. **Longford Park vent shaft** is located within 1.5km of Chorlton Ees and Ivy Green SBI. Habitats within the areas appear to be of local ecological value. The vent shaft location may support some common protected and notable species. **Phoebe Street vent shaft** is a highly urbanised site, which consists of hardstanding and buildings only. The buildings may be suitable to support roosting bats **Northern Elysian Street vent shaft** is located in a highly urbanised environment of habitats of low ecological value. **Northern Somerset Road vent shaft** located within 50m of Medlock Vale & Lumb Clough (South) SBI consisting of woodland and water bodies and 700m of Clayton Vale LNR consisting of unimproved grassland, woodland, water bodies and the River Medlock. The habitats at the vent shaft consist of woodland . The vent shaft site consists of woodland habitat. No records of protected and notable species on the site, however, it has the potential to support a number of species including bat, badger, breeding birds. **Northern Knott Lane vent shaft** is located within approximately 1km of Hollinwood Branch Canal Site of Special Scientific Interest (SSSI) and two areas of ancient and semi-natural woodland (Daisy Nook Wood and Holden Clough) are located immediately north of the vent shaft site. A number of water bodies are located within 500m of the vent shaft site, which could have the potential to support breeding GCN. Therefore, the site could be supporting terrestrial habitat for GCN. No records of protected and notable species on the site, however, it has the potential to support a number of species including bat, badger, breeding birds, birds listed under Schedule I of The Wildlife and Countryside Act 1981, (as amended). **Northern Lees New Road vent shaft** is not located within the vicinity of any statutory or non-statutory designated sites. The habitats within the vent shaft site consist of grassland and scrub, immediately adjacent to the River Medlock. No records of protected and notable species on the site, however, it has the potential to support a number of species including bat, badger, breeding birds, and GCN. **Given the impacts at Princess Spinney and Barlow Pit vent shafts, including direct impact to SBIs, it is considered that this route would result in a worsening compared to the baseline.**	- -	**Vent Shaft D S1: Bowland Road** - No designated sites or areas of ancient woodland additional to that already assessed. Habitats within the areas appear to be of local ecological value. No known water bodies within 500m of the vent shaft location. The vent shaft location may support some common protected and notable species. **Vent Shaft D S2: Fairy Lane -** No designated sites or areas of ancient woodland additional to that already assessed. Habitats within the areas appear to be of local ecological value. There are water bodies within 500m of the vent shaft location, which may have the potential to support breeding GCN. Therefore, the site could be supporting terrestrial habitat for GCN. The vent shaft location may support some additional common protected and notable species, potentially including water vole. **Vent Shaft D S3: Wilbraham Road** - No designated sites or areas of ancient woodland additional to that already assessed. Habitats within the areas appear to be of local ecological value. No known water bodies within 500m of the vent shaft location. The vent shaft location may support some common protected and notable species. **Vent Shaft D S4; Carriage Street** - Salford Quays (North) SBI is within 2km of the vent shaft location. The vent shaft location is a highly urbanised site, which consists of hardstanding and buildings only. The buildings may be suitable to support roosting bats. **Vent Shaft D N1: Clayton Vale** is located within Clayton Vale LNR and immediately adjacent to Clayton Vale SBI. The LNR consists unimproved grassland, woodland, water bodies and the River Medlock. Rochdale Canal Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC) is located to the north, approximately 1.8km distant from the vent shaft location. Additionally, Bank Bridge Meadow SBI (< 500m), Ashton Canal (West) SBI (<1km), Brookdale Clough (West) SBI and Brookdale Clough (East) SBI (c.1km), Medlock Vale & Lumb Clough (North) SBI (c.1.6km), Medlock Vale & Lumb Clough (South) SBI (c.1.6km), Brookdale Clough (West) SBI (c.1.9km), and Jericho Clough SBI (c.1.9km) are all located within 2km of the vent shaft location. The grassland habitats may be of impotence, and require additional assessment. Desk study records show the location of a badger sett at the vent shaft location and more within the vicinity (CONFIDENTIAL). There are records of water vole and Kingfish (a Schedule 1 bird species) along the River Medlock, north of the vent shaft location. The records of a number of bat and birds species are present within the vicinity of the vent shaft location. The vent shaft location has potential to support these species and further notable species. **Vent Shaft D N2: Lumb Lane** is located within 150m south Hollinwood Branch Canal SSSI, which main habitats include open water, swamp, and tall fen. Also, cited for the SSSI is unimproved neutral grassland, and several regionally and nationally rare floral species. Holden Clough Ancient Woodland is located within 1.5km of the vent shaft location. Many of the non-statutory designated sites listed under the Clayton Vale vent shaft assessment are also within 2km of the Lumb Lane vent shaft. The vent shaft location is located within 500m of water bodies. However, following an assessment of aerial imagery, the vent shaft location is under development and therefore an accurate assessment of the ecological value could not be completed at this stage. **Vent Shaft D N3: Alt Hill Lane** is located within 1km of Holden Clough Ancient Woodland, closer than the above vent shaft location. A mosaic of semi-natural habitats are located at the vent shaft location and there are water bodies located within 500m. The vent shaft location has potential to support a number of protected and notable species. **Vent Shaft D N4: Lees New Road** is not located within the vicinity of any statutory or non-statutory designated sites. The habitats within the vent shaft site consist of grassland and scrub, immediately adjacent to the River Medlock. No records of protected and notable species on the site, however, it has the potential to support a number of species including bat, badger, breeding birds, and GCN. **Given the impacts at Clayton Vale LNR, it is considered that this route would result in a worsening compared to the baseline.**	- -
	Operation	5	No operational impacts	O	No operational impacts	O	No operational impacts	O	No operational impacts	o
Historic Environment	Construction	2, 6, 12	Two Grade II listed buildings are located within the settlement contours of the tunnel and will require monitoring for potential adverse physical impacts. The construction of the Ashton Moss vent shaft will have a direct physical impact on peat deposits likely to contain archaeological or paleoenvironmental evidence. N.B. Historic Environment data does not extend to the eastern extreme of the sift route (as is the same for all sifted options)	O	Given the tunnelled nature of the scheme across the city, it is likely that considerably more listed buildings will require monitoring due to the potential impacts caused by settlement than the current HbD. Vent Shaft B S1 Princes Spinney: no impact Vent Shaft B S2 Barlow Tip: limited archaeological potential given former use of site as gravel quarry. However, the river terrace deposits at the site may have a moderate geoarchaeological potential and any impact to non-designated assets at this location would be direct and permanent Vent Shaft B S3 Longford Park: Longford Park may be considered a non-designated heritage asset as the park is associated with the former Longford Hall and John Rylands. There is the potential for minor impacts through changes to setting and direct physical impacts on any remains associated with the hall. Vent Shaft B S4 North Phoebe Street: The location is the site of anon-designated former glass works noted in the Historic Environment Record. As such there is the potential for direct physical impacts to the asset during construction. Vent Shaft B N1 Elysian Street: no known impacts to the Historic Environment Resource Vent Shaft B N2 Somerset Road: no known impacts to the Historic Environment Resource Vent Shaft B N3 Knott Lane: Historic Environment data doesn't extend this far east Vent Shaft B N4 Lees New Road: Historic Environment data doesn't extend this far east The number of listed buildings likely to be affected by the tunnelled route, and the additional impacts from the vent shaft sites, results in a slight worsening of impacts in comparison to the baseline	- -	Given the tunnelled nature of the scheme across the city, it is likely that considerably more listed buildings will require monitoring due to the potential impacts caused by settlement than the current HbD. Vent Shaft B S1 Princes Spinney: no impact Vent Shaft B S2 Barlow Tip: limited archaeological potential given former use of site as gravel quarry. However, the river terrace deposits at the site may have a moderate geoarchaeological potential and any impact to non-designated assets at this location would be direct and permanent Vent Shaft B S3 Longford Park: Longford Park may be considered a non-designated heritage asset as the park is associated with the former Longford Hall and John Rylands. There is the potential for minor impacts through changes to setting and direct physical impacts on any remains associated with the hall. Vent Shaft B S4 North Phoebe Street: The location is the site of anon-designated former glass works noted in the Historic Environment Record. As such there is the potential for direct physical impacts to the asset during construction. Vent Shaft B N1 Elysian Street: no known impacts to the Historic Environment Resource Vent Shaft B N2 Somerset Road: no known impacts to the Historic Environment Resource Vent Shaft B N3 Knott Lane: Historic Environment data doesn't extend this far east Vent Shaft B N4 Lees New Road: Historic Environment data doesn't extend this far east The number of listed buildings likely to be affected by the tunnelled route, and the additional impacts from the shaft sites, results in a slight worsening of impacts to the baseline	- -	Given the tunnelled nature of the scheme across the city, it is likely that considerably more listed buildings will require monitoring due to the potential impacts caused by settlement than the current HbD. Vent Shaft D S1: Bowland Road - no known impacts to the Historic Environment Resource Vent Shaft D S2: Fairy Lane - no known impacts to the Historic Environment Resource Vent Shaft D S3: Wilbraham Road - no known impacts to the Historic Environment Resource Vent Shaft D S4: Carriage Street - no known impacts to the Historic Environment Resource Vent Shaft D N1: Clayton Vale - located in the approximate location of a non-designated Iron Age Trackway, which could result in direct physical impacts to a non-designated asset. Vent Shaft D N2: Lumb Lane - the location is adjacent to a Grade II listed farmhouse and construction works are likely to result in temporary and permanent impacts to the value of the asset through changes in its setting Vent Shaft D N3: Alt Hill Lane - Historic Environment data does not extend this far east Vent Shaft D N4: Lees New Road - Historic Environment data does not extend this far east The number of listed buildings potentially affected by the route of the tunnel, and the additional impacts from the vent shaft locations, result in a slight worsening in comparison to the baseline.	- -
	Operation	2, 6, 12	There are no additional operational impacts of the CP3 and NPR scheme	O	There are no operational impacts from the proposed option	O	There are no operational impacts from the proposed option	O	There are no operational impacts from the proposed option	O
Human Health	Construction	4, 6	Altrincham Road vent shaft: No impacts. Palatine Road vent shaft: The loss of one residential property, Withington Golf Club's club house, car park and four holes of the course. The loss of land at the gold course will affect its ability to operate. Wilmslow Road vent shaft: Residential properties on Wilmslow Road will experience significant noise and visual impacts resulting in adverse change to neighbourhood quality. The loss Christie Hospital Car Park D will have an adverse health impact on patients and staff accessing the hospital. Birchfield Road vent shaft: Residential properties on Birchfields Road will experience significant noise and visual impacts resulting in an adverse change to neighbourhood quality. Birchfields Primary school (60m north of vent shaft site) will experience significant noise and visual impacts. Manchester Tunnel north portal: No impacts. NPR Oldham Road vent shaft: Visual impacts for local residents. One PRoW will be affected. NPR Ashton Moss vent shaft: A PRoW crosses the construction compound and a network of PRoWs are situated to the east. Views for footpath users would likely be adversely impacted. The Ashton Moss vent shaft is immediately south of residents along Warne Avenue and east of residents along Wren Close. Hawthorns Community School and its playing fields, and Aldwyn Primary School are located approximately 150m to the south. NPR Node L vent shaft: Cockfields Farm, a children's visitor attraction, is located to the south of the vent shaft and residential receptors are also located approx. 200m north-west of the Node L vent shaft location.	O	Vent Shaft B S1 Princes Spinney: Princes Spinney is not publicly accessible so no loss to open space. Residential properties are located immediately west of the site on Baxter Gardens, and on the opposite side of Royal Oak Road (Maldon Grove and Pentwyn Grove).Construction of the vent shaft may result in a neighbourhood quality impact for people living in the community. Vent Shaft B S2 Barlow Tip: Barlow Tip is publicly accessible open space, with maintained footpaths throughout. The temporary and permanent loss of this space may result in a significant health impact given the urban location and importance of access to green space. A footpath along the River Mersey runs along the southern edge (National Cycle Route 62 follows the same route). Chorlton Water Park is located immediately east of the site, and Chorlton-cum-Hardy Golf Club is immediately north and west of the site. Construction may impact the amenity of these resources. The loss of this open space may affect users of the local footpath network along the river and through the water park due to loss of, or changes to, access. Chorlton Water Park Sure Start Children's Centre and Barlow Hall Primary School are located approximately 300m north-east of the site, there may be adverse noise and visual impacts on these resources, as well as for the residential receptors along Redwing Avenue and Woodpecker Road. Vent Shaft B S3 Longford Park: Temporary and permanent loss of open space and parkland within a residential area. Loss of approx. 1/3 of area used for disc golf - the loss of the open space and recreational facility will be significant. Firswood Community centre is located immediately to the north of the site, construction may have noise and visual impacts on users of the centre. Land required for the vent shaft will cover parts of the footpaths within Longford Park, which may affect access to all parts of the park for local residents. Longford Park School and St Teresa's Primary School are approximately 350m to the west and east (respectively) of the proposed site. Residential properties are located immediately north, south and east of the site. Construction may result in a neighbourhood quality impact in this area. Vent Shaft B S4 North Phoebe Street: Construction will result in the demolition of Jump Ninja Trampoline Park, there are no alternatives in the local area. This may impact the ability of people to access physical activity. Manchester Private Hospital is approximately 200m to the west of the site and may be impacted by construction noise and traffic, this may result in an adverse health impact. Vent Shaft B N1 Elysian Street: The site covers the south-eastern corner of Openshaw Park. Construction will result in the permanent loss of two children's play areas, a tennis court and a Mixed Use Games Area (MUGA), reducing access to physical activity and recreational facilities. Access to the park may be affected, particularly from the southern and eastern sides. There are limited alternatives in the local area which is a mixture of residential and industrial. Residential properties are located immediately east and approximately 50m to the north. These properties may experience noise, visual and construction traffic impacts resulting in a neighbourhood quality impact. Vent Shaft B N2 Somerset Road: Construction will result in the loss of publicly accessible green space between houses on Gloucester Road and the railway line. There are a number of alternative spaces in the area. Residential properties along Gloucester Road will be immediately south of the site and may experience noise and visual impacts during construction. Vent Shaft B N3 Knott Lane: Located on the southern edge of Daisy Nook Country Park. Footpaths leading into and out of the country park may be impacted by land requirements for construction of the vent shaft, this would impact people's ability to access open green space. Vent Shaft B N4 Lees New Road: The proposed site is public open space with a number of footpaths running across it, including the Oldham Way. A number of footpaths, including the Oldham Way, may be affected by construction of the vent shaft, and may need to be permanently diverted depending on the exact location of the vent shaft once construction is complete. Alt Academy (primary school) is located 340m uphill from the site. There are residential properties approximately 100m to the north-east of the site. Alt Academy and the residential properties may experience noise and visual impacts during construction. Overall, the requirement for a number of public parks and green space, alongside the proximity of residential properties and community resources mean that this route is considered to be a major worsening compared to the baseline.	- - -	Vent Shaft B S1 Princes Spinney: Princes Spinney is not publicly accessible so no loss to open space. Residential properties are located immediately west of the site on Baxter Gardens, and on the opposite side of Royal Oak Road (Maldon Grove and Pentwyn Grove).Construction of the vent shaft may result in a neighbourhood quality impact for people living in the community. Vent Shaft B S2 Barlow Tip: Barlow Tip is publicly accessible open space, with maintained footpaths throughout. The temporary and permanent loss of this space may result in a significant health impact given the urban location and importance of access to green space. A footpath along the River Mersey runs along the southern edge (National Cycle Route 62 follows the same route). Chorlton Water Park is located immediately east of the site, and Chorlton-cum-Hardy Golf Club is immediately north and west of the site. Construction may impact the amenity of these resources. The loss of this open space may affect users of the local footpath network along the river and through the water park due to loss of, or changes to, access. Chorlton Water Park Sure Start Children's Centre and Barlow Hall Primary School are located approximately 300m north-east of the site, there may be adverse noise and visual impacts on these resources, as well as for the residential receptors along Redwing Avenue and Woodpecker Road. Vent Shaft B S3 Longford Park: Temporary and permanent loss of open space and parkland within a residential area. Loss of approx. 1/3 of area used for disc golf - the loss of the open space and recreational facility will be significant. Firswood Community centre is located immediately to the north of the site, construction may have noise and visual impacts on users of the centre. Land required for the vent shaft will cover parts of the footpaths within Longford Park, which may affect access to all parts of the park for local residents. Longford Park School and St Teresa's Primary School are approximately 350m to the west and east (respectively) of the proposed site. Residential properties are located immediately north, south and east of the site. Construction may result in a neighbourhood quality impact in this area. Vent Shaft B S4 North Phoebe Street: Construction will result in the demolition of Jump Ninja Trampoline Park, there are no alternatives in the local area. This may impact the ability of people to access physical activity. Manchester Private Hospital is approximately 200m to the west of the site and may be impacted by construction noise and traffic, this may result in an adverse health impact. Vent Shaft B N1 Elysian Street: The site covers the south-eastern corner of Openshaw Park. Construction will result in the permanent loss of two children's play areas, a tennis court and a Mixed Use Games Area (MUGA), reducing access to physical activity and recreational facilities. Access to the park may be affected, particularly from the southern and eastern sides. There are limited alternatives in the local area which is a mixture of residential and industrial. Residential properties are located immediately east and approximately 50m to the north. These properties may experience noise, visual and construction traffic impacts. Vent Shaft B N2 Somerset Road: Construction will result in the loss of publicly accessible green space between houses on Gloucester Road and the railway line. There are a number of alternative spaces in the area. Residential properties along Gloucester Road will be immediately south of the site and may experience noise and visual impacts during construction. Vent Shaft B N3 Knott Lane: Located on the southern edge of Daisy Nook Country Park. Footpaths leading into and out of the country park may be impacted by land requirements for construction of the vent shaft, this would impact people's ability to access open green space. Vent Shaft B N4 Lees New Road: The proposed site is public open space with a number of footpaths running across it, including the Oldham Way. A number of footpaths, including the Oldham Way, may be affected by construction of the vent shaft, and may need to be permanently diverted depending on the exact location of the vent shaft once construction is complete. Alt Academy (primary school) is located 340m uphill from the site. There are residential properties approximately 100m to the north-east of the site. Alt Academy and the residential properties may experience noise and visual impacts during construction. Overall, the requirement for a number of public parks and green space, alongside the proximity of residential properties and community resources mean that this route is considered to be a major worsening compared to the baseline.	- - -	Vent Shaft D S1: Bowland Road: The loss of part of Baguley Park will impact access to green space and physical activity, resulting in a health impact. The potential loss of Early Inspirations Pre-School will have an adverse impact, although there are a number of alternative nearby. There is the potential for neighbourhood quality impacts for the community immediately adjacent to the site, including residents to the north, east, west and south of the site. There may be noise and visual impacts on Baguley Hall Primary School, Kids Start Nursery and Holyrood Nursery which are located approximately 150m to the west of the site. Vent Shaft D S2: Fairy Lane: Construction will result in the temporary loss of approximately three of 28 grass sports pitches at University of Manchester Wythenshawe Sports Ground, there will also be a permanent land requirement affecting one or more of the pitches. This may have an impact on access to green space and physical activity for users of the facility. Vent Shaft D S3: Wilbraham Road: The temporary and permanent loss of informal public open space adjacent to Maine Road Football Club (the land may also be used informally by the football club), may impact people's access to local green space. There is the potential for a neighbourhood quality impact on residents immediately adjacent to the site to the north, south and east. Vent Shaft D S4: Carriage Street: Land required for the construction of the vent shaft may result in the loss of a play area on Carriage Street and the loss of a church (AD MSBN church) operating out of the industrial estate that is being demolished. Residential properties are located immediately adjacent to the site. There are a number of community facilities within a 250m radius of the site including: St Alphonsus Primary School, Afifah School, Old Trafford Children's Centre, Lowry Lodge Sheltered Housing, Brooks Bar Medical Centre, Arabic Church Manchester, Jame'ah Majid E Noor Mosque, Igreja Evangelica Brasileira and Kingdom Hall. Construction may result in a neighbourhood quality impact on this area due to noise, visual and traffice impacts during construction. Vent Shaft D N1: Clayton Vale: Approximately one fifth of Clayton Vale is required for the construction of the vent shaft. It is a recreational area used for activities including picnics, biking and walking. Noise and visual impacts may impact residential receptors approximately 100m to the south, and St. Willibrods Catholic Primary School, approximately 200m to the east. The loss of this green space will affect the local communities access to green space and physical activity. Vent Shaft D N2: Lumb Lane: The vent shaft will be located on the car park, playground and playing field of Laurus Ryecroft High School. The permanent loss of these school facilities may affect the schools ability to function. If not, there will be noise and visual impacts on the school, and residential properties to the east and south. Vent Shaft D N3: Alt Hill Lane: Potential neighbourhood quality impact on residential properties on Alt Hill Lane, adjacent to the site. Vent Shaft D N4: Lees New Road: The proposed site is public open space with a number of footpaths running across it, including the Oldham Way. A number of footpaths, including the Oldham Way, may be affected by construction of the vent shaft, and may need to be permanently diverted depending on the exact location of the vent shaft once construction is complete. Alt Academy (primary school) is located 340m uphill from the site. There are residential properties approximately 100m to the north-east of the site. Alt Academy and the residential properties may experience noise and visual impacts during construction. Overall, the requirement for a number of public parks and green space, alongside the impacts on a number of educational facilities, proximity of residential properties and community resources mean that this route is considered to be a major worsening compared to the baseline.	- - -
	Operation	4, 6	No operational health impacts.	O	For the purpose of this assessment is it assumed that there will be a permanent requirement for land for the vent shafts but that the rest of the land required during construction can be returned to its original use. Taking into account the loss of community resources detailed above and the assumption, there are not expected to be any further community impacts during operation. However, given the land required from public parks and green spaces, this route is considered to be a minor worsening compared to the baseline.	- -	For the purpose of this assessment is it assumed that there will be a permanent requirement for land for the vent shafts but that the rest of the land required during construction can be returned to its original use. Taking into account the loss of community resources detailed above and the assumption, there are not expected to be any further community impacts during operation. However, given the land required from public parks and green spaces, this route is considered to be a minor worsening compared to the baseline.	- -	For the purpose of this assessment is it assumed that there will be a permanent requirement for land for the vent shafts but that the rest of the land required during construction can be returned to its original use. Taking into account the loss of community resources (and potential residential properties) detailed above and the assumption, there are not expected to be any further community impacts during operation. However, given the land required from public parks and green spaces, this route is considered to be a minor worsening compared to the baseline.	- -
Land Quality	Construction	16	No significant construction impacts at the Manchester Tunnel vent shafts or Manchester Tunnel north portal. No additional sig impacts associated with NPR node 3.	O	Vent Shaft B S1 Princes Spinney - Likely to have remained undeveloped. Fly tipping could have impacted on underlying soils but could be managed through CoCP. Vent Shaft B S2 Barlow Tip: is located on the site of a former tip with active gas measures. Although construction impacts could be mitigated through the CoCP this could require considerable assessment and negotiation with owner and EA and may present a challenge. Not a coal mining reporting area. Vent Shaft B3 Longford Park - looks undeveloped. Close to Thirlmere aqueduct. Not likely to have any significant LQ construction impacts. Not a coal mining reporting area. Vent Shaft B4 North Phoebe Street - area of former industry, including saw mills, rail sidings, Salford gas works and tunnel located to the west. Till over Sandstone (Principal aquifer). Coal mining reporting area but not development high risk area. impacts can be mitigated by CoCP. Vent Shaft B N1 Elysian Street: Likely to have remained undeveloped as a recreation ground although some surrounding industry within 250m. Till over Sandstone (Principal aquifer). Coal mining reporting area but not development high risk impacts can be mitigated by CoCP. Vent Shaft B N2 Somerset Road: Likely farmland until construction of housing. Near to a cutting leading to rail to north. Coal mining reporting area but not development high risk. Site on Till over sandstone (principal aquifer). impacts can be mitigated by CoCP. Vent Shaft B N3 Knott Lane: Greenfield site, no previous development apparent. No contaminative activities in the vicinity. Underlain by sand and gravel over till, over coal measures. Coal mining reporting area but not development high risk. Vent Shaft B N4 Lees New Road: Greenfield site, no previous development apparent. No contaminative activities in the vicinity. Till over coal measures. Coal mining reporting area and development high risk area.	- - -	Vent Shaft B S1 Princes Spinney - Likely to have remained undeveloped. Fly tipping could have impacted on underlying soils but could be managed through CoCP. Vent Shaft B S2 Barlow Tip: is located on the site of a former tip with active gas measures. Although construction impacts could be mitigated through the CoCP this could require considerable assessment and negotiation with owner and EA and may present a challenge. Not a coal mining reporting area. Vent Shaft B3 Longford Park - looks undeveloped. Close to Thirlmere aqueduct. Not likely to have any significant LQ construction impacts. Not a coal mining reporting area. Vent Shaft B4 North Phoebe Street - area of former industry, including saw mills, rail sidings, Salford gas works and tunnel located to the west. Till over Sandstone (Principal aquifer). Coal mining reporting area but not development high risk area. impacts can be mitigated by CoCP. Vent Shaft B N1 Elysian Street: Likely to have remained undeveloped as a recreation ground although some surrounding industry within 250m. Till over Sandstone (Principal aquifer). Coal mining reporting area but not development high risk impacts can be mitigated by CoCP. Vent Shaft B N2 Somerset Road: Likely farmland until construction of housing. Near to a cutting leading to rail to north. Coal mining reporting area but not development high risk. Site on Till over sandstone (principal aquifer). impacts can be mitigated by CoCP. Vent Shaft B N3 Knott Lane: Greenfield site, no previous development apparent. No contaminative activities in the vicinity. Underlain by sand and gravel over till, over coal measures. Coal mining reporting area but not development high risk. Vent Shaft B N4 Lees New Road: Greenfield site, no previous development apparent. No contaminative activities in the vicinity. Till over coal measures. Coal mining reporting area and development high risk area.	- - -	Vent Shaft D S1 (Bowland Road) - apparently undeveloped with no contaminative activities at or immediate vicinity of site. Superficial geology absent, Bowland Mudstone (Secondary aquifer). Not in a coal mining reporting area. impacts can be mitigated by CoCP. Vent Shaft D S2 (Fairy Lane). Looks undeveloped, no nearby industry apart from substation to the north. Sand and gravel over Tarporley Siltstone. Not in a coal mining reporting area. impacts can be mitigated by CoCP. Vent Shaft D S3 (Wilbraham Road). Has remained undeveloped apart from sports pitches. Surrounding area is residential (incl. historically). Sand and gravel over Wilmslow SST (principal aquifer). Not in a coal mining reporting area. impacts can be mitigated by CoCP. Vent Shaft D S4 (Carriage St) - Site of a former motor works, now industrial estate so some contaminative history. Sand and gravel over sandstone (principal aquifer). Coal mining reporting area but not high risk development area. impacts can be mitigated by CoCP. Vent Shaft D N1 (Clayton). Site itself appears not to be developed previously. Former infectious disease hospital and landfill site some 100m to the north. Landfill on northern bank of River Medlock (subject site to south). Alluvium over till over sandstone (principal aquifer). Coal mining reporting area but not high risk development. impacts can be mitigated by CoCP. Vent Shaft D N2 Lumb Lane - No obvious historical contaminative uses. Currently being developed sd Laurus Ryecroft Secondary School Relatively rural. Till over coal measures. Coal mining reporting area but not high risk development. Impacts can be mitigated by CoCP. Vent Shaft D N3 (Alt Hill Lane) Historic mapping shows no development at site but Tanpit Row some 150m to north. Till over coal measures SST. River Medlock showt distance to west. Coal mining reporting area but not high risk development. impacts can be mitigated by CoCP. Vent Shaft B N4 Lees New Road: Greenfield site, no previous development apparent. No contaminative activities in the vicinity. Till over coal measures. Coal mining reporting area and development high risk area. Overall this is considered neutral to baseline option.	O
	Operation	16	No operational land quality impacts.	O	There are no operational impacts from the proposed option	O	There are no operational impacts from the proposed option	O	There are no operational impacts from the proposed option	O

Landscape and Visual	Construction	1, 4, 5, 6	Construction impacts upon landscape character and visual amenity will arise from demolitions, the presence of construction plant, compounds and fencing. Landscape and visual receptors surrounding the station will experience a reduction in permeability and legibility caused by temporary footway diversions and site hoarding. Noise and activity generated during construction will further diminish existing low levels of tranquillity. Residential receptors and PRoW will be affected at: Palatine Road vent shaft, Wilmslow Road vent shaft, Birchfields Road vent shaft, Northern Tunnel Portal, NPR Oldham Road vent shaft, NPR Ashton Moss vent shaft and NPR Node L vent shaft. Palatine Road vent shaft will have significant impacts upon Mersey Valley Managed Open Space Landscape Character Area resulting from construction activities.	O	Construction activities described in the baseline option will be similar in this option. Vent Shaft B S1 (Princes Spinney): Landscape character impacts from loss to woodland of value. Visual impacts to immediate surrounding residential receptors and Regional Cycle Route 85 along Hall Lane. Vent Shaft B S2 (Barlow Tip) – Landscape character impacts are likely from the loss of mature vegetation within a well-used recreational area. Potential impacts upon neighbouring Chorlton Waterpark and the series of PRoW and cycle routes than run between. The well-used footpath alongside the River Mersey is likely to be impacted. This includes the Trans Pennine Trail route 62. Visual receptors along these routes, at Sale Gold course, Chorlton -Cum-Hardy Gold course, as well as residents to the and Barlow Hall Primary School to the north of the Site. Vent Shaft B S3 (Longford Park) – Landscape character impacts are likely from the disturbance this well used recreational park. Visual impacts to users of the National Cycle network which runs through the park and users of the disc golf course. Neighbouring residents overlooking the park, in particular, those along Kings Road and Great Stone Road are likely to be impacted as well as Firswood Community centre on the edge of the park. Vent Shaft B S4 (North Phoebe Street) – Impacts upon landscape character are not likely to be significant given the baseline setting of an industrial area. Residential receptors are likely to experience some disturbance during construction works. Vent Shaft B N1 (Elysian Street) – Landscape character impacts are likely from the disturbance to Openshaw Park including the Openshaw Playground and sports pitches. Visual impacts to users of the park and surrounding residents overlooking the park, in particular those along Parkhouse Street, Elysian Street and Meech Street. Vent Shaft B N2 (Somerset Road) - Landscape character impacts are likely from the loss of mature vegetation. Visual impacts to users of the cycleway and PRoW in the area and surrounding residents overlooking the Site, in particular those along Parvet Avenue, Gloucester Road and Somerset Road. Vent Shaft B N3 (Knott Lane) – Landscape character impacts are likely on the Daisy Nook Country Park and its associated mature woodland vegetation. Visual impacts to users of the PRoW to the north as well as residential receptors using Daisy Nook country park and residents to the south. Vent Shaft B N4 (Lees New Road) – Landscape character impacts are likely from the disturbance to this area of open grassland and scrub. Visual impacts to users of a number of PRoW in the area, cycle paths and residents to the west and Cockfields Farm Park to the south. Given the increase in impacts to features that contribute to landscape character and the increase in impacts to recreational receptors, it is considered that this route would result in a minor worsening compared to the baseline option during construction.	- -	Construction activities described in the baseline option will be similar in this option. Vent Shaft B1 S1 (Princes Spinney): Landscape character impacts from loss to woodland of value. Visual impacts to immediate surrounding residential receptors and Regional Cycle Route 85 along Hall Lane. Vent Shaft B1 S2 (Barlow Tip) – Landscape character impacts are likely from the loss of mature vegetation within a well-used recreational area. Potential impacts upon neighbouring Chorlton Waterpark and the series of PRoW and cycle routes than run between. The well-used footpath alongside the River Mersey is likely to be impacted. This includes the Trans Pennine Trail route 62. Visual receptors along these routes, at Sale Gold course, Chorlton -Cum-Hardy Gold course, as well as residents to the and Barlow Hall Primary School to the north of the Site. Vent Shaft B1 S3 (Longford Park) – Landscape character impacts are likely from the disturbance this well used recreational park. Visual impacts to users of the National Cycle network which runs through the park and users of the disc golf course. Neighbouring residents overlooking the park, in particular, those along Kings Road and Great Stone Road are likely to be impacted as well as Firswood Community centre on the edge of the park. Vent Shaft B1 S4 (North Phoebe Street) – Impacts upon landscape character are not likely to be significant given the baseline setting of an industrial area. Residential receptors are likely to experience some disturbance during construction works. Vent Shaft B1 N1 (Elysian Street) – Landscape character impacts are likely from the disturbance to Openshaw Park including the Openshaw Playground and sports pitches. Visual impacts to users of the park and surrounding residents overlooking the park, in particular those along Parkhouse Street, Elysian Street and Meech Street. Vent Shaft B1 N2 (Somerset Road) - Landscape character impacts are likely from the loss of mature vegetation. Visual impacts to users of the cycleway and PRoW in the area and surrounding residents overlooking the Site, in particular those along Parvet Avenue, Gloucester Road and Somerset Road. Vent Shaft B1 N3 (Knott Lane) – Landscape character impacts are likely on the Daisy Nook Country Park and its associated mature woodland vegetation. Visual impacts to users of the PRoW to the north as well as residential receptors using Daisy Nook country park and residents to the south. Vent Shaft B1 N4 (Lees New Road) – Landscape character impacts are likely from the disturbance to this area of open grassland and scrub. Visual impacts to users of a number of PRoW in the area, cycle paths and residents to the west and Cockfields Farm Park to the south. Given the increase in impacts to features that contribute to landscape character and the increase in impacts to recreational receptors, it is considered that this route would result in a worsening compared to the baseline option during construction.	- -	Construction activities described in the baseline option will be similar in this option. Vent Shaft D S1 (Bowland Road): Landscape character impacts are likely from the disturbance to Baguley Park. Visual impacts to users of the park, Baguley Hall Primary School, as well as surrounding residents overlooking the park, in particular those along Bowland Road, Ackworth Drive, Hall Lane and Oakmoor Road. Vent Shaft D S2 (Fairy Lane): Landscape character impacts are likely from the disturbance to the sports fields of Wythenshawe Sport Ground. Visual impacts to users of the sports ground and PRoW within it. Residents overlooking the sports ground along Fairy Lane. Vent Shaft D S3 (Wilbraham Road): Landscape character impacts are likely from the disturbance to the sports fields of St Margarets Sports Fields. Visual impacts to users of the sports fields and residents overlooking the sports field, in particular, those along Morville Road, Brantingham Road and A6010 Wilbraham Road. Vent Shaft D S4 (Carriage Street): Impacts upon landscape character are not likely to be significant given the baseline setting of an industrial estate. Nearby residential receptors are likely to experience some disturbance to views during construction works. Vent Shaft D N1 (Clayton Vale): Landscape character impacts are likely from the disturbance to Clayton Vale and loss of mature vegetation within the green space. Visual impacts to users of the surrounding extensive PRoW network and cycle path/trails as well as potential impacts to St Willbroards Catholic Primary School. Vent Shaft D N2 (Lumb Lane): Impacts upon landscape character are not likely to be significant given the baseline setting of large scale buildings on an urban edge. Visual impacts to users of the PRoW and cycleways along Manchester and Ashton under Lyne Canal, recreational users of Brookdale Golf Course and the PRoW that run along its southern boundary parallel with the river Medlock, Laurus Ryecroft High School, as well as, residents to the south and east. Vent Shaft D N3 (Alt Hill Lane): Landscape character impacts are likely from the disturbance to open countryside near Alt Hill Lane. Visual impacts to users of the surrounding PRoW and cycle paths and residents off Alt Hill Lane. Vent Shaft D N4 (Lees New Road): Landscape character impacts are likely from the disturbance to this area of open grassland and scrub. Visual impacts to users of a number of PRoW in the area, cycle paths and residents to the west and Cockfields Farm Park to the south. Given the increase in impacts to features that contribute to landscape character and the increase in impacts to recreational receptors, it is considered that this route would result in a worsening compared to the baseline option during construction.	- -
	Operation	1, 4, 5, 6	Impacts upon residential receptors and people using PRoW at: Palatine Road vent shaft, Wilmslow Road vent shaft, Birchfields Road vent shaft, Northern Tunnel Portal, NPR Oldham Road vent shaft, NPR Ashton Moss vent shaft and NPR Node L vent shaft. Mersey Valley Managed Open Space Landscape Character Area will have significant impacts resulting from the introduction of Palatine Road vent shaft and auto-transformer station which will be uncharacteristic new features in the landscape.	O	The nature of operational features, such as vent shafts are understood in the baseline option are assumed to be similar in this option. Vent Shaft B S1 (Princes Spinney): Landscape character impacts from loss to woodland of value and the introduction of incongruous features within this landscape. Visual impacts to immediate surrounding residential receptors and Regional Cycle Route 85 along Hall Lane. Vent Shaft B S2 (Barlow Tip) – Landscape character impacts are likely from the loss of mature vegetation within a well-used recreational area and the introduction of incongruous features within this landscape. Potential impacts upon neighbouring Chorlton Waterpark and the series of PRoW and cycle routes than run between. The well-used footpath alongside the River Mersey is likely to be impacted. This includes the Trans Pennine Trail route 62. Visual receptors along these routes, at Sale Gold course, Chorlton -Cum-Hardy Gold course, as well as residents to the and Barlow Hall Primary School to the north of the Site. Vent Shaft B S3 (Longford Park) – Landscape character impacts are likely from the introduction of incongruous features within this well used recreational park. Visual impacts to users of the National Cycle network which runs through the park and users of the disc golf course. Neighbouring residents overlooking the park, in particular, those along Kings Road and Great Stone Road are likely to be impacted as well as Firswood Community centre on the edge of the park. Vent Shaft B S4 (North Phoebe Street) – Impacts upon landscape character are not likely to be significant given the baseline setting of an industrial area. There are residential receptors with likely views towards the Site but the vent shaft features will be similar to their existing views. Vent Shaft B N1 (Elysian Street) – Landscape character impacts are likely from the introduction of incongruous features within Openshaw Park. Visual impacts to users of the park and surrounding residents overlooking the park, in particular those along Parkhouse Street, Elysian Street and Meech Street. Vent Shaft B N2 (Somerset Road) - Landscape character impacts are likely from the loss of mature vegetation and the introduction of incongruous features within the woodland landscape. Visual impacts to users of the cycleway and PRoW in the area and surrounding residents overlooking the Site, in particular those along Parvet Avenue, Gloucester Road and Somerset Road. Vent Shaft B N3 (Knott Lane) – Landscape character impacts are likely on the Daisy Nook Country Park and its associated mature woodland vegetation due to the introduction of incongruous features within this high value landscape. Visual impacts to users of the PRoW to the north as well as residential receptors using Daisy Nook country park and residents to the south. Vent Shaft B N4 (Lees New Road) – Landscape character impacts are likely from the introduction of incongruent features into the landscape. Visual impacts to users of a number of PRoW in the area, cycle paths and residents to the west and Cockfields Farm Park to the south. Given the increase in impacts to features that contribute to landscape character and the increase in impacts to recreational receptors, it is considered that this route would result in a minor worsening compared to the baseline option during operation.	- -	The nature of operational features, such as vent shafts are understood in the baseline option are assumed to be similar in this option. Vent Shaft B1 S1 (Princes Spinney): Landscape character impacts from loss to woodland of value and the introduction of incongruous features within this landscape. Visual impacts to immediate surrounding residential receptors and Regional Cycle Route 85 along Hall Lane. Vent Shaft B1 S2 (Barlow Tip) – Landscape character impacts are likely from the loss of mature vegetation within a well-used recreational area and the introduction of incongruous features within this landscape. Potential impacts upon neighbouring Chorlton Waterpark and the series of PRoW and cycle routes than run between. The well-used footpath alongside the River Mersey is likely to be impacted. This includes the Trans Pennine Trail route 62. Visual receptors along these routes, at Sale Gold course, Chorlton -Cum-Hardy Gold course, as well as residents to the and Barlow Hall Primary School to the north of the Site. Vent Shaft B1 S3 (Longford Park) – Landscape character impacts are likely from the introduction of incongruous features within this well used recreational park. Visual impacts to users of the National Cycle network which runs through the park and users of the disc golf course. Neighbouring residents overlooking the park, in particular, those along Kings Road and Great Stone Road are likely to be impacted as well as Firswood Community centre on the edge of the park. Vent Shaft B1 S4 (North Phoebe Street) – Impacts upon landscape character are not likely to be significant given the baseline setting of an industrial area. There are residential receptors with likely views towards the Site but the vent shaft features will be similar to their existing views. Vent Shaft B1 N1 (Elysian Street) – Landscape character impacts are likely from the introduction of incongruous features within Openshaw Park. Visual impacts to users of the park and surrounding residents overlooking the park, in particular those along Parkhouse Street, Elysian Street and Meech Street. Vent Shaft B1 N2 (Somerset Road) - Landscape character impacts are likely from the loss of mature vegetation and the introduction of incongruous features within the woodland landscape. Visual impacts to users of the cycleway and PRoW in the area and surrounding residents overlooking the Site, in particular those along Parvet Avenue, Gloucester Road and Somerset Road. Vent Shaft B1 N3 (Knott Lane) – Landscape character impacts are likely on the Daisy Nook Country Park and its associated mature woodland vegetation due to the introduction of incongruous features within this high value landscape. Visual impacts to users of the PRoW to the north as well as residential receptors using Daisy Nook country park and residents to the south. Vent Shaft B N4 (Lees New Road) – Landscape character impacts are likely from the introduction of incongruent features into the landscape. Visual impacts to users of a number of PRoW in the area, cycle paths and residents to the west and Cockfields Farm Park to the south. Given the increase in impacts to features that contribute to landscape character and the increase in impacts to recreational receptors, it is considered that this route would result in a worsening compared to the baseline option during operation.	- -	The nature of operational features, such as vent shafts are understood in the baseline option are assumed to be similar in this option. Vent Shaft D S1 (Bowland Road): Landscape character impacts are likely from the introduction of incongruous features within Baguley Park. Visual impacts to users of the park, Baguley Hall Primary School, as well as surrounding residents overlooking the park, in particular those along Bowland Road, Ackworth Drive, Hall Lane and Oakmoor Road. Vent Shaft D S2 (Fairy Lane): Vent Shaft D S2 (Fairy Lane): Landscape character impacts are likely from the introduction of incongruous features within the sports fields of Wythenshawe Sport Ground. Visual impacts to users of the sports ground and PRoW within it. Residents overlooking the sports ground along Fairy Lane. Vent Shaft D S3 (Wilbraham Road): Landscape character impacts are likely from the introduction of incongruous features within the sports fields of St Margarets Sports Fields. Visual impacts to users of the sports fields and residents overlooking the sports field, in particular, those along Morville Road, Brantingham Road and A6010 Wilbraham Road. Vent Shaft D S4 (Carriage Street): Impacts upon landscape character are not likely to be significant given the baseline setting of an industrial estate. There are residential receptors with likely views towards the Site but the vent shaft features will be similar to their existing views. Vent Shaft D N1 (Clayton Vale): Landscape character impacts are likely from the introduction of incongruous features within Clayton Vale and loss of mature vegetation within the green space. Visual impacts to users of the surrounding extensive PRoW network and cycle path/trails as well as potential impacts to St Willbroards Catholic Primary School. Vent Shaft D N2 (Lumb Lane): Impacts upon landscape character are not likely to be significant given the baseline setting of large scale buildings on an urban edge. Visual impacts to users of the PRoW and cycleways along Manchester and Ashton under Lyne Canal, recreational users of Brookdale Golf Course and the PRoW that run along its southern boundary parallel with the river Medlock, Laurus Ryecroft High School, as well as, residents to the south and east. Vent Shaft D N3 (Alt Hill Lane): Vent Shaft D N3 (Alt Hill Lane): Landscape character impacts are likely from the introduction of incongruent features within open countryside near Alt Hill Lane. Visual impacts to users of the surrounding PRoW and cycle paths and residents off Alt Hill Lane. Vent Shaft D N4 (Lees New Road): Landscape character impacts are likely from the introduction of incongruent features into the landscape. Visual impacts to users of a number of PRoW in the area, cycle paths and residents to the west and Cockfields Farm Park to the south. Given the increase in impacts to features that contribute to landscape character and the increase in impacts to recreational receptors, it is considered that this route would result in a worsening compared to the baseline option during operation.	- -
Socio-economics	Construction	3, 4	54 business resource impacted resulting in approximately 660 job losses. 12.8km Manchester Tunnel - no impact Altrincham Road vent shaft - no impact Palatine Road vent shaft - loss of Withington Golf Club's club house, car park and several golf holes providing approximately 10 jobs. Wilmslow Road vent shaft - loss of one of the Christie Hospital car parks and three business providing approximately 10 jobs. Birchfields Road Vent shaft - loss of half the Fallowfield retail park containing three businesses and its car park providing approximately 80 jobs. Manchester tunnel north portal - loss of 46 business resources providing approximately 570 jobs NPR Oldham Road vent shaft - no impact NPR Ashton Moss vent shaft - no impact NPR Node L vent shaft - no impact	O	Five business resources impacted resulting in approximately 20 job losses. Given the decrease of ~650 job losses, it is considered this option would result in a major improvement compared to the baseline option during construction. Vent Shaft B S1 (Princes Spinney) - no impact Vent Shaft B S2 (Barlow Tip) - no impact Vent Shaft B S3 (Longford Park) - Loss of ~1/3 of disk golf facility run from Caffeine & Co Longford Park providing approximately 2 jobs Vent Shaft B S4 (North Phoebe Street) - Loss of two buildings containing four businesses (three builders warehouses and a trampoline park) to the west of Red Rose Retail Park providing approximately 20 jobs. Vent Shaft B N1 (Elysian Street) - no impact Vent Shaft B N2 (Somerset Road) - no impact Vent Shaft B N3 (Knott Lane) - no impact Vent Shaft B N4 (Lees New Road) - no impact	+ + +	Five business resources impacted resulting in approximately 20 job losses. Given the decrease of ~650 job losses, it is considered this option would result in a major improvement compared to the baseline option during construction. Vent Shaft B S1 (Princes Spinney) - no impact Vent Shaft B S2 (Barlow Tip) - no impact Vent Shaft B S3 (Longford Park) - Loss of ~1/3 of disk golf facility run from Caffeine & Co Longford Park providing approximately 2 jobs Vent Shaft B S4 (North Phoebe Street) - Loss of two buildings containing four businesses (three builders warehouses and a trampoline park) to the west of Red Rose Retail Park providing approximately 20 jobs. Vent Shaft B N1 (Elysian Street) - no impact Vent Shaft B N2 (Somerset Road) - no impact Vent Shaft B N3 (Knott Lane) - no impact Vent Shaft B N4 (Lees New Road) - no impact	+ + +	14 business resources impacted resulting in approximately 140 job losses. Given the decrease of ~500 job losses, it is considered this option would result in a major improvement compared to the baseline option during construction. Vent Shaft D S1 (Bowland Road) - Loss of Early Aspirations Pre-school to north east of site providing approximately 5 jobs. Vent Shaft D S2 (Fairy Lane) - no impact Vent Shaft D S3 (Wilbraham Road) - no impact Vent Shaft D S4 (Carriage Street) - loss of 13 business from the Global Trading Estate (if entire site is required) includes Car/MOT and suppliers providing approximately 130 jobs. Vent Shaft D N1 (Clayton Vale) - no impact Vent Shaft D N2 (Lumb Lane) - Loss of Laurus School playing fields. Unlikely to impact jobs. Vent Shaft D N3 (Alt Hill Lane) - no impact Vent Shaft D N4 (Lees New Road) - no impact	+ + +
	Operation	3, 4	Birchfield Road vent shaft creates a new site suitable for development fronting Birchfields Road.	O	Assume no future development opportunities	- -	Assume no future development opportunities	- -	Assume no future development opportunities	- -
Sound, Noise and Vibration	Construction	4, 6, 7	Manchester tunnel: The Christie Foundation NHS Trust (Hospital) on Wilmslow Road is located approximately 90m from the route of the Proposed Scheme. The hospital has been identified to have vibration sensitive equipment/operations. A specific risk assessment has therefore been carried out for this receptor. The predicted vibration levels at the closest hospital building with vibration sensitive equipment is above the established criteria during TBM works for a period greater than one month. The Christie Hospital is therefore identified as being subject to a likely significant adverse impact in terms of vibration. Altrincham Road vent shaft: Significant adverse construction noise impacts have been identified at the Open University and the Royals offices on Altrincham Road during the daytime period. Palatine Road vent shaft: No significant impacts have been identified. Wilmslow Road vent shaft: A significant adverse impact due to construction noise and vibration has been identified for the community of Withington during the daytime and night-time periods. Birchfield Road vent shaft: A significant adverse impact due to construction noise, vibration and traffic has been identified for the community of Birchfields Road during the daytime period, together with a significant adverse impact due to construction noise at Birchfields Primary School. Manchester Tunnel north portal: A significant adverse impact due to construction noise has been identified for the community of Beswick during the daytime periods, together with a significant adverse impact due to construction noise at the offices within West Way Nissan on Chancellor Lane. Manchester Piccadilly Station: A significant adverse impact due to construction noise and vibration has been identified for the 12 communities in the area of Hulme, Piccadilly and New Islington. A further 34 significant adverse noise, or noise and vibration, impacts have been identified at sensitive non-residential receptors in the vicinity of Piccadilly. NPR Oldham Road vent shaft: Potential for community significant adverse impacts due to construction noise and vibration at the nearest residential properties to the northwest and southeast of the proposed vent shaft. NPR Ashton Moss vent shaft: Potential for community significant adverse impacts due to construction noise and vibration at the nearest residential properties to the north and west of the proposed vent shaft. NPR Node L vent shaft: The potential for community significant adverse impacts due to construction noise and vibration is unlikely due to the distance between the proposed vent shaft and nearest residential receptors to the east.	O	Vent Shaft B S1 Princes Spiny: Potential for community significant adverse impacts due construction noise and vibration at the residential properties which surround the proposed vent shaft. Vent Shaft B S2 Barlow Tip: The potential for significant adverse community impacts due to construction noise and vibration is unlikely due to the distance between the proposed vent shaft and nearest residential receptors to the north and east of the Site. Vent Shaft B S3 Longford Park: Potential for community significant adverse impacts due construction noise and vibration at the residential properties to the north-west and north-east of the proposed vent shaft, together with the Firswood Community Centre. Vent Shaft B S4 North Phoebe Street: Potential for adverse impacts due construction noise at the Manchester Private Hospital and to a lesser extent the residential properties to the south of proposed vent shaft. These receptors would be subject to relatively high baseline sound levels due to road traffic on the A57. The Manchester Private Hospital may also be a vibration sensitive receptor. Vent Shaft B N1 Elysian Street: Potential for community significant adverse impacts due construction noise and vibration at the residential properties to the east and south of the proposed vent shaft. Vent Shaft B N2 Somerset Road: Potential for community significant adverse impacts due construction noise and vibration at the residential properties to the south of the proposed vent shaft. Vent Shaft B N3 Knott Lane: The potential for significant adverse community impacts due to construction noise and vibration is unlikely due to the distance between the proposed vent shaft and nearest residential receptors. Vent Shaft B N4 Lees New Road: Potential for community significant adverse impacts due construction noise at the residential properties to the north-east of the proposed vent shaft. Overall, the number of vent shafts and the proximity of residential properties and sensitive non-residential receptors means that this route is considered to be a minor worsening compared to the baseline.	- -	Vent Shaft B S1 Princes Spiny: Potential for community significant adverse impacts due construction noise and vibration at the residential properties which surround the proposed vent shaft. Vent Shaft B S2 Barlow Tip: The potential for significant adverse community impacts due to construction noise and vibration is unlikely due to the distance between the proposed vent shaft and nearest residential receptors to the north and east of the Site. Vent Shaft B S3 Longford Park: Potential for community significant adverse impacts due construction noise and vibration at the residential properties to the north-west and north-east of the proposed vent shaft, together with the Firswood Community Centre. Vent Shaft B S4 North Phoebe Street: Potential for adverse impacts due construction noise at the Manchester Private Hospital and to a lesser extent the residential properties to the south of proposed vent shaft. These receptors would be subject to relatively high baseline sound levels due to road traffic on the A57. The Manchester Private Hospital may also be a vibration sensitive receptor. Vent Shaft B N1 Elysian Street: Potential for community significant adverse impacts due construction noise and vibration at the residential properties to the east and south of the proposed vent shaft. Vent Shaft B N2 Somerset Road: Potential for community significant adverse impacts due construction noise and vibration at the residential properties to the south of the proposed vent shaft. Vent Shaft B N3 Knott Lane: The potential for significant adverse community impacts due to construction noise and vibration is unlikely due to the distance between the proposed vent shaft and nearest residential receptors. Vent Shaft B N4 Lees New Road: Potential for community significant adverse impacts due construction noise at the residential properties to the north-east of the proposed vent shaft. Overall, the number of vent shafts and the proximity of residential properties and sensitive non-residential receptors means that this route is considered to be a minor worsening compared to the baseline.	- -	Vent Shaft D S1: Bowland Road: Potential for community significant adverse impacts due construction noise and vibration at the residential properties to the east and south, together with the sensitive non-residential receptors of Baguley Primary School and Baguley Methodist Church, which surround the proposed vent shaft. Vent Shaft D S2: Fairy Lane: The potential for significant adverse community impacts due to construction noise and vibration is unlikely due to the distance between the proposed vent shaft and nearest residential receptors to the south of the Site. Vent Shaft D S3: Wilbraham Road: Potential for community significant adverse impacts due construction noise and vibration at the residential properties which surround the proposed vent shaft. Vent Shaft D S4: Carriage Street: Potential for community significant adverse impacts due construction noise and vibration at the residential properties to the north-east and north-west of the proposed vent shaft. Vent Shaft D N1: Clayton Vale: Potential for adverse impacts due construction noise at the residential properties to the south of proposed vent shaft. Vent Shaft D N2: Lumb Lane: Potential for adverse impacts due construction noise at the residential properties to the south of proposed vent shaft on Lumb Lane. Vent Shaft D N3: Alt Hill Lane: Potential for adverse impacts due construction noise and vibration at the residential properties to the east of proposed vent shaft. Vent Shaft D N4: Lees New Road: Potential for community significant adverse impacts due construction noise at the residential properties to the north-east of the proposed vent shaft. Overall, the number of vent shafts and the proximity of residential properties and sensitive non-residential receptors means that this route is considered to be a minor worsening compared to the baseline.	- -
	Operation	4, 6, 7	Manchester tunnel: The Christie Foundation NHS Trust (Hospital) on Wilmslow Road is located approximately 90m from the route of the Proposed Scheme. The hospital has been identified to have vibration sensitive equipment/operations. A specific risk assessment has therefore been carried out for this receptor. The predicted vibration levels at the Christie Hospital are below the agreed criteria for the hospital's most sensitive equipment, indicating that vibration from passing trains should not affect the operation of vibration sensitive equipment, and therefore a likely significant impact has not been identified. Operational Noise - Stationary Systems: Detailed assessment of the station systems have not been undertaken at this stage. It is assumed that the nominated undertaker would design, construct, operate and maintain the stationary systems (including mechanical ventilation at intervention shafts) so that the rating level of the fixed installations in normal operation at the worst affected residential receptor, minus the background level, is not more than -5 dB, determined in accordance with BS4142:2014. Where it is not reasonably practicable to achieve this objective, the nominated undertaker would develop and adopt robust procedures to ensure that sound from all stationary systems is reduced as far as is reasonably practicable. In such cases, the nominated undertaker would design, construct, operate and maintain the stationary systems so that, under all reasonably foreseeable circumstances, the rating level of the stationary systems in normal operation at the worst affected residential receptor, minus the existing background level, is not more than +5 dB, determined in accordance with BS4142:2014.	O	Tunnel alignment: It is assumed that the speeds of trains would be similar to that of the Manchester tunnel, i.e. mitigation could be incorporated to reduce the ground-borne noise and vibration impacts at sensitive receptors above the tunnel. However, the tunnel alignment would need further consideration as the detailed design progresses to identify potential non-residential receptors which may potentially be sensitive to vibration from the operational trains. Operational Noise - Stationary Systems: It is assumed that the nominated undertaker would design, construct, operate and maintain the stationary systems (including mechanical ventilation at intervention shafts) so that the rating level of the fixed installations in normal operation at the worst affected residential receptor, minus the background level, is not more than -5 dB, determined in accordance with BS4142:2014. Where it is not reasonably practicable to achieve this objective, the nominated undertaker would develop and adopt robust procedures to ensure that sound from all stationary systems is reduced as far as is reasonably practicable. In such cases, the nominated undertaker would design, construct, operate and maintain the stationary systems so that, under all reasonably foreseeable circumstances, the rating level of the stationary systems in normal operation at the worst affected residential receptor, minus the existing background level, is not more than +5 dB, determined in accordance with BS4142:2014.	O	Tunnel alignment: It is assumed that the speeds of trains would be similar to that of the Manchester tunnel, i.e. mitigation could be incorporated to reduce the ground-borne noise and vibration impacts at sensitive receptors above the tunnel. However, the tunnel alignment would need further consideration as the detailed design progresses to identify potential non-residential receptors which may potentially be sensitive to vibration from the operational trains. Operational Noise - Stationary Systems: It is assumed that the nominated undertaker would design, construct, operate and maintain the stationary systems (including mechanical ventilation at intervention shafts) so that the rating level of the fixed installations in normal operation at the worst affected residential receptor, minus the background level, is not more than -5 dB, determined in accordance with BS4142:2014. Where it is not reasonably practicable to achieve this objective, the nominated undertaker would develop and adopt robust procedures to ensure that sound from all stationary systems is reduced as far as is reasonably practicable. In such cases, the nominated undertaker would design, construct, operate and maintain the stationary systems so that, under all reasonably foreseeable circumstances, the rating level of the stationary systems in normal operation at the worst affected residential receptor, minus the existing background level, is not more than +5 dB, determined in accordance with BS4142:2014.	O	Tunnel alignment: It is assumed that the speeds of trains would be similar to that of the Manchester tunnel, i.e. mitigation could be incorporated to reduce the ground-borne noise and vibration impacts at sensitive receptors above the tunnel. However, the tunnel alignment would need further consideration as the detailed design progresses to identify potential non-residential receptors which may potentially be sensitive to vibration from the operational trains. Operational Noise - Stationary Systems: It is assumed that the nominated undertaker would design, construct, operate and maintain the stationary systems (including mechanical ventilation at intervention shafts) so that the rating level of the fixed installations in normal operation at the worst affected residential receptor, minus the background level, is not more than -5 dB, determined in accordance with BS4142:2014. Where it is not reasonably practicable to achieve this objective, the nominated undertaker would develop and adopt robust procedures to ensure that sound from all stationary systems is reduced as far as is reasonably practicable. In such cases, the nominated undertaker would design, construct, operate and maintain the stationary systems so that, under all reasonably foreseeable circumstances, the rating level of the stationary systems in normal operation at the worst affected residential receptor, minus the existing background level, is not more than +5 dB, determined in accordance with BS4142:2014.	O
Traffic and Transport	Construction	4	Construction phasing enables replacement car parks and New Sheffield St to be built at early stage thus minimise impacts on car parking and keeping construction traffic and activities away from main pedestrian access routes (i.e. to/from centre).	O	Likely to involve significant disruption to the existing highway network. Both temporary and permanent diversions will be required. Scored as neutral.	- -	Likely to involve significant disruption to the existing highway network. Both temporary and permanent diversions will be required. Scored as neutral.	- -	Likely to involve significant disruption to the existing highway network. Both temporary and permanent diversions will be required. Scored as neutral.	- -
	Operation	4	The operational impacts of the baseline on the route in terms of traffic and transport are relatively minor.	O	The operational impacts on the route in terms of traffic and transport are similar to those in the baseline therefore scored as neutral.	O	The operational impacts on the route in terms of traffic and transport are similar to those in the baseline therefore scored as neutral.	O	The operational impacts on the route in terms of traffic and transport are similar to those in the baseline therefore scored as neutral.	O
Water resources and flood risk management	Construction	6, 11, 2017	Altrincham Road vent shaft is located outside of flood zones and is constructed in the Tarporley Siltstone (Secondary A aquifer). The assessment has shown no impacts are expected on water resources and flood risk. Palatine Road vent shaft is in the Didsbury Flood Storage Basin; and in the flood zone 3. The current Palatine Road vent shaft location leads to significant impacts from increased flood risk at local receptors (including four properties close to the vent shaft location and hundreds of properties in Northenden). Wilmslow Road and Birchfield Road Vent shafts are located in the Sherwood Sandstone Group. Up-coning of saline groundwater in the Sherwood Sandstone Group aquifer has occurred in the Trafford Park area, located approximately 6.5km north-west of the vent shafts, as a result of high levels of groundwater abstraction from deep boreholes over many years. There is no evidence of up-coning of saline groundwater at depth in the Sherwood Sandstone Group in the vicinity of the Manchester tunnel. Construction of these two vent shafts will involve open excavation of through the sandstone, with progressive SCL, with internal dewatering from within the shaft to minimise the risk of drawing in poor quality water from deep in the aquifer or along fault lines. This is assessed to have a potential significant impact on water quality in the Sherwood Sandstone Principal aquifer. The Manchester tunnel will be partially constructed through the Appleby Group Principal Aquifer. The construction of the tunnel will create an extended cylinder of no flow in this aquifers and may have a significant impact on groundwater flow. The Oldham Road Vent Shaft and Node L vent shaft are located close to the River Medlock and within flood zone. There is an increased flood risk to local receptors due to the presence of the vent shafts in the floodplain. The Lees New Road Vent shaft is located on top of Rowton Clough watercourse (which would need to be realigned around the vent shaft site) and would need to be realigned around the shaft site. Numerous springs to west, south and east (between 200 and 500m away are likely to be temporarily impacted during construction (due to dewatering). The Leeds tunnel will pass through the Pennine Middle and Pennine Lower Coal Measures to the east of the A627 with extensive shallow and deeper shaft mine workings are present. It may be necessary to carry out ground improvement works (grouting) of some of these mine workings. If such grouting is required there is a risk that blanket grouting of mine workings could lead to increased risk of groundwater flooding (from poor quality rising mine water levels). The tunnel will create a barrier to ground water flows, which could lead to an increased in groundwater flooding risk.	O	During construction of **Princes Spinney Vent Shaft** dewatering there is the potential for temporary impacts on Baguley brook (located 350m north) and a potential spring (300m East). There could also be short term impacts on groundwater levels beneath the Blackcarr Wood & Baguley Bottom and Wrengate Wood which are potentially water dependent habitats. Impact similar to baseline (Altrincham Road vent shaft). **Barlow Tip Vent Shaft** is located on a historical landfill site, impacts on groundwater quality due to construction in a historical landfill site are discussed in the Land quality section. The site is raised and is therefore located outside of Flood zone 2 or 3 of River Mersey. This site is considered a **significant improvement over baseline** (Palatine Road vent shaft). **Longford Park Vent Shaft** will be constructed through glaciofluvial deposits (Secondary A aquifer) and Wilmslow Sandstone Formation (Principal aquifer). This shaft site is located closer to Trafford Park (where historical saline up-coning occurred) compared to baseline and therefore there is an increased risk of saline upwelling creating water quality issues in the Principal aquifer. This is considered a minor worsening over Wilmslow road vent shaft **Phoebe Road Vent Shaft** will be constructed through the glacial till (Secondary (Undifferentiated) aquifer) and into the Chester Formation (Principal aquifer). This shaft site is located closer to Trafford Park (where historical saline up-coning occurred) compared to baseline and therefore there is an increased risk of saline upwelling creating water quality issues in the Principal aquifer. This site is also located approximately 280m from gas distribution station - potential impacts on groundwater quality are set out in the Land quality section. This is considered a minor worsening over Birchfields Road vent shaft The **Manchester tunnel** will not be constructed through small faulted blocks of bedrock and therefore slight improvement over baseline as remove risk of groundwater flooding in Appleby Group. **Elysian Street Vent Shaft** is not location within flood zone 2 or 3. This site is considered a slight improvement over baseline as it is not in flood zone. **Somerset Road Vent Shaft** is not location within flood zone 2 or 3. The River Medlock located approximately 100m North on the other side of existing railway. The shaft will be constructed through the glacial till (Secondary (Undifferentiated) aquifer) and into the underlying Pennine Upper Coal measures (similar to Oldham Road). During construction dewatering could potentially have an adverse impact on the Medlock Vale & Lumb Clough (potential water dependent habitat) and a number of small springs in Lumb Clough around 400-600m to the east. However, overall this is considered to be a slight improvement over baseline as not in flood zone. **Knott Lane Vent Shaft** and **Lees New Road Vent Shaft** the impacts are likely to be similar to baseline. **The Leeds tunnel** will still pass through the Pennine coal measures with extensive shallow and deep mining and therefore the impacts on groundwater flood risk are similar to baseline. **Overall, this route is considered to be a minor improvement over existing scheme route**	+	During construction of **Princes Spinney Vent Shaft** dewatering there is the potential for temporary impacts on Baguley brook (located 350m north) and a potential spring (300m East). There could also be short term impacts on groundwater levels beneath the Blackcarr Wood & Baguley Bottom and Wrengate Wood which are potentially water dependent habitats. Impact similar to baseline (Altrincham Road vent shaft). **Barlow Tip Vent Shaft** is located on a historical landfill site, impacts on groundwater quality due to construction in a historical landfill site are discussed in the Land quality section. The site is raised and is therefore located outside of Flood zone 2 or 3 of River Mersey. This site is considered a **major improvement over baseline** (Palatine Road vent shaft). **Longford Park Vent Shaft** will be constructed through glaciofluvial deposits (Secondary A aquifer) and Wilmslow Sandstone Formation (Principal aquifer). This shaft site is located closer to Trafford Park (where historical saline up-coning occurred) compared to baseline and therefore there is an increased risk of saline upwelling creating water quality issues in the Principal aquifer. This is considered a minor worsening over Wilmslow road vent shaft **Phoebe Road Vent Shaft** will be constructed through the glacial till (Secondary (Undifferentiated) aquifer) and into the Chester Formation (Principal aquifer). This shaft site is located closer to Trafford Park (where historical saline up-coning occurred) compared to baseline and therefore there is an increased risk of saline upwelling creating water quality issues in the Principal aquifer. This site is also located approximately 280m from gas distribution station - potential impacts on groundwater quality are set out in the Land quality section. This is considered a minor worsening over Birchfields Road vent shaft The **Manchester tunnel** will not be constructed through small faulted blocks of bedrock and therefore slight improvement over baseline as remove risk of groundwater flooding in Appleby Group. **Elysian Street Vent Shaft** is not location within flood zone 2 or 3. This site is considered a slight improvement over baseline as it is not in flood zone. **Somerset Road Vent Shaft** is not location within flood zone 2 or 3. The River Medlock located approximately 100m North on the other side of existing railway. The shaft will be constructed through the glacial till (Secondary (Undifferentiated) aquifer) and into the underlying Pennine Upper Coal measures (similar to Oldham Road). During construction dewatering could potentially have an adverse impact on the Medlock Vale & Lumb Clough (potential water dependent habitat) and a number of small springs in Lumb Clough around 400-600m to the east. However, overall this is considered to be a slight improvement over baseline as not in flood zone. **Knott Lane Vent Shaft** and **Lees New Road Vent Shaft** the impacts are likely to be similar to baseline. **The Leeds tunnel** will still pass through the Pennine coal measures with extensive shallow and deep mining and therefore the impacts on groundwater flood risk are similar to baseline. **Overall, this route is considered to be a minor improvement over existing scheme route**	+	**Bowland Road Vent Shaft** is located outside of flood zones, over 500m from Baguley Brook. Considered a slightly improvement compared to baseline and option 1/2. **Fairy Lane Vent Shaft** is located on an area of raised ground and as such it is located outside of flood zone 2 or 3 of River Mersey. This site is considered a **major improvement over baseline** (Palatine Road vent shaft). **Wilbraham Road Vent Shaft** has a similar impact to baseline option (Wilmslow road) **Carriage Street Vent Shaft** is located over the top of culverted Corn Brook and this culverted watercourse would need to be realigned. This vent shaft is located closer to Trafford Park with history of saline up-coning, therefore there is increased risk of water quality impacts in construction. this is considered a minor worsening compared to baseline (Birchfields road). **Clayton Vale Vent Shaft** is located within Clayton Vale which is a potential water dependent habitat (SBI, LNR and green belt). Construction dewatering could lead to temporary impacts on groundwater levels at this site. However, the shaft is not located within a Flood and overall this is considered of similar scale to baseline. **Lumb Lane Vent Shaft** is located close to the Manchester and Ashton under Lyme canal with some small watercourses in the vicinity and springs feeding them. Construction dewatering could lead to temporary impacts on the minor watercourses. However, the site is outside of the flood zone and therefore this is considered to be a minor improvement compared to baseline. **Alt Hill Vent Shaft** is located close to the River Medlock but outside of flood zone 2 and 3. Tributary of Medlock runs to the south of shaft feed by spring. Construction dewatering could lead to temporary impacts on these surface water course. Impacts are similar to baseline **Lees New Road Vent Shaft** is similar to the baseline option. The **Leeds tunnel** will still pass through the Pennine coal measures with extensive shallow and deep mining and therefore the impacts on groundwater flood risk are similar to baseline. **Overall likely to be slight improvement over existing scheme route**	+
	Operation	6, 11, 17	No impacts on water resources and flood risk expected from the operation of the Proposed Scheme	O	No impacts on water resources and flood risk expected from the operation of the Proposed Scheme	O	No impacts on water resources and flood risk expected from the operation of the Proposed Scheme	O	No impacts on water resources and flood risk expected from the operation of the Proposed Scheme	O
Climate change	Construction	8, 9, 15, 17	Carbon: Manchester tunnel - 12.8km of excavated material resulting in 213,615m3 of concrete required for the station and approaches as well as 38,514tonnes of steel. The construction of these assets will result in A1-3 material, A4 transport and A5 plant emissions to implement the design.	O	Carbon: This option will result in in 323,000m3 of concrete required for the station and approaches as well as 56,500tonnes of steel resulting in additional materials and emissions when compared against the baseline - ranking this option the second worst. The construction of these assets will result in A1-3 material, A4 transport and A5 plant emissions to implement the design. Note that the sprayed concrete in the mined tunnels will have a high CEM I content of approx. 400 kg/m3 and will have a wastage rate of 1.8-2 resulting in additional embodied emissions. Furthermore, this option will also require the demolition of 28,400m2 of commercial and residential properties further increasing the A5 plant emissions to undertake the activity and A4 transport to dispose of the construction demolition waste.	--	Carbon: This option will result in in 245,000m3 of concrete required for the station and approaches as well as 24,800tonnes of steel resulting in additional materials and emissions and a minor worsening when compared against the baseline - ranking this option the best option after the HbD. The construction of these assets will result in A1-3 material, A4 transport and A5 plant emissions to implement the design. Note that the sprayed concrete in the mined tunnels will have a high CEM I content of approx. 400 kg/m3 and will have a wastage rate of 1.8-2 resulting in additional embodied emissions. Furthermore, this option will also require the demolition of 53,610m2 of commercial and residential properties further increasing the A5 plant emissions to undertake the activity and A4 transport to dispose of the construction demolition waste.	--	Carbon: This option will result in in 366,000m3 of concrete required for the station and approaches as well as 64,050tonnes of steel resulting in additional materials and emissions when compared against the baseline - ranking this option the worst. The construction of these assets will result in significant A1-3 material, A4 transport and A5 plant emissions to implement the design. Note that the sprayed concrete in the mined tunnels will have a high CEM I content of approx. 400 kg/m3 and will have a wastage rate of 1.8-2 resulting in additional embodied emissions. Furthermore, this option will also require the demolition of 34,210m2 of commercial and residential properties further increasing the A5 plant emissions to undertake the activity and A4 transport to dispose of the construction demolition waste.	- - -
	Operation	8, 9, 15, 17	Carbon: Minor B2 maintenance and B4 replacements emissions are expected due maintain the assets over its 120 design life.	O	Carbon: Minor B2 maintenance and B4 replacements emissions are expected due maintain the assets over its 120 design life.	--	Carbon: Minor B2 maintenance and B4 replacements emissions are expected due maintain the assets over its 120 design life.	--	Carbon: Minor B2 maintenance and B4 replacements emissions are expected due maintain the assets over its 120 design life.	--
Electromagnetic interference	Construction		Manchester tunnel - Alignment close to Palatine Road vent shaft risk of EMI impacts on Christie Hospital.	O	The alignment of Option B is significantly different to the Baseline, in order to fully assess the impact of Option B on EMI a more detailed understanding of the typical electrical/electronic equipment operated within the vents shafts, headhouses and intervention cores is required. Option B is located further from the Christie hospital than the baseline, however, due to the scale of the study, it is anticipated that overall EMi impacts are expected to be similar to the Baseline.	O	The alignment of Option B1 is significantly different to the Baseline, in order to fully assess the impact of Option B1 on EMI a more detailed understanding of the typical electrical/electronic equipment operated within the vents shafts, headhouses and intervention cores is required. Option B1 is located further from the Christie hospital than the baseline, however, due to the scale of the study, it is anticipated that overall EMi impacts are expected to be similar to the Baseline.	O	The alignment of Option D is significantly different to the Baseline, in order to fully assess the impact of Option D on EMI a more detailed understanding of the typical electrical/electronic equipment operated within the vents shafts, headhouses and intervention cores is required. Option D is located further from the Christie hospital than the baseline, however, due to the scale of the study, it is anticipated that overall EMI impacts are expected to be similar to the Baseline. Alignment D Northern Vent Shaft option at Lumb Lane. The presentation shows a nearby school and this requires further investigation.	O
	Operation		Impacts are expected to be similar to the Baseline.	O	Impacts are expected to be similar to the Baseline.	O	impacts are expected to be similar to the Baseline.	O	Impacts are expected to be similar to the Baseline.	O
Major accidents and natural disasters	Construction		Appropriate design and H&S risk control measures as required under construction H&S legal requirements will be in place to minimise the likelihood of a MA&D occurring.	O	No significant change to the baseline.	O	impacts are expected to be similar to the Baseline.	O	impacts are expected to be similar to the Baseline.	O
	Operation		Appropriate design of the vent/intervention shafts and headhouses will be in place to minimise the likelihood of a MA&D occurring and appropriate emergency access and evacuation routes provided under existing fire safety legislation.	O	No significant change to the baseline.	O	impacts are expected to be similar to the Baseline.	O	impacts are expected to be similar to the Baseline.	O
Waste & material resources	Construction	14	Manchester tunnel - 12.8km, plus NPR Remit 6 length of tunnel	O	The track length of the option is similar to the baseline. The excavation passes through the Barlow Tip (also known as Barlow Eye). There is a methane extraction plant to the west of the landfill, which indicates that the site contains significant organic waste. The material excavated would be considered to be either U1b or U2 and would therefore require suitable disposal. The proposed route option also passes through a number of sites that are considered Mineral Safeguarding Areas. This option will require a similar quantity of material to construct the various vent shafts, head houses and escape cores as well as the underground track as the baseline, given they are of similar length. There will be a number of new areas considered for demolition generating waste that requires managing, however it is possible that this will not be too dissimilar to that identified by the Hybrid Bill option. Note we do not have mass balance or cut/fill information for this option and therefore the assessment for this option is incomplete and subject to change. It is important to identify that material quantum cannot normally be viewed independently and should instead be viewed in relation to the overall mass haul. As a result, changes may not necessarily be detrimental/advantageous to the project. However, this option generates U1b/U2 material that will require disposal. If the quantity of material from the landfill excavation is significant then this could represent a major adverse impact.	--	The track length of the option is similar to the baseline. The excavation passes through the Barlow Tip (also known as Barlow Eye). There is a methane extraction plant to the west of the landfill, which indicates that the site contains significant organic waste. The material excavated would be considered to be either U1b or U2 and would therefore require suitable disposal. If the quantity of material from the landfill excavation is significant then this could represent a major adverse impact. The proposed route option also passes through a number of sites that are considered Mineral Safeguarding Areas. This option will require a similar quantity of material to construct the various vent shafts, head houses and escape cores as well as the underground track as the baseline, given they are of similar length. There will be a number of new areas considered for demolition generating waste that requires managing, however it is possible that this will not be too dissimilar to that identified by the Hybrid Bill option. Note we do not have mass balance or cut/fill information for this option and therefore the assessment for this option is incomplete and subject to change. It is important to identify that material quantum cannot normally be viewed independently and should instead be viewed in relation to the overall mass haul. As a result, changes may not necessarily be detrimental/advantageous to the project. However, this option generates U1b/U2 material that will require disposal. If the quantity of material from the landfill excavation is significant then this could represent a major adverse impact.	--	As the track length is approx. 3km shorter than the baseline this will result in significantly less material being excavated when compared to the baseline. However, this is not currently quantified. The proposed route option passes through a site that is considered a Mineral Safeguarding Area. This option will require a similar quantity of material to construct the various vent shafts, head houses and escape cores as the baseline. There will be a number of new areas considered for demolition generating waste that requires managing, however, a comparison has not been made with the baseline. Note we do not have mass balance or cut/fill information for this option and therefore the assessment for this option is incomplete and subject to change.	O
	Operation	14		O	This option is not expected to result in additional impacts to waste and material uses from the baseline option.	O	This option is not expected to result in additional impacts to waste and material uses from the baseline option.	O	This option is not expected to result in additional impacts to waste and material uses from the baseline option.	O
Preferred Option:		**Overall Rating**		O	Overall Option B is considered a minor worsening compared to the Baseline. Major wosenings have been identified for Community and Human Health, Minor worsenings have been identified for ecology, historic environment, landscape and Visual, socio-economic (con)	--		--		--
		Baseline Preferred Underground OPtion B/B1 (same	The main environmental constraints associated with the Baselien relates to the Palatine Road vent shaft which is located in the Didsbury Flood Staorage Basin and results ini the loss of the Withington Golf Club due to the demolition of its club house; and the Birchfields Road vent shaft which results in 50% loss of the Fallowfield Retail Park and associated car park.							
		Reason:								

Environmental Appraisal for Station

Location	Manchester Piccadilly, MAxx - Node MA (Manchester Airport tunnel portal) to Node 3 (NPR route towards Leeds)
Purpose of Sift	to assess alternative Underground options for integrating HS2 and NPR at Manchester Piccadilly
Sift Level	2

Options Considered			BASELINE HbD Surface Station for Phase 2b + NPR route to Node 3		**Option B** Combined Underground - deep box station		**Option B1** Combined Underground - 'shallow' box station		**Option D** Combined Underground - hybrid box/mined station	
Description			*Station Box* *Construction Compound and above ground elements in Ardwick*		*Option B* *Station open deep cut station box with mined approaches* *Western Kings Street Crossover box and* *Western Kings Street Ventilation Headhouse* *Ardwick Escape Shaft* *Ardwick Ventilation Headhouse*		*Option B* *Station open cut station box with mined approaches* *Western Kings Street Crossover box and* *Western Kings Street Ventilation Headhouse* *Ardwick Escape Shaft* *Ardwick Ventilation Headhouse* *Station Intervention Escape Shaft*		*Open cut (narrow) box with mined approaches and outer platforms*	
Topic	**Stage : Construction or Operation**	**Environmental Design Aim considered (Inc. Topic and Ref No)**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**
Agriculture, Forestry and Soils	Construction	6, 13	There are no impacts on agricultural land and limited impacts on soils.	O	Impacts are expected to be similar to the baseline.	O	Impacts are expected to be similar to the baseline.	O	Impacts are expected to be similar to the baseline.	O
	Operation	6	There would be no permanent loss of any agricultural land and would have limited impacts on soil.	O	Impacts are expected to be similar to the baseline.	O	Impacts are expected to be similar to the baseline.	O	Impacts are expected to be similar to the baseline.	O
Air Quality	Construction	4, 10	Construction dust: Construction would be in close proximity to a number of receptors. Dust emissions are assumed to be controlled through CoCP measures to avoid significant air quality impacts. Construction traffic: Potential for air quality impacts on receptors close to roads within the Greater Manchester AQMA. Due to a lack of traffic data it is not possible, at this stage, to determine the likelihood of significant impacts.	O	Construction dust: Similar to baseline Construction traffic: There is significantly more material to be excavated than the baseline. However, the plan is to remove 90% of this material by rail which will mitigate the impact of construction traffic. Nevertheless, due to the significant impacts identified for the HBD design and presence of the AQMA this is considered to be a minor worsening compared to the baseline	- -	Construction dust: Similar to baseline Construction traffic: There is significantly more material to be excavated than the baseline. However, the plan is to remove 90% of this material by rail which will mitigate the impact of construction traffic. Nevertheless, due to the significant impacts identified for the HBD design and presence of the AQMA this is considered to be a minor worsening compared to the baseline	- -	Construction dust: Similar to baseline Construction traffic: There is significantly more material to be excavated than the baseline. However, the plan is to remove 90% of this material by rail which will mitigate the impact of construction traffic. Nevertheless, due to the significant impacts identified for the HBD design and presence of the AQMA this is considered to be a minor worsening compared to the baseline	- -
	Operation	4, 10	Operational activities: Air quality impacts are likely to be small and not significant during normal operation of the railway. Operational traffic: The proposals include road realignments and changes to access arrangements which could affect air quality at receptors close to roads within the Greater Manchester AQMA. It is not possible at this stage to determine whether significant impacts would occur.	O	Operational traffic - Wider traffic and transport traffic demand will be similar to that of the baseline, however the higher levels of capacity that are retained to the east of the station in this option will result in lower congestion. This would result in a minor improvement in air quality (assuming that lower congestion doesn't result in an increase in traffic growth)	+	Operational traffic - Wider traffic and transport traffic demand will be similar to that of the baseline, however the higher levels of capacity that are retained to the east of the station in this option will result in lower congestion. This would result in a minor improvement in air quality (assuming that lower congestion doesn't result in an increase in traffic growth)	+	Operational traffic - A minor improvement to the baseline is expected due to the reduction in impact on Pin Mill Brow and the Ring Road (assuming that lower congestion doesn't result in an increase in traffic growth)	+
Community	Construction	1, 2, 3, 4, 6	Construction of Manchester Piccadilly High Speed Station including the station viaduct and highways works, and construction work at New Islington, will be in proximity to 385 residential properties on Chapeltown Street, 360 residential properties on Pollard Street, 950 in New Islington and 230 on Ducie Street. Significant noise and visual impacts on these properties will result in a significant community impact. There are a number of demolitions of community resources as a result of construction: SOL Christian Academy (Fairfield Street) MO:DEL (Fairfield Street) MASH (Fairfield Street) True Jesus Church (St Andrews Street) Construction will also prevent all pedestrian and vehicular access to Frontline Fitness Performance Centre and SBG Gym, this may affect their ability to operate.	O	Western Kings Street Crossover box and Ventilation Headhouse: Demolition of an office block and commercial properties. Construction will result in the loss of a public square situated between 55 and 61 King Street. Construction may result in changes to access to surrounding buildings and the amenity of local residents / occupants / users. Ardwick Escape Shaft and Ventilation Headhouse: No community impacts Piccadilly Station (including city centre escape core): Demolition of a 4 storey residential building at 31-35 Sparkle Street. Other community demolitions remain the same as the baseline. As detailed in the baseline, construction work may result in noise, visual, transport and air quality impacts on residents in the area. As the construction period is significantly greater than the Baseline these impacts will be felt for a longer period of time. Overall, this alignment is considered to result in a minor worsening compared to the baseline due to the significantly longer duration of construction work	- -	Western Kings Street Crossover box and Ventilation Headhouse: Demolition of office block and commercial properties. Construction will result in the loss of a public square situated between 55 and 61 King Street. Construction may result in changes to access to surrounding buildings and the amenity of the outside environment. Ardwick Escape Shaft and Ventilation Headhouse: No community impacts Piccadilly Station (including city centre escape core): Demolition of Mr Fit personal training centre and a 4 storey residential building at 31-35 Sparkle Street. Other community demolitions remain the same as the baseline. As detailed in the baseline, construction work may result in noise, visual, transport and air quality impacts on residents in the area. Overall, this alignment is considered to result in a minor worsening compared to the baseline due to the significantly longer duration of construction work.	- -	City Centre Headhouse: Construction requires the demolition of River Street Tower Student Accommodation, which can accommodate up to 790 students. This will have an impact on the availability of student housing in the area. Northern Headhouse: Barking Street, Bradford: The nearest residential properties are located approximately 50m from the site and may experience noise and visual impacts from construction. Bradford Intervention/Escape Core: There are residential properties in the vicinity of the site, the nearest are located immediately north-west of the site. The Parish Church of the Apostles is located approximately 150m away, and immediately to the south of the site is a dance school, wrestling club and music rehearsal and recording studios. Construction impacts on these resources are likely to be small. The towpath may be temporarily disrupted along the Ashton Canal affecting users of the recreational walking and cycling route. City Centre Intervention/Escape Core: Construction will require the demolition of approximately 200 residential apartments within the Manchester New Square apartment block. Construction work may result in changes to amenity (i.e. from noise, visual, transport and air quality impacts) for residents in the area. Piccadilly Station: Three residential buildings will be demolished as a result of construction of the station; Wharf Close Apartments, 2-6 Laystall Street, and Whittles Croft. Eternal Life Sanctuary Church on Great Ancoats Street will also be demolished. Construction work may result in changes to amenity (e.g. noise, visual, transport and air quality impacts) for residents in the area. Construction may also require the closure or diversion of the towpath along Ashton Canal. Overall, this alignment is considered to result in a minor worsening compared to the baseline due to the significantly longer duration of construction work.	- -
	Operation	2, 3, 4, 6	No operational community impacts are expected.	O	No operational community impacts are expected.	O	No operational community impacts are expected.	O	No operational community impacts are expected.	O
Ecology	Construction	5	As the CCB around the Station box will be entirely cleared in order to accommodate the construction compound, the associated impacts to the ecological receptors. The ecological receptors are considered to be: Rochdale Canal SAC and SSSI – potential hydrological connections to the scheme and air quality impacts; Ashton Canal (West) LWS and Rochdale Canal, Stott's Lane - Ducie Street Basin LWS; Roosting bats; Black redstart; assumed open mosaic habitats (NERC s.41); and Protected and/or notable species, including roosting bats.	O	Construction impacts are expected to be similar to the Baseline.	O	Construction impacts are expected to be similar to the Baseline. However, further assessment of the alterations to the River Medlock alignment would be required.	O	Construction impacts are expected to be similar to the Baseline.	O
	Operation	5	It is considered that these receptors will mainly be impacted during construction.	O	Operational ecological impacts are expected to be similar to the Baseline.	O	Operational ecological impacts are expected to be similar to the Baseline.	O	Operational ecological impacts are expected to be similar to the Baseline.	O

Historic Environment	Construction	2, 6, 12	The construction of the CP3 design Overground station will cause direct physical harm to the Grade II listed Piccadilly train shed. The land required for the construction of the station and the Manchester Tunnel North Portal will cause direct physical impacts, through removal, to a number of low value non-designated assets as well as the high value St. Andrew's burial ground. The impact to the setting of the asset and adjacent designated assets will be subject to further assessment The construction of the NPR route viaduct will require the total or partial demolition of a number of non-designated structures of low value, related to the original railway construction.	o	The construction boundary of the combined underground station site has similar impacts to the Hybrid bill Design in terms of the removal of non-designated buried assets. Despite the station being underground, there will still be direct physical impacts to the Grade II listed train shed, required to enable connectivity between the two stations. The Western Kings Street Crossover box and Ventilation Headhouse construction boundary is adjacent to the Grade II listed Pall Mall Court (NHLE 1246934), including raised Piazza and Podium to the west side, and may result in both direct physical impacts and impacts through changes in setting to the asset . Additionally, the location is within the Upper King Street Conservation Area and surrounded by a number of other Grade I, II* and II listed buildings. All of which could experience adverse impacts due to changes in their setting. Given the tunnelled nature of the scheme across the city, it is likely that considerably more listed buildings will require monitoring due to the potential impacts caused by settlement than the current HbD. The additional impact of the headhouse location represents a minor worsening of impacts in comparison to the baseline	- -	The construction boundary of the combined underground station site has similar impacts to the Hybrid bill Design in terms of the removal of non-designated buried assets. Despite the station being underground, there will still be direct physical impacts to the Grade II listed train shed, required to enable connectivity between the two stations. The Western Kings Street Crossover box and Ventilation Headhouse construction boundary is adjacent to the Grade II listed Pall Mall Court (NHLE 1246934), including raised Piazza and Podium to the west side, and may result in both direct physical impacts and impacts through changes in setting to the asset . Additionally, the location is within the Upper King Street Conservation Area and surrounded by a number of other Grade I, II* and II listed buildings. All of which could experience adverse impacts due to changes in their setting. Given the tunnelled nature of the scheme across the city, it is likely that considerably more listed buildings will require monitoring due to the potential impacts caused by settlement than the current HbD. The additional impact of the cross over box and headhouse location represents a minor worsening of impacts in comparison to the baseline	- -	The Underground Station Construction Boundary requires the demolition of a Grade II listed stable block, creating a major adverse impact, which subsequently causes adverse impacts to the associated Grade II listed Junction Works through changes in its setting. However, reconstruction may be achievable given the size and age of the building. The demolition of the non-designated Iron and Steel Warehouse would also be required. The non-designated Ashton Canal would need to be stopped up and dismantled during the construction phase, causing direct physical impacts to the non-designated asset of moderate value. However, these impacts would be temporary and the canal would be reinstated following construction of the proposed station. The intention is to find engineering solutions to protect the Grade II* listed Store Street Aqueduct from physical harm during construction. However, there will still be temporary harm, to both the canal and the aqueduct, from the closure of the canal system through changes in their setting. The demolition of buildings and the presence of construction machinery is likely to cause temporary and permanent harm through changes in the setting of listed buildings including the Grade II listed London Warehouse and Crusader Works. Any route tunnelled under the city centre will require considerably more monitoring for listed buildings within the settlement contours in comparison with the CP3 route. City Centre Escape Core – is located within the Whitworth Street Conservation Area, surrounded by a number of Grade II and Grade II* listed buildings. There is the potential for temporary and permanent construction impacts through changes in the setting of the assets. Pollard Street headhouse – currently checking the status of walls to east of Brunswick Mill and whether they would count as curtilage listed. If they are curtilage listed this would cause a direct permanent physical impact to a Grade II listed building. Bradford Headhouse – the location is site of a non-designated former Brickworks noted in the HER. Any impacts would be direct and permanent. The requirement for the demolition of a Grade II listed building and the impacts to the canal, albeit temporary, along with the additional impacts through changes to the setting of listed buildings created by the escape core and headhouses, result in a major worsening of impacts in comparison to the baseline	- - -
	Operation	2, 6, 12	The operation will have no additional impacts on the fabric or setting of designated assets	o	The operation will have no additional impacts on the fabric or setting of designated assets	o	The operation will have no additional impacts on the fabric or setting of designated assets	o	The operation will have no additional impacts on the fabric or setting of designated assets	o
Human Health	Construction	4, 6	Construction of Manchester Piccadilly High Speed Station including the station viaduct and highways works, and construction work at New Islington, will be in proximity to residential properties on Chapeltown Street, Pollard Street, in New Islington and on Ducie Street. Significant noise and visual impacts will have an adverse health impact on neighbourhood quality in these areas. There are a number of demolitions of resources as a result of construction: SOL Christian Academy (Fairfield Street) - education. MO:DEL (Fairfield Street) - reduction in provision of specialist services MASH (Fairfield Street) - reduction in provision of specialist services True Jesus Church (St Andrews Street) - limiting opportunities for accessing a community facility. Construction will also prevent all pedestrian and vehicular access to Frontline Fitness Performance Centre and SBG Gym, this may affect their ability to operate and reduce access to physical activity opportunities.	o	Western Kings Street Crossover box and Ventilation Headhouse: Demolition of office block and commercial properties. Construction will result in the loss of a public square situated between 55 and 61 King Street. Construction may result in changes to access to surrounding buildings and changes to the neighbourhood quality of the outside environment. Ardwick Escape Shaft and Ventilation Headhouse: No health impacts Piccadilly Station (including city centre escape core): Demolition of a 4 storey residential building at 31-35 Sparkle Street. Other community demolitions remain the same as the baseline. As detailed in the baseline, construction work may result in changes to neighbourhood quality (e.g. noise, visual, transport and air quality impacts) affecting the area. Overall, this alignment is considered to result in a minor worsening compared to the baseline due to the significantly longer duration of construction work.	- -	Western Kings Street Crossover box and Ventilation Headhouse: Demolition of office block and commercial properties. Construction will result in the loss of a public square situated between 55 and 61 King Street. Construction may result in changes to access to surrounding buildings and the amenity of the outside environment. Ardwick Escape Shaft and Ventilation Headhouse: No health impacts Piccadilly Station (including city centre escape core): Demolition of Mr Fit personal training centre and a 4 storey residential building at 31-35 Sparkle Street. Other community demolitions remain the same as the baseline. As detailed in the baseline, construction work may result in noise, visual, transport and air quality impacts on residents in the area. Overall, this alignment is considered to result in a minor worsening compared to the baseline due to the significantly longer duration of construction work.	- -	City Centre Headhouse: Construction requires the demolition of River Street Tower Student Accommodation, which can accommodate up to 790 students. This will have an impact on the availability of student housing in the area. Northern Headhouse: Barking Street, Bradford: The nearest residential properties are located approximately 50m from the site and may experience noise and visual impacts from construction. Bradford Intervention/Escape Core: There are residential properties in the vicinity of the site, the nearest are located immediately north-west of the site. The Parish Church of the Apostles is located approximately 150m away, and immediately to the south of the site is a dance school, wrestling club and music rehearsal and recording studios. Construction impacts on these resources are likely to be small. The towpath may be temporarily disrupted along the Ashton Canal affecting users of the recreational walking and cycling route. City Centre Intervention/Escape Core: Construction will require the demolition of approximately 200 residential apartments within the Manchester New Square apartment block. Construction work may result in changes to neighbourhood quality (e.g. from noise, visual, transport and air quality impacts) noticeable by those in the area. Piccadilly Station: Three residential buildings will be demolished as a result of construction of the station; Wharf Close Apartments, 2-6 Laystall Street, and Whittles Croft. Eternal Life Sanctuary Church on Great Ancoats Street will also be demolished. Construction work may result in changes to neighbourhood amenity (e.g. noise, visual, transport and air quality impacts) affecting those in the area. Construction may also require the closure or diversion of the towpath along Ashton Canal. Overall, this alignment is considered to result in a minor worsening compared to the baseline due to the significantly longer duration of construction work.	- -
	Operation	4, 6	No operational health impacts.	o	No operational health impacts.	o	No operational health impacts.	o	No operational health impacts.	o
Land Quality	Construction	16	There is potential for unknown contamination to be intercepted during earthworks (particularly due to the excavation of material beneath the ground) near to: • the Depot which will be adjacent east to the proposed scheme from approximate chainages 304+600 to 304+800; • the Phoenix Works which will be adjacent east to the proposed scheme; • Mayfield Station (including disused railway lines) which will be adjacent west to the proposed scheme from approximate chainages 304+400 to 304+800; and • the existing tramway which will be adjacent west to the proposed scheme from approximate chainages 304+400 to 305+000. The associated risks with respect to land quality are considered to be slightly higher due to: • volume of excavated material is significantly increased along with the need to handle, dispose and reuse excavated material due to the earthworks required for a below ground concourse; and • increased potential for unknown contamination to be encountered during material excavation • increased potential for unknown contamination to be encountered during material excavation Any unknown contaminants encountered during earthworks will be managed in accordance with the draft CoCP and legislative requirements.	o	Station box similar size but transposed to the east. Two additional areas of deep excavation King street and at Ardwick Dept. Overall likely to be a minor worsening due to increase footprint of excavation in potentially contaminated soils and encountering groundwater. Dewatering in excavation more likely to be required.	- -	Similar to option B although will involved greater excavation of shallower soils which have a higher likelihood of being contaminated. Lower likelihood of encountering groundwater.	- -	The realigned station box in alignment D intercepts a number of historical potentially contaminating sites, but overall probably a similar number to the baseline option with similar underlying geology. Excavation volumes not known. Similarly the Ardwick depot site still involves demolition and excavation of this site although now does not include deep portal structure and associated excavation and dewatering. Option now includes the Cambrian Street and Pollard Street are also in areas of former industry/factories. The Barking Street site is located adjacent to the former Bradford Road gasworks. Although understood to be partially remediated there can still be a legacy of contamination and infrastructure in the ground and to the potential for significant contamination at such sites should be considered. Gas works sites typically include the presence of dense non-aqueous phase liquids which can extend to some depth and can present a challenge with excavation of volatile contaminant impacted soils and issues surrounding dewatering and contaminant migration. Geology comprises alluvium associated with Medlock over Coal measures. River Medlock nearby in culvert under Bradford Road Gasworks. Overall considered to be a minor worsening given the additional shaft sites in areas of former industrial usage (incl. gas works).	- -
	Operation	16	It is assumed that the long-term operation of the Station would not result in land contamination.	o	There are no operational impacts from the proposed option	o	There are no operational impacts from the proposed option	o	There are no operational impacts from the proposed option	o
Landscape and Visual	Construction	1, 4, 5, 6	Construction impacts upon landscape character and visual amenity will arise from demolitions, the presence of construction plant, compounds and fencing. Landscape and visual receptors surrounding the station will experience a reduction in permeability and legibility caused by temporary footway diversions and site hoarding. Noise and activity generated during construction will further diminish existing low levels of tranquillity.	o	Station open deep cut station box with mined approaches: Impacts associated with works being carried out in CCB likely to be similar despite reduced size. Western Kings Street Crossover box and Western Kings Street Ventilation Headhouse: Landscape character impacts are likely from the disturbance to the street high quality street scene and King Street Conservation Area. Visual impacts to recreational users of the busy thoroughfare, residents and workers in surrounding multi-storey buildings that overlook the Site. City Centre Intervention/Escape Core: The removal of Gateway House will have a large impact upon the character of the station approach area causing disturbance during construction. Visual impacts for people accessing the station. Ardwick Ventilation Headhouse: Given the low quality existing landscape character and lack of visual receptors in the area, impacts are expected to be similar to the baseline option. Given the increase in impacts as a result of additional areas of construction within the city centre, in particular around King Street, it is considered that this option would result in a minor worsening compared to the baseline option during construction.	- -	B1 Station open cut station box with mined approaches: Impacts associated with works being carryout out in CCB likely to be similar despite increased size. Western Kings Street Crossover box and Western Kings Street Ventilation Headhouse: Landscape character impacts are likely from the disturbance to the street high quality street scene and King Street Conservation Area. Visual impacts to recreational users of the busy thoroughfare, residents and workers in surrounding multi-storey buildings that overlook the Site. City Centre Intervention/Escape Core: The removal of Gateway House will have a large impact upon the character of the station approach area causing disturbance during construction. Visual impacts for people accessing the station. Ardwick Ventilation Headhouse: Given the low quality existing landscape character and lack of visual receptors in the area, impacts are expected to be similar to the baseline option. Given the increase in impacts as a result of additional areas of construction within the city centre, in particular around King Street, it is considered that this option would result in a worsening compared to the baseline option during construction.	- -	Open cut (narrow) box with mined approaches and outer platforms: Impacts associated with works being carried out in CCB likely to be higher despite reduced size as a result of location being closer to sensitive receptors including residents. City Centre Headhouse: Given the existing urban context of large scale buildings, it is unlikely there would be significant impacts to landscape character. Visual receptors at the nearby River Street student accommodation and nearby apartments will likely experience impacts during construction. City Centre Intervention/Escape Core: Adjacent residential receptors and workers overlooking the site, as well as people using the PRoW along Ashton Canal will experience impacts to views during construction. Northern Headhouse, Barking Street, Bradford and Interventions/Escape Core: Given the existing urban context, it is unlikely there would be significant impacts to landscape character. Visual impacts to nearby residents to the north and on Bradford Road are likely during construction. Given the increase in impacts as a result of construction activities within the city centre, in particular around Whitworth Street and on PRoW along Ashton Canal, it is considered that this option would result in a minor worsening compared to the baseline option during construction.	- -
	Operation	1, 4, 5, 6	Number of nearby residential receptors will continue to see train station features within their view, albeit at closer proximity due to the new station. Option allows for the creation of new areas of high quality public realm at New Sheffield Street. The new station building will provide a unified frontage to the area. This option will have beneficial impacts on visual amenity from the creation of the new area of public realm on the Gateway House ramp. Adverse impacts on the landscape character will arise from increased severance caused by the railway line on viaduct. Large areas of land clearance and building demolitions provide greater sense of openness.	o	Station open deep cut station box with mined approaches: Less site clearance as a result of reduced CCB and therefore less opportunity for continuous development and links with wider area including Medlock Valley. Approaches will be underground rather than on viaduct compared with the baseline option. Western Kings Street Crossover box and Western Kings Street Ventilation Headhouse: Landscape character impacts are likely from the change to the street high quality street scene and King Street Conservation Area. Visual impacts to recreational users of the busy thoroughfare, residents and workers in surrounding multi-storey buildings that overlook the Site. City Centre Intervention/Escape Core: The removal of Gateway House will have a large impact upon the station approach and give the potential for a larger boulevard/station approach. Ardwick Ventilation Headhouse and Ardwick Escape Shaft: Given the low quality existing landscape character and lack of visual receptors in the area, impacts are expected to be similar to the baseline option. Given the increase in impacts as a result of additional features within the city centre, in particular around King Street, it is considered that this option would result in a minor worsening compared to the baseline option during operation.	- -	B1 Station open cut station box with mined approaches: More Site clearance as a result of increased CCB and therefore more opportunity for continuous development and links with wider area including SRFs and Medlock Valley. Approaches will be underground rather than on viaduct compared with the baseline option. Western Kings Street Crossover box and Western Kings Street Ventilation Headhouse: Landscape character impacts are likely from the change to the street high quality street scene and King Street Conservation Area. Visual impacts to recreational users of the busy thoroughfare, residents and workers in surrounding multi-storey buildings that overlook the Site. City Centre Intervention/Escape Core: The removal of Gateway House will have a large impact upon the station approach and give the potential for a larger boulevard/station approach. Ardwick Ventilation Headhouse and Ardwick Escape Shaft: Given the low quality existing landscape character and lack of visual receptors in the area, impacts are expected to be similar to the baseline option. Given the increase in impacts as a result of additional features within the city centre, in particular around King Street, it is considered that this option would result in a minor worsening compared to the baseline option during operation.	- -	Open cut (narrow) box with mined approaches and outer platforms: Site clearance in more built up area compared with Baseline option which saw clearance of lower quality buildings and features. Impacts likely upon residents to be higher than baseline option as a result. Approaches will be underground rather than on viaduct compared with the baseline option. City Centre Headhouse: Given the existing urban context of large scale buildings, it is unlikely there would be significant impacts to landscape character. Visual receptors at the nearby River Street student accommodation and nearby apartments will see the City Centre Headhouse within the context of an existing urban setting. City Centre Intervention/Escape Core: Adjacent residential receptors and workers overlooking the site will experience impacts to views, as well as people using the PRoW along Ashton Canal. Northern Headhouse, Barking Street, Bradford and Interventions/Escape Core: Given the existing urban context, it is unlikely there would be significant impacts to landscape character. Visual impacts to nearby residents to the north and on Bradford Road are likely. Given the increase in impacts as a result of additional features within the city centre, in particular around Whitworth Street and on PRoW along Ashton Canal, it is considered that this option would result in a minor worsening compared to the baseline option during operation.	- -
Socio-economics	Construction	3, 4	109 business resources impacted resulting in approximately 2,710 job losses. Station Box - 8 business resources containing approximately 60 jobs Construction Compound and above ground elements in Ardwick - 101 business resources providing approximately 2,650 jobs.	o	94 business resources impacted resulting in approximately 3,600 job losses. Given the increase of ~900 job losses, it is considered this option would result in a major worsening compared to the baseline option during construction. Station open deep cut station box with mined approaches - 69 business resources impacted resulting in approximately 2,430 job losses. Western Kings Street Crossover box and Western Kings Street Ventilation Headhouse - 8 business resources containing approximately 1,010 jobs. Ardwick Escape Shaft - 2 business resources containing approximately 10 jobs. Ardwick Ventilation Headhouse - 1 business resources containing approximately 20 jobs. Station Intervention Escape Shaft - 14 business resources containing approximately 130 jobs.	---	169 business resources impacted resulting in approximately 4,300 job losses. Given the increase of ~1,600 job losses, it is considered this option would result in a major worsening compared to the baseline option during construction. Station open deep cut station box with mined approaches - 134 business resources impacted resulting in approximately 3,160 job losses. Western Kings Street Crossover box and Western Kings Street Ventilation Headhouse - 8 business resources containing approximately 1,010 jobs. Ardwick Escape Shaft - 2 business resources containing approximately 10 jobs. Ardwick Ventilation Headhouse - 1 business resources containing approximately 20 jobs. Station Intervention Escape Shaft - 14 business resources containing approximately 130 jobs.	---	89 business impacted resulting in 1,910 job losses. Given the decrease of ~800 job losses, it is considered this option would result in a major improvement compared to the baseline option during construction. Open cut (narrow) box with mined approaches and outer platforms - 76 business resources impacted resulting in approximately 1,710 job losses. City Centre Headhouse - loss of Premier Inn and car park and Downding Students (River Street) Student Accommodation providing approximately 50 job losses. Northern Headhouse, Barking Street - 2 business resources impacted resulting in approximately 10 job losses. Bradford Intervention/Escape Core - 2 business resources impacted resulting in approximately 20 job losses. City Centre Intervention/Escape Core - Unknown number of businesses but likely to provide approximately 50 jobs. Rail sidings at Ardwick - 7 business resources impacted resulting in approximately 70 job losses.	+
	Operation	3, 4	The new HS2 station is expected to bring substantial benefits to Manchester and provide opportunities to support Manchester City Council and other local stakeholders realise their aspirations for the station. Within the CCB, there is 614,134sqm of Gross External Area for commercial development opportunities.	o	Within the CCB, there is 513,683 sqm of Gross External Area for commercial development opportunities. Compare development land created with this option with the SRF & identify potential development plots within the CCB. Only consider direct impacts within CCB (not Indirect adjacent, induced 25-50yr impacts)	+	Within the CCB, there is 821,302 sqm of Gross External Area for commercial development opportunities. Compare development land created with this option with the SRF & identify potential development plots within the CCB.	+	Within the CCB, there is 575,328 sqm of Gross External Area for commercial development opportunities. Compare development land created with this option with the SRF & identify potential development plots within the CCB.	---
Sound, Noise and Vibration	Construction	4, 6, 7	Construction activity noise and vibration: There are a number of sensitive residential receptors located within 170 m from the construction boundary where construction noise and vibration impacts are likely. Construction traffic noise: Significant construction traffic movements are expected around the station; however, these will be on heavily trafficked urban roads which will reduce potential impacts.	o	Manchester Piccadilly: The change in the CCB could lead to a minor worsening of construction phase impacts on the surrounding communities and sensitive non-residential receptors surrounding the station, headhouses and the intervention shafts.		Manchester Piccadilly: The change in the CCB could lead to a minor worsening of construction phase impacts on the surrounding communities and sensitive non-residential receptors surrounding the station, headhouses and the intervention shafts. It is noted that this option is likely to generate additional spoil/HGV movements when compared to Option B.		Manchester Piccadilly: The change in the CCB could lead to a change and potential minor worsening of the significant adverse construction phase impacts on the surrounding communities and sensitive non-residential receptors surrounding the station and intervention shafts.	
	Operation	4, 6, 7	The nearest sensitive residential receptors fall within 170m of the Station. It is assumed that appropriate noise mitigations will be in place by the time of the operation of the Station.	o	Operational Noise - Stationary Systems: It is assumed that the nominated undertaker would design, construct, operate and maintain the stationary systems (including mechanical ventilation at intervention shafts) so that the rating level of the fixed installations in normal operation at the worst affected residential receptor, minus the background level, is not more than -5 dB, determined in accordance with BS4142:2014. Where it is not reasonably practicable to achieve this objective, the nominated undertaker would develop and adopt robust procedures to ensure that sound from all stationary systems is reduced as far as is reasonably practicable. In such cases, the nominated undertaker would design, construct, operate and maintain the stationary systems so that, under all reasonably foreseeable circumstances, the rating level of the stationary systems in normal operation at the worst affected residential receptor, minus the existing background level, is not more than +5 dB, determined in accordance with BS4142:2014	o	Manchester Piccadilly Station: A significant adverse airborne noise impact due to the new highway layout has been identified for the community of Chapeltown Street, together with a beneficial airborne noise impact due to reduced traffic flows at residential properties on Store Street (including committed developments). Operational Noise - Stationary Systems: It is assumed that the nominated undertaker would design, construct, operate and maintain the stationary systems (including mechanical ventilation at intervention shafts) so that the rating level of the fixed installations in normal operation at the worst affected residential receptor, minus the background level, is not more than -5 dB, determined in accordance with BS4142:2014. Where it is not reasonably practicable to achieve this objective, the nominated undertaker would develop and adopt robust procedures to ensure that sound from all stationary systems is reduced as far as is reasonably practicable. In such cases, the nominated undertaker would design, construct, operate	o	Operational Noise - Stationary Systems: It is assumed that the nominated undertaker would design, construct, operate and maintain the stationary systems (including mechanical ventilation at intervention shafts) so that the rating level of the fixed installations in normal operation at the worst affected residential receptor, minus the background level, is not more than -5 dB, determined in accordance with BS4142:2014. Where it is not reasonably practicable to achieve this objective, the nominated undertaker would develop and adopt robust procedures to ensure that sound from all stationary systems is reduced as far as is reasonably practicable. In such cases, the nominated undertaker would design, construct, operate and maintain the stationary systems so that, under all reasonably foreseeable circumstances, the rating level of the stationary systems in normal operation at the worst affected residential receptor, minus the existing background level, is not more than +5 dB, determined in accordance with BS4142:2014	o
Traffic and Transport	Construction	4	Construction phasing enables replacement car parks and New Sheffield St to be built at early stage thus minimise impacts on car parking and keeping construction traffic and activities away from main pedestrian access routes (i.e. to/from centre).	o	There is significantly more material to be excavated than the baseline. However, the plan is to remove 90% of this material by rail which will mitigate the impact of construction traffic. There will be significant temporary disruption to the local road network to the north of the station with long term diversions but not thought to be materially worse than baseline impact. Overall impact is likely neutral when compared to the baseline.	o	There is significantly more material to be excavated than the baseline. However, the plan is to remove 90% of this material by rail which will mitigate the impact of construction traffic. There will be significant temporary disruption to the local road network to the north and east of the station with long term diversions that will be longer than those in the baseline. Overall impact is minor worsening when compared to the baseline.	-	There is significantly more material to be excavated than the baseline. However, the plan is to remove 90% of this material by rail which will mitigate the impact of construction traffic. There will be significant temporary disruption to the local road network to the north of the station with long term diversion of Great Ancoats Street although the diversion is a relatively straightforward in traffic management terms. Overall impact is likely neutral when compared to the baseline.	-
	Operation	4	Scheme offers potential to double overall rail passenger demands by 2040. Limited anticipated impact on movements to/from existing NR, as Metrolink, taxi and short stay car park retained, plus new facilities on New Sheffield St. Retention of Travis St enables north south connectivity. Limited opportunity for bus /coach interchange. New car parks over 3 sites provides flexibility but restricts opportunity for eastern access to station. Potential to phase relocation of Shuttlebus to NSS as Piccadilly development zone built out.	o	Station area highway disruption similar to baseline although there is a potential to provide greater permeability across the station footprint on completion for pedestrians, cyclists and surface public transport which is an improvement on the baseline. There is an improvement on the baseline Approach Viaduct as Pin Mill Brow existing provision is able to be retained during construction and also following. Wider traffic and transport traffic demand will be similar to that the baseline, however the higher levels of capacity that are retained to the east of the station in this option will result in lower congestion generally in the area and therefore it is considered that this option will be a major improvement in traffic and transport terms when compared to the baseline	+ + +	Station area highway disruption similar to baseline although there is a potential to provide greater permeability across the station footprint on completion for pedestrians, cyclists and surface public transport which is an improvement on the baseline. There will be disruption to Pin Mill Brow during construction which will necessitate the construction of a new junction. The space available will allow a similar sized junction or equivalent to that which is there at present with links to Mancunian Way, Great Ancoats Street, Ashton Old Road and Chancellor Lane all retained. Wider traffic and transport traffic demand will be similar to that for baseline, however the higher levels of capacity that are retained to the east of the station in this option will result in lower congestion generally in the area and therefore it is considered that this option will be a major improvement in traffic and transport terms when compared to the baseline.	+ + +	Station area highway disruption will be distinct from that in the baseline due to the alignment being so different although traffic and transport differences will be relatively minor with the opportunity to retain permeability for cycling and walking across the station footprint following completion. Permanent disruption to major routes will be relatively minor with Great Ancoats Street retained and major city centre routes largely retained. The overall impact therefore is likely to be a major improvement when compared to the baseline due to the reduction in impact on Pin Mill Brow and the Ring Road.	+ + +
Water resources and flood risk management	Construction	6, 11, 17	In this area the geology is Chester Formation (Principal aquifer) overlain by Till (Secondary undifferentiated). The station and associated structures are likely to require piling which may enter the Principal aquifer. This piling could impact on Water quality (creating a pathway between groundwater and surface water) but with appropriate mitigation impacts would be reduced. The station basement box will penetrate through the glacial till superficial deposits and into the underlying Chester Formation (principal aquifer). Maximum groundwater levels in the sandstone are estimated to be lower than the basement and as such the basement is not expected to intercept groundwater in the sandstone Principal aquifer. However, the basement will penetrate through the glacial till and could therefore form a barrier to groundwater flow in the till, potential increasing the risk of groundwater flooding to the north of the station. With appropriate drainage design (if required) impacts would be reduced. The Piccadilly approach viaduct crosses the River Medlock and viaduct peirs are located with flood zone 2 and 3., appropriate replacement floodplain storage has been provided in the design to ensure no increase in flood risk to local receptors. The removal of the existing culvert (upstream of the viaduct crossing at enterprise park) provides a slight beneficial impact on WFD hydromorphology on the River Medlock. The Manchester Tunnel north tunnel portal and associated Ardwick cuttings have the potential to block groundwater flow, and could lead to an increased risk of groundwater flooding in this area. Further site and ground investigations are required to assess the groundwater flood risk. This significant impact could be mitigated by drainage if necessary. No significant impacts on WFD waterbodies or flood risk is expected. Shooter Brook requires diversion.	o	The station and Metrolink are to be constructed in a deep box with a similar location and orientation to the baseline station option. The box will extend to approximately 0mAOD, with piles extending below the base of the box structure. Therefore, the basement structure will be below groundwater level in the Chester Formation Principal aquifer. The deep box would therefore create a local barrier to groundwater flow in the area, and additional mitigation (such as behind wall drainage) may be needed to ensure no adverse increase in groundwater levels. Risk of groundwater flooding from the barrier to groundwater flow in the glacial till would be the same as baseline. This is considered a slight worsening on groundwater over baseline due to the impacts on the Principal aquifer. The route will pass beneath the River Medlock in tunnel (track level approximately 6mAOD, tunnel soffit approximately 13mAOD). The River Medlock is approximately 32mAOD at the crossing point, providing more than 2 tunnel diameters between the top of the tunnel and the base of the river. No impact expected on the River Medlock. Removal of existing culvert at Enterprise Park remains as per baseline. The City Centre Headhouse & escape Core are not located within floodplains or near surface watercourses. They will extend through the superficial glacial till (Secondary (Undifferentiated) aquifer) and into the underlying Chester Formation (Principal aquifer) but are of small spatial extent. Some impacts on groundwater flow in the Principal aquifer and Secondary (undifferentiated) aquifer but should be mitigable. The Ardwick Headhouse and Intervention/Escape Core, are not location in flood zones and there are no surface water bodies nearby. They will extend through the superficial glacial till (Secondary (Undifferentiated) aquifer) and into the underlying Halsowen Formation (Secondary A aquifer) but are of small spatial extent. Some impacts on groundwater flow in the Secondary aquifers but should be mitigable. This is considered a minor improvement over the baseline option as it removes the need for extensive retaining walls and reduces risk of groundwater flooding. Overall, this is considered a minor worsening from baseline due to the impacts on groundwater flow in the Principal aquifer.	-	The station and Metrolink are to be constructed in a shallow box with a similar location and orientation to the baseline station option, however the box will be significantly longer than the baseline option. The box will extend to approximately 12mAOD, with piles extending below the base of the box structure. Therefore, the basement structure will be below groundwater level in the Chester Formation Principal aquifer. The shallow box would therefore create a local barrier to groundwater flow in the area, and additional mitigation (such as behind wall drainage) may be needed to ensure no adverse increase in groundwater levels. Risk of groundwater flooding from the barrier to groundwater flow in the glacial till would be the same as baseline. This is considered a slight worsening on groundwater over baseline due to the impacts on the Principal aquifer. The route will pass beneath the River Medlock in the box structure (track level approximately 16mAOD). A new channel will therefore need to be constructed to converge the River Medlock over the new tunnel structure. This channel will need to be an artificial (concrete lined) channel. The existing Enterprise Park culvert will be removed however, an extension of 125m to the existing culvert beneath the existing mainline will be required. The artificial channel and the extended culvert will have an adverse impact on the WFD of River Medlock. This will lead to a net loss of open channel of around 65m. In addition, a temporary diversion of the River Medlock would be required during construction of the Box structure in this area and the creation of the new river channel. This will have a temporary adverse impact on the River Medlock. Consideration in management of the flood risk both temporarily during construction and permanently is required to ensure no increase in flood risk to local receptors (likely to include requirement for replacement floodplain storage). The City Centre Headhouse & escape Core are not located within floodplains or near surface watercourses. They will extend through the superficial glacial till (Secondary (Undifferentiated) aquifer) and into the underlying Chester Formation (Principal aquifer) but are of small spatial extent. Some impacts on groundwater flow in the Principal aquifer and Secondary (undifferentiated) aquifer but should be mitigable. The Ardwick Headhouse and Intervention/Escape Core, are not location in flood zones and there are no surface water bodies nearby. They will extend through the superficial glacial till (Secondary (Undifferentiated) aquifer) and into the underlying Halsowen Formation (Secondary A aquifer) but are of small spatial extent. Some impacts on groundwater flow in the Secondary aquifers but should be mitigable. This is considered a minor improvement over the baseline option as it removes the need for extensive retaining walls and reduces risk of groundwater flooding. Overall, due to the impacts on groundwater flows in the Principal aquifer and the impacts on WFD on the River Medlock this is considered a major worsening compared to baseline	---	The station and Metrolink are to be constructed in a deep box set at 90 degrees to the baseline station alignment. The box will extend to approximately 0mAOD, with piles extending below the base of the box structure. Therefore, the basement structure will be below groundwater level in the Chester Formation Principal aquifer. The deep box would therefore create a local barrier to groundwater flow in the area, and additional mitigation (such as behind wall drainage) may be needed to ensure no adverse increase in groundwater levels. Risk of groundwater flooding from the barrier to groundwater flow in the glacial till would be the similar to the baseline option, and may require behind wall drainage to be provided. This is considered a slight worsening on groundwater over baseline due to the impacts on the Principal aquifer. The route will pass beneath the Ashton Canal. In order to construction the box structure it is proposed to block off the canal drain down the section before installing diaphragm walls and piles. Reinforced pile caps will then be installed along the line of the canal and the new canal aqueduct constructed. Excavation can then continue beneath the new section of canal as required. The Ashtons Canal is a WFD waterbody and therefore the design and construction works will need to be carried out with due consideration to WFD objectives and mitigation measures. Shooters brook (D/S) runs beneath Storey Street and is culverted for its entire length (at approx. 6-10m below ground - which is estimate to be 31.5mAOD to 30mAOD). The bored tunnel to the east of the station box will also run beneath Storey Street (track level approximately 6mAOD, tunnel soffit approximately 13mAOD). Impacts on this watercourse from the proposed scheme are not expected. City Centre Headhouse & escape Core - Not in flood zones some sw flooding. Adjacent to River Medlock (in culvert) , Till and Chester Formation. Barking Street Bradford Headhouse and Intervention/Escape Core - No flood zones and not in area of SW flooding. 250m from River Medlock. Pennine Upper Coal and will - slight improvement over Ardwick retained cuttings as removes groundwater flood risk. Overall, this is considered a minor worsening from baseline due to the impacts on groundwater flow in the Principal aquifer.	-
	Operation	6, 11, 17	No impact on water resources and flood risk from the operation of the proposed scheme	o	No impact on water resources and flood risk from the operation of the proposed scheme	o	No impact on water resources and flood risk from the operation of the proposed scheme	o	No impact on water resources and flood risk from the operation of the proposed scheme	o
Climate change	Construction	8, 9, 15, 17	Carbon: Manchester tunnel - 12.8km of excavated material resultin in 213,615m3 of concrete required for the station and approaches as well as 38,514tonnes of steel. The construction of these assets will result in A1-3 material, A4 transport and A5 plant emissions to impliment the design.	o	Carbon: This option will result in in 323,000m3 of concrete required for the station and approaches as well as 56,500tonnes of steel resulting in additional materials and emissions when compared against the baseline - ranking this option the second worst. The construction of these assets will result in A1-3 material, A4 transport and A5 plant emissions to impliment the design. Note that the sprayed concrete in the mined tunnels will have a high CEM I content of approx. 400 kg/m3 and will have a wastage rate of 1.8-2 resulting in additional embodied emissions. Furthermore, this option will also require the demolition of 28,400m2 of commerical and residential properties further increasing the A5 plant emissions to undertake the activity and A4 transport to dispose of the construction demolition waste. This option does also have a longer route and longer tunnels resulting in further A1-3 materials, A4 transport and A5 plant emissions resulting in this option being the worst.		Carbon: This option will result in in 245,000m3 of concrete required for the station and approaches as well as 24,800tonnes of steel resulting in additional materials and emissions and a minor worsening when compared against the baseline - ranking this option the best option after the HBD. The construction of these assets will result in A1-3 material, A4 transport and A5 plant emissions to impliment the design. Note that the sprayed concrete in the mined tunnels will have a high CEM I content of approx. 400 kg/m3 and will have a wastage rate of 1.8-2 resulting in additional embodied emissions. Furthermore, this option will also require the demolition of 53,610m2 of commerical and residential properties further increasing the A5 plant emissions to undertake the activity and A4 transport to dispose of the construction demolition waste. This option does also have a longer route and longer tunnels resulting in further A1-3 materials, A4 transport and A5 plant emissions resulting in this option being the 2nd best after the HBD and Option D		Carbon: This option will result in in 366,000m3 of concrete required for the station and approaches as well as 64,050tonnes of steel resulting in additional materials and emissions when compared against the baseline - ranking this option the worst. The construction of these assets will result in significant A1-3 material, A4 transport and A5 plant emissions to impliment the design. Note that the sprayed concrete in the mined tunnels will have a high CEM I content of approx. 400 kg/m3 and will have a wastage rate of 1.8-2 resulting in additional embodied emissions. Furthermore, this option will also require the demolition of 34,210m2 of commerical and residential properties further increasing the A5 plant emissions to undertake the activity and A4 transport to dispose of the construction demolition waste. This option does however, have the shortest route and shortest tunnels which will have a greater saving on the overal design when the route and station are assessed together resulting in Option D being the best option after the HBD.	
	Operation	8, 9, 15, 17	Carbon: Minor B2 maintenance and B4 replacements emissions are expected due maintain the assets over its 120 design life.	o	Carbon: Minor B2 maintenance and B4 replacements emissions are expected due maintain the assets over its 120 design life.	o	Carbon: Minor B2 maintenance and B4 replacements emissions are expected due maintain the assets over its 120 design life.	o	Carbon: Minor B2 maintenance and B4 replacements emissions are expected due maintain the assets over its 120 design life.	o
Electromagnetic interference	Construction		The Baseline option is unlikely to cause any significant Electromagnetic Interference during construction, however, the tunnel alignment is close to the Christie hospital which has been identified as a key receptor for EMI for the Baseline.	o	The alignment of Option B is significantly different to the Baseline, in order to fully assess the impact of Option B on EMI a more detailed understanding of the typical electrical/electronic equipment operated within the vents shafts, headhouses and intervention cores is required. Option B is located further from the Christie hospital than the baseline, however, due to the scale of the study, it is anticipated that overall EMi impacts are expected to be similar to the Baseline.	o	The alignment of Option B1 is significantly different to the Baseline, in order to fully assess the impact of Option B1 on EMI a more detailed understanding of the typical electrical/electronic equipment operated within the vents shafts, headhouses and intervention cores is required. Option B1 is located further from the Christie hospital than the baseline, however, due to the scale of the study, it is anticipated that overall EMi impacts are expected to be similar to the Baseline.	o	The alignment of Option D is significantly different to the Baseline, in order to fully assess the impact of Option D on EMI a more detailed understanding of the typical electrical/electronic equipment operated within the vents shafts, headhouses and intervention cores is required. Option D is located further from the Christie hospital than the baseline, however, due to the scale of the study, it is anticipated that overall EMI impacts are expected to be similar to the Baseline.	o
	Operation		The Baseline option is unlikely to cause any significant Electromagnetic Interference during operation, however, the tunnel alignment is close to the Christie hospital which has been identified as a key receptor for EMI for the Baseline.	o	impacts are expected to be similar to the Baseline.	o	impacts are expected to be similar to the Baseline.	o	Impacts are expected to be similar to the Baseline.	o
Major accidents and natural disasters	Construction		Appropriate design and H&S risk control measures as required under construction H&S legal requirements will be in place to minimise the likelihood of a MA&D occurring.	o	impacts are expected to be similar to the Baseline.	o	impacts are expected to be similar to the Baseline.	o	Impacts are expected to be similar to the Baseline.	o
	Operation		Appropriate design of the vent/intervention shafts and headhouses will be in place to minimise the likelihood of a MA&D occurring and appropriate emergency access and evacuation routes provided under existing fire safety legislation.	o	Appropriate design of the vent/intervention shafts and headhouses will be in place to minimise the likelihood of a MA&D occurring and appropriate emergency access and evacuation routes provided under existing fire safety legislation.	o	No significant change to the baseline.	o	impacts are expected to be similar to the Baseline.	o
Waste & material resources	Construction	14	alignment length 28.12km	o	The deep box excavation is likely to result in increased waste when compared to the baseline. There is a scarcity of available information and therefore there is a potential for unknown contamination to be encountered during material excavation. The increased size of the station box will result in significantly more material being excavated when compared to the baseline - estimated to be approx. 1.5Mm3 of excavated material more than the baseline. The excavation passes through the Barlow Tip (also known as Barlow Eye). There is a methane extraction plant to the west of the landfill, which indicates that the site contains significant organic waste. The material excavated would be considered to be either U1b or U2 and would therefore require suitable disposal. Note we do not have mass balance or cut/fill information for this option and therefore the assessment for this option is incomplete and subject to change. It is important to identify that material quantum cannot normally be viewed independently and should instead be viewed in relation to the overall mass haul. As a result, changes may not necessarily be detrimental/advantageous to the project. However, this option generates U1b/U2 material that will require disposal. If the quantity of material from the landfill excavation is significant then this could represent a major adverse impact.	---	The shallow box excavation is likely to result in increased waste when compared to the baseline. There is a scarcity of available information and therefore there is a potential for unknown contamination to be encountered during material excavation. The increased size of the station box will result in significantly more material being excavated when compared to the baseline - estimated to be approx. 1.5Mm3 of excavated material more than the baseline. Note we do not have mass balance or cut/fill information for this option and therefore the assessment for this option is incomplete and subject to change. It is important to identify that material quantum cannot normally be viewed independently and should instead be viewed in relation to the overall mass haul. As a result, changes may not necessarily be detrimental/advantageous to the project. However, this option generates U1b/U2 material that will require disposal.	---	The shallow box excavation is likely to result in increased waste than the baseline. There is a scarcity of available information and therefore there is a potential for unknown contamination to be encountered during material excavation. There will be a number of new areas considered for demolition generating waste that requires managing, however, a comparison has not been made with the baseline. Note we do not have mass balance or cut/fill information for this option and therefore the assessment for this option is incomplete and subject to change. It is important to identify that material quantum cannot normally be viewed independently and should instead be viewed in relation to the overall mass haul. As a result, changes may not necessarily be detrimental/advantageous to the project.	---
	Operation	14		o	This option is not expected to result in additional impacts to waste and material uses from the baseline option.	o	This option is not expected to result in additional impacts to waste and material uses from the baseline option.	o	This option is not expected to result in additional impacts to waste and material uses from the baseline option.	o
Preferred Option:		**Baseline**		o	**significantly longer than baseline and will be the critical path for Phase 2b western leg.** **Construction duration from hybrid bill Royal Assent to Handover to Client is approx. 15.5 years.**	---		---		---
Preferred underground Station		**B**								
		Reason:								

18 Appendix E – Stakeholder Engagement

- Record of engagement
- Opportunities identified by stakeholders
- Comments received from Stakeholders.

Record of Review

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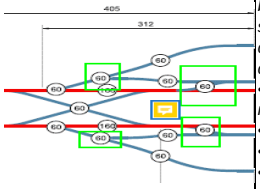
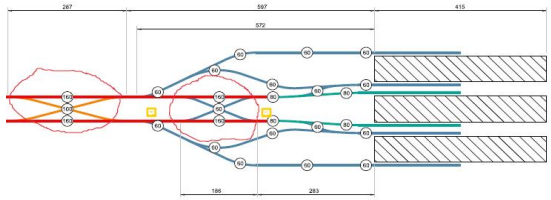
These are initial comments based on the presentation and do not necessarily provide an exhaustive list. [redacted] reserve the right to raise further comments.

Reviewer	Comment Ref No.	Subject	Section number	Comment	Response	Status (Opened / Closed)
[redacted]	001	General	Slide 15 of 126	What speed will the rolling stock be driving to a stop in the station? Is this speed reflective of the achievable speed on the S&C or is the S&C over specified? The Project Requirement Specifications can be challenged, and if produces an efficiency, surely this is worth exploring with the client.	This is the shortest S&C which can be used for main-line moves under normal operations has a radius of 500m The specified max speed for this turnout is 60kph.	Closed
[redacted]	002	General	Slide 15 of 126	Rather than operational benefits, it looks like more failure (S&C) points have been created, this is due to potentially not requiring as much S&C to support the current ITSS. The layout allows parallel moves to be made, but are parallel moves needed to accommodate the ITSS now the operation of the station has changed? Potential design refinement saving? 	HS2 wish to consider the station as operating as a terminal station during the period between completion dates (HS2 v NPR). The HS2 requirements are: *For movements in the same direction (in either direction), it shall be possible an arrival into any platform to be made simultaneously to a departure from another platform for any combination of points (i.e. Overlaps / End of Authorities to be clear of relevant point work).* *•The 'HS2' end station throat shall have all possible parallel moves on a flat layout, that is:* *•Platform 1 arrivals parallel to Platform 2 departures* *•Platform 2 arrivals parallel to Platform 3 departures* *•Platform 3 arrivals parallel to Platform 4 departures* *•Platform 4 arrivals parallel to Platform 5 departures, and* *•Platform 5 arrivals parallel to Platform 6 departures*	Closed
[redacted]	003	Crossover	Slide 17 of 126	It seems like the perturbation crossover is duplicating the inner crossover functionality. Does an underground station make the inner crossover redundant as the perturbation crossover provides the functionality, if constructed near the station? Are two crossovers needed? Can the inner crossover be removed to reduce the S&C space required? 	1.The innermost crossover within the throat enables parallel moves between platforms P1 & P2, and Platforms P2 & P3. It does not allow an incoming train to access the outermost platform on the opposite side. 2.The outermost (perturbation) crossover allows an incoming train to access the outermost platform on the opposite side. 3.A single crossover does not perform these combined functions. The current layout is based on the CP3 (terminating) layout. Both HS2 tracks can reach any of the 6 platforms, and parallel moves can be achieved between any pair of platforms during normal working. To comply with this the inner and outer crossovers are co-dependent.	Closed
[redacted]	004	Braking	Slide 17 of 126	Are trains able to come to a stand from the perturbation crossover at 100kph into the station? - ie. 820m & 610m - assuming platform already occupied, while maintaining passenger comfort?	If they can't come to a stand at 100kph they will approach at a lower speed. Operational requirements are under review but would suggest that the 100kph allows quicker exit from the station under perturbation.	Closed
[redacted]	005	Perturbation	Slide 17 of 126	Why is the perturbation area smaller in the mined tunnel than the shallow box? Why can't this size be reflected in the shallow box tunnel? It is understood that the perturbation areas are modelled on Old oak common which is significantly larger than what Manchester will require.	The crossover in the shallow box spans across a wider track interval (governed by the platform width), than that in the mined layout. The crossover in the mined layout is governed more by the maximum achievable cavern widths, and minimum achievable main line tunnel spacing.	Closed

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[redacted]	006	Stuttgart Station	Slide 23 of 126	The Stuttgart station has a smaller footprint than Manchester, but has more S&C as it is 4-track into 8 platforms and longer platforms. Manchester shows 2 tracks into 6 and is longer. Logically, you would think Manchester's footprint would be smaller. Why is this not the case?	HS2 Alignment and S&C standards have been used for this preliminary analysis.	Closed
[redacted]	007	Stratford Station	Slide 25 of 126	Has the Stratford International Station cost been subject to inflation? - was completed in 2006. With inflation (£2.5% over 16 years) this increases to £313m.	These are headline costs taken from public source information intended to provide a likely scale not an detailed comparison.	Closed
[redacted]	008	Mined tunnel	Slide 27 of 126	The mined tunnel seems excessively low. could the transfer level be removed along with the spacing tunnel to make it shallower, or is prohibited?	This is a potential opportunity with greater understanding of the approaching track vertical alignment. This layout, as outlined on Page 29 requires regular 50m spacing of lifts and escalators along the platform length. In order to provide cross platform connections and conform to fire and escape requirements it is deemed a 'mid-level' transfer concourse is required. An altertive platform layout, for example with two exit points, (e.g similar to crossrail layout) would enable deletion of the transfer level. A Cavern type station construction, as shown in the Appendix, would also permit this approach.	Closed
[redacted]	009	General	Slide 27 of 126	Throughout the presentation the PRS layout is mentioned. Its difficult to compare as operationally these stations should be designed to have different layouts. The PRS requirements should be revisited during the underground station development. E.G. wasn't one of the original proposals for the surface station to have 8 platforms?	At this early stage, the spatial requirements defined in the PRS, applied to the hybrid bill design, are being used to enable a like-for-like comparison between options. The compliance with both the PRS & the TSS within the context of an underground HS2/NPR station can be further reviewed at the next stage.	Closed
[redacted]	010	Alignment sizing comparison	Slide 33 of 126	It was stated in the last meeting that a preference to move alignment B - away from the city to the East, but this hasn't been picked up on. This was stated in [redacted] email on 21/09/2020 that reviewed the initial slides, where options to look at tweaking the alignment was put forward. As also raised in the Technical meeting on 29/10/2020, can the Alignment B be moved to the east to avoid London road and the listed buildings?	The movement of Alignment B can be considered as part of the additional studies to be commenced following the stakeholder feedback. Discussion ongoing between TfN/MCC/TfGM/HS2/DfT in relation to investigating alternative options to those in the agreed scope.	Closed
[redacted]	011	Alignment sizing comparison	Slide 33 of 126	Alignment C was asked to be reviewed in another location in [redacted] review email on 21/09/2020 along Store Street. This was followed up in the technical meeting on 29/10/2020 by both [redacted]. Can this alternative location be looked at, which I believe is a similar alignment to Store street?	The consideration of a new Alignment can be reviewed as part of the additional studies to be commenced following the stakeholder feedback. Discussion ongoing between TfN/MCC/TfGM/HS2/DfT in relation to investigating alternative options to those in the agreed scope.	Closed
[redacted]	012	Ventilation	Slide 35 of 126	The Crossover box summary states that the perturbation crossover ventilation in Manchester will be similar in size to the Victoria Road Perturbation box size at Old Oak Common. During an excellent presentation on Ventilation on 12/11/2020, it was stated that the requirements for Manchester would likely be significantly less that the requirements for Old Oak Common. Can the developed option take this into consideration as the slides don't seem to acknowledge this?	The indicative provision and sizing of the ventilation requirements was provided to give an understanding of the site area, buildings, equipment and adjacencies which have been developed for the Victoria Road Box. The final sizing and configuration for Manchester will be considered in subsequent stages, both in size and site placement, as an iterative process with increased engineering input	Closed
[redacted]	013	Ventilation	Slide 36 of 126	The slide mentions removal of spoil by canal. This seems quite novel in 2020. Is this realistic for the quantity of spoil required to be removed?	A variety of spoil removal options have been considered, and we agree it is not deemed to be practical for all spoil, but could be used to mitigate some lorry movements.	Closed
[redacted]	014	Outline programme	Slide 43 of 126	The slide mentions risk of +/- 2 years. Has initial G. I work not been undertaken for piling for the original station? Surely this should provide more certainty if you have an idea of the ground conditions? With Manchester being a well built area, the ground conditions should be widely available and known so the risk would be low.	A ground investigation has not been carried out, and would reduce risk, however it is not usual to carry one out prior to hybrid bill.	Closed
[redacted]	015	Outline programme	Slide 43 of 126	The slide mentions that changing the current CP3 Hybrid Bill Design will add an additional 3 to 5 years to the project. Please provide further information on how this has been assessed. Is that purely design updates required or / and the additional length of time that the Hybrid Bill process is required to take through governance? What are the options for mitigating this delay?	The slide illustrates our assessment that the overall construction would take a longer to complete that the CP3 design. This also shows we are moving from a CP3 design at Hybrid Bill to recommencing early stage design of a new Station proposal. Our understanding of the programme impacts can be developed further.	Closed

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[redacted]	016	Station Configuration	Slide 45 of 126	Preference for Option 1 - Single concourse as this would be preferable for a shallow box at grade	Noted	Closed
[redacted]	017	Station Configuration	Slide 45 of 126	Preference for Option 1 - Single concourse as this would be preferable for a deep box solution	Noted	Closed
[redacted]	018	Station Configuration	Slide 45 of 126	Preference for Option 2 - Dual concourse would be preferable for a mined box solution. This is due to the larger station being required and providing multiple access points	Noted	Closed
[redacted]	019	Station Construction	Slide 49 of 126	[redacted] preferred construction solution would be: 1. Shallow Box 2. Deep Box 3. Mined Box This preference is driven by a programme which minimises blight, minimises SRF impact and final passenger experience. The caveat being that each alignment has it pro's and cons and [redacted] would like to see at least one example of each construction methodology taken forward to the next stage.	Noted. Please note shallow box is predicated on the selection of this approach for the alternative Alignment location C, or shifted position of Alignment B	Closed
[redacted]	020	Alignment A Alternative	Slide 55 of 126	Alignment A has been moved by designers to avoid clash with Piccadilly Station by 20m. Why can the station not be constructed where originally positioned? What would the challenge be and how could it be overcome?	The adjustment was made to mitigate the risk of undermining the foundations of the classic station and provide sufficient working space for the excavation. The extent of this move can be further refined as the station configuration is developed and site ground and constraint impacts further understood. It is anticipated that any new station construction should be no less than 10m from existing sensitive local constraints.	Closed
[redacted]	021	Alignment A Alternative	Slide 55 of 126	[redacted] believes that Alignment A has an unacceptable impact on the SRF area.	Noted.	Closed
[redacted]	022	Alignment A Shallow Box	Slide 56 of 126	The shallow alignment for option A conflicts with the Rochdale Canal & London Road warehouse quite significantly and enters the Stevenson Square Conservation area. Is there an engineering solution where these listed buildings can avoid being demolished or moved elsewhere? Its disappointing to see that this option has been discounted without exploring potential engineering solutions when compared to the additional cost of the deep box and mined solutions. Its noted that the Deep box station can be moved to avoid clashing with the canal and listed buildings. Why can't this move be applied to the shallow box options also to see if the moving the alignment works?	It is difficult to see a solution that mitigates the impact on the buildings affected. Moving buildings is both expensive and time consuming but can be considered if felt essential. From reviewing the options at a strategic level, the engineering challenges of a constructing a shallow station box and throat were deemed significant, with the most appropriate response to be a deeper station and mined throat in the alignment location provided.	Closed
[redacted]	023	Alignment A Deep Box	Slide 57 of 126	The buildings that are noted as being near the works, how will they be protected?	The requirements of protection will need to be developed but typically will include settlement monitoring/compensation and measures to mitigate vibration, noise and dust.	Closed
[redacted]	024	Alignment A Deep Box	Slide 58 of 126	There is a potential benefit to the road and Public transport network as after construction, could Travis Street, Metrolink and Store Street be put back into use?	Yes absolutely, notwithstanding that some above ground structures will be required for access, ventilation etc the land above can be reclaimed/redeveloped.	Closed
[redacted]	025	Alignment A Deep Box	Slide 59 of 126	Note 1 states that the Ashton Canal will need re-routing. Is that temporary or permanent?	Both options could be viable and will be considered.	Closed
[redacted]	026	Alignment A Deep Box	Slide 60 of 126	Can more details be provided on the potential conflict on listed building and vent shafts as the listed building comment doesn't seem to tally with the vent shaft locations on slide 61 which show car parks.	We will consider the route alignment and vent shaft locations in more detail at the next stage. Slide 61 highlights some early options however it is noted that there are a number of heritage buildings on this route. This slide also make suggestions of suitable sites in proximity to the route, however it is noted that re-alignment may be required in order to utilise these.	Closed

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[redacted]	027	Alignment A Deep Box	Slide 62 of 126	Construction impact - Discussion in the Underground station on 16/11/20 that stated that HS2 require a formal letter to move the alignment for options B & C. Slide 62 proposes moving alignment A with no formal to the east to avoid conflict with Ashton canal and listed buildings. Why is this acceptable when the designers suggest the move, but not [redacted]?	Differences of opinion between HS2 and MCC/TfN/TfGM have been discussed regarding the difference between alignment refinement and alignment change. In this instance, the reference to moving the alignment is considered a refinement rather than a change.	Closed
[redacted]	028	Alignment A Deep Box	Slide 62 of 127	Construction, Cost, Risk Programme - Where is this comment referring too? Existing Piccadilly station?	This is referring to proposed mined solution to the station throat.	Closed
[redacted]	029	Alignment A Deep Box	Slide 62 of 127	Passenger experience - If the only aspect lacking that is making this a yellow rather than a green is the fact they aren't physically linked, surely a transition area between the 2 stations can be created. I think this should be green?	The assessments are subjective however in comparison to option B in which there is no separation this must be a disbenefit.	Closed
[redacted]	030	Alignment A Deep Box	Slide 62 of 127	Local Environment - All options impact Metrolink and buildings, but the majority of these issues are temporary during construction. Does temporary make this yellow?	Noted but temporary in the context of building this station is really a significant timescale. Circa 10 years.	Closed
[redacted]	031	Alignment A Mined	Slide 63 of 126	In note 1, why do the residential buildings need demolition if the station is mined. Can't the buildings be worked around?	In its current location, the central box structure does impact the residential building. However, we note that the station box could be moved to reduce this impact, however this building will still be in close proximity to a live construction site and may increase the complexity of work and cause significant local disruption for remaining residents.	Closed
[redacted]	032	Alignment A Mined	Slide 64 of 126	Would the closure of Store street and Travis Street be permanent?	The rerouting of streets may be possible, or integration of a ground level street through the station box. This will have to be explore in subsequent stages	Closed
[redacted]	033	Alignment A Mined	Slide 64 of 126	Will Metrolink avoid disturbance during construction?	That would be the current assessment.	Closed
[redacted]	034	Alignment A Mined	Slide 65 of 126	Why are the Canals impacted by a mined solution. Would these not just sit above the station if constructed in Bedrock?	The solid black box illustrates a surface structure which would cut through the canal as shown. This may be able to be avoided through reconfiguration of the station, subject to further development, but may increase impacts elsewhere	Closed
[redacted]	035	Alignment A Mined	Slide 67 of 126	If the mined station is much longer than the deep box station, why is it suggesting the same perturbation boxes?	This slide does not suggest the same perturbation boxes. The final sizing of the perturbation boxes will be evaluation alongside further work to throat and approaches. Noted that same sites are suggested for this construction, which will need to be re-evaluated as development progresses	Closed
[redacted]	036	Alignment A Mined	Slide 68 of 126	Should the construction impact also mention the issue with the Canal conflict?	Noted, this could be included.	Closed
[redacted]	037	Alignment A Mined	Slide 68 of 126	Construction, Cost, Risk Programme - The risk is less, but the construction programme and cost are more. Should this not be considered amber if risk is less or is more weighting applied to cost and programme?	We have given them equal weighting however the assessment is subjective.	Closed
[redacted]	038	Alignment A Mined	Slide 68 of 126	Passenger experience - If the only aspect lacking that is making this a yellow rather than a green is the fact they aren't physically linked, surely a transition area between the 2 stations can be created. I think this should be green? If dual concourses are provided, is the increased travel time issue mitigated?	The assessments are subjective however in comparison to option B in which there is no separation this must be a disbenefit.	Closed
[redacted]	039	Alignment A Mined	Slide 68 of 126	Commercial Development - Agreed that this doesn't align with the SRF which is one reason why [redacted] prefer Alignment B moved towards the east, which is suggested in for Alignment A.	Noted	Closed
[redacted]	040	Alignment A Mined	Slide 68 of 126	Local Environment - Are the canals impacted temporary or permanent? Would moving the alignment resolve this issue?	It would need to be a permanent diversion - relocation of the station would resolve it.	Closed
[redacted]	041	Alignment B Alternative	Slide 70 of 126	This 35m alignment move now makes the footprint clash with London road warehouse. Can an alignment avoid both of these?	We believe it is possible to miss the London Warehouse, even with a shallow box throat. However, this option also impacts London Road and several listed buildings to the West	Closed

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[redacted]	042	Alignment B Shallow	Slide 71 of 126	Previous comment it has been requested that the station alignment is moved towards the East to avoid London road, London road warehouse & Joshua Hoyle listed buildings. That movement combined with a shorter S&C section could make this a viable option that would not require demolition of listed buildings. Can this be looked into further as a shallow box option to take forward? - This would probably be the least expensive construction option and provide the closest link to the existing Piccadilly Station and retaining the majority of the existing footprint.	Yes this was noted and discussed in the meeting of the 29/10/2020	Closed
[redacted]	043	Alignment B Deep Box	Slide 72 of 126	Alignment B deep box would be [redacted] 2nd option if the alignment B alteration for a shallow box is not achievable	Noted	Closed
[redacted]	044	Alignment B Deep Box	Slide 73 of 126	As the Metrolink is above ground, is there an engineering solution that would allow the Metrolink to continue operation?	It is possible to build a supporting structure parallel to the current route - transfer use and then work below the suspended 'bridge' created.	Closed
[redacted]	045	Alignment B Deep Box	Slide 74 of 126	What would a proposed solution look like for moving shooters brook?	This has not been developed but would involve realignment of the culvert.	Closed
[redacted]	046	Alignment B Deep Box	Slide 75 of 126	Can more information be provided on the potential location of the vent shaft in note 1?	We note this label may be positioned in error, and should relate to the deep box plan below. Further information can be provided in due course when the ventilation requirements have been better developed.	Closed
[redacted]	047	Alignment B Deep Box	Slide 76 of 126	Choosing a ventilation site looks to be a difficult choice, which [redacted] and [redacted] would want to be involved with in order to find a suitable solution.	The team understand the sensitivity of the location and appearance to the surrounding area, and can be discussed through further engangement	Closed
[redacted]	048	Alignment B Deep Box	Slide 77 of 126	Construction impact - Does this need to include Travis & store street along with ventilation shaft issues?	The description could be more inclusive the main sewer runs down Travis street and location of ventilation shafts is common to all options.	Closed
[redacted]	049	Alignment B Deep Box	Slide 77 of 126	Construction, Cost, Risk Programme - Where is this comment referring too? Existing Piccadilly station?	This refers to the caverns created for the station throat and approaches.	Closed
[redacted]	050	Alignment B Deep Box	Slide 77 of 126	Passenger Experience - Should this be a yellow considering the depth required to travel to access the train from a time perspective?	Passenger experience has been considered in a subjective way simply against the other options. We note the increased depth (~8m compared to the shallow box) however this is not thought to be significant when compared to other impact	Closed
[redacted]	051	Alignment B Deep Box	Slide 77 of 126	Local Environment - Is impact on Metrolink more a construction impact rather than local environment? Can Metrolink remain open during construction with a clever engineering solution?	It is feasible to maintain Metrolink during construction the impact has been categorised in accordance with the general environmental impact assessment headings.	Closed
[redacted]	052	Alignment B Mined	Slide 78 of 126	How much will the SRF area be impacted by the mined solution as the footprint looks wider?	Please refer to Slide 81 which details these impacts. Due to the increased width of the mined station ground level boxes, there is thought to be greater impact than a box station in this alignment	Closed
[redacted]	053	Alignment B Mined	Slide 79 of 126	If the central fire reservation is moved, will Metrolink still require re-routing?	This is the intention of moving the box.	Closed
[redacted]	054	Alignment B Mined	Slide 81 of 126	This option impacts the SRF area, which doesn't fit with the [redacted] vision for the area.	Noted	Closed
[redacted]	055	Alignment B Mined	Slide 83 of 126	Should the construction impact also mention the issue with the Canal conflict?	There isn't a conflict with this solution as mining will be carried out below the canal.	Closed
[redacted]	056	Alignment B Mined	Slide 83 of 126	Construction, Cost, Risk Programme - The risk is less, but the construction programme and cost are more. Should this not be considered amber if risk is less or is more weighting applied to cost and programme?	On balance the engineering disciplines considered this be, subjectively, a red evaluation when considered against the other options	Closed
[redacted]	057	Alignment B Mined	Slide 83 of 126	Passenger experience - If dual concourses are provided, is the increased travel time issue mitigated?	This would need to be developed during more detailed consideration.	Closed
[redacted]	058	Alignment C Alternative	Slide 85 of 126	If the solution is mined, does it matter where the alignment is?	The station shift in this alignment primarily is in relation to a box station, where we are ensuring the station box is not positioned over existing classic rail tracks. The mined station has greater flexibility, and its location will be refined in the next stage	Closed
[redacted]	059	Alignment C Alternative	Slide 85 of 126	To avoid huge disruption, it appears only a mined solution would be practical, is this the case?	It certainly offers opportunities for minimising surface impact during construction.	Closed

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[redacted]	060	Alignment C Alternative	Slide 85 of 126	Alignment C along store street would be good to see if this works better as a solution?	Noted at the meeting of the 29/10/2020	Closed
[redacted]	061	Alignment C Deep Box	Slide 92 of 126	An alternative alignment could work with linking the HS2 station with the classic station.	Noted at the meeting of the 29/10/2020	Closed
[redacted]	062	Alignment C Deep Box	Slide 96 of 126	This alignment would have a big impact on the SRF area, which would be unacceptable to [redacted]	Noted	Closed
[redacted]	063	Alignment C Deep Box	Slide 100 of 126	Note all alignment selections for the construction methodology, but would like to see a Shallow box proposal developed for Alignment B & Alignment C moved closer to Store Street.	Noted at the meeting of the 29/10/2020	Closed
[redacted]	064	Decision Point 1	Slide 101 of 126	1km seems excessive in length when compared to similar construction examples provide - i.e. Stuttgart which is has more platforms, which are longer and more S&C requirements. The shallow box needs work to reduce the S&C size to allow the station to work. The shallow station could also benefit from moving East as proposed in Alignment A's deep box solution.	Noted	Closed
[redacted]	065	Decision Point 1	Slide 101 of 126	Agree with the construction methodology assessment, but should include shallow and deep box selections.	Noted. A shallow box has been demonstrated to not be viable, in the alignment station location provided. However, opportunities to reduce the depth of the box will be explored, as well as opportunities to reduce overall excavation (e.g hybrid approach)	Closed
[redacted]	066	Alignment A Box station	Slide 103 of 126	Metrolink is shown retaining its current layout. Can this be maintained through construction?	Yes although works will be required to integrate this.	Closed
[redacted]	067	Alignment A Box station	Slide 103 of 126	Like the idea of the concourse being provided closer to the city.	Noted	Closed
[redacted]	068	Alignment B Box station	Slide 105 of 126	Will the Multimodal hub suffer from the same issues that are currently being experienced with the design as the space allocated looks similar to the surface station proposal?	There is increased flexibility with the station below ground to utilise space around the eastern station entrance, including under the area denoted as car park.	Closed
[redacted]	069	Alignment B Box station	Slide 105 of 126	The boulevard should remain as part of this option as a key part of the SRF design. Traffic and Metrolink should be minimised as this should be pedestrianised.	Noted	Closed
[redacted]	070	Alignment C	Slide 106 of 126	Wouldn't like to see this station any deeper than 25m to create a good passenger experience and natural light for the station platforms.	Noted	Closed
[redacted]	071	Alignment C	Slide 106 of 126	The mined station doesn't create as much opportunity as envisaged as all the other elements - back of house and car park etc take up the majority of the development and scythe through the SRF area which [redacted] oppose.	Noted	Closed
[redacted]	072	(HS2 with terminating & de-coupling)	Slide 111 / 112 / 113 of 126	Retaining as much S&C as possible with the inner terminating platforms for HS2 would be preferable as it creates options to deal with perturbation of HS2 & NPR.	Noted	Closed
[redacted]	073	Hybrid & Caverned Approach	Slide 115 of 126	Preferred option of construction order: 1. 70m width 2. 85m width 3. 110m width 4. 150m width Shallower the better	Noted	Closed
[redacted]	074	Hybrid box	Slide 116 of 126	This solution would be good to reduce the impact on the SRF are for Alignments A & B.	Noted	Closed
[redacted]	075	Cavern Station	Slide 121 of 126	The caverned station would be the preferred mined solution for Alignment C.	Noted	Closed
[redacted]	076	Station orientation	Slide 125 of 127	Different orientations and movements to optimise the alignments are welcomed. We'd like to see alignment B moved bore towards the highways as the although this would cause disruption in the short term, this could lead to a better solution for Manchester Piccadilly regarding Alignment B and a Shallow box.	Noted	Closed
[redacted]	077	Oversite development	N/A	Please provide further information on the opportunities and technical implications for oversite development for each of the construction methodologies	In theory any building can be constructed above the underground station but the requirements would need to be developed and agreed with HS2/GM Partners.	Closed
[redacted]	078	Impact/benefits	N/A	The assessment of the options needs to include the wider impact and benefits, including temporary & permanent land take, economic development and job potential	This will be developed in further detail over the course of subsequent stages by all parties	Closed

Record of Review

Document	**Piccadilly Underground Station Presentation 29-10-20**					
Document Date	**29/10/2020**					
Source	[redacted]					
Revision						
Date of Review	**29/10/2020**					
[redacted]	079	Selected options	N/a	[redacted] are happy that the construction methods selected in the meeting for each alignment are taken forward: Alignment A - Deep Box Alignment B - Shallow & Deep Box Alignment C - Mined & Deep Box HS2 need to look at variations of Alignment B (moving the alignment east to avoid listed buildings) and to design a shallow box, on a revised alignment C between Store street & Ducie street.	Noted	Closed
[redacted]	080	Access to underground S&C	General	Reference is made in the minutes for the Workshop held on 29/10/2020 (Item 1.8) to there being a need for ancillary buildings to be positioned over the underground S&C to provide access. This appears to mean that one or more buildings and access shafts will be required above the station approach fans, which would be difficult to accommodate in the options where one or more of the fans are positioned under numerous existing buildings, many of which are listed. Please clarify this requirement.	There are the requirement for additional surface buildings which have been identified in the presentation, and will be developed further at subsequent stages and with opportunity for stakeholder input.	Closed
[redacted]	081	Alignment at approaches to HS2/NP underground station.	Slide 36 of 126	Please advise whether or not there is scope to introduce horizontal curvature into the track alignments in the areas between the station throats and the crossover boxes to potentially assist in positioning the crossover box ventilation shafts within appropriate locations, particularly within the city centre.	This would prove difficult as the horizontal layout is optimised in terms of allowable curves. It could be considered.	Closed
[redacted]	082	Modification to Alignment A	Slide 62 of 126	Reference is made to the deep box being moved to the east to avoid conflict with the canal and the listed former warehouse building. This modification is supported.	Noted	Closed
[redacted]	083	Modification to Alignment B	Slide 71 of 126	The minutes for the Workshop held on 29/10/2020 include an action on MWJV to (Item 1.14) to test shifting Alignment B to the south and east to enable progression of either a deep or shallow box option. This presumably involves the station being moved such that the west end of the west approach fan (hatched in red in the slide) is positioned below Gateway House. Whilst this enables the shallow box option to be progressed, it moved the station centre point a significant distance to the east and farther from the city centre. Presumably this alternative position is to be considered for the shallow box option alone, with the current position progressed for the deep box. If not, we seem to be losing a potentially good option (i.e. deep box option with station centre positioned as close as practicable to the city centre). The preference is for the deep box option to be positioned as far to the west as practicable. In addition, should this approach also be taken for Alignment A?	Discussion ongoing between TfN/MCC/TfGM/HS2/DfT in relation to investigating alternative options to those in the agreed scope. It is correct to note that any shift of Alignment B (to the east) would be with the aim of enabling a shallow box methodology. For Alignment B in the agreed scope, a deep box would be progressed. Regarding Alignment A, there has been agreement in all meetings following the 29/10/20 that a deep box methodoloy for Alignment A, in its agreed position, is to be progressed.	Closed
[redacted]	084	Modification to Alignment C	Slide 93 of 126	The fully mined option for Alignment C is positioned such that the vertical access cores conflict with Metrolink and potentially one or more listed buildings. If this option is progressed, consideration should be given to moving the alignment to the east to avoid conflicting with Metrolink. However, [redacted] current view is that this position for Alignment C should be paused and the alternative alignment proposed further to the west (understood to be named Alignment D) should be progressed. [redacted] has provided HS2 Ltd with a sketch detailing the proposed position for this alternative alignment (see email from [redacted] to [redacted] on 6/11/2020 @ 11:20) as agreed at the workshop.	Noted	Closed
[redacted]	085	Pedestrian connection between HS2 Station and existing railway station.	Slide 105 of 126 (and others).	There appears to be scope to provide underground pedestrian connections between the proposed HS2 mid-level transfer concourses and the existing railway station for this and the other alignment options. This should improve the passenger experience. Please consider such connections as part of further design development.	Noted	Closed
[redacted]	086	Metrolink	Slide 105 of 126 (and others).	This option shows the Metrolink tracks being diverted to the north side of the HS2 station. There is a need to develop proposals for the modified Metrolink infrastructure (for this and the other options), including provision of a new larger tram stop needed to increase capacity (in part due to demand created by HS2 and NPR). It may be preferable to position the new tram stop in the area between the existing railway station and proposed HS2 station for this option to improve integration.	The high level strategic impact on Metrolink will be considered at the next stage.	Closed
[redacted]	087	Servicing of Network Rail station.	Slide 105 of 126 (and others).	Please confirm whether or not consideration has been given to servicing requirements for the Network Rail station.	Not at this stage.	Closed

[redacted]

Document Review - Feedback Capture Sheet

Document Title:	HS2 Piccadilly Underground Study
Document Number:	2DE01-MWJ-EN-PRE-M003-000027 (Draft)

Reviewers:	[redacted]	

				Delivery Partner			
Item no.	Reviewer initials	Para/Clause No.	Comment	Suggested Revision	Response to comment / suggested Revision	Response Accepted (Y/N)	Escalated	Comments
001	[redacted]	Slide 12	Does a deeper mined box need to have fully mined approaches? Presumable a deep mined box could have a box throat on one side for example (depending on ground levels/conditions).		As a baseline configuration, we have proposed that both mined throats require a deeper box. However, dependant on local ground conditions, (i.e sufficient cover from ground level to top of tunnel crown) it may be possible to combine a shallow or deep station box with either throat being mined/box)			
002	[redacted]	Slide 14	I would like to see more details of the S&C layout on the approach to the station. Could alternative layouts be considered to reduce the overall length of the box?		Planned as a stakeholder workshop.			
003	[redacted]	Slides 14, 15 & 16	There appears to be an opportunity to reduce the length/width of the approach box by adopting a different platform layout (2 islands + 2 flanking platforms). It is noted this would slightly increase the width of the platform box however there still appears to be an opportunity to reduce the width/length of the approach box		There are opportunities for optimisation dependant upon operational requirements into the next phase of work.			
004	[redacted]	Slide 14	(See Comment 1) The current layout gives a lot of parallel move opportunities. Given the majority of services could be continuing through the station do we need this much flexibility? Could we look to rationalise the S&C to reduce the total length of the box with fewer parallel move opportunities?		HS2 wish to consider the station as operating as a terminal station during the period between completion dates (HS2 v NPR). The HS2 requirements are: *For movements in the same direction (in either direction), it shall be possible an arrival into any platform to be made simultaneously to a departure from another platform for any combination of points (i.e. Overlaps / End of Authorities to be clear of relevant point work).* *•The 'HS2' end station throat shall have all possible parallel moves on a flat layout, that is:* *•Platform 1 arrivals parallel to Platform 2 departures* *•Platform 2 arrivals parallel to Platform 3 departures* *•Platform 3 arrivals parallel to Platform 4 departures* *•Platform 4 arrivals parallel to Platform 5 departures, and* *•Platform 5 arrivals parallel to Platform 6 departures*			
005	[redacted]	Slide 14	Has any analysis been undertaken to confirm if the layout is needed to accommdoate the ITSS or has it simply been adopted from the surface station (which operates differently)?		Please see response to item No 4			
006	[redacted]	Slide 14	Minor point, do the end of the platforms (beyond the operational length) and the decoupling zone have to be straight? Seems to be an opportunity to refine the layout to make the approaches slightly narrower.		This needs to be reviewed against the requirements but may be an opportunity for refinement.			
007	[redacted]	Slides 14, 15 & 17	Would the station perform better if the outer platforms had the higher speeds as they will have through services and shorter trains? Consider amending the layout so slow speeds for terminating platforms.		Station performance, i.e operational throughput must be balanced with other aspects of the station layout & configuration and placement of platforms and other key functions.			
008	[redacted]	Slide 14	It would be helpful if key features such as stairs or lifts were labelled or a key provided		Noted, this can be considered for future presentations			
009	[redacted]	Slide 14	What is the tunnel separation on the appoaches (particularly as we might be in bedrock)? Are there opportunities to reduce the length of the station throat by bringing the lines closer together at this point? Could we consider alternatives such as single bore twin track tunnel here (with a deeper box to maintain tunnel cover)?		There is very limited information on ground conditions at this stage. The design assumes a nominal one times tunnel diameter seperation. Other alternatives are possible but at this stage we are applying reasonable best practice solutions for the purpose of comparison.			

Item no.	Reviewer initials	Para/Clause No.	Comment	Suggested Revision	Response to comment / suggested Revision	Response Accepted (Y/N)	Escalated	Comments
010	[redacted]	Slide 16	Would having three twin track tunnels (and 2 island platforms) make this layout more efficient? Could a hybrid option with partial box also help to make this design more efficient?		Yes there may be the potential for efficiencies to be gained in the layout. The design has adopted the 3 island solution to provide the most efficient station box width and being directly comparable with the current hybrid bill design.			
011	[redacted]	Slide 16 & 29	It would be helpful if an outline or some indication of where surface access would be needed were provided		Noted, this can be reviewed as the design progresses for future presentations			
012	[redacted]	Slide 18	Is there any guidance on the maximum/minimum distance from the station for the perturbation / ventilation crossover box? Or would it simply be effect on speed/jounrey time?		Not that we are aware of. The placing of the perturbation box from a track perspective needs to be on a straight and level piece of track. The further the ventilation is placed the more dificult it becomes to design a means of preventing over pressure into the station.			
013	[redacted]	Slide 20	We would not support providing capacity for 8tph on either approach to the station. The minimum we would accept is 12tph noting in some scenarios for NPR and HS2 we coud have up to 14tph on the London side to maximise utilisation of the Manchester tunnel		The ITSS to be used for this study is as per the agreed scope			
014	[redacted]	Slide 20	Presumably there is a degree of flexibility with the layout to suit site constraints? It would be useful to understand what one of these sites could look like in Mancheste for one of the city centre tunnel options.		The layout is intended to show an approximate minimum area that would be required, and key adjacencies ofbuildings and equipment. These sites will need to be configured to suit local requirements and a degree of flexibility required.			
015	[redacted]	Slide 22	Please can you clarify what the £1.3bn cost covers. Is that the full cost of the station or just one of the main construction contracts? To make a fair comparison we would need to understand the total cost for similar infrastructure (including approach crossover boses etc).		We can provide clarity on where the costs have come from in a future meeting.			
016	[redacted]	Slide 27	Is the mid-level transfer concourse needed? Does it need to be so deep? This seems quite conservative. What approach have Crossrail used for their deeper stations?		This layout, as outlined on Page 29 requires regularly 50m spacing of lifts and escalators along the platform length. In order to provide cross platform connections and conform to fire and escape requirements it is deemed a 'mid-level' transfer concourse is required. Crossrail does not have a mid level transfer concourse as the central stations have only 2 platforms, from which passengers can travel directly to ticket halls via an escalator, as highlighted on Page 32			
017	[redacted]	Slide 45-48	The layout of the station would need to consider the location of the four Metrlolink platforms, this is likely to have a signfiicant effect on the layout and would need to be considered in more detail at the next stage of development		This design considers 6 platforms for HS2/NPR. The high level strategic impact on Metrolink will be considered at the next stage.			
018	[redacted]	Slide 46 & 47	Given box construction would require the site to be cleared, what impact would the concourse/station access have on the choice of option at the current stage? We would expect in this case the surface access would be incorporated into the oversite development proposals and access would be identified to suit the station.		The integration of surface structures into the urban reconstruction of the area is something to be addressed at a more detailed stage. Surface ticket halls and ventilation/plant and equipment requirements can be integrated into the base of OSD proposals, subject to further study.			
019	[redacted]	Slide 46 & 47	It would be useful however if any key access requirements such as ventilation or maintenance which are likely to be fixed in size and location by engineering requirements were identified.		Noted for future presentations			
020	[redacted]	Slide 48	Is the intention with this proposal that passenger circulation would be at ground level? Could a shallow subterrenean concourse be provided with localised lower levels providing access to the platforms to reduce the amount of excavation?		In this mined layout it is intended for circulation (i.e cross station movement) to be at ground level. This layout shows an indicative lower level concourse that permits passenger circulation, accessed from two local ground level ticket halls.			
021	[redacted]	Slide 55	What is the basis for 20m clearance? If bedrock is expected around 8-10m below ground level do we need this much clearance? Also the structure north of the station is a metallic deck and the HS2 surface station is located much closer to it than is being suggested here		A 20m clearance is indicative and intended to provide a clear seperation between the viaduct and an HS2 station wall. Further refinements can be reviewed in the context of other local constraints when developed to further detail at the next stage			
022	[redacted]	Slide 55	What is the distance between the existing station and the proposed underground station at the western end? The interchange distance is not desirable		Horizontally it is approximately 80m.			
023	[redacted]	Slide 56/57	It appears minor changes to the position/orientation of the station could avoid the need to demolish the Grde II listed London Warehouse building. It is noted that a shallow box would not be able to avoid all the the listed buildings in the area.		The station alignment provided by HS2 sits tight between the Crusader Works and London Warehouse. While rotating the station north may allow the London Warehouse to be avoided, this would roatate the Eastern throat south and impact on the classic rail station. In addition, as you note, this would not remove all impacts.			
024	[redacted]	Side 60	Clash with current development proposals noted however there are also opportunities for oversite development and the land between the two stations could be released for development		Noted and agreed, the extent of OSD can be considered further at the next stage			

Item no.	Reviewer initials	Para/Clause No.	Comment	Suggested Revision	Response to comment / suggested Revision	Response Accepted (Y/N)	Escalated	Comments
025	[redacted]	Slides 70&71	See comments for Slide 55. We would like to see further consideration of the positioning of the station. For example, moving the station approximately 100m to the east could avoid many of the impacts north and west of London Road. Combined with rationalisation of the S&C layout this could reduce overall impacts. It is noted that relocating the station eastwards is likely to affect the Mancunian Way / Pin Mill Brow junction.		Noted. The station may need to be moved approx. 200m east to realise these benefits. Discussion ongoing between TfN/MCC/TfGM/HS2/DfT in relation to investigating alternative options to those in the agreed scope.			
026	[redacted]	Slides 70&71	Could a hybrid option considering an initial open cut in the space between the station and London Road with mined caverns to the north-west be considered? This could lead to a more optimal solution.		Noted and this will be considered in the context of our response to Item 25.			
027	[redacted]	Slides 86, 87 & 93	I agree that the impacts for a surface option on Alignment C would be unacceptable and this option can be discontinued.		Noted			
028	[redacted]	Slides 86, 87 & 93	We agree with [redacted] proposal to consider an alternative Alignment C with the station located further to the north and west between Ducie Street and Store Street. This could be either a deep box or mined. We also suggest the new station could partially pass under the existing station (but west of the the existing buffer stops) to reduce the risk of clashing with foundations for the buildings at Piccadilly Place.		Noted and this will be considered in the context of our response to Item 25.			
029	[redacted]	Slide 100	The following options are preferred to be taken forward: •Option A – Deep Box •Option B – Box (either shallow or deep TBC) •Option C – Relocate to Store Street/Ducie Street area and consider whether box or mined would be most suitable.		Noted			
030	[redacted]	Slide 103	How would this option accommodate the larger Metrolink station and wider [redacted] Metrolink proposals?		The high level strategic impact on Metrolink will be considered at the next stage.			
031	[redacted]	Slide 103	How would the eastern access fit in the wider redevelopment proposals? Would this be better located further west and closer to the eastern corner of the existing station to improve integration between the stations?		Location of ticket halls and concourses at grade and their intermodal connectivity and integration with local areas and OSD is to be considered at the next stage			
032	[redacted]	Slide 103 & Slide 105	Could the eastern approach to the station be box construction? The car park etc could then be partially underground above the rail lines (with allowances for rail maintenance access).		The proposal to be taken forward for Alignment A was selected as a deep box. The final station configuration will continue to be reviewed and minor changes to this construction methodology can be considered alongside the benefits it may bring.			
033	[redacted]	Slide 105	Does the Metrolink need to be located the north? Could it be located between the two station or partially above the HS2/NPR station? Having the Metrolink line so far north would result in relatively long interchange for Metrolink passengers from the existing rail station		The high level strategic impact on Metrolink will be considered at the next stage.			
034	[redacted]	Slide 105	We would like to see if partial or full approach box to the west of the platforms considered further using the Gateway House area but avoiding the London Warehouse building. The box would end at London Road to avoid major demolitions to the north west.		Noted and this will be considered in the context of our response to Item 25.			
035	[redacted]	Slide 105	Is there an opportunity to slightly reorientate the station such that the western end of the station is slightly closer to the existing station and the eastern end of station is further away. If we could tweak the bearing to avoid the Great Ancoats Street/Mancunian Way/Pin Mill Brow junction that could make construction simpler (but noting this would require the RIver Medlock to be diverted further).		Noted and the final location and configuration can be reviewed alongside the outcome of the additional study for Alignment B shallow box proposal.			
036	[redacted]	Slide 105	We would need to understand potential options for the perturbation cross0ver box west of the station for this option as this might affect the position/orientation of the station		The drawing needs to be increased in extent to show this likely impact - which is noted for future presentations.			
037	[redacted]	Slide 106	It would be helpful to see how passengers could interchange between the existing station and the proposed station. Could the cross-section have the current railway station platform level added for information?		This aspect will be considered at a more detailed stage.			
038	[redacted]	Slide 106	It would be helpful to see how passengers could interchange between the existing station and the proposed station. Could the cross-section have the current railway station platform level added for information?		Duplicate of the above.			
039	[redacted]	Slide 107	No comments on this design as we would like to consider an alternative position for the station in the Store Street / Ducie Street area.		Noted			

Item no.	Reviewer initials	Para/Clause No.	Comment	Suggested Revision	Response to comment / suggested Revision	Response Accepted (Y/N)	Escalated	Comments
040	[redacted]	Appendix A General	Will there be an opportunity at some point to consider the hybrid options identified to see if those would have benefits over the basic concepts considered so far?		Decision point 1 is intended to select four station options to take forward to the SIFT process. Hybrid options and Cavern approach are considered as part of the Box & Mined Station solutions respectively and will be considered at the next stage.			
041	[redacted]	Slide 111	There are several alternative arrangements we could consider. Suggest we also consider a two island platform arrangement to see if that would have any advantages.		Three island platforms provides the most efficient station box to meet the brief requirement of 6 platform faces as per the current hybrid bill design. Further review of the TSS may be required as the project develops			
042	[redacted]	Slide 111	It would also be worth ensuring the layout gives priority to through services rather than terminating services		Noted			
043	[redacted]	Slide 112	Does the decoupling zone allowed at the end of the platforms need to be straight?		The PRS denotes it is preferable for platforms to be straight, however there is guidance on the amount of curvature that is permissable. However at this early stage we have started with the optimal station solution			
044								
045								
046								
047								
048								
049								

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[redacted] DRN Feedback Capture Sheet

DRN reference number	n/a
Document title	HS2 Piccadilly Underground - Alternative Alignment Studies
ProjectWise reference number	n/a
Version number	Interim Draft
Work Package	n/a
Issue date (Draft for comment)	18/12/2020
Response date	

Comments classification	
2A	Quality of submission - Accept with suggested ammendments
2B	Client preference / change - Accept with suggested
3A	Quality of submission - Do not accept
3B	Client preference / change - Do not accept
4	For information only
5	Highlight a 'Safe by Design' feature

Reviewer	[redacted]
Organisation	[redacted]
Position	[redacted]
Discipline	n/a
Initial	[redacted]
Date	*DD/MM/YYYY*

Report and Supporting Files		

No.	Section No.	Clause / Paragraph / Table Number	Comments	Initial	Comment classification
1	Slide 6	-	What are the green letters A, B and C referring to?	[redacted]	
2	Slide 11	-	It is not clear why the 'Alternative Alignment D' has been moved 70m towards the north-east, causing a direct impact on Great Ancoats Street. The 20m move towards the south-east is understandable to avoid the London Warehouse building.	[redacted]	
3	Slides 11, 12, 13, 15, 16, 17 & 18	-	Has the risk associated with potential deep foundations / underground car park levels under Piccadilly Place (immediately west of Piccadilly station) been considered? May we need to consider a slightly different orientation to avoid possible underground obstacles?	[redacted]	
4	Slide 12	-	Similar to Comment 2 - why is the station moved 40m to the north-east for the alternative alignment? It appears the solution is trying to avoid Gateway House and the NR station access from Ducie Street and the associated level difference? Is this necessary?	[redacted]	
5	Slide 13		Similar to Comment 2 - why is the station box so far north-east that it affects Great Ancoats Street?	[redacted]	
6	Slide 13		Would the depth of the hybrid solution be similar to the 'Deep box' option? What is the overal width of this option?	[redacted]	
7	Slide 14		Agree the shallow box option is not viable for this alignment	[redacted]	
8	Slide 14		Related to previous comments, why do the two 'deep box' options need to be constructed under Great Ancoats Street? Why can't the station box be slightly further south-west?	[redacted]	
9	Slide 14		Whilst agree that a hybrid option has more flexibility due to narrower footprint, would construction be more complex trying to tunnel and excavate a deep box in close proximity?	[redacted]	
10	Slide 15		Presumably the three access boxes do not need to be located at the ends and middle of the platforms and there would be some scope to position them to avoid surface obstacles?	[redacted]	
11	Slide 15 /16		Has the option of moving the station slightly further to the south-west been considered such that the southern access box would be located on the current site of Gateway House / NR Access?	[redacted]	
12	Slide 16		Could the northern box be moved further south to avoid the impact on Great Ancoats Street?	[redacted]	
13	Slide 15/16/17		There is a tall development (Oxygen Manchester) currently being constructed in the parcel of land bounded by Store Street, Great Ancoats Street and Millbank Street. There would appear to be an impact on this development	[redacted]	

14	Slide 17		Could an option be considered on a slightly different bearing such that the southern end is as shown on Slide 17 but the northern end is moved further west to avoid the 'Oxygen Manchester' development?	[redacted]	
15	Slide 17		Please comment on the risk of tunnelling under Piccadilly as this was one of the reasons 'Alignment C' was discounted. Presumably the risk is lower as there are fewer tunnels directly under the NR viaduct and the tunnels are predominantly located under the station concourse / buffer stops? Could this principle be applied to the 'deep box' option?	[redacted]	
16	Slide 17		How does the impact on the viaduct compare to the proposed impact associated with the current surface station design?	[redacted]	
17	Slide 18		This slide needs further explanation. How is the section between the two surface access boxes constructed? Is the intention this will be mined? In this case how are the previous concerns about spacing of mined tunnel caverns addressed? A cross-section would be helpful here	[redacted]	
18	Slide 18		Presumably the two boxes could be larger to minimise the extent of mined construction?	[redacted]	
19	Slide 18		See previous comment about slightly reorientating the station to move the southern end further east and the northern end further west. This could avoid deep foundations at Piccadilly Place and the new 'Oxygen Manchester' development	[redacted]	
20	Slide 19		Agree the first three options can be discounted however a hybrid of the fourth option and the 'deep box' option seems to be a better overall solution. This could also be combined with a slight reorientation of the station to further reduce the impacts	[redacted]	
21	Slide 20		See comment above. Agree a deep box is probably the best solution for this alignment option. However there are several opportunities to refine this design to optimise such as slightly reorientating the station and considering splitting the sub-surface box into two smaller boxes with a short mined section between them. What refinement opportunities are there?	[redacted]	
22	Slide 21		Has there been any consideration of a reduced footprint for the station throat (proposal was attached to the track alignment presentation comments)? Potentially, if the station throat could be reduced in length by 50m, there could be a significant difference in the performance of this option	[redacted]	
23	Slide 22		Several of the impacts identified would also apply to the surface station option (e.g. loss of the NR access Ramp, demolition of the multi-storey car park and impacts on the road network around Pin Mill Brow / Mancunian Way)	[redacted]	
24	Slide 22		It is worth noting any impacts on the road network would only be during construction and could potentially be mitigated through phasing / temporary diversion	[redacted]	
25	Slide 22		The risk associated with the River Medlock is noted and would probably apply to any underground station option on this orientiation	[redacted]	
26	Slide 22		It appears a hybrid option of the two shallow boxes and the 'deep box' option may be the optimal solution for this alignment. What opportunity is there for option refinement in the current development and timescales?	[redacted]	
27	Slide 25		There may be opportunity to reduce the depth of the box or increase the tunnel cover if the station approaches were slightly inclined. This would also have performance benefits. This should be considered during any option refinement	[redacted]	
28	Slide 25		What is the level of the existing station platforms/concourse? It would be useful to add for reference	[redacted]	
29	Slide 26		See comment 25, agree we should consider hybrid options. There may be opportunity here to use the space between the platform box and London Road / Store Street to have part of the station throat in the box to reduce the length/complexity of the mined approach	[redacted]	
30	Slide 26		Given the shallow clearance, has the vertical alignment of the track been considered (i.e. putting the station throat on an incline to increase cover)?	[redacted]	

31	Slide 26		Why are the approach tracks limited to 0.2% gradient? I can understand the platforms being limited to this value given current Group standards but why can't steeper gradients be applied on the approaches?	[redacted]	
32	Slide 27		Agree with assessment that a 'deep box' is likely to be the better option for Alignment D and that hybrid options and further refinement should be considered to reduce impacts / risk / complexity	[redacted]	
33	Slide 27		From the work undertaken it appears the optimal solution for 'Alignment B' is likely to be a hybrid of the three options considered (the two shallow box locations and the 'deep box'). What opportunity is there for optimising the proposal considering hybrid options?	[redacted]	
34	Slide 27		The final decision should be taken in the management meeting but a recommendation can be made from the technical workshops	[redacted]	
35					

Record of Review

Document	**HS2 Piccadilly Underground - Track Alignments / Station Box Depth / Station Ventilation 04-03-21**
Document Date	**04/03/2021**
Source	[redacted]
Revision	**n/a**
Date of Review	**04/03/21 - 29/03/21**

These are initial comments based on the presentation and do not necessarily provide an exhaustive list. [redacted] reserve the right to raise further comments.

Reviewer	Comment Ref No.	Subject	Section number	Comment	Response	Status (Opened / Closed)
Track Alignments						
[redacted]	001	Alignments B and D Early Assumptions	Track Alignments Presentation - Slide 2 of 16	Please explain the meaning of the shaded areas shown on this slide and how they have been defined.	These were indicative alignments based on the shortest distances between nodes which would be possible when taking into account the bearing and location of the Airport Station, Piccadilly Station and Node 3 approach. The shaded areas are a 1km wide deviation from those routes to inform early planning and environmental discussions. The routes have been further developed to take account of possible vent shaft locations and train deceleration profiles during later design iterations.	
[redacted]	002	Alignments B, B1 and D Tunnel Ventilation Shafts	Track Alignments Presentation - Slide 4 of 16	Please clarify the critical factor(s) in defining the 3.3 km maximum spacing.	The HS2 technical standard shafts states intermediate shafts shall be provided at regular distances typically (2-3km) for fire and life safety provisions. The 3.3 km maximum spacing relates to the acceptability of the intervention distance for fire fighters in the UK.	
[redacted]	003	Alignments B, B1 and D Tunnel Ventilation Shafts	Track Alignments Presentation - Slide 4 of 16	Please clarify the basis for the assumption that the maximum distance between the Piccadilly Underground Station throat ventilation shaft and the following tunnel ventilation shaft is 3 km. Could this distance be increased to the 3.3 km value if necessary?	If Operations can please provide a response	
[redacted]	004	Alignments B and D Common Ventilation Shafts	Track Alignments Presentation - Slide 5 of 16	It appears that the length of Alignments B and B1 at the south approach to the station could potentially be shortened if additional tunnel shaft locations were identified. Please confirm whether or not this was considered.	The alignments remain indicative, as do the vent shaft locations. However, the circuitous route adopted by Alignments B/B1 to the south of the station is necessary due to the speed profile of the trains. During later development, this speed profile has been developed further. The number and spacing of vent shafts is largely driven by operational headway requirements and fire safety regulations.	
[redacted]	005	Alignments B and B1 Ventilation Shafts Dissimilarities	Track Alignments Presentation - Slide 6 of 16	Please confirm the distance between the ventilation shafts at the south approach to the station for Alignment B1 if an additional shaft is not provided. Is this 3.3 km?	At the stage of design development which these slides represented, the southern route alignments for B & D converged through common (indicative) vent shaft locations . However later design development has taken into account the deceleration profile of trains and renders this approach less feasible. As the designs no longer adopt the routes shown the query is not as relevant. however, from an OPS perspective, the distance between the final vent shafts should be less than 3.3km because the trains are running at lower speeds and the vent shafts also serve as signalling blocks.	
[redacted]	006	Alignments B and B1 Ventilation Shafts Dissimilarities	Track Alignments Presentation - Slide 6 of 16	Slide 7 shows same number of vent shafts for options B & D even though the distances are significantly different however, slide 6 suggests an additional vent shaft is required between option B & B1. Please set out why this is?	This was before further work was carried out to locate the 'least worst' location for the southbound outer scissors crossover cavern. It was assumed at the stage of the design which this presentation covered, that the outer scissors would moved commensurately with the station itself. This in turn would increase the spacing between it and the indicative first mainline vent shaft to more than the requisite maximum, hence the need for an additional vent shaft. During later design development the outer scissors cavern location has been fixed and is common for both B & B1, hence their main line vents were also the same. However, please note that the proposed alignments and vent shaft locations remain indicative only.	
[redacted]	007	Alignments B, B1 and D Speed Profiles	Track Alignments Presentation - Slide 7 of 16	At the south approach to Piccadilly Station, Alignment D is less curved than B and B1 and there would appear to be an opportunity for Alignment D to accommodate a higher speed, leading to a reduction in journey time.This does not appear to be the case from the presented speed profiles. Please confirm whether or not Alignment D does, or has the potential to, achieve higher speeds.	The approach curves for both alignments need to be managed to ensure that the trains can decelerate to 60kph before they encounter the station throat. Furthermore, the speed of the through route at the outer scissors location cannot exceed 160kph due to the limitations of the S&C. So, higher speeds between nodes might lead to a longer route to enable management of the decelaration profile.	
[redacted]	008	Alignments B, B1 and D Speed Profiles	Track Alignments Presentation - Slide 7 of 16	Please confirm whether or not the journey time implications of the different alignments have been assessed and, if not, when this will be done.	Clarification has been provided by OPS during later development.	
[redacted]	009	Alignments B, B1 and D Speed Profiles	Track Alignments Presentation - Slide 10 of 16	Reference is made to the limiting minimum gradient in a tunnel being 0.3 %. HS2 Ltd has previously issued [redacted] with Technical Standard - Track Alignment Design (Document no.: HS2-HS2-RT-STD-000-000001 Rev. P01), which gives a limiting minimum gradient of 0.2 % (Ref. 14.04). Please confirm whether or not this standard has been superseded. If it has, please issue [redacted] with the current version.	Rev P04 of HS2-HS2-RT-STD-000-000001 states 0.5% desirable / 0.3% limiting / 0.2% as a departure subject to HS2 Head of Drainage acceptance and HS2 HoTE approval.	

[redacted]	010	Vertical Alignments Alignment B - South	Track Alignments Presentation - Slide 10 of 16	There was some discussion in the meeting regarding the 0.5 % gradient limit being associated with the proposed scissors crossovers and that, if these were replaced by two separate crossovers, a steeper gradient could be achieved. Has this been considered further?	Separating the scissors would resolve the 0.5% limiting gradients, however this would introduce more mining, with each crossover requiring its own cavern and intervention shaft.	
[redacted]	011	Vertical Alignments Alignment B - South	Track Alignments Presentation - Slide 10 of 16	Reference is made to the depth of the ventilation shafts increasing if the minimum longitudinal gradient is changed from 0.3 % to 0.5 %. Presumably low points in the tunnel alignment are positioned close to the tunnel shafts to suit water being pumped to ground level from the low point via the shaft. Please confirm if this is correct and, if so, what the maximum distance is between the shaft and low-point.	If the ventilation shaft does not align with the tunnel low point then a dedicated sump cross passage is designed at the tunnel low point to capture fire water which is then pumped to the shaft. The tunnel drainage system is designed for fire water whereas surface run-off is captured at tunnel portals. At this stage of the design the ventilation shaft locations are indicative only and their spacings are intended to inform the interdisciplinary issues relating to them and give equitable comparisons between options.	
[redacted]	012	Vertical Alignments Alignment B - North	Track Alignments Presentation - Slide 13 of 16	As the station throat is contained within tunnels, does the 0.3 % minimum longitudinal gradient value not apply?	Yes. Further design development places all station throats on a gradient.	
[redacted]	013	Vertical Alignments Alignment B1 – River Irwell	Track Alignments Presentation - Slide 16 of 16	Please confirm whether or not any problems are anticipated with regards to the estimated cover between the tunnel and river.	C&L / Tunnelling have provided answers to this in subsequent presentations and documentation.	
[redacted]	014	Vertical Alignments Alignment B1 – River Irwell	Track Alignments Presentation - Slide 16 of 16	If a common vent isn't used for B1 and D, does there need to be an additional vent for B1?	Vent shaft locations are indicative only. The design has progressed and the routes no longer converge at the location shown in the 4th March presentation.	
[redacted]	015	General	General	The map resolution and scale makes it difficult to identify location of tunnels. As well as drawing resolution (slide 10-15) makes it difficult to see long section and detail.	Noted. General Arrangement drawings have been produced in the interim. These have been issued with the Sift 2 presentation material.	
Station Box Depth Presentation						
[redacted]	016	Stage 1 Development Mined Cavern v Station Box	Station Box Depth Presentation - Slide 4 of 15	Please confirm the level of certainty with regards to the position of the top of the unweathered sandstone: is this well defined by existing borehole data or is there a risk that it could be significantly lower than currently anticipated?	The weathered sandstone profile has been anticipated to be in the region of 2m thick, but until proven otherwise (by deep, high quality drilling and good core recovery) this may range from 1m up to 5m, especially near to old buried channels/water courses. There is evidence and case histories that demonstrate that this weathered zone is recovered as sand in some boreholes, so has a loose, porous and un-cemented nature. As it also contains mudstone bands up to 0.5m thick, these weather to a less competent clay material. Few boreholes are currently available that provides full information on this horizon, so the risk remains.	
[redacted]	017	Stage 1 Development Mined Cavern v Station Box	Station Box Depth Presentation - Slide 4 of 15	The adequacy of the lateral clearances between the tunnel caverns was questioned in the meeting and HS2 Ltd agreed to investigate this further. Please advise on your findings.	Clearances from intrados to intrados will be 3-4m between the ends of the turnout caverns and the inner scissors cavern. In detailed design, pilot tunnels may be needed to replace these pillars with reinforced concrete prior to cavern excavation.	
[redacted]	018	Stage 1 Development Mined Cavern v Station Box	Station Box Depth Presentation - Slide 4 of 15	Please confirm the basis of the 11 m cover of unweathered rock needed over the caverns.Is this based on precedents elsewhere? Could a greater clearance potentially be needed?	This is based on a rule of thumb of half the width of cavern. The scissors caverns are approximately 21m wide. Yes, greater clearence could be needed depending on the orientations and spacings of discontinuities in the rock, their roughness and infill materials, as well as the rock's strength and groundwater inflows. There will be a trade-off in detailed design between rock cover, pre-excavation grouting requirements, support requirements (i.e. shotcrete and/or rockbolts), and excavation sequence and advance lengths.	
[redacted]	019	Stage 1 Development Box Positioning	Station Box Depth Presentation - Slide 5 of 15	Can HS2 confirm and provide a description on the slide what the '30 storey' represents?	illustrative indication of potential OSD and possible height. Illustrated in dash line as not a core deliverable at this time.	
[redacted]	020	Stage 1 Development Box Positioning	Station Box Depth Presentation - Slide 5 of 15	The cross sections appear to show piles constructed below the station boxes at a depth where it is understood that they would be located within the unweathered sandstone. Please confirm whether or not these are piles and, if so, the basis for their inclusion. They could presumably have a significant cost implication.	Piles are indicative however they are assumed to be part of emerging design. Refer also to structural appendix information issued following presentation 15 & 16 April	
[redacted]	021	Stage 1 Development Shallow box vertical alignment	Station Box Depth Presentation - Slide 6 of 15	The vertical chain-dashed lines appear to relate to columns associated with the over-site development that pass down through the station. Please confirm whether or not this is correct and, if so, what diameter of column is anticipated and how close these are positioned to the platform edges.	Columns anticipated are 1.6m wide with 3m platform space adjacent.	
[redacted]	022	Stage 1 Development Shallow box vertical alignment	Station Box Depth Presentation - Slide 6 of 15	Reference is made to ground levels along the length of the station box potentially leading to an adjustment in levels. If there is a need for the proposed ground level on top of the box to vary, please advise how this would be accommodated (e.g. would the level of the top slab be varied to suit changing ground levels?).	The ground levels vary across the site. The station box would be required to adjust locally. i.e. ticket hall level at each entrance would vary acordingly.	

[redacted]	023	Stage 1 Development Shallow box vertical alignment	Station Box Depth Presentation - Slide 6 of 15	The cross section shows a ground level over the box of 40.5 m AOD, which is the level within Piccadilly Undercroft and on the adjacent section of London Road. Please note that options under consideration by [redacted] for Metrolink, include the tram stop being positioned below ground level and partially within the top level of the HS2 station box. This Metrolink option would require a higher ground level than 40.5 m.	MWJV are not aware of Metrolink desire to have an underground metrolink at time of the presentation. MWJV are informed on 16/03/21 of [redacted] proposal. Note also While MWJV note the potential benefits of an underground metrolink option it was highlighted that additional time was required to verify feasibility and integrate proposal. Note also an extension of programme would be requied and which was not instructed therefore an underground metrolink has not been integrate at this time. This does not limit capacity for it to be further investigated in subsequent stages.	
[redacted]	024	Stage 1 Development Shallow box vertical alignment: Concourse above ground	Station Box Depth Presentation - Slide 7 of 15	Positioning separate concourses between the tunnel ventilation ducts would also presumably prevent it being possible to connect to ground level by means of a single shared access point, the position of which within the station cross section would be relatively flexible. This would make it more difficult to position facilities above the underground station, such as a Metrolink tram stop that overlaps the station box.	Refer notes to item 023. Note also locating concourse etween ventilation shafts is not a viable option as outline on 04/03/21	
[redacted]	025	Stage 1 Development Shallow box vertical alignment	Station Box Depth Presentation - Slide 7 of 15	Connecting the platform vertical access cores directly to ground level without an intermediate underground concourse means that the access points would be spread over the full width of the station box, thereby preventing other facilities (such as a Metrolink tram stop) being positioned over the station box in that area.	Refer notes to item 023. Note also platform access to intermediate concourse level is required in normal and ermergency operation. Note integration of a below ground metrolink impacts numerous components including ventilation and may impact station depth. Metrolink subject to further additional study.	
[redacted]	026	Manchester Piccadilly High Speed Station Ventilation - Introduction	Station Ventilation Presentation - Slide 4 of 12	Reference is made to the assumption that piston pressures at the station would be negligible as they would mostly be relieved by ventilation provided at the crossover box. If ventilation is not provided at the crossover box, could it be provided at the station instead?	It can be in priniciple. The draught relief would need to be located at station ends and would require complex set of analysis to investigate the minimum size needed to be effective without the station being adversely impacted. Furthermore, the crossover box (open and ventilatied) prevents hot tunnel air from entering the station thus miniming the effort needed to cool the station.	
[redacted]	027	Alignment B Deep Box	Station Ventilation Presentation - Slide11 of 15	We are currently looking with HS2 at putting Metrolink underground, we wouldn't want that to further push HS2 design down and need to understand what this does to HS2 depth levels. The height of the platforms needs to be retained at an acceptable level.	MWJV are not aware of Metrolink desire to have an underground metrolink at time of the presentation. MWJV are informed on 16/03/21 of [redacted] proposal	
Station Ventilation Presentation						
[redacted]	028	Manchester Piccadilly High Speed Station Ventilation – Smoke Control	Station Ventilation Presentation - Slide 5 of 12	This slide appears to indicate that the axial fans are positioned in the TV service zone (i.e. the level directly above the underground platforms). Please confirm whether or not this is correct.	It does appears to be the case. We have reviewed this further and found that the ventilation fan room at a floor above would be more suitable.	
[redacted]	029		Slide 9 of 12	Can HS2 clarify why the cross section differs from slide 6 i.e. Why are there two bored tunnels?	It reflects the Alignment D station cross section where outer platform are mined and away from the station box. Platform smoke control ventilation system would extend to them too.	
[redacted]	030	Manchester Piccadilly High Speed Station Ventilation – Smoke Control	Station Ventilation Presentation - Slide 10 of 12	Has consideration been given to providing additional cross passages to contain the ventilation ducting such that headroom within the pedestrian tunnels can be maximised?	Additional cross passages have been implemented. The height of these cross passages has been increased from 6m to 8m. Further reviews found that the ventilation ducts can only be routed via certain cross passages (2 number) to the mined platform to facilitate access. Together, a clear height of not less than 4m can be achieved for passengers spatial comfort.	

MWJV Response to Document Ref:

MAN-PICC_Underground_Key_OppsQueries_P01.pdf

Received from HS2 Ltd on 30 March 2021.

[redacted] comments referenced '[redacted]' are from separate document MA08-ST-ROR-0015.xlsx also received 30.03.2021.

Manchester Piccadilly Underground Station Options

Key Opportunities and Queries

This document describes the key opportunities and remaining queries identified by Manchester City Council (MCC), Transport for Greater Manchester (TfGM) and Transport for the North (TfN) relating to the ongoing development of underground station options by HS2 at Manchester Piccadilly.

In summary the key queries and opportunities are:

• The length and layout of the station throat/approaches

• Opportunities to create further hybrids of shallow/deep/mined station layouts

• The perturbation crossovers in the city centre

• Refinement of platform requirements (length/width/curvature)

• Integration of Metrolink into the options being considered

• Integration with the conventional rail station at Manchester Piccadilly

• The depth of the 'shallow box' Option B1

• Relaxation of HS2 standards and requirements

• Quantifying the potential benefits of a 'through' layout in terms of rail capacity/performance (i.e. potential additional paths, flexibility, resilience)

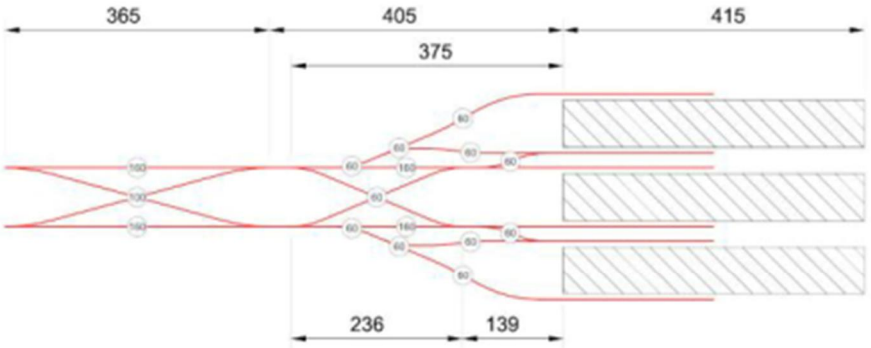
• Alternative ways to accommodate the train service specification with a through station

Section 1.1 Length and layout of the station throat / approaches

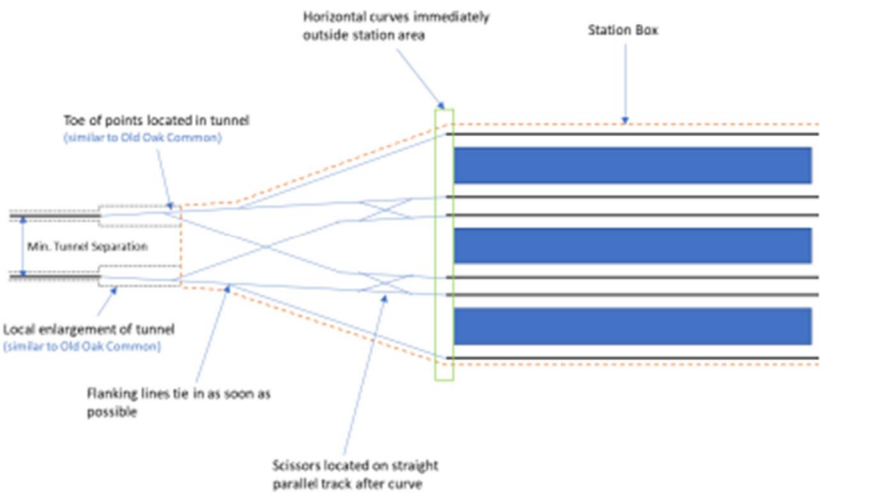
The footprint of the underground station is a key driver of cost therefore this needs to be minimised. Given the high cost of the underground caverns/box, non-preferred track geometry and S&C layouts should be considered as increased maintenance costs likely to be outweighed by capital cost savings.

The layout can be refined to provide parallel moves with a reduced footprint using non-preferred arrangements such as scissors crossovers. We should also look at opportunities to minimise the footprint by relaxing HS2 standards, especially those relating to separation of S&C.

Current HS2 Proposal (Shallow Box)

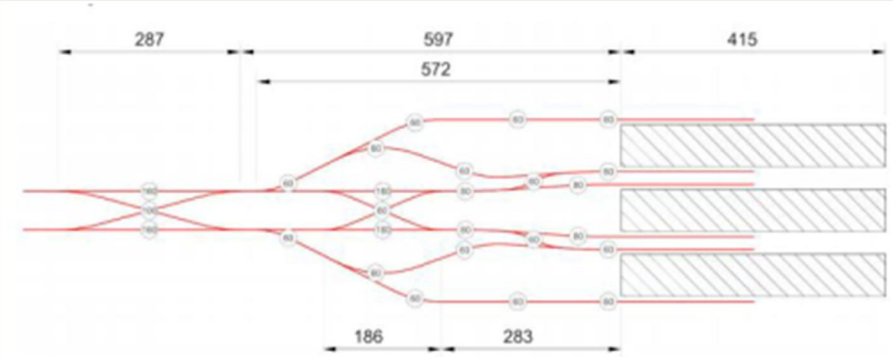


Alternative (Shallow Box)

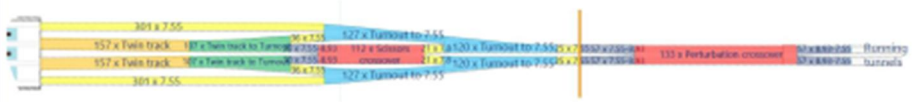


Potential Opportunity: The use of scissors crossovers simplifies and reduces the overall length of the station throat whilst still permitting parallel moves. Reducing the footprint of the approach could significantly reduce cost.

Current HS2 Proposal (Deep Box)

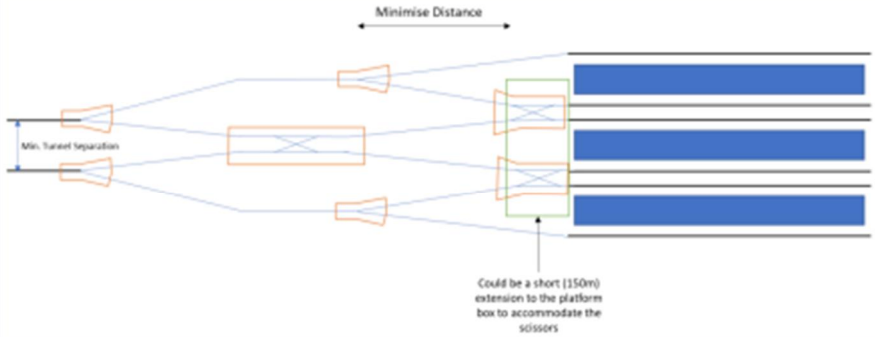


Track Schematic Layout



Tunnel Schematic

Alternative (Deep Box)



Potential Opportunity: The current HS2 proposal requires a number of large underground caverns in close proximity to each other. The technical feasibility of construction is noted as a significant risk. The cost of each cavern is likely to be high therefore the number and length of caverns needs to be minimised. The alternative proposal would reduce the number and length of caverns whilst still allowing parallel moves in and out of the station. There is potentially a further opportunity to locate the scissors crossovers immediately outside the platforms in a box structure.

Further Comments

See [redacted] comments (04/03/21)

- Limiting gradients in tunnels and through S&C (GM#009, GM#010, GM#011, GM#012)
- Location of vent shafts and influence of track radii on approach (GM#004, GM#007)

MWJV Response to Section 1.1

There may be an opportunity to reduce the throat layout footprint, particularly at the Leeds end of the station.

For the study and its outcome, the throats have been regarded as identical at both ends of the station. The full parallel moves may not be required at the NPR end.

This would need to be confirmed via a combined HS2/NPR operations and timetabling requirements (in principle) Statement which would take account of TSS and future proofing requirements.

Switches and Crossing (S&C) is designed based on TSI/NTSN and BS EN compliance alongside due consideration of UIC guidance and European experience. Non-preferred geometry has been considered, and included, where it is deemed appropriate.

Given that the study has considered three distinct construction methods, each resulting in its own bespoke track layout, it would seem prudent to minimise the use of non-preferred components and/or geometry so as not to impose undue bias on one of the three track layouts over the others.

Separation of turnouts, and their relationship to follow-on plain line geometry is, in most cases, necessary to reduce the relative movement of carriage ends as they traverse reverse curves, thereby mitigating against potential buffer locking or centre-throw gauging issues. In other instances, the separation is necessary to ensure maintainable componentry.

Each instance would need to be considered on its own merit at a later stage of the design or detailed design.

Maintenance cannot, and should not, be considered on a cost only basis. The designer must consider whether their design introduces a higher likelihood of exposure to hazards. Also, the environment in which the hazards are encountered, and the impact associated with them must also be considered when calculating the overall risk (likelihood x impact).

Scissors crossovers have been incorporated in all throat layouts. The suggested alternative (shallow box and deep box) layouts contain more scissors units than the MWJV layouts proposed in the study. This could potentially lead to greater maintenance intervention.

Additionally, in the suggested shallow box layout, the central platforms could only be accessed via the scissors. Also, with the Shallow box proposal sketch, the concepts limits opportunity for implementation of a vertical curve to provide a change of gradient between platforms and S&C.

In the deep box proposal sketch, the spacing between S&C and platform ends will require careful consideration alongside CCS requirements. It should be noted that that the length of the throat is not necessarily determined by the complexity of the S&C within it, but rather by the limitations on plain line geometry required to connect the outer platforms to the central two tracks.

It is acknowledged that increasing the extent of open-cut construction into the mined throats would reduce the extent of mining, however there are other potential impacts such as to construction methodology, operations, environment and project delivery, these would have to be assessed through further study at a later date.

While these proposals may indeed provide some benefit, in order to assess the proposed options further design development would be needed to assess the many complex design issues involved (as the text above illustrates).

Further design development has not been instructed and any additional design development would be pending Decision Point 3 (Ministerial Decision).

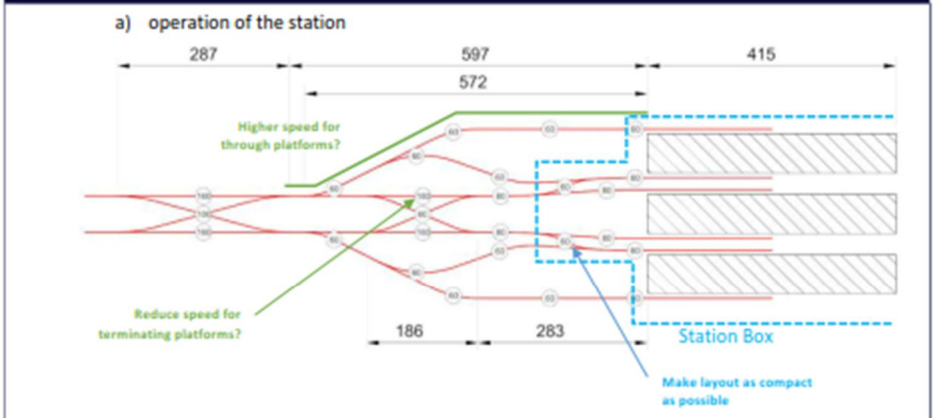
It is noted that any further development work is unlikely to change the overall sift assessment against the Baseline.

Section 1.2 Further hybrids of shallow/deep box and mined elements

Accommodating a full length 'shallow' box in a city centre location is very challenging and would be very disruptive. Deep box and mined options are technically very challenging, costly, and slow to construct therefore should only use these elements where specific surface impacts need to be avoided.

There is a need to achieve a balance between the cost/complexity of the mined/deep elements and the impacts on the city centre.

Alternative 1 – Refine the 'deep box' by providing part of the station throat in the station box



Part of the station throat could be located in a slightly extended station box to minimise the length of tunnelled caverns and improve access for construction. This could also be linked to reducing the speed into the 'terminating' platforms where the S&C is more complex with higher speeds favoured for the outer 'through' platforms.

Alternative 2 – Further consider extending the station box to the east instead of mined caverns

There is generally more access to the east of the station, away from the city centre which could be used to reduce the complexity/duration of tunnel cavern construction. There may also be opportunities to use the additional excavated depth between rail level and ground level for plant rooms, car parking, bus/coach facilities or other ancillary purposes to minimise the overall surface impact of the station. Also, extending the construction site eastwards may allow access to the Ardwick area and a possible railhead for removing large volumes of spoil from the worksite.

Alternative 3 – Consider the 'Option D' hybrid layout for the Option B location
There may be advantages of using the hybrid layout developed for Option D at the Option B location in terms of orientation and location of the station box.

MWJV Response to Section 1.2

With regards to sketch "Alternative 1". higher speed turnouts are likely to lengthen the cavern for the route to outer platforms. As the centre platforms are on straight track the speed is only limited by the maximum speed for the through route of S&C (160kph for low speed fixed nose S&C on HS2).

It should be noted that all trains stop at Piccadilly and under the assumed phased construction and to accommodate potential large-scale operational disruption to services at either end of the station all platforms have been considered, in the context of the track layout, as terminating. Furthermore, under a fully integrated system with built-in flexibility, it could be argued that no platform should be assumed as being for a singular purpose. The layout has been made as compact as possible whilst adhering to HS2 Track Alignment and S&C standards as far as reasonably possible.

With regards to sketch "Alternative 2", the concept of constructing the eastern throat via open-cut method and has wider ranging consequences to the construction methodology, operations, environment and project delivery. It would mean the open excavation to a deeper level, whilst potentially reducing risks does increase the volume of excavation. It should be noted that there is potential for reducing the eastern throat complexity in conjunction with finalised operational requirements for the NPR end.

With regards to "Alternative 3", potentially there could benefits to the proposal. However, this is a deviation from the process of selection and convergence agreed. Further work would need to be instructed to identify and assess the complexities of the design against any other.

While these proposals may indeed provide some benefit, in order to assess the proposed options further design development would be needed to assess the many complex design issues involved as the text above illustrates.

Further design development has not been instructed and any additional design development would be pending Decision Point 3 (Ministerial Decision).

It is noted that any further development work is unlikely to change the overall sift assessment against the Baseline.

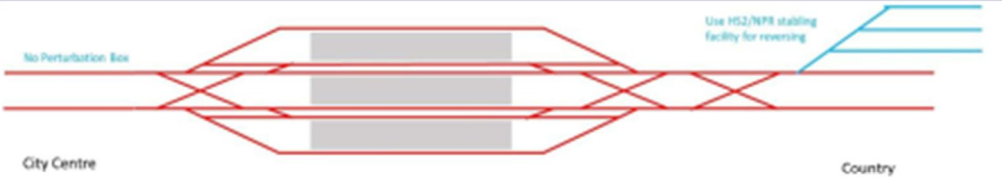
Section 1.3 Perturbation Crossover Box/Cavern

The perturbation box/cavern is difficult to locate in a city centre location due to size. The box/cavern would not be required in normal operation therefore need to consider implications for perturbed operation if not provided. Only Platforms 1 and 6 would need to use the cross-over box in perturbed situations however it also provides flexibility for other platforms.

Alternative 1 – Turnback siding east of the station

A turnback siding east of the station (where access is more available and a box structure more feasible) could allow trains to leave the outer platforms, reverse, and then return via one of the inner platforms.

Alternative 2 – Use a HS2/NPR sidings facility east of the station to reverse services



It is likely a sidings facility will still be needed for an underground station to release train paths on the Manchester Spur therefore the opportunity to use this facility to reverse trains in perturbed operation should be considered.

Alternative 3 – Do not provide reversing capability for outer platforms

As the cost of providing reversing capability for the outer platforms is very high, further study is needed to determine if the station could operate with only the four inner platforms allowing reversing in perturbed operation. The impact of resilience at the station in this scenario would need to be evaluated.

MWJV Response to Section 1.3

The requirement for the outer scissors is an operational issue. Their function, under normal operation, is to provide access to the outermost platforms for both main lines.
Stabling sidings are excluded from the scope of this study. However, the following should be noted.

A central turnback would lead to a widening of the track centres to house the third tunnel. Furthermore, three caverns would be required for the turnouts from each running line to the turnback. The maximum gradient from stabling trains (0.25% as defined in the INF NTSN) is less than the limiting minimum gradient for tunnels. This would require special consideration for the design of drainage systems and likely to increase complexity of project.

Given the topography of Manchester heading towards the Peak District/Pennines it would be challenging to provide the stabling sidings as an above ground facility. Providing these sidings underground would likely require a very large system of caverns with associated construction and surface impact issues.

If a route was provided to an above ground site, the length of the sidings would likely require large earthworks to provide 0.25% stabling sidings when the topography typically rises at greater than this gradient.

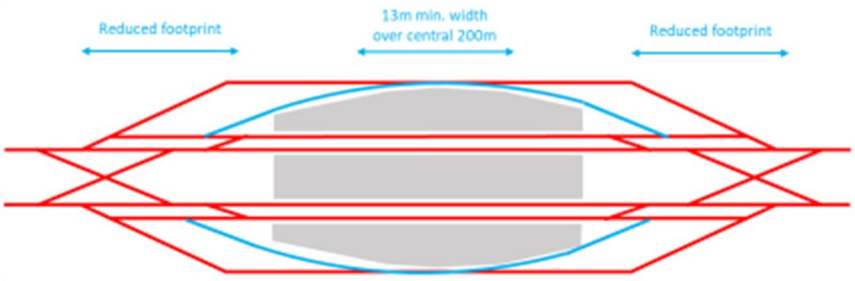
As stated by HS2 Ltd, the sidings are assumed to be outside of the area and scope of study for the purposes of the sift. These do not provide opportunities for improvement under the current requirements.

Section 1.4 Refinement of Platform Requirements

NPR trains are 200m length and will utilise a 'conventional compatible' type rolling stock therefore a full platform width over the 400m length is not necessarily required. 400m platforms provide future proofing for longer NPR trains in future and allow 400m HS2 sets to use the platform in perturbed operation.

The current design is based on 6x400m straight platforms with a uniform width and an overall station box length of 465m.

Opportunity 1 – Reduced platform width for outer platforms



The outer platforms are expected to be predominantly used by 200m length NPR services therefore 400m platform length may not be needed. A potential compromise could be to have reduced platform width at the ends of the platforms which are likely to be little used by NPR but still provides capability for occasional use by 400m length trains (such as perturbed operation). This would require curved platforms on a large radius. Changing the bearing of the lines at the ends of the outer platforms could reduce the footprint of the station.

Opportunity 2 – Reduce the platform box length

Look at opportunities to reduce the box length. What requirements result in the platform box being 50m longer than the 415m minimum platform length?

Opportunity 3 - Curved Platforms / Vertical grade through station

Allowing curved platforms and constant shallow vertical grades through the station would provide additional flexibility to avoid surface impacts and could simplify construction.

MWJV Response to Section 1.4

Opportunity 1 – Whilst this 'might' truncate the overall length of the throat, limiting the outer platform capacity to 200m reduces the potential for flexibility of combined operations and would also hinder future capacity enhancement. Furthermore, it is understood that parallel platform width is needed along the whole length of the station to accommodate structural supports under the current station design proposal.

Opportunity 2 – Splitting and joining of trains needs to be considered along with the type of signalling controls used. Also, under a phased scheme, it may be necessary to provide more space off the end of the platforms for a compliant buffer-stop zone under more detailed consideration.

Opportunity 3 - Acceptable gradients for platforms is 0.25% based on HS2 Standards and INF NTSN and thus unlikely to provide significant depth benefits. If the station was on a single grade then surface relationship becomes more complex, requiring further detailed study to understand impact on track further out.

Section 1.5 Integration of Metrolink

We would like to see outline proposals for the location and integration of Metrolink with the three station options. Note [redacted] have made numerous comments highlighting the need to consider the location of Metrolink both in plan and vertically within the station for all underground station options. The interaction between Metrolink and vertical passenger circulation to underground platforms needs to be considered. [See also [redacted] Comments (04/03/21): [redacted]023, [redacted]024, [redacted]025 & [redacted]027].

MWJV Response to Section 1.5

A high-level assessment of Metrolink impacts is within the scope of the study.

However, in order to address the concerns of [redacted] some design consideration has been made for the relocation of a surface Metrolink station as shown on the sift drawings.

It should be noted that integration of an underground Metro station, as believed to be desired by the stakeholders, would increase the complexity and cost of the option proposals and would require instruction and further study to adequately evaluate.

Options B, B1 & D address the impact and integration of HS2 underground proposals i with Metrolink.

The design team engaged in four collaborative workshops with [redacted] in Spring 2021. The integrated [redacted] preferred option for D was received in the workshop on 2 March 2021

and adopted for Option B1. This is because the spatial relationships are similar and a preferred [redacted] Option for B1 was not available at that time.

For Option B, the design team investigated [redacted] initial preferred option of Metrolink on an elevated Metrolink on the existing Network Rail ramp. MWJV provided additional alternatives including outlining impacts in the workshop on 16 March 2021, where a further [redacted] alternative for Metrolink as an underground proposal for Alignment B was presented.

It was noted that further stakeholder coordination (with [redacted] was required by [redacted] before this new proposal could be confirmed as a stakeholder preferred option.

MWJV recognises and agrees that an underground proposal for Metrolink provides benefits. It is highlighted that while not confirming feasibility, the integration of this required further study and testing. With limited time available in the condensed study programme (or room to change dates), incorporating the new underground option for Metrolink in alignment B was not progressed as instructed by HS2 Ltd.

MWJV highlighted that further additional time would be required to incorporate and understand from further stakeholder engagement that an underground proposal for Metrolink may also be preferred for Options B1 and D. Whilst not confirming feasibility without testing the proposal (including any impact on station depth), MWJV has highlighted that B1 and D may be better and less constrained candidates to incorporate an underground Metrolink compared to Option B.

Regarding comments [redacted]023, [redacted]024, [redacted]025 & [redacted]027, please refer to the MWJV response provided. It is noted that these comments also refer to an underground Metrolink which has been covered in our response above.

Section 1.6 Integration with Conventional Rail Station

Although recent presentations have provided an overview of how the station could be integrated with the urban environment there is limited detail of the integration with the existing station. It is currently assumed that the existing station entrances will be used however there may be opportunities to improve integration by reconfiguring the station entrances. Examples include:

• Provision of sub-surface pedestrian links between the HS2/NPR station and conventional station

• A southern/eastern entrance and concourse at the conventional station (primarily for Option B1 but also potential for Option B)

• Travel distance and routes from Option D to the conventional station

MWJV Response to Section 1.6

The Interchange between the classic Network Rail Station and the proposed High-Speed Station is critical.

The current design in Alignment B, B1 and D would all provide a new northern entrance to the Network Rail Station. Providing a direct entrance that faces onto Piccadilly SRF and HS2 Ticket-hall for better wayfinding and improving on interchange time. This was illustrated in the slide pack from the 15 April 2021.

Additionally, in options B and D (deeper stations), the designs incorporate an underground walkway between the proposed and the classic rail stations.

Section 1.7 Depth of 'Shallow Box' Option B1

The latest presentations have shown the depth of the 'shallow' box option has been significantly increased compared to the previous stage of development. This appears to be driven by several constraints:

- The depth of the tunnel at the River Irwell crossing near Pomona
- Depth of tunnels on approach
- Provision of a deep 'ventilation' zone above the rail levels
- Provision of second subsurface concourse
- Metrolink

Depth at River Irwell

The current design for the tunnel under the River Irwell crossing assumes that the river has a depth of 8m and 16m of cover is required from bed level to tunnel crown. This seems very conservative as it is likely the bed rock level will be similar to the surrounding area.

It could also be argued that a short section of shallower cover at the river would be acceptable given the impact on the overall design. Suggest the assumed 'average' bed rock level is used throughout with a risk noted at the river crossing and this constraint is removed from the design if it is determining the depth of the 'shallow' box.

MWJV Response

The depth of the Option B1 station box is a combination of station requirements balanced with approach tunnels. This is informed by operational requirements and standards governing their design.

The relationship with the River Irwell balances these, including limited knowledge of geotechnical issues with risks, including construction and environment.

In respect of accommodating the outer scissors' headhouse proposed location and the rail level in the shallow box, the vertical alignment is required to adopt a combination of horizontal and vertical geometry which would still be present even if a less conservative estimate of depth of cover to the Irwell was assumed.

While the above response discusses the River Irwell located to the west of option B & B1 The river Medlock located to the East is required to pass over the caverned approach and cut and cover throat of B & B1 respectively. The throat of B1 integrates the River Medlock above the track lines. Noting that culverting the river under or pumping over are not feasible options the level of the River Medlock is a significant constraint to adjustment of B1 box depth.

Depth of Tunnel on Approach to Station

Related to the comment above, it appears to have been assumed that 1D cover is required below weathered bedrock, even at the station. Whilst 1D cover to weathered bedrock seems appropriate for the main length of tunnel, it would also seem appropriate to consider shallower tunnels in the vicinity of the station.

In this case higher ground risk and slower construction rate may be acceptable over a short length on the approach to the station if this results in significant reductions to the depth of the station overall. This would be akin to a tunnel portal where a short length of shallower cover will be inevitable.

MWJV Response

The assumptions for the depth of the approaches have been made based on the available information and the level of analysis undertaken.

The ground represents significant risk and as suggested above, looking at less conservative approaches is likely to result in high costs for work such as grouting to maintain stability and a slower rate of progress.

Whilst fine tuning at any later design stage may provide some benefit, in order to assess the proposed options, further study would be needed to be instructed to assess

the many complex design issues together with geotechnical data (assuming one of the options is carried forward).

Further design development has not been instructed and any additional design development would be pending Decision Point 3 (Ministerial Decision).

However, it is unlikely to change the overall sift assessment against the Baseline.

Provision of Ventilation Zone above Rail Level

Looking at other sub-surface stations (e.g. Berlin Hauptbahnhof – images below) there does not appear to be active provision for ventilation of smoke/fire. What alternatives are there to an active system? Could smoke be allowed to leave the station via the box roof slab into atmosphere using a more passive approach?

The earlier presentation about Old Oak Common station ventilation showed how that station is based on a largely passive system. Given the ventilation system requires a 6m deep zone for ducts and equipment, alternatives using a more open layout should be considered.

It is noted that the mechanical ventilation may be unavoidable for the 'deep' station options, particularly Option D, however alternatives need to be considered for the shallow option. If the ventilation system is found to be determining the depth of the deep options, then alternative ventilation strategies may also need to be considered.

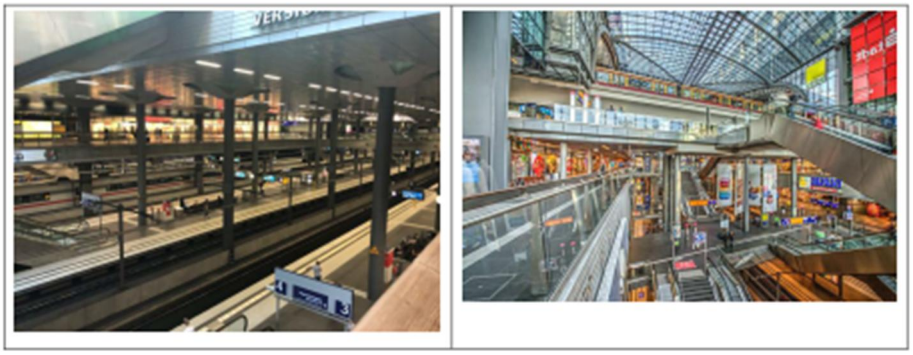


Figure 1: Berlin Hauptbahnhof subsurface platforms

MWJV Response

At time of construction of the Berlin Hauptbahnhof, fire regulations were limited and did not include mechanical smoke extract. As regulations, including in Germany, have evolved, the station has retrofitted mechanical smoke extract.

The design team has noted that the roof lights provide daylight opportunity and their use as part of a mixed mode ventilation strategy would require further detailed modelling. Note this is for normal air ventilation and not part of a smoke extract strategy. It is important to distinguish and separate the two.

The roof lights would not form a part of a smoke extract strategy as a passive provision cannot be relied upon in emergency nor would the roof lights have capacity for smoke extract required. The ducts located above the track/platform level are required for the smoke extract strategy. The depth of the duct and the depth of structural beam are both benchmarked with OOC which also requires ducts of similar size for smoke extract.

At this high level of design, it is prudent to assume full mechanical ventilation and space proof accordingly.

Provision of Second Subsurface Concourse

A second underground concourse could increase the depth of the station. This requirement appears to be driven by a requirement to provide permeability through the station outside the station gate line. There are several opportunities to provide permeability through the station without resorting to a full depth concourse such as:

- Providing two discrete ticket halls roughly at the quarter points of the station which would have better passenger circulation capability than ticket halls at each end whilst still allowing permeability
- Consider different vertical circulation options to provide permeability for non-passengers (e.g. footbridges or an additional level above ground level over the station concourse). There are significant differences in level across the site which could be used to the advantage however it is noted this requires more detailed design than currently achievable.

MWJV Response

The requirement of concourse is driven by operational requirements rather than exclusively by the benefit of permeability (which is an important consideration not to be discounted). The concourse is a component of the station circulation both in normal operation and emergency. The concourse facilitates passenger clearance of platform in emergency within three minutes and avoids congestion in normal operation.

Using the platform for horizontal circulation impacts clearance time making the station non-compliant. Adding additional ticket halls increases operational requirement but would not obviate the need for a concourse below ground for circulation and emergency requirements already stated.

There are also limitations on escalators that would not go from platform to ticket hall in a single lift. It should also be noted that depth of, or requirement of concourse, cannot be viewed in isolation of linked components including depth of track level which in the case of B & D are directly linked with selected construction methodology, including mined throats to station approach which determine level of station box depth rather than concourse.

In respect of B1, the depth of station is an interlinked combination of station requirements and the interrelationship of station track level with clearance below the River Irwell and River Medlock.

Metrolink

See Section 1.6 however for Option B1 in particular it is necessary to understand potential options for integrating passenger circulation for the underground HS2/NPR platforms and the Metrolink lines (which are likely to be at or around ground level). This should seek to avoid further lowering the platform levels for the HS2/NPR lines where possible.

MWJV Response

Please refer to the response to Section 1.6.

Section 1.8 Relaxation of HS2 Standards / Requirements

The current proposals appear to be based on full compliance with HS2 standards and requirements. We would like to understand where HS2 specific standards and requirements are having a significant influence on the design (such as S&C positioning) and the potential opportunities to relax some of these where a significant opportunity may be available.

Possible opportunities:

- Reducing the spacing between S&C and using more compact, non-preferred S&C arrangements; and
- Length of platform box – can this be reduced from 465m? What requirements result in a platform box 65m longer than the trains using the platforms.

MWJV Response to Section 1.8

As stated previously in response to Section 1.1, 'S&C is designed based on TSI/BS EN compliance alongside due consideration of UIC guidance and European experience.

Minimum separation between S&C reduction is risky without having exact S&C to understand location of welds and the support system to be used.'

Station length is subject to further work and consideration of construction phasing to understand impact of the interim terminal operations.

The minimum platform length should be able to cater for train de-coupling which requires space between the trains, presented in the study as 415m as a direct comparison to the CP3 design but should ideally be 435m.

There will be a need for buffer stops at the end of each platforms which will need to be located with consideration for railway system design and the interface with future construction strategy.

The PRS states the following for provision of Buffer Stops: 'For high speed platforms in terminal stations there shall be a 10m distance between a train's normal stop position and the end of the platform, followed by a tracked 40m buffer zone, as shown in Approach to Platform Ends at Terminal Stations under ETCS (HS2-HS2-OP-SKE-000-000001). [P2bPRS.705]'

Section 1.9 Quantifying performance benefits/opportunities from a through station

Direct Rail Benefits

To assess the direct rail user benefits we need journey times from Manchester Airport to 'Node 3' to be provided by HS2. These journey times will need to be split such that we have:

- Manchester Airport to Manchester Piccadilly (Stop to Stop)
- Manchester Piccadilly to 'Node 3' (Stop to Point)
- The achieved speed at the handover at 'Node 3'

Land availability for development

To undertake an initial assessment of the potential value of additional land we will need HS2 to quantify the difference in permanent footprint for the station options including the surface station for comparison.

For a more detailed analysis it will be necessary to identify different permanent boundaries for the options to be considered. Further collaboration between HS2, Manchester stakeholders and [redacted]DfT analysts to estimate the impact on land use around the station will also be required.

Indirect Benefits

A through station inherently has more capacity for train services. Even noting the limitations of the HS2 Manchester Spur it is likely a through station can provide the following benefits:

• More flexibility with services arriving/departing the station allowing more of the capacity of the Spur to be utilised (i.e. allow up to 14/16tph to be operated reliably on the Manchester Spur?)

• Reduced crossing moves would be expected to improve reliability as fewer potential conflicts and reduced sensitivity to delays elsewhere

• A through station is likely to unlock more capacity towards Leeds/Sheffield as arriving/departing services no longer need to share the same approach to the station

It is important the comparison of underground options against the surface option considers these potential benefits. Further discussions are needed to agree how these benefits can be objectively assessed and quantified so they can be included in the decision-making process.

MWJV Response to Section 1.9

Journey time impacts have been presented as part of the study after this comment was made. These are contained within the Sift Matrix.

In response to the indirect benefits of the through station, while the station is designed as a through station configuration, the iTSS combines the 'turnback' nature of the HS2 services with the 'through' nature of the NPR services.

Providing six platforms enables the iTSS to function reliably with both services (see response to 1.10 below), but there are limitations on realising further capacity because of this dual function.

Section 1.10 Alternative Ways to Accommodate the iTSS

The current arrangement is largely based on 'replicating' the surface station underground however this approach does not necessarily consider the potential opportunities resulting from a through station. Opportunities such as:

- Reducing the number of platforms from six to four. If all services were to pass through the station, then it is likely that only four platforms would be needed. This would have several advantages in terms of reducing the size of the station box and simplifying the station throat layout. The main challenge would be HS2 Captive Manchester to London services which currently terminate at Piccadilly. Could the station operate with turnback sidings for these services? Are there other alternative uses for these services we could consider?
- Using the 400m length platforms differently. The NPR trains are 200m length so it would be possible to stack two services in a single platform. Could this capability be used beneficially (for example allowing terminating NPR services from east of Manchester).

It would be helpful if the potential advantages/disadvantage of these potential opportunities could be discussed, in high level terms, as part of the decision-making process.

MWJV Response to Section 1.10

Agreed that the arrangement is based on replicating the surface station. As a general point, as with the theme of much of the responses, the potential opportunities require a different solution that is beyond the remit of this study and difficult to assess on a single discipline basis without impacting other disciplines.

Reducing the number of platforms from Six to Four:
The nature of the NPR 6tph service means that it may be logical to structure this as a 4tph pattern to/from Liverpool, with 2tph from Birmingham Curzon Street overlaid, which provides an even interval service to both destinations (with a 30 minute pattern to Birmingham overlaid on a 15 minute pattern to Liverpool).

However, the consequence of this is that it may be necessary to plan a train to/from Liverpool at or close to a train from Birmingham at or close to three minute headways through Manchester Piccadilly to achieve this on top of HS2 Euston services (whose timings are fixed by Euston station).

This headway requires the two trains to use different platforms at Manchester Piccadilly, as sufficient platform re-occupation cannot be achieved in the same platform (especially as a three minute dwell time is required for an underground station, so the second arrival would need to be simultaneous to the previous departure, which is impossible).

Therefore, for any Underground station alignment to offer the same choice of timetable flexibility and capacity as the CP3 it must provide two through platforms per direction for NPR services, segregated from two platforms to turnback HS2 Euston services whose turnaround times at Piccadilly are fixed by constraints at Euston; therefore a total of six platforms is the minimum requirement.

A four platform Underground station would be likely fix the NPR service pattern closer approximate 10 minute intervals through Piccadilly resulting in:

- Less resilience for HS2 services, as capability to manage NPR perturbation is diminished
- An uneven NPR service to Liverpool at 10/20 minute intervals, and
- May cause constraints when integrating services onto the existing Network beyond Leeds with fewer timetable choices available on HS2 infrastructure.

The platform lengths need to be flexible to accommodate HS2 or NPR trains

Stacking of NPR Services

Assuming there were 2tph or 4tph overlaid onto the iTSS on top of the 6tph NPR through services then initial thoughts are that this would likely be worse than the baseline option for two reasons;

- The surface station is advantageous for this because it is a turn back layout. This means that “top train working” can be employed for terminating shuttle services; one can arrive at the buffer stop end of the platform, and then a through NPR services arrives and departs at the “country” end, and after this the shuttle departs after its turnaround time. This is clearly not possible on a through station as the trains would block each other.
- In the baseline surface station option, we also design the two-track “chords” to aid the turnback operation so that departures/arrivals on the same side of the station to/from NPR could operate in parallel.

Manchester Piccadilly Comments

Escalated / Key Comments

The following comments have been identified as higher priority for HS2 review/response.

Document	Comment No.	Slide/Page No	Escalated Comment	MWJV Response
210401 HS2 Piccadilly Underground - Sift Presentation 00 COMBINED_compressed	A10	42	It would be useful if there was a comparison between the Piccadilly proposals and the HS2 Old Oak Common proposals given both stations would have six platforms in a sub-surface box.	Context: OOC setting is suburban, historical light industrial and parkland. Note the western approach of OOC shall have park above the cut/cover approach . Manchester context is densly urban with numerous constraints including listed buildings and rivers. The context has a bearing on the station box. Outer Crossover: It should be noted the outer crossover and station box are interlinked and informed by horizontal and vertical alignment which are subsequently informed by constraints and geotechnics to name a few. OOC Outer crossover at Victoria road is an open cut box C130M X 24M located in brownfield site with wider development surounding under construction. Man' Picc' outer crossover for all options is proposed as a cavern construction as it has less impact on the context which is sensetive conservation area of dense city centre. A cavern crossover rquires rock cover as explained for the tunnel approaches of B & D. In addition B & B1 approach takes into account the river Irwell Context and constraints inform the depth of station box. C&L: Old Oak Common has concourse at the surface and therefore doesn't need to be as deep. Although depth is different, width and length is similar to B1. If we made B1 shallower with concourse at the surface, this would pose challenges for outer scissors mined cavern near King Street, which would be too shallow. Also, it would be difficult to get the bored tunnels deep enough under the River Irwell, unless it can be proven that the river is shallower than assumed and the ground conditions between the river and the TBMs are impermeable enough to allow shallower cover.
210401 HS2 Piccadilly Underground - Sift Presentation 00 COMBINED_compressed	A15	53	Have HS2 assessed whether there would be any significant difference in the sift outcomes if the station was designed without OSD or with lower height OSD compared to the current assumptions?	REFER ALSO A63 Note the sift process doesnt review variations however response below should assist. Variation in height will vary the commercial yield Assesment of variations with or without OSD have not been carried out in the scope of proposals. Scope has not allowed for development or assement of variations. Current proposal assumes 12 stories OSD as a starting point or initial provision providing flexible volume for further development including intention for the volume to be reduced where required to suit design requirements. Within the current proposal if the OSD was lower it would reduce commercial benefit and allow structure in station box to be marginally smaller but limits flexibility of future growth of OSD. The reduction in height and hence smaller structure in station may allow the station width to reduce but unlikely to be significant enough to alter the sift outcome. Regarding reduction in width refer also to response to comment A24, A25 & A38 below. The OSD can go taller, however this would need detailed integration of structute in particular the OSD core. Taller OSD has not been integrated in current proposal. Refer also to structural appendix where further considerations regarding scale of OSD has been examined. Looking at the commercial aspect of the sift a comparable reduction/loss in OSD across the alignment options In terms of Commercial Development Assessment, the overall ranking will be similar, the greatest indicative achievable floorspace within CCB will still be Alignment B1 with Alignment B and D achieving slightly lower. However, the scoring on the matrix will be downgraded from 'Major Improvement' for Alignment B1 to 'Minor Improvement' or 'Neutral'. Alignment B and D will be downgraded to 'Minor Worsening'.
210401 HS2 Piccadilly Underground - Sift Presentation 00 COMBINED_compressed	A24 A25 A38	102 102 149/150	There appear to be opportunities to reduce the volume/size of the station boxes, particularly for Option B1. It would be useful to understand the impact on the sift findings if the Option B1 box were, for example, 5m narrower over the full length.	P102 Refers to B P 149/150 Refers B1 Q: Could the station box be 5m narrower? A: Without examining in detail the feasibility of how 5m reduction is achieved it should be highlighted alterations in structuram span can inpact beam depth and affect station depth in particular B1. Noting that the station box is twice the depth an increase in depth may discount beneftit of reduction in width. Examining the impact of width reduction and on Sift the following can highlight impact: Urban impact: Change in width may provide extra breathing space between B and existing station or provide additional urban space B or B1. Reduction in width of station box would not change OSD as proposed as OSD is narror than station box already. Environment: Reduction in width will have little impact on environmental impact of B or B1 noting neither are in close proximity of receptors in the way D is constrained. Cost: While the reduction in width will likely provide cost change the scale of impact is would not create a differenciator or change the sift outcome. C&L: If box were 5m narrower this would reduce the volume by approx. 6-7%. The reduction in overall programme duration to Entry into Service is 2 months. This is a level of refinement applicable to surface station also however noting the maturity of the design this should be recognised as an oportunity for further detail examination before implementation. Noting that flexibility is desirable in early design stages.note this would usually done at this stage of the design and it would be looked at a later stage of the design or detailed design A potential reduction of 5m in width of box would not change outcome of sift.
210401 HS2 Piccadilly Underground - Sift Presentation 00 COMBINED_compressed	A31	107	Would the ventilation system be more efficient if the Back of House area near the centre of the box were used to assist ventilation? Would this result in smaller ventilation ducts above platform level?	"It is likely to be less efficient and more complex as more equipment is involved e.g. ventilation fans, dampers, controls etc. The ventilation ducts above the platform can be smaller but the extent will depend on the number of fan room serving the station. Currently a fan room serves about 220m of the station length. If there are four fan rooms where each serves about 100m of the station (with half the ventilation capacity, smaller fans and smaller fan rooms) then the ventilation duct can be reduced by half. This is only possible if the station ventilation is standalone and has no interaction with the approach tunnels which none of the Underground Station options are. The current station end fan room design is also used to ventilate the tunnel approaches. Some coordination with Railway Systems would be necessary. As such reducing the ventilation capacity in order to reduce the ventilation ducts size is not feasible at this stage of design. A study to explore the possibility to reduce the ventilation ducts size can be done at a later design stage and when the ventilation capacity to ventilation the tunnel approaches are known."
210401 HS2 Piccadilly Underground - Sift Presentation 00 COMBINED_compressed	A34	137	We have previously suggested a slight change to the bearing of B1 west of Piccadilly could make the Major Street car park a candidate site for a crossover cavern/shaft. Would this obviate the need for an additional intervention shaft at the corner with Ducie Street? Would this also allow a shorter route to Manchester Airport?	Change in bearing impacts location of station box which introduces a new alignment option. In order to utilise this a new station alignment option would need to be further designed for further sift considered. The revised alignment would locate station Box between that of B/B1 and D. Note Outer scissor on other side requires further indepth consideration. Note the proposed location in new alignment would require further design of station throat. Revised location impacts Canal, increases residential impact and Etihad stadium and requires additional design stage consideration.
210401 HS2 Piccadilly Underground - Sift Presentation 00 COMBINED_compressed	A52 A56	259 265	We would like to see a comparison of the performance of the underground and surface station options with 14tph (i.e. the maximum capacity of the Spur). The current appraisal of relative performance is quite limited.	
210401 HS2 Piccadilly Underground - Sift Presentation 00 COMBINED_compressed	A57	265	Do not agree that "underground alignments cannot serve Sheffield". This is a limitation of the current scope which has not considered how a Sheffield Connector could be accommodated. The report should not make any definitive statements about a Sheffield Connector unless HS2 can demonstrate it has been tested. The report should simply state it was not considered and therefore cannot comment on feasibility but could acknowledge likely increased complexity and cost.	RSADS: Before any conversation on a civil solution can be explored, the feasibility of how adding Sheffield services into the through station on top of the 14tph iTSS would potentially affect the current layout and design needs to be assessed.

210401 HS2 Piccadilly Underground - Sift Presentation 00 COMBINED_compressed	A63	316	Have HS2 considered how the station box would have looked if there was no OSD or reduced height OSD? Would this make any signficant difference to the sift? There may be opportunities for develop contributions to the 'extra over' cost for accommodating OSD compared to a more basic structure to achieve the requirements of HS2/NPR.	Refer also Item A15 Proposals have not considered variations to the options including with or without OSD. Noting the primary focus of the scope is development of underground station proposals the primary impact of the station across the disciplines assesed in the sift comes from the station box. Proposals with no OSD provides limits commercial benefits. Note: With the exception of structure within the station box overall cost of OSD has not been included in the cost. Omiting the cost uplift to the inegrated structure would be unlikely to significantly alter the cost profile of options or sift outcome. Examining whether the uplift in structure to suport OSD above has a impact on cost the outcome would not change the cost significantly.
210401 HS2 Piccadilly Underground - Sift Presentation 00 COMBINED_compressed	A73	N/A	Options B and B1 appear to pass close to railway lines and the Manchester Ship Canal in the Salford area. Did HS2 consider potential for a tunnel construction compound in this area to reduce the reliance on construction from Manchester Airport? Would this have any benefit to the indicative construction programme? Could these sites be used to remove material from central Manchester?	C&L: This would have no effect on the programme because the TBM drives are not on the critical path. It may be beneficial in terms of environmental impact if excavated material can be loaded onto barges/ships.
210401 HS2 Piccadilly Underground - Sift Presentation 00 COMBINED_compressed	A75	414	Given the caverns will have 11m depth of competent rock above and the rock is expected to have very high stiffness would there be much surface settlement? Can understand large settlement being an issue in soils such as in London but it is less clear why there would be large settlement if tunnelling in rock.	C&L: In theory, settlements may be small, but there is no empirical evidence of construction of large caverns in this geology to back this up. Table 1 of "HS2-HS2-TN-STD-000-000005 HS2 standard - Ground movement and assessment from below ground construction" specifies values of volume loss to be used. No value is given for Sherwood Sandstone, but the value for sprayed concrete tunnelling in Mercia Mudstone is 1.5%. If this value were used, settlements would be in excess of 100 mm and would cause significant damage to overlying buildings and utilities.
Overground Structures for Alignment B_B1_D Handout 150421	C10	N/A	Have HS2 undertaken a comparison of the overall impact of the surface impacts for the HS2/NPR designs in the Ardwick/Ashburys area against the tunnelled underground options? The appraisal presented is only useful for comparing between underground options, will HS2 be providing further information at a later date for the comparison of surface and underground options?	Commercial Development: The Stage 1: Sift Level 2 Report will include comparison of surface impacts for HS2/NPR design in the Ardwick/Ashbury area against the tunnelled underground options and Hybrid Bill option. This has been taken into account when assessing the Commercial Development opportunity within the CCB for each of the alignment against the Hybrid Bill design. Environment: The underground option impacts have been written by the various environmental impacts on the basis of the proposed vent shafts/escape cores of the underground options in comparison to the viaduct extending from the Ardwick area into Piccadilly Station. All environmental topics commented on the likely impacts within the envvironmental section of the sift matrix and report. These impacts have been written on the basis of has been compared to both the baseline options and to the other underground options.

Stakeholder comments received and responses provided to

Manchester Piccadilly High Speed Station

Design of an Alternative Underground Station

Options Assessment - Sift Level 2 Appraisal

Record of Review

Document	**HS2 Piccadilly Underground - Draft Sift report**
Document Date	**28/05/2021**
Source	[redacted]
Revision	**M1**
Date of Review	**14/06/20201**

These are initial comments based on the presentation and do not necessarily provide an exhaustive list. [redacted] reserve the right to raise further comments.

Reviewer	Comment Ref No.	Subject	Page	Section number	Comment	Response
[redacted]	1	Capacity	5/265	1.1.1	Refers to working with stakeholders on the surface station. No reference is made to the concerns raised over a number of years by [redacted] and [redacted] on the capacity and operationality of the surface station.	Noted, these concerns are captured in other feedback documents from stakeholders on the hybrid Bill design to date.
[redacted]	2	Development	6/265	1.1.11	No evidence is given for the statement that "detailed development of options is unlikely to change the overall assessment". As stated in the covering response, the underground options have not been fully optimised so it is not possible to draw such a conclusion.	the paragraph includes the words 'based on the agreed scope and requirements of the study' - it is noted a change in scope and strategic ask at Manchester by Government may result in further optimisation of an Underground station in comparison to a surface station
[redacted]	3	Remit 6	28/265	4.1.1	[redacted] has not seen the Remit 6 information.	A breifing session has been arranged for 29th June for HS2 Ltd to inform Greater Manchester stakeholders of the Option 0 route in Remit 6 study which forms part of the baseline option to provide for a node-to-node comparison with Underground options
[redacted]	4	Rail Systems	99/265	8.1.1	Statement doesn't recognise the 2 minute journey time benefits from the Airport to Leeds from B & B1	Disagree - this is shown in the "Airport <> Leeds" column.
[redacted]	5	Construction Feasibility	102/265	8.1.18	We have some concerns about the size and position of the plaza proposed for B1, which we feel is disconnected from the city centre. We believe further opportunities could be provided for public realm for B if an alternative alignment was provided for Metrolink (as requested by [redacted]	Noted - assessment has been made on the current design of the underground station option.
[redacted]	6	Benefits analysis	107/265	8.1.32	the benefits analysis undertaken is extremely limited. We strongly dispute the assumption that the largest benefit is provided from the largest CCB. This does not recognise the wider blight and environmental impact caused from a larger CCB.	HS2 Ltd cannot provide a robust view on development opportunities outside the proposed construction boundary. Land within the construction boundary and not subsequently required for the operational railway, would be subject to acquisition by the Secretary of State and would potentially be available to be returned to its original owner for development after construction assuming the land has not materially changed. This has been quantified as part of the study. However, no view can be provided on development opportunities beyond the construction boundary, as these would be subject to wider market forces. If further work on wider benefits and commercial development opportunities is to be carried out, this should be done by an organisation other than HS2 Ltd.
[redacted]	7	Comparison of options to the baseline	116/265	9.1.33	This section highlights the issues with retaining Gateway House within the hybrid Bill design and the benefits provided by all of the underground options for an improved civic presence and connections into the city centre. These factors should be more strongly weighted within the assessment	This has been factored into the assessment and can be found under "Strategic Fit - Urban Design", under Legacy. The scores for the alternatives all see improvements over baseline.
[redacted]	8	Construction	6/265	1.1.6	Construction of a large railway station within the UK is not unprecedented. Whilst elements of the construction are novel, precedents are available within the UK such as Old Oak Common, which was highlighted as a precedent within this study. If the station design had been optimised further it is likely that the challenges highlighted could be reduced.	The unprecedented nature of the challenge mainly refers to the scale and complexity of the mined caverns that would be required. In that specific context, Old Oak Common is not a comparable project. Even should further design development for the mined options be undertaken, there would still be significant engineering challenges and associated risks.
[redacted]	9	Cost	6/265	1.1.9	Figures on estimated cost for each underground option have changed again, with land values now included. This is new information.	These figures are consistent with those presented to the Piccadilly Board on 19/05/21, except for the inclusion of [redacted] which were not available at that point in time.
[redacted]	10	Text error	10/265	2.3.0	Appendix A is not the signed off scope - it is Appendix B	Noted
[redacted]	11	Text error	10/265	2.3.1	The document contains 2 appendix B's due to having appendices of other documents included.	Noted
[redacted]	12	Sift Scope	15/265	3.1.1	2RS02-WSP-OP-NOT-M005-000002 - Phase 2b 2RS02 Manchester Piccadilly Operations with HS2 & NPR Technical Note - Conclusion - 6.1.3 - States that "It is advised that when NPR and HS2 is operational, sidings should be provided" . Is this due to the lack of operational flexibility in the existing surface station design? It is felt that the stabling sidings should have been included as part of the scope to better understand how both stations will actually function meaning that the whole picture hasn't been presented as part of the study.	HS2 Ltd have advised that sidings may be required when HS2 and NPR services are operational, as the operations of NPR services amongst HS2 services on the HS2 network is dependent on the end-state of the NPR network and amount of interaction that NPR services have with the CRN to evaluate performance and reliability requirements - HS2 Ltd are not able to quantify at this stage if the sidings are a must or a 'nice to have' given the unknowns on the NPR network and new line interfaces.
[redacted]	13	SIFT scope	18/265	3.2.3	We do not believe that stakeholders consulted on using this sift matrix? Please confirm when this was done.	Sift criteria were discussed and agreed as part of the scope with a supplementary note entitled "HS2 – Manchester Piccadilly High Speed Combined Underground Station - Sift Level 2 Criteria Note" shared in October 2020. The sift matrix is a table that presents the criteria outlined within that note.
[redacted]	14	SIFT scope	18/265	3.2.5	These minutes have only just been shared with Stakeholders from over 4 weeks ago.	Noted
[redacted]	15	Sift Assumptions	19/265	3.3.1	The assumptions list is new information for stakeholders. Why hasn't this been shared previously?	The stakeholders have been party to the development of the design through regular information workshops in which assumptions and approach has been discussed the table is a collation of the work.
[redacted]	16	Sift Assumptions	19/265	3.3.2	The statement that the current HS2 business case doesn't support a phased opening this rationale seems at odds with the Phase 1 phased opening of Old Oak Common, which is opening 5 years before Euston is completed. There may be similar opportunities to explore for Manchester to have a phased opening on a similar basis.	While it could be considered possible to use Manchester Airport as a temporary Terminus a feasibility study would need to be started to look at this. This is not instructed work, nor particularly relevant to this study, as a 'like for like' comparison must be sought between the Surface Station and Underground Options. Additionally this is an assumption under Appendix B, Line 2. and 4
[redacted]	17	Design for SIFT	21/265	3.4.0	[redacted] have constantly stressed throughout the CP3 design process that this number of car parking spaces being provided is unacceptable.	Noted - car parking spaces provided are the same for all options to provide a fair comparison.
[redacted]	18	Design for SIFT - Alignment	22/265	3.4.7	Would an underground station require a new hybrid Bill and make the current contract null?	In this context, the reference to contracts is irrelevant and has been removed to avoid confusion. The principle of the design being in accordance with HS2 standards remains valid.
[redacted]	19	Design for SIFT - Alignment	22/265	3.4.7	This sentence does not make sense	3.4.7 is merely stating that the design must comply with HS2 standards as a matter of legal requirement.
[redacted]	20	Design for SIFT - Rail Systems	22/265	3.4.9	At the 03/06/21 Technical workshop, it was disclosed that the current HS2 surface station design cannot support the current ITSS without additional mitigations being implemented. As the underground stations have been designed using the same principles as a surface station, this is the reason why all 3 underground stations suffer from the same operational issues.	HS2 Ltd are unable to reply without understanding what is meant by 'additional mitigations'.
[redacted]	21	Design for SIFT - Rail Systems	24/265	3.4.11	No reference provided.	Corrected - referred to the figure immediately below.
[redacted]	22	Design for SIFT - Rail Systems	24/265	3.4.16	This statement doesn't fit with Oakervee's integration of transport services as it portrays Metrolink as a minor element of the scheme, whilst it should be key part of the scheme.	This statement refers to the underground station options in which the construction of the Metrolink is indeed much less significant than compared with the underground proposal for the surface station.
[redacted]	23	Options - Baseline, NPR Remit 6, Option 0	28/265	4.1.1	If remit 6 isn't part of the scope it is not clear why is it being referenced.	Remit 6 refers to a study carried out by HS2 for the NPR route from the hybrid bill design to Leeds. To provide a node to node comparison the design team have combined the hybrid bill design plus the preferred option from Remit 6 to provide a comparable assessment against the underground options developed.
[redacted]	24	Options - Baseline, NPR Remit 6, Option 0	28/265	4.1.1	What about the additional infrastructure that is needed above ground to support remit 6? This study has not considered the futureproofing aspects for Manchester and the predicted future operational needs of the railway. Potentially a significant portion of land in East Manchester could become taken up with large sidings and additional rail viaducts. Whilst Remit 6 isn't part of the scope, its impact is getting bigger. [redacted] still have not been presented the findings of remit 6 but from conversations about its content we believe it should have formed part of this scope and are very concerned.	The additional infrastructure on approach to the surface station at Manchester Piccadilly needed to support Remit 6 ITSS relates specifically to the study request from co-clients to investigate NPR services to Sheffield interacting with the HS2 network at Manchester Piccadilly Surface station to align with NPR programme Concept 2G for Manchester to Sheffield Corridor. The question of NPR services to Sheffield interacting with a combined Underground option was not instructred to be investigated in this study and therefore this comment is not relevant to comparing like for like options investigated in the Underground study, however we note further questions arise for the NPR programme on future proofing questions of NPR services to Sheffield interacting with the HS2 network option at Manchester Piccadilly.
[redacted]	25	Rail Systems	61/265	4.5.2	This point proves that the underground station and surface station optimum designs are different and that the potential of the underground station scheme hasn't been reached as part of this programme.	Noted - this is the point being made in the report but it was not considered part of the study to challenge the iTSS rather to comment on where capacity enhancements could be made.
[redacted]	26	Case Studies - Large Cavern Construction	69/265	5.2	Are these caverns needed for a through station?	Caverns are needed in Options B and D for the approach track junctions and the outer scissors crossovers. For B1 they are only needed for the outer scissors crossovers because the approaches are within a box structure. The approach track junctions are an essential part of a through station to enable trains to get to more than one platform.
[redacted]	27	Enviro Appraisal - Baseline, NPR Remit 6, Option 0	72/265	6.1.0	Has this document been shared with all stakeholders? This assessment includes Option 0 even though 3.1.1 states that option 0 will not be included as part of the assessment. As a result, we believe this information shouldn't be used	This document is part of a separate story. NPR Remit 6 has been used as part of the Baseline for the environmental assessment in addition to the hBD as per the instruction to provide a fair comparison.
[redacted]	28	Enviro Appraisal - Underground Option B	75/265	6.2.4	This location was selected without discussions with stakeholders who believe this could potentially be relocated to the other side of the River Irwell.	I presume this comment is about King Street site? We believe relocating the shaft and outer scissors crossover to the other side of the River Irwell would be suboptimal compared to having it at King Street. The impact on the alignment would be severe, since the crossover needs to be on a straight, and the horizontal curve and braking profile on the approach to the station have been designed to work together. It is also likely that another shaft would be required between the station and this new location. The impact of construction on this site would be no worse than for construction of a new building. It should be noted that many similar city centre sites were used for Crossrail and the impacts can be managed.
[redacted]	29	Enviro Appraisal - Underground Option B	76/265	6.2.6	[redacted] support the removal of gateway house in all station scenarios.	Noted
[redacted]	30	Enviro Appraisal - Underground Option B	76/265	6.2.7	Why doesn't the baseline option highlight this job loss information? What about the economic gains once the station is built and the additional employment the construction will bring to the city, such as the additional OSD?	This is captured within Appendix C, the Environmental Matrix.
[redacted]	31	Enviro Appraisal - Underground Option B	76/265	6.2.8	It is felt that too much weight has been given to the impact of the vent shaft locations. It was reported that these were indicative locations and therefore the detailed assessment is premature. It's also noted that the track alignment hasn't been optimised, so these locations would likely move.	Refer to assumptions. Sift has assessed the current design.
[redacted]	32	Enviro Appraisal - Underground Option B, Operation	77/265	6.2.11	The additional OSD should be making this scoring positive.	If OSD hasn't been calculated in the same manner as our Socio-Ec team, then their scoring will remain the same.
[redacted]	33	Enviro Appraisal - Underground Option B, Operation	77/265	6.2.13	The OSD should bring more jobs and offset the reduced CCB once construction is completed.	As above.
[redacted]	34	Enviro Appraisal - Underground Option B, Operation	77/265	6.2.14	The baseline carbon emissions should be included for reference.	Within the Environmental Matrix in Appendix C.
[redacted]	35	Enviro Appraisal - Underground Option B, Operation	77/265	6.2.14	What is the baseline amount of demolitions?	Within the Environmental Matrix in Appendix C.

[redacted]	36	Enviro Appraisal - Underground Option B, Summary	78/265	6.2.17	The scoring system identified option B as red (major worsening) but the overall summary gives a minor worsening.	Cumulation of both the construction and operation impacts.
[redacted]	37	Enviro Appraisal - Underground Option B, Summary	78/265	6.2.17	The environmental benefits of the underground station need to be referenced, not just the negatives. Increased socio-economic benefit due to the OSD and the land and the visual and growth benefits of not having a large viaduct above ground blighting the area which will create a physical barrier within Manchester and take up additional land that could be developed.	These are covered in the Environmental Appraisal
[redacted]	38	Enviro Appraisal - Underground Option B1	78/265	6.3.0	"Issues" needs replacing in the environmental section with "points for consideration", as not all points should be regarded as negative.	The word "issues" doesn't cover all points for consideration. Comment is noted but no change to wording proposed.
[redacted]	39	Enviro Appraisal - Underground Option B1	78/265	6.3.1	The amount of spoil that the baseline is removing needs inserting for comparison.	Within the Environmental Matrix in Appendix C.
[redacted]	40	Enviro Appraisal - Underground Option B1	78/265	6.3.2	It is noted that the station takes longer to build and is a more substantial structure	Noted.
[redacted]	41	Enviro Appraisal - Underground Option B1	80/265	6.3.11	We would say this scores the same due to not needing a huge viaducts that would partition and blight the city permanently.	the viaducts are not considered a worsening, refer to landscape and visual section.
[redacted]	42	Enviro Appraisal - Underground Option B1	81/265	6.3.13	Stakeholders were told that vent shaft locations could be moved. This should not be included as part of the scoring as the track design is likely to move.	Refer to assumptions. Sift has assessed the current design.
[redacted]	43	Enviro Appraisal - Underground Option B1	81/265	6.3.14	What are the other environmental considerations? These need referencing.	These are covered in the Environmental Appraisal
[redacted]	44	Enviro Appraisal - Underground Option B1 - Summary	82/265	6.3.21	Why has the scoring system identified option B1 as red (major worsening) if the overall summary is a minor worsening?	Cumulation of both the construction and operation impacts.
[redacted]	45	Enviro Appraisal - Underground Option D	82/265	6.4.0	Format issue	Noted.
[redacted]	46	Enviro Appraisal - Underground Option D	85/265	6.4.10	Stakeholders were informed that vent shafts are indicative and can be moved. This information should not be included within the report.	Refer to assumptions. Sift has assessed the current design.
[redacted]	47	Enviro Appraisal - Underground Option D - Summary	86/265	6.4.18	This should be the case for all options. If the track alignment can change in the next design phase, these vent shaft locations are indicative and the assessment provided should not form part of the report.	Refer to assumptions. Sift has assessed the current design.
[redacted]	48	Stakeholders input to SIFT - Engagement	93/265	7.2.7	A design freeze time of 31/03/21 was not stated in the agreed programme or communicated to stakeholders until now.	See response to comment 93
[redacted]	49	Summary of comparison of underground options	101/265	8.1.15	Error in text should read "below ground provision for Metrolink has"	The text has been amended
[redacted]	50	Summary of comparison of underground options - Enviro impacts	102/265	8.1.1 ***(*draft report not in proper numerical onwards from this point)***	Option B &B1 in the report is considered overall a minor worsening - see 6.2.17 & 6.3.21 respectively. B & B1 have been scored the as a major worsening in the sift scoring. This should be changed to minor worsening.	This is on the basis of the cumulative score for operation and construction.
[redacted]	51	Summary of comparison of underground options - Enviro impacts	/265	8.1.2	How many active sports pitches are lost with option D?	Refer to environmental appraisal.
[redacted]	52	Summary of comparison of underground options - Construction and Logistics	105/265	8.1.4	Option B has had an additional year added to the construction programme compared to the sift scoring matrix presented at joint board. No explanation has been provided for why this has changed.	An error was found, where the fit-out logic applied to B was different to B1 and D, and this was rectified.
[redacted]	53	Summary of comparison of underground options - Construction and Logistics	104/265	8.1.5	Option B was originally presented as 13.5 years. More information is needed on why this has changed.	An error was found, where the fit-out logic applied to B was different to B1 and D, and this was rectified.
[redacted]	54	Summary of comparison of underground options - Construction feasibility	105/265	8.1.10	This is the first time stakeholders have had the term "station" defined. This has caused confusion throughout this initial design stage. Please confirm if this definition has been used to compile the scoring for Route and Station sections.	This definition is used in the SIFT matrix to separate 'Construction feasibility - route' and 'Construction feasibility - station'.
[redacted]	55	Summary of comparison of underground options - Construction feasibility	105/265	8.1.13	The length of time for the Metrolink closure against the baseline should also be provided here.	The baseline requires 8 months of single line running and 23 months of full closure. This will not be added to the text here, because this section is for comparing the underground options against each other. It will be added to paragraph 9.1.56 in the following chapter where the underground options are compared to the baseline.
[redacted]	56	Summary of comparison of underground options - Construction feasibility	105/265	8.1.14	This should say partial closure of the Ashton canal. The whole canal isn't closing.	It is closed to through traffic in the same way that Metrolink is closed.
[redacted]	57	Summary of comparison of underground options - Construction feasibility	105/265	8.1.18	What does this sentence mean?	This was a heading, which got reformatted by accident when the document was 'tidied up' before issuing.
[redacted]	58	Summary of comparison of underground options - Construction feasibility	106/265	8.1.19	Geotechnical risk is high due to the overly complex station approach layout, as its been designed as a terminus station. If the layout was simplified to a through station approach, which is what the station then several of the key risks would likely decrease.	This is a high level design at this stage for level 2 (Outline routes for development) further development would be required if the option was taken forward to address identified issues of programme and approach optimisation.
[redacted]	59	Summary of comparison of underground options - Construction feasibility	106/265	8.1.20	There will be more risks by building an underground station. However, once the appropriate H&S mitigations are put in place the CSM scoring is the same. The mitigation put in place with the CSM being scored the same as the baseline should be mentioned here.	All reasonably practicable H&S mitigations will be applied to the baseline and to the underground options. Construction and operation of an underground station will almost always have more residual risk than a surface station, except in special circumstances.
[redacted]	60	Summary of comparison of underground options - Construction feasibility - Health and Safety	106/265	8.1.23	[redacted] highlighted that option D was using the former Central Retail Park after the CCB area was presented after the first sift in January. From an assessment perspective, this isn't scoring each option equally as the design is not right. It is suggested that the cost benefit area for an area the size of the compound proposed for the central retail park should be included for fairness as its assumed this amount of land will still be needed, but in a different location.	For construction purpose, note the way the CCB is done requires we take whole parcels of land and this is why the whole retail park is taken. Not all the space is needed. RW: For commercial development sifting purpose the achievable floorspace within the former Central Retail Park parcel has been deducted in Alignment D. Former Central Retail Park is currently being promoted for redevelopment under baseline option by MCC. Therefore, there shouldn't be any distinction to count it as Alignment D benefit only.
[redacted]	61	Summary of comparison of underground options - Commercial Development	106/265	8.1.25	Please see comment above.	It is unclear what specific issue is being commented on. Responses have been provided to the above comments.
[redacted]	62	Summary of comparison of underground options - Commercial Development	107/265	8.1.26	Please see comment above.	It is unclear what specific issue is being commented on. Responses have been provided to the above comments.
[redacted]	63	Summary of comparison of underground options - Benefit Analysis	107/265	8.1.28	The specific benefits should be highlighted here in more detail for a fair comparison. This section currently provides no information on the benefits.	Noted. Benefits analysis has been carried out by DfT and TfN using inputs provided by HS2 Ltd and its consultants. This has been presented in full in its own Appendix to try and make the distinction between work carried out by HS2 Ltd (and its consultants) and other organisations. The side-by-side comparison of benefits is presented in Appendix I.
[redacted]	64	Summary of comparison of underground options - Benefit Analysis	107/265	8.1.28	These programme dates feel very excessive without a detailed programme to support them.	It is assumed that the comment relates to 8.1.32 of the draft report. A high-level programme has been included within Appendix F along with associated assumptions. These are also expanded upon in Section 3.4, Sections 8.1.30 onwards, and 9.1.41 onwards.
[redacted]	65	Summary of comparison of options to baseline - Railway systems	109/265	9.1.4	When was a the idea of a neutral outcome for railway operations agreed with stakeholders? We do not believe that [redacted] agreed to this.	By stating neutral outcome, what we mean is a like for like iTSS where all options have been designed to support the iTSS.
[redacted]	66	Summary of comparison of options to baseline - Railway systems	109/265	9.1.4	The ambition as stated by the GM Mayor and included within the scope was not a like for like comparison. It was for a "fully and fairly compared" station, where things are similar and comparable, not exactly the same. The items that were like for like were the ITSS and 6 platforms, 400m in length.	This is at odds with the scope document where section 1.1.2 states "One of the key aims of the study is to be able to undertake a like for like ("apples with apples") between the surface hybrid Bill station and the underground alternative"
[redacted]	67	Summary of comparison of options to baseline - Railway systems	110/265	9.1.8	This was a question about futureproofing to understand what additional capacity was available. None of the analysis of this work has been made available to stakeholders or were stakeholders asked about requirements for what services could run. Can the full findings please be shared and more information provided in the report?	The available information is as presented within this report and its appendices.
[redacted]	68	Summary of comparison of options to baseline - Railway systems	110/265	9.1.9	This scenario on potential shuttle services is new information to stakeholders. [redacted] believe that a through station option should have been considered, similar to how the NPR Sheffield service would operate to Liverpool, rather than a shuttle services.	This is beyond the definition of the iTSS and is considered beyond the remit of the scope of the study.
[redacted]	69	Summary of comparison of options to baseline - Railway systems	110/265	9.1.9	Has the surface station the capacity to be able to accept these additional services, as per the current design?	Only with additional infrastructure, such as the “Chords” to/from NPR, plus suitable siding provision for HS2 de-strengthening.
[redacted]	70	Summary of comparison of options to baseline - Railway systems	110/265	9.1.9	Evidence has not been provided that the surface station has the capacity to accommodate a terminating shuttle service. If all the trains were through services from Manchester to Liverpool then the underground through service would be a better option. The scope on this wasn't agreed with stakeholders.	Covered in the NPR Remit 6 study material such as 2RS02-WSP-OP-PRE-M005-000001. It is illustrating an example of a future service choice that would be more compatible with one layout than the other.
[redacted]	71	Summary of comparison of options to baseline - Railway systems	112/265	9.1.15	Has the additional ATFS been included in the price?	Additional ATFS has not been costed for the underground options because it was not included in the route schematic diagram.
[redacted]	72	Conclusions and recommendations	124/265	10.1.2	All information was expected to be presented to stakeholders on 1st April as per the programme not 15th / 16th April. New information has been issued to stakeholders on further development of the works up until 28 May. Stakeholders received 136 slides on 1st April, since then 1269 pages / slides have been issued after this date with content that had been changed, with further new and changed information presented in the sift report.	Noted. It is acknowledged that, as the sifting analysis came towards its conclusion in April 2021, a large amount of information was shared in a relatively short space of time. Any new information was intended to address stakeholder comments on the initial information that was shared.
[redacted]	73	Conclusions and recommendations	124/265	10.1.2	The scoring in the sift appraisal below is different to the what was presented on 22nd April - slide 10 of 20 in Piccadilly Underground Sift Summary - Decision Point 2 - 22.04.21 -final.	Agreed that the sifting scores for the Node-to-Node apraisal was slightly amended. The row amended was the Strategic Fit - Urban Design. The scores for Option B and B1 were updated following the slides referenced
[redacted]	74	Conclusions and recommendations	124/265	10.1.2	The scoring table originally presented to stakeholders on 22nd April contained 11 / 16 scoring options. The slides sent to stakeholders on 5th May of this meeting scored differently and contained 20 scoring options. This presentation contains 19 scoring options. These scoring criteria have therefore changed make it difficult to comment on.	Noted: The scoring tables were amended to best showcase the scores via reviews between HS2 and the Design organisations.
[redacted]	75	Conclusions and recommendations	125/265	10.1.7	We do not agree with this point. The scope for a "fair and full comparison" was not followed as the design of the stations have been based on a surface turnback layout (a "like for like" replica) and so an optimised underground station has not been developed.	Noted. The node-to-node comparison of all options developed to Sift Level 2, in line with the agreed scope, enables a like-for-like comparison. It is noted that there are opportunities to develop in individual options if they were carried out for development beyond Sift Level 2 stage.
[redacted]	76	Conclusions and recommendations	125/265	10.1.7	Example of the "like for like" design is in the assumptions (which is new information), which states the entire track route from Nodes to the station for options B and B1 are just an inverse of the current surface station design. This has led to vent shaft locations being chosen that are not ideal.	As set out in Line 19 on appendix B - Assumptions, the alignments had been developed for sift level 2 purposes, which was discussed with Stakeholders. It is agreed that the vent shafts are not 'optimised', but as set out in the scoping document (Section 8i) [the alignment] will consider, in high level terms, the potential length of tunnels, and number of vent shafts...
[redacted]	77	Conclusions and recommendations	125/265	10.1.7	What this work has highlighted is that the surface station designed ITSS works for an the Underground station, but the additional capacity of a 6 platform through station cannot be realised by assessing it against this ITSS. An Underground station needs its own ITSS to fully understand its benefits and appropriate time to fully develop it.	The response to opportunities identified by stakeholder in Appendix E in section 1.10 allludes to some initial thoughts from stakeholders on the Underground station having its own individual ITSS for consideration, however this would likely require different solutions to the infrastructure for an Underground station solution that would also need to be equally tested with the Surface station design for a like-for-like comparison to be undertaken.
[redacted]	78	Conclusions and recommendations	125/265	10.1.8	A section should be given for stakeholder views. i.e. section 11.0.0	Noted. A new section has been added before the Conclusions to capture stakeholder feedback and identify potential future areas for consideration.
[redacted]	79	Conclusions and recommendations	124/265	10.1.8	This is HS2's recommendation and doesn't represent stakeholder views. This should be stated.	Text of 10.1.8 has been updated to make this clear.
[redacted]	80	References	128/265	12	This document hasn't been made available to [redacted]	It is unclear which document is being referred to. HS2 Ltd can look to provide any outstanding documentation.

[redacted]	81	Appendix A - Scope document	130/265 ***(PDF doc page number from this point)***	n/a	This document is different to the one presented to stakeholders on 01/04/2021 that was to be used for scoring. Please clarify which document was used scoring for scoring the sift criteria.	This document (Appendix A) describes the agreed criteria that were used for the sift assessment. It is unclear what difference is being referred to.
[redacted]	82	Appendix A - Scope document	132/265	1.12	The key aim of the study was to provide a full and fair comparison to an underground station, not a replica. This has led to an underground station that doesn't reach its full potential as it has been designed as a replica of the surface station underground.	The underground stations have been design from first principles to establish space proofing and adjacencies at high level
[redacted]	83	Appendix A - Scope document	140/265	3.8.3	Resilience and capability for additional services was given minimal attention - see sift document 9.1.9. One of the major reasons why this study was requested was to understand the futureproofing of the station. We believe that this has not adequately been explored as part of the study.	Noted
[redacted]	84	Appendix B - Final scope for sift 2 underground	148/265	NOTE:	[redacted] continue to have serious reservations around the performance of the hybrid Bill station.	Noted
[redacted]	85	Appendix B - Assumptions	156/265	14	This is first time this information has been made available to stakeholders. Why wasn't this made available earlier?	Refer to response to comment 15
[redacted]	86	Appendix B - Assumptions	157/265	n/a	The risk and opportunities for the baseline station haven't been presented. Therefore it's very difficult to understand what risks or opportunities are specific to the underground or surface station.	Noted
[redacted]	87	Appendix B - Assumptions - Table	157/265	Table: Ref 2 Phasing	This cost would not be significant in comparison to the cost of the whole scheme to achieve and would sit within existing land acquired under the hybrid bill. This would be similar to Old Oak Common.	It remains an assumption as no detailed study of the impact of phased opening has been made. Ashfield rail depot is to the South of Manchester Airport, and so any works trains from there would need slots in between HS2 services to supply materials for track and rail systems installation.
[redacted]	88	Appendix B - Assumptions - Table	157/265	Table Ref. 11 Construction	The geotechnical issues are imported from the track design which is a replica of the surface station like for like. The track design should be modified to minimise the construction risk for mining.	It is unclear what the comment is specifically referring to. It is felt that the assumption is valid for the design work that has been undertaken.
[redacted]	89	Appendix B - Assumptions - Table	157/265	Table Ref. 19 Alignment	Acknowledgment that opportunities important to stakeholders haven't been developed due to the timescales.	Noted
[redacted]	90	Appendix B - Assumptions - Table	158/265	Table Ref. 22 Alignment	The design was rushed due to tight timescales. This makes the layout and vent shaft locations less relevant as the chance of these moving at a later stage is highly probable, make decisions at this stage on the information available not applicable.	The level detail is commensurate with a pre-hybrid bill maturity of design and would not be considered 'rushed'.
[redacted]	91	Appendix B - Assumptions - Table	158/265	Table Ref. 24 Alignment	These options were put forward with the limited information available to stakeholders. This comment insinuates that another station footprint has been considered be the design organisation, but not shared with stakeholders.	This refers to both MWJV internal considerations and the workshops with stakeholders in which the long list options were adjusted under request from stakeholders to position D and B1 for example.
[redacted]	92	Appendix B - Assumptions - Table	158/265	Table Ref. 29 Alignment	Another example of the design team not having the time to develop the track design adequately and importing a variant of the existing surface station track layout that isn't optimised for working underground with the alternative vent shaft locations.	The alignment has been developed using an approach for managing lateral acceleration under braking which is known to be acceptable to HS2 as it has already been adopted for the hybrid bill.
[redacted]	93	Appendix B - Assumptions - Table	159/265	Table Ref. 43 Alignment	The 31st March design standards freeze was not shared with stakeholders. This request to look at curved platforms from stakeholders was submitted on 30th March. The design freeze was not published or stakeholders would have made the request sooner.	Noted - The design freeze was simply the point in the programme at which development needed to stop and production start.
[redacted]	94	Appendix B - Assumptions - Table	159/265	Table Ref. 44 Alignment	This shows that the design process was rushed due to the time restrictions placed upon it and the potential of the underground station hasn't been fully explored.	The comment reflects that the work was to sift level 2 and further development could be undertaken.
[redacted]	95	Appendix B - Assumptions - Table	160/265	Table Ref. 47 Alignment	The ITSS has put restrictions on the underground station development. A wholly underground station ITSS should be developed to realise the potential.	While a wholly underground option with a new ITSS could be developed, it is deemed outside of the current scope, and therefore is not covered as part of this study.
[redacted]	96	Appendix B - Assumptions - Table	160/265	Table Ref. 48 Alignment	Can 8 platforms be utilised effectively with the ITSS?	The assumption refers previous work carried out for the HbD in which it was found that a total of 6 platform edges would be required for HS2 and NPR. Although not examined for reasons of trying to minimise cost it is suspected that further platforms would result in inefficiencies.
[redacted]	97	Appendix B - Assumptions - Table	160/265	Table Ref. 49 Alignment	Please provide more information on what is being inferred here regarding other alignments.	It is inferred that given a different set of design criteria there may be opportunity for refinement.
[redacted]	98	Appendix B - Assumptions - Table	160/265	Table Ref. 57 Rail Systems	The industry standard for signal sighting for drivers is 25m. 50m is overstated and 25m should be more than acceptable to professional driving standards.	465m is consistent with previous work
[redacted]	99	Appendix B - Assumptions - Table	160/265	Table Ref. 58 Rail Systems	Please clarify what is meant by protection points.	Protection Points are typically known as 'traps'
[redacted]	100	Appendix B - Assumptions - Table	161/265	Table Ref. 60 Alignment	Please clarify - does this mean the inclusion of trap points somewhere?	No this is referring to buffer overruns and stress transitions for the CWR.
[redacted]	101	Appendix B - Assumptions - Table	161/265	Table Ref. 62 Alignment	This could also be a reassessment of the ITSS.	The dwell time assumptions are consistent with other HS2 stations.
[redacted]	102	Appendix B - Assumptions - Table	161/265	Table Ref. 63 Alignment	The current understanding is that no options can accommodate the ITSS (surface or underground) without additional sidings	Noted
[redacted]	103	Appendix B - Assumptions - Table	161/265	Table Ref. 70 Rail Systems	Phasing HS2 could ensure that the airport could receive passengers earlier, which is also a key destination on the network	See response to Comment 16
[redacted]	104	Appendix B - Assumptions - Table	161/265	Table Ref. 70 Rail Systems	Please confirm the basis of the comment on little added benefit comment.	Does not meet HS2 strategic goal of city centre connection.
[redacted]	105	Appendix B - Assumptions - Table	161/265	Table Ref. 72 Rail Systems	Has the railhead in Ashbury's that is being proposed been taken into account?	Yes, the Ashley Railhead was included in the assessment
[redacted]	106	Appendix C - SIFT Matrix	164/265	Sift Appraisal Table - Summary of node to node ratings	The first time this was presented on 22nd April, 11 / 16 options considered were presented in the sift matrix. On the 5th April 20 options for consideration were presented in the sift matrix. In this sift report issued on 28th May, it shows 19 options for consideration. Changing the scoring criteria and the scoring itself multiple times during an intense sifting process is very difficult for stakeholders to track what has changed, as no explanation has been provided by HS2.	Unclear what this is referring to. The sift has only ever compared 3 options against the baseline.
[redacted]	107	Appendix C - SIFT Matrix	164/265	Sift Appraisal Table - Summary of node to node ratings	Stakeholders haven't provided a preferred option. Please clarify why the stakeholder preferred section is coloured green.	The scoring of a green indicates a minor improvement over the baseline for the reasons provided in the breakdown.
[redacted]	108	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Strategic Fit - HS2 Strategic Goals	Item 2.2 in the strategic goals and objectives for HS2 states that the designs should integrate seamlessly with other integrated transport models. Saying the design delivers only City to City connectivity indicates that not enough work has taken place due to the tight design timescales and cannot be compared fairly with the hybrid Bill station for all underground station options.	Noted
[redacted]	109	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Strategic Fit - HS2 Strategic Goals	What consideration has been made for the passenger experience on the High speed NPR train service which is required to turn-back? Also, how does this impact people who request a forward facing seat for their journey from Liverpool to Leeds, but then find themselves reversing out of Manchester and in a rear facing seat? This doesn't seem like the passenger experience is being put first.	The operational details of passenger seating were not considered at this level of detail for initial route selection.
[redacted]	110	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Strategic Fit - HS2 Strategic Goals	The commercial opportunity hasn't been explored fully as part of all the underground station designs	Commercial Opportunity has been explored in accordance with the HS2 standards for level 2 sift.
[redacted]	111	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Strategic Fit - HS2 Strategic Goals	Please clarify what is classed as a small difference.	This is a subjective assessment.
[redacted]	112	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Strategic Fit - HS2 Strategic Goals	HS2 and NPR require a sidings near Manchester once both services are fully operational for surface station and underground station due to empty coaching stock not being able to travel to Crewe. This means that at present, all designs produced cannot achieve the ITSS. This should be noted in this section.	The surface station is accommodated by use of the 'NPR' platforms and then new sidings when NPR comes into service. The need for sidings for the underground options have understood but the location excluded from this work.
[redacted]	113	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Strategic Fit - Urban Design	The station is also set 200m further back, which from a place point of view, should score negatively against the surface station	The surface station or baseline is always scored as neutral under the HS2 procedure.
[redacted]	114	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Strategic Fit - Urban Design	In the slides shared with stakeholders on 05/05/2021, all options scored the same as the baseline and a lot more new information has been presented on this option. Please clarify why this has changed.	The slides were shared to openly engage with the stakeholders as a work in progress.
[redacted]	115	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Strategic Fit - Urban Design	This is new information. The 3 core principles now has a 4th core principle around legacy which hasn't been shared with stakeholders previously.	Noted
[redacted]	116	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Strategic Fit - Urban Design	The surface station also visibly divides the city with a 1.6km viaduct that reduces the amount of future development that can take place. (equivalent to 6 Westminster palaces),	Noted but the baseline is always scored as neutral
[redacted]	117	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Strategic Fit - Urban Design	All the underground station options free up the land where the surface viaducts would have been and doesn't create a 1.6km structure that creates a visible division in the city.	Noted and accounted for.
[redacted]	118	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Construction Feasibility - Route	This information has changed. Please confirm why the route lengths haven't been scored since they were on the previous summary. D should score a big positive due to being 3km less in length.	Route lengths are not in and of themselves a significant factor in construction feasibility and so no score is given.
[redacted]	119	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Construction Feasibility - Route	This section has changed from the slides shared on 5th May	Not sure what slides are being referred to?
[redacted]	120	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Construction Feasibility - Route	This is the first time stakeholders have been presented with this high level programme in the appendices	Noted. It was not possible to complete work on the programme until the design was finalised - this is similar to the cost estimate.
[redacted]	121	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Construction Feasibility - Route	This is new Information. Option B has had an additional year added on to it, but no explanation is given.	An error was found, where the logic applied to B was different to B1 and D, and this was rectified.
[redacted]	122	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Construction Feasibility - Station	This is new Information. This is the first time stakeholders have been presented with this high level programme.	Noted. It was not possible to complete work on the programme until the design was finalised - this is similar to the cost estimate.
[redacted]	123	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Construction Feasibility - Station	Please explain why criteria that assessed the station length has been removed. This was present in the slides shared with Stakeholders on 05/05/2021	The full technical note including all of the design information is reference No 1 in section 12.
[redacted]	124	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Construction Feasibility - Station	Option D also means that the existing Network Rail building Square One is retained, which also houses Northern Rail, so option D has a reduced impact on NR facilities.	Text in SIFT matrix amended to make clear Square One is not demolished as part of Option D. However, still scored equal to baseline because D involves demolition of approach ramps and Gateway House near NR station main entrance, which are not in the baseline.
[redacted]	125	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Construction Feasibility - Station	Under option D Metrolink can continue to operate as it does today with significantly less than the 7 years disruption caused by the hybrid Bill design. This should be a positive impact for option D.	hBD requires 8 months of single line running and 23 months of full closure. Disruption due to relocation of tram stops for D may be less than this. Scoring in SIFT matrix adjusted to 'Minor Improvement' for D.
[redacted]	126	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Operation Feasibility - railway operations	How has this been assessed against the baseline? No evidence has been provided to stakeholders.	Baseline details added to Sift Matrix
[redacted]	127	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Operation Feasibility - railway operations	During the technical meeting on 03/06/2021, stakeholders were told that the sidings were required and that none of the current surface & underground station designs can operate the ITSS without this service siding.	See response to comment 112
[redacted]	128	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Operation Feasibility - Station for passenger & place	Scoring has changed from the 05/05/21 slides	It was highlighted at issue that the information presented was draft
[redacted]	129	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Operation Feasibility - Station for passenger & place	Scoring and narrative has changed from 05/05/21 slides.	Narrative added to reflect scoring
[redacted]	130	Appendix C - SIFT Matrix	165/265	Sift Table Heading: Operation Feasibility - Station for passenger & place	In previous versions, all underground stations were scored positively, but now they are below the baseline. Rationale isn't clear why it's so negatively impacted.	Narrative in the sift matrix adds explanation to scoring
[redacted]	131	Appendix C - SIFT Matrix	166/265	Sift Table Heading: Operation Maintenance	The 05/05/21 slide had a narrative in this section, which has now disappeared. Please clarify.	Text has been added back in

[redacted]	132	Appendix C - SIFT Matrix	166/265	Sift Table Heading: Environment	Option B & B1 in the report are considered an overall minor worsening - see 6.2.17 & 6.3.21 respectively. B & B1 have been scored the as a major worsening, in red, in the sift scoring. This should be changed to minor worsening as per the sift report recommendation of the option against the Baseline.	This is on the basis of the cumulative score for operation and construction.
[redacted]	133	Appendix C - SIFT Matrix	166/265	Sift Table Heading: Environment	Please provide the document name and number which include these assessments. We are not clear if they have been shared with stakeholders.	Assessment is below at the bottom of the page and spans over pg 161, 162, 163, and 164.
[redacted]	134	Appendix C - SIFT Matrix	166/265	Sift Table Heading: Stakeholders	New information provided to stakeholders in this section.	Noted
[redacted]	135	Appendix C - SIFT Matrix	166/265	Sift Table Heading: Commercial Development	The original CCB has a significant additional land take should be considered when calculating the total area that can be developed as part of the hybrid Bill scheme. You can't develop above the station or the viaduct. The station and viaduct footprint is a 1.6km stretch (6 Westminster palaces in length). This needs subtracting from total CCB area that can be developed in order to make the assessment fair.	The assessment has been carried out in accordance with HS2 procedures. CCB are Consolidated Construction Boundary that calulates the area required to build HS2 and it's associated infrastructure. The CCB have not been used as a metric for Commercial Development assessment. Both a very diifferent topics. Commercial development assessment has been conducted on the residual land that was required temporarily for the construction of HS2 (no permeanly required land has been included e.g. station or viaduct), Indicative achievable floorspace has been calculated for assessment purposes.
[redacted]	136	Appendix C - SIFT Matrix	166/265	Sift Table Heading: Commercial Development	We disagree how this has been assessed. A larger CCB means that more disruption is caused to the City, but is given a positive in this assessment.	Noted - assessed as part of environmental appraisal
[redacted]	137	Appendix C - SIFT Matrix	166/265	Sift Table Heading: Cost	All cost information is new and wasn't shared in the 05/05/21 slides.	Noted
[redacted]	138	Appendix C - SIFT Matrix	166/265	Sift Table Heading: Cost	Why haven't land, property and compensation been included? They have in section 1.1.9 in the executive summary and was confirmed in the technical meeting on 03/06/21	[redacted]
[redacted]	139	Appendix C - SIFT Matrix	166/265	Environmental Appraisal for Route	This appraisal is entirely new and has not previously been shared with stakeholders.	Noted
[redacted]	140	Appendix C - SIFT Matrix	166/265	Environmental Appraisal for Route Table Topic: Community - Construction	Stakeholders were informed that the vent shaft locations were indicative and were likely to change as the track layout has not been optimised. The information should be included in the sift report to highlight these areas, bit the sift scoring should all be neutralised to N/A for all underground options as the detailed work to determine where the Vent shafts would be located on an optimised alignment hasn't been determined as part of this study due to time constraints put on the design process.	Vent shaft locations would be sifted as part of future development of an option. The key thing here is that the options are compared on a fair basis.
[redacted]	141	Appendix C - SIFT Matrix	167/265	Environmental Appraisal for Route Table Topic: Landscape and Visual	The surface station scheme is constructing a 1.6km concrete viaduct through a busy part of a growing city centre. This would be extremely negative from a landscape & visual perspective compared with a single head house as part of an underground solution. As all underground options don't have a 1.6km divide running through Manchester the scoring should reflect that by making all the underground stations positive.	The assessment has been carried out in accordance with HS2 procedures.
[redacted]	142	Appendix C - SIFT Matrix	167/265	Environmental Appraisal for Route Table Topic: Traffic and Transport - construction	If it is scored a neutral, why has a negative score been awarded for all underground stations? scoring needs changing to all neutral.	Noted
[redacted]	143	Appendix C - SIFT Matrix	168/265	Environmental Appraisal for Route Table Topic: Climate Change - operation	All comments are the same for underground and baseline. We would expect to see neutral scoring across all options.	Operational scores are assessed as neutral and the rationale for the negative Construction stage scores is provided.
[redacted]	144	Appendix C - SIFT Matrix	168/265	Environmental Appraisal for Route Table Topic: Electromagnetic interference	As the underground options are all subterranean, this should provide additional natural shielding from the additional rock cover. I'd expect the underground station to have big benefits here as being underground should mitigate the EMI issues completely.	This requires additional study that would not be completed within the timescales given, so a neutral score will have to remain until such time that a study is commissioned.
[redacted]	145	Appendix C - SIFT Matrix	168/265	Environmental Appraisal for Route Table: Preferred Option - overall rating	Indicative vent shaft locations have been used to justify a very negative scoring of the route. Due to this, we do not believe it should be used as part of the sift scoring matrix.	The design has adopted reasonable positions for vent shafts - see response to comment 140
[redacted]	146	Appendix C - SIFT Matrix	168/265	Environmental Appraisal for Station Table	This appraisal is entirely new and has not previously been shared with stakeholders.	Noted
[redacted]	147	Appendix C - SIFT Matrix	168/265	Environmental Appraisal for Station Table: Historic Environ - construction	Is this tunnelling comparable to Crossrail?	The assessment and scoring has been based on this study alone and not compared to Crossrail.
[redacted]	148	Appendix C - SIFT Matrix	168/265	Environmental Appraisal for Station Table: Human Health - construction	Option B and B1 seem like they should be scored neutral to the baseline and D scored a minor worsening.	The assessment has been carried out in accordance with HS2 procedures.
[redacted]	149	Appendix C - SIFT Matrix	169/265	Environmental Appraisal for Station Table: Landscape and Visual	The surface station scheme is constructing a 1.6km concrete viaduct through a busy part of a growing city centre. This would be extremely negative from a landscape & visual perspective compared with a single head house as part of an underground solution. As all underground options don't have a 1.6km divide running through Manchester the scoring should reflect that by making all the underground stations positive.	see response to comment 141
[redacted]	150	Appendix C - SIFT Matrix	169/265	Environmental Appraisal for Station Table: Socio-economics - construction	We would expect HS2 work with the companies impacted and [redacted] try to relocate them before job losses occurred. Please confirm if the loss of the square one office been included in the job losses for the hybrid Bill option. This is new information	All hybrid bill assessments are based on the NPR Study.
[redacted]	151	Appendix C - SIFT Matrix	169/265	Environmental Appraisal for Station Table: Socio-economics - construction	How many jobs will be created by the HS2 construction programme that offset these losses?	This is not factored in to the sift appraisal.
[redacted]	152	Appendix C - SIFT Matrix	169/265	Environmental Appraisal for Station Table: Socio-economics - construction	Rail sidings job losses at Ardwick impacts all options, not just option D	Noted.
[redacted]	153	Appendix C - SIFT Matrix	169/265	Environmental Appraisal for Station Table: Sound, Noise and Vibration - construction	Why have the underground stations been scored red but only considered a minor worsening?	It still represents a worsening.
[redacted]	154	Appendix C - SIFT Matrix	169/265	Environmental Appraisal for Station Table: Traffic and Transport - construction	Why has Option D been awarded a minor worsening score when the comment says it should be neutral?	The rationale for the scoring has been presented within the sift matrix.
[redacted]	155	Appendix C - SIFT Matrix	169/265	Environmental Appraisal for Station Table: Electromagnetic interference	As the underground options are all subterranean, this should provide additional natural shielding with the additional rock cover. I'd expect the underground station to have benefits here as being underground should mitigate the EMI issues.	This requires additional study that would not be completed within the timescales given, so a neutral score will have to remain until such time that a study is commissioned.
[redacted]	156	Appendix C - SIFT Matrix	169/265	Environmental Appraisal for Station Table: Waste & material resources - construction	Why are the baseline options not containing minimal information for a scoring comparison with the underground? More information needed.	Agreed that more information on prospective waste and material arisings are required to make a more thorough assessments behind a high level estimate. However, these aren't available without further study.
[redacted]	157	[redacted]	210/265	Programme Table	Nothing mentioned in this programme about a design freeze on 31st march.	See response to comment 93
[redacted]	158	Appendix F - Indicative construction programmes	250/265	n/a	This is all completely new information	It is accepted that this information had not been previously shared in this format prior to completion of the draft report. Previous verbal comments had sought further detail on the construction programme so it was included to provide further detail in response.
[redacted]	159	Appendix F - Indicative construction programmes	251/265	18.1.0	Why can this not be staged? decision is not clear. Old Oak Common is acting as a temporary terminus whilst Euston is being completed as part of phase 1, why can't the same rationale be applied to Manchester?	While it could be considered possible to use Manchester Airport as a temporary Terminus a feasibility study would need to be started to look at this. This is not instructed work, nor particularly relevant to this study, as a 'like for like' comparison must be sought between the Surface Station and Underground Options. Additionally this is an assumption under Appendix B, Line 2. and 4
[redacted]	160	Appendix F - Indicative construction programmes	253/265	18.1.0 Table	The Phase 2b western leg programme only considers HS2 and not NPR operations. The comparison between the surface station programme and Under ground stations is therefore not a fair comparison.	Disagree. As per the fourth assumption in 18.1.0 of the draft report "The programme and timelines are for delivery of HS2 to Manchester in an underground station". These do not consider the NPR route to Leeds to the east of the underground stations." Therefore it is considered that the chart does indeed reflect a like-for-like comparison.
[redacted]	161	Appendix F - Indicative construction programmes	253/265	18.1.0 Table	The NPR programme needs to be included in this section for a fair comparison.	It is not possible to programme the NPR bored tunnels, because we do not know where the tunnels end beyond Node 3, and so we do not know where the TBMs will launch from or how long the drives are. Construction of NPR approaches, outer scissors crossover and portal shaft are included in the programme as they may affect the critical path for the station. One of the programme assumptions we have had to make is that NPR construction does not affect the HS2 and Manchester Piccadilly high speed station opening.
[redacted]	162	Appendix F - Indicative construction programmes	253/265	18.1.0 Table	Why can enabling works commence before royal assent for the surface station, but not the Underground station?	Appendix F has been amended to remove this discrepancy. Enabling Works is now shown commencing after Royal Assent for all options.
[redacted]	163	Appendix F - Indicative construction programmes	262/265	23.2	A more detailed analysis of the benefits was proposed but due to the time constraints this was not possible to complete the analysis in time for the sift report publication	Noted. Benefits analysis has been carried out by DfT and TfN using inputs provided by HS2 Ltd and its consultants.

[redacted] DRN Feedback Capture Sheet

DRN reference number	2DE01-MWJ-EN-REP-M003-000032
Document title	Design of an Alternative Underground Station - Options Assessment - Sift Level 2 Appraisal
ProjectWise reference number	2DE01-MWJ-EN-REP-M003-000032
Version number	P02
Work Package	n/a
Issue date (Draft for comment)	28/05/2021
Response date	

Comments classification
Quality of submission - Accept with suggested amendments
Client preference / change - Accept with suggested amendments
Quality of submission - Do not accept
Client preference / change - Do not accept
For information only
Highlight a 'Safe by Design' feature

Reviewer	[redacted]
Organisation	[redacted]
Position	[redacted]
Discipline	n/a

Report and Supporting Files	

No.	Section No.	Clause / Paragraph / Table Number	Comments	MWJV RESPONSE
1	1	1.1.9	It would be useful for HS2 to explicitly state this includes the entire route from the Airport to Node 3 including the station costs.	Wording of 1.1.9 has been updated to make this clear.
2	2	2.5.6	It would be helpful if Option A was identified as the fourth option that was not taken forward noting the options taken forward were better performing in the initial assessment.	Wording of 2.5.7 has been updated to include this.
3	3	3.1.1	This paragraph is not clear. Has Option 0 been included (excluding the sidings) or has it been omitted entirely? I believe it is the former but please clarify.	The impacts of option) have been assessed without the sidings.
4	3	3.1.1	If Option 0 has been assumed then this is key for comparison of operational capability. According to information provided by HS2 to [redacted] Option 0 is capable of 8tph for NPR (and possibly up to 10tph with a heavily constrained timetable). We believe the underground station options would be able to handle at least 10tph (possibly more but limited by Manchester Spur) with fewer timetable constraints. This difference in capability needs to be assessed/recorded	The assessments are made on the basis to meet the ITSS
5	3	3.1.5	Node 3 is a nominal point on the NPR representative alignments to allow direct comparability to the surface station. There are opportunities to refine the alignments from the underground options taking a more holistic view of the route towards Leeds however Node 3 was used to limit the scope of design work for HS2 for this study.	Noted . Node 3 formed part of the agreed scope.
6	3	3.2.5	The use of the phrase ' joint workshops' implies the sift appraisal was a joint effort. A number of comments were raised by the stakeholders and implying the appraisal was jointly agreed is not representative. Suggest this amended to "The appraisal of options against the sift criteria by HS2 was discussed with the stakeholders at a series of workshops on the 15/16 April; [redacted] as this would be more representative	wording amended
7	3	Table 1	Should a key assumption be that that oversite development will be provided. This appears to have governed a number of key decisions about the sizing of elements with the box structures	OSD was developed as an illustration of what can be achieved to meet the needs of stakeholders and is consistent with scope requirement to 'Select and develop a wholly underground station concept'
8	3	Table 1 / 3.4.10 bullets 3 & 4	The assumption that the underground station options have been designed as a terminus is key as it has a major influence over the complexity of the station throats. In particular the need to be able to reverse trains out of all platforms has a major influence on the solution and negates some of the potential advantages of a through station.	Noted
9	3	Table 1	What assumption has been made regarding the operation of NPR? Is it assumed NPR will be delivered later? Given the later delivery of underground options, does this assumption remain valid?	It is assumed that an underground station will operate as a terminus until NPR is constructed.
10	3	3.3.3	Bullet 3 - Suggest this amended to "Potential NPR connection to Sheffield"	Text amended.
11	3	3.4.1	This needs to be explained further. Why has Option B not been developed? How is this considered (or not) in the sifting	Additional text added to highlight [redacted] proposal for underground station was not incorporated due to programme constraints. Regarding the Sift the proposal i.e. current provision is scored in the sift matrix. refer also 3.4.2
12	3	3.4.8	Node 3 is an assumed position for this study to tie in with NPR alignments for the surface station. If an underground station were taken forward for further development then further consideration of the route to Leeds and potential stabling facilities would be needed	Noted
13	3	3.4.12	Is it definitely the case for all options that the tunnel from the Airport could not have an intermediate construction site? Did HS2 consider potential alternative sites and if so where is this evidenced? The assumptions log in Appendix B suggests alternatives were not considered	Intermediate construction sites will be required at the vent shaft locations. However, if the comment refers to the main tunnelling works spoil is removed via the portal at the airport.
14	3	3.4.18	For the route from Manchester Airport to Piccadilly how does this assumption compare to the baseline scheme? Is this consistent with assumptions for the hybrid Bill scheme?	It is completely consistent with the hybrid bill scheme.
15	3	3.4.20	How does this rate compare to the planned Old Oak Common excavation for example?	Reference has been made to tunnelling works across HS2 taking into account ground conditions likely to be encountered.
16	3	3.4.12 to 3.4.24	It would be helpful if there was a cross-reference to the construction programme in Appendix F. There is relatively little detail of the assumed durations of activities and dependencies which have been used to derive this duration.	Noted. This reference has been added at 3.4.25.
17	3	3.4.12 to 3.4.24	Further to the comment above, it is not clear from the information provided in the report or Appendix F why the station civils would take over 8 years to complete. How does this duration compare to Old Oak Common which has a comparable footprint (albeit with a shallower depth)?	Amendments to Appendix F to resolve inconsistences
18	4	4.1.0 / 4.1.1 / 4.1.2	It is assumed these paragraphs are not finished and will be updated in the final version	Text amended.
20	4	4.1 General	This section needs to also describe the Remit 6 NPR route to the tunnel portal near Gorton (but excluding the sidings).	Section 4.1 has been amended to include this description.
21	4	4.1 General	It may also be worth noting that the NPR team also developed an alignment without sidings which entered tunnel earlier than the Remit 6 Option 0 design which has a smaller footprint in the Ashburys / Gorton area	Noted
22	4	4.1 General	It should be noted that the maximum capacity of Option 0 is 8tph from the Airport through to Node 3 which is likely to be less than an underground station. To achieve 10tph through the surface station requires more infrastructure in Manchester (known as Option 2b) which has higher costs and a larger footprint.	Comment noted, however the questions relating to Option 2b in Remit 6 which includes for NPR services to Sheffield which was not instructed for investigation in the Underground study - therefore it is unfair in understanding a like for like comparison to include for detail on Remit 6 Option 2b and the capability or infrastructure requirements of a surface station without assessing the same for the Underground options.
23	4	4.1.0 / 4.2.0	Can we expect the final version to include comparable statistics for the baseline scheme with total lengths of tunnel and surface running?	Further information added
24	4	4.2.11	Is the outer scissors needed for normal operation (when most services are continuing through the station) or for perturbed operation? This needs to be clearer what the purpose these cross-overs is and whether there has been any consideration as to whether the ITSS can be accommodated without the crossovers.	The outer crossover scissors are for perturbed scenarios at the end state but also enable HS2 trains to access all platforms when the station is HS2 turnback only (ref 3.4.10 & 3.4.11).
25	4	Figure 9 / Figure 13 / Figure 17	The key features including the two cross-over locations should be labelled to give context for the text which follows.	Noted
26	4	4.2.14	Why cannot the outer cross-over be moved to the site of the Rondin Road intervention core rather than having two separate structures?	This could be examined at the next stage if the option is taken forward but would require careful consideration of the impact of cavern ing under the viaduct present in that area and the impact of the headhouse compound on Rondin Road.
27	4	4.2.35	Given a key advantage of the underground station is expected to be additional capacity for more services it is likely these concourse areas would need to be enlarged accordingly. This would be expected to have a minimal effect on overall cost but should be noted particularly if a larger concourse would be challenging to provide.	In the comparison section it has been highlighted that expansion of B & D ticket halls are constrained where as B1 is not.
28	4	4.2.41	How has the ratio of western/eastern concourse size been determined? What assumptions have been made? (Same comment applies to all options)	Additional text is added to clarify. refer 4.2.36
29	4	4.2.44	Has the Metrolink been retained in the current location because it will not fit anywhere else or because a solution has not yet been developed? Need to be clear whether a 4x80m Metrolink can be accommodated for this option as this is a requirement. If not then then report should state this.	Cross reference to 3.4.2 where this is discussed is added
30	4	4.3.0	It would be worth noting a bespoke horizontal alignment was not developed for Option B1 specifically but uses the same horizontal alignment as Option B for design expediency. There may be opportunities for refinement for B1 if it were treated independently of Option B.	Noted. However, during the alignment development, it was deemed that there was no discernible value in producing differing alignments for B vs B1 while they share a common straight through the centre of Manchester.
31	4	4.3.10	Add a reference to 5.1.4 and give the full name of Bologna AV Central station	Updated
32	4	4.4.10	Could relocation/reconstruction be considered for the Grade II listed stable block?	Notes added. note context is important consideration
33	4	4.4.25	Suggest the first sentence is amended to "The two outer platforms are constructed as mined caverns with each serving a single through line." to improve clarity.	Noted and updated
34	4	4.5.1	Is it worth noting therefore that a change to the ITSS would be needed with all trains including HS2 London services continuing to a location east of Piccadilly? This could be a turnback sidings facility relatively close to Piccadilly.	The statement was made to suggest that reducing the layout to 4 platforms would not be possible in line with the iTSS. Exploring 4 platforms to an alternative iTSS was not intended to be carried out within the remit of this study.

35	4	Figure 21	It may be better providing this as an appendix as it is not possible to read at the size presented	To be added into a new Appendix J
36	4	4.5 General	Does this section need to comment on the potential phases of the ITSS (i.e. the surface station is HS2 only then HS2+NPR). Does this apply to the underground station or is it assumed HS2/NPR would come online simultaneously due to the longer delivery timescales of the underground options?	Assumption 71 in Appendix B assumes NPR would be in service at a later date. No defined dates were provided in the NPR Remit 6 report to determine whether the dates coincide.
37	4	4.5 General (4.5.2)	Has there been any assessment of how many paths would be available? Is it reasonable to assume the underground station would only be limited by the capacity of the Manchester Spur? If not, what are the constraints?	Previous work on the surface station shows how the capacity of the surface station can be enhanced, however similar constraints exists with the underground options. Blending of the paths of the Manchester spur acts as the overarching constraint.
38	5	5.1 (General)	Is there any data regarding the construction cost/durations for any of the case studies presented for comparison to the underground options at Piccadilly? Would have expected HS2 would be able to provide a more comprehensive comparison to Old Oak Common in particular.	No further data available. Costs and programme durations are not often published, and when they are it is not usually clear what is included. The construction programme for Old Oak Common (OOC) was looked at, but as this has not been built yet we do not know whether it was sensible. OOC is in very different ground conditions and has a very different design.
39	5	5.2.2	Is the risk here the construction of caverns in close proximity to each other? From the Stepney Green example it is apparent a technical solution would be available to construct a cavern in much weaker material. Please can you clarify	The risk is largely due to construction of such large caverns in close proximity to each other. The technology and expertise exists to construct 21m wide single caverns. However, even for a single cavern, controlling ground movements and avoiding building damage will be challenging and will remain a residual risk.
40	5	5.2.4	Comment noted. However, would this also apply to the HS2 Manchester tunnels in any case? It is understood that further effort would be required to prove the viability of a novel technique or usage (i.e. the closely spaced caverns) prior to a hybrid Bill submission. Is it also worth noting that the Channel Tunnel would have had very limited records of historic borehole data to inform initial assessments of ground conditions.	The Manchester bored tunnels will be constructed using closed-face TBMs, and there is no risk that this will be unfeasible. The Channel Tunnel site investigation needed to prove the continuity and levels of the Lower Chalk across the channel and is not a direct analogy to the situation in Manchester, as you say. This was mentioned only to show that it is possible to undertake significant site investigation to assess feasibility prior to hybrid Bill passage.
41	5	5.2.9	The settlement risk is related to the strength and stiffness of the Sherwood sandstone. This should be noted.	Sentence added to this paragraph.
42	6	6.2.8 / 6.3.1	There is an assumption that the material excavated from the box would have little value and would need to be disposed of. Given a significant percentage of the material will either be weathered sandstone (potentially sand) or solid sandstone these materials may have value as site won aggregate or for other markets. It could be worth noting this as an opportunity.	The quality and potential to reuse this material has not been considered in this sift.
43	6	6.2.11 / 6.2.14	There is a slight contradiction here. The earlier paragraph suggests there would be less site clearance but the later paragraph then suggests there will higher emissions due to additional demolitions. Given the lower footprint I would expect there to be an overall reduction due to site clearance unless the alignment was affecting taller structures. Please clarify	This is due to additional demolitions in the city centre caused by the headhouses and intervention cores. Please refer to detail within Appendix C.
44	6	6.2.14 / 6.3.2	How do these volumes compare to the baseline scheme?	This should be in the Construction section of the matrix.
45	6	6.2.15	Can this be expanded to explain this assessment is based on the much higher impacts during construction? Is this statement solely related to the carbon emissions described in the preceding paragraph?	Please refer to Appendix C, as the Sift Matrix expands on many of these points.
46	6	6.2.16	It is unclear why the option has been assessed as neutral overall during operation. Would expect there to be benefits from moving railway underground in terms of noise etc	Please refer to Appendix C, as the Sift Matrix expands on many of these points.
47	6	6.3.7	To be clear, is this an increased CCB compared to the baseline or the other underground options? Data previously provided suggested the CCB for this option would be slightly smaller than the baseline.	Refer to sift matrix for CCB comparisons
48	6	6.4.1	This could be clearer. It is my understanding that the excavation volumes for Option D would be less than the other underground options but more than the baseline option. Would be worth noting this option has the lowest excavation quantities.	This section compares Option D against the Baseline rather than other options. Excavation quantities are addressed elsewhere. Paragraphs 8.1.28 and 29 provide a high level summary.
49	6	6.4.10 & 6.4.11	Given the uncertainty with both the route and the vent shaft positions can these statements be so definitive? There is significant scope, especially east of Piccadilly for different vent shaft sites. Is there a view as to whether these impacts could be mitigated to the point where they would be no worse than the baseline? Or is the view that Alignment D is intrinsically more likely to have greater impacts (noting the comments in 6.4.18)?	The sift has been carried out in accordance with the scope and HS2's Route Development Procedure. Refer to assumptions reagrding indicative nature of the vent shaft locations.
50	8	8.1.9	This is only correct for B1 assuming the only access to the NR platforms is via the existing northern/western concourse. If B1 were taken forward alternative configurations for passenger circulation could be discussed with NR to improve passenger interchange. We also note recent NR master planning presentations which considering alternative southern entrance configurations.	Notes added to reflect B1.
51	8	8.1.10	See previous comments about Metrolink provision for Option B. Is this a fundamental limitation of the option or simply that a 4 platform Metrolink option has not been produced for Option B?	See response to Comment 11
52	8	8.1.3-8.1.6	There is no detail provided in the report relating to C&L prior to this. I was expecting a more detailed section outlining how the programme has been determined and the key assumptions/constraints/outline sequence for each option to have been provided earlier in the report. Are the paragraphs 3.4.12 to 3.4.24 the extent of the programming activity?	Key construction programme assumptions were provided in Section 3.4 Basis of Design. A detailed construction programme was developed for all three underground station options, including sequence sketches. These were not included in the report because the brief was to keep it concise and it would have been difficult for non-specialists to interpret. This is similar to the cost estimate, for which the detailed calculations have not been provided.
53	8	8.1.7 - 8.1.9	A comparison to the baseline scheme tunnel drives would be helpful. Can HS2 confirm their current view regarding the tunnel drives relative to the baseline scheme?	This section is not for comparison to Baseline, and therefore is not included here
54	8	8.1.13	A comparison to the duration of Metrolink closure for the baseline scheme would be helpful here.	This chapter is for comparing the underground options with each other. The duration of Metrolink closures in the baseline has been added to the equivalent paragraph in Chapter 9, which is 9.1.56.
55	8	8.1.15	How does the diversion requirement of Pin Mill Brow and junctions compare to the baseline scheme?	It is similar, with a similar layout after construction.
56	8	8.1.16	I thought there was an opportunity to avoid the works to Great Ancoats Street by moving the box slightly further west? This would also avoid the Travis Street sewer diversion. Highlight this key opportunity	Adjustment in location was tested however option D is constrained also on the west by requirement to include western ticket hall which is also constrained by Metrolink. The opportunity was highlighted during workshops and noted for testing following development of ticket halls. refer diagram in Technical Note refer 5.2.2 of presentation material issued 15/04/21
57	8	8.1.30	For completeness please include the baseline cost here for comparison	Section 8 is intended to focus on the three underground options against each other, rather than against the baseline. The baseline cost is reported in 9.1.66 of the draft report.
58	8	8.1.32	For completeness please include the baseline entry into service date for HS2 Phase 2b and note the NPR delivery date is TBC but expected to be a few years later (nominally 2040 currently but this has not been subject to detailed planning)	Noted. Sections 8.1.59 and 9.1.70 have been added.
59	9	9.1.0	This may be better presented as table. It would also be helpful if the total tunnel length and surface length were also provided for all options for comparison	Alignment - Content converted to table.
60	9	9.1.5	Would this restriction on the technical headway limit the capacity of the underground stations to less than the capability of the Manchester Spur? Could this be mitigated by an alternative approach to ventilation in the underground station throat? Would this restriction in the station throat apply to Option B1 which is potentially more open than Options B/D?	Provided the ventilation spacing provided for the underground options supports the 3 minute headway then the overall capacity of the underground station will not be affected, however the technical headway that underpins this is likely to be longer therefore the potential performance recovery between consecutive trains may be reduced.
61	9	9.1.5	Does this 1 train per ventilation block requirement limit the parallel move capability?	To confirm, it is one train per vent block per direction.
62	9	9.1.7	It would be worth acknowledging the simplistic methodology used to determine these values. Can more sophisticated journey time calculations be undertaken with the current level of alignment development?	The assessment was carried out as a desktop assessment. More refined assessments are not considered to create significant changes and would be done at a future stage if an option were to progress where a definitive route layout was determined.
63	9	9.1.9 Bullet 1	According to work by HS2 on behalf of NPR, the 'top train working' capability has only limited value as the capacity of the station is limited by the station throat except in perturbed operation. This should be noted for completeness	This doesn't necessarily create more tph, what it achieves is additional choices for how the additional tph can be timetabled, particularly if a future TSS with shuttle services is considered.
64	9	9.1.9 Bullet 2	The two-track 'chords' are not part of the Option 0 baseline. These would require a much wider footprint and slightly higher costs than the baseline option. According to information provided to [redacted] by HS2, Option 0 cannot easily accommodate shuttle services alongside HS2 ECS moves. It would not be fair to compare a different option without including the full impacts of alternative option in the baseline option.	Noted. This paragraph was included in response to the query form the stakeholders in considering what would be achievable if additional NPR shuttle services were to be added to the underground. The outcome that was written is that it would be the NPR Remit 6 Option 2B scenario.
65	9	9.1.9	Disagree with the comments here and would like to see more details of this assessment. With a through station, the NPR services would approach from the opposite direction to HS2 stations, reducing the number of potential conflicts in the station throat (which is the limiting factor of the surface turnback). The through services will also occupy a platform for a shorter duration, potentially allowing more services to use each platform per hour. A more holistic view of overall performance/capacity is needed.	The design of the surface station throat has been optimised to make its capability match the capability of the Manchester spur once the HS2 and NPR paths are overlaid with each other. Ultimately the constraint on the Manchester spur remains whereby NPR timetable patterns are required to fit around HS2 timetable patterns due to the constraint of Euston timetable.
66	9	9.1.12	To be clear, do HS2 think this will have any significant impact on any of the sift criteria or is just a risk to be noted?	This is not considered to have an impact on the Sift Criteria. The Station is likely to act as the rescue facility point. There is a small risk that there may be minor adjustments to the station design to accommodate this rescues facility but not anticipated to change the general form significantly
67	9	9.1.14	It would be worth noting that NPR designs continue to develop and it is possible 'Node 3' could be moved to a surface location to allow for a systems handover in east Manchester.	Nothing identified that there is a possible change to Node 3 and the study doesn't recognise this opportunity.
68	9	9.1.15	Are HS2 able to provide any indication as to how far from the station this point is likely to be?	The location was not identified specifically, mainly due to the limitations on the vertical track geometry whereby the closest point at which the alignment was able to surface is considered to definitely be beyond the limit of the current traction power capabilities.
69	9	9.1.22	Given the need for vertical circulation, it would be possible to configure the escalators such that the horizontal distance is minimised as far as practicable. This has not been considered in detail by HS2 at this stage so should be noted as an opportunity.	Note added
70	9	9.1.25	It is worth noting there would probably need to be more detailed discussions regarding the relative area of the OSD and the need to create a pleasant environment for passengers by providing more natural light / openness should an underground station be developed further.	Notes added to 9.1.24 as more relevant location.
71	9	9.1.27	To be clear, is this saying that the only way Option B could accommodate 4x80m Metrolink platforms would be to provide them on the surface?	Additional above ground options were examined however [redacted] preferred option as underground option not incorporated due to programme restraints however it should be noted the feasibility of this is untested refer also to 3.4.2
72	9	9.1.29 -9.1.36	It would be helpful if there was a summary providing a view as to whether the options are better or worse overall than the baseline option or if it is quite mixed with no clear difference between options.	Noted
73	9	9.1.40 - 9.1.57	There is a lot of duplication / overlap between the content of this section and the preceding section in Section 8. Would there be a way to consolidate these sections to improve readability?	Chapter 8 is comparing the underground options against each other, Chapter 9 compares them to the baseline. It is not possible to merge the two chapters.
74	9	9.1.48/49	Were any alternative sites for tunnel launches considered, possibly launching from a shaft in the Salford area? Would this have any advantages?	There would be no programme advantages, because the station is the critical path. There may be environmental benefits if excavated material can be removed.

75	9	9.1.56	Why is there no comparison to the hB design here?	The Metrolink closure duration in the hBD has been added.
76	9	9.1.59-62	This paragraphs simply restate information provided previously in Section 8. How do the figures compare to the baseline?	A comparative assessment of the baseline scheme is not presented as part of this report.
77	9	9.1.63	The results show the underground options have slightly higher benefits compared to the surface station. This is largely the result of reduced dwell times through the station for Options B and B1. Option D gains a further benefit from improved journey times each side of the station.	Noted. The journey times between the nodes of interest in this study have been presented in Appendix I, along with the analysis carried out by DfT.
78	9	9.1.66	It is important to note, for full transparency, the HS2 surface station and approach has been developed with a lower contingency than the other options and NPR route due to the higher level of design development.	This is described in Section 20.1.6 in Appendix G of the draft report.
79	10	10.1.5	Suggest 'strategic fit' is amended to 'HS2 strategic fit' as there is some disagreement due to differing strategic priorities amongst the organisations involved.	Disagree. This is strategic fit as defined under the HS2 Route development procedure, HS2 strategic goals and programme benefits, and all other references within the report. As such it is evident what "Strategic fit" is in this context.
80	10	10.1.8	Can additional paragraphs or an additional section be added to this conclusion so that the views from the stakeholder organisations are recorded? Appreciate the sift assessment and recommendation is governed by the HS2 sift process however I think it would beneficial to separately include the views of stakeholders here for completeness alongside the sifting recommendation.	A new chapter has been added before the Conclusions to highlight key stakeholder comments, concerns and potential areas for further work. Additionally, the Exec Summary and Conclusions have been re-worded to make clear that the recommendations are those of HS2 Ltd.
81	Appendix B	Assumption 10	Is the 3no. Trains a fixed upper limit? Would an additional train per day be possible? How has the upper limit for excavation been assessed?	3no. train paths per day is a fixed upper limit determined by studies for the hybrid Bill Design. No additional trains are possible. The 1800m3/day is also a reasonable estimate of average daily excavation in the station box.
82	Appendix B	Assumption 27	Further development is both an opportunity and a risk therefore I think it would be appropriate for the corresponding opportunity (Assumption 26) to also be flagged as a key assumption.	Noted
83	Appendix B	Assumption 30	We would like more clarity on this policy. Would a cover of less than 18m to the tunnel portal actually require purchase of the land or would it require compensation payments to the landowner?	It is a general rule of thumb that where the tunnel crown is more than 18m below ground level, only sub-surface land acquisition powers need to be sought through the hybrid Bill. This general guidance is appropriate for informing a sift level of design but powers are determined on a case-by-case basis.
84	Appendix B	Assumption 31	The provision of the outer scissors crossover has a significant influence over the design of the station and route therefore I would have thought this would be a key assumption	Noted
85	Appendix B	Assumption 50 / 52	Introducing surface running before Node 3 would also be an opportunity as a surface route is likely to be less costly than a tunnelled route provided it emerged in a corridor which is not heavily developed and land acquisition/compensation costs do not offset the construction cost saving	True but the topology does not make this feasibility
86	Appendix B	Assumption 54	Agree the stabling facility is a significant cost risk and should be highlighted however for the purposes of comparing the surface and underground options the stabling facility is excluded as potential solutions have not been investigated for the underground options.	Noted
87	Appendix B	Assumption 59	Has this been assessed as an increased cost because the route may need to be longer? Please clarify. Would also note that the systems handover is required to be on the surface which would be expected to be lower cost than a tunnel.	The assumption acknowledges the practical difficulty of achieving a vertical alignment that both serves the underground station and meets an appropriate handover section within scope of the design.
88	Appendix B	Assumption 62	Why would a reduction in dwell time result in increased cost? Would expect this to be an opportunity too. Unless an assessment of the timetable implications is undertaken we cannot be certain of potential impacts across the network.	Column heading states "*what happens if the assumption is invalid*". If the assumption is not realised and a longer dwell time is required then that is why.
89	Appendix B	Assumption 71	There may also be efficiencies by delivering the HS2/NPR elements together	Noted
90	Appendix C	Construction Feasibility - Station - Metrolink	Given Option D can be built independently of Metrolink and would only require a very short duration closure compared to the hBd I would have expected this to be positive compared to the baseline.	Noted
91	Appendix C	Operation Feasibility - Railway Operations - flexibility/reliability of track layout	A through station has fewer potential conflicting moves and the reduced dwell times could potentially be used for recovery as platform occupancy will be lower for a given TSS. Do not agree is a worsening. This assessment does not appear to take cognisance of the performance advantage for through services.	Due to the limitations of the capacity of the approach and throat capability rather than the platforms. Therefore the iTSS that has been used for this study, platform occupancy are already relatively low, reducing the platform occupancy time won't have a significant benefit to performance robustness for the defined iTSS.
92	Appendix C	Operation Feasibility - Railway Operations - future proofing	Again, would expect the through station to avoid the constraints in the station throat for through services and have a benefit for through services. What assessment has been undertaken to reach this conclusion?	The station throat of the surface station has been developed and optimised so that it does not act as a constraint on the iTSS used in this study. This assessment was undertaken as part of the Hybrid Bill design and is the basis of the underground alternatives.
93	Appendix C	Ecology	Given the low level of certainty is there a view whether the issues identified for the vent shafts could be avoided by relocating the vent shafts / amending the alignment? Are these representative of an underground option generally or just the current assumed alignment (i.e. could the impact be readily designed out)?	The Sift has been carried out in accordance with HS2's Route Development Procedure. Refer to assumptions regarding the indicative nature of the vent shaft locations.
94	Appendix C	General	Similar to comment on Ecology, the assessment is based on the assumed positions of vent shafts which have a low level of confidence. Are these impacts representative (i.e. similar impacts would result regardless of refinement) or would it be expected these could be mitigated through design refinement. It seems the current underground alignments have selected more greenfield locations for shafts compared to the hBd which seems to affect more brownfield sites.	The Sift has been carried out in accordance with HS2's Route Development Procedure. Refer to assumptions regarding the indicative nature of the vent shaft locations.
95	Appendix C	Socio-economics	Has there been a similar assessment for the NPR western portal for Option 0 which would affect a number of business including an aggregates facility or is this included in the Manchester Tunnel north portal calculation?	This sift environmental assessment has used the hBD Manchester Piccadilly High Speed station, Ardwick and Manchester tunnel (including vent shafts) and NPR Remit 6 design.
96	Appendix C	Sound/Noise	The surface viaduct and associated infrastructure for the surface station would be expected to have a significant noise impact even with mitigations such as acoustic barriers (which would have a visual impact). The impacts from moving the route into tunnel would be more localised to vent shaft positions and possibly ground vibrations. Has a comparison of the surface section noise impact been undertaken?	This sift environmental assessment has used the hBD Manchester Piccadilly High Speed station, Ardwick and Manchester tunnel (including vent shafts) and NPR Remit 6 design.
97	Appendix F	Construction Programme	The CP3 programme shows the enabling works commencing prior to Royal Assent but the underground options all show this activity starting immediately following Royal Assent. Why can the CP3 programme start earlier and the underground options cannot? This would allow the utility works to be brought forward and allow station construction to begin sooner.	Appendix F has been amended to remove this discrepancy. Enabling Works is now shown commencing after Royal Assent for all options.
98	Appendix F	Construction Programme	Why does the Civils Station Construction need to wait until the enabling works are largely complete? I would expect there to be opportunities to commence primary construction in one part of the site whilst enabling works / utility diversions complete in another part of the site.	The same Enabling Works durations and logic from the hybrid Bill Design Piccadilly Station construction programme were used for the underground station options.
99	Appendix F	Construction Programme	It is not wholly clear why the construction programme for the tunnel from Manchester Airport takes 3 years longer than the hybrid Bill. Due to the change in construction methodology can see the duration increasing by 18 months but not 3 years. Please explain.	The production rates used for the tunnel drives are the same as those used for the hybrid Bill Manchester Tunnels South, i.e. a long average of 80m/week from the Manchester Airport portal.
100	Appendix F	Construction Programme	It would be helpful if the CP3 programme separated the tunnel and station construction activities so the programme can be more readily compared to the underground options.	Noted. Main focus of this work has been the three underground options with the baseline programme shown for indicative comparison purposes.
101	Appendix F	Construction Programme	It is not clear why the rail systems durations is much longer for the underground options compared to the CP3 programme	The construction of the underground station requires additional infrastructure to be constructed compared to the CP3 scheme, in the form of additional underground systems in a station environment and ventilation shafts. The access and logistics restrictions of an underground station also impact the duration of the programme. (Lessons learnt from Crossrail)
102	Appendix F	Construction Programme	Why is Testing and Commissioning integrated into the installation activity for the CP3 programme but a separate 2 year activity is included for the underground options? Can understand an underground station with more systems and greater complexity having a longer duration but on what basis has a duration several years longer been determined?	The programme bars are a simplification of the actual programme. In the CP3 version there will be elements of overlap between the 2, as some elements must be powered up to support other elements. The extension in duration is aligned to underground station fitout programmes (Crossrail and OOC) and associated with the logistics and access considerations that impact on the ability of being able to construct/install items simultaneously or in close proximity compared to the over ground station.
103	Appendix G	Cost Estimate	It is not clear what elements of the scope are included in the 'Station' and 'Approach' Costs. Suggest a diagram showing which elements are included in which cost element is provided for all options (including the CP3 design)	Appendix G has been updated to include such a diagram.
104	Appendix G	Cost Estimate	How does the station cost of Option B1 (approx. £7bn) compare to Old Oak Common (station + Victoria Rd Crossover Box)?	No information on Old Oak Common costs is in a position to be shared, other than what is already available within the public domain.
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Record of Review

Document	**Manchester Piccadilly High Speed Station, Design of an Alternative Underground Station, Options Assessment - Sift Level 2 Appraisal (Document No. 2DE01-**
Document Da	**04/03/2021**
Source	[redacted]
Revision	**P02**
Date of Revie	**01/06/2021**

These are initial comments based on the presentation and do not necessarily provide an exhaustive list. [redacted] reserve the right to raise further comments.

Reviewer	Comment Ref No.	Subject	Section number	Comment	Response
[redacted]	001	-	1.1.1 / p5	*...an optimised alternative for a combined Underground station.* [redacted] do not consider that the underground options presented to date to have been sufficiently 'optimised' at the stage of design development that has been reached to support a decision on the preferred option between surface and underground options. As set out in the letter from the HS2 Minister Andrew Stephenson to Andy Burnham, Mayor of Greater Manchester, it is essential that this study produces a "fair and robust evidence base for decision making". The conclusions presented within the draft sift report include the identification of considerable risks, opportunities, and uncertainty associated with a wide range of technical disciplines. As a direct result of this, the report identifies a number of specific requirements for further areas of work to be progressed, which would be needed to ensure there is a complete enough basis on which to inform a strategic decision of the level of national significance associated with the design of the Manchester Piccadilly High Speed station. Given the considerable risks, opportunities, and uncertainty identified within the sift report, there is a risk that	The suggestion for a section of the report to set out that further detailed work on assessing Underground options is noted by HS2 Ltd. concerns stated here by stakeholders should be discussed with DfT due to the request for additional assessments being beyond the scope of the study
[redacted]	002	-	1.1.2 / p5	*"...development to assist stakeholders identify their preferred option."* This early section of sift report sets a tone that suggests that all stakeholders would agree / have agreed on a preferred option for an alternative underground station option. The report needs to make clear, wherever a 'preferred' option is set out, that this is only from the perspective of HS2 Ltd. This issue needs to be addressed throughout the report, including later references to the surface station emerging as the preferred option as the overall outcome of the study (e.g. section 1.1.10 - see comment 005).	Sections 1.1.11 and 1.1.12 have been amended to make clear that these are HS2 Ltd recommendations.
[redacted]	003	-	1.1.4 / p6	*"Node 3"* Need clear recognition that Node 3 is notional - an artificial constraint. Linked to comment 001, the requirement for further work has been identified in order to produce a fair and robust evidence base for decision making considering an optimised alternative for a combined Underground station.	3.1.6 quotes the rationale for Node 3 as agreed with the co-clients and stakeholders for the study to correspond and enable future integration with work on the NPR Programme.
[redacted]	004	-	1.1.6 / p6	*"HS2 Ltd recommended Alignment B1 as the better performing of the Underground options."* This conclusion needs to be reviewed after consideration of wider challenges presented by partners in comments on the draft sift report, and also accounting for the identified requirements for further areas of work to be progressed.	The conclusion of sift assessment was drawn based on the work carried out in line with the agreed scope.
[redacted]	005	-	1.1.10 / p6	*"...the Surface station would be the preferred option."* This conclusion needs to be reviewed after consideration of wider challenges presented by partners in comments on the draft sift report, and also accounting for the identified requirements for further areas of work to be progressed. Also see comment 002 - it could be read that this is the preference of all stakeholders. It needs to be made clear that this is the preference of HS2 Ltd only, and not of wider partners.	A new chapter has been added to identify potential future work. Sections 1.1.11 and 1.1.12 have been amended to make clear that these are HS2 Ltd recommendations.
[redacted]	006	-	1.1.11 / p6	*"Further detailed development of the options, based on the agreed scope and requirements of this study, is unlikely to significantly change the overall assessment and comparative difference between a Surface and Underground High Speed station at Manchester Piccadilly, particularly in respect to cost and programme."* It is too early to draw this conclusion without the further detailed development work. [redacted] consider this study to be a first pass of what an underground station could look like for Manchester Piccadilly. It is clear that a further piece of work is required to provide a thorough assessment comparing an optimised underground station design with the Baseline surface station option. Also see comment 001.	Noted. See response to Comment 1.
[redacted]	007	-	Executive Summary	The Executive Summary needs to capture the uncertainty / risks / opportunities and the identified requirement for further areas of work to be progressed as outlined later in the report. Information presented to Ministers must also reflect this.	A new section has been added to the Exec Summary to synopsise the new Chapter 10
[redacted]	008	-	2.1.0 / p8	*"...following a robust sifting process of alternatives."* Were these alternatives all surface turn-back options? And also all HS2-only options pre-NPR? Clarify.	This included all options to serve Manchester City Centre and several options for shallow box stations and an Underground (Option 17) in the Piccadilly area, information can be found in the Options for Phase Two of the High Speed Rail Network report (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/68965/options-for-phase-two-of-the-high-speed-rail-network.pdf) page 106 onwards and table 4.1
[redacted]	009	-	2.1.7 / p9	*"...an optimised alternative for a combined Underground station."* See comment 001.	See response to Comment 1
[redacted]	010	-	2.3.3 / p11	Whilst this section sets out the agreed programme dates, it is also important to note delays in the provision of information. The agreed programme set out that partners would discuss and agree a preferred underground station option at Decision Point 2 on 22 April 2021, with information to support this decision to be provided in full to partners three weeks in advance on 01 April 2021. Full information was not provided in a timely manner to support the requirements of Decision Point 2.	Noted. It is acknowledged that, as the sifting analysis came towards its conclusion in April 2021, a large amount of information was shared in a relatively short space of time.
[redacted]	011	-	3.1.1 / p15	First mention of "Option 0" - need to add explanation earlier. Further detail on Remit 6 Option 0 also needs to be provided as part of the supporting documentation for the sift report.	Further text added
[redacted]	012	-	3.1.1 / p15	Building on the above point, this paragraph needs to be made clearer. This feels like a significant point on stabling / sidings. How and when should these additional requirements be considered?	A stabling strategy is in place for the baseline but outside of consideration for the underground stations.
[redacted]	013	-	Figure 2 / p16	Is "passive provision" the right term for the Baseline option? This option must consider the impacts of the full proposed route between the limits of Node MA and Node 3, with the full route infrastructure between these limits being assessed to ensure a fair 'like-for-like' comparison with the proposed underground options. Please confirm that all assessment criteria consider the impacts of Piccadilly to Node 3 for the Baseline option.	The term refers to works under HS2 remit that would enable the construction of NPR without operational impact on HS2.
[redacted]	014	-	3.1.6 / p16	"Node 3" See comment 003.	See response to comment 003
[redacted]	015	-	3.3.1 / p19	*"Appendix B contains a full table developed during the design listing the assumptions made, rationale and potential impacts if found to be incorrect."* [redacted] note that this is new presentation of detailed information unseen prior to the draft sift report being shared with partners - adding to the significant challenge of reviewing within the programme timescales.	The development of the design together with assumptios were shared through numerous information and design workshops the table represents a collation of the work.
[redacted]	016	-	3.3.3 / p20	Exclusions - *"Vent shaft locations and head house designs"* In line with this exclusion, the sift assessment should reflect the uncertainty around this - i.e. there shouldn't be too much weight attached to the impacts at specific locations - needs to be proportionate to the stage of design development. The vent shaft locations identified for each option have been noted as indicative, and it is recognised that further work would be required to optimise both the route alignments and the resulting requirements for vent shaft locations, which would include the potential for design optimisation and impact mitigation.	Noted
[redacted]	017	-	3.3.3 / p20	Exclusions - *"Connection to Sheffield"* Integrated network planning between HS2 and NPR service and infrastructure proposals is fundamental to achieving an optimised station design at Manchester Piccadilly. Wider aspects will also be of significant importance to the design, notably integration with the emerging options for connecting NPR services between Manchester and Sheffield into the High Speed station. The connection to Sheffield is an exclusion within the current study and should be brought into the scope for full consideration. It is considered that the underground station options are favourable for connecting Sheffield NPR services over the Baseline design. This need for additional work is now of heightened importance due to further progress that has been made within the Remit 6 work in considering the NPR connection to Sheffield.	Noted
[redacted]	018	-	3.3.3 / p20	*Exclusions - "Stabling" and "Sidings"* Linked to comment 001 re: design optimisation and comment 023 re: ITSS assumptions, it is important to progress the further work requirements identified in order to optimise the station design to make best use of stabling / sidings facilities - and in such a way that supports efficient operations.	Noted
[redacted]	019	-	3.3.3 / p20	Exclusions - *"NPR continuity"* See comment 003 (re: Node 3).	See response to comment 004
[redacted]	020	-	3.3.3 / p20	Exclusions - "Design of Metrolink Track & Station" Noting this exclusion, and as agreed between HS2 Ltd and wider partners, it must be ensured that the design of Metrolink track and station options are not being factored in within the sift assessment.	Metrolink options have been included in the sift It was not agreed to omit all the Metrolink option from the sift. The sift report highlight that option B provision as existing is not [redacted] preferred option. Additionally it was discussed that Metrolink would not be used a a deciding differenciator. The Sift outcome is deterimed from a number of criteria including Metrolink however Metrolink has not been used as the differenciator to determine outcome. Refer also minutes of management mtg and follow up email [redacted] 06/04/21

[redacted]	021	-	3.4.1 / p21	*"Metrolink proposal for B1 and D were developed with [redacted] designers over a series of workshops. Option B utilities existing provision and does not include the new and additional underground Metrolink proposal."* [redacted] have developed options for the design of Metrolink track and station arrangements that are considered, at the current level of design development, to work for each of the options considered within this study. These options have not all been progressed into the options assessed within the draft sift report due to timescale constraints.	Design team incorporated design proposal from [redacted] for B1 and D. Design team have not recieved a design proposal from [redacted] for option B other than statement in workshop that it is preferred to be integrated as an underground proposal. As stated an underground option could no be integrated in the programme and should be noted that its feasibility is untested including potential impact on depth of hs2 station. Refer also 3.4.2
[redacted]	022	-	3.4.5 / p22	*"For SIFT purpose, only GEA quantum within CCB has been assessed."* The assessment of commercial development impacts within the sift assessment has been based only on the potential development opportunities within the defined CCB, and not wider development opportunities beyond the CCB. This restricted assessment is not in line with the agreed scope. A revised 'wider development opportunity' assessment needs to be produced to ensure a holistic approach is undertaken.	HS2 Ltd cannot provide a robust view on development opportunities outside the proposed construction boundary. Land within the construction boundary and not subsequently required for the operational railway, would be subject to acquisition by the Secretary of State and would potentially be available to be returned to its original owner for development after construction assuming the land has not materially changed. This has been quantified as part of the study. However, no view can be provided on development opportunities beyond the construction boundary, as these would be subject to wider market forces. If further work on wider benefits and commercial development opportunities is to be carried out, this should be done by an organisation other than HS2 Ltd.
[redacted]	023	-	3.4.9 / p22	"The rail systems design was required to replicate the ITSS." Fundamentally, as a 'through' station, the track layouts associated with the underground station options must be considered to provide greater capacity, flexibility, reliability, and future-proofing compared to the Baseline surface 'turnback' option. The current scope, whilst only considered a 'starting point', makes it very difficult to assess the significant differences between the additional opportunities brought about by an underground 'through' station. More generally, we know that there is uncertainty around the ITSS because of the indicative nature of it and the near-certain likelihood it will change at points in the future as the scheme progresses towards delivery and operation. This poses a considerable risk to the restricted scope of the study. Further to this, it is not sensible to assume that the initial fixed ITSS would be the only operational configuration that would need to be accommodated over such a long scheme life as is expected. To demonstrate the full potential of the underground 'through' station options, further assessment work is required that is not constrained by the fixed ITSS, that considers HS2 and NPR services in an integrated manner, and that is designed to deliver benefits in line with the strategic reasons for the proposed underground station options.	Comment acknowledged, the ITSS for the study was agreed between all parties when scoping the study and is aligned from a HS2 perspective with the HS2 services outlined in the Phase 2b business case (noting Birmingham to Manchester services are extended to Leeds and beyond for NPR programme outputs)
[redacted]	024	-	3.4.16 / p24	"Metrolink construction is assumed to be a minor non-critical element and not included in the programme for any of the underground options." Whilst Metrolink construction may not be on critical path for the High Speed station options being considered for Manchester Piccadilly, the complexities of constructing Metrolink should not be underestimated. This should be reflected in revised wording within the sift report.	Wording has been revised to reflect the relative nature of the commment when compared to the surface option of an underground Metro station.
[redacted]	025	-	4.1.0 / p28	*"Passive provision"* See comment 013.	refer response to 013
[redacted]	026	-	4.1.4 / p28	*"Gateway House"* If it is the case that end of platforms aligned with NR platforms for the Baseline surface station option, [redacted] can't see how leaving Gateway House to block flow of passengers at such close proximity to embarkation point could be a realistic possibility. This appears to be an artificial difference between surface and underground station options. There needs to be a more realistic consideration of the future of Gateway House within the Baseline option, especially noting the clear benefits associated with the removal of the building as set out for the underground options.	[redacted] The assessment has been carried out in accordance with HS2 Hybrid Bill Station Design. Gateway House was retained in HS2 Hybrid Bill scheme. The assessment has been carried out in accordance with HS2 proceduces
[redacted]	027	-	Figure 6 / p29	Looking beyond the immediate area surrounding Manchester Piccadilly, the study needs to look in more detail at the likely land use impacts to the East of Manchester city centre in relation to the substantial amount of rail infrastructure that would be expected to be present. For the Baseline option there would be viaducts heading both south towards the HS2 tunnel portal and north towards the proposed NPR infrastructure. There would also be potential sidings and stabling facilities and the potential for a further NPR connection to and from the route to Sheffield. All this proposed HS2 and NPR infrastructure would clearly be in addition to the substantial amount of classic rail infrastructure that exists immediately to the east of Manchester, including viaducts, cuttings, surface running lines, and depots and stabling facilities.	[redacted] Noted, text has been added to highlight the regeneration challenge to the east of ring road within CCB for Baseline Option in Section 4.1.
[redacted]	028	-	Figure 8 / p32	How wide is the Baseline HS2 / NPR station? Shown as 70m here, but 65m noted at 4.1.5. Clarify.	65m . Text and image updated
[redacted]	029	-	Figure 8 / p32	What is the platform configuration for the Baseline HS2 / NPR station? Shown as 2 island platforms + 2 side platforms here, but 4.1.24 says 3-island platforms. Clarify.	3 island platforms. text and image update.
[redacted]	030	-	4.2.32 / p40	*"Metrolink maintained in existing configuration."* [redacted] firm view is that, as per the Baseline option, Metrolink would need enhancing and therefore relocating as part of a High Speed proposal. This should be made clear, and the uncertainty around this noted. Also see comments 020 and 021.	Additional notes added to 3.4.2 and crossreference added here. Refer also response to 020 & 021
[redacted]	031	-	4.2.39 / p41	*"Note Gateway house is removed providing clear line of sight to City and London Road."* See comment 026.	refer response to comment 26
[redacted]	032	-	4.2.44 / p42	*"Metrolink maintained in existing configuration."* See comments 020, 021, and 030.	refer response to 020,021 & 030
[redacted]	033	-	4.3.35 / p49	*"Metrolink located in Gateway plaza."* See comments 020 and 021.	refer response to 020 & 021 Note also metrolink propoal for B1 here aligns with [redacted] proposal
[redacted]	034	-	4.3.51 / p51	*"Metrolink provision include four platforms arranged in parallel above ground."* See comments 020 and 021.	refer response to 020 & 021 Note also metrolink propoal for B1 here aligns with [redacted] proposal
[redacted]	035	-	4.4.51 / p59	*"The Plaza provide above ground location for Metrolink provision."* See comments 020 and 021.	refer response to 020 & 021 Note also metrolink propoal for B1 here aligns with [redacted] proposal
[redacted]	036	-	4.5.2 / p61	"A point to note in developing the underground stations as a through station layout to satisfy the iTSS of trying to achieve the combined operation of one turnback service (HS2) and one through service (NPR) is that the full potential capability of the through layout is not realised." See comment 023.	Refer to response to comment 023.
[redacted]	037	-	5.1.2 / p63	Whilst the main differences between Manchester Piccadilly and Stratford are noted, further information should be drawn out in relation to the similarities - considering how challenges were managed / mitigated / overcome.	The similarities are outlined in 5.1.2, particularly the dimensions of the box. Detail has been added on how they dealt with groundwater, which was included in the presentations but not in the report.
[redacted]	038	-	5.1.3 / p64	*"The volume of excavation was only 0.75 Mm3, compared to 2.25 Mm3 for B1."* Also add in figures for options B and D.	Comparable figures for excavation for the examples given will be provided in the update where available.
[redacted]	039	-	5.1.7 / p67	Whilst the main differences between Manchester Piccadilly and Old Oak Common are noted, further information should be drawn out in relation to the similarities - considering how challenges were managed / mitigated / overcome. In addition, more detailed information and comparison should be included for Old Oak Common given the availability of information to HS2 Ltd and the natural tendency to draw comparisons between stations on the HS2 route.	Old Oak Common has not been built yet, so challenges have only been addressed in design and construction planning. Old Oak Common is more similar to Stratford International than to Manchester Piccadilly, in its setting on railway lands and by having a concourse at the surface.
[redacted]	040	-	6.1.2 / p72	*"...new station and viaducts and other structures in Ardwick."* See comment 027.	Request for a further study noted.

[redacted]	041	-	6.1.3 / p72	The Baseline option viaduct impacts have been ignored in the environmental appraisal – both the connection to the Manchester HS2 tunnel heading South towards Manchester Airport and the above ground NPR development as part of Option 0 to allow HS2 and NPR to operate a basic level of service. This is a significant issue which results in an unfair comparison between the Baseline option and the proposed underground options. This is not a true 'like-for-like' assessment. This option must consider the impacts of the full proposed route between the limits of Node MA and Node 3, with the full route infrastructure between these limits being assessed to ensure a fair 'like-for-like' comparison with the proposed underground options. Please confirm that all assessment criteria consider the impacts of Piccadilly to Node 3 for the Baseline option. Further to the above, in line with the assessment of the three underground route options, [redacted] do not consider it to be acceptable to suggest that the environmental impacts of vent shafts locations for tunnelled routes can be considered in any way comparable to the significant negative impacts associated with the proposed viaduct structures and surface running.	As above this is considered in the landscape and visual section of the environmental matrix and not considered a significant differentiaor between the options due to the nature of the existing area.
[redacted]	042	-	6.2.2 / p75	*"...the disruption of a number of public parks and green spaces."* See comment 016.	Noted
[redacted]	043	-	6.2.6 / p76	*"With regard to landscape and visual impacts, the removal of Gateway House will have a large impact upon the character of the station approach area causing disturbance during construction, and visual impacts for people accessing the station."* See comment 026. Additionally, this section needs to be clearer in terms of setting out positive and negative impacts of the removal of Gateway House separately.	Refer to environmental matrix for further details.
[redacted]	044	-	6.2.13 / p77	*"Within the CCB…"* See comment 022.	Noted
[redacted]	045	-	6.3.10 / p80	*"...disruption of a number of public parks and green space, alongside the proximity of residential properties and community resources."* See comment 016.	Noted
[redacted]	046	-	6.3.11 / p80	*"With regard to landscape and visual impacts, the removal of Gateway House will have a large impact upon the character of the station approach area causing disturbance during construction, and visual impacts for people accessing the station."* See comment 043.	See comment 043 response.
[redacted]	047	-	6.3.18 / p82	Presumably this should say "within the CCB"? Needs to be clarified. Also see comment 022.	Within the CCB is correct. Comment 022 Noted
[redacted]	048	-	6.4.11 / p85	*"...the loss of a number of public parks and green space, alongside the impacts on a number of educational facilities."* See comment 016.	Noted
[redacted]	049	-	Section 7	Check dates - various mix ups between "2020" and "2021".	Comment noted and Section reviewed for dates.
[redacted]	050	-	7.2.1 / p92	*"Decision Point 2 – Agree Preferred Underground Station (22 April 2021)"* See comment 010.	Response given in Comment 010.
[redacted]	051	-	7.2.5 / p92	*"HS2 Ltd advised TfGM that Integration of these new Metrolink station options could not be considered at this stage a this would impact the already constrained programme."* See comments 020 and 021.	Response given in Comments 020 and 021
[redacted]	052	-	7.3.9 / p94	*"Following discussion with HS2 Ltd, Decision Point 2 was deferred to allow MCC, TfGM and TfN more time to consider and advise HS2 Ltd. which option they preferred."* With respect to Decision Point 2 being deferred to allow MCC, TfGM, and TfN more time to consider and advise HS2 Ltd on a preferred option, it must be noted that this was as a direct result of the delays in the provision of information in line with the agreed programme and the presentation of information in a format that could facilitate a direct comparison between the shortlisted options.	Comment noted. This comment does not mention the months of design development consultation on Options B1 , B and D.
[redacted]	053	-	7.5.7 / p98	The conclusions presented within the draft sift report include the identification of considerable risks, opportunities, and uncertainty associated with a wide range of technical disciplines. As a direct result of this, the report identifies a number of specific requirements for further areas of work to be progressed, which would be needed to ensure there is a complete enough basis on which to inform a strategic decision of the level of national significance associated with the design of the Manchester Piccadilly High Speed station. Given the considerable risks, opportunities, and uncertainty identified within the sift report, there is a risk that significant improvements in outcomes associated with the underground options may never be captured if not considered as part of current sift. It is vital that these aspects are made very clear to inform the Ministerial decision. The final report should be clear in setting out the likely impacts on the assessment of these findings and how and when the recommended further work is to be progressed.	Noted. Further design development has not been instructed and any additional design development would be pending Decision Point 3 (Ministerial Decision).
[redacted]	054	-	8.1.16 / p101	*"...catalysing the regeneration of East Manchester."* See comment 027.	The text refers to East Manchester as in MCC Manchester Piccadilly SRF Area within the Ring Road and does not include area to the east of Ring Road as defined in MCC Manchester Piccadilly SRF March 2018. For further response please refer to comment 027
[redacted]	055	-	8.1.1 / p102	*"...all three options in this sift (B, B1 and D) are considered a major worsening compared to the Baseline."* [redacted] draw attention to two fundamental concerns relating to the environmental appraisal that has been carried out as part of the option sift to date. These concerns call into question whether the comparison between the Baseline option and the proposed underground options has been fair based on a true 'like-for-like' assessment. The environmental appraisal needs to be reassessed to account for these concerns. Tunnel vent shafts: Vent shaft locations and head house designs being specifically noted as an exclusion of the current study. The vent shaft locations identified for each option have been noted as indicative, and it is recognised that further work would be required to optimise both the route alignments and the resulting requirements for vent shaft locations. In line with the exclusion, the sift assessment should reflect the uncertainty around this aspect and the weighting applied within the assessment is disproportionate to the stage of design development. These elements would be revisited and optimised at a later stage of design development, which would include the potential for impact mitigation. Baseline option viaduct: The Baseline option viaduct impacts have been ignored in the environmental appraisal –	The report repeatedly states that the vent shaft locations are indicative, however we have to assess the indicative locations in order to provide a like for like comparison, as was required in the scope. The baseline impact of the viaduct from Ardwick has not been ignored, as referred to in the Environmental Matrix. It is however assessed to be of less significance than [redacted] believe it to be.
[redacted]	056	-	Table 4 / p104	See comment 110.	See response to comment 110.
[redacted]	057	-	8.1.13 / p105	*"Options B and B1 require closure of the Metrolink Ashton line for approximately 7 years or 9 years, respectively. Option D only requires closure for short periods when it is relocated."* For Options B and B1, [redacted] would not anticipate closing the Ashton Line for such lengthy periods and would expect operations to continue as close as possible to Manchester Piccadilly. It would be required to look at temporary mitigations for the continuation of through services, in the same way as considered under the hybrid Bill option design. For Option D, it should be assumed that the Metrolink Ashton line would remain operational throughout the period of construction.	The only way to keep Metrolink running while constructing the station box for B or B1 would be to construct a bridge over the box at roof slab level. Diversions of Metrolink do not seem possible. Metrolink would still need to be closed during later stages of Enabling Works, then during diaphragm wall installation, bearing piles/plunge columns installation and then the 'bridge' structure. This would likely take significantly longer than the closures in the hybrid Bill Design, which are 8 months of single line working and 23 months of full closure.
[redacted]	058	-	8.1.21 / p106	*"Commercial Development has been assessed based on potential development opportunities within the defined CCB…"* See comment 022.	Please see response to Comment 22.
[redacted]	059	-	9.1.8 and 9.1.9 / p106 and p107	This section is somewhat confusing. We know that further consideration is needed to look beyond the constraints of the current ITSS, but this feels like a scenario test which is overly constrained when considering the fuller potential of a through station. Also need to consider in line with comment 023.	The 'fuller potential' above what is noted in section 9.1.8 & 9.1.9 requires consideration of HS2 trains continuing to Leeds which is beyond the remits of the study.
[redacted]	060	-	9.1.27 / p114	See comments 020 and 021.	refer response to 020 & 021
[redacted]	061	-	9.1.33 / p116	*"The location of Baseline Station struggles to form a gateway experience into Manchester…"* See comment 026.	refer to comment 026
[redacted]	062	-	9.1.36 / p116	*"...the presence of viaduct and embankment along the approach of Baseline HS2 track alignment hinders pedestrian permeability and future flexibility to the surrounding development."* See comment 013.	Noted - additional text added to highlight the challenge
[redacted]	063	-	9.1.56 / p121	"Options B and B1 require closure of the Metrolink Ashton line for approximately 7 years or 9 years, respectively. Option D is comparable to the hBD station design, where the Metrolink is only closed for short periods." See comment 057. Further, [redacted] agree that, with the hybrid Bill option design, Metrolink would only require closure for short periods.	Paragraph text amended to: "Options B and B1 require closure of the Metrolink Ashton line for approximately 7 years or 9 years, respectively. Option D only requires closure for short periods to allow relocation of the tram stop to a new location. The hybrid Bill Design requires 8 months of single line running and 23 months of full closure." Refer 9.1.57

[redacted]	064	-	Figure 36 / p124	Where are rail operation impacts, notably reliability and resilience drawn out in the presentation of options within the main body of the report?	Assuming the comment refers to the category of "Operation Feasibility - Railway Operations" then in line with the sub headings of this section, the advantages are in the dwell time figures where the NPR services benefit from a 2min gain. This is noted in the report in section 9.1.6 & 9.1.7
[redacted]	065	-	Appendix B / PDF p145	*"The Consultant is to confirm the right number of platforms and length at the earliest opportunity in order to inform the sift."* This element of the agreed scope has not been reported within the draft sift report. The findings of this work need to be added in, and with further opportunity for partners to review. Also see comment 001 re: optimisation of design and comment 023 re: the ITSS.	Responses regarding stakeholder queries on the number of platforms are included within Appendix G.
[redacted]	066	-	Appendix B / Assumption Ref: 10	*"This is the capacity of 3no. trains per day from Ardwick rail sidings based on 600m3 per train."* What is the source of this assumption?	This comes from the hybrid Bill design, for which there was a detailed study of available train paths.
[redacted]	067	-	Appendix B / Assumption Ref: 24	*"The bearing and locations of the Station Footprints (B, B1 & D) is fixed."* Requirement for further work identified - see comment 001. Need to ensure that the uncertainty around this assumption is reflected in the scoring and recommendations.	This is a high level design appropriate for a sift level 2 route selection, further refinement can achieved if the option is taken forward tor development.
[redacted]	068	-	Appendix B / Assumption Ref: 31	*"The outer scissors are required during normal operation for access to the opposite outermost platforms."* Requirement for further work identified - see comment 001. Need to ensure that the uncertainty around this assumption is reflected in the scoring and recommendations.	This is a high level design appropriate for a sift level 2 route selection, further refinement can achieved if the option is taken forward tor development.
[redacted]	069	-	Appendix B / Assumption Ref: 47	*"Piccadilly Underground Station requires 6 platforms."* Requirement for further work identified - see comment 001. Also see comment 065. Need to ensure that the uncertainty around this assumption is reflected in the scoring and recommendations.	This is a high level design appropriate for a sift level 2 route selection, further refinement can achieved if the option is taken forward tor development. Also see response to comment 65
[redacted]	070	-	Appendix B / Assumption Ref: 51	*"The location and bearing of Node 3, provided in document P2B-HS2-EN-NOT-M005-000001, is not at the optimum location relative to the station footprints."* Requirement for further work identified - see comment 001. Need to ensure that the uncertainty around this assumption is reflected in the scoring and recommendations.	This is a high level design appropriate for a sift level 2 route selection, further refinement can achieved if the option is taken forward tor development.
[redacted]	071	-	Appendix B / Assumption Ref: 55	*"A connection to Sheffield from the Leeds bound (northern) section of the route has been excluded from this study."* See comments 017 and 027. Requirement for further work identified - see comment 001. Need to ensure that the uncertainty around this assumption is reflected in the scoring and recommendations.	This is a high level design appropriate for a sift level 2 route selection, further refinement can achieved if the option is taken forward tor development.
[redacted]	072	-	Appendix B / Assumption Ref: 76	*"Metrolink requirement has been safeguarded through space proofing at this stage of design. Detail design not developed at this stage. Space proofing assumptions has been based upon Baseline Option."* See comments 020 and 021.	See response to comments 20 and 21
[redacted]	073	-	Appendix C / SIFT matrix	[redacted] note that this section includes new and changed detailed information unseen prior to the draft sift report being shared with partners - adding to the significant challenge of reviewing within the programme timescales.	Noted - prior sight of work in progress was provided to help with the review of the final information
[redacted]	074	-	Appendix C / SIFT matrix	Strategic Fit - HS2 Strategic Goals The strategic fit elements of the current study are too narrowly focussed on the strategic goals and objectives of the HS2 programme and don't sufficiently capture the broader strategic reasons behind the case for an underground 'through' station at Manchester Piccadilly. This would likely prove to be a risk to any decision to discard underground options at this stage. Whilst it is acknowledged that a restrictive scope can be beneficial in terms facilitating the progress of technical elements of the study, it is essential that the work of this study is combined with a fit-for-purpose assessment of the broader strategic case – i.e. an assessment which is appropriate in terms of reflecting the significant strategic scale and importance of the infrastructure being considered – at a national level. This study alone is not sufficient to inform final decisions on the preferred way forward for the arrangement of the proposed High Speed station at Manchester Piccadilly. Specifically, it is also noted that a broader strategic fit assessment must also, as a minimum, consider the strategic goals and objectives of the NPR programme.	Disagree. The HS2 route development procedure does not view the wider stakeholder goals as HS2's strategic Goals, despite some alignment with our own. The scoping document , Appendix A, section 2.2.2-2.2.4 states that the strategic assessment will be against: •HS2 Ltd strategic goals and programme benefits; and •HS2 Ltd Phase 2b Project Requirements Specification, to ensure that options considered meet the expectation of the DfT. HS2 has however added additional text to help define this better
[redacted]	075	-	Appendix C / SIFT matrix	*Strategic Fit - HS2 Strategic Goals: 2. Capacity and connectivity* The assessment of all four options states *"the design delivers city centre connectivity i.e. Manchester to Birmingham and London.*" This does not capture the full range of HS2 objectives. 2.1 To deliver the required capacity, journey time, reliability and availability The current strategic fit assessment only considers city to city connectivity. Where is the assessment of the other elements, including reliability? 2.2 To integrate seamlessly with complementary transport modes The current strategic fit assessment does not capture integration with other transport modes. 2.3 To maximise benefits for the whole UK transport network The current strategic fit assessment does not capture the benefits for the whole UK transport network. This is a significant gap.	The options have been assessed against the seven HS2 strategic goals.
[redacted]	076	-	Appendix C / SIFT matrix	Strategic Fit - HS2 Strategic Goals: 3. Value for money The assessment of all four options states "the design provides opportunity for commercial development in accordance with the MCC SRF." This does not capture the full range of HS2 objectives. *3.1 To deliver the programme on time and on cost while achieving the expected benefits* The current strategic fit assessment only considers commercial development and is the same across all options. Programme impacts not considered here in line with the strategic objectives. *3.2 To deliver and operate a quality railway efficiently and to ensure commercial viability.* No assessment provided that considers delivery and operation focussing on a "quality efficient railway". In addition, any assessment of commercial viability needs to extend beyond the narrow focus of commercial development - including the commercial viability of rail services. *3.3 To actively seek innovative opportunities to achieve new standards and practices in order to increase whole life value.* No assessment provided that considers innovative opportunities or whole life value.	The options have been assessed against the seven HS2 strategic goals.
[redacted]	077	-	Appendix C / SIFT matrix	*Strategic Fit - HS2 Strategic Goals: 7. Sustainability and good neighbour* This assessment is framed only as a positive aspect based on varying 'opportunities' across the options. The underground options appear to score negatively compared to the Baseline due to being less intrusive on the surface. This assessment feels skewed and somewhat counter-intuitive in some aspects.	Noted
[redacted]	078	-	Appendix C / SIFT matrix	*Strategic Fit - HS2 Strategic Goals* *"The small differences are not a differentiator at a strategic level of consideration."* Need to reconsider following consideration of the comments on the Strategic Fit assessment.	Noted
[redacted]	079	-	Appendix C / SIFT matrix	*Strategic Fit - HS2 Strategic Goals* *"The Indicative Train Service Specification (ITSS) for HS2 Phase 2b hB can be achieved with the design and does not preclude Northern Powerhouse Rail."* See comment 023.	See response to comment 023
[redacted]	080	-	Appendix C / SIFT matrix	*Strategic Fit - HS2 Strategic Goals* *"The Indicative Train Service Specification (ITSS) for HS2 Phase 2b hB can be achieved with the design and does not preclude Northern Powerhouse Rail."* No consideration of operational flexibility and future-proofing potential that would be brought about by the underground options - linked to comment 023.	See response to comment 024
[redacted]	081	-	Appendix C / SIFT matrix	Strategic Fit - Urban Design "Urban integration has been developed against this option through the consultation with Stakeholders." The assessment criteria sets out that an assessment should be provided. No assessment or associated scoring of options has been provided.	The assessment is based upon the design produced to support the work.
[redacted]	082	-	Appendix C / SIFT matrix	*Strategic Fit - Urban Design: HS2 Design vision principles* Strong case for all underground options to be scored major improvements compared to the Baseline option. All present clear potential for improvement, but with differences between the underground options.	All have been assessed as improvements against the baseline with option B1 a major improvement.
[redacted]	083	-	Appendix C / SIFT matrix	*Strategic Fit - Urban Design: HS2 Design vision principles - Place* Need to draw out that the underground options offer much greater opportunities for development in and around the station location. Currently not differentiated against the Baseline option.	All have been assessed as improvements against the baseline with option B1 a major improvement.
[redacted]	084	-	Appendix C / SIFT matrix	*Strategic Fit - Urban Design: HS2 Design vision principles - Time* Baseline option assessment focuses on the programme, whereas the underground options focus on interchange time for passengers. This assessment is inconsistent.	Noted and amended

[redacted]	085	-	Appendix C / SIFT matrix	*Construction Feasibility - Route: Assess the route alignment changes, i.e. formation of route and length of route.* Underground options have not been scored. Also see comment 013 (re: viaduct / surface formations to the North). This needs to be reassessed - including the assessment / scoring of the three underground options.	It was a deliberate decision not to score this. The length of the route, or the proportion that is within tunnel, in and of itself has very little impact on construction feasibility and so has not been scored.
[redacted]	086	-	Appendix C / SIFT matrix	*Construction Feasibility - Route: Assess the relative disruption of route to existing infrastructure.* Baseline option: *"All route in tunnel except for short section up to station from the North portal."* This is not true. Also see comment 013 (re: viaduct / surface formations to the North). This needs to be reassessed - including the assessment / scoring of the three underground options.	The 'station' includes the approach junctions and outer scissors crossover up to the portal shafts for the underground options. Therefore, to ensure a fair comparison, for the baseline the impact of the approach viaducts is included in the 'station' section, not in the 'route' section.
[redacted]	087	-	Appendix C / SIFT matrix	*Construction Feasibility - Route: Assess the relative disruption to existing Metrolink infrastructure.* See comment 057.	The assessment was done based on the baseline and underground options as described.
[redacted]	088	-	Appendix C / SIFT matrix	*Operation Feasibility - Railway Operations: Assess the relative flexibility and reliability of the track layout* Fundamentally, the track layouts associated with the underground station options must be considered to provide greater flexibility and reliability compared to the Baseline option. In considering the nature of these aspects, the assessments should not be constrained by the fixed ITSS. We know that there is uncertainty around the ITSS (the indicative nature of it and near-certain likelihood to change in the future) which poses a considerable risk to the restricted scope of the study. How is this risk captured? How can it be addressed going forwards? Despite the study scope, in considering flexibility and reliability for any infrastructure scheme, it is not sensible to assume that only the initial fixed ITSS would need to be accommodated over such a long scheme life. Also see comment 023.	See response to comment 023
[redacted]	089	-	Appendix C / SIFT matrix	*Operation Feasibility - Railway Operations: Assess the relative futureproofing capability of the track layout* Fundamentally, the track layouts associated with the underground station options must be considered to provide greater future-proofing compared to the Baseline option. In considering the nature of these aspects, the assessments should not be constrained by the fixed ITSS. We know that there is uncertainty around the ITSS (the indicative nature of it and near-certain likelihood to change in the future) which poses a considerable risk to the restricted scope of the study. How is this risk captured? How can it be addressed going forwards? Despite the study scope, in considering future-proofing for any infrastructure scheme, it is not sensible to assume that only the initial fixed ITSS would need to be accommodated over such a long scheme life. Also see comment 023.	See response to comment 023
[redacted]	090	-	Appendix C / SIFT matrix	*Operational Feasibility - Station for passenger & place: Assess Passenger Dispersal covering road (right of way), rail and public transport* Should reflect the significant passenger dispersal issues caused by the retention of Gateway House in the Baseline option.	Refer strategic fit Urban design
[redacted]	091	-	Appendix C / SIFT matrix	*Operational Feasibility - Station for passenger & place: Assess Passenger Dispersal covering road (right of way), rail and public transport* Should reflect the passenger dispersal benefits caused by the removal of Gateway House in the underground options. Scoring to be reconsidered following this.	Refer Strategic fit Urban design
[redacted]	092	-	Appendix C / SIFT matrix	*Operational Feasibility - Station for passenger & place: Assess Passenger Dispersal covering road (right of way), rail and public transport* Metrolink interaction should be removed from the assessment of underground options as the designs have not yet been completed to enable a fair assessment.	They have been completed to a high level sufficient for sift level 2. Refer also response to comment 020
[redacted]	093	-	Appendix C / SIFT matrix	*Operational Feasibility - Station for passenger & place: Assess the relative 'Way Finding' of station layouts i.e. logical flow* Scoring of the underground options is overly negative. The assessment shows a mixed picture of positive and negative aspects, but not sufficient to land at an overall negative impact for underground options.	Noted Key differentiator is Horizontal space is more legible in Baseline compared to Vertical change in level required in underground station
[redacted]	094	-	Appendix C / SIFT matrix	*Operational Feasibility - Station for passenger & place: Assess the relative security or perception of security of station layouts* Underground options being more controllable is stated as a positive, but not considered a differentiator, and also scored as a negative. This is very much mixed up. This is an aspect of significant importance and should be scored as a positive across all underground options (especially noting the negative scores arrived at for emergency evacuation earlier on in the assessment - need to ensure fairness in the assessment).	Noted
[redacted]	095	-	Appendix C / SIFT matrix	*Environment* A summary is still missing from this assessment - making comparison between options very difficult. References to separate assessment is not an acceptable approach - it is entirely possible to provide a summary within the summary sift matrix.	An overall summary table is provided on the page prior to the detailed sift appraisal matrix.
[redacted]	096	-	Appendix C / SIFT matrix	*Environment* See comment 041.	See response to comment 041
[redacted]	097	-	Appendix C / SIFT matrix	Stakeholders "A sub surf ace station is the preference from the Stakeholders to provide greater opportunities and improved integration." From a stakeholder perspective, a sub-surface station would provide significantly greater opportunities and significantly improved integration compared to the Baseline option and should be scored as major improvements across all underground options.	Noted
[redacted]	098	-	Appendix C / SIFT matrix	*Stakeholders* *"...the overall quantum is higher than Hybrid Bill Design, resulting in a minor improvement."* The overall quantum estimates are significantly higher than the Baseline option and should be scored as major improvements across all underground options.	Noted
[redacted]	099	-	Appendix C / SIFT matrix	*Commercial Development* See comment 022. This needs to be reassessed - including the assessment / scoring of the three underground options.	See response to comment 22
[redacted]	100	-	Appendix C / SIFT matrix	*Demand* Incorrect journey time information presented within the assessments for each of the underground options - needs to be corrected.	Sift matrix to be corrected
[redacted]	101	-	Appendix C / SIFT matrix	*Demand* Need to set out and justify the thresholds for the assessments landing at 'minor worsening' for a journey time increase of 15 seconds.	15 seconds either considered as minor or neutral and by the same measure, if changed to neutral then the minor improvements would also be categorised as neutral ultimately resulting in all journey times for B & B1 as having no difference (other than through NPR trains).
[redacted]	102	-	Appendix C / SIFT matrix	*Cost* Information presented is incomplete - needs to be completed and subsequently reassessed across all options. Stakeholders will need to review a complete version.	Completed and added to the matrix
[redacted]	103	-	Appendix C / SIFT matrix	*Schedule & Delivery into Service* This reflects the programme as already assessed within the earlier construction programme sections. Need to ensure that impacts are not being double-counted in the overall assessment. Need to note within this summary sift matrix where double-counting is a risk.	The assessment has been made in accordance with HS2 procedures.
[redacted]	104	-	Appendix C / Environmental appraisal	[redacted] note that this is new presentation of a substantial amount of detailed technical information unseen prior to the draft sift report being shared with partners - adding to the significant challenge of reviewing within the programme timescales.	Noted
[redacted]	105	-	Appendix C / Environmental appraisal	*Route* See comment 016.	Noted
[redacted]	106	-	Appendix C / Environmental appraisal	*Route* See comment 041.	See above, this is addressed in the landscape and visual section of the sift matrix
[redacted]	107	-	Appendix E Section 1.1 / PDF p231	*"This would need to be confirmed via a combined HS2/NPR operations and timetabling requirements (in principle) Statement which would take account of TSS and future proofing requirements."* See comment 001.	See response to comment 001
[redacted]	108	-	Appendix E Section 1.1 / PDF p233	*"It is noted that any further development work is unlikely to change the overall sift assessment against the Baseline."* At this stage, it is premature to draw this conclusion given the identified requirements for further detailed development work across a wide range of disciplines, which could have a significant bearing on the overall study conclusions. Also see comment 001.	See response to comment 001
[redacted]	109	-	Appendix E Section 1.1 / PDF p245	*"Providing six platforms enables the iTSS to function reliably with both services, but there are limitations on realising further capacity because of this dual function."* See comments 023 and 065.	See response to comments 23 and 65

[redacted]	110	-	Appendix F	With regards to the programme, we note the operational date for HS2 Phase 2b services under the Baseline surface station option as being 2036. However, [redacted] question the programme timescales associated with the underground options. Clearly it is expected that the programme would be longer for underground options, but it is not understood why, for example, Option B and Option D show a duration of four years for hybrid Bill development whereas Option B1 shows a duration of two years for the same activity. The conclusions presented within the draft sift report, and also drawing on associated input from partners, include the identification of considerable risks, opportunities, and uncertainty associated with a wide range of technical disciplines. As a direct result of this, the report identifies a number of specific requirements for further areas of work to be progressed, which would be needed to ensure there is a complete enough basis on which to inform any final decision the design of the Manchester Piccadilly High Speed station. These areas of further work can be expected to result in material changes to the design of the underground station options that are being assessed, and that changes to cost and programme estimates will require further assessment.	Given the considerable deliverability risks generated by the extent of mined construction in Options B and D, particularly large diameter caverns in close proximity at the station throats, it is expected that intrusive ground investigation and analysis would be required to confirm the viability of the Option B and D proposals prior to full development for hybrid Bill. Executing the GI will require the GI to be scoped, procured, access arrangement agreed, executed and reported/interpreted. The GI may lead to the need for a deeper station and or longer and wider mined station throats and hence it is key that this information is obtained prior to HS2 developing a hybrid Bill which needs to provide a conservative envelope that will allow the scheme to be constructed with a high level of confidence. It is estimated that this process of investigation and analysis could take an additional two years to the level of investigation required for Option B1. The costs and programme have been developed based on the design options that have been produced. HS2 are confident that the cost and programme are robust for the level of review. It is agreed that if the design were to change, the cost and programme would need to be reassessed.
[redacted]	111	-	Appendix F / Programme	New and changed information provided to stakeholders within this section of the document for the first time. Additional time required for review.	It is accepted that this information had not been previously shared in this format prior to completion of the draft report. Previous verbal comments had sought further detail on the construction programme so it was included to provide further detail in response.
[redacted]	112	-	Appendix F	In terms of the cost information presented, it is important for partners that HS2 Ltd clarify exactly what is included within the costs for the Baseline option, including the assumptions that have been made regarding construction between Manchester Piccadilly and Node 3. The conclusions presented within the draft sift report, and also drawing on associated input from partners, include the identification of considerable risks, opportunities, and uncertainty associated with a wide range of technical disciplines. As a direct result of this, the report identifies a number of specific requirements for further areas of work to be progressed, which would be needed to ensure there is a complete enough basis on which to inform any final decision the design of the Manchester Piccadilly High Speed station. These areas of further work can be expected to result in material changes to the design of the underground station options that are being assessed, and that changes to cost and programme estimates will require further assessment. Further to the above, to help in the definition of requirements for further areas of work, it would be helpful to have detailed breakdowns of the cost estimates provided to help determine the scope and scale of opportunities to be assessed.	The costs and programme have been developed based on the design options that have been produced. It is agreed that if the design were to change, the cost and programme would need to be reassessed.
[redacted]	113	-	Appendix F / Costs	New and changed information provided to stakeholders within this section of the document for the first time. Additional time required for review.	These figures are consistent with those presented to the Piccadilly Board on 19/05/21, except for the inclusion of Land & Property costs which were not available at that point in time.
[redacted]	114	-	General	Can HS2 confirm that all detailed route alignment plans across all options have been shared with local partners?	All design information pertaining to this study has been shared with MCC, TfN and TfGM.
[redacted]	115	-	General	Across a number of important pieces of information provided to partners, much of the information is either too detailed to effectively review and sift, or too high-level to be of use in considering material differences between the options presented. Specifically related to this point, can HS2 Ltd confirm that all the detailed alignment plans, across the full range of options presented, have been shared with local partners.	All design information pertaining to this study has been shared with MCC, TfN and TfGM.

Record of Review

Document	**Manchester Piccadilly High Speed Station, Design of an Alternative Underground Station, Options Assessment - Sift Level 2 Appraisal (Document No. 2DE01-MWJ-EN-REP-M003-**
Document Date	**04/03/2021**
Source	[redacted]
Revision	**P02**
Date of Review	**01/06/2021**

These are initial comments based on the presentation and do not necessarily provide an exhaustive list. [redacted] reserve the right to raise further comments.

Reviewer	Comment Ref No.	Subject	Section number	Comment	Response
[redacted]	001	Executive Summary/Scope of Study	1	The Executive Summary concludes that the surface station proposal should be retained for the Phase 2b Western Leg hybrid Bill design on the basis of 'cost, construction safety and programme implications to the Delivery-into-service date of HS2 to Manchester'. It is also stated that 'Further detailed development of the options, based on the agreed scope and requirements of this study, is unlikely to significantly change the overall assessment and comparative difference between a Surface and Underground High Speed station at Manchester Piccadilly, particularly in respect to cost and programme.' In [redacted] opinion, these conclusions are driven to a large extent by a number of decisions and assumptions that led to the arrangement of the platforms and tracks for the underground station options being the same as, or similar to, the surface station. The scope of the study was required to enable a 'like-for-like' comparison to be made between the surface and underground station options. It is noted that the agreed scope states that 'The starting point for the design is the indicative Train Service Specification (iTSS) in Annex B, which is the same as that used for the CP3 hybrid Bill design (with HS2 services operating first and then NPR ones). This will allow a consistent comparison between underground and surface station options. The TSS will determine the number and length of platforms required. The Consultant is to confirm the right number of platforms and length at the earliest opportunity in order to inform the sift.' It is [redacted] view that the work presented to date does not adequately demonstrate that a 6-platform underground station is required, and there may be an opportunity to reduce the number of platforms from six. We note that the report states (in an appendix) that there are some assumptions for which, if a different approach was taken, significant improvements could be made to the underground station options. In [redacted] view there are a number of opportunities that could and should be taken to reduce the number of underground platforms required and thereby narrow the underground station boxes, shorten the approach throats, reduce the size of the caverns, reduce the depth of the station boxes, reduce the excavation required, reduce the construction programme, reduce disruption during construction and reduce the cost. A key issue associated with the underground station options is HS2 Ltd's proposal to design them on the basis that, if one of the two tunnelled approach routes is blocked, a full service can be operated on the tunnelled route that is not obstructed with all the trains turning back at the underground station. In [redacted] opinion this approach is not justifiable. In the event of one of the tunnels being blocked, a reduced service should be run to Piccadilly on the un-blocked approach and facilities should be provided elsewhere on the HS2 network to accommodate this reduction in service (rather than providing infrastructure to accommodate disruption underground within Manchester at large cost and impact). This is clearly a key review comment that needs to be discussed and resolved as a matter of urgency and prior to the report being finalised and issued to the DfT. In [redacted] opinion, the report should, as a minimum, include a prominent section that highlights the key areas where there are opportunities to improve the underground station proposals (clearly there is a need for some discussion between	As noted by Stakeholder in paragraph 2 of the comment - the response to opportunities identified by stakeholders in Appendix E in section 1.10 provides a rationale as to the requirements for a 6-platform station for operational requirments to meet the ITSS and confirms the Ministers ask and Richard George reccomendations to undertake the like-for-like comparison of a 6-platform surface station with a 6-platform Underground station Concerning the key issue raised on disruption and pertubation, the performance requirements of the HS2 network is a key Sponsors Requirement set by Government. The suggestion for a new section of the report is noted by HS2 Ltd and concerns stated by stakeholders here should be discussed with DfT due to the request for additional assessments being beyond the scope of the study
[redacted]	002	General comment on figures	N/A	The image quality for many of the figures is such that the information is illegible (e.g. Figure 21). We reserve comments on these elements of the draft sift report until a legible version is provided.	Noted
[redacted]	003	Scope of study	2.2.0	It is stated that the DfT requested HS2 Ltd to develop the design for an optimised alternative 6-platform combined underground station for HS2 and NPR. However, the scope of the study agreed with the GM Partners (as detailed in Appendix B of the Sift Level 2 Criteria Note included in Appendix A) was based on the underground station being able to accommodate the indicative Train Service Specification (TSS) from which the number and length of underground platforms would be determined: the consultant was required to 'confirm the right number of platforms and length at the earliest opportunity in order to inform the sift.' See Comment 001 above.	As noted by Stakeholder in paragraph 2 of Comment 001 - the response to opportunities identified by stakeholders in Appendix E in section 1.10 provides a rationale as to the requirements for a 6-platform station for operational requirments to meet the ITSS and confirms the Ministers ask and Richard George reccomendations to undertake the like-for-like comparison of a 6-platform surface station with a 6-platform Underground station
[redacted]	004	Layout of Tracks at Approaches to Underground Station Options	3.3.2	Table 1 includes the assumption that the track layout at both station approaches is identical at both ends. [redacted] understands that the layout of the tracks at each of the underground station approaches have been designed to enable all platforms to be used to turn back services from either direction and to accommodate parallel moves. In [redacted] opinion this functionality cannot be justified and is one of the factors leading to the underground station options being over-designed (see Comment 001 above).	The throats have been space proofed to meet HS2 standards appropriate for a level 2 high level sift.
[redacted]	005	Metrolink Safeguarding	3.3.3	Reference is made to Metrolink being safeguarded through space proofing. However, [redacted] and HS2 Ltd failed to agree on Metrolink proposals for all of the underground station options and therefore [redacted] disagrees with the statement that Metrolink has been safeguarded at this stage.	Noted
[redacted]	006	Number of Platforms	3.4.0	Reference made to six platforms being a design parameter. [redacted] position is that the number of platforms needed was to be determined by the study (see Comment 001 above).	A reduction in platforms was considered and concluded that it would impact a resilient HS2 operation.
[redacted]	007	Number of Spaces for Parking, Taxis etc.	3.4.0	Please note that the [redacted] have some concerns regarding the number of spaces being allowed for parking, taxis (etc.) in the hybrid Bill design and duplicated here. This needs to be resolved during further design development.	Noted - however spaces have been duplicated to provide a fair comparison
[redacted]	008	Metrolink Platform Dimensions	3.4.0	There is a clear requirement for further work to assess and optimise Metrolink design integration in alignment with the range of underground station options presented.	Noted
[redacted]	009	Metrolink	3.4.1	It is stated that Metrolink proposals were developed for Alignments B1 and D with [redacted] designers during workshops and that Alignment B incorporates the existing Metrolink arrangement. At the Management Meeting held on 29/03/2021, it was agreed that Metrolink wouldn't be considered in the assessment of any of the underground options as an agreed arrangement for Alignment B hadn't been developed and only considering Metrolink proposals for B1 and D could skew the assessment. This needs to be made clear in the report.	Metrolink options have been included in the sift It was not agreed to omit all the Metrolink optiond from the sift. The sift report highlight that option B provision as existing is not [redacted] preferred option. Additionally it was discussed that Metrolink would not be used a a deciding differenciator. The Sift outcome is deterimed from a number of criteria including Metrolink however Metrolink has not been used as the differenciator to determine outcome. Refer also minutes of management mtg and follow up email [redacted] 06/04/21
[redacted]	010	Assessment of Regeneration Opportunities	3.4.5	It is stated that, for the purpose of sifting, only the Gross External Area (GEA) quantum within the Consolidated Construction Boundary (CCB) has being assessed. In order to undertake a meaningful comparison between the regeneration opportunities associated with each of the underground options and the surface station, presumably the same overall area needs to be considered for each option with its extent encompassing the CCBs of all the station options (above and below ground). In this way, the benefit gained by the underground options that do not obstruct development (such as in the Ardwick area, where the viaduct and retained cutting that lead to surface station take land that could otherwise be developed) will be captured. Please clarify whether or not this is the approach that has been taken.	HS2 Ltd cannot provide a robust view on development opportunities outside the proposed construction boundary. Land within the construction boundary and not subsequently required for the operational railway, would be subject to acquisition by the Secretary of State and would potentially be available to be returned to its original owner for development after construction assuming the land has not materially changed. This has been quantified as part of the study. However, no view can be provided on development opportunities beyond the construction boundary, as these would be subject to wider market forces. If further work on wider benefits and commercial development opportunities is to be carried out, this should be done by an organisation other than HS2 Ltd.
[redacted]	011	Alignment Design	3.4.7	Reference is made to symmetrical station throats being conservatively assumed at this stage for the underground station. We would expect the arrangement of the throats to be driven by the iTSS and platform arrangement.	Noted
[redacted]	012	Basis of Design for Sift	3.4.10	A number of criteria are identified as being adopted to enable a 'like-for-like' comparison to be made between the surface station and the underground station options and these were apparently the 'starting point' (see 3.4.0). These include the following: - Provision of six platforms. - HS2 trains being able to arrive at and depart from all platforms. It is [redacted] position that the study was required to determine the number of platforms required for the underground station options rather than simply duplicating the above-ground provision (see Comment 001 above). Within the scope (not just [redacted]	See response to comment 006
[redacted]	013	Rock head level	3.4.18	Reference is made to the rock head level being taken as the average. However, it is stated in Section 3.3.2 that no ground investigation has been undertaken. Please clarify the source of the rock head levels from which the average value was determined. In addition, please provide details of the variation in rock head level in the area of the proposed underground stations and approach tracks. Is the use of an average level appropriate (i.e. is there a significant variation)?	Rockhead levels were estimated based on historic site investigation. The variation was described in the SIFT Information pack in the geotechnical section.
[redacted]	014	Piccadilly Central	4.1.34	It is stated that passive provision is being made for Piccadilly Central Tram Stop. This approach is not accepted by [redacted] on the basis that this stop is needed from opening of the new Metrolink infrastructure as Piccadilly so it can act as the replacement for the existing Sheffield Street Turnback, which is lost as a result of the proposed works. A turnback is needed to enable some services to terminate at Piccadilly. HS2 Ltd has suggested that the track spur leading the Piccadilly Central Tram Stop could be used to turn back trams, rather than the stop. This approach is not accepted by [redacted] on the basis that the proposed track alignment in this area includes longitudinal gradients that would not be suitable for a turnback and, if the tracks were constructed at a lower level to remove the gradient, it would not be possible to raise the tracks in the future without disrupting Metrolink services.	The tram stop referred to as Piccadilly Central was incorporated into the design as a provision of space (passive provision) in response to the stakeholder's intension to expand the tram network along Ashton Old road. The construction sequence is based on the principles (as per the IPD design) of: • Metrolink can operate on single track running between Piccadilly and New Islington for a period; • Metrolink can operate without a connection between Piccadilly and New Islington for a period (whilst new box section is constructed underneath existing track); and • Metrolink require an operational turnback area outside of the station footprint whilst track is closed to New Islington.
[redacted]	015	Access to Piccadilly Central Tram Stop	4.1.35	Reference is made to vertical circulation being provided to the east of Piccadilly Central tram stop in the baseline design. [redacted] understanding is that vertical circulation elements are only proposed at the west end of this tram stop. Please clarify.	Text amended
[redacted]	016	Smoke extraction from Metrolink stops	4.1.36	Reference is made to the need for smoke extraction from the Metrolink stops. Only Piccadilly Tram Stop requires smoke extraction. Piccadilly Central Tram Stop is positioned in the open.	reference added regarding Piccadilly tram stop
[redacted]	017	Option B - Station Dimensions	4.2.6	It is noted that, if an underground station with a reduced number of platforms is proposed (see Comment 001 above), the width of the station box would be reduced significantly. There may also be an opportunity to reduce the size of the approach fan caverns, which would presumably enable the depth of the station to be reduced.	refer response to 001. Note depth of station is determined by depth of cavern aproach among orther constraints. Reduction in platforms may not necessarily change cavern design hence depth
[redacted]	018	Option B - Station Throat	4.2.11	It is stated that two outer scissors crossovers are required to enable trains to cross lines and that the facility for trains to cross lines is a functional requirement. Please refer to Comment 001 above.	refer response to 001 above
[redacted]	019	Option B - Number of Platforms	4.2.24	Reference is made to six tracks/platforms. Please refer to Comment 001 above.	refer response to 001 above
[redacted]	020	Option B - Metrolink	4.2.32 and 4.2.44 to 4.2.46	Reference is made to Metrolink being retained in its current position. There is a need for new Metrolink infrastructure to be provided, in part due to additional passenger demand associated with HS2 and NPR. It would be [redacted] position that, should this option be developed further, proposals should be developed for the modified Metrolink infrastructure. [redacted] preference is for this to include a sub-surface tram stop, as discussed at the Management Meeting held on 29/03/2021.	Additional notes added to 3.4.2 and crossreference added here.
[redacted]	021	Option B1 - Length of Station Throat	4.3.6	It is noted that, if an underground station with a reduced number of platforms is proposed (see Comment 001 above), there should be an opportunity to shorten the station throats.	refer response to 001 above
[redacted]	022	Option B1 - Number of Platforms	4.3.28	Reference is made to six tracks/platforms. Please refer to Comment 001 above.	refer response to 001 above
[redacted]	023	Option B1 - Connection Between HS2 and NR Stations	4.3.35	[redacted] preference is for a covered connection (potentially an underground link) to be provided between the HS2 and NR stations for pedestrians, as discussed during previous meetings.	refer figure 12 which outlines covered connection between hs2 underground concourse to NR Station
[redacted]	024	Option B1 - Metrolink	4.3.51 to 4.3.53	At the Management Meeting held on 29/03/2021, it was agreed that Metrolink wouldn't be considered in the assessment of any of the underground options as an agreed arrangement for Alignment B hadn't been developed and only considering Metrolink proposals for B1 and D could skew the assessment.	Refer response to 020 [redacted] contributor 1 and 009 above

[redacted]	025	Option D - Number of Platforms	4.4.9	Reference is made to six tracks/platforms. Please refer to Comment 001 above.	refer response to 001 above
[redacted]	026	Option D - Track Level	4.4.12	If an arrangement with a reduced number of platforms is proposed, would simplifications to the approach tracks enable smaller caverns to be proposed, thereby enabling the track level to be raised?	refer response to 017
[redacted]	027	Option D - Number of Platforms	4.4.31	Reference is made to six tracks/platforms. Please refer to Comment 001 above.	refer response to 001 above
[redacted]	028	Option D - Metrolink	4.4.43 and 4.4.56 to 4.4.58	At the Management Meeting held on 29/03/2021, it was agreed that Metrolink wouldn't be considered in the assessment of any of the underground options until an arrangement for Metrolink proposals for each option has been agreed.	Refer response to 020 [redacted] contributor 1 and 009 above
[redacted]	029	Rail Systems	4.5.1	For clarity on the important issue of railway operations assumptions and proposals associated with the underground station, please include details of the following within this report: - Details of the timetable flexibility and capacity requirements that have been applied. - Details of the assumptions regarding junction margins, minimum turnback times (etc.) that have been used in the assessment. - Details of the platform occupation and timings used for non HS2 services. - Confirmation of which version of the ITSS has been used for comparison purposes and if this includes growth paths etc. - It is claimed that two platforms are required for turning back Euston services whose constraints are fixed at Euston. Please clarify if this includes the Euston growth path.	The basis of the analysis in this study is previous capacity analysis work undertaken for the surface station. This largely concluded that the ITSS considered for NPR (And the basis of the Underground station study) could be accommodated on either the surface or underground stations. In either case, the overall constraint is blending of NPR services with HS2 service patterns on the spur via Manchester Airport, not Manchester Piccadilly itself. This has taken Euston to be the starting point of timetable development, determining HS2 paths on the Manchester Spur, and then NPR service patterns overlaid on top of this. All turnback times are as per HS2 standards (i.e. at least 20 minutes for Euston services). NPR reversals in the surface station are assumed to be feasible in 5 minutes. On the underground station, through dwell times are assumed to be 3 minutes. Platform-end margins/re-occupations on the surface station are assumed to be 3,4 or 5 minutes depending on platform (As per CP3 Headway & Technical Capability Report). On the Underground station, 4 minute platform re-occupations are assumed. On all layouts, 3 minute planning headways are assumed between consecutive trains. The ITSS used for the basis of this study is: •3tph Euston-Manchester (HS2) •2tph Curzon Street-Manchester-Leeds-beyond •4tph Liverpool-Manchester-Leeds-beyond
[redacted]	030	Environmental Appraisal - Option B	6.2.6	Reference is made to the removal of Gateway House having a large impact upon the character of the station approach and having visual impacts for people accessing the station. Please note that removal of Gateway House is viewed by [redacted] as being a benefit and an improvement on the hybrid Bill design as it enables an appropriate gateway into the new station from the city centre to be provided.	Noted
[redacted]	031	Environmental Appraisal - Option B	6.2.8	It is understood that the proposed vent shaft locations are indicative. Is there not scope to relocate the Barlow Tip tunnel vent to avoid the organic waste?	Yes subject to a more detailed investigation and specific sift
[redacted]	032	Environmental Appraisal - Option B	6.2.11	This paragraph appears to be stating that, as the Option B CCB is smaller than that of the Baseline, there would be less opportunity to develop the land that would be cleared within the CCB. If so, surely this is not a significant issue: there would still be potential to redevelop the areas that fall within the Baseline CCB, but are outside the Option B CCB and this could potentially be implemented in advance of HS2. It is also noted that the Baseline works include significantly more above-ground infrastructure that obstructs future re-development. Has this been considered in the socio-economic assessment?	The assessment has been carried out in accordance with HS2 standards.
[redacted]	033	Environmental Appraisal - Option B	6.2.13	Please confirm if the GEA for Option B is less than that for the Baseline because the CCB for the Baseline is significantly larger? Reference is made to there being a major socio-economic worsening compared to the baseline option **during construction**. However, in the long term, surely Option B, which provides significantly less above-ground infrastructure than the Baseline, would result in a significant improvement over the Baseline.	The socio-economic section in the environmental matrix within Appendix C covers these matters and has been assessed.
[redacted]	034	Environmental Appraisal - Option B1	6.3.8	In the long-term, presumably the additional job losses associated with Option B1 during construction are offset by the potential for Option B1 to enable significantly more new jobs to be created than the Baseline as Option B1 has less above-ground infrastructure that would obstruct development. Please confirm whether or not this is correct.	The socio-economic section in the environmental matrix within Appendix C covers these matters and has been assessed.
[redacted]	035	Environmental Appraisal - Option B2	6.3.11	See previous comment on paragraph 6.2.6.	Noted
[redacted]	036	Environmental Appraisal - Option B3	6.3.12	The baseline proposal obstructs external views to the Grade II listed train shed from the north. Has that been taken into account? How have the various effects been compared and ranked?	Impacts to the listed train shed have been considered by the heritage team, and are addressed within the envirionmental matrix.
[redacted]	037	Environmental Appraisal - Option D	6.4.1	This paragraph states that the Option D tunnels are significantly shorter than the baseline and will therefore result in significantly less material being excavated in comparison to the baseline, but then notes that the alignment is indicative and that it is expected that the waste generated by the vent shafts would be similar. Whilst waste generated from the vent shafts may be similar (assuming the shorter tunnel length does not enable the number of shafts to be reduced); the waste generated from the tunnel should be significantly less than for the baseline. Has this been assessed as an improvement?	"Yes, as the track length is approx. 3km shorter than the baseline this will result in significantly less material being excavated when compared to the baseline. However, this is not currently quantified. Furthermore, the proposed D route option passes through a site that is considered a Mineral Safeguarding Area."
[redacted]	038	Carbon Impacts - Option D	6.4.2	Have the savings in concrete tunnel linings and reduction in tunnel excavation (associated with the shorter approach tunnels for Option B in comparison with the Baseline) been taken into account?	Final construction material arisings have not been thoroughly calculated, so estimations of waste and materials were created from tunnel lengths and CCB sizes.
[redacted]	039	Socio-Economic Impact - Option D	6.4.5	This paragraph appears to be stating that the Baseline is preferable in terms of commercial development opportunities. This is presumably because the Option D CCB is considerably smaller than that of the Baseline and the assessment only considers the area within the CCB. If so, this is misleading and not a fair comparison as, if Option D is chosen, the significantly sized area occupied by the Baseline station and approach viaduct and cutting would be available for development, albeit not directly associated with the station works. Assuming this is correct, the report needs to make this failing of the assessment method clear.	"On the basis that the CCB is correct then our assessment is correct. The greater the demolition required the worse socio-ec scores during construction. But a larger CCB has the potential to generate more sites suitable for development and therefore could score higher for socio-ec during operation. The CCB as per the hBD assumptions and, therefore the m2 shown on the drawings is a realistic CCB and a fair comparision in the sift. The last part of their comment can be rebutted with the landscape section of the sift."
[redacted]	040	Historic Environment - Option D	6.4.6	Crusader Works is positioned at a relatively large distance from the Option D works. Please clarify how Option D affects the setting of this existing building.	Please refer to the CCB outline within the report which shows the CCB reaching said building.
[redacted]	041	Metrolink	8.1.10 (Page 100)	At the Management Meeting held on 29/03/2021, it was agreed that Metrolink would not be considered in the assessment of any of the underground options as an agreed arrangement for Alignment B hadn't been developed and only considering Metrolink proposals for B1 and D could skew the assessment. The report should be neutral on this issue.	See response to Comment 009
[redacted]	042	Page numbering	Page 102	There is an error in the page numbering (8.1.1 follows 8.1.26 and leads to duplication of paragraph numbers).	Noted
[redacted]	043	Precedents for Large Caverns	8.1.11 (Page 105)	It is stated that there are no precedents for the large caverns at the mined approaches. If the number of platforms were reduced (see Comment 001 above), would the examples of similar caverns be available?	There are precedents for the size of the caverns, but not such large caverns in close proximity in an urban area.
[redacted]	044	Settlement	8.1.11 (Page 105)	Reference is made to there being a major risk of settlement associated with the mined approaches for Options B and D. Would the risk be significantly less if the number of platforms were reduced (see Comment 001 above) and the track approaches simplified?	The risk would be reduced as the area of impact would be reduced and probably the maximum settlements would also be reduced if there were not large caverns adjacent to each other. However, just one 21m wide cavern in an urban area would still be considered a major risk, it is not inconsequential.
[redacted]	045	Railway Systems	9.1.4	It is stated that the railway operations for the underground stations were designed to work in a similar manner to the baseline to enable a like-for-like comparison. [redacted] position is that a like-for-like comparison should be achieved by designing the underground stations to accommodate the iTSS (see Comment 001 above).	The track layout and consequently the station layout were derived by the iTSS in line with the aspirations of the 'Definitions & References' section of the scope.
[redacted]	046	Ventilation	9.1.5	Reference is made to the one train per vented section rule limiting the number of trains that can operate within the station throat. Presumably the throat could be designed with a ventilation system that would prevent smoke being blown in the direction of escape (which is understood to be the reason for the one train per vented section rule). Please confirm whether or not this is correct.	There are a number of factors behind this design rationale key being: •One train per ventilation zone is the safety basis for HS2 based on the Common Safety Method legislation using the similar reference system. •Our safety basis has been accepted by the regulators and is in the process of being accepted by the fire and rescue services and one train per ventilation zone has been achieved in all designs to date and is being constructed at present. •One train per ventilation zone, or the equivalence of this, is required by BS9992 and is being designed for on projects like Crossrail 2.
[redacted]	047	Railway Systems	9.1.3 to 9.1.16	See Comment 001 above.	See response to 001 above.
[redacted]	048	Metrolink	9.1.27	At the Management Meeting held on 29/03/2021, it was agreed that Metrolink wouldn't be considered in the assessment of any of the underground options until an arrangement for Metrolink proposals for each option has been agreed.	Refer to Comment response 020 from [redacted] Contributor 1 and 009 above
[redacted]	049	Regeneration Opportunities - Option D	9.1.32	Reference is made to the overall regeneration area for Option D being similar to the baseline. However, the baseline is a surface station with large approach viaducts and no OSD proposed. The underground station options minimise the above-ground infrastructure required and therefore maximise the regeneration potential. How can this be 'similar'?	This is in reference to Piccadilly SRF Regeneration Area as defined by MCC. Text added to clarify point
[redacted]	050	Flexibility	9.1.36	Please explain how the baseline option provides greater flexibility to adapt to changing city dynamics. Presumably it would be possible to modify the OSD in the future if necessary. Once the baseline station is constructed it will prevent development within its footprint. Please clarify.	The text has been reworded. Baseline Option flexibility in this context refers to ASD only. Yes it is possible to modify OSD within limit of the station box structure, hence less flexible in comparison to ASD which is built on clean plots. Station itself is another topic on flexibility.
[redacted]	051	TBMs	9.1.49	Would it not be possible to dig a shaft to start tunnel boring at Piccadilly (with tunnel spoil removed to a railhead by conveyor, as is understood to be proposed for spoil generated by the underground station boxes)?	There isn't sufficient space for a TBM drive site at the HS2 end of the station boxes for any of the underground options. It is possible that NPR TBMs could be driven from Ardwick for Options B or B1, but the excavated material could not be taken away by rail if the TBMs are driving at the same time as the station excavation, because the station excavation is using all the muck train capacity.
[redacted]	052	Volume of Excavated Material Comparison	9.1.55/Figure 35	Please confirm whether or not this figure just relates to the station area and not the approach tunnels.	These figures include the approaches, specifically, everything within the portal shafts.
[redacted]	053	Conclusions and Recommendations	10.1.7	It is stated that further detailed development of the options, based on the agreed scope and requirements of this study, is unlikely to significantly change the overall assessment and comparative difference between a Surface and Underground High Speed station at Manchester Piccadilly, particularly in respect to cost and programme. Please refer to Comment 001 above.	Please see response to Comment 001
[redacted]	054	Assumptions	Appendix B - Assumption 31 and 32	It is stated that, if the outer scissors are not needed, the construction impact on the city centre would be significantly improved for all options. Why is this not a key assumption? Where are the assumptions relating to railway operations?	The outer scissors are required.
[redacted]	055	Assumptions	Appendix B - Assumption 34	Are there any precedents for complex S&C being installed on gradients of up to 1 % on high speed railways? If this approach was taken the benefits could be significant, as is noted. It is stated that further design development exceeds the scope of the study; however, the report should identify areas where there are opportunities to make changes that would have a significant impact on the sifting and potentially change the outcome. This information should be included in a prominent position and effectively provide a sensitivity assessment.	Yes there are but as stated these are subject ot individual assessment. The design is considered appropriate for a sift level 2 comparison. The magnitude of impact is debatable given the currently unquantified benefit this could provide. Although an increased gradient may provide greater flexibility for the track design any design changes would require holisitc multi-disciplineary assessment to confirm the benefits. As such it has been excluded from the SIFT report.

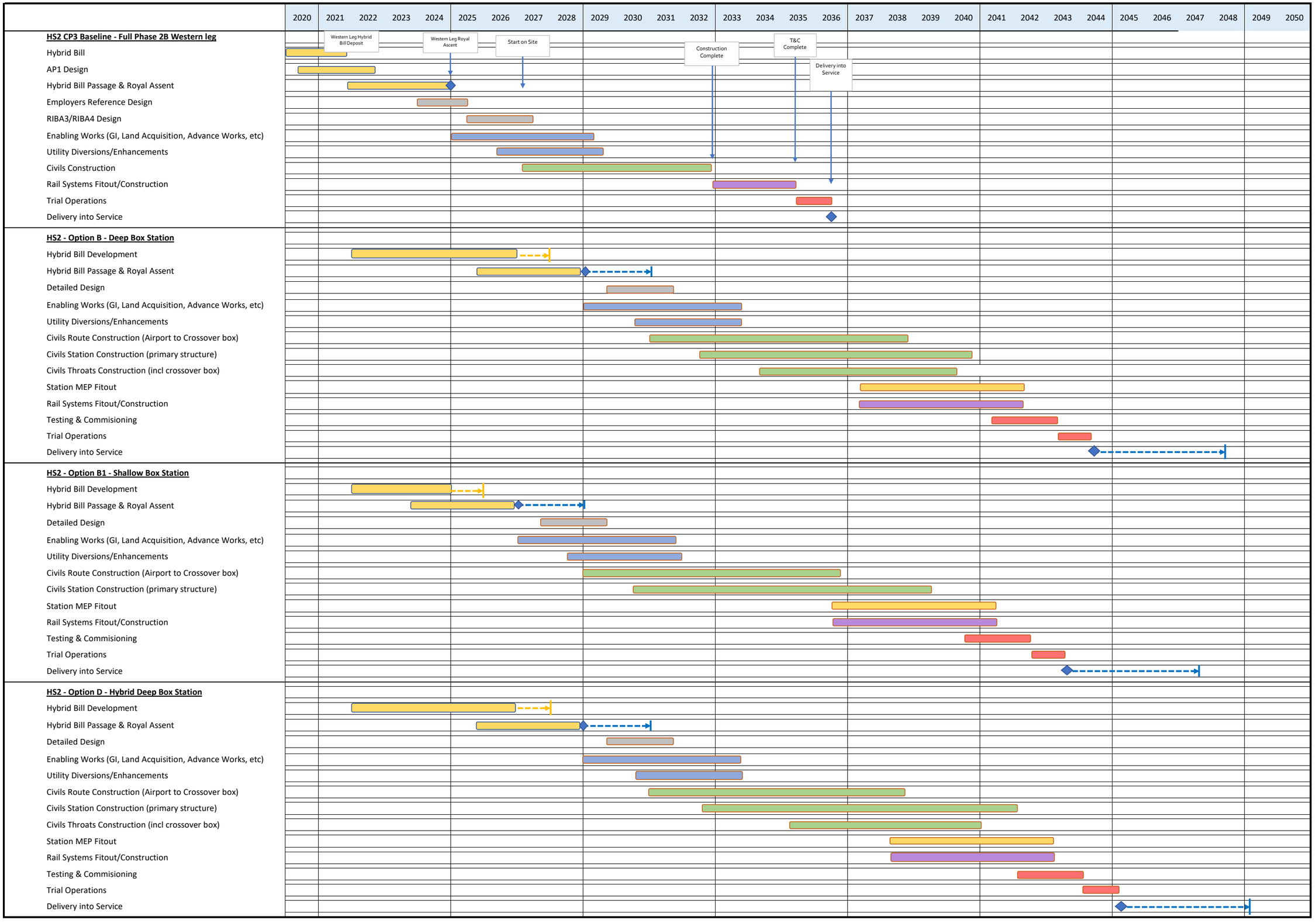
[redacted]	056	Assumptions	Appendix B - Assumption 36	It is noted that the use of slower speed turnouts would enable the size of the caverns to be reduced. As the size of the caverns has been identified as a major risk, this opportunity should be highlighted (see previous comment).	Slower speed turnouts will reduce the length of the cavern but not the width, the width is a product of space between tunnel bores. Yes, the width of a cavern is driven by the space between tunnels at the headwall of the cavern. Stepney Green crossover on Crossrail was only 18m wide because the tunnels are smaller diameter than the HS2 bored tunnels (6.2m ID vs 7.55m ID). Our caverns are approximately the same width as the Channel Tunnel undersea crossover caverns.
[redacted]	057	Assumptions	Appendix B - Assumption 39	This assumption relates to the need for parallel moves into and out of all platforms and it is acknowledged that, if this is not required, a shorter track layout could be developed. Please refer to Comment 001 and identify this opportunity in a prominent position within the report.	It is acknowledged that further development of the requirements applied to the required standards may result in a more efficient design in respect to cost, however any potential savings would need to be understood against other factors such as operational robustness and safety. As such it has been excluded from the SIFT report.
[redacted]	058	Assumptions	Appendix B - Assumption 40	This assumption notes that there may be an opportunity to simplify the arrangement of the tracks at the approach to the Leeds end of the station. This would result in a shorter throat length. Please identify this opportunity in a prominent position within the report.	See response to comment 057. The use of symetircal layouts was agreed during design development [as presented on date 20.11.2020 and 04.03.2021] and does not preclude the opportunity of an asymetrical layout.
[redacted]	059	Response to review comment	Item No. 004 (PDF Page 219 of 265)	HS2 Ltd's explanation for the need for the approach fans for the underground station options matching that of the surface station is that, for the period between completion of HS2 and NPR, they want to operate the station as a terminus, with all platforms being accessible. Could the number of platforms that are operational not be restricted during this period?	The 6 platforms are required due to the turnaround for the HS2 services terminating at Manchester Piccadilly High Speed Station.
[redacted]	060	Response to review comment	Page 234 of 265	Reference is made to all the underground platforms being designed as terminus stops with turn back in part to 'accommodate potential large-scale operational disruption to services at either end of the station.' It is also stated that this approach has been taken to provide a 'fully integrated system with built-in flexibility.' Please refer to Comment 001 above.	Noted. See response to comment 001.

19 Appendix F – Indicative construction programmes

Indicative programmes for each of the three alignment options are provided below along with the following table of assumptions.

Assumption	Comment
GI and enabling works for underground options start after Royal Assent	In developing the design for the underground options for hybrid Bill, additional GI would be required prior to Royal Assent.
More detailed GI is required for Alignments B and D due to the extent of the mined approaches and, particularly for D, the location of the station box.	Ardwick fault runs close to/through this location.
For Alignment B1, it is assumed that less GI is required and therefore has the shortest indicative timeline to Royal Assent.	Assumed that risks relating to settlement for B1 can be dealt with after Royal Assent.
The programme and timelines are for delivery of HS2 to Manchester in an underground station. These do not consider the NPR route to Leeds to the east of the underground stations.	NPR running tunnel construction and integration not on the critical path for HS2 delivery into service.
NPR approach civils construction occurs at the same time as the HS2 approach civils construction	This includes the portal shaft at Ardwick for B and B1 and at Barking Street for D, as well as intervention shafts. This will enable NPR TBMs to be driven into the portal shaft from outside the city and extracted and will minimise impacts on the station itself.
The western leg (Crewe to Manchester Piccadilly) has one Delivery into Service (DiS) date	Airport Station will NOT be operational in advance of Manchester Piccadilly UG. (i.e no staged opening of the Manchester spur)
Ashley Railhead will be used to support the rail systems construction to the eastern extents of the UG box/throat in line with the RS C&L strategy for HBD	
TBM starting at Manchester airport driving towards the city.	With the change in position to how the HS2 tunnels approach the station there is no immediate site on the route to tunnel from both directions as in the baseline scheme and so the tunnels will be driven into the city centre from the Airport Portal. 2no. HS2 TBMs are driven from the Manchester Airport Portal all the way to Piccadilly, with a 2 month stagger. Activities prior to TBM launch are the same as for the Hybrid Bill Design. The TBM advance rate is 80 m/week after a 250m learning curve, which is limited by HGV movements allowed at the Airport Portal and is the same as for the Hybrid Bill Design.
Programme durations have not taken account of risk related to each option. Sensitivity analysis would need to be carried out to understand the magnitude of potential delays to the overall programme.	
Enabling, advance and utilities works have the same duration as in the baseline for Piccadilly Station (the Hybrid Bill Design) including demolitions.	
Rock head levels taken as the ‘average’ level, i.e. at +30 mOD.	
Depth of weathering and rock UCS taken as the ‘average’ values, i.e. 2 m of weathering and 20 MPa, respectively. (Note	

Assumption	Comment
that in the programme the UCS affects the diaphragm wall excavation rate only and so a higher value is more conservative).	
Station box excavation is limited to 1800 m^3/day, which is the capacity of 3no. trains per day from Ardwick rail sidings based on 600m^3 per train.	This is also estimated to be close to the upper limit for excavation plant operating in the box based on a number work fronts.
Civils and MEP fit-out of the station box finishes 2 years after internal concrete works (slabs, skin walls and RC columns). Where end sections of the box are used for mined approach construction and finish later than the main part of the station box, then civils and MEP fit-out can finish a minimum of 1 year after the internal civil concrete works have been finished.	
Rail systems and MEP fit-out of HS2 approach structures starts after secondary lining of mined caverns has been completed for B and D. For B1 the rail systems and MEP fit-out of the approach tunnels, intervention shaft and portal shaft outside of the approach box can start after TBM extraction and secondary lining of the outer scissors cavern. Duration is 2 years.	
Integrated testing and commissioning has a duration of 2 years, which may overlap with the latest civil and MEP fit-out activity by 1 year.	
Trial operations to follow after integrated testing and commissioning and have a duration of 1 year.	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Western Leg Hybrid Bill Deposit
Western Leg Royal Ascent
Start on Site
Construction Complete
T&C Complete
Delivery into Service
HS2 CP3 Baseline - Full Phase 2B Western leg
Hybrid Bill
AP1 Design
Hybrid Bill Passage & Royal Assent
Employers Reference Design
RIBA3/RIBA4 Design
Enabling Works (GI, Land Acquisition, Advance Works, etc)
Utility Diversions/Enhancements
Civils Construction
Rail Systems Fitout/Construction
Trial Operations
Delivery into Service
HS2 - Option B - Deep Box Station
Hybrid Bill Development
Hybrid Bill Passage & Royal Assent
Detailed Design
Enabling Works (GI, Land Acquisition, Advance Works, etc)
Utility Diversions/Enhancements
Civils Route Construction (Airport to Crossover box)
Civils Station Construction (primary structure)
Civils Throats Construction (incl crossover box)
Station MEP Fitout
Rail Systems Fitout/Construction
Testing & Commisioning
Trial Operations
Delivery into Service
HS2 - Option B1 - Shallow Box Station
Hybrid Bill Development
Hybrid Bill Passage & Royal Assent
Detailed Design
Enabling Works (GI, Land Acquisition, Advance Works, etc)
Utility Diversions/Enhancements
Civils Route Construction (Airport to Crossover box)
Civils Station Construction (primary structure)
Station MEP Fitout
Rail Systems Fitout/Construction
Testing & Commisioning
Trial Operations
Delivery into Service
HS2 - Option D - Hybrid Deep Box Station
Hybrid Bill Development
Hybrid Bill Passage & Royal Assent
Detailed Design
Enabling Works (GI, Land Acquisition, Advance Works, etc)
Utility Diversions/Enhancements
Civils Route Construction (Airport to Crossover box)
Civils Station Construction (primary structure)
Civils Throats Construction (incl crossover box)
Station MEP Fitout
Rail Systems Fitout/Construction
Testing & Commisioning
Trial Operations
Delivery into Service

20 Appendix G – Methodology of HS2 cost estimate

20.1 Option Description Comparison

20.1.0 To facilitate analysis of each option, the costs have been split into cost breakdown zones: HS2 route, HS2 approach, station, NPR approach and NPR route as per figure 41 below.

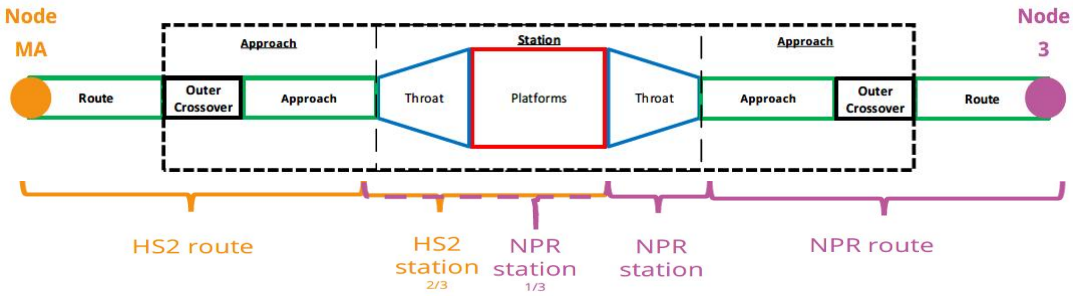


Figure 38 - Manchester Piccadilly UG Station Options Cost Breakdown Zones

20.1.1 A summary of the key quantity comparisons by cost breakdown zones is detailed in the following.

HS2 Route

20.1.2 The HS2 Route encompasses a twin-bore tunnel from Manchester Tunnel south porous portal up to the turnout toes into the surface station (equivalent to all works covered in Community Area MA07) for the comparative baseline and from Node MA (equivalent to Manchester Tunnel south porous portal) up to the start of the crossover cavern for the underground station options.

20.1.3 Excavated materials from the tunnel will need to be transported from site for disposal. For comparative purposes, no allowance for the establishment of Ardwick mass haul construction sidings has been included in the surface and underground options.

20.1.4 Refer to table 6 for a comparison of the key quantities for HS2 Route.

Table 6 - Key quantity comparison for HS2 Route

	CP3 Surface	Option B	Option B1	Option D
Length of HS2 tunnel route (Surface -Mcr Tunnel Sth Porous Portal to Nth Porous Portal UG - Node MA to outer crossover)	12.8km	14.0 km	14.0 km	11.0 km
Length of HS2 surface route (length from Mcr North Porous Portal to remaining MA07)	0.6 km	N/A	N/A	N/A

	CP3 Surface	Option B	Option B1	Option D
Tunnel Systems	2 porous portals	1 porous portal	1 porous portal	1 porous portal
	4 vent shafts	4 vent shafts	4 vent shafts	4 vent shafts
	3 ATS 1 SATS	3 ATS	3 ATS	3 ATS
Traction Power				

HS2 Approach

20.1.5 The HS2 Approach for systems encompasses the underground cavern up to the turnout toes. The rationale for splitting the Approach from the Route is to provide a comparison between underground options on the variances in the length of route required between the outer crossover (within underground cavern) and the statin box (inclusive of throat).

20.1.6 This length of route between the underground cavern and the station box varies for each underground option, as there are constraints on the ability to locate the crossover box in close proximity to the station box. This is not applicable for the surface option.

20.1.7 The HS2 Approach for civils includes infrastructure for the operational caverns and vent shafts associated with the caverns. Differences in tunnel length from the cavern are reflect in the station costs. Cavern tunnel lengths are priced at the same length of 293m.

20.1.8 Refer to table 7 for a comparison of the key quantities for HS2 Approach.

Table 7 - Key quantity comparison for HS2 Approach

	CP3 Surface	Option B	Option B1	Option D
HS2 Crossover cavern (systems)	N/A	0.4 km	0.8 km	1.0 km
HS2 Crossover cavern (civils)	N/A	0.3 km	0.3 km	0.3 km
Tunnel Systems	N/A	1 intervention and vent shaft	1 intervention and vent shaft	1 intervention and vent shaft
Switches and Crossings	N/A	1 x 80k diamond crossing	1 x 80k diamond crossing	1 x 80k diamond crossing

20.1.9 For comparison, Options B and D will be constructed using mined excavation techniques which is deeper to allow adequate rock cover over the mined caverns, whereas Option B1 will utilise a cut and cover construction methodology which results in a shallower station box, refer to figure 42.

Figure 39 - Comparison of station depths and widths

Station

20.1.10 For the comparative baseline, access to the station (from London HS2 Route and Leeds NPR Route) converge via a single throat to a terminating station, as such there is no northern throat. The Station cost breakdown zone encompasses the station throat from the southern turnout toes up to the three terminal island platforms for the comparative baseline (equivalent to all works covered in Community Area MA08).

20.1.11 The comparative baseline design for the station comprises elevated track on viaduct and fans out to six terminating lines. The new surface station is on the same level and adjoins the existing NR station. The baseline relocates the existing Metrolink stop from below the NR station to below the new surface station.

20.1.12 For the underground options, the Station is a through station which comprises symmetrical throat layouts on both south and north of the station box. The Station cost breakdown zone encompasses the southern turnout toes up to the station box and from the station box up to the northern turnout toes.

20.1.13 The civils station costs include infrastructure associated with Metrolink, infrastructure in the approach throat to the station and all ancillary works adjacent to the station for the baseline and all options.

20.1.14 Option B assumes an open cut station box, with mined throat at each end. As the Station concourse and platforms are located below ground, ventilation will be provided. Metrolink is maintained in its existing configuration within the existing station.

Figure 40 - Option B platform and throat arrangement

20.1.15 Option B1 assumes shallow cut and cover station box and integrated throat as opposed to the Options B and D where the throat is mined. As the Station concourse and platforms are located below ground, ventilation will be provided. Metrolink provision include four platforms arranged in parallel above ground served by tracks above ground.

Figure 41 - Option B1 platform and throat arrangement

20.1.16 Option D assumes a slimmer open cut central station box with mined throat and two mined outer platforms. The central box serves four platforms and two additional platforms provided by mining tunnels on either side of the central box. As the Station concourse and platforms are located below ground, ventilation will be provided. Metrolink provision include four platforms arranged in parallel above ground served by tracks above ground.

20.1.17 Option D is bisected by the Ashton canal, as such will require the canal to be temporarily diverted during construction and re-provided above the station box.

Figure 42 - Option B1 platform and throat arrangement

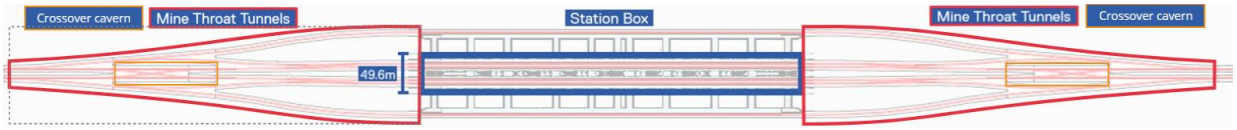


Table 8 - Key quantity comparison for Station

	CP3 Surface	Option B	Option B1	Option D
Length of station and southern throat	0.9 km	0.7 km	0.5 km	0.6 km
Length of northern throat	N/A	1.0 km	0.6 km	0.8 km
Station– Platform	6 platform surface platforms	6 platform in station box	6 platforms in station box	4 platforms in station box + 2 side platforms in single track tunnel bores
Station – Concourse Level	1 concourse below ground 1 concourse above ground	Above platform level but below ground	Above platform level but below ground	Above platform level but below ground
Metrolink	4 new platform below HS2 station	No change 2 platform under existing station	4 new platform at grade	4 new platform at grade
	Relocate existing track, decomm. existing stop	Temp diversion and reinstate over station box	Relocate existing track, decomm. existing stop	Relocate existing track, decomm. existing stop
Switches and Crossings	11 x 60 kph 4 x 70 kph 2 x 80 kph 2 x 100 kph turnouts	16 x 80 kph turnouts	16 x 80 kph turnouts	16 x 80 kph turnouts
Traction Power	N/A	1 SATS	1 SATS	1 Enhanced ATS

NPR Approach

20.1.18 Similar to HS2 Approach, the NPR Approach comprises the large underground caverns required for the outer crossover area for all options. Refer to table 9 for a comparison of the key quantities for NPR Approach.

Table 9 - Key quantity comparison for NPR Approach

	CP3 Surface	Option B	Option B1	Option D
NPR Crossover cavern (systems)	N/A	0.6 km	0.6 km	1.0 km
NPR Crossover cavern (civils)	N/A	0.3 km	0.3 km	0.3 km
Tunnel Systems	N/A	1 intervention core and vent shaft	1 intervention core and vent shaft	1 intervention core and vent shaft
Switches and Crossings	N/A	1 x 80kph diamond crossing	1 x 80kph diamond crossing	1 x 80kph diamond crossing

NPR Route

20.1.19 Similar to HS2 Route, the NPR Route encompasses a twin-bore tunnel from the crossover cavern up to Node 3.

Refer to table 10 for a comparison of the key quantities for NPR Route.

Table 10 - Key quantity comparison for NPR Route

	CP3 Surface	Option B	Option B1	Option D
Length of NPR surface route (From Mcr Picc Station throat to Leeds Porous Portal)	3.9 km	N/A	N/A	N/A
Length of NPR tunnel route to Node 3 (Surface -Leeds Porous Portal to Node 3 UG – Outer crossover cavern to Node 3)	9.0 km	10.8 km	10.8 km	10.1 km
Tunnel Systems	1 porous portal	1 intervention shaft	N/A	1 intervention shaft
	3 vent shafts	4 vent shafts	4 vent shafts	4 vent shafts
Structural interventions	1 x viaduct 5 x underbridges	N/A	N/A	N/A
Construction facilities	5 x const. compounds	N/A	N/A	N/A

21.2 Cost Summary

Cost Estimate Summary Breakdown

20.2.0 The following table 11 shows the civils and systems cost estimate.

Table 11 - Cost Estimate Summary

Item	Comparative Baseline (£m)	Option B (£m)	Option B1 (£m)	Option D (£m)
Cost of HS2 Route (£m)	1,142	1,157	1,148	1,038
Civils	974	984	998	895
Systems	168	173	172	143
Cost of HS2 Approach (£m)	N/A	143	150	149
Civils	N/A	132	135	132
Systems	N/A	11	15	17
Cost of Station (£m)	1,028	3,321	2,845	3,239
Civils	970	3,243	2,774	3,164
Systems	58	78	71	75
Cost of NPR Approach (£m)	N/A	149	150	156
Civils	N/A	136	137	138
Systems	N/A	13	13	18
Cost of NPR Route (£m)	1,265	1,112	1,065	1,087
Civils	1,116	975	928	957
Systems	149	137	137	130
Sub-total - Node MA to Node 3 (£m)	3,435	5,881	5,380	5,668
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
HS2 Indirect Costs	690	1,182	1,081	1,139
Contingency	2,383	4,877	4,526	4,823
Grand Total (£m)	6,962	12,267	11,384	12,131

20.2.1 All costs are stated at base date Q1 2015 excluding VAT.

20.2.2 Baseline includes the currently proposed surface station and route from the Manchester Tunnel South Porous Portal to Manchester Piccadilly surface station (community areas MA07 and MA08) as per hybrid Bill design, plus NPR Remit 6 Option 0 with an additional 2,068m length of tunnel from Node L to Node 3 (excluding ECS stabling) to provide a like-for-like comparison with the scope of the option studies.

[redacted]

20.2.4 The cost of the potential over-site development (OSD) has not been included for comparison. This includes any enhancements required to the below ground assets or surface structures being used to accommodate station facilities to support these developments.

20.2.5 Indirect costs comprise HS2 corporate costs, project management, design development & insurances. Indirect costs are calculated at a rate of 20.1% of the direct infrastructure cost estimate (civils and systems) in line with Baseline 2.0.

20.2.6 The comparative baseline uses a blended contingency. A contingency rate of 45.2% has been used for the HS2 hybrid Bill estimates in line with the treatment of contingency in Phase 2b Baseline 2.0 and a contingency rate of 66% for the NPR Remit 6 Option 0 values (based on the Green Book optimism bias) to reflect the conceptual nature of the designs and the lack of survey and design details.

20.2.7 All Manchester Piccadilly underground station options include a contingency rate of 66% (based on the Green Book optimism bias) to reflect the conceptual nature of the designs and the lack of survey and design details.

20.2.8 It is worth noting that there are significant risks associated with the underground caverns as the constructability of the same is sensitive to ground conditions. As such, there is an argument that the HS2 Approach and NPR Approach should incur a higher contingency rate than the current 66% applied. However, to ensure consistency in the approach, a contingency rate of 66% has been maintained to enable comparison.

21 Appendix H – Methodology to commercial development analysis

Summary

21.1.0 HS2 aimed to assist in the deliberations on the underground station options, alignments B, B1 & D, in the context of high-level estimates for residual land values. These were derived from standard property industry software development appraisals of land that would be permanently acquired by the Secretary of State for Transport and anticipated to not be required for future operational railway purposes.

[redacted]

[redacted]

21.1.3 The appraisals carry a substantial number of assumptions and caveats which are critical in the context of understanding the numbers reported. These reflect requirements such as fully assignable collateral warranties to be available for the OSD plots and an assumption of appraisal inputs that reflect a pre-Covid market place as the effects of the pandemic on the property market are not yet fully understood in terms of cost pressures, occupational demand and investor appetite all of which drive the final RLV numbers.

21.1.4 All three appraisals assume 100% of the developments are let simultaneously albeit with rent free periods being granted but this is unlikely in reality to occur as developers would only take plots once they were confident of the letting prospects and had funding for the developments available. However, this assumption reflects the difficulty in projecting floorspace absorption rates in two decades time and being common to all options enables a like for like comparison.

21.1.5 The key to the analysis was to also include the anticipated capital value of potential revenue streams from car parking, retail and advertising generated under each option.

21.1.6 Assuming a hybrid Bill DiS date of 2038 and the associated receipt of created value, the impact of DiS movements to 2044, 2045 and 2046 for the three underground options B1, B & D, and what impact this would have, were looked at.

21.1.7 The nominal numbers reported have been discounted for time using a Present Value technique and adopting a blended yield or discount rate of 5.2% to reflect the yields adopted in the appraisals.

21.1.8 This technique has also been applied to the nominal retail, car parking and advertising capital values to enable the figures to be collated to provide a relative out-turn of the numbers noted in the below table for comparison purposes.

Table 12 - Discounted for time and (nominal) Residual Land Value / Retail value / Advertising / Car park value

	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

22 Appendix I – Methodology to benefits analysis

22.1 Background

22.1.0 As part of the Manchester Piccadilly underground station options study, the Department for Transport (DfT) together with Transport for the North (TfN) have worked to provide an indication of the productivity and journey time benefits and the jobs impacts that the underground stations could have.

22.1.1 This indication is intended to provide a relative assessment of the underground options to enable a preferred underground option to be sifted.

22.1.2 The benefits appraisal for this sifting process was carried out using the NoRMS and NELUM models used in the NPR business case. These are models that DfT has been working alongside TfN to develop that analyse journey time benefits and productivity and jobs impacts respectively.

	Airport <> Piccadilly	Assumed Piccadilly Dwell Time	Piccadilly <> Leeds	Airport <> Leeds
CP3 Baseline	6¼ minutes (Westbound) 6½ minutes (Eastbound)	5 minutes	5 minutes (Westbound from Node L) 4½ - 4 ¾ minutes (Eastbound to Node L) Plus ¾ minute [Estimated based on 2.61km Node L <> Node 3 at 230km/h e/w]	17 minutes (Westbound) 16¾ - 17 minutes (Eastbound)
Option B	+¼ minute	3* minutes	- ¼ minute	-2 minutes
Option B1				
Option D	-½ minute		-½ minute	-3 minutes

*3 minutes based on NPR Pedestrian Flow modelling work, with 80% of passengers assumed to board/alight

Figure 43 - Journey time impacts provided by HS2's consultants

Figure 44 - Estimates of land available for development provided by HS2's consultants

22.2 Journey Time Benefits

22.2.0 To calculate journey time benefits, a "Value of a Minute" approach was used. From previous tests in the NoRMS model, the monetary value in appraisal terms of an additional minute of journey time saved into Manchester Piccadilly from the East (eg. Leeds) and West (eg. Manchester Airport is known.

22.2.1 Assumptions on journey time impacts used for the analysis were in-line with the estimates provided by HS2's consultants in the table above

- Option B/B1 – 1.5 minutes saved from East of Piccadilly (Leeds)
- Option D – 2 minutes saved from East of Piccadilly (Leeds), 0.5 minutes saved from West of Piccadilly (Manchester Airport)

22.2.2 These value of a minute figures provided 60-year PV benefits figures of £200m for Options B/B1 and £400m for Option D. Note that benefits were rounded to the nearest £50m for presentation purposes.

Table 13 - Journey Time benefits (60 year PV, 2010 prices, £m)

Station Option	Total Journey Time Benefits Impact (PV 2010 prices, £m)	Benefits impact from West of Manchester (MIA etc.) (PV 2010 prices, £m)	Benefits impact from East of Manchester (Leeds etc.) (PV 2010 prices, £m)
Option B	200	0	200
Option B1	200	0	200
Option D	400	150	250

22.2.3 These figures are incremental over the hybrid Bill station design (eg. the time savings calculated are against a baseline with the surface station). These figures include static wider economic impacts (known as Level 2 benefits).

22.2.4 Note the following caveats with this work:

- Journey time changes to/from Sheffield have not been included as this was not part of the agreed study scope but would be expected to produce disbenefits for some options.
- Benefit impacts shown are based on journey time changes only. Analysis has not yet been done to establish whether a through station would have additional benefits to the scheme that turnback station options would not. However, any benefits are likely to be marginal.
- JT impacts from passenger access time to/from underground platforms have not been included but would be expected to produce disbenefits.

22.3 Productivity Benefits/ Jobs Impacts

- To calculate productivity and jobs impacts, a "Value of a Hectare" approach was used. In a similar method to calculating journey time benefits, NELUM tests were run to show the value an additional hectare in the Piccadilly area would have. An assumption was made that 75% of the additional land would be used for commercial purposes and 25% for residential purposes. The value of a hectare was then scaled up to account for the total land made available for development once the estimates were provided.

- The value of an individual hectare in the Piccadilly area in agglomeration/ productivity terms was estimated at c. £500,000 in 60-year Present Value terms. This figure is in-line with what would be seen in a TAG compliant appraisal.

- In terms of jobs, an individual hectare was estimated to provide 520 additional jobs at the district level and 400 at the Greater Manchester level. Additional jobs are those that are not displaced or relocated from within the same area.

22.3.0 These individual hectare figures scaled up to provide the productivity benefits and jobs impacts in the table below. Option B1 was estimated to provide the largest benefits when looking at the CCB area only. When including wider development opportunities identified as part of the Manchester Strategic Regeneration Framework, Option D provided the largest benefits. It should be noted that these wider opportunities would lie outside any potential hybrid Bill powers for the CCB.

Agglomeration (60 year present value 2010 Prices £m)			
Station Option	**GEA in CCB**	**GEA - Wider Dev**	**Total**
HB Design	£32m	£31m	£63m
Alignment B	£27m	£53m	£79m
Alignment B1	£43m	£32m	£75m
Alignment D	£30m	£70m	£100m

Additional Jobs (District Level)			
Station Option	**GEA in CCB**	**GEA - Wider Dev**	**Total**
HB Design	32k	31k	62k
Alignment B	27k	53k	79k
Alignment B1	43k	32k	74k
Alignment D	30k	70k	100k

Additional Jobs (Greater Manchester)			
Station Option	**GEA in CCB**	**GEA - Wider Dev**	**Total**
HB Design	25k	23k	48k
Alignment B	21k	40k	61k
Alignment B1	33k	24k	57k
Alignment D	23k	54k	77k

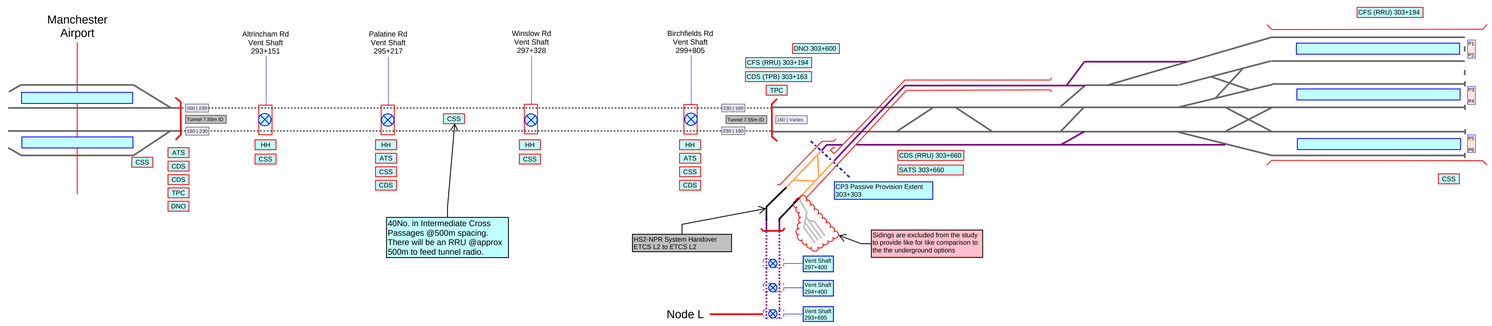
Figure 45 - Productivity benefits and jobs impact from developable land estimates

Note : (GEA stands for Gross External Area – measure of available developable land)

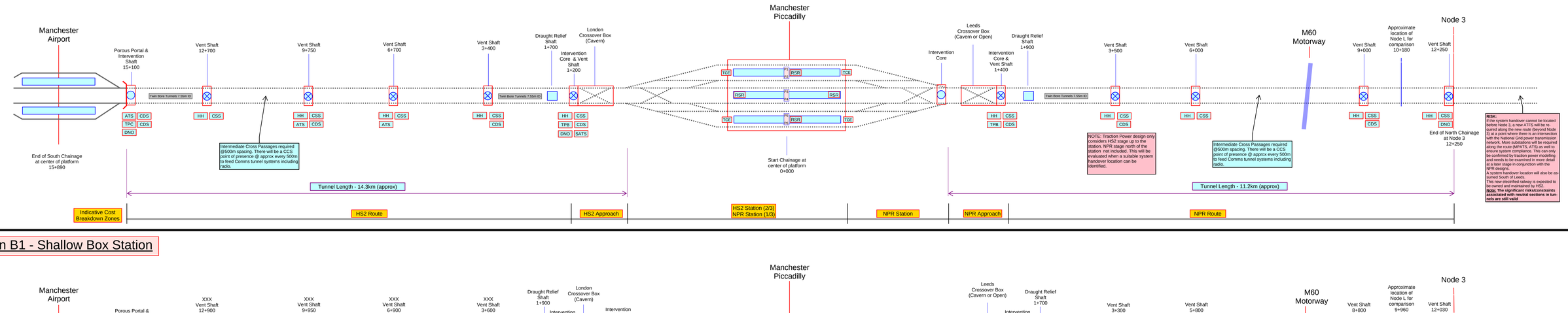
22.3.1 Note that these figures are absolute figures and are not incremental on the hybrid Bill station design. CCB figures refer to the land made available within the construction boundaries of the station options.

23 Appendix J – Rail Schematic Drawing

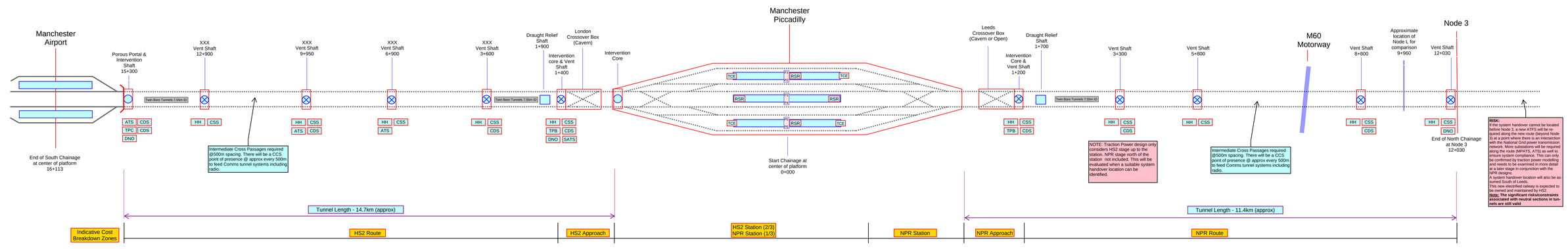
Baseline Design - CP3 Hybrid Bill



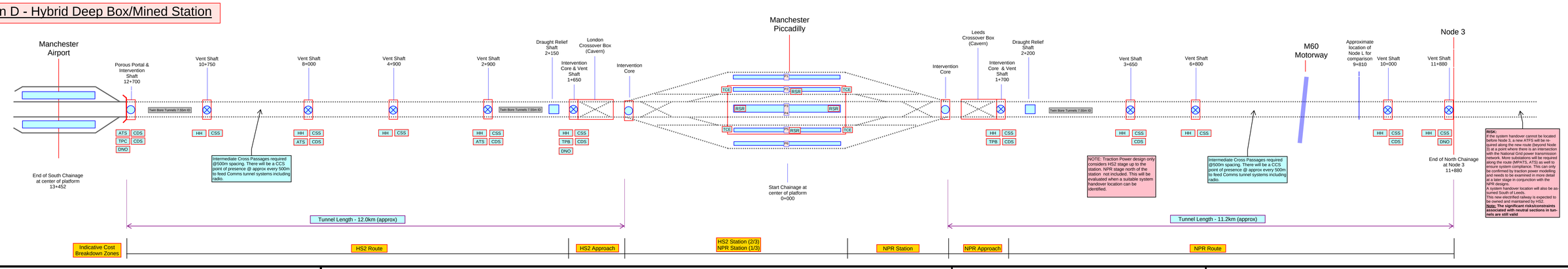
Option B - Deep Box Station



Option B1 - Shallow Box Station



Option D - Hybrid Deep Box/Mined Station



Legend

- Platform Number (P1 P2)
- Platform
- HS2 Track - Overground/Exposed
- HS2 Track - Underground
- Track Speed Change (230 | 160)
- NPR Track - Overground/Exposed
- NPR Track - Underground
- Civils Structure
- Vent Shaft & Intervention Core
- Intervention Core

- TCE Trackside Cable Entry Room
- RSR Rail Systems Room in Station
- TPC Tunnel Portal Compound
- TPB Tunnel Portal Building
- ATS Autotransformer Site
- DNO Distribution Network Operator
- SATS Sectioning Autotransformer Site
- CSS Communication Spur Site
- CDS Communication Distribution Site
- HH Head House

Notes:

1. CP3 Schematic copied from the Physical Infrastructure Diagram (PID). Ref: 2RS02-WSP-RT-DSC-M000-200001 P07
2. The NPR leg of the baseline schematic is taken to be Option 0 of the Remit 6 study without the Sheffield link or stabling.
3. This schematic should be read in conjunction with the track alignment drawings. Ref: PICC-UG-TRK-ALGB-NTH-GA, PICC-UG-TRK-ALGB-STH-GA, PICC-UG-TRK-ALGB1-NTH-GA, PICC-UG-TRK-ALGB1-STH-GA, PICC-UG-TRK-ALGD-NTH-GA, PICC-UG-TRK-ALGD-STH-GA, PICC-UG-TRK-THROATS-GA, PICC-UG-TRK-ALGB-STH-SKT01, PICC-UG-TRK-ALGB1-STH-SKT01, PICC-UG-TRK-CAVERN-SKT01.
4. Details relating to the specific requirements and assumptions of the rail systems design for this study will be documented in the Sift Report.
5. Vent Shaft buildings will house all required railway systems infrastructure in comparable layouts as per CP3. Specific designs have not been carried out at this stage.
6. The location of a handover point between the HS2 and NPR systems has not been identified before Node 3 due to constraints in achieving a suitable section of overground line. This will need to be analysed further if an option is instructed to progress beyond the Sift level of design.
7. All infrastructure south of a handover point is assumed to be owned and operated by HS2.

Revision:

Rev 01 - First Issue
Rev 02 - Adjustments to ATS locations
Rev 03 - Adjustments to ATS locations and addition of SATS
Rev 04 - Alteration of NPR Remit 6 to Option 0 in notes.
Addition of Cost zones
Addition of location of Node L for reference

Issued for Information only

Manchester Piccadilly Underground SIFT Study

Route Schematic Diagram

Sketch No: PICC-UG-SK-RSD-001	11th May 2021	Rev 04

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